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Rail Baltica Final Report

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Rail Baltica
Final Report

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1 Introduction

1 Introduction

This Final Report is being produced under the Contract for carrying out a Feasibility Study for a Standard Gauge Separate Railway Line within the “Rail Baltica” Corridor through Estonia, Latvia and Lithuania. This Final Report contains information on all section/tasks identified in the Terms of Reference.

The main objective of this feasibility study is to identify the most desirable feasible development option for a TEN-T Core Network 1435 mm gauge line in the Rail Baltica corridor evolving from a “top-down” transport strategy covering all the three Baltic States and an EU-wide rail network rationale, and to give a complete and substantiated picture for the authorities of the 3 Baltic countries and the EU if the project seems viable enough to justify a more detailed analysis on the respective national levels and to propose a possible period for implementation of further studies at the national levels.

The Final Report consists of four (4) Documents:

1) Executive Summary;

2) Volume I: Final Report;

3) Volume II: Appendix A-F;

4) Volume III: Appendix G-H.

2 Methodology

2 Methodology

2.1 Overall Methodology

Our overall strategy in undertaking this project is to combine the ten principal tasks outlined in the terms of reference and to group them into three principal phases. The split of phases and tasks is shown on

Figure 1 at the end of this section of the report. A critical philosophy underpinning the development of the study is the requirement to effectively define and seek sponsor approval for a functional specification for a new rail system. This process will ensure that technical proposals developed for Rail Baltica will be aligned to agreed economic and social objectives. The functional specifications will provide a robust mechanism for testing both the effectiveness and relevance of the various technical proposals.

Phase A: Defining the overall demand and service specification for Rail Baltica

In undertaking a strategic study for a new rail route where previously, either only weak or nonexistent corridors were in place requires both an understanding of current and past demand for passenger and freight transport services and a sound appreciation of the future long term political and economic drivers. In this context it is recognised that the reliance on classical demand models, although important will need to be effectively supplemented by a sound understanding of the national, regional and international social and economic growth strategies. A key component of this phase will be the utilisation of common study terms to facilitate a consistent approach to rail service definition.

A1: The Assumptions Register

Underpinning the study will be the need to establish an effective system which identifies records and monitors the wide range of assumptions which will need to be made particularly if the case for the future development of the corridor is to be adequately understood. As a first step, a project register will be established within which all major assumptions made particularly in the first phase can be recorded and approved both internally and by stakeholders. The register will also provide a mechanism by which assumptions can be challenged and if necessary, altered. It will deliver an effective audit trail within which all assumptions can be tracked and monitored.

One example of an initial assumption which will need to be made is to define the primary purpose of the network. Studies undertaken to date suggest that within existing geographic parameters, an essential component of demand for the route will be from freight transit particularly within the international market. In this context it is useful to assume that in the first instance, the corridor would be established and designed to maximise freight movements. Passenger movements could then be accommodated incrementally onto what would be essentially a freight railway. Where the route is unable to meet the functional requirements of passenger movements, incremental facilities can be developed to overcome the identified constraint. This is not to say that passenger services will not be considered within the scheme. Indeed, it is the opposite. However, in making such assumptions, the study process will be effectively sped up. It will also allow for example the incremental cost of the functional requirements to be effectively identified and incorporated within the emerging business case.

A2: Defining long run social and economic factors which impact on Rail Baltica

This work activity will examine and identify the long term economic factors which will influence the demand for freight and passenger rail services in the corridor. In undertaking this activity, it is recognised that any decisions made in respect of rail infrastructure development will have to consider factors outside existing parameters included within conventional demand analysis. It is important to establish factors which will give a good overall perspective of the future business case for Rail Baltica which will not be derived entirely from conventional demand analysis.

This activity will involve the analysis of published national and international long term economic and social objectives within and influencing the region. Where agreed, an understanding of known political objectives will be incorporated into the analysis and as such, a study of European Union regional and transport objectives will be made. The key objective of this study will be to inform the process which will allow a position to be taken on the long term strategic requirements of the Rail Baltica corridor. In this context, it is expected that the output will inform decisions on the capacity and capability of the corridor over a 10, 20 and 30 year time frame. In addition, it is anticipated that an understanding will be derived of the underlying economic and social factors which influence the overall demand for transport within the wider region and the issues which need to be addressed to facilitate a modal shift in favour of rail.

A3: Understanding transport demand

This activity will be concerned with developing an effective model which will assist the study in understanding the overall demand for transport in the region based on existing flow information for both freight and passenger movements. It is anticipated that a model will be developed which will allow predictions to be made for freight and passenger demand over the 30 year study period. The model will also be able to advise on the likely shift of traffic towards the rail mode as services are enhanced through the development of the corridor itself. A key component will be the ability to predict likely changes in rail demand which will arise through the development of rail system capabilities. An excellent example here is the impact of changes to passenger demand arising from improvements in point to point journey time. Clearly there is a high degree of interaction which needs to be incorporated into the decision making process.

The modelling of freight demand is also a critical component of this study. In this area, it is recognised that traffic flows will be over a wider area and as such international and well as regional demand will need to be considered. One key issue for development will be the need to identify the requirements and processes needed to facilitate the utilisation of the traditional 1520mm gauge and the 1435mm Rail Baltica system. In this context, assumptions will need to be made at an early stage on the type and effectiveness of systems used noting impact on journey time and transit cost.

As noted above, the demand modelling for both freight and passenger services will need to identify national, regional and international flows. For freight, the opportunities will also be required to be broken down into commodity type. Importantly, this study area will work closely with study area A2 and will recognise the strengths and long term challenges inherent in demand modelling.

A4: Developing the Functional Requirements Specification (FRS)

The functional requirements of the proposed rail system set out in sufficient detail the train service specification which will be required to operate over the study period. The FRS will be derived from the analysis of potential national, regional and international demand for rail transport services. In its most basic form, the FRS could be described as the broad components of a railway timetable optimised to maximise the demand for rail transport through the Rail Baltica corridor. It will recognise that requirements will change over the study period and as such this will inform decision making on such matters as the timing of system implementation.

The FRS will form the linkage between system demand and the required technical capability of a proposed system. It will acknowledge that there will need to be a recognition that functional requirements may need to change to reflect technical constraints either in physical or economic terms. As such it will be necessary to incorporate an effective and transparent mechanism to monitor and facilitate change. The FRS will enable engineering teams to define system parameters in the sure knowledge that auditable requirements have been approved and established.

The FRS will include (but not exclusively) the following parameters:

- Service requirements between nodal points for both freight and passenger modes including calling patterns from origin to destination
- Journey time requirements between nodal points
- Service frequency between nodal points
- Train length and axle weight requirements
- Traffic mix between freight and passenger services and between national, regional and international flows
- System performance requirements
- Interchange facilities for both passenger and freight services
- Terminal facilities

Phase B: Defining project technical parameters

B5: Establishing applicable international standards

It is recognised that Rail Baltica will need to be developed within the framework of applicable international and national standards. The understanding of these standards is a key determinant of the cost and feasibility of the emerging proposals and as such it is important that the study includes all relevant factors.

This work area will undertake to review the application of international and national technical standards including assessing the impact of interoperability regulations and their associated technical standards. The study will also recognise the importance of national standards particularly given the interface with heritage systems.

Importantly, the study will also take into account the application of current and applicable EU Railway Directives in so much as they will determine organisational structures and operational procedures. It is noted that all standards and legislative measures may have a negative or positive impact on the business case for Rail Baltica. As such these impacts will be identified and included within the analysis noting any emerging benefits which might arise.

B6: Review of existing proposals

The study recognises that there are a number of previous studies which may be relevant to the current project. It is also acknowledged that there are a number of studies which are currently being undertaken which may be of relevance to the current work. In this respect, the project will undertake a review of current and past work to ensure that any duplication of work is avoided and accepted conclusions are incorporated into this study.

In common with many other railway projects it is expected that some relevant work may have been undertaken which may benefit from further development. This phase of the work will seek to identify and codify such areas and work in a transparent manner with stakeholders to agree further development options. It is anticipated that this may contribute to effective resource utilisation.

B7: Defining technical options

This activity will seek to define the project technical parameters in terms of:

- Route alignment options
- Control systems
- Motive power
- Rolling stock
- Interchange options
- Passenger handling options
- Civil engineering requirements (track and structures)
- Electrical systems
- Telecommunications

It is recognised that the level of detail which will be provided will reflect the accuracy needed to make effective decisions given the current phasing of the project. It is also noted that the parameters which are developed will have implications for both the deliverability of the functional requirements and the emerging operational costs of the railway. As such, part of the decision making process with seek to balance continuing maintenance, renewal costs of the proposal with capital requirements for construction and the need to meet the FRS. It is acknowledged that this will be an iterative decision making process and it is proposed that this is managed within a transparent process.

It is recognised that a range of possible options will be developed for each sub system. In order to distinguish between options and develop a realistic menu from which relevant proposals can be derived, a hierarchy of consideration will need to be employed. Within this hierarchy, routing and trace alignment will come above the technical sub systems. It is believed that in most cases the unit cost of sub systems will remain constant. The total cost will be a factor of the routes chosen.

B8: Understanding ongoing system operations, maintenance and renewal costs

The technical proposals produced will all have cost profiles associated with system operation, maintenance and renewals over the life span of the asset. It is important that these costs are incorporated into the business case for each of the options developed.

Phase C: Single option development and implementation strategy

C9: Single option development

The key objective of the study is to define a single option which meets the needs of the FRS and has the most effective business case. Phase B will have identified a range of options and a process will be undertaken to review the whole life costs of all options against their ability to meet the FRS. It is recognised that during this stage, tradeoffs will need to be made between functionality (as defined in terms of system capability) and the options developed. This process will again use an options hierarchy focusing initially on alignments and critical nodal points.

The single option produced will be delivered to a sufficient level of detail to allow project sponsors to make an informed decision on future design development. Critically, the decision making process will incorporate a robust audit trail allowing transparency in the decision making process.

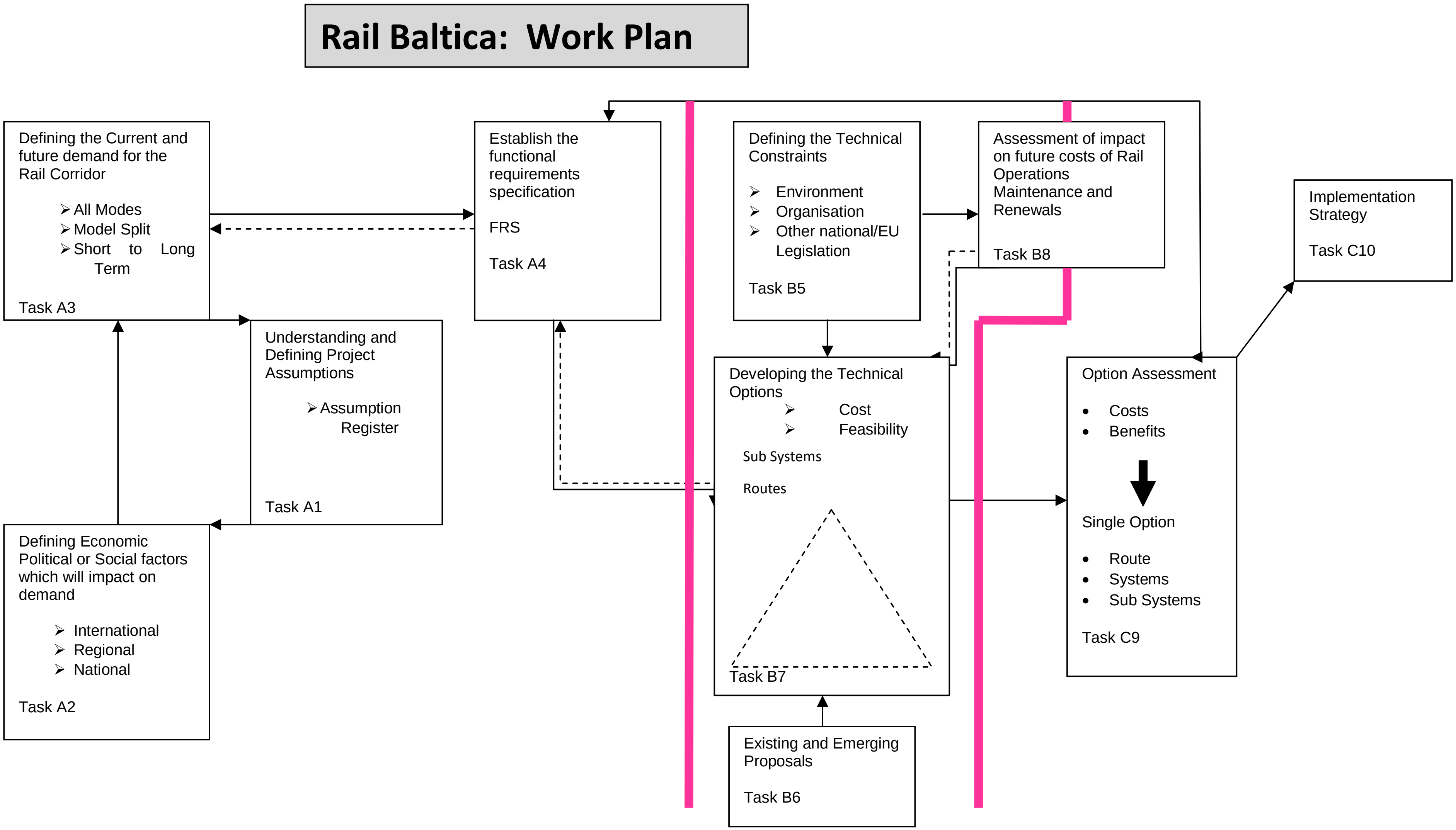
C10: Implementation strategy

The final stage of the project will be to provide a high level review of further implementation. It is recognised that with a project of this importance and complexity, it will be necessary to undertake a protracted development process. In this context this activity will focus on three principle areas:

- Identification of further activities needed to refine system capabilities
- Identification of activities need to refine the technical characteristics of the system
- Provision of a ‘road map’ indicating the recommended next steps

In all three activities, it is recognised that any decision to proceed to the next phase of development will need to be taken at a political level.

Figure 1- Work Plan



3 Background and Context

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3.1 Project History

The issue of an interoperable North-South railway corridor linking the Baltic Countries (Lithuania, Latvia and Estonia) with Poland and the rest of the EU rail network (hereafter – "Rail Baltica") can be seen as pivotal from the perspective of development of the railway transport mode in the region. The idea of Rail Baltica first appeared in 1994 in the joint political document "Vision and Strategies around the Baltic Sea 2010" as an important element for spatial development in the Baltic Sea Region.

The Baltic countries have historically been linked in transportation terms on an east-west axis and this is reflected in current rail traffic flows. Most rail freight traffic originates from Russia and as such, rail organisations in all 3 countries have been geared up to servicing that market. In physical terms, the provision of rail transport services is through the 1520 mm gauge system which makes interconnecting traffic with Poland both difficult to operate and costly to provide. Given the historical and physical constraints which exist, the ability of rail to contribute to real economic growth is extremely limited. For all intents and purposes, the Baltic rail system is incompatible with mainland European standards. Until, Estonia, Latvia and Lithuania joined the European Union, the issue was not considered a high priority. Now, within the European Union, there is a full consensus that the 3 countries need to be fully integrated into the wider rail transport system.

In October 2001 the European Commission initiated a revision of the TEN-T guidelines. This resulted in the adoption by the European Parliament and the Council in April 2004 of Decision No. 884/2004/EC amending the community guidelines for the development of the TEN-T. This Decision dedicated particular attention to the development of the trans-national infrastructure projects providing a response to the growth of international traffic whilst promoting cohesion within the EU, notably in the sections of the pan-European corridors situated within the territory of the new Member States as well as to the concept of "motorways of the sea". Within this Decision the Rail Baltica axis Warsaw – Kaunas – Riga – Tallinn was identified as priority project No. 27 with the following timeframe for implementation:

i) Warsaw – Kaunas (2010)

ii) Kaunas – Riga (2014)

iii) Riga – Tallinn (2016)

On 15 September 2003 the Rail Baltica Coordination Group (representing Poland, Lithuania, Latvia and Estonia) agreed on the key aspects to be considered in future studies for investment in Rail Baltica. This was followed on 27 March 2006 by the signature of a Declaration of Intent by the transport ministers of the four project countries and Finland to implement Rail Baltica. In the meantime between November 2005 and December 2006 the European Commission Directorate – General Regional Policy commissioned a strategic study of the Rail Baltica railway. The final report, published in January 2007, acknowledged that none of the options identified had a dominant business case.

Most recently, on 8 June 2010 representatives of the transport ministries of Poland, Lithuania, Latvia, Estonia and Finland during the conference "TEN-T Days 2010: Trans-European Transport Networks" held in Zaragoza, Spain, signed a memorandum expressing their political will to continue with the implementation of the Rail Baltica project. In addition, The Rail Baltica development plans have been evaluated in the Context of the White Paper – Roadmap to a Single European Transport Area – towards a Conventive and Resource Efficient Transport System, dated March 28, 2011.

3.2 Compliance with National Level Planning Strategies

3.2.1 Estonia

(1) Estonian National Strategic Reference Framework 2007-2013

a. Priority 3: Better connection opportunities.

b. Tasks:

i. Railway infrastructure and its carrying capacity will be developed for continuation of the transit sector development, advancement of railway traffic and reduction of the traffic load on roads. In the long-term perspective it is important to establish a fast railroad connection to Middle-Europe that would enable stimulation of the development of the North-South traffic of goods. Thus, it is very important to participate in development projects such as Rail Baltica in co-operation with Latvia, Lithuania, Poland and Finland;

ii. Improvement of connections between the regions includes the development of all transport modes for conveyance of passengers – development of bus transport, development of railway connections. The aim will be to guarantee accessibility to everyday activity and services, including the needs of handicapped people.

(2) Operational Programme for the Development of Economic Environment

a. Article 2.3. Transport investments of strategic importance – “...In view of the strong growth of air passenger numbers, Tallinn Airport and its transport links with the city centre need to be adapted to the evolving needs. In addition, a modern rail connection to Europe (Rail Baltica) should be established in a longer term in order to reduce distances in time and space and facilitate the growth of freight traffic to and from the South”;

b. Article 2.3.3. Indicative list of planned actions – “...ensuring the operation of international passenger and freight traffic, especially the improvement of the ability of railways and ports to handle more diversified freight flows and the readiness of waterways...” and “...preparations for the establishment of a high-speed international rail connection to Central Europe (Rail Baltica) will also continue during the current period.”

(3) Estonian Transport development plan 2006-2013

The main objectives that may be associated with railway transport development are:

a. Vision 2: High quality state infrastructure;

   i. Objective 2 - to develop the national transport infrastructure to meet the needs of the population and business communities;

   ii. Objective 3 - to create spatial balance and reduce developmental differences within the country.

b. Vision 3: Reduce the negative environmental impact of the transport sector;

   i. Objective 5 To minimize the negative impact of the transport sector on the environment

3.2.2 Latvia

(1) Latvian National Development Plan 2007 – 2013

a. Objective 5.2.3. - Multimodal, integrated, accessible for the public and safe transportation system.

b. Tasks:

   i. to ensure improvement and development of the international transportation infrastructure, including modernisation of all major national motorways, railroad infrastructure, ports and airports, thereby ensuring compatibility of Latvia’s and EU traffic control system, thus guaranteeing full integration into the Pan-European transportation network and connection with networks used by Eastern neighbouring countries;

   ii. to improve the public transportation system: increase the accessibility of public transportation services on national, regional and local levels, to improve the quality of regional and local services by optimisation of route network, determining priority modes of transportation, and retaining rail transportation of passengers and ensuring its accessibility for all social groups;

   iii. to diversify transportation and logistics services by creating an integrated and multimodal national transportation system which is competitive in the European and global service market.

(2) Transportation Development Guidelines 2007 – 2013

a. Overall objective - high quality and competitive transport infrastructure that is integrated into common Eurasian transport system; safe traffic and transit, logistical and public transport services that are available to everybody;

b. Goals and tasks:

   i. Comfortable and safe railway transportation services consistent with demand and available financial resources;

   ii. resources;

   iii. Effective and public needs orientated public transport system.

(3) Operational programme: „Infrastructure and services”

a. Article 72 – “...The project aim – linking the Baltic countries with other EU states with an effective rail freight system meeting market requirements. ... An additional detailed study is necessary in order to carry out analysis of all aspects and make a justified decision on further development of the project- construction of European standard railway track (1435 mm) that would connect the Baltic States with Central Europe”;

b. Article 73 – “Within 2007-2013 programming period implementation of route Rail Baltica so-called 1st stage is envisaged- modernization of train traffic management and signalling system on the existing route where it has not been carried out previously, as well as other improvements to the infrastructure for which co-financing from Trans-European Network (TEN-T) Budget is not applied for".

3.2.3 Lithuania

(1) Operational Programme for Economic Growth for 2007–2013

a. Article 1.4. "Transport Network – "...Substantial improvement of the railway line between Lithuania and Poland while implementing Phase 1 of the Rail Baltica project as part of TEN-T has been identified as a priority."

b. Objective 3 of the Operational Programme: Increase efficiency of economic infrastructure – "...Establishment and development of a modern North-South transport link (Tallinn–Riga–Kaunas–Warsaw) connecting the Baltic States and Poland could meet the increasing needs of the EU Member States in terms of trade and services. The key priority is to create conditions necessary for the interoperability with the EU railways network within the framework of the Rail Baltica project...."

c. Government of Lithuania by the Resolution dated 2011.04.07 approved Rail Baltica as a project of significant importance to the state.

d. Seimas (Parliament of Lithuania) on 2011.04.12 adopted the Law Nr. XI-1307 on Expropriation of the land for public needs implementing the projects of significant importance to the state. The law was adopted for Rail Baltica project, also for Nuclear power plant, electricity bridge LitPol Link, public logistic sites, mayor roads and other.

(2) Long–term development strategy of the Lithuanian transport system

The main objectives of the long-term railway transport development are:

a. to create a legal framework and strengthen a market regulating authority to effectively participate in the EU railway transport market;

b. to fully restructure the railway sector;

c. to create a strong and effective system of traffic safety control;

d. to create an integral system of railway environmental protection covering all potential sources of pollution (air, water, soil);

e. to modernize the infrastructure so as to allow a successful integration into the EU transport system and modernize it in accordance with AGC and AGTC agreements and guidelines of the European Council and of the Parliament for the development of the trans-European transport network;

f. to implement the Lithuanian railway transport sector reform according to EU legislation in order to increase the competitiveness of the national railways in the European transport services market;

g. to acquire passenger and freight rolling stock complying with the parameters of the modernized infrastructure;

h. to ensure railway transport safety taking account of the fact that the increasing demand for international services in terms of network and system intercompatibility and the opening of the market call for the reassessment of the problems of railway safety. The compatibility of systems should ensure the same (or even higher) level of safety as the one already achieved in every EU state. Therefore, the European Council Directive 96/48/EC on the Interoperability of the Trans-European High-Speed Rail System and Directive 2001/16/EC of the European Parliament and of the Council on the Interoperability of the Trans-European Conventional Rail System mentions safety as one of the most necessary requirements for operation of the trans-European rail system. This encourages taking of actions on both the technical and administrative levels.

(3) Lithuanian Strategic National Rail Transport Development Plan for 2005-2015

a. Article 4.3 – Future need for infrastructure modernisation: "... The future role of the Rail Baltica line is therefore to capture a larger part of the freight and passengers from the roads and to assure a higher quality of safety, speed and inter-modal transportation. As a priority project the EU has included Rail Baltica on the list of Pan-European priority projects. It is a project connecting Finland and the Baltic countries and Poland with a new European gauge line. Construction of Rail Baltica will create conditions for modern transportation of freight and passengers and will further enhance the integration of this region into the railway networks of EU states"

3.3 EU Defence and NATO

One of the most important factors in national and international planning is that of providing a sufficiently high standard of transport infrastructure to support the defence and security needs of member states of different organisations. The three Baltic states would be strategically much better connected to the heartland of the European Union if the Rail Baltica project goes ahead. The three Baltic states are part of the 27 countries that make up the European Union. They are also members of NATO whose mission is a political one to share democratic values and cooperate on defence with its 28 members. NATO is committed to peaceful resolution of disputes but if diplomacy fails it has the military capacity needed to undertake crisis management operations. In a worst case scenario a fast, direct rail route connecting the Baltic states to Central Europe would facilitate the swift movement of military equipment to the necessary locations. Increasingly military equipment is being moved in containers and the provision of intermodal terminals enables this to happen seamlessly.

4 Macro-Economic Data and Sector Context

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4.1 Macro – Economic Data

This section contains a summary of the key factors to be used in the demand forecasting for Rail Baltica. These factors are considered to be

- Population
- GDP
- GVA
- Trade/Commodity flows

The full information is given in the Economic Development Study that forms Appendix A to this report.

4.1.1 Population Trends in the Baltic Region

As well as the Baltic States and Poland population trends have also been examined in Germany, the St. Petersburg region and Finland as it is considered that Rail Baltica will create demand in both the freight and passenger sectors within these regions.

Historic data

Most of the countries in Eastern Europe and the former Soviet Union have populations that are aging rapidly. The most striking case is the Russian Federation, where the population has already fallen from 149 million in 1990 to 142 million in 2010.

This aging trend is the consequence of demographic transition, which is when populations progress from pre-modern regimes, where both mortality and fertility are high, to post-modern regimes, where both mortality and fertility are low. The cause of the transition lies in the control of epidemics and contagious diseases, which eventually contribute to lower mortality, and in the processes of modernization, which leads to lower levels of fertility.

The timing of the demographic transition has varied in different regions of the world, but there is a global trend toward higher life expectancy, lower fertility, and the resulting aging of population distributions. As is the case for industrial countries, most countries in Eastern Europe and the former Soviet Union have either completed their demographic transition or are on the path to completion.

In fact, the most rapid aging during the next two decades worldwide will be in Eastern Europe and the former Soviet Union because of unprecedented declines in fertility and the increases in life expectancy of the past decades.

The population of the countries related with the Rail Baltica project has fallen from 139.4 million people in 2000 to about 138.6 million in 2009, a decrease of 0.6%. It should be noted however that the population trends in the region have not been homogeneous. For example during this period Finland experienced an average annual growth of 0.33% whilst Latvia's average annual growth was negative -0.58%.

Forecast

The changes in fertility and life expectancy have shaped the current demographic situation in the region, determining population sizes, growth rates, and population structures.

The rapid declines in fertility even among countries that already had very low levels of fertility, have meant that relatively smaller cohorts were being added to the national populations and because longevity has continuously improved, especially in those countries with already long life expectancies, it has expanded population numbers above all in the upper age groups. The net result of these changes has been a slowdown in the growth rate of populations and an increase in the proportion of the elderly in the total population.

Population in Eastern Europe is aging rapidly. By 2025, the median age will be more than 10 years greater than it is now in about half of the countries in the region. In 18 of the 28 countries in the region, the population will actually shrink by 2025.

The number of elderly people is already high in many countries and will continue to rise during the next two decades. For example, in Poland, the proportion of the population over 65 years old is projected to increase from 13 percent in 2005 to 21 percent in 2025.

The aging process has been occurring for many decades in most countries in Eastern Europe and the former Soviet Union and is expected to continue to be the major demographic phenomenon during the next 25 years and beyond. As elsewhere, the two primary contributing factors have been significant declines in fertility and major improvements in longevity, resulting from advances in healthcare. The effect of those changes on both the size and the structure of the population in the region's countries have been substantial.

The forecast of population trend has been undertaken for the following countries and regions:

(1) Finland;

(2) Estonia,

(3) Latvia;

(4) Lithuania;

(5) Poland;

(6) Germany;

(7) The St. Petersburg region.

In order to estimate the population trend we have gathered and revised the forecasts prepared by the National Statistical Bureau of each country, EUROSTAT and the United Nations, and used a simple linear regression model based on the historic data. It should be noted that all forecasts were rather similar, varying by no more than 15%.

The table below reflects the average forecast population from the various sources mentioned above.

Table 1 - Average Forecast Population

Year / Country/	2015	2020	2025	2030	2035	2040	2045	2050	CAGR (%)
Finland	5 420	5 470	5 519	5 569	5 619	5 668	5 718	5 768	0.2
Estonia	1 325	1 313	1 301	1 289	1 277	1 265	1 253	1 242	-0.2
Latvia	2 200	2 152	2 104	2 056	2 008	1 960	1 912	1 864	-0.5
Lithuania	3 248	3 164	3 080	2 995	2 911	2 827	2 742	2 658	-0.6
St. Petersburg region	6 059	5 927	5 796	5 665	5 533	5 402	5 270	5 139	-0.5
Poland	37 637	37 118	36 599	36 079	35 560	35 041	34 522	34 003	-0.3
Germany	80 430	78 934	77 438	75 942	74 446	72 950	71 454	69 958	-0.4

The table below reflects the forecast of population trend in Estonia, Latvia, and Lithuania at NUTS3 level. It is assumed that negative growth is less negative in and around the largest cities within the Baltic States i.e. existing urbanization trends will continue over the next decades.

Table 2 - Forecast of population trend in Estonia, Latvia, and Lithuania at NUTS3 level.

Region	2015	2020	2025	2030	2035	2040	2045	2050	CAGR (%)
EE001Põhja-Eesti	524	524	523	522	522	521	521	520	-0,02
EE004Lääne-Eesti	158	155	152	150	147	145	143	141	-0,34
EE006Kesk-Eesti	137	135	133	131	129	127	126	124	-0,31
EE007Kirde-Eesti	166	163	161	158	156	153	151	149	-0,32
EE008Lõuna-Eesti	340	336	331	327	323	319	312	308	-0,28
LV003KurzemeRegion	289	280	270	261	251	241	232	222	-0,74
LV005LatgaleRegion	330	320	309	298	288	277	267	253	-0,74
LV006Riga	706	700	694	688	683	677	671	665	-0,17
LV007RigaRegion	383	381	379	377	375	373	372	370	-0,10
LV008VidzemeRegion	223	213	203	192	182	172	162	155	-1,00
LV009ZemgaleRegion	269	259	249	239	229	219	209	198	-0,85
LT001AlytusCounty	167	160	154	147	140	133	127	119	-0,93
LT002KaunasCounty	650	633	617	600	583	566	549	531	-0,57
LT003KlaipėdaCounty	373	369	365	360	356	352	348	344	-0,23
LT004MarijampolėCounty	173	167	161	155	149	143	136	130	-0,78
LT005PanevėžysCounty	267	255	243	232	220	208	196	187	-0,99
LT006ŠiauliaiCounty	331	318	306	293	280	268	255	240	-0,89
LT007TauragėCounty	121	117	113	108	104	100	95	91	-0,78
LT008TelšiaiCounty	165	159	154	148	142	136	129	122	-0,84
LT009UtenaCounty	164	159	154	149	144	139	133	127	-0,72
LT00AVilniusCounty	837	826	815	804	793	782	775	766	-0,25

These forecasts of population growth will be used in the passenger demand modelling.

Major Population Centres in the Baltic States

ESTONIA

There are 7 cities in Estonia with a population in excess of 20,000 inhabitants. These are shown in

Figure 2 - Population of Estonia below:

Figure 2 - Population of Estonia

The key cities are:

TALLINN – The capital of Estonia has a population of 406,703 (1/01/10). Tallinn has a diversified business structure, which combines advanced service-based enterprise with an industry moving towards high technology. Emotion-based economy (cultural economy, creative economy) including tourism-oriented services and, in addition, entrepreneurship connected with international logistics and transportation services are central to the field of service.

TARTU - Tartu, the second city of Estonia has a population of 102,414 (statistics Estonia, 2008). It is situated approximately 186 km southeast of Tallinn. In contrast to the capital Tallinn, Tartu is considered as the intellectual and cultural hub of Estonia, especially since it is home to Estonia's oldest and most renowned university.

Tartu is mostly known as a university town, but it is also a site of heavy industry and its manufacturing represents ~15 per cent of total manufacturing of Estonia.

Tartu industry is modernised and has been in the phase of rapid development for the last decade. Large foreign investments have been made into Tartu's traditionally strong sectors – engineering, electronics, and food industry – as well as the new ones – information technology, the glass industry and biotechnology. Foreign companies have invested also in the public services: city energy, transport and maintenance companies.

NARVA - Narva the third largest city in Estonia has a population of 65,881 (2010 figures). It is located at the eastern extreme of Estonia, by the Russian border, on the Narva River.

The town's economy is currently based on the textile industry and power engineering. The largest employers are the two local power stations and Kreenholm Holding. Traditional fields of activity also include clothing manufacture, metal-working and wood-working, as well as the production of furniture, building materials, controlling and measuring apparatuses, and industrial equipment.

KOHTLA – JARVE - Kohtla-Järve the fourth city of Estonia has a population of 44,492 (2010 figures). The city is highly industrial, and both processes oil shale (Approximately 95 per cent of produced energy in Estonia is made by burning oil – shale) and is a large producer of various petroleum products.

PARNU - Parnu has a population of 43,488 (01/01/08) and is located in South-West Estonia on the shores of the Gulf of Parnu. Pärnu is a health resort of international stature. According to the data of the Tax and Customs Board almost 4 thousand businesses were registered in Pärnu as of January 1, 2008. The leading industries that provide most of the city's GVA are:

- Tourism, recreation and rehabilitation (Rehabilitation Centre Tervis, SPA Estonia AS, Strand SPA & Conference, Ammende Villa, Art Nouveau style restaurant and hotel etc.);
- Forestry and wood processing (Viisnurk AS, Valmos AS, Tarriks AS etc.);
- Textile and clothing industry;
- Metal processing;
- Peat mining and processing;
- Agriculture and fishery.

VILJANDI - Viljandi is the sixth largest city in Estonia and has a population of 19,963 (2010 figures). There are almost 1 000 businesses in Viljandi, with approximately 50% of them in the service industry, 45% in trade, and 5% in production. The major industries are the construction materials industry, the textile industry, and the food and bakery industry.

VALGA/VALKA (Latvia) - Latvian town Valka and the Estonian town Valga are twin towns, separated by the Estonian/Latvian border but using the slogan "One Town, Two States". With the expansion of the Schengen Agreement and abolition of the Estonian/Latvian border in 2007 all border crossing-points were removed and since then it is possible to talk about a joint economic zone.

Total number of Valga/Valka inhabitants is 20 500.

Leading industries that mainly are represented by small companies are:

- Forestry and wood processing;
- Peat mining and processing;
- Agriculture;
- Tourism.

LATVIA

There are 9 major cities in Latvia. These are shown in

Figure 3 - Major Cities in Latvia below:

Figure 3 - Major Cities in Latvia

RIGA - Riga is the capital of Latvia, with 709,145 inhabitants (2010 figures). The population of the total Riga Metropolitan area is approximately 1, 09 million. It is the largest city of the Baltic States and third-largest in the Baltic region, behind Saint Petersburg and Stockholm.

The capital of Latvia is a lively transport hub with railway, seaport, and aviation and road networks. Modern technology and some of the world's fastest internet connections are available in Riga, while its numerous logistics parks, business and education centres support the development of new enterprises.

DAUGAVPILS - Daugavpils is the second largest city in Latvia with a population of 104,857 (01/01/09). Daugavpils is a big railway junction and industry centre (approximately 20% of all employed people in 2007 were engaged in manufacturing).

The city of Daugavpils has enterprises active in the following sectors: metal processing, food processing, civil engineering, chemicals and textile industry. Daugavpils City Municipality is planning to develop a City Business and Technology Park by 2011 – 2012 with the required infrastructure for immediate commencement of business operations. Daugavpils plans to provide a 50% real estate tax allowance for investment projects.

JELGAVA - Jelgava has a population of 65,419 (2009 figures). Jelgava is often called the City of Students as more than eight thousand students study there. One of the major strengths of Jelgava is its connectivity to the rest of Europe. Jelgava is located at a major railway junction with routes leading in both east-west and north-south directions. Moreover, the city is located in the middle of the country and is traversed by many transit roads.

The main industries in Jelgava are metallurgy, woodworking, food production, mineral based production, textiles, and plastics, publishing and polygraphs. Jelgava is home to the largest industrial park in Latvia. It occupies 23 ha and rents over 111 thousand m² of space to companies. The park is located just 2 kilometres from the main road, which runs from Riga to Lithuania and from there to the rest of Western Europe.

VENTSPILS - Ventspils is the sixth largest city in Latvia with a population of 44,100 and is one of the largest ports in the Baltic Sea region. Approximately 1000 companies and their representative offices operate in Ventspils.

Ventspils City Council along with the Free Port Authority has designated a territory of more than 1000 ha for the realization of industrial projects, including the implementation of the Ventspils Industrial Park project. Ventspils industrial sector is growing fast; the city has managed to attract new companies as well as promoting the development of already existing companies in wood processing, metal processing, engineering and automotive industries, light and chemical industry, IT and electronics sectors.

VALMIERA - Valmiera is the largest town of the historical Vidzeme region and has a population of 27,569 (2008 figures).

Over the years Valmiera has evolved into an industrial centre of Vidzeme; it hosts a number of large and well-known enterprises - “Valmieras stikla šķiedra” (fibre-glass), “Valpro Corporation” (metal processing), “Valmieras piens” (food production), “Byko-Lat” (wood-processing).

LIEPAJA - Liepāja is the third largest city in Latvia and is an important ice-free port. As of 1 January 2010 Liepāja had a population of about 83000. Liepaja is a city successfully combining manufacturing traditions, an ice-free port, great intellectual potential and rich historical and cultural heritage.

JEKABPILS - Jēkabpils is a town roughly halfway between Riga and Daugavpils. The total number of inhabitants as of 2010 was 25 900.

REZEKNE - Rēzekne is a city in the Latgale region of eastern Latvia. It has a population of 35,883 (2008). Since 1997 the “Law on Rezekne Special Economic Zone (RSEZ)” has been applied in Rezekne giving tax rebates to companies with RSEZ status. Rezekne’s largest industrial enterprises are producing electrical instruments, milking clusters, wood, meat and corn products.

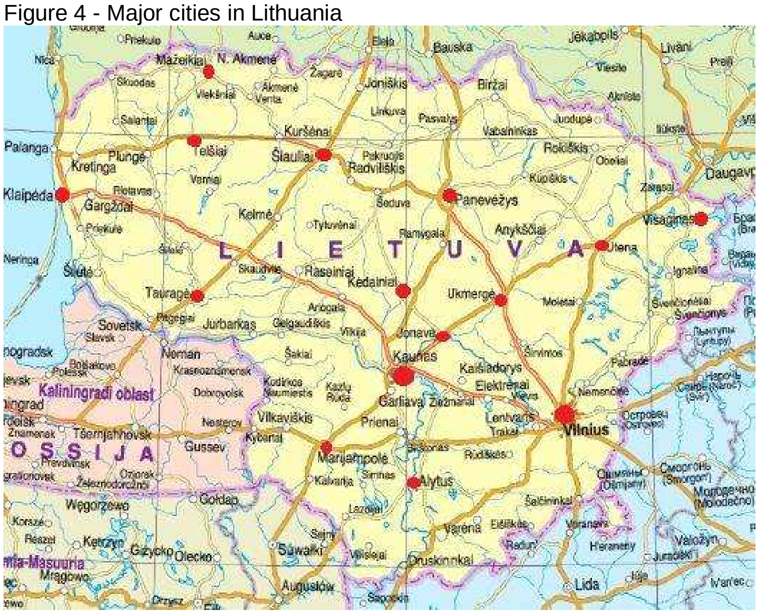
CESIS - Cēsis is located in the northern part of the Vidzeme central upland and has a population of 18,065 (2008 figures). Cēsis could be called the tourism capital city of Vidzeme as every year Cēsis attracts thousands of visitors that come to enjoy the Baltic Knight Festival, outdoor opera performances staged in the Livonian castle ruins, as well as the national dance festival “Vendene”. The main industries are associated with the food industry, tourism, information technologies and rendering of services. In accordance with the Cesis City development plan, tourism, wood-processing, food-processing and IT are the future priorities for development. Currently, the largest companies in Cesis city are the brewery (Cēsu alus), a honey processing plant, a meat processing plant, bakeries, and a printing house.

LITHUANIA

There are 15 major cities in Lithuania (defined as having a population greater than 25,000 inhabitants. These are shown in

Figure 4 - Major cities in Lithuania below:

Figure 4 - Major cities in Lithuania



VILNIUS - Vilnius is the capital of Lithuania, and its largest city, with a population of 555,613 (847,954 together with Vilnius County) as of 2008.The city is home to major companies and key financial institutions. Highly developed infrastructure, high quality services, and increased spending power of the inhabitants all attract large foreign investments. As compared with the general situation in Lithuania, Vilnius County has a better-developed production and non-production service sector.

KAUNAS - Kaunas is the second largest city in Lithuania with a population of more than 440,000 inhabitants (including the suburbs of Kaunas). It is not only a city of old traditions, but also a large centre of business and industry. It can also lay claim to be a city of young people with over 35,000 students studying at one of the seven universities. The main industries are construction materials, food processing and textiles.

Kaunas Free Economic Zone (KFEZ, www.ftez.lt) is a 5,000 ha site located just 7 km from Kaunas. It is located on the intersection of Via Baltica, the Warsaw - Helsinki road and the Vilnius highway, which also links Klaipeda sea port with Russia and Ukraine. A company, operating in the Kaunas FEZ, pays an 80% reduced rate of income tax for the first 5 years of its operation and a 50% reduced rate of income tax for the following 5 years.

KLAIPEDA - As of 2010, the population was of Klaipeda city was 182,752. Business activities in Klaipeda are closely related to the port. The Port of Klaipėda is the principal ice-free port on the eastern coast of the Baltic Sea. It is the most important Lithuanian transportation hub, connecting sea, land and railway routes from East to West. The annual port cargo handling capacity is up to 40 million tonnes. According to the level of economic development, Klaipeda County is one of the most successfully developing regions in the Lithuania.

ŠIAULIAI - Šiauliai is the fourth largest city in Lithuania, with a population of 129,075. According to the level of economic development, Šiauliai County slightly lags behind the national average. Šiauliai has better developed industry and construction; generating 30.8 % of the gross value added (GVA) in the county. The key industries are beer production, manufacture of TVs, bicycles, plastic and paper packaging, and furniture.

PANEVEŽYS - Panevėžys, the capital of Aukštaitija Ethnographic Region, has been the fifth largest city in Lithuania for more than a century. It has a population of 112,000 inhabitants.In 2007 there were 3 307 companies operating in Panevėžys. The food industry (beer, milk and meat products, sugar, and flour) accounts for the largest sector (29%) of production.

On September 3, 2009, after the evaluation of preparatory works, the Minister of National Economy of the Republic of Lithuania allocated the support of 17.5 mln. Litas for the construction of the infrastructure associated with a new Industrial Park (local roads, water supply and sewage, electricity networks, etc.). The construction works were started on October 19, 2009. In autumn 2010 it is proposed to offer a high quality Industrial Park to perspective investors.

TELŠIAI COUNTY – The largest towns within Telšiai County are:

(1) Telšiai with 30 000 inhabitants;

(2) Mažeikiai with 40 000 inhabitants.

According to the level of economic development, Telšiai County lags behind the national average; however, it may be classified as one of the strongest ones, together with those of Vilnius, Kaunas and Klaipeda. Telšiai County produced 4.3 % of country's gross domestic product (GDP).

UTENA COUNTY – The largest towns within Utena County are:

(1) Utena with 32 000 inhabitants;

(2) Visaginas with 28 000 inhabitants.

According to the level of economic development, Utena county considerably lags behind the national average. Utena county produced 4 % of the country's gross domestic product (GDP).

TAURAGĖ COUNTY - Tauragė is the capital city of Tauragė County. In 2010, its population was 27,500. Tauragė is situated on the Jūra River, close to the border with the Kaliningrad Oblast, and not far from the Baltic Sea coast.

ALYTUS COUNTY

Alytus is a city with municipal rights in southern Lithuania. It is the capital of Alytus County. Its population in 2010 was 66,841.

According to the level of economic development, Alytus County significantly lags behind the national average.

MARIJAMPOLĖ COUNTY - Marijampolė is an industrial city and the capital of the Marijampolė County in the south of Lithuania, bordering Poland and Russian Kaliningrad oblast. The population of Marijampolė is 46,256 (2010).

According to the level of economic development, Marijampolė County considerably lags behind the national average. Marijampolė County produced 3.2 % of county gross domestic product (GDP).

4.1.2 Macro Economic Analysis and Forecasts

GDP is the internationally recognised measure used in the analysis and forecasting of economic performance and growth. In the subsequent paragraphs the forecasts given are based upon the average data obtained from numerous sources such as the IMF and Eurostat.

Gross added value (GVA) is a measure of the value of goods and services produced in an economy and is linked to GDP as follows:

GVA + Taxes on Products – Subsidies on Products = GDP

In the passenger demand modelling GVA has been used as it enables regional differences in growth to be taken into account as GVA historic data is available at a NUTS 3 level. This historic data combined with forecast GDP growth has been used to derive forecasts of GVA growth at NUTS 3 level.

Trends in GDP

Table 3 - Recent trends in GDP below highlights the recent trends in GDP for the countries in the Baltic Region.

Table 3 - Recent trends in GDP

	Average GDP growth per annum 2000 - 2008	GDP Growth 2009
Finland	3.6%	-7.2%
Estonia	13.1%	-14.6%
Latvia	7.3%	-18.0%
Lithuania	7.0%	-14.8%
Poland	4.0%	1.7%

As can be seen in the table in the period 2000-2008 all of the countries achieved an average growth in GDP greater than the EU average of 2.4% p.a. The global recession in 2008 – 2009 had a dramatic effect on GDP growth in all countries except Poland who managed to avoid a recession and record a growth of 1.7%.

Forecasts of the growth in GDP (July 2010) for the duration of the study period have been obtained from several sources:

- EBRD
- IMF
- Eurostat
- Local Authorities (Ministry of Finance, Central Bank)
- Credit Rating agencies

The forecasts given in the tables below represent an average of the forecasts obtained.

Table 4 - Figures for Estonia, Latvia and Lithuania contains the figures for Estonia, Latvia and Lithuania and Table 5 - Figures for Rail Baltica the figures for the countries potentially influenced by Rail Baltica.

Table 4 - Figures for Estonia, Latvia and Lithuania

Country / Year	Growth Forecast (%)						
	2008	**2009**	**2010**	**2011**	**2012**	**2013**	**Av. Long term growth**
ESTONIA							
GDP, M EUR	16 073	13 730					
GDP Growth %	2.9	-14.6	0.8	2.9	2.2	3.8	**2.4**
GDP per capita (EUR)	11 987	10 243					
LATVIA							
GDP, M EUR	23 157	18 845					
GDP Growth %	-4.6	-18.0	-2.7	1.2	1.9	2.8	**2.2**
GDP per capita (EUR)	10 174	8 358					
LITHUANIA							
GDP, M EUR	32 203	26 650					
GDP Growth %	2.8	-14.8	-0.1	2.3	3.9	3.5	**2.2**
GDP per capita (EUR)	9 590	7 980					

Table 5 - Figures for Rail Baltica

Country / Year	Growth Forecast (%)						
	2008	**2009**	**2010**	**2011**	**2012**	**2013**	**Av. Long term growth**
FINLAND	2.6	-7.2	1.7	2	2.5	2.9	**1.8**
POLAND	5.0	1.7	2.6	3.2	3.6	4.3	**2.0**
RUSSIA	5.6	-7.9	4.1	4.1	4.5	4.6	**3.5**
GERMANY	1.3	-4.9	1.6	1.5	1.8	1.7	**1.5**
AUSTRIA	4.1	-1.8	1.2	1.3	1.8	1.7	**1.5**
HUNGARY	0.6	-1.7	0.6	2.5	3.7	3.4	**2.0**
CZECH REPUBLIC	2.5	-4.2	1.9	2.5	3.8	3.7	**2.2**
ITALY	-1.0	-5.0	0.7	1.3	1.3	1.0	**1.0**
UKRAINE	2.3	N/A	3.3	3.6	4.8	4.2	**3.5**
BELARUS	10.2	0.2	2.6	4.3	5.0	5.0	**3.5**

Forecast GVA

GVA has been forecast using a trend extrapolation method applying existing economic conditions (expected changes in demography and tax or monetary policies, for example) and consensus methods by gathering a list of expert opinions thus creating a synthesis of factors affecting GVA changes in the future.

The tables below show the GVA forecast for each of the three Baltic countries split down to NUTS 3 level.

The tables clearly illustrate that growth in GVA is stronger in the urban areas than in the rural areas with percentage growth being generally above the average for the country concerned.

Table 6 - GVA Forecast for Estonia

GVA Baltic States	**2009**	**2010**	**2011**	**2012**	**2013**	**2015**	**2020**	**2025**	**2030**	**2035**	**2040**	**2045**	**Av. Growth**
Estonia total, incl	**11 875,1**	**11 932,2**	**12 325,0**	**12 682,8**	**13 185,1**	**13 948,2**	**15 712,4**	**17 749,5**	**20 105,0**	**22 832,6**	**25 994,9**	**29 666,1**	**2.6**
EE001 Põhja-Eesti	7 079,9	7 186,0	7 454,6	7 715,6	8 075,1	8 597,5	9 830,2	11 267,1	12 942,9	14 898,4	17 181,6	19 848,8	**2.9**
EE004 Lääne-Eesti	1 019,5	990,3	1 009,7	1 023,1	1 042,7	1 073,8	1 153,2	1 239,4	1 332,9	1 434,5	1 544,8	1 664,6	**1.4**
EE007 Kirde-Eesti	894,3	879,6	901,6	913,6	936,2	964,9	1 037,1	1 115,5	1 200,6	1 293,0	1 393,2	1 502,2	**1.5**
EE006 Kesk-Eesti	797,6	787,0	808,0	819,5	838,4	865,8	934,5	1 009,2	1 090,4	1 178,5	1 274,4	1 378,6	**1.5**
EE008 Lõuna-Eesti	2 083,8	2 089,3	2 151,0	2 211,0	2 292,6	2 446,4	2 757,3	3 118,3	3 538,3	4 028,2	4 600,9	5 271,9	**2.6**

Table 7 - GVA Forecast for Latvia

GVA Baltic States	2009	2010	2011	2012	2013	2015	2020	2025	2030	2035	2040	2045	Av Growth
Latvia total, incl	**17 118,8**	**16 297,5**	**16 325,3**	**16 707,5**	**17 053,0**	**17 740,6**	**19 786,4**	**22 156,8**	**24 913,3**	**28 130,6**	**31 899,5**	**36 330,7**	**2.2**
RIGA (LV006)	9 208,4	8 798,2	8 787,0	8 973,6	9 165,5	9 540,0	10 963,6	12 643,4	14 630,8	16 988,2	19 791,3	23 132,3	**2.7**
LV007 Riga Region	2 096,1	1 978,9	1 973,5	2 012,7	2 052,8	2 135,4	2 406,3	2 718,6	3 080,0	3 500,0	3 990,6	4 566,8	**2.3**
LV008 Vidzeme Region	1 249,1	1 187,0	1 197,3	1 231,6	1 254,6	1 301,8	1 366,9	1 436,3	1 510,2	1 589,0	1 673,1	1 762,8	**1.0**
LV003 Kurzeme Region	1 794,9	1 697,1	1 710,5	1 758,8	1 795,7	1 869,4	1 973,7	2 085,6	2 205,7	2 334,8	2 473,8	2 623,9	**1.1**
LV009 Zemgale Region	1 460,4	1 386,3	1 400,0	1 443,4	1 471,2	1 528,2	1 630,5	1 741,6	1 862,3	1 993,5	2 136,2	2 291,5	**1.3**
LV005 Latgale Region	1 309,9	1 249,9	1 256,9	1 287,5	1 313,1	1 365,8	1 445,3	1 531,2	1 624,2	1 725,0	1 834,4	1 953,5	**1.1**

Table 8 - GVA Forecast for Lithuania

GVA Baltic States	2010	2011	2012	2013	2015	2020	2025	2030	2035	2040	2045	Av Growth
Lithuania total , incl	**23 843,1**	**24 322,2**	**25 234,8**	**26 097,6**	**27 247,5**	**30 367,5**	**33 874,9**	**37 821,6**	**42 266,4**	**47 276,9**	**52 930,1**	**2.2**
LT001 Alytus County	2 480,6	2 525,9	2 608,6	2 694,1	2 790,1	3 045,8	3 325,6	3 631,8	3 967,0	4 334,1	4 736,2	**1.8**
LT002 Kaunas County	4 281,2	4 371,3	4 523,9	4 682,1	4 910,5	5 534,3	6 241,9	7 045,1	7 957,5	8 994,9	10 175,3	**2.4**
LT003 Klaipėda County	2 502,3	2 556,5	2 646,6	2 740,1	2 875,2	3 243,6	3 660,7	4 133,0	4 668,1	5 274,5	5 962,0	**2.4**
LT004 Marijampolė County	705,0	717,4	743,4	766,6	794,4	868,7	950,2	1 039,6	1 137,7	1 245,5	1 363,8	**1.8**
LT005 Panevėžys County	1 312,4	1 332,9	1 379,8	1 420,8	1 473,2	1 613,1	1 766,8	1 935,6	2 121,1	2 325,0	2 549,2	**1.9**
LT006 Šiauliai County	1 645,1	1 672,4	1 732,0	1 784,7	1 848,1	2 017,1	2 202,0	2 404,5	2 626,3	2 869,3	3 135,6	**1.8**
LT007 Tauragė County	378,8	384,4	397,6	409,3	424,0	463,5	506,8	554,3	606,5	663,8	726,8	**1.8**
LT008 Telšiai County	927,1	941,2	974,4	1 002,8	1 039,0	1 135,5	1 241,4	1 357,5	1 484,9	1 624,7	1 778,3	**1.8**
LT009 Utena County	920,7	934,6	967,6	995,3	1 030,9	1 125,6	1 229,7	1 343,9	1 469,5	1 607,5	1 759,3	**1.8**
LT00A Vilnius County	8 690,0	8 885,7	9 260,9	9 601,9	10 062,1	11 320,3	12 750,0	14 376,3	16 227,7	18 337,5	20743.7	**2.5**

4.1.3 Trade and Commodity Flows

The key to the success of Rail Baltica will be its ability to capture a significant percentage of the international trade between the Baltic States and the surrounding countries particularly that percentage of the overall trade moving in a north/south direction. Table 9 below shows the overall trade between these countries in 2008. It should be noted that the figure quoted for trade between Russia and Germany is a total figure much of which is carried in an east/west direction and therefore of little interest to Rail Baltica. The trade between Russia and Germany that is of interest is that to the St Petersburg region however that split is not available.

The major commodity flows (greater than 300,000 tonnes) have been examined and are listed in Table 9 - Commodity Flows below:

Table 9 - Commodity Flows

Origin - Destination	**Commodity**	**Thousands metric tons (2008)**
Finland - Germany	Paper	2 549
Latvia – Finland	Wood Products	1 257
Finland – Poland	Mineral Fuels and Oils	1 149
Finland – Germany	Wood Products	1 084
Lithuania – Latvia	Mineral Fuels and Oils	825
Lithuania – Estonia	Mineral Fuels and Oils	599
Lithuania – Finland	Wood Products	411
Finland – Poland	Paper	404
Germany – Finland	Iron and Steel	404
Finland – Germany	Mineral Fuels and Oils	347
Latvia – Germany	Wood products	325
Poland - Lithuania	Food	305

A conservative approach was taken in forecasting future freight demand. In fact, since the preparation of the freight model, a number of factors, some of which were expected, have all enhanced the case about rail freight's prospects given the right infrastructure and market conditions:

1) Continuing rise in world fuel prices.
2) Competition – which is starting to evolve in the Baltic States
3) Container market is growing again
4) EU Policy is favouring a move to more sustainable transport, as referenced in the EC White Paper "Roadmap to a Single European Transport Area"

Year 2008		**TOTAL FIGURES**											
		Imports, M, EUR											
Exports, M, EUR	Country	Finland	Estonia	Latvia	Lithuania	Poland	Germany	Russia	Austria	Hungary	Czech Rep.	Ukraine	Belarus
	Finland		1 438	471	442	2 115	6 560	7 618	420	352	351	628	129
	Estonia	1 380		762	613	**160**	429	880	38	17	46	141	54
	Latvia	195	885		1053	**236**	510	629	27	20	40	92	139
	Lithuania	220	918	1 766		**929**	1 151	2 582	48	53	116	523	723
	Poland	1 074	**497**	**769**	**2 112**								
	Germany	8 787	1 456	1 397	2 505			32 212					
	Russia	10 174	832	1 140	6 330		37 087						
	Austria	562	85	183	186								
	Hungary	383	71	124	175								
	Czech Rep.	629	136	161	315								
	Ukraine	65	117	100	295								
	Belarus	157	318	356	361								

4.2 Analysis of Supply of transport Services

This section of the report contains a summary of the overall analysis of the supply of transport services in the three Baltic States. The full version of the analysis is given in Appendix B. In the subsequent paragraphs a brief description is given for each mode of transport in each country. A system of quality, service and pricing metrics has then been used to offer a comparison between the various modes.

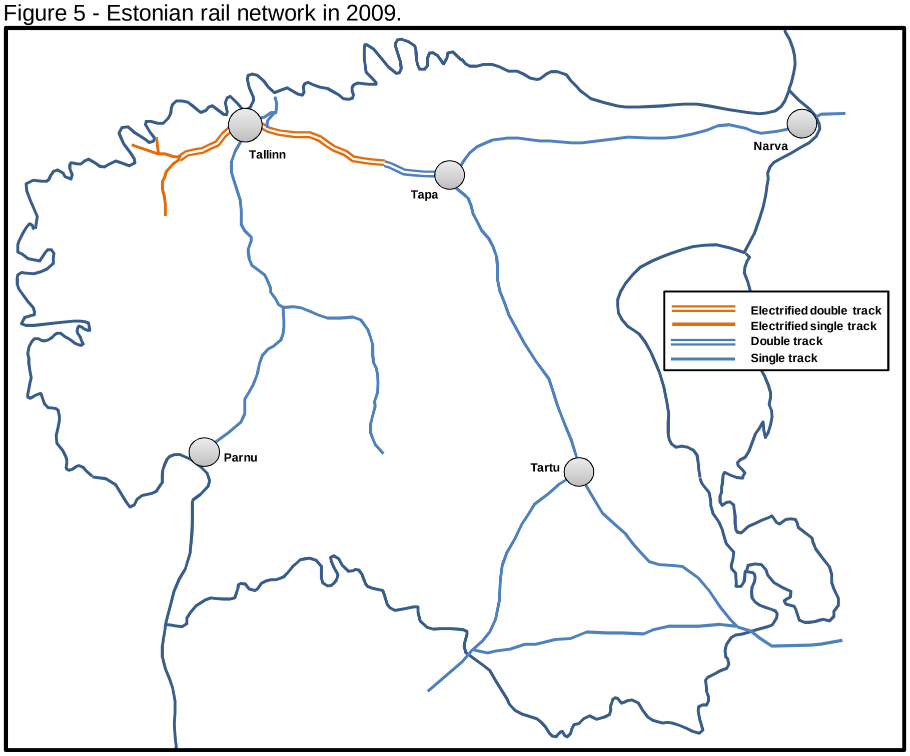
4.2.1 Description of Available Services

ESTONIA

Rail Network - The Estonian railway network is principally a single track network linking the capital city, Tallinn, with the other major towns of Narva, Tartu, Parnu and Viljandi. Additional sections of network link Tartu to the border of Latvia and the Russian Federation, with a further section of track linking up these two borders. It should be noted, however, that in 2009 there were no international rail services across the Latvian Border. In the vicinity of Tallinn the network is double-tracked and electrified.

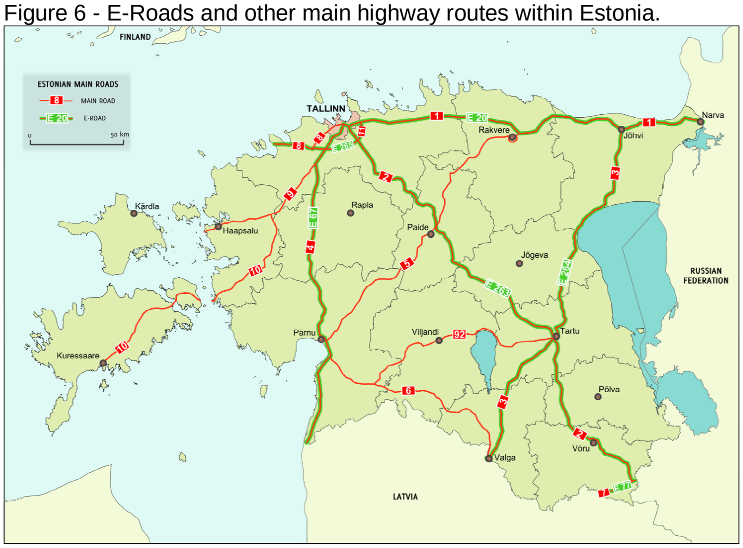
Although there are rail services on the key corridors from Tallinn to Parnu and Tallinn to Tartu these are infrequent and suffer from slow average journey speeds, reducing the competitiveness of rail compared to coach and car. The state of the rolling stock can at best be described as satisfactory but does vary significantly depending upon the route. Some routes operate different classes of travel allowing passengers to choose their desired quality. In overall terms punctuality and safety are good.

Figure 5 - Estonian rail network in 2009.



Road Network - Estonia has a number of E-Roads linking cities with neighbouring countries. Of particular interest to the study are the E67 linking Tallinn with Parnu and the Latvian border, the E263 linking Tallinn with Valga on the Latvian border via Tartu. Other key routes include the E20 east-west route from Tallinn through to Narva on the border of the Russian Federation. In general, the quality of the roads can be considered good. The busiest highways (for example Tallinn-Tartu) are considered to be over capacity and for this reason a little unsafe. Some of the busiest highways have received criticism due to the low number of driving lanes and what are arguably low speed limits compared to elsewhere in Europe.

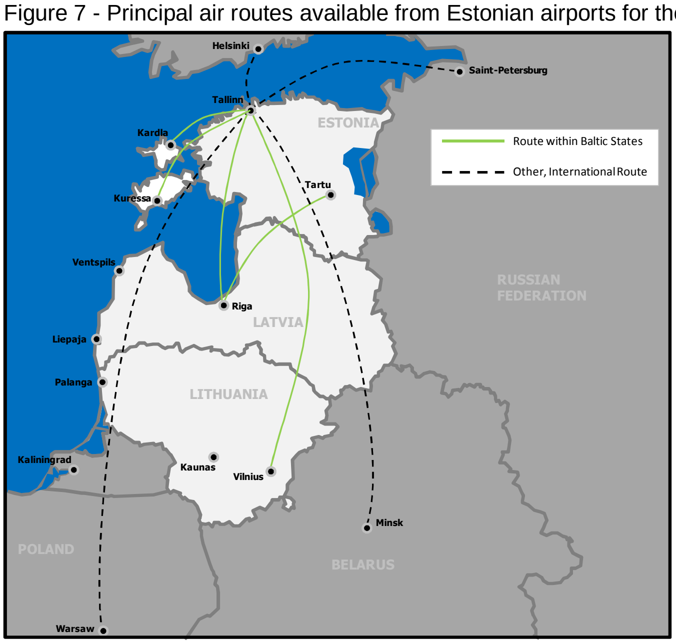
Figure 6 - E-Roads and other main highway routes within Estonia.



Coach Network - An extensive network of inter city coach services has developed in Estonia operated by modern coaches with high levels of customer service, particularly on the busier routes such as Tallin – Tartu and Tallinn – Parnu. Tallin is linked to Tartu at least every 30 minutes and approximately every hour to Parnu. All in all, the perceived quality of coach transport is different depending on the destinations but on average can be estimated as good.

Air Network - There are a number of airports in Estonia providing commercial civil aviation including international flights these include, Kardla airport, Kuressaare airport, Parnu airport, Lennart Meri Tallinn airport and Tartu-Ulenurme. Tallinn airport is the biggest of these facilities. During the first quarter of 2010 it handled a total of 304,700 passengers, which is 8% less than the same period the previous year. There are a number of commercial internal flights; however, these principally cater for travel from the mainland to the islands to the north of the Gulf of Riga, the two largest of which are Saaremaa and Hiiumaa.

Figure 7 - Principal air routes available from Estonian airports for the Baltic region.



Sea Traffic - Passenger transport by sea is at very low levels for origins and destinations relevant to Rail Baltica therefore this has not been taken into account in the passenger demand modelling. There are no north – south services in the corridor except very long distance services from Germany – Estonia which would be expected to be used for leisure purposes.

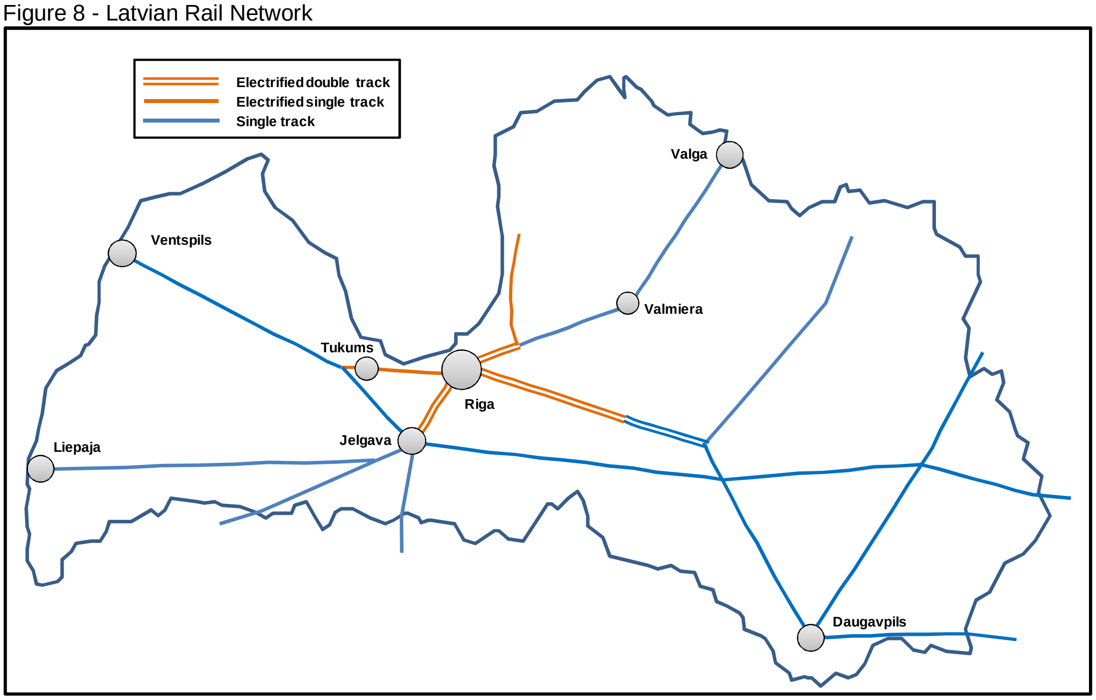
The main port in Estonia is the port of Tallinn which accounted for 82% of sea freight tonnage in 2009 (31.6 million tonnes). Other ports include Kunda, Miiduranna, Pärnu and Vene Balti, however, these ports do not have annual tonnages which would make them of relevance to this project.

LATVIA

Rail Network - The Latvian rail network is comprised of Russian gauge (1,520 mm) lines, with a small proportion of electrified track, principally around Riga with the longest section covering the 82km route from Riga to Aizkraukte. A smaller proportion of railway lines into Riga are also double-track. Figure 4.53 shows a map of the national railway network. There are regular services on the local rail network radiating from Riga; however services are less frequent on longer distance routes.

Generally speaking, the railway stations have not been renovated for a long period of time. Therefore they require investment both in the infrastructure by improving the functionality of the stations, as well as in design by, for example, simply renovating them. The same is true for the rolling stock, which have in many cases not been modernized since the 1990s. In general terms the punctuality of the railway is excellent with DZ/PV indicating a punctuality of 98%.

Figure 8 - Latvian Rail Network

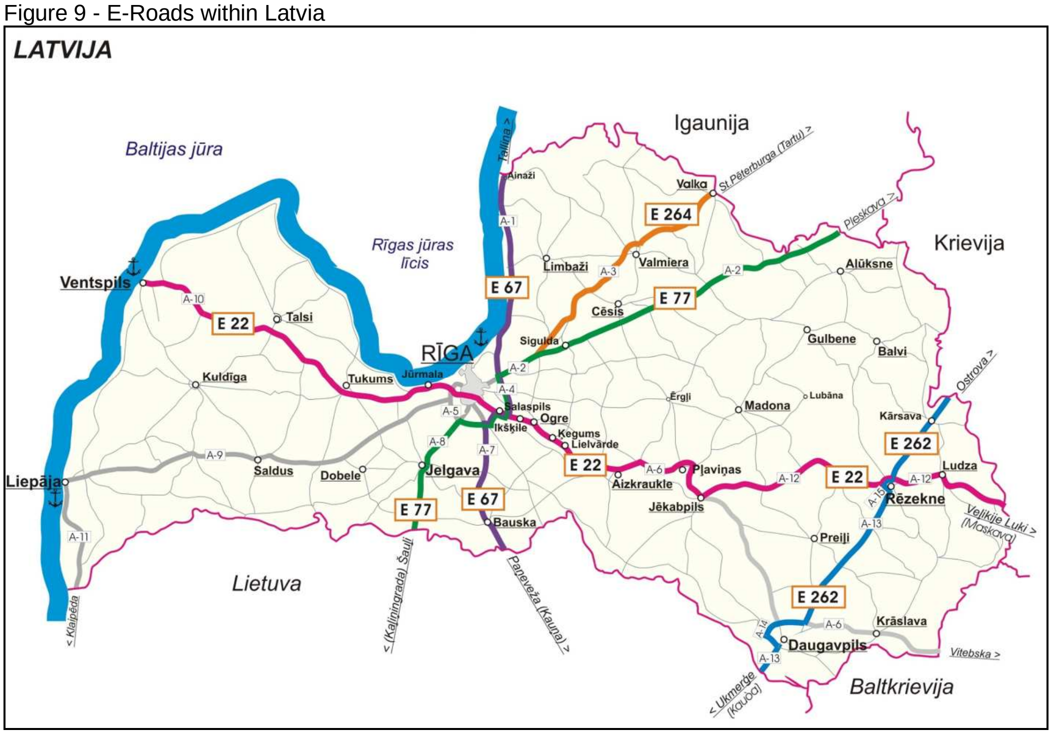


Road Network - Latvia has a number of E-Roads linking with Estonia and Lithuania. The E67 is the principal road route from Riga to Tallinn and the E264 is the most direct route from Riga to Tartu. The E77 also links Riga with Estonia; however, it crosses the border very close to the Estonian / Russian Federation border providing a route from Latvia to St Petersburg. The principal links between Riga and Lithuania are the E77 to Siauliai (and also on to Kaliningrad) and the E67 to Panevezys.

Figure 9 - E-Roads within Latvia below displays all the routes classified as E-Roads within Latvia together with the other main highway routes.

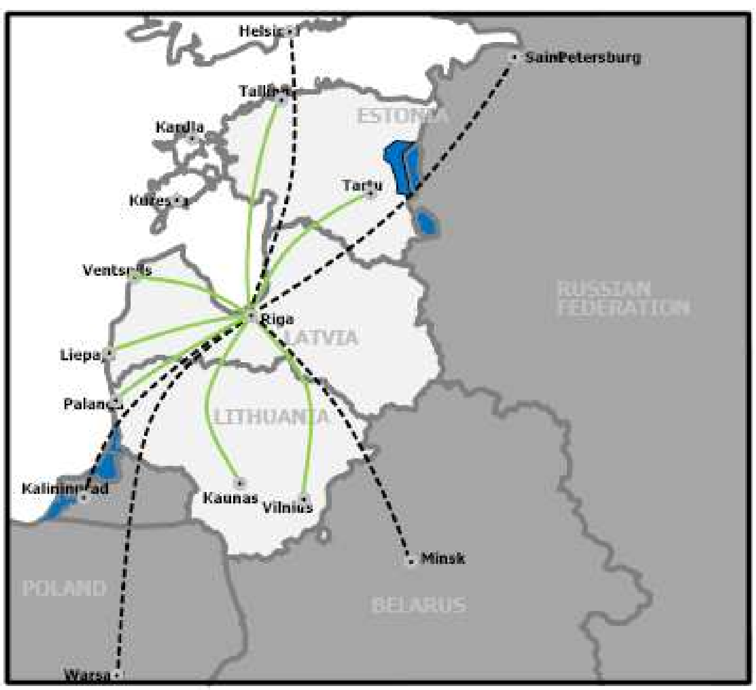
Coach Network - Similar to the other Baltic States an extensive inter-city coach network has been established in Latvia operated by a modern fleet of coaches and competes with existing rail services internal to Latvia. On the core route from Riga to Jelgava, there are high frequency mini bus services (approx 80 per day), providing strong competition to the rail service on this corridor.

Figure 9 - E-Roads within Latvia



Air Network - There are a number of civil airports in Latvia providing commercial aviation including international flights, these include Riga International Airport, Liepaja International Airport and Ventspils International Airport. There are domestic flights in Latvia between Riga and Ventspils and between Riga and Liepaja, but none that link the key routes described above. During the period from January - May 2010, Riga airport handled a total of 2.1 million passengers, which was 15.1% more than the same period the previous year.

Figure 10 - Principal air routes available from Latvian airports for the Baltic region.



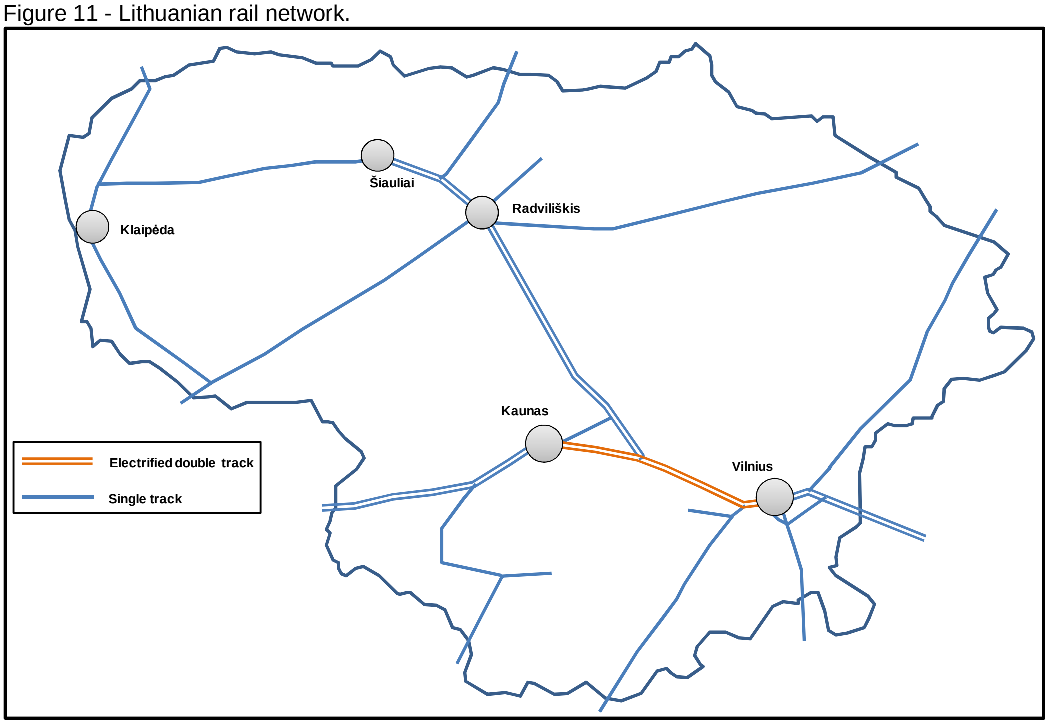
Sea Traffic - Sea transport of freight accounted for 62 million tonnes in 2009, a slight decrease on 2008. The majority of freight by sea is loaded at Riga or Ventspils. With a very large imbalance being present between cargoes loaded and unloaded (cargoes unloaded only represent 7% of the total).

Passenger transport by sea is at very low levels for origins and destinations relevant to Rail Baltica therefore this has not been taken into account in the passenger demand modelling. There are no regular north – south services in the corridor from Riga

LITHUANIA

Rail Network - The Lithuanian rail network is formed of Russian gauge (1,520mm) lines and is entirely operated by Lithuanian Railways, the National, State-owned railway company. 122 km of the route (about 7%) is electrified, with a significant proportion of the network linking Vilnius, Kaunas, Radviliskis and Siauliai comprised of double track. The punctuality of the network is good however the rolling stock would benefit from modernisation.

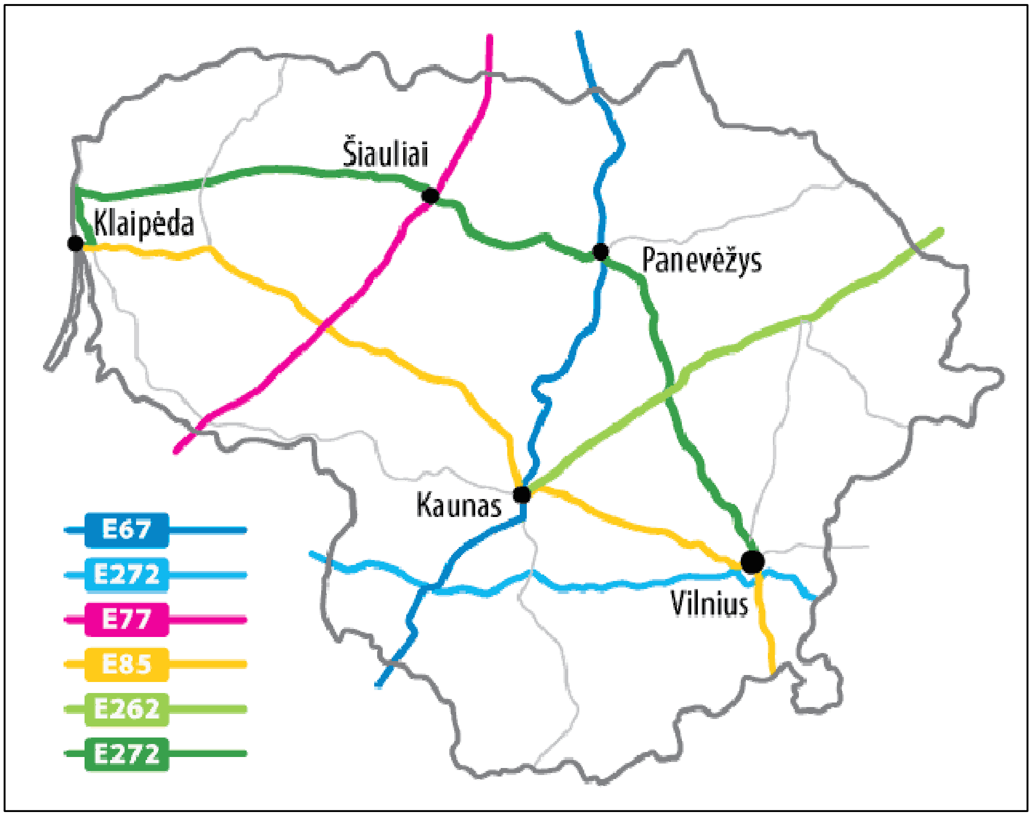
Figure 11 - Lithuanian rail network.



Road Network - Lithuania has two key E-Roads linking with Latvia: the E77 from Siauliai to Riga and the E67 from Panevezys to Riga. Figure12 - Road Network displays all the routes classified as E-Roads within Lithuania together with the other main highway routes.

Coach Network - Like Estonia and Latvia there is an extensive intercity coach network in Lithuania competing with existing rail services

Figure12 - Road Network



Air Network - There are four international airports in Lithuania at: Vilnius, Kaunas, Palanga and Siauliai. Vilnius is the largest of these in terms of air passenger traffic, handling 1.3 million passengers in 2009. Over the first seven months of 2010, Lithuanian airports served 1.3 million passengers, an increase of 22.6 percent year-on-year.

Figure 13 - Principal air routes available from Lithuanian airports for the Baltic region.

Sea Traffic - There are two major ports in Lithuania – Klaipeda and Butinge. Klaipeda accounted for 77% of freight tonnage in 2009 or 28 million tonnes. The vast majority of freight handled at Butinge is liquid bulk from Russia (95% in 2008), therefore this port has not been analysed in further detail.

Passenger transport by sea is at very low levels for origins and destinations relevant to Rail Baltica therefore this has not been taken into account in the passenger demand modelling.

4.2.2 Comparison of Transport Services

A number of metrics have been established to enable the existing supply of transport services for the various modes to be scored in relation to quality, service and price, thereby providing a simple framework for comparing existing transport service provision on the corridor. The assessment has been quantitative where possible, but each metric has been related to a five point scoring system to permit comparison between modes and journeys and for ease of presentation in the summary tables. The scoring system is shown in Table 10 below.

Table 10 - Scoring system

Excellent	5
Good	4
Fair	3
Poor	2
Very Poor	1

The following tables show the comparisons for:

- International passenger movements
- Internal passenger movements
- International/Internal Freight Movements

Table 11 - International passengers movements

	Rail							Road (car)							Road (coach)							Air							Volume (passengers per day) one-way
	Quality		Service					Quality		Service					Quality		Service					Quality		Service					
	Comfort	Facilities	Freq	Reliability	Speed	Pricing	Mode Share	Comfort	Facilities	Freq	Reliability	Speed	Pricing	Mode Share	Comfort	Facilities	Freq	Reliability	Speed	Pricing	Mode Share	Comfort	Facilities	Freq	Reliability	Speed	Pricing	Mode Share	
E S T O N I A																													
Tallinn-Riga	-	-	-	-	-	-	-	3	3	5		2	3	63%	3	3	4		2	4	16%	4	4	3	3	4	1	21%	1,001
Tallinn – Kaunas	-	-	-	-	-	-	-	3	3	5		2	3	86%	3	3	3		1	3	14%	-	-	-	-	-	-	-	28
Tallinn – Vilnius	-	-	-	-	-	-	-	3	3	5		2	3	43%	-	-	-	-	-	-	11%	4	4	2	3	4	1	47%	160
Tallinn - Warsaw	-	-	-	-	-	-	-	2	2	5		2	3	19%	-	-	-	-	-	-	2%	-	-	-	-	-	-	79%	68
L A T V I A																													
Riga-Tallinn	-	-	-	-	-	-	-	3	3	5		2	3	63%	3	3	4		2	4	16%	4	4	3	3	4	1	21%	1,001
Riga-Vilnius	-	-	-	-	-	-	-	2	2	5		3	3	40%	3	3	3		2	3	25%	4	4	3	3	4	1	35%	587
Riga-Kaunas	-	-	-	-	-	-	-	2	2	5		2	3	61%	3	3	2		1	3	25%	4	4	2	3	3	1	14%	232
Riga - Warsaw	-	-	-	-	-	-	-	2	2	5		2	3	27%	3	3	1		1	3	4%	4	4	2	3	4	1	69%	69
L I T H U A N I A																													
Vilnius-Riga	-	-	-	-	-	-	-	2	2	5		3	3	40%	3	3	3		2	3	25%	4	4	3	3	4	1	35%	587
Vilnius-Warsaw	3	3	1	1	1	3	5%	2	2	5		2	3	24%	3	3	1		2	3	25%	4	4	2	3	4	1	45%	135
Vilnius - Tallinn	-	-	-	-	-	-	-	3	3	5		2	3	43%	-	-	-	-	-	-	11%	4	4	2	3	4	1	47%	160
Kaunas-Riga	-	-	-	-	-	-	-	2	2	5		2	3	61%	3	3	2		2	3	25%	4	4	2	3	3	1	14%	232
Kaunas-Warsaw	3	3	1	1	1	3	2%	2		5		2	3	89%	3	3	1		2	3	8%	4	4	2	3	4	1	0%	197
Kaunas - Tallinn	-	-	-	-	-	-	-	3		5		2	3	86%	3	3	3		1	3	14%	-	-	-	-	-	-	-	28

Excellent	5	Good	4	Fair	3	Poor	2	Very Poor	1

Note: The Passenger volumes between Vilnius – Warsaw and Kaunas – Warsaw give in the Table are average daily one-way volumes. The numbers have been calculated from data obtained from Lithuanian National Statistics Database (http://www.stat.gov.lt/en)

Table 12 - Internal passenger movements

	Rail					Road (car)					Road (coach)					Air					
	Service					Service					Service					Service					
	Quality	Freq	Speed	Pricing	Mode Share	Quality	Freq	Speed	Pricing	Mode Share (%)	Quality	Freq	Speed	Pricing	Mode Share (%)	Quality	Freq	Speed	Pricing	Mode Share (%)	Total Volume
E S T O N I A																					
Tallinn-Tartu	3	2	2	4	5	3	5	2	3	72	4	4	2	3	23	-	-	-	-	-	4,846
Tallinn-Parnu	3	1	1	4	2	3	5	2	3	79	4	3	1	3	18	-	-	-	-	-	3,589
L A T V I A																					
Riga-Jelgava	3	4	1	4	19	3	5	2	3	69	3	4	1	4	11	-	-	-	-	-	10,462
Riga-Daugavpils	3	1	2	4	11	3	5	2	3	65	3	4	2	4	24	-	-	-	-	-	6,760
Riga-Tukums	3	3	1	4	16	3	5	2	3	74	3	3	1	4	9	-	-	-	-	-	3,833
Riga - Valmeira	3	1	1	4	2	3	5	2	3	79	3	3	1	4	19	-	-	-	-	-	3,697
L I T H U A N I A																					
Kaunas – Vilnius	3	3	2	4	13	4	5	2	3	73	3	4	2	3	14	-	-	-	-	-	20,087
Kaunas - Šiauliai	3	1	2	4	3	3	5	2	3	81	3	3	1	3	16	-	-	-	-	-	3,626

Excellent	5	Good	4	Fair	3	Poor	2	Very Poor	1

Table 13 - International/Internal Freight Movements

			RAIL			ROAD			SEA			Current Modal Split		
From	*To*	*Type*	*Quality*	*Service*	*Pricing*	*Quality*	*Service*	*Pricing*	*Quality*	*Service*	*Pricing*	*Rail*	*Road*	*Sea*
Finland	Germany		No Current Service			3 4	2 2	1	5	3 3	4	0%	1%	99%
Germany	Finland		No Current Service			As above		As above	5	3 3	4	0%	1%	99%
Germany	St Petersburg		No Current Service			4 1	2 1	2	4	3	5	0%	0%	100%
St Petersburg	Germany		No Current Service			As above		As above	4	3	5	0%	0%	100%
Latvia	Germany		No Current Service			4	4 2	3	4	4 4	5 5	0%	6%	94%
Lithuania (N)	Lithuania	Bulk non-bulk	5 2	5 2	4 3	5	5	5	No Service			10%	90%	0%
Latvia	Finland		No Current Service			3 4		3	4	3	3	0%	2%	98%
Estonia (N)	Estonia	Bulk non-bulk	5 2	5 2	5	4	4 5	4	No Service			11%	89%	0%
Lithuania	Germany		No Current Service			4	4	3	4	4	4	0%	40%	60%
Estonia (S)	Estonia		As Estonia (N)			4	4	4	No Service			13%	87%	0%
Germany	Lithuania		No Current Service			4	4 3	3	4	3 4	4	0%	34%	66%
Poland	St Petersburg		No Current Service			4 1	4 1	3	4	4	4	0%	100%	0%
Germany	Latvia		No Current Service			4	4 3	3	4	4 4	4	0%	24%	76%
Lithuania	Poland	Bulk non-bulk	2	5	4 3	4	3	3	4	3	4	41%	44%	16%
Latvia (N)	Latvia	Bulk non-bulk	5 2	5 2	4 4	4	4	5	No Service			1%	99%	0%
Estonia	Germany		No Current Service			4	2	2	4	4	4	0%	12%	88%
Lithuania	St Petersburg		No Current Service			4 1	4 5	4	4	1 4	3	0%	97%	3%
Lithuania (S)	Lithuania		As Lithuania (N)									1%	99%	0%
Lithuania	Latvia	Bulk non-bulk	5 2	5 2	4 3	4	4	3	2			57%	32%	11%

Excellent	5
Good	4
Fair	3
Poor	2
Very Poor	1

4.2.3 Summary

In terms of rail throughout the Baltics the international passenger service is poor and whilst there are a number of key internal routes served the services are generally perceived as being infrequent and slow. The services however are relatively cheap and do offer reasonable quality. For freight there is a developed east/west network but not a competitive north/south one.

The lack of a passenger rail service, combined with a comprehensive road network, has led to the development of a reasonable quality coach network offering both internal and international services which is very popular particularly for the shorter distances. For longer distances air becomes more popular even though its cost is significantly higher.

For north/south freight movement road and sea are the main options.

4.3 Existing Demand

Gaining an understanding of the existing transport demand in the Rail Baltica corridor is the first step in the forecasting process. The Rail Baltica service can be expected to compete on the corridor with existing rail services and other modes of transport e.g. by air, by road and by sea. This section of the report discusses the existing level of demand in the Rail Baltica corridor, for both passengers and freight, for various existing modes and summarises the total volume of passenger trips and freight tonnages between key centres which are potentially in scope of the new rail service. The existing level of trips on the corridor forms the starting point for forecasting future overall corridor demand and subsequent assessment of transfer to the potential Rail Baltica Rail service, which is discussed in Section 4 of this report.

4.3.1 Passenger Demand Data Sources

The sections below discuss the sources which have used to derive existing levels of demand on the corridor for each of the main existing passenger transport modes. The report then summarises by each of the Baltic States the existing volume on the corridor for key movements within each of the Baltic States and then for key International cross border movements.

In summary there is more available data relating to international cross border movements by the various alternative modes of transport than for movements internal to countries. For International cross border movements this data has generally been used as the basis for our assessment of existing demand. For movements internal to countries we have synthesised existing demand for key origin – destination pairs by developing a gravity model which we have calibrated where possible against the available data for internal movements. The process adopted for synthesising existing demand is described in Section 4 of this report, with the sections below referencing when this method has been adopted to calculate the existing demand.

Table 14 - Summarises the rail data sources for Estonia, Latvia and Lithuania.

Source	Function
E S T O N I A	
Number of goods and passenger trains between cities on Estonian rail network in 2009. Source: Statistics Estonia;	This data provides details of the average number of trains per day in 2009 on the eastern lines from Tallin (between Tallinn and Tapa, Tapa and Tartu, Tapa and Narva) and on the southern lines from Tallinn to Parnu and Viljandi. Number of trains to Narva on Russian border used to estimate demand from Tallinn to St Petersburg
Passenger traffic on railways by year and month (total volumes and passenger kms). Presented for 2009 and 2010 for whole country. Source: Statistics Estonia;	Provides total passenger volumes for Estonia, but does not include any additional detail (e.g. line section or origin and destination breakdown).
Boarding and alighting passenger for all rail stations in Estonia for 2009. Source: Estonian Technical Surveillance Authority	Has been used to assist in calibrating the synthetic demand model for movements internal to Estonia
Eesti Raudtee Annual Report, 2009	Rail freight current volumes and origins / destinations, information on current train weights
Eurostat	Used to cross-check Eesti Raudtee information for origins and destinations
L A T V I A	
Latvia Rail Brochure – total internal and international rail passengers in 2009. Source: LDZ (Latvia)	Provides total internal and international passengers but does not include any additional detail.

Rail passenger flows between cities in Latvia. Source: PV	Provides total passenger flows on rail sections defined, including: Riga – Tukums, Riga – Jelgava and Riga – Daugavpils for years from 2005 to 2009.
2009 passenger movements between stations on key rail lines relevant to Rail Baltica Source: LDZ (Latvia)	Has been used to assist in calibrating the synthetic demand model for movements internal to Latvia
2009 passenger flows on international lines from Latvia, including Riga to Moscow and Riga to St Petersburg. Source: LDZ (Latvia)	Has been used to calculate passenger flows for Riga to Moscow and Riga to St Petersburg. Conformation also provided that In the year 2009 there were no international trains from Latvia to Estonia and Lithuania.
Detailed rail freight volumes by origin / destination and border crossing station. Some commodity information provided for inter-baltic flows. Source: LDZ (Latvia)	Rail freight current volumes and origins / destinations,
L I T H U A N I A	
International passenger rail embarkation and disembarkation figures for Lithuania by country for 2004 – 2008. Source: Statistics Lithuania;	Provides detail to calculate international passenger totals travelling into and out of Lithuania, but not sufficient detail to distinguish between journey start / end in Lithuania.
Lithuanian railways passengers 2006 – 2010 split between local and international networks. Source: JSC "Lithuanian Railways"	International data included split by transit trip and trips terminating or originating in Lithuania. This provided an estimate of demand between Kaliningrad and Russia
Rail passengers flows on lines in Lithuania, 2005 – 2010; Source: JSC "Lithuanian Railways"	Provides passenger totals on rail links between cities including: Kaunas – Vilnius, and Vilnius – Daugavpils. Does not however provide details relating to boarding alighting at intermediary locations on line. The total flow between specific origins and destinations is therefore unclear, especially between Kaunas and Vilnius.
Detailed rail freight volumes by origin / destination and border crossing station. Commodity information provided for inter-baltic flows. Source: JSC "Lithuanian Railways"	Rail freight current volumes and origins / destinations,
I N T E R N A T I O N A L	
Annual national and international railway passenger transport by region of embarkation and region of disembarkation (NUTS 2, number of passengers, 2005 data). Source: Eurostat	Provides demand into the Baltic states from countries external to the region. Also provides indication of very low volumes of rail trips between the Baltic states and Poland.
Detailed rail freight volumes by origin / destination and border crossing station. Commodity information provided for inter-baltic flows. Source: JSC "Lithuanian Railways"	Rail freight current volumes and origins / destinations for transit traffic.

Table 15 - Contains a summary of the data sources used for estimating car volumes.

Source	Function
E S T O N I A	
Plan of Estonian link traffic volumes (2009 AADT) on approaches to main cities.	Provides volume data to be used in synthesising internal Estonian origin / destination car flows.
L A T V I A	
Latvian Border road traffic counts (2005, 2009) – counts for around 20 highway routes, disaggregated by vehicle type.	Provides a calibration dataset for calculating international traffic volumes.
Plan of Latvian link traffic volumes (2009 AADT, including heavy vehicle volumes).	Provides volume data to be used in synthesising internal Latvian origin / destination car flows.

L I T H U A N I A	
Plan of Lithuanian link traffic volumes (2009 AADT, including heavy vehicle volumes). Source: Lithuanian Ministry of Transport and Communications	Provides volume data to be used in synthesising internal Lithuanian origin / destination car flows.
I N T E R N A T I O N A L	
2004 Via Baltica Road Side Interview Surveys at border crossing locations between Baltic States plus at Lithuanian / Polish Border.	Base source for cross border car movements, which has been calibrated to 2009 observed border crossing flows based on other data sets

Table 16 - Contains a summary of the data available for coach passenger volumes.

Source	Function
2004 Via Baltica Road Side Interview Surveys at border crossing locations between Baltic States plus at Lithuanian / Polish Border.	Base source for cross border bus movements, which has been calibrated to 2009 observed border crossing flows based on other data sets
Estonian Passenger transport by bus on scheduled domestic highway lines and scheduled international routes (2000-2009) Statistics Estonia.	Provides growth data as well as 2009 calibration total international passenger volume
Lithuanian bus passengers, international, national and regional by year to 2008 (passenger volumes, passenger km and vehicle kms). Statistics Lithuania.	Provides passenger growth data and average bus occupancy data.
Lithuanian Passenger traffic by buses by administrative territory, type of route (2004-2008) Statistics Lithuania.	Data split by International traffic routes and Long distance traffic routes which allowed estimate internal demand to be made and provided calibration point for international trips
Various timetables providing details of cross border Inter City coach services and key services internal to countries Source: Operator timetables	Has been used to provide a forecast of bus demand for key cross border and internal inter city coach services. Subsequently been used to assist in calibrating the synthetic demand model for movements within Baltic States and provide estimate of cross border coach volumes.

Table 17 - Contains a summary of the data sources used for estimating road freight volumes.

Source	Function
L I T H U A N I A	
2008 detailed origin and destination information for Lithuania: Provided by Lithuanian government	Inter-Lithuania volumes
I N T E R N A T I O N A L	
Eurostat loading and unloading information by NUTS3 region for Lithuania, Latvia and Estonia	Provides base volumes for the freight model for journeys to and from Lithuania, Latvia and Estonia except for inter-Lithuania journeys
Eurostat loading and unloading information by country for Germany, Poland, Finland, Italy, Austria, Ukraine, Belarus, Hungary, Czech Republic, Russia	Provides base volumes for transit journeys within the freight model
Individual country commodity data Source: Eurostat	Used to determine split of road freight into bulk and non bulk traffic
Eurostat vehicle km and tonne km information for road freight by commodity for Lithuania, Latvia, Estonia and Poland	Used to determine average lorry weight for bulk and non-bulk traffics

Table 18 - Contains a summary of the data available for air passenger volumes.

Source	Function
E S T O N I A	
Freight and passenger traffic through Tallinn airport by year for 2009. Source: Statistics Estonia.	Provides calibration data
Freight and passenger traffic through all Estonian airports by year for 2009. Source: Statistics Estonia.	Provides calibration data for total country demand
Air passenger totals to Helsinki, Vilnius, Riga and Warsaw from Tallinn airport 2005 – 2009. Source: Statistics Estonia	Provides volumes for specific movements in matrix
Total Passengers at Tallinn Airport 2000-2009 (both arriving and departing) Top 10 destinations served from Tallinn Airport 2009 (share of total passengers on scheduled flights) Source: www.tallinn-airport.ee/eng/associates/GeneralInfo/statisticsandsurveys	Provides basis for calculation of demand to specific locations from Tallinn airport
L A T V I A	
Passenger arrivals and departures from Riga airport by country. Statistics Latvia	Provides basis for calculation of demand from Riga airport to countries outside the Baltic region.
Riga airport passenger volumes to Tallinn, Vilnius, Kaunas, Helsinki, Warsaw and transfer passengers. Statistics Latvia	Provides demand from Riga to key cities in Baltic Region
L I T H U A N I A	
Lithuanian air passenger arrivals and departures for Vilnius, Kaunas, Siauliai and Palanga to 2008. Source: Statistics Lithuania.	Provides basis for calculation of demand from specific locations within Lithuania
Lithuanian air passenger totals for origin countries for 2000 and 2008. Source: Statistics Lithuania.	Provides basis for calculation of demand to specific locations from airports in Lithuania

Table 19 - Contains a summary of the data available for sea freight volumes.

Source	Function
Eurostat port information giving origin and destination tonnages for containers, ro ro, general cargo, liquid bulk and dry bulk for 2008	Provides base sea freight model volumes
Eurostat information on the weight of a maritime container for Lithuania, Latvia, Estonia and Poland	Used within the model to estimate average container weights

4.3.2 Existing Passenger Volumes

Passenger trip matrices have been developed for each mode based on the data sources described above. Where demand for a movements has been fully observed this data has been used to populate the demand matrices. Examples of situations where demand has been observed are for cross border car trips where demand was observed in 2004 RSI surveys undertaken for Via Baltica study; and air trips where annual passenger volumes for specific routes are available. For movements internal to countries observed data that gives the direct demand between origins and destinations has not been available. For these movements we have synthesised existing demand for key origin – destination pairs by developing a gravity model which we have calibrated where possible against the available count data and estimates of demand based on service capacities. The process adopted for synthesising existing demand is described in Section 4.4 of this report. The calculated existing volumes for key routes are described in the section below. The matrices have been colour coded to indicate whether demand has been derived from directly observed data sets or synthesised. The following colour code has been adopted.

Description	Colouring
Derived directly from observed data	(green)
Synthesised based on origin – destination socio-economic characteristics and calibrated to observed data where available	(orange)

Table 20 - Contains a summary of the estimated existing volumes for key internal movements in Estonia by mode.

		Rail	Road (Car)	Road (Coach)	Total
Tallinn – Tartu	Passengers per day	299	3,305	1,119	**4,724**
	% mode share	6%	70%	24%	**100%**
Tallinn – Parnu	Passengers per day	56	2,872	662	**3,589**
	% mode share	2%	80%	18%	**100%**

Table 21 - Contains a summary of the estimated existing volumes for key internal movements in Latvia by mode.

		Rail	Road (Car)	Road (Coach)	Total
Riga – Jelgava	Passengers per day	3,166	7,234	1,191	**11,592**
	% mode share	27%	62%	10%	**100%**
Riga – Daugavpils	Passengers per day	185	3,239	1,384	**4,808**
	% mode share	4%	67%	29%	**100%**
Riga – Tukums	Passengers per day	758	2,828	394	**3,980**
	% mode share	19%	71%	10%	**100%**
Riga Valmiera	Passengers per day	72	2,909	713	**3,694**
	% mode share	2%	79%	19%	**100%**

Table 22 - Contains a summary of the estimated existing volumes for key internal movements in Lithuania by mode.

		Rail	Road (Car)	Road (Coach)	Total
Kaunas – Vilnius	Passengers per day	2,740	14,586	2,784	**20,110**
	% mode share	14%	73%	14%	**100%**
Kaunas – Siauliai	Passengers per day	112	2,936	579	**3,626**
	% mode share	3%	81%	16%	**100%**
Kaunas – Paneyvezys	Passengers per day	0	3,308	718	**4,026**
	% mode share	0%	82%	18%	**100%**

The estimated existing volumes for key international routes are described in the section below. Table below contains a summary of the estimated existing volumes of international rail passengers.

Table 23 - Contains a summary of the estimated existing volumes for key internal movements in Lithuania by mode.

	Description	Passengers per day
E S T O N I A		
Tallinn – Riga	No international services run across the Estonian Latvian border	0
Tallinn – Kaunas	No international services run across the Estonian Latvian border	0
Tallinn – Vilnius	No international services run across the Estonian Latvian border	0
Tallinn – Warsaw	No international services run across the Estonian Latvian border	0
L A T V I A		
Riga – Tallinn	No international services run across the Latvian Estonian border	0
Riga – Vilnius	No international services run across the Latvian Lithuanian border	0
Riga – Kaunas	No international services run across the Latvian Lithuanian border	0
Riga – Warsaw	No international services run across the Latvian Lithuanian border	0
L I T H U A N I A		
Vilnius – Riga	No international services run across the Latvian Lithuanian border	0
Vilnius – Warsaw	Eurostat data indicated very low volumes of rail trips between Poland and Lithuania	14
Vilnius – Tallinn	No international services run across the Estonian Latvian border or the Latvian Lithuanian border	0
Kaunas – Riga	No international services run across the Latvian Lithuanian border	0
Kaunas - Warsaw	Eurostat data indicated very low volumes of rail trips between Poland and Lithuania	10
Kaunas - Tallinn	No international services run across the Estonian Latvian border or the Latvian Lithuanian border	0

The estimated existing volumes for key international routes are described in the section below. Table 24 - Estimated existing volumes of international rail passengers contains a summary of the estimated existing volumes of international rail passengers.

Table 24 - Estimated existing volumes of international rail passengers

	Description	Passengers per day
E S T O N I A		
Tallinn – Riga	No international services run across the Estonian Latvian Border	0
Tallinn – Kaunas	No international services run across the Estonian Latvian Border	0
Tallinn – Vilnius	No international services run across the Estonian Latvian Border	0
Tallinn – Warsaw	No international services run across the Estonian Latvian Border	0
L A T V I A		
Riga – Tallinn	No international services run across the Estonian Latvian Border	0
Riga – Vilnius	No international services run across the Estonian Lithuanian Border	0
Riga – Kaunas	No international services run across the Estonian Lithuanian Border	0
Riga – Warsaw	No international services run across the Estonian Lithuanian Border	0
L I T H U A N I A		
Vilnius – Riga	No international services run across the Latvian Lithuanian Border	0
Vilnius – Warsaw	Eurostat data indicated very low volumes of rail trips between Poland and Lithuania	14
Vilnius – Tallinn	No international services run across the Estonian Latvian Border	0
Kaunas – Riga	No international services run across the Latvian Lithuanian Border	0
Kaunas - Warsaw	Eurostat data indicated very low volumes of rail trips between Poland and Lithuania	10
Kaunas - Tallinn	No international services run across the Estonian Latvian Border	0

Table 25 - Contains a summary of the estimated existing volume of international passenger cars.

	Description	Vehicles AADT
E S T O N I A		
Tallinn – Riga	Calibrated from border crossing O-D surveys and counts.	1520
Tallinn – Kaunas	Calibrated from border crossing O-D surveys and counts.	60
Tallinn – Vilnius	Calibrated from border crossing O-D surveys and counts.	160
Tallinn - Warsaw	Calibrated from border crossing O-D surveys and counts.	30
L A T V I A		
Riga – Tallinn	Calibrated from border crossing O-D surveys and counts.	1520
Riga – Vilnius	Calibrated from border crossing O-D surveys and counts.	560
Riga – Kaunas	Calibrated from border crossing O-D surveys and counts.	340
Riga - Warsaw	Calibrated from border crossing O-D surveys and counts.	45
L I T H U A N I A		
Vilnius – Riga	Calibrated from border crossing O-D surveys and counts.	560
Vilnius – Warsaw	Calibrated from border crossing O-D surveys and counts.	80
Vilnius - Tallinn	Calibrated from border crossing O-D surveys and counts.	160
Kaunas – Riga	Calibrated from border crossing O-D surveys and counts.	340
Kaunas - Warsaw	Calibrated from border crossing O-D surveys and counts.	420
Kaunas - Tallinn	Calibrated from border crossing O-D surveys and counts.	60

Table 26 - Contains a summary of the estimated existing volume of international coach passengers.

	Description	Passengers per day
E S T O N I A		
Tallinn – Riga	Based on estimate derived from timetable information	320
Tallinn – Kaunas	Based on estimate derived from timetable information	8
Tallinn – Vilnius	Based on estimate derived from timetable information	40
Tallinn - Warsaw	Based on estimate derived from timetable information	2
L A T V I A		
Riga – Tallinn	Based on estimate derived from timetable information	320
Riga – Vilnius	Based on estimate derived from timetable information	300
Riga – Kaunas	Based on estimate derived from timetable information	120
Riga - Warsaw	Based on estimate derived from timetable information	6
L I T H U A N I A		
Vilnius – Riga	Based on estimate derived from timetable information	300
Vilnius – Warsaw	Based on estimate derived from timetable information	60
Vilnius – Tallinn	Based on estimate derived from timetable information	40
Kaunas – Riga	Based on estimate derived from timetable information	120
Kaunas - Warsaw	Based on estimate derived from timetable information	40
Kaunas - Tallinn	Based on estimate derived from timetable information	8

Table 27 - Contains a summary of the estimated existing volume of international air passengers.

	Description	Passengers per day
E S T O N I A		
Tallinn – Riga	From Tallinn Airport Statistics/ Riga Airport Statistics	430
Tallinn – Kaunas	From Tallinn Airport Statistics/ Lithuanian Airport Statistics	0
Tallinn – Vilnius	From Tallinn Airport Statistics/ Lithuanian Airport Statistics	220
Tallinn - Warsaw	From Tallinn Airport Statistics	100
L A T V I A		
Riga – Tallinn	From Tallinn Airport Statistics/ Riga Airport Statistics	430
Riga – Vilnius	From Riga Airport Statistics/ Lithuanian Airport Statistics	420
Riga – Kaunas	From Riga Airport Statistics/ Lithuanian Airport Statistics	70
Riga - Warsaw	From Riga Airport Statistics	100
L I T H U A N I A		
Vilnius – Riga	From Lithuanian Airport Statistics / Riga Airport Statistics	420
Vilnius – Warsaw	From Lithuanian Airport Statistics	120
Vilnius – Tallinn	From Lithuanian Airport Statistics / Tallinn Airport Statistics	220
Kaunas – Riga	From Lithuanian Airport Statistics / Riga Airport Statistics	70
Kaunas - Warsaw	From Lithuanian Airport Statistics	0
Kaunas - Tallinn	From Lithuanian Airport Statistics / Tallinn Airport Statistics	0

Table 28 - Contains a summary, by all modes, of international transport volumes for key international movements relating to the Rail Baltica scheme.

	Rail	Road (Car)	Road (Coach)	Air	Total
E S T O N I A					
Tallinn – Riga	0	1520	320	430	**1,650**
Tallinn – Kaunas	0	60	8	0	**128**
Tallinn – Vilnius	0	160	40	200	**400**
Tallinn - Warsaw	0	30	2	100	**142**
L A T V I A					
Riga – Tallinn	0	1520	320	430	**1,650**
Riga – Vilnius	0	560	300	420	**1,680**
Riga – Kaunas	0	340	120	70	**770**
Riga - Warsaw	0	45	6	100	**186**
L I T H U A N I A					
Vilnius – Riga	0	560	300	420	**1,680**
Vilnius – Warsaw	14	80	60	120	**254**
Vilnius – Tallinn	0	160	40	220	**480**
Kaunas – Riga	0	340	120	70	**770**
Kaunas - Warsaw	10	420	40	0	**350**
Kaunas - Tallinn	0	60	8	0	**88**

4.3.3 Existing Freight Demand

Destinations and Connectivity

Rail Baltica is designed to fill a gap on a North-South axis linking key destinations in the Baltic States of Estonia, Latvia and Lithuania into the European Union rail network in Poland. It is considered that to give the new railway the best chance of obtaining a positive business case the new route will be capable of carrying mixed traffic, including express passenger and a variety of freight trains.

The corridor will connect Tallinn, Riga or Jelgava, Kaunas and Warsaw. In terms of route option development this means in effect connecting Tallinn, Riga, Kaunas and Šeštokai, the existing connection into the Polish rail network on the Lithuania / Polish border. To maximise potential demand on the route it is important to consider how the route will serve/connect to other key cities, industrial areas, ports, etc. The main potential international destinations for freight via Rail Baltica are likely to be those shown on the map below. Analysis has been carried out using these as a starting point and eliminating origins / destinations where Rail Baltica either cannot provide competitive pricing or significant volumes which could use the line do not exist.

Figure 14 - Main potential international destinations for freight via Rail Baltica

Key Information Used in Determining the Number of Trains Required

The following key information has been used in determining the number of freight trains likely to run on Rail Baltica.

- What is the current situation
- Who will use the new line
- What is the anticipated growth in freight transport
- Potential journey times versus other modes
- Potential journey cost versus other modes
- Reliability of service

Likely Train or Logistics Companies that might use Rail Baltica

There are various rail freight operators or bigger logistics companies that might be interested in operating services along the Rail Baltica corridor and they include;

- Freight operator DB Schenker whose rail Division expects to spend €410m on fleet modernisation this year to support a large expansion plan throughout Europe
- Captrain Deutschland, owned by SNCF, is actively looking to expand across Europe.
- DSV Transport AS, DSV is a global supplier of transport and logistics services. Following the acquisition of ABX Logistics, in 2008, it has become one of the leading transport and logistics companies in Europe.
- Unieveem Eesti OÜ is an Estonian based logistics company.
- Contimer OÜ use various transport methods - maritime, road, rail - to satisfy the specific needs of each of our customers, resulting in improved efficiency costs and on time delivery through one central point of control.
- LDz Cargo Loģistika Ltd. works in close collaboration with LDz Cargo Ltd., ports and terminals, to provide transport services for clients.
- Baltijas Ekspresis operates freight services and were the first licensed private sector rail freight company in Latvia.

- Lithuanian Railways (AB Lietuvos Geležinkeliai) moved 19,3 million tones of Oil products – (45,2 per cent of the total freight), and 9 million tonnes of fertilizers in 2009 together making up 66% of all the traffic. But container traffic is becoming the main trend in developing freight services due to its versatility. The Viking project of combined traffic has been running successfully and a total of 39.5 thousand containers (TEU) were carried on this award winning container train in 2009.
- Estonian Railways Ltd. (AS Eesti Raudtee) founded two new affiliates: AS EVR Infra and AS EVR Cargo and the latter provides rail freight services.
- CTL Logistics S.A. is the largest privately-owned logistics company in Poland operating in the area of rail transportation.
- PKP is the national railway company in Poland, both providing transport services and managing rail infrastructure.
- Rail Polska Sp. operates rail freight business in Poland.
- Freightliner Poland, mainly run bulk trains but operate container trains in the UK.
- TXCARGOSTAR is a German operator specialising in intermodal transport

Market Segments to Consider – Commodity Types

Rail traditionally offers benefits over road when there is a flow of a large volume between two fixed points over a reasonably long distance where the network is available. Hence the reason why the movement of coal, metals, petrochemicals and aggregates have been suited to rail. However one of the fastest growing markets in rail freight has been the movement of deep-sea containers bringing imports often from the Far East, and the intermodal movements of boxes and swapbodies. This latter sector is interesting in that several logistics integrators are combining goods from several companies on to trains.

We have examined the potential north – south rail flows using trade data and consulted with various companies and organisations. It is our view that the following represents the main flows of over 300,000 tonnes per annum

Table 29 - Main flows of over 300,000 tonnes per annum

O-D	Commodity	Tonnes
Finland - Germany	Paper	2,549,000
Latvia - Finland	Wood Products	1,257,000
Finland – Poland	Mineral Fuels & Oils	1,149,000
Finland – Germany	Wood Products	1,094,000
Lithuania - Latvia	Mineral Fuels & Oils	825,000
Lithuania - Estonia	Mineral Fuels & Oils	599,000
Lithuania - Finland	Wood Products	411,000
Finland - Poland	Paper	404,000
Germany - Finland	Iron & Steel	404,000
Finland - Germany	Mineral Fuels & Oils	347,000
Latvia - Germany	Wood Products	325,000
Poland - Lithuania	Food	305,000

(Tonnages have been estimated using trade data from the Finnish value per tonne for traffics which do not travel to/from Finland)

Those highlighted in orange could be containerised in future years. Increasing containerisation is a global trend and this will be input within the model when forecasting the structure of future demand.

In addition to the statistics gained, 3 trade associations have provided opinions of what type of traffics they see using the line. These were:

1. Timber and paper products – unanimous agreement
2. Goods currently carried by truck e.g. food – unanimous agreement
3. Trailers – unanimous agreement
4. Containers – one thought yes, one thought no, one unsure
5. Oil and Petrochemicals – mentioned by 1
6. Fertilizers – mentioned by 1

Based upon the available information it is thought Rail Baltica will most likely carry timber and paper products, food, containers and potentially some other products in lower volumes such as fertilizers, fuel and chemical products and manufactured goods.

Rail Baltica in being a new mixed railway is likely to attract a wide variety of commodities over time providing it is set up correctly. The range of products that could be handled and the type of wagons that would probably be used are listed in this section and include:

Current Inter Baltic Traffic

Some of the current rail traffic between Baltic States may shift due to decreased journey times on the new route. Traffic that is more likely to switch are time sensitive goods for example intermodal and post/parcels. This proportion is likely to be small for the reasons that most existing rail users are content with their current service and perhaps have their own dedicated rolling stock which they are unlikely to change in the short term. If companies have not been happy with the rail service they probably have already switched to road and it will be difficult to attract them back to rail.

Automotive Products (cartics and cargo wagons)

With production of certain car models being centred in just one or two factories across Europe there is a significant number of movements of components, spare parts and finished cars to and from Central Europe. Much of this goes by road but it is believed there may be scope for more of this type of traffic by rail through from the production heartlands to the regional markets.

Agricultural Products (intermodal flats or cargo wagons or tanks or grainflow wagons)

There is a considerable volume of agricultural products using coastal shipping and more could move by rail. The movement of fertiliser is a well established trade by rail for example 9 million tonnes moved in 2009 in Lithuania but it is a low margin product and fluctuates with seasonal requirements. The new line could provide not only a wider potential catchment for fertiliser travels south but an enhanced ability to bring seasonal agricultural products that are grown in Central and Southern Europe such as fruit and vegetables north to the Baltic States. There are modern grain wagons running on several European railways and there could be potential for using these on the line. Apart from grain for human consumption there could be business in the movement of animal feedstuff.

Biomass (closed top hoppers)

Biomass is an emerging market and is unknown in terms of volume. As various sources can be used including wood chips, nut husks and various bi-products from food processing there is a potential rail market. It is understood that there is a need to use closed top wagons to keep the product dry. It is likely that this product will replace a proportion of the current coal movements to coal fired power stations. But as it is more bulky than mineral coal it may require more trains.

Construction Materials / Aggregates (hoppers)

There is a definitely potential for the aggregate market and many demolition projects generate large volumes of material to take away and then in the construction phase there are significant volumes of aggregates, cement, steel members and other material required. Assuming the building of the new line goes ahead there will be significant volumes of construction material required for this alone. When building the line materials such as aggregates and metals will be required. This should provide new work for existing business and much of this material could be brought to site by rail. In addition the building of a new line can create what is known as the “sparks” effect – where new facilities such as logistics parks and other businesses set up next the new line due to increased connectivity provided. For example in the UK when the East Coast Mainline was electrified and journey times improved, people moved to live near to the new line and all the major towns on the route grew, house prices doubled and new businesses came in along the route. The new railway represents a completely new facility to Latvia, Lithuania and Estonia (a through connection to Western Europe and a much quicker connection north-south between the 3 countries) therefore there is likely to be some level of induced demand.

Container Traffic (Deep-Sea) (intermodal flats)

There is a continuing growth in the use of Deep Sea Maritime Containers and as more products are imported/exported by this method there is an opportunity to create a network of terminals and services by rail feeding to/from the container ports. There is a need to understand the effect of Deep Sea movements and the interaction between intermodal and feeder vessels and how will this affect traffic migration. Increasing the number of transhipments increases the total costs of the whole operation. Coastal feeders do take boxes to Baltic ports where road vehicles often complete the final leg. But there could be potential for some urgent boxes to be transhipped at ports such as Rotterdam for onward movement to Germany, Poland and possibly some Baltic countries.

European Intermodal (intermodal flats)

There is strong agreement that this market is evolving and if sensibly nurtured will deliver good volumes in the future for the rail sector. However reliability is essential, seven day operation is important, quick journey times are valuable to at least match road and the availability of contingency plans should incidents happen is critical, such as the provision of alternative routes. Although this sector is being led by the integrators there are good opportunities for major retailers and manufacturers as well.

Express Parcels (swapbodies and cargo wagons)

The postal and parcel companies traditionally used rail but due to the need for urgent deliveries much of this market either goes by direct lorry or air freight. However rail could offer an express service for mail and parcels between key airports and European cities. Air France and DHL both have business models exploring the opportunity to link a European network of express freight by rail. This could replace some short-haul flights in Europe which would be better for the environment.

Food & Drink Production and Retailing (intermodal flats / swapbodies / cargo wagons)

There is a significant volume of freight movements associated with the food and drinks industry. This might include the imports of fresh produce from mainly Mediterranaen countries of vegetables and fruits and some of this requires keeping at chilled or frozen temperatures. The potential for rail, could be significant and could supply National Distribution Centres of food retailers in the Baltic Countries. Produce is likely to come in cargo vans or chilled/freezer boxes.

Groupage (cargo wagons / swapbodies)

It is believed that an addressable market for rail is groupage – particularly less than full train loads that aren't time sensitive. This represents a significant market that has only been touched upon in previous works. There are various Pallet Networks which tend to have freight exchanges building up considerable volumes that then are moved on the main roads/motorways at night when there would be capacity on the rail network. A rail network of trunking between key European cities should be considered. For regular full-load and part-load services, intermodal services such as DHLs offers an alternative to road transport. Since fuel is less of a determining factor in the cost price, the price range for intermodal transportation is more stable. This means intermodal transportation isn't just an environmental alternative, but also an economical one, to pure road haulage.

Manufactured Goods (intermodal flats / cargo wagons / swapbodies)

There is potential for rail services to move manufactured and part processed goods. These either go for further manufacturing or to distribution centres for onward movement to retailers. Products can come in a range of sizes and hence could either go in containers, swapbodies of conventional wagons.

Metals (flats/steeliners)

This is another traditional market for rail that could have some flows on the new line. There are various different types of steel, from fairly cheap grades for the mass market to specialist grades of steel. If less metal production happens in the Baltic states then potentially more flows will either arrive at ports for example imports from the Far East whilst potentially other metals could be exported to other European countries.

Minerals and Ore (hoppers)

It is important to not forget the movement of coal and iron ore which are still some of the biggest markets for rail and likely to continue to be. Although many coal movements are associated with the power generators there are still some industrial users. But the main flows of coal and minerals are still likely to remain on the east-west axis to/from Russia and hence are less likely to need large numbers of freight train paths on Rail Baltica.

Oil and Petrochemical Industry (tankers)

The movement of oil and chemicals between refineries and terminals where there is insufficient volume to justify a pipeline is an addressable market for rail. Oil is already the largest commodity moved by Lithuanian Railways and the introduction of a new railway line will certainly not reduce that but may in fact stimulate new opportunities in other countries. Similarly the movement of chemicals from production plants are suited to the use of rail. There could be significant interest in running rail tankers of chemicals from Central Europe through to the Baltic States providing direct links can be made from Rail Baltica as this avoids the need to change wheels on the tank wagons. One of the best known private rail freight operators in Europe, Rail4chem, was set up in 2000 under the initiative of German chemical firm BASF to have better control over the chemical supply chain by rail. This company was successful in expanding the market and has more recently been bought by Veolia Cargo which has been incorporated into Captrain Deutschland, owned by SNCF.

Hazardous Goods

Rail Baltica would be suitable to carry hazardous goods in its various forms, liquid or dry bulk and in tanks, tanktainers or packaged goods in containers or in cargo wagons. For hazardous goods moving between Central Europe and the Baltic States the very fact that the train may not have to change gauge or be transhipped will be a very positive move in reducing the chance of a serious Health & Safety incident. This alone could attract new tonnage to the line.

Waste (hoppers)

There is an emerging understanding of recycling and how society wants to treat waste in the future. Instead of flows going to a convenient landfill site there are several differentiated flows including recyclates, reformed waste in combustible briquettes, specialist higher value waste and possibly the remainder destined to “waste to energy” plants. These flows could be suitable to the rail market in the future.

Wood & Forest Products (flats / cargo wagons)

Wood and Forest products such as timber, paper and pulp are potentially a large market for Rail Baltica. The movement of logs, timber and paper from countries such as Finland are significant in volumes and although the movement by water on the Baltic Sea is cheap there are destinations in central Europe that cannot easily be reached by water. According to Eurostat information there was approximately 325,000 tonnes of forest products going by sea last year from Latvia to Germany and there is likely to be more of a potential market for products that travels to Central and southern Germany than the area near the ports in the north.

Potential Customers

We canvassed a range of logistics companies and freight forwarders to ascertain their views on Rail Baltica. In conducting this Market Research we used a number of techniques including telephone surveys and electronic mail. We made contact with over twenty companies in each of the following countries, Estonia, Finland, Latvia and Lithuania. Many companies responded even if it was to say they would not be interested in the prospective new railway, and in these cases the conversation ended there. Some companies said they would send responses but did not and were followed up, but in general the response rate was reasonable. The following section outlines the main responses by country and gives some information on the companies that expressed a view, even if it was a negative observation. It is important to draw realistic conclusions from the information collected.

Latvia

11 Latvian Freight Forwarders don't use rail and will not do so in the future. This is not necessarily saying that the Rail Baltica project is not required but merely suggesting that for many companies rail is not on the freight companies’ agenda. However, three Latvian Freight Forwarders were more positive and had some positive comments:

- One forwarder operates several dry cargo terminals at the Riga Free Port, where they offer a stevedoring service for the receipt, storage and reloading of cargo. They also offer a processing, screening, crushing and magnetic clearing of steel coil and handle the transportation and Forwarding services of 5 million tonnes of coal per year to Russia. The company is comfortable with the current rail lines, and see the main potential for the proposed line as passenger orientated and the new line will be a key factor in ensuring the development of tourism.
- Another respondent was one of the leading retailers in food and fast moving consumer goods in Latvia, operating through different retail chains suiting different customers. They have established their own distribution centre that is the largest and most up-to-date distribution centre in the Baltic States. At the time of writing the company had 107 stores including 15 hypermarkets, and 92 other stores. The company does not currently use railway, as there is not a suitable rail route to meet the needs of the business. However they would be interested in Rail Baltica to transfer goods to or from Estonia, and Poland. The main operational factors the new line should offer are that it needs to be fast enough and have the capability to carry frozen food products in containers.
- A large plywood producer sited along the proposed railway route said that they have seen a decrease in incoming goods in 2009 due to the recession from around 700 wagons monthly to about 30 and they only take goods via road. However the company plans to sell around 190,000 tons of plywood in 2010 and has seen its production volumes return to the 2008 level with a 50% increase in turnover in the first six months of 2010 compared to 2009. The higher volumes may suit some movement by rail in the future.

There has been a recent trade conference proving that new cooperation between Latvia and the United States has much potential. Around 15,000 containers of U.S. freight have been shipped via Latvian ports in transit so far, representing food industry, construction, household appliance production and other sectors, It is possible that some of this transit traffic could go by rail depending on the destinations.

Lithuania

10 Lithuanian Freight Forwarders said they would not use Rail Baltica mainly as the majority of traffic is on the east-west axis and hence have no need of the line. However, 10 Lithuanian Freight Forwarders had more in-depth comments:

- One respondent was the official agent of the shipping line Hyundai Merchant Marine (HMM) in the Baltics offering cargo carrying services along the HMM line‘s routes. The main carriage directions are the Far and Middle East and North America. As this company only provides shipping services for Hyundai containers they would not have any real interest in transporting by rail in the future.
- Another respondent is a maritime agency that carries out various freight forwarding, shipping and other transportation and logistics services. The company provides transportation services for all types of marine, rail and road transport and has extensive experience in organizing transportation of sea containers. They were unable to provide an exact percentage of freight they move by rail but stated that they prefer to send by sea to the nearest port and use rail over a shorter distance. They do move freight to Tallinn, Warsaw, Belarus and Ukraine meaning they could utilise Rail Baltica for freight as it provides a direct connection to Tallinn and Warsaw and a connection to Belarus and Ukraine.
- Another respondent operates mainly by sea, road and air. They maintain a fleet of over 5,000 trucks on four continents and also have specialist air freight teams located across five continents constantly monitoring direct flights and offer freight consolidation, door-to-door and express traffic. They also offer port-to-port, door-to-door pick-ups and deliveries for FCL, LCL, groupage or breakbulk goods, plus Roll-On/Roll-Off services and complete logistics packages. Currently, 5% of their containers received by sea are forwarded via rail with 1% of their rail freight being transported to Kazakhstan. Rail Baltica would provide a transfer point to rail connections to Kazakstan via Warsaw. Hellmann said that it is conceivable that Rail Baltica may allow them to extend their rail forwarding operation to Tallinn and Warsaw.
- Another shipping company said that they provide a number of services such as cargo clearance for freight arriving / leaving port by sea, ordering of railway and road transport as well as forwarding of cargo arriving by containers. This allows clients to collect cargo arriving by different types of transport for onward movement, and arranging “door-to-door” delivery to final destination. The types of cargo usually carried are frozen fish, frozen meat and poultry, fruits and general cargo. They move 10% of their freight by rail to such destinations as Belarus, Kazakhstan, Warsaw and Tallinn. They mainly move freight to the Ukraine by lorry as costs are too high to use rail. With the introduction of Rail Baltica it is possible that they may use rail to transport freight to the Ukraine in future, providing the costs are competitive.
- Another respondent was a merchant shipping company offering services that connect ports in the area of Baltic Sea, Mediterranean Sea, North Sea, Black Sea, Azov Sea and Atlantic Ocean. They are an independent freight forwarding company based in Lithuania offering cost effective sea, road, railway and air freight forwarding services around the world and are capable of delivering any cargo to any port including offshore operation. They already transport 100% of their freight to such destinations as Latvia (Liepaja), Belarus and Russia by rail. Rail Baltica would improve connections to their current destinations and provide additional interchange points.
- Another company specialises in railway transportation to and from the Baltic States and CIS, with 100% of their freight being transported between Klaipeda and Russia goes by rail. They are interested in extending their operation to include transporting heavy cargo from Germany and Poland which would be possible using Rail Baltica.
- Another respondent is a freight forwarder who guarantees a high quality service. They currently transport the majority, between 80% and 100%, of their freight via rail. They specialise in transporting frozen products to Kyrgyzstan and Kazakhstan. The speed and efficiency with which goods can be transported to Kyrgyzstan and Kazakhstan could be greatly improved with the Rail Baltica link to connecting railway.
- One of the leading companies in the Baltic states dealing with shipping agency services, brokerage, freight forwarding and transportation said that they have long-term experience in transporting various goods from the USA, Greece, the Netherlands, France, Germany, Russia and many other countries. They currently transport 50% of their cargo via rail. They would be interested in increasing the proportion of freight they move by rail by using Rail Baltica but it would depend on how competitively priced the service will be.

- One of the largest cargo carriers and forwarding companies in Lithuania providing logistics services for cargo movement in Western, Eastern and Central Europe, Scandinavia, Poland, other Baltic and CIS countries and within Lithuania itself said that they transport reefer cargo, metals, fertilizers, timber and bulk products as well as cargo with special requirements in terms of temperature, packaging, etc. They deliver cargo "door to door" by combining transportation by sea, by land and by air. They are interested in increasing the amount of freight they move by rail and would be very interested in using Rail Baltica in the future to achieve this. They believe it would help to increase the amount of liquid cargo that they transport across Europe due to the easy link provided by Rail Baltica as it will decrease the time taken to transport goods from Poland to the Baltic region by negating the need to change wheels between rail gauges.
- An international logistics and maritime service provider specialising in door-to-door transports of FCL, LCL, project and break bulk cargoes from/to overseas destinations with special focus on the Asia CIS trade said that they receive 30% of the freight from Europe and 50% from China and send more than 50% of their freight by rail. They think, however, that this new rail line will not provide significant competition to marine transportation services due to cheap sea tariffs for containers but may be competitive against road in transporting goods in cargo wagons.

Estonia

9 Freight Forwarders said they would not use Rail Baltica mainly as they were mainly in sea transport only or their traffic is on the east-west axis and hence have no need of the line. 6 Estonian Freight Forwarders had more in-depth comments:

- A negative view from a director of a freight forwarding company was “Rail rates are always twice as expensive as maritime rates. When you have an international “transit” journey you have several countries, all of whom have different tariffs, taxes and each will want to earn money, or one combined company that will serve the whole line will want to quickly recover the investment and the tariffs are likely to be too high and our children will have to repay debts! The only ones who can send their goods along the new rail to Latvia and Estonia are the Poles, and this will be in small quantities. Poland also has a port through which it is more profitable to send the cargo to Latvia and Estonia.”
- A port agency providing freight forwarding services in all Baltic ports said that they currently move all their freight by road but would be interested in moving loads, such as peat, wood and wooden houses, by rail in future. Rail Baltica could aid them in doing this, if it is priced competitively to compete with road transport.
- A company providing worldwide door-to-door freight transportation services across Europe, Russia, C.I.S. and the Baltic States said that they provide freight forwarding services using rail, road, air and marine transport. Of these modes they use rail to transport 50% of their freight and this is only to Russia currently. They would be interested in expanding their operations to other areas and in using Rail Baltica to do this, though how much of their trade they would be able to transfer to rail would depend on their clients.
- Another respondent was an independent provider of port agency and shipbroking services across the international shipping markets providing the full scope of liner shipping agency services for container, general cargo, ro-ro and passenger lines. They currently move their freight by sea but would be interested in moving a proportion of this, possibly 5000 tons / month, by rail in the future using Rail Baltica if it was competitively priced.
- Another respondent’s main activity is sea transport management which includes: full ship's management, shipping, chartering, technical supervision, carrying out technical inspections on ships and brokerage. They do not currently use rail to transport goods but are interested in Rail Baltica for future operations. They currently move 1000 tons/month of frozen foods which could potentially be moved by rail.
- A well known shipper dealing mainly in containers, but also general cargo said that some of their freight is carried by rail. They move 20-40 containers / month and approximately 500 tonnes of general cargo, including various non hazardous goods amounting to approximately 1000 tons per month. The traffic flows to the Baltic states are mainly to/from Germany, Holland, Italy, Belgium and France. The following items would be the main requirements for them to use the new line, good price, short transit-time, and ready availability of rail platforms / wagons. The journey time is now spread over several days and it is acceptable to have a 5-10 day journey depending on destination / origin. To start with a weekly service frequency from the main origins would be acceptable. The level of reliability would need to have a performance of about 95% of trains arriving within 15 minutes of the planned time. There are two main reasons why they might not use the line firstly if the freight booked needed to be carried on the East – West axis and not North – South and secondly it depends on rates. They are happy with current modes of transport but lower prices would entice them to change. The key factors to ensure that the line attracts new traffic are; competitive rates, service reliability, good transit-time, availability of terminals, containers and wagons.

Finland

18 Freight Forwarders said they would not use Rail Baltica as they were mainly in sea or road transport only or their traffic is on the east-west axis from Finland to Russia and hence have no need of the line and did not contribute further to the survey. There were a number of companies that did comment about Rail Baltica;

- An independent Finnish freight forwarding and transportation company moving regular road-traffic to / from all European and Baltic countries said that they offer access to a range air, sea and railway transportation, customs clearances, distribution and logistical services. Significantly they have subsidiaries in the following countries: Estonia, Latvia, Lithuania, Poland and Hungary, which closely mirrors the route of Rail Baltica. The group has been expanding their Latvian operations and built a logistics centre in the town of Marupe in Latvia in 2007. Currently they carry all kinds of goods from Hungary to Finland, but only via road, would use rail if there would be railway line going through Poland. Main potential is the transfer of wood all over the world. A key factor in whether the line is successful is in providing a tracking service on the goods/wagons so there is visibility as to the location of the products at any time.
- A Finnish third party logistics company operating in international logistics, warehousing, supply chain management and forwarding services said that they carry any kind of goods, mainly from the Far East to Finland and Finnish exports are electronics, metal, paper and forest products. They use rail but for less than 5% of their freight. The new line must be competitive to road, and offer similar or better timings. They see high potential for this line and would like through services to run at least 2 or 3 times a week, from Finland to Poland.
- A well known third party logistics operator carries all kind of goods to Finland, but not via rail. However their European arm does offer services when customers need to move single wagons, wagon groups or complete trains across Europe from siding to siding or door to door. The main potential for the line is for the transfer of goods all over the Europe, for every type of goods. A key factor is in offering a tracking service. Their European rail division can offer a “Track and trace” service throughout the whole transport chain and they can also offer ADR capabilities for the movement of hazardous goods. Their intermodal division concentrates on putting high payloads into various compatible loading units, be it a container, a swap body or semi-trailer. The loading unit itself is compatible with all road, rail and ocean transport.
- An international shipping and logistics company said that they offer a wide range of logistics solutions both in Northern Europe and worldwide. They carry anything from electrical goods to machinery, worldwide. They move, more by sea and air, and rail is less than 10% of volumes. However they think that Rail Baltica could be a good solution and would use rail if and when they have specific cargo needing that route.
- A Finnish agency carrying different exhibition goods said that they currently only use road, air, and sea as they think that rail is more expensive than road. However they consider there could be potential for new line for companies from Finland.
- A Container Terminal operator said that they think that rail is more expensive and pricing would have to be competitive to attract customers to Rail Baltica.
- A Freight Forwarding/Port Operator said that they currently move about 50.000 – 100.000 tonnes of electronic, industrial and forest products per year from Finland to Poland and Germany via Tallinn. So there is a possibility of moving containers, and paper and board in normal cargo wagons on the line. As a price indication for a round trip from Tallinn to the Southern part of Poland it costs 800 euros per 40’ container. The current journey times between Finland and key destinations are; to the southern part of Poland is 4 days, and to Germany depending on the location varies from 5 days to 7 days. They said that good reliability is important where 95% of trains arrive within 15 minutes of the planned time. According to this company the key factors in ensuring that the line attracts new traffic are that Continental gauge is a must, and frequent services are wanted with a frequency of at least twice a week to different destinations. They also suggested that there should be a network of terminals to allow the possibility of reloading and backloading.
- An international transport and forwarding company located in Lahtio offering transport, customs clearance services said that they offer road, air and sea transport and have services between Italy-Finland and Spain-Finland. They carry kitchen appliances, furniture, olive oil, and wine and only use trucks from Italy and Spain to Finland as they believe rail is too slow. A new railway that offers faster journey times would potentially be of interest but would have to offer something new.

The Finnish Transport Agency, Liikennevirasto is a government agency responsible for Finnish land and sea transport network infrastructure. The Agency was created combining parts of Finnish Maritime, Road and Railway Administrations. We have received a personal view on the potential for freight traffic to use the Rail Baltica line.

They stated that on the map Rail Baltica looks interesting; it could be an alternative for the usual transport routes by sea to the established terminals on the south coast of the Baltic sea (Kiel, Lubeck, Travemunde, Rostock). The export industry have expressed their interest in principle, but in practical terms it could prove difficult to convince freight forwarders to shift the transports to Rail Baltica as the present routes are well established and previous investments in infrastructure, in dedicated slots, in handling equipment, in terminals on the continent guarantee a service level which is accepted by both the customers and the export industry.

Routing the export goods via Tallinn requires a crossing of the Gulf of Finland which may add an extra loading procedure. These comments are valid for the main export streams from Finland to Western and Central Europe. Export volumes to the Baltic markets themselves are thought to be too small for regular train services.

Looking for future prospects and to use the advantage of transports on broad gauge (no reloading), the markets in the south-east of Europe offer worthwhile potential to develop. This is also a route to avoid the congested areas of central Europe. However customers have to bear in mind that as they leave the EU the experience is that they are confronted with problems of an administrative nature. Trials made by rail, have not worked out well.

The main export ports in South of Finland are Kotka/Hamina, Hanko and Rauma. They all have daily services to the mentioned ports in the southern part of the Baltic. These regular shipping services cover the distance in less than 48 hours. The fastest Ferries (Hanko) do it in less than 24 hours in the summer time. Ships leave normally in the afternoon. Export goods from the papermills are fed on a regular and continuous basis by lorries to the port warehouses (Rauma is serviced by train).

They stated that they do not see Riga as a feeding port for goods to be transported along RB. In the east-west transports all the Baltic ports (Kaliningrad, Klaipeda, Ventspils, Riga, Tallinn) have been actively offering rail services.

The main export products suitable for rail transportation (paper, board, steel) are delivered to the consumers in a seamless logistics chain minimizing stocks, therefore reliability is most important. How it is defined is a contract matter varying from customer to customer.

As to what time of day services would be required to run i.e. would night-time only work, or 16 hours per day or more required it depends on how the service between Finnish ports and Tallinn will be organized and how the logistics chain to the consumer will be worked out.

Planning of inland hubs should take into consideration how the expected crossing traffic is planned to be developed. In the Baltic area the connections are to the south-east Europe, in Poland and Germany the connections are to central Europe.

4.3.4 Freight Demand Matrices

The following tables give the total volumes of freight, both bulk and non-bulk in the base year of 2008.

Table 30 - Bulk Freight

Road	Latvia Total	Riga Region	Kurzeme Region	Latgale Region	Zemgale Region	Vidzeme Region	Riga City	Lithuania Total	Vilnius city municipality	Kaunas city municipality	Klaipėda city municipality	Panevėžys city municipality	Šiauliai city municipality	Alytus city municipality	Telsiai	Taurage	Marijampole	Utena	Estonia Total	*Põhja-Eesti*	*Lääne-Eesti*	*Kesk-Eesti*	*Kirde-Eesti*	*Lõuna-Eesti*	Finland	Germany	Poland	Austria	Northwestern economic region of Russia	Czech Republic	Ukraine	Belarus	Italy	Hungary
Latvia Total	36453	6080	7993	4207	6443	4557	7173	305	39	51	83		131						210	87	20	38	20	44	21	196	152		514	6				
Riga Region	6361	1061	1395	734	1124	795	1252	8	1	1	2		3																					
Kurzeme Region	7331	1223	1607	846	1296	916	1443	61	8	10	17		26																					
Latgale Region	3896	650	854	450	689	487	767	8	1	1	2		4						150	63	14	28	15	31										
Zemgale Region	5429	906	1190	627	960	679	1068	16	2	3	4		7																					
Vidzeme Region	4402	734	965	508	778	550	866	13	2	2	4		6						59	25	6	11	6	12										
Riga City	9035	1507	1981	1043	1597	1129	1778	198	26	33	54		85														150							
Lithuania Total	420	20	104	53	50	18	175	28094	6356	5844	4152	2200	2808	1493	1883	777	1117	1463	66	39				28	239	348	283		600					6
Vilnius city municipality	87	4	21	11	10	4	36	6917	1565	1439	1022	542	691	368	464	191	275	360	44	26				18			165							
Kaunas city municipality	107	5	26	13	13	5	44	5276	1194	1098	780	413	527	280	354	146	210	275	22	13				9			118							
Klaipėda city municipality	116	5	29	15	14	5	48	4168	943	867	616	326	417	221	279	115	166	217																
Panevėžys city municipality	50	2	12	6	6	2	21	2452	555	510	362	192	245	130	164	68	98	128																
Šiauliai city municipality	60	3	15	8	7	3	25	2495	565	519	369	195	249	133	167	69	99	130																
Alytus city municipality								1445	327	300	213	113	144	77	97	40	57	75																
Telsiai								1638	371	341	242	128	164	87	110	45	65	85																
Taurage								857	194	178	127	67	86	46	57	24	34	45																
Marijampole								1367	309	284	202	107	137	73	92	38	54	71																
Utena								1480	335	308	219	116	148	79	99	41	59	77																
Estonia Total	289	227				62		92	20	71									22905	7958	2724	8094	2475	1655	156	62			323	3				
Põhja-Eesti	142	112				30		45	10	35									7834	2722	931	2768	846	566			100							
Lääne-Eesti																			3233	1123	384	1142	349	234										
Kesk-Eesti	23	18				5		7	2	6									7783	2704	926	2750	841	562										
Kirde-Eesti																			2754	957	328	973	298	199										
Lõuna-Eesti	124	98				26		39	9	31									1301	452	155	460	141	94										
Finland	26							16											210						158432	25	114	2	290	11				7
Germany	243							317											103						15		7592		1					
Poland	83							268	108	160									18						111	7796	651725		1092	614				82
Austria	16							19											14						1	2367	443	2	1	903				830
NW economic region of Russia	105							75											189						504	1	132			27				
Czech Republic	19							57																	12	978	1398		51					
Ukraine	6							5											13								89							
Belarus	42							30											3															
Hungary	2							17											13															
Italy	2							15											20															

Sea	Latvia Total	Riga Region	Kurzeme Region	Latgale Region	Zemgale Region	Vidzeme Region	Riga City	Lithuania Total	Vilnius city municipality	Kaunas city municipality	Klaipėda city municipality	Panevėžys city municipality	Šiauliai city municipality	Alytus city municipality	Telsiai	Taurage	Marijampole	Utena	Estonia Total	*Põhja-Eesti*	*Lääne-Eesti*	*Kesk-Eesti*	*Kirde-Eesti*	*Lõuna-Eesti*	Finland	Germany	Poland	Austria	Northwestern economic region of Russia	Czech Republic	Ukraine	Belarus	Italy	Hungary
Latvia Total								3			3								73	73					2394	3856	17		7				230	
Riga Region																																		
Kurzeme Region								3			3								15	15					717	895	6		6				82	
Latgale Region																																		
Zemgale Region																																		
Vidzeme Region																																		
Riga City																			58	58					1677	2961	11		1				148	
Lithuania Total	97		97																1	1					341	607	87		27				23	
Vilnius city municipality																																		
Kaunas city municipality																																		
Klaipėda city municipality	97		97																1	1					341	607	87		27				23	
Panevėžys city municipality																																		
Šiauliai city municipality																																		
Alytus city municipality																																		
Telsiai																																		
Taurage																																		
Marijampole																																		
Utena																																		
Estonia Total	32		7				25																		3003	676								
Põhja-Eesti	32		7				25																		2244	572								
Lääne-Eesti																									311	76								
Kesk-Eesti																									448	28								
Kirde-Eesti																																		
Lõuna-Eesti																																		
Finland	207		170				37	64			64								2151	2090	11	50				3245	244						809	
Germany	102		69				33	144			144								211	166	34	11			1456				289					
Poland	10						10	166			166								6	6					294									
Austria																																		
Northwestern economic region of Russia	99		6				93	29			29															2271								
Czech Republic																																		
Ukraine																									7									
Belarus																																		
Hungary																																		
Italy																									43									

Current Rail	**Latvia Total**	Riga Region	Kurzeme Region	Latgale Region	Zemgale Region	Vidzeme Region	Riga City	**Lithuania Total**	Vilnius city municipality	Kaunas city municipality	Klaipėda city municipality	Panevėžys city municipality	Šiauliai city municipality	Alytus city municipality	Telsiai	Taurage	Marijampole	Utena	**Estonia Total**	*Põhja-Eesti*	*Lääne-Eesti*	*Kesk-Eesti*	*Kirde-Eesti*	*Lõuna-Eesti*	Finland	Germany	Poland	Austria	Northwestern economic region of Russia	Czech Republic	Ukraine	Belarus	Italy	Hungary
Latvia Total	23				12	11		426		426									156	156														
Riga Region								426		426									156	156														
Kurzeme Region																																		
Latgale Region																																		
Zemgale Region	11					11																												
Vidzeme Region	12				12																													
Riga City																																		
Lithuania Total	458	458						403				12		391													358							
Vilnius city municipality																																		
Kaunas city municipality	458	458																									358							
Klaipėda city municipality																																		
Panevėžys city municipality								391						391																				
Šiauliai city municipality																																		
Alytus city municipality								12				12																						
Telsiai																																		
Taurage																																		
Marijampole																																		
Utena																																		
Estonia Total	57	57																	379	189				190	18									
Põhja-Eesti	57	57																	190					190	18									
Lääne-Eesti																																		
Kesk-Eesti																																		
Kirde-Eesti																																		
Lõuna-Eesti																			189	189														
Finland																																		
Germany																											9							
Poland								91		91																25								
Austria																																		
Northwestern economic region of Russia																																		
Czech Republic																																		
Ukraine																																		
Belarus																																		
Hungary																																		
Italy																											25							

Table 31 - Non Bulk Freight

Road	Latvia Total	Riga Region	Kurzeme Region	Latgale Region	Zemgale Region	Vidzeme Region	Riga City	Lithuania Total	Vilnius city municipality	Kaunas city municipality	Klaipėda city municipality	Panevėžys city municipality	Šiauliai city municipality	Alytus city municipality	Telsiai	Taurage	Marijampole	Utena	Estonia Total	*Põhja-Eesti*	*Lääne-Eesti*	*Kesk-Eesti*	*Kirde-Eesti*	*Lõuna-Eesti*	Finland	Germany	Poland	Austria	Northwestern economic region of Russia	Czech Republic	Ukraine	Belarus	Italy	Hungary
Latvia Total	13775	2298	3020	1590	2434	1722	2711	153	20	26	42		66						100	42	9	18	10	21	21	137	66		224	2				
Riga Region	2404	401	527	277	425	300	473	4	0	1	1		2																					
Kurzeme Region	2770	462	607	320	490	346	545	31	4	5	8		13																					
Latgale Region	1472	246	323	170	260	184	290	4	1	1	1		2						72	30	7	13	7	15										
Zemgale Region	2051	342	450	237	363	256	404	8	1	1	2		3																					
Vidzeme Region	1663	277	365	192	294	208	327	7	1	1	2		3						28	12	3	5	3	6										
Riga City	3414	569	749	394	603	427	672	100	13	17	27		43														65							
Lithuania Total	258	12	64	32	31	11	107	22188	5020	4616	3279	1738	2218	1179	1487	614	883	1155	50	29				21	367	375	196		417					5
Vilnius city municipality	53	2	13	7	6	2	22	5463	1236	1136	807	428	546	290	366	151	217	284	33	19				14			114							
Kaunas city municipality	66	3	16	8	8	3	27	4167	943	867	616	326	417	221	279	115	166	217	17	10				7			82							
Klaipėda city municipality	71	3	18	9	9	3	30	3292	745	685	487	258	329	175	221	91	131	171																
Panevėžys city municipality	31	1	8	4	4	1	13	1936	438	403	286	152	194	103	130	54	77	101																
Šiauliai city municipality	37	2	9	5	4	2	15	1971	446	410	291	154	197	105	132	55	78	103																
Alytus city municipality								1141	258	237	169	89	114	61	76	32	45	59																
Telsiai								1293	293	269	191	101	129	69	87	36	51	67																
Taurage								677	153	141	100	53	68	36	45	19	27	35																
Marijampole								1080	244	225	160	85	108	57	72	30	43	56																
Utena								1169	264	243	173	92	117	62	78	32	46	61																
Estonia Total	159	125				34		65	15	51									15587	5416	1853	5507	1684	1126	216	60	62		202	2				
Põhja-Eesti	78	61				17		32	7	25									5331	1852	634	1884	576	385			62							
Lääne-Eesti																			2200	764	262	777	238	159										
Kesk-Eesti	13	10				3		5	1	4									5296	1840	630	1871	572	383										
Kirde-Eesti																			1874	651	223	662	203	135										
Lõuna-Eesti	68	54				15		28	6	22									886	308	105	313	96	64										
Finland	18							13											171						261035	28	84	2	215	8				5
Germany	163							272											84						26		5728		0					
Poland	42							177	71	106									12						143	7061	377369		633	355				48
PL1								75	30	44																	75090							
PL2																											79782			241				
PL3								87	35	52																	64086							
PL4																											60328							
PL5																											41847			114				
PL6								16	6	10																	56235							
Austria	10							17											11						3	3958	334	4	1	681				626
NW economic region of Russia	54							49											120						649	0	76			15				
Czech Republic	9							38																	15	886	809		29					
Ukraine	3							3											8								52							
Belarus	21							20											2															
Hungary	1							11											9															
Italy	1							13											16															

Sea	**Latvia Total**	Riga Region	Kurzeme Region	Latgale Region	Zemgale Region	Vidzeme Region	Riga City	**Lithuania Total**	Vilnius city municipality	Kaunas city municipality	Klaipėda city municipality	Panevėžys city municipality	Šiauliai city municipality	Alytus city municipality	Telsiai	Taurage	Marijampole	Utena	**Estonia Total**	*Põhja-Eesti*	*Lääne-Eesti*	*Kesk-Eesti*	*Kirde-Eesti*	*Lõuna-Eesti*	Finland	Germany	Poland	Austria	Northwestern economic region of Russia	Czech Republic	Ukraine	Belarus	Italy	Hungary
Latvia Total																									61	1031	17		1					
Riga Region																																		
Kurzeme Region																										387	6		1					
Latgale Region																																		
Zemgale Region																																		
Vidzeme Region																																		
Riga City																									61	644	11							
Lithuania Total	13						13												5	5						474	87							
Vilnius city municipality																																		
Kaunas city municipality																																		
Klaipėda city municipality	13						13												5	5						474	87							
Panevėžys city municipality																																		
Šiauliai city municipality																																		
Alytus city municipality																																		
Telsiai																																		
Taurage																																		
Marijampole																																		
Utena																																		
Estonia Total	4						4	18			18														108	248								
Põhja-Eesti	4						4	18			18														108	248								
Lääne-Eesti																																		
Kesk-Eesti																																		
Kirde-Eesti																																		
Lõuna-Eesti																																		
Finland	78		9				69	98			98								145	145						6601	244							
Germany	1157		294				863	993			993								524	524					6167				6392					
Poland	10						10	166			166								6	6					294									
PL1																																		
PL2																																		
PL3																																		
PL4																																		
PL5																																		
PL6																																		
Austria																																		
Northwestern economic region of Russia	8		7				1	5			5															3200								
Czech Republic																																		
Ukraine																																		
Belarus																																		
Hungary																																		
Italy																																		

Current Rail	**Latvia Total**	Riga Region	Kurzeme Region	Latgale Region	Zemgale Region	Vidzeme Region	Riga City	**Lithuania Total**	Vilnius city municipality	Kaunas city municipality	Klaipėda city municipality	Panevėžys city municipality	Šiauliai city municipality	Alytus city municipality	Telsiai	Taurage	Marijampole	Utena	**Estonia Total**	*Põhja-Eesti*	*Lääne-Eesti*	*Kesk-Eesti*	*Kirde-Eesti*	*Lõuna-Eesti*	Finland	Germany	Poland	Austria	Northwestern economic region of Russia	Czech Republic	Ukraine	Belarus	Italy	Hungary
Latvia Total	6				3	3		107		107									39	39														
Riga Region								107		107									39	39														
Kurzeme Region																																		
Latgale Region																																		
Zemgale Region	3					3																												
Vidzeme Region	3				3																													
Riga City																																		
Lithuania Total	114	114						101				3		98													89							
Vilnius city municipality																																		
Kaunas city municipality	114	114																									89							
Klaipėda city municipality																																		
Panevėžys city municipality								98						98																				
Šiauliai city municipality																																		
Alytus city municipality								3				3																						
Telsiai																																		
Taurage																																		
Marijampole																																		
Utena																																		
Estonia Total	14	14																	95	47				47	4									
Põhja-Eesti	14	14																	47					47	4									
Lääne-Eesti																																		
Kesk-Eesti																																		
Kirde-Eesti																																		
Lõuna-Eesti																			47	47														
Finland																																		
Germany																											2							
Poland								23		23																6								
PL1																																		
PL2																																		
PL3																																		
PL4																																		
PL5																																		
PL6																																		
Austria																																		
Northwestern economic region of Russia																																		
Czech Republic																																		
Ukraine																																		
Belarus																																		
Hungary																																		
Italy																											6							

4.4 Prognosis of Traffic Flows

The following section presents the approach to modelling both passenger and freight flows for the new line. The modelling approach for passenger flows is presented first, followed by the modelling approach for freight flows.

4.4.1 Passenger Flows

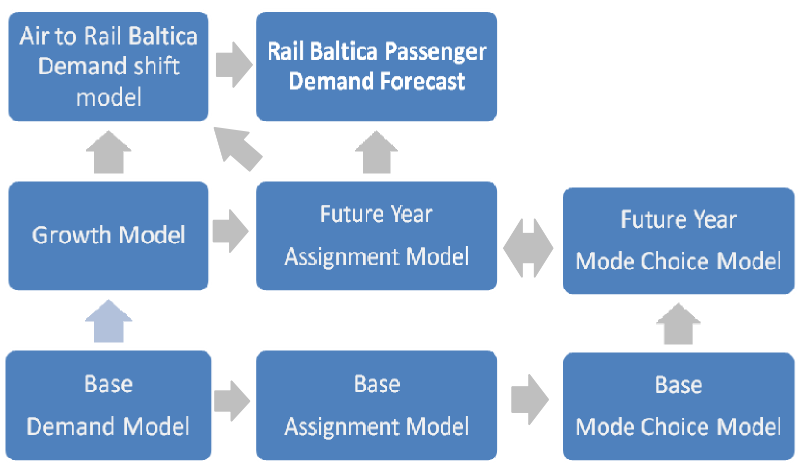
A common approach to forecasting changes in rail demand following changes in service provision or pricing is through the application of simple elasticities. This approach can provide a useful starting point for when there is an existing rail service and can reduce the need for more complex transport modelling. Within the Baltic States however there is only a very limited existing rail service across national borders, which means there is no existing rail demand to forecast forward from. Internal to each country although there are existing rail services the proposed high speed Rail Baltic service is likely to provide a "step change" in level of service which means that the simple elasticity approach will only provide part of the answer.

The main component of potential demand for Rail Baltica is transfer from existing competing modes such as Road, Coach and Air and therefore a modelling approach which captures the transfer from other modes is required.

A modelling suite has been developed that represents both the existing base year demand by different modes as well as the generalised cost (in terms of wait time, travel time, fares and vehicle operating costs) of making journeys by these modes. Based on these base year costs a mode choice model has been developed and calibrated to reflect the split between modes on existing movements. This modelling base provides, along with an estimation of trip growth, a tool to assess how mode shares for all modes will alter in future when Rail Baltica becomes an option for travellers. A key strength of this approach is that the forecasts of Rail Baltica patronage is driven not from the very small number of exiting international trips, but from an calculation of the proportion of the existing rail, air, bus and car trips that will shift to Rail Baltica.

Figure 15 - Modelling approach below summarises the modelling approach

Figure 15 - Modelling approach



Base Passenger Model Construction

The base year demand model contains average daily trip volumes in 2009 for the following modes:

- Air trips
- Car trips
- Bus trips
- Rail Trips
- Sea Trips

The demand is held in origin destination matrices with a zone system consistent with the assignment model. The demand populating the model has been derived in two key methods:

1. Based on the existing observed (2009) demand for travel between key origin / destination pairs within the study collated from the data sources described in the Existing Demand Section

2. Calculated within a synthetic demand model (from origin and destination socioeconomic characteristics and journey generalised costs) which has been calibrated, where data is available to observed data sets described in Existing Demand Section

Method 1 has been used in preference to method 2, and where data exists as it provides a more reliable picture of base demand. In most cases international base year demand has been derived using method 1 and can be directly traced back to observed trip volumes. There was, however, more limited data for car, rail and bus trips within the states. It has therefore been necessary to use the synthetic demand model, which has been calibrated to observed data where it is available, to 'infill' unobserved volumes.

The synthetic demand model is described in further detail below.

Synthetic Demand Model

The synthetic demand model is a spreadsheet based model which assesses the following elements to define base year demand, by mode, between origin and destinations within the region:

- Trip Generation,
- Trip Distribution
- Mode Choice

Each of the model elements is described in further detail blow. An independent model has been produced for each Baltic state, synthesising the demand by model between key cities in each state. All three models are based on a common set of model parameters which have been calibrated to ensure the synthetic demand reflects observed demand for movements where observed data is available.

Trip Generation

Trip generation is calculated on the basis of population and gross value added (GVA) data at the trip origin and destination. These data are combined so that the volume of production / attraction trips to any zone in the model is related to the population of a zone together with its productivity. The formulation for each zone is as follows:

$$A_i O_i = a_{Pop} Pop_i + a_{GVA} GVA_i \text{ and}$$
$$B_j D_j = b_{Pop} Pop_j + b_{GVA} GVA_j$$

Where

AiOi is the trip production factor for origin i; BjDj is the trip attraction factor for destination j;

aPop is the trip production population coefficient; bPop is the trip attraction population coefficient;
aGVA is the trip production GVA coefficient; bGVA is the trip attraction GVA coefficient;
Popi is the population of origin i and GVAi is the GVA of zone i.

Trip Distribution

Generalised costs have been calculated for all modes (rail, road(car), road(coach), air).

Generalised cost is a function of all elements of a journey (access time (AT), wait time (WT), journey time (JT), fare, vehicle operating cost (VoC), and egress time (ET)0 and is represented in units of time. Value of time (VoT)) is therefore a key input as this links the value of monetary costs to the value of time savings. Generalised cost (GC) is given by:

$$GC_{ij} = (AT_i + WT_i * \text{wait time weighting} + JT_{ij} + ET_j] + (Fare_{ij} + VoC_{ij}) / (VoT/60)$$

The elements of Generalised cost are described in detail later in thi section. A composite generalised cost has been calculated across all modes.

The total demand for each zone – zone movement is calculated by multiplying its composite generalised cost by AiOi and BjDj. As the generalised cost of trips from an origin varies by the destination, the number of trips from each origin will vary by destination. The model structure is such that the demand generated for trips from an origin with a higher generalised cost (for example a longer journey time, or a higher fare) will be lower than teh demand generated for trips with a lower generalised cost.

Mode Choice

The mode choice model applied within the synthetic demand model has the same structure and parameters as the mode choice model used for the wider demand forecasting, and described further in the following sections.

The mode shares calculated from the mode choice model have been multiplied by the total demand calculated through the trip distribution process to produce a matrix of demand for each mode

Model Calibration

The synthetic demand model has been calibrated to ensure that the output mode matrices reflect observed trip data for key movements taken from the base demand model, both in terms of total demand, and demand by mode.

Table 32 - Key routes used for calibration

Model	**Calibration Movements**
Estonia	Tallinn – Tartu, Tallinn - Parnu
Latvia	Riga – Jelgava, Riga – Valmiera, Riga - Tukums
Lithuania	Kaunas – Vilnius, Kaunas - Siauliai

Calibration has been applied to match overall volumes on the key routes as well as the mode split between car, coach and rail modes. Calibration has been achieved by changing the production and attraction parameters (described in the trip generation section above) to produce the closest overall match between observed and modelled demand for the key movements. The parameter values have been kept consistent between all versions of the synthetic demand model.

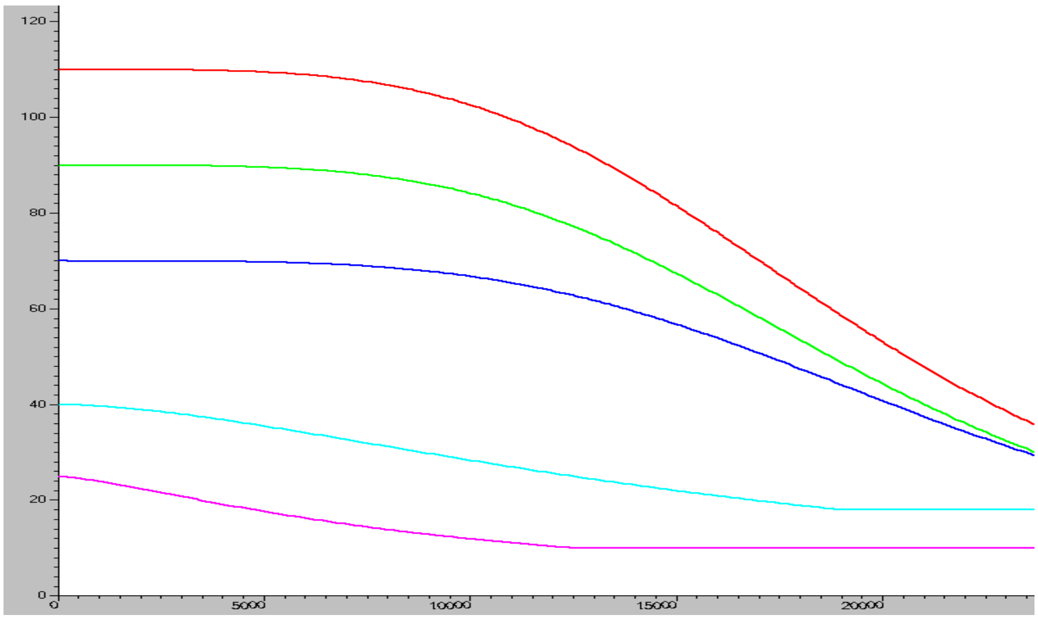
Assignment Model

An Emme/3 model of the study area has been constructed to incorporate the base demand constructed using the methodology described above, and to assign the demand to the existing transport network.
The model includes strategic highway, rail and air links within the Baltic States and includes a representation of the inter-urban bus network.

Highway links in the model have been allocated to one of the following link categories:

- 11 Motorway
- 12 dual carriageway (rural)
- 13 single carriageway main road (rural)
- 14 minor rural road
- 15 Local road (Urban)

Each category has an associated Volume delay curve (VDF) which is used within the model to define the link speed that will occur at a given volume of traffic. This is particularly important for future year models where traffic volumes are expected to have grown with a resultant reduction in travel speeds. The volume delay curves are shown below.



Highway links have also been allocated a bus speed to reflect the slower journey time for buses than cars. These values have been set globally by link type, but calibrated along the key city to city routes to reflect current timetabled journey times.

Mode Choice Model

The mode choice model takes travel costs (travel times and distance) from the assignment model and calculates for each origin to destination movement the generalised cost of travel by Car, Rail, Bus, and Rail Baltica.

The Generalised Cost (GCij) for each movement has been calculated for each mode using the formulation given below:

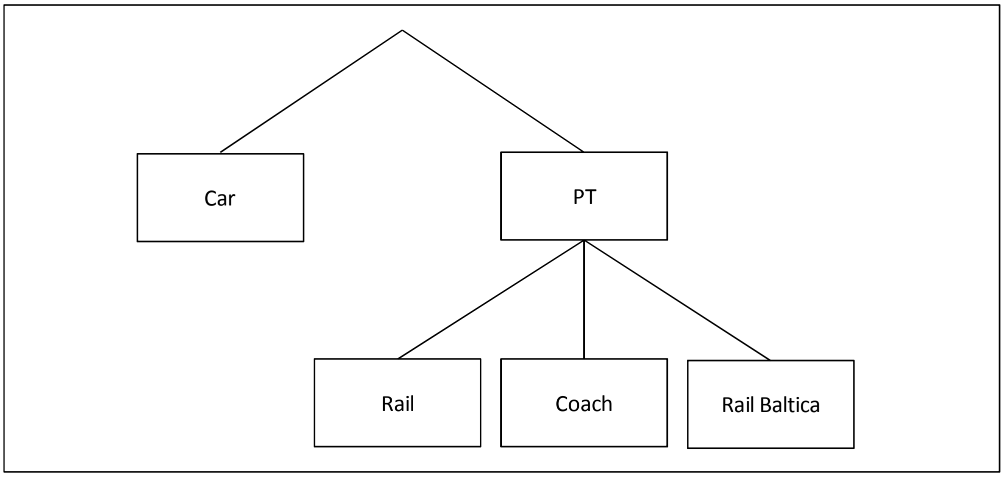
GCij = ((ATi + WTi * wait time weighting + JTij + ETj]) + (Fareij + VoCij) / (VoT/60))

Table 33 - Sources of the elements of the generalised cost calculation

<table>
<tr><th colspan="3">Cost Element</th><th>Car</th><th>Bus</th><th>Rail</th><th>Rail Baltica</th></tr>
<tr><td>Access Time</td><td>AT_i</td><td>Average time to access mode at origin</td><td>0</td><td colspan="3">Large Cities: 30 minutes
Small Cities and Towns: 20 minutes</td></tr>
<tr><td>Wait time</td><td>WT_i</td><td>Average time to wait for mode at origin</td><td>0</td><td colspan="3">Wait time calculated as half the average time between service departures, therefore wait time varies by Origin to Destination movement depending on frequency of service. The maximum wait time has been set at 3 hours to reflect teh fact that people time their arrival at bus and rail stations for infrequent services.</td></tr>
<tr><td>Wait time weighting</td><td></td><td>Factor to reflect dissatisfaction with waiting for public transport services</td><td>-</td><td colspan="3">2.0 used in line with standard industry practice.</td></tr>
<tr><td>Journey time</td><td>JT_{ij}</td><td>In-vehicle journey time</td><td colspan="4">From assignment model</td></tr>
<tr><td>Egress time</td><td>ET_j</td><td>Average time to travel from mode stop to ultimate destination origin</td><td>0</td><td colspan="3">Large Cities: 30 minutes
Small Cities and Towns: 20 minutes</td></tr>
<tr><td rowspan="2">Fare</td><td rowspan="2">F_{ij}</td><td rowspan="2">Public transport Fare</td><td rowspan="2">-</td><td colspan="2">Trip length (in km) from Assignment model * Average fare rate for mode in country based on observed data:</td><td rowspan="2">Trip length (in km) from Assignment model * Average fare rate</td></tr>
<tr><td>Estonia €0.050 per km
Latvia €0.041 per km
Lithuania €0.063 per km</td><td>Estonia €0.038 per km
Latvia €0.040 per km
Lithuania €0.054 per km</td></tr>
<tr><td>Vehicle Operating Costs</td><td>VOC_{ij}</td><td>Vehicle operating costs</td><td>€0.07 per km, based on fuel price.</td><td>-</td><td>-</td><td>-</td></tr>
<tr><td>Value of Time</td><td>VOT</td><td>Value of time</td><td colspan="4">Estonia €8.5 per hour
Latvia €7.3 per hour
Lithuania €6.8 per hour</td></tr>
</table>

The mode choice model has been established as a nested logit model with the top tier choice between car and public transport and the second tier choice between the various public transport alternatives (bus and coach). A composite generalised cost for PT modes has been created by taking the natural log of the sum of individual mode utilities and multiplying it by 1 divided by the car / PT elasticity.

Figure 16 - Mode Choice Model Structure



Mode share utilities have been calculated according to this formulation:

$$U_m = e^{\lambda_m (GC_{ij,m} + \theta_m)}$$

Where

λ is the elasticity,
θ is the mode share constant, and
GCij is the generalised cost for mode m.

Mode choice proportions are calculated by dividing the utility for each mode by the composite utility (for all modes on the top tier and for PT modes on the second tier). Car mode share is factored by a sensitivity parameter based upon car ownership levels.

Table 34 - Mode Choice Parameters below outlines the key model parameters that have been adopted. These have been calibrated such that the modelled mode splits on key movements within the Baltic States reflect observed mode shares.

Table 34 - Mode Choice Parameters

	Estonia	**Latvia**	**Lithuania**
Car Mode Constant (minutes)	0	0	0
Bus Mode Constant (minutes)	60	90	60
Rail Mode Constant (minutes)	70	50	80
Rail Baltica Mode Constant (minutes)	50	50	50
Car / PT elasticity	-0.012		
Bus / Rail / Rail Baltica elasticity	-0.020		
Car sensitivity parameter	0.92		

Air to Rail Baltica Demand shift model

The assessment of the volume of existing air passengers who will shift to Rail Baltica has adopted an alternative methodology. It is standard practice to consider the shift from Air to rail as dependent primarily on the duration of the new rail service which is introduced. This is in contrast to other modes where the generalised cost of the existing journey has a large influence on the size of the mode shift.

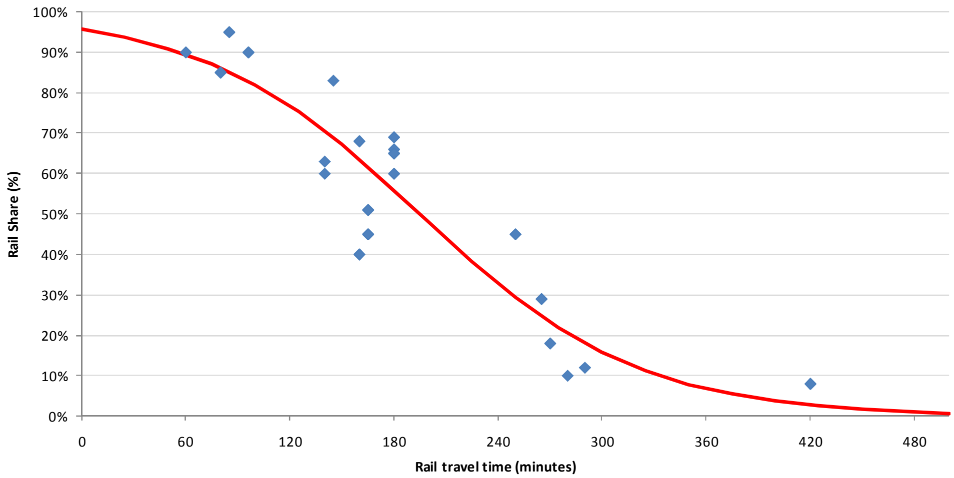
A Logit model has been built using observed data from a series of case studies across Europe, where new rail services were in traduced and demand shifted from existing air services. The case studiers include a range of both high speed and conventional rail services, and come from a range of countries.

Table 35 - Contains a summary of the rail journeys used for this purpose.

Rail Journey	Journey Time for new rail service (hh:mm)	Distance (km)	Share of Air Demand prior to open that switched to rail
London - Paris	02:40	160	68%
London - Brussels	02:20	140	63%
Paris - Marseille	03:00	180	66%
Paris - Bordeaux	03:00	180	65%
Madrid - Barcelona	04:40	280	10%
Madrid - Sevilla	02:25	145	83%
Rome - Florence	01:36	96	90%
Frankfurt - Cologne	01:00	60	90%
Paris - Strasbourg	02:20	140	60%
Madrid - Barcelona (highspeed)	02:40	160	40%
Madrid - Seville	02:45	165	51%
Paris - Marseille	03:00	180	69%
Madrid -Barcelona - 2005	04:50	290	12%
Madrid -Barcelona - 2002	07:00	420	8%
London -Edinburgh - 2004	04:30	270	18%
London - Edinburgh - 1999	04:25	265	29%
Paris Brussels	01:25	85	95%
Paris - London	03:00	180	60%
Paris - Amsterdam	04:10	250	45%
London - Brussels	02:45	165	45%

The fitted logit curve is displayed in Figure 17 - Fitting of Logit Curve to European Observed Rail Data and the equation is provided below.

Figure 17 - Fitting of Logit Curve to European Observed Rail Data



$$Rail\ Share = \frac{1}{1 + e^{\lambda(T+\theta)}}$$

where:

T = Rail Travel Time,

λ = 0.0159 and

θ = 195 minutes

It is clear that the relationship fits the observed data well and that when new services are opened that provide a rail alternative to air that has a journey time of less than 2 hours significant proportions of the existing air market (~80%) will shift, whereas when the rail alternative has a journey time of over 4 hours the share of the air market that shifts falls to around 30%.

Base Model Calibration and Validation

The base models have been calibrated and validated to observed demand and journey characteristic data.

- Base demand has been calibrated to observed demand initially at a zone to zone level, where data is available; followed by calibration to observed volumes at a national level.
- The Base assignment model has been calibrated to ensure highway volumes match 2009 AADT traffic counts on all strategic roads within the Baltic States.
- The base assignment model has also been validated to match observed travel times, as defined by route planner software.
- The base mode choice model has been calibrated to match observed mode shares on key movements within the region.

In summary the model suite provides a sound basis on which to conduct option tests.

Forecasting Approach

Population and Economic Growth

Population and GVA data has been obtained for Estonia, Latvia, Lithuania and some other locations around the Baltic states. These data are mostly at a NUTS3 level and contain historic data and forecasts approximately in the range 2000 – 2050. In addition, population and GVA data for other parts of Europe have been collated from Eurosta, UN and other statistical databases.

The forecasting model estimates the total trip growth for each model zone based upon population growth and GVA per head growth for the area. It has been assumed that traffic will grow at 60% of the rate of GDP per head and 100% of the rate of population growth.

The table below shows the average annual demand in passenger growth predicted using the economic information presented in the macro-economic data section.

Table 36 - Average Annual Growth in Passenger Demand by Region

Period	Estonia	Latvia	Lithuania	Baltic Region	International
2009 - 2020	1.50%	0.63%	1.14%	1.06%	0.88%
2020 - 2030	1.46%	1.25%	1.15%	1.23%	0.84%
2030 - 2040	1.52%	1.35%	1.16%	1.29%	0.88%

The zone growth rates are then applied to individual movements (each origin / destination pair is factored by the average of its origin and destination growth factor) in order to produce a complete matrix of growth factors, which is applied to base demand in the assignment model. This means that there will be different growth rates for each movement. The growing economic differences between the Baltic states, which are reflected in differential GVA growth rates for the states, will therefore result in higher growth in trips into and out of states that are growing strongly than for trips into and out of states that are forecast to grow less strongly.

The Impact of the shadow economy has also been captured in the approach adopted. The level of demand in future years is based on two elements, the current level of demand, and how this will grow over time. The base demand in the model has been calibrated against various sources of observed data. This observed data includes both trips made as a result of both economic activity which is captured in the official accounts, as well as activities within the shadow economy. The modelling approach uses GVA forecast to drive growth in trip making rather than as a driver of absolute demand. We have adopted an assumption that the shadow economy (which is already driving some of the existing demand) will grow at the same rate as the 'official' economy (i.e. GVA), and therefore growth in GVA provides a good proxy for the growth in total economic activity (both official and unofficial).

Value of Time Elasticity

A value of time for each zone within the model has been calculated using an elasticity formulation against GVA forecasts. It has been assumed that Value of time will grow at half the rate of GVA per head growth.

Induced Demand

Induced demand is often observed when a new service or infrastructure reduced travel costs between two locations. Typically the level of additional demand induced is related to the size of the reduction in travel costs. The level of induced demand has been calculated for the Rail Baltica service scenarios on a origin-destination level using an elasticity approach. A separate induced factor is calculated for each movements and demand segment (i.e. trips diverted from car, trip diverted from bus, etc.) based on the reduction in travel time which results from switching from the exiting mode to Rail Baltica and an elasticity of -0.3.

Assignment Model

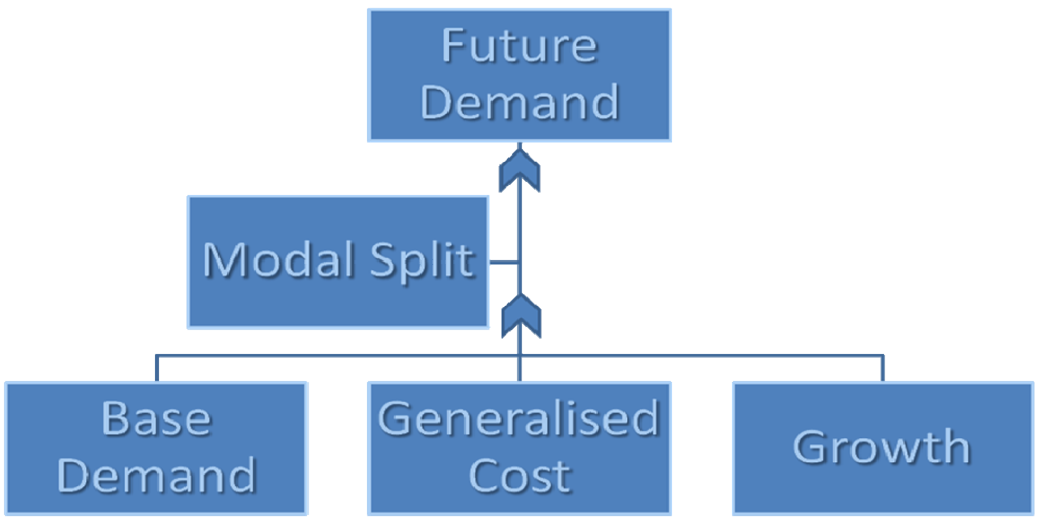
The base year assignment model has formed the basis of the future year models. Key forecast assumptions have included:

- Increase in car congestion will be captured by volume delay curves as a result of larger future year traffic volumes.
- Local traffic, which is included in the model as fixed volumes will grow in line with average rate of traffic growth across the region
- Coach journey times will increase at 1% per annum as a result of increasing congestion.

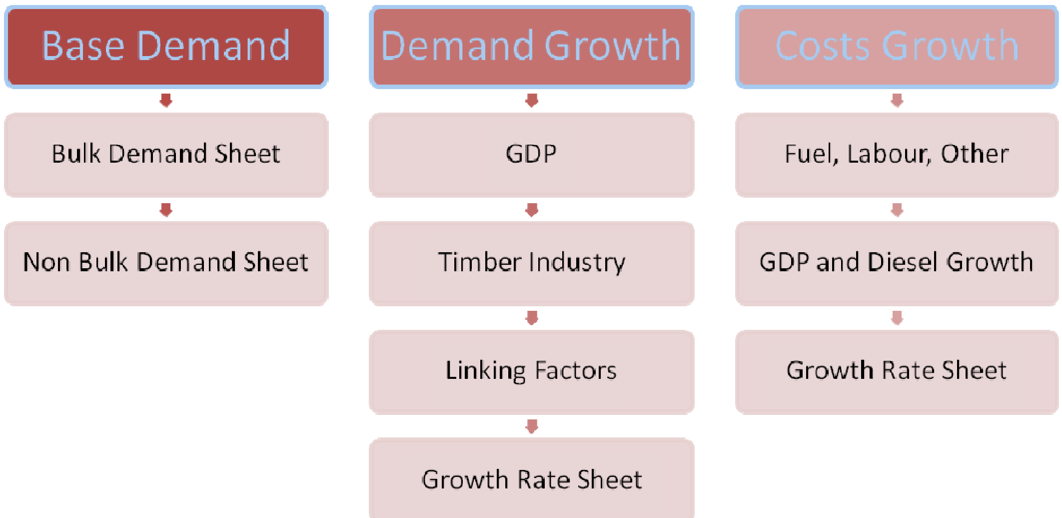
4.4.2 Freight Model Structure and Process for Forecasting Demand

Taking account of the factors described above a model has been developed to assist the study in understanding the overall demand for freight transport in the region based on existing flow information for freight movements, allowing the prediction of demand over the 30 year study period. The model considers both international, national and regional demand: forecasts and base year estimates are based on a NUTS3 detail level for Lithuania, Estonia and Latvia traffic and on a country wide basis for other international destinations.

The model that has been created is a mode choice model accounting for road, rail and sea traffic. The model has two streams which run in parallel; demand and modal split. By considering all modes and calculating the modal split based on the generalised cost the model can predict future potential for shift from existing road, rail and sea onto the Rail Baltica line. The model is structured as follows:



Base demand is split into bulk and non bulk commodities. Demand growth has been forecast using GDP growth forecasts and separate timber industry forecasts where applicable. Change in future costs has been predicted using growth in fuel, labour and other costs.



Model Base Year

The model base year has been taken as 2008. 2009 saw dramatic changes in tonnage levels for the majority of origins / destinations north-south due to the global recession. The Future of Transport, Focus Groups' Report, 20.02.2009 states that transport demand is closely linked to economic growth. In times of economic slowdown, there tends to be a sudden fall in transport demand, which however is bound to recover more quickly than the rest of the economy. Reactions during previous recessions clearly confirm this resilience of transport demand. In times of economic recovery, freight transport usually grows faster than overall GDP. This can in part be explained with the faster growth in international trade. Based upon this reasoning it was decided to take 2008 as the base year as this is likely to be more representative of long term volumes than 2009 information.

Factors Affecting Modal Switch to Rail Baltica for Freight Traffic

Train Frequency and Sufficient Critical Mass to Run a Train

A major factor affecting mode choice is the frequency of services and the business model of some operators as requiring guarantees for regular full trainloads is demanding. For market entry on a flow in general there has to be enough demand for a daily round-trip block train. Freight forwarders are required to provide certainty on train utilisation to rail freight operators in order to use this mode, as well as provide sufficient volumes to block-book full trainloads. A number of freight forwarders suggested that this was a difficult commitment for even the biggest companies to satisfy, and therefore for small volumes rail as an option is largely ruled out. However, most operators are flexible and are willing to look at a range of options to develop the market. One of these options is to work with groups of clients on flows where there is insufficient demand for one company to block-book a train. There is support for the creation of a spot-market for wagons, although it is recognised that this might need to be supported by governments or its agencies until a 'critical mass' of volume is reached.

Reliability and Flexibility

There are perceived and real differences in flexibility and reliability, between road and rail. Road is inevitably more flexible and allows even "same day" changes in delivery schedules or volumes. Cost can be instantly reduced by cancelling a required number of lorries. It is not so easy to do this on the railways. Similarly the ability to increase volumes at short notice is relatively limited. However, on the issue of reliability many operators are showing real improvement in reliability and indeed some companies are as good as or even better than road freight (LDZ currently has 91% reliability for rail freight services). Some rail freight operator's business models incorporate exacting reliability factors.

Journey Distance

Traditional wisdom has been that for rail freight to be financially attractive the journey has to have sufficient distance: typically over 150 kilometres. This is based upon the operator's rationale that while rail has high fixed costs it has low marginal cost (on a per kilometre basis) making it competitive over trucks for longer distances. However, given the right circumstances rail could be competitive at any distance. There are specific examples where distances as short as 80-100 kilometres would be considered due to particularly bad road congestion, where very efficient utilisation and rotation of rolling stock can be obtained, or where rail offers payload advantages.

Fast Speeds and Quicker Journey Times

Typical average speeds in Europe are approximately 140kph for passenger services and 70-75 kph for freight services. Several potential customers of rail freight are saying that journey times should be fast. Intermodal services and express parcel services can generally travel quicker (top speed of 120km/hour) than bulk trains which are usually restricted to 100km/hour. The top speed of these intermodal trains is 33% faster than the standard top speed for lorries and if this advantage can be used then rail can be competitive on end-to-end journey times. As a comparison typical European rail journey times are:

- Milan to Venice – distance 277 km, passenger 2:35, freight train 4:23
- Milan to Zurich – distance 279 km, passenger 3:41, freight train 5:41 (terrain more mountainous giving slower journey time)

Avoiding Unnecessary Delays

As an operating principle, the infrastructure managers should aim to achieve this through running of freight trains, seeking timetabling and signalling solutions in preference to the use of passing loops. This has the potential to deliver significant environmental, operating and economic efficiencies, particularly if delivered alongside existing plans to reduce the level of delay to freight trains.

Operational Resilience to Satisfy Customer Requirements

There are a number of issues concerning rail freight operations that in practice may negatively impact on the service provided by Rail Baltica and these are detailed below.

- Irregular patterns of long distance services lead to sub-optimal use of capacity;
- Lack of parallel routes with adequate loading gauge, electrification and line speed reduces opportunities for freight to be routed away from capacity constrained sections;

- Performance problems when services are running out of train path. The mix of high speed passenger trains with varying stopping patterns and slower passenger and freight services may make it difficult to contain delays; and
- The presence of different rail gauges in the region means diversionary routes can often be long and circuitous or non-existent, so trains have to be cancelled when the main route is unavailable

Environmental Factors

In addition to long-run capital and operational costs there are environmental benefits of rail transport to consider. Environmental issues are currently more of a governmental priority but this is changing fast and some major international companies are seeking to dramatically reduce their "carbon footprint". Customers including several of the major manufacturers and retailers are taking a more environmental view on distribution and are working towards modal shift from road to rail where it is viable and practicable to do so. For rail, typical CO2 (Carbon Dioxide) emissions can be around five times better per tonne moved than by road transport, depending on many factors including motive power, lading factors etc. Economic incentives for industry would include carbon trading and Eurovignette if / when this were to be introduced (EC proposals currently include external costs inclusion within the Eurovignette which would incentivise use of rail). With the likely introduction of carbon trading levies, or similar "green tax", then rail should become even more attractive to customers if it can be efficient.

Fuel taxes within the Baltic states are currently low compared to the European average therefore it is assumed that these will increase, in addition as fuel forms a higher proportion of road freight costs (36% approx according to TREMOVE) than for rail freight (14% according to LDZ), as oil prices and fuel duty increase in the long term road freight costs are likely to increase faster than the cost of rail.

Competition in the Rail Freight Sector

With regard to competition, in a survey conducted in the UK for the ORR (Office of Rail Regulation) more than four fifths of respondents thought that it is very or fairly important to have a choice of rail freight service provider, recognising the importance of this in driving down prices and improving service quality. As an example at the time of writing there are six Freight Operating Companies actually running trains in the UK in competition with each other and a further four logistics integrators that charter trains as well giving customers a real choice. The rail freight market in the UK has grown around 60% in tonne kilometres in the last ten years thanks partly to competition. Competition is not present yet within all Baltic States to a large degree.

Additional Rail Freight Terminals

There are some gaps in the national provision of "open user" rail freight terminals. The definition of "open user" in this case means a freight terminal able to handle different types of traffic and by different operators and this is particularly relevant for intermodal rail services. The geographical gap in provision has been a contributory factor in the development of a patchy network of rail freight services. The development of a good geographical network of terminals will facilitate a comprehensive supply of interconnecting services. Generally rail freight has a high level of reliability in terms of journey times, particularly on time-critical "just in time" intermodal flows and as a consequence is increasing the level of supply chain confidence. A main obstacle to potential growth is the lack of provision of high quality rail freight interchange terminals in key locations and the need for development funding of high quality rail terminal facilities within these terminals.

Rail Productivity and Length of Train

Clearly economies of scale come from longer and heavier trains where it is practicable to run them. The maximum capacity for European Intermodal Freight Trains will be for a length of 775m long. A 775m train length is considered desirable as this is seen as being the future 'standard' inter-modal train length (118 SLU / 755m plus locomotive) and moves more volume in the same number of train paths. Longer trains also achieve a better cost/rate per mile or kilometre. There are issues of signal spacing, length of passing loops and acceleration rates to consider. Generally electric locomotives have better haulage and acceleration capabilities than diesel locomotives. Electrification would therefore be beneficial as electric locomotives are more likely to have the capability of hauling a 775m long train in a standard train path. Although this capability can be built into a new railway, increasing train length from 500m to 775m is not straightforward on certain parts of the European network, and the ability of trains of this length to perform adequately within available paths and on a mixed traffic network need to be considered. Trains may be required to split at Warsaw freight yard for onward movement to other parts of Europe.

Competition with the Road Freight Sector

Although Rail Baltica could gain modal shift from water freight because the cost base of shipping is so low, if suppliers and end users are relatively close to ports which have linking services it is less likely that rail will be able to offer a competitive package. So it is important to consider the factors that are either already affecting or could affect the road freight sector in the future as its this sector that might provide more opportunities for modal shift to rail especially if there are more service and cost pressures on road than rail.

Costs of Road Haulage

The average costs of road haulage including for example fuel costs, vehicle costs, driver and overheads are set to increase over time as world fuel prices and wage costs increase. At the moment it is estimated to cost roughly €1 per kilometre for a 40 tonne articulated lorry (Source: Estonian Logistics & Freight Forwarding Association (ELEA)). The costs of this are higher in parts of Western Europe and over time there is likely to be more of a levelling of costs Europe-wide. Typically in road freight labour and fuel represent about a third each of costs whereas these two factors represent a lower percentage of total costs in the rail freight sector. Therefore when fuel and labour costs rise, rail generally becomes more cost competitive.

Lorry Road User Charging / Eurovignette

There are European regulations allowing member states to introduce certain forms of road charging or Eurovignette. There are road tolls in several countries and a charge on lorries for example in Germany, called the Maut and in Lithuania. In certain countries they are concerned about introducing what may be seen as another tax on road hauliers which ultimately is passed on to the customer in higher prices. It is uncertain how likely it is that this will be introduced across most of Europe but it would affect costs and competitiveness against rail. There are mixed views on its introduction and for example ELEA said they thought it is necessary and will be good for the overall industry.

Border Crossings and Delays

It is understood that there are sometimes problems for road freight due to queuing at the borders, particularly with Russia. For example in Estonia there are three different border points with Russia and the biggest is Narva where there can be queues usually lasting approximately three days and only about 70 trucks per day can cross the border. This is only a problem when crossing the Russian border with trucks, as there appear to be no problems with the railway.

Comparative Journey Times by Road

Comparative journey times by road have been taken for all origins and destinations using AA Route Planner and HGV speed limits and driver rest requirements. Journey times are likely to decrease in the future with the introduction of new motorway infrastructure.

Road Improvements Which May Impact on Rail Baltica

European Route E67 is a road running from Prague in the Czech Republic to Helsinki in Finland by way of Poland, Lithuania, Latvia, and Estonia. It is known as the Via Baltica between Warsaw and Tallinn, a distance of 970 kilometres and is a significant road connection between the Baltic States. The final stretch between Tallinn and Helsinki is by ferry. Road improvements on this route and other parallel routes may have a negative impact on Rail Baltica since it may lead to shorter journey times and a competitive advantage for road haulage against rail freight. E67 road improvements include the extension of Riga ring-road and Kekava ring-roads. Another major route that might have an effect is the reconstruction of Tallinn – Tartu road (E263) which is the longest road that crosses Estonia diagonally being a connecting link between the North and South-East of Estonia. There are also road improvements in Poland which will affect overall journey times.

Legal Compliance by Road Hauliers

The cost competitiveness of hauliers from one company to another can vary depending on how strictly the operator obeys European transport laws such as driving hour’s rules and weight limits. Enforcement has increased recently in certain member states but is likely to increase further in the future. It is understood that in Estonia the rules are enforced very strictly and this is a very important question, because they state that whilst these rules might work alright for middle Europe they place limitations on Northern countries. Sometimes Estonian trucks stay overnight just on Latvian-Estonian border, as the truck cannot make a full return trip in a day due to legal driver rest breaks.

Vehicle Size

HGV size and weight limits vary across Europe, for example 50 tonne lorries are currently in operation in Holland whilst 40 or 44 tonne lorries are the maximum in many other European countries. In the Baltic States 40 tonnes is the limit, or 44 tonnes when carrying a 40' container. Although some road freight groups are campaigning for heavier lorries, many countries including the UK and Estonia have decided that their roads are not suitable or ready for an increase in weight and changes of this kind will take more time and money. There is debate on the overall dimensions of HGVs with a possible height limit being introduced of 4 metres. This is being challenged in several countries including Germany and the UK.

Demand

The level of demand has been calculated by taking the 2008 base demand in tonnes and applying growth factors for the 3 modelled years, these factors have been calculated using GDP forecasts and factored to freight growth as detailed below.

The data used within the model is predominantly taken from Eurostat. This data and the data provided by the Lithuania, Latvian and Estonian governments largely agrees however there have been some instances where one countries statistics states that trade with another country is X tonnes and the receiving country states a different figure. Where this has happened the most sensible figure has been taken as correct. Eurostat data has primarily been used as this data is more detailed in relation to modal split and origin destination than the data available from the Lithuania, Latvian and Estonian governments and in addition data is available for transit routes. Detailed road freight data was provided by Lithuania for domestic journeys and this has been used within the model.

A furnessing process has been used in the Rail Baltica freight model for the road freight base demand in order to provide a consistent base matrix. Furnessing is commonly used with transportation modelling as a method of matching base matrices to new row and column totals.

Since two data sources, Eurostat database and statistics provided by the Governments have been used to provide detailed movements at NUTS3 level for flows to, from and within Latvia, Lithuania and Estonia, furnessing has been required to level out minor inconsistencies in the data. The Lithuanian Government Statistics provide complete flows at NUTS3 level but the totals entering and leaving these regions does not, in some cases, match the Eurostat totals entering and leaving these regions." For Latvia and Estonia origins and destination pair data by NUTS3 area has been synthesised using the furnessing process on loading and unloading data available from Eurostat.

Correlation of GDP to Freight Growth

GDP has been used to forecast future freight growth. Historic information for GDP and freight growth from 2003 – 2008 has been compared and it has been determined that for the majority of flows there is a very strong correlation between freight growth and GDP growth (see below):

Table 37 - Correlation of GDP of Freight Growth

Origin	Destination	Correlation	Freight Growth as a % of GDP Growth	Origin	Destination	Correlation	Freight Growth as a % of GDP Growth
Russia	Latvia	0.79	29%	Latvia	Poland	0.85	74%
Russia	Germany	0.87	305%	Estonia	Latvia	0.72	88%
Russia	Lithuania	0.99	283%	Germany	Estonia	0.99	134%
Finland	Germany	-0.34	-57%	Estonia	Germany	-0.64	-300%
Germany	Russia	0.98	397%	Finland	Italy	0.58	794%
Germany	Finland	0.94	119%	Latvia	Italy	0.83	822%
Latvia	Germany	0.44	175%	Poland	Latvia	0.53	33%
Latvia	Finland	0.97	338%	Estonia	Lithuania	0.78	75%
Lithuania	Latvia	0.95	52%	Poland	Estonia	0.95	224%
Germany	Lithuania	0.98	84%	Lithuania	Finland	0.12	114%
Latvia	Estonia	0.82	265%	Finland	Latvia	0.99	241%
Finland	Poland	0.96	363%	Italy	Lithuania	0.94	201%
Poland	Lithuania	1.00	189%	Finland	Lithuania	0.92	259%
Lithuania	Germany	-0.97	-125%	Estonia	Poland	0.76	50%
Lithuania	Russia	0.88	114%	Lithuania	Italy	-0.45	-329%
Lithuania	Poland	-0.31	-9%	Czech Republic	Lithuania	0.59	50%
Latvia	Russia	0.98	142%	Lithuania	Czech Republic	0.71	173%
Germany	Latvia	0.97	37%	Italy	Finland	0.07	112%
Latvia	Lithuania	0.86	93%	Italy	Estonia	0.80	54%
Poland	Finland	0.43	154%	Latvia	Lithuania	0.86	93%
Lithuania	Estonia	0.79	93%				

For some flows where the correlation is low (or even negative) it has been determined that this is likely due to the high dependence of freight volumes on timber / wood products flows. These flows have been forecast separately as described in the assumptions table. The table above also shows the relationship between freight growth and GDP i.e. % freight growth as a proportion of % GDP growth. This relationship is assumed to continue for the flows that have not been forecast separately.

Modal Split

Within the Rail Baltica Freight Model a modal split calculation is made which, for each Origin-Destination pair, converts the generalised cost for each mode into a percentage split between modes.

The equation has the form;

$$P_{ij}^{x} = \frac{\exp\left(-\alpha C_{ij}^{x}\right)}{\exp\left(-\alpha C_{ij}^{x}\right) + \exp\left(-\beta C_{ij}^{y}\right) + \exp\left(-\delta C_{ij}^{z}\right)}$$

Where P_{ij}^{x} is the probability of using mode x to go between i and j. C is the generalised cost and α, β, δ are fixed weighting parameters.

In the model $\alpha = 0.01, \beta = 0.008, \delta = 0.009$ for Non Bulk and $\alpha = 0.01, \beta = 0.009, \delta = 0.009$ for Bulk. These are the parameters for Road, Rail and Sea respectively. Using these parameters if the generalised cost of the modes for a particular non bulk journey were equal at 100 then 30% would use Road, 37% Rail and 33% Sea.

The model has been calibrated so that there is no unrealistic shift between modes in future years. For example; in future years there are no major shifts from Road to Sea because there is no major shift in generalised cost for these modes.

As can be seen the driving force of the modal split calculation is the generalised cost which is calculated as:

Generalised Cost = (Journey Time x Value of Time) + Journey Cost + Handling Costs

This calculation has been completed for each Origin-Destination for Rail, Road and Sea, as well as Bulk and Non Bulk. Each element of the generalised cost has been discussed in the assumptions section.
As an example the generalised cost for Finland to Germany in 2020 for each mode;

Generalised Cost	Road	Rail	Sea
Non Bulk	2562	2539	2141
Bulk	2118	1176	1174

Road is the least favourable mode for both Bulk and Non Bulk, these numbers would lead to Sea taking the majority of traffic with some, especially bulk, for Rail.

Where the 1520 gauge line is involved a separate handling cost and time has to be added thus increasing the generalised cost for this journey which helps to explain why there is little transfer from the existing lines to the Rail Baltica Line since it is less attractive than remaining on the existing route in most cases.

Rail Freight Pricing Options
The model has 3 pricing options High, Medium and Low which are detailed below:

High

Type		Transit	Import, Export, Domestic
Per tonne km	Bulk	0.038	0.05
Per container km	40'	1.38	3.00
Per container km	20'	0.69	1.51

Medium

Type		Transit	Import, Export, Domestic
Per tonne km	Bulk	0.03	0.04
Per container km	40'	0.86	1.30
Per container km	20'	0.48	0.84

Low

Type		Transit	Import, Export, Domestic
Per tonne km	Bulk	0.02	0.04
Per container km	40'	0.56	0.86
Per container km	20'	0.29	0.66

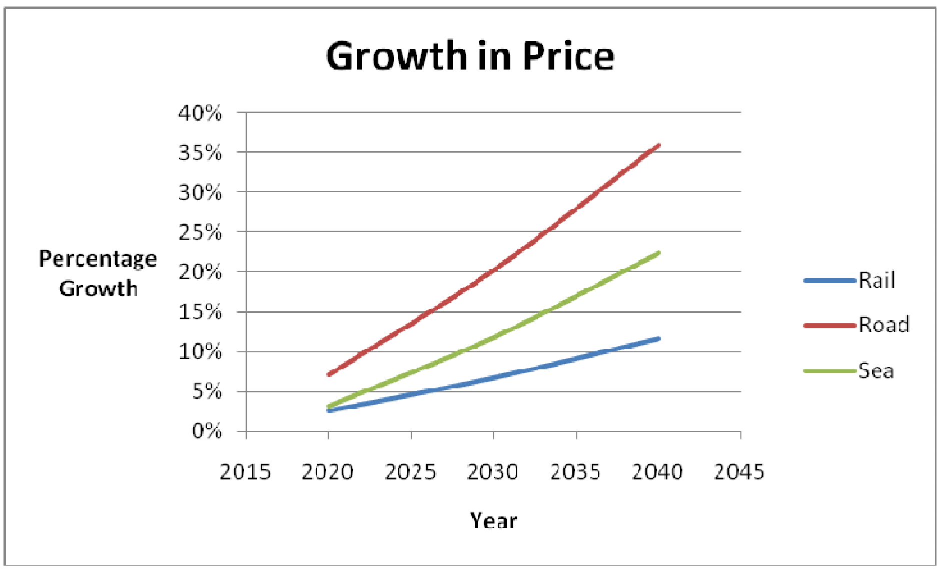
These have been calculated from the quoted prices from Latvia, Lithuania and Estonia.

Induced Demand

It is assumed that induced demand will be seen at a level of approximately 15% additional traffic over mode shift demand. This is based upon international examples of new lines such as freight induced demand estimates for the new rail corridor linking Melbourne and Brisbane (Phil B Goodwin and ATEC (Australian Transport & Energy Corridor Ltd) financial study). A maximum of 30% additional traffic will be tested within the model based upon the maximum seen in international examples (Noland, R.B., Cowart, W.A., 2000. Analysis of metropolitan highway capacity and the growth in vehicle miles of travel). The level of induced demand will be highly dependent on both pricing policies and policy regarding Free Economic Zones. If, for example, Free Economic Zones are limited to solely the ports much lower levels of induced demand are likely to be seen on the railway.

Growth in Price

The growth in rail, road and sea freight prices is forecast as below. Due to the higher proportion of road and sea freight prices related to labour and fuel it is likely that these prices will rise faster than for rail freight, meaning that rail freight is likely to become increasingly competitive in future years.



Model Assumptions

A full list of the model assumptions and the sources of each assumption can be found below:

Table 38 - Table of Assumptions

<table>
<tr><th>Assumption</th><th>Affects</th><th>Source of Assumption</th></tr>
<tr><td>Sea freight costs</td><td>Mode choice</td><td>Sea freight quotes provided for 40’ containers by a wide variety of shippers and the assumption has been made that 20’ = 80% cost of 40’ from average of quotes provided by Ahlers Latvia, Samskip and Unifeeder</td></tr>
<tr><td>Road freight costs</td><td>Mode choice</td><td>Road freight costs per kilometre provided by a range of Hauliers who operate in the study area, this includes costs for overnight haulage and multi-manning where appropriate. Prices quoted range from €0.9 to €1.15 per km. €0.9 has been assumed for single manned journeys €1.15 for multi-manned. €50 has been assumed for overnights.</td></tr>
<tr><td>Rail freight costs</td><td>Mode choice</td><td>Rail freight costs based on quotes provided by LDZ and Eesti Raudtee and on standard tariffs available on the websites for LDZ, Eesti Raudtee and Lithuania Railways for 20’ containers, 40’ containers and bulk freight. Low, medium and high costs have been assessed based upon these values.</td></tr>
<tr><td>Values of Time</td><td>Mode Choice</td><td>Values of time taken from Tremove – the European Commission’s modelling system for Bulk, General Cargo and Unitised Freight for Road, Rail and Sea in various EU countries. Lithuania, Latvia, Estonia and Polish all had the same values and Russia is assumed the same.
<table>
<tr><th></th><th></th><th>Baltics</th><th>Germany</th><th>Finland</th></tr>
<tr><td rowspan="2">Bulk</td><td>Train and Ship</td><td>0.002</td><td>0.005</td><td>0.005</td></tr>
<tr><td>Road Freight</td><td>0.002</td><td>0.006</td><td>0.006</td></tr>
<tr><td rowspan="3">General Cargo</td><td>Train</td><td>0.002</td><td>0.007</td><td>0.007</td></tr>
<tr><td>Ship</td><td>0.003</td><td>0.009</td><td>0.009</td></tr>
<tr><td>Road Freight</td><td>0.004</td><td>0.012</td><td>0.011</td></tr>
<tr><td rowspan="3">Unitised</td><td>Train</td><td>0.006</td><td>0.017</td><td>0.033</td></tr>
<tr><td>Ship</td><td>0.008</td><td>0.021</td><td>0.033</td></tr>
<tr><td>Road Freight</td><td>0.010</td><td>0.028</td><td>0.026</td></tr>
</table>
Based upon port statistics
• For Baltics = 34% of Bulk + General Cargo = General Cargo
• For Finland = 58% of Bulk + General Cargo = General Cargo
• For Germany = 26% of Bulk + General Cargo = General Cargo</td></tr>
<tr><td>Tonnes Per Container</td><td>Number of Trains</td><td>14 Tonnes based upon average container weight over Lithuania, Latvia and Estonia from Eurostat</td></tr>
<tr><td>Tonnes per Lorry for Bulk Cargo</td><td>Number of Trains</td><td>18 Tonnes based upon average lorry weight for bulk traffics over Lithuania, Latvia and Estonia from Eurostat</td></tr>
<tr><td>Trucks Per Train</td><td>Number of Trains</td><td>50 for Non Bulk, 200 for Bulk. This gives average train weights of 3,600 tonnes for bulk and 900 tonnes for non bulks. This is based upon information provided by University of Riga. These are heavier than general European trains (for example the average UK container train is 450 tonnes and average bulk is 1,500 tonnes), however, they are lighter than the current Russian gauge trains LDZ have stated that on the other sections of Latvian railway infrastructure, where there are container trains, the weight of container train is around 1800-2100 tonnes and bulk trains can run up to 5,100 tonnes and trains of up to 5,300 tonnes run through Narva. Estonian information indicated an average container train weight of 850 tonnes and average bulk train weight of 4,000 tonnes. Trains may be required to split at Warsaw freight yard for onward movement to some parts of Europe.</td></tr>
</table>

<table>
<tr><th>Assumption</th><th>Affects</th><th>Source of Assumption</th></tr>
<tr><td>Handling Charges</td><td>Mode Choice</td><td>Handling charges have been taken from information available from NYK Logistics (in Euros).
<table>
<tr><th></th><th>Estonia</th><th>Latvia</th><th>Lithuania</th><th>Finland</th><th>St Petersburg</th><th>Poland</th><th>Germany</th><th>Italy</th><th>Hungary</th><th>Czech Republic</th><th>Other</th></tr>
<tr><td>Terminal Handling Charge - 20'</td><td>30</td><td>50</td><td>50</td><td>110</td><td>220</td><td>92</td><td>92</td><td>92</td><td>92</td><td>92</td><td>92</td></tr>
<tr><td>Terminal Handling Charge - 40'</td><td>30</td><td>70</td><td>50</td><td>110</td><td>220</td><td>96</td><td>96</td><td>96</td><td>96</td><td>96</td><td>96</td></tr>
<tr><td>Charge for lifting laden containers from truck to terminal</td><td>25</td><td></td><td></td><td></td><td></td><td>25</td><td>25</td><td>25</td><td>25</td><td>25</td><td>25</td></tr>
<tr><td>Release Order</td><td>10</td><td>30</td><td></td><td></td><td></td><td>20</td><td>20</td><td>20</td><td>20</td><td>20</td><td>20</td></tr>
<tr><td>20' Cost</td><td>65</td><td>80</td><td>50</td><td>110</td><td>220</td><td>137</td><td>137</td><td>137</td><td>137</td><td>137</td><td>137</td></tr>
<tr><td>40'Cost</td><td>65</td><td>100</td><td>50</td><td>110</td><td>220</td><td>141</td><td>141</td><td>141</td><td>141</td><td>141</td><td>141</td></tr>
</table>
It has been assumed that the rail handling charge will be approximately €50 based on handling charges for rail freight terminals in Eastern Europe taken from the assessment for Sofia Intermodal Terminal.</td></tr>
<tr><td>Local Road Haulage</td><td>Mode Choice</td><td>Local road haulage costs have been assumed to be €40 Euros at either end of rail or sea journey. This is based on a charge of €1 per km and a hinterland of approximately 40km.</td></tr>
<tr><td>Gauge Transfer Cost</td><td>Mode Choice – Russia</td><td>Taken as 220 Euros based upon St Petersburg handling charges</td></tr>
<tr><td>Handling Times</td><td>Mode Choice</td><td>2 hours for Rail and Sea for transfer between modes or gauge changes. Based upon information provided by University of Riga on gauge transfer and on standard handling times for terminals.</td></tr>
<tr><td>Sea journey times</td><td>Mode Choice</td><td>Sea journey times have been taken from quotes provided by a variety of shipping lines</td></tr>
<tr><td>Road journey times</td><td>Mode Choice</td><td>Have been taken from AA Route Planner and adjusted to reflect a realistic truck speed. Legal requirements for driver breaks have then been added in under EU legislation.</td></tr>
<tr><td>Rail Speeds</td><td>Mode Choice</td><td>70 kilometres per hour average for normal speed, a high speed option of 90 kilometres per hour is also included. This is based upon average speeds within the COWI report.</td></tr>
<tr><td>Future changes in Sea Journey Times</td><td>Mode Choice</td><td>Sea journey times have been assumed to remain the same in the future.</td></tr>
<tr><td>Future changes in Road Journey Times</td><td>Mode Choice</td><td>Road journey times have been assumed to reduce by 10% by 2020 due to the new motorway construction and to remain at this level for the remaining study period.</td></tr>
</table>

<table>
<tr><th>Assumption</th><th>Affects</th><th>Source of Assumption</th></tr>
<tr><td>Composition of Road, Rail and Sea Costs</td><td>Future growth in prices, future modal choice</td><td>The split between labour, fuel and other costs has been taken from TREMOVE for road freight, taken from information provided by LDZ for rail freight and taken from Statistical coverage and economic analysis of the logistics sector in the EU (SEALS), European Commission, 2008 for sea freight.
<table>
<tr><th>Price Growth Rate</th><th colspan="3">Percentage Split</th></tr>
<tr><td></td><td>Fuel</td><td>Labour</td><td>Other</td></tr>
<tr><td>Rail Freight</td><td>14%</td><td>14%</td><td>72%</td></tr>
<tr><td>Road Freight</td><td>36%</td><td>45%</td><td>18%</td></tr>
<tr><td>Sea Freight</td><td>11%</td><td>31%</td><td>58%</td></tr>
</table></td></tr>
<tr><td>Growth in labour, fuel and other costs</td><td>Future growth in prices, future modal choice</td><td>Labour price growth is assumed to follow GDP forecasts, Fuel follows trends provided by European Transport Trends to 2030, European Commission. Other costs have been assumed to remain the same in real terms.
<table>
<tr><th></th><th>2020</th><th>2030</th><th>2040</th></tr>
<tr><td>Fuel</td><td>12%</td><td>15%</td><td>17%</td></tr>
<tr><td>Labour</td><td>6%</td><td>33%</td><td>66%</td></tr>
</table></td></tr>
<tr><td>GDP</td><td>Demand growth</td><td>As detailed within the economic section</td></tr>
<tr><td>Timber industry Forecast</td><td>Demand growth</td><td>Some major flows are dominated by paper products, e.g. Latvia-Germany, for these the future growth in the timber industry has been used, taken from EU forecasts (Development of a Model of the World Pulp and Paper Industry, European Commission).</td></tr>
<tr><td>Germany Traffic</td><td>Demand</td><td>It has been assumed that 50% of sea traffic to/from Germany would be able to use Rail Baltica (representing traffic currently travelling from southern Germany). Northern flows are unlikely to use the line.</td></tr>
<tr><td>Current Rail Bulk Percentage</td><td>Base Demand</td><td>It has been assumed that the existing railway is 20% Non Bulk, the remaining 80% is assumed to be bulk, this is based on information obtained from Lithuanian Railways and LDZ relating to the composition of current rail freight flows.</td></tr>
<tr><td>Inter Baltic Rail traffic</td><td>Demand</td><td>The following proportions of Inter Baltic rail traffic using the current railway lines are assumed to shift to the new line:
<table>
<tr><td>Lithuania - Estonia</td><td>0.4%</td></tr>
<tr><td>Lithuania - Latvia</td><td>1.7%</td></tr>
<tr><td>Estonia - Lithuania</td><td>2.0%</td></tr>
<tr><td>Latvia - Lithuania</td><td>4.1%</td></tr>
<tr><td>Latvia - Estonia</td><td>2.7%</td></tr>
<tr><td>Estonia - Latvia</td><td>6.2%</td></tr>
</table>
This is based upon an assessment of the commodity types which form current traffic and a determination of which of these commodities are likely to be high value or express freight which may wish to use the new line.</td></tr>
</table>

Future Forecasts

Future forecasts for have been calculated as follows. The below indicate growth factors above base year levels.

Destination	GDP Forecast			Freight Forecast		
	2020	2030	2040	2020	2030	2040
Põhja-Eesti	26%	60%	103%	3%	7%	12%
Estonia	11%	41%	78%	1%	5%	9%
Riga	-2%	22%	52%	0%	3%	8%
Vidzeme	-30%	-13%	8%	-5%	-2%	1%
Zemgale	-19%	1%	25%	-3%	0%	4%
Kurzeme	-25%	-7%	16%	-4%	-1%	2%
Latvia	-2%	22%	52%	0%	3%	8%
Vilnius	23%	53%	90%	5%	11%	19%
Kaunas	15%	43%	78%	3%	9%	16%
Klaipėda	18%	46%	82%	4%	10%	17%
Lithuania	9%	36%	68%	2%	7%	14%
Poland	34%	63%	99%	14%	27%	42%
Germany	13%	31%	52%	23%	55%	92%
Finland	15%	37%	64%	8%	20%	34%
St Petersburg	39%	96%	176%	19%	48%	88%
Italy	6%	17%	30%	5%	13%	22%
Czech Republic	24%	51%	84%	2%	4%	6%
Hungary	25%	52%	85%	15%	31%	51%

4.4.3 Model Outcomes

Model outcomes for both freight and passenger traffic can be found in Section 7.

4.5 Potential Core Business Determined Through the Model

4.5.1 Freight Core Business

Based upon the model outputs the key traffics for Rail Baltica are the services shown in Table 40. More information and full freight demand forecasts can be found in Section 7.

The potential core business based upon this is primarily non-bulk transit traffic from central Europe to Finland and the St Petersburg area. This type of traffic requires good service levels, a high level of reliability and modern wagons and equipment for the handling of combined transport. This type of traffic is also generally more sensitive to journey times than bulk traffic therefore the faster the service provided the higher the levels of attraction that are likely. Gauge transfer facilities will be required for traffics to St Petersburg. These will need to be efficient and reliable in order to attract this type of business.

The second layer of core business is exports of non bulk goods from the Baltic states (with Lithuania and Latvia forming the majority of traffic). Traffics are likely to be primarily containerised on the long run (as this is the most efficient manner of transporting non bulk goods long distance) which may be comprised of traffics such as food and drink, manufactured goods, wood and paper products and even products such as peat in the long term. These types of traffics are likely to include some deep sea intermodal boxes arriving through the ports of Riga and Klaipeda travelling to St Petersburg, Finland and central

Europe. Some bulk exports may also be seen particularly from Lithuania to central Europe and from Latvia to St Petersburg. Capturing this type of traffic will require efficient handling facilities for combined transport in Latvia and Lithuania (such as the facility being developed at Kaunas).

Table 39 - Key Potential Freight Services

Origin	**Destination**	**Trains per Day, Red Route, Medium Case, 2040**	**Cargo Type**
Poland	St Petersburg	5	Non Bulk
Finland	Germany	3	Non Bulk
Lithuania	St Petersburg	3	Non Bulk
Germany	Finland	2	Non Bulk
Lithuania Internal Southbound		2	Non Bulk
Lithuania	Finland	2	Non Bulk
Lithuania	Poland	2	Non Bulk
Latvia	Finland	2	Non Bulk
Lithuania Internal Northbound		2	Non Bulk
Finland	Poland	1	Non Bulk
Germany	Estonia	1	Non Bulk
Lithuania	Latvia	1	Non Bulk
Poland	Finland	1	Non Bulk
Latvia	St Petersburg	1	Bulk
Estonia Internal Northbound		1	Non Bulk
Latvia	Lithuania	1	Non Bulk
Latvia	Finland	1	Non Bulk
Lithuania	Germany	1	Non Bulk
Estonia Internal Southbound		1	Non Bulk
Lithuania	Poland	1	Bulk
Lithuania	Germany	1	Bulk
Poland	Lithuania	1	Non Bulk
Lithuania	Finland	1	Bulk
Germany	Lithuania	1	Non Bulk
St Petersburg	Poland	1	Non Bulk
Latvia	Lithuania	1	Bulk

The third layer of core business is inter-baltic traffics. These types of traffic are likely to be at lower levels than transit and export traffics. Traffic is most likely to be time sensitive goods for example intermodal and post/parcels. Interest has been expressed in use of the line by some major domestic retailers within the countries. It should be noted that any traffic with origin and destination between Tallinn and Kaunas can only be considered a “core business” for Rail Baltica if the transport quality is perceivably higher than on the competing and already existing 1520 mm gauge line. The functional requirement specification indicates substantially reduced journey times indicating that this should be the case. In addition in order to capture the potential for this type of traffic (particularly the potential for inter-Baltic intermodal) the provision of modern and efficient handling facilities for combined transport will be required (as is the case for export traffic).

Finally some import traffics are likely to be seen on the line; however, this is likely to be at lower levels than exports due to the balance of trade currently seen. The main traffics from the information within the model are likely to be non bulks from Germany to Estonia and Lithuania and Poland to Lithuania.

Volumes are likely to be primarily transferred from existing road freight traffic with some volumes transferred from existing sea freight services. The proportion expected to be transferred from each mode is indicated below (out of the total of 100% transferred):

	Non Bulk		**Bulk**	
	Sea	*Road*	*Sea*	*Road*
2020	42%	58%	44%	56%
2030	24%	76%	34%	66%
2040	17%	83%	42%	58%

In the case of both types of traffic the attractiveness of rail compared to road is likely to increase in the future as it is likely that road prices will rise at a faster rate than rail, due to the differences in the makeup of road and rail freight costs.

The majority of the traffics indicated above are likely to require reliable and competitive journey times and good quality handling facilities in order to be realised. In addition a large proportion of this traffic may require the availability of track and trace systems, which it is noted are offered by companies such as Eesti Raudtee, DB Schenker and Lithuania Railways. In addition the availability of an integrated door to door service provision offer may well influence the extent to which rail is used for these types of traffics: it is noted that the Baltic rail freight operators do advertise the provision of such services.

Importance of the Pricing Structure

As can be seen from the sensitivity testing carried out the levels of traffic which are likely to be seen on Rail Baltica they are highly dependent on price and are also relatively dependent on the routing option selected (as this affects both the attractiveness of the journey time and the distance and therefore price). As noted previously different pricing systems are in place in each of the countries. In order to get the most out of the line a consistent and simple pricing system will be required such as is in operation for the specialised container trains provided as a joint offer to destinations such as Moscow, Odessa and Central Asia.

The policy within the tariffs of charging twice as much for a 40' as a 20' may deter a proportion of larger box intermodal traffic from using the line. Quoted prices for sea freight generally have 40' containers charged at between 20% and 60% more than 20' containers and road freight operators charge the same for both. The use of 40' containers has generally been rising for many of the flows likely to be attracted to Rail Baltica therefore this issue is likely to become more rather than less important in the future. Quoted prices for Estonian rail freight do not indicate a 2:1 differential therefore it is assumed that there may be some flexibility in this tariff structure.

Imbalanced Flows

The imbalance in northbound and southbound traffic predicted within the model may affect the potential volumes available on the sections through Latvia and Estonia in particular as it is unlikely that a backload will be able to be found for much of the potential traffic (roughly twice as much demand is predicted northbound as southbound). This could lead to increased costs for the freight operating companies and therefore tariffs may be higher.

Case Study Analysis Showing Key Aspects Relating to the Future Success of the Rail Line

The case studies below provide examples of the key aspects likely to influence the future success of the rail line. The case studies are drawn from across Europe and illustrate in a practical manner how the various factors can combine to provide a successful rail freight line.

CASE STUDY – New North-South Rail Services

DB Schenker is to run new European services on north-south corridor

DB Schenker is investing heavily across Europe for example it is building a new hub in the northern suburbs of Helsinki and some port terminals in Poland. Also it is offering new pick-up and delivery services by its' Swiss subsidiary, Hangartner, which will be handled by truck, transferring to rail for the middle leg of the journey. The company said the flexibility of intermodal services is useful where trucks cannot be used, such as during weekend or Sunday driving bans or because of tunnel restrictions. The company is offering the new service on a north-south corridor between Finland, Sweden, Norway and Central Europe to Italy. Its intermodal operating centre in Zürich will operate around 4,000 block trains a year on regular scheduled services several times a week on fixed routes. DB Schenker said: "We would like to get more shipments onto rail. We are combining the flexibility of the truck with the benefits of rail transport, which will also have a positive impact on the environment."

CASE STUDY – Rail Connectivity to Ports is Important

Port of Gothenburg shows the way with rail

Road has for a long time been the conventional mode of transporting goods but recently the Port of Gothenburg has significantly increased the proportion of traffic moving by rail. At a time when the rest of Europe is struggling to make rail transport more successful compared to road, the proportion of the port's hinterland traffic moving by rail recently reached 60%. Six years ago it was just 23%. In comparison, Hamburg's proportion last year was 33%, and it was second only to Bremerhaven in terms of rail access in northern Europe. Gothenburg's success stems from the electrification of its port railway infrastructure in 2005, and the dominance of Maersk Line, which remains very pro-rail and is expected to carry around 75% of the port's total traffic moving by rail. Gothenburg handles around 70% of Sweden's total container traffic and currently offers 24 rail shuttle services. It is not clear how these have helped the port to grow its container traffic, but its rail traffic increased by 5.2% in the first half of the year, up to 183,000TEU. Last year the gateway's total container traffic reached 862,500TEU, including cargo staying in the port area or awaiting transhipment.

CASE STUDY – Rail Freight needs to be Responsive in Operations and Pricing

Port of Rotterdam Modal Split 2009

Last year rail transport declined from 13% to 11% and is back at the 2006 level. Road transport fell from 57% to 56%. Rail transported 755,000teu, down 25% on 2008, while and truck volumes dropped 14% from 4.47 million teu to 3.84 million teu. The port reported that rail transport did not want to adapt, or could not adapt its tariffs, fast enough to arrest the declining total volume. Betuweroute tariffs, for example, were lowered only in late 2009. The goal is to realise a modal split in 2035 of inland shipping 45%, rail 20% and road 35%.

CASE STUDY – Lessons from a New Freight Railway

Betuweroute, a new European Corridor running through Holland

The Betuweroute is a 160km long double-track freight railway and was one of the largest infrastructure projects in the Netherlands. Construction started in June 1997 and on its completion in 2007 it had cost 4.7bn euros, significantly more than was originally estimated. It was designed to link Rotterdam with Zevenaar on the Dutch/German border and may accommodate trains of double stacked containers in the future as operated widely in USA. In June 2010 the Port of Amsterdam was connected to the Betuweroute. The first train from Amsterdam consisted of 48 four-axle coal hoppers wagons with a total weight of 4,400 tons and was hauled by two locomotives (DB Schenker) due to it being one of the heaviest trains in the Netherlands. Due to the closure of many German coal mines, the country is reliant on imported coal and some of this is coming through Dutch ports. The new line has had problems apart from the overspend including major environmental opposition, complex non-standard equipment and the fact that the Germans have not yet invested in the 60kms connecting line in their country which would have improved overall journey times. Originally by this year (2010), it was predicted that up to 10 trains an hour, travelling at an average speed of 100 km per hour, would use the line. Keyrail, the operator, aimed at reaching a traffic level of 900 trains / week by 2013 in order to be profitable. Recently the number of trains using the Betuweroute recorded by Keyrail has increased considerably to 320 trains/week and they hope to reach 350 trains / week by the end of the year; still significantly below their target but at least it is growing.

CASE STUDY – Change in Supply Chains can be achieved with Cooperation

Flowers and plants with Shortsea from Holland to Finland

Flowers and plants are mainly distributed in Europe by truck, often in driver accompanied temperature controlled vehicles. At the initiative of the VGB (the wholesale trade organisation for flowers and plants in the Netherlands) some flowers and plants have been shipped from Rotterdam to Helsinki, Finland by a shortsea operator Containerships vessel. The plants were shipped by exporter Fertiplant through logistics provider DSV. The flowers were loaded in a reefer container which had a tracking and tracing system using a TraSec BV control unit that continually monitored the temperature to ensure the products arrived in excellent condition. The goods left on a Friday and by Monday the container arrived in the Finnish capital after a sea journey of 4 days. By truck it takes two days to arrive in Helsinki. The door to door shortsea trip saved approximately 20% in transport costs. The trial shipment by sea is part of a project "Containerisation and Conditioning in the Floriculture (CoCos).

CASE STUDY – Rail Freight Competition is Important

Channel Tunnel operator, Eurotunnel has bought the third largest UK rail freight operator, GBRailfreight (GBRf) to compete with Captrain (SNCF Fret) and DB Schenker

Eurotunnel has bought GBRf, the third largest UK rail freight operator and said the deal was in line with its strategy of developing a leading position in the European rail freight market. The company already owns Veolia Cargo France and these will complement the services offered by Eurotunnel’s rail freight subsidiary, Europorte. The acquisition would allow Eurotunnel to offer new services for intra-European cargo currently travelling on the roads. The company said that growing concerns about the environment and the increasing need for freight transport over both long and short distances mean that rail freight is a buoyant market. Environmental pressures and the increasing cost of fuel would make rail freight a more attractive mode of transport in the future.

CASE STUDY – Russian Railways Expansion Plans have Competing Routes

Between 2003 and 2008, Russian Railways (RZD) carried an annual average of 1•3 billion tonnes, equivalent to a 43% share of the national freight market in terms of tonne-km. RZD's growth strategy, 'Strategy for Railway Development up to 2030', envisages that freight volumes will increase by 70% and passenger traffic by 30% between now and 2030. One of the main objectives is to integrate Russian Railways more closely into the European rail network, and promote the development of international transit corridors. This will improve rail's competitiveness against road and sea for freight and against air for passengers. One of the new schemes is for a Moscow - St Petersburg high speed line which could be built by 2015 which will release some capacity on the existing routes for additional freight trains.

Eurasia Rail Logistics (ERL) has been founded in Moscow as a joint venture of Railion Deutschland, RZD Russian Railroads, PKP Cargo (Poland) and Belarus Railroads, with the aim of improving rail freight transport on the corridor between Germany and Asia via Russia. ERL aim to optimise the legal, operational, technical and commercial conditions of rail freight transport on pan-European Corridor II (Germany-Poland-Belarus-Russia, with an extension to Asia), in order to improve the quality of services and come up with more attractive transit times and pricing for customers.

Russian Railways (RZD OJSC), together with the transport authorities in Austria, Slovakia and Ukraine have signed an agreement in 2010 for the construction of a broad-gauge railway line between Kosice (Slovakia) and Vienna (Austria). The railway project will connect the rail network of Central Europe with the Trans-Siberian network. The implementation of this project will bring transit traffic on the Asia - Russia - Central Europe route and help boost the competitiveness of rail transport compared with shipments by sea or road transport. According to estimates, the transport volume on the Kosice – Bratislava line could reach 23.7 million tonnes by 2025, and 18.5 million tonnes on the Bratislava – Vienna line. The planned route to Europe will carry both containers and raw materials and the reverse route will carry containers. According to preliminary estimates, the cost of the project could exceed EUR 4.7 Billion. This along with other international projects of Russian Railways, are to be a centre of gravity for other areas of business, cumulatively forming a powerful trade and transport system. This will prove to be a catalyst for effective cooperation between 1520 mm and 1435 mm gauge railway systems, between countries of the European Union and Russia.

CASE STUDY – The Interoperability of Freight Corridors

Corridor F improves transport between Eastern and Western Europe via Warsaw

The European integration of rail freight transport requires a completely functional and integrated European transport network. This means less traffic delays for freight transport operators and definitely less time at border crossings. The interoperability of freight corridors depends to a great extent on the European Railway Transport Management System (ERTMS). Therefore, in 2006, the European Commission established six rail transport corridors to be equipped with the ERTMS, lettered from A to F. In 2009, it was established that rail freight transport needs are particularly addressed on these corridors. The relevance of this is that Corridor F connects to Rail Baltica at Warsaw giving good connectivity.

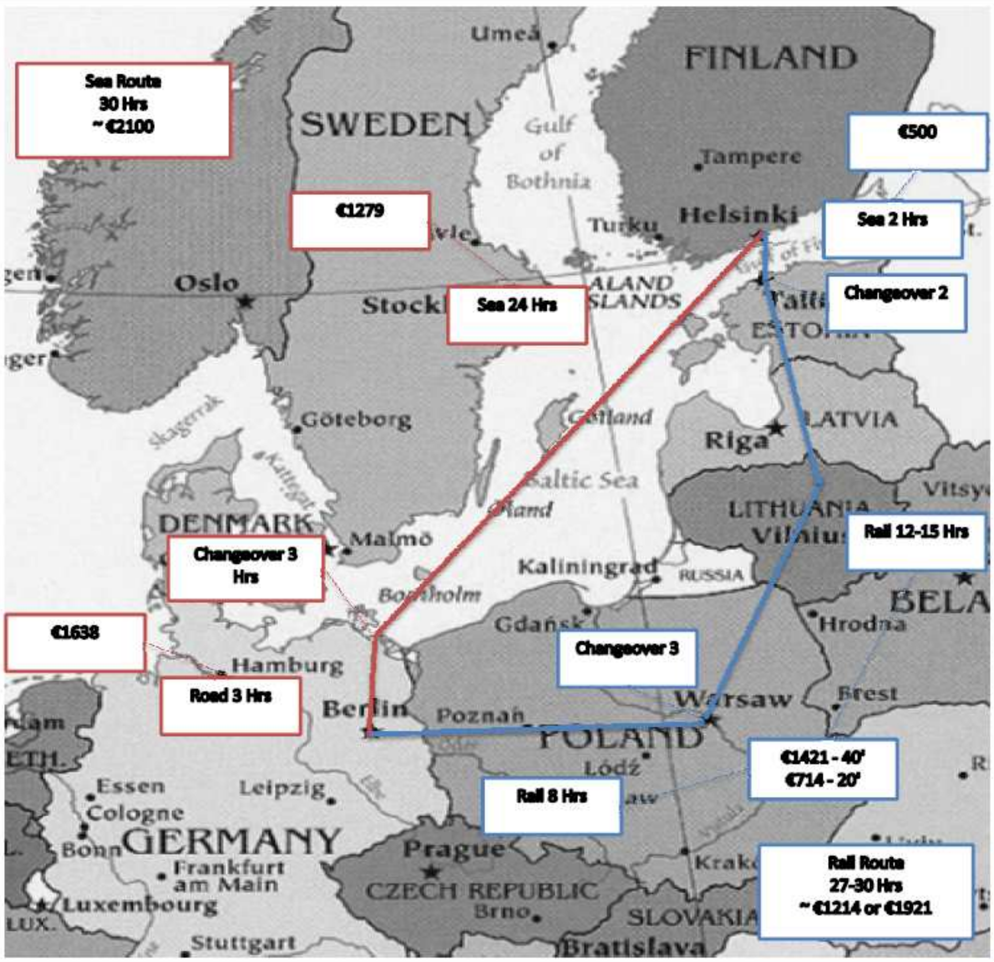
Corridor F has been developed to ease cargo transit on one of the most important routes which crosses Europe from East to West. The corridor connects Terespol (at the border of Poland with Belarus) via Warsaw, and it has been recently decided to expand it to the ports of the North Sea, Anvers/Zeebrugge and Rotterdam. This step was taken after the intensification of commercial flows between the Netherlands, Belgium, Germany, Poland and the countries of former USSR and Asia. The route has been defined based on traffic and trade prospects, but also because it is the most convenient East-West route in Central Europe. The development of this corridor is mainly tasked with encouraging modal shift from road to rail goods transport, as well as reaching EU's sustainable development targets. The six freight corridors to be entirely equipped with the ERTMS benefit from the financial support of the European Commission.

Apart from the EUR 260 Million already established funds, an additional EUR 240 Million have been granted from TEN-T co-financing funds. Although these corridors represent only 6% of the TEN-T length they carry 20% of European freight traffic. By 2015, member states must equip important sections of the six corridors (over 9,000 km) and by 2020, these corridors must be completely equipped (an additional 5,500 km) and a number of key freight terminals should be connected to the six routes (nearly 10,000 km). Works to a pilot line have already been initiated in Poland in 2009 and rail undertakings will also have to equip vehicles. To facilitate freight traffic between West and East, connections with other ERTMS corridors will also be accelerated, which will stimulate not only the efficiency and competitiveness of the entire traffic corridor. According to a CER study by McKinsey on the development of rail freight corridors, investments of EUR 145 Billion by 2020 could increase the capacity of rail transport by 72% on the six ERTMS-based rail freight corridors, representing 34% of the volumes carried in Europe. The overall modal share of rail could increase from 17% to 23% and such investments in rail infrastructure will eventually lead to a strengthening of combined transport.

CASE STUDY – Modal Comparison

This map below shows the calculation of time and cost for a journey from Helsinki, Finland to Berlin, Germany by two alternative routes; overland using rail, or by sea.

Sea or Rail Comparison-Helsinki to Berlin



For sea and road costs and times are based on current observed data. Rail timings are based on Rail Baltica predictions, costs are based on the cost of transit by rail in Latvia applied to the entire length of the route. This comparison shows the benefit of the new proposed railway in terms of time and cost.

Gauge and Transfer Facilities

Railway tracks in Europe have three basic gauges. Most countries, including Poland, use a 1,435 mm span, but Lithuania, Latvia, Belarus, Russia and Finland have predominantly 1,520 mm while Spain and Portugal have 1,688 mm. Rail Baltica will be compliant with the relevant TSI's and the track width will be built to European gauge 1435mm. The overall gauge will have the capability of carrying all forms of container and 'trailer on wagon' traffic to give it a strong freight capability.

Because of the differences in gauge there are “gauge transfer facilities” at border-crossings when either rail cargo is reloaded or bogies are changed, either way boosting costs and adding delays. Changing the bogies on a train can take up to 5–6 hours and require special, heavy equipment. In many cases, and especially for containerised freight, it is easier and quicker to transship boxes from one train to another instead of changing the bogies. In the case of liquids, frozen goods and hazardous materials, however, the bogies are usually changed. With Rail Baltica there will be a need for “gauge transfer facilities” at major intersections with key East – West Russian gauge (1520mm) routes, where wheel sets (bogies) either have to be changed or an alternative found. As there is likely to be limited capture of freight needing to travel on both gauges we are suggesting limiting this to one facility per country. An example of the two different gauges (Finnish/European) under one roof is in the SeaRails reloading terminal in Turku harbour, Finland. In this terminal they can conveniently reload goods from wagon to truck or vice versa and from train to train.

It is recognised that there are several alternatives including the SUW 2000 system that allows automatic wheel span adjustments on rolling stock, enabling trains to travel over different-gauged tracks. The device is regularly used on some Polish-Lithuanian services and the system cut border crossing times for Warsaw-Vilnius passenger trains from 140 to 60 minutes.

It is likely that at these interchanges warehouses and distribution facilities should be sited. In addition some goods will transfer to lorry for local delivery. The South to St Petersburg direction connection is the most likely to be completely justified due to volumes on this route.

4.5.2 Core Business for Passenger Traffic

The passenger market for any future Rail Baltica service will be composed of two key elements:

1. Existing Demand which has moved to Rail Baltica from an existing alternative mode of transport; and
2. Induced Demand which will be generated by the availability of new or reduced cost (in terms of travel time) travel options.

In the analysis of existing passenger demand section we have identified the existing volume of trips on the potential rail Baltica corridor between key cities for all modes. This includes demand internal to the Baltic States and transit trips, and indicates the total existing demand which is potentially inscope of the Rail Baltica Corridor. The volume of passengers that use the new service will, however, depend upon the characteristics of the new rail service relative the existing modes.

For existing trips to transfer, Rail Baltica will have to provide a more attractive service than the existing alternatives. We have discussed in the supply of transport services section the relative qualities of the existing modes of transport for key movements in the corridor. The transport model will be used to assess the impacts of these various variables by calculating the volume of current users who will shift to Rail Baltica reflecting the specific balance between the existing service characteristics and those of the new alternative. The share of the existing demand that will shift to Rail Baltica will therefore vary by movement and will depend heavily upon a number of the service characteristics of the new Rail Baltica service. These service characteristics include:

- Service Objective: to what extent is the service an ‘international’ service and to what extent is it providing for movements within the Baltic States themselves. This will need to be considered with regard to the fact that existing international demand is relatively low with a constraint due to border crossing and language differences; and that existing demand within the Baltic States is much larger providing a larger potential market for Rail Baltica.
- Route: there is a balance between routing via the larger population and economic centres, thus accessing a larger potential market, such as Tartu in Estonia, and the subsequent travel time increases this causes for transit trips
- Journey time: line speeds will heavily influence the attractiveness of Rail Baltica as an alternative to existing modes.
- Fare: the price of tickets on Rail Baltica relative to alternative modes. There is a balance between maximising revenue at the expense of patronage and maintaining higher passenger numbers with lower fares.

5 Economic, Enviornmental, Regulatory and Technical Constraints

5 Economic, Environmental, Regulatory and Technical Constraints

5.1 Economic Constraints

5.1.1 Government Funding

In 2009 the government debt in Lithuania was 7,85 billion EUR (28% of GDP), in Estonia it was 0,92 billion EUR (7.2% of GDP) and in Latvia it was 6,8 billion EUR 36.1% of GDP. In 2009 the government deficits in percentage of GDP were -8.9% in Lithuania, -1.7% in Estonia and -9.0% in Latvia. This is an important economic constraint on the development of the Rail Baltica project, as the situation in the government budget will affect the decisions about the necessary minimum of 15% co-financing made by each of the Baltic State authorities. In case of Latvia, all the financing decisions made by the governments needs to be aligned with the agenda set by the International Monetary Fund at the moment, which might put an extra restriction to proceed with the Rail Baltica project. If Latvia manages to start repaying the debt gradually, the coordination with the IMF might be less of a problem. Meanwhile, Lithuania has borrowed both in the domestic and foreign market, to finance their government debt, which also imposes extra control over the decisions in the government.

Further, each of the Baltic States still have differing currencies, which imposes currency and exchange rate risk. In January 2011 Estonia joined the Euro zone; Latvia and Lithuania is planned to join in 2015. Nevertheless, the join of Latvia and Lithuania is still uncertain and depends on the economic development of the countries.

5.1.2 EU Funding

The current EU budgetary period is 2007 – 2013 and serves as a benchmark for further comprehension of the operations of these funds. The next EU budgetary period is planned to be 2014 – 2020.

5.1.2.1 Financial Management

Although the Structural Funds are part of the EU budget, the way they are spent is based on a system of shared responsibility between the European Commission and the member state authorities:

- The Commission negotiates and approves the National Strategic Reference Framework and Operational Programs proposed by the member states, and uses these as a basis for allocating resources.
- The member states and their regions manage the programs. This includes implementing the Operational Programs by selecting individual projects, controlling and assessing them.
- The Commission is involved in overall program monitoring, pays out approved expenditure and verifies the national control systems.

Financial management of the EU funds

There is a general rule that EU funds can each finance in a complementary and limited fashion actions falling within the scope of the assistance of another fund (this is limited to no more than 10% of the resources allocated by the Community to each priority area of an operational programme). The exception to the rule “One programme = one fund” is that the <u>ERDF and the Cohesion Fund intervene jointly for programmes covering infrastructure and environment</u>.

Multiplication of the Rail Baltica project:

- Cohesion fund:
  - o Trans-European Transport Network (TEN-T)
    - Latvia
    - Lithuania
    - Estonia
- European Regional Development Fund (ERDF)
  - o Baltic Sea Region
  - o Cross border cooperation programmes:
    - Estonia – Latvia – Russia Cross Border Cooperation Programme
    - Estonia – Latvia Cross Border Cooperation Programme
    - Latvia – Lithuania Cross Border Cooperation Programme
- Joint Assistance to Support Projects in European Regions (JASPERS)

The project budget should be divided between the involved countries. It is necessary to apply for funds in each country separately as to benefit each separate infrastructure.

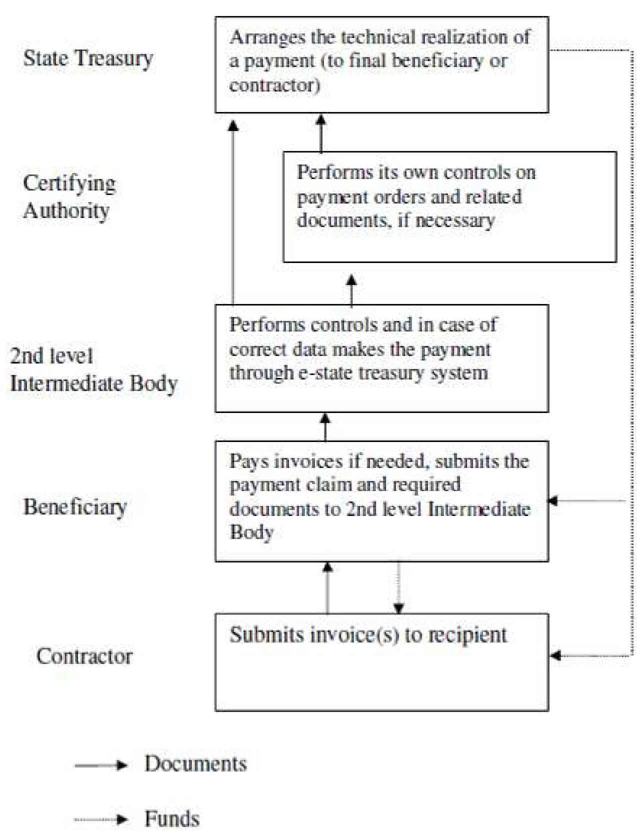
Within Cohesion fund and ERDF it should be pre-specified if it is acceptable to acquire funds from more than one sub-project (e.g. Baltic Sea Region and Cross border cooperation programme).

JASPERS is designed as support for ERDF and CF funded projects.

Cohesion policy 2014 -2020 timetable

- July 2010: Budget Review
- November 2010: 5th Cohesion Report
- December 2010: Cohesion Forum
- Early 2011: Proposal for Financial perspective
- Spring 2011: Legal proposals, impact assessment
- 2012/13: Adoption of legislative package
- 2014: Entry into force

The general scheme of payments for the Operational Programme



5.1.2.2 Available financing in 2007-2013

In order to grasp the scale of available funding, EU budgetary period 2007-2013 is used as a benchmark.

TEN-T

Co-financing rate: 85.00%

Full funding of the fund for Latvia **856 966 451 EUR**

Co-financing of Latvia 151 229 374 EUR

Full funding of the fund's Priority 5 in Lithuania **1 279 372 469 EUR**

Funding specifically for Railways (TEN-T) in Lithuania 535 359 806 EUR

Co-financing of Lithuania 191 905 871 EUR

Full funding of Priority 3.3 in Estonia **618 114 459 EUR**

Co-financing of Estonia 92 717 169 EUR

Latvia–Lithuania Programme

EUR 60 million.

Co-financing rate: 85%

Estonia – Latvia Programme

Maximum amount available: **5 074 064 EUR**

Co-financing rate: 85%

The co-financing share from the Programme depends of the status of the partner – private companies can receive 50% of their share in the project budget, whereas public, public equivalent and NGO partners can receive 80-85% (depending on the support priority).

Estonia – Latvia – Russia Cross Border Cooperation Programme

Total funding: **EUR 47 million**

Co-financing rate: 90%

Co-financing from private enterprises' is min 50%.

Total = **236,6 MEUR**

Co-financing rate

Over 230 million euro earmarked by the European Commission and the Government of Norway will cover:

- up to 75% of eligible project costs generated by partners from Denmark, Germany, Sweden, Finland
- up to 85% of eligible project costs generated by partners from Estonia, Latvia, Lithuania and Poland
- up to 50% of eligible project costs generated by partners from Norway
- up to 90% of eligible project costs generated by partners from Belarus

JASPERSA new technical assistance partnership

In the smaller countries where there will not be many projects of this size, JASPERS will concentrate on the largest projects.

5.1.2.3 Forecasts of the EU Structural Funds budgetary period 2014 -2020

According to the Baltic Sea Region "European Territorial Cooperation post 2013 – Position Paper", after 2013 programmes should be targeted on a small number of intervention areas rather than offering a little bit of everything.

A clear EU focus should be related to place-based issues. The three strands tend to have different focus: cross border cooperation is clearly place-based with a local focus; transnational cooperation is a mixture of place-based needs and EU priorities, whereas inter-regional cooperation is solely based on EU priorities. Macro-regional strategies may apply to all of them horizontally, whenever appropriate.

The European Commission has identified four overall challenges to guide the Baltic Sea Strategy: 1) to create a sustainable environment, 2) to increase prosperity, 3) to increase accessibility and attractiveness, and 4) to improve safety and security in the region. The Strategy builds on the fundamental idea that no new institutions are to be created, no new budget funds are to be allocated and no special legislation is required. Instead, concrete results are to be achieved through deeper cooperation with existing institutions and resources.

Cohesion Fund

According to the Community of European Railway and Infrastructure Companies (CER), the EU regional development policy might face an uncertain future because member states that pay more than they receive are likely to put severe pressure to reduce spending compared to the 2007-2013 period.

To improve Cohesion Fund efficiency the European Commission proposes a reform of Cohesion Policy for the upcoming EU budgetary period, which would be organised around the following four main improvements: reinforcing strategic programming and concentration of resources; strengthening performance through conditionality and incentives; evaluation, performance and results; and new financial instruments.

These aim at decisively orient the policy towards results; obliging Member States and regions to prioritise investment and orient it toward growth enhancing areas; and ultimately improving the accountability and responsibility of Member States and regions.

Cohesion Policy needs to be closely coordinated with the Europe 2020 strategy. This coordination requires, first of all, clearer guidance at European level and a more strategic negotiation process and follow-up.

One of the proposed actions by the Commission is to adopt a Common Strategic Framework delineating a comprehensive investment strategy, which translates the targets and objectives of Europe 2020 into investment priorities for Cohesion Policy.

Furthermore, the Commission plans to introduce new forms of finance for investment, to move away from traditional grant-based financing and to look for innovative ways of combining grants and loans. Current examples of new financing forms are JEREMIE, JESSICA, and macro-finance initiatives. These instruments contribute to change cultural attitudes toward public intervention, by decreasing dependence on public support, promoting risk taking, and strengthening leverage of public resources. Moreover, they ensure that schemes supported by Cohesion Policy add rather than replace existing banking and other private investment opportunities.

TEN-T

The Community of European Railway and Infrastructure Companies (CER) favours the Commission's future TEN-T planning approach and the development of a core network as the essential part of the future TEN-T structure. According to "CER Response to Commission Working Document on Future TEN-T Policy", planning the core network according to future traffic flows (passenger and freight) as the main criteria is an economically sensible and realistically quantifiable starting point.

However, CER would prioritize the criteria for identifying the core network as follows:

Priority 1: Improving the environmental and safety performance of the transport sector;

Priority 2: Promoting European socio-economic cohesion;

Priority 3: Strengthening the overall European economic development

Priority 4: Removal of bottlenecks / missing links

Priority 5: Improving the efficiency of the network.

Bearing in mind social and demographic differences in some of the new member states (less agglomeration, more rural), special efforts are needed to connect the infrastructure networks in the new member states with that in the "old Europe".

In order to implement the future TEN-T policy and to complete the priority projects, a proper and adequate EU budget is a necessary precondition. CER believes that Member States should be provided with more incentives to invest in transport infrastructure by increasing the EU cofounding rate for TEN-T projects and by raising the EU TEN-T budget to €30 billion in the next financial perspectives 2014-2020 (In the budgetary period 2007-2013 the TEN-T budget was €8 billion).

Baltic Sea Region

Sweden is currently coordinating a transport study "Baltic Transport Outlook 2030" that will cover all modes of transport and both passenger and goods traffic. It is a joint project between the transport authorities in the Baltic Sea region. The study is intended to function as a basis for future cooperation between the Baltic Sea countries in the transport area and must be completed by autumn 2011.

European Union Strategy for the Baltic Sea Region - Action Plan: "Facilitate efficient overall Baltic freight transport and logistics solutions by removing non infrastructure-related bottlenecks, promoting inter-modal connections, developing the Green Corridor concept through the implementation of concrete projects, developing infrastructure, supporting logistics service providers, establishing harmonised electronic administrative procedures, harmonising control procedures.

5.1.2.4 Management of funds

The bureaucracy and process of employing the aforementioned EU funds are symmetric in all three Baltic States. They differ considering differences in government and institutional structure.

The following institutions are responsible for the management of EU Structural Funds in each of the Baltic States:

In Latvia

- Managing Authority – Ministry of Finance
- Audit Authority – Ministry of Finance
- Paying Authority – State Treasury
- Certifying Authority – State Treasury
- Responsible Institutions – Ministry of Transport, Ministry of Regional Development and Local Government
- Co-operation Institutions – Central finance and Contracting Agency, Investment and Development Agency of Latvia
- Monitoring Committee – Included regions, NGOs, social partners, SMEs
- Procurement Monitoring Bureau

In Lithuania

Support Administrating Institutions (Managing, Paying and Intermediary):

- Ministry of Finance
- Ministry of Transport and Communications
- Information Society Development Committee under the Government of Republic of Lithuania
- Ministry of Economy

EU Structural Funds` Support Implementing Institutions:

- Central Project Management Agency (CPMA)
- Transport Investment Directorate (TID)

Other Institutions Involved in National Support:

- Lithuanian Development Agency
- Lithuanian Innovation Centre
- National Regional Development Agency (NRDA)
- Social and Economic Development Centre (SEDC)
- Agency for International Science and Technology Development Programmes
- CSC Investments and Business Guarantees – INVEGA

In Estonia

Managing Authority, Auditing and Paying Authority

Ministry of Finance

Implementing Authorities and/or Intermediate bodies:

Economic Affairs and Communications Ministry

The Ministry of Interior

Technical Surveillance Authority

Maritime Administration

Road Administration

State Chancellary

Economic Development Operational Programme, Ministry of the Environment

Tallinn Airport

Final beneficiaries:

- Central and local government institutions
- Private companies and natural persons
- Local governments
- NGOs
- Regions

Cross border cooperation programmes

Project partners can be:

- local and regional public authorities;
- national institutions;
- public equivalent bodies such as educational, business support, culture, social organisations, associations, development agencies, etc.;
- non profit non-governmental organisations.

Baltic Sea Region

Responsible national authorities:

In Latvia:

- Ministry of Regional Development and Local Governments
- State Regional Development Agency

In Estonia:

- Ministry of the Interior, Department of Regional Development
- Ministry of Economic Affairs and Communications

In Lithuania:

- Ministry of Interior of Lithuania

Who can apply?

- Public authorities from national, regional and local levels
- Public equivalent bodies (e.g. research and training institutions, business development institutions and other non-profit organisations)
- Private (commercial) organisations as additional partners with own financing
- Within limits, programme funds can be applied for by partners from outside the eligible area

Partners from other EU and non-EU areas may join individual projects and benefit from the programme funds (under certain conditions)

5.1.2.5. Summary and Recommendation

Currently, there is no singular EU fund that would be legally allowed to support all the included stakeholder countries together (Latvia, Estonia and Lithuania, as well as neighbouring countries of the Baltic States - Finland, Russia, Belarussia and Poland) without a multi-national cooperation agreement in which a leading partner is identified. Article 4 of Regulation (EC) No 680/2007 defines general rules for the granting of EU TEN financial aid. An application for EU financial aid should be submitted to the Commission by one or more Member States, with the agreement of the MS concerned, by international organizations, joint undertakings, or public or private undertakings or bodies.

Usual practice in infrastructure projects in Eastern Europe (that are financed through EU structural funds - ERDF) is that:

(1) all countries involved nominate a leading partner (the one who can be considered as a final beneficiary), who is responsible for submission of application form and provides overall project management for the whole project and implements project in its domicile country;
(2) Partners establish a Programme Steering Committee (PSG) and an Integrated Programme Organization (IPO) that act as project management team on behalf of the leading partner;
(3) The IPO can prepare the grant, but it has to be signed either by a leading partner or by all partners that may be considered as a final beneficiaries

Furthermore, it should be emphasized that right now there are only forecasts of the allocation and management of the EU co-financing for the 2014 - 2020, as well as the structure of EU funding programmes. The available information about the next EU financial period varies and is not yet relaible. However, the uncertainty of the funding allocation for the next financial period of 2014-2020 can be used in the interests of Rail Baltica. By increasing the awareness of the necessity of Rail Baltica, the funding can be allocated in the most beneficial way for infrasturucture of the Baltics.

5.1.3 Human resource and immigration strategies

It is very important to take into account the total scope of emigration/immigration and natural population increase/decrease trends in Baltic states. These trends construct the environment in which migration issues are discussed in Baltics. Baltic states have been a countries of emigration since independence in 1990. According to Eurostat Baltic states have one of the biggest negative net migration populations (per 1000 persons, data for 2009) – Lithuania – (4,7), Latvia – (2,1), Estonia – (0).

The outflows exceeds inflows several times. It should be noted that even during times of economic growth, Baltic states lost more residents due to emigration than it received due to immigration. Immigration remains feeble and is not able to compensate the losses caused by emigration. This situation along with negative birth rate in all Baltic countries has led to situation noticed in Chapter No. 4.1.1.

Recent discussions in Baltic states indicate that attitude to immigration becomes quite pragmatic (also on political level) and is based mainly on economic considerations. Immigrants often are perceived as a resource for economic development of Baltic states. Municipalities in Baltics are directly subjected to consequences of emigration and bad demographic trends that adversely affect regional development. It is expected that labour shortage may hamper successful attraction of investments and adversely affect national budgets and welfare of local residents. The opinions of employers show the need for immigrants because they can offer specific knowledge and skills which local employees do not possess. Also employers often foresee labour shortage as an obstacle to economic recovery.

The main strategic goals for all Baltic states for the next decade seems to be quite similar:

(1) to reduce emigration of residents in order to strengthen the economic welfare of the countries through economic, educational, social and cultural factors;

(2) to increase the involvement of the local workforce in the labour market (increasing the level of participation of the local workforce through promotion of internal labour mobility and labour flexibility);

(3) to promote the return of economic migrants;

(4) to attract workers from third countries (simplified recruitment process of foreigners who are in shortage in Baltic states, changing family reunification procedures, increasing attractiveness of Baltic states).

In accordance with the White Paper “Roadmap to a Single European Transport Area – Towards a competitive and resource efficient transport system”:

(1) human resources are a crucial component of any high quality transport system. It is known that labour and skill shortages may become a serious concern for transport in the future. Therefore, it might be necessary that for Rail Baltica project there is a need to strengthen capacity of persons who will be responsible for running Rail Baltica. This can be done either by building local knowledge or by allowing persons from other countries to join companies associated with Rail Baltica;

(2) new transport patterns must emerge, according to which larger volumes of freight and greater numbers of travellers are carried jointly to their destination by the most efficient (combination of) modes. Future development must rely on a number of strands: “... advanced logistic and market measures such as full development of an integrated European railway market”.

5.2 Environmental Constraints

5.2.1 Noise

Noise has to be considered on two levels. Firstly there are the source noise levels and then secondly there are the noise levels at the building facades which are used to determine the mitigation measures required. The European Directive 2001/16 Interoperability of the trans – European conventional rail system prescribes noise limits for rolling stock in the following categories:

- Stationary Noise
- Starting Noise
- Pass by noise
- Interior Noise

Currently in the specific case for Estonia, Latvia and Lithuania these noise limits do not have to be complied with as a series of measurements are being carried out in the three countries that will lead to a revision to the TSI. By the time the line is constructed compulsory noise limits will have been established.

The limiting noise values, as measured at the building facades, are different in Estonia, Latvia and Lithuania. In general the levels vary between 35 dBA for residential and other critical areas at night to 50 dBA during the day.

5.2.2 Emissions Limits

The emission limits are based on the requirements of EU Directive 2004/26/EC as amended by the Corrigendum to the Directive 2004/26/EC dated 25 June 2004. The limits are expressed in the tables below for Carbon Monoxide, the sum of Hydrocarbons and oxides of Nitrogen and particulates.

Table 40 - Locomotive Engines

Category: Net Power (P kW)	Carbon Monoxide CO (g/kWh)	Sum of hydrocarbons and oxides of nitrogen (HC + NO_x) (g/kWh)	Particulates PT (g/kWh)
RC B: 130 kW < P	3.5	4.0	0.025

Table 41 - Railcar Engines

Category: Net Power (P kW)	Carbon Monoxide CO (g/kWh)	Hydrocarbons HC (g/kWh)	Oxides of Nitrogen (NO_x) (g/kWh)	Particulates PT (g/kWh)
RC B: 130 kW < P	3.5	0.19	2.0	0.025

5.2.3 Protected Territories

Within the Baltic States there are a large number of Natura 2000 sites. Natura 2000 is the main part of EU nature & biodiversity policy. It is an EU wide network of nature protection areas established under the 1992 Habitats Directive. The aim of the network is to assure the long-term survival of Europe's most valuable and threatened species and habitats. It is comprised of Special Areas of Conservation (SAC) designated by Member States under the Habitats Directive (SCI), and also incorporates Special Protection Areas (SPAs) which are designated under the 1979 Birds Directive. Wherever possible in the development of the route options these areas should be avoided.

5.2.4 Sustainability Targets

All three countries have long term national strategies setting overall targets for sustainable development. These documents are consistent with EU Sustainable Development Strategy and intended to implement EU sustainability targets at the national level.

ESTONIA

Estonian National Strategy on Sustainable Development, 2030 sets the following overall sustainability target:

“the country should be successful in global competition with sustainable development model and preservation of the traditional values of Estonia.”

Specific sustainability targets are:

- Visibility of the Estonian cultural space,
- growth of welfare,
- coherent society,
- ecological balance.

LATVIA

Sustainable Development Strategy of Latvia, 2030 sets the following sustainability targets/vision:

- happy people in prosperous country,
- sustainable and healthy lifestyle,
- creative, tolerant and “youthful” society,
- cooperation based competitiveness,
- the state as partner in responsiveness and adaptivity.

LITHUANIA

Lithuanian National Strategy for Sustainable Development, 2020 sets the following overall sustainability target:

“achieve the present developmental level of EU countries by 2020, according to indicators of economic and social development as well as the efficiency in consumption of resources, and not to exceed allowable EU standards, according to indicators of environmental pollution, while meeting the requirements of international conventions in the field of minimization of environmental pollution and input into global climate change.”

5.3 Regulatory Constraints

The key regulatory constraints cover the following areas:

- Planning
- Land Expropriation
- Setting of Tariffs

The subsequent paragraphs give a summary of the procedures and issues invoved however a detailed explanation is contained in Appendix C.

5.3.1 Planning

The planning process is broadly similar in all three Baltic States with three levels of planning starting at National or State level and going down to the detailed plan level. In Estonia for a railway the middle planning level, the municipality level is not required for a new railway.

If the new route could be constructed in such a way that no additional land is required or the land use of land adjacent to the railway is not chnaged in any way then it is not necessary to go through the planning process.

The time taken to complete the planning process is different in all three countries but in the worst case could take in excess of seven years. In some European countries the designation of a project as being in the ‘national interest’ allows a reduction in the planning process but that is not the case in the the Baltics.

5.3.2 Land Expropriation

In all three countries the process of land expropriation can only be instigated by the state or under certain circumstances by the municipalities. The process can only be started once the plans justifying the need for the land have been approved. Each country has a well defined expropriation process and whilst there is no overall defined timeframe, historically in Estonia the process can take between 2 – 2.5 years.

5.3.3 Setting of Tariffs

ESTONIA

Infrastructure access fee

Entity setting the infrastructure usage fee

Currently the infrastructure usage fee is determined by the Estonian Technical Surveillance Authority (the Regulator), a state authority independent from market participants. The Regulator detremines the tariffs to ensure non-discriminatory access to the public railway as currently the infrastructure managers belong to the same group as the train operators.

Legal basis and aim of regulated tariffs

The Tariff is determined on the basis of the Railways Act and the national methodology for calculation of the railway infrastructure usage fee (the Methodology) .

The Tariff comprises the costs of giving the railway infrastructure into use and of a reasonable commercial profit.

Separate tariffs

Separate tariffs are determined for main services, additional services and ancillary services (scope of these services is similar, but not identical to the catalogue provided in Annex II to Directive 2001/14/EC).

Tariffs for main services and additional services include the costs of giving the railway infrastructure into use and of a reasonable commercial profit. The tariffs for ancillary services include costs, but profits only if multiple ancillary service providers exist.

Structure of total cost base

The cost base (Total Cost Base) for determining the Tariff is the sum of the following components:

- Operational cost of the respective service (direct costs and proportional part of overheads);
- Depreciation allowance calculated from regulatory value of [i.e. value of necessary investments at cost (no revaluations are taken into account] the regulatory asset base;
- Reasonable profit [regulatory (not market based) WACC applied to the value of the regulatory asset base.

Components of the Tariff

The Tariff consists of two components:

- Fixed part calculated based on reserved train kilometres (effectively working as reservation charge);
- Variable part calculated based on actual gross ton-kilometres (=weight of train in tons multiplied by the covered distance in kilometres).

The Fixed part is payable based on train paths reserved by (allocated to) a train operator in the capacity allocation process irrespective of whether the paths are used. Therefore the fixed part also works as a reservation charge.

The fix part must be in the range of 4.15-6.39 EUR per train kilometre and the variable part in the range of 0,00255-0,00447 EUR per gross ton-kilometre.

Overview of the Tariff levels

The following table provides overview of the average fixed and variable parts of the Tariff (adjusted) for the use of EVR Infra AS infrastructure (majority of the Estonian rail network) during the last timetable periods:

Table 42 - Overview of the average fixed and variable parts of the Tariff

Timetable Period	Average Fixed Part (EUR/ train/km)	Average Variable Part (EUR/ gross ton km)
2005/2006	1.625	0.002
2006/2007	1.569	0.002
2007/2008	2.302	0.003
2008/2009	5.701	0.004
2009/2010	5.236	0.004
2010/2011	4.274	0.004

Possibilities to negotiate different tariffs

The Methodology stipulates a possibility to negotiate tariffs different from tariffs determined under the rules provided above if the infrastructure manager and the train operator are concluding a contract for use of rail infrastructure for a longer period than one timetable period. In such a case the tariff to be used in the contract must be approved by the Regulator. The negotiation procedure should be used in situations where there is a need to tariffs for several years and to overcome insecurity arising from the fact that the tariffs are regulated on yearly basis. The approval will be granted based on proposals by the infrastructure manager and the train operator and economical justifications to the proposed tariff and the competition situation in the rail freight market. If the operator commits to guaranteed volume, some discounts may be available, but it should still be cost based and in line with general principles on calculating the tariff. There is no public information on such negotiated tariffs.

Possible regulatory difficulties for setting different level tariffs for Rail Baltica

In Estonia the Tariffs are determined based on actual costs of a respective rail infrastructure. So it is not contradicted, but alleged that because of the investments necessary for Rail Baltica the Tariffs for Rail Baltica will be different (presumably higher) than the current tariffs.

For mitigating risk of or allegation on cross-subsidies between existing infrastructure and Rail Baltica it may be advisable to assure that Rail Baltica is regarded as an infrastructure separate from the other infrastructures servicing East-West or other traffic, and separate tariff is determined for Rail Baltica.

Another concern is related to level of tariffs, if the current Methodology is used. Because of some features of the current Methodology aimed to keep the tariffs on low level (e.g. prohibition to calculate depreciation allowances from fair value of the infrastructure) the tariffs for Rail Baltica, if aim is to charge the total costs, may not be competitive with the tariffs for older 1,520 mm railway. Achieving competitive tariff levels may require substantial public funding.

Based on above it is recommended to conduct a simulation of possible Rail Baltica tariffs if current charging principles are applied. The simulation may reveal that the current models are not suitable for Rail Baltica and new models need to be designed, possibly demanding material changes in policy (e.g. abandoning total cost recovery in pricing).

The Methodology can be changed with a regulation of the Minister of Economics and Communication. Recently it has been done without much public debate. This allows flexibility in tariff policies for Rail Baltica; however this increases the risk of arbitrary and short-term policy decisions.

Setting of passenger tariffs

The tariffs to passengers are set by passenger train operators. These tariffs are not directly regulated and depend on the level of service, distance covered, type of ticket (single, period) etc. Also some special discounts can be available for limited groups of persons (e.g. children, students, retired persons). However the tariffs determined by the passenger train company cannot exceed the maximum ticket price and kilometre price determined by the Ministry of Economic Affairs and Communication under the public service contract. Maximum prices are determined so that on one hand the revenue from tickets would cover reasonable part of the costs arising from the service, but at the same time maintaining the affordability of passenger train transport.

Setting of freight tariffs

The tariffs for carriage of cargo are determined by cargo train operators. These tariffs are not regulated, except general restrictions arising from the competition law (prohibition to charge excessive prices, discriminate or cross-subsidise). The cargo operators calculate exact price for carriage of particular shipment on basis of type of cargo, distance, volume etc.

Tariffs and subsidies for other modes of transport

Public transport is organised on two levels – municipality level by municipalities and national level by county governments (intra-county lines), the Ministry of Economic Affairs and Communications and the Government.

The following modes of public regular service are subsidised from the state budget:

- National train service;
- Intra-county bus lines and national non-commercial long-distance lines;
- Ship and ferry lines connecting Estonian islands with mainland (or small islands with islands);
- Air service lines connecting Estonian islands with mainland (or small islands with islands).

The following modes of public regular service are subsidised from the municipalities' budget:

- Intra-city or other national train services;
- Intra-city bus, tram, trolley-bus lines, intra-parish bus lines, lines connecting neighbouring municipalities;
- Intra-municipality ship and ferry lines.

Only public regular service lines serviced under public service contract are entitled to public subsidies. The public service contracts are awarded based on public tendering. For larger contracts public procurement regulations must be applied. The main financial criterion for selecting a successful bid is the (lowest) price of line kilometre.

The tariffs for public regular service are set by entities responsible for organising respective mode of transport on level affordable to the customers. The gap between line kilometre of the successful tender and funds received from sales of tickets are covered by subsidies. Total amounts of state subsidies are determined by the parliament in the course of adopting annual state budget.

International air services (inter alia airport services) and commercial lines (e.g. intercity express buses) are not subsidised.

LATVIA

Infrastructure access fee

According to the Railway Law, the Public Utilities Commission, in consultation with the operators of the public use railway infrastructure, develops methodology for calculating tariffs for the use of public railway infrastructure. Such methodology was developed and approved on 18 January 2006.

In principle, the tariffs for the use of public railway infrastructure as such, based on the methodology, should be calculated by the operator of the railway infrastructure. However, the Railway Law entrusts Public Utilities Commission to set tariffs in those cases when both – the operator of the railway infrastructure and the carrier are related companies. Since in Latvia this is the case because state owned company "Latvijas Dzelzceļš", who is the operator of the public railway infrastructure, is in the same holding as the carrier of cargos and the provider of international passenger carriage services, on 29 November 2010 the Public Utilities Commission has set tariffs for use of "Latvijas Dzelzceļš" public railway infrastructure for carriage.

The tariffs are set for the use of public railway infrastructure for the year 2011. The calculation for the tariff was submitted by the operator of the public railway infrastructure ("Latvijas Dzelzceļš"), and according to the approved methodology for calculating this tariff, the calculation is done on the basis of the total cost of the infrastructure, cost for maintaining and operating the infrastructure, investments in the infrastructure, taxes and duties and the correction of costs. Detailed formulas for calculating each of these elements are found in the methodology, approved by the Public Utilities Commission.

In accordance with the amendments in the Railway Law, starting from 1 January 2011 a new commercial entity had to be established which would perform the main functions of a railway infrastructure operator and among other things it would set tariffs for the use of the public railway infrastructure on the basis of a methodology, approved by the Public Utilities Commission. However, as outlined above, for the time being the tariffs are set by the Public Utilities Commission.

Setting of passenger tariffs

Tariffs for carriage of passengers in principle are set by the carriers themselves, except, there is a methodology, according to which tariffs for services of public transportation (such as carriage of passengers by railway) shall be calculated. Carrying of passengers by railway in most, if not all, routes in Latvia is procured by the state as the public transportation services.

The methodology for calculating tariffs for carriage of passengers is not publicly available, except the methodology for calculating tariffs for services of public transportation. This methodology allows the procurer of these services to set the tariffs. If this has not been done, the carrier is allowed to set tariffs after they have been accepted by the procurer of the services of the public transportation. The methodology itself relates to carrying passengers within Latvia and mainly describes different methods, available to the carrier for setting tariffs, such as on the basis of the distance, zones, period of time etc. This methodology envisages that:

In the cases of routes of regional local importance or routes between cities, the tariff is based on the passenger kilometre and it is calculated by dividing the anticipated total costs of carriage with the anticipated number of kilometres of carriage.

In the routes within the cities the tariff is calculated on the basis of cost for carrying one passenger, which is calculated by dividing the anticipated total cost for carrying passengers in the given network of routes with the number of passengers.

Tariff for carrying luggage and animals can be disproportional to the length of a trip.

In addition it should be mentioned that according to the Railway Law the carriers of passengers get compensated from the State budget for their payments for the use of railway infrastructure for carrying passengers on inland routes. Such compensation is not available to carriers of cargoes.

Setting of freight tariffs

Tariffs for carrying of cargos are not regulated by governmental institutions. However, for information purposes explanation of tariffs of “LDz Cargo” is available publicly.

Information about methodology of setting tariffs by “LDz Cargo” reveals that “LDz Cargo” calculates its tariff on the basis of cargo (according to the Harmonised Cargo Nomenclature), distance, type of carriage, speed, weight, type and ownership of the rolling stock, category and ownership of the container, services to be provided. Detailed algorithm for calculating the tariff is available in the Tariffs for transit of cargos for year 2010 KTT-LV/2010.

Private freight operator’s possibilities to negotiate different tariffs

As far as we are informed, one of the few private cargo carriers – “Baltijas ekspresis” – complained in the court against the set tariffs for the use of the public railway infrastructure in the year 2009. So far the court has rejected this complaint, reasoning that the tariffs are equally applicable to any cargo carrier; therefore there is no basis to complain about these tariffs. “Baltijas ekspresis” initially complained also about the methodology for calculating these tariffs, but the court did not accept the complaint.

We are not aware of any other discussions or negotiations, because setting the tariffs for the carriage of cargos is within the competency of the carrier itself.

Possible regulatory difficulties for setting different level tariffs for Rail Baltica

With respect to the possible tariffs for the use of the infrastructure of Rail Baltica the answer depends on the owner of it. If the owner of the infrastructure in Latvia will be “Latvijas Dzelzceļš”, until an independent railway infrastructure operator will be established, the tariffs for the use of this infrastructure will have to be set by the Public Utilities Commission. At this point in time it is impossible to tell if the Public Utilities Commission will be ready to set different tariffs for different types of infrastructure. If, however, the owner of the infrastructure will be another entity, which is not connected to the carriers of passengers or cargos, tariff will be set by that entity. In both scenarios the methodology for calculating tariffs for the use of public railway infrastructure, in force at the given time, will have to be complied with. This methodology is approved by the Public Utilities Commission.

As explained earlier, setting of tariffs for carrying of passengers and cargos is within the competency of the carrier itself. The only exception, which we can see at this point in time, is related to providing the so called “services of public transportation“, carrying of passengers by railway being one of them. In case carriers of passengers, operating through Rail Baltica, will receive the rights to provide the mentioned services of public transportation (in Latvia) they will be constrained by the requirements of the procurer of the services and the methodology. This methodology is approved by the Government (the Cabinet of Ministers).

Additional difficulty may arise from the regulations of the Cabinet of Ministers No 854, dated 14 September 2010, which set the criteria for establishing that the main purpose of the service is carrying of passengers between different Member States of the European Union, as well as set criteria for recognising that such service distorts the economical balance of the concluded contracts for services of public transportation. In accordance with these regulations, if embarking and disembarking of passengers within the territory of Latvia distorts the economical balance of the concluded contracts for services of public transportation, the State Railway Administration may impose restrictions on embarking and disembarking of passengers within the territory of Latvia. In accordance with these regulations it is considered that there is a distortion of the economical balance if, firstly, the ticket price is cheaper than the price for equivalent ticket by the local carrier multiplied by 1,2. and/or secondly, if more that 1/3 of the passengers were carried within the territory of Latvia and the departing time of the train is within 10 minutes to 1 hour (depending on the number of local trains per day in the same route) from the departing time of the local train.

Tariffs and subsidies for other modes of transport

International air services (inter alia airport services) and commercial lines (e.g. international intercity express buses) are not subsidised. A concealed way of subsidising inter city bus and train routes within Latvia is the procurement of "services of public transportation".

As explained earlier, setting of tariffs for carrying passengers are within the competency of the carrier itself, except in the case of the so called "services of public transportation" the carrier is constrained by the requirements of the procurer of these services and by the methodology for calculating tariffs for these services, approved by the Cabinet of Ministers.

Since carrying of passengers between Riga and Tallinn currently would not be considered as "service of public transportation" for the purposes of regulating methodology for calculating tariffs, the carrier will be free to set tariffs by itself. On the other hand, carrying of passengers between Riga and Jelgava is falling under the "procured services of public transportation"; therefore setting of tariffs is and most probably will remain constrained by the requirements of the procurer of these services and by the methodology for calculating tariffs for these services, approved by the Cabinet of Ministers.

LITHUANIA

Infrastructure charge

An infrastructure charge is paid by the railway company (the carrier) to the operator of the railway infrastructure (which is the state owned company AB "Lietuvos geležinkeliai") for the use of the railway infrastructure and the services, provided by the operator.

The method of calculation for this charge is established by the Cabinet of Ministers of Lithuania , however the detailed figures (indices, coefficients etc) used in the calculation are set by the State Railway Inspection who operate under the Ministry of Transport. The methodology is mainly based on the actual costs and utilisation of the respective section of rail infrastructure under consideration.

Tariffs for carrying of freight

Tariffs for the carrying of freight are not regulated by governmental institutions. Carriage of freight and other services provided by the railway operator are charged in accordance with the charges set forth in the contract of carriage or contract for organisation of carriage. Carriage tariffs are fixed by the railway operator (AB „Lietuvos geležinkeliai").The tariff book for import, export and local transportation of freight is publically available . The calculation of the tariff is mainly based on the distance, weight and type of carriage.

Setting of passenger tariffs

In Lithuania the maximum tariffs for carrying of passengers on local service routes are regulated by the State Price and Energy Control Commission (the Regulator).

It should be noted, that recently the Regulator proposed to the Government of Lithuania to discontinue the regulation of tariffs in the railway, water and long-distance road transport sectors. However, the Government decided to uphold the regulation of tariffs in monopolistic sectors. Thus, regulation of the maximum tariffs for the carrying of passengers on the railway remained unaltered, the regulation of water transport was slightly liberalised and the regulation of long-distance road transport was withdrawn.

The tariffs in the railway sector are determined on the basis of the Railways Transport Code of the Republic of Lithuania and the Methodology for Determining Maximum Tariffs for Carriage of Passengers on Local Service Routes .

According to the methodology the maximum tariffs are to be set by the Regulator for every operator individually. The calculation methodology is based on the costs incurred by the operator. The formula components, determining the maximum tariff are:

- Incomes for ensuring profitable activities (planned incomes plus indispensable expenditures);
- The average tariff for the carriage of passengers on local service routes (incomes for ensuring profitable activities divided by the traffic of passengers (turnover) and multiplied by 100);
- After evaluation of additional services for every type of carriages, passengers' comfort level, speed of the train - additional coefficients are determined;
- Planned kilometres of the passengers on local service routes in different carriages.

Charges for the carriage of passengers and luggage on international service routes are fixed by the operator in accordance with the procedure established by international treaties of the Republic of Lithuania concerning cross border railway service.

Private freight operator's possibilities to negotiate different tariffs

There is no specific regulation in Lithuania as regards to the possibility for the private freight operators to negotiate different tariffs. However, according to publicly available information big strategic companies (e.g. Orlen Lietuva), generating a substantial volume of freight enjoy more beneficial tariffs. We are not aware of other discussions or negotiations as setting of the tariffs for the carriage of freights is within the competence of the carrier itself.

Possible regulatory difficulties for setting different level tariffs for Rail Baltica

As the with other countries the diffulties will change depending upon who owns and who operates Rail Baltica. Assuming that Rail Baltica as a part of the public railway infrastructure and is owned by the state (operated by AB "Lietuvos geležinkeliai") the the regulations mentioned above apply.

It should be noted that in Lithuania the detremination of the tariffs is based on actual costs and utilisation of the corresponding rail infrastructure. Accordingly, the investment necessary for the construction of Rail Baltica would influence the tariffs.

Tariffs and subsidies for other modes of transport

International air services and commercial lines (e.g. intercity express buses) are not subsidised.

The setting of passenger tariffs are the responsibility of the carrier, except in the case of the so called "services of public transportation", where the tariff is set by the municipality.

5.4 Technical Constraints

Rail Baltica will be constructed to the latest Technical Specifications for Interoperability (TSI). The primary scheme parameters have been developed based on a New Core TEN-T line operating as a mixed traffic line.

Key Parameters are:

Line Category IV-M

Structure Gauge GC

Maximum axle Load 25 tonne

Maximum line speed 240 km/h

Maximum Train Length 750m

Since the success of Rail Baltica is founded on a mix of freight and passenger service on the line, fast conventional service is being proposed rather than very high speed rail service. In order to run at very high speeds, HSR trains need to be far more powerful than conventional trains. In order to maintain their top speeds, the lines that they travel on must be built with the fewest possible curves – and where curves are unavoidable, they must use larger turning circles to change direction. Braking distances must also be longer to allow the trains to slow down safely and rail construction tolerances are far more exact, all of which considerably increase construction and maintenance costs.

Table 43 – Design parameter comparison (conventional vs.HSR)

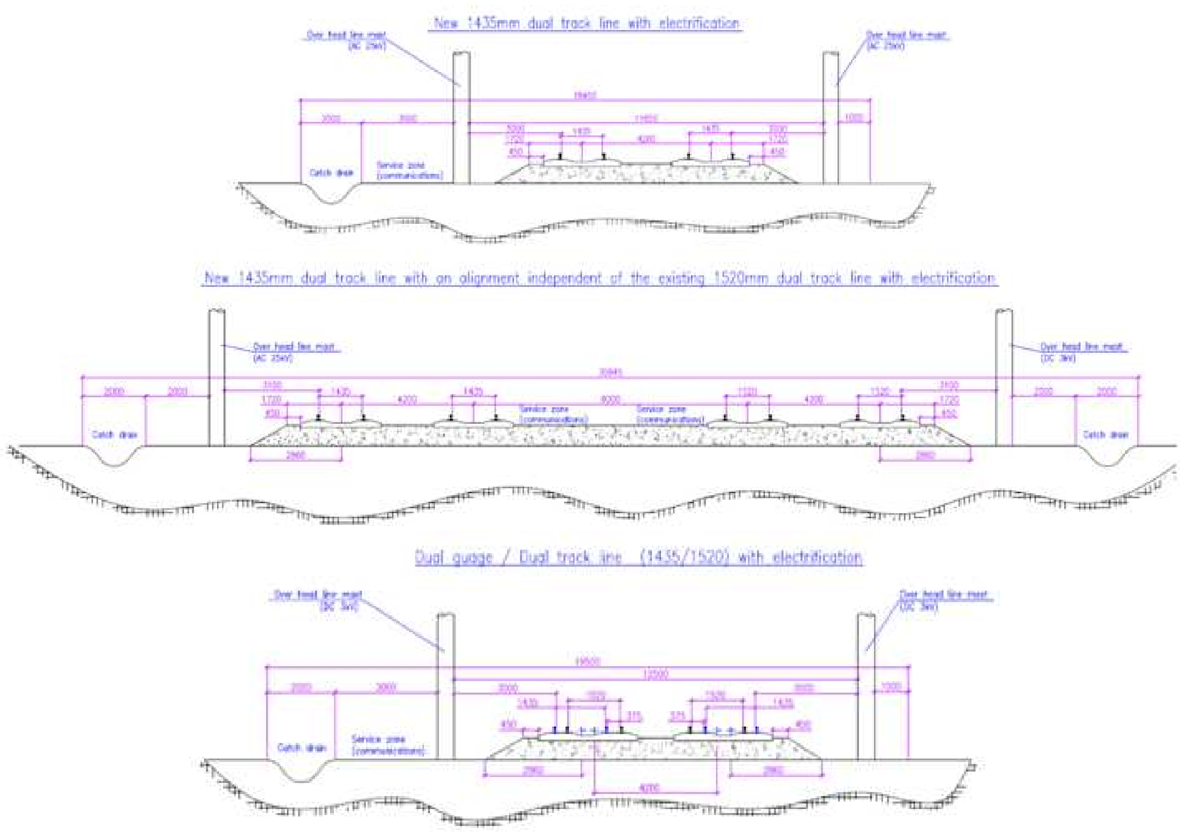
	Conventional Rail	HS Rail
Top speed (kph)	200	400
Installed power (MW)	4	20
Maximum gradient incline (%)	1	3
Minimum radius of curvature (m)	1800	7200
Average braking distance (m)	2000	5500

(Note: these figures are representational and are based on typical design parameters for comparison purposes only)

In addition, the train design and the stations serving them must also have different characteristics. High speed stations are more comparable to airport terminals than conventional train stations, which in the context of Rail Baltica is not required based on passenger densities anticipated as calculated and validated via journey time sensitivity analyses in the passenger demand models of this study

Three different infrastructure implementation scenarios were evaluated – independent 1435mm gauge line (new alignments), 1435mm Gauge Line adjacent to the existing 1520mm gauge line (existing alignments), and dual gauge 1435/1520mm line. Technical constraints were outlined for rail infrastructure, civil and structures, signalling and telecoms, electrification, maintainability and rolling stock. Each option under consideration includes various combinations of the infrastyructure scenarios depicted below. The dual guage scenario, due to the technical constraints inherent in the design of such layouts, is to be considered a worst-case scenario and is contemplated only in urban areas where other options are not viable.

Figure 18 – Infrastructure implementation scenarios



In the table below we have set out the various technical constraints which have been identified associated with the three primary options being considered.

Table 44 - Technical constraints

	Impacts of Constraint to Each Scenario		
Constraint Description	**Independent 1435mm Gauge Line (new alignment)**	**1435mm Gauge Line (adjacent to the existing 1520mm Gauge line)**	**Dual gauge 1435mm/1520mm Line**
Technical Constraints			
Infrastructure			
Track			
Rail	-	-	Gauge difference is too small to implement three rail application. Existing 1520mm rails will need relaying on new extended sleepers to enable fitment of 1435mm gauge.
Sleepers	-	-	See above
Ballast			
Broken stone ballast	-	Existing ballast must be renewed and extended.	Will probably be renewed to cater for the increased construction depth and extended sleepers needed for higher speed line.
Geometry / alignment			
Curve radius in plan	Speed may be restricted in urban areas due to land availability which will compromise journey times.	Differential speeds of existing and new route will result in incompatibility of curve radius and need for increased corridor width	Differential speeds of existing and new route will result in incompatibility of curve radius. Speed on new rate will have to be reduced to match radii on existing route
Vertical curve radius	-	-	
Switches (Points)	-	Bespoke crossings (frogs) will be required to effect turnout of 1520mm route across 1435mm route at junctions (or vice versa) OR Grade separate routes at junctions	Switches on 1435mm line will need to be displaced geographically from switches for 1520mm. Switches will be low speed.
Civil & structures			
Platform clearances/stepping distance		Conflicting platform clearances and stepping distances. Need for indpendent platform faces	Conflicting platform clearances and stepping distances. Need for indpendent platform faces

		will increase corridor width requirements	will increase corridor width requirements and complexity of station approaches. The platform position within dual gauge sections would need to be positioned to reflect passenger usage. Where both gauges carry passenger traffic, specific arrangements would be required, such as separate platforms on opposite faces, or retracktable steps on the vechicles.
Underbridge loading	New underbridges required for river/water crossings	Additional underbridge spans are likely to be required to cross rivers, rail corridors, etc.	Additional underbridge spans are likely to be required to cross rivers, rail corridors, etc.
Overbridges	New overbridges required to remove at grade road crossings OR Road diversions required to alternative routes	New overbridges required to remove at grade road crossings OR Road diversions required to alternative routes	New overbridges required to remove at grade road crossings OR Road diversions required to alternative routes
Earthworks	Fills, cavities, soil change on weak bases	Likely to require additional earthworks and benching in which will have impact on existing earthworks	Fills, cavities, soil change on weak bases
Clearance/land availability for line and support structures	Need 100% purchase of land.May be constrained where route enters built up/urban areas due to land availability	Need significant additional land but not as much as for a new route. May be constrained where route enters built up/urban areas due to land availability	Little additional land required. Only potential requirements at stations
Signalling & Telecoms			
Control	New control required	Single control point for both gauge routes (new 250kmph), (extst.120kmph) required in common geographic sections	Single control point for both gauge routes (new 250kmph), (extst.120kmph) required in common geographic sections
Interlocking	-	Interlocking common to both gauge routes at junctions OR Grade separate junctions	Safe interlocking of conflicting elements of both gauge routes required. Interlocking common to both gauge routes required.

Train detection	-	Common train detection system required at junctions that is common to both gauges. OR Grade separate junctions	Complexity of bonding, particularly at junctions. Consider axle counters
Signal sighting	-	-	Sub-optimal position of signals for sighting on one of the gauge routes. Consider in-cab signalling as overlay for 1435mm gauge.
Train protection	-	Balise or inductor based	Balise or inductor based
Point machine/drive mechanism	-	-	Complexity of drive and detection arrangements. Consider in-bearer point machines.
Line side cable route	-	Consideration needs to be given to maintenance access for equipment sited between gauge routes	Consideration needs to be given to maintenance access for equipment sited between gauge routes
Line side equipment cases	-	-	-
Level crossings	-	Will need removing in line with policy not to have at grade crossings on 1435mm line. Road diversion or bridge required	Will need removing in line with policy not to have at grade crossings on 1435mm line. Road diversion or bridge required
Electrification			
Power supply and system voltage	Will need new power suplly system and connections	Conflicting power supply systems/ rolling stock where exsiting electrification exists Will need reconstruction of existing power suplly system	Conflicting power supply systems/ rolling stock where exsiting electrification exists. Dual voltage rolling stock required Will need reconstruction of existing power suplly system
Return traction	-	-	
Catenary and contact wire	-	Neutral sections may be required at junctions which are already electrified with different AC voltage	Stagger of contact wire will need to be restricted to ensure its suitability for trains on both gauges

Earthing and bonding	-	Additional measures required where DC electrification exists along or adjacent to the route	Additional measures required where DC electrification exists along or adjacent to the route
EMC	Will trigger need for immunisation on other lines (direct connection or where route crosses another line)	Will trigger need for immunisation on other lines (direct connection or where route crosses another line)	Will trigger need for immunisation on other lines (direct connection or where route crosses another line)
Clearance/land for support structures	May be constrained where route enters built up/urban areas due to land availability	May be constrained where route enters built up/urban areas due to land availability	May be constrained where route enters built up/urban areas due to land availability
Maintainability			
Plant and equipment	1435mm track plant will be required	1435mm track plant will be required	Specialist plant will be required
Maintenance procedures		Access and possession planning will need to consider adjacency of railways	
Rolling stock			
Up to 200 km/h	New stock required	New stock required	New stock required
Over 200 km/h	New stock required	New stock required	New stock required
Signaling Train protection	Stock will need to be compatible with trackside infrastructure	Stock will need to be compatible with trackside infrastructure	Stock will need to be compatible with trackside infrastructure
Gauge transfer	Only at dedicated locations unless automatic wheel change employed	Only at dedicated locations unless automatic wheel change employed	Not required

From the above table it can be seen that the most significant technical constraints are associated with the dual 1435/1520 track option. For that reason it is envisaged that this solution will only be used on sections where other constraints make the introduction of a separate 1435 gauge line impossible. The ways in which the signalling and OHL issues can be mitigated in the dual gauge sections are explained in more detail below.

OHL Issues

The proposed Rail Baltica would utilise a 25kV AC OLE traction supply. The existing electrified sections of track use a 3kV DC system. Obviously it is not possible to run both systems simultaneously and so the new Rail Baltcia rolling stock would have to be able to operate on dual voltage.

Dual voltage trains are commonly used on other European networks;

French TGV trains operate between 25kV ac , 1.5kV dc and 3kV dc

Belgian TGV trains operate between 25kV ac and 3kV dc

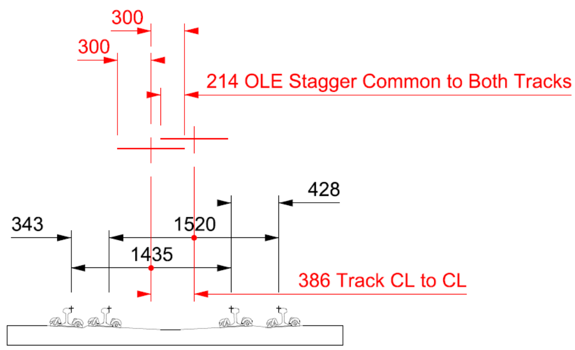
German ICE trains operate between 25kV ac and 3kV dc

Channel tunnel Eurostar (TGV) operate between 25kV ac OLE and 750v dc third rail

A typical arrangement for a 1435 / 1520mm dual gauge is shown in the attached below, and could involve a minimum centreline offset between adjacent rails of 343mm, providing a minimum dimension between fixings (cast-in housing on concrete sleepers). This would result in an associated track/ gauge centreline offset of 386mm.

For overhead line electrified railway, this track centreline offset could be accommodated within the OLE catenary stagger (typically 300 – 380mm), which would allow vehicles using either gauge track to use a common OLE catenary wire. The typical catenary stagger would be 214mm, which would require restrictions in the installation and maintenance tolerances of these sections of OLE to account for the restricted staggers.

Figure 19 - Typical Dual Gauge Layout



Variation in stagger is normally preferred to ensure an even wear profile across the vehicle pantograph. With the restricted stagger pantograph wear might be an issue in the long term.

The use of a base-plated track fixing system may allow the track gauge spacing to be reduced slightly, though this and the typical dimensions quoted above would need to be confirmed during subsequent scheme development.

Signalling Issues

Signalling Dual Gauge Lines

Main line railways ensure the safe passage of trains on a system of fixed blocks that underpin the signalling system. The signalling system ensures that only one train may occupy a block section at any one time.

On a dual gauge railway, the 1435mm gauge line and the 1520mm gauge line will run in the same block section. The passage of a train on the one gauge will effectively occupy the same block section in the 1520mm gauge line and vice versa. Consequently the control of any given section of dual gauge route must have a single system responsible for safety integrity on both gauges to ensure that a train is routed safely and protected whilst using the route both from other trains on the same gauge and trains using the alternate gauge. Movement authority must be given reliably to trains using each gauge. Speed supervision and train protection must be provided for trains using each gauge.

The existing signalling systems on the route will vary but will generally comprise of the following key elements:

Control centre equipment

- Control panel
- Interlocking

Track side equipment

- Train detection system
- Point operating mechanism,
- Line side Signals

The primary function of the interlocking is to provide safety integrity in the system preventing the setting of unsafe situations and conflicting train movements. On a dual gauge railway, a single interlocking must detect the state of the railway and control routes on both gauges. On the Rail Baltica route where conversion of the existing 1520mm route is desirable to overcome restricted corridors, reconfiguration of the existing signalling systems will be required.

ERTMS

The Trans European Network Route will need to be compliant with European Standards for Inter-operability. These standards mandate European Train Management System (ERTMS) as a solution.

ERTMS consists of two elements; the European Train Control System (ETCS) and Global System Mobile – Railways (GSM-R). The ETCS provides common automatic train protection functionality together with in-cab signalling of movement authority and speed information for the driver. The GSM-R provides a common radio system for trains operating across European borders.

Three levels of ERTMS are envisaged but only Levels 1 and 2 are in commercial use:

Level 1 – An overlay to line side signalling systems that provides enhanced safety through the provision of automatic train protection system that supervises the train speed against the speed profile calculated by the on-board system in relation to the limit of movement authority received. It utilises the existing train detection and interlocking but provides in cab signalling of movement authority by taking aspect information form the line side signal circuits and communicates this into the cab via Local Electronic Units (LEU) and track mounted balise.

Level 2 – Provides additional functionality and flexibility by removing the need for line side signals. Train position is detected by the track side train detection system via the interlocking. Track mounted balise provide odometry referencing for the on board system. Movement authority is communicated to the train from a Radio Block Centre via the GSM-R radio system based upon safety integrity information from the interlocking. The interlocking must be capable of two way communication with the RBC. This generally requires the renewal of the interlocking. This level of ERTMS enables more flexible use of the underlying block system and can enhance capacity of the network.

Level 3 – Provides moving block functionality. It removes the need for track based train detection and line side infrastructure other than passive balise mounted in the track; and the GSM-R radio system. Level 3 systems are still being developed and are not in commercial use in main line railways. The level 3 system is not constrained by fixed blocks and can have high levels of capacity and operational flexibility as a consequence.

Signalling Dual Gauge Lines on Rail Baltica

The use of ERTMS on the Rail Baltica route is specified by the Technical Specifications for Interoperability. Where a dual gauge route is desirable in an area of restricted corridor, the overlay of ERTMS level 1 would provide a solution that:

1. enables the continuation of ERTMS signalling control for trains running on the 1435mm route;
2. provides a common European train protection interface between infrastructure and train; and
3. minimises alterations to the existing signalling systems or rolling stock that use the 1520mm gauge line.

The existing system would need to be altered as follows:

1. The track based train detection would need to be reconfigured to incorporate rails in both gauges as one circuit.
2. Local Electronic Units would need to be provided to derive information form the signal aspect circuits that feed the line side signals.
3. Track balise would need to be provided to communicate signal aspect information into the on-board ERTMS equipment from the LEU and communicate the static profile of the route ahead.
4. Interlocking logic alterations would need to be undertaken where points in different gauges are introduced into the layout.
5. Alterations to the control panel would need to be undertaken to reflect revised track layouts where additional points are provided for 1435mm gauge line.

In these dual gauge areas Rail Baltica would be constrained as the ERTMS system would be constrained by the underlying block system of the fixed block system. Specifically

1. Line speed would be constrained to the design speed of the underlying fixed block system
2. Capacity would be constrained by the design capacity of the underlying fixed block system

5.5 Social and Political Constraints

5.5.1 Social

5.5.2 Language

With Estonia, Latvia and Lithuania all having their own individual languages there is the possibility that language barriers will create issues in the development and internal management of the Rail Baltica project. On top of the individual language of the three countries there is also the further issue of the Russian language being widely used throughout the existing railway network.

5.5.2.1 Severance

With the potential line speed dictating an absence of at grade crossings then whichever option is chosen a number of smaller roads will have to be 'stopped up' or diverted leading to potential severance within some of the communities. This in turn will potentially lead to greater objections coming from the municipalities during the planning process and increase the risk of delays to the project implementation.

5.5.2.2 Population

As discussed in section 4 of this report the population in the Baltic Region is generally declining. This will have a two fold effect on the project. Firstly there is obviously a limit on those people that will be using the service but more importantly there is potentially a shortage of skilled labour available to both construct and operate the service.

5.5.3 Political

National Parliament and municipal elections in each of the Baltic States take place in different years and cycles (see the table below). This implies that changes in political authority increases the possibility of alteration in political agendas and priorities in each of the countries on national and local authority level.

Table 45 - Municipal Elections

National Parliament elections in each of the Baltic States every 4 years	Latvia: 2010 Lithuania:14.10.2012 Estonia: 06.03.2011
Regular municipal elections in each of the Baltic States	Latvia: Lithuania: 20.02.2011 Estonia: 20.10.2013
European Parliament elections in each of the Baltic States every 5 years	Latvia: 06.2014 Lithuania: 06.2014 Estonia: 06.2014
Presidential elections in Lithuania every 4 years	Latvia: 07.2011 Lithuania: 05.2014 Estonia: 08.2011

Furthermore, non-symmetrical bureaucracy in the governments of the Baltic States complicates collective decision making. This may alter changes in the confirmation and implementation process.

Finally, each Baltic country separately lobbies its airports, harbours, as well as road and railway industries. The Rail Baltica development will have future impact on the road and air transport industries, which may increase the tendency of political parties to favour their supporting industries and companies. This may again trigger extra disagreements between the involved parties during the consensus building process of the project.

In order to implement this project, joint management institutions, including regulatory bodies, should be considered. Nevertheless, this can be a complicated.

Bear in mind that there are several Free Economic Zones in the Baltic States: Klaipėda Free Economic Zone in Lithuania, and Rēzekne, Liepāja, Rīga Free Port economic zones in Latvia.

Rail Baltica would be beneficial for civil emergency planning of NATO. Civil Emergency Planning is first and foremost a national responsibility and civil assets remain under national control at all times. However, the magnitude and duration of a disaster situation may extend beyond the capacity of the affected country and its repercussions may reach far beyond national borders. NATO plays its part by serving as a forum for comparing and analyzing national programmes to ensure that plans and procedures are operational and that the necessary assets are available for addressing emergency situations jointly if need be. This would imply the there is a necessity to align the project with the suggestions of civil emergency planning, as well as multinational integrated logistics support of NATO.

6 Option Identification

6 Option Identification

6.1 Option Identification Methodology

The first stage in the identification of potential routes for Rail Baltica was to plot on to background mapping the potential constraints, such as the Natura 2000 sites, that have to be avoided wherever possible, and the potential demand drivers, such as the major centres of population and development identified in the macro-economic data. As a result of this exercise it was decided that the geography between the key destinations dicussed in the terms of reference should be broken down into segments. Four segments were identified: 1) Tallinn to Parnu/Tartu, 2) Parnu/Tartu to Riga, 3) Riga to Radviliskis/Panevežys and 4) Radviliskis/Panevežys to the Lithuanian border via Kaunas. When looking at new alignments care was taken to miss settlement areas wherever possible to minimise the environmental impact.

Segment 1 – Tallinn to Parnu/Tartu

Within this segment two primary options exist which are to travel either through Parnu or Tartu. This can be done either by utilizing the existing/parallel rail alignments or proposing new/independent rail alignments. The new alignments were chosen in an effort to minimise journey times. The existing/parallel alignments can also result in either adjacent segregated dual track configurations and/or dual gauge dual track configurations. The new/independent alignments will result in new dual track independent 1435mm infrastructure. A third option was considered via Vijandi but as this route would be longer than the route via Parnu and would not pass through as many major population centres as the route via Tartu it was dismissed at an early stage.

Segment 2 - Parnu/Tartu to Riga

In segment 2 from the Parnu/Tartu line to Riga a greater number of options were initially identified depending upon the start location. From Parnu three primary options were identified - direct new alignment to Riga, existing/parallel alignment to Riga and a hybrid new/existing alignment through Valmiera to Riga. The aim of this last alignment being to increase potential passenger numbers on this route. From Tartu two options were identified - existing/parallel alignment through Valga, Valmiera and Cesis to Riga or existing/new alignment through Valga, Valmiera, bypass Cesis to Riga. The different track configurations would be as for segment 1.

Segment 3 – Riga to Radviliskis/Panevežys

From Riga three primary options were identified - existing/parallel alignment to Radviliskis via Jelgava, a hybrid new/existing alignment through Jelgava to Radviliskis, and a direct new alignment to Panevezys. Track configurations as above.

Segment 4 - Radviliskis/Panevežys to the Lithuanian border via Kaunas

From Radviliskis two primary options were identified - existing/parallel alignment to Lithuanian Border via Kaunas or a hybrid new/existing alignment through Kaunas to Lithuanian Border. From Panevezys a direct new alignment to the Lithuanian Border was considered. Track configurations as above.

The various options are shown on the figure below:

Figure 20 - Initial Option Variations

The above process resulted in over 20 variations which following further investigation have been narrowed down to 4 key options. In the refinement process options were rejected which failed to fulfill certain key criteria for example N13 that passed to the west of Kaunas and was therefore not able to serve the proposed new intermodal facility planned near the airport . Others like N10 were rejected as they added distance but without the benefits of passing through a major population centre. Some of the variations remain which will be tested as part of the overall option analyses.

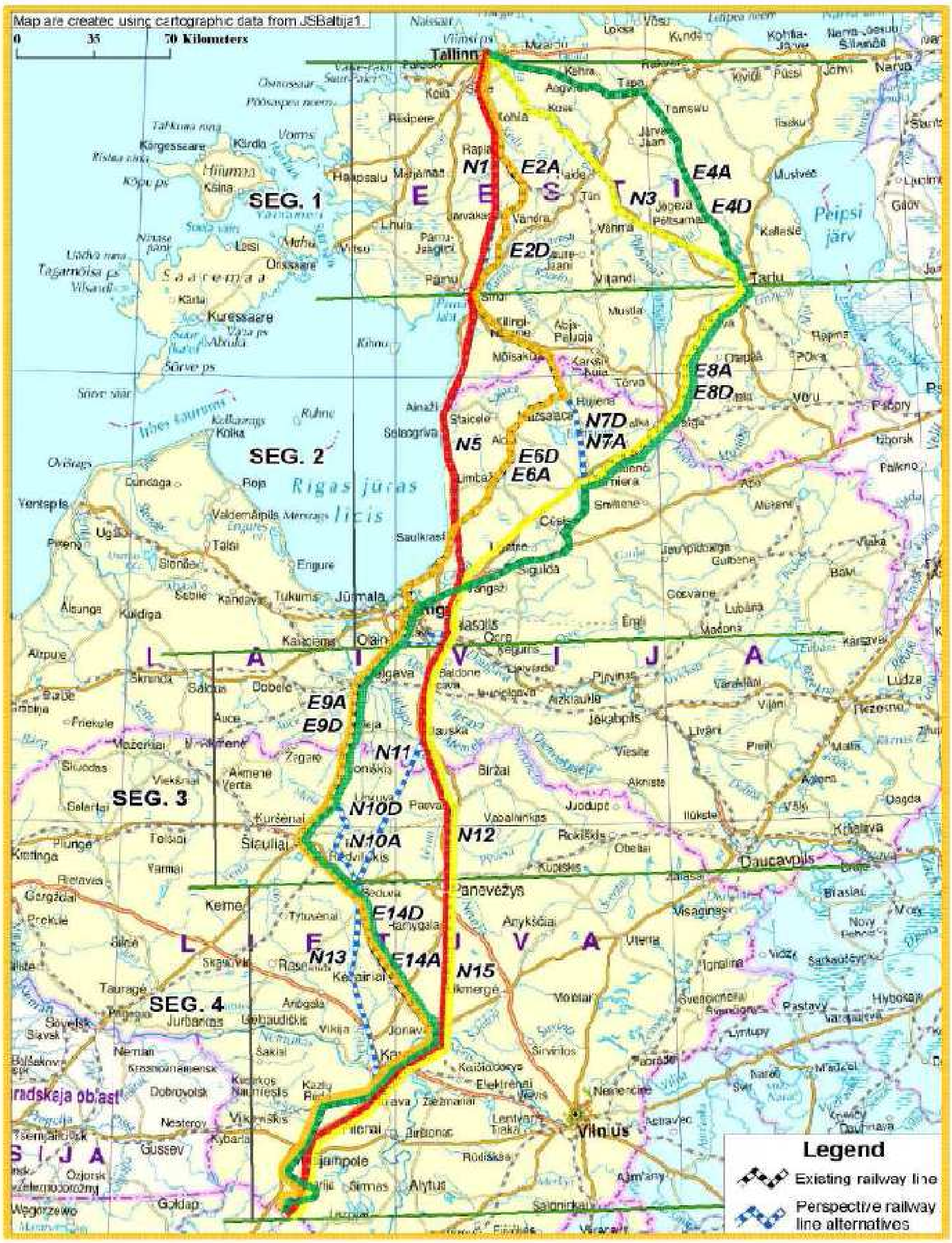
The key options are shown in the figure below together with a table of distances and estimates of journey time. In assesseing the journey times and average speeds, particularly for routes adjacent to the existing routes, consideration was given to the various constraints governing the existing alignment speed and where it was felt that these could not be easily negated a similar speed was used for the new route. Due consideration was also given to station dwell time, acceleration and declaration.

Table 46 - Distances and Journey Times

		PASSENGER / FREIGHT		
		Distance (km)	Journey Time (hrs) (hours_minutes)	Ave. Speed (kph)
Option 1	New Alignment			
LT Border – Kaunas – Panevežys – Riga – Parnu – Tallinn		701/708	4.13/10.38 (4h8m/10hr23m)	170/68
Option 2	Existing Alignment			
LT Border – Kaunas – Jelgava – Riga – Parnu – Tallinn		788/804	6.14/11.56 (6h8m/11h34m)	128/70
Option 3	New Alignment			
LT Border – Kaunas - Panevežys – Riga – Valmiera – Tartu - Tallinn		791/792	4.81/11.17 (4h49m/11h10m)	165/71
Option 4	Existing Alignment			
LT Border – Kaunas – Jelgava – Riga – Valmiera – Tartu – Tallinn		858/859	6.74/11.88 (6h44m/11h53m)	127/72

(Note: Distances differ between passenger and freight routes due to differing locations of passenger stations and freight ports/facilities)

Figure 21 - Route Options



6.2 Key Option Description

An outline of each of the 4 key options is given below. Details of the specific issues related with each option can be found in Appendix D. One issue common to all routes is the connection to Riga airport. The location of Riga airport is such that its connection to any north south route is very complicated and to offer a good connection to any airport a service freqency is required, proably in the order of one train every 15 – 20 minutes, which is much greater than that provided by the potential Rail Baltica service which would be hourly at best. As a result of this we have assumed that all routes will serve Riga Central Station only. Connection to the airport will be by other pulic transport providers.

Option 1 – Red Route

This alignment has been selected and designed to be the most direct and shortest route from the southern most point to the northern most point of the corridor. The new 1435mm gauge line starts at the LT border and proceeds into Kaunas on a new alignment to minimize curves and speed restrictions. At Kaunas the route will not serve the Central Station directly but will use Palemonas station as the transfer connection to the existing 1520mm gauge line to link to the Central Station and a transfer location for shuttle service to the airport via bus or rail. The new proposed intermodal facility is also in this area and can also be easily served by this route. The line progresses northbound through the west-side of Panevezys, where a stop for passengers and freight is planned, and continues north into Latvia. In Latvia the alignment proceeds adjacent to Iecava and then crosses the Daugava River to the east of Riga, at Salaspils at which point an east-west intermodal transfer station is contemplated. Riga City is served by utilizing the old "Ergli" alignment through to the Central Station. Trains from Central Station use the same route to arrive back at the main north south section. From this connection point the line proceeds northbound following parallel to the Via Baltica roadway alignment to Parnu, another intermediate stop and subsequently to Tallinn Central Station stopping first at Tallinn Airport. In the vicinity of Tallinn spurs are provided from the main line to serve both Muuga Port and the proposed location of the proposed fixed crossing to Helsinki.

Option 2 – Orange Route

This alignment has been selected as the most direct existing rail route from the southern most point to the northern most point of the corridor. The new 1435mm gauge line starts at the LT border and proceeds into Kaunas on the existing alignment to minimize right of way acquisition costs and additional infrastructure costs. The line progresses northbound along the existing corridor through Jonava, Kedainiai, Radviliskis, Sauliai, Joniskis and continues north into Latvia. In this stretch of the railway multiple interface and intermodal connections are possible with the existing 1520mm east-west alignments. In Latvia, the alingment proceeds into Jelgava, where a stop for passengers is provided and an east-west intermodal transfer station is contemplated. The route then continues along the existing alingment and crosses the Daugava River in the center of Riga over the existing railway bridge and connects to Riga Central Station. From Riga Central Station the line proceeds northbound following the existing railway alignment to Parnu via Limbaz. It is proposed to provide a passenger stop at Parnu. From Parnu the route continues on to Tallinn Central Station. Muuga port, the proposed location of the Helsinki fixed link and Tallinn airport would all be served by a new line continuing on from the Central Station. A bypass will be provided so that freight traffic does not have to enter the Central Station.

Option 3 – Yellow Route

This alignment has been selected to try and maximise potential passenger demand by passing through the majority of the major population centres. The new 1435mm gauge line starts at the LT border and proceeds into Kaunas on a new alignment to minimize curves and speed restrictions. As with option 1 Palemonas is used as the passenger stop rather than Kaunas Central Station. The line progresses northbound through the west-side of Panevezys, where a passenger and freight stop is also provided, and continues north into Latvia. In Latvia the alingment proceeds adjacent to Iecava and then crosses the Daugava River, to the east of Riga, at Salaspils at which point an east-west intermodal transfer station is contemplated. Connect to Riga is as per option 1. From the connection point at Riga the line proceeds northbound following parallel to the existing Valmiera/Valka line but gets diverted at Vangazi to follow the Valmeira highway to avoid impacting the extensive Natura 2000 site between Sigulda and Valmiera. The alignment passess through Valmiera, where a passenger stop is anticipated and proceeds along the existing railway corridor through Valka/Valga to Tartu. A station reconstruction is anticipated at Tartu. The railway proceeds northwest on a new alignment to Tallinn stopping first at Tallinn Airport and then Tallinn Central Station. Muuga port and the proposed Helsinki fixed link are served as in option 1.

Option 4 – Green Route

This alignment has been selected to utilize ALL existing routes from the southern most point to the northern most point of the corridor. The new 1435mm gauge line starts at the LT border and proceeds parallel to the existing alignment into Kaunas (possibly utilizing the already proposed designs and newly installed dual gauge rail track). The line progresses northbound along the existing corridor through Jonava, Kedainiai, Radviliskis, Sauliai, Joniskis and continues north into Latvia. In this stretch of the railway multiple interface and intermodal connections are possible with the existing 1520mm east-west alignments. In Latvia, the alignment proceeds into Jelgava, where a passenger stopm and an east-west intermodal transfer station are contemplated. The route then continues along the existing alingment and crosses the Daugava River in the center of Riga over the existing railway bridge and connects to Riga Central Station. From Central Station the line proceeds northbound following parallel to the existing Valmiera/Valka line through Sigulda, Cesis and Valmiera. The alignment passess through Valmiera, where a passenger stop is assumed and the proceeds along the existing railway corridor through Valka/Valga to Tartu. A station reconstruction is anticipated at Tartu. The railway proceeds along the existing rail alignment through Tapa and northwest to Tallinn stopping first at Tallinn Airport and then Tallinn Central Station. The line is also proposed to have northbound connections to Muuga Port and the proposed Helsinki fixed link.

Figure 22 – Distance/passenger journey time comparison with the Business As Usual case scenario and the Existing Service

7 Technical Analysis Packages

7 Technical Analysis Packages

7.1 Do Minimum Option

The business as usual case defines the reference scenario against which the various options will be appraised. The Do Minimum includes the following elements, including those defined in the study Terms of Reference:

- 1520mm gauge line between Marijampole and Tallinn upgraded to minimum 120kph line speed wherever physically possible.
- Estonia
  - Tartu – Valga rail line upgrade
  - Tallinn – Tartu – Voru road enhancements
- Latvia
  - Riga – Krustpils second rail track
  - Riga Ring road Daugava Crossing
  - Kekava Bypass
  - Development of Riga International Airport hub including its envisaged rail connection
- Lithuania
  - 1435mm gauge track installed between PL/LT border and Kaunas
  - Vilnius - Kaunas Rail modernisation (160kph)
  - Kaunas intermodal terminal
  - Improvements to E77 (Riga-Siauliai-Taurage-Kallingrad)

7.2 Demand on the Alternative Routes

This section of the report summarises the current Rail Baltica forecasts for both passenger and freight for the 4 scenarios covered by the interim report.

7.2.1 Passenger Forecasts

7.2.1.1 Core Assumptions

Outlined below are the core assumptions currently adopted in relation to journey times, service frequency and fares for the Rail Baltica service.

Passenger Journey Times

The four route options identified in section 6 have been assessed in the transport model. The key characteristics of each option in relation to passenger services are summarised below.

Table 47 – Passenger yourney times

			TOTAL	PASSENGER		
Description		Alignment	km	km	hrs	Av. kph
Option 1						
	LT BORDER - TALLINN via KAUNAS/PANEVEZYS/RIGA/PARNU	New	728	701	4.13	170
Option 2						
	LT BORDER - TALLINN via KAUNAS/JELGAVA/RIGA/PARNU	Existing	815	788	6.14	128
Option 3						
	LT BORDER - TALLINN via KAUNAS/PANEVEZYS/RIGA/VALMIERA/ TARTU	New/Existing	818	791	4.81	165
Option 4						
	LT BORDER - RIGA via JELGAVA	Existing	885	858	6.74	127

Service Frequency

The initial assumption adopted is that there will be a service every 2 hours along the route of Rail Baltica. This assumption has been adopted based on our initial review of overall corridor demand and a level of service which will be attractive to passengers.

We have subsequently undertaken an additional sensitivity test assuming a more frequent service to assess the impact of service frequency on patronage. This analysis is discussed in section 7.2.1.5.

Fare Rates

The initial assumption adopted is that the Rail Baltic Passenger fare will be €0.05 per km. This is in line with current rail fare rates and provides a starting point for the analysis. A revenue optimisation exercise has then been undertaken to determine the fare rates that generate the maximum revenue for each route option. These 'revenue maximising' fare rates have been adopted in the central case.

7.2.1.2 Base Case Passenger Forecast (Fares in line with existing rail fares)

As a starting point for the analysis and appraisal of passenger demand a base case has been specified. This case adopts all the assumptions discussed above, but with a fare rate of €0.05 per km. This fare rate is in line with current rail fare rates in the region and provides an indication of the levels of Rail Baltica patronage that could be generated if a similar fare structure to the excising rail service was adopted.

Table below shows the annual average daily 2-way flow for each section of the four Rail Baltica route options in 2020, 2030 and 2040 and with a fare rate of €0.05 per km.

Table 48 - 2-way average daily passenger volumes (Fare rate of €0.05 per km)

Flow (2-way Daily)	Red			Orange			Yellow			Green		
	2020	2030	2040	2020	2030	2040	2020	2030	2040	2020	2030	2040
Tallinn to Parnu	4,029	4,734	5,545	2,834	3,339	3,923	-	-	-	-	-	-
Parnu to Riga	3,004	3,566	4,204	1,964	2,343	2,775	-	-	-	-	-	-
Tallinn to Tartu	-	-	-	-	-	-	4,261	5,017	5,916	2,677	3,191	3,808
Tartu to Valmiera	-	-	-	-	-	-	2,564	3,113	3,644	1,397	1,695	2,008
Valmiera to Riga	-	-	-	-	-	-	3,730	4,417	5,109	2,306	2,706	3,136
Riga to Jelgava	-	-	-	3,963	4,581	5,200	-	-	-	4,307	4,965	5,600
Jelgava to Kaunas	-	-	-	2,724	3,188	3,624	-	-	-	2,902	3,402	3,855
Riga to Panevezys	3,572	4,172	4,736	-	-	-	3,578	4,180	4,733	-	-	-
Panevezys to Kaunas	6,523	7,428	8,336	-	-	-	6,529	7,435	8,331	-	-	-
Kaunas to Poland	2,272	2,486	2,654	1,730	1,889	2,004	2,267	2,483	2,653	1,727	1,887	2,002

7.2.1.3 Fare Optimisation

Model scenarios have been run with varying Rail Baltica fare rates. Model runs for the following fare rates have been undertaken:

€ 0.05 per km

€ 0.06 per km

€ 0.07 per km

€ 0.08 per km

€ 0.09 per km

€ 0.10 per km

€ 0.11 per km

€ 0.12 per km

€ 0.13 per km

€ 0.14 per km

€ 0.15 per km

€ 0.175 per km

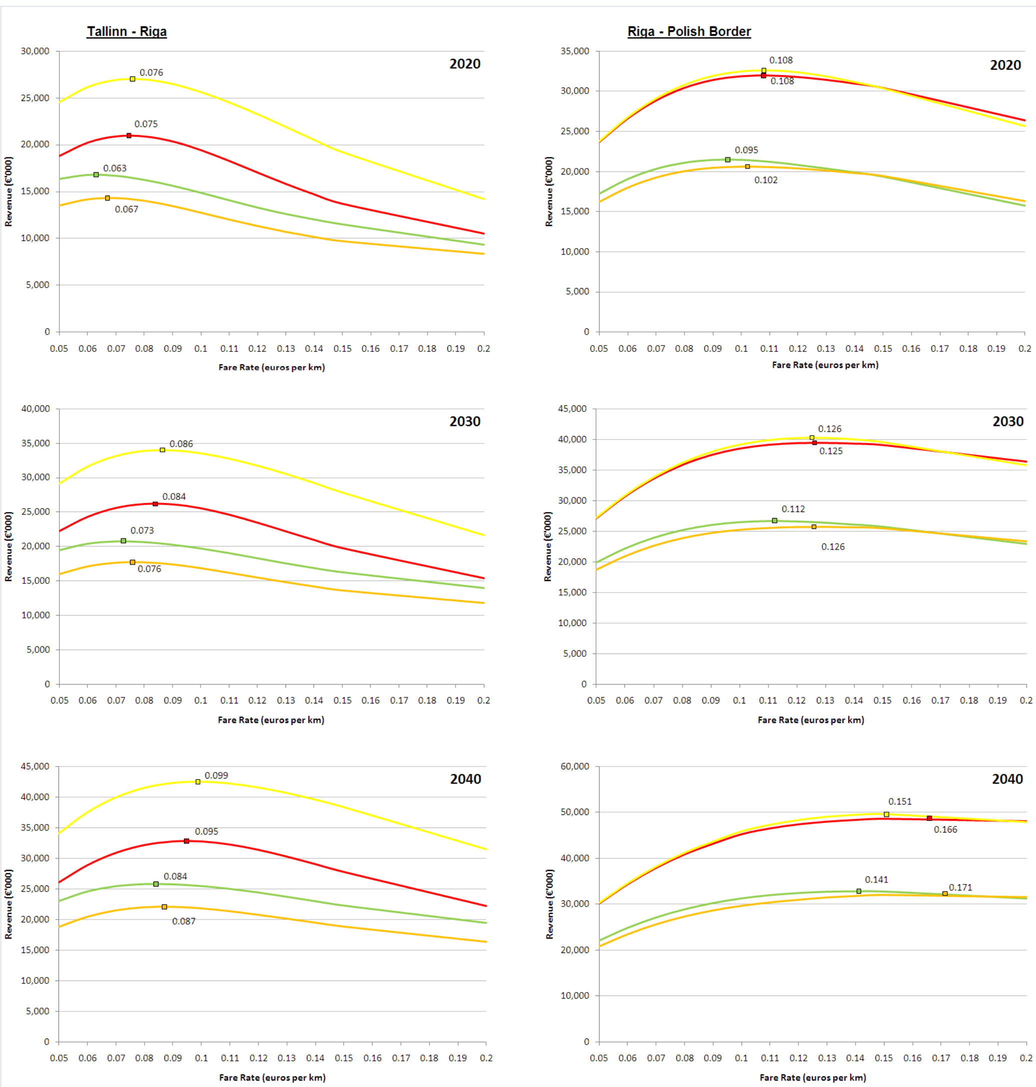
€ 0.20 per km

For each fare rate scenario the passenger demand has been extracted and the resulting Rail Baltica revenue calculated. The routes have been separated into two sections (Tallinn to Riga and Riga to Polish border) for the revenue calculation to allow varying optimal fares to be considered.

As fare rates increase passenger demand falls. At low fare rates generally demand falls by less than the fare has risen meaning there will be an increase in revenue as a result of the fare rise. However, a point will be reached where further increases in fare result in a reduction in demand greater than the fare increase. When this happens the revenue starts to fall. This feature of demand/cost relationship means that for each route there is a fare rate that gives the maximum revenue which will be different for different routes depending upon the route characteristics.

The model results have been used to construct revenue curves for each of the route options. These are shown below in Figure 23. Also shown is the fare rate for each route at which the revenue is maximised.

Figure 23 – Revenue Maximising Curves



It is clear from Figure 23 that it is possible to generate significantly more revenue at fare rates higher than €0.05 per km for all route options. Generally it is also shown that the revenue maximising fare rate is higher for the faster route options (Red route, Option 1 and Yellow route Option 3) than for the slower routes (Orange route, Option 2 and Green route Option 4). As expected the optimum fare rates also increase in the future due to growth in the value of time.

The revenue maximising fare rates have been considered when defining the central case fare rates to be adopted. For the Tallinn – Riga section of the routes the revenue maximising fare rates calculated above have been adopted. For the Riga – Polish border section of the routes , options share identical routes the average of the revenue maximising fare rates have been adopted. This is to ensure consistency and comparability between routes.

Table below summarises the fare rates adopted for the central case for the four route options.

Table 49 - Central Case Fare Rates (€/km)

		2020	2030	2040
Red	Tallinn - Riga	€ 0.075	€ 0.084	€ 0.095
	Riga-Poland	€ 0.108	€ 0.126	€ 0.158
Orange	Tallinn - Riga	€ 0.067	€ 0.076	€ 0.087
	Riga-Poland	€ 0.099	€ 0.119	€ 0.141
Yellow	Tallinn - Riga	€ 0.076	€ 0.086	€ 0.099
	Riga-Poland	€ 0.108	€ 0.126	€ 0.158
Green	Tallinn - Riga	€ 0.063	€ 0.073	€ 0.084
	Riga-Poland	€ 0.099	€ 0.119	€ 0.141

Table below shows the sectional fares in 2020 that result from the fare rates shown above

Table 50 - Single Fare (1-way) 2020

	Red	Orange	Yellow	Green	Existing Bus Service	Existing Rail Service
Tallinn to Parnu	€ 10.4	€ 9.8	-	-	€ 7.7	€ 5.4
Parnu to Riga	€ 15.4	€ 15.1	-	-	-	-
Tallinn to Tartu	-	-	€ 12.2	€ 11.7	€ 9.6	€ 6.7
Tartu to Valmiera	-	-	€ 10.7	€ 8.9	-	-
Valmiera to Riga	-	-	€ 9.0	€ 8.4	€ 4.2	€ 4.0
Tallinn to Riga	**€ 25.7**	**€ 25.0**	**€ 32.0**	**€ 29.0**	**€ 15.5**	**-**
Riga to Jelgava	-	€ 3.3	-	€ 3.3	€ 2.1	€ 1.9
Jelgava to Kaunas	-	€ 23.4	-	€ 23.4	-	-
Riga to Panevezys	€ 18.7	-	€ 18.7	-	-	-
Panevezys to Kaunas	€ 9.5	-	€ 9.5	-	-	-
Riga to Kaunas	**€ 28.2**	**€ 26.6**	**€ 28.2**	**€ 26.6**	**€ 24.2**	**-**
Kaunas to Polish Border	€ 10.6	€ 12.3	€ 10.6	€ 12.3	-	
Tallinn to Polish Border	**€ 64.5**	**€ 63.9**	**€ 70.7**	**€ 68.0**	**-**	**-**

7.2.1.4 Central Case Passenger Forecast (Revenue maximising fares)

The central case has adopted the key assumptions described in section 7.2.1.3 and the revenue maximising fares derived above. The following tables outline in detail, the passenger demand and revenue generated under this scenario.

Table 51 - Whole Route Revenue €'000,000

Segment	Yellow		
	2020	**2030**	**2040**
1	13.7	17.1	21.6
2	17.6	22.6	28.3
3	16.2	20.9	27.2
4	20.4	25.0	31.0
Total	**68.0**	**85.6**	**108.2**
Segment	**Green**		
	2020	**2030**	**2040**
1	9.2	11.4	14.5
2	8.9	11.2	14.0
3	10.1	13.2	16.9
4	16.0	20.0	24.9
Total	**44.2**	**55.8**	**70.3**
Segment	**Red**		
	2020	**2030**	**2040**
1	11.4	14.2	17.8
2	13.7	17.3	21.7
3	16.0	20.6	26.8
4	20.3	24.8	30.9
Total	**61.4**	**76.9**	**97.2**
Segment	**Orange**		
	2020	**2030**	**2040**
1	8.1	10.1	12.9
2	8.4	10.5	13.4
3	9.5	12.4	15.9
4	15.4	19.2	24.0
Total	**41.3**	**52.2**	**66.2**

Table 52 - Daily 2-way Passenger Demand

2-way Daily Flow	Red			Orange			Yellow			Green		
	2020	2030	2040	2020	2030	2040	2020	2030	2040	2020	2030	2040
Tallinn to Parnu	3,015	3,361	3,721	2,261	2,485	2,755	-	-	-	-	-	-
Parnu to Riga	2,168	2,432	2,695	1,510	1,672	1,867	-	-	-	-	-	-
Tallinn to Tartu	-	-	-	-	-	-	3,068	3,378	3,716	2,144	2,305	2,545
Tartu to Valmiera	-	-	-	-	-	-	1,819	2,088	2,276	1,043	1,150	1,272
Valmiera to Riga	-	-	-	-	-	-	2,735	3,062	3,314	1,805	1,926	2,083
Riga to Jelgava	-	-	-	3,067	3,324	3,625	-	-	-	3,325	3,581	3,867
Jelgava to Kaunas	-	-	-	2,034	2,211	2,402	-	-	-	2,157	2,343	2,530
Riga to Panevezys	2,566	2,837	2,945	-	-	-	2,603	2,883	2,989	-	-	-
Panevezys to Kaunas	4,611	4,972	5,120	-	-	-	4,649	5,018	5,165	-	-	-
Kaunas to Poland	1,114	1,038	856	857	768	710	1,104	1,021	836	844	751	694

Average train loadings have been calculated based on an assumed train capacity of 400 and a service pattern of 8 trains per day. These are shown below. It is clear that the forecast demand does not exceed capacity on any section in any of the assessment years.

Table 53 - Average Train Loading

Train Loadings	Red			Orange			Yellow			Green		
	2020 € 0.08	2030 € 0.08	2040 € 0.10	2020 € 0.07	2030 € 0.08	2040 € 0.09	2020 € 0.08	2030 € 0.09	2040 € 0.10	2020 € 0.06	2030 € 0.07	2040 € 0.08
Tallinn to Parnu	47%	53%	58%	35%	39%	43%	-	-	-	-	-	-
Parnu to Riga	34%	38%	42%	24%	26%	29%	-	-	-	-	-	-
Tallinn to Tartu	-	-	-	-	-	-	48%	53%	58%	34%	36%	40%
Tartu to Valmiera	-	-	-	-	-	-	28%	33%	36%	16%	18%	20%
Valmiera to Riga	-	-	-	-	-	-	43%	48%	52%	28%	30%	33%
Riga to Jelgava	-	-	-	48%	52%	57%	-	-	-	52%	56%	60%
Jelgava to Kaunas	-	-	-	32%	35%	38%	-	-	-	34%	37%	40%
Riga to Panevezys	40%	44%	46%	-	-	-	41%	45%	47%	-	-	-
Panevezys to Kaunas	72%	78%	80%	-	-	-	73%	78%	81%	-	-	-
Kaunas to Poland	17%	16%	13%	13%	12%	11%	17%	16%	13%	13%	12%	11%

7.2.1.5 Passenger Sensitivity Tests

A number of different sensitivity tests have been undertaken where key input assumptions in the model process have been altered. Tests have included:

- Rail Baltic Service Frequency;
- Rail Baltic Journey Times;

In each test the central case scenario has been adjusted and re-assigned to determine the impact on passenger demand and revenue of varying one input assumption in isolation.

Table below summarises the key results statistics for the central case against which the sensitivity tests will be compared

Table 54 - Central Case Key Results Statistics

		2020	2030	2040
Red Route	Volume in Million passenger km	665	728	771
	Revenue in Million Euros	61.4	76.9	97.2
Orange Route	Volume in Million passenger km	497	537	585
	Revenue in Million Euros	41.3	52.2	66.2
Yellow Route	Volume in Million passenger km	745	818	863
	Revenue in Million Euros	68.0	85.6	108.2
Green Route	Volume in Million passenger km	551	589	636
	Revenue in Million Euros	44.2	55.8	70.3

Rail Baltic Passenger Service Frequency Sensitivity

A test scenario has been assessed with an hourly Rail Baltica service frequency. This compares to the 2-hourly service frequency adopted in the central case. Table below summaries the key results statistics for this scenario and compares the patronage and revenue against the Central Case.

Table 55 - Hourly Service Key Results Statistics

Options		2020		2030		2040	
			% difference to Central Case		% difference to Central Case		% difference to Central Case
Red Route	Volume in Million passenger km	957	44%	1055	45%	1133	47%
	Revenue in Million Euros	87.3	42%	110.0	43%	138.4	42%
Orange Route	Volume in Million passenger km	762	53%	815	52%	870	49%
	Revenue in Million Euros	62.5	51%	79.0	51%	99.4	50%
Yellow Route	Volume in Million passenger km	1,205	62%	1330	63%	1423	65%
	Revenue in Million Euros	106.7	57%	134.9	58%	169.6	57%
Green Route	Volume in Million passenger km	901	63%	966	64%	1046	65%
	Revenue in Million Euros	70.0	58%	89.2	60%	113.4	61%

The table above shows that when the number of trains doubles (increase in frequency from 2-hourly to hourly), the revenue and demand only increase by 40% - 65%. This indicates that the average train load factors and revenue per train would be lower for hourly service and will not offset the increase in operating costs.

Table below shows the increase in passenger volumes when the frequency doubles, by route section. This indicates that there are several sections where doubling the frequency of the service does lead to a doubling of passenger demand, possibly making a more frequent service viable.

Table 56 - Increase in passenger demand with hourly service when compared to 2-horly central case

increase in passenger demand	Red			Orange			Yellow			Green		
	2020	2030	2040	2020	2030	2040	2020	2030	2040	2020	2030	2040
Tallinn to Parnu	55%	56%	56%	68%	68%	67%						
Tallinn to Tartu							114%	115%	116%	76%	78%	81%
Parnu to Riga	46%	47%	49%	60%	59%	57%						
Tartu to Valmiera							49%	49%	49%	100%	105%	109%
Valmiera to Riga							64%	63%	63%	93%	98%	101%
Riga to Jelgava				76%	75%	71%				72%	71%	69%
Jelgava to Siauliai				35%	33%	29%				30%	29%	26%
Riga to Panevezys	30%	31%	34%				29%	30%	33%			
Siauliai to Kaunas				35%	33%	29%				30%	29%	26%
Panevezys to Kaunas	46%	46%	49%				45%	46%	48%			
Kaunas to Poland	45%	46%	50%	45%	35%	22%	46%	48%	52%	47%	37%	24%

Rail Baltic Passenger Journey Time Sensitivity

Two test scenarios have been assessed with improved Rail Baltica service speed. In the first scenario all Rail Baltica journey sections have 15% higher speed compared to the central case, in the second scenario average speeds are increased by 30%. Table below summaries the key results statistics for the 15% increased speed scenario and summaries the key results statistics for the 30% increased speed scenario. Both tables include a comparison of patronage and revenue against the Central Case.

Table 57 - 15% Faster Service Key Results Statistics

Options		2020		2030		2040	
			% difference to Central Case		% difference to Central Case		% difference to Central Case
Red Route	Volume in Million passenger km	742	12%	814	12%	864	12%
	Revenue in Million Euros	68.2	11%	85.6	11%	108.2	11%
Orange Route	Volume in Million passenger km	596	20%	644	20%	700	20%
	Revenue in Million Euros	49.2	19%	62.0	19%	78.4	18%
Yellow Route	Volume in Million passenger km	844	13%	927	13%	980	14%
	Revenue in Million Euros	76.4	12%	96.3	12%	121.7	12%
Green Route	Volume in Million passenger km	694	26%	747	27%	807	27%
	Revenue in Million Euros	54.5	23%	69.0	24%	86.8	24%

Table 58 - 30% Faster Service Key Results Statistics

Options		2020		2030		2040	
			% difference to Central Case		% difference to Central Case		% difference to Central Case
Red Route	Volume in Million passenger km	806	21%	887	22%	943	22%
	Revenue in Million Euros	73.7	20%	92.8	21%	117.5	21%
Orange Route	Volume in Million passenger km	674	36%	729	36%	790	35%
	Revenue in Million Euros	55.4	34%	69.9	34%	87.9	33%
Yellow Route	Volume in Million passenger km	925	24%	1018	24%	1078	25%
	Revenue in Million Euros	83.3	23%	105.1	23%	133.0	23%
Green Route	Volume in Million passenger km	784	42%	844	43%	911	43%
	Revenue in Million Euros	61.1	38%	77.5	39%	97.2	38%

As expected, increasing the average journey speed increases both demand and revenue. The impact is less marked for the faster routes (Red route, Option 1 and Yellow route Option 3), however, as these route options already offer significant journey time savings over the alternative modes in the central case. It can also be seen that the increases in revenue are greater when increasing the central case speeds by 15% than when increasing the speeds from +15% to +30%. This implies there is limited scope to generate much higher revenues by increasing design speed.

Abstraction from existing modes

Table below shows the number of trips that will be abstracted from existing modes in 2020. It should be noted that whilst some of these trips will be long distance trips, such as Tallinn to Warsaw, the majority of the trips on Rail; Baltica will be much shorter distance trips within the states themselves.

Table 59 - Abstraction from existing modes

2020 (Total trips per day, 2-way)		Red	Yellow	Green	Orange
Trips Diverted from Existing modes	Car	2,133 (28%)	2,322 (25%)	1,632 (26%)	1,473 (27%)
	Bus	3,452 (45%)	3,894 (43%)	2,379 (38%)	2,122 (39%)
	Rail	222 (3%)	827 (9%)	819 (13%)	481 (9%)
	Air	844 (11%)	771 (8%)	599 (10%)	698 (13%)
Induced Trips		1,039 (14%)	1,332 (15%)	804 (13%)	722 (13%)
Total Rail Baltica Trips per Day		**7,689**	**9,146**	**6,234**	**5,496**

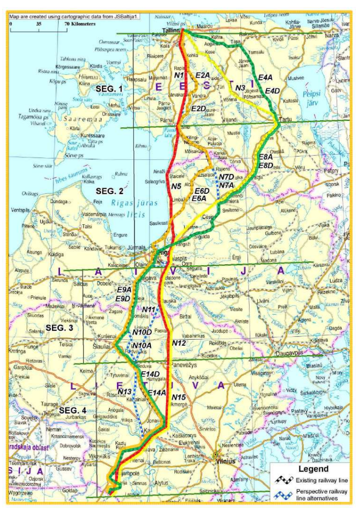
It is clear from the data above that for all options there is a significant diversion from coach; the diversion from rail is highest for options which follow existing rail routes; and diversion from air is highest for the fastest route options

7.2.2 Freight Forecasts

7.2.2.1 Core Assumptions

The model has been designed to allow easy sensitivity testing of some of the key variables. Options within the freight model include:

- Routing Option 1 (Red):
  - Lithuania - Riga via Panevezys
  - Riga – Tallinn via Parnu
- Routing Option 2 (Orange):
  - Lithuania - Riga via Jelgava
  - Riga – Tallinn via Parnu
- Routing Option 3 (Yellow):
  - Lithuania - Riga via Panevezys
  - Riga – Tallinn via Tartu
- Routing Option 4 (Green):
  - Lithuania - Riga via Jelgava
  - Riga – Tallinn via Tartu
- Rail price options low, medium and high
- Induced demand options low, medium and high
- Potential increase in traffic with green agenda or not
- Choice of 70kph or 90kph



In the current model, each of the routes, red, orange, yellow and green, use Palemonas as the main Kaunas station with no 1435mm access to Kaunas Central Station and no need for tunnel upgrades. The freight hub would be built away from the housing areas on the direct line to reduce the impact of the development on the community. This means that freight trains can avoid the busy central station area and reduces the chance of delays to both passenger and freight trains thus increasing the reliability of the Rail Baltica line. In case of incidents the option for freight trains to travel via central station should be considered but would be an expensive option.

Key Growth Assumptions

The core scenarios discussed below are based on a mid set of assumptions in relation to core factors such as price, speed, induced demand and the green agenda. We have subsequently undertaken sensitivity tests based on a low and high scenario. The core assumptions adopted for these scenarios are outlined below.

Medium Case
- Medium Freight Price
- Average Speed 70kph
- 15% induced demand
- No green agenda

Low Case
- Highest Freight Price
- Average Speed 70kph
- No induced demand
- No green agenda

High Case
- Low Freight Price
- Average speed 90kph
- 30% induced demand
- Strong green agenda

7.2.2.2 Central Case Freight Forecast (Medium Case Assumptions)

The following outputs show the model results for each of the 4 routing scenarios under the medium price and induced demand scenarios and with a speed of 70kph. Results have been derived for key freight service indicators, including:

- Volume of Freight Carried (in million Tonnes)
- Revenue (in million Euros)
- Journey Time savings (in million Euros)
- CO_2 Savings in Tonnes
- GHG CO_2E Savings in Tonnes

Table 60 - Central Case

Options	Sensitivity	2020	2030	2040
Red Route	Volume in Million Tonnes	9.8	12.9	15.8
	Revenue in Million Euros	132	176	222
	Journey Time savings in Million Euros	37	52	69
	CO_2 Saved Tonnes	374	517	672
	GHG CO_2E Saved Tonnes	380	525	683
Orange Route	Volume in Million Tonnes	7.6	10.1	12.6
	Revenue in Million Euros	106	144	188
	Journey Time savings in Million Euros	25	36	50
	CO_2 Saved Tonnes	264	377	514
	GHG CO_2 E Saved Tonnes	269	383	522

Yellow Route	Volume in Million Tonnes	8.1	10.6	13.2
	Revenue in Million Euros	107	144	187
	Journey Time savings in Million Euros	25	36	50
	CO_2 Saved Tonnes	268	380	513
	GHG CO_2 E Saved Tonnes	273	386	521
Green Route	Volume in Million Tonnes	6.6	8.7	10.9
	Revenue in Million Euros	88	120	160
	Journey Time savings in Million Euros	18	26	38
	CO_2 Saved Tonnes	200	287	405
	GHG CO_2 E Saved Tonnes	204	291	412

In the central case the red route provides the highest volumes carried, revenue, journey time saving and emissions savings, this is due to the red route being the shortest of the four routes so attracting the largest modal shift. The Orange and Yellow routes are very similar due to having similar distances and the green route provides the lowest volumes carried, revenues, journey time savings and emissions savings.

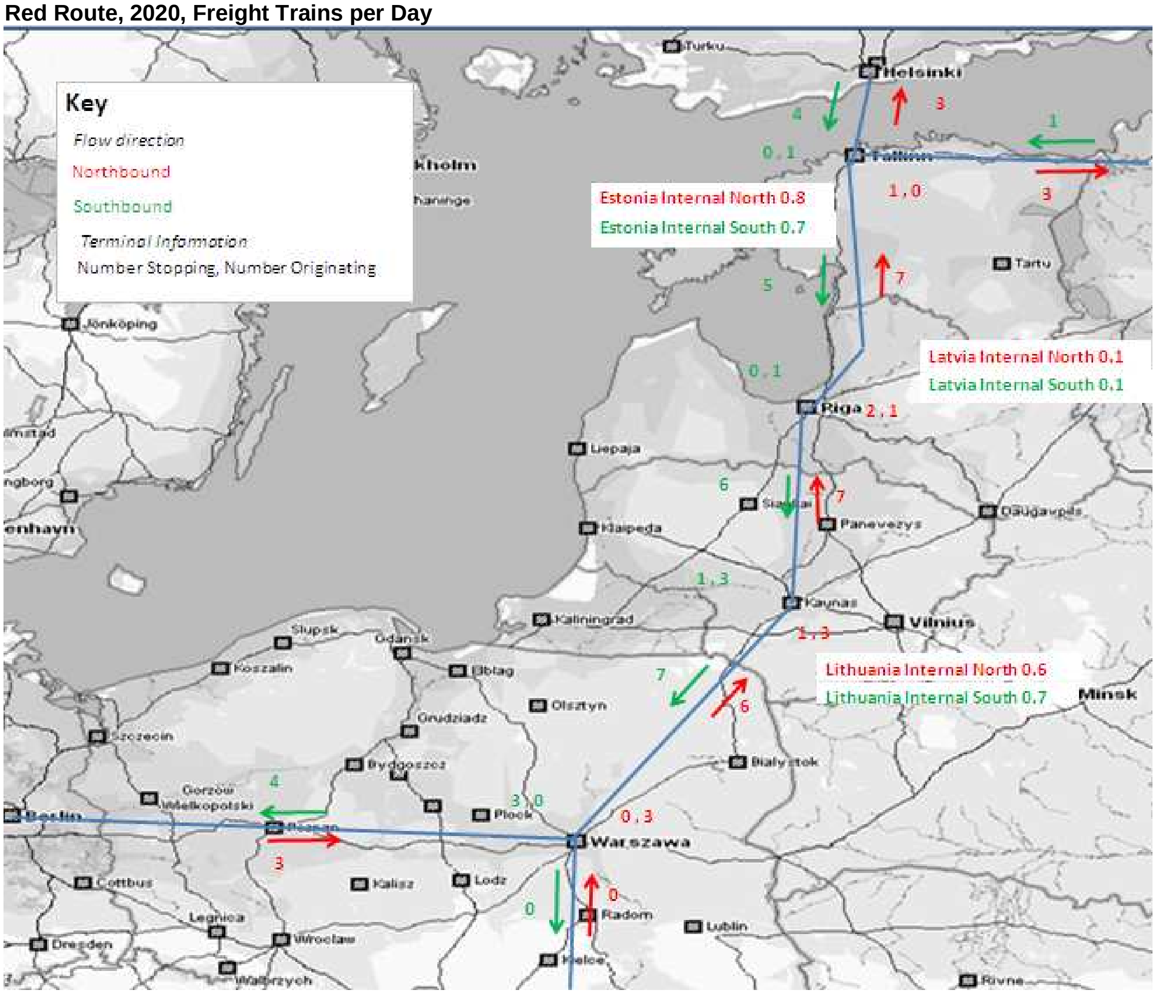
The COWI Report page 221 states that 60 million tonnes is expected to be moved on the North-South Corridor in the Baltic States in 2034, 22% of this is expected to be by Rail, thus 13 million tonnes carried by rail.

The figures below show the central case freight trains per day for 2020, 2030 and 2040. Terminal information is shown in form first figure = number stopping, second figure = number originating. The red arrows represent northbound traffic and green arrows represents southbound. Figures for international traffic are rounded to integers therefore in some instances it may appear that there is a difference of one train between the inbound and outbound trains at a particular stop. The potential internal traffic shown is in addition to the international traffic represented upon the lines.

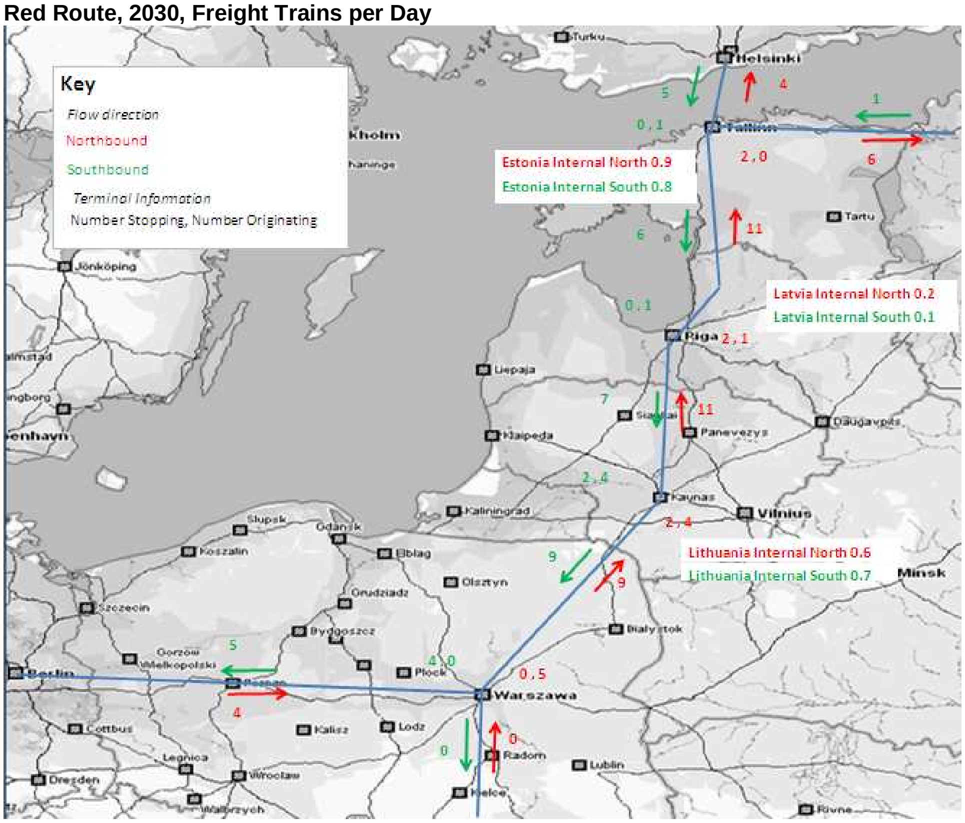
The imbalance in northbound and southbound traffic predicted within the model may affect the potential volumes available on the sections through Latvia and Estonia in particular as it is unlikely that a backload will be able to be found for much of the potential traffic (roughly twice as much demand is predicted northbound as southbound). This could lead to increased costs for the freight operating companies and therefore tariffs may be higher.

For each major city there are two numbers in green for southbound trains, the first number describes the number of freight trains that terminate at that freight yard; the second figure is those that originate from that yard and continue south. These figures DO NOT include the international trains that call en-route to set down and pick up. Against the green arrow is the number of international trains heading south between countries. Lastly domestic trains are only shown in the white boxes described as "internal trains". They should NOT be confused with the number of international trains.

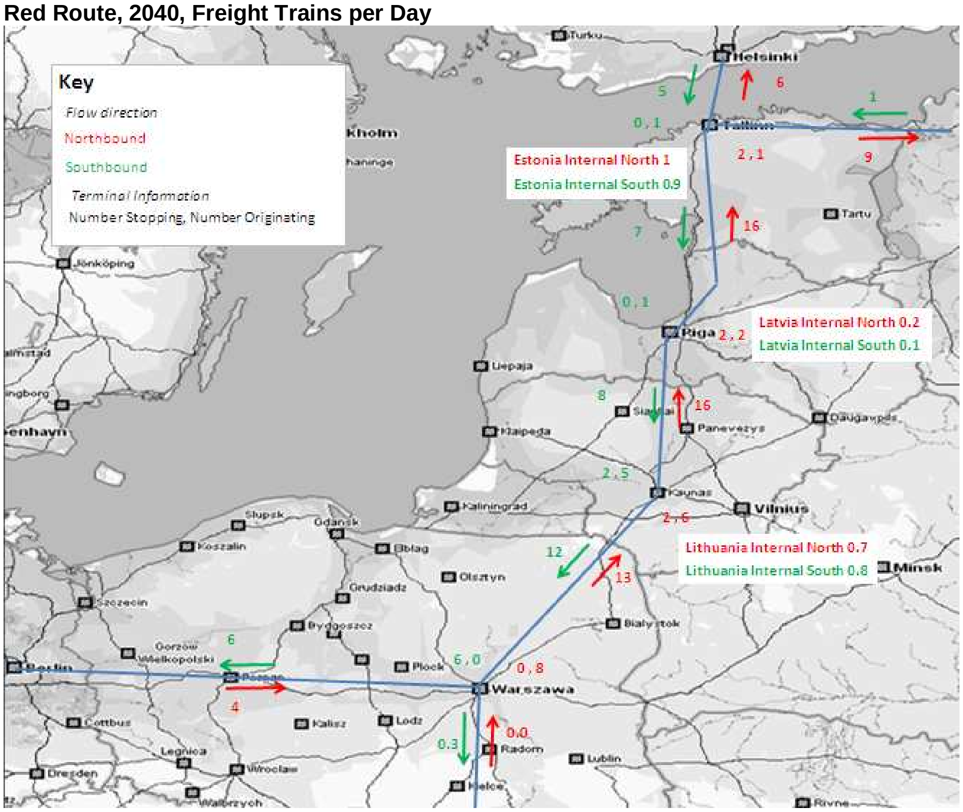
Red Route, 2020, Freight Trains per Day



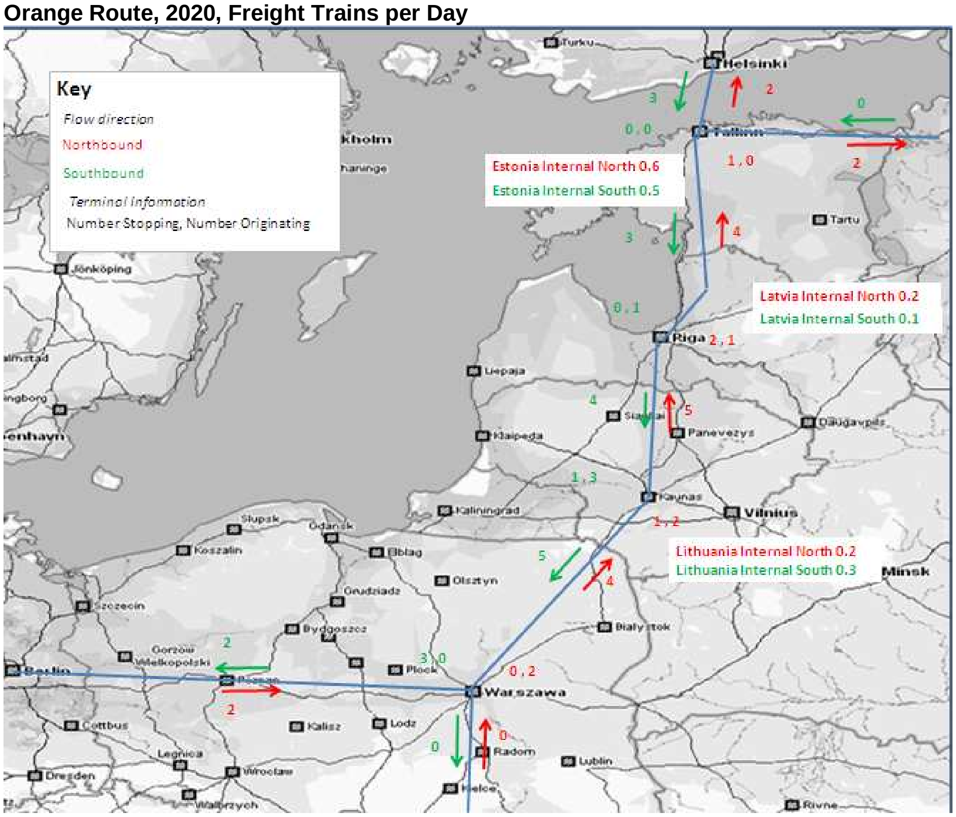
Red Route, 2030, Freight Trains per Day



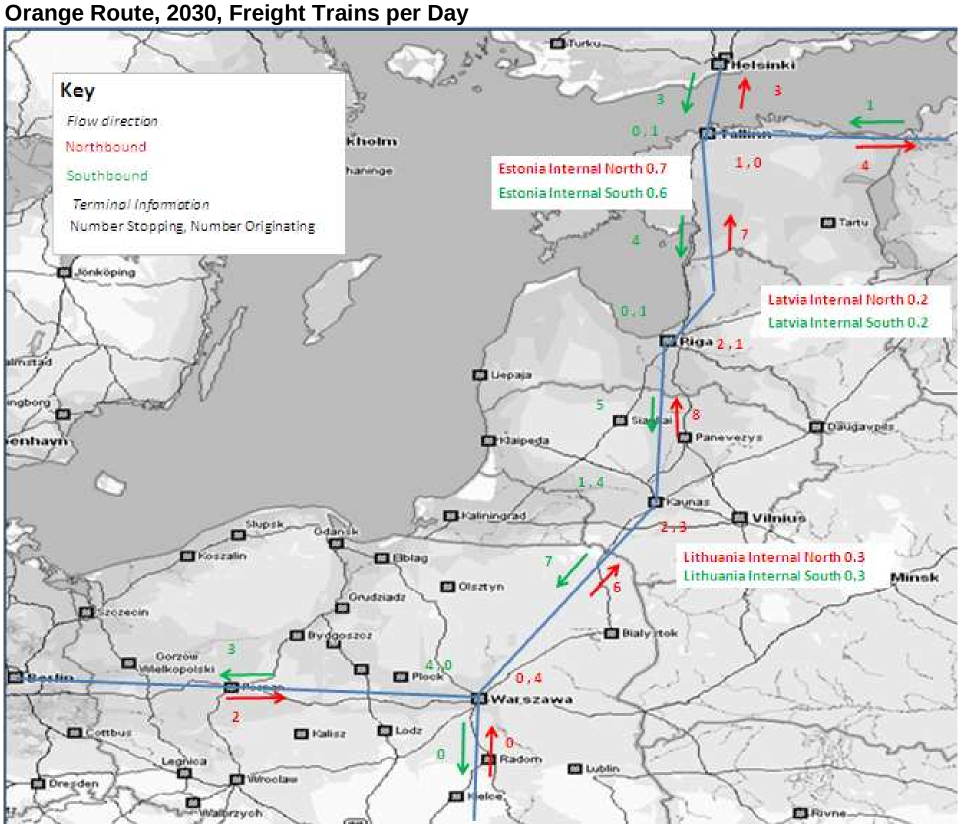
Red Route, 2040, Freight Trains per Day



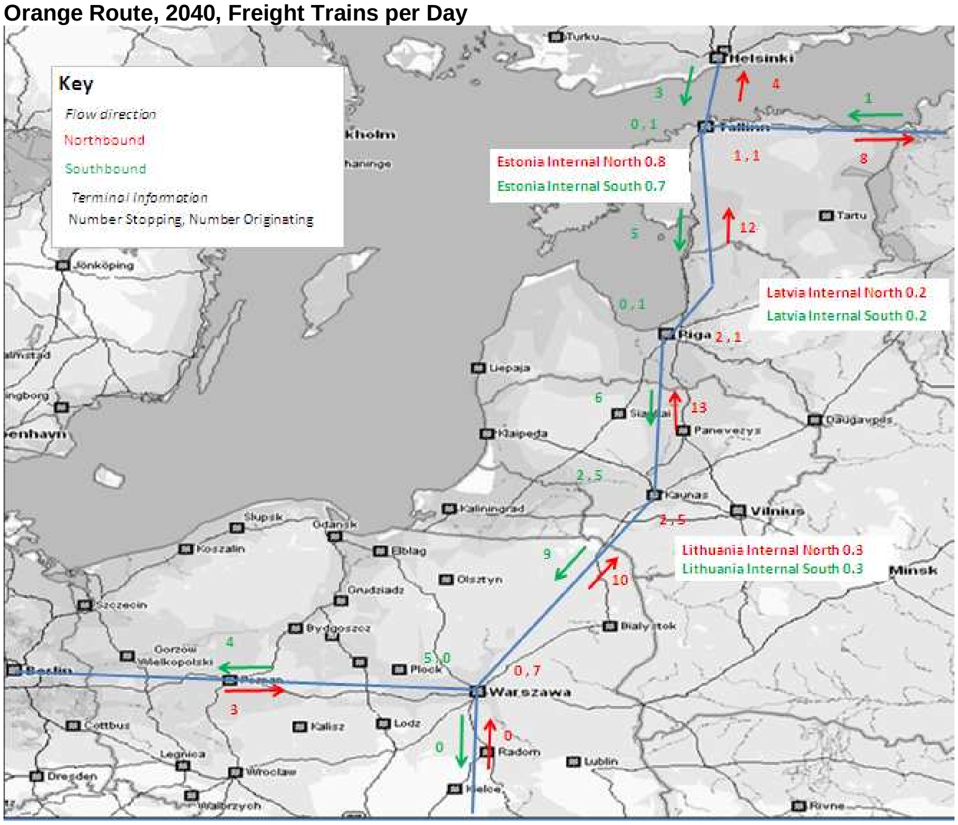
Orange Route, 2020, Freight Trains per Day



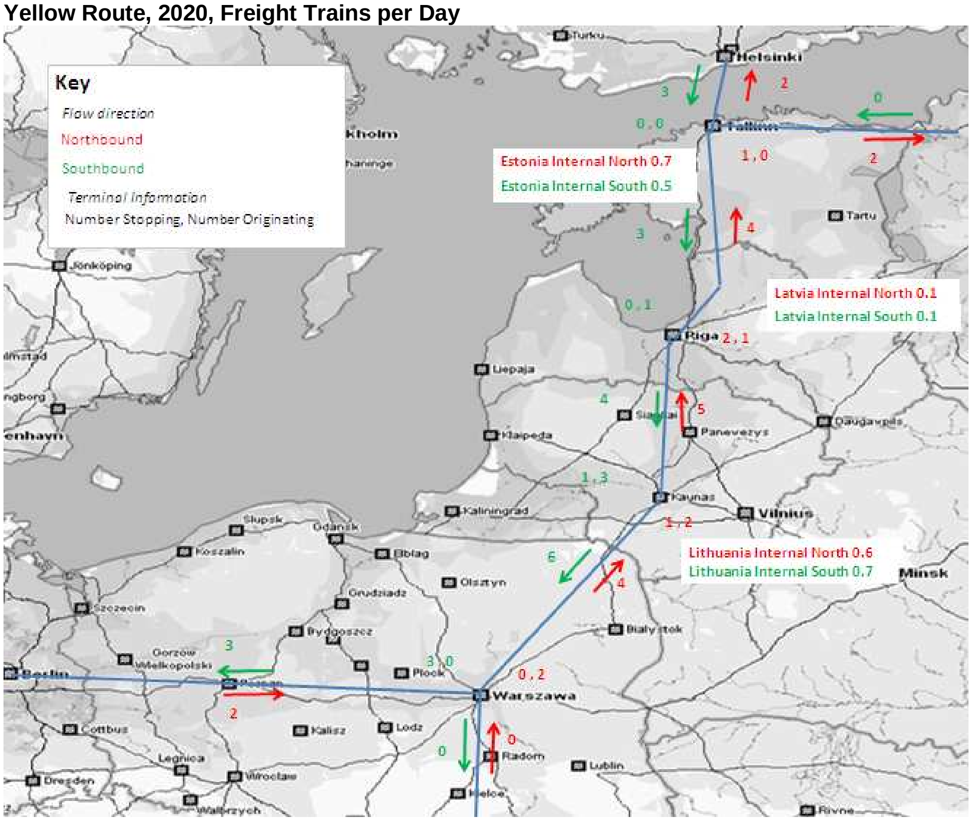
Orange Route, 2030, Freight Trains per Day



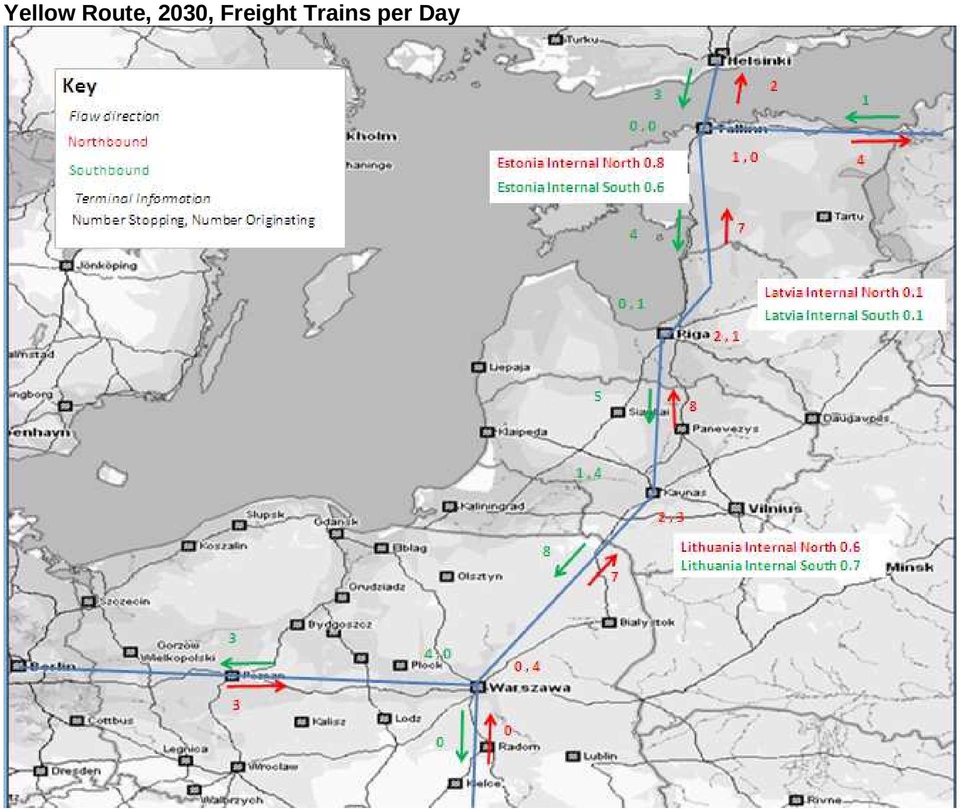
Orange Route, 2040, Freight Trains per Day



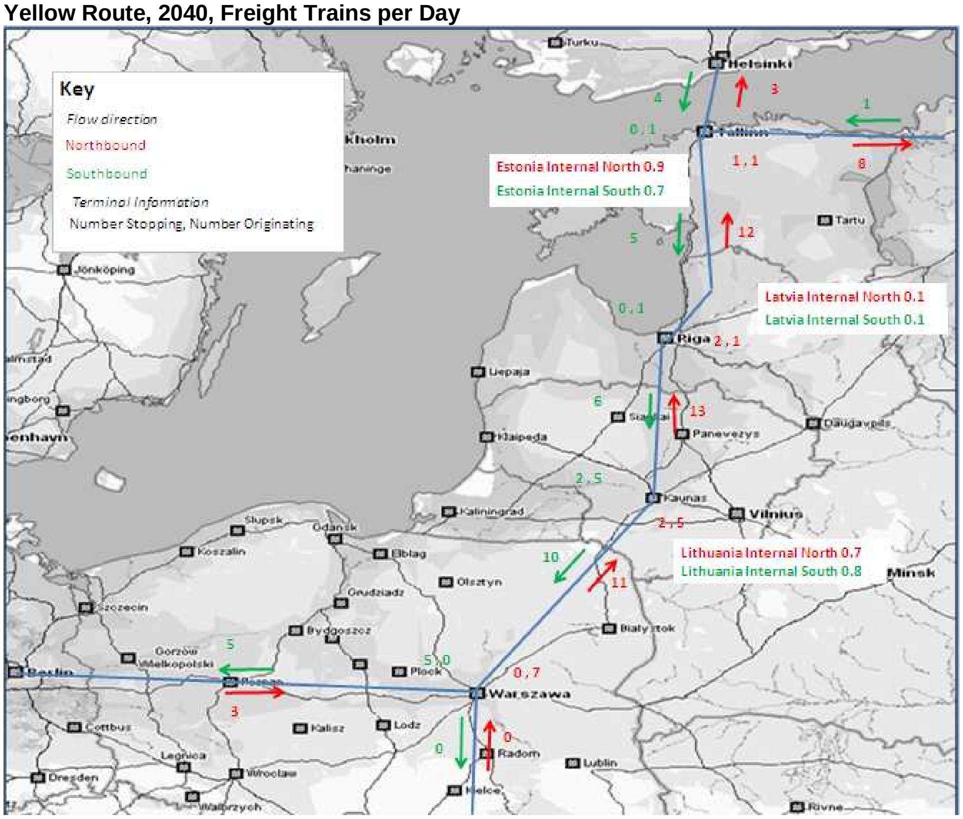
Yellow Route, 2020, Freight Trains per Day



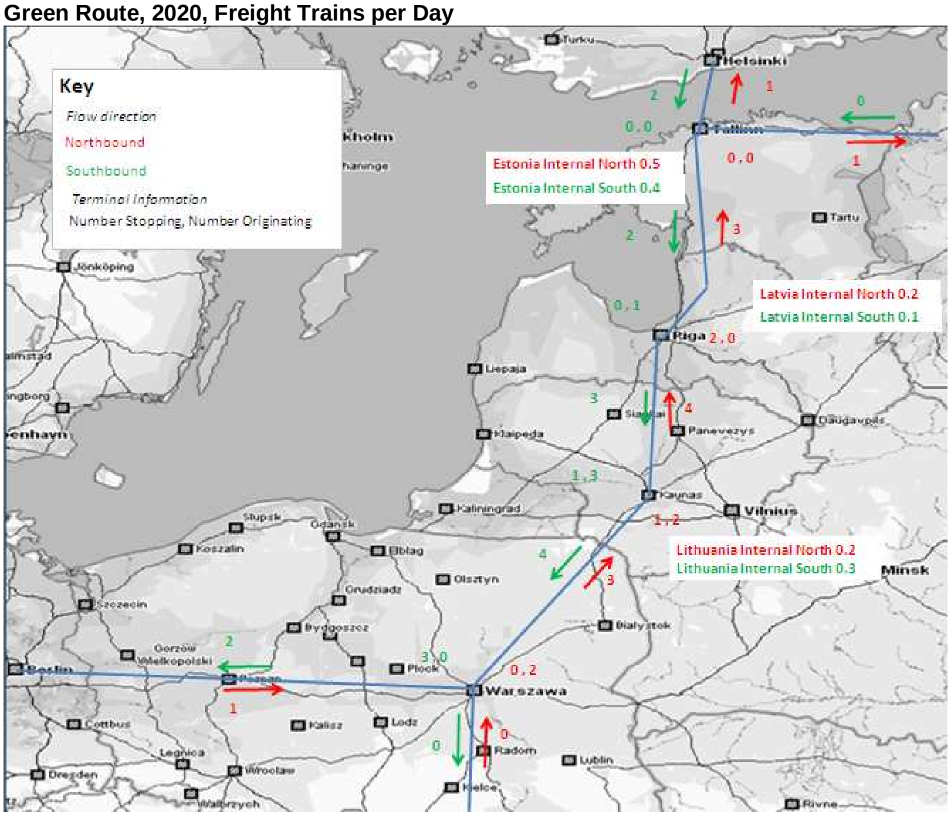
Yellow Route, 2030, Freight Trains per Day



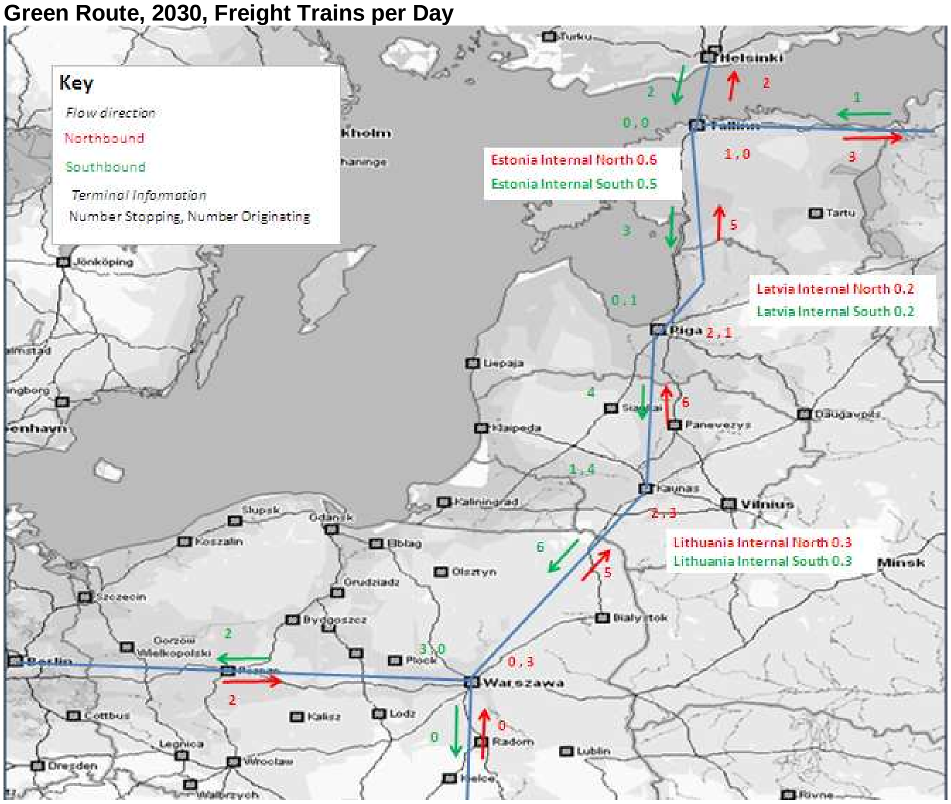
Yellow Route, 2040, Freight Trains per Day



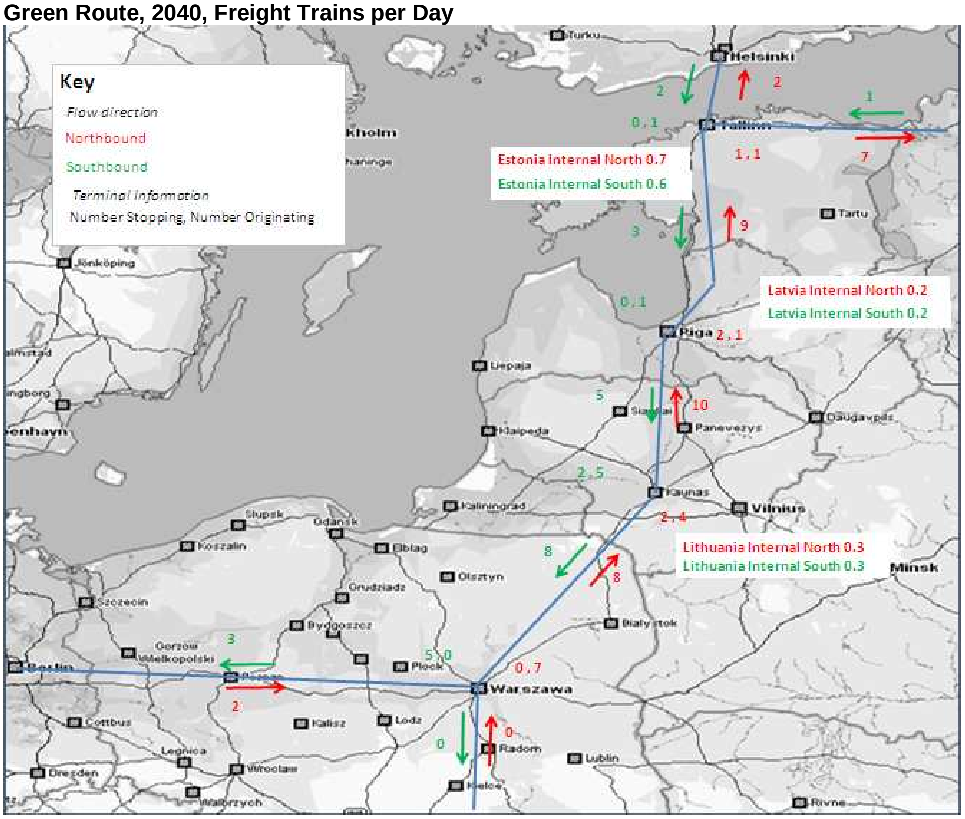
Green Route, 2020, Freight Trains per Day



Green Route, 2030, Freight Trains per Day



Green Route, 2040, Freight Trains per Day



7.2.2.3 Freight Sensitivity Tests

A number of sensitivity tests have been undertaken using the freight demand model.

- Higher and lower freight prices
- Higher and lower levels of induced demand
- Introducing the effect of a stronger green agenda affecting modal choice
- Higher average speed of freight trains, raised from 70 to 90kph

For each of the modelled years 2020, 2030 and 2040 the following attributes have been calculated:

- Volume of Freight Carried (in million Tonnes)
- Revenue (in million Euros)
- Journey Time savings (in million Euros)
- CO_2 Savings in Tonnes
- GHG CO_2E Savings in Tonnes

For each scenario a sensitivity results table has been produced for all four routing options (red, orange, yellow and green) for the three pricing categories, low, medium and high.

Rail Baltic Freight Price Sensitivity

The first sensitivity tested is the price; keeping all other factors the same the prices have been changed to low and high figures based on averages of actual tariffs and are shown in Tables below.

Table 61 - Low Price

Options	Sensitivity	2020	2030	2040
Red Route	Volume in Million Tonnes	19.1	23.5	27.5
	Revenue in Million Euros	200	245	287
	Journey Time savings in Million Euros	82	105	126
	CO_2 Saved Tonnes	821	1040	1243
	GHG CO_2E Saved Tonnes	834	1057	1263
Orange Route	Volume in Million Tonnes	16.4	20.4	24.1
	Revenue in Million Euros	188	234	276
	Journey Time savings in Million Euros	63	82	101
	CO_2 Saved Tonnes	678	870	1059
	GHG CO_2 E Saved Tonnes	689	885	1085
Yellow Route	Volume in Million Tonnes	17.0	20.9	24.7
	Revenue in Million Euros	187	232	275
	Journey Time savings in Million Euros	65	84	103
	CO_2 Saved Tonnes	686	879	1068
	GHG CO_2 E Saved Tonnes	697	894	1085
Green Route	Volume in Million Tonnes	14.9	18.5	22.0
	Revenue in Million Euros	177	221	265
	Journey Time savings in Million Euros	52	67	84
	CO_2 Saved Tonnes	584	752	931
	GHG CO_2 E Saved Tonnes	593	764	946

In the low price scenario all routes provide higher returns than the medium price scenario. The red route still performs best and the orange route performs slightly better than the yellow route. The orange route attracts greater bulk volumes between Latvia and Finland due to the shorter Riga-Tallinn leg, the yellow route tends to attract more short distance journeys than the orange route and this has an effect on the revenues accrued.

Table 62 - High Price

Options	Sensitivity	2020	2030	2040
Red Route	Volume in Million Tonnes	5.1	6.8	8.1
	Revenue in Million Euros	87	120	152
	Journey Time savings in Million Euros	19	28	37
	CO_2 Saved Tonnes	188	271	353
	GHG CO_2E Saved Tonnes	191	276	359
Orange Route	Volume in Million Tonnes	4.0	5.4	6.5
	Revenue in Million Euros	67	97	131
	Journey Time savings in Million Euros	12	20	28
	CO_2 Saved Tonnes	130	198	277
	GHG CO_2 E Saved Tonnes	132	201	282
Yellow Route	Volume in Million Tonnes	4.2	5.6	6.8
	Revenue in Million Euros	68	97	131
	Journey Time savings in Million Euros	13	20	28
	CO_2 Saved Tonnes	132	200	277
	GHG CO_2 E Saved Tonnes	134	203	282
Green Route	Volume in Million Tonnes	3.4	4.6	5.7
	Revenue in Million Euros	55	80	115
	Journey Time savings in Million Euros	9	15	22
	CO_2 Saved Tonnes	98	152	229
	GHG CO_2 E Saved Tonnes	100	155	232

The high price scenario substantially reduces the volumes carried by all routes, and thus impacts on the revenue, journey time savings and emissions savings. Notably the emissions saved are almost halved by increasing the price from medium to high.

As can be seen from the sensitivity testing carried out the levels of traffic which are likely to be seen on Rail Baltica are highly dependent on price and are also relatively dependent on the routing option selected (as this affects both the attractiveness of the journey time and the distance and therefore price). As noted previously different pricing systems are in place in each of the countries. In order to get the most out of the line a consistent and simple pricing system will be required such as is in operation for the specialised container trains provided as a joint offer to destinations such as Moscow, Odessa and Central Asia.

The policy within the tariffs of charging twice as much for a 40' as a 20' may deter intermodal traffic from using the line. Quoted prices for sea freight generally have 40' containers charged at between 20% and 60% more than 20' containers and road freight operators charge the same for both. The use of 40' containers has generally been rising for many of the flows likely to be attracted to Rail Baltica therefore this issue is likely to become more rather than less important in the future. Quoted prices for Estonian rail freight do not indicate a 2:1 differential therefore it is assumed that there may be some flexibility in this tariff structure.

Rail Baltic Induced Freight Demand Sensitivity

Induced demand is new business attracted to the area and hence railway line because of the enhanced infrastructure. Many new roads, ports and railways generate interest from inward investors that consider the potential offered by new infrastructure that typically might improve journey times and connect centres of population that were previously poorly served. We have assumed a 15% induced demand in the central case. The effect of removing any induced demand, and having 30% induced demand has been calculated for each route and each pricing structure. The induced demand is applied as a direct uplift on freight volumes and does not affect the modal share. As can be seen in the table below that this uplift relates directly to the volume carried, revenue, journey time saved and emission saved, and as an example the central case is 15% higher than the "no induced" demand.

It should be noted that the effect of the induced demand has been included in the journey time and CO2 saved calculations even though this volume is not taken from other modes. By the nature of induced demand it should be thought of as "new" traffic, however, it could be considered that businesses relocating in order to take advantage of the new infrastructure would make similar distance journeys from their existing base and so these savings should be included in the calculations.

Table 63 - Low Price No Induced Demand

Options	Sensitivity	2020	2030	2040
Red Route	Volume in Million Tonnes	16.6	20.4	23.9
	Revenue in Million Euros	174	213	249
	Journey Time savings in Million Euros	71	91	110
	CO_2 Saved Tonnes	713	904	1081
	GHG CO_2E Saved Tonnes	725	919	1098
Orange Route	Volume in Million Tonnes	14.3	17.7	20.9
	Revenue in Million Euros	164	203	240
	Journey Time savings in Million Euros	55	71	88
	CO_2 Saved Tonnes	590	757	921
	GHG CO_2 E Saved Tonnes	599	769	944
Yellow Route	Volume in Million Tonnes	14.8	18.2	21.5
	Revenue in Million Euros	163	202	239
	Journey Time savings in Million Euros	56	73	89
	CO_2 Saved Tonnes	597	765	928
	GHG CO_2 E Saved Tonnes	606	777	944
Green Route	Volume in Million Tonnes	13.0	16.1	19.2
	Revenue in Million Euros	154	192	230
	Journey Time savings in Million Euros	45	59	73
	CO_2 Saved Tonnes	508	654	809
	GHG CO_2 E Saved Tonnes	516	665	822

The low price, no induced demand scenario shows the same trends as the low price central case but all values are 15% higher in the low price central case.

Table 64 - Medium Price No Induced Demand

Options	Sensitivity	2020	2030	2040
Red Route	Volume in Million Tonnes	8.6	11.2	13.8
	Revenue in Million Euros	115	153	193
	Journey Time savings in Million Euros	32	45	60
	CO_2 Saved Tonnes	325	449	584
	GHG CO_2E Saved Tonnes	331	457	594
Orange Route	Volume in Million Tonnes	6.6	8.8	11.0
	Revenue in Million Euros	92	126	163
	Journey Time savings in Million Euros	22	31	43
	CO_2 Saved Tonnes	230	328	447
	GHG CO_2 E Saved Tonnes	234	333	454
Yellow Route	Volume in Million Tonnes	7.0	9.2	11.5
	Revenue in Million Euros	93	125	162
	Journey Time savings in Million Euros	22	32	44
	CO_2 Saved Tonnes	233	330	446
	GHG CO_2 E Saved Tonnes	237	335	453
Green Route	Volume in Million Tonnes	5.7	7.5	9.5
	Revenue in Million Euros	77	104	139
	Journey Time savings in Million Euros	16	23	33
	CO_2 Saved Tonnes	174	249	352
	GHG CO_2 E Saved Tonnes	177	253	358

Table 65 - High Price No Induced Demand

Options	Sensitivity	2020	2030	2040
Red Route	Volume in Million Tonnes	4.5	5.9	7.1
	Revenue in Million Euros	75	104	133
	Journey Time savings in Million Euros	17	24	32
	CO_2 Saved Tonnes	163	236	307
	GHG CO_2E Saved Tonnes	166	240	312
Orange Route	Volume in Million Tonnes	3.5	4.7	5.7
	Revenue in Million Euros	58	84	114
	Journey Time savings in Million Euros	11	17	24
	CO_2 Saved Tonnes	113	172	241
	GHG CO_2 E Saved Tonnes	115	175	245
Yellow Route	Volume in Million Tonnes	3.6	4.9	5.9
	Revenue in Million Euros	59	84	114
	Journey Time savings in Million Euros	11	17	25
	CO_2 Saved Tonnes	115	174	241
	GHG CO_2 E Saved Tonnes	116	176	245
Green Route	Volume in Million Tonnes	3.0	4.0	5.0
	Revenue in Million Euros	48	70	100
	Journey Time savings in Million Euros	8	13	20
	CO_2 Saved Tonnes	85	132	199
	GHG CO_2 E Saved Tonnes	87	134	202

Table 66 - Low Price 30% Induced Demand

Options	Sensitivity	2020	2030	2040
Red Route	Volume in Million Tonnes	21.6	26.5	31.1
	Revenue in Million Euros	226	277	324
	Journey Time savings in Million Euros	92	118	142
	CO_2 Saved Tonnes	928	1175	1405
	GHG CO_2E Saved Tonnes	943	1195	1428
Orange Route	Volume in Million Tonnes	18.6	23.0	27.2
	Revenue in Million Euros	213	264	313
	Journey Time savings in Million Euros	71	93	114
	CO_2 Saved Tonnes	767	984	1197
	GHG CO_2 E Saved Tonnes	779	1000	1227
Yellow Route	Volume in Million Tonnes	19.2	23.7	27.9
	Revenue in Million Euros	212	262	310
	Journey Time savings in Million Euros	73	95	116
	CO_2 Saved Tonnes	776	994	1207
	GHG CO_2 E Saved Tonnes	788	1010	1227
Green Route	Volume in Million Tonnes	16.9	20.9	24.9
	Revenue in Million Euros	201	250	299
	Journey Time savings in Million Euros	58	76	95
	CO_2 Saved Tonnes	660	850	1052
	GHG CO_2 E Saved Tonnes	671	864	1069

Table 67 - Medium Price 30% Induced Demand

Options	Sensitivity	2020	2030	2040
Red Route	Volume in Million Tonnes	11.1	14.6	17.9
	Revenue in Million Euros	149	199	251
	Journey Time savings in Million Euros	42	59	78
	CO_2 Saved Tonnes	423	584	759
	GHG CO_2E Saved Tonnes	430	594	772
Orange Route	Volume in Million Tonnes	8.6	11.4	14.3
	Revenue in Million Euros	120	163	213
	Journey Time savings in Million Euros	28	41	57
	CO_2 Saved Tonnes	299	426	581
	GHG CO_2 E Saved Tonnes	304	433	590
Yellow Route	Volume in Million Tonnes	9.1	12.0	14.9
	Revenue in Million Euros	120	163	211
	Journey Time savings in Million Euros	29	41	57
	CO_2 Saved Tonnes	303	429	580
	GHG CO_2 E Saved Tonnes	308	436	589
Green Route	Volume in Million Tonnes	7.4	9.8	12.3
	Revenue in Million Euros	100	136	181
	Journey Time savings in Million Euros	20	30	43
	CO_2 Saved Tonnes	226	324	458
	GHG CO_2 E Saved Tonnes	230	329	466

Table 68 - High Price, 30% Induced Demand

Options	Sensitivity	2020	2030	2040
Red Route	Volume in Million Tonnes	5.8	7.7	9.2
	Revenue in Million Euros	98	136	172
	Journey Time savings in Million Euros	22	32	42
	CO_2 Saved Tonnes	212	306	399
	GHG CO_2E Saved Tonnes	216	312	405
Orange Route	Volume in Million Tonnes	4.5	6.1	7.4
	Revenue in Million Euros	76	110	148
	Journey Time savings in Million Euros	14	22	32
	CO_2 Saved Tonnes	147	224	314
	GHG CO_2 E Saved Tonnes	150	228	319
Yellow Route	Volume in Million Tonnes	4.7	6.3	7.7
	Revenue in Million Euros	76	110	148
	Journey Time savings in Million Euros	14	22	32
	CO_2 Saved Tonnes	149	226	314
	GHG CO_2 E Saved Tonnes	151	229	319
Green Route	Volume in Million Tonnes	3.9	5.2	6.5
	Revenue in Million Euros	62	90	130
	Journey Time savings in Million Euros	10	16	25
	CO_2 Saved Tonnes	111	172	259
	GHG CO_2 E Saved Tonnes	113	175	263

Green Agenda Sensitivity

Although the environmental impacts of transport on the climate are now widely discussed and understood, most organisations are still making choices as to which mode of transport to use based mainly on price and service rather than that of environmental impacts such as level of Carbon Dioxide produced. However in the future it is expected that with schemes such as carbon trading that the green agenda could have more effect. So in addition to the modal choice calculations we have factored in a “green agenda” sensitivity, shifting an additional 10% of road freight onto rail. This increases the modal share of rail and thus increases the revenues, journey time savings and emission savings across all pricing structures.

It should be noted that the effect of the green agenda is increased in scenarios where the base has lower volumes for rail; this can be seen in the tables below where the orange, yellow and green routes show a greater improvement than the red route.

This effect can be significantly higher than expected and as an example on the green route the increase in rail volumes is in the region of 40% higher.

Table 69 - Low Price, Green Agenda

Options	Sensitivity	2020	2030	2040
Red Route	Volume in Million Tonnes	21.1	25.4	29.6
	Revenue in Million Euros	218	262	305
	Journey Time savings in Million Euros	88	110	132
	CO_2 Saved Tonnes	881	1097	1306
	GHG CO_2E Saved Tonnes	896	1115	1328
Orange Route	Volume in Million Tonnes	18.6	22.4	26.3
	Revenue in Million Euros	211	256	300
	Journey Time savings in Million Euros	69	88	107
	CO_2 Saved Tonnes	745	935	1129
	GHG CO_2 E Saved Tonnes	757	950	1156
Yellow Route	Volume in Million Tonnes	19.1	23.0	26.9
	Revenue in Million Euros	208	252	296
	Journey Time savings in Million Euros	71	90	109
	CO_2 Saved Tonnes	752	943	1137
	GHG CO_2 E Saved Tonnes	765	958	1156
Green Route	Volume in Million Tonnes	17.1	20.7	24.3
	Revenue in Million Euros	202	246	291
	Journey Time savings in Million Euros	58	73	91
	CO_2 Saved Tonnes	654	821	1006
	GHG CO_2 E Saved Tonnes	665	835	1022

Table 70 - Medium Price, Green Agenda

Options	Sensitivity	2020	2030	2040
Red Route	Volume in Million Tonnes	12.3	15.3	18.4
	Revenue in Million Euros	163	206	254
	Journey Time savings in Million Euros	45	60	78
	CO_2 Saved Tonnes	456	599	761
	GHG CO_2E Saved Tonnes	464	608	773
Orange Route	Volume in Million Tonnes	10.2	12.7	15.4
	Revenue in Million Euros	144	182	228
	Journey Time savings in Million Euros	33	44	59
	CO_2 Saved Tonnes	352	465	610
	GHG CO_2 E Saved Tonnes	358	473	620
Yellow Route	Volume in Million Tonnes	10.6	13.2	15.9
	Revenue in Million Euros	142	179	224
	Journey Time savings in Million Euros	34	45	59
	CO_2 Saved Tonnes	355	468	609
	GHG CO_2 E Saved Tonnes	361	475	618
Green Route	Volume in Million Tonnes	9.2	11.3	13.7
	Revenue in Million Euros	130	162	205
	Journey Time savings in Million Euros	26	34	47
	CO_2 Saved Tonnes	291	380	506
	GHG CO_2 E Saved Tonnes	295	386	514

Table 71 - High Price, Green Agenda

Options	Sensitivity	2020	2030	2040
Red Route	Volume in Million Tonnes	7.9	9.6	11.1
	Revenue in Million Euros	140	173	209
	Journey Time savings in Million Euros	28	38	48
	CO_2 Saved Tonnes	280	366	459
	GHG CO_2E Saved Tonnes	285	372	467
Orange Route	Volume in Million Tonnes	6.8	8.2	9.6
	Revenue in Million Euros	131	161	200
	Journey Time savings in Million Euros	21	29	38
	CO_2 Saved Tonnes	225	296	386
	GHG CO_2 E Saved Tonnes	229	301	392
Yellow Route	Volume in Million Tonnes	7.0	8.4	9.8
	Revenue in Million Euros	126	156	193
	Journey Time savings in Million Euros	22	29	39
	CO_2 Saved Tonnes	226	297	386
	GHG CO_2 E Saved Tonnes	230	302	392
Green Route	Volume in Million Tonnes	6.3	7.5	8.8
	Revenue in Million Euros	122	149	189
	Journey Time savings in Million Euros	17	23	32
	CO_2 Saved Tonnes	195	253	340
	GHG CO_2 E Saved Tonnes	198	257	345

Rail Baltic Freight Speed Sensitivity

Higher speed sensitivity has been tested where the average speed of a freight train is 90 kph rather than 70 kph. There is a slight increase in volume carried, revenue, journey time saved and emissions saved from the central case. The comparatively small effect is because this factor only applies to the actual travelling time which makes up only part of the total journey time.

Table 72 - Low Price, Higher Speed

Options	Sensitivity	2020	2030	2040
Red Route	Volume in Million Tonnes	19.3	23.7	27.7
	Revenue in Million Euros	202	248	290
	Journey Time savings in Million Euros	92	117	141
	CO_2 Saved Tonnes	831	1051	1255
	GHG CO_2E Saved Tonnes	844	1068	1275
Orange Route	Volume in Million Tonnes	16.6	20.5	24.2
	Revenue in Million Euros	190	236	279
	Journey Time savings in Million Euros	72	94	115
	CO_2 Saved Tonnes	687	880	1069
	GHG CO_2 E Saved Tonnes	698	894	1095
Yellow Route	Volume in Million Tonnes	17.1	21.1	24.8
	Revenue in Million Euros	189	234	277
	Journey Time savings in Million Euros	74	95	116
	CO_2 Saved Tonnes	695	889	1078
	GHG CO_2 E Saved Tonnes	706	903	1095
Green Route	Volume in Million Tonnes	15.1	18.6	22.2
	Revenue in Million Euros	179	223	267
	Journey Time savings in Million Euros	60	78	97
	CO_2 Saved Tonnes	591	760	939
	GHG CO_2 E Saved Tonnes	601	772	954

Table 73 - Medium Price, Higher Speed

Options	Sensitivity	2020	2030	2040
Red Route	Volume in Million Tonnes	10.0	13.0	16.0
	Revenue in Million Euros	135	179	225
	Journey Time savings in Million Euros	42	59	77
	CO_2 Saved Tonnes	381	525	681
	GHG CO_2E Saved Tonnes	388	534	692
Orange Route	Volume in Million Tonnes	7.7	10.2	12.8
	Revenue in Million Euros	108	147	191
	Journey Time savings in Million Euros	29	41	57
	CO_2 Saved Tonnes	270	383	521
	GHG CO_2 E Saved Tonnes	274	389	529
Yellow Route	Volume in Million Tonnes	8.2	10.7	13.3
	Revenue in Million Euros	109	147	190
	Journey Time savings in Million Euros	29	42	57
	CO_2 Saved Tonnes	274	386	520
	GHG CO_2 E Saved Tonnes	278	392	529
Green Route	Volume in Million Tonnes	6.6	8.8	11.0
	Revenue in Million Euros	90	122	163
	Journey Time savings in Million Euros	21	30	43
	CO_2 Saved Tonnes	204	291	411
	GHG CO_2 E Saved Tonnes	207	296	417

Table 74 - High Price, Higher Speed

Options	Sensitivity	2020	2030	2040
Red Route	Volume in Million Tonnes	5.2	6.9	8.2
	Revenue in Million Euros	89	122	155
	Journey Time savings in Million Euros	21	31	41
	CO_2 Saved Tonnes	192	275	358
	GHG CO_2E Saved Tonnes	195	280	363
Orange Route	Volume in Million Tonnes	4.0	5.4	6.6
	Revenue in Million Euros	68	99	133
	Journey Time savings in Million Euros	14	22	31
	CO_2 Saved Tonnes	133	201	281
	GHG CO_2 E Saved Tonnes	135	204	285
Yellow Route	Volume in Million Tonnes	4.2	5.7	6.8
	Revenue in Million Euros	69	99	132
	Journey Time savings in Million Euros	15	22	32
	CO_2 Saved Tonnes	134	203	281
	GHG CO_2 E Saved Tonnes	137	206	285
Green Route	Volume in Million Tonnes	3.5	4.7	5.8
	Revenue in Million Euros	56	81	117
	Journey Time savings in Million Euros	10	17	25
	CO_2 Saved Tonnes	100	154	231
	GHG CO_2 E Saved Tonnes	102	157	235

Rail Baltic Freight Sensitivity Summary

As a summary the sensitivity test results for the red route option (which is currently the preferred freight option) have been collated into a single table

Table 75 shows all the sensitivity tests for the red route option. The final line of the table shows the range for the different sensitivities. In summary in 2040:

- The central case has a volume moved of 15.8 million tonnes;
- In the same year the highest scenario with 30% induced demand and a low price gives a volume moved of 31.1 million tonnes;
- The lowest sensitivity has no induced demand and a high price, volume is 7.1 m. tonnes.

Table 75 - Red Route Sensitivities

Options	Price	Sensitivity	2020	2030	2040
Central Case		Volume in Million Tonnes	9.8	12.9	15.8
		Revenue in Million Euros	132	176	222
Pricing	Low Price	Volume in Million Tonnes	19.1	23.5	27.5
		Revenue in Million Euros	200	245	287
	Medium Price	Volume in Million Tonnes	9.8	12.9	15.8
		Revenue in Million Euros	132	176	222
	High Price	Volume in Million Tonnes	5.1	6.8	8.1
		Revenue in Million Euros	87	120	152
No Induced Demand	Low Price	Volume in Million Tonnes	16.6	20.4	23.9
		Revenue in Million Euros	174	213	249
	Medium Price	Volume in Million Tonnes	8.6	11.2	13.8
		Revenue in Million Euros	115	153	193
	High Price	Volume in Million Tonnes	4.5	5.9	7.1
		Revenue in Million Euros	75	104	133
30% Induced Demand	Low Price	Volume in Million Tonnes	21.6	26.5	31.1
		Revenue in Million Euros	226	277	324
	Medium Price	Volume in Million Tonnes	11.1	14.6	17.9
		Revenue in Million Euros	149	199	251
	High Price	Volume in Million Tonnes	5.8	7.7	9.2
		Revenue in Million Euros	98	136	172
Green Agenda	Low Price	Volume in Million Tonnes	21.1	25.4	29.6
		Revenue in Million Euros	218	262	305
	Medium Price	Volume in Million Tonnes	12.3	15.3	18.4
		Revenue in Million Euros	163	206	254
	High Price	Volume in Million Tonnes	7.9	9.6	11.1
		Revenue in Million Euros	140	173	209
Higher Speed	Low Price	Volume in Million Tonnes	19.3	23.7	27.7
		Revenue in Million Euros	202	248	290
	Medium Price	Volume in Million Tonnes	10.0	13.0	16.0
		Revenue in Million Euros	135	179	225
	High Price	Volume in Million Tonnes	5.2	6.9	8.2
		Revenue in Million Euros	89	122	155
Range	Maximum	Volume in Million Tonnes	21.6	26.5	31.1

		Revenue in Million Euros	226	277	324
	Minimum	Volume in Million Tonnes	4.5	5.9	7.1
		Revenue in Million Euros	75	104	133

Table 76 - Red Route Sensitivities Percentage Change from Central Case

Options	Price	Sensitivity	2020	2030	2040
Pricing	Low Price	Volume in Million Tonnes	94%	82%	74%
		Revenue in Million Euros	51%	39%	29%
	Medium Price	Volume in Million Tonnes	0%	0%	0%
		Revenue in Million Euros	0%	0%	0%
	High Price	Volume in Million Tonnes	-48%	-47%	-49%
		Revenue in Million Euros	-34%	-32%	-31%
No Induced Demand	Low Price	Volume in Million Tonnes	69%	58%	51%
		Revenue in Million Euros	31%	21%	13%
	Medium Price	Volume in Million Tonnes	-13%	-13%	-13%
		Revenue in Million Euros	-13%	-13%	-13%
	High Price	Volume in Million Tonnes	-55%	-54%	-55%
		Revenue in Million Euros	-43%	-41%	-40%
30% Induced Demand	Low Price	Volume in Million Tonnes	120%	106%	96%
		Revenue in Million Euros	71%	58%	46%
	Medium Price	Volume in Million Tonnes	13%	13%	13%
		Revenue in Million Euros	13%	13%	13%
	High Price	Volume in Million Tonnes	-41%	-40%	-42%
		Revenue in Million Euros	-26%	-23%	-22%
Green Agenda	Low Price	Volume in Million Tonnes	114%	97%	87%
		Revenue in Million Euros	65%	49%	38%
	Medium Price	Volume in Million Tonnes	25%	19%	16%
		Revenue in Million Euros	23%	17%	14%
	High Price	Volume in Million Tonnes	-20%	-26%	-30%
		Revenue in Million Euros	6%	-2%	-6%
Higher Speed	Low Price	Volume in Million Tonnes	96%	84%	75%
		Revenue in Million Euros	53%	41%	31%
	Medium Price	Volume in Million Tonnes	1%	1%	1%
		Revenue in Million Euros	2%	2%	2%
	High Price	Volume in Million Tonnes	-47%	-47%	-48%
		Revenue in Million Euros	-33%	-30%	-30%

There is an anomaly in the scenario with the green agenda and the high price. In the high rail prices scenarios there is a greater modal share for road and so when the green agenda factor is applied there is a greater modal shift, however due to the natural cost increase for road in comparison to other modes the modal share of road falls from 2020, to 2030 and 2040 and thus the green agenda effect is lessened. This is shown in the row above which has 6% change in revenue in 2020 to a -6% change by 2040.

Assessment

The demand attracted by Rail Baltica associated with Finland and St Petersburg has a risk element with regard to extra handling times and charges compared to sea or road modes. In order to assess the level of risk several sensitivity tests have been undertaken, firstly on the Finland-Germany route effect cost and time associated with the change from Sea to Rail has been calculated. Secondly, effect of the border waiting time for at the Russian border for road modes has been investigated.

<u>Finland-Germany</u>

Table 77 - Modal Split for Finland-Germany Non-Bulk Traffic with full costs

Year	Road	Rail	Sea
2020	0%	16%	84%
2030	0%	17%	83%
2040	0%	19%	81%

Table 78 - Modal Split for Finland-Germany Non-Bulk Traffic with Sea-Rail Handling cost removed

Year	Road	Rail	Sea
2020	0%	34%	66%
2030	0%	36%	64%
2040	0%	40%	60%

The tables above show that removing this extra interchange increases the demand for rail considerably.

<u>Lithuania-Northwest Russia</u>

Table 79 - Modal Split for Lithuania-Northwest Russia Non-Bulk Traffic with full costs

Year	Road	Rail	Sea
2020	74%	23%	3%
2030	73%	25%	2%
2040	74%	26%	1%

Table 80 - Modal Split for Lithuania-Northwest Russia Non-Bulk Traffic with Russian border waiting costs removed

Year	Road	Rail	Sea
2020	100%	0%	0%
2030	100%	0%	0%
2040	100%	0%	0%

With the costs and time relating to waiting to cross the Russian border for road modes removed, transporting freight by road becomes more favourable and takes the entire modal share for traffic from Lithuania going to North West Russia.

7.2.2.4 Freight Forecast Justification

Freight forecasts have been prepared based on sound data and methodologies. In fact, since the preparation of the freight model, a number of factors, some of which were expected, have all enhanced the case for being optimistic about rail freight's prospects given the right infrastructure and market conditions:

Continuing rise in world fuel prices.
Fuel taxes within the Baltic states are currently low compared to the European average therefore it is assumed that these will increase, in addition as fuel forms a higher proportion of road freight costs (36% approx according to TREMOVE) than for rail freight (14% according to LDZ), as oil prices and fuel duty increase in the long term road freight costs are likely to increase faster than the cost of rail. (source: page 89 of Interim Report).

Fuel prices have continued to rise and with demand from china and india its unlikely that they are likely to reduce significantly. Rail benefits from higher fuel prices.

Competition
The rail freight market in the UK has grown around 60% in tonne kilometres in the last ten years thanks partly to competition. Competition is not present yet within all Baltic States to a large degree. (source: page 89 of Interim Report).

Several privately owned rail freight companies are expanding rapidly across Europe and are looking for new opportunities to grow their business. The recent agreement between DB Schenker Rail Polska and Lithuanian Railways to operate freight trains from Poland to Šeštokai and invest in infrastructure also further supports the feeling that rail freight is on the rise. There is also evidence that private operators in Europe are looking to the container market for growth in long distance rail freight with the new Antwerp-Chongqing rail connection daily freight service showing that rail is a viable alternative to Sea for long distance journeys.

Container Market
The world container market is growing again and although parts of North-eastern Europe have a relatively low level of trade moving in containers this trend is likely to grow, which makes the transhipment of goods from road or shipping to rail much easier.

The growth in container traffic has been considerable in recent years except for the effects of the recession; Estonian Railways reported a 74% increase in container traffic in first quarter of 2011, to 8046 TEUs. There is also vast capacity for further growth with at present only one container train a day travelling between Estonia and Russia. Throughput at Estonia's ports could be enhanced by containerisation and boxes being moved on Roll On/Roll Off ferries between Finland and Tallinn feeding into Rail Baltica.

European Policy
It was known that EU Policy was favouring a move to more sustainable transport, hence schemes like Motorways of the Sea and TEN-T grants. So the recently issued European Commission White Paper "Roadmap to a Single European Transport Area" had few surprises. It states a number of key objectives towards improving the European transportation system, and Rail Baltica is a key part of these plans. Furthermore, Rail Baltica will become part of the TEN-T "Core" network connecting the Baltica states with the wider European network at Warsaw with a safe and reliable service which will boost trade between the Baltic States, Western European countries such as Poland, Germany and France and transit traffic between Finland, Russia and the rest of Europe. This will lead to increased trade between States, improved passenger service choice, reliability and speed and investment opportunities.

The EC White Paper "Roadmap to a Single European Transport Area" highlights ambitious but achievable aims to shift 30% and 50% of road freight journeys over 300 km to other modes by 2030 and 2050 respectively. Rail Baltica is in line with these ambitions by forecasting a change in modal split for Non-Bulk traffic from 46%/4%/50% (Road/Rail/Sea) in 2008 to 19%/22%/59% in 2040 showing that Rail Baltica will be well positioned to compete with Road and Sea in terms of attractiveness to customers.

Previous research
In previous work into forecasting the potential market for freight on the Rail Baltica corridor (page 143 final report volume 1) the COWI report expected 60 million tonnes to be moved on the North-South corridor in the Baltic States in 2034. 22% of this was predicted to be by rail, equating to 13 million tonnes. The study undertaken by AECOM is predicting 12.9 million tonnes by 2030 and 15.8 million tonnes by 2040 (page 143 final report volume 1) carried by rail, indicating that the current research is robust and consistent with previous work.

7.2.3 Forecast Summary

Table 81 - Summaries the key forecast indicators for the passenger and freight central cases.

2040 Forecast Summary		Option 1 Red	Option 2 Orange	Option 3 Yellow	Option 4 Green
Total Passenger km ('000,000)		771	585	863	636
Total Freight Tonnes ('000,000)		15.8	12.6	13.2	10.9
Revenue (€'000,000)	Passenger	97	66	108	70
	Freight	222	188	187	160
	Total	**319**	**254**	**295**	**230**

7.3 Review of options for compliance against existing Spatial Plans

Implementation of such an important transport infrastructure project as Rail Baltica is not possible without timely spatial planning at all planning levels. In all three Baltic States the planning system and approach are built on a similar platform – from national to local level. The difference is in the administrative levels and land use policies in each country.

As it was assumed at the very beginning stage of the project the Nuts 3 level was considered as a baseline and the assessment of spatial plans was based on the regional level.

In order to assess the compliance of the different options with the spatial plans, different level planning documents from all three Baltic countries were analysed and summarized.

The planning levels reviewed were:

- in Estonia – national level, district level, in some cases (in cities etc.) local government level spatial plans;
- in Latvia – national level, regional level, local government level spatial plans;
- in Lithuania – national level, district level, in some cases local government level spatial plans.

Detailed information for each of the options is given below.

Alternative I (Red)

Alternative I, the red route, is the most direct route from Tallinn to the border of Lithuania/Poland. Only over short sections of the route near Tallinn and Kaunas does it coincide with or goes alongside the existing rail track. The rest of the route crosses territories with other types of land use, primarily agricultural and forestland. In Estonia and Latvia the route is generally close to the VIA Baltica road corridor. In the National Spatial Plan of Estonia the route is included as one of three perspective alternatives for international rail routes (See Appendix D). In the Estonian district level planning documents the route is not defined. At the border of Latvia and Estonia (Haademeste) the old railway corridor is indicated as a potential route in the local municipality spatial plan.

In Latvia the section of the route between Ainaži and Riga is located next to the VIA Baltica Riga-Tallinn highway. As in Estonia, this section of the route is only shown in the national level planning documents (Appendix D). Within the lower-level planning documents all that is shown is a section from Skulte as a prolongation of the existing railway line (Orange route). Around Riga the route goes through a perspective corridor, which is defined at national, regional as well as local municipality level. Currently two potential crossing points of the Riga HPP's (hydroelectric power plant) reservoir are earmarked in the spatial plans, the first over the existing reservoir dam and the second a new route directly across the reservoir. From Riga to the border of Latvia/Lithuania the red option is defined in both national and regional level planning documents; however at a local level the route is only defined in the planning documents of the municipalities of the Riga agglomeration.

In Lithuania for the section up to Panevezys the route goes close to the VIA Baltica Riga-Vilnius highway. The section of the route from the border of Latvia/Lithuania up to Kaunas is not defined in the spatial plans. From Kaunas up to the border of Lithuania/Poland the red route matches the Rail Baltica rail route planned by the district and local municipalities (Appendix D).

Since Alternative 1 is basically only defined in the national level planning documents of Estonia and Latvia and even then has been assigned a low priority and because in Lithuania it is largely unidentified we believe that from the point of view of planning risk it should be allocated a medium risk factor.

As we concluded, the Alternative I is defined in national plans and strategies of Latvia and Estonia with different priority. A railway corridor around the Riga agglomeration is proposed in regional and local level planning documents. In Lithuania the Alternative I is defined just from Kaunas to Lithuania/Poland border in Long-term Strategy (until 2025) of Lithuanian Transport System Development. The same section of railway track is defined in regional spatial planning documents in Lithuania. These already reserved areas must be kept as Rail Baltica alternatives in spatial documents until the next planning steps.

Therefore for the next years is important to define railway track firstly in regional level spatial plans and development strategies for following administrative levels – Harju, Rapla, Parnu counties in Estonia, Riga and Zemgale planning regions in Latvia, Panevezys and Kaunas districts in Lithuania. The perspective corridor of Alternative I is defined in such regional or district level spatial documents – territorial plan of Marijampoles and Kaunas district, spatial plan of Riga region as well as reserved territories for transport infrastructure in such local level planning documents – territorial plan of Marijampole municipality, territorial plan of Kekava, Salaspils, Garkalnes, Adazu, Sejas and Saulkrastu municipality. Estonia has only foreseen the Rail Baltica corridor in the national plan and no reservation has been made so far in planning documents of other, resp. lower level.

Totally the Alternative 1 is crossing 16 local municipalities, Tallinn, Parnu cities and Rapla town in Estonia, accordingly 13 local municipalities, Riga city, Saulkrasti, Salaspils and Bauska towns in Latvia, 8 local municipalities, Kaunas city, Panevezis and Marijampoles towns in Lithuania. The municipalities are listed in the following table:

Table 82 - The municipalities crossing Alternative 1

Lithuania:	**Latvia:**	**Estonia:**
Kaunas	Riga	Tallinn
Panevezis	Bauska	Parnu
Marijampole	Salaspils	Rapla
Marijampoles rajonas	Saulkrasti	Haademeeste vald
Prienai rajonas	Iecavas novads	Surju vald
Kaunas rajonas	Baldones novads	Sauga vald
Kaisiadoris rajonas	Kekavas novads	Are vald
Jonavas rajonas	Salaspils novads	Halinga vald
Kedainiai rajonas	Stopinu novads	Marjamaa vald
Panevezis rajonas	Bauskas novads	Raikkula vald
Pasvalis rajonas	Garkalnes novads	Rapla vald
	Adazu novads	Kohila vald
	Sejas novads	Kiili vald
	Saulkrastu novads	Rae vald
	Limbazu novads	Juuru vald
	Salacgrivas novads	Paikuse vald
	Ropazu novads	Saarde vald
		Saku vald
		Tahkuranna vald

Practically for all 37 local municipalities, 4 cities and 6 towns the spatial plans should be revised for defining the proposed railway track. To follow planning procedure the route has to be designated in spatial plans of the above listed administrative territories. The municipalities have to initiate and develop amendments to the existing spatial plans or develop new spatial plans for their territories. Spatial plans are planning documents that are subject for strategic environmental assessment. In average this process takes at least one year as involves public consultations.

For the last decade the Rail Baltica alternatives have been considered at several planning levels of Baltic States. The summarized information from the spatial plans about the perspective Rail Baltica routes is displayed in the Appendix D.

The proposed alignment of the Alternative I is only partly defined in the spatial plans of the national or regional level. To continue the project implementation it is important to ensure that already reserved sections of the Alternative I are kept in spatial plans of all levels until the next planning steps and the plans are amended accordingly to reserve the whole Alternative I.

Alternative II (Orange)

Alternative II, the orange route, runs adjacent to the existing railway line from Tallinn to the border of Lithuania/Poland through Parnu, Limbazi, Riga, Jelgava, Siauliai and Kaunas. This route therefore for most part crosses territories that are either already used or earmarked for railway development. The route is included in the National Spatial Plan of Estonia as one of three perspective alternatives for an international rail route (Appendix D). The route is defined as being of the highest priority option from the Estonian/Latvian border to Kaunas at National, regional and district planning levels.

As the route utilises the existing rail corridor which passes through numerous settlement areas then there is the possibility that a large number of plans will need revision and as such this route is designated as high risk from a planning perspective.

Alternative III (Yellow)

Alternative III, the yellow route consists mainly of a new alignment from Tallinn to the border of Lithuania/Poland. It goes through Tallinn, Tartu, Valga, Valmiera, Riga, Panevezys and Kaunas. The route is proposed as a new alignment from Tallinn to Tartu, from Tartu to Valmiera it goes close to the existing line and from Valmiera to the Lithuania/Poland border it is a new alignment. Near Tallinn and Kaunas the route is generally close to the existing rail track. From Riga to the Lithuania/Poland border this option follows the same alignment as the red route.

The section of the yellow route from Tallinn to Tartu is not defined in the spatial plans. In contrast the section from Tartu to Valmiera where the route follows the existing alignment is defined as the main alternative for Rail Baltica in Estonia and one of the alternatives in Latvia.

Around Riga the route passes through a perspective corridor, which is defined in national and regional spatial plans as well as in the spatial plans of the local municipalities. As with the red route two possible crossings of the hydroelectric power plant reservoir are identified. From Riga to the Lithuanian/Polish border the route is as the red option.

In general terms the planning risk of the yellow route is similar to that of the red route and so it has been designated as a medium risk.

Alternative IV (Green)

Alternative IV, the green route passes along the existing rail corridor from Tallinn to the border of Lithuania/Poland through Tartu, Valga, Valmiera, Riga, Jelgava, Siauliai and Kaunas. The green route by virtue of the fact that it is predominantly within the existing corridor crosses territories that are either already used or earmarked for railway development. The green route is included in the National Spatial Plan of Estonia as an option for an international rail route (Appendix D). In Latvia from the Estonian/Latvian border to Riga the green route is defined as an alternative for a new rail route, but from Riga to Kaunas the route is defined in the national, regional and district planning documents as the alignment with the highest priority.

Although the green route is included in the planning documents at all levels and predominately follows the existing rail corridor it does pass through numerous settlements and crosses territories with upland relief, so for these reasons we have designated the green route as high risk with regard to planning.

7.4 Environmental Considerations

This initial environmental assessment of the proposed alternative routes has been carried out with the aim of identifying any potential obstacles and limitations that in the following stages of the project development, e.g. environmental impact assessment procedure, may lead to rejection of any selected alternative.

From an environmental point of view the potential impacts from the railway corridor as a linear object have to be considered during both construction and operational phases. The following environmental aspects should be taken into account during the construction phase: biodiversity, noise and exhaust gas emissions from machinery and transport, waste generation (construction waste, excavated polluted soil and ballast, demolition waste), use of natural resources (natural construction material, like sand, stone chippings etc.), impact on hydrological regime and water quality of watercourses, potential accidents and emergency situations. Not all of these aspects will have significant impact on the environment. The operational stage is mostly associated with impact on protected nature territories, landscape and migration corridors for animals, noise emissions, air pollution, potential pollution due to accidents and emergency situations.

Impact on protected nature territories, noise emissions, and impact on water courses have been assessed during this initial assessment as these are the most significant aspects to be taken into account in selection of the most feasible alternative.

This has to be considered only as initial environmental screening, as construction of a new railway line will be subject for full environmental impact assessment. This process normally includes detailed field studies, investigations, modelling of noise impact, potential accidents, analysis of available data, expert assessment etc. The environmental impact assessment has to be carried out in accordance with legal requirements of each country. In average this process takes 1 – 1,5 years.

7.4.1 Effect on Natura 2000 Sites

Natura 2000 sites located within the 2 km corridor, i.e. the area of 1 km to each side from the planned railway line alternatives were selected (Figure 22). In total 78 Natura 2000 sites are located within 2 km corridor. During implementation of an EIA the distance to the protected territories would be defined more precisely. Information on these territories was summarized using Natura 2000 standard data forms (SDF), mainly identifying the type of protection, the area of the site, most significant species and other characterizing indicators (Appendix E).

Impact of the newly constructed routes on nature territories, animal and plant species is expected to be more significant than the impact of the routes which are located in existing railway corridors. Currently the proposed alternatives would pass 34 and would be located close to (ie. 500 m) 25 Natura 2000 sites. Table 81 shows the relationship of each alternative to the Natura 2000 sites. The most significant impact from the planned route would be on those protected territories that are established mainly for the protection of animals – Birds Directive Sites (SPA) and Birds and habitats directives sites (C) as the animal species are more sensitive to disturbances. If possible the routes should not cross the biotopes or influence their abiotic conditions, the impact on biotopes can be considered as moderate or minor. Detailed analysis is provided in Appendix E.

Table 83 – Number Natura 2000 sites up to 1 km distance from Rail Baltica alternatives

	Number of Natura 2000 sites within 1 km corridor			
Alternatives	Crosses	Distance < 500 m	Distance 0.5 km-1 km	Total
I (Red)	10	16	6	32
II (Orange)	12	16	6	34
III (Yellow)	9	7	9	25
IV (Green)	8	10	10	28

In all cases when significant impact to Natura 2000 territories is expected, there is a rather high probability that compensation measures will have to be foreseen and implemented. Compensation measures may include, but are not limited to, restoration of similar habitat in another site, implementation of additional protection or management measures.

Analysis of Natura 2000 sites carried out during this stage provides information on potential conflict zones, however the exact impact of the route on the protected territories will be assessed within the procedure of environmental impact assessment (EIA). During detailed assessment nature management plans, functional zoning and restrictions of each protected sites as well as species protection plans should be reviewed. At the same stage should be revise nature protected areas with national, regional and local importance, because some of them are not include in list of Natura 2000 sites.

Figure 24 - Sites within 1km either side of the routes

In addition to the impact of the planned railway track on protected nature territories, impact on the ecosystem as a whole or landscape pattern at both – regional and local levels have to be assessed. This type of linear transport infrastructure component would increase landscape fragmentation; therefore preservation of the ecologic corridor functionality has to be considered timely, mainly in relation to large river valley crossings and animal migration corridors. Most significant impact on the landscape is expected in territories, where the railway line will follow the new route. The prospective railway line will mainly affect the ecological value of the landscape with forest dominance and visual aspects of the open landscape with agricultural lands.

The impacts on landscape will be different in construction and operational phase. Mitigation measures should be considered especially in construction phase. Those will depend on species conditions for nesting, migration etc. Transformation of landscape and its elements will be more significant for new (I, III) alternatives than for reconstruction of existing (II, IV) lines. Since the fences will be located in forest areas, the green corridors providing migration possibilities should be planned.

Following the selection of the optimal Rail Baltica railways route an additional assessment has been performed in order to analyse the potential impact on the various environmental aspect including biodiversity. The summary of the information related to the Natura 2000 territories that are traversed by the selected railway route alternative is presented in Table 81 and Figure 22. Although the table covers exclusively the Natura 2000 territories which are crossed by the proposed route, further evaluation will incorporate the assessment of all the territories identified during the preliminary investigation stage and the impact on these territories within the 2 km wide corridor will be included. In addition, impact mitigation measures will be proposed for the future analysis. A comparison of the Nature 2000 territories in all three Baltic State demonstrated that the protected territories were created with a similar, yet somewhat different outlook. For instance, in Estonia many smaller size protected areas can be found, aimed at conservation of just one species - black stork *Ciconia nigra*. Taking into consideration that this species is sensitive to the anthropogenic disturbance, in particular cases it is also necessary to evaluate broader territories, exceeding the regions within the protected areas. Similarly, further investigation will present a detailed analysis of the railway route impact on the species migratory routes, taking into consideration the important role Natura 2000 territories play in the conservation of the various ecosystem functions.

The proposed route of the perspective railway was designed to bypass the Natura 2000 sites. As the result the selected route mainly crosses rivers and river valleys. All the impacted rivers depending on their length and the size of their catchments represent ecological corridors of various importance. When planning a detailed railway route it is important to assess the ecosystem value within each Natura 2000 territories and make the necessary adjustments to the route in order to minimise the potential impact on the protected species and habitats. Such route adjustments would be required around all the rivers that are located within Nature 2000 territories. When crossing the rivers and river valleys the route should primarily utilise the existing bridges; necessary these bridges can be widened. In the case of Natura 2000 sites “Vitrupes ieleja” (LV0530500) and „Sventosios upe zemiau Andrioniskio” (LTUKM0002) it is important in assess an option of bypassing the abovementioned territories. In order to minimise the fragmentation of the natural habitats, it is advisable to plan the proposed railway tracks in line with the existing railway tracks and other linear infrastructural objects, as it has been previously done with regards to the development of the route of VIA Baltica transport corridor and other existing roadways in the Baltic States.

Figure 25 - Natura 2000 sites crossed by the Alternative

Table 84 - Natura 2000 sites up to 1 km distance from Rail Baltica alternatives.

Name of site	**Site code**	**Site type**	**Railway's proximity to site (distance to track)**	**Area (ha)**	**Potential impact**
Option I					
Taarikõnnu-Kaisma	EE0020340	Birds directive site (SPA)	< 500 m	7519	Significant
Põhja-Liivimaa	EE0040344	Birds directive site (SPA)	< 500 m	19336	Significant
Luitemaa	EE0040351	Birds and habitats directives site (C)	< 1 km	12982	Habitats – minor Birds - moderate
Salavalge-Tõrasoo	EE0020314	Habitats directive site (SCI)	< 500 m	4534	Significant
Rahaaugu	EE0020319	Habitats directive site (SCI)	< 500 m	473	Significant
Raikküla-Paka	EE0020322	Habitats directive site (SCI)	< 500 m	139	Minor
Kuusiku	EE0020336	Habitats directive site (SCI)	< 500 m	121	Moderate
Kaisma	EE0040306	Habitats directive site (SCI)	< 500 m	3170	Moderate
Kivikupitsa	EE0040317	Habitats directive site (SCI)	< 500 m	135	Minor
Laiksaare	EE0040322	Habitats directive site (SCI)	< 500 m	399	Significant
Nepste	EE0040335	Habitats directive site (SCI)	< 500 m	34	Significant
Lemmejõe	EE0040342	Habitats directive site (SCI)	crosses	5	Significant
Pärnu jõe	EE0040345	Habitats directive site (SCI)	crosses	862	Moderate
Pärnu	EE0040347	Habitats directive site (SCI)	< 500 m	519	Moderate
Tolkuse	EE0040359	Habitats directive site (SCI)	<1 km	809	Moderate
Reiu jõe	EE0040384	Habitats directive site (SCI)	crosses	104	Significant
Salacas ieleja	LV0302200	Birds and habitats directives site (C)	crosses	6251	Habitats – significant Birds - significant
Dzelves-Krona purvs	LV0523300	Birds and habitats directives site (C)	< 500 m	1197	Habitats – moderate Birds - significant
Garkalnes mezi	LV0527400	Birds and habitats directives site (C)	crosses	1785	Habitats – significant Birds - significant
Vitrupes ieleja	LV0530500	Habitats directive site (SCI)	crosses	126	Significant
Adazi	LV0600800	Birds and habitats directives site (C)	< 500 m	6128	Habitats – moderate Birds - significant
Runeikiu miskas	LTKED0005	Habitats directive site (SCI	<1 km	57	Minor
Budos-Pravieniskiu miskas	LTKAI0005	Habitats directive site (SCI)	<1 km	1004	Minor
Budos - Pravieniskiu	LTKAIB006	Birds directive site (SPA)	< 500 m	5174	Moderate

Name of site	Site code	Site type	Railway's proximity to site (distance to track)	Area (ha)	Potential impact
miskai					
Kauno marios	LTKAUB008	Birds directive site (SPA)	< 1 km	5773	Moderate
Kauno marios	LTKAU0007	Habitats directive site (SCI)	< 500 m	9026	Moderate
Naujosios Fredos fortas	LTKAU0011	Habitats directive site (SCI)	< 1 km	30	Minor
Jiesios upe ir jos sleniai	LTKAU0014	Habitats directive site (SCI)	crosses	388	Moderate
Kauno azuolynas	LTKAU0020	Habitats directive site (SCI)	< 500 m	62	Minor
Sventosios upe zemiau Andrioniskio	LTUKM0002	Habitats directive site (SCI)	crosses	1654	Moderate
Neries upe	LTVIN0009	Habitats directive site (SCI)	crosses	2395	Moderate
Kalvarijos apylinkes	LTKALB001	Birds directive site (SPA)	crosses	19751	Significant
Option II					
Taarikõnnu-Kaisma	EE0020340	Birds directive site (SPA)	< 500 m	7519	Moderate
Kõnnumaa-Väätsa	EE0020341	Birds directive site (SPA)	crosses	17955	Significant
Kikepera	EE0040316	Birds directive site (SPA)	crosses	10402	Significant
Taarikõnnu	EE0020315	Habitats directive site (SCI)	crosses	2857	Significant
Rabivere	EE0020316	Habitats directive site (SCI)	crosses	2169	Significant
Kurtna-Vilivere	EE0020318	Habitats directive site (SCI)	< 500 m	71	Moderate
Ridaküla	EE0020321	Habitats directive site (SCI)	< 500 m	144	Moderate
Kõnnumaa	EE0020325	Habitats directive site (SCI)	crosses	11397	Moderate
Tillniidu	EE0020326	Habitats directive site (SCI)	crosses	346	Significant
Mukri	EE0020327	Habitats directive site (SCI)	< 500 m	2211	Moderate
Nõlvasoo	EE0020337	Habitats directive site (SCI)	< 500 m	1106	Moderate
Allikukivi	EE0040301	Habitats directive site (SCI)	< 500 m	17	Minor
Metsaääre	EE0040302	Habitats directive site (SCI)	< 500 m	160	Minor
Siiraku	EE0040314	Habitats directive site (SCI)	< 500 m	685	Significant
Kuiaru	EE0040320	Habitats directive site (SCI)	< 500 m	222	Moderate
Mõrdama	EE0040331	Habitats directive site (SCI)	< 500 m	1524	Moderate
Pärnu jõe	EE0040345	Habitats directive site (SCI)	crosses	862	Moderate

Name of site	Site code	Site type	Railway's proximity to site (distance to track)	Area (ha)	Potential impact
Pärnu	EE0040347	Habitats directive site (SCI)	< 500 m	519	Minor
Reiu jõe	EE0040384	Habitats directive site (SCI)	crosses	105	Significant
Sanga	EE0040362	Habitats directive site (SCI)	< 500 m	153	Significant
Piejura	LV0301700	Birds and habitats directives site (C)	crosses	4141	Habitats – significant Birds - significant
Salacas ieleja	LV0302200	Birds and habitats directives site (C)	<500 m	6251	Habitats – moderate Birds - moderate
Vecdaugava	LV0518300	Habitats directive site (SCI)	< 500 m	238	Moderate
Lielupes palienas plavas	LV0523100	Birds and habitats directives site (C)	< 500 m	354	Habitats – minor Birds - moderate
Zuvinto, Zaltycio ir Amalvo pelkes	LTALYB003	Birds directive site (SPA)	<1 km	14196	Moderate
Zuvinto ezeras ir Buktos miskas	LTALY0005	Habitats directive site (SCI)	<1 km	18492	Minor
Kauno marios	LTKAU0007	Habitats directive site (SCI)	< 500 m	9026	Moderate
Jiesios upe ir jos sleniai	LTKAU0014	Habitats directive site (SCI)	crosses	388	Moderate
Kauno azuolynas	LTKAU0020	Habitats directive site (SCI)	< 1 km	62	Minor
Kauno marios	LTKAUB008	Birds directive site (SPA)	< 1 km	5773	Moderate
Naujosios Fredos fortas	LTKAU0011	Habitats directive site (SCI)	<1 km	30	Minor
Azuolu budos miskas	LTMAR0001	Habitats directive site (SCI)	<1 km	859	Minor
Neries upe	LTVIN0009	Habitats directive site (SCI)	crosses	2395	Moderate
Kalvarijos apylinkes	LTKALB001	Birds directive site (SPA)	crosses	19751	Moderate
Option III					
Kõnnumaa-Väätsa	EE0020341	Birds directive site (SPA)	< 500 m	17955	Moderate
Kämbla	EE0010103	Habitats directive site (SCI)	< 500 m	165	Moderate
Paunküla	EE0010104	Habitats directive site (SCI)	<1 km	623	Moderate
Ardu	EE0010112	Habitats directive site (SCI)	<1 km	43	Significant
Pärnu jõe	EE0040345	Habitats directive site (SCI)	< 500 m	862	Moderate
Vapramäe	EE0080309	Habitats directive site (SCI)	< 500 m	100	Moderate
Kärevere	EE0080371	Birds and habitats directives site (C)	crosses	2509	Significant

Name of site	Site code	Site type	Railway's proximity to site (distance to track)	Area (ha)	Potential impact
Elva-Vitipalu	EE0080318	Habitats directive site (SCI)	crosses	921	Moderate
Mõneku	EE0080472	Habitats directive site (SCI)	< 500 m	48	Significant
Gaujas nacionalais parks	LV0200100	Birds and habitats directives site (C)	crosses	92286	Habitats – minor Birds - moderate
Linezers	LV0525200	Habitats directive site (SCI)	<1 km	127	Minor
Sedas purvs	LV0526800	Birds and habitats directives site (C)	< 500 m	7261	Habitats – moderate Birds - significant
Garkalnes mezi	LV0527400	Birds and habitats directives site (C)	crosses	1785	Habitats – moderate Birds - significant
Ziemelgauja	LV0600700	Birds and habitats directives site (C)	crosses	21750	Habitats – significant Birds - significant
Runeikiu miskas	LTKED0005	Habitats directive site (SCI	<1 km	57	Minor
Budos-Pravieniskiu miskas	LTKAI0005	Habitats directive site (SCI)	<1 km	1004	Minor
Budos - Pravieniskiu miskai	LTKAIB006	Birds directive site (SPA)	<1 km	5174	Moderate
Kauno marios	LTKAUB008	Birds directive site (SPA)	<1 km	5773	Moderate
Kauno marios	LTKAU0007	Habitats directive site (SCI)	< 500 m	9026	Moderate
Naujosios Fredos fortas	LTKAU0011	Habitats directive site (SCI)	<1 km	30	Minor
Jiesios upe ir jos sleniai	LTKAU0014	Habitats directive site (SCI)	crosses	388	Moderate
Kauno azuolynas	LTKAU0020	Habitats directive site (SCI)	< 1 km	62	Minor
Sventosios upe zemiau Andrioniskio	LTUKM0002	Habitats directive site (SCI)	crosses	1654	Significant
Neries upe	LTVIN0009	Habitats directive site (SCI)	crosses	2395	Significant
Kalvarijos apylinkes	LTKALB001	Birds directive site (SPA)	crosses	19751	Significant
Option IV					
Ohepalu	EE0020205	Birds and habitats directives site (C)	<1 km	5928	Habitats – minor Birds - significant
Kõrvemaa	EE0060171	Birds directive site (SPA)	<500 m	22888	Moderate
Vooremaa	EE0080171	Birds directive site (SPA)	<1 km	3750	Moderate
Kõrvemaa	EE0060119	Habitats directive site (SCI)	<500 m	20646	Moderate

Name of site	Site code	Site type	Railway's proximity to site (distance to track)	Area (ha)	Potential impact
Seljamäe	EE0060211	Habitats directive site (SCI)	<500 m	215	Moderate
Äntu	EE0060212	Habitats directive site (SCI)	<500 m	391	Minor
Mustallika	EE0080109	Habitats directive site (SCI)	<500 m	50	Moderate
Vooremaa järvede	EE0080110	Habitats directive site (SCI)	<1 km	2109	Minor
Vapramäe	EE0080309	Habitats directive site (SCI)	< 500 m	100	Moderate
Elva-Vitipalu	EE0080318	Habitats directive site (SCI)	crosses	926	Moderate
Mõneku	EE0080472	Habitats directive site (SCI)	< 500 m	48	Significant
Gaujas nacionalais parks	LV0200100	Birds and habitats directives site (C)	crosses	92286	Habitats – significant Birds - significant
Melturu sils	LV0527800	Habitats directive site (SCI)	crosses	288	Significant
Lielupes palienas plavas	LV0523100	Birds and habitats directives site (C)	< 500 m	354	Habitats – minor Birds - moderate
Jaunciems	LV0524600	Habitats directive site (SCI)	<1 km	351	Minor
Sedas purvs	LV0526800	Birds and habitats directives site (C)	< 500 m	7261	Habitats – moderate Birds - significant
Garkalnes mezi	LV0527400	Birds and habitats directives site (C)	crosses	1785	Habitats – moderate Birds - significant
Ziemelgauja	LV0600700	Birds and habitats directives site (C)	crosses	21750	Habitats – significant Birds - significant
Zuvinto, Zaltycio ir Amalvo pelkes	LTALYB003	Birds directive site (SPA)	<1 km	14196	Moderate
Zuvinto ezeras ir Buktos miskas	LTALY0005	Habitats directive site (SCI)	<1 km	18492	Minor
Kauno marios	LTKAU0007	Habitats directive site (SCI)	< 500 m	9026	Moderate
Jiesios upe ir jos sleniai	LTKAU0014	Habitats directive site (SCI)	crosses	388	Moderate
Kauno azuolynas	LTKAU0020	Habitats directive site (SCI)	< 1 km	62	Minor
Kauno marios	LTKAUB008	Birds directive site (SPA)	< 1 km	5773	Moderate
Naujosios Fredos fortas	LTKAU0011	Habitats directive site (SCI)	<1 km	30	Minor
Azuolu budos miskas	LTMAR0001	Habitats directive site (SCI)	<1 km	859	Minor
Neries upe	LTVIN0009	Habitats directive site (SCI)	crosses	2395	Significant
Kalvarijos apylinkes	LTKALB001	Birds directive site (SPA)	crosses	19751	Moderate

Table 85 - Description of the Natura 2000 sites crossed by the Alternative I

						Birds listed on Annex I of Council directive 79/409/EEC		Listed on Annex II of Council directive 92/43/EEC					
Name of site	Site code	Area, ha	Site type	Annex 1, habitat types	Annex 1, Territory covered by habitat, %	Birds, Annex 1	Regularly occurring Migratory Birds	Mammals	Amphibians	Fishes	Invertebrates	Plants	Comment
Lemmejõe	EE0040342	5	Habitats directive site (SCI)	*3260*	100	No data	No data	*Lutra lutra*	No data	*Lampetra fluviatilis*	*Unio crassus*	No data	Crossing the river
Pärnu jõe	EE0040345	862	Habitats directive site (SCI)	*3260, 6450, 6530*	100	No data	No data	No data	No data	*Cobitis taenia, Cottus gobio, Lampetra fluviatilis, Salmo salar*	Unio crassus	No data	Crossing the river
Reiu jõe	EE0040384	104	Habitats directive site (SCI)	*3260*	100	No data	No data	*No data*	No data	*Cobitis taenia, Cottus gobio, Lampetra fluviatilis*	*Unio crassus*	No data	Crossing the river

Salacas ieleja	LV0302200	6251	Birds and habitats directives site (C)	*9180, 91D0, 8310, 8220, 7160, 7110, 6430, 6210, 3260, 91E0, 6510, 6270, 6450, 6230, 7150, 7220*	24.5	*See Note 1*	No data	*Lutra lutra, Myotis dasycneme, Ursus arctos*	No data	*Cobitis taenia, Cottus gobio, Lampetra fluviatilis, Salmo salar, Rhodeus sericeus amarus, Pelecus cultratus, Misgurnus fossilis, Lampetra planeri*	*Leucorrhinia pectoralis, Ophiogomphus cecilia, Osmoderma eremita, Unio crassus, Vertigo angustior, Vertigo geyeri*	*Agrimonia pilosa, Dicranum viride*	Crossing the river
Garkalnes mezi	LV0527400	1785	Birds and habitats directives site (C)	*9010, 4030*	8.5	*See Note 2*	No data	No data	No data	No data	Ophiogomphus cecilia	Pulsatilla patens	Crossing forest area
Vitrupes ieleja	LV0530500	126	Habitats directive site (SCI)	*9180, 91F0, 9010, 8220, 3260, 6270, 6450*	45.5	*See Note 3*	No data	Lutra lutra	No data	*Cobitis taenia, Cottus gobio, Lampetra fluviatilis, Lampetra planeri, Salmo salar*	*Lycaena dispar, Unio crassus, Vertigo genesi*	No data	Crossing the river
Jiesios upe ir jos sleniai	LTKAU0014	388	Habitats directive site (SCI)	*9180*	11	No data	No data	Lutra lutra	No data	No data	Cucujus cinnaberinus	No data	Crossing the river
Sventosios upe zemiau Andrioniskio	LTUKM0002	1654	Habitats directive site (SCI)	*No data*	*No data*	No data	No data	Lutra lutra	No data	*Cobitis taenia, Lampetra fluviatilis, Rhodeus sericeus amarus, Sabanejewia aurata, Salmo salar*	Ophiogomphus cecilia	No data	Crossing the river

Neries upe	LTVIN0009	2395	Habitats directive site (SCI)	*3260*	11	No data	No data	Lutra lutra	No data	*Aspius aspius, Cobitis taenia, Cottus gobio, Lampetra fluviatilis, Rhodeus sericeus amarus, Salmo salar*	Ophiogomphus cecilia	No data	Crossing the river
Kalvarijos apylinkes	LTKALB001	19751	Birds directive site (SPA)	*6210, 6430, 6450, 6510*	No data	*See Note 4*	No data	No data	No data	No data	No data	No data	Crossing agricultural and forest areas

Data source: Natura 2000 standard data form (http://natura2000.eea.europa.eu)

Habitat Code	Habitat description
3260	Water courses of plain to mountain levels with the *Ranunculion fluitantis* and Callitricho-Batrachion vegetation
6210	Semi-natural dry grasslands and scrubland facies on calcareous substrates (Festuco-Brometalia) (* important orchid sites)
6230	Species-rich Nardus grasslands, on silicious substrates in mountain areas (and submountain areas in Continental Europe)
6270	Fennoscandian lowland species-rich dry to mesic grasslands
6430	Hydrophilous tall herb fringe communities of plains and of the mountain to alpine levels
6450	Northern boreal alluvial meadows
6450	Northern boreal alluvial meadows
6510	Lowland hay meadows (Alopecurus pratensis, Sanguisorba officinalis)
6530	Fennoscandian wooded meadows
7110	Active raised bogs
7150	Depressions on peat substrates of the Rhynchosporion
7160	Fennoscandian mineral-rich springs and springfens
7220	Petrifying springs with tufa formation (Cratoneurion)
8220	Siliceous rocky slopes with chasmophytic vegetation
8310	Caves not open to the public
9180	Tilio-Acerion forests of slopes, screes and ravines
4030	European dry heaths
9010	Western Taiga
91E0	Alluvial forests with Alnus glutinosa and Fraxinus excelsior (Alno-Padion, Alnion incanae, Salicion albae)
91F0	Riparian mixed forests of Quercus robur, Ulmus laevis and Ulmus minor, Fraxinus excelsior or Fraxinus angustifolia, along the great rivers (Ulmenion minoris)

Note 1: *Alcedo atthis, Bonasa bonasia, Ciconia ciconia, Ciconia nigra, Crex crex, Dendrocopos leucotos, Dendrocopos medius, Dryocopus martius, Ficedula parva, Glaucidium passerinum, Lullula arborea, Lanius collurio, Pandion haliaetus, Picoides tridactylus, Picus canus, Strix uralensis, Tetrao urogallus*

Note 2: *Aegolius funereus, Anthus campestris, Caprimulgus europaeus, Ciconia nigra, Coracias garrulus, Crex crex, Dryocopus martius, Lanius collurio, Lullula arborea, Pernis apivorus, Picus canus*

Note 3: *Alcedo atthis, Bonasa bonasia, Caprimulgus europaeus, Crex crex, Dendrocopos leucotos, Dendrocopos medius, Dryocopus martius, Glaucidium passerinum, Lanius collurio, Lullula arborea, Picoides tridactylus, Strix uralensis*

Note 4: *Alcedo atthis, Anthus campestris, Asio flammeus, Botaurus stellaris, Caprimulgus europaeus, Chlidonias niger, Ciconia ciconia, Circus aeruginosus, Circus pygargus, Crex crex, Grus grus, Lullula arborea, Pernis apivorus, Picus canus, Porzana parva, Porzana porzana, Sterna hirundo*

7.4.2 Noise impact

Both construction phase and operational phase of railway line will be associated with noise emissions from machinery and vehicles used during construction and railway traffic during operation of *Rail Baltica.*

During the construction impact will be short term and, as it is linear object, noise emission source will be mobile. However operation of railway line will be associated with permanent noise emissions. It is obvious that noise emission modelling has to be done during the environmental impact assessment, but based on expert experience and available information it should be noted that there is high risk to exceed noise limit values in populated areas. Potential risk zones have been identified for each option and summarised in the following table:

Alternatives	*Number of populated areas (cities/town) crossed*			*Total*
	LT	*LV*	*EE*	
I (Red)	17	5	7	29
II (Orange)	16	13	15	44
III (Yellow)	17	5	6	28
IV (Green)	16	13	17	46

In all route options the detailed effects of noise will have to be considered and the necessary mitigation measures planned. Options I and II are crossing considerably less cities/towns with potential conflict zones requiring planning and implementation of noise reduction/mitigation measures.

Option I Red

The alternative is passing nearby or through the following populated areas where is a potential risk to exceed noise limit values:

- Lithuania: Luidvinavas, Patasine, Raišupys, Smilgiai, Barsukine, Leskava, Joudbudis, Daniunai, Rukai, Baisogula, Velzys, Pajuostis, Pavartycai, Pasvalyis, Preiciunai, Staciunai, Mekiai,
- Latvia: Jauneikas, Code, Iecava, Skulte, Jelgavkrasti,
- Estonia: Voidu, Parnu, Mahlamae, Salutaguse, Prillimae, Luige, Tallinn.

Option II Orange

The alternative is passing nearby or through the following populated areas where is a potential risk to exceed noise limit values:

- Lithuania: Sestokai, Jungenai, Marijampole, Garliava, Kaunas, Neveronys, Kozlu Ruda, Mauruciai, Jonova, Kedainia, Baisogala, Radviliskis, Kutiskiai, Silenai, Siaulai, Mekiai.
- Latvia: Eleja, Jelgava, Ozolnieki, Jaunolaine, Tiraine, Riga, Garkalne, Garciems, Carnikava, Saulkrasti, Skulte, Limbazi, Valka
- Estonia: Moisakula, Saarde, Jaamakula, Selja, Eidapere, Lelle, Keava, Valtu, Rapla, Hagudi, Kohila, Kiisa, Saku, Manniku, Tallinn.

Option III Yellow

The alternative is passing nearby or through the following populated areas where is a potential risk to exceed noise limit values:

- Lithuania: Luidvinavas, Patasine, Raišupys, Smilgiai, Barsukine, Leskava, Joudbudis, Daniunai, Rukai, Baisogula, Velzys, Pajuostis, Pavartycai, Pasvalyis, Preiciunai, Staciunai, Mekiai.
- Latvia: Jauneikas, Code, Iecava, Valmiera, Valka
- Estonia: Valga, Tsirgullina, Elva, Voika, Tartu, Tallinn.

Option IV Green

The alternative is passing nearby or through the following populated areas where is a potential risk to exceed noise limit values:

- Lithuania: Sestokai, Jungenai, Marijampole, Garliava, Kaunas, Neveronys, Kozlu Ruda, Mauruciai, Jonova, Kedainia, Baisogala, Radviliskis, Kutiskiai, Silenai, Siaulai, Mekiai.
- Latvia: Eleja, Jelgava, Ozolnieki, Jaunolaine, Tiraine, Riga, Garkalne, Sigulda, Ligatne, Cesis, Liepa, Valmiera, Valka
- Estonia: Valga, Tsirgullina, Elva, Voika, Tartu, Karkna, Tabivere, Jogeva, Rakke, Tamsalu, Vahakulmu, Tapa, Lehtse, Aegviidu, Kehra, Raasiku, Tallinn.

7.4.3 Impact on rivers and water courses

All alternative routes are crossing large numbers of small rivers, whose hydrological regime will be affected during the construction stage, but impact will be predominantly in the short-term and minor.

All alternative routes also cross large and medium size rivers. In all cases when a new crossing/bridge is located next to the existing one or the existing crossing/bridge is widened it is considered that the impact on the hydrological regime will be moderate. However in cases when the route requires the construction of a new bridge the impact is considered as being significant. More details of the watercourses affected by each option are given below:

Option I Red

The route is passing several rivers and watercourses that hydrological regime may be influenced during the construction stage:

- Lithuania:
  - the route is crossing Baisogalos small hydro power station water reservoir (located on Kirsinas river near Baisogala town),
  - large/medium rivers with major impact: Nemunas (near Kaunas and Raudondvaris), Kaunas water reservoir on Nemunas River (Kauno Mario), Neris (near Jonava), Musa (near Pasvalys and Pakruojis)
- Latvia:
  - large/medium rivers with significant impact: Memele, Riga hydro power station water reservoir on Daugava River, Gauja, Salaca
- Estonia:
  - large/medium rivers with moderate impact: Parnu.

Option II Orange

The route is passing several rivers and watercourses that hydrological regime may be influenced during the construction stage:

- Lithuania:
  - large/medium rivers with moderate impact: Nemunas (near Kaunas and Raudondvaris), Kaunas water reservoir on Nemunas River (Kauno Mario), Neris (near Jonava), Nievezis (near Kedainiai). As there already exist railway bridges and construction of new bridges or widening of existing ones will have less environmental impact.
- Latvia:
  - large/medium rivers with moderate impact: Lielupe, Daugava, channel between Juglas Lake and Baltezers Lake, Milgravis Channel, Gauja,
- Estonia:
  - large/medium rivers with significant impact: Parnu.

Option III Yellow

The route is passing several rivers and watercourses that hydrological regime may be influenced during the construction stage:

- Lithuania:
  - the route is crossing Baisogalos small hydro power station water reservoir (located on Kirsinas river near Baisogala town),

  - o large/medium rivers with major impact: Nemunas (near Kaunas and Raudondvaris), Kaunas water reservoir on Nemunas River (Kauno Mario), Neris (near Jonava), Musa (near Pasvalys and Pakruojis)
- Latvia:
  - o large/medium rivers with moderate impact: Memele, Riga hydro power station water reservoir on Daugava River, Gauja
- Estonia:
  - o large/medium rivers with moderate impact: Vaike Emajogi
  - o large/medium rivers with significant impact: Emajogi

Option IV Green

The route is passing several rivers and watercourses that hydrological regime may be influenced during the construction stage:
- Lithuania:
  - o large/medium rivers with moderate impact: Nemunas (near Kaunas and Raudondvaris), Kaunas water reservoir on Nemunas River (Kauno Mario), Neris (near Jonava), Nievezis (near Kedainiai). As there already exist railway bridges and construction of new bridges or widening of existing ones will have less environmental impact.

- Latvia:
  - o large/medium rivers with moderate impact: Lielupe, Daugava, channel between Juglas Lake and Baltezers Lake, Gauja.
- Estonia:
  - o large/medium rivers with moderate impact: Vaike Emajogi, Emajogi.

7.4.4 Impact on cultural heritage

The Baltic States have a long history and there are designated a large number of cultural heritage sites of national and local importance. Approx. number is around 8000 cultural heritage sites in each country. Therefore only rough estimate of number of sites in major cities has been done and detailed assessment has to be done for the alternative selected for the further assessment. The information is summarised in the following table.

Number of heritage sites in the major cities

City	Number of heritage sites	Alternative concerned
Kaunas	943	All alternatives
Panevezys	179	Alternative I and III
Siaulai	112	Alternative II and IV
Riga	531	Alternative II and IV
Valmiera	14	Alternative III and IV
Tartu	295	Alternative III and IV
Parnu	78	Alternative I and II

Considering number of the heritage sites the most acceptable is alternative I, because crossing Parnu that has significantly less sites than Tartu and not crossing Riga. The alternative with lower priority is the alternative IV, because crossing Riga and Tartu.

In total each alternative may concern the following number of the heritage sites:

- Alternative I – 1 200 heritage sites;
- Alternative II – 1 664 heritage sites;
- Alternative III – 1 252 heritage sites;
- Alternative IV – 1 895 heritage sites.

7.4.5 Land cover of perspective corridor

In order to characterize the land-use type within the 2 km-wide corridor chosen for the Alternative I railway track route, the land use types were analysed based on the classification provided by the Corine Land Cover (CLC) database (www.eea.europa.eu/data-and-maps/data/). This database was created by the European Topic Centre for Land Use and Spatial Data Information and is widely used by the European Environmental Agencies of the EU member states when analysing land cover, land-use change, land-use planning etc. Corine Land Cover database provides land cover data for the territory of all the European States produced using the uniform methodology with the 100 m-precision and represents the land cover for the year 2006. Within the route corridor of the perspective railway track 24 land cover classes can be identified out of the total 44 recognised by Corine in Europe. Table 84 summarises the identified land cover types by the total area and number of plots with the specific land cover found within the proposed railway route corridor.

The total area size of the perspective railway track route 2 km wide corridor is 132 460 ha. Agricultural land is the prevailing land cover within the corridor, covering 48% of the total corridor area and is mainly found in the southern parts of Latvia and Lithuania. Arable land constitutes approximately half of the agricultural land. The remaining half is characterised by a complex cultivation patterns with pastures and land principally occupied by agriculture with significant areas of natural vegetation. This type of a complex agricultural land use is more common for Estonia and northern Latvia where territory is characterised by a highly heterogenic mosaic pattern of the land cover.

The second most common land use type is forests which covers up to 37% of the total proposed corridor area and can be mainly found in Estonia and northern Latvia. The major part of the forest area is covered by mixed and coniferous forests, with the small regions of broad-leaved forests. Semi-natural and artificial surfaces cover 7% and 6% of the total corridor area respectively. The major part of the semi-natural area is occupied by the scrubs, which in the Baltic States often appear on the abandoned agricultural land. Taking into consideration that the proposed railway route deliberately bypasses urban areas, the proportion of this land cover type within the corridor is small. Mainly urban areas overpass territories adjacent to the planned railway stations (Tallin, Parnu, Riga, Panevezys, Kaunas). Within the broad class of urban land cover, the major types are discontinuous urban fabric, industrial or commercial units, green urban areas and road and rail networks and associated land. Here, it is important to note that the proposed railway route within the urban areas will go through the territories which are currently used as the railway corridors; therefore there will be no significant change in the land use within the urban areas. Finally, the insignificant proportion (approx. 1%) of the total perspective railway corridor area is covered by wetlands and water bodies.

Table 86 demonstrates that the perspective railway route will trespass territories with various land cover types. Agricultural land and forests cover major area within the proposed railway corridor, and therefore in the next stages of the project development it is necessary to consider measure that will minimise the impact of the land cover fragmentation throughout the perspective route and insure the availability of the optimal land plots. Figures 24-28 clearly demonstrates land cover types in the territories crossed by the perspective railway route. The perspective railway route mainly crosses forest land and semi natural areas from Tallinn till Iecava. Agricultural areas are mainly concentrated in the section from Iecava till Jonava.

Table 86 - The distribution of CLC classes in 2 km corridor of the Alternative I

CLC code	CLC class	Area of Rail Baltica			Total area of EE, LT and LV, ha	% from total area of EE, LT and LV
		ha	%	count		
	Artificial surfaces	**8270**	**6,2**		**396045**	**2,1**
	Urban fabric					
111	Continuous urban fabric	112		3		
112	Discontinuous urban fabric	3838		61		

	Industrial, commercial and transport units					
121	Industrial or commercial units	2692		39		
122	Road and rail networks and associated land	456		9		
124	Airports	143		1		
	Mine, dump and construction sites					
131	Mineral extraction sites	300		6		
133	Construction sites	30		3		
	Artificial, non-agricultural vegetated areas					
141	Green urban areas	493		11		
142	Sport and leisure facilities	206		4		
	Agricultural areas	**63288**	**47,8**		**8287221**	**0,8**
	Arable land					
211	Non-irrigated arable land	36164		167		
222	Permanently irrigated land	482		7		
	Pastures					
231	Pastures	5605		100		
	Heterogeneous agricultural areas					
242	Complex cultivation patterns	13461		168		
243	Land principally occupied by agriculture, with significant areas of natural vegetation	7576		169		
	Forest and semi natural areas	**58432**	**44,1**		**7935989**	**0,7**
	Forests					
311	Broad-leaved forest	11088		177		
312	Coniferous forest	18400		188		
313	Mixed forest	19877		260		
	Scrub and/or herbaceous vegetation associations					
321	Natural grasslands	84		2		
322	Moors and heathland	66		1		
324	Transitional woodland-shrub	8917		183		
	Wetlands	**1421**	**1,1**		**417133**	**0,3**
	Inland wetlands					
411	Inland marshes	149		6		
412	Peat bogs	1272		8		
	Water bodies	**1048**	**0,8**		**501953**	**0,2**
	Inland waters					
511	Water courses	608		6		
512	Water bodies	440		9		
	Total:	***132460***	**100**		**17538341**	**0,8**

7.4.6 Geological conditions

Geological conditions are important factor for engineering and construction of railway line as have direct impact on selected ballast, construction technology etc. The key task during this stage was to identify areas where geological conditions are difficult and where particular attention has to be paid during next stages of the project development. As difficult conditions are considered gypsum bedrock where is very high risk to develop karst processes.

There has not been identified any area with particularly difficult geological conditions in Estonia. Latvia – potential risk zones are in Stopini novads, Salaspils novads and Baldones novads. Lithuania – the Alternative I is not crossing areas with difficult geological condition. Areas with gypsum bedrock are located to the East from the selected railway corridor.

7.5 Technical Analysis Summary

The results of the various analyses undertaken in the preceding sections have been summarised in the table below. In some case values have been used but where this has not been possible the options have either been assigned a ranking from 1-4 or an impact classified as high, medium or low. The values have been based on the 2020 year values and the medium or central cases.

The detailed analysis table on the following page can be simplified as shown below:

Aspect	Best Route
Capital Cost	Red
Journey time savings	Red
Revenues	Red
Wider Economic Benefits	Red and Yellow equal
Environment	Red , in terms of CO_2 savings

Therefore, considering the wider economic benefits of each of the options it is important to note that both Parnu and Panevezys will experience significant benefits to their business climate and economic growth based on increased accessibility for passenger and freight service to and from these locations in the North-South direction. Each location will require capital investments in station infrastructure which have been taken into consideration, but the benefits should quickly outweigh the investment costs.

The Red option, Alternative 1 appears to be the route that offers the greatest benefits for the least capital cost.

		Comment		Red	Orange	Yellow	Green
Government	Capital Cost *	(incl estimate of land cost)		€4.88bn	€5.08bn	€5.51bn	€5.30bn
	Journey Time Savings	Annual Passenger Hours ('000)		1,939	872	1,996	983
		Passenger €'000		€ 14,153	€ 6,365	€ 14,573	€ 7,173
		Freight €'000		€ 37,000	€ 25,000	€ 25,000	€ 18,000
	Wider Economic Benefits Ranked as 1=best, 4 =worst	Labour mobility	Rail Baltica project will increase workplace accessibility and will expand labour market catchment areas.	2	4	3	1
		Efficiency gains and improved distribution	Rail Baltica project will deliver time, cost, frequency, quality and reliability savings to freight carriers and passengers.	3	4	2	1
		Business and economy	Rail Baltica can facilitate impact on business efficiency and the economy through productivity improvement, agglomeration benefits and the narrowing of the international production gap.	1	3	2	4
		Land development and investment	Rail Baltica project will offer major development opportunities that will present themselves either in the city centres particularly around Rail Baltica stations or in the outskirts of big cities.	4	2	3	1

		Accessibility	Tourism can become a crucial area for the cities and regions provided with railway. The accessibility of a city is highly crucial for foreigners	1	4	2	3
		Multimodal corridors	Connectivity with other transport hubs (airports, harbours, roads) increases value of the rail, as well as it helps faster integration of the Rail Baltica in the current transport infrastructure..	2	3	1	4
Operator of Rail Baltica							
	Revenues	annual					
	Passenger	€'000		41,392	23,893	46,010	30,487
	Freight	€'000		132,000	106,000	107,000	88,000
Operators of Competing Modes							
AIR	Passenger	Trips Diverted per annum ('000)		-258	-184	-238	-167
		Annual Lost Revenue €'000		-47560	-34768	-51216	-28580
	Freight			TBC	TBC	TBC	TBC
COACH	Passenger	Trips Diverted per annum ('000)		-613	-401	-740	-491
		Annual Lost Revenue €'000		-8281	-5552	-11680	-6189
	Freight			TBC	TBC	TBC	TBC
RAIL	Passenger	Trips Diverted per annum ('000)		-21	-89	-108	-135
		Annual Lost Revenue €'000		-245	-1064	-1479	-1471

	Freight			TBC	TBC	TBC	TBC
Environment	Noise		Number of populated sites crossed	MEDIUM-will cross 29 populated areas with rather high potential to have a conflict zones where are exceeded noise emission limit values	HIGH - will cross 44 populated area with rather high potential to have a conflict zones where are exceeded noise emission limit values	MEDIUM-will cross 28 populated areas with rather high potential to have a conflict zones where are exceeded noise emission limit values	HIGH - will cross 46 populated area with rather high potential to have a conflict zones where are exceeded noise emission limit values
	Air Quality	CO_2 Saved tonnes Freight		374000	264000	268000	200000
	Greenhouse Gas Emissions	CO_2 E Saved tonnes Freight		380000	269000	273000	204000
	Landscape/Town scape			HIGH-will cause significant landscape transformation in regional and local scale, will cross areas with valuable landscapes	MEDIUM/LOW-Enlarging of existing railway corridor in several sections with typical landscapes	HIGH/MEDIUM-will cause significant landscape transformation in regional and local scale, will cross several areas with valuable landscapes	MEDIUM-Enlarging of existing railway corridor in several sections with valuable landscapes
	Bio-diversity			HIGH/MEDIUM-will cross or goes close (till 500 m) to 25 Natura 2000 sites as new alignment	HIGH/MEDIUM-will cross or goes close (till 500 m) to 27 Natura 2000 sites using existing corridor	MEDIUM-will cross or goes close (till 500 m) to 14 Natura 2000 sites mostly using existing corridor	MEDIUM/LOW-will cross or goes close (till 500 m) to 17 Natura 2000 sites using existing corridor
	Heritage		Number of heritige sites located in the major cities	LOW - potentially will have lower possibility for conflict with cultural heritage sites, because crosses the major cities withy the less number of such sites (1200 sites)	HIGH/MEDIUM - potentially will have rather high possibility for conflict with cultural heritage sites, because crosses the major cities with 1664 sites	LOW/MEDIUM - potentially will have moderate possibility for conflict with cultural heritage sites, because crosses the major cities with 1252 sites	HIGH - potentially will have the highest possibility for conflict with cultural heritage sites, because crosses the major cities with the highest number of such sites (1895 sites)
	Water environment		Existing or new crossings	HIGH-potentially will have a significant impact on water environment during building new crossings	LOW/MEDIUM-will cross water bodies in places where bridges are already located and water environment is already affected.	HIGH/MEDIUM-potentially will have rather high impact on water environment during building new crossings	LOW/MEDIUM-will cross water bodies in places where bridges are already located and water environment is already affected.

**Note: Detailed Capital Cost Calculations are presented in Appendix F*

8 Best Feasible Option

8 Best Feasible Option

8.1 Introduction

In the preceding sections of this report investigations were undertaken to identify the most likely feasible option for the new standard European gauge Rail Baltica. Following analysis of the factors summarized in Section 7.5 Technical analysis summary, it was proposed that Option 1, the Red Route should be the subject of a more detailed economic analysis. This proposal was accepted by the Rail Baltica Steering Committee at their meeting on 17 March 2011.

The preferred alignment (Option 1 – Red Route) for the Core TEN-T Rail Baltic 1435mm route was selected and designed to offer the most direct and shortest route from the southern-most point to the northern most point of the corridor. The new 1435mm gauge line starts at the LT border and proceeds into Kaunas on a new alignment to minimize curves and speed restrictions. At Kaunas the route will not serve the Central Station directly but will use Palemonas station as the transfer connection to the existing 1520mm gauge line to link to the Central Station and a transfer location for shuttle service to the airport via bus or 1520 mm rail. The new proposed intermodal facility is also in this area and can also be easily served by this route. The line progresses northbound through the west-side of Panevezys, where a stop for passengers and freight is planned, and continues north into Latvia. In Latvia the alignment proceeds adjacent to Iecava and then crosses the Daugava River to the east of Riga, at Salaspils at which point an east-west intermodal transfer station is contemplated. Riga City is served by new 1435mm gauge rail infrastructure utilizing the old "Ergli" alignment through to the Central Station. Trains from Central Station use the same route to arrive back at the main north south section. From this connection point the line proceeds northbound following parallel to the Via Baltica roadway alignment to Parnu, another intermediate stop and subsequently to Tallinn Central Station stopping first at Tallinn Airport. In the vicinity of Tallinn spurs are provided from the main line to serve both Muuga Port and the proposed location of the proposed fixed crossing to Helsinki.

The key features of the route are:

- Overall length of new track 728km
- Design speed 240 kph maximum
- The route is a mixed traffic conventional route
- Journey times between Tallinn and the Lithuanian/Polish Border (Table 1.1)
    - Passenger 4.13 hrs (4h8m)
    - Freight 10.38 hrs (10h29m) (variable time depending on the number of calls)
- Average speeds
    - Passenger 170 kph
    - Freight 68 kph
- Passenger service frequency every 2 hrs starting at 06.00 and finishing at 24.00hrs approximately
- New/Upgraded passenger stations at Palemonas, Panevežys, Riga Central Station, Parnu, Tallinn Airport and Tallinn Central Station.
- Connection from Palemonas Station to Kaunas Central Station and Vilnius Central Station is proposed using the existing 1520 mm gauge line and connection to the Kaunas International Airport using express coach shuttle or a new 1520 mm extension from Palemonas to the Airport.
- Primary intermodal terminals at Tallinn, Riga and Kaunas and secondary intermodal terminals at Panevezys and Parnu.
- Maintenance facilities at Rapla, Riga, and Jonava.
- The route is twin track for its entire length on mainly new alignment
- Some dual gauge (1520/1435) sections are required.

Note: High speed rail passenger service was not considered due to timetabling conflicts within a mixed train service network unjustifyabl with HSR infrastructure high initial capital costs associated.

In considering and evaluation the best feasible option, it was determined to list various alternatives that could be considered during lated stages of the project development. Three solutions were identified along the corridor that would merit further study and analysis:

1) Suboption 1: Tallin – Rapla (See Figure 26) via the existing alignment. This Sub-option should be considered if N-S Service along the existing 1520 mm gauge route is significantly reduced.

2) Suboption 2 – Surju – Skulte via Limbazi (See Figure 26, 27) this Sub-option should be considered if land expropriation becomes problematic along the newly proposed alignment, the segment between Limbazi and Skulte is already reserved for Rail Baltic acurrent territorial plans.
3) Suboption 3 – Marijampole – LT/Polish Border (See Figure 28). This Sub-option should be considered, since this segment and its upgrades to 1435 mm gauge is already under construction. Although, it has been determined by AECOM that the use of this updated infrastructure will not meet the current TSI's for this project.

In addition two additional location specific options must be considered in close coordination with the local municipalities in Riga and Kaunas.

1) City of Riga – Central Station link to Riga International Airport via existing 1520 mm gauge upgrade (shuttle express rail service) or via extension of city of Riga public transportation tram network.
2) City of Kaunas – Palemonas link to Kaunas Central station via existing 1520 mm gauge upgrade (express rail shuttle service) or via dual gauge upgrade through existing tunnel to connect new 1435 mm gauge service directly to Kaunas central station.

Figure 26 - The Preferred Alternative

Figure 27 – Best Feasible Option – Red Route

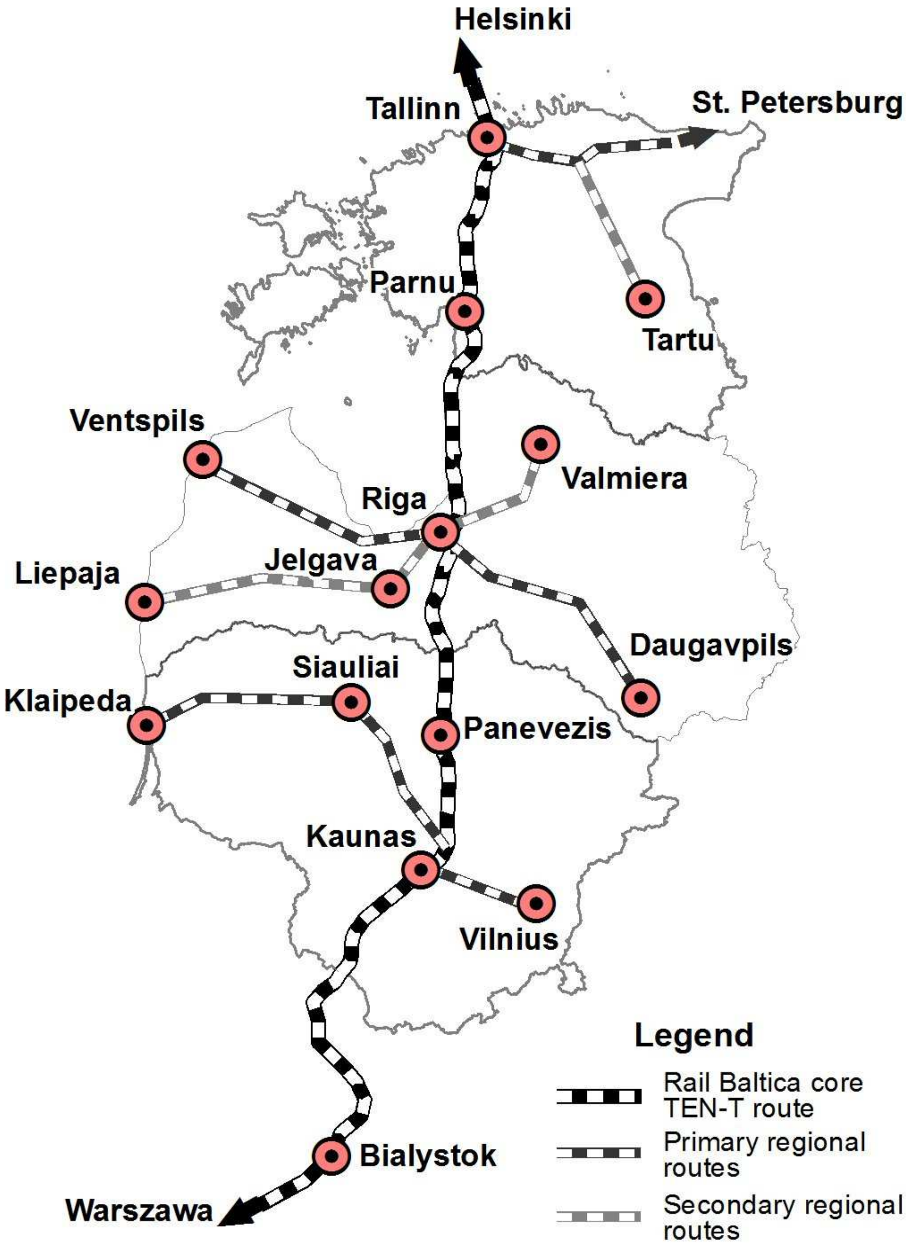


Figure 28 - Journey Times – Preferred Option – Red Route

Section code	Cross-section type	Length, km	Passenger Design speed limits	Passenger Journey Times	Freight Design speed limits	Freight Journey Times
A	1,2	10,6				
B	2	10,1			60	0,17
C	2	5,8			60	0,10
Tallinn				0,08		
E (1)	2,3	6,9	80	0,09		
TLL				0,05		
E (2)	2,3	8,7	80	0,11		
D	1	2,4	80	0,03	60	0,04
F	1	10,9	160	0,07	100	0,11
G	1	27,5	240	0,11	120	0,23
H	1	83,6	240	0,35	120	0,70
Parnu				0,05		
I	2	4,0	80	0,05	80	0,05
J	1	58,3	240	0,24	120	0,49
K	1	61,1	240	0,25	120	0,51
L	1	30,8	240	0,13	120	0,26
M	1	5,2	240	0,02	120	0,04
N	1	15,4	240	0,06	120	0,13
O (in)	1,3	25,4	80	0,32	80	0,32
Riga				0,08		2,00
O (out)	1,3	25,4	80	0,32	80	0,32
P	1	71,7	240	0,30	120	0,60
Q (1)	1	62,5	240	0,26	120	0,52
Panevezys				0,05		
Q (2)	1	80,7	240	0,34	120	0,67
R	1	23,9	160	0,15	120	0,20
Kaunas				0,08		2,00
S	2	15,4	80	0,19	60	0,26
T	1	61,8	240	0,26	120	0,52
U	1	10,9	240	0,05	120	0,09
V	1	7,6	200	0,04	120	0,06
W	2	1,1	160	0,01	100	0,01
TOTAL:		**727,7**	**170**	**4,13**	**68**	**10,38**

Note: Section codes are included in the reference drawings included in Appendix G

Journey times will differ between the Rail Baltica Core TEN-T 1435mm route and the regional 1520mm rail network. The regional rail network journey times as were considered in the future Business as Usual case scenario (at max speeds of at least 120 kmh without any restrictions) are roughly similar to travel times via the road network. The current passenger rail network is considerably slower (i.e. journey time from Riga to Valmiera is currently 2 hours 20 minutes). Other key urban centers in the Baltic States that are not directly on the 1435mm gauge line that have been considered for connection to the Rail Baltica line are Tartu, Daugavpils, Ventspils, Jelgava, Liepaja, Sauliai, Klaipeda and Vilnius.

Figure 29 – Journey Times (core vs. regional network) and Connectivity (Destinations)

8.2 Compliance with Existing Spatial Plans

The selected alternative (Option 1 – The Red Route) is defined in the national plans and strategies of Latvia and Estonia, but with different priority levels. A railway corridor around the Riga agglomeration is foreseen in both the regional and local level planning documents. In Lithuania the alternative is defined just from Kaunas to the Lithuania/Polish border in the Long-term Strategy (until 2025) of the Lithuanian Transport System Development Plan. The same section of the route is also defined in the Lithuanian regional spatial planning documents. From a planning perspective therefore it is important that in the near future the selected preferred route is defined in the regional level spatial plans and development strategies for following administrative levels – Harju, Rapla, Parnu counties in Estonia, Riga and Zemgale planning regions in Latvia, and Panevezys and Kaunas districts in Lithuania. In total, the route crosses 16 local municipalities, Tallinn and Parnu cities and Rapla town in Estonia, 13 local municipalities, Riga city, Saulkrasti, Salaspils and Bauska towns in Latvia, and 8 local municipalities, Kaunas city, Panevezys and Marijampoles towns in Lithuania.

Table 87 - Municipalities impacted by Rail Baltica

Lithuania:	**Latvia:**	**Estonia:**
Kaunas	Riga	Tallinn
Panevezis	Bauska	Parnu
Marijampole	Salaspils	Rapla
Marijampoles rajonas	Saulkrasti	Haademeeste vald
Prienai rajonas	Iecavas novads	Surju vald
Kaunas rajonas	Baldones novads	Sauga vald
Kaisiadoris rajonas	Kekavas novads	Are vald
Jonavas rajonas	Salaspils novads	Halinga vald
Kedainiai rajonas	Stopinu novads	Marjamaa vald
Panevezis rajonas	Bauskas novads	Raikkula vald
Pasvalis rajonas	Garkalnes novads	Rapla vald
	Adazu novads	Kohila vald
	Sejas novads	Kiili vald
	Saulkrastu novads	Rae vald
	Limbazu novads	Juuru vald
	Salacgrivas novads	Paikuse vald
	Ropazu novads	Saarde vald
		Saku vald
		Tahkuranna vald

On average, in order to follow the necessary planning procedures the selected route has to be designated in the spatial plans of the above listed administrative territories. The municipalities have to initiate and develop amendments to the existing spatial plans or develop new spatial plans for their territories. Spatial plans are planning documents that are subject to strategic environmental assessment. In average this process takes at least one year as it involves various public consultations.

All currently reserved territories must remains reserved until the nest planning stages. All municipalities that are located in the potenctial Rail Baltica “Red route” corridor should forsee this project in local planning document.

Figure 30 - Estonia Municipalities Map

Figure 31 - Latvia Municipalities Map

Figure 32 - Lithuania Municipalities Map

8.3 Effect on Natura 2000 Sites

Following the selection of the preferred route, an additional assessment has been performed in order to analyse further the potential impact on the various environmental aspects including biodiversity. The summary of the information related to the Natura 2000 territories that are traversed by the selected route is presented in Figure 30 and Table 86. Although the table covers exclusively the Natura 2000 territories which are crossed by the proposed route, further evaluation during subsequent design stages, will incorporate the assessment of all the territories identified during the preliminary investigation stage and the impact on all territories within the 2 km wide proposed corridor. In addition, impact mitigation measures will be proposed as part of this future analysis.

A comparison of the Natura 2000 territories in all three Baltic States demonstrates that the protected territories were created with a similar, yet somewhat different outlook. For instance, in Estonia many smaller sized protected areas can be found, aimed at conservation of just one species, for example the black stork (*Ciconia nigra*). Taking into consideration that this species is sensitive to anthropogenic disturbance, it is also necessary to evaluate broader territories, exceeding the regions within the protected areas. As such, the future investigations will present a detailed analysis of the impact of the route on the species migratory routes, taking into consideration the important role that the Natura 2000 territories play in the conservation of the various ecosystem functions.

In general, wherever possible, the proposed route was designed to bypass the Natura 2000 sites. As a result the key environmental areas crossed are mainly the various rivers and river valleys. All the rivers crossed, depending on the length and the size of their catchments; represent ecological corridors of various levels of importance. At the detailed design stage it is important to assess the ecosystem value within each Natura 2000 territory and make the necessary adjustments to the route in order to minimise the potential impact on the protected species and habitats.

In order to minimise the fragmentation of the natural habitats, it is advisable, wherever possible, to ensure that the proposed route utilises the same overall corridor as other linear infrastructure objects. Additional environmental assessments and specific field research must be conducted at later planning/design stages to determine if the preferred alignment may need to be slightly adjusted at both Natura 2000 sites "Vitrupes ieleja" (LV0530500) and „Sventosios upe zemiau Andrioniskio" (LTUKM0002) to minimize disruption of these natural habitats.

In addition, environmental aspects such as geological sink holes and agricultural aspects are significant, but are not excluding factors. Each issue would require specific technical/ regulatory solutions to ensure safe traffic. These aspects have to be considered and analyzed in the EIZ study and only then decision makers will have sufficient information for acceptance or refusal of planned activity

Figure 33 - "Vitrupes ieleja" (LV0530500) and „Sventosios upe zemiau Andrioniskio" (LTUKM0002)

Figure 34 - Natura 2000 Sites Crossed by the Preferred Route

Table 88 - Description of the Natura 2000 sites crossed by the Alternative I

Name of site	Site code	Area, ha	Site type	Annex 1, habitat types	Annex 1, Territory covered by habitat, %	Birds listed on Annex I of Council directive 79/409/EEC		Listed on Annex II of Council directive 92/43/EEC					Comment
						Birds, Annex 1	Regularly occurring Migratory Birds	Mammals	Amphibians	Fishes	Invertebrates	Plants	
Lemmejõe	EE0040342	5	Habitats directive site (SCI)	*3260*	100	No data	No data	*Lutra lutra*	No data	*Lampetra fluviatilis*	*Unio crassus*	No data	Crossing the river
Pärnu jõe	EE0040345	862	Habitats directive site (SCI)	*3260, 6450, 6530*	100	No data	No data	No data	No data	*Cobitis taenia, Cottus gobio, Lampetra fluviatilis, Salmo salar*	Unio crassus	No data	Crossing the river
Reiu jõe	EE0040384	104	Habitats directive site (SCI)	*3260*	100	No data	No data	*No data*	No data	*Cobitis taenia, Cottus gobio, Lampetra fluviatilis*	*Unio crassus*	No data	Crossing the river
Salacas ieleja	LV0302200	6251	Birds and habitats directives site (C)	*9180, 91D0, 8310, 8220, 7160, 7110, 6430, 6210, 3260, 91E0, 6510, 6270, 6450, 6230, 7150, 7220*	24.5	*See Note 1*	No data	*Lutra lutra, Myotis dasycneme, Ursus arctos*	No data	*Cobitis taenia, Cottus gobio, Lampetra fluviatilis, Salmo salar, Rhodeus sericeus amarus, Pelecus cultratus, Misgurnus fossilis, Lampetra planeri*	*Leucorrhinia pectoralis, Ophiogomphus cecilia, Osmoderma eremita, Unio crassus, Vertigo angustior, Vertigo geyeri*	*Agrimonia pilosa, Dicranum viride*	Crossing the river
Garkalnes mezi	LV0527400	1785	Birds and habitats directives site (C)	*9010, 4030*	8.5	*See Note 2*	No data	No data	No data	No data	Ophiogomphus cecilia	Pulsatilla patens	Crossing forest area

Vitrupes ieleja	LV0530500	126	Habitats directive site (SCI)	*9180, 91F0, 9010, 8220, 3260, 6270, 6450*	45.5	*See Note 3*	No data	Lutra lutra	No data	*Cobitis taenia, Cottus gobio, Lampetra fluviatilis, Lampetra planeri, Salmo salar*	*Lycaena dispar, Unio crassus, Vertigo genesi*	No data	Crossing the river
Jiesios upe ir jos sleniai	LTKAU0014	388	Habitats directive site (SCI)	*9180*	11	No data	No data	Lutra lutra	No data	No data	Cucujus cinnaberinus	No data	Crossing the river
Sventosios upe zemiau Andrioniskio	LTUKM0002	1654	Habitats directive site (SCI)	*No data*	*No data*	No data	No data	Lutra lutra	No data	*Cobitis taenia, Lampetra fluviatilis, Rhodeus sericeus amarus, Sabanejewia aurata, Salmo salar*	Ophiogomphus cecilia	No data	Crossing the river
Neries upe	LTVIN0009	2395	Habitats directive site (SCI)	*3260*	11	No data	No data	Lutra lutra	No data	*Aspius aspius, Cobitis taenia, Cottus gobio, Lampetra fluviatilis, Rhodeus sericeus amarus, Salmo salar*	Ophiogomphus cecilia	No data	Crossing the river
Kalvarijos apylinkes	LTKALB001	19751	Birds directive site (SPA)	*6210, 6430, 6450, 6510*	No data	*See Note 4*	No data	No data	No data	No data	No data	No data	Crossing agricultural and forest areas

Data source: Natura 2000 standard data form (http://natura2000.eea.europa.eu)

Habitat Code	Habitat description
3260	Water courses of plain to mountain levels with the *Ranunculion fluitantis* and Callitricho-Batrachion vegetation
6210	Semi-natural dry grasslands and scrubland facies on calcareous substrates (Festuco-Brometalia) (* important orchid sites)
6230	Species-rich Nardus grasslands, on silicious substrates in mountain areas (and submountain areas in Continental Europe)
6270	Fennoscandian lowland species-rich dry to mesic grasslands
6430	Hydrophilous tall herb fringe communities of plains and of the mountain to alpine levels
6450	Northern boreal alluvial meadows
6450	Northern boreal alluvial meadows
6510	Lowland hay meadows (Alopecurus pratensis, Sanguisorba officinalis)
6530	Fennoscandian wooded meadows
7110	Active raised bogs

7150	Depressions on peat substrates of the Rhynchosporion
7160	Fennoscandian mineral-rich springs and springfens
7220	Petrifying springs with tufa formation (Cratoneurion)
8220	Siliceous rocky slopes with chasmophytic vegetation
8310	Caves not open to the public
9180	Tilio-Acerion forests of slopes, screes and ravines
4030	European dry heaths
9010	Western Taiga
91E0	Alluvial forests with Alnus glutinosa and Fraxinus excelsior (Alno-Padion, Alnion incanae, Salicion albae)
91F0	Riparian mixed forests of Quercus robur, Ulmus laevis and Ulmus minor, Fraxinus excelsior or Fraxinus angustifolia, along the great rivers (Ulmenion minoris)

Note 1: *Alcedo atthis, Bonasa bonasia, Ciconia ciconia, Ciconia nigra, Crex crex, Dendrocopos leucotos, Dendrocopos medius, Dryocopus martius, Ficedula parva, Glaucidium passerinum, Lullula arborea, Lanius collurio, Pandion haliaetus, Picoides tridactylus, Picus canus, Strix uralensis, Tetrao urogallus*

Note 2: *Aegolius funereus, Anthus campestris, Caprimulgus europaeus, Ciconia nigra, Coracias garrulus, Crex crex, Dryocopus martius, Lanius collurio, Lullula arborea, Pernis apivorus, Picus canus*

Note 3: *Alcedo atthis, Bonasa bonasia, Caprimulgus europaeus, Crex crex, Dendrocopos leucotos, Dendrocopos medius, Dryocopus martius, Glaucidium passerinum, Lanius collurio, Lullula arborea, Picoides tridactylus, Strix uralensis*

Note 4: *Alcedo atthis, Anthus campestris, Asio flammeus, Botaurus stellaris, Caprimulgus europaeus, Chlidonias niger, Ciconia ciconia, Circus aeruginosus, Circus pygargus, Crex crex, Grus grus, Lullula*

8.4 Land Use of Perspective Corridor

In order to characterize the land-use type within the 2 km-wide corridor of the selected route, the land use types were analysed based on the classification provided by the Corine Land Cover (CLC) database (www.eea.europa.eu/data-and-maps/data/). This database was created by the European Topic Centre for Land Use and Spatial Data Information and is widely used by the European Environmental Agencies of the EU member states when analysing land cover, land-use change, land-use planning etc. The Corine Land Cover database provides land cover data for all of the European States produced using a uniform methodology with 100m precision and represents the land cover for the year 2006. Within the selected route corridor 24 land cover classes can be identified out of the total 44 recognised by Corine in Europe.

The total area of the 2km wide corridor is 132,460 ha. Agricultural land is the prevailing land cover type within the corridor, covering 48% of the total corridor area and is mainly found in the southern parts of Latvia and Lithuania. Arable land constitutes approximately half of the agricultural land. The remaining half is characterised by complex cultivation patterns. This type of complex agricultural land use is more common in Estonia and northern Latvia where the territory is characterised by a highly heterogenic mosaic pattern.

The second most common land use is forest which covers up to 37% of the total proposed corridor area and can be mainly found in Estonia and northern Latvia. The major part of the forest area is covered by mixed and coniferous forests, with small regions of broad-leaved forest. Semi-natural and artificial surfaces cover 7% and 6% of the total corridor area respectively. The major part of the semi-natural area is occupied by scrub, which in the Baltic States often appears on abandoned agricultural land. Taking into consideration that the proposed railway route deliberately bypasses urban areas, it is not surprising that the area of artificial surface is low. In general the urban areas crossed are adjacent to the planned railway stations (Tallinn, Parnu, Riga, Panevezys, Kaunas). Within the broad class of urban land cover, the major types are discontinuous urban fabric, industrial or commercial units, green urban areas and road and rail networks and associated land. Here, it is important to note that the proposed route within the urban areas goes through territories that are currently used as the railway corridors; therefore there will be no significant change in the land use within these urban areas.

Finally, an insignificant proportion (approx. 1%) of the total perspective area is covered by wetlands and water bodies.

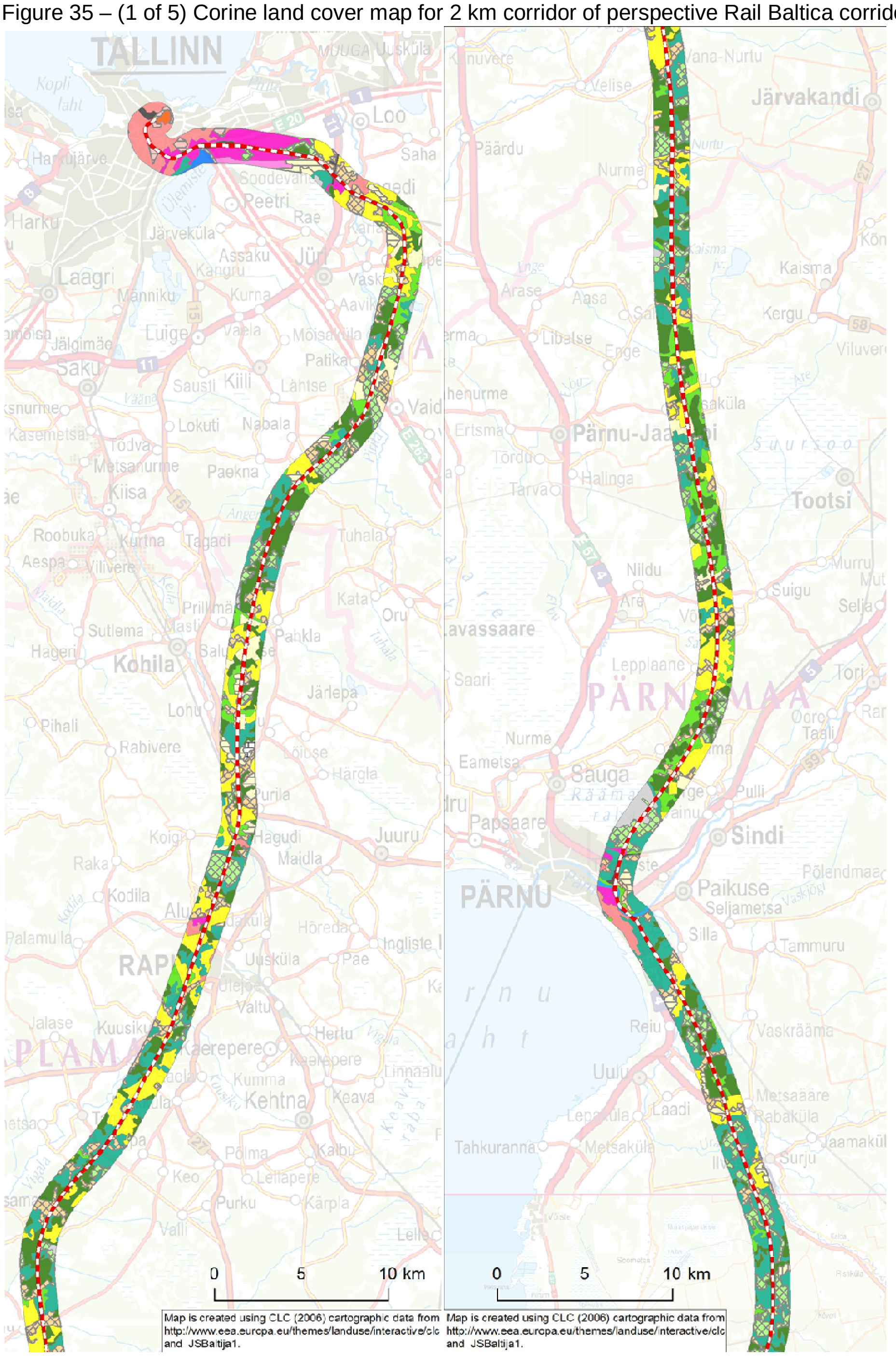
Table 89 - Distribution of CLC classes in 2km corridor of the Preferred Alternative

The distribution of CLC classes in 2 km corridor of the Alternative I

CLC code	CLC class	Area, ha	Count
	Artificial surfaces		
	Urban fabric		
111	Continuous urban fabric	112	3
112	Discontinuous urban fabric	3838	61
	Industrial, commercial and transport units		
121	Industrial or commercial units	2692	39
122	Road and rail networks and associated land	456	9
124	Airports	143	1
	Mine, dump and construction sites		
131	Mineral extraction sites	300	6
133	Construction sites	30	3
141	*Artificial, non-agricultural vegetated areas* Green urban areas	493	11
142	Sport and leisure facilities	206	4
	Agricultural areas		
	Arable land		
211	Non-irrigated arable land	36164	167
222	Permanently irrigated land	482	7
	Pastures		
231	Pastures	5605	100
	Heterogeneous agricultural areas		
242	Complex cultivation patterns	13461	168
243	Land principally occupied by agriculture, with significant areas of natural vegetation	7576	169
	Forest and semi natural areas		
	Forests		
311	Broad-leaved forest	11088	177
312	Coniferous forest	18400	188
313	Mixed forest	19877	260
	Scrub and/or herbaceous vegetation associations		
321	Natural grasslands	84	2
322	Moors and heathland	66	1
324	Transitional woodland-shrub	8917	183
	Wetlands		
	Inland wetlands		
411	Inland marshes	149	6
412	Peat bogs	1272	8
	Water bodies		
	Inland waters		
511	Water courses	608	6
512	Water bodies	440	9
	Total:	***132460***	

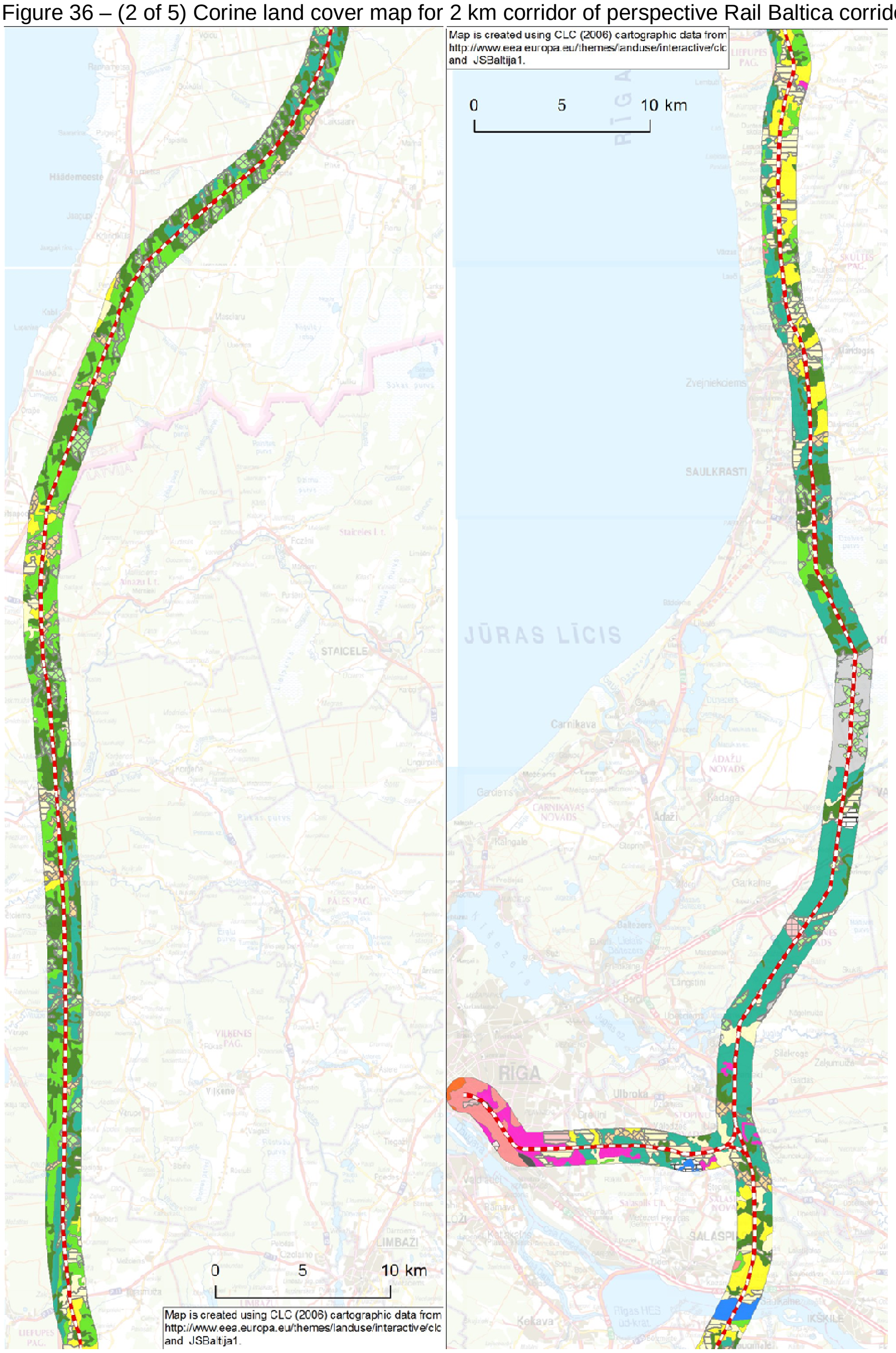
Given that agricultural land and forests occupy the greatest part of the proposed corridor in the next stages of the project development it is necessary to consider measures that will minimise the impact of the land cover fragmentation throughout the perspective route.

Figure 35 – (1 of 5) Corine land cover map for 2 km corridor of perspective Rail Baltica corridor, section Tallinn-Raplama-Parnu



(Legend on Map page 5 of 5)

Figure 36 – (2 of 5) Corine land cover map for 2 km corridor of perspective Rail Baltica corridor, section Parnu-Limbazi-Salaspils

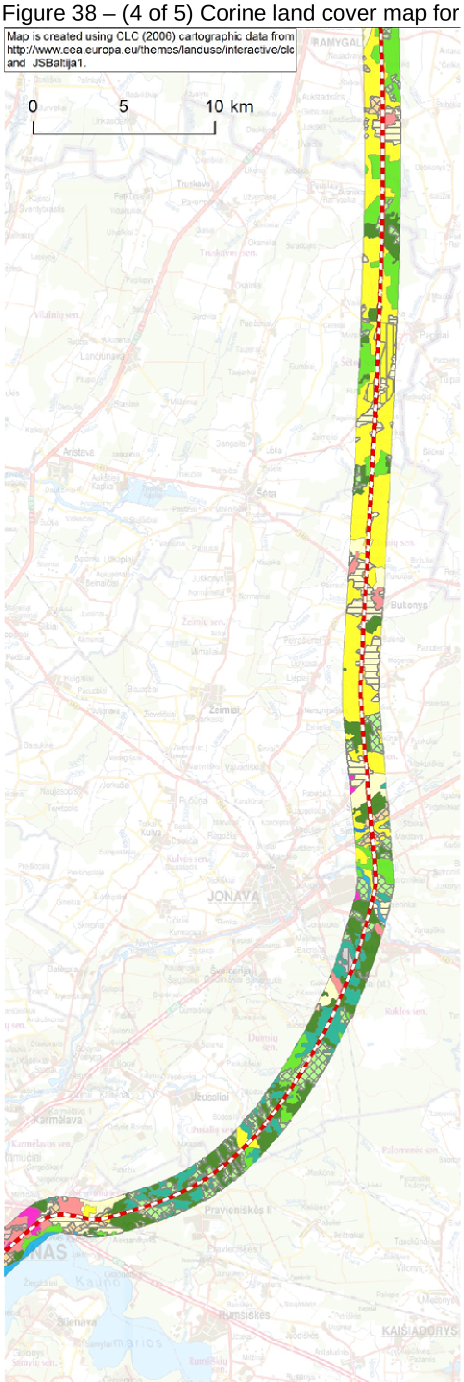


(Legend on Map page 5 of 5)

Figure 37 – (3 of 5) Corine land cover map for 2 km corridor of perspective Rail Baltica corridor, section Salaspils-Bauska-Ramigala

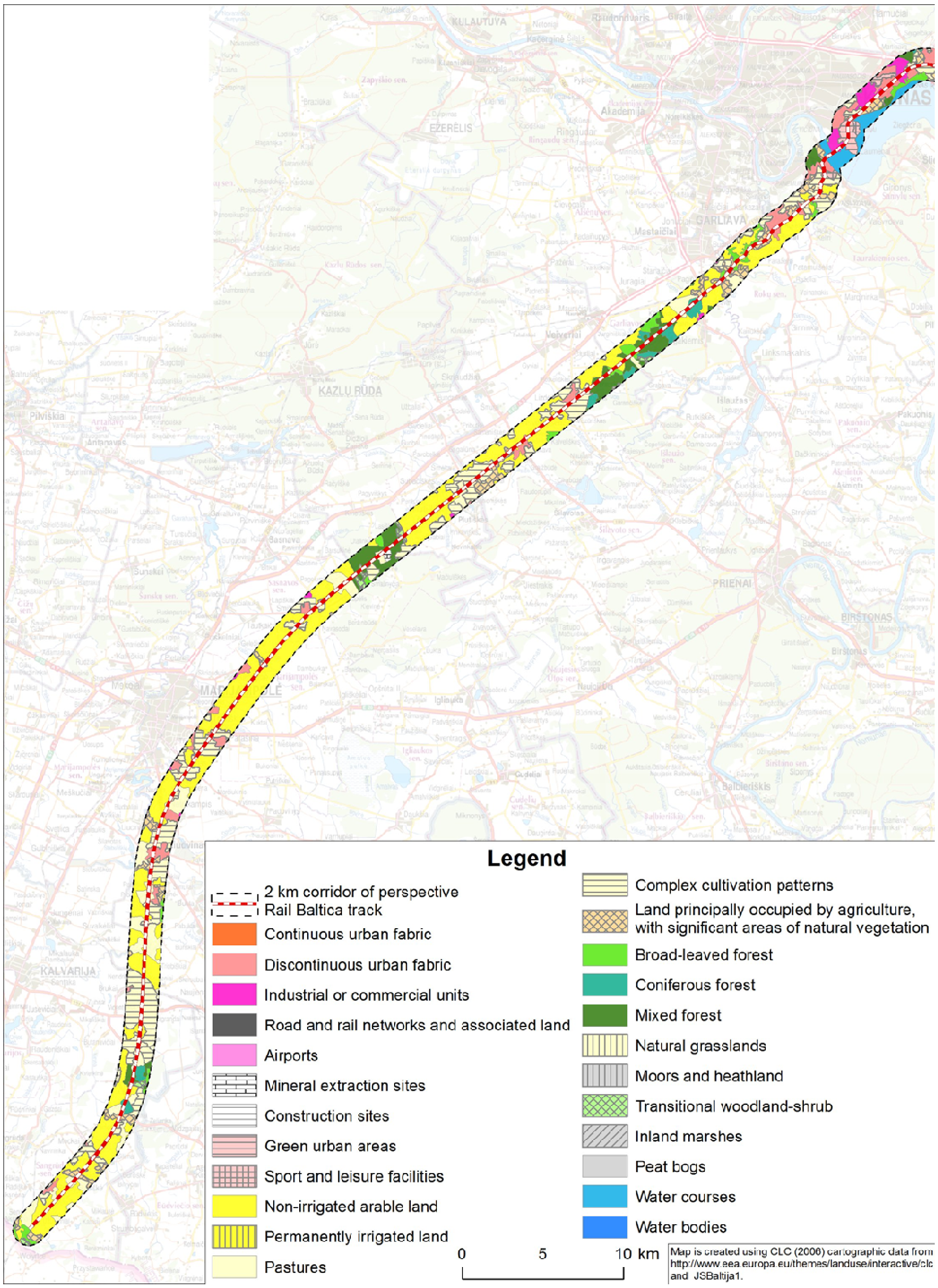
(Legend on Map page 5 of 5)

Figure 38 – (4 of 5) Corine land cover map for 2 km corridor of perspective Rail Baltica corridor, section Ramigala-Kaunas



(Legend on Map page 5 of 5)

Figure 39 – (5 of 5) Corine land cover map for 2 km corridor of perspective Rail Baltica corridor, section Kaunas-border of Lithuania/Poland



8.5 Proposed Service Provision

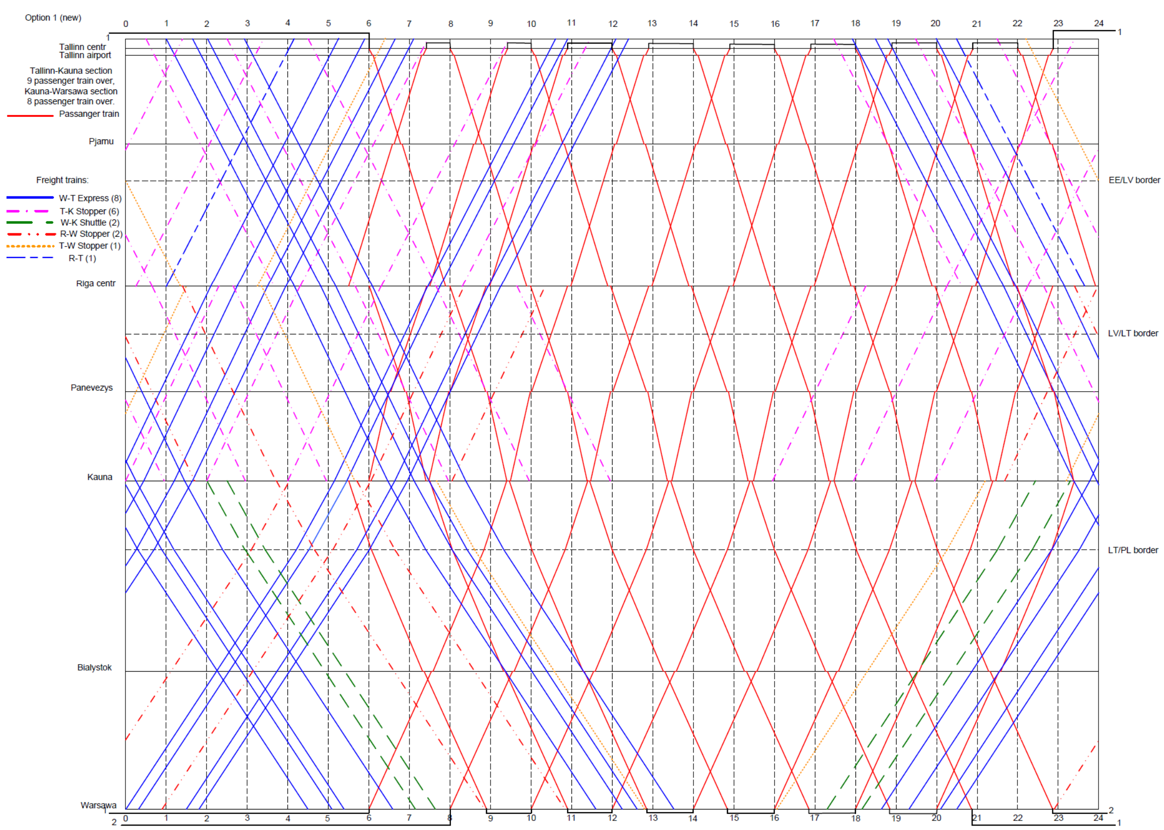
To maximize effectiveness, the operational framework for Rail Baltica aims to utilize the infrastructure asset to the maximum extent possible which in turn will require less train sets for both passenger and freight service. This gives the best return on investment, utilization of assets and lower operating costs.

Initial assumptions for the mixed-train service:

1) The timetable has been based on a 24 hour day operating on six days of the week.
2) The track will need to be inspected roughly once a week.
3) Sundays have been identified for a limited service to enable planned maintenance or reactive maintenance should inspection and testing require it.
4) Facing and trailing crossovers will be situated along the track to facilitate single line working
5) Maintenance can be carried out on a single line at a time (this will not apply to crossover areas where all lines will need to be blocked to undertake works.
6) Periodic blocks of a longer period (18-27 hours) will be available but not on a planned weekly basis
7) Time difference between Warsaw and Baltic States not taken into consideration duration are critical factors in determining service provisions. Exact and time zones need to be clarified at final design stages and integration with local arrivals and departures.

These assumptions will provide the basis for enabling the passenger and freight traffic to meet its market demand requirements in a more cost effective manner (i.e. reduce the number of train sets through availability of a longer operating day; and need for less stabling/handling sidings; less crew).

Figure 40 - Proposed Mixed-train Service Timetable



8.5.1 Passenger Services

A daily every two hour passenger service has been anticipated based on the passenger demand models. Sunday service may be limited on an infrequent basis to enable planned maintenance.

Services

Passenger's trains start from Tallinn at 06:00 a.m., from Riga to Tallinn at 05.30 a.m., from Riga to Warsaw direction at 06.00 a.m., from Kaunas to Tallinn direction at 06.00 and 07.30 a.m., from Kaunas to Warsaw at 05:30 a.m., and from Warsaw at 06.00 and 08:00 a.m.

Further the trains are sent from the starting station (Tallinn and Warsaw) every two hours. The last trains are sent: from Tallinn at 22.00, which travel to Riga and stay there till 5:30 to drive back to Tallinn. The other two trains leaving from Tallinn at 20.00 and 18.00 run until Kaunas to start on the way back to Tallinn at 6:00 and 7:30 a.m. The last train leaves from Warsaw at 20.00 and runs until Kaunas to start on the way back to Warsaw at 5:30 a.m. The former train leaves from Warsaw at 18.00 and runs until Riga to start on the way back to Warsaw at 6:00 a.m.

Overtaking points (crossovers or passing loops) are necessary at all intermediate stations: Parnu, Riga, Panevezys, Kaunas, Bialystok and LT (border LT).

Based on the timetable, 8 (eight) locomotives or ICE trains are required (not including reserve) for 9 pairs of passenger trains serving direction Tallinn - Kaunas and 8 pairs of trains serving direction Kaunas - Warsaw.

Infrastructure Requirements

Passenger service is highly dependent on streamlined access, entry and exit from each of the stations proposed on the line.

Estonia

- Tallinn Central Station
  - 2 European gauge tracks and platforms (dual track if required)
  - Extension of service to passenger ferries via local municipality public transit extension
- Tallinn Airport Station
  - 2 European gauge tracks and platforms (dual track if required)
  - Extension of service to airport via local municipality public transit extension°
  - Passing loop
- Parnu Station
  - 2 European gauge tracks and platforms (dual track if required)
  - Passing loop

Latvia

- Riga Central Station
  - 2 European gauge tracks and platforms (dual track if required) – Preferred location at central station platform No.1. (Other locations can be considered in conjunction with Airport rail link final solution).
  - Extension of service to airport via local municipality public transit and/or railway express shuttle via 1520mm gauge alignment.
  - Additional crossover/passing opportunities will be provided off of the mainline on the Riga spur between Upeslejas and Riga Central Station.

Lithuania

- Panevezys Station
  - 2 European gauge tracks and platforms (dual track if required)
  - Passing loop

- Kaunas (Palemonas) Station
  - 2 European gauge tracks and platforms (dual track if required)
  - Extension of service to airport via local municipality public transit.
  - Extension to Kaunas Central Station and Vilnius Central Station via existing 1520mm rail infrastructure (Platform configuration will require further definition)
  - Passing loop

8.5.2 Freight Services

The freight infrastructure requirements for Rail Baltica bave been based on the tonnages predicted in the “Medium” Case for the Red Route. Timetabling and infrastructure requirements are heavily dependent on demand.

Figure 41 - 2020 Intermodal Demand in Trains per Day

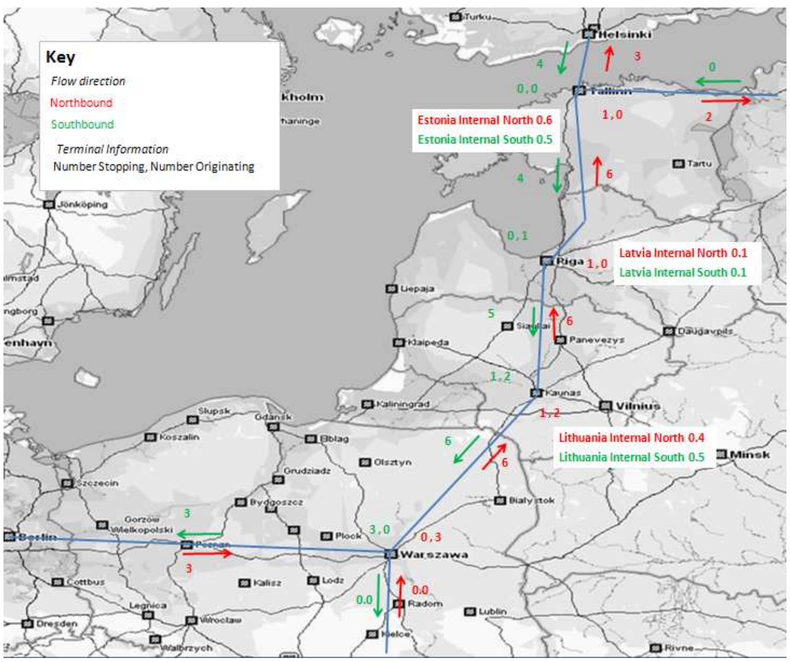
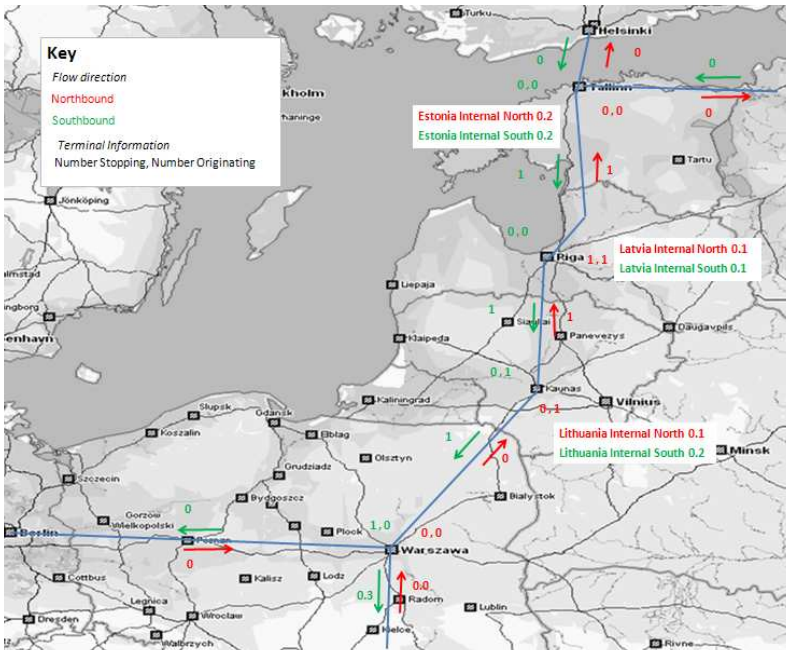


Figure 42 - 2020 Bulk Demand in Trains per Day



Services

The following freight service timetable for each of the planned freight service types on the preferred alternative has been established.

It has been calculated that the following services are sufficient to meet the demand:

Table 90 - Services and number of daily trains

Train Type	Service Types	2020	2030	2040
Intermodal	Warsaw-Tallinn Express	2	4	8
Intermodal	Warsaw-Kaunas Shuttle	2	2	2
Intermodal	Kaunas-Tallinn Stopper	2	4	6
Intermodal	Warsaw-Tallinn-Kaunas	1	1	1
Intermodal	Kaunas-Tallinn-Warsaw	1	1	1
Bulk	Riga-Tallinn	1	1	1
Bulk	Riga-Warsaw Stopper	2	2	2
Total		**11**	**15**	**21**

Tables below shows a possible way to accommodate the trains with contingency for maintenance.

Table 91 - Stabling of Trains in 2020

Train Type	Service Types	Total	Warsaw	Kaunas	Riga	Tallinn
Intermodal	Warsaw-Tallinn Express	2	1			1
Intermodal	Warsaw-Kaunas Shuttle	2	1	1		
Intermodal	Kaunas-Tallinn Stopper	2		1		1
Intermodal	Warsaw-Tallinn-Kaunas	1		1		
Intermodal	Kaunas-Tallinn-Warsaw	1	1			
Bulk	Riga-Tallinn	1			1	
Bulk	Riga-Warsaw Stopper	2	1		1	
Total Intermodal		**8**	**3**	**3**		**2**
Total Bulk		**3**	**1**		**2**	

Table 92 - Number of trains stabled in each country and contingency

Country	Type	2020	2030	2040
Poland	Intermodal	3	4	7
Lithuania	Intermodal	3	4	5
Estonia	Intermodal	2	4	6
Latvia	Bulk	3	3	3
Contingency	Intermodal	1	1	2
Contingency	Bulk	1	1	1
Total	**Intermodal**	**9**	**13**	**20**
Total	**Bulk**	**4**	**4**	**4**

Freight train schedule lines mainly were located on night time to minimize the number of overtaking points. Overnight intermodal trains that arrive at their terminals by 6am/7am enable a morning delivery to be made which offers a good level of customer service. This is seen as being important in rail winning modal share from road freight. The reality is that freight companies will want to use Rail Baltica at the times that suit their costumers and overall business needs. Even though the indicative timetable shows few freight services running in the day time, the infrastructure manager will need to be flexible in the provision of freight train paths.

Priority was given to freight trains group (Priority) of Warsaw-Tallinn Express (8 pairs of trains) and Tallinn-Warsaw Stopper (1 pair of trains). The Tallinn-Warsaw Stopper waiting time on Riga and Kaunas stations will be 2 hours on every station.

The second big group of freight trains (Group 2) are Tallinn-Kaunas Stopper (6 pairs of trains) and Warsaw-Kaunas Shuttle (2 pairs of trains). The train Tallinn-Kaunas Stopper will wait on Riga station – 2 hours.

The third group of freight trains (Group 3) are Tallinn-Riga (1 pair of trains) and Riga-Warsaw Stopper (2 pairs of trains are for the movements of bulk on the routes).

Infrastructure Requirements

Based on the demand and services discussed above, the infrastructure requirements have been calculated for each country, this infrastructure is sufficient to run the services.

2020 infrastructure

Figure 39 below shows the infrastructure required at each of the major terminals, it should be noted that each country will require a domestic siding possibly in conjunction with a freight loop.

Estonia

- Doubled ended siding with engine runround for bulk commodity trains
- Tallinn Intermodal terminal (Lagedi)
  - 2 European gauge double ended tracks plus engine runround
  - 1 Dual Gauge track with engine runround (would facilitate through Russian services)
- Maintenance facility for 10% spare intermodal trains and stabling and rail infrastructure (Rapla)
- A domestic siding in south Estonia in the vicinity of a freight loop

Latvia

- Riga Bulk Terminal (via 1520mm gauge line)
  - 2 track double ended siding and engine runround
- Riga Intermodal Terminal (Salaspils)
  - 2 track double ended siding and engine runround
- Possible Riga Port Siding and engine runround (via 1520mm gauge line)
- Freight loop
- Maintenance facility for bulk trains and rail infrastructure (Krievupe/Riga)
- A domestic siding in south Latvia in the vicinity of a freight loop (Iecava)

Lithuania

- Kaunas Intermodal Terminal (Palemonas)
  - 4 track double ended sidings and engine runround
- Bulk doubled ended siding with engine runround
- Maintenance facility for 10% spare intermodal trains and stabling and rail infrastructure (Jonava)
- A domestic siding in the vicinity of a freight loop

Poland

- Warsaw Intermodal Terminal
  - 4 track double ended sidings and engine runround
- Bulk doubled ended siding with engine runround
- Maintenance facility for 10% spare intermodal trains and stabling

2030 Infrastructure

In 2030 it is anticipated that there will be an additional 2 Warsaw-Tallinn intermodal express services and 2 Kaunas-Tallinn intermodal stopper services. In order to accommodate these it will require increasing the intermodal capacity at Tallinn, Kaunas and Warsaw, this can be achieved by building a further 2 tracks with double ended sidings at Tallinn and 1 additional track at each of Kaunas and Warsaw. When the original terminal is built land will be reserved for future-proofing the facility for the additional tracks needed.

2040 Infrastructure

By 2040 it is anticipated that a further 4 Warsaw-Tallinn intermodal express services will be in operation and an additional 2 Kaunas-Tallinn intermodal stopper services will run daily on top of 2030 services. This will require increasing capacity by building 3 further tracks and sidings at Tallinn, 2 further tracks and sidings in Warsaw and 1 further siding in Kaunas.

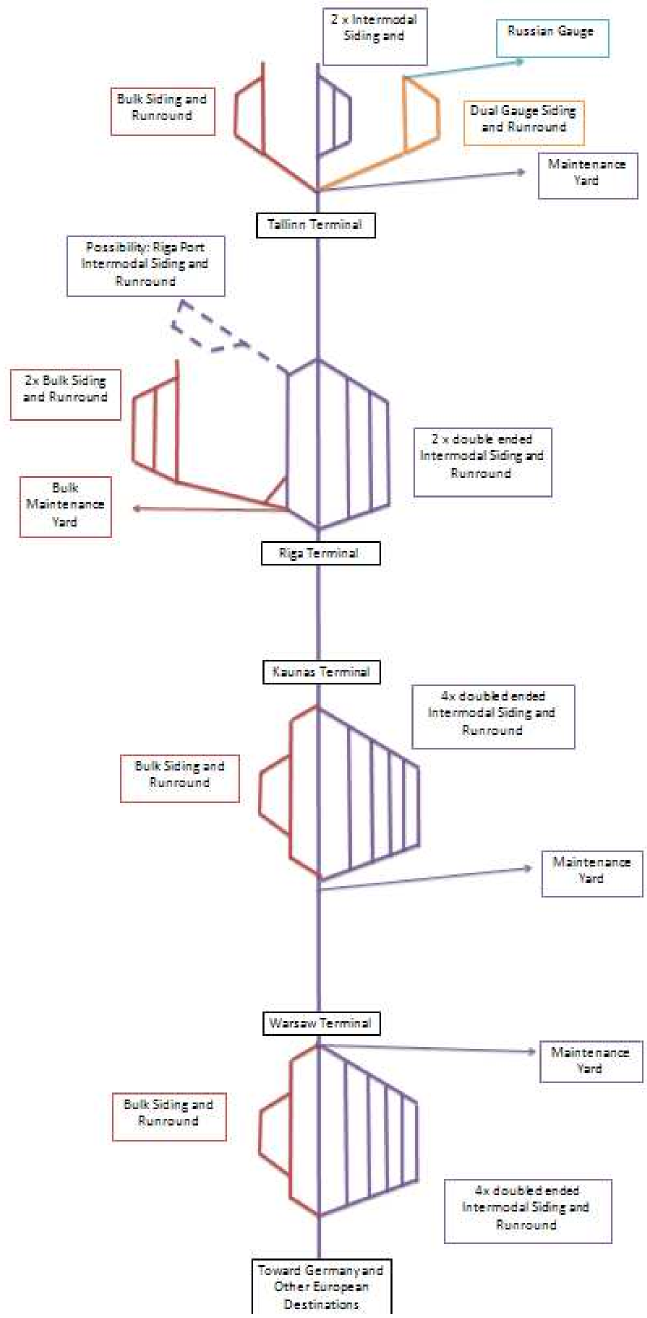
Table below shows the intermodal terminal requirements at Tallinn, Riga, Kaunas and Warsaw for 2020, 2030 and 2040.

Table 93 - Intermodal Terminal Requirements

Location		**Number of Tracks with Sidings**		
		2020	2030	2040
Tallinn	European	2	3	5
	Dual	1	2	3
Riga		2	2	2
Kaunas		4	5	6
Warsaw		4	5	7

It is anticipated that the 2020 infrastructure for bulk will be sufficient to handle the demand in 2040.

Figure 43 - 2020 Infrastructure Requirements



Risks

As with any proposed mixed-train service on independent and dedicated rail infrastructure certain compromises/risks must be evaluated to propose alternate solutions for risk aversion.

Maintenance

The primary risk to the proposed timetable is related to maintenance. Maintenance opportunities are severely limited based on the mixed-services required and the number and types of trains travelling on the route. This could have a potential long term impact on service reliability. The effects of this limited maintenance could be mitigated by over-engineering the track infrastructure (increased capital/construction costs) or incorporating train based methods, such as track recording vehicles, to supplement traditional inspections within the limited maintenance windows (increased operational costs of equipment procurement).

The track infrastructure maintainance technology could comprise train based inspection, monitoring and testing equipment, eg. track geometry, visual inspection, ultrasonic rail testing. Other maintenance activities, such as maintaining track geometry by using high output tamping machines, rail head profile maintenance using high speed grinders, would optimise maintenance output within reduced track access periods. The passing loops would facilitate maintenance access, by allowing operational traffic to by-pass section of track which could be taken for maintenance activity. The passing loops would also, and probably more frequently, be used for operational flexibility to regulate freight trains, allowing fast trains to pass. They should not be used for stabling maintenance vechicles.

The decision of where to locate the maintenance yards and freight terminals are mainly dictated by sensible operational practice and demand. The plan includes provision for stabling and maintenance facilities in each of the Baltic States including Poland on Rail Baltica. This not only shares out the work among the countries on the route and hence is seen to be as fair as possible in terms of new economic activity, but also ensures there is a body of trained staff with knowledge and also parts availability in reasonably close proximity to anywhere on the line. Therefore maintenance facilities are required at Tallinn, Riga, Kaunus and Warsaw. It is suggested that the maintenance facilities are developed in a multi-functional way so that any synergies in train servicing, permanent way, signalling and general maintenance can be made. Therefore sidings used for stabling passenger trains at night could be used for stabling a maintenance or freight train during the day. Similarly train washing and general utilities could be shared across all functions. Passing loops should mainly be used for the main purpose intended and that is to hold slower moving trains whilst faster trains overtake and should not be used as sidings. Passing loops offer flexibility in timetabling and operational running. On a route where there is a significant imbalance between high speed passenger trains and freight trains there is a need to ensure these passing loops are of sufficient length and are located strategically to avoid building in unnecessary delays to either types of train.

Another mitigation tactic would be to include additional crossovers to create discrete route sections which would allow more opportunity for maintenance access with single line working on the adjacent line (increased capital/construction costs). This would also provide enhanced operational flexibility in perturbed situations, i.e. bypassing a failed train or track defect.

Maintainance facilities have been identified in three (3) locations along the Route:

1) Lithuania maintenance facility at Jonava;
2) Latvia maintenance facility at Krievupe
3) Estonia maintenance facility at Rapla

The decision of where to locate the maintenance yards and freight terminals are mainly dictated by sensible operational practice and demand. The specific locations were selected in more remote areas to provide the necessary flexibility for the facility, access to labor, as well as to maximize connections with major roadways.

Overlap of services

Another risk is related to the cross-over/convergence of the EU gauge train sets with the existing 1520mm gauge train sets at stations and freight facilities. The timetable for the new service and the existing service will need to be calibrated to allow for efficient services for both systems.

Table 94 - Passenger Train Service Time Table

Passenger Train Service Time Table

Tallinn-Kaunas section 9 passenger train over.
Kaunas-Warsaw section 8 passenger train over

Stop and waiting station	Departure station	Time	Arrival station	Time	Journey time, h	
	Tallinn	6:00	Warsawa	12:51	6:51	6,9
Warsawa		12:51		14:00	1:09	1,2
	Warsawa	14:00	Tallinn	20:54	6:54	6,9
Tallinn		20:54		22:00	1:06	1,1
	Tallinn	22:00	Riga	23:54	1:54	1,9
Riga		23:54		5:30	5:36	5,6
	Riga	5:30	Tallinn	7:25	1:55	1,9
Tallinn		7:25		8:00	0:35	0,6
	Tallinn	8:00	Warsawa	14:50	6:50	6,9
Warsawa		14:50		16:00	1:10	1,2
	Warsawa	16:00	Tallinn	22:52	6:52	6,9
Tallinn		22:52		6:00	7:08	7,1
	Kauna	5:30	Warsawa	8:54	3:24	3,4
Warsawa		8:54		10:00	1:06	1,1
	Warsawa	10:00	Tallinn	16:55	6:55	6,9
Tallinn		16:55		18:00	1:05	1,1
	Tallinn	18:00	Kauna	21:21	3:21	3,4
Kauna		21:21		6:00	8:39	8,7
	Kauna	6:00	Tallinn	9:25	3:25	3,4
Tallinn		9:25		10:00	0:35	0,6
	Tallinn	10:00	Warsawa	16:51	6:51	6,9
Warsawa		16:51		18:00	1:09	1,2
	Warsawa	18:00	Riga	22:51	4:51	4,9
Riga		22:51		6:00	7:09	7,2
	Riga	6:00	Warsawa	10:54	4:54	4,9
Warsawa		10:54		12:00	1:06	1,1
	Warsawa	12:00	Tallinn	18:54	6:54	6,9
Tallinn		18:54		20:00	1:06	1,1
	Tallinn	20:00	Kauna	23:22	3:22	3,4
Kauna		23:22		7:30	7:08	7,2
	Kauna	7:30	Tallinn	10:54	3:24	3,4
Tallinn		10:54		12:00	1:06	1,1
	Tallinn	12:00	Warsawa	18:51	6:51	6,9
Warsawa		18:51		20:00	1:09	1,2
	Warsawa	20:00	Kauna	23:24	3:24	3,4
Kauna		23:24		5:30	6:06	6,1
	Warsawa	6:00	Tallinn	12:54	6:54	6,9
Tallinn		12:54		14:00	1:06	1,1
	Tallinn	14:00	Warsawa	20:52	6:52	6,9
Warsawa		20:52		6:00	9:08	9,1
	Warsawa	8:00	Tallinn	14:54	6:54	6,9
Tallinn		14:54		16:00	1:06	1,1
	Tallinn	16:00	Warsawa	22:51	6:51	6,9
Warsawa		22:51		8:00	9:09	9,2
						191,8 h

Table 95 - Freight Train (Priority) Service Time Table

Freight Train (Priority) Service Time Table

Tallinn-Warsawa Express (8), Stopper (2)

Stop and waiting station	Departure station	Time	Arrival station	Time	Journey time, h	
	Tallinn	1:00	Warsawa	11:36	10:36	10,6
Warsawa		11:36		18:39	7:03	7,1
	Warsawa	18:39	Tallinn	5:15	10:36	10,6
Tallinn		5:15		17:56	12:41	12,7
	Tallinn	17:56	Warsawa	4:30	10:34	10,6
Warsawa		4:30		19:20	14:50	14,8
	Warsawa	19:20	Tallinn	5:54	10:34	10,6
Tallinn		5:54		18:30	12:36	12,6
	Tallinn	18:30	Warsawa	5:07	10:37	10,6
Warsawa		5:07		20:06	14:59	15
	Warsawa	20:06	Tallinn	6:39	10:33	10,6
Tallinn		6:39		18:48	12:09	12,15
	Tallinn	18:48	Warsawa	5:23	10:35	10,6
Warsawa		5:23		20:30	15:07	15,1
	Warsawa	20:30	Tallinn	7:06	10:36	10,6
Tallinn		7:06		20:00	12:54	12,9
	Tallinn	20:00	Warsawa	6:36	10:36	10,6
Warsawa		6:36		0:00	17:24	17,4
	Warsawa	0:00	Tallinn	10:36	10:36	10,6
Tallinn		10:36		1:39	15:03	15,05
	Tallinn	1:39	Warsawa	12:15	10:36	10,6
Warsawa		12:15		0:20	12:05	12,1
	Warsawa	0:20	Tallinn	10:54	10:34	10,6
Tallinn		10:54		2:00	15:06	15,1
	Tallinn	2:00	Warsawa	12:36	10:36	10,6
Warsawa		12:36		1:30	12:54	12,9
	Warsawa	1:30	Tallinn	12:06	10:36	10,6
Tallinn		12:06		2:56	14:50	14,8
	Tallinn	2:56	Warsawa	13:30	10:34	10,6
Warsawa		13:30		1:48	12:18	12,3
	Warsawa	1:48	Tallinn	12:24	10:36	10,6
Tallinn		12:24		22:12	9:48	9,8
	Tallinn	22:12	Riga	1:21	3:09	3,2
Riga						2,0
	Riga	3:21	Kauna	5:39	2:18	2,3
Kauna						2,0
	Kauna	7:39	Warsawa	12:48	5:09	5,2
Warsawa		12:48		16:04	3:16	3,3
	Warsawa	16:04	Kauna	21:12	5:08	5,1
Kauna						2,0
	Kauna	23:12	Riga	1:30	2:18	2,3
Riga		1:30		3:15	1:45	1,8
	Riga	3:15	Tallinn	6:30	3:00	3,0
						413,6 h

Table 96 - Freight Train (Group 2) Service Time Table

Freight Train (Group 2) Service Time Table

Tallinn-Kauna Stopper (6), Kauna-Warsawa Shuttle (2)

Stop and waiting station	Departure station	Time	Arrival station	Time	Journey time, h	
	Tallinn	17:28	Riga	20:36	3:09	3,2
Riga						2
	Riga	22:36	Kauna	0:57	2:18	2,3
Kauna		0:57		2:30	1:33	1,6
	Kauna	2:30	Warsawa	7:38	5:08	5,2
Warsawa		7:38		17:18	9:40	9,7
	Warsawa	17:18	Kauna	22:26	5:08	5,2
Kauna					1:34	1,6
	Kauna	0:00	Riga	2:18	2:18	2,3
Riga						2,0
	Riga	4:18	Tallinn	7:27	3:09	3,2
Tallinn		7:27		19:28	12:01	12,0
	Tallinn	19:28	Riga	22:39	3:11	3,2
Riga						2,0
	Riga	0:39	Kauna	2:57	2:18	2,3
Kauna		2:57		2:00	23:03	23,1
	Kauna	2:00	Warsawa	7:08	5:08	5,2
Warsawa		7:08		18:10	11:02	11,0
	Warsawa	18:10	Kauna	23:18	5:08	5,2
Kauna		23:18		2:00	2:42	2,7
	Kauna	2:00	Riga	4:18	2:18	2,3
Riga						2,0
	Riga	6:18	Tallinn	9:27	3:09	3,2
Tallinn		9:27		21:30	12:03	12,1
	Tallinn	21:30	Riga	0:39	3:09	3,2
Riga						2,0
	Riga	2:39	Kauna	4:57	2:18	2,3
Kauna		4:57		15:58	11:01	11,0
	Kauna	15:58	Riga	18:15	2:18	2,3
Riga						2,0
	Riga	20:15	Tallinn	23:24	3:09	3,2
Tallinn		23:24		0:30	1:06	1,1
	Tallinn	0:30	Riga	3:39	3:09	3,2
Riga						2,0
	Riga	5:39	Kauna	7:57	2:18	2,3
Kauna		7:57		17:57	10:00	10,0
	Kauna	17:57	Riga	20:15	2:18	2,3
Riga						2,0
	Riga	22:15	Tallinn	1:24	3:09	3,2
Tallinn		1:24		2:30	1:06	1,1
	Tallinn	2:30	Riga	5:39	3:09	3,2
Riga						2,0
	Riga	7:39	Kauna	9:57	2:18	2,3
Kauna		9:57		19:57	10:00	10,0
	Kauna	19:57	Riga	22:15	2:18	2,3
Riga						2,0
	Riga	0:15	Tallinn	3:24	3:09	3,2
Tallinn		3:24		4:30	1:06	1,1
	Tallinn	4:30	Riga	7:39	3:09	3,2
Riga						2,0
	Riga	9:39	Kauna	11:57	2:18	2,3
Kauna		11:57		4:00	16:03	16,1
	Kauna	4:00	Riga	6:18	2:18	2,3
Riga						2,0
	Riga	8:18	Tallinn	11:27	3:09	3,2
Tallinn		11:27		17:28	6:00	6,0
						241,0 **h**

Table 97 - Freight Train (Group 3) Service Time Table

Freight Train (Group 3) Service Time Table

Riga-Tallinn (1), Riga-Warsawa Stopper (2)

Stop and waiting station	Departure station	Time	Arrival station	Time	Journey time, h	
	Riga	1:00	Tallinn	4:09	3:09	3,15
Tallinn		4:09		20:30	16:21	16,4
	Tallinn	20:30	Riga	23:33	3:03	3,05
Riga		23:33		1:24	1:51	1,85
	Riga	1:24	Kauna	3:42	2:18	2,3
Kauna						2
	Kauna	5:42	Warsawa	10:48	5:06	5,1
Warsawa		10:48		22:54	11:42	11,7
	Warsawa	22:54	Kauna	4:02	5:06	5,1
Kauna						2
	Kauna	6:02	Riga	8:20	2:18	2,3
Riga		8:20		23:24	15:04	15,07
	Riga	23:24	Kauna	1:42	2:18	2,3
Kauna						2
	Kauna	3:42	Warsawa	8:48	5:06	5,1
Warsawa		8:48		0:54	16:06	16,1
	Warsawa	0:54	Kauna	6:02	5:08	5,1
Kauna						2
	Kauna	8:02	Riga	10:20	2:18	2,3
Riga		10:20		1:00	14:40	14,7
						119,62 h

8.6 Costing Information

The costs of implementing and operating Rail Baltica are extremely important inputs to determine the economic costs and benefits of the project. Given that the project is in the early stage of the planning process and the cost model is subject to various uncertainties and therefore contingencies have been included to mitigate these uncertainties. The costing information for the preferred alignment includes various elements that relate to capital costs (CAPEX - planning, design, land, and construction costs), as well as operational costs (OPEX costs covered in the section – Cost Benefit Analysis). All costs represented in the analysis, do not include VAT.

CAPEX Unit Cost Methodology

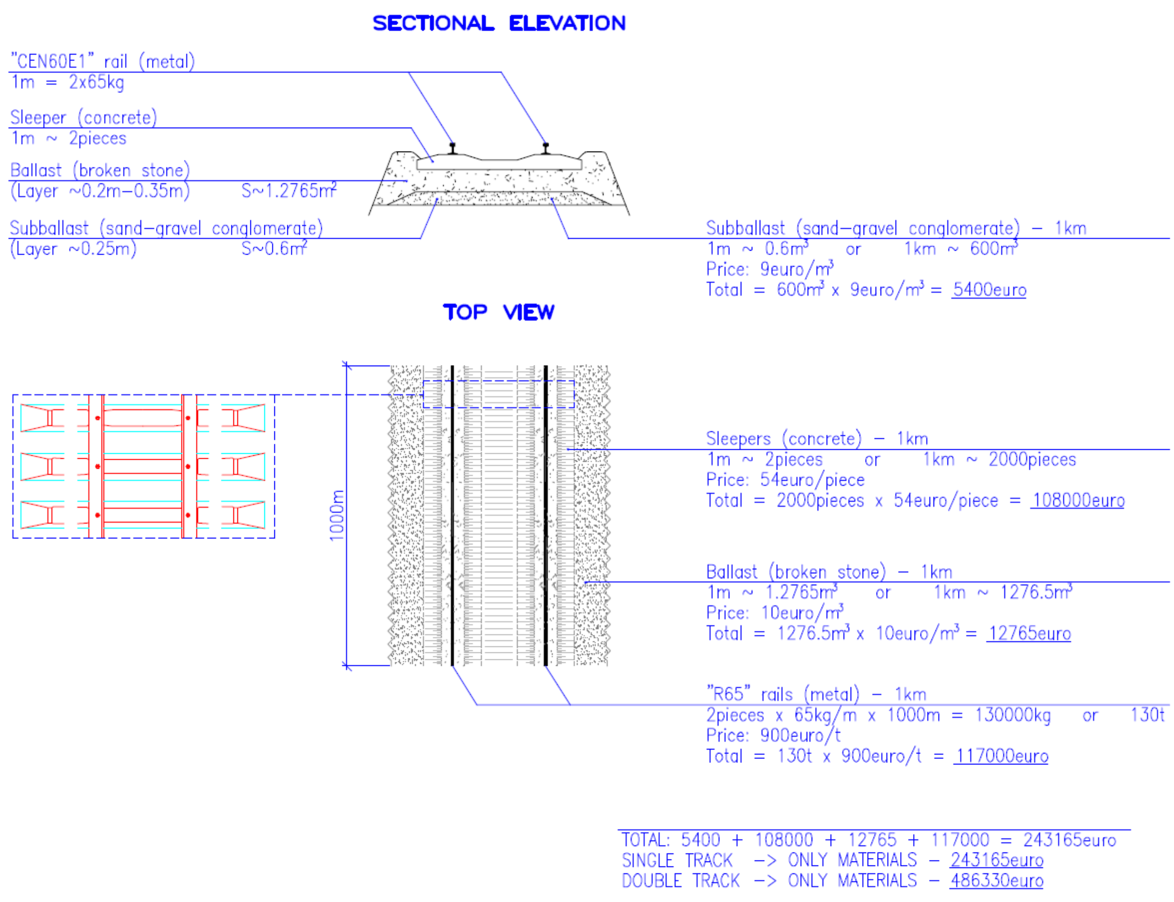
The capital costs were calculated on a unit costs basis in relation to various cost elements per segment of the entire route. The entire alignment was divided into 27 (A-W) segments of various lengths depending on geographic points/landmarks along the route (11 segments – Estonia, 7 segments – Latvia, 8 segments - Lithuania). Each section has a specific length based on the total alignment for the preferred alternative – total length 728 km.

Table 98 - Alignment Segmentation.

Section code	Cross-section type	Length, km
A	1,2	10,6
B	2	10,1
C	2	5,8
Tallinn		
E (1)	2,3	6,9
TLL		
E (2)	2,3	8,7
D	1	2,4
F	1	10,9
G	1	27,5
H	1	83,6
Parnu		
I	2	4,0
J	1	58,3
K	1	61,1
L	1	30,8
M	1	5,2
N	1	15,4
O (in)	1,3	25,4
Riga		
O (out)	1,3	25,4
P	1	71,7
Q (1)	1	62,5
Panevezys		
Q (2)	1	80,7
R	1	23,9
Kaunas		
S	2	15,4
T	1	61,8
U	1	10,9
V	1	7,6
W	2	1,1
TOTAL:		**727,7**

As referenced in the table above, each segment has a track cross-section type based on its geometry and other constraints related to the location and required engineering of the track. In most cases the cross-section is a new 1435 mm gauge double track electrified railway, that in urban areas becomes constrained based on the existing system and therefore either transitions to a more constrained urban cross-section or becomes (as a worst-case scenario) dual gauge.

Figure 44 - Basis of Track Unit Costs



The track infrastructure estimate is based on materials (50%), equipment (20%), labour (22%) and other (8%) costs associated with double railway track, power network, electrification, SCB network, telecommunications, and GSM-R network. In addition, costs related to topographic surveys, geotechnical investigations, planning and design, author/technical supervision and a 5% contingency have been added to calculate the total expenditures related to track infrastructure.

Table 99 - Track Infrastructure Cost Estimate per Kilometer

Nr.	Item expenses	Cost
1	Double railway track	
	- materials (50%)	486 330 €
	- equipment (20%)	194 532 €
	- labour (22%)	213 985 €
	- other (8%)	77 813 €
	Sum:	**972 660 €**
2	Power network	
	- materials (50%)	125 000 €
	- equipment (20%)	50 000 €
	- labour (22%)	55 000 €
	- other (8%)	20 000 €
	Sum:	**250 000 €**
3	Electrification	
	- materials (50%)	500 000 €
	- equipment (20%)	200 000 €
	- labour (22%)	220 000 €
	- other (8%)	80 000 €
	Sum:	**1 000 000 €**
4	SCB network	
	- materials (50%)	142 857 €
	- equipment (20%)	57 143 €
	- labour (22%)	62 857 €
	- other (8%)	22 857 €
	Sum:	**285 714 €**
5	Telecommunication	
	- materials (50%)	64 286 €
	- equipment (20%)	25 715 €
	- labour (22%)	28 286 €
	- other (8%)	10 286 €
	Sum:	**128 573 €**
6	GSM-R netowrk	
	- materials (50%)	42 857 €
	- equipment (20%)	17 143 €
	- labour (22%)	18 857 €
	- other (8%)	8 657 €
	Sum:	**87 514 €**
7	Topography	
	- price: 200 €/ha	
	- zone length: approx 810km	
	- zone width: approx 100m	
	- area: approx 8100ha	
	Sum:	**2 000 €**
8	Geology	
	- price: 85 €/point	
	- point interval: approx 250m	
	- zone length: approx 810km	
	- point quantity: approx 3240	
	Sum:	**340 €**
9	Planning & design	
	- approx 4% of realization cost	
	Sum:	**109 072 €**
10	Author/technical supervision	
	- approx 0,1% of realization cost	
	Sum:	**2 836 €**
11	Contingency	
	- approx 5% of realization cost	
	Sum:	**141 935 €**
12	Total expenditures	
	- materials	1 361 330 €
	- equipment	544 533 €
	- labour	598 985 €
	- other	475 796 €
	Overall:	**2 980 644 €**

* VAT is not included

Cost Model Assumption:
3,000,000 EUR for typical section,
3,500,000 EUR suburban section,
4,000,000 EUR urban section,
4,500,000 EUR complicated urban section

Table 100 - Total Track Infrastructure Related Costs

Section code	Length, km	Cost per km, €	Cost, €
A	10,6	3 500 000,0	37 100 000,0
B	10,1	3 000 000,0	30 300 000,0
C	5,8	3 000 000,0	17 400 000,0
Tallinn			
E (1)	6,9	4 000 000,0	27 600 000,0
TLL			
E (2)	8,7	4 000 000,0	34 800 000,0
D	2,4	4 000 000,0	9 600 000,0
F	10,9	3 000 000,0	32 700 000,0
G	27,5	3 000 000,0	82 500 000,0
H	83,6	3 000 000,0	250 800 000,0
Parnu			
I	4,0	3 000 000,0	12 000 000,0
J	58,3	3 000 000,0	174 900 000,0
K	61,1	3 000 000,0	183 300 000,0
L	30,8	3 000 000,0	92 400 000,0
M	5,2	3 000 000,0	15 600 000,0
N	15,4	4 000 000,0	61 600 000,0
O (in)	25,4	4 500 000,0	114 300 000,0
Riga			
O (out)	25,4		
P	71,7	4 000 000,0	286 800 000,0
Q (1)	62,5	4 000 000,0	250 000 000,0
Panevezys			
Q (2)	80,7	4 000 000,0	322 800 000,0
R	23,9	4 000 000,0	95 600 000,0
Kaunas			
S	15,4	3 500 000,0	53 900 000,0
T	61,8	3 000 000,0	185 400 000,0
U	10,9	3 000 000,0	32 700 000,0
V	7,6	3 000 000,0	22 800 000,0
W	1,1	3 000 000,0	3 300 000,0
TOTAL:	**727,7**		**2 430 200 000,0**

The total track-related construction costs are roughly 2,430M EUR.

In addition to the track infrastructure, additional above-grade road crossings and water crossings need to be considered along the entire alignment since TSI's dictate grape – separated crossing along the entire route (exceptions in urban areas). A total of 521 road crossings or road diversions were identified that included crossings of main roads, 1[st] class roads, 2[nd] class roads and other roads. Each road crossing or road diversion was assigned a unit cost.

Table 101 - Road Crossings

Section code	Length, km	Road crossings (bridges)							
		main roads (A, E class)	Cost per unit, €	1st class roads	Cost per unit, €	2nd class roads	Cost per unit, €	other roads	Cost per unit, €
A	10,6	1	400000	1	350000	4	300000	19	250000
B	10,1	1	400000	1	350000	1	300000	6	250000
C	5,8					1	300000	4	250000
Tallinn									
E (1)	6,9					1	300000		
TLL									
E (2)	8,7					1	300000		
D	2,4	4	400000	1	350000	2	300000	13	250000
F	10,9	1	400000			2	300000	6	250000
G	27,5	1	400000	2	350000	3	300000	15	250000
H	83,6			2	350000	16	300000	44	250000
Parnu									
I	4,0	1	400000					3	250000
J	58,3	1	400000	3	350000	8	300000	16	250000
K	61,1			3	350000	11	300000	25	250000
L	30,8			2	350000	6	300000	12	250000
M	5,2	1	400000			2	300000	6	250000
N	15,4			2	350000			31	250000
O (in)	25,4	2	400000	2	350000	4	300000	6	250000
Riga									
O (out)	25,4								
P	71,7	3	400000	6	350000	31	300000	33	250000
Q (1)	62,5	2	400000	2	350000	16	300000	13	250000
Panevezys									
Q (2)	80,7	3	400000	3	350000	19	300000	13	250000
R	23,9	1	400000			2	300000	11	250000
Kaunas									
S	15,4			2	350000	5	300000	10	250000
T	61,8	1	400000	3	350000	19	300000	12	250000
U	10,9			2	350000	2	300000	2	250000
V	7,6					2	300000	3	250000
W	1,1							1	250000
TOTAL:	**727,7**	**23**		**37**		**158**		**304**	

Table 102 - Water Crossings

Section code	Length, km	Water crossings					
		rivers	Cost per unit, €	reservoirs	Cost per unit, €	lakes	Cost per unit, €
A	10,6						
B	10,1						
C	5,8	1	350000				
Tallinn							
E (1)	6,9						
TLL							
E (2)	8,7	1	350000				
D	2,4						
F	10,9	3	350000				
G	27,5	4	350000				
H	83,6	22	350000				
Parnu							
I	4,0						
J	58,3	13	350000			1	400000
K	61,1	40	350000				
L	30,8	21	350000				
M	5,2	2	350000				
N	15,4	3	350000				
O (in)	25,4	1	350000				
Riga							
O (out)	25,4						
P	71,7	42	350000	1	212940000		
Q (1)	62,5	17	350000				
Panevezys							
Q (2)	80,7	13	350000				
R	23,9	7	350000				
Kaunas							
S	15,4	9	350000				
T	61,8	20	350000			1	400000
U	10,9	4	350000				
V	7,6	2	350000				
W	1,1						
TOTAL:	**727,7**	**225**		**1**		**2**	

Total costs associated to bridges are roughly 438M EUR.

In addition to rail infrastructure and bridges, additional costs were included for passenger station upgrades/construction, intermodal terminal construction, maintenance facility construction, cross-over integration and required passing-loops.

Note: The Daugava River crossing estimate of probable cost has been calculated based on a bridge lenghth of 3.380m, a bridge widh of 12.6m, and a cost/SQM of bridge deck of 5'000 EUR/SQM.

Total additional costs for facilities related improvements and construction is roughly 522M EUR.

Costs for land expropriation were established by reviewing current market assessment values (using 2011 market data) for the various types of land that will be required for implementing the preferred alternative. Various territory types will be required as referenced in the Land Uses (forest, agricultural and wetlands) and various settlement types will be impacted (towns/cities and suburbs). It is also assumed that a new alignment will require 100m ROW and an existing alignment will require 50m additional ROW.

Table 103 - Land Expropriation Average Cost Assumptions

Land Cost Assumptions:

Territories:	**COST/ ha**	**COST/ km**
Forests	3000 EUR/ha	30000 EUR/km
Fields	2600 EUR/ha	26000 EUR/km
Swamps	1500 EUR/ha	15000 EUR/km
Cities:		
Tallinn	300000 EUR/ha	3000000 EUR/km
Parnu	70000 EUR/ha	700000 EUR/km
Riga	150000 EUR/ha	1500000 EUR/km
Jelgava/Bauska/Iecava	30000 EUR/ha	300000 EUR/km
Panevezys	60000 EUR/ha	600000 EUR/km
Kaunas	45000 EUR/ha	450000 EUR/km
Villages:		
EE Villages	15000 EUR/ha	150000 EUR/km
LV Villages	15000 EUR/ha	150000 EUR/km
LT Villages	15000 EUR/ha	150000 EUR/km

Note: In Tallinn land costs are estimated to be higher than Riga, due to the fact that there is a need to buy back some land that could be used for residential and commercial areas.

For Riga, the land costs are lower since the alignment corresponds mainly with existing alignments or remote industrial areas, some of them may even be considered brownfields.

Table 104 - Total Land Costs

Section code	Length, km	Territory type, km						Settlements, km			
		forest	Cost, €	fields	Cost, €	swamps	Cost, €	towns	Cost, €	suburbs	Cost, €
A	10,6							10,6	31 800 000		
B	10,1							10,1	30 300 000		
C	5,8			4,8	124 800					1	150 000
Tallinn											
E (1)	6,9							6,9	20 700 000		
TLL											
E (2)	8,7	0,5	30 000	1,1	28 600			6,2	18 600 000	0,9	135 000
D	2,4			1,2	31 200					1,2	180 000
F	10,9	4,6	138 000	4,8	124 800	0,7	10 500			0,8	120 000
G	27,5	12,6	378 000	7,6	197 600	5,7	85 500	0,7	490 000	0,9	135 000
H	83,6	40,4	1 212 000	17,5	455 000	24,5	367 500			1,2	180 000
Parnu											
I	4,0	0,6	18 000	2,6	67 600	0,8	12 000				
J	58,3	36,6	1 098 000	11,6	301 600	10,1	151 500				
K	61,1	42,4	1 272 000	13,1	340 600	1,2	18 000			4,4	660 000
L	30,8	18,7	561 000	1,8	46 800	8,9	133 500			1,4	210 000
M	5,2	4,6	138 000	0,6	15 600						
N	15,4	13,1	393 000	2,3	59 800						
O (in)	25,4	4,5	135 000	0,5	13 000			12,4	18 600 000	8,0	1 200 000
Riga											
O (out)	25,4	4,5		0,5				12,4		8,0	
P	71,7	18,8	564 000	51,2	1 331 200	1,2	18 000			0,5	75 000
Q (1)	62,5	16,0	480 000	44,1	1 146 600			1,5	900 000	0,9	135 000
Panevezys											
Q (2)	80,7	23,4	702 000	54,3	1 411 800			2	1 200 000	1	150 000
R	23,9	15,8	474 000	3,9	101 400			4,2	1 890 000		
Kaunas											
S	15,4	1,2	36 000	3,5	91 000			5,1	2 295 000	5,6	840 000
T	61,8	19,5	585 000	36,8	956 800			1,7	765 000	3,8	570 000
U	10,9	2,2	66 000	8,7	226 200						
V	7,6			7,3	189 800					0,3	45 000
W	1,1			1,1	28 600						
TOTAL:	**727,7**	**280,0**		**280,9**		**53,1**		**73,8**		**39,9**	

Total cost for land expropriation (based on 2011 values) is roughly 149M EUR.

TOTAL CAPEX = 3,539M EUR

CAPEX SUMMARY (M EUR)	Construction	Land	TOTAL	%
Estonia	€ 935	€ 108	€ 1 043	29%
Latvia	€ 1 196	€ 26	€ 1 222	35%
Lithuania	€ 1 259	€ 15	€ 1 274	36%
TOTAL	**€ 3 390**	**€ 149**	**€ 3 539**	

Note: Costs have been validated to the accuracy required for this study. Any additional value engineering studies would need to be conducted as part of the technical design process.

Table 105 - Total CAPEX Costs

Section code	Length, km	Cost per km, €	Cost, €	Road crossings (bridges): main roads (A, E class)	Cost per unit, €	1st class roads	Cost per unit, €	2nd class roads	Cost per unit, €	other roads	Cost per unit, €	Water crossings: rivers	Cost per unit, €	reservoirs	Cost per unit, €	lakes	Cost per unit, €
A	10,6	3 500 000,0	37 100 000,0	1	400000	1	350000	4	300000	19	250000						
B	10,1	3 000 000,0	30 300 000,0	1	400000	1	350000	1	300000	6	250000						
C	5,8	3 000 000,0	17 400 000,0					1	300000	4	250000	1	350000				
Tallinn																	
E (1)	6,9	4 000 000,0	27 600 000,0					1	300000								
TLL																	
E (2)	8,7	4 000 000,0	34 800 000,0					1	300000			1	350000				
D	2,4	4 000 000,0	9 600 000,0	4	400000	1	350000	2	300000	13	250000						
F	10,9	3 000 000,0	32 700 000,0	1	400000			2	300000	6	250000	3	350000				
G	27,5	3 000 000,0	82 500 000,0	1	400000	2	350000	3	300000	15	250000	4	350000				
H	83,6	3 000 000,0	250 800 000,0			2	350000	16	300000	44	250000	22	350000				
Parnu																	
I	4,0	3 000 000,0	12 000 000,0	1	400000					3	250000						
J	58,3	3 000 000,0	174 900 000,0	1	400000	3	350000	8	300000	16	250000	13	350000			1	400000
K	61,1	3 000 000,0	183 300 000,0			3	350000	11	300000	25	250000	40	350000				
L	30,8	3 000 000,0	92 400 000,0			2	350000	6	300000	12	250000	21	350000				
M	5,2	3 000 000,0	15 600 000,0	1	400000			2	300000	6	250000	2	350000				
N	15,4	4 000 000,0	61 600 000,0			2	350000			31	250000	3	350000				
O (in)	25,4	4 500 000,0	114 300 000,0	2	400000	2	350000	4	300000	6	250000	1	350000				
Riga																	
O (out)	25,4																
P	71,7	4 000 000,0	286 800 000,0	3	400000	6	350000	31	300000	33	250000	42	350000	1	212940000		
Q (1)	62,5	4 000 000,0	250 000 000,0	2	400000	2	350000	16	300000	13	250000	17	350000				
Panevezys																	
Q (2)	80,7	4 000 000,0	322 800 000,0	3	400000	3	350000	19	300000	13	250000	13	350000				
R	23,9	4 000 000,0	95 600 000,0	1	400000			2	300000	11	250000	7	350000				
Kaunas																	
S	15,4	3 500 000,0	53 900 000,0			2	350000	5	300000	10	250000	9	350000				
T	61,8	3 000 000,0	185 400 000,0	1	400000	3	350000	19	300000	12	250000	20	350000			1	400000
U	10,9	3 000 000,0	32 700 000,0			2	350000	2	300000	2	250000	4	350000				
V	7,6	3 000 000,0	22 800 000,0					2	300000	3	250000	2	350000				
W	1,1	3 000 000,0	3 300 000,0							1	250000						
TOTAL:	**727,7**		**2 430 200 000,0**	**23**		**37**		**158**		**304**		**225**		**1**		**2**	
Includes Electification																	

Section code	Territory type, km: forest	Cost, €	fields	Cost, €	swamps	Cost, €	Settlements, km: towns	Cost, €	suburbs	Cost, €	Adjacent to the existing track, km
A							10,6	31 800 000			4,4
B							10,1	30 300 000			7,4
C			4,8	124 800					1	150 000	-
Tallinn											
E (1)							6,9	20 700 000			
TLL											
E (2)	0,5	30 000	1,1	28 600			6,2	18 600 000	0,9	135 000	2,6
D			1,2	31 200					1,2	180 000	15,0
F	4,6	138 000	4,8	124 800	0,7	10 500			0,8	120 000	-
G	12,6	378 000	7,6	197 600	5,7	85 500	0,7	490 000	0,9	135 000	-
H	40,4	1 212 000	17,5	455 000	24,5	367 500			1,2	180 000	-
Parnu											
I	0,6	18 000	2,6	67 600	0,8	12 000					
J	36,6	1 098 000	11,6	301 600	10,1	151 500					-
K	42,4	1 272 000	13,1	340 600	1,2	18 000			4,4	660 000	-
L	18,7	561 000	1,8	46 800	8,9	133 500			1,4	210 000	-
M	4,6	138 000	0,6	15 600							-
N	13,1	393 000	2,3	59 800							-
O (in)	4,5	135 000	0,5	13 000			12,4	18 600 000	8,0	1 200 000	13,0
Riga											
O (out)	4,5		0,5				12,4		8,0		
P	18,8	564 000	51,2	1 331 200	1,2	18 000			0,5	75 000	-
Q (1)	16,0	480 000	44,1	1 146 600			1,5	900 000	0,9	135 000	-
Panevezys											
Q (2)	23,4	702 000	54,3	1 411 800			2	1 200 000	1	150 000	-
R	15,8	474 000	3,9	101 400			4,2	1 890 000			-
Kaunas											
S	1,2	36 000	3,5	91 000			5,1	2 295 000	5,6	840 000	22,5
T	19,5	585 000	36,8	956 800			1,7	765 000	3,8	570 000	-
U	2,2	66 000	8,7	226 200							-
V			7,3	189 800					0,3	45 000	-
W			1,1	28 600							1,0
TOTAL:	**280,0**		**280,9**		**53,1**		**73,8**		**39,9**		**65,9**
Includes Electification		**8 280 000**		**7 290 400**		**796 500**		**127 540 000**		**4 785 000**	

Section code	Passenger stations	Cost per unit, €	Intermodal terminals	Cost per unit, €	Maintenance facilites	Cost per unit, €	Crossovers	Cost per unit, €			Total cost, € / Kopā, € /
A											43 800 000,00
B											32 850 000,00
C											19 050 000,00
Tallinn	1	5000000									5 000 000,00
E (1)											27 900 000,00
TLL	1	30000000	1	50000000			1	3000000			83 000 000,00
E (2)											35 450 000,00
D											15 400 000,00
F											36 250 000,00
G							1	3000000			92 650 000,00
H											275 000 000,00
Parnu	1	5000000	1	10000000	1	50000000	1	3000000			68 000 000,00
I											13 150 000,00
J											187 700 000,00
K											207 900 000,00
L							1	3000000			108 250 000,00
M											18 800 000,00
N											71 100 000,00
O (in)											118 850 000,00
Riga	1	30000000	1	50000000	1	50000000	1	3000000			133 000 000,00
O (out)											-
P							1	3000000			538 290 000,00
Q (1)											265 500 000,00
Panevezys	1	5000000	1	10000000	1	50000000	1	3000000			68 000 000,00
Q (2)											338 550 000,00
R											101 800 000,00
Kaunas	1	100000000	1	50000000			1	3000000			153 000 000,00
S											61 750 000,00
T							1	3000000			205 950 000,00
U											35 900 000,00
V											24 850 000,00
W											3 550 000,00
TOTAL:	**6**		**5**		**3**		**9**		**0**		**3 390 240 000,00**

Land Cost, €		**148 691 900,00**

Construction Cost, €		**3 390 240 000,00**
Land Cost, €		**148 691 900,00**

TOTAL CAPEX, €		**3 538 931 900,00**

8.7 Cost Benefit Analysis and Risk Analysis

8.7.1 Cost Benefit Analysis Overview

This chapter discusses the economic cost-benefit analysis which assesses the value for money of the project from the viewpoint of society as a whole, regardless of to whom the benefits and costs fall.

An economic cost-benefit analysis assigns a value to certain goods, such as travellers' time, accidents and vehicle emissions, for which there is no direct market; and combines these with the values of elements such as capital costs, revenues and operating and maintenance costs to assess the overall project performance.

In the case of the Rail Baltica, a summary of the main costs and benefits, and their treatment in the economic cost-benefit analysis, is shown in Table below.

Table 106 - Economic Costs Benefit Analysis

Source of Cost / Benefit	Economic Cost Benefit Analysis	Source
Rail Manager		
Capital Cost	Cost of all elements of infrastructure including design and planning, land, construction, supervision and contingency	Valued net of VAT on materials, and social cost on labour
Maintenance Cost	All ongoing costs of maintaining the infrastructure during the appraisal period	
Track Access Charges	Charge paid by the passenger and freight operators to the manager for use of infrastructure	Based on approach outlined in EC document 2010/0253(COD)
Residual Value of the Project	Value of infrastructure at the end of the appraisal period.	Valued at a fraction of the construction cost depending upon the scale of the infrastructure.
Rail Operators		
Operating and Maintenance Costs	Costs of operating and maintaining the freight and passenger services, includes an elements to pay track access charge to manager	Valued net of VAT on materials
Revenues	Revenues generated over the appraisal period from fares paid by passengers and hauliers	Valued net of VAT
Transport Users		
Travellers Time Savings	Valued according to economic cost, by either savings to economy for business journeys, or value assigned by individuals for non business journeys	HEATCO values of time used for each country
External Effects		
Accident Savings	Valued according to economic cost, i.e. direct cost of emergency services, loss of the economic value of the lost working time in the case of death or serious injury. An allowance for pain and suffering can also be included	HEATCO values of time used for each country
Benefits From Reduced Emissions	Economic value assigned to the reduction in emissions of both greenhouse gases and local air pollutants..	IMPACT recommended value for CO_2 emissions and HEATCO recommended value for air pollution emissions used

Note*: The economic cost-benefit analysis is concerned with the resource value of goods, and it therefore excludes "transfer" payments, such as VAT and social payments, which are money payments transferred from one group in society to another, and do not represent the real consumption of resources.*

The economic cost benefit analysis considers the resource cost of goods. Transfer payments such as VAT, which is considered a transfer payment because it generates a dis-benefit to the purchaser that is equally outweighed by the corresponding benefit to the government, are excluded from the analysis. VAT has been excluded from the capital costs, maintenance and operating costs and passenger and freight revenue lines in the analysis.

There are a number of guidance documents specific to the EU. These documents provide valuations and approach and hence have all contributed to the detailed approach to generating the economic cost benefit analysis including the placing of monetary values on air pollution, climate change and time savings as well as the processes for calculating costs.

The documents reviewed and used in some way included:

- Guide to Cost Benefit Analysis of Investment Projects – Structural Funds, Cohesion Fund and Instrument for Pre Accession – Final Report/ 16th June 2008 (European Commission Directorate General Regional Policy);
- Railway Project Appraisal Guidelines (RailPAG), EIB
- Developing Harmonised European Approaches for Transport Costing and Project Assessment (HEATCO) Deliverable 5 – Proposal for Harmonised Guidelines; February 2006 (EC)
- IMPACT (Internalisation Measures and Policies for All external Cost of Transport) Handbook on estimation of external costs in the transport sector, February 2008 (EC)

In accordance with the EC Guide to Cost Benefit Analysis of Investment Projects the economic analysis was prepared by the incremental method, which calculates the difference in the value of the economic parameters of the 'without project' and 'with project' alternatives. This means that only the costs and benefits associated with new or changed elements of the 'with project' scenario, that are different from the 'without project' scenario, have been assessed.

In the case of the evaluation of the Rail Baltica Scheme, the 'Business as usual' scenario includes the existing bus, rail and highway networks and foreseeable modernisation plans and future projects, including the following elements, (including those defined in the study Terms of Reference):

- 1520mm gauge line between Marijampole and Tallinn upgraded to minimum 120kph line speed wherever physically possible.
- Estonia
  - Tartu – Valga rail line upgrade
  - Tallinn – Tartu – Voru road enhancements
- Latvia
  - Riga – Krustpils second rail track
  - Riga Ring road Daugava Crossing
  - Kekava Bypass
  - Development of Riga International Airport hub including its envisaged rail connection
- Lithuania
  - 1435mm gauge track installed between PL/LT border and Kaunas
  - Vilnius - Kaunas Rail modernisation (160kph)
  - Kaunas intermodal terminal
  - Improvements to E77 (Riga-Siauliai-Taurage-Kallingrad).

The 'with project' is identical to the 'Business as usual' option in all respects except it includes the proposed Rail Baltica red route option 1 service providing a higher speed rail link along the Warsaw to Tallinn corridor. This means that the elements listed above are also included in the 'with project' scenario. This enables the effect of Rail Baltica to be isolated from all other projects.

To conduct the analysis and evaluation of the project, an integrated dynamic cost benefit model has been developed, data models created and processes for investment and operational activities included.

The economic cost benefit analysis sums costs and benefits over a 30 year horizon period, with all data presented in years. The stages of implementation are:

- Investment period (13 years): 2012 – 2024;
- Operational period (30 years): 2025 – 2054.

An appraisal period of 30 years is recommended in the EC Guide to Cost benefit analysis for investment project for Rail Schemes. The 30 year appraisal period has been applied after opening to capture the project costs and benefits over the lifetime of the project.

The appraisal uses a discounted cash flow to take account of the fact that benefits and costs that occur in the future are valued less highly than those that occur in the shorter term. In the calculation, the discount value used is 5.5%, in accordance with the EC Guide to Cost Benefit Analysis of Investment Projects.

8.7.2 Investment Costs

For this project the main source of expenditure is the initial capital costs.

Table 107 below summarises the estimate of capital costs for Rail Baltica Option 1.

Table 107 - Capital Costs (Millions of Euros)

Cost Component	Total Cost	Spend Profile												
		2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024
Planning and Design	102	5%	5%	5%	5%	20%	20%	20%	20%					
Land	149					25%	25%	25%	25%					
Construction Costs	3,390									20%	20%	20%	20%	20%
Project Management	34	3%	3%	3%	3%	10%	10%	10%	10%	10%	10%	10%	10%	10%
Site Supervision	3									20%	20%	20%	20%	20%
VAT	744	0.2%	0.2%	0.2%	0.2%	0.7%	0.7%	0.7%	0.7%	19%	19%	19%	19%	19%
TOTAL CAPITAL COSTS	**4,422**	**0.2%**	**0.2%**	**0.2%**	**0.2%**	**1.5%**	**1.5%**	**1.5%**	**1.5%**	**19%**	**19%**	**19%**	**19%**	**19%**

The spend profile is based upon the project implementation plan.

Component parts of the construction cost have been estimated separately, the resultant split is summarised in Table 108.

Table 108 - Construction Costs Composition

Cost Component	Share
Equipment	20%
Materials	50%
Labour	22%
Other costs	8%

As part of the economic analysis, identifiable fiscal transfer payments should be eliminated from the project cash flow. These include, basic transfers include VAT as well as payment involving salaries and other taxes (e.g. fuel tax). The net financial flows for each year of analysis have therefore been adjusted by removing VAT and applying coefficients to remove social taxes.

In the CBA the objective is to appraise the social value of the investment. In some situations observed prices do not provide a fair measure of the social opportunity costs. This is usually due to market distortions. This issue is addressed by adopting conversion factors to convert from financial costs to economic costs. The EC Guide to Cost Benefit Analysis of Investment Projects indicates that these values should be calculated by the planning office of the member state and not on a project-by-project basis.

Given that as an EU financed projects all materials for the Rail Baltica project will be bought from EU countries, we assume that there will be limited price distortions. We have therefore adopted a Standard Conversion Factor of 1.0 in line with EC guidance in situations where the planning authority does not offer its own estimates.

Labour costs have, however, had the social tax element of wages removed by applying a further conversion factor of 0.76 to account for the average social tax in the Baltic States.

Table 109 below summarises the costs in the cost benefit analysis including a calculation of the total cost discounted to 2010 to take account of the fact that benefits and costs that occur in the future are valued less highly than those that occur in the shorter term.

Table 109 - Construction Costs used in Economic Appraisal

Total costs (€ '000,000)	**Cost Estimate**	**Costs used in CBA**	
		Undiscounted	*Discounted*
Design and Planning	102	102	71
Land	149	149	100
Construction Costs	3,390	3,208	1,692
Project Management	34	34	21
Site Supervision	3	3	2
VAT	744	0	
Residual Value		-1,238	-117
Total Capital Cost	**4,422**	**2,257**	**1,769**

8.7.3 Rail Manager Costs and Benefits

Once constructed the rail manager has to incur annual maintenance costs in order to ensure that the infrastructure remains available for passenger and freight services and safe to use. This cost will be offset to some degree by the track access charge that is paid to the manager by both passengers and freight service operators. These different cost elements are discussed below.

8.7.3.1 Maintenance Costs

The following elements have been included in the maintenance costs estimate:

Track	**Price**	**Frequency**
Rail Grinding	1000 € per km.	Once every 3 years
Ballast Supplement	1000 € per km.	Once every 5 years
Track Tamped	4000 € per km.	Once every 5 years
Tensioning and Control	1000 € per km.	Once every 5 years
Insulated joint replacement	4000 € each, 1.3 per km.	Once every 8 years
Ballast cleaned	30,00 € per km.	Once every 20 years
Larger switch parts replaced	15,000 € per switch.1 switch per 5 km	Once every 20 years
Signalling and Telecommunication		
Safety installations (station)	1 million € per station (1 station per 20 km)	Once every 20 years
Safety installations (switches)	100,000 € per switch (1 station per 20 km, 4 switches per station)	Once every 20 years
Safety installations (blocks)	100,000 € per block, 1 block per 3 km	Once every 20 years
Overhead contact line / the catenary system		
Foundations and Poles		Assumed not to require replacement during appraisal period
All suspensions and catenary cables:	1,500 € per suspension, 20 suspensions per km	Once every 25 years
The overhead contact line	15,00 € per km.	Once every 25 years
Surrounding areas		
Weed control	5 m^2 per 1 metre of track 0.1€ per m^2	

Over the 30 year appraisal period this amounts to a total maintenance cost of 353 million Euro, equivalent to an average annual cost of 11.8 million Euro. It should be noted however that due to the differing replacement intervals the annual maintenance costs vary from year to year.

The maintenance costs has been discounted to a 2010 base to take account of the fact that benefits and costs that occur in the future are valued less highly than those that occur in the shorter term. This results in a total discounted maintenance cost over the 30 year appraisal period of 61 million Euros.

The maintenance rates per km of track are the same in all countries. Therefore when splitting maintenance costs between nations costs have been allocated according to the track length in each country. This leads to total discounted maintenance cost over the 30 year appraisal period of 19 million Euro in Estonia, of 20 million Euro in Latvia and of 22 million Euro in Lithuania.

8.7.3.2 Track Access Charges

The track access charge is paid by the passenger and freight operators to the rail manager. It is a reservation charge and allows the operator to use the infrastructure that is provided by the manager for a specific train path.

The current size of charge and method of calculation of track access charges vary across the three Baltic states, a common feature, however, is that the values currently charged are significantly higher than charged elsewhere in the EC. It is important in the analysis that the charges used reflect the charges that will be adopted if Rail Baltica is implemented. This study has therefore derived typical charges based upon the approach outlined in EC directives.

The EC document 2010/0253(COD) ‘Proposal for a Directive of the European Parliament and of the council establishing a single European railway area (recast)’ outlines proposals for changes to the directives covering the rail sector. This document includes changes to the principles of charging (article 31); and introduces exceptions to charging principles (article 32) to improve the coherence of national track access charging schemes through the introduction of common criteria for identifying market segments on which operators may be able to pay a mark-up in access charge

Article 31 (Principles of charging) indicates that *“the charges for the minimum access package shall be set at the cost that is directly incurred as a result of operating the train service”. Annex VIII, point 1 goes on to identify that the “direct costs of the train service referred to in Article 31(3), which are related to infrastructure wear and tear, shall exclude the following items:*

(a) Network-wide overhead costs, including salaries and pensions;

(b) Interest payable on capital;

(c) More than one tenth of costs related to scheduling, train path allocation, traffic management, dispatching and signalling of a train run;

(d) Depreciation of information, communication or telecommunication equipment;

(e) Costs related to real estate management, in particular acquisition, selling, dismantling, decontamination, recultivation or renting of land or other fixed assets;

(f) Social services, schools, kindergartens, restaurants;

(g) Costs related to acts of God, accidents, service disruptions.

When direct costs exceed, on a network-wide average, 35 % of average costs of maintaining, managing and renewing the network calculated on the basis of a train kilometre run, the infrastructure manager shall justify this in detail to the regulatory body. The average costs calculated for this purpose shall exclude cost elements referred to in points (e), (f) or (g).”

However, Article 32 (Exceptions to charging principles) identifies that *“in order to obtain full recovery of the costs incurred by the infrastructure manager a Member State may, if the market can bear this, levy mark-ups on the basis of efficient, transparent and non-discriminatory principles, while guaranteeing optimal competitiveness in particular of international rail freight.”* Annex VIII, point 3 identifies the market segments which the infrastructure manager has to demonstrate to the regulatory body have the ability to pay mark-ups. This includes a distinction between passenger and freight services;

The EC document indicates that the starting point for setting track access charges should be a calculation of direct costs to the rail manager of the services running. This is calculated below based on the total rail managers maintenance cost over the appraisal period, and the total number of train km.

Table 110 - Track Access Charges based on Direct costs

	Total Maintenance Cost	353	million Euro
Total train km	*Freight*	*326*	million train km
	Passenger	*220*	
	Total	546	
	Track access charge	**€ 0.65**	**per train km**

These initial track access charges have been implemented in the financial analysis with the result that the Rail manger makes a loss (FNPV/C of -1,905 million Euro over the appraisal period excluding the EU grant and a FNPV/K of -286 million Euro over the appraisal period including the EU grant) while the operators make a profit, with a discounted NPV of 429 million Euro for the passenger operator (MIRR of 7.35%) and 875 million Euro for the freight operator (MIRR of 7.70%) over the appraisal period. This suggests that, in accordance with Article 32 of EC document 2010/0253(COD) mark-ups may be applied to obtain full recovery of the costs incurred by the infrastructure manager.

Track access Charges have been varied in an iterative process to minimise the financial losses of the rail manager whilst still providing financial return for the operators. The following optimal charges were determined:

Passenger services ***€ 3.95 per train km***

Freight services ***€ 5.92 per train km***

The charges have been set to meet the following requirements:

- Increase the rail manager’s internal rate of return on investment cost (excluding impact of EU grant) above zero
- Equalise the passenger and freight operators profitability over the appraisal period as measured by their Modified Internal Rate of Return (MIRR)

This charging arrangement leads to a situation where:

- The ***rail manager*** has an internal rate of return over the appraisal period on the cost of investment excluding the impact of the EU grant (FIRR/C) of 0.05%. When the EU grant is included in the financial analysis the financial return on own national resource (FIRR/K) is 3.70%. These are higher than the rates of return achieved by the manager when no mark-up is added to the track access charge (FIRR/C of -2.69% and FIRR/K of 1.93%).
- The ***passenger rail operator*** has profitability over the appraisal period of 6.18% (as calculated by the Modified Internal Rate of Return (MIRR). This is a reduction from a profitability of 7.35% when no mark-up is added to the track access charge
- The ***freight rail operator*** has profitability over the appraisal period of 6.22% (as calculated by the Modified Internal Rate of Return (MIRR). This is a reduction from a profitability of 7.70% when no mark-up is added to the track access charge
- The approach adopted to determine whether the market can bear the cost of the track access charge mark-up has been based on an assessment of the level of operator profitability (calculated from the modified internal rate of return of the revenue in-flows on the operating cost out-flows including track access charges). As part of project development it may be necessary

for the infrastructure manager to conduct a more detailed market analysis, potentially split by further market segments, to compare costs of Rail Baltica against existing competing services to confirm the ability of the market to bear the cost of track access mark-ups. The analysis will, however, need to recognise that the quality of the service provided by Rail Baltica is higher than existing modes in terms of connectivity.

Over the 30 year appraisal period this amounts to a total passenger service track access cost of 744 million Euros, equivalent to an average annual cost of 24.8 million Euro; and a total freight service track access cost of 1,764 Million Euro, equivalent to an average annual cost of 58.8 million Euro.

The track access costs have been discounted to a 2010 base to take account of the fact that benefits and costs that occur in the future are valued less highly than those that occur in the shorter term. This results in a total discounted track access cost over the 30 year appraisal period of 351 million Euro for freight services and 170 million Euro for passenger services.

The track access charges per train km are the same in all countries. Therefore when splitting charges between nations costs have been allocated according to the train km in each country (this includes an element allocated to Poland). This leads to total discounted track access cost over the 30 year appraisal period of 108 million Euro in Estonia, of 111 million Euro in Latvia and of 125 million Euro in Lithuania.

Note: Additional charges for the use of contact network in Lithuania is taken into consideration and is included as part of the overall track access charges.

8.7.4 Rail Operator Costs and Benefits

The rail operator has to incur operating and train maintenance costs in order to provide a service. This cost will include a payment to the rail manager to allow access to the track. These costs are offset to some degree by the revenue that is paid to the operator by both passengers and freight hauliers. These different cost elements are discussed below.

8.7.4.1 Operating Cost

Cost estimates have been made for the operating costs of the proposed passenger and freight Rail Baltica services.

Passenger service is assumed to be electric and passenger freight service is assumed to be diesel.

Freight Service Operating Costs

Table 111 below outlines the freight service operating cost elements included in the estimate, along with sources of the cost per train km.

Table 111 - Freight Service Operating Cost

		2020	2030	2040	Source
Freight Service Operating Cost (Euro per train km)	Fuel	2.75	2.75	2.75	Fuel prices based on average 2010 Diesel price in Baltic states, excluding VAT. Diesel fuel consumption is based on Freight Best Practice Research which looked at fuel use in three European operators and averaged around 0.5kms/litre
	Labour	0.36	0.36	0.36	Based on an estimate of staff numbers, wage rate per hour and employee costs
	Total Cost of Rolling Stock	1.79	1.79	1.79	Railway Wagon Costs and Maintenance based on WH Davis wagon manufacturer prices and rates for leasing and maintenance. Train Depreciation – based on writing down costs over 10 years when a refurbishment would be required
	Lease Charges loco	*0.58*	*0.58*	*0.58*	
	Lease Charges Wagons	*0.38*	*0.38*	*0.38*	
	Maintenance Charges loco	*0.50*	*0.50*	*0.50*	
	Maintenance Charges Wagons	*0.34*	*0.34*	*0.34*	
	Overheads	0.72	0.72	0.72	Based on EC document 2010/0253(COD) See section 8.7.3.2 above
	Track Access	5.92	5.92	5.92	
	Total Operating Cost	**11.55**	**11.55**	**11.55**	
	Total annual train km ('000,000)	4.577	6.676	10.141	Based on service pattern outlined in provisional timetable. Train numbers increase in later appraisal years due to larger freight demand volume.
	Total annual cost million Euro	**52.9**	**77.1**	**117.1**	
	Total annual track access million Euro	**27.1**	**39.5**	**60.0**	

Passenger Service Operating Costs

Table 112 below outlines the Passenger service operating cost per train km. The calculation is based on the Track access charge discussed in section 7.3.2 above and a bottom up calculation of the operating cost based on service elements such as staffing, fuel, rolling stock and overheads.

Table 112 - Passenger Service Operating Cost

		2020	2030	2040	Source
Passenger Service Operating Cost (Euro per train km)	Fuel	1.95	1.95	1.95	Electric cost is approximately 30% lower than Diesel based on research conducted for ORR, figure also corroborated by an EU passenger service operator.
	Labour	0.53	0.53	0.53	Based on an estimate of staff numbers, wage rate per hour and employee costs. Assumes 2 drivers and 2 conductors per service
	Total Cost of Rolling Stock	2.20	2.20	2.20	Lease and maintenance based on average cost of 5/6 car electric multiple units capable of achieving required speed, for example Hitachi class 395.
	Lease Charges	*0.64*	*0.64*	*0.64*	Assumes a 30 year life span with full refit after 15 years
	Maintenance Charges	*0.64*	*0.64*	*0.64*	Overheads assumed to be higher than freight given extra requirement for documentation, ticketing and other sundries
	Overheads	*0.92*	*0.92*	*0.92*	
	Track Access Charge	3.95	3.95	3.95	Based on EC document 2010/0253(COD) See section 8.7.3.2 above
	Total Operating Cost	**8.63**	**8.63**	**8.63**	
Total annual train km ('000,000)		6.282	6.282	6.282	Based on service pattern outlined in provisional timetable. Train numbers are constant across appraisal years as service pattern remains constant.
Total annual cost million Euro		**54.2**	**54.2**	**54.2**	
Total annual track access million Euro		**24.8**	**24.8**	**24.8**	

Over the 30 year appraisal period this amounts to a total passenger service operating cost of 1,626 Million Euro, equivalent to an average annual cost of 54.2 Million Euro; and a total freight service operating cost of 3,440 Million Euro, equivalent to an average annual cost of 114.7 Million Euro.

The operating costs have been discounted to a 2010 base to take account of the fact that benefits and costs that occur in the future are valued less highly than those that occur in the shorter term. This results in a total discounted operating cost over the 30 year appraisal period of 685 million Euro for freight services and 372 million Euro for passenger services

The operating costs per freight/passenger train km are the same in all countries. Therefore when splitting costs between nations costs have been allocated according to the train km in each country (this includes an element allocated to Poland). This leads to total discounted operating cost over the 30 year appraisal period for passenger service of 77 million Euro in Estonia, of 79 million Euro in Latvia and of 89 million Euro in Lithuania; and for freight service of 142 million Euro in Estonia, of 146 million Euro in Latvia and of 164 million Euro in Lithuania.

8.7.4.2 Revenue

Revenue will be generated for the operators of both the passenger and freight services from charges made to customers. Revenue estimates have been developed as part of the initial option appraisal. These revenue forecasts have been adjusted by removing VAT to ensure that fiscal transfer payments have been eliminated from the project cash flow.

The table below summarises the revenue cash flow net of VAT.

Table 113 - Passenger and Freight Service Revenue

	Annual Revenue (€,000,000 per year)	
	Passenger Service	*Freight Service*
2020	64.3	109.2
2030	78.3	145.4
2040	95.6	183.2

Note: *Revenue includes element generated by Rail Baltica users on section from Warsaw to Tallinn.*

Over the 30 year appraisal period this amounts to total passenger service revenue of 2,842 million Euro, equivalent to an average annual revenue of 94.7 million Euro; and a total freight service revenue of 5,429 million Euro, equivalent to an average annual cost of 181.0 million Euro.

The revenues have been discounted to a 2010 base to take account of the fact that benefits and costs that occur in the future are valued less highly than those that occur in the shorter term. This results in total discounted revenue over the 30 year appraisal period of 1,142 million Euro for freight services and 605 million Euro for passenger services

When splitting revenue between nations costs have been allocated according to the revenue generated in each country (this includes an element allocated to Poland). This leads to total discounted revenue over the 30 year appraisal period for passenger service of 129 million Euro in Estonia, of 160 million Euro in Latvia and of 215 million Euro in Lithuania; and for freight service of 353 million Euro in Estonia, of 339 million Euro in Latvia and of 322 million Euro in Lithuania

8.7.5 Social Costs and Benefits

A key element of the economic cost benefit analysis is allocation of monetary values to the non market impacts of the scheme. These are impacts that are relevant to society but for which a market value is not available. Impacts include:

- Savings in travel time
- Prevention of road fatalities and accidents from diverting passengers and freight to the Rail Baltica
- Reductions in road air pollution emissions from diverting passengers and freight to the Rail Baltica
- Reductions in green house gas emissions from diverting passengers and freight to the Rail Baltica

The monetisation of these impacts are discussed in detail below.

8.7.5.1 Journey time savings

When a new transport service is introduced it usually provides a time benefit for the users who choose to use it. The benefit associated with the user time savings provided by the new service can be expressed in monetary terms by considering the economic cost of the time, as either savings to economy for business journeys, or value assigned by individuals for non business journeys. The economic value of the time saved will vary depending upon the trip purpose. For this analysis business trips and non-business trips have been considered.

In order to calculate the scale of time saving benefits three key market segments need to be considered:

- Existing Rail users who benefit from improved travel times;
- Modal transfer journeys that are created because of the improved attractiveness that the scheme provides.
- Newly generated trips which are made as a direct result of lower journey costs (induced demand).

The calculation of transport user benefits is based on a conventional consumer surplus theory. In simple terms, 'consumer surplus' is defined as the benefit which a consumer enjoys, in excess of the costs which he or she perceives. Across all travellers, the change in consumer surplus is the difference between the time the consumer is willing to spend making the journey and the prevailing journey time of the trip.

The method used to calculate the user time benefits and operating cost benefits uses the principle of a “rule of a half”. This takes into account the fact that in usual conditions, demand changes in response to the increase or decrease in costs, there is therefore a lesser impact on new or mode shifting travellers. The conventional approach is to attribute half of the change in costs to the trip lost or gained. The rule of a half principle is therefore applied to calculate the user time saving benefits for these trips in accordance with EC guidance. This is shown as Equation 1.

Figure 45 - Equation 1 User Time Benefits Calculation

$$B_{UserTime} = \sum_i \sum_j (D_0 + D_1) * (C_0 - C_1) / 2$$

Where:

$B_{UserTime}$ – Total user time savings in minutes;

D_0 – Trip matrix in the Do-Minimum (reference case) scenario;

D_1 – Trip matrix in the Test scenario (post-demand model calculations);

C_0 – Travel time matrix in minutes in the Do-Minimum (reference case) scenario; and

C_1 – Travel time matrix in minutes in the Test scenario.

It should be noted that when calculating consumer surplus using the rule of half the do minimum travel cost (time in this case) against which the change in travel cost is assessed is that for the mode to which the users have switched and not the mode from which they have shifted. In this case that is the do minimum freight and passenger rail travel times.

Time-saving benefits have been assessed separately for passengers and freight users.

Passenger time saving benefits

The passenger group experiencing the greatest time saving benefit are Rail Baltica users who previously travelled by train, there are however very low levels of existing international demand using rail in the corridor meaning that this group is very small. Rail Baltica users who previously travelled by other modes, such as bus or car, experience lower benefits per person than users who previously travelled by train due to the application of the rule of a half. Nonetheless, this group forms the majority of the passenger time saving benefits due to the large number of passengers who are expected to shift to rail Baltic from competing modes. There is also a benefit to users who remain on the road due to reduced congestion and improved travel times in the Rail Baltica Corridor. It should be noted, however, that road decongestion benefits are expected to be very low relative to time saving benefits experienced by users who shift to Rail Baltica.

Passenger user time benefits have been calculated at a matrix level for both Rail Baltica users (both those who used rail in the do minimum and those who used other modes) and car users. This allows the rule of half to be applied

Freight time saving benefits

Time-saving benefits have been calculated at a matrix level for freight demand allowing the rule of a half to be applied. This is because the vast majority of freight demand is predicted to use Rail Baltica transfers from Road.

The Passenger and Freight models are based on a 24-hour day simulation period; for an average day (AADT). In order to assess the benefits of each scheme over the full appraisal period, these benefits are annualised using a factor of 365.

Over the 30 year appraisal period this amounts to a total passenger time saving benefit of 1,627 Million Euro, equivalent to an average annual cost of 54.2Million Euro; and a total freight time saving benefit of 4,150 million Euro, equivalent to an average annual cost of 138.3 Million Euro.

The time saving benefits have been discounted to a 2010 base to take account of the fact that benefits and costs that occur in the future are valued less highly than those that occur in the shorter term. This results in a total discounted time saving benefit over the 30 year appraisal period of 818 million Euros for freight users and 340 million Euros for passenger users.

When splitting benefits between nations benefits have been allocated according to the origin and destination country of the trip. This means that an element of the time saving, associated with trips from outside the Baltic States is allocated to Poland. This leads to total discounted time saving over the 30 year appraisal period for passenger users of 135 million Euro in Estonia, of 88 million Euro in Latvia and of 71 million Euro in Lithuania; and for freight users of 262 million Euro in Estonia, of 252 million Euro in Latvia and of 213 million Euro in Lithuania.

8.7.5.2 Accidents

Accident benefits to society arise as a result of reductions in road vehicle kilometres. This is particularly the case for Rail Baltica as a large number of truck trips are expected to shift to rail. An economic cost to society can be calculated for each road accident depending on its level of severity. The equation from which these impacts are calculated is shown by Equation 2.

Figure 46 - Equation 2 Accident Impact Calculation

Accident Impact = Accident rate per vehicle kilometre x Change in vehicle kilometres x Cost per accident.

Accident rates have been obtained for Latvia from the European Commission and Eurostat. The UK does have a comprehensive database of accident rates for different road types, and severity split of casualties (fatal, serious and slight). We therefore used the UK accident rates per road type, and severity split of casualties, but adjusted these to be compatible with the Latvian data for the overall accident rate for all roads, and the number of fatalities, serious and slight injuries. This method retains the integrity of the Latvian data. The critical assumption here is that the relationship between accident rates on different types of road is similar in both the UK and Baltic Countries.

It is recognised that accident rates will almost certainly reduce, as vehicles and roads become safer, and driving standards improve. Therefore, the accident rates were decreased over time by 1% per annum.

The savings resulting from reduced accident rates can be expressed as a monetary benefit. The benefits from a reduced number of road accidents consist of:

- Savings in the direct costs of providing emergency services;
- Savings due to reduced loss of economic output; and
- An estimate of the “value” of grief and suffering.

The monetary benefit for casualties avoided is provided in the EC Guide to Cost Benefit Analysis of Investment Projects. Values are given separately for Estonia, Latvia and Lithuania and vary by accident severity.

The total volume of traffic removed from road by passengers and freight shifting to the Rail Baltica service has been determined from the demand models by calculating the change in road vehicle km that result from implementing the Rail Baltica service. It should be noted that the new rail service will remove a significant volume of trucks from the road. This amounts to a large reduction in vehicle km due to the long distance of truck trips, which in turn leads to significant accident savings.

Reductions in vehicle km in each country have been calculated, allowing the country specific cost per accident provided by the EC guidance to be applied. These benefits have been calculated over a 24 hour period and then annualised.

Over the 30 year appraisal period 6,560 accidents are expected to be avoided, (leading to a reduction of fatalities of 856, a reduction of severe injuries of 1,591 and a reduction of light injuries of 6,402). These accident reductions have a corresponding monetary value of 1,652 million Euro, equivalent to an average annual benefit of 55.1 million Euro

The accident reduction benefits have been discounted to a 2010 base to take account of the fact that benefits and costs that occur in the future are valued less highly than those that occur in the shorter term. This results in a total discounted accident reduction benefit over the 30 year appraisal period of 338 million Euros.

When splitting benefits between nations benefits have been allocated according to the country in which the accident reduction occurs (including an element allocated to Poland). This leads to total discounted accident saving over the 30 year appraisal period of 116 million Euro in Estonia, of 105 million Euro in Latvia and of 89 million Euro in Lithuania.

8.7.5.3 Air pollution

There are external costs resulting from air pollution, which are a measurable financial burden to the Society. Air pollutants from vehicles are a complex mix of chemicals that change, and after that leave the emission source. These include particulate matter, sulphur oxide, nitrogen oxides, carbon monoxide and CO_2. These pollutants impose a financial burden on the society by increasing health costs and damage to buildings, crops, flora and fauna.

The impact of air pollution can be quantified and is related to travel speed and vehicle type. The following relationship between vehicle speed and the emission of harmful substances has been used in other European countries

Figure 47 - Equation 3 Emissions of Harmful Substances Calculation

Light Vehicle

CO: $e = 123.89 . V^{-0.5383}$

NO_2: $e = -1E . V^3 + 0.0006V^2 – 0.0373V + 2.0389$

SO_2: $e = 0.3293.V^{-0.3776}$

$PM_{2.5}$: $e = 1.6369.V^{-0.93}$

Heavy Vehicle

CO: $e = 257.77 . V^{-1.0217}$

NO_2: $e = 54.386.V^{-0.3871}$

SO_2: $e = 10.37.V^{-0.5569}$

$PM_{2.5}$: $e = 4.2296V^{-0.7508}$

Where

e is emission in g/km

V is travel speed in km/h

Reductions in emissions have been calculated separately for motorway, primary, secondary and urban roads. This is necessary as the average speed of vehicles, and therefore the emission per vehicle km will vary significantly across the different road types. The analysis has also identified the emissions savings in each country.

Over the 30 year appraisal period air pollution reduction benefits total 704 million Euro, equivalent to an average annual benefit of 23.5 million Euro.

The air pollution reduction benefits have been discounted to a 2010 base to take account of the fact that benefits and costs that occur in the future are valued less highly than those that occur in the shorter term. This results in a total discounted air pollution reduction benefit over the 30 year appraisal period of 148 million Euros.

When splitting benefits between nations benefits have been allocated according to the country in which the emission reduction occurs (including an element to Poland). This leads to total discounted emissions saving over the 30 year appraisal period of 35 million Euro in Estonia, of 29 million Euro in Latvia and of 77 million Euro in Lithuania.

8.7.5.4 Climate change

There are also external costs associated with changes in greenhouse gas emissions which should be included in the economic analysis. The costs due to changes in the volume of CO_2 emitted are calculated according to equation below.

Figure 48 - Equation 4 CO_2 Emissions Impact Calculation

Passenger Car Emissions Impact = Rate of CO_2 emitted in kg per vehicle km x Change in vehicle kilometres x Cost per kg CO_2.

Freight Emissions Impact = Rate of CO_2 emitted in kg per Tonne km x Change in tonne kilometres x Cost per kg CO_2.

The EC Guide to Cost Benefit Analysis of Investment Projects provides estimates of monetary value of CO_2 emissions savings that have been identified by the IMPACT study. Central values have been adopted for this study.

Over the 30 year appraisal period CO_2 emission reduction benefits total 1,778 million Euro, equivalent to an average annual benefit of 59.3 million Euros

The CO_2 emission reduction benefits have been discounted to a 2010 base to take account of the fact that benefits and costs that occur in the future are valued less highly than those that occur in the shorter term. This results in a total discounted CO_2 emission reduction benefit over the 30 year appraisal period of 342 million Euros.

When splitting benefits between nations benefits have been allocated according to the country in which the emission reduction occurs (including an element to Poland). This leads to total discounted climate change saving over the 30 year appraisal period of 117 million Euro in Estonia, of 108 million Euro in Latvia and of 85 million Euro in Lithuania.

8.7.5.5 Social benefits from increased employment.

The project will generate jobs in two key ways:

- Direct job creation in the construction phase
- Direct job creation in the operation phase.

Estimates of the number of direct jobs that will be created have been made by considering the labour cost share of the construction cost and operating costs. These are discussed below.

Direct job creation in the construction phase

The total labour element of the construction cost has been determined for each nation. From this and the following key assumptions the number of Full Time Equivalent (FTE) jobs created has been calculated.

- Construction period 5 years (2020-2024)
- Working hours per day 8 hours
- Working days per year 253
- Labour costs per hour (based on average labour costs from three Baltic states for construction jobs) € 6.19 per hour

Over the five year construction period 11,900 FTE jobs will be created (3,283 in Estonia, 4,199 in LV and 4,419 In Lithuania)

Direct job creation in the operation phase.

The labour element of the operating cost has been determined for passenger and freight services. . From this and the following key assumptions the number of Full Time Equivalent (FTE) jobs created has been calculated.

- Working hours per day 8 hours
- Working days per year 253
- Labour costs per hour (based on average labour costs from three Baltic states for transport, storage and communication jobs) € 7.49per hour

From opening the passenger service creates 221 FTE jobs. As the number of freight services increased the number of FTE jobs created ranges from 110 on opening, 160 in 2030 to 244 in 2040.

8.7.6 Cost Benefit Analysis Parameter Assumptions

The assumptions for the parameters to be used in the analysis of the economic and financial performance of the scheme are discussed in Table 114.

Table 114 - CBA Parameters

Input	Source	Application in the Cost Benefit Analysis
Capital Costs	Capital costs are calculated by applying specified quantity unit cost rates per km for land and track; and, specific infrastructure costs (such as tunnels, bridges, stations, intermodal facilities and passing loops), as specified calculated from local experience.	Unit rates are: • Land (Forest €30000 per km, Field €26000 per km, Marsh €15000 per km) • New Rail track excluding bridges €3m-€4m per km Additional costs calculated as a percentage of construction costs: • Planning and Design costs 3% • Contingency 10% • Project Management 1.0% • Site Supervision 0.1% VAT (at ES:20%, LV:22%, LT:21%) is excluded from all costs in economic appraisal, Labour element of capital costs are adjusted for the economic appraisal by applying an adjustment factors to take account of social taxes. Capital cost spend profile is specified across a 13 year implementation period (2012-2024).
Residual value		Value at end of 30yr appraisal (2054):30% of construction cost for standard rail infrastructure, 50% of construction cost for major infrastructure such as bridges and stations and 30% of land costs.
Accident rate (Scheme and DM)	(Accident rates calculated from 2000 Latvian Eurostat data)	Accident rates for Fatal, Serious and Slight Injuries are included within CBA assessment and applied to each modelled year by road classification. Accident rates are assumed to decline at a rate of 1% per annum throughout the 30 appraisal period. Accident rates as presented as 10-^{6}/v/km, non-motorway accident rates are: • 2020: Fatal (F) 0.063, Serious Injury (SI) 0.118, Slight Injury (SLI) 0.470 • 2030: F 0.057 , SI 0.106, SLI 0.425 • 2040: F 0.052 , SI 0.096, SLI 0.385
Value of Time (by traffic class)	HEATCO (Developing Harmonised European Approaches for Transport Costing and Project	Value of rail business passenger time is given in HEATCO for each of the Baltic countries in 2002 prices. These values have been rebased to 2010 values and prices using Eurostat EU HICP data and GDP elasticity of 0.7.

<table>
<tr><th>Input</th><th>Source</th><th>Application in the Cost Benefit Analysis</th></tr>
<tr><td></td><td>Assessment) identified in Guide to Cost Benefit Analysis of Investment Projects, EC 2008</td><td>
An average value has then been calculated. Value of rail non-business passenger time has been estimated as 30% of business value in line with range in EC Guidance.
Value of freight time given in HEATCO in € per tonne hour in 2002 prices. These values have been rebased to 2010 values and prices using Eurostat EU HICP data and GDP elasticity of 0.7.
All VOT values are adjusted over the appraisal period on the basis of elasticity to growth of GDP/capita of 0.7, as specified in HEATCO .
<table>
<tr><th></th><th colspan="2">Passenger</th><th rowspan="2">Freight</th></tr>
<tr><th></th><th>business</th><th>non-business</th></tr>
<tr><td></td><td colspan="2">€₂₀₁₀ per passenger hour</td><td>€₂₀₁₀ per tonne hour</td></tr>
<tr><td>2020</td><td>26.11</td><td>7.83</td><td>1.34</td></tr>
<tr><td>2030</td><td>30.54</td><td>9.16</td><td>1.57</td></tr>
<tr><td>2040</td><td>35.73</td><td>10.72</td><td>1.84</td></tr>
</table>
</td></tr>
<tr><td>Values of accidents</td><td>HEATCO (Developing Harmonised European Approaches for Transport Costing and Project Assessment) identified in Guide to Cost Benefit Analysis of Investment Projects, EC 2008</td><td>
Accident severity cost values are given for Baltic counties in HEATCO in 2002 prices. These values have been rebased to 2010 values and prices using Eurostat EU HICP data and GDP elasticity of 0.7.
Accident severity cost values are adjusted over the appraisal period on the basis of elasticity to growth of GDP/capita of 0.7, as specified in EC guidance.
<table>
<tr><th></th><th>Fatal</th><th>Severe Injury</th><th>Slight Injury</th></tr>
<tr><td></td><td colspan="3">€₂₀₁₀,000 per occurrence</td></tr>
<tr><td>2020</td><td>1,047</td><td>142</td><td>10.2</td></tr>
<tr><td>2030</td><td>25</td><td>7.6</td><td>1.6</td></tr>
<tr><td>2040</td><td>30</td><td>8.9</td><td>1.8</td></tr>
</table>
</td></tr>
<tr><td>Values of environmental impacts:

Air pollution</td><td>Cost rates extracted from HEATCO (Developing Harmonised European Approaches for Transport Costing and Project Assessment)</td><td>
Air quality impacts are calculated within the CBA assment by applying the following equations based on the traffic volumes and average modelled speed.
Light Vehicle
CO: e = 123.89 . V-0.5383
NO_2: e = -1E6 . V3 + 0.0006V2 – 0.0373V + 2.0389
SO_2: e = 0.3293.V-0.3776
$PM_{2.5}$: e = 1.6369.V-0.93
Heavy Vehicle
CO: e = 257.77 . V-1.0217
NO_2: e = 54.386.V-0.3871
SO_2: e = 10.37.V-0.5569
</td></tr>
</table>

Input	Source	Application in the Cost Benefit Analysis
		$PM_{2.5}$: e = 4.2296V-0.7508 Where: e is emission in g/km V is travel speed in km/h ***2010 Cost Rates:*** extracted from HEATCO, rebased to 2010 values and prices using Eurostat EU HICP data and GDP elasticity of 0.7. **€$_{2010}$ per kg** | **Estonia** | **Latvia** | **Lithuania** Health damage cost **$PM_{2,5}$** | 41.31 | 39.78 | 48.96 Health damage cost **SO_2** | 1.84 | 2.14 | 2.75 Health damage cost **NO_2** | 2.14 | 2.75 | 3.18 Health damage cost **VOC** | 0.76 | 0.76 | 0.76 Health damage cost **CO** | 0 | 0 | 0
Values of environmental impacts: Climate change	Cost per tonne CO_2 emitted (IMPACT recommended values) identified in Guide to Cost Benefit Analysis of Investment Projects, EC 2008 Consultants calculation of Tonnes CO_2 emitted per vehicle km	Climate change cost rates calculated and interpolated between established values. ***IMPACT recommended Values*** | **2020** | **2030** | **2040** | **2050** €/tonne CO2 | 40 | 55 | 70 | 85 Climate cost rates applied to vehicle kilometres travelled in the complete Transport Model for the WP and WOP scenarios throughout the appraisal period. ***Emission rates:*** kg CO_2 emitted per vehicle km | 0.127 kg CO_2 emitted per Freight Tonne km | 0.124
Traffic forecasts	Traffic forecast based on the GDP and population growth assumptions outlined in Economic Development Study	GDP growth forecasts are applied to create the forecast matrices for the transport model assessment. Within the CBA analysis GDP growth per head is applied to calculate forecast rates and costs for value of time, accident costs etc.
Conversion factors from market to economic prices	Guide to Cost Benefit Analysis of Investment Projects, EC 2008	Discount rate 5.5% applied to convert market prices to economic price base year of 2010.

8.7.7 Economic Performance Indicators

The project brings economic benefits such as, reducing travel time, generating revenue whilst improving traffic safety and road emissions. The Economic Cost Benefit uses discounted cash flow techniques to take account of the fact that benefits and costs that occur further into the future are valued less highly than those that occur in the short term. The positive impact of the project is measured by the economic indicators of the ***Net Present Value (NPV)*** of the project, which is the sum of the net benefits of the project discounted using the given rate to base year (2010) values, and in terms of the ***Economic Rate of Return (EIRR)***, which is the discount rate which gives a Net Present Value of zero.

National Governments and international bodies such as the European Union set certain standards for the EIRR of transport infrastructure projects: as a benchmark the EIRR of rail projects sponsored by the EU during the previous programming period was 11.6%. A summary of the economic results for the Rail Baltica preferred option is shown in Table 115.

Table 115 - Rail Baltica Preferred Option Economic Appraisal Table

Economic Impact (€,000,000)	**Un-discounted Cost or Benefit**	**Discounted Cost or Benefit**	**Share in Total Costs/ Benefits**
Cost to Infrastructure Manager/Government			
Capital / Investment Costs	3,496	1,886	103%
Residual Value	-1,238	-117	-6%
Maintenance Costs	353	61	3%
Benefit to Manager			
Track access charges	2,508	521	16%
Passenger	744	*170*	
Freight	1,764	*351*	
Benefit to Operator			
Passenger Operator			
Operating costs *(including track access charges)*	-1,626	-372	-12%
Revenues	2,842	605	19%
Freight Operator			
Operating costs *(including track access charges)*	-3,440	-685	-21%
Revenues	5,429	1,142	36%
Benefit to Users			
Value of Time Savings		1,158	36%
Passenger	1,627	*340*	
Freight	4,150	*818*	
External Impacts			
On Safety (Accidents)	1,652	338	11%
Air Pollution	704	148	5%
Climate Change	1,778	342	11%
Total Costs		**1,829**	
Total Benefits		**3,198**	
Net Present Value (NPV)		1,368	
EIRR		**9.3%**	
Benefit/Cost Ratio		**1.75**	

The analysis shows that, under the assumptions made for the project, the key indicators for the Rail Baltica project are positive. With a discount rate of 5.5%, there is a positive NPV of €1,368m, at 2010 prices, and a benefit cost ratio of 1.75. The corresponding EIRR is 9.3%.

8.7.8 Country Specific Economic Performance Indicators

The elements of the total costs and benefits that are experienced by each nation have been isolated. This allows the CBA to be run for each individual Baltic nation. It should be noted however, that the benefits allocated to each country will only be generated if the whole scheme is implemented.

To breakdown the CBA to a national level the costs and benefits have been split across the states. This allocation has been based on either allocating benefits to the country in which they occur, such as accident savings and emissions reductions; or, allocating them to the country from which the trip originated or was destined, such as journey time savings. Details of how costs and benefits have been split are given below.

Capital Investment Costs – calculated for each nation by considering the length of track and specific land type and infrastructure elements required within each country. This means the cost per km of track varies with countries that contain a greater number of crossings and infrastructure experiencing a greater average cost per km.

Maintenance Costs – calculated for each nation by considering the share of the track length within each country. This means the maintenance cost per km of track is constant across the countries; however, the total cost varies due to differing track lengths within each country.

Operating Costs - Calculated for each nation by considering the share of the total annual train- km within each country. For Passenger services, which run from Warsaw to Tallinn the share of train-km is the same as the share of track km. however, for freight services, as service patterns vary with differing numbers of services on different sections of track the share of train-km is not the same as the share of track km.

Track Access Charges – Calculated for each nation by considering the share of the total annual train- km within each country. For Passenger services, which run from Warsaw to Tallinn the share of train-km is the same as the share of track km. however, for freight services, as service patterns vary with differing numbers of services on different sections of track the share of train-km is not the same as the share of track km.

Revenue – Calculated for each nation by considering the share of the total annual train- km within each country. For Passenger services, which run from Warsaw to Tallinn the share of train-km is the same as the share of track km. however, for freight services, as service patterns vary with differing numbers of services on different sections of track the share of train-km is not the same as the share of track km.

Passenger Time Savings – Calculated on a matrix level, therefore benefits have been allocated to each nation based on the origin and destination of each trip. Benefits associated with trips internal to a country have been entirely allocated against that nation, whilst the benefits associated with international trips have been split equally between the origin and destination nations. This means the benefits are higher for countries with large volumes of internal trips, and for countries where there are key trip attractors.

Freight Time Savings – Calculated on a network basis. Journey time savings have been allocated to the country in which they occur. This means that the journey time saving for a freight trip from Estonia to Lithuania will be split between all three nations depending upon the difference between the 'with project' and 'without project' times on the stretches of the route within each country.

External impacts, such as accidents and emissions benefits have been allocated to the nation where the reduction in accidents or emissions occurs.

Job Creation - Over the five year construction period 11,900 FTE jobs will be created (3,283 in Estonia, 4,199 in LV and 4,419 In Lithuania). From opening the passenger service creates 221 FTE jobs. As the number of freight services increased the number of FTE jobs created ranges from 110 on opening, 160 in 2030 to 244 in 2040. The impact of direct job creation has not been explicitly included in the CBA analysis. The EC guidance indicates that job creation benefits should not be included explicitly as they are already accounted for in the adjustment to shadow prices (conversion factors).

The allocation of benefits and costs to nations means that there are elements of the whole scheme benefits and costs which are allocated to nations outside the Baltic region; these include revenue, operating costs and track access charges from the Lithuanian border to Warsaw and elements of the time savings for trips originating or destined outside the Baltic states (e.g. trips to/from Poland). In summary the benefits and costs allocated to nations outside the Baltic region include:

- Track access charges paid by Rail Baltica passenger and freight operators to the Polish rail manager for use of the stretch of track from Polish/Lithuanian border to Warsaw
- Operating costs, paid by Rail Baltica operators, of passenger and freight services on the stretch of track from Polish/Lithuanian border to Warsaw
- Revenues paid by passenger and freight customers to Rail Baltica operators for the stretch of track from Polish/Lithuanian border to Warsaw
- An element of the travel time savings experienced by users who have either an origin or destination outside the three Baltic states
- Accident benefits generated on Polish Road network due to shift of car and freight users from road to Rail Baltica on the stretch of track from Polish/Lithuanian border to Warsaw
- Emissions benefits generated on Polish Road network due to shift of car and freight users from road to Rail Baltica on the stretch of track from Polish/Lithuanian border to Warsaw

Table 116, Table 117 and Table 118 below show the economic performance indicators of the Rail Baltica preferred option for each nation.

Table 116 - Rail Baltica Preferred Option Economic Appraisal Table - Estonia

Economic Impact (€,000,000 discounted)	**Cost or Benefit** Un-discounted	**Cost or Benefit** Discounted	**Discounted Cost or Benefit** *(per km of track)*	**Commentary**
Cost to Infrastructure Manager/Government				
Capital / Investment Costs	1,031	565	2.47	*Construction cost per km: 4,100,000 Euro/km This is lowest of the three nations due to smaller number of infrastructure elements required (e.g. bridges etc.) Land cost per km: 470,000 Euro/km This is highest of the three nations due higher cost and amount of urban land required to purchase in Estonia*
Residual Value	-354	-34	-0.15	
Maintenance Costs	111	19	0.08	*Maintenance cost per km of track is the same for all countries*
Benefit to Manager				
Track access charges	521	108	0.47	*Track access charge per train-km is the same for all countries*
Passenger	155	*35*	*0.15*	
Freight	367	*73*	*0.32*	
Benefit to Operator				
Passenger Operator				
Operating costs *(including track access charges)*	-338	-77	-0.34	*Operating cost per train-km is the same for all countries*
Revenues	609	129	0.56	*Optimum fares are lower on Rail Baltica north of Riga than south of Riga, leading to a slightly lower average revenue per km of track than in other countries*
Freight Operator				
Operating costs *(including track access charges)*	-715	-142	-0.62	*Operating cost per train-km is the same for all countries*
Revenues	1,686	353	1.54	*Revenues per km of track are higher than in other countries due to a larger domestic market*
Benefit to Users				
Value of Time Savings		397	1.73	
Passenger	652	*135*	0.59	*Value of passenger time savings in Estonia are higher as the new line provides a large journey time saving to passengers travelling between Parnu and Tallinn, which are entirely allocated to Estonia*
Freight	1,337	*262*	1.14	*Freight time savings per km of track are higher than in other countries due to a larger domestic market*
External Impacts				

Economic Impact (€,000,000 discounted)	**Cost or Benefit** Un-discounted	**Cost or Benefit** Discounted	**Discounted Cost or Benefit** *(per km of track)*	**Commentary**
On Safety (Accidents)	572	116	0.51	*Over the 30 year appraisal period in Estonia 2,254 accidents are expected to be avoided, (leading to a reduction of fatalities of 296, a reduction of severe injuries of 548 and a reduction of light injuries of 2,193). Benefits are slightly higher than in other countries as reduction in road vehicle km is greater. This is predominantly due to larger removal of trucks from the road.*
Air Pollution	172	35	0.15	*Benefits are slightly higher than in other countries as reduction in road vehicle km is greater. This is predominantly due to larger removal of trucks from the road*
Climate Change	614	117	0.51	*Benefits are slightly higher than in other countries as reduction in road vehicle km is greater. This is predominantly due to larger removal of trucks from the road*
Total Costs		**550**	**2.41**	
Total Benefits		**1,034**	**4.52**	
Net Present Value (NPV)		484		
EIRR		**9.7%**		
Benefit/Cost Ratio		**1.88**		

Table 117 - Rail Baltica Preferred Option Economic Appraisal Table – Latvia

Economic Impact (€,000,000 discounted)	**Cost or Benefit** Un-discounted	**Cost or Benefit** Discounted	**Discounted Cost or Benefit** *(per km of track)*	**Commentary**
Cost to Infrastructure Manager/Government				
Capital / Investment Costs	1,207	648	2.76	*Construction cost per km: 5,700,000 Euro/km This is highest of the three nations due to a larger number of infrastructure elements required (e.g. the bridge over the Daugava.) Land cost per km: 120,000 Euro/km This is middle value of the three nations due lower cost and amount of urban land required to purchase than in Estonia, but higher amount of urban land required to purchase than in Lithuania*
Residual Value	-449	-43	-0.18	
Maintenance Costs	114	20	0.08	*Maintenance cost per km of track is the same for all countries*
Benefit to Manager				
Track access charges	535	111	0.47	*Track access charge per train-km is the same for all countries*
Passenger	159	*36*	*0.15*	
Freight	377	*75*	*0.32*	
Benefit to Operator				
Passenger Operator Operating costs *(including track access charges)*	-347	-79	-0.34	*Operating cost per train-km is the same for all countries*
Revenues	761	160	0.68	*Optimum fares are lower on Rail Baltica north of Riga than south of Riga, leading to a slightly lower average revenue per km of track than in Lithuania, but a higher revenue per km of track than in Estonia*
Freight Operator Operating costs *(including track access charges)*	-734	-146	-0.62	*Operating cost per train-km is the same for all countries*
Revenues	1,618	339	1.44	*Revenues per km of track are lower than in Estonia due to a smaller domestic market;*
Benefit to Users				
Value of Time Savings		340	1.45	*Passenger journey time savings are mid value of the three nations. It should be noted, however, that the time savings are all generated from international movements (as there is only one station in Latvia) which mean benefits have been shared between origin and destination countries. Freight time savings are lower than in Estonia due to a smaller domestic market*
Passenger	427	*88*	*0.38*	
Freight	1,282	*252*	*1.07*	

Economic Impact (€,000,000 discounted)	**Cost or Benefit** Un-discounted	**Cost or Benefit** Discounted	**Discounted Cost or Benefit** *(per km of track)*	**Commentary**
External Impacts				
On Safety (Accidents)	514	105	0.44	*Over the 30 year appraisal period in Latvia 2,028 accidents are expected to be avoided, (leading to a reduction of fatalities of 266, a reduction of severe injuries of 493 and a reduction of light injuries of 1,973). Benefits are slightly higher than in Lithuania and slightly lower than in Estonia as reduction in road vehicle km is greater in Estonia, and less in Lithuania. This is predominantly due to larger removal of trucks from the road in Estonia*
Air Pollution	142	29	0.13	*Benefits are slightly lower than in other countries as reduction in road vehicle km is greater in Estonia which is predominantly due to larger removal of trucks from the road; and the reduction in road km in Lithuania has come from mainly fast moving roads with higher emissions per vehicle.*
Climate Change	565	108	0.46	*Benefits are slightly higher than in Lithuania and slightly lower than in Estonia as reduction in road vehicle km is greater in Estonia, and less in Lithuania. This is predominantly due to larger removal of trucks from the road in Estonia*
Total Costs		**625**	**2.66**	
Total Benefits		**967**	**4.11**	
Net Present Value (NPV)		342		
EIRR		**8.4%**		
Benefit/Cost Ratio		**1.55**		

Table 118 - Rail Baltica Preferred Option Economic Appraisal Table - Lithuania

Economic Impact (€,000,000 discounted)	**Cost or Benefit** Un-discounted	**Cost or Benefit** Discounted	**Discounted Cost or Benefit** *(per km of track)*	**Commentary**
Cost to Infrastructure Manager/Government				
Capital / Investment Costs	1,258	674	2.55	*Construction cost per km: 4,800,000 Euro/km This is mid value of the three nations. Land cost per km: 56,000 Euro/km This is lowest of the three nations due higher cost and amount of urban land required to purchase in Estonia and Latvia*
Residual Value	-435	-41	-0.16	
Maintenance Costs	128	22	0.08	*Maintenance cost per km of track is the same for all countries*
Benefit to Manager				
Track access charges	601	125	0.47	*Track access charge per train-km is the same for all countries*
Passenger	178	*41*	*0.15*	
Freight	423	*84*	*0.32*	
Benefit to Operator				
Passenger Operator Operating costs *(including track access charges)*	-390	-89	-0.34	*Operating cost per train-km is the same for all countries*
Revenues	1,016	215	0.81	*Optimum fares are higher on Rail Baltica south of Riga than north of Riga, leading to a slightly higher average revenue per km of track than in the other countries*
Freight Operator Operating costs *(including track access charges)*	-825	-164	-0.62	*Operating cost per train-km is the same for all countries*
Revenues	1,514	322	1.22	*Revenues per km of track are lower than in Estonia and Latvia as the share of the domestic market is slightly smaller than in Estonia and volumes of freight on the Warsaw -Kaunas section are lower than the other route sections*
Benefit to Users				
Value of Time Savings		284	1.08	
Passenger	333	*71*	*0.27*	*Passenger journey time savings are lower than in other countries as patronage south of Kaunas is lower than other sections of the route*
Freight	1,073	*213*	*0.81*	*Freight time savings are lower than in Estonia and Latvia as the volume of freight traffic on the Warsaw -Kaunas section is lower than the other route sections*

Economic Impact (€,000,000 discounted)	**Cost or Benefit** Un-discounted	**Cost or Benefit** Discounted	**Discounted Cost or Benefit** *(per km of track)*	**Commentary**
External Impacts				
On Safety (Accidents)	425	89	0.34	*Over the 30 year appraisal period in Lithuania 1,719 accidents are expected to be avoided, (leading to a reduction of fatalities of 221, a reduction of severe injuries of 414 and a reduction of light injuries of 1,693). Benefits are slightly lower than in the other countries as the reduction in road vehicle km is lower in Lithuania.*
Air Pollution	358	77	0.29	*Benefits are higher than in other countries as the HEATCO health damage costs are higher for Lithuania and the reduction in road vehicle km in Lithuania has come from mainly fast moving roads with higher emissions per vehicle.*
Climate Change	438	85	0.32	*Benefits are slightly lower than in other countries as reduction in road vehicle km is greater in Estonia and Latvia than in Lithuania.*
Total Costs		**654**	**2.48**	
Total Benefits		**944**	**3.58**	
Net Present Value (NPV)		289		
EIRR		**7.9%**		
Benefit/Cost Ratio		**1.44**		

Table 119 below summarises the costs and benefits for each nation. It shows that due to the differing infrastructure and user and operator benefits in each country the average cost and average benefits per km of track vary.

Table 119 - Total Discounted Benefit and Cost per km of Track.

	Estonia	**Latvia**	**Lithuania**	**Whole**
Total Discounted Cost per km	2.41	2.66	2.48	1.66
Total Discounted Benefit per km	4.52	4.11	3.58	2.90

Note: whole route includes stretch from Polish/Lithuanian Border to Warsaw

8.7.9 Risk Analysis.

8.7.9.1 Methodology

The risk assessment methodology comprises 4 key steps:

1. Identify through sensitivity tests of the critical variables which have an impact on the performance of the proposed Rail Baltica option
2. Identify and allocate probability distributions to reflect uncertainty in future values of the critical variables
3. Undertake 10,000 simulation runs of the economic assessment calculation selecting values for the key variables in accordance with the uncertainty distributions.
4. Assess the variation in the resultant economic and financial indicator parameters leading to definition of P95 and P50 values (these are values which have a 95% and 50% chance of being exceeded respectively)

8.7.9.2 Sensitivity Tests

Key inputs in the CBA analysis are the sensitivity tests. These tests are designed to do two things:

- Indicate the stability in the assessment of NPV and EIRR in the event of changes to costs and benefits;
- Identify which factors make the most difference to the economic assessment (the critical variables).

The sensitivity tests will assess changes in amount and timing of investment costs; ongoing costs including operation and maintenance; the amount of benefit produced; and the monetary value of that benefit.

For the Rail Baltica options roads decongestion is not a major issue. Hence, the benefits of the improvements are proportional to the traffic flows. This means that it is a reasonable approximation to undertake sensitivity tests in the economic assessment spreadsheet without rerunning the traffic model.

The following sensitivity tests have been undertaken

- Sensitivity Test 1 Increase Investment Costs by 30%
- Sensitivity Test 2 Change of Investment Cost Profile
- Sensitivity Test 3 Change of Operation and Maintenance Cost
- Sensitivity Test 4 Reduce Total Demand Volumes by 30% (both Freight and Passenger Demand)
- Sensitivity Test 5 Reduce Freight Demand Volumes by 50%
- Sensitivity Test 6 Reduce Value of Time Savings by 40%
- Sensitivity Test 7 Reduce GDP Growth by 10%

Sensitivity Test 1 Increase Investment Costs by 30%

Investment costs include:

- Land;
- Construction;
  - Equipment
  - Materials
  - Labour
- Project management;
- Site supervision; and
- Publicity

Investment costs have been developed using unit rates per kilometre and identification of key infrastructure requirements such as road and river crossings. Construction costs are the largest element of investment costs by a considerable margin. Hence, this sensitivity test is essentially considering the impact if construction is more expensive than expected.

Table 120 - Results of Sensitivity Test 1

	NPV	**EIRR**
Base Case	1,368	9.3%
Increase Investment Costs by 30%	838	7.4%
Percentage Change	**-39%**	**-20%**

Sensitivity Test 2 Change of Investment Cost Profile

The Base Case assumes that the expenditure is spread throughout the construction period as shown earlier in Table 7.2 and that the Rail Baltica service opens immediately it is complete. This sensitivity test brings forward the costs (so that all costs occur in the first year) but leaves the opening date unchanged. This sensitivity test represents two effects. The first is that expenditure occurs earlier. The second is that there is a delay to scheme opening after costs have been incurred.

Table 121 - Results of Sensitivity Test 2

	NPV	**EIRR**
Base Case	1,368	9.3%
100% Construction Costs Occur in First Year (2020)	1,183	8.3%
Percentage Change	**-14%**	**-11%**

Sensitivity Test 3 Change of Operation and Maintenance Cost

The cost of maintenance is determined by the length of various standards of road. Some activities must be undertaken every year whilst some activities are undertaken periodically:

This test investigates the impact of increasing maintenance costs by 30%

Table 122 - Results of Sensitivity Test 3

	NPV	EIRR
Base Case	1,368	9.3%
Increase Operation and Maintenance Costs by 30%	1,190	8.8%
Percentage Change	**-13%**	**-5%**

Sensitivity Test 4 Reduce Total Demand Volumes by 30%

This test can represent two situations. First, it can represent a situation where scheme capture is reduced, that is more passenger and freight traffic remains on the existing modes. In this case, fewer people obtain the benefit as the remaining modes do not gain any reduction in cost. Secondly, it can represent a reduction in demand but the same capture rate.

Table 123 - Results of Sensitivity Test 4

	NPV	EIRR
Base Case	1,368	9.3%
Reduce Traffic Volume by 30%	248	6.3%
Percentage Change	**-82%**	**-32%**

Sensitivity Test 5 Reduce Freight Demand Volumes by 50%

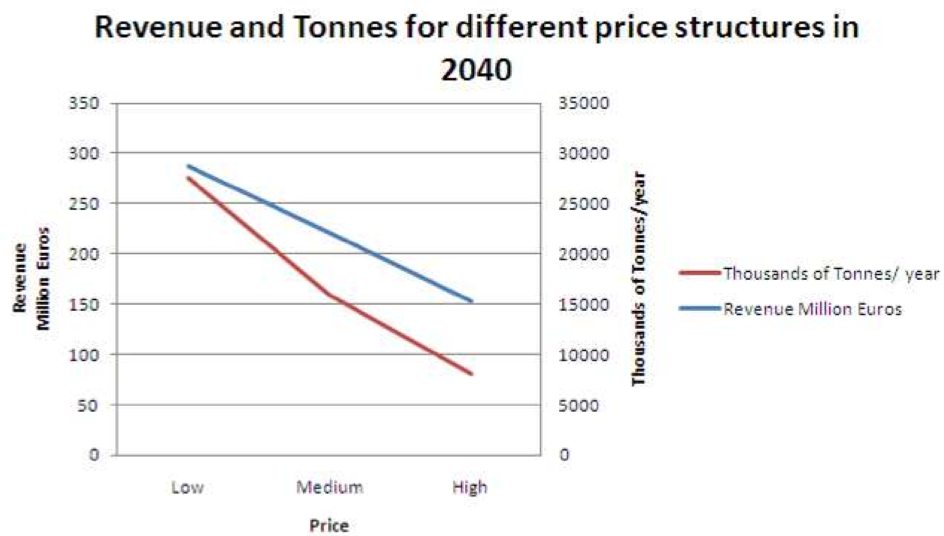
This test can represent two situations. First, it can represent a situation where freight capture is reduced, that is more freight traffic remains on the existing modes. In this case, fewer people obtain the benefit as the remaining modes do not gain any reduction in cost. Secondly, it can represent a reduction in the overall market but the same capture rate.

Table 124 - Results of Sensitivity Test 5

	NPV	EIRR
Base Case	1,368	9.3%
Reduce Freight Volume by 50%	28	5.6%
Percentage Change	**-98%**	**-40%**

Note: The research into the freight market took actual prices from the three different countries, Estonia, Latvia and Lithuania and averaged them with a low, medium and high price. A number of sensitivities were tested to ascertain the best feasible option, one of these involved adjusting the price of freight (page 156 final report volume 1). This shows that when prices are increased from medium to high, the volume of freight decreases by almost a half from 15.8 to 8.1 million tonnes. As a result revenue decreases from 222 million Euros in 2040 to 152 million Euros.

The graph below shows that once you go below the medium price the tonnes/year grows faster than the revenue, thus the revenue per tonne reduces. For prices above medium the tonnes/year decreases at the same rate as revenue and hence there is little point in investing beyond this level. Given that cost is directly proportional to the tonnes carried it is clear that below the medium price profit suffers where as above the medium price there is no increase in profit per tonne. Therefore selecting the medium price maximises the external benefits of shifting freight onto rail as well as maximising revenue against cost.



Sensitivity Test 6 Reduce Value of Time Savings by 40%

For the new rail Baltica Service the main economic benefit to users would be generated by the savings of travel time, related to the value of time. This test can also represent two situations. First it can represent the situation where the number of minutes saved, does not change but their valuation does change. However, the resulting benefits will be the same for the same proportional change in the number of minutes saved but an unchanged valuation.

Table 125 - Results of Sensitivity Test 6

	NPV	**EIRR**
Base Case	1,368	9.3%
Reduce Value of Time Savings by 40%	905	8.1%
Percentage Change	**-34%**	**-12%**

Sensitivity Test 7 Reduce GDP Growth by 10%

GDP affects the level of traffic demand which, in turn, has an effect on all types of benefits. It also has an effect on the valuation of benefits, particularly value of time. This test does not affect the Base Year but does affect growth beyond the Base Year. It has a progressively greater impact on the level of benefits as the assessment period progresses.

Table 126 - Results of Sensitivity Test 7

	NPV	**EIRR**
Base Case	1,368	9.3%
Reduce GDP Growth by 10%	258	6.1%
Percentage Change	**-81%**	**-34%**

8.7.9.3 Switching Values

These are the changes required in each of the variables to reduce the NPV to zero.

Table 127 - Switching Values

Variable	Percentage Change needed to reduce NPV to zero
Investment Cost	77%
Maintenance Cost	2254%
Operating Cost	167%
Traffic Volume	-43%
Value of Time	-118%

8.7.9.4 Risk Analysis

The sensitivity tests have each concentrated on one variable. There is no reason to believe that most of these variables are correlated; however, it is possible that some of them will be downside whilst others are upside at the same time. One approach to assess the impact of this would be to develop an upside scenario and a downside scenario using combinations of some of these variables. There are, however, two problems with the scenario analysis approach. First, there is no reliable way of assigning probabilities to the outcomes; secondly, the combination of variables takes no account of whether they are positively or negatively correlated or not correlated at all.

It is true that some variables are correlated, for example values of time and economic growth. Combining low economic growth and low value of time growth is legitimate and these are linked in the economic analysis spreadsheet. However, there is no reason to believe that a change in investment costs should influence traffic volumes. There is also the possibility that some variables will diverge from forecasts in a favourable direction while other changes are unfavourable. For this reason, we have conducted a risk analysis using @Risk. This uses a Monte Carlo simulation approach.

Risk Analysis addresses several of the weaknesses of the scenario approach.

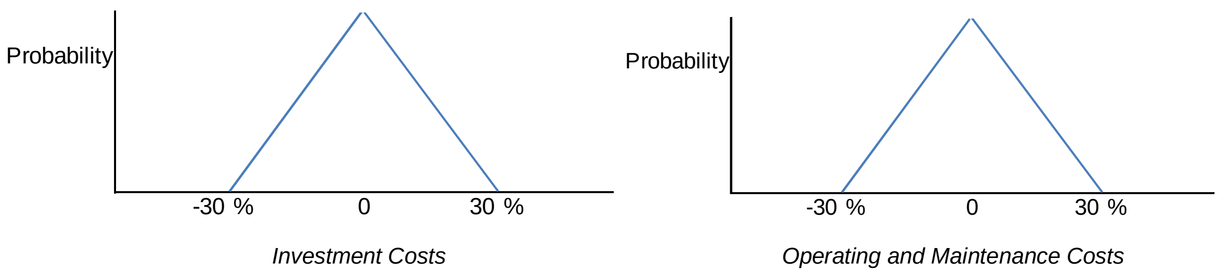
- First, it does produce probabilities of certain outcomes, and it does so with complete flexibility – any outcome can be assigned a probability.
- Secondly, variables which are correlated (or not) can be specified as such (indeed more complex dependency structures can also be specified).

Risk Distributions for Costs

Changes in the spend profile have only a small impact compared to changes in the total investment cost. Hence, it is the investment cost which is incorporated into the risk analysis. The maximum extent of the difference modelled is 30%. It is assumed that the cost may vary up or down by this amount. It is most likely that the actual cost will be close to the estimate, taking account of compensating errors. Hence, we are using a triangular distribution with the apex in the middle.

We are making a similar assumption for operation and maintenance costs. This is assumed not to be correlated with construction costs.

Figure 49 - Probability Distribution of Investment, Operating and Maintenance Costs



Risk Distributions for Benefits

There are normally two types of uncertainties in the assessment of benefits for New rail projects: patronage and freight capture from existing modes and growth. Capture is nearly always the most significant effect in the early years (a base year issue) with growth becoming progressively more significant (a forecasting years' issue).

Base year risks are those that are due to our imperfect understanding of the present situation. These risks may be due to statistical uncertainty in the surveys or variations in the speed of competing modes in the traffic model. These risks are static risks and will not change over time. These risks apply to the opening year although their effects will persist into the future.

The second major class of risk is forecast risk. This represents uncertainty in growth parameters. This type of risk includes factors such as GDP; we have greater confidence about the level of GDP next year than we are in 20 years time.

The risk in the early years of the project is dominated by the base year risk. The later years of the concession are dominated by the forecast risks.

Base Year Risks

The base year risk can best be understood as the uncertainty there would be if the Rail Baltica service were in operation at this point in time. This removes any growth issues but does include:

a. Existing levels of demand. Any error in this estimate will have a proportional impact on the benefits as there will be less passengers and freight volumes to benefit from the improvements.

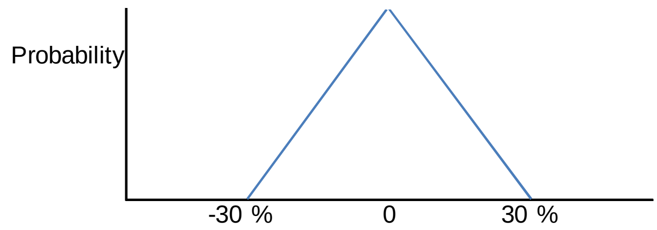
b. Pattern of origins and destinations. This can affect the assessment of the number of users who will transfer to the new service, and hence the number who will gain the benefit from it.

c. Network speeds and capacities. The benefit achieved is partly determined from the saving in journey time. Hence, we must model the journey times on the new service and on the alternative modes. Any errors in the model will affect the assessment of the amount of time saved.

d. Value of Time. This will affect the balance between time savings and costs differences in the choice of mode. It will also impact on the value put on the time savings.

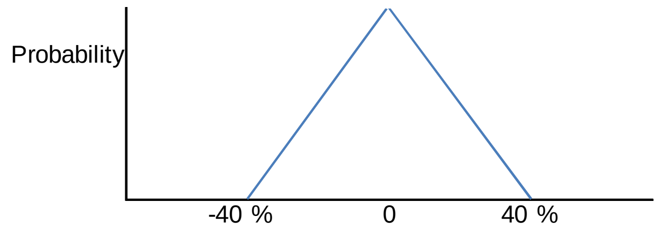
The first two of these risks (a, b) affect the amount of demand gaining the benefit. This is modelled as a triangular distribution with the apex in the middle. The maximum deviation is ±30%.

Figure 50 - Probability Distribution of Opening Year Demand



The third risk (c) and the fourth risk (d) relate to the time saving benefit. One of them relates to the amount of time saved, while the other relates to the valuation of it. It is the product of these two variables which gives the overall benefit. Hence, a proportional change in one of them has exactly the same effect on the benefits as the same proportional change in the other. This is modelled as a triangular distribution with the apex in the middle. The maximum deviation is ±40%.

Figure 51 - Probability Distribution of Value of Time Savings



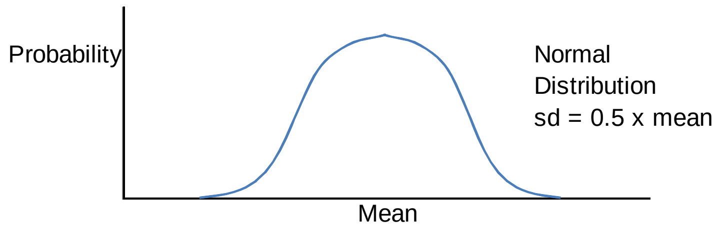
The potential errors described above do not necessarily imply a wide risk distribution in the base year. Lack of correlation in the variables will result in compensating errors.

Forecast Year Risks

The key driver of growth is GDP. If GDP differs from its forecast levels then demand growth with also be different. GDP growth may be higher than forecast in some years but lower in others. There is considerable variation in the short term to GDP growth but long term average growth levels tend to hold.

To represent this uncertainty in the GDP growth we use a normally distributed random variable for GDP growth with a mean value equal to the most recent GDP growth forecast and a standard deviation of half of the forecast growth. There is no correlation between years. The effect of this is that the absolute variability in the growth increases each year, but the relative variability (compared to the total growth) reduces over time.

Figure 52 - Probability Distribution of Year-on-Year GDP Growth



Value of time is closely tied with GDP growth. The GDP and value of time effects are already linked in the economic appraisal spreadsheet and no further adjustment is required.

8.7.9.5 Risk Analysis Results

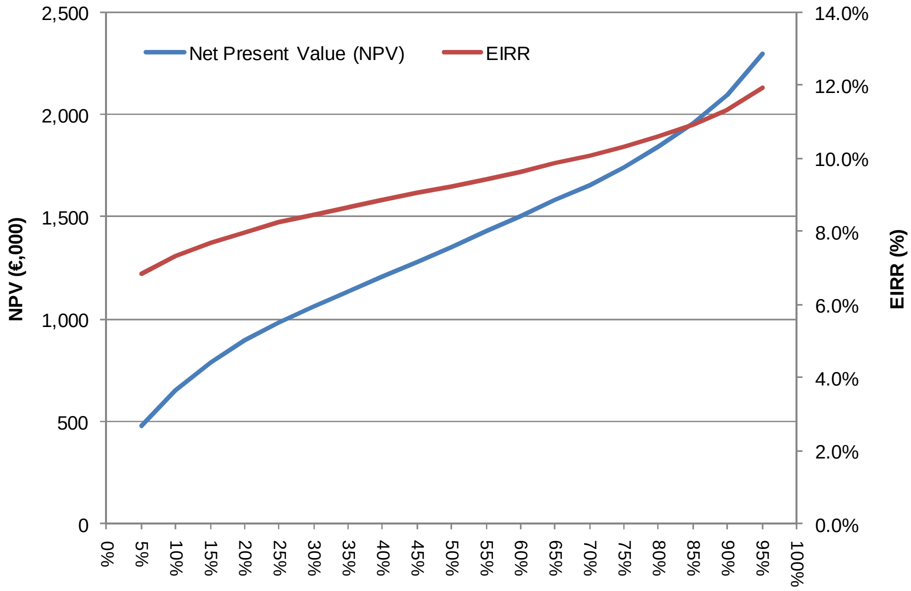
All these factors are then combined to produce an alternative NPV and EIRR. This process is undertaken 100,000 times to provide a distribution of results.

Table 128 - Risk Analysis Results

Name	Net Present Value (NPV)	EIRR
Model Value	1,368	9.3%
Minimum	-351	4.5%
Mean	**1,368**	**9.3%**
Maximum	3,370	15.5%
Std Deviation	551	1.5%
5% Percentile	**476**	**6.8%**
10% Percentile	649	7.3%
15% Percentile	788	7.7%
20% Percentile	893	8.0%
25% Percentile	982	8.2%
30% Percentile	1,062	8.5%
35% Percentile	1,138	8.7%
40% Percentile	1,208	8.9%
45% Percentile	1,281	9.1%
50% Percentile	**1,353**	**9.2%**
55% Percentile	1,427	9.4%
60% Percentile	1,504	9.6%
65% Percentile	1,581	9.9%
70% Percentile	1,654	10.1%
75% Percentile	1,741	10.3%
80% Percentile	1,845	10.6%
85% Percentile	1,959	10.9%
90% Percentile	2,094	11.3%
95% Percentile	2,297	11.9%

The quantitative risk analysis has considered the impacts on the economic performance of the project (in terms of NPV and EIRR) that result from uncertainty in the underlying analysis assumptions. This captures the risk associated with differences between the predicted value and out-turn value of economic growth, demand forecasts and cost estimates. It should be noted, however, that there are additional implementation risks that surround the project organisational arrangements. These issues are identified in the risk register and discussed in section 10.8. It is, however, difficult to quantify the financial impact on project performance indicators and to allocate probability distributions to these risks. The quantitative risk assessment therefore excludes the impact of these risks

Figure 53 - NPV and EIRR



The mean value of the distribution for NPV and EIRR matches the model value reflecting the fact that the uncertainty distributions of the input variables are symmetrical. The median (50th percentile) is slightly lower than the model value indicating some skewdness in the output distribution. The percentiles for the NPV distribution demonstrate that less than 5% of the distribution is below zero. There is therefore a more than 95% chance that the NPV will be positive.

8.8 Financial Analysis

8.8.1 Introduction.

This section discusses the financial analysis and how it considers the financial impacts of transactions that affect the financial flows for the project owner/operator. Financial analysis values all quantities according to their financial cost, or revenue, as they accrue to the project's owner and operator. This is in contrast to the economic cost benefit analysis which aims to assess the value for money of projects from the viewpoint of wider society and contains differing costs and benefits.

The nature of the construction and operation of Rail Baltica mean that there are two sets of stakeholders, from whose viewpoint the financial analysis needs to be undertaken. These are:

- ***The Rail Manager***, who constructs and maintains the rail line, these costs are offset to some extent by the track access charges paid by the operators
- ***The Passenger and Freight Service Operators*** who operate the services whose costs include maintenance of the train fleet and payment of access charges to the rail manager in exchange for the opportunity to run services on the track. These costs are offset to some extent by the revenue paid by the passengers and hauliers who use the service.

A summary of the main costs and benefits associated with the Rail Baltica option, and their treatment in the financial analysis, are shown in Table below.

Table 129 - Financial Analysis Costs and Benefits

Source of Cost / Benefit	Economic Cost Benefit Analysis	Source
Rail Manager		
Capital Cost	Cost of all elements of infrastructure including design and planning, land, construction, supervision and contingency	Valued Net of VAT on materials
Maintenance Cost	All ongoing costs of maintaining the infrastructure during the appraisal period	
Track Access Charges	Charge paid by the passenger and freight operators to the manager for use of infrastructure	Based on EC document 2010/0253(COD) See section 8.7.3.2 above
Residual Value of the Project	Value of infrastructure at the end of the appraisal period.	Valued at a fraction of the construction cost depending upon the scale of the infrastructure.
Rail Operators		
Operating and Maintenance Costs	Costs of operating and maintaining the freight and passenger services, includes an element to pay track access charge to manager	Valued net of VAT on materials
Revenues	Revenues generated over the appraisal period from fares paid by passengers and hauliers	Valued net of VAT as these cash flows are passed from users to authority.
Transport Users and External Effects		
Travellers Time Savings	Not Included in financial analysis as there is no direct income to the project owner from these sources	
Accident Savings		
Benefits From Reduced Emissions		

In the financial analysis VAT has been excluded from passenger and freight revenue cash flows as these elements of the charges paid by users are passed directly from the operator to the government and therefore are not considered a cash in-flow. VAT has also been excluded from capital costs because the project is revenue generating; similarly, VAT is also excluded from operating and maintenance costs as the manger and operators will be able to reclaim any VAT spent.

8.8.2 Assumptions, Values and Methodology

The financial analysis has been undertaken following the methodology outlined in the EC Guide to Cost Benefit Analysis of Investment Projects – Structural Funds, Cohesion Fund and Instrument for Pre Accession – Final Report/ 16th June 2008 (European Commission Directorate General Regional Policy)

The following stages in the analysis are identified in the EC guidance:

1. Assessment of total investment costs
2. Assessment of operating costs and revenues
3. Calculation of financial return on investment cost (FNPV(C) and FRR(C))
4. Identification of sources of funding, including calculation of EC grant
5. Calculation of financial return on national capital (i.e. the element of the investment cost funded by the member nation (FNPV(K) and FRR(K))
6. Assessment of financial stability

The Financial analysis was prepared by the incremental method, which calculates the difference in the value of the financial parameters of the 'without project' and 'with project' alternatives. In the case of the Rail Baltica scheme, the 'without project' scenario includes the existing bus, rail and highway networks and foreseeable modernisation plans and future projects.

The 'with project' is identical to the 'without project' option in all respects except it includes the proposed Rail Baltica Option 1 service providing a higher speed rail link along the Warsaw to Tallinn corridor. This enables the effect of Rail Baltica to be isolated from all other projects.

Financial projections are calculated in real prices on a base of 2010, in Euro. In accordance with EC guidance a discount value of 5.0% is used with an appraisal period covering 30 years post opening:

- Investment period (13 years): 2012 – 2024;
- Operational period (30 years): 2025 – 2054.

The 30 years appraisal period, recommended for rail projects, is applied after opening as it related to the project lifetime.

8.8.3 Investment Costs

The investment costs for the project are discussed in detail in section 8.7. Table below summarises the capital cost estimate for Rail Baltica Option 1.

Table 130 - Capital Costs

Cost Component	Total Cost	Spend Profile												
		2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024
Planning and Design	102	5%	5%	5%	5%	20%	20%	20%	20%					
Land	149					25%	25%	25%	25%					
Construction Costs	3,390									20%	20%	20%	20%	20%
Project Management	34	3%	3%	3%	3%	10%	10%	10%	10%	10%	10%	10%	10%	10%
Site Supervision	3									20%	20%	20%	20%	20%
VAT	744	0.2%	0.2%	0.2%	0.2%	0.7%	0.7%	0.7%	0.7%	19%	19%	19%	19%	19%
TOTAL CAPITAL COSTS	**4,422**	**0.2%**	**0.2%**	**0.2%**	**0.2%**	**1.5%**	**1.5%**	**1.5%**	**1.5%**	**19%**	**19%**	**19%**	**19%**	**19%**

The investment cost included in the financial analysis excludes VAT. The residual value of the asset is determined at the end of the forecast period as the difference between the initial investment value and the depreciation accumulated up till that moment in time. The transport infrastructure (track, bridges) have an average set life of 50-60 years; consequently in a horizon period of 30 years a 30% residual asset value has been allowed for standard rail infrastructure, 50% of construction cost for major infrastructure such as bridges and stations and 30% of land costs.

8.8.4 Operating costs and revenues

The ***operating costs*** include purchase of all goods and services which are not of an investment nature as they are consumed within the appraisal period and are expected to start from the first year of operation, 2025; this includes:

For the Rail Manager:

- Maintenance of the rail track and infrastructure post opening.

For the Rail Operators:

- Payment of the track access charge to the train manager for use of the rail infrastructure; and
- Costs associated with operation of passenger and freight services including:
  - Staff wages;
  - Rolling stock lease and maintenance;
  - Fuel; and
  - Overheads and other direct costs

The ***revenue*** is the cash inflow during the appraisal period; this includes:

For the Rail Manager

- Track access charge paid by the rail operators for use of the rail line.

For the Rail Operators

- Payment of passenger fares by users of passenger service; and
- Payment of freight haulage charges by users of freight service.

Details of the calculation of operating and maintenance costs and passenger and freight revenue are discussed in detail in section 8.7.

In the financial analysis identifiable fiscal transfer payments should be eliminated from the project cash flow. The net revenue and operating cost flows for each year of analysis have therefore been adjusted by removing VAT.

8.8.5 Calculation of Financial Return on Investment Cost

The financial projections have been made based on conditions and assumptions explained above.

The data on investment costs and operating costs has been used to evaluate the financial return on the investment. The indicators needed for testing the project's financial performance are:

- Financial Net Present Value of the project (FNPV);
- Financial Internal Rate of Return (FRR):

Initially the financial return on the ***total investment cost*** has been calculated. This excludes the impact of any EU funding. FNPV/C and FRR/C have been calculated in accordance with method set out in the EC Guide to Cost Benefit Analysis of Investment Projects.

The financial analysis for the investment, without EU funding from the view point of the train manager, the train operator and the project as a whole is shown in Table 130.

Table 131 - Financial Indicators of the Investment - Without EU Funding

Indicator	Total (€ million)				
	To Rail Manager	To Rail Operator			Consolidated
		Total	Freight	Passenger	
Investment Cost excluding EU Grant	*3,678*				*3,678*
Maintenance	*353*				*353*
Residual Asset Value	*-1,569*				*-1,569*
Operating Costs		*2,559*	*1,676*	*882*	*2,559*
Track Access Charges		*2,508*	*1,764*	*744*	*2,508*
Total Outflows	***2,463***	***5,066***	***3,440***	***1,626***	***7,529***
Track Access Charges	*2,508*				*2,508*
Revenues		*8,270*	*5,429*	*2,842*	*8,270*
Total Inflows	***1,365***	***8,270***	***5,429***	***2,842***	***10,778***
Net Cash Flows	45	3,204	1,988	1,216	3,249
Net Cash Flows (discounted)	-1,386	785	517	268	-601
Financial NPV of Investments (FNPV/C)	**-1,386**	**785**	**517**	**268**	**-601**
Financial IRR of Investments (FIRR/C)	**0.05%**	**-**	**-**	**-**	**3.10%**
Financial MIRR of Investments (MIRR)			**6.22%**	**6.18%**	

Note: *Track access charges appear as both an inflow and outflow in the consolidated account. This is because this is a transfer payment between operators and manager.*

8.8.6 Sources of Financing

As part of the financial analysis, identification of the different sources of funding is required in order to calculate the total financial resources available to the project. Within the framework of EU co-financed projects, the main sources of funding are:

- Community assistance (EU Grant);
- National public contribution (capital subsidies at central government level). Financial sources of national contribution are:
    - Governmental budgets
    - Loans from financial institutions like European Investment Bank, European Bank , European Bank for Reconstruction and Development;
    - The issue of Eurobonds/E-bonds.
- Local resources – not foreseen for this project.
- Private Public Partnership combined with Loan Guarantee instrument for TEN-T projects – LGTT.

Calculation of EU grant

The EU contribution is generally determined by multiplying the project's eligible expenditure by the co-financing rate of the relevant operational programme priority axis.

In order to modulate the contribution from the Funds, the maximum eligible expenditure is identified by Article 55(2) Reg. 1083/2006. Such identification of the eligible expenditure aims at ensuring enough financial resources for the project implementation, avoiding at the same time, the granting of an undue advantage to the recipient of the aid.

For a revenue generating projects the EU grant is determined using the funding gap approach. This involves three steps:

1. Identification of the Funding Gap Rate ($\%_{FG}$), which is the share of the total discounted investment cost not covered by the discounted net revenue of the project.
2. Identification of the amount to which the co-financing rate for the priority axis applies. This Decision Amount (DA) is defined as the Eligible Cost (EC) multiplied by the Funding Gap Rate ($\%_{FG}$). In this project the eligible cost has been taken to include all costs incurred prior to opening.
3. Identification of the maximum EU grant, which is equal to the Decision Amount (DA) multiplied by the maximum co-funding rate (MAX CRpa) of the relevant operational programme priority axis

The EU grant is calculated from the view point of the rail manager. This is in line with Revised Guidance Note on Article 55 of Council Regulation no 1083/2006: Revenue Generating Projects.

For this project the funding gap calculation considers the following cash flow elements related to the rail managers account in the calculation of the Funding Gap Rate:

- Investment costs – Total cost of design and construction
- Operating costs – cost of maintenance of the trail infrastructure
- Revenues – Track access charge payments from the rail operators.

The key inputs to the first calculation stage (the funding gap rate calculation) are set out in Table 131.

The second and third calculation stages are shown in Table 132 leading to a calculated EU funding amount of **2,070 Million** Euros this is 56.3% of the total investment cost.

Table 132 - Funding Gap Calculation

No.	Main Elements and parameters		Value Not Discounted	Value Discounted (NPV)
			€ million	
1	Reference period (years)	30		
2	Financial discount rate (%)	5.0%		
3	Total investment cost excluding contingencies		3,678	
4	Total investment cost			2,093
5	Residual value		1,569	
6	Residual value			183
7	Revenues			594
8	Operating costs			71
Funding Gap				
9	Net revenue = revenues – operating costs + residual value = (7) – (8) + (6)			707
10	Investment cost – net revenue = (4) – (9)			1,386
11	**Funding gap rate (%) = (10) / (4)**	**66%**		

Table 133 - Community Contribution Calculation

No.		Value (€ million)
1	Eligible cost (not discounted)	3,678
2	Funding gap rate (%)	66.2%
3	Decision amount, i.e. the "amount to which the co-financing rate for the priority axis applies" = (1)*(2).	2,436
4	Co-financing rate of the priority axis (%)	85.0%
5	**Union contribution (in euro) = (3)*(4)**	**2,070**

Note: *Co-financing rate of 85% adopted in line with Ceilings Applicable to Co-financing Rates identified in Annex III COUNCIL REGULATION (EC) No 1083/2006*

8.8.7 Calculation of Financial Return on National Capital

Following calculation of the EU grant, the financial return on the ***national capital*** has been calculated. This includes the impact of EU funding in terms of a reduced investment cost. In effect this is a measure of the value for money in terms of the balance between benefits and only the element of capital investment made by the member states.

FNPV/K and FRR/K have been calculated in accordance with method set out in the EC Guide to Cost Benefit Analysis of Investment Projects. These indicators are summarised in Table 134 below.

Table 134 - Financial Return of Own / National Resources (FNPV/K)

Indicator	**Total (€ million)**				
	To Rail Manager	To Rail Operator			Consolidated
		Total	Freight	Passenger	
Investment Cost	*3,678*				*3,678*
Maintenance	*353*				*353*
EU Grant	*-2,070*				*-2,070*
Residual Asset Value	*-1,569*				*-1,569*
Operating Costs		*2,559*	*1,676*	*882*	*2,559*
Track Access Charges		*2,508*	*1,764*	*744*	*2,508*
Total Outflows	***392***	***5,066***	***3,440***	***1,626***	***5,458***
Track Access Charges	*2,508*				*2,508*
Revenues		*8,270*	*5,429*	*2,842*	*8,270*
Total Inflows	***2,508***	***8,270***	***5,429***	***2,842***	***10,778***
Net Cash Flows	2,115	3,204	1,988	1,216	5,319
Net Cash Flows (discounted)	-208	785	517	268	577
Financial NPV of Investments (FNPV/K)	**-208**	**785**	**517**	**268**	**577**
Financial IRR of Investments (FIRR/K)	**3.70%**	**-**	**-**	**-**	**8.17%**
Financial MIRR of Investments (MIRR)			**6.22%**	**6.18%**	

Note: *Track access charges appear as both an inflow and outflow in the consolidated account. This is because this is a transfer payment between operators an manager.*

National public contribution

Financial sources of national contribution might be several.

- Governmental budgets
- Loans from financial institutions like European Investment Bank (EIB), European Bank for Reconstruction and Development (EBRD);
- The issue of Eurobonds/E-bonds.

Aforementioned financial sources may be mixed to any proportion. Our suggestion would be to apply lowest capital cost strategy, i.e. during the period of application for EU grant it would necessary to evaluate which financial sources or its mixture are most viable:

- If there are surpluses in budgets of central governments (what seems to be unlikely in foreseeable future), budget financing may be used to finance Rail Baltica. Positive aspect for this scenario that there is no direct financial cost.
- Standard EIB and EBRD senior loans are made either directly to promoters/projects or on a bank intermediated / guaranteed basis. EIB and EBRD shall be considered as a source of financing since banks are able to raise funds at advantageous rates due to an excellent AAA credit reputation. EIB, being a non-profit-motivated institution, passes on the benefits to its clients in the form of loans at fine rates. Interest rates are based on EIB's and EBRD's borrowing cost with a small margin to cover administrative expenses and other costs. As part of its overall strategy for financing TENs, EIB is also considering the utilisation of instruments providing improved leverage on the use of EIB as well as the resources of risk sharing partners. (see chapter discussing PPP issues).

EIB and the EU Commission expects in nearest future to support the development of TEN-T project bonds (so called Eurobonds or e-bonds), notably by providing credit enhancement facilities. It is expected that TEN-T Eurobonds will be guaranteed by EU Commission and, therefore, will be able to deliver lower project financing costs.

Tables below show the calculation of financial return on investment and national capital split down into the individual nations.

Table 135 - Financial Return of Investment (FNPV/C) and Financial Return of Own / National Resources (FNPV/K) – Estonia

Indicator	**Total (€ million)**				
	To Rail Manager	To Rail Operator	Freight	Passenger	Overall
Investment Cost	*1,081*				*1,081*
Maintenance	*111*				*111*
EU Grant	*-694*				*-694*
Residual Asset Value	*-439*				*-439*
Operating Costs		*532*	*348*	*183*	*532*
Track Access Charges		*521*	*367*	*155*	*521*
Total Outflows (with EU Grant)	***59***	***1,053***	***715***	***338***	***1,112***
Total Outflows (without EU Grant)	***753***	***1,053***	***715***	***338***	***1,806***
Track Access Charges	*521*				*521*
Revenues		*2,295*	*1,686*	*609*	*2,295*
Total Inflows	***521***	***2,295***	***1,686***	***609***	***2,816***
Without EU Grant					
Net Cash Flows	-232	1,242	971	271	1,010
Net Cash Flows (discounted)	-471	298	239	59	-173
Financial NPV of Investments (FNPV/C)	**-471**	**298**	**239**	**59**	**-173**
Financial IRR of Investments (FIRR/C)	**-0.91%**	**-**	**-**	**-**	**3.20%**
With EU Grant					
Net Cash Flows	462	1,242	971	271	1,704
Net Cash Flows (discounted)	-71	298	239	59	227
Financial NPV of Investments (FNPV/K)	**-71**	**298**	**239**	**59**	**227**
Financial IRR of Investments (FIRR/K)	**3.23%**	**-**	**-**	**-**	**9.63%**
Financial MIRR of Investments (MIRR)			**7.18%**	**6.24%**	

Table 136 - Financial Return of Investment (FNPV/C) and Financial Return of Own / National Resources (FNPV/K) – Latvia

Indicator	**Total (€ million)**				
	To Rail Manager	To Rail Operator	Freight	Passenger	Overall
Investment Cost	*1,271*				*1,271*
Maintenance	*114*				*114*
EU Grant	*-823*				*-823*
Residual Asset Value	*-576*				*-576*
Operating Costs		*546*	*358*	*188*	*546*
Track Access Charges		*535*	*377*	*159*	*535*
Total Outflows (with EU Grant)	***-14***	***1,081***	***734***	***347***	***1,067***
Total Outflows (without EU Grant)	***809***	***1,081***	***734***	***347***	***1,891***
Track Access Charges	*535*				*535*
Revenues		*2,379*	*1,618*	*761*	*2,379*
Total Inflows	***535***	***2,379***	***1,618***	***761***	***2,914***
Without EU Grant					
Net Cash Flows	-274	1,297	883	414	1,023
Net Cash Flows (discounted)	-549	311	219	92	-237
Financial NPV of Investments (FNPV/C)	**-549**	**311**	**219**	**92**	**-237**
Financial IRR of Investments (FIRR/C)	**-0.90%**	**-**	**-**	**-**	**2.82%**
With EU Grant					
Net Cash Flows	549	1,297	883	414	1,847
Net Cash Flows (discounted)	-82	311	219	92	229
Financial NPV of Investments (FNPV/K)	**-82**	**311**	**219**	**92**	**229**
Financial IRR of Investments (FIRR/K)	**3.22%**	**-**	**-**	**-**	**9.22%**
Financial MIRR of Investments (MIRR)			**7.02%**	**6.70%**	

Table 137 - Financial Return of Investment (FNPV/C) and Financial Return of Own / National Resources (FNPV/K) – Lithuania

Indicator	Total (€ million)				
	To Rail Manager	To Rail Operator	Freight	Passenger	Overall
Investment Cost	*1,326*				*1,326*
Maintenance	*128*				*128*
EU Grant	*-854*				*-854*
Residual Asset Value	*-554*				*-554*
Operating Costs		*613*	*402*	*211*	*613*
Track Access Charges		*601*	*423*	*178*	*601*
Total Outflows (with EU Grant)	***46***	***1,214***	***825***	***390***	***1,260***
Total Outflows (without EU Grant)	***900***	***1,214***	***825***	***390***	***2,114***
Track Access Charges	*601*				*601*
Revenues		*2,531*	*1,514*	*1,016*	*2,531*
Total Inflows	***601***	***2,531***	***1,514***	***1,016***	***3,132***
Without EU Grant					
Net Cash Flows	-299	1,316	690	626	1,017
Net Cash Flows (discounted)	-568	322	178	143	-246
Financial NPV of Investments (FNPV/C)	**-568**	**322**	**178**	**143**	**-246**
Financial IRR of Investments (FIRR/C)	**-0.96%**	**-**	**-**	**-**	**2.77%**
With EU Grant					
Net Cash Flows	555	1,316	690	626	1,871
Net Cash Flows (discounted)	-85	322	178	143	237
Financial NPV of Investments (FNPV/K)	**-85**	**322**	**178**	**143**	**237**
Financial IRR of Investments (FIRR/K)	**3.20%**	**-**	**-**	**-**	**9.29%**
Financial MIRR of Investments (MIRR)			**6.61%**	**7.13%**	

8.8.8 Calculation of Financial return of Private Capital

PPP implies the transfer of risks from the public to the private sector. Main question is to determine whether the demand risk is being passed on or not (and if yes, then LGTT financing may be involved). Given the uncertainty around traffic forecasts (optimism bias issue) the pricing of demand risk can be expensive. Therefore, for initial calculations it is necessary to assume that total risks of the Project are the same; nevertheless, the Project is implemented by a private partner or central government institutions.

The blending of EU grants with PPPs may represent an effective way to reduce the cost of private capital. It is assumed that private partner will be subject to a maximum ceiling of €200 million within LGTT scheme.

We suggest that the mechanism of PPP that is worth to be considered concession model, where private partner receives fees from infrastructure users. Any other alternative (for example, DBFO, BOT) financially is likely to be more expensive than credits or bond issue by national governments.

The residual value is here excluded because usually in PPP contracts the infrastructure is returned to the public sector at the end of the period.

It is clearly seen that PPP concession model (private partner – Rail Manager) without large subsidies from central governments is not viable since track access charges do not cover all expenses that private partner will face during the project cycle. Mainly this is due to extensive lending cost that private partner will face during the project cycle. Therefore it is needed either to revise track access charges (it is not recommended since demand is expected to fall dramatically if this is the case) or provide subsidies from central governments to private partner.

It is recommended that private partner shall be involved as a rail operator since with existing assumptions this section of Rail Baltica is considered as profitable and might exist without subsidies from central governments.

Table 138 - Calculation of Financial return of Private Capital

Indicator	Total (€ million)				
	To Rail Manager	To Rail Operator	Freight	Passenger	Consolidated
Total Investment Cost	*3,678*				*3,678*
Maintenance	*353*				*353*
EU Grant	*-2,070*				*-2,070*
Residual Asset Value	*0*				*0*
Concession Fee to Public Partner	*30*				
Private equity	*-10*				
Loan Reimbursement and Interest	*3,019*				
Operating Costs		*2,559*	*1,676*	*882*	*2,559*
Track Access Charges		*2,508*	*1,764*	*744*	*2,508*
Total Outflows	***5,000***	***5,066***	***3,440***	***1,626***	***7,027***
Track Access Charges	*2,508*				*2,508*
LGTT financing	*200*				*200*
Revenues		*8,270*	*5,429*	*2,842*	*8,270*
Total Inflows	***2,708***	***8,270***	***5,429***	***2,842***	***10,978***
Net Cash Flows	-2,292	3,204	1,988	1,216	3,951
Net Cash Flows (discounted)	-1,226	785	517	268	-441
Financial NPV of Investments (FNPV/K)	**-1,226**	**785**	**517**	**268**	**-441**
Financial IRR of Investments (FIRR/K)	**-9.56%**	**-**	**-**	**-**	**1.97%**

8.8.9 Financial Sustainability

Having determined the investment costs, operating costs and sources of finance, it is possible to determine the project's financial sustainability. A project is financially sustainable when it does not incur the risk of running out of cash in the future. The sustainability assessment determines whether the timing of cash spending and generation results in the cash inflows consistently matching the cash outflows. Stability occurs if the cumulative net cash flow is positive in all years.

Table below summarises the financial sustainability assessment findings.

Table 139 - Financial Sustainability of the Project

	Rail Manager				Passenger Rail Operator				Freight Rail Operator				Consolidated			
	Total Inflows	Total Outflows	Net Cash Flow Annual	Net Cash Flow Cumulative	Total Inflows	Total Outflows	Net Cash Flow Annual	Net Cash Flow Cumulative	Total Inflows	Total Outflows	Net Cash Flow Annual	Net Cash Flow Cumulative	Total Inflows	Total Outflows	Net Cash Flow Annual	Net Cash Flow Cumulative
2011	0.0	0.0	0.0	**0**	0.0	0.0	0.0	**0**	0.0	0.0	0.0	**0**	0.0	0.0	0.0	**0**
2012	5.9	5.9	0.0	**0**	0.0	0.0	0.0	**0**	0.0	0.0	0.0	**0**	5.9	5.9	0.0	**0**
2013	5.9	5.9	0.0	**0**	0.0	0.0	0.0	**0**	0.0	0.0	0.0	**0**	5.9	5.9	0.0	**0**
2014	5.9	5.9	0.0	**0**	0.0	0.0	0.0	**0**	0.0	0.0	0.0	**0**	5.9	5.9	0.0	**0**
2015	5.9	5.9	0.0	**0**	0.0	0.0	0.0	**0**	0.0	0.0	0.0	**0**	5.9	5.9	0.0	**0**
2016	60.9	60.9	0.0	**0**	0.0	0.0	0.0	**0**	0.0	0.0	0.0	**0**	60.9	60.9	0.0	**0**
2017	60.9	60.9	0.0	**0**	0.0	0.0	0.0	**0**	0.0	0.0	0.0	**0**	60.9	60.9	0.0	**0**
2018	60.9	60.9	0.0	**0**	0.0	0.0	0.0	**0**	0.0	0.0	0.0	**0**	60.9	60.9	0.0	**0**
2019	60.9	60.9	0.0	**0**	0.0	0.0	0.0	**0**	0.0	0.0	0.0	**0**	60.9	60.9	0.0	**0**
2020	682.1	682.1	0.0	**0**	0.0	0.0	0.0	**0**	0.0	0.0	0.0	**0**	682.1	682.1	0.0	**0**
2021	682.1	682.1	0.0	**0**	0.0	0.0	0.0	**0**	0.0	0.0	0.0	**0**	682.1	682.1	0.0	**0**
2022	682.1	682.1	0.0	**0**	0.0	0.0	0.0	**0**	0.0	0.0	0.0	**0**	682.1	682.1	0.0	**0**
2023	682.1	682.1	0.0	**0**	0.0	0.0	0.0	**0**	0.0	0.0	0.0	**0**	682.1	682.1	0.0	**0**
2024	682.1	682.1	0.0	**0**	0.0	0.0	0.0	**0**	0.0	0.0	0.0	**0**	682.1	682.1	0.0	**0**
2025	57.5	0.8	56.7	**57**	70.9	54.2	16.7	**17**	126.0	63.8	62.2	**62**	254.5	118.8	135.7	**136**
2026	58.8	0.8	58.0	**115**	72.3	54.2	18.1	**35**	129.7	66.3	63.4	**126**	260.8	121.3	139.5	**275**
2027	60.1	2.4	57.7	**172**	73.8	54.2	19.6	**54**	133.5	68.8	64.6	**190**	267.3	125.4	141.9	**417**
2028	61.4	0.8	60.6	**233**	75.3	54.2	21.1	**76**	137.3	71.5	65.8	**256**	274.0	126.5	147.6	**565**
2029	62.9	10.3	52.5	**286**	76.7	54.2	22.5	**98**	141.3	74.2	67.1	**323**	280.9	138.8	142.1	**707**
2030	64.3	2.4	61.9	**348**	78.3	54.2	24.1	**122**	145.4	77.1	68.3	**391**	288.0	133.7	154.3	**861**
2031	65.8	0.8	65.0	**413**	79.9	54.2	25.7	**148**	148.8	80.1	68.8	**460**	294.5	135.0	159.5	**1021**
2032	67.4	9.3	58.1	**471**	81.5	54.2	27.3	**175**	152.3	83.1	69.2	**529**	301.2	146.6	154.6	**1175**
2033	69.1	2.4	66.7	**537**	83.1	54.2	28.9	**204**	155.9	86.3	69.5	**599**	308.0	142.9	165.1	**1340**
2034	70.8	10.3	60.4	**598**	84.8	54.2	30.6	**235**	159.5	89.6	69.8	**669**	315.0	154.2	160.8	**1501**
2035	72.5	0.8	71.7	**669**	86.5	54.2	32.3	**267**	163.2	93.1	70.1	**739**	322.2	148.1	174.1	**1675**
2036	74.4	2.4	72.0	**741**	88.2	54.2	34.0	**301**	167.0	96.7	70.3	**809**	329.6	153.3	176.3	**1852**
2037	76.3	0.8	75.5	**817**	90.0	54.2	35.8	**337**	170.9	100.4	70.5	**880**	337.2	155.4	181.8	**2033**
2038	78.2	0.8	77.4	**894**	91.8	54.2	37.6	**374**	174.9	104.3	70.7	**950**	345.0	159.2	185.7	**2219**
2039	80.3	11.9	68.4	**963**	93.7	54.2	39.5	**414**	179.0	108.3	70.7	**1021**	353.0	174.4	178.6	**2398**
2040	84.8	9.3	75.5	**1038**	95.6	54.2	41.4	**455**	183.2	117.1	66.1	**1087**	363.6	180.6	183.0	**2581**
2041	86.9	0.8	86.1	**1124**	97.3	54.2	43.1	**498**	186.9	121.1	65.8	**1153**	371.1	176.1	195.0	**2776**
2042	88.9	2.4	86.5	**1211**	99.0	54.2	44.8	**543**	190.7	125.1	65.6	**1219**	378.7	181.7	197.0	**2973**
2043	91.0	0.8	90.2	**1301**	100.7	54.2	46.5	**590**	194.5	129.1	65.4	**1284**	386.2	184.1	202.1	**3175**
2044	93.0	169.3	-76.2	**1225**	102.5	54.2	48.3	**638**	198.3	133.1	65.2	**1349**	393.8	356.6	37.2	**3212**
2045	95.1	2.4	92.7	**1318**	104.2	54.2	50.0	**688**	202.0	137.1	64.9	**1414**	401.3	193.7	207.6	**3420**
2046	97.1	0.8	96.3	**1414**	105.9	54.2	51.7	**740**	205.8	141.1	64.7	**1479**	408.9	196.1	212.8	**3632**
2047	99.2	0.8	98.4	**1512**	107.7	54.2	53.5	**793**	209.6	145.1	64.5	**1543**	416.4	200.1	216.3	**3849**
2048	101.2	10.9	90.4	**1603**	109.4	54.2	55.2	**848**	213.4	149.1	64.3	**1608**	424.0	214.2	209.8	**4058**
2049	103.3	82.0	21.3	**1624**	111.1	54.2	56.9	**905**	217.1	153.1	64.0	**1672**	431.5	289.3	142.2	**4201**
2050	105.3	0.8	104.6	**1729**	112.8	54.2	58.6	**964**	220.9	157.1	63.8	**1735**	439.1	212.1	227.0	**4428**
2051	107.4	2.4	105.0	**1834**	114.6	54.2	60.4	**1024**	224.7	161.1	63.6	**1799**	446.7	217.7	228.9	**4657**
2052	109.5	0.8	108.7	**1942**	116.3	54.2	62.1	**1086**	228.5	165.1	63.3	**1862**	454.2	220.1	234.1	**4891**
2053	111.5	0.8	110.7	**2053**	118.0	54.2	63.8	**1150**	232.2	169.1	63.1	**1925**	461.8	224.1	237.6	**5128**
2054	113.6	11.9	101.6	**2155**	119.7	54.2	65.5	**1216**	236.0	173.1	62.9	**1988**	469.3	239.3	230.1	**5358**

Note: *Cash inflow to rail manager between 2011 and 2020 comes from EU grant and national public contribution.*

Overall the project shows positive cumulative cash flow in all years suggesting that at this level the project is financially stable.

The net cash flow for the rail manager is positive in all years except 2044. The negative cash flow in these years is due to a series of maintenance tasks expected to occur after 25 yrs of operation. The positive annual cash flow leads to a large cumulative net cash flow by the end of the appraisal period.

9 Investigation on Interoperability Assessment

9 Investigation on Interoperability Assessment

(Excerpts from "Guide for the application of Technical Specifications for Interoperability (TSIs), by the European Railway Authority, December 2010)

The Interoperability Directive (2008/57/EC) is a recast of the former Interoperability Directives – 96/48/EC on high speed (HS), 2001/16/EC on conventional rail (CR), both of which were amended by Directives 2004/50/EC and 2007/32/EC. The Interoperability Directive follows the principle of the new-approach directives, consisting of laying down essential requirements and leaving their technical fulfilment to harmonised standards on voluntary basis.

However, due to the complexity of the rail system and of its integrated aspects regarding the essential requirements, it was necessary to set up TSIs to ensure the mandatory interoperability of the rail system. They specify the "conditions to be met to achieve interoperability" and are to be considered as a definition of the "optimal level of technical harmonisation" (Article 1 of the Interoperability Directive).

The objectives of the Interoperability Directive should be understood as a part of the EU approach to improve the performance of rail transport, whose cornerstones are:

- open access in rail transport to favour competition and create incentives for product innovation and service quality;
- fostering the interoperability of the national networks (and hence international services) through technical harmonisation;
- developing an European rail network, by means of extending the Trans-European Network to the whole Community rail system;
- implementing a common rail safety approach to facilitate market access while maintaining a reasonably high level of safety.

Member States (in this case Estonia, Latvia and Lithuania collectively) may decide to apply a TSI or certain requirements of a TSI beyond the technical scope defined in the TSIs themselves or in situations not defined in the Interoperability Directive. In this case, it should be reflected in each of the national legislations in exactly the same way to ensure consistency of the entire Rail Baltica system.

9.1 Interoperability

"Interoperability" means the ability of the rail system to allow the safe and uninterrupted movement of trains which accomplish the required levels of performance. This ability depends on all the regulatory, technical and operational conditions which must be met in order to satisfy the essential requirements.

The Interoperability Directive and its related TSIs are designed to facilitate the "optimal level of technical harmonisation" of the entire EU rail system with a view to improving its competitiveness, for example, by lowering production, acceptance, operation and maintenance costs. The aim is, on one hand, to facilitate international railway services and, on the other hand, to set up common EU-wide rules for conformity assessment and placing in service of infrastructure, fixed facilities and vehicles.

In recent years, a number of new trains have been brought into service on international routes. This has been achieved safely and with minimum disruption, but nearly all of these new trains achieved cross-border interoperability on a route specific basis (very similar to Rail Baltica). In other words, these new trains relied on forms of interoperability that were not fully compliant with the Interoperability Directive and its related TSIs. Typically, the vehicles used on these international routes were specifically equipped for those routes with, for instance, multiple control systems allowing it to switch rapidly from one control system to another where necessary. Such specific solutions, which encompassed the rules of different states, entail additional production and conformity assessment costs.

9.2 Subsystems

"Subsystems" means the result of the division of the rail system, as shown in Annex II [of the Interoperability Directive]. These subsystems, for which essential requirements must be laid down, may be structural or functional.

Annex II states that, for the purposes of the Interoperability Directive, the rail system may be broken down into five (5) structural subsystems:

- infrastructure,
- energy,
- track side control-command and signalling,
- on board control-command and signalling and
- and rolling stock;

(the former three subsystems may be called network related subsystems, the latter two may be called vehicle related subsystems)

and three (3) functional subsystems:

- operation and traffic management,
- maintenance,
- telematic applications for passenger and freight services.

The subsystems shall comply with the TSI in force at the time of their placing in service, upgrading or renewal, in accordance with 2008/57/EC Directive; this compliance shall be permanently maintained while each subsystem is in use.

Article 5(2) [Conformity of a subsystem with TSIs] states the obligation of compliance with the TSIs only for those structural subsystems that have been placed in service (following their construction, upgrading or renewal) after coming in force of these TSIs – therefore, the entire Rail Baltica system. The adoption of a TSI does not have a retroactive character. It does not impose an obligation to bring the existing structural subsystems in compliance with it, unless these subsystems are upgraded or renewed. This may apply to upgrades and renewals required in and around existing stations and existing rail infrastructure.

Article 15 [Placing in service of structural subsystems] states that each Member State shall authorise the placing in service of those structural subsystems constituting the rail system which are located or operated in its territory. To this end, Member State particularly checks:

- "the technical compatibility of these subsystems with the system into which they are being integrated" (Art.15(1));
- "the safe integration of these subsystems in accordance with" the Safety Directive (Articles 4.3 and 6.3);
- their compliance "with the relevant TSI provisions on operation and maintenance", if applicable.

The subsystem constituting the rail system should be subjected to a verification procedure. This verification must enable the authorities responsible for authorising their placing in service to be certain that, at the design, construction and putting in service stages, the result is in line with the regulations and technical and operational provisions in force.

In practice, for authorising a subsystem to be placed in service, the National Safety Authority has to check whether following procedures have been carried out with a positive result:

- 'EC' verification,
- Verification of conformity with applicable notified national rules (open points, specific cases, derogations),
- Risk evaluation and assessment, if required according to Commission Regulation 352/2009/EC.

After a subsystem is placed in service, care should be taken to ensure that it is operated and maintained in accordance with the essential requirements relating to it. For this purpose, the Safety Directive defines responsibilities of Railway Undertakings and Infrastructure Managers regarding the subsystems they operate. The Member States have to check that these responsibilities are met on occasion of granting and supervision of safety certificates and safety authorisations.

9.3 Structure and Content of TSIs

Article 5(3) indicates the contents of TSIs, to the extent necessary to achieve interoperability within the EU rail system.

Table 140 - Contents of TSIs

Each TSI shall: *a) indicate its intended scope (part of network or vehicles referred to in Annex I [of the Interoperability Directive]; subsystem or part of subsystem referred to in Annex II [of the Interoperability Directive]);*	These contents are in Chapters 1 and 2 of the TSIs.
b) lay down essential requirements for each subsystem concerned and its interfaces vis-à-vis other subsystems;	The essential requirements are set out in general terms in Annex III of the Interoperability Directive; they are further elaborated upon for each subsystem in Chapter 3 of the TSIs.
c) establish the functional and technical specifications to be met by the subsystem and its interfaces vis-à-vis other subsystems. If need be, these specifications may vary according to the use of the subsystem, for example according to the categories of line, hub and/or vehicles provided for in Annex I [of the Interoperability Directive];	The subsystem-specific essential requirements are reflected in the technical parameters, interfaces and performance requirements set out for each subsystem in Chapter 4 of the TSIs. As example of this variation of requirements, reference can be made to different categories of line defined in the HS and CR Infrastructure TSI, different power supply systems in the HS and CR Energy TSI, and so on.
d) determine the interoperability constituents and interfaces which must be covered by European specifications, including European standards, which are necessary to achieve interoperability within the rail system.	Chapter 5 of the TSIs deals with constituents and interfaces covered by European specifications. Standards (voluntary or obligatory) that ensure the compliance with the essential requirements of the Interoperability Directive enable the fulfilment of the technical characteristics of the subsystems defined in Chapter 4 of the TSIs and not directly the essential requirements of the Directive.

e) state, in each case under consideration, which procedures are to be used in order to assess the conformity or the suitability for use of the interoperability constituents, on one hand, or the 'EC' verification of the subsystem, on the other hand. These procedures shall be based on the modules defined in Decision 93/465/EEC and its following amendments;	Chapter 6 of TSIs. It has also to be pointed out that the indicated Decision was replaced by Decision 768/2008/EC. Furthermore, a specific Decision on railway modules has been adopted. TSIs adopted on or after adoption of this specific decision make reference to it. TSIs adopted before that date contain the description of the modules in each TSI itself.
f) indicate the strategy for implementing the TSIs. In particular, it is necessary to specify the stages to be completed in order to make a gradual transition from the existing situation to the final situation in which compliance with the TSIs will be the norm;	Chapter 7 of the TSIs, which includes specific cases, defines also transitional periods for application of different provisions of the TSI and allowing for a certain time to place in service subsystems conform to the rules that were in force before the adoption of the TSI.
g) indicate, for the staff concerned, the professional qualifications and health and safety conditions at work required for the operation and maintenance of the above subsystem, as well as for the implementation of the TSIs.	These elements are described in Chapter 4, as part of the characterisation of subsystem.

If certain technical aspects corresponding to the essential requirements cannot be explicitly covered in a TSI they shall be clearly identified in an annex as “open points”. The idea is that certain aspects are considered to be necessary for satisfying the essential requirements, but (because of their complexity or a lack of time) it has not yet been possible to define an appropriate specification for the target system. In this case, a TSI may be adopted with a view of closing the open point in further revisions. In the meantime, notified national rules apply for this open point.

The following table provides a status of the present TSIs.

Table 141 - TSI State of Play (March 2011)

Subsystem	**High Speed**	**Conventional**
Infrastructure	Decision 2008/217/EC (20 Dec 2007)	Adopted 2011/275/EU (26 April 2011)
Energy	Decision 2008/284/EC (6 Mar 2008)	Adopted 2011/274/EU (26 April 2011)
Control-Command and Signalling (CCS) (on board and track side)	Decision 2006/860/EC (7 Nov 2006)	Decision 2006/679/EC (28 Mar 2006)
	Decision 2008/386/EC modifying Annex A	
	New revision under preparation. Expected to be adopted in 2011/2012	
Rolling Stock. Locomotives and passenger rolling stock	Decision 2008/232/EC (21 Feb 2008)	Expected to be adopted in 2011
Rolling Stock. Freight Wagons	Not applicable	Decision 2006/861/EC (28 Jul 2006) amended by Decision 2009/107/EC (14 Feb 2009) New revision under preparation. Expected to be adopted in 2011/2012
Rolling Stock. Noise (transversal TSI including locomotives, passenger rolling stock and freight wagons)		Decision 2006/66/EC (23 Dec 2005) New revision expected to be adopted in 2011
Operation and Traffic Management	Decision 2008/231/EC (1 Feb 2008)	Decision 2006/920/EC (11 Aug 2006) amended by Decision 2009/107/EC (14 Feb 2009)
	Decision 2010/640/EU amending Decisions 2006/920/EC and 2008/231/EC (21 Oct 2010)	
	New revision expected to be adopted in 2011	
Telematic Applications for Freight Services	Not applicable	Regulation 62/2006/EC (23 Dec 2005)
Telematic Applications for Passenger Services	Expected to be adopted in 2011	
Safety in railway tunnels (transversal TSI including infrastructure, energy, CCS and rolling stock)	Decision 2008/163/EC (20 Dec 2007)	
Accessibility for PRM (transversal TSI including infrastructure and rolling stock)	Decision 2008/164/EC (21 Dec 2007)	

Therefore, the preferred alignment for the Rail Baltica project (a new conventional line) includes subsystems Infrastructure, Energy (since the line is proposed to be electrified) and Track side CCS. The TSIs relevant for each of these subsystems are:

- Infrastructure: CR INF TSI,
- Infrastructure: PRM TSI (since the line includes stations),
- Energy: CR ENE TSI (since the line is electrified),
- Track side CCS: CR CCS TSI

In addition, since the system will have new conventional locomotives (for passenger and freight service) the project includes subsystems RST and On board CCS. The TSIs applicable to each of these subsystems are:

- RST: CR LOC&PAS TSI, RST Noise TSI
- On board CCS: CR CCS TSI

In addition, since the system will have and independent Infrastructure Manager the project includes subsystems related to Operation and Traffic Management and Telematic Applications for both Freight and Passenger Services.

9.4 Infrastructure Subsystem (Infrastructure and Stations)

Directive 2008/57/EC (newly adopted 2011/275/EU - 26 April 2011) concerning the technical specification for interoperability related to the Infrastructure Subsystem (CR INF TSI) defines the functional and technical specifications for rail infrastructure related to 'Categories of Line' with respective 'Performance Parameters'. The 'Categories of Line' determine specific levels of requirements for Basic Parameters.

Conventional rail lines types for different types of traffic include:

- Type of Line IV – New core TEN line
- Type of Line V – Upgraded core TEN line
- Type of Line VI – New other TEN line
- Type of Line VII – Upgraded other TEN line

Rail Baltica is considered a Type IV Line – New Core TEN line with Mixed-train Service, therefore its 'Performance Parameters' are as follows:
Axle Load = 25 tonnes
Line Speed = 200 km/h
Train Length = 750 meters

It is permissible to design lines such that they will also accommodate larger gauges, higher axle loads, greater speeds and longer trains. It is also permissible for a line or sections of a line to be designed for speeds and/or train length less than those specified in the TSI, where necessary to meet geographical, environmental or other constraints.

Infrastructure designed to the minimum requirements of the TSI does not provide the capability to meet both maximum speed and maximum axle load in combination.

The CR INF TSI covers:

- the infrastructure structural subsystem
- the part of the maintenance functional subsystem relating to the infrastructure subsystem (e.g. Washing machines)

The scope of the CR INF TSI therefore includes the following basic parameters:

- Line layout, track parameters, switches and crossings
    - Structure gauge (all Categories of Line)
        - The structure gauge shall be set on the basis of the gauge set out as performance parameters for Categories of Line.
        - Calculations of the structure gauge shall be done using the kinematic method in accordance with the requirements of chapters 5, 7, 10 and the Annex C of prEN 15273-3:2009.
    - Distance between track centres (all Categories of Line)
        - The distance between track centres shall be set on the basis of the gauge.
        - Where appropriate the minimum distance between track centres shall also take into account aerodynamic effects. The rules for taking account of aerodynamic effects ... are an open point.
    - Maximum Gradients for new lines for mixed and freight traffic
        - Maximum gradients as steep as 12.5 mm/m are permitted for main tracks at the design phase
        - Gradients of stabling tracks intended for parking rolling stock shall

        - not be more than 2.5 mm/m
    - Minimum radius of horizontal curve (all Categories of Line)
        - The minimum design radius of horizontal curve shall be selected with regard to the local design speed of the curve.
        - For stabling tracks or sidings the minimum horizontal design curve radius shall not be less than 150 m.
        - Reverse curves … with radii in the range from 150 m up to 300 m shall be designed in accordance to EN 13803-2:2006 section 8.4 to prevent buffer locking.
    - Minimum radius of vertical curve (all Categories of Line)
        - The radius of vertical curves shall be at least 600 m on a crest or 900 m in a hollow.
        - For humps in marshalling yards the radius of vertical curves shall be at least 250 m on a crest or 300 m in a hollow.
    - Nominal Track Gauge = 1435mm
    - Cant = design limit 160mm for mixed-train service
    - Rate of Change of Cant = The maximum rate of change of cant through a transition shall be 70 mm/s.
    - Cant Deficiency =
        - Plain Track - for trains which are not fitted with cant deficiency compensation systems cant deficiency shall not exceed
            - 130 mm for freight wagons
            - 150 mm for locomotives of passenger coaches
        - Diverging Track of Switches –
            - 120 mm for … turnout speeds of 30 km/h ≤ V ≤ 70 km/h
            - 105 mm for … turnout speeds of 70 km/h < V ≤ 170 km/h
            - 85 mm for … turnout speeds of 170 km/h < V ≤ 200 km/h
    - Equivalent Conicity =
        - Design values of track gauge, rail head profile and rail inclination for plain line shall be selected to ensure that the equivalent conicity limit of 0.25 (60 km/h < V ≤ 200 km/h) is not exceeded, when modelled wheelsets passing over the designed track conditions.
    - Rail Head Profile = geometrical dimensions
    - Rail Inclination = The rail shall be inclined towards the centre of the track. The rail inclination for a given route shall be selected from the range 1/20 to 1/40.
    - Track stiffness = Open point
    - Electrical Insulation of Rails = the design value of minimum electrical resistance shall be 3 Ωkm in wet conditions
    - Switches and Crossings =
        - The technical characteristics of switches and crossings for the track gauge of 1435 mm shall comply with the following inservice limits:
            - Maximum value of free wheel passage in switches: 1380 mm
            - Minimum value of fixed nose protection for common crossings: 1392 mm
            - Maximum value of free wheel passage at crossing nose: 1356 mm
            - Maximum value of free wheel passage at check rail/wing rail entry: 1380 mm
            - Minimum flangeway width: 38 mm
            - Minimum flangeway depth: 40 mm
            - Maximum excess height of check rail: 70 mm
- Track and Structure Resistance to Loads
    - Vertical Loads = The track shall be designed to withstand at least axle load, max. dynamic wheel force, max. quasi-static wheel force
    - Longitudinal Track Resistance = The track shall be designed to withstand at least forces arising from braking (deceleration) … from temperature changes in the rail (use of braking systems independent of wheel-rail adhesion condition)
    - Lateral Track Resistance = The track shall be designed to withstand at least maximum total dynamic lateral force, quasi static guiding force

- o Resistance of New Bridges to Traffic Loads = Structures shall be designed to support vertical loads in accordance with load model 71, defined in EN 1991-2:2003 (in addition load model SW/0 for continuous bridges). The load models shall be multiplied by the factor alpha ( ) depending on Categories of Line.
- o Equivalent Vertical Loading for New Earthworks and Earth Pressure Effects = similar to bridges
- o Resistance of New Structures Over or Adjacent to Tracks = Aerodynamic actions from passing trains shall be taken into account as set out in EN 1991-2:2003 paragraph 6.6.
- o Resistance of Existing Bridges and Earthworks to Traffic Loads = Upgraded bridges and earthworks shall be brought to a specified level of interoperability according to the Category of Line. The capability requirements for structures are defined by a combined quantity comprising of the Line Category set out in EN 15528:2008 (or if relevant Locomotive Class) and a corresponding maximum speed.

- Track geometrical quality
  - o Track Twist = difference between two cross levels taken at a defined distance apart, usually expressed as a gradient. The track twist limit is a function of the measurement base applied (l) according to the formula: Limit twist = (20/l + 3) with a maximum value of 7 mm/m.
  - o Variation of Track Gauge = Minimum and maximum track gauge depending on the speed.
  - o In Service Cant = +/- 20 mm with a max. of 170 mm for mixed-train service lines.
- Platforms
  - o Usable Length = The platform length shall be sufficient to accommodate the longest interoperable train intended to stop at the platform in normal service. When determining the length of trains intended to stop at the platform, consideration shall be given to both the current service requirements
  - o Further BPs related to platforms are set out in the PRM TSI
- Health, safety and environment, provisions for operation
  - o Maximum pressure variations in tunnels
  - o Noise and vibration limits and mitigation measures
  - o Protection against electric shock
  - o Safety in railway tunnels
  - o Effects of cross winds
- Fixed installations for servicing trains
  - o Toilet discharge
  - o Train external cleaning facilities
  - o Water restocking
  - o Refuelling
  - o Electrical shore supply

All of the defined functional and technical specifications should be taken into consideration and should be able to be met in the eventual design of the Rail Baltica new 1435mm conventional rail line.

9.5 Energy Subsystem (Electrification)

The Energy TSI (CR ENE TSI - newly adopted as 2011/274/EU - 26 April 2011) specifies those requirements which are necessary to assure the interoperability of the rail system related to energy. This TSI covers all fixed installations, DC or AC that are required to supply, with respect to the essential requirements, traction energy to a train.

The energy subsystem also includes the definition and quality criteria for interaction between a pantograph and the overhead contact line.

The energy subsystem consists of:

- Substations: connected on the primary side to the high-voltage grid, with transformation of the high-voltage to a voltage and/or conversion to a power supply system suitable for the trains. On the secondary side, substations are connected to the railway contact line system;
- Sectioning Locations: electrical equipment located at intermediate locations between substations to supply and parallel contact lines and to provide protection, isolation and auxiliary supplies;

- Separation Sections: equipment required to provide the transition between electrically different systems or between different phases of the same electrical system;
- Contact Line System: a system that distributes the electrical energy to the trains running on the route and transmits it to the trains by means of current collectors. The contact line system is also equipped with manually or remotely controlled disconnectors which are required to isolate sections or groups of the contact line system according to operational necessity. Feeder lines are also part of the contact line system;
- Return Circuit: all conductors which form the intended path for the traction return current and which are additionally used under fault conditions. Therefore, so far as this aspect is concerned, the return circuit is part of the energy subsystem and has an interface with the infrastructure subsystem.

In addition, according to the Directive 2008/57/EC, the energy subsystem includes:

- On-board Parts of the Electric Consumption Measuring Equipment - for measurement of electric energy taken from or returned to (during regenerative braking) the contact line by the vehicle, supplied from the external electric traction system. The equipment is integrated into and put into service with the traction unit, and is in the scope of the conventional rail locomotives and passenger rolling stock TSI (CR LOC&PAS).

The Directive 2008/57/EC also foresees that the current collectors (pantographs), which transmit electrical energy from the overhead contact line system to the vehicle, are in the rolling stock subsystem. They are installed and are integrated into and put into service with the rolling stock and are in the scope of CR LOC & PAS TSI.

The power supply system has to be designed such that every train will be supplied with the necessary power. Therefore, the supply voltage, current draw of each train and the operating schedule are important aspects for performance.

Power supply:

- Voltage and frequency
- Parameters relating to supply system performance
- Continuity of power supply in case of disturbances in tunnels
- Current capacity, DC systems, trains at standstill
- Regenerative braking
- Electrical protection coordination arrangements
- Harmonics and dynamic effects for AC systems, and
- Electric energy consumption measuring equipment

As with any electrical device, a train is designed to operate correctly with a nominal voltage and a nominal frequency applied at its terminals, i.e. the pantograph(s) and wheels. Variations and limits of these parameters need to be defined in order to assure the anticipated train performance. Modern, electrically powered trains are often capable of using regenerative braking to return energy to the power supply, reducing power consumption overall. The power supply system can be designed to accommodate such regenerative braking energy.

In any power supply, short-circuits and other fault conditions may occur. The power supply needs to be designed so that the controls detect these faults immediately and trigger measures to remove the short-circuit current and isolate the affected part of the circuit. After such events, the power supply has to be able to restore supply to all installations as soon as possible in order to resume operations.

A compatible geometry of the overhead contact line to the pantograph is an important aspect of interoperability. As far as geometrical interaction is concerned, the height of the contact wire above the rails, the variation in contact wire height, the lateral deviation under wind pressure and the contact force have to be specified. The geometry of the pantograph head is also fundamental to assure good interaction with the overhead contact line, taking into account vehicle sway.

Geometry of the OCL and quality of current collection:

- Geometry of the overhead contact line
- Pantograph gauge
- Mean contact force
- Dynamic behaviour and quality of current collection

- Pantograph spacing
- Contact wire material
- Phase separation sections, and
- System separation sections

In order to support interoperability of European networks, the pantographs specified in CR LOC&PAS TSI are the target.

The interaction between an overhead contact line and a pantograph represents a very important aspect in establishing reliable power transmission without undue disturbances to railway installations and the environment. This interaction is mainly determined by:

- static and aerodynamic effects dependent upon the nature of the pantograph contact strips and the design of the pantograph, the shape of the vehicle on which the pantograph(s) is (are) mounted and the position of the pantograph on the vehicle,
- the compatibility of the contact strip material with the contact wire,
- the dynamic characteristics of the overhead contact line and pantograph(s) for single unit or multiple unit trains,
- the number of pantographs in service and the distance between them, since each pantograph can interfere with the others on the same overhead contact line section.

The AC 25 kV 50 Hz system is to be the target supply system, for reasons of compatibility with the electrical generation and distribution systems and standardisation of substation equipment.

Available energy and grid capacity within the existing Rail Baltica alignment needs to be studies in depth in the preliminary planning and design stages to clearly define if additional loads need to be requested from the local utilities.

9.6 Control-Command and Signalling (CCS) (on board and track side)

Decision 2006/679/EC concerning the technical specification for interoperability relating to the "control-command and signalling subsystem" of the trans-European conventional rail system defines the functional and technical specifications related to the both track-site and on-board systems:

- Control-command safety characteristics relevant to interoperability
- On-board ETCS functionality
- Track-side ETCS functionality
- EIRENE functions
- ETCS and EIRENE air gap interfaces
- On-board interfaces internal to control-command
- Trackside interfaces internal to control-command
- Key management
- ETCS-ID management
- HABD (hot axle box detector)
- Compatibility with tTrack-side train detection systems
- Electromagnetic compatibility
- ETCS DMI (Driver machine interface)
- EIRENE DMI (Driver machine interface)
- Interface to data recording for regulatory purposes
- Visibility of track-side control-command objects

In addition, the TSI defines the functional and technical specifications of the interfaces to other subsystems including traffic operation and management, rolling stock, infrastructure and energy. The TSI also states the required:

- Operating Rules
- Maintenance Rules
- Professional Qualifications
- Health and Safety Conditions
- Infrastructure and Rolling Stock Registers

The Rail Baltica 1435mm rail line will need to be compliant with European Standards for Inter-operability. These standards mandate European Train Management System (ERTMS) as a solution.

ERTMS consists of two elements; the European Train Control System (ETCS) and Global System Mobile – Railways (GSM-R). The ETCS provides common automatic train protection functionality together with in-cab signalling of movement authority and speed information for the driver. The GSM-R provides a common radio system for trains operating across European borders.

Three levels of ERTMS are envisaged but only Levels 1 and 2 are in commercial use:

- Level 1 – An overlay to line side signalling systems that provides enhanced safety through the provision of automatic train protection system that supervises the train speed against the speed profile calculated by the on-board system in relation to the limit of movement authority received. It utilises the existing train detection and interlocking but provides in cab signalling of movement authority by taking aspect information form the line side signal circuits and communicates this into the cab via Local Electronic Units (LEU) and track mounted balise.
- Level 2 – Provides additional functionality and flexibility by removing the need for line side signals. Train position is detected by the track side train detection system via the interlocking. Track mounted balise provide odometry referencing for the on board system. Movement authority is communicated to the train from a Radio Block Centre via the GSM-R radio system based upon safety integrity information from the interlocking. The interlocking must be capable of two way communication with the RBC. This generally requires the renewal of the interlocking. This level of ERTMS enables more flexible use of the underlying block system and can enhance capacity of the network.
- Level 3 – Provides moving block functionality. It removes the need for track based train detection and line side infrastructure other than passive balise mounted in the track; and the GSM-R radio system. Level 3 systems are still being developed and are not in commercial use in main line railways. The level 3 system is not constrained by fixed blocks and can have high levels of capacity and operational flexibility as a consequence.

The use of ERTMS on the Rail Baltica route is specified by the Technical Specifications for Interoperability. Where a dual gauge route is desirable in an area of restricted corridor, the overlay of ERTMS level 1 would provide a solution that:

1. enables the continuation of ERTMS signalling control for trains running on the 1435mm route;
2. provides a common European train protection interface between infrastructure and train; and
3. minimises alterations to the existing signalling systems or rolling stock that use the 1520mm gauge line.

The existing system would need to be altered as follows:

1. The track based train detection would need to be reconfigured to incorporate rails in both gauges as one circuit.
2. Local Electronic Units would need to be provided to derive information form the signal aspect circuits that feed the line side signals.
3. Track balise would need to be provided to communicate signal aspect information into the on-board ERTMS equipment from the LEU and communicate the static profile of the route ahead.
4. Interlocking logic alterations would need to be undertaken where points in different gauges are introduced into the layout.
5. Alterations to the control panel would need to be undertaken to reflect revised track layouts where additional points are provided for 1435mm gauge line.

In these dual gauge areas Rail Baltica would be constrained as the ERTMS system would be constrained by the underlying block system of the fixed block system. Specifically

1. Line speed would be constrained to the design speed of the underlying fixed block system
2. Capacity would be constrained by the design capacity of the underlying fixed block system

As with large implementation projects such as Rail Baltica, particular caution will need to be placed on specific issues of implementation of the TSI for Control-Command including but not limited to:

- General migration criteria
- Timing criteria
- Implementation: infrastructure (stationary equipment)
- Implementation: rolling stock
- Particular migration paths
- Conditions under which optional functions are required

9.7 Rolling Stock – Noise

Decision 2006/66/EC concerning the technical specification for interoperability relating to the subsystem rolling stock — noise of the trans-European conventional rail system along with the Commission Decision of 4 April 2011 concerning the technical specifications of interoperability relating to the subsystem 'rolling stock – noise' of the trans-European conventional rail system (notified under document C(2011) 658) (Text with EEA relevance) (2011/229/EU) defines the functional and technical specifications related to:

- Noise emitted by freight wagons (limits for pass-by noise and stationary noise)
- Noise emitted by locomotives, multiple units and coaches (limits for stationary noise starting noise, pass-by noise), and
- Interior noise of locomotives, multiple units and driving trailers

In addition, the TSI defines the functional and technical specifications of the interfaces including the conventional rail rolling stock subsystem (locomotives, multiple units and coaches subsystems). The TSI also states the required:

- Operating Rules
- Maintenance Rules
- Professional Qualifications
- Health and Safety Conditions
- Infrastructure and Rolling Stock Registers

All of the defined functional and technical specifications should be taken into consideration and should be able to be met in the eventual design of the Rail Baltica new 1435mm conventional rail line. Particular caution will need to be placed on the urban sections of the railway, since the noise parameters will be more stringent and the existing conditions will be constrained.

Note: The (2006/66/EC) and (2011/229/EU) TSIs include:
1) Limits for pass-by noise for freight wagons in Finland, Estonia, Latvia and Lithuania (Category T1 — temporary) - The noise emission limits for freight wagons are not valid for Finland, Estonia, Latvia and Lithuania. The reason for this is the safety aspects under Nordic winter conditions. This specific case is valid until the functional specification and assessment method for composite brake blocks are incorporated in the revised version of the WAG TSI. That does not preclude freight wagons from other Member States from operating in Nordic and Baltic States.
2) a "Specific case for Estonia, Latvia and Lithuania (Category 'T1' — temporary) - The noise emission limits for all rolling stock (locomotives, coaches, EMUs and DMUs) are not valid for Estonia, Latvia and Lithuania until the revision of this TSI. In the meantime, measurement campaigns will be carried out in these States; the revision of this TSI shall take into account the results of these campaigns.

9.8 Operation and Traffic Management

Decision 2006/920/EC concerning technical specification of interoperability relating to the subsystem "Traffic Operation and Management" of the trans-European conventional rail system includes in particular:

- Procedures and related equipment enabling a coherent operation of the different structural subsystems, both during normal and degraded operation, including in particular train driving, traffic planning and management.
- Professional qualifications which may be required for carrying out cross-border services

The essential requirements cover:

- Safety,
- Reliability and Availability,
- Health,
- Environmental Protection,
- Technical Compatibility.

Alignment of the network operating rules and the qualifications of drivers, on-board staff and traffic managers must be such as to ensure operating efficiency on the trans-European conventional rail system, bearing in mind the different requirements of cross-border and domestic services.

The specification dictates roles and responsibilities for staff who contribute to the operation of the subsystem by performing safety critical tasks involving a direct interface between a Railway Undertaking and an Infrastructure Manager.

Railway Undertaking staff:

- undertaking the task of driving trains (referred to throughout this document as ‘driver’) and forming part of the ‘train crew’,
- undertaking tasks on-board (other than driving) and forming part of the ‘train crew’,
- undertaking the task of preparing trains.

Infrastructure Manager’s staff:

- undertaking the task of authorising the movement of trains

In addition, the functional and technical specification includes specific details regarding:
— Vehicle Identification
— Train Braking
— Train Composition
— Freight Vehicle Loading
— Safety Related Communication
— Degraded Operation
— Managing an Emergency Situation

All of the defined functional and technical specifications should be taken into consideration and should be able to be met in the implementation planning and structuring of the Rail Baltica Infrastructure Management organization.

9.9 Telematic Applications for Freight and Passenger Services

This TSI concerns the telematic applications subsystem for freight services shown in Directive 2001/16/EC.

The commercial operation of trains, wagons and intermodal units throughout the trans-European rail network requires efficient interchange of information between the different Infrastructure Managers, Railway Undertakings and other service providers. Performance levels, safety, quality of service and cost depend upon such compatibility and interchange as does, in particular, the interoperability of the trans-European conventional rail system.

The technical specification for interoperability also has an impact on the conditions of use of rail transport by users. In this respect the term users is understood to mean not only infrastructure managers or railway undertakings but also all other service providers such as wagon companies, intermodal operators and even customers.

Last but not least, the benefit of interoperability of the conventional rail system was taken into account to bring about the conditions for greater interoperability between modes of transport, in particular between conventional rail transport and combined rail transport.

The purpose of this TSI is to ensure also that efficient interchange of information is at all times best adapted, with regard to quality and quantity, to changing requirements so that the transport process may remain as economically viable as possible and that freight transport on rail maintains its hold on the market against the intense competition it has to face.

The subsystem Telematic Applications for Freight is defined by Annex II of the Directive 2001/16/EC, Section 2.5(b). It includes in particular:

- applications for freight services, including information systems (real-time monitoring of freight and trains),
- marshalling and allocation systems, whereby under allocation systems is understood train composition,
- reservation systems, whereby here is understood the train path reservation,
- management of connections with other modes of transport and production of electronic accompanying documents.

This TSI takes into account the present service providers and the various possible service providers of the future involved in freight transport as they are for (this list is not exhaustive):

- wagons
- locomotives
- drivers
- switching and hump shunting
- slot selling
- shipment management
- train composition
- train operation
- train monitoring
- train controlling
- shipment monitoring
- inspections and repair of wagon and/or locomotive
- customs clearance
- operating intermodal terminals
- haulage management.

Some specific service providers are defined explicitly in the Directives 2001/14/EC and 2001/16/EC. Since both directives have to be taken into account, this TSI considers in particular the definition of (see also Annex A, Index 6):

“Infrastructure Manager (IM)” means any body or undertaking that is responsible, in particular, for establishing and maintaining railway infrastructure. This may also include the management of infrastructure control and safety systems. The functions of the infrastructure manager on a network or part of a network may be allocated to different bodies or undertakings.

Based on this definition, this TSI regards an IM as the service provider for the allocation of paths, for controlling/ monitoring the trains and for train/path related reporting.

Whereas a “Railway Undertaking” is defined as any public or private undertaking, licensed according to applicable Community legislation, the principal business of which is to provide services for the transport of goods and/or passengers by rail with a requirement that the undertaking must ensure traction; this also includes undertakings which provide traction only.

Based on this definition, this TSI regards the RU as the service provider for operating trains.

The RUs/LRUs must in general have, at minimum, the capability of:

- DEFINING services in terms of price and transit times, wagon supply (where applicable), wagon/intermodal unit information (location, status and the wagon/intermodal unit related estimated time of arrival 'ETA'), where shipments can be loaded on empty wagons, containers, etc.
- DELIVERING the service that has been defined in a reliable, seamless manner through the use of common business processes and linked systems. There must be a capability for RUs, IMs and other service providers and stakeholders such as customs to exchange information electronically,
- MEASURING the quality of the service delivered compared to what was defined. i.e. billing accuracy against price quoted, actual transit times against commitments, wagon ordered against supplied, ETAs against actual arrival times,
- OPERATING in a productive manner in terms of utilisation: train, infrastructure and fleet capacity through the use of business processes, systems and data exchange required to support wagon/intermodal unit and train scheduling.

Summary of Impacts on Rail Baltica

As mentioned before, the Interoperability Directive and its related TSIs are designed to facilitate the "optimal level of technical harmonisation" of the entire EU rail system with a view to improving its competitiveness, for example, by lowering production, acceptance, operation and maintenance costs. The aim is, on one hand, to facilitate international railway services and, on the other hand, to set up common EU-wide rules for conformity assessment and placing in service of infrastructure, fixed facilities and vehicles.

In respect to the Rail Baltica 1435mm railway, the Directive and its related TSIs must set the "optimal level of technical harmonisation" of the entire Rail Baltica system, as well as within each of the three (3) distinct and different Baltic States and in relation to the neighbouring counties Poland and Helsinki.

Table 142 - Key Issues related to Compliance with Interoperability Directives

Interoperability Directives Related to Rail Baltica

Subsystem	Reference	Specification Parameter	Potential Impacts/Risks
Infrastructure	CR INF TSI	Line Layout, Track Parameters, Switches, and Crossings	Adjacency to existing 1520mm gauge tracks, dual gauge track complications, minimum radius of curves in constrained locations, internal (1435mm) and external (1435/1520mm) switching and crossings.
		Track and Structure Resistance to Loads	Resistance of existing bridges and earthworks to traffic loads
		Track Geometrical Quality	Geometrical quality at locations near stations, terminals and facilities where 1520mm gauge exists
		Platforms	Lenghts and heights of platforms in existing stations, access and entry/exit to stations and dedicated platform locations
Energy	CR ENE TSI	Power Supply	Overall capacity and grid, substation connections and location on new corridors, sectioning locations, separation sections and return circuits
		Geometry of the OCL and Quality of Current Collection	Contact line systems and interference with adjacent existing electrified 1520mm lines, geometry, pantograph gauge and contact force at cross-overs with existing 1520mm electrification.
Control-Command and Signalling (CCS)	2006/679/EC	On-board systems	ERTMS implications on ETCS functionality, interfaces to internal and external control-command, electromagetic compatibility
		Track-side systems	ERTMS implications on ETCS functionality, interfaces to internal and external control-command, track-side train detection systems in urban areas/cross-overs of various gauge lines.
Rolling Stock - Noise	2006/66/EC & 2011/229/EU	Noise Emitted by Freight Wagons	Development of new noise TSIs during project development that currently are not mandated based on "Specific Cases" for Estonia, Latvia, and Lithuania.
		Noise Emitted by Locomotives, Multiple Units and Coaches	Development of new noise TSIs during project development that currently are not mandated based on "Specific Cases" for Estonia, Latvia, and Lithuania.
		Interior Noise of Locomotives, Multiple Units and Driving Trailers	Development of new noise TSIs during project development that currently are not mandated based on "Specific Cases" for Estonia, Latvia, and Lithuania.
Operation and Traffic Management	2006/920/EC	Staff/Organization	Establishing appropirate roles and responsibilities for railway undertakings staff and infrastructure manager staff to ensure safety, reliability, availability, health, environmental protection and technical compatibility of the line.
Telematic Applications for Freight and Passenger Services	2001/16/EC	Information Systems & Monitoring	State-of-the-art systems and monitoring devices will be employed and will be required to share data and information with existing inforamtion systems at the national level.
		Marshalling and Allocation Systems	Marshalling and allocation systems will need to interface with existing 1520mm gauge freight systems at intermodal terminal locations.
		Management of Connections with Other Modes of Transport	Specifically at transfer points for both passenger services (ports/airports/train stations) and freight services (ports/intermodal terminals).

10 Implementation Issues

10 Implementation Issues

10.1 Introduction

The output of this report has been to identify the most desirable options for a north – south rail corridor between Estonia and Poland which will provide for the first time, comprehensive access to the European rail networks. In defining a single option rail solution, it is noted that the project is in the very early stages of development and as such, significant further activity will need to take place before comprehensive decisions can be made which will allow the programme to be delivered.

The Rail Baltica programme will deliver range of economic and social benefits not just to Estonia, Latvia and Lithuania but also to the region as a whole and the European Union in general. In defining the principle activities which need to be addressed within the implementation strategy, it is therefore necessary to ensure that the requirements of multiple stakeholders and both acknowledged and incorporated into future decision making process.

Programme implementation processes at a strategic level could in normal circumstances be seen as a relatively straight forward proposition given the current level of development of the Rail Baltica feasibility study. This study has identified a preferred single option using derived market data information and the application of standard rail transport analysis techniques. It has allowed a range of technical parameters to be developed which has indicated where optimum rout alignments may lie and has shown the likely functional requirements of the system itself. This process has allowed a creditable single strategic option to be proposed which meets the critical objectives set at the outset of the study. In moving the proposal forward, scheme promoters must however address not simply the complexity of developing the single option but also must acknowledge the challenges of doing so in a multi stakeholder environment. In this context, future implementation strategy will need to define how the single option is to be refined and establish the relative complex processes within which the programme can be implemented.

The Implementation strategy will address:

- The principle objectives for the next phase of the programme
- The organisational structures required to efficiently deliver and undertake the necessary activities
- The extent to which the economic and social benefits of the single option can be maximised within a range of rail service levels
- Further developments of the technical characteristic of the system which will facilitate design options
- Scheme roadmap

10.2 Objectives of the Implementation Strategy – next phase

The current feasibility study has in the simplest terms provided the economic and technical justification for a single option route alignment to be considered further. Given the strategic and feasibility nature of the study, it cannot be assumed that the route identified is now in a position where more detailed design can be considered. The study has simply identified the broad parameters of a major rail programme which can now be further developed and refined as projects within their own right. The identification of a single route option cannot be considered as the definition of a single option for a rail system. This requirement is the starting place for the next phase of the Rail Baltica Programme.

It is recommended that the principle objectives of the Rail Baltica implementation should encompass the principle elements:

1) The definition of an overriding sponsorship remit for the Rail Baltic programme in general and the key individual national programme elements. The sponsor remit must address critical issues which will include:
    - Confirmation of the strategic, social and economic benefits required from the scheme at a EU, regional and national level – the critical measures of success
    - Definition of how the programme will achieve a strategic fit with local, national, EU and international transport policies and other strategies being employed
    - The definition of critical programme outputs from a transportation perspective including the definition of rail service requirements and interface strategies with all other modes including conventional rail, road, sea and air
    - An acknowledgement the quality standards required from the programme both in terms of output requirements and whole life cost principles
    - An understanding of scheme prioritisation within the context of Rail Baltica and also in respect of other critical national and international objectives

- Recognition of the boundaries of the programme. This is a critical issue for Rail Baltica given the likely wide spread impact both within the countries concerned and within a wider stakeholder environment. Strict boundaries will need to be established with prevents scheme creep and ensures costs and programme risks are contained. Boundaries will need to be defined geographically, financially and in project terms.
- A definition of what changes will be acceptable to adjoining rail networks and the definition of what processes should be used to address these issues.
- A requirement to define basic programme timescales acknowledging the impact of external issues including national and EU priorities, availability of finance and other critical resources
- The requirement to adopt national and EU standards including those associated with interoperability.

2) The development of a refined statement of benefits and costs arising from the preferred route option. This objective is required to allow the business case for the proposal to be further refined incorporating:

- More detailed cost information as this becomes available
- Refined demand information as the rail service specification is refined
- Application of geographically focused economic and social impact data including derived external benefits (incorporating sustainability criteria)
- The definition and delivery of a business case for the Rail Baltic programme which is capable of defining within laid down probabilistic ranges the overall scheme risk profile

3) An assessment of the current capability of the existing systems and railway facilities which would be impacted on or be part of the Rail Baltica programme. This requirement is needed to identify any emerging constraints in respect of the capability of existing asserts of facilities which would be required as a key component of the overall programme.

4) The development of stage 1 single option designs to route sections noting the overall programming phasing requirements. These designs will be required to generate to a satisfactory standard, programme costs. In addition they will provide the basis on which market testing can be carried out in respect of future scheme procurement. Of particular concern will be the need to ensure designs conform to national, EU and international environmental and sustainability requirements.

5) The Rail Baltica programme will consist of a number of individual (but in their own right) major projects. Under the single option developed in this study, there will be a range on individual programme options. As part of the overall programme assessment, each individual option should be assessed in respect of its ability to meet both the overall programme requirements and those identified at a local level. This process will require value engineering studies to be carried out of system wide component options and geographically defined route choices.

6) Refinement of system functional specifications. Report into changes which will emerge the functional specifications including detailed assessment s of operating and technical systems required to meet commercial objectives. It is noted that Rail Baltica may be developed over a number of time periods and as such, the demands placed on the system and the emergence of new technological solutions is likely to require refinements to functional specifications at a local and regional level.

7) A report into the constructability of the whole programme and the individual components. This ongoing report is required at all stages of the programme to confirm not only are the individual design proposals capable of meeting the commercial specification, but also to ensure that it is feasible to build. The criticality of this element should be noted given some of the challenging terrain through which the proposed routes will transverse. The report will be a key component in assessing overall programme construction risk.

8) The definition of a robust national and international consultation strategy.

10.3 Organisational Structure

As discussed previously, the Rail Baltic programme is in its early stages of development and significant activities will need to be undertaken prior to concluding final service specifications, technical requirements, route alignments and final single option design components. Such a situation is commonplace amongst all major transport projects. The position is however complicated by the following factors:

- the presence of up to 4 nation stakeholders in addition to other national interested parties
- the existence of differing regional economic objectives
- the need to accommodate the requirements of a range of stakeholders including potential users, railway undertakings, infrastructure managers
- an acknowledgement that the programme will challenge existing regional transport provision and will impact on current rail solutions employed

Setting these issues in context, it is important to note the high degree of co-operation which has been achieved to date between the project countries and the acceptance that robust arrangements need to be in place to facilitate project delivery including construction and finance. Further, the strategic objectives of the European Union, their ongoing support and the existence of mandatory technical standards will have a significant positive impact on programme delivery. The mandatory requirement to conform to interoperability requirements will do much to remove technical risks associated with the introduction of new systems. The ongoing political support of the EU will also provide support in mitigating some financial risks associated with the programme.

10.3.1 Establishing a Programme Steering Group (PSG)

It is recommended that Rail Baltica development should as now be overseen by a programme steering group (PSG). The PSG function would be to have overall control of the strategic delivery of the Rail Baltica programme. The PSG would comprise of representatives from the principle member states and assisted by other key stakeholders including the European Union. The PSG would be responsible for:

- establishing the overall programme objectives and time scales
- provision of programme finance
- establishing the relevant delivery organisations and appointment of key personnel
- defining overall programme requirements depending on project phase and communicating there instructions to the relevant delivery organisations
- undertaking strategic review of programme progress and overall reporting to Governments and European Union agencies

It is suggested that in proposing the necessary steps for future Rail Baltica implementation, and overall organisation assuming responsibility must recognise the need to control development in a manner which allows technical progress to be made in a manner with is free from undue short term influences. In this context, the PSG would need to define at the earliest opportunity:

- group structure and membership
- protocol for defining overall programme objectives taking into account EU, regional and national objectives
- processes for dispute resolution and arbitration
- protocol for communication with delivery agencies
- processes for review, monitoring and reporting
- financing arrangements
- governance protocols
- legal structures and commercial agreements

10.3.2 Establishing a Integrated Programme Organisation (IPO)

Whatever development option is chosen, it is recommended that an integrated programme organisation (IPO) is established at the earliest opportunity with the principle objective of facilitating project development. The IPO must be a technical based organisation operating within defined terms of reference and be of short term of regional, national and local influences. International experience suggests that an independent IPO will be able to execute programme functioned quickly within the terms of reference. Project activities can be effectively undertaken without time consuming and costly interventions.

The objectives of any IPO would be to:

- work within the terms of referenced agreed
- refine and establish critical project success criteria and agree programme specifications
- undertake all necessary activities associated with programme development and define critical programme challenges and milestones
- define programme design requirements
- establish organisational proposals for undertaking stakeholder consultation and incorporating emerging requirements
- establish at appropriate timing, programme delivery structures

The IPO should be both organisationally and financially separate and independent from existing national and international bodies. Its senior organisation would be responsible to its principle shareholders which would in this case be the members of the PSG. Never the less, the organisation would be free to undertake its own management affairs subject to normal governance arrangements and terms of reference.

By separating the functions of strategic control and programme, the delivery risk which has surrounded many international projects in the past can be more effectively controlled. By allowing the IPO to focus on delivery within a tightly set objectives and financial protocol, inefficiencies arising from the need to secure agreements by from all parties, can be controlled. Such structures allow decisions to be taken by the most appropriate bodies and facilitate effective programme development.

10.4 Maximising programme economic and social benefits

The development of the Rail Baltica programme will release a range of social and economic benefits for the region and the individual countries involved in the programme. In practice such benefits can only be realised through the actual rail service offered by the system. In practice, the service capability of the system, either for freight or passenger services will ultimately be determined by the system technical specification. In the early stages of programme development, it is critical that the correct technical specification is defined which represents a balance being achieved between:

- the strategic social and economic objectives of Rail Baltica
- the commercial train service requirements for passenger and freight services
- the capability of existing rail technology
- the pre existing topographical and environmental constraints
- future changes to commercial requirements
- future changes to rail capability
- programme risk
- availability of funds

The current study has identified these elements at a strategic level in order to define route and corridor preferred options. There are however three critical issues which imply that these issues must be continually be addressed within the programme implementation plan. There include:

- recognition that the current study is at a feasibility level
- there are likely to be emerging commercial options at a micro rout level which need to be addressed
- the acknowledgement that market, commercial and political objectives are continually changing

- the ability to take on in planning terms changes to the cost and technical performance of rail systems

Given the life expectancy of installed rail systems, it is critical that emerging technical plans reflect the most up to date political, economic and social requirements. Once railway systems are delivered, change is both technically difficult and expensive. In this context, the best system delivered is one which both meets existing commercial, social and political objectives and if effectively future proofed. To achieve this aim, considerable focus must be given in the planning process.

On completion of parts of the rail network, it may be possible to implement interim rail services which will provide a flow of benefits to the programme prior to final completion. Such a staged approach to service implementation for both freight and passenger services is an acceptable railway strategy. Such a program needs to be an integral part of the technical implementation strategy which will be adopted by Rail Baltica.

The extent to which Rail Baltica can adopt an incremental approach to train service delivery will be dependent on:

- The construction methodology and staging employed
- The extent to which the emerging infrastructure provides viable service potential
- The impact on the overall construction program

As a general rule of thumb, interim services should only be provided if the final planned infrastructure layouts permit such operation. In general terms it is unlikely that interim service provision would warrant the construction on new and incremental infrastructure however this would need to be examined on a case by case basis. The time frame for the construction of the system And the extent to which it operates through Poland, Lithuania, Latvia and Estonia suggests that there will be political, and social advantages of providing interim rail services, The extent to which this can be made economically feasible will be determined in part by programme. In this context it is recommended that further analysis be given the program staging options and that initial assumptions within the planning process are made in respect of early service introduction. An early assessment will need to be made in respect of the impact on program staging given that it may be more beneficial from a service perspective to commence development at less advantageous location from a constructability perspective.

In all cases it is recommended that any decision is subject to ratification from an economic, political and program perspective

10.4.1 Establishing an Independent Review Group (Business Case)

It is recommended that one of the key objectives of the PSG would be to put in place an independent review group (IRG) which would allow programme business objectives to be kept under review. The role of an independent review board would be to provide the PSG (and through them, the IPO) with the very latest information on:

- emerging national, regional and international commercial requirements in terms of rail systems looking ahead in a 5, 10 and 30 year time period
- a review of the current and future technical capabilities of rail systems which may warrant inclusion within the Rail Baltica programme.

It is recommended that the international group be comprised of independent rail and commercial experts who can draw on both regional and international experience. The IRG should also have access to all relevant international standards which are appropriate to Rail Baltica and also have the facility to make further recommendations on incorporating east – west commercial traffic opportunities. It is suggested that the independent review board should meet on a quarterly basis to provided effective input into the programme.

10.5 Developing programme technical characteristics

The Integrated programme organisation (IPO) should have relatively high degrees of autoimmunity to pursue the required project delivery phases. Not only should the IPO be free (subject to normal rules) to propose the most relevant system technical solution, but it should also be free to develop project phasing proposals and appropriate implementation strategies.

10.5.1 Establishing an In dependant Review Group (Technical)

In acknowledging this independence, control of development activities should be managed through the development of an additional independent review group (IRG) which would act on behalf of the PSG to confirm that al all stages of the programme development, the systems, operational plans and routes were capable of meeting the required service level objectives.

In this context, the PSG would need to define at an early stage (and incorporate it into any legal development agreements) critical service level specifications. These would include:

i) service frequency

ii) overall infrastructure capacity availability

iii) service type (freight and passenger)

iv) point to point journey time

v) system reliability

vi) system availability

It would be a requirement of the IPO to undertake relevant measuring and analysis activities which would confirm to independent inspection that these parameters were being net at all stages of programme development.

It is recommended that the second IRG should be established at an early stage and report directly to the PSG. The IRG should comprise of railway experts who have operational experience in the delivery of rail systems. IRG experts would need access to relevant system modelling and support tools at all stages of the process.

10.6 Summary of critical implementation issues

The following elements are considered critical implementation issues which would need to be addressed at the next stage of the Rail Baltica programme:

- Programme output definition – the Rail Baltica Steering Committee, in cooperation with external consultants, drafts an overall outline of the Programme output (organizational structure, potential financing schema, risk management overview, pre-planning budget, pre-planning time-line, etc.)
- Programme organisational structure, governance arrangements and reporting structures – the Rail Baltica Steering Committee nominates and establishes the PSG and IPO teams, as well as the two indendent review groups.
- Programme financing options – the PSG and IPO teams work to develop the financing and funding schema to be presented to the Member States and the EC for general approval.
- Implementation of programme risk management strategies – the IPO works to develop the Risk Management Plan and presents it to the PSG and Member States for approval.
- Resource planning with particular reference to the early identification of long lead items – the IPO develops a resource-based critical path implementation programme for review and acceptance by the PSG and follows with a staffing plan for internal resources and external consultancies.
- Implementation of robust and effective stakeholder consultation programmes at all stages of the process – the IPO and PSG solicit the involvement of a public-relations consultant to assist in establishing the necessary public relations campaign for the programme.
- Integration strategies with existing rail systems throughout the system – the IPO establishes a system-wide audit of all existing systems and planned improvements to be an input into the Options Assessment and Definition phase of Pre-Planning.
- Impact assessment of programme on regional transport market provision and competing modes – the IPO conducts, in cooperation with external consultants, a detailed transport market analysis to further justify the transportation models developed during the feasibility study.
- Identification and consultation on programme phasing requirements noting commercial, social and political imperatives – the IPO shall enhance the critical path implementation programme with required interfaces at the national, regional and municipal levels to streamline the planning, land expropriation and design approvals processes.

- Definition and establishment of robust co-ordination arrangements which provide accessibility to all interested parties but facilitates programme delivery – the IPO established monthly and quarterly workshops with project stakeholders to facilitate decision-making and information exchange.
- Ongoing assessment of contribution to environmental and sustainability objectives - the IPO engages the independent review groups to establish an assessment methodology and on-going monitoring procedures

10.7 Implementation road map

The following Implementation Road Map provides an indicative timeframe for the implementation of the Rail Baltica programme. At all stages of the programme, options will exist for decision review criteria to be applied by the PSG. It should be noted that many tasks can be undertaken simultaneously as is conceptually defined in the following Rail Baltica Implementation Programme.

Table 143 - Implementation Road Map

	Task	Duration	Notes
1	Review and confirm high level feasibility report	6 months	Accepting strategic objectives and preferred routing will require significant consultation
2	Establish PSG, IPO and the 2 IRGs	6 months	Agreeing composition, terms of reference and governance structures will be complex but can be undertaken in parallel with task 1.
3	Strategic stakeholder consultation	6 months	A critical process to ensure all parties endorse strategy
4	Definition of programme plan, resourcing and financing arrangements	9 months	Establishing at a strategic level, overall structures for progressing with the programme including high level procurement and financing strategies. Opportunities to propose financing arrangements including PPP.
5	Review of options assessment for individual projects within the programme	12 months	Process designed to allow scheme to move towards single option design for all components of the system. Opportunity to test proposal option]s and apply value and risk management processes
6	Environmental Impact Statement	24 months	Environmental Impact Assessment of proposed option, including alternative solutions. Strategic environmental assessment has to be done by municipalities in parallel.
7	Spatial and Regional Planning	36 months	Detail planning and reservation of territories
8	Single option design	24 months	Activity to cover all elements
9	Scheme procurement	48 months	Rolling programme to procure all necessary elements associated with scheme construction. Land acquisition will be a significant issue and consideration will need to be given to corridor reservation and acquisition.
10	Construction	60 months	
11	Testing and commissioning	6 months	

The times indicated on the road map are purely indicative at this stage of the process and are dependent on a wide range of factors. These include:

- Requirements at a national level to introduce relevant legislation which facilitates the construction of the new rail system
- The ability of the States to comply with relevant European legislation particularly in relation to environment
- The extent to which there is widespread stakeholder support for the program and the effectiveness of engagement strategies
- The ease by which the required corridors can be acquired
- The extent to which effective governance arrangements can be defined

- The availability of program financing
- The availability of geo technical and other relevant data
- The extent to which international standards can be transposed into local standards.
- The extent to which local construction difficulties are encountered

In addition, consideration will have to be given to the local availability of construction resources including skilled personnel. In this context, any times given should be regarded as illustrative. General comment can be made however on the normal time it takes a new railway to move from inception to final delivery. For planning purposes, a ten to fifteen year time horizon would be considered normal.

In Poland and Finland, the rail system is gradually being upgraded including those lines providing access to rail Baltica. In this context, it should be assumed that Polish and Finish rail capability will be ahead of any developments within Rail Baltica. In order to ensure full functionality in terms of comparable system capability, early harmonization of development plans between the two networks is recommended.

Figure 54 – Planned Rail Infrastructure Improvement Projects in Poland

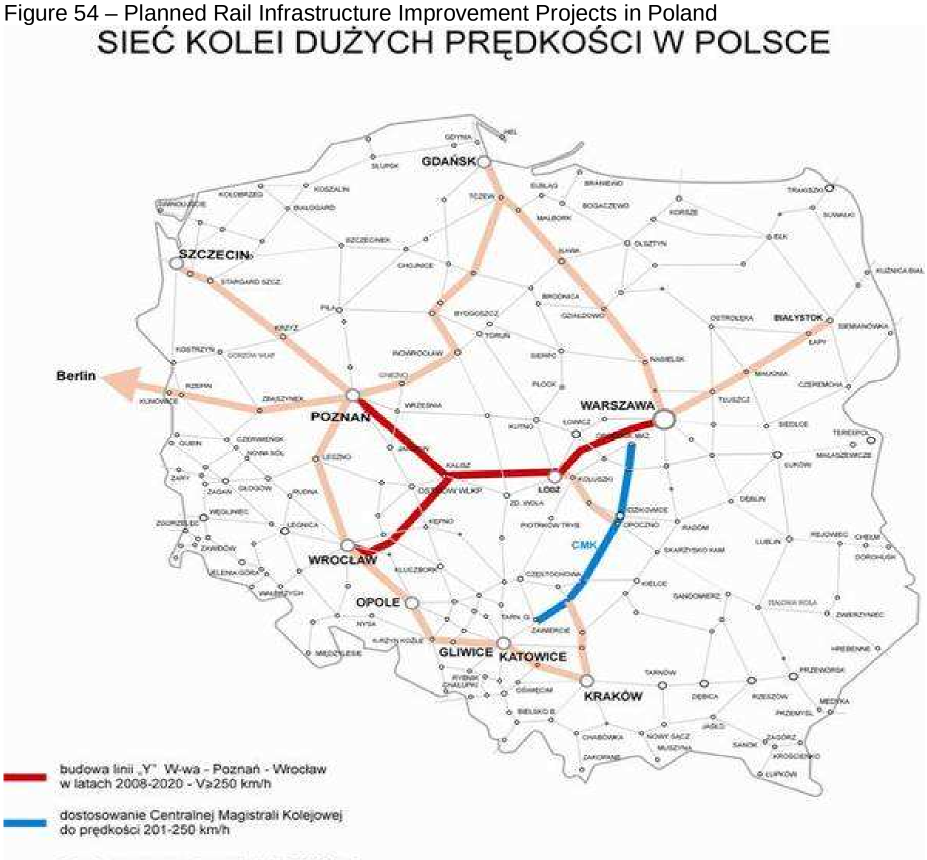
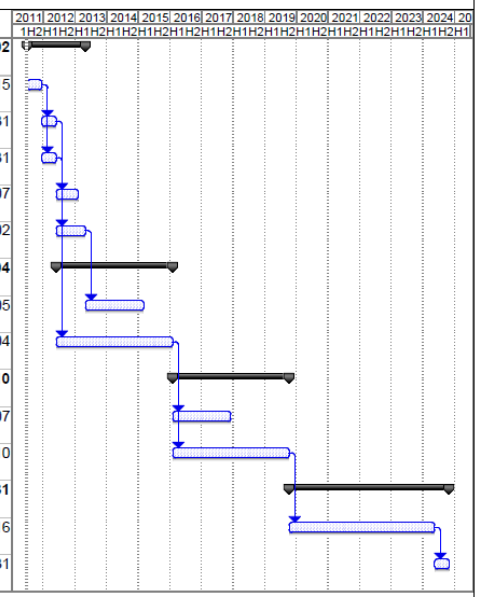


Figure 55 – Implementation Programme

RAIL BALTICA
IMPLEMENTATION PROGRAMME

ID	Task Name	Duration	Start	Finish
1	**PHASE 1: PRE-PLANNING**	**24 mons**	**Fri 11.07.01**	**Thu 13.05.02**
2	Task 1: Confirm Feasibility Report (Baltic States/EU)	6 mons	Fri 11.07.01	Thu 11.12.15
3	Task 2: Establish PSG/IPO/IRG(2)	6 mons	Fri 11.12.16	Thu 12.05.31
4	Task 3: Strategic Stakeholder Consultation	6 mons	Fri 11.12.16	Thu 12.05.31
5	Task 4: Programme Planning/Resourcing/Financing	9 mons	Fri 12.06.01	Thu 13.02.07
6	Task 5: Options Assessment	12 mons	Fri 12.06.01	Thu 13.05.02
7	**PHASE 2: PLANNING**	**48 mons**	**Fri 12.06.01**	**Thu 16.02.04**
8	Task 6: Environmental Impact Statement	24 mons	Fri 13.05.03	Thu 15.03.05
9	Task 7: Spatial/Regional/Detail Planning	48 mons	Fri 12.06.01	Thu 16.02.04
10	**PHASE 3: DESIGN/PROCUREMENT**	**48 mons**	**Fri 16.02.05**	**Thu 19.10.10**
11	Task 8: Technical Design	24 mons	Fri 16.02.05	Thu 17.12.07
12	Task 9: Scheme Procurement	48 mons	Fri 16.02.05	Thu 19.10.10
13	**PHASE 4: CONSTRUCTION**	**66 mons**	**Fri 19.10.11**	**Thu 24.10.31**
14	Task 10: Construction	60 mons	Fri 19.10.11	Thu 24.05.16
15	Task 11: Testing and Commissioning	6 mons	Fri 24.05.17	Thu 24.10.31



Project: 110531_Rail Baltica Implemen
Date: Fri 11.06.17

Task	Milestone	External Tasks	
Split	Summary	External Milestone	
Progress	Project Summary	Deadline	

10.8 Risk Register

In considering the overall objectives of the project and the critical implementation issues the PSG will need to consider the following issues:

- Adopting a phased aproach to delivering the network
- Setting up an effective program delivery organisation
- Getting risk transfers correct betwwen bodies responsible for delivery
- Ensuring that thewre is strong cross party political support
- Early identificatrion of local funding oppotrtunities
- Identifying system intergration issues
- Establisheing early the operational and comercial arrangements
- Understanding the impactr of and on complementaary and competing transport modes
- Defining the correct procurment strategy with particular reference too unbundeling elements of program delivery

Additional risks to be considered are described in the Risk Register.

Table 144 - Risk Register (1 of 2)

Rail Baltica
Project Risk Register

Description of Risk	RISK IMPACT (1 to 5)													Comment (include details of qualitative or quantities impact, e.g. from sensitivity tests)	Likelihood
		CAPEX	OPEX	Revenue: Freight	Revenue: Passenger	Patronage: Freight	Patronage: Passenger	Programme	Quality	Safety	Financeability	Legality	Approvability		1 Very Unlikely (0-20%) 2 Unlikely (21%-40%) 3 Neutral (41-60%) 4 Likely (61%-80%) 5 Very Likely (81%-100%)
	5	+40%						>10 year delay to opening	High impact						
	4	+30%						>5 year delay to opening							
	3	+20%						>2 year delay to opening	Medium impact						
	2	+10%						>1 year delay to opening							
	1	+5%						<1 year delay to opening	Low impact						
Approvals															
The Estonian Technical Surveillance Authority delays in issuing construction permit (-s) for railway civil engineering works								1				3	3		2
Delays in approval of territorial plans								3				3	3		3
Municipalities delay issueing construction permit (-s) for buildings necessary for using the railway (station buildings, access roads)								1				3	3		3
The State Railway Technical Inspectorate delays issuing construction permit (-s)								1				3	3		3
Delays in approval of territorial plans								3				3	3		3
The Lithuanian Railways Inspectorate delays issuing construction permit (-s)								1				3	3		3
Delays in approval of territorial plans								3				3	3		3
Legal															
Legal action against territorial plans								3				3	3		3
Full environmental assessment required								3							4
Prohibition of action due to environmental concerns								4				5	5		2
Legal action against environmental assessment or approval of action								3				3	3		3
Legal action against land expropriation								3				3	3		3
Legal action in respect of the price for the expropriated land								4				1	1		4
Increase of infrastructure access fee					1										4
Misalignments among national,as well as EU laws								2		1	3	5	5		1
Issues regarding land expropriation								5		1	3	4	4		3
Financing															
Negative credit rating changes for Baltic states		2									2				1
Changes in financing structure (for example, due to rise of construction cost, share of EU funding drops)		1									2				2
Rise in interest rates		2									2				3
Contractor insolvency		1	1					3	4	4	1	1			1
Commodity price risk (steel, fuel, etc.)		3									3				3
Lack of financing of the governments of each involved country								3			5				3
Lack of financing of the local municipalities of each involved countries								3			5				5
Lack of EU financing in the time period of 2014 -2020: EU Cohesion Fund								4			5				2
Lack of EU financing in the time period of 2014 -2020: TEN –T policy								4			5				2
Lack of EU financing in the time period of 2014 -2020: Baltic Outlook Project								4			5				2

Table 145 - Risk Register (2 of 2)

Description of Risk		RISK IMPACT (1 to 5): CAPEX	OPEX	Revenue: Freight	Revenue: Passenger	Patronage: Freight	Patronage: Passenger	Programme	Quality	Safety	Financeability	Legality	Approvability	Comment (include details of qualitative or quantities impact, e.g. from sensitivity tests)	Likelihood: 1 Very Unlikely (0-20%) 2 Unlikely (21%-40%) 3 Neutral (41-60%) 4 Likely (61%-80%) 5 Very Likely (81%-100%)
	5			+40%				>10 year delay to opening	High impact						
	4			+30%				>5 year delay to opening							
	3			+20%				>2 year delay to opening	Medium impact						
	2			+10%				>1 year delay to opening							
	1			+5%				<1 year delay to opening	Low impact						
Traffic															
Economic growth in the region is lower than expected				3	2	3	2							a 1% reduction in GDP growth will lead to a 0.6% reduction in passenger demand	2
Competing Ferry companies reduce price for Freight truck movements to recapture market share				2		2									3
Environmental															
EIA identifies unacceptable impacts e.g. waste disposal, air pollution, etc		1						1	2			3	3		1
Traffic noise limits exceeded									2			3	3		2
Not approved changes in land use plans/ land transformation not possible								2				3	3		2
Significant impact to Natura 2000 sites (crossing is not allowed)								3				3	3		4
Failure to implement ecological mitigation, particularly in relation to protected species and biotopes (outside Natura 2000 sites)								2				3	3		3
Potential delays arising as a consequence of seasonal constraints on activities related to flora and fauna								2				1	1		4
Potential for objections by residents from environmental impacts (e.g. loss of property, noise, visual impact of structures, effects on cemetery) requiring additional mitigation								2	1				3		4
Failure to implement mitigation measures for cultural heritige sites								2				3	3		3
Design															
Detailed design reveals need for additional land		1						2			1		2		2
Ground investiagtion reveals conditions requireing more complex design solutions		3						1			2				3
TSI used as basis for outline design is not implemented or is implemented in changed version.		1						1			1				2
Signalling system required to meet interoperability rules cannot be implemented on dual gauge sections of track		2						1		2	2				3
Use of shared cathenary cannot be achieved in dual gauge sections		2						1			2				3
Problems agreeing environmental mitigation measures		1						1			1		1		4
Constructability															
Ground conditions, unforeseen geo-environmental issues, contamination, etc., that cause delay to construction programme and additional costs for removal, handling and appropriate disposal of materials, etc.		2						1		2		1	1		3
Access to sections requiring dual gauge giving programme constraints		1						2			1				4
Restrictions on working hours imposed due to works in urban environment.		1						1			1				2
Construction Risks															
Unforseen ground conditions		1						1							3
Unidentified Utilities discovered		1						1		1					5
Unexpected hazardous waste		1						1		1					2
Problems achieving track access for dual gauge sections								1		1					4
Unexpected archeological finds		1						1							2
Temporary permits/easements expire		1						1				2	2		2
Delays caused by utility diversions								1							4
Market changes in prices of materials and labour		2									2				3
Health and Safety risks of construction workers								1		1					4
As construction in stages risk of poor tie in of adjacent stages		1						1	2	2			2		3
Local unavailability of skilled workers and contractors		1						1	3	2					3
Operation															
Rolling stock purchase/lease costs higher than expected			2												4
Fuel Cost increases			2												5
Labour cost rises			2												5
Maintenance															
Extreme weather events increase maintenance costs			3						2	2					2
Administrative															
Agenda synchronization among the involved countries and the respective governments								4			3	3	5		3
Potential language issues for coordination of the administrative issues								4			3	3	5		2
Political															
Superficial discussions and incorrect interprations of the projects due to the project used for political intrigues and election period								4			3	1	3		3
Lack of the cross border cooperation experience								4	3	3	3	2	3		4
Negative attitude from the general public								4	1	1	1	1	2		4
Non equal level of priority of the project in each of the countries								4	2	1	4	4	4		3

11 Conclusion

11 Conclusion

An interoperable North-South railway corridor linking the Baltic Countries with Poland and the rest of the EU rail network has been seen by many as pivotal from the perspective of development of the railway transport mode in the region. The idea of Rail Baltica first appeared in 1994 in the joint political document “Vision and Strategies around the Baltic Sea 2010” as an important element for spatial development in the Baltic Sea Region.

Initially over 20 different route segments were considered before condensing them down to 4 key route options, designated the red, orange, yellow and green routes. The red and yellow routes were for the most part on new alignments the primary difference between them being in Estonia where the red route passes through Parnu and the yellow route passes through Tartu. The orange and green routes followed for the most part the existing route corridors and again the primary difference is in Estonia where the orange route passes through Parnu and the green route passes through Tartu.

For each of the four options freight and passenger demand was assessed along with other issues including environmental impacts and the wider economic benefits, based upon an initial assumption of a mixed service, with passenger trains every 2 hours and freight trains running predominantly during the night. The results of the assessment showed that for passengers the yellow option would be best. The reasons for this were that it offered a fast journey time and picked up a significant internal demand at Tartu. For freight the greatest demand was seen on the red route predominantly as a result of the shortest journey time. The key issue with freight demand was however found to be price.

A full qualitative assessment of each route option was undertaken taking into account the wider economic benefits, the potential planning impacts and environmental issues. From this analysis it was recommended that the red route option should be investigated further, in the form of a detailed Cost Benefit Analysis (CBA) as it was felt that it offered the potentially most viable solution.

As stated above the red option is primarily on a new alignment passing through mainly agricultural and forest land. Whilst it passes through a number of Natura 2000 sites and this will have an effect on the planning process it is not anticipated that this will present a major problem to the projects implementation. Obviously a full Environmental Impact Assessment will have to be undertaken as part of the future project development.

The results from the CBA, based on the assumptions made for the project are such that the project can be considered as generally viable. With an overall discount rate of 5.5%, there is a positive NPV of 1,368M EUR, at 2010 prices, and a benefit cost ratio of 1.75. The corresponding EIRR is 9.3%. However, in normal circumstances to attract EU funding for transportation projects The EIRR would normally have to be greater than 11.0% and the BCR higher. Political factors will be a serious factor in the future of this project both in terms of the desire of the EU to link the Baltic States with the rest of the EU using a standard gauge railway and in terms of the individual Baltic States whose development could be stimulated by this project.

In addition, the Financial Analysis shows the project having a positive cumulative cash flow in all years suggesting that at this level the project is financially stable. Financial indicators of the investment, without EU funding, show negative results emphasising the importance of securing the EU funding. Although, FRR/K on a consolidated basis (IRR of national investments), which has been calculated in accordance with method set out in the EC Guide to Cost Benefit Analysis of Investment Projects is 3.10%.

The figures also show that there should be no need for subsidies during the operational period, although in order to help stimulate initial demand, in particular for freight traffic subsidies may be helpful during the start up period.
On a country basis it is seen that the best results are in Estonia. This is not particularly surprising as passenger benefits are accrued by having three stations; Tallinn Central, Tallinn Airport and Parnu as opposed to one station in Latvia and two in Lithuania. In addition freight demand is strong and therefore the benefits higher as a result of the strong flows from St Petersburg and Finland. Construction costs are also lower in Estonia as there are no major structures required.

Sensitivity tests were run for the CBA on the whole route focussing on the key variables of capital cost, spend profile, operation and maintenance costs, demand, cost of time savings and GDP growth. With each parameter change the NPV remained positive, but in the case of a 50% freight demand drop only just. There is no reason to believe that most of these variables are correlated; however, it is possible that some of them will be downside whilst others are upside at the same time. For this reason, to assess the likely results of parameter fluctuation a risk analysis was conducted using @Risk which uses a Monte Carlo simulation approach. The result of the risk analysis is that there is a more than 95% chance that the NPV will be positive.

The project should be able to be implemented to comply with the Technical Standards of Interoperability, but certain parameters will need to be carefully engineered in relation to infrastructure, energy, and control-command and signalization systems. The overall framework and procurement of the required operational equipment will also need close scrutiny to comply with directives related to rolling stock, operations and information systems.

From an implementation perspective, it is recommended that Rail Baltica development should be overseen by a programme steering group (PSG). The PSG function would be to have overall control of the strategic delivery of the Rail Baltica programme. The PSG would comprise of representatives from the principle member states and assisted by other key stakeholders including the European Union. Upon commencement of the implementation, it is recommended that an integrated programme organisation (IPO) is established at the earliest opportunity with the principle objective of facilitating project development. The IPO must be a technical based organisation operating within defined terms of reference and be of short term of regional, national and local influences. The IPO should be both organisationally and financially separate and independent from existing national and international bodies.

By separating the functions of strategic control and programme, the delivery risk which has surrounded many international projects in the past can be more effectively controlled.

In order to successfully implement such a large scale project it is also necessary to have sound project communication with and between the parties involved. It is very necessary to provide appropriate marketing and public communications support – a solid public affairs strategy to build consensus among the various stakeholders of the project including, but not limited to: decision makers of the involved countries of Rail Baltica; the involved countries and the EU member states; the involved countries and EU institutions; all involved parties within each of the involved countries (governments and local municipalities), and the general public.

Table 146 - Economic Analysis Summary

Economic Impact (€,000,000)	Rail Baltica Total: Discounted Cost or Benefit	Rail Baltica Total: Share in Total Costs/ Benefits	Rail Baltica Estonia: Discounted Cost or Benefit	Rail Baltica Estonia: Discounted Cost or Benefit (per km of track)	Rail Baltica Latvia: Discounted Cost or Benefit	Rail Baltica Latvia: Discounted Cost or Benefit (per km of track)	Rail Baltica Lithuania: Discounted Cost or Benefit	Rail Baltica Lithuania: Discounted Cost or Benefit (per km of track)
Cost to Infrastructure Manager/Government								
Capital / Investment Costs	1,886	103%	565	2.47	648	2.76	674	2.55
Residual Value	-117	-6%	-34	-0.15	-43	-0.18	-41	-0.16
Maintenance Costs	61	3%	19	0.08	20	0.08	22	0.08
Benefit to Manager								
Track access charges	521	16%	108	0.47	111	0.47	125	0.47
Passenger	*170*		*35*	*0.15*	*36*	*0.15*	*41*	*0.15*
Freight	*351*		*73*	*0.32*	*75*	*0.32*	*84*	*0.32*
Benefit to Operator								
Passenger Operator								
Operating costs *(including track access charges)*	-372	-12%	-77	-0.34	-79	-0.34	-89	-0.34
Revenues	605	19%	129	0.56	160	0.68	215	0.81
Freight Operator								
Operating costs *(including track access charges)*	-685	-21%	-142	-0.62	-146	-0.62	-164	-0.62
Revenues	1,142	36%	353	1.54	339	1.44	322	1.22
Benefit to Users								
Value of Time Savings	1,158	36%	397	1.73	340	1.45	284	1.08
Passenger	*340*		*135*	*0.59*	*88*	*0.38*	*71*	*0.27*
Freight	*818*		*262*	*1.14*	*252*	*1.07*	*213*	*0.81*
External Impacts								
On Safety (Accidents)	338	11%	116	0.51	105	0.44	89	0.34
Air Pollution	148	5%	35	0.15	29	0.13	77	0.29
Climate Change	342	11%	117	0.51	108	0.46	85	0.32
Total Costs	**1,829**		**550**	**2.41**	**625**	**2.66**	**654**	**2.48**
Total Benefits	**3,198**		**1,034**	**4.52**	**967**	**4.11**	**944**	**3.58**
Net Present Value (NPV)	1,368		484		342		289	
EIRR	**9.3%**		**9.7%**		**8.4%**		**7.9%**	
Benefit/Cost Ratio	**1.75**		**1.88**		**1.55**		**1.44**	