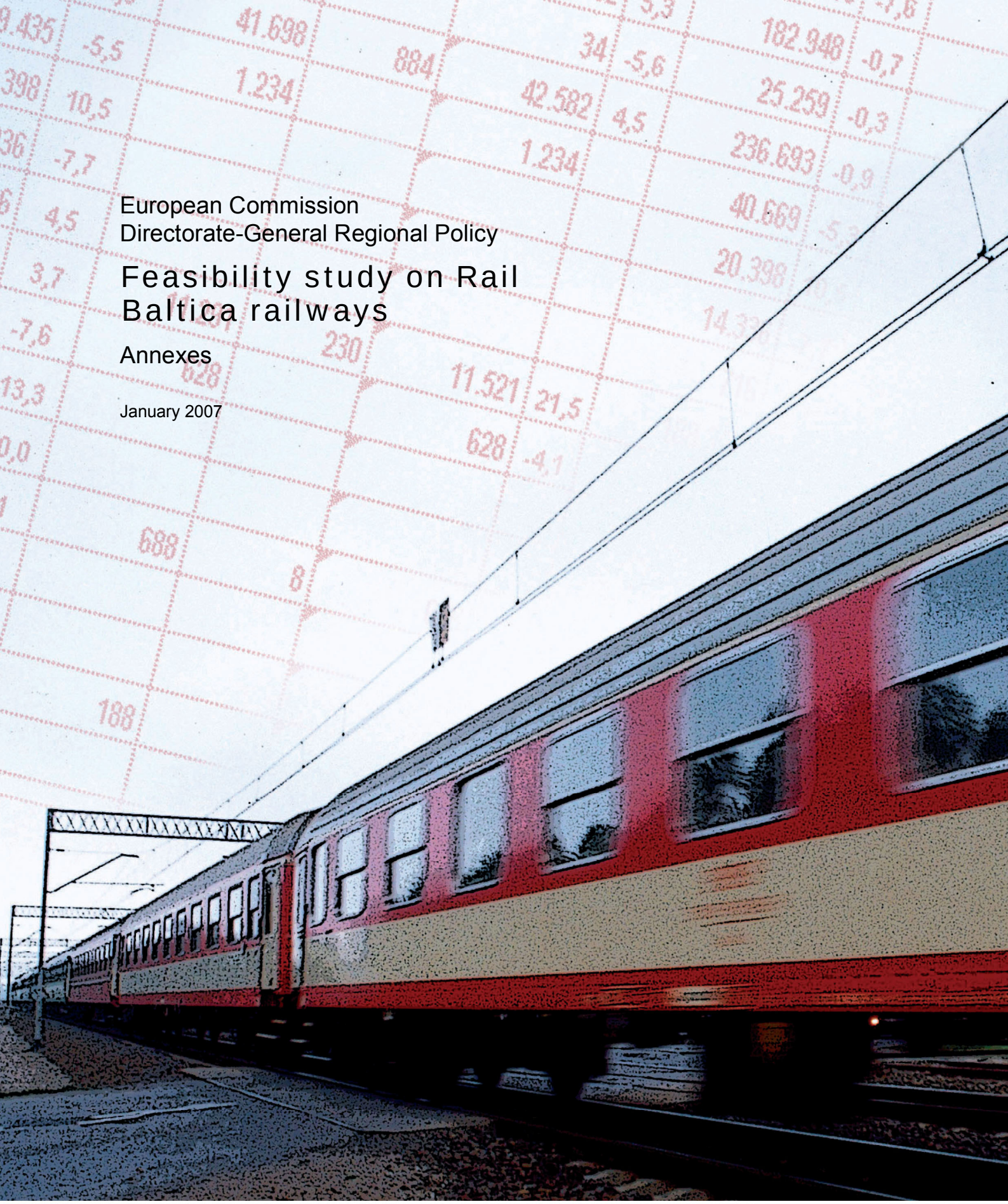

European Commission
Directorate-General Regional Policy

Feasibility study on Rail Baltica railways

Annexes

January 2007

COWI

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European Commission
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Annexes

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Figure A.1 Outline plan, EU-25 (road)

Annex B: Existing infrastructure

Table B.1 Current state of railway infrastructure in Estonia - Rail Baltica axis

Line sections		Track		Line lenght	Line speed	Stations	Level crossings	El traction	Caternary Voltage	Bottlenecks on the	Signalling system	ATC	Planned project
City	City	Double	Single	km	km/h	number	number	Y / N	AC / DC ?	section		Y / N	<2008
Tallin	Aegviidu	56.7		56.7	80 / 120		10	Yes	3,3 KV DC	Traffic	A L Block	N	
Aegviidu	Tapa	20.8		20.8	80 / 120		4	No	-	Traffic	A L Block	N	
Tapa	Tartu		112.5	112.5	80 / 120		33	No	-	Traffic	A L Block	N	Renewal
Tartu	Elva		25.3	25.3	40		9	No	-		A L Block	N	
Elva	Valga		57.6	57.6	40		11	No	-		A L Block	N	
Valga	Border LV		1.87	1.87	40		0	No	-		A L Block	N	
Total	Km / No			274.77			67						

Line sections		Track		Line lenght	Line speed	Stations	Level crossings	El traction	Caternary Voltage	Bottlenecks on the	Signalling system	ATC	Planned project
City	City	Double	Single	km	km/h	number	number	Y / N	AC / DC ?	section		Y / N	<2008
Tallin	Rapla		54.4	54.4	80			No	-	Traffic	A L Block	N	
Rapla	Lelle		17.5	17.5	80			No	-	Traffic	A L Block	N	
Lelle	Pärnu		69.5	69.5	80			No	-	Traffic	A L Block	N	
Pärnu	Moisakula		48.6	48.6	40			No	-		A L Block	N	
Total	Km / No			190									

Note: Split on single/double track based on readings from schematic maps.

Table B.2 Current state of railway infrastructure in Latvia - Rail Baltica axis

Line sections		Track		Line lenght	Line speed	Stations	Level crossings	El traction	Caternary Voltage	Bottlenecks on the	Signalling system	ATC	Planned project
City	City	Double	Single	km	km/h	number	number	Y / N	AC / DC ?	section		Y / N	<2008
Border EE	Valka		2.8	2.8	120				-		Automatic block system	Y / N	
Valka	Valmiera		45.4	45.4	120	10	9	N		Curve 160			
Valmiera	Cesis	3.7	23.3	27.0	100	33	12	N		Curve 1180			
Cesis	Sigulda		39.9	39.9	100	30	9	N		Curve 160			
Sigulda	Riga	48.4	3.8	52.2	100	81	12	N		Curve 1315			Traffic
Riga	Jelgava	42.9		42.9	100	108	7	Y	3.3kV DC	Curve1700			
Jelgava	Eleja		27.8	27.8	120	95	6	N			semi automatic	N	
Eleja	Border LT		5.2	5.2	120	5		N					
Total		95	148.2	243.2		362	55			4515			

Table B.3 Current state of railway infrastructure in Lithuania - Rail Baltica axis

Line sections		Track		Line lenght	Line speed	Stations	Level crossings	El traction	Caternary Voltage	Bottlenecks on the	Signalling system	ATC	Planned project	Planned project
City	City	Double	Single	km		number	number	Y / N	AC / DC ?			Y / N	<2008	<2008
Border LV	Joniskis		15.44	15.44	100-80	1	5	N			SAB	N		
Joniskis	Meskuiciai		22.3	22.3	100-80	2	8	N			SAB	N		
Meskuiciai	Siauliai		21.8	21.8	100-60	2	6	N			SAB	N		
Siauliai	Radviliskis	19.8		19.8	120-80	3	3	N		2. track	AB	Y	2. track	
Radviliskis	Baisogala	18.2	6.7	24.9	120-80	3	8	N			AB	Y		
Baisogala	Gudziunai	12.1		12.1	120-80	1	1	N			AB	Y		
Gudziunai	Dotnuva	14.5		14.5	120-80	1	4	N			AB	Y		
Dotnuva	Kedainai	12.9		12.9	120-80	1	2	N			AB	Y		
Kedainai	Jonava	14.3	16.7	31	120-80	4	4	N			AB	Y		
Jonava	Kaunas	9.6	32.8	42.4	80-40	3	4	Y/N	AC(9,6km)	Tunnel	AB/SAB	Y/N	Tunnel	
Kaunas	Garliava	9		9	120-90	1	2	N			AB	Y		
Garliava	Kazlu Ruda	27.9		27.9	120-80	3	6	N			AB/SAB	Y/N		
Kazlu Ruda	Marijampole		24	24	80-40	2	7	N			SAB	N		
Marijampole	Sestokai		32.9	32.9	70-40	2	15	N			SAB	N		
Sestokai	Border PL		21.9	21,9*	70-40	1	12	N	Gauges differe		SAB	N		
Total	Km / No	138.3	194.54	332.84		23	87							

* gauge 1435 mm (up to Mockava (8,1 km) with 1520 mm)

Table B.4 Current state of railway infrastructure in Poland - Rail Baltica axis

Line sections		Track		Line lenght	Line speed	Stations	Level crossings	El traction	Caternary Voltage	Bottlenecks on the section	Signalling system	ATC	Planned project
City	City	Double	Single	km	km/h	number	number	Y / N	AC / DC ?			Y / N	<2008
Warszawa Rembertów	Zielonka	8.7		8.7	80			Y	3 kV DC		A L Block		
Zielonka	Wołomin	6.9		6.9	50			Y	3 kV DC		A L Block		
Wołomin	Tłuszcz	16.4		16.4	60			Y	3 kV DC		A L Block		
Tluszcz	Łochów	20.7		20.7	120			Y	3 kV DC	Bridge	A L Block		
Łochów	Małkinia	29.5		29.5	120			Y	3 kV DC		A L Block		
Małkinia	Szepietowo	39.4		39.4	120			Y	3 kV DC		A L Block		
Szepietowo	Łapy	26.7		26.7	120			Y	3 kV DC		A L Block		
Łapy	Białystok	23.3		23.3	80			Y	3 kV DC		A L Block		
Białystok	Czarna Białostocka		21.9	21.9	80			Y	3 kV DC	Bridge	A L Block		
Czarna Białostocka	Sokółka		19.4	19.4	80			Y	3 kV DC		A L Block		
Sokółka	Dąbrowa Białostocka		32.7	32.7	80			N	-		A L Block		
Dąbrowa Białostocka	Augustów		34.9	34.9	90			N	-		A L Block		
Augustów	Suwałki		31.3	31.3	90			N	-		A L Block		
Suwałki	Trakiszki / state border		28.6	28.6	60 / 40			N	-	Gauge 1435	A L Block		
Total	Km / No / Average	171.6	168.8	340.4									

Annex C: Cost assessment of development options

Introduction

This section provides the background for the costs assessment of the development options for Rail Baltica.

The railway lines in the Baltic countries are generally constructed during the same period and by the use of comparable principles:

- The main lines in the Baltic counties were previously narrow gauge or west European gauge.
- All the lines are designed to 120 km/h.
- Many of the lines are originally constructed by Germans and reconstructed after Second World War. The main difference at the last reconstruction was change in gauge from 1000 mm and 1435 mm to 1520 mm gauge.
- After the Second World War the lines were reconstructed to broad gauge by use of the old or other used materials or new constructed just beside the existing line still by using old Russian components.
- The lack of maintenance and poorly maintained track, lack of money for spare parts and just lack of spare parts means that the operational speed usually is much less than 120 km/h.
- The present track design rules only covers technical parameters up to 120 km/h.
- Above this level the TSI rules shall be followed.

It will be clear from the following that the systems used in Poland are quite similar to those used in the Baltic States.

Methodology

The various technical systems are more or less the same in the Baltic countries and similar to the systems in Poland. It is clear based on data collection, interviews and site visits that the condition of the railway lines in the Baltic countries and Poland may be compared and hence a generalisation is possible.

This means that e.g. the line geometry standard in the various countries is considered to be the same. It is anticipated that number of level crossings are comparable for the different lines, signalling systems are more or less alike etc. There are of course differences in number of tracks and other differences which will be taken into account in the following.

Basic assumptions

The European High Speed Interoperability Directive or Technical Specifications for Interoperability (in the following abbreviated HS-TSI), describes two different scenarios for a high-speed line, either to upgrade an existing line or to build a completely new one. The line speed on the feeder lines can be up to 200 km/h but the normal line speed should be at least 250 km/h to be mentioned as a high speed line.

In Rail Baltica the required maximum speed will be 160 km/h, except for the section from Kaunas to the Lithuanian/Polish border which is designed for a maximum speed of 200 km/h.

The technical specification will therefore follow the directives for conventional rail systems.

Track system

A modern train is designed to run on continuously welded rails when the speed increases 120 km/h. An upgrade to continuously welded UIC60 rail on mono-block concrete sleepers with modern fastening system on sections not equipped with them must therefore be done both for upgrading to 160 km/h or new lines for 160 km/h.

Estonia
Based on information received and site visits it can be assumed that most of the lines are with jointed rails either R-65 or UIC60 rail on mono-block sleepers with Russian K-fasteners.

Latvia
As for Estonia it is assumed that most of the lines are with jointed rails either R-65 or UIC60 rail on mono-block sleepers with Russian K-fasteners.

Lithuania
From a previous study in Lithuania it was concluded that approximately 80% of a line was with continuously welded rail. The remaining is considered to be jointed rail on wooden sleepers. Further most of the lines are with continuously welded rail either R-65 on mono-block sleepers with Russian K-fasteners or UIC60 rail on mono-block sleepers with Pandrol fasteners.

Poland
The track system in Poland is similar to that in Lithuania.

Track geometry

Vertical geometry
The vertical geometry of a railway is defined by the straight lines (inclinations and descending) and vertical radii of the line. In general, it is better with low inclination and a high vertical radius than the opposite.

The vertical geometry of the existing lines in question is not known in detail but based on a previous study it is anticipated that the inclination generally is low and below what is normally considered to be limiting values. The same goes for vertical radius.

Horizontal geometry
The horizontal geometry of a railway is defined by the pieces of straight lines, the horizontal radii (the curvature with the applied cant) and the length of the transition curves between the straight lines and the radii of the line. These are interdependent of each other and the permissible speed.

The TSI defined values making it possible to calculate cant and minimum horizontal radius but not length of transition curves. Based on national German standard the transition curves can be calculated.

The following values then apply:

- Maximum permissible applied cant is 180 mm for 160 km/h
- Maximum permissible cant deficiency is 160 mm for 160 km/h

The Lithuanian standard allows for maximum permissible applied cant of 150 mm. increasing it to 180 mm, as stated in the TSI, would increase lateral forces and wear on inner string from slow heavy haul trains. A decrease in maximum permissible applied cant from 180 to 150 mm generates an increase in minimum curve radius with only 9%. The following analysis is therefore based on a maximum permissible applied cant of 150 mm.

If these values are applied it means that:

- Minimum horizontal radius at 160 km/h is 980 m

The length of the transition curves should be:

- 205 m for 160 km/h in a curve with minimum radius and maximum cant

Based on the above listed values and assumption a line of a length of about 240 km has previously been analysed in Lithuania. It is assumed based on the information received during data collection, interviews and site visits that the result of that analyse applies for all the sections considered.

For 160 km/h the result of the analysis showed that:

- 64% of the railway line has sufficient horizontal radius, length of transition curves and sufficient close to sufficient cant, which can be covered by the general upgrade of the track substructure.
- 22% of the railway line has sufficient horizontal radius, but increase in cant and length of transition curve is necessary.

- 14% of the railway line has insufficient horizontal radius and the cant, the horizontal radius and the length of the transition curves must be altered.

The above-mentioned has the effect that for 160 km/h:

- 22% of the line needs repositioning of entire curve and adjustment in sub-structure.
- 14% needs change of entire curve and new substructure.

Electric traction power supply

There is only catenary system on the existing line in Poland from Sokolka to Warsaw and on a short section in Lithuania from Kaunas towards Vilnius.

Signalling

The TSI states that the signalling system on a high-speed line should be ETCS/ERTMS compatible. In general the signalling system today is relay-based with an automatic train stop function (automatic line block system) but without ATP (Automatic Train Protection).

Centralized Traffic Control (CTC) seems not to be installed.

Bridges and structures

Based on the above-mentioned study of a railway section with a length of approximately 240 km in Lithuania it could be anticipated that only a few of the bridges are capable of carrying trains at a speed of 160 km/h. It is therefore assumed that 75% of the bridge length needs to be upgraded to 160 km/h.

In Estonia all civil works structures (bridges etc.) on the line Tallinn - Tartu have been recalculated or renewed after they bought American locomotives with 32 tonnes axel load.

Level crossings

The TSIs do not specify requirements on level-crossings when upgrading lines but refer to local national requirements. None of the countries have standards for a speed of 120 km/h and above.

The United Nations European Agreement on main International railway lines (AGC standard) aims at progressive elimination of existing level crossings when increasing speed to 160 km/h or above. On the other hand in a number of European countries it is normal with level crossings for a speed up to 160 km/h or even 200 km/h (Sweden). It is understood that the Baltic countries and Poland accepts level crossing for a speed up to 160 km/h.

For this study it has been assumed that level crossings can continue to exist for a speed up to 160 km/h. It is further assumed that in general the level crossings are not equipped in an appropriate way with regard to higher speed and consequently level crossings have to be upgraded for a speed up to 160 km/h. It is assumed that level crossings exist for each 5-10 km of railway line.

Existing level crossings are generally equipped with bells and light signals but not with bars in all cases.

Land acquisition

The costs of land acquisition are extremely difficult to assess, as:

- The future legislation enabling expropriation is unclear and differs substantially in the various countries. In Lithuania legislation enabling expropriation is under negotiation in the parliament whereas in Latvia expropriation is difficult. Here it is only possible to purchase land under normal commercial conditions meaning that prices could be rather high due to ownership speculation.
- The costs of land have increased substantially over the years and it is impossible to forecast how it will develop in the future.
- The cost of land differs substantially across countries and regions.
- The future alignment of Rail Baltica is not known.
- It has been noted that there generally along the existing lines is a quite wide (green) corridor up to 30 - 50 m to both sides from the existing tracks centreline making it possible in principle to construct new tracks without land acquisition. The purpose of this corridor is not clear but the railway authorities insist on keeping the width of this corridor meaning that new land has to be acquired anyway in order to maintain the width.

The table below summarises the key costs figures for Latvia, Lithuania and Poland. It can be seen that there is substantial differences across countries.

Table C.1 Unit cost for land (€/m^2, 2006-prices)

	Estonia	Latvia[1]	Lithuania[2, 4]	Poland[3, 4]
Urban	80.0	64.0	82.0	10.4
Arable	0.07-1.10	0.12	0.55	0.44

[1] Figures for Urban are for residential land in Riga, figures for arable land are average of Central and Northern Latvia. [2] Figures for Urban are for residential land in Kaunas and Vilnius, figure for Arable are highly uncertain as range is given as 1400-190,000, source: inreal.lt [3] Figures for urban are average of 'developed land' for Poland, source: Central Statistical Office. [4] Figures for 2005 has been increased by 10% to reflect increase in prices from 2004-2005 (increase observed in Poland for developed land, 2004-2005)

The cost assessment is based on an average unit cost figure of 0.5 €/m^2 (2006-prices) for arable land and 80 €/m^2 for urban land.

It is assumed, that the construction of a new line requires that a 10 m wide corridor is established.

Cost assessment

Unit costs

Prices for track renewal of an existing line (to 120 km/h) were in the various countries indicated to be as indicated in the table below.

Table C.2 Indicated costs for track renewal (to 120 km/h)

Country	Costs (million €/km single track)	Comment
Estonia	0.35	-
Latvia	0.40	-
Lithuania	0.70	Prepared for double track
Poland	0.40	-

Since the railway systems in the four countries are comparable the same unit prices for upgrading or construction of lines are used for calculation of construction costs. The unit prices are based on the indications given in each of the countries modified based on a concrete assessment of the complexity of the construction works.

In the cost assessment the prices indicated in the table below have been used.

Table C.3 Unit values used in cost assessment

Category	million €
Upgrade of existing line to 120 km/h (per km single track)	0.5
Upgrade of existing line to 160 km/h (per km single track)	0.7
New line, Russian standard (no electrification) (per line-km)	1.9[1]
New electrified line, European standard (per line-km)	2.5[1]

[1] Including 25% double line

Generally it is assumed that the unit prices per kilometre track renewal are very similar through the countries due to the similar technical systems and limited differences in salary level.

The salary part of construction works can be estimated to around 1/3 of the total construction cost. Component prices are the same all over Europe. Hence the price levels in the Baltic Countries and Poland are comparable with other European countries. Therefore the price levels from similar projects and as investigated by UIC infracost working group can be used.

The report *"Infracost - The Cost of Railway Infrastructure"* was published in June 2002 by UIC. The objective of the study was to benchmark real projects such as new lines, extension/upgrading and major renewal against each other. The project database is updated yearly and hence gives a very representative indication on cost development and levels. Together with a participant from the UIC working group the Consultant has verified the estimated unit cost used for the Rail Baltica study with the data provided by UIC report. Further the Consultant has compared the estimated unit cost with present data from on-going projects in Denmark and Eastern Europe mainly Poland.

Also potential major reconstruction works in especially cities are excluded.

The differences in unit prices for track renewal for 120 to 160 km/h is primarily due the necessary geometrical changes caused by speed increase.

For new lines it is assumed that 25% of the line is constructed with double track (stations, sidings etc.) in order to allow for passing trains or overtaking of slow (freight) trains.

Cost assessment for development options

The results of the cost assessment for three investment packages are shown in the table below.

Table C.4 Summary of investment cost assessment, main options (million €)

	Package 1			Package 2			Package 3		
	Construc-tion	Land	Total	Construc-tion	Land	Total	Construc-tion	Land	Total
Estonia	0[1,2]	0	0	241[2]	0	241	450[2]	8	458
Latvia	169	0	169	231	0	231	513	8	521
Lithuania	572	33	605	575	33	608	790	33	823
Poland	204[3]	0	204	466[4]	0	466	566[4]	0	566
Total	**945**	**33**	**979**	**1,513**	**33**	**1,546**	**2,319**	**50**	**2,369**

[1] Estonia has recently spent 66 million € on upgrading the existing line from Tallinn via Tartu to Valga to 120 km/h. [2] On the section Tallinn - Tapa – Jõgeva – Tartu - Valga the line capacity is almost depleted. Hence in case the implementation of Rail Baltica transfers or induces large volumes of freight or passenger traffic it could be necessary to built an additional track between Tapa and Tartu. This is not included in the construction cost estimate. This issue should be investigated further in the design phase. [3] Poland has continuously spent resources on maintaining the standard of the existing line from Warsaw to Bialystok, which implies that only minor upgrades are necessary for this section. Upgrades are however necessary on the section from Bialystok to the Lithuanian border. [4] Including costs for upgrading existing bridges.

The costs assessment of the sub-variants are summarised in the tables below.

Table C.5 Summary of investment cost assessment, sub-variants to investment package 1 and 2 (million €)

	Package 1, sub-variant A (Existing line in LT)			Package 2, sub-variant A (Via Panevezys)			Package 2, sub-variant B (Existing line in LT)		
	Construc-tion	Land	Total	Construc-tion	Land	Total	Construc-tion	Land	Total
Estonia	0	0	0	241	0	241	241	0	241
Latvia	169	0	169	319	8	327	231	0	231
Lithuania	437	17	453	593	25	618	495	17	512
Poland	204	0	204	466	0	466	466	0	466
Total	**810**	**17**	**827**	**1,618**	**34**	**1,652**	**1,433**	**17**	**1,450**

Table C.6 Summary of investment cost assessment, sub-variants to investment package 3 (million €)

	Package 3, sub-variant A (via Lelle/Pärnu in Estonia)			Package 3, sub-variant B (no electrification)		
	Construc-tion	Land	Total	Construc-tion	Land	Total
Estonia	475	16[1]	491	338	8	346
Latvia	513	8	521	384	8	393
Lithuania	790	33	823	593	33	626
Poland	566	0	566	466	0	466
Total	2,344	58	2,402	1,780	50	1,830

[1] The cost of land in Estonia could prove to be slightly higher for the option via Lelle/Pärnu due to extra need for land acquisition in urban areas.

Maintenance cost for a railway line

Maintenance of a railway line can be divided into four main elements

- The tracks - the part of the line with most wearing parts
- The signalling and telecommunication installations where the electronic components decide the lifetime (practically no wearing parts)
- Overhead contact line - where mainly the overhead line is worn, the rest is exposed to the weather.

- Surrounding areas - ditches, track benches, additional areas - must be maintained to prevent the vegetation from spreading into the track.

Beside maintenance cost there are administration costs and cost to cover accidents and operation damages.

The maintenance cost for a standard West European gauge of 1435 mm as for a Russian gauge of 1520 mm is considered to be comparable.

The description provided below covers new/reconstructed lines. A special assessment is made for the reference case.

Regarding the track
For a railway line with a yearly gross tonne load of less than 10 million tonnes, the tracks are constructed with a lifetime of about 50 years.

During the tracks lifetime the following main activities must take place:

- About every third year the rails must be grinded, price 1 €/m.
- Every fifth year the ballast must be supplemented, price 1 €/m.
- Every fifth year the tracks must be tamped, price 4 €/m.
- Every fifth year tensioning and control of the entire system must take place, price 1 €/m
- Every eight year the insulated joints must be replaced (4 per 3 km), price 4,000 € each
- Every twentieth year the ballast must be cleaned, price 30 €/m
- Every twentieth year larger switch parts must be replaced, price 15,000 €/switch (1 station per 20 km, 4 switches per station)

Signalling and telecommunication systems
The signalling and telecommunication installations are not really worn down as only the relays have movable parts, but the technology becomes obsolete. Part of the safety installations can therefore be more than 50 years, however with new technology and additional functions.

The maintenance costs are thus difficult to estimate but below are some key figures for the replacement costs.

- Safety installations per station about 1 million € (1 station per 20 km)
- Safety installations per switch about 100,000 € (1 station per 20 km, 4 switches per station)
- Safety installations per block section per about 3 km track, price 100,000 €.

It is here assumed that the installations are replaced every twentieth year.

Overhead contact line / the catenary system
The overhead power can be divided into three main groups:

- Foundations and poles: These are designed for at least 50 years lifetime, normal distance 40 m. Foundations and poles are only replaced when damaged or changed, price about 15,000 € each. Newer types of poles of Corten steel need no maintenance. Hence costs for foundations and poles are not included here.
- All suspensions and catenary cables: These are primarily worn by weather, normal distance is 40-60 m (here assumed to be 50 m), price 1,500 €/suspension. Suspensions and catenaries are rarely replaced. It is here assumed that these are replaced after 25 years.
- The overhead contact line (the primary wearing part): The overhead power is replaced when the limit values for wear are reached. The wear of course depends on the traffic load, but close to 25 years is expected. Price of 15,000 € per km.

Surrounding areas
A price for weed control pr. m^2 is needed. For a 10 m wide single track railway line at least 5 m^2 area maintenance per running meter shall be budgeted. The same figures apply for a 15 m wide double track railway as the area between the tracks is only sparsely vegetated. Maintenance price is in the region of 1€/10 m^2.

No costs for *preservation of rural amenities* and *cutting of vegetation* are included here.

Total costs of maintenance
The costs have been estimated on an annual basis in the planning period (2007-2045) split on the above main components for both the reference scenario (dominimum) and the three main investment packages. For the reference scenario the maintenance work (including error corrections) necessary to maintain the current level of service and to maintain present standards have been estimated taking into account the current condition of the railway (i.e. lack of maintenance and poorly maintained track).

An extract of the estimated maintenance costs are shown in the table below. Please note that the costs of maintaining the infrastructure are the same for the years 2007-2015 for all the options. Please note that the costs of the investment packages all included the costs of maintaining the existing (north-south) infrastructure in case a new north-south is constructed, e.g. the cost of maintaining the existing line in Estonia is included for investment package 3, as a new and more direct line is constructed.

Table C.7 Summary of maintenance cost in the planning period (million €)

	Country	2007-2015	2016-2045	Total	Difference to Reference case
Reference case	Estonia	14	82	96	
	Latvia	12	74	86	
	Lithuania	15	91	106	
	Poland	18	108	126	
	Total	**60**	**355**	**415**	
Investment package 1	Estonia	14	63	78	-19
	Latvia	12	55	67	-19
	Lithuania	15	136	151	45
	Poland	18	80	98	-28
	Total	**60**	**333**	**393**	**-22**
Investment package 2	Estonia	14	63	78	-19
	Latvia	12	55	67	-19
	Lithuania	15	136	151	45
	Poland	18	80	98	-28
	Total	**60**	**333**	**393**	**-22**
Investment package 3	Estonia	14	129	143	47
	Latvia	12	125	137	51
	Lithuania	15	164	179	73
	Poland	18	96	114	-11
	Total	**60**	**514**	**574**	**159**

It should be noted that the totals in the table above are simple aggregated costs over the years and thus do not indicate costs in net present value. In fact, a larger proportion of the costs in the reference scenario occur early in the investment period compared to the investment packages.

Estimated costs for constructing a railway line

Based on general experience it is anticipated that the costs for constructing a railway line today divided on the following main elements as follows:

- Permanent Way
- Signalling and Telecommunication
- Catenary System

If the cost for constructing a railway is considered to be 100 in today's price level the cost over time is considered to be reduced compared to the price level today.

In 10 and 20 years from now the prices are expected to be reduced especially for signalling and catenery systems due to higher standardisation of these systems. The implementation of ERTMS is considered to increase the competition

between suppliers of signalling systems due to higher standardisation leading to lower prices.

For Permanent Way it is expected that higher use of machinery will increase the cost to machinery but on the other hand reduce the cost for Labour. During the latter years the construction of permanent way has been more efficient with use of more efficient machinery leading to reduced use of labour.

Table C.5 Estimated costs of constructing a railway line

In year		0	10	20
Permanent way	Material	25%	25%	25%
	Machinery	20%	21%	22%
	Labour	5%	4%	3%
Signalling and telecommunication	Machinery	20%	15%	10%
	Labour	5%	5%	5%
Catenary system	Machinery	15%	10%	10%
	Labour	10%	10%	10%

Design and supervision costs are approximately 5% of the total cost.

Investment for land acquisition and rolling stock are not included in the above figures. Also variations in material cost are not included. Especially cost for tracks may differ considerable due to steel prices.

Further increasing salaries are not included. On the other hand labour cost amounts only to a minor part of the total cost and is therefore not considered to alter the above picture considerably.

Annex D: Traffic forecast assumptions

The purpose of this appendix is to present the assumptions made for forecasting traffic from the base year, 2004, to 2034. Some data are used both for forecasting passenger and freight traffic whereas other data are only applied for one of the two types of traffic.

The appendix contains first, a description of the macro economic data applied for forecasting traffic. Next, user costs for transport services are presented.

Macro economic data

Population

The forecast of population trends comprises the countries Estonia, Latvia, Lithuania and Poland. Instead of constructing simple demographic models for those countries, which would have to be based on a set of uniform assumptions about demographic coefficients, it has been decided to use the most recent forecast of population of EUROSTAT. The baseline variant of "trend scenario, national level - base year 2004" is taken as baseline for the assumptions on demographic trends.

Concerning the evolution of population in those countries directly concerned by the Rail Baltica, the Baltic States and Poland different average annual growth rates for the period 2004 to 2034 can be derived from the EUROSTAT forecasts. Table D.1 shows that they represent a decline in each of the four countries. The following figures display the demographic trend for Estonia, for Latvia, Lithuania and Poland.

Table D.1: Average annual population growth rates for the period 2004 to 2034

	Average annual growth rate 2004 to 2034	Population 2004 [inhabitants]	Population 2034 [inhabitants]
Estonia	-0.43%	1,351,100	1,185,609
Latvia	-0.51%	2,319,200	1,986,839
Lithuania	-0.40%	3,445,900	3,054,564
Poland	-0.18%	38,190,600	36,166,407

Figure D.1 Evolution of population in Estonia

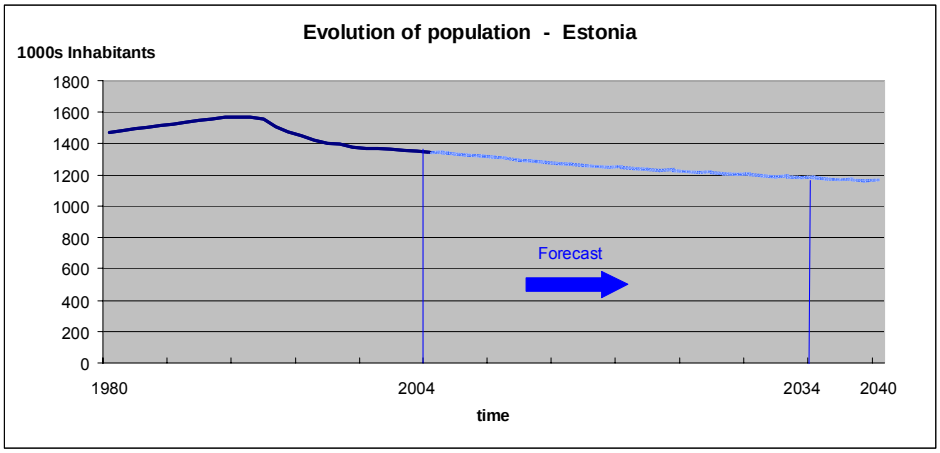


Figure D.2 Evolution of population in Latvia

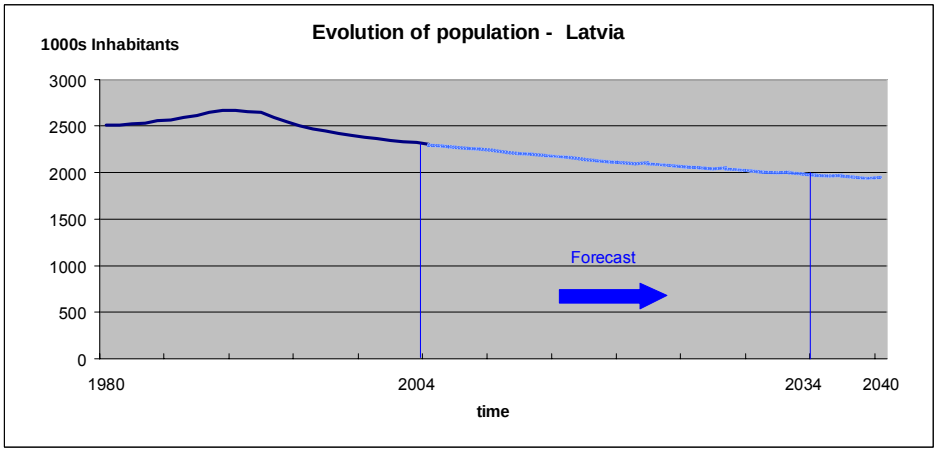


Figure D.3 Evolution of population in Lithuania

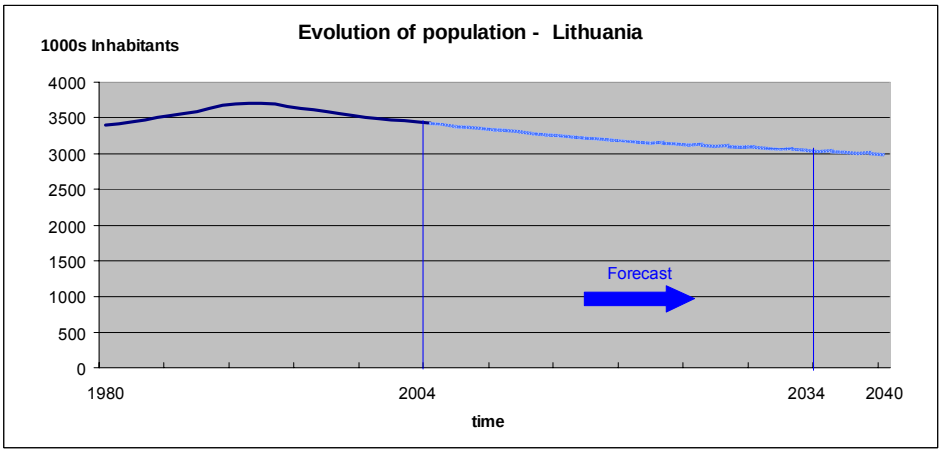
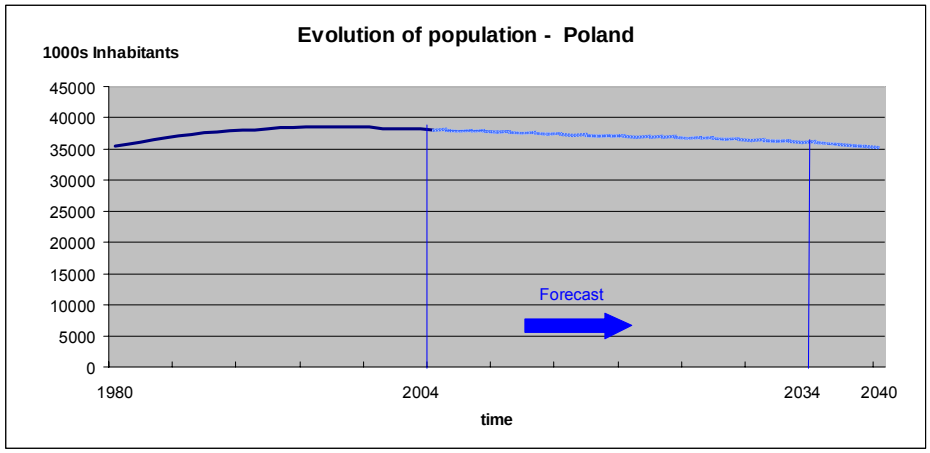
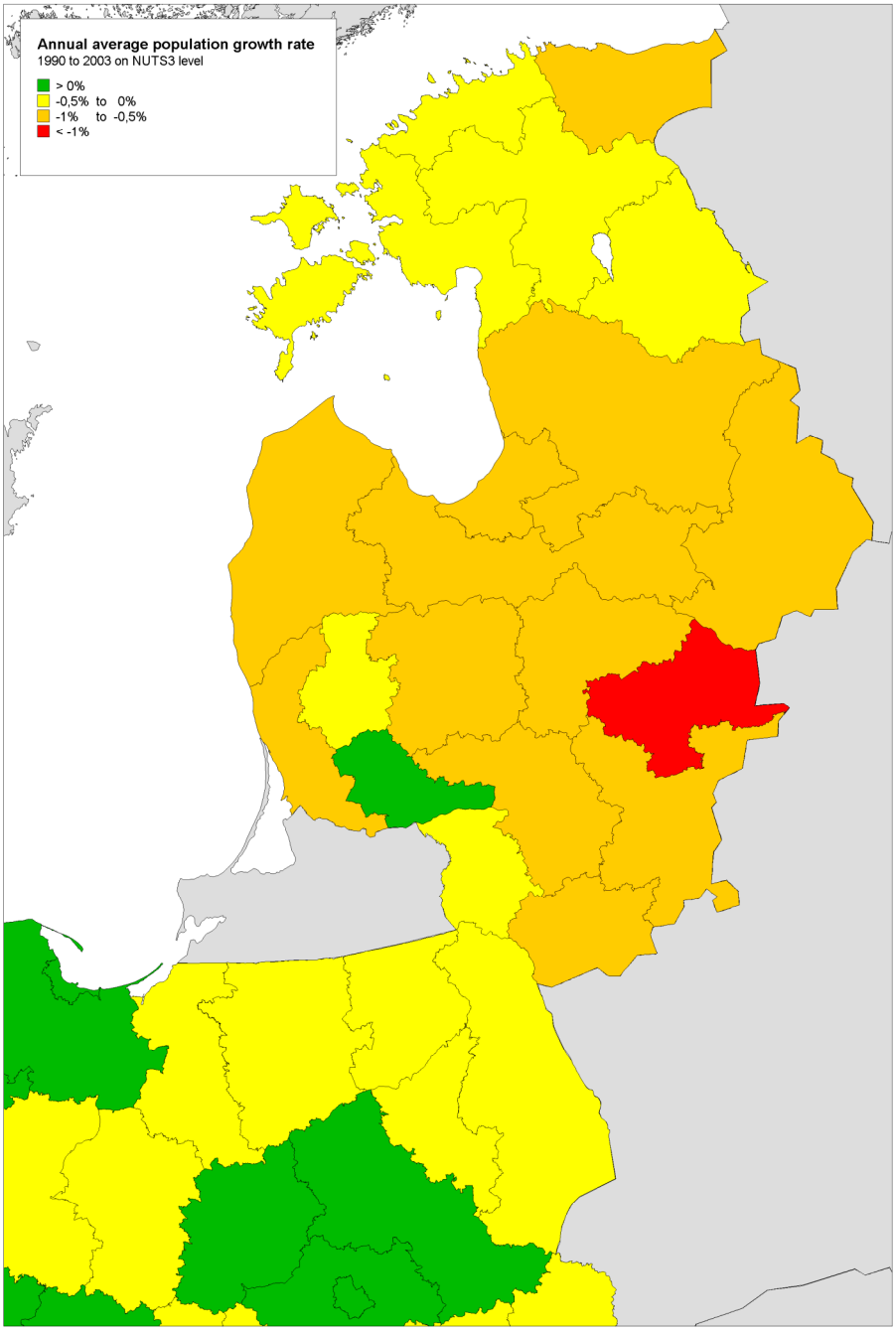


Figure D.4 Evolution of population in Poland



In order to get insight in the past demographic trends in Polish and Baltic regions, time series data from EUROSTAT have been analysed. Figure D.5 illustrates the annual average population growth rate at NUTS3 level for the period 1990 to 2003.

Figure D.5 Annual population growth rates in 1990-2003

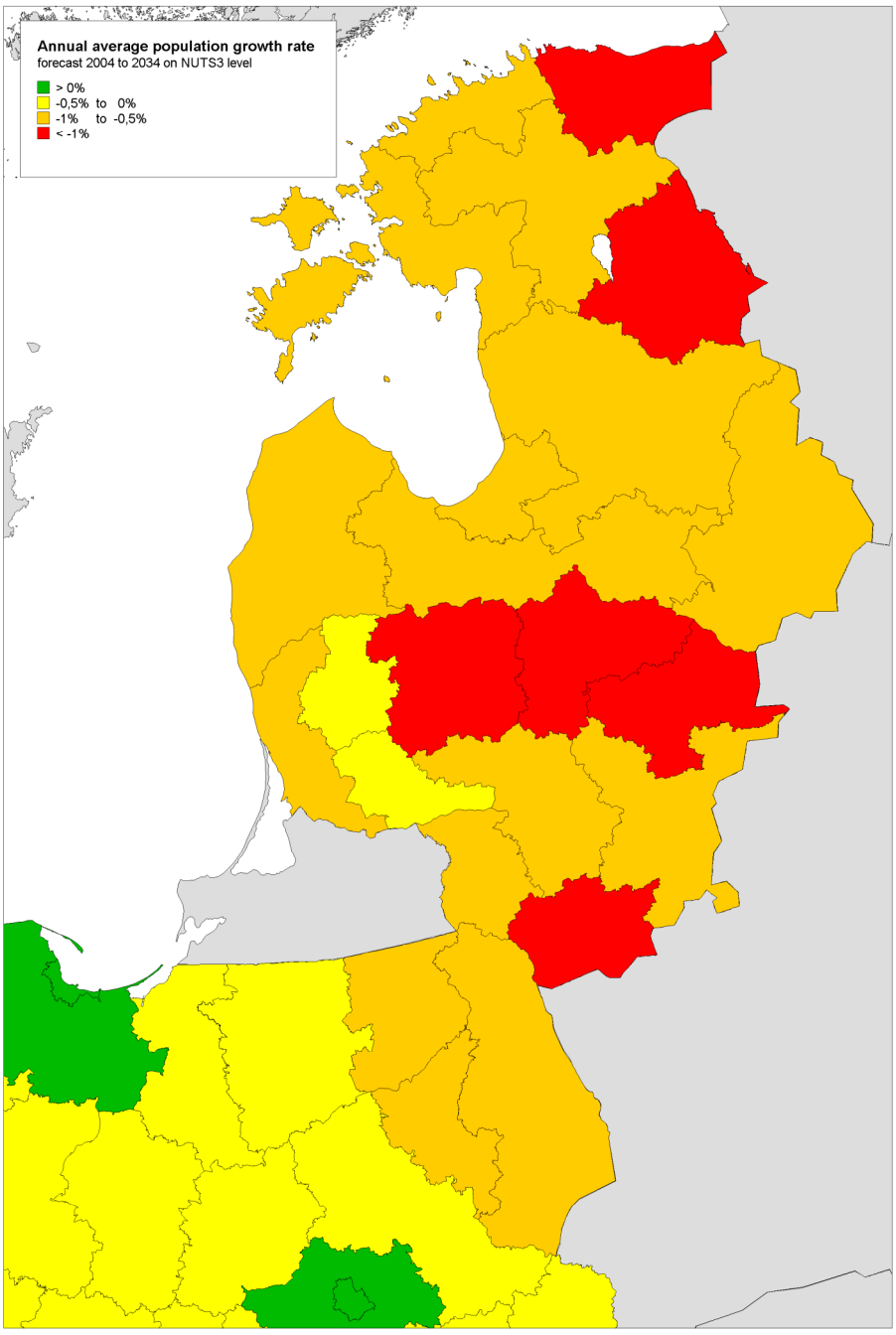


Projections of demographic changes in the Baltic States and Poland are derived by combining

- the EUROSTAT forecasts at the level of NUTS0, and
- the past demographic tendencies in the period of time 1990-2003 at NUTS3 level.

Hence the demographic trends in the three countries have been generated by joining EUROSTAT forecasts at country level with regional trends, which were derived from time series data. Figure D.6 illustrates the obtained annual rates of changes for the period 2004 to 2034.

Figure D.6 Forecasted annual population growth rates in 2004-2034



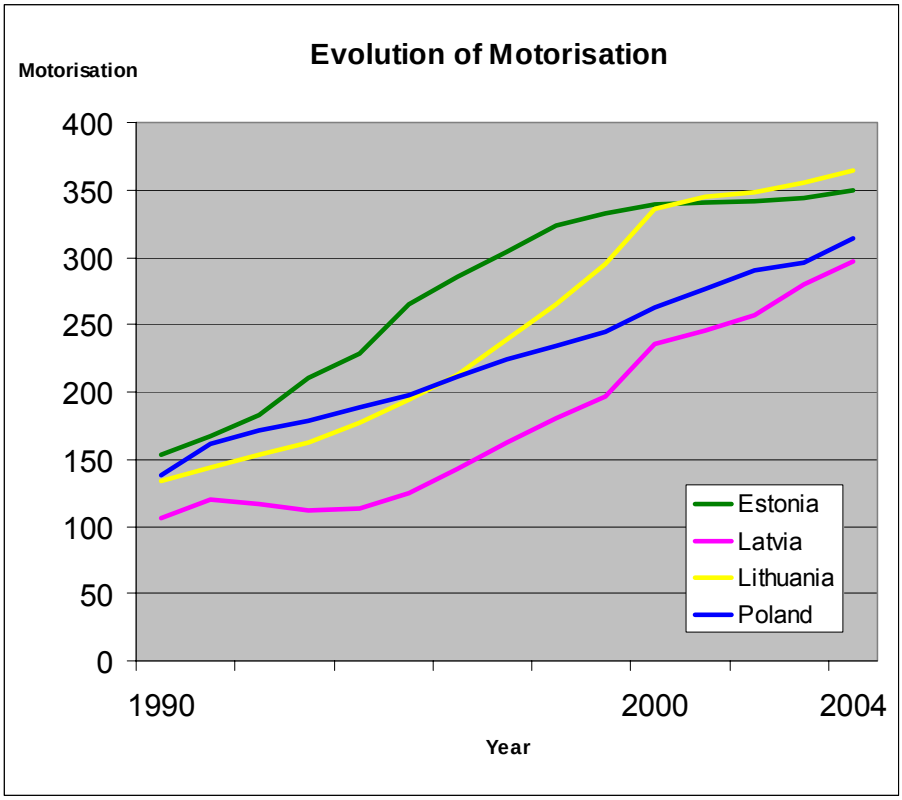
Some regional distinctions can be observed within such an analysis of annual population growth rates at NUTS3 country level. Polish regions in the wider catchment areas of larger cities like Warsaw and Gdansk highlight with an assumed increase in number of inhabitants, whereas in most of the other regions the number of inhabitants is expected to decline.

Motorisation

The level of motorisation (number of passenger cars per 1000 inhabitants) is forecasted for the Baltic States and Poland by applying a regression approach, which links motorisation with GDP per capita.

Figure D.7 displays the evolution of motorisation in the recent years by applying data of motorisation development from European Union and EUROSTAT[1] for the period 1990 to 2004.

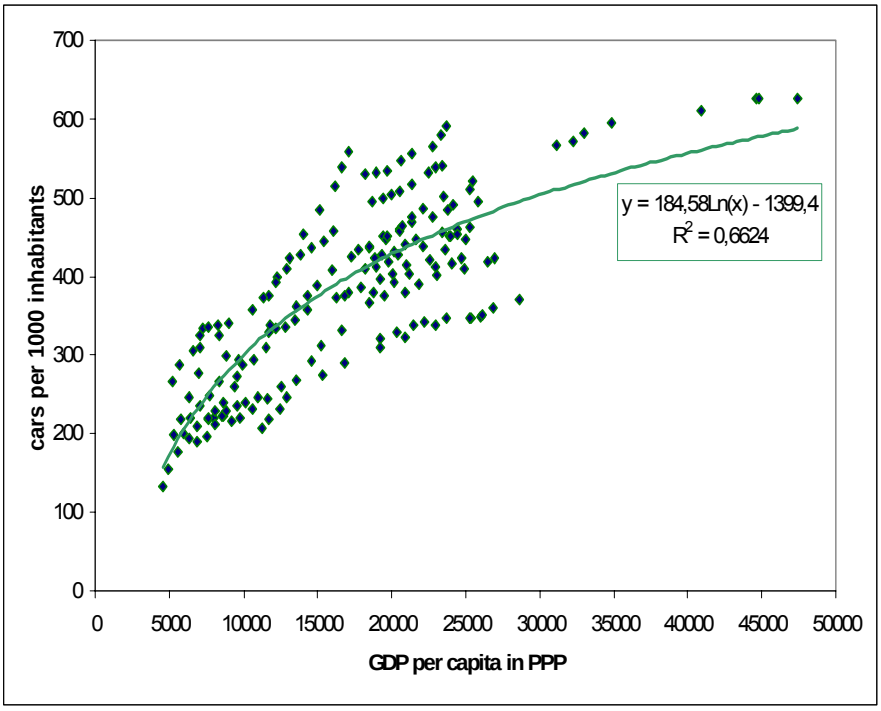
Figure D.7 Evolution of motorisation in the Baltic States and Poland



When applying the regression approach it is assumed that the GDP per capita is the decisive influencing factor for motorisation. GDP per capita is measured at PPP to minimize purchasing differences. The regression is based on the sample of the EU-25 member states by using data at NUTS0 level for the period 1995 to 2002. Figure D.8 illustrates the results of this regression.

[1]European Commission, DG TREN, Energy & Transport In Figures 2005

Figure D.8 Connectivity of GDP per capita at PPP and motorisation



It can be noted that the stability index of the chosen regression of 0.6624 is higher for a logarithmic trend line than the stability index of 0.6317 for a linear trend line. This reflects the fact of the existence of a possible saturation level at 450-550 cars per 1000 inhabitants achieved by the countries with the GDP per capita levels of above 20,000 Euro. Hence it was decided to use a logarithmic trend line.

GDP per capita projections are adopted from PRIMES[2]. Since this study only provides GDP forecasts until 2030, it is assumed for the forecast of motorisation that the development of the period 2020 to 2030 will continue in the same way for the period 2030 to 2034. Table D.1 shows the average annual motorisation growth rates for the forecasted period for the Baltic States and Poland.

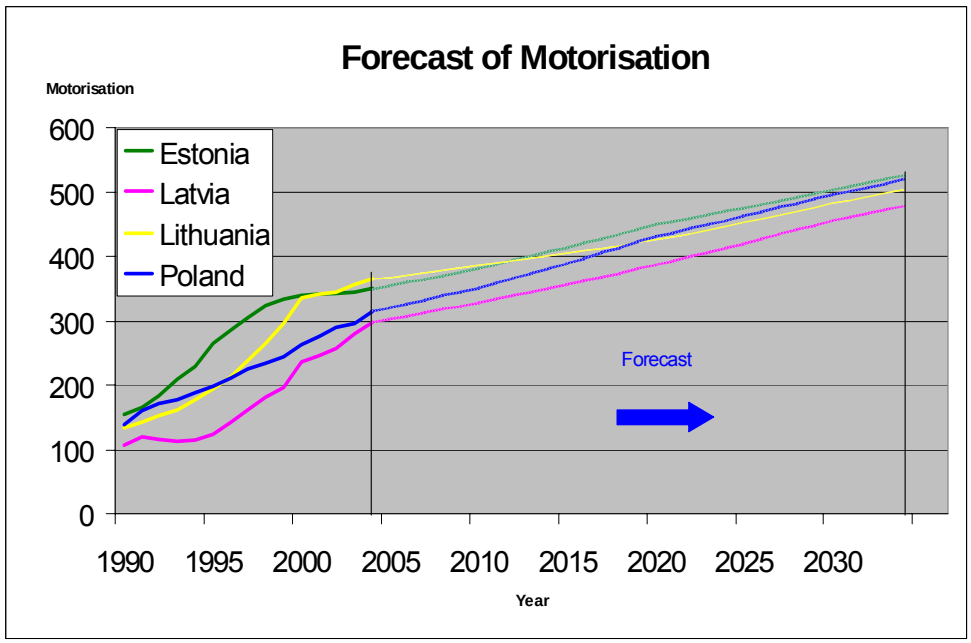
[2] European Commission, DG TREN, European energy and transport trends to 2030, Part III, EU candidate and neighbouring countries´ energy and transport outlook to 2030, http://ec.europa.eu/dgs/energy_transport/figures/trends_2030/4_chap3_en.pdf

Table D.1 Average annual motorisation growth rates for the forecasted period

	Estonia	Latvia	Lithuania	Poland
2004-2010	1.5%	1.7%	1.0%	1.9%
2010-2020	1.7%	1.7%	1.0%	2.1%
2020-2034	1.1%	1.7%	1.3%	1.4%
Motorisation 2004 [cars/ 1000 inh.]	349	297	365	314
Motorisation 2034 [cars/ 1000 inh.]	526	477	505	519

Figure D.9 illustrates the forecast of motorisation for period 2004 to 2034.

Figure D.9 Forecast of motorisation in the Baltic States and Poland



By PRIMES[3] higher GDP per capita growth rates are assumed in the period of time 2000-2010 for Estonia than for to Lithuania. Furthermore, higher growth rates are assumed for Poland than for Lithuania in the period of time 2010-2030. These assumptions are reflected by the motorisation forecast. Table D.2 represents the average GDP per capita growth rates for the forecast horizon.

[3] European Commission, DG TREN, European energy and transport trends to 2030, Part III, EU candidate and neighbouring countries´ energy and transport outlook to 2030, http://ec.europa.eu/dgs/energy_transport/figures/trends_2030/4_chap3_en.pdf)

Table D.2 Average annual GDP per capita growth rates for the forecast horizon

GDP per capita annual growth rate	Estonia	Latvia	Lithuania	Poland
2000-2010	5.38%	5.69%	4.98%	3.90%
2010-2020	3.75%	3.81%	4.17%	4.45%
2020-2030	3.00%	2.78%	3.14%	3.93%

Source: PRIMES[4].

For cross-checking purposes the assumed annual growth rates of motorisation have been compared to values of the external scenario of SCENES[5] for the year 2020, which is shown by Table D 3. The assumed growth rates represent a similar structure. However, the derived assumptions for the present study are slightly more optimistic than the forecast from SCENES. In case of Poland larger differences occur, which is due to the solid economic growth rates in Poland for the period of time 2010-2030.

Table D 3 Motorisation for the year 2020

	Annual growth rate 2004 to 2020 Forecast assumptions	Annual growth rate 2000 to 2020 Scenes
Estonia	1.6%	1.4%
Latvia	1.7%	1.3%
Lithuania	1.0%	1.2%
Poland	2.0%	1.4%

User costs for transport services

User costs for passenger transport are determined by a wide range of different determinants and are subject to political objectives of national and European transport policy and even of the political situation at a global level. Particularly the development of oil prices is subject to uncertainty. The main determinants by mode are as follows:

In the air market an increasing market penetration by low-cost airlines has been occurring within the last years. In some market segments in Europe however, the considerable increase in low-cost service and low-cost carriers might lead to a consolidation of the low-cost air market. However, also "conventional" airlines have been reacting on the competition by low-cost carriers and have been

[4] European Commission, DG TREN, European energy and transport trends to 2030, Part III, EU candidate and neighbouring countries´ energy and transport outlook to 2030, http://ec.europa.eu/dgs/energy_transport/figures/trends_2030/4_chap3_en.pdf)

[5] Deliverable 7, SCENES Transport Forecasting Model: Calibration and Forecast Scenario Results, http://www.iww.uni-karlsruhe.de/SCENES/Download/SCENES_D7.pdf)

tending to lower their prices. Thus overall a slight decrease in air tariffs seems plausible. Overall a decrease by 0.4 percent per year can be expected.

The rail market in Central European countries can be expected to undergo further deregulation steps, which might increase the competition and decrease the tariffs. However, public subsidies for local and regional passenger services might decline in the future. The development of tariffs for long-distance services in several Western European countries has been highlighting the tendency that tariff schemes are more and more oriented on market-oriented structures. The latter developments imply rising user costs. Also a comparison of rail tariffs in the concerned countries (especially the Baltic States) with other EU countries confirms the assumption that user costs for rail are expected to rise. Overall the costs are assumed of rising by 0.35 percent annually.

In the road market the main drivers are on the one hand improved engine technologies, which increase energy efficiency and reduce fuel costs. On the other hand tendencies are prevailing to purchase more expensive passenger cars and to purchase larger cars, whose fuel consumption partly outweighs the savings caused by increased energy efficiency. Overall the user costs are assumed of remaining unchanged. An introduction of motorway tolls in the next 30 years in Poland and the Baltic States seems realistic.

The assumptions made for the changes in the user cost reflect the assumptions made within the TEN-STAC[6] project.

GDP and sector growth for freight forecasts

The modelling assumptions used within this study with respect to the demographic and economic environment are compatible with the European Commission's reference scenario of the transport and energy projections taken from the report "European energy and transport trends to 2030"[7]. They are shown in table in Table D.4.

[6] TEN-STAC: Scenarios, traffic forecasts and analysis of corridors on the Trans-European network. Deliverable D3: Description of the base year 2000 and forecasts 2020. http://www.nea.nl/TEN-STAC/

[7] http://europa.eu.int/comm/dgs/energy_transport/figures/trends_2030/index_en.htm

Table D.4 Average growth (%) per sector per zone in the period 2004-2034

Geo-zone	GDP	Agriculture	Industry	Mining
Belarus	3.2%	-3.2%	4%	-7.4%
Benelux	2.2%	0.7%	1.9%	-0.7%
Estonia	3.5%	0.4%	3.9%	1.9%
Germany	2.1%	1.3%	2.2%	-1%
Latvia	4.3%	0.8%	4.3%	4.2%
Lithuania	4.2%	1.3%	4.5%	-0.8%
Poland	4%	1.6%	4.1%	-0.2%
Rest of East Europe	3.6%	1.5%	3.6%	0%
Rest of West Europe	2.5%	0.8%	2.5%	1.7%
Rest of World	2.9%	2.3%	3%	2.7%
Russia	3%	-2.6%	5.6%	0.1%
Scandinavian countries	2.1%	0.6%	2.3%	2.7%
Ukraine	3.7%	-1.5%	6.4%	1.4%

Annex E: Via Baltica in Poland

Currently there is a dispute in Poland between national and local authorities, and ecological organisations (WWF, Greenpeace, Bank Watch, etc.) about the alignment options of Via Baltica on the section between Warsaw and Suwałki.

The alignment options for Via Baltica are shown in the figure below (see Table E. 1 for explanations of symbols)

Figure E.1 Alignment options for Via Baltica (author: T. Cofta)

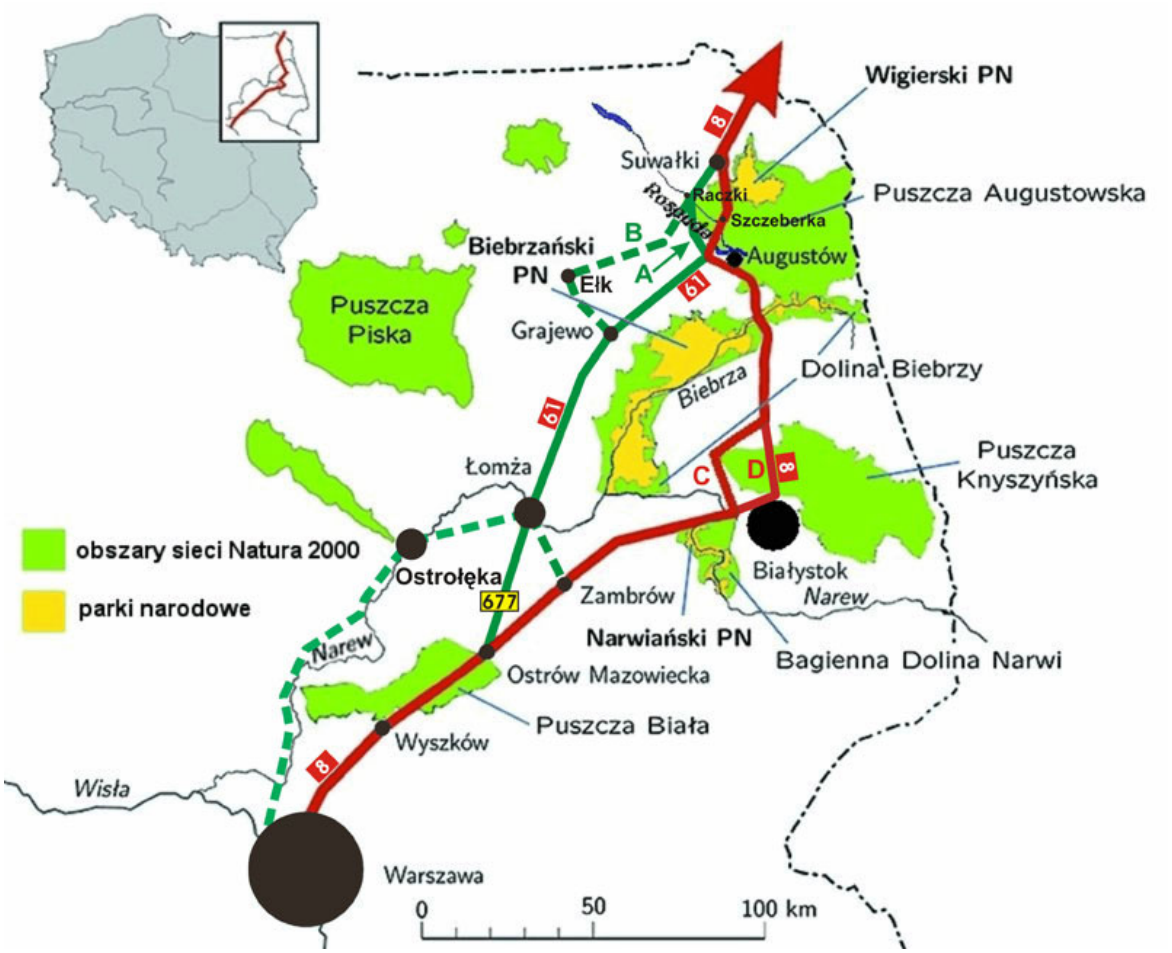


Table E. 1 Symbols

Symbol	Description
A	Alternative options of Augustów by-pass, which allows going around the Augustów Forrest and the Rospuda River Valley.
B	Express road Suwałki – Raczki – Kalinowo – Ełk according to the Spatial Development Plan of Gmina Raczki (1993).
C	Section by-passing the Knyszyn Forrest, which has been promised by the GDDKiA (General Directorate for National Roads and Motorways) some years ago. However, its alignment through individual Gminas (Communes) has not been established yet.
D	This section is modernised right now within the frames of Via Baltica Project.

The alignment option promoted by the local authorities is marked in **red** (so-called 'via Białystok' option). However, the ecologists consider this option as very harmful to the environment, because in this option Via Baltica goes through valuable areas proposed for Natura 2000 sites and protected under Polish law as well as international conventions in the Podlasie region of Poland: **Augustów Forest** with the unique **Rospuda River Valley** – an Important Bird Area (IBA) and a potential Natura 2000 site, **Biebrza River Valley** – a national park, a Ramsar site, an Important Bird Area (IBA) and a potential Natura 2000 site, **Knyszyn Forest** – a forest landscape park, an Important Bird Area and a potential Natura 2000 site, and in close proximity to the **Marshy Valley of the Narew River** – a national park, an Important Bird Area (IBA) and potential Natura 2000 site.

It is possible to by-pass these sites, routing Via Baltica through the city of Łomża and this is an option promoted by the ecological organizations (marked in **green**, with some modifications).

The ecological organisations expects also that the Polish government will take some actions to connect the construction of Via Baltica with the construction of Rail Baltica, which should help to shift the freight transport from road to rail. The integration of these two corridors should be especially based on increasing the rail usage for transporting trucks on wagons.

The latest news on Via Baltica are summarised below:

- **17 March 2006** – It has been stated by the representative of General Directorate for National Roads and Motorways, Białystok Division that the routing of the Via Baltica will be determined after 30 November 2006 (the deadline of preparing the document on the Environmental Assessment of Via Baltica by Scott Wilson Kirkpatrick & Co. Ltd. agency).

- **2 March 2006** – After considering the dispute between supporters and opponents of the Via Baltica alignment option going through the Rospuda River Valley, Minister of Environment, Mr. Jan Szyszko, has decided that the road would go through the Valley in the tunnel and not as a flyover (as it was planned before).
- **February 2006** - Agency Scott Wilson Kirkpatrick & Co. Ltd has won the tender for preparing the document "Development Strategy of I Pan-European Transport Corridor. Part I: Road Corridor", i.e. the Environmental Impact Assessment of Via Baltica. More than 30 alignment option will be analysed in the document.
- **December 2005** – Polish government stopped the beginning of construction of some by-passes of towns lying on the route Białystok-Augustów (the construction of those by-passes was connected with the construction of Via Baltica) due to some legal errors made by the local authorities of Podlaskie Voivodship during the process of taking decision of beginning the investment.

The following link provides more information about the protest:

http://www.darzbor.v24.pl/via-baltica/index.html

http://www.greenpeace.pl/campaigns/topic_20.html

Annex F: Selection of investment packages

A number of alignment options for Rail Baltica are discussed in the four project countries. Furthermore, a wide range of technical options are discussed ranging from limited upgrading of the existing infrastructure based on Russian standard (gauge) with an improved re-loading station to upgrading of some existing infrastructure and the construction of new lines based on European gauge standard with high speeds.

The relevant combinations of alignment options and technical standards are presented below.

The selection of the promising investment options to be considered in more detail in the cost-benefit analysis and financial analysis has been established on the basis of the results of the screening process and comments provided at the Second Work Group meeting on 26th July in Brussels following the delivery of the Draft Interim Report and comments provided at the Third Group Meeting on October 26th in Vilnius following the delivery of the draft final report.

Gross list of development options

First the gross list of alignment options is presented followed by a description of the technical options discussed. Finally the relevant combinations of alignment options and technical options are presented.

Alignment options
Tallinn to Riga

Four alignment options are discussed in Estonia of which two are connected in Pärnu. The alignment options discussed in Estonia correspond well to the options for alignments north of Riga discussed in Latvia.

The four alignment options are presented in Table F.1 and Figure F.1.

Table F.1 Alignment options from Tallinn to Riga

Option - Name	Route	Descriptions
1 - Via Tartu (Red line)	Tallinn - Tapa - Jõgeva - Tartu - Valga/Valka (existing border crossing) - Valmiera - Riga	This route will follow the existing line and connect the two major cities in Estonia, Tallinn and Tartu. The link from Tallinn - Tartu is currently heavily loaded with east-west traffic, which requires that this section should use 1520/1524 mm standards. The Estonian part of the section is upgraded to 120 km/h irrespective of the development of Rail Baltica.
2 - Via Viljandi (Green line)	Tallinn - Rapla - Lelle - Türi - Viljandi - Mõisaküla - Riga	This route follows the existing line from Tallinn via Lelle to Vilandi, which is the end point of the existing line. A new line is constructed from Viljandi to Moisaküla, after which it follows the existing line from Moisaküla to Riga. The existing line is generally of poor quality.
3- Via Lelle/Pärnu (Light blue line)	Tallinn - Rapla - Lelle - Pärnu - Mõisaküla - Riga	This route follows the existing line via Lelle, Pärnu and Mõisaküla to Riga. The existing line is of poor quality.
4 - Via Pärnu (Purple line)	Tallinn - Rapla - Pärnu - Riga	A new direct line, in line with the agreements of the Rail Baltica Co-ordination Group-

Figure F.1 Alignment options from Tallinn to Riga

Note: The red circle indicates that more than one alignment option is considered.

Riga to Kaunas

Four alignments are discussed for the section between Riga and Kaunas. Except for the option along the existing line, virtually no details are available for any of the three other options discussed.

The four alignment options are presented in Table F.2 and Figure F.2.

Table F.2 Alignment options from Riga to Kaunas

Option - Name	Route	Descriptions
1 - Along the existing line (Light blue line)	Riga - Jelgava - Existing LV/LT border crossing - Joniskis - Siauliai - Radviliskis - Kaunas	Along the existing line.
2 - Via Radviliskis/W. by-pass (Red line)	Riga - Jelgava - Existing LV/LT border crossing - Joniskis - Radviliskis - Western by-pass of Kaunas	This route follows the existing line from Riga to Joniskis. A new more direct line is constructed from Jonisis - via Radviliskis to Kaunas. Western by-pass in Kaunas.
3 - Via Radviliskis/E. by-pass (Green line)	Riga - Jelgava - Existing LV/LT border crossing - Joniskis - Radviliskis - Eastern by-pass of Kaunas	This route follows the existing line from Riga to Joniskis. A new more direct line is constructed from Jonisis - via Radviliskis to Kaunas. Eastern by-pass in Kaunas.
4 - Via Panevezys (Brown line)	Riga - New LV/LT border crossing - Panevèzys - Kaunas	Construction of a new line via Bauska and Panevezys.

Figure F.2 Alignment options from Riga to Kaunas

Note: The red circle indicates that more than one alignment option is considered.

Kaunas to Warsaw

Detailed analyses exist of the alignment from Kaunas to the Lithuanian/Polish border and the alignment is in principle agreed on politically. Two options are discussed in Poland.

The two alignment options are presented in Table F.3 and Figure F.3.

Table F.3 Alignment options from Kaunas to Warsaw

Option - Name	Route	Descriptions
1 - Via Sokolka (Red line)	Kaunas - Existing LT/PL border crossing - Trakiszki - Suwalki - Sokólka - Bialystok - Warsaw	Along the existing line. However, environmental issues create significant problems, since the line in this area runs through several environmentally sensitive areas. Also the ground conditions are quite poor (many loose soils and marshy grounds). The section from Warsaw to Bialystok is upgraded irrespectively of the implementation of Rail Baltica.
2 - Via Elk (Green line)	Kaunas - Existing LT/PL border crossing - Trakiszki - Suwalki - Elk - Bialystok- Warsaw	Along the existing line. Not in severe conflict with environmental areas and its technical status is reasonable, especially on the section Białystok – Ełk. The line is single-tracked, but there is plenty of space for an additional track. Unfortunately, in terms of upgrading, the section *Ełk – Olecko – Suwałki* also creates some problems. It runs through hilly regions and there will be a need to cut numerous curves in the track. The section from Warsaw to Bialystok is upgraded irrespectively of the implementation of Rail Baltica.

Figure F.3 Alignment options from Kaunas to Warsaw

Note: The red circle indicates that more than one alignment option is considered.

Options in and around the main cities

In addition to the alignment options outlined above, several options/solutions for Rail Baltica in and around the cities of Tallinn, Riga and Kaunas are discussed. These discussions are very important from a local point of view, but are less important from a corridor point of view. As the focus here is on assessing the potential for developing the corridor, this study will not go into detail except for a short discussion of two of the options around Kaunas (Option 2 and Option 3 for the section from Riga to Kaunas). It is up to more detailed local analyses to assess the other options.

Technical options

The technical options for establishing Rail Baltica range from:

- Limited upgrading of the existing infrastructure based on Russian standards (gauge) with an improved re-loading station
- Upgrading of some existing infrastructure and the construction of new lines based on European gauge standards, electrified and at high speeds.

Between these two extremes, a potentially large number of options exist.

Definition of technical standards
To allow a comparison in the screening phase of the alignment options 3 technical standards were defined. It should be noted that not all standards are relevant for all alignment options. Furthermore it should be noted that the technical standards defined here is not identical to those used for describing the investment packages which are considered in the cost-benefit analysis and the financial analysis. The standards are simply defined to evaluate the full range of options discussed.

The following standards are considered in the screening phase.

- Standard 1: Limited/medium upgrading of the existing infrastructure and limited construction of new lines
- Standard 2: Medium/comprehensive upgrading of the existing infrastructure and limited construction of new lines
- Standard 3: Construction of electrified line with European gauge. Mainly construction of new lines.

The standards are defined on the following five parameters: Speed, gauge, single/double track, electrification, and axle load.

Standard 1 is characterised by a design speed of 120 km/h (which all lines are designed for at present) based on the existing gauge standard, the existing signalling system, no (further) electrification and a standard axle load on wood or concrete sleepers of 22 tonnes.

Standard 2 presents an upgrade of the design speed to 160 km/h, which among other things requires an increase in the cant and length of the transition curve (see Annex C for more details). Furthermore, the axle load is upgraded to 25 tonnes (and 30 tonnes for heavy haul at low speed). Otherwise, the standard is identical to standard 1.

Standard 3 - the "high speed solution" - is based on a design speed of 200 km/h, European gauge standard, ERTMS signalling system, full electrification and an axle load of 25 tonnes (and 30 tonnes for heavy haul at low speed).

The details on the specification of each of the three standards are summarised in Table F.4 below.

Table F.4 Technical standards

Parameter	Standard 1	Standard 2	Standard 3
Speed, km/h	120	160	200
Gauge	Existing[1]	Existing[1]	European
Signalling	Existing	Existing	ERTMS
Single/double track	(x trains per day)[2]	(x trains per day)[2]	(x trains per day)[2]
Electrification	Existing (no)	Existing (no)	Yes
Axle load	22	25 (30)	25 (30)

[1] Except for the Polish border-Kaunas: European gauge.

[2] The need for single/double tracks is assessed on the basis of the number of trains per day.

A "high-speed" line (standard 3) will in principle enable high-quality transport of both passenger and freight. Though, a high number of (slow) freight trains will limit the scope for high-speed passenger service.

Relevant combinations of alignment options and technical options

The relevant combinations of alignment options and standards are presented in the table below.

It is not considered relevant to consider all combinations of alignment options and technical options in the screening phase:

- The advantage of a high-speed line is that it will provide a direct connection between the major cities along the line. Hence, it is not considered relevant to consider the construction of a high-speed line Via Viljandi (option 2) and Via Lelle/Pärnu (option 3) as these alignment options do not provide a direct link between Tallinn and Riga. Furthermore, it is not a realistic option to construct a high-speed line along the existing line from Riga and Kaunas, as the existing line does not provide the required direct link.
- Furthermore, no new lines will be constructed at a design speed of less than 160 km/h. This makes it irrelevant to consider standard 1 for the Via Pärnu option (option 4) from Tallinn to Riga and construction of a new line Via Radviliskis (options 2 and 3) and Via Panevezys (option 4) from Riga to Kaunas.
- Standard 2 is relevant for all alignment options except for the direct link Via Pärnu (option 4). The reason being that if it is decided to establish a 160 km/h link through the southern part of Estonia, it would follow the existing line either Via Viljandi (option 2) or Via Lelle/Pärnu (option 3).

The relevant combinations of alignment options and standards are summarised in the table below.

Table F.5 Relevant combinations of alignment options and standards (+=relevant, -=not relevant)

Connection	Alignment option	Std 1	Std 2	Std 3
Tallinn-Riga	1 - Via Tartu	+	+	+
	2 - Via Viljandi	+	+	-
	3 - Via Lelle/Pärnu	+	+	-
	4 - Via Pärnu	-	-	+
Riga-Kaunas	1 - Along existing line	+	+	-
	2 - Via Radviliskis/W. by-pass	-	+	+
	3 - Via Radviliskis/E. by-pass	-	+	+
	4 - Via Panevezys	-	+	+
Kaunas-Warsaw	1 - Via Sokolka	+	+	+
	2 - Via Elk	+	+	+

The screening process

The screening was done on the basis of a qualitative multi-criteria assessment resting on the following four criteria:

1) *Costs*: The level of infrastructure investments required (e.g. taking financial constraints such as available Cohesion Fund sources into consideration) and also taking into account the costs of maintenance and operation.
2) *Passenger traffic*: The potential improvement of passenger traffic services and the modal split.
3) *Freight traffic*: The potential improvement of freight traffic services and the modal split.
4) *Environmental issues*: The potential environmental problems.

The evaluation is briefly discussed below.

Criterion 1: Costs
In the light of the limited sources of funding available for implementing Rail Baltica, the costs of upgrading the existing infrastructure and the construction of new infrastructure are one of the most important criteria for selecting the most promising development options.

A preliminary cost assessment for each of the relevant combinations of alignment options and technical options specified above were made on the basis of the following assumptions:

- All existing lines are designed to 120 km/h. However, due to lack of maintenance including poorly maintained tracks etc, the operational speed is usually much less than 120 km/h.
- The various technical systems are today more or less the same in the Baltic countries and similar to the systems in Poland. A generalisation is therefore possible.
- It is anticipated that the **inclination and vertical radius** are low and below what is normally considered to be limiting values.
- For upgrading to 160 km/h:
  - 64% of the railway line has a sufficient horizontal radius, length of transition curves and cant, which can be covered by the general upgrading of the track substructure.
  - 22% of the railway line has sufficient horizontal radius, but an increase in the cant and length of the transition curve is necessary.
  - 14% of the railway line has an insufficient horizontal radius. The cant, the horizontal radius and the length of the transition curves must therefore be altered.
- The above has the effect that for upgrading to 160 km/h:
  - 22% of the line needs repositioning of the entire curve and adjustment of the substructure.
  - 14% of the line needs a change of the entire curve and a new substructure.

- For new lines it is assumed that 25% of the line are constructed with a double track (stations, sidings etc) in order to allow passing trains or overtaking slow (freight) trains.
- Only a few of the existing **bridges** are capable of carrying trains at a speed of 160 km/h. It is anticipated that 75% of the bridge length need to be upgraded to 160 km/h and all bridges have to be upgraded to 200 km/h.
- It is assumed that **level crossings** can continue to exist for speeds up to 160 km/h, but should be eliminated above this speed. It is further assumed that in general, the level crossings are not equipped in an appropriate way with regard to higher speed and, consequently, level crossings have to be upgraded for a speed up to 160 km/h. It is assumed that level crossings exist for each 5-10 km of railway line. Existing level crossings are generally equipped with bells and light signals, but not with bars in all cases.
- The situation of **land acquisition** is unclear. The costs estimates provided below are without major land acquisition.
- Also potential major **reconstruction works in especially cities** are excluded.

The cost assessment for the screening phase was based on the unit prices reproduced in the table below. The unit values used have been estimated on the basis of information received from the countries, UIC estimates and the price levels of similar projects in the western part of the EU.

Table F.6 Unit values used in the cost assessment (2006 price level)

Category	Costs (million €/km single track)
Rehabilitation or track renewal of existing railway up to 120 km/h	0.5
Track renewal of existing railway up to 160 km/h	0.7
Construction of new railway up to 160 km/h (standard 1/2)	1.0
Construction of new single-track railway for 200-250 km/h including new signalling system (standard 3).	2.5

The results of the preliminary cost assessment for all relevant combinations of alignment options and technical options are presented in Table F.7 below.

Table F.7 Preliminary assessment of the investment costs of relevant combinations of alignment options and standards, rounded figures (million €, 2006 price level)

Connection	Alignment option	Std 1	Std 2	Std 3
Tallinn-Riga	1 - Via Tartu[1]	-	400	1,400
	2 - Via Viljandi	400	400	
	3 - Via Lelle/Pärnu	400	400	
	4 - Via Pärnu			900
Riga-Kaunas	1 - Along existing line	200	250	
	2 - Via Radviliskis/W. by-pass		250	650
	3 - Via Radviliskis/E. by-pass		250	650
	4 - Via Panevezys		300	800
Kaunas-Warsaw	1 - Via Sokolka[2]	250	400	1,300
	2 - Via Elk[2]	300	450	1,400
Least cost solution[3]		450[4]	1,000-1,100	2,800-2,900

[1] Estonia has recently spent 66 million € on upgrading the existing line from Tallinn via Tartu to Valga to 120 km/h. [2] Poland has continuously spent resources on maintaining the standard of the existing line from Warsaw to Bialystok . The travel speed is therefore today 160 km/h on more than 80% of the line. Some upgrades are however still necessary (e.g. bridges) if Rail Baltica is developed. This is included in the costs estimates. [3] Based on construction costs only. 4 Assuming no upgrade in Estonia.

The main conclusions in relation to criterion 1 are summarised below.

Tallinn to Riga

Most of the Estonian part of the line via Tartu (option 1) has recently been upgraded to 120 km/h. Estonia has spent roughly 66 million € on this upgrade. The remaining section will be upgraded to 120 km/h irrespective of the implementation of Rail Baltica. This naturally implies that few (if any) resources are required to implement a connection from Tallinn to Riga at a speed of 120 km/h.

If the aim is to secure a speed up to 160 km/h, it will cost roughly the same to establish the connection Via Tartu, Via Viljandi[8] or Via Lelle Pärnu[9].

Option 4 via Pärnu is the most direct line from Tallinn to Riga. This makes it the cheapest option for constructing a high-speed line (standard 3).

[8] The existing line to from Tallinn to Viljandi in Estonia and from Riga to (close to) the Estonia/Latvian border in Latvia is of so poor quality that it is assumed a new line is required.

[9] The existing line to from Tallinn to Moisakula via Lelle/Pärnu in Estonia and from Riga to (close to) the Estonia/Latvian border in Latvia is of so poor quality that it is assumed a new line is required.

Riga-Kaunas

For the section from Riga to Kaunas it will only cost slightly more to establish a partly new line via Radviliskis to Kaunas (option 2/3)[10] at a speed of 160 km/h compared to upgrading the existing line to 120 km/h.

It will cost around 600-700 million € to construct a high-speed line via Radviliskis, while a new high-speed line via Panevezys is estimated to cost around 800 million €.

Kaunas-Warsaw

The section from Warsaw to Bialystok will be upgraded to 120 km/h irrespective of the implementation of Rail Baltica. However, it will still be necessary to e.g. upgrade bridges on this section if Rail Baltica is implemented. This is included in the costs estimates.

The option via Elk is slightly longer compared to the option via Sokolka. Hence, it appears that it will be slightly more costly to upgrade this section compared to the option via Sokolka. The difference it so small, however, that a more detailed costs assessment could easily alter this conclusion.

Total costs

Regarding the total costs for implementing Rail Baltica we can conclude that:

- It is extremely costly to establish a new "high-speed" line based on European standards (standard 3). The minimum costs for establishing a full high-speed line between Tallinn and Warsaw will be around 2,900 million €. Despite that no firm data are available on the funds of implementing Rail Baltica (partly because the funding depends on the outcome of this study), it is estimated that it exceeds the available funds.
- The least-cost solutions for upgrading the full line from Tallinn to Warsaw to a minimum of 120 km/h are estimated to cost around 600-650 million €. It should be noted that the Estonian section from Tallinn to Valga is upgraded to 120 km/h irrespective of the plans for Rail Baltica.
- The least-cost solutions for upgrading the full line from Tallinn to Warsaw to a minimum of 160 km/h are estimated to cost around 1,000 million €.

The least-cost solutions are shown in Table F.8 below.

[10] Upgrade the existing line from Riga to Joniskis and new line from Joniskis to Kaunas.

Table F.8 Least-cost solutions for implementing Rail Baltica

	Min. 120 km/h (standard 1)	Min. 160 km/h (standard 2)	Min. 200 km/h (standard 3)
Tallinn - Riga	Option 1	Option 1/2/3*	Option 4
Riga - Kaunas	Option 1/2/3*/**	Option 2/3*	Option 2/3*
Kaunas - Warsaw	Option 1/2*	Option 1/2*	Option 1/2*

* Less than 10% difference in cost estimates. ** Option 2/3 of standard 2.

In addition, it should be noted that from an overall perspective, any development option including the construction of a new line will increase the costs of maintenance, as it is considered unlikely that the construction of new infrastructure will lead to the closure of existing lines. Furthermore, the costs of constructing a new line is most likely underestimated, as the cost estimates do not include major land acquisition. This naturally speaks in favour of "Option 1 - Via Tartu" from Tallinn to Riga and "Option 1 - Along the existing line" from Riga to Kaunas. The ranking of the two alignment options in Poland is not influenced by this, due to the limited need for acquiring land.

Furthermore, it is important to realise that it is very costly to operate and maintain a separate "high-speed" system. Again, this contributes to the assessment that the case for establishing a "high-speed" line from Tallinn to Warsaw is very weak.

Criterion 2: Passenger traffic

The second criterion relates to the potential improvements of passenger traffic services and modal split effects.

The assessment presented below only provides a very rough indication of the potential improvements of passenger traffic services and modal split effects. The purpose of making this assessment is solely to identify the development options, which provide the largest potentials.

The assessment of the screening was based on the following assumptions/parameters:

- The forecasted level of traffic on the relevant rail section in 2034 in the reference scenario.
- The level of traffic on competing road links.
- The potential for shifting traffic from the relevant road links. This is assessed on the basis of a rough evaluation of the difference between the rail speed without Rail Baltica and the relevant speed if Rail Baltica is implemented as well as an evaluation of the degree to which road and rail compete on the relevant section. It is assumed that there is a large potential for shifting traffic from coaches to rail.

- The potential for shifting traffic from air to rail. It is assumed that all traffic between the major cities in neighbouring countries will shift from air to rail if a high-speed line is established. It is furthermore assumed that the annual air traffic volumes will grow by 5%.
- A high-speed line has no potential for attracting local transport, as it will have few stops. It is, for example, assumed that a high-speed line following the existing line via Tartu will only stop in Tartu and Valmiera between Tallinn and Riga.
- The net benefits of travel time savings are assessed on the basis of an average value close to 5€ per hour[11].
- The value of travel time benefits is compared to the annualised investment costs to get an impression of which options provide the most "value for money". The investment costs are annualised on the basis of a 5% discount rate and a 30-year time horizon. It should be noted that this assessment is made on the basis of traffic volumes in 2034. Hence, the assessment most likely overestimates the "share".

In general, it is our opinion that the assessment reflects an optimistic view on the potential for attracting passengers to rail from other modes.

Tallinn-Riga

The analysis for the options between Tallinn and Riga showed that:

- The alignment option Via Tartu has the largest potential for attracting passengers.
- Standard 2 provides the largest benefits (travel time savings) compared to the investment costs for alignment options 1-3.
- A high-speed line via Via Tartu can attract more passengers than a direct high-speed line via Pärnu to Riga, but this is not sufficient to outweigh the higher investment costs.
- In general, the value of travel time savings accounts for a rather small share of the (annualised) investment costs.

We conclude that option 1 - Via Tartu appears to be the most promising alignment option. Furthermore, it appears that standard 2 provides good "value for money" - especially for the sections with most passengers, i.e. from Tallinn-Tartu and Valmiera-Riga.

Riga - Kaunas

Similarly, the assessment of the development options for the section Riga-Kaunas showed that:

- The four alignment options will attract approximately the same number of passengers.

[11] This is in the low end of range of values provided by HEATCO for different trip purposes.

- The two direct options Via Radviliskis (options 2 and 3) appear to generate the largest benefits (travel time savings) compared to the investment costs. It can, however, not be ruled out that the alignment option Via Panevezys could prove to be an attractive alternative. An upgrading of the existing line (option 1) appears to be a less attractive solution.
- The scope for a high-speed line between Riga and Kaunas is limited.

We conclude that options 2, 3 and 4 could be attractive solutions for developing Rail Baltica. The higher level of traffic on this section compared to the section from Tallinn to Riga could justify the upgrading to a higher technical standard.

Kaunas - Warsaw

Finally the assessment of the development options for the section Riga-Kaunas showed that:

- There is a large potential for attracting a high level of passengers on this sections, as future traffic volumes appear to be four times higher compared to those on the section from Riga to Kaunas.
- The construction of a high-speed line could attract a high number of passengers, but this is still not sufficient to justify the high investment costs.
- Standard 2 appears to provide more "value for money" compared to both standards 1 and 3.
- The alignment option Via Sokolka appears to have the largest potential for attracting passengers.

We conclude that there seems to be a potential for upgrading the section from Kaunas to Warsaw and that standard 2 appears to give most "value for money". The options via Sokolka appear to be the most promising options.

Criterion 3: Freight traffic
The potential improvements of freight transport services and the modal split effects for freight were as mentioned also assessed.

The assessment was based on the view that reliability and integration with the transport system are key issues for freight transport.

The maximum possible speed is of less importance, whether the infrastructure allows travelling at a speed of 120 km/h, 160 km/h or even at 200 km/h. The screening therefore concentrates on the different alignment options and how they can be ranked.

Tallinn to Riga

The freight traffic assessment for the alignment options between Tallinn and Riga is summarised in Table F.9.

Table F.9 Freight traffic assessment of alignment options, Tallinn-Riga

Alignment option	Freight assessment
1 - Via Tartu	The sections from Tallinn-Tapa and Tapa-Tartu are heavily loaded with east-west transit goods traffic (up to 30 and 15 million tonnes, respectively, in 2004). Furthermore, around 5-10 million tonnes are transported on the Latvian section from Valka to Riga (in 2004). Accordingly, improvements of this section could provide significant direct benefits to freight transport in Estonia and Latvia. It should be noted, however, that the sections in Estonia will be upgraded to 120 km/h irrespective of the Rail Baltica project. Hence, Rail Baltica will provide little additional benefits for freight transport in Estonia.
2 - Via Viljandi	There is virtually no freight transport on the part of this section, which today runs from Lelle to Viljandi. This is a natural consequence of the fact that the line ends at Viljandi at present. The construction of a link from Tallinn to Riga via Viljandi could, however, possibly shift traffic from the present rail line via Pärnu to this section. The direct benefits are, however, believed to be small. The line could potentially shift some traffic from the line of Via Tartu, thereby generating additional benefits elsewhere on the network. The line is approx. 150 km shorter than the line via Tartu, which would generate savings in distance-dependent costs compared to the line via Tartu. Finally, the direct competition with Via Baltica is larger than for the line via Tartu. Hence, there may be a large potential for shifting traffic from road to rail.
3 - Via Lelle/Pärnu	There is no railway connection from Pärnu to Moisakula. The construction of a link from Tallinn to Riga via Lelle/Pärnu would more or less have the same freight benefits as a line via Viljandi (option 2), but the line would be slightly shorter.
4 - Via Pärnu	The conclusions regarding the link via Lelle/Pärnu (option 3) are similar to the conclusions that can be drawn on this section. The only difference is that option 4 is slightly shorter, which would generate small extra benefits related to distance-dependent costs.

The main conclusions are that:

- An upgrade of the existing line "Via Tartu" (option 1) will provide the largest benefits for the existing rail traffic, as larger volumes are transported on this part of the network compared to the volumes in options 2-4.

- Options 2-4 are shorter than option 1, which will provide larger benefits related to distance-dependent costs for rail traffic transported all the way between Tallinn and Riga compared to option 1. Hence, rail traffic shifting from option 1 to one of the options 2-4 would gain a distance-dependant benefit. On the other hand, the present rail freight volumes on this part of the network are small compared to those in option 1.
- Finally, options 2-4 are in more direct competition with road traffic on Via Baltica and they might therefore attract more freight volumes from roads.

Riga to Kaunas

The freight traffic assessment for the alignment options between Riga and Kaunas is summarised in Table F.10.

Table F.10 Freight traffic assessment of alignment options, Riga-Kaunas

Alignment option	Freight assessment
1 - Along the existing line	Between 5 and 15 million tonnes are transported by rail as north-south bound traffic. For freight traffic it is considered that there are only minor differences between options 1, 2 and 3.
2 - Via Radviliskis/W. by-pass	
3 - Via Radviliskis/E. by-pass	
4 - Via Panevezys	This option is better integrated in the remaining transport system, as this alignment follows the Via Baltica road corridor. There is a potential for positive modal split effects.

The main conclusions are that:

- Upgrades related to alignment options 1-3 will provide roughly the same benefits to freight transport.
- Option 4 will have the advantage that it follows the Via Baltica road corridor and as such might provide an additional potential for better integration into the transport system. This could improve the potential for positive modal split effects.

Kaunas to Warsaw

The freight traffic assessment for the alignment options between Kaunas and Warsaw is summarised in Table F.11.

Table F.11 Freight traffic assessment of alignment options, Kaunas-Warsaw

Alignment option	Freight assessment
1 - Via Sokolka	Between 5 and 10 million tonnes are transported by rail between Kaunas and Warsaw. This route is the preferred route today. Via Baltica runs through Sokolka.
2 - Via Elk	The volumes on the link between Suwalki and Elk appear to be smaller than those of the other option, but otherwise there is no big difference between to two options.

The main conclusion is that:

- There does not appear to be major differences between the two alignment options from Kaunas to Warsaw. A slight advantage of the option Via Sokolka is that Via Baltica also runs through Sokolka.

Criterion 4: Environmental issues
Environmental issues could pose a major barrier for developing Rail Baltica along some of the alignment options discussed. This section provides an overall environmental evaluation of each of the alignment options.

The most important environmental impacts are determined by the construction of a new alignment or e.g. by adding a new track. The technical solution is of relatively little importance for the overall impact on the environment. Hence, the assessment below focuses on evaluating the alignment options discussed and not the differences between the technical options.

Tallinn to Riga

The lack of precisely defined alignments and the lack of complete environmental information make it impossible to make a detailed analysis of the environmental issues for the four alignment options from Tallinn to Riga.

Table F.12 provides a brief overview of the positive and negative aspects of each of these options, to the extent that the available information allows such an assessment. The table also presents and indicative ranking of the current alignment options.

Table F.12 Environmental assessment of alignment options, Tallinn-Riga

	Option 1 - Via Tartu	**Option 2 - Via Viljandi**	**Option 3 - Via Lelle/Pärnu**	**Option 4 - Via Pärnu**
Positive aspects	Existing alignment	Insufficient information	Insufficient information	Insufficient information
Negative aspects	Many Natura 2000 sites are impacted. Gauja National Park is impacted.	Partly new alignment Insufficient information	Partly new alignment Insufficient information	New alignment Insufficient information
Indicative ranking	1	2	3	4

The table shows that development option 1 "Via Tartu" is considered to have the least effects on the environment, whereas the construction of a new direct line "Via Pärnu" will have the largest impact on the environment.

Riga to Kaunas

Table F.13 gives a similar assessment of the options from Riga to Kaunas. The lack of precise descriptions of the considered alignment options makes a comparison very difficult. The indicative ranking presented in the table below is made on the basis of a very general assessment of the environmental impacts.

Table F.13 Environmental assessment of alignment options, Riga-Kaunas

	Option 1 - Along the existing line	**Option 2 - Via Radviliskis/W. by-pass**	**Option 3 - Via Radviliskis/E. by-pass**	**Option 4 - Via Panevezys**
Positive aspects	Existing alignment			
Negative aspects		New alignment	New alignment	New alignment
Indicative ranking	1	2	2	3

The table shows that development option 1 "Along the existing line" is considered to have the least effects on the environment, whereas option 4 "Via Panevezys" is considered to have the largest impact on the environment. No distinction can be made between options 2 and 3, as the only difference between these to alignment options relates to the by-pass of Kaunas.

Kaunas to Warsaw

Table F.14 presents a similar assessment of the alignment discussed for the section between Kaunas and Warsaw.

Table F.14 Environmental assessment of alignment options, Kaunas-Warsaw

	Option 1 - Via Sokolka	Option 2 - Via Elk
Positive aspects	Existing alignment	Existing alignment
Negative aspects	Environmental issues create significant problems for this alignment, as the line runs through several environmentally sensitive areas including a large number of Natura 2000 sites and national parks. Upgrading of this line will require that large areas of forest are to be cut down.	This option conflicts with less environmentally sensitive areas.
Indicative ranking	2	1

The table shows that the option "Via Elk" is considered to be the best alternative from an environmental point of view.

It is also worth noting that the alignment option "Via Sokolka" runs close to Augustów, which has been the centre of the dispute over Via Baltica (for more information about the dispute, please refer to Annex E). Even though the railway line does not pass through the most sensitive areas in the Augustów area (e.g. Rospuda River Valley), it is our impression, obtained through interviews with stakeholders in Poland, that it is politically unfeasible to develop Rail Baltica along the "Via Sokolka" alignment.

Results of the screening process

The results of the screening process are synthesised below. The results provide the basis for selecting the packages of development options, which will be analysed in further details.

Tallinn to Riga

The alignment option via Tartu (option 1) appears to be the most promising option for implementing Rail Baltica on the section from Tallinn to Riga, as:

- It has the largest potential for attracting passenger traffic
- It generates the largest benefits for freight traffic
- It provides the best "value for money" (measured as the value of travel time savings compared to the investment costs)
- It is the most attractive option from an environmental point of view

Furthermore, the screening has shown that there is little scope for establishing a European standard high-speed line from Tallinn to Riga. Hence, standard 1 (120 km/h) and standard 2 (160 km/h) are the most relevant technical solutions for developing Rail Baltica on this section.

Riga to Kaunas
The picture is more ambiguous on the section between Riga and Kaunas. The screening has shown that:

- It is only slightly more costly to establish a new line with a service speed of 160 km/h from Joniskis to Kaunas (options 2 and 3) than to upgrade the existing (longer) line.
- The two direct options Via Radviliskis (options 2 and 3) appear to generate the largest benefits (travel time savings) compared to the investment costs. It can, however, not be ruled out that the alignment option Via Panevezys could prove to be an attractive alternative.
- A further argument for considering the option via Panevezys is that this option could generate positive modal split effects, as the alignment follows the Via Baltica road corridor. This option could prove to become better integrated in the transport system.
- The scope for a high-speed line between Riga and Kaunas is limited.

Hence, it appears relevant to consider in further details both the construction of a partly new line via Radviliskis and the construction of a new line via Panevezys. Again, we can conclude that there appears to be little scope for constructing a European standard high-speed line. For the construction of a new line, standard 2 is the most relevant option.

Taking into account the tight financial constraints for the development of Rail Baltica, it also appears to be relevant to consider in detail an upgrading of the existing line.

Kaunas to Warsaw
The two alignment options for the section between Kaunas and Warsaw are rather similar. The main arguments for the option Via Sokolka are that:

- It more or less follows the Via Baltica road corridor and could as such generate positive modal split effects.
- It appears that it has a larger potential for attracting passengers.

The main argument against this option is that it passes through environmentally sensitive areas. The current dispute about the development of Via Baltica could most likely imply that this option is politically unfeasible.

In Lithuania, it is in principle politically agreed to establish a new European gauge high-speed line from Kaunas to the Lithuania border. This makes it relevant to consider this solution. However, due to tight financial constraints it is also considered relevant to consider upgrading the existing line.

In general, the large volumes of passenger and freight volumes crossing the Lithuanian/Polish border could justify a more ambitious plan for upgrading the section from Kaunas to Warsaw.

Final selection of investment packages for further analysis

The results of the screening process were presented in the Interim report and discussed at the Second Work Group meeting on 26th July in Brussels following the delivery of the Draft Interim Report. Further the investment packages were discussed in Vilnius at the Third Work Group meeting following the delivery of the Draft Final Report.

The discussion led to the following conclusions:

- The European gauge option should not be ruled out on the basis of the screening procedure and the analysis should consider both electrification and no electrification.
- The European gauge option should consider both the alignment option via Rapla/Pärnu to Riga and the options via Rapla/Lelle/Pärnu to Riga.
- The cost-benefit analysis and financial analysis should cover both the construction of a (partly) new line with a design speed of 160 km/h via Panevezys and via Radviliskis.
- Upgrading of the existing line north of Kaunas to the Latvian/Lithuanian border should be considered.
- The construction of a new line with European gauge from Kaunas to the Lithuanian/Polish border should be included for all investment packages. Electrification should not be included for package 1 and 2. Package 3 should consider both electrification and no electrification.

The resulting definition of the investment packages which is analysed in further detail is presented in Chapter 6.

Annex G: Freight modelling

Link between commodity nomenclature, manifestation and economy sectors

Having in mind that different commodity groups have different cross-elasticities for modal choice by rail versus road, the following relations are used to allocate the NST/R goods nomenclature to the type of manifestation and to production sector and attraction sector of the economies of the trading countries.

For modelling the growth of freight transport the economic growth model and modal split model were applied on each trade relation contained in the basic matrix.

Table G.1 Link between commodity nomenclature, manifestation and economy sectors

NSTR2	NSTR1	Class	Production sector	Attraction sector
00	0	Dry bulk	Agriculture	GDP
01	0	Dry bulk	Agriculture	GDP
02	0	Dry bulk	Agriculture	GDP
03	0	Dry bulk	Agriculture	GDP
04	0	Dry bulk	Agriculture	GDP
05	0	Dry bulk	Agriculture	GDP
06	0	Dry bulk	Agriculture	GDP
09	0	Dry bulk	Agriculture	GDP
11	1	Dry bulk	Agriculture	GDP
12	1	Dry bulk	Agriculture	GDP
13	1	Dry bulk	Agriculture	GDP
14	1	Dry bulk	Agriculture	GDP
16	1	Dry bulk	Agriculture	GDP
17	1	Dry bulk	Agriculture	GDP
18	1	Dry bulk	Agriculture	GDP
21	2	Dry bulk	Mining & quarring	-
22	2	Dry bulk	Mining & quarring	-
23	2	Dry bulk	Mining & quarring	-
31	3	Liquid Bulk	-	GDP
32	3	Liquid Bulk	Industry	-
33	3	Liquid Bulk	Industry	-
34	3	Liquid Bulk	Industry	-
41	4	Dry bulk	Industry	Industry
45	4	Dry bulk	Industry	Industry

NSTR2	NSTR1	Class	Production sector	Attraction sector
46	4	Dry bulk	Industry	Industry
51	5	Dry bulk	Industry	Industry
52	5	Dry bulk	Industry	Industry
53	5	Dry bulk	Industry	Industry
54	5	Dry bulk	Industry	Industry
55	5	Dry bulk	Industry	Industry
56	5	Dry bulk	Industry	Industry
61	6	Dry bulk	Industry	-
62	6	Dry bulk	Industry	-
63	6	Dry bulk	Industry	-
64	6	Dry bulk	Industry	-
65	6	Dry bulk	Industry	-
69	6	Dry bulk	Industry	-
71	7	Dry bulk	Industry	Agriculture
72	7	Dry bulk	Industry	Agriculture
81	8	Liquid Bulk	Industry	Industry
82	8	Liquid Bulk	Industry	Industry
83	8	Liquid Bulk	Industry	Industry
84	8	Liquid Bulk	Industry	Industry
89	8	Liquid Bulk	Industry	Industry
91	9	General cargo	Industry	-
92	9	General cargo	Industry	-
93	9	General cargo	Industry	-
94	9	General cargo	Industry	-
95	9	General cargo	Industry	-
96	9	General cargo	Industry	-
97	9	General cargo	Industry	-
99	9	General cargo	Industry	-

The modelling assumptions used within this study with regard to the economic environment are compatible with the European Commission's reference scenario on transport and energy projections taken from the report "European energy and transport trends to 2030".They are shown in Table G.2.

Table G.2 Average growth (%) per sector per zone in the period 2004-2034

Geo-zone	GDP	Agriculture	Industry	Mining
Belarus	3,2	-3,2	4	-7,4
BENELUX	2,2	0,7	1,9	-0,7
Estonia	3,5	0,4	3,9	1,9
Germany	2,1	1,3	2,2	-1
Latvia	4,3	0,8	4,3	4,2
Lithuania	4,2	1,3	4,5	-0,8
Poland	4	1,6	4,1	-0,2
Rest of East Europe	3,6	1,5	3,6	0
Rest of West Europe	2,5	0,8	2,5	1,7
Rest World	2,9	2,3	3	2,7
Russia	3	-2,6	5,6	0,1
Scandinavian countries	2,1	0,6	2,3	2,7
Ukraine	3,7	-1,5	6,4	1,4

Table G.3 Freight flows per mode per OD relation in 2004

Freight volumes on the Baltic States' rail networks in 2004 per OD relation (tons)

Origin	Belarus (rest)	Belarus (W)	BENELUX	Estonia	Finland	Germany	Kaliningrad	Latvia	Lithuania	NW Russia	Poland	Rest East Europe	Rest West Europe	Rest World	Russia (rest)	Scandinavian Counties	Ukraine (rest)	Ukraine (W)	**Total**
Belarus (rest)			4.312.367	191.358	2.759.145	299.053	617.012	790.492	2.590.915	1.342	304.331	2.422.463	233.405	1.223.370	2.603	1.695.379			**17.443.235**
Belarus (W)			959.057	68.774	466.771	62.693	532.659	284.234	1.347.461	482	109.324	443.273	71.289	309.992	936	530.575			**5.187.520**
BENELUX	5.796	2.082					3.517	709	17.581	11.957		235		34.629	19.694		3.010	1.620	**100.830**
Estonia	9.196	3.384		3.100.001		1.834	5.667	463.208	139.541	72.114	95	2.249		21.747	139.987		88.467	48.193	**4.095.683**
Finland	1.456	524		4.645			314	1.669	544	1.066		38		2.016	1.757		698	377	**15.104**
Germany	383.886	137.911	539	1.842			11.046	1.993	73.084	210.565	45	20.378		205.697	313.157		193.496	104.191	**1.657.830**
Kaliningrad	33.580		15.123	1.886		772		2.925	99.277	4.961		4.253	17.225	49.419	1.053.741	1.124	41.801	70	**1.326.157**
Latvia	60.188	31.619		136.699	91.275	101	14.167	1.202	242.486	81.486	214.502	43.065		71.016	158.180	11.360	6.714	4.531	**1.168.591**
Lithuania	203.927	100.144	130	657.518	126.569	812	247.394	1.350.160	8.873.572	31.716	712.284	87.027	4.531.322	142.175	80.458	34.872	209.075	93.771	**17.482.926**
NW Russia			15.339.916	1.017.789	2.083	201.560	68.334	419.166	1.114.685		9.338	2.492.662	98.514	806.187		363.811			**21.934.045**
Poland				21.069				30.453	103.267	8.487		54		23.404	25.347		40	17	**212.138**
Rest East Europe	80	28	5.763	51.193	3.711	6.735	803	32.271	43.098	1.549		752	44	1.304.289	117	862	3	2	**1.451.300**
Rest West Europe	1.365	488			55		991	4.906	5.830	3.414		49		5.920	5.518	1	703	380	**29.620**
Rest World	64.373	23.124	740.216	45.801	273.274	780.221	89.491	256.316	135.943	89.829	1.000	242.838	18.397	214.940	147.980	119.650	33.528	18.055	**3.294.976**
Russia (rest)			23.931.105	1.975.711	1.800.969	1.145.440	3.801.938	813.676	1.394.902		801.592	4.838.960	2.209.926	1.654.712		1.663.489			**46.032.420**
Scandinavian Counties	20.138	7.236					4.503		10.749	15.308		1.269		29.354	25.215		33.602	18.094	**165.468**
Ukraine (rest)	33	12	309.154	171.760	112.440	189.843	82.402	256.159	429.692		6.233		7.247	45.605		161.606			**1.772.186**
Ukraine (W)	17	6	166.468	117.231	60.548	102.217	15.073	138.264	150.488		3.358		3.902	24.555		87.021			**869.148**
total	**784.035**	**306.558**	**45.779.838**	**7.563.277**	**5.696.840**	**2.791.281**	**5.495.311**	**4.847.803**	**16.773.115**	**534.276**	**2.162.102**	**10.599.565**	**7.191.271**	**6.169.027**	**1.974.690**	**4.669.750**	**611.137**	**289.301**	**124.239.177**

Freight volumes on the Baltic States' road networks in 2004 per OD (relation)

Origin	Belarus (rest)	Belarus (W)	BENELUX	Estonia	Finland	Germany	Kaliningrad	Latvia	Lithuania	NW Russia	Poland	Rest East Europe	Rest West Europe	Rest World	Russia (rest)	Scandinavian Counties	Ukraine (rest)	Ukraine (W)	Total	
Belarus (rest)				1.690	113			114.556			246.016								**362.375**	
Belarus (W)				608	40			1.351			88.376								**90.375**	
BENELUX				33.474				62.087	294.776	33.832					38.084				**462.253**	
Estonia	414	150	41.033	19.913.384	216.313	130.709	2.972	164.517	284.109		99.237	37.334	1.697.668	344	1.217	7.373	910	488	**22.598.172**	
Finland	269	95	68	317.296		434	1.549	33	134.868		108.978	43.815	390	114	724		330	177	**609.140**	
Germany				82.341	310			132.638	805.526										**1.020.815**	
Kaliningrad				701	87			2.001	43.175	1.041					446.308				**493.313**	
Latvia	108.597	774	95.026	183.523		244.928	9.181	31.312.783	490.590	367.350	253.237	54.467	204.482	1.184	121.542	29.796	591	318	**33.478.369**	
Lithuania			331.688	301.682	35.435	912.427	97.341	1.040.329	44.003.820	901.176	4.993.601	306.000	473.204	39.311	1.418.215	206.340			**55.060.569**	
NW Russia			2.706				200	365.167	142.823	64		168	9.575	204	58	1.199			**522.164**	
Poland	265.499	95.374		164.577	42.246			327.317	6.917.903		489.987.883								**497.800.799**	**7.812.916**
Rest East Europe				72.336	47.674			113.300	410.700	1.697					1.021				**646.728**	
Rest West Europe				1.378.684	500			105.203	373.229	34.025					27.985				**1.919.626**	
Rest World				265	152			945	25.015	15.420					11.461				**53.258**	
Russia			1.316	283	102		186.096	99.398	246.447	1		134	5.841	1.138	188	1.335			**542.279**	
Scandinavian Counties				1.057				3.911	232.100	1.103					2.388				**240.559**	
Ukraine (rest)				1.143				1.051											**2.194**	
Ukraine (W)				616				567											**1.183**	
total	**374.779**	**96.393**	**471.837**	**22.453.660**	**342.972**	**1.288.498**	**297.339**	**33.847.154**	**54.405.081**	**1.355.709**	**495.777.328**	**441.918**	**2.391.160**	**42.295**	**2.069.191**	**246.043**	**1.831**	**983**	**615.904.171**	
											5.789.445								**125.916.288**	

Rail Freight volumes directed to/from the Baltic States' ports per OD relation in 2004 (tons)

Origin	Belarus (rest)	Belarus (W)	BENELUX	Estonia	Finland	Germany	Kaliningrad	Latvia	Lithuania	NW Russia	Poland	Rest East Europe	Rest West Europe	Rest World	Russia (rest)	Scandinavian Counties	Ukraine (rest)	Ukraine (W)	Total
Belarus (rest)			4.312.063		2.758.756	299.053				1.342	208.937	2.422.463	233.405	1.223.012	2.603	1.695.279			**13.156.913**
Belarus (W)			958.947		466.771	62.693				482	75.054	443.273	71.289	309.864	936	530.540			**2.919.849**
BENELUX	5.796	2.082					3.517		17.581	11.957		235		34.629	19.694		3.010	1.620	**100.121**
Estonia						1.834					95			5.645			143	76	**7.793**
Finland	1.456	524					314		410	1.066		38		2.016	1.757		698	377	**8.656**
Germany	383.886	137.911	539	1.439			11.046	505	48.687	210.565	45	20.378		205.697	313.157		193.496	104.191	**1.631.542**
Kaliningrad						772			86.309			3	17.225	19.985		1.124			**125.418**
Latvia					91.146	101								4.544					**95.791**
Lithuania			130		126.569	748							4.525.697	1.327		34.790			**4.689.261**
NW Russia			15.012.253		2.083	201.560			728.675			2.492.662	95.783	805.680		362.823			**19.701.519**
Poland																			**0**
Rest East Europe	80	28	5.763		3.711	6.735	185			1.549		752	44	1.304.289	117	862	3	2	**1.324.120**
Rest West Europe	1.365	488			55		991		3.894	3.414		49		5.920	5.518	1	703	380	**22.778**
Rest World	64.373	23.124	605.859		273.274	732.662	26.422	24.798	116.447	89.829		242.838	6.254	214.940	147.960	95.666	33.528	18.055	**2.716.029**
Russia (rest)			20.871.150		4.043	391.256						4.838.653	185.931	1.555.613		691.714			**28.538.360**
Scandinavian Counties	20.138	7.236					4.503		9.763	15.308		1.269		29.354	25.215		33.602	18.094	**164.482**
Ukraine (rest)			306.459		112.440	189.843					5.434		7.208	45.566		161.606			**828.556**
Ukraine (W)			165.017		60.548	102.217					2.923		3.881	24.534		87.021			**446.141**
total	**477.094**	**171.393**	**42.238.180**	**1.439**	**3.899.396**	**1.989.474**	**46.978**	**25.303**	**1.011.766**	**335.512**	**292.488**	**10.462.613**	**5.146.717**	**5.792.615**	**516.957**	**3.661.426**	**265.183**	**142.795**	**76.477.329**

Road Freight volumes directed to/from the Baltic States' ports per OD relation in 2004 (tons)

Origin	Belarus (rest)	Belarus (W)	BENELUX	Estonia	Finland	Germany	Kaliningrad	Latvia	Lithuania	NW Russia	Poland	Rest East Europe	Rest West Europe	Rest World	Russia (rest)	Scandinavian Counties	Ukraine (rest)	Ukraine (W)	Total
Belarus (rest)					113														**113**
Belarus (W)					40														**40**
BENELUX				732				369	7.546	3.112					350				**12.109**
Estonia			1.622		216.294	2.796			11.506				1.606.571			3.325	28	14	**1.842.156**
Finland	0	0		317.296					59					1	115				**317.471**
Germany				499				645	8.300										**9.444**
Kaliningrad				251	36			830											**1.117**
Latvia			3.497			5.031			18.240				10.987	22		15.823			**53.600**
Lithuania			11.981	12.192	1.690	7.688		252.448			569.928	4.860	5.386	28.998		104.690			**999.861**
NW Russia			397							64			1.478	9	10	726			**2.684**
Poland								0	45.224										**45.224**
Rest East Europe					40				4.952						83				**5.075**
Rest West Europe				1.328.749				1.025	5.407	1.888					581				**1.337.650**
Rest World									15.490	2.659					1.202				**19.351**
Russia			332							1			1.943	572		418			**3.266**
Scandinavian Counties				98				3.041	175.027	452					656				**179.274**
Ukraine (rest)								2											**2**
Ukraine (W)																			**0**
total	**0**	**0**	**17.829**	**1.659.817**	**218.213**	**15.515**	**0**	**258.360**	**291.751**	**8.176**	**569.928**	**4.860**	**1.626.365**	**29.602**	**2.997**	**124.982**	**28**	**14**	**4.828.437**

Rail freight volumes in which no Baltic States' ports are used per OD relation in 2004 (tons)

Origin\Destination	Belarus (rest)	Belarus (W)	BENELUX	Estonia	Finland	Germany	Kaliningrad	Latvia	Lithuania	NW Russia	Poland	Rest East Europe	Rest West Europe	Rest World	Russia (rest)	Scandinavian Counties	Ukraine (rest)	Ukraine (W)	Total
Belarus (rest)	0	0	304	191.358	389	0	617.012	790.492	2.590.915	0	95.394	0	0	358	0	100	0	0	**4.286.322**
Belarus (W)	0	0	110	68.774	0	0	532.659	284.234	1.347.461	0	34.270	0	0	128	0	35	0	0	**2.267.671**
BENELUX	0	0	0	0	0	0	0	709	0	0	0	0	0	0	0	0	0	0	**709**
Estonia	9.196	3.384	0	3.100.001	0	0	5.667	463.208	139.541	72.114	0	2.249	0	16.102	139.987	0	88.324	48.117	**4.087.890**
Finland	0	0	0	4.645	0	0	0	1.669	134	0	0	0	0	0	0	0	0	0	**6.448**
Germany	0	0	0	403	0	0	0	1.488	24.397	0	0	0	0	0	0	0	0	0	**26.288**
Kaliningrad	33.580	0	15.123	1.886	0	0	0	2.925	12.968	4.961	0	4.250	0	29.434	1.053.741	0	41.801	70	**1.200.739**
Latvia	60.188	31.619	0	136.699	129	0	14.167	1.202	242.486	81.486	214.502	43.065	0	66.472	158.180	11.360	6.714	4.531	**1.072.800**
Lithuania	203.927	100.144	0	657.518	0	64	247.394	1.350.160	8.873.572	31.716	712.284	87.027	5.625	140.848	80.458	82	209.075	93.771	**12.793.665**
NW Russia	0	0	327.663	1.017.789	0	0	68.334	419.166	386.010	0	9.338	0	2.731	507	0	988	0	0	**2.232.526**
Poland	0	0	0	21.069	0	0	0	30.453	103.267	8.487	0	54	0	23.404	25.347	0	40	17	**212.138**
Rest East Europe	0	0	0	51.193	0	0	618	32.271	43.098	0	0	0	0	0	0	0	0	0	**127.180**
Rest West Europe	0	0	0	0	0	0	0	4.906	1.936	0	0	0	0	0	0	0	0	0	**6.842**
Rest World	0	0	134.357	45.801	0	47.559	63.069	231.518	19.496	0	1.000	0	12.143	0	20	23.984	0	0	**578.947**
Russia (rest)	0	0	3.059.955	1.975.711	1.796.926	754.184	3.801.938	813.676	1.394.902	0	801.592	307	2.023.995	99.099	0	971.775	0	0	**17.494.060**
Scandinavian Counties	0	0	0	0	0	0	0	0	986	0	0	0	0	0	0	0	0	0	**986**
Ukraine (rest)	33	12	2.695	171.760	0	0	82.402	256.159	429.692	0	799	0	39	39	0	0	0	0	**943.630**
Ukraine (W)	17	6	1.451	117.231	0	0	15.073	138.264	150.488	0	435	0	21	21	0	0	0	0	**423.007**
total	**306.941**	**135.165**	**3.541.658**	**7.561.838**	**1.797.444**	**801.807**	**5.448.333**	**4.822.500**	**15.761.349**	**198.764**	**1.869.614**	**136.952**	**2.044.554**	**376.412**	**1.457.733**	**1.008.324**	**345.954**	**146.506**	**47.761.848**

Road Freight volumes not going via the Baltic States' ports per OD relation in 2004 (tons)

Origin\Destination	Belarus (rest)	Belarus (W)	BENELUX	Estonia	Finland	Germany	Kaliningrad	Latvia	Lithuania	NW Russia	Poland	Rest East Europe	Rest West Europe	Rest World	Russia (rest)	Scandinavian Counties	Ukraine (rest)	Ukraine (W)	Total	
Belarus (rest)	0	0	0	1.690	0	0	0	114.556	0	0	246.016	0	0	0	0	0	0	0	**362.262**	
Belarus (W)	0	0	0	608	0	0	0	1.351	0	0	88.376	0	0	0	0	0	0	0	**90.335**	
BENELUX	0	0	0	32.742	0	0	0	61.718	287.230	30.720	0	0	0	0	37.734	0	0	0	**450.144**	
Estonia	414	150	39.411	19.913.384	19	127.913	2.972	164.517	272.603	0	99.237	37.334	91.097	344	1.217	4.048	882	474	**20.756.016**	
Finland	269	95	68	0	0	434	1.549	33	134.809	0	108.978	43.815	390	113	609	0	330	177	**291.669**	
Germany	0	0	0	81.842	310	0	0	131.993	797.226	0	0	0	0	0	0	0	0	0	**1.011.371**	
Kaliningrad	0	0	0	450	51	0	0	1.171	43.175	1.041	0	0	0	0	446.308	0	0	0	**492.196**	
Latvia	108.597	774	91.529	183.523	0	239.897	9.181	31.312.783	472.350	367.350	253.237	54.467	193.495	1.162	121.542	13.973	591	318	**33.424.769**	
Lithuania	0	0	319.707	289.490	33.745	904.739	97.341	787.881	44.003.820	901.176	4.423.673	301.140	467.818	10.313	1.418.215	101.650	0	0	**54.060.708**	
NW Russia	0	0	2.309	0	0	0	200	365.167	142.823	0	0	168	8.097	195	48	473	0	0	**519.480**	
Poland	265.499	95.374	0	164.577	42.246	0	0	327.317	6.872.679	0	489.987.883	0	0	0	0	0	0	0	**497.755.575**	**7.767.692**
Rest East Europe	0	0	0	72.336	47.634	0	0	113.300	405.748	1.697	0	0	0	0	938	0	0	0	**641.653**	
Rest West Europe	0	0	0	49.935	500	0	0	104.178	367.822	32.137	0	0	0	0	27.404	0	0	0	**581.976**	
Rest World	0	0	0	265	152	0	0	945	9.525	12.761	0	0	0	0	10.259	0	0	0	**33.907**	
Russia	0	0	984	283	102	0	186.096	99.398	246.447	0	0	134	3.898	566	188	917	0	0	**539.013**	
Scandinavian Counties	0	0	0	959	0	0	0	870	57.073	651	0	0	0	0	1.732	0	0	0	**61.285**	
Ukraine (rest)	0	0	0	1.143	0	0	0	1.049	0	0	0	0	0	0	0	0	0	0	**2.192**	
Ukraine (W)	0	0	0	616	0	0	0	567	0	0	0	0	0	0	0	0	0	0	**1.183**	
total	**374.779**	**96.393**	**454.008**	**20.793.843**	**124.759**	**1.272.983**	**297.339**	**33.588.794**	**54.113.330**	**1.347.533**	**495.207.400**	**437.058**	**764.795**	**12.693**	**2.066.194**	**121.061**	**1.803**	**969**	**611.075.734**	
											5.219.517								**121.087.851**	

Annex H: Environmental assessment

Summary of findings

The main idea behind the development of Rail Baltica is to provide attractive rail connections between the capitals and/or economic centres of the Baltic States (Estonia, Latvia and Lithuania) and Poland.

The current environmental assessment provides information on possible impacts on Natura 2000 sites, governed by the EU Birds and Habitats directives, in relation to the proposed Rail Baltica project. Findings must be studied in more detail in the EIAs conducted during the detailed design stages of forthcoming specific projects. In this sense, the current assessment should be regarded as a part of the scoping process prior to the detailed design studies.

The current options for the Rail Baltica alignment include present as well as new railway corridors. In existing corridors several options for railway upgrading are being considered. The present environmental assessment cannot take into account such details, though an overview of the possible environmental consequences are presented. For new alignments, the current proposals must be considered as drafts, which have not been located precisely. Therefore there is a lack of specific information at this stage concerning their exact location. In the case of the new alignment proposed from Tallinn to Parnü (project package 3 with sub-variant) in Estonia no indication of the precise location of the alignments has been available.

Natura 2000 sites consist of; areas designated to protect birds listed in Annex I covered by article IV of the Birds Directive 79/409/EEC, the so called Special Protection Areas (SPA)s and areas designated to protect habitat types and flora and fauna species listed in Annex II of Habitat Directive92/43/EEC, the so called Special Areas of Conservation (SAC)s. Finally Sites of Community Importance, (SCI)s are sites proposed as eligible for SAC or SPAs but not yet designated. In this assessment many of the sites are still classified as SCIs.

From an environmental perspective any infrastructural development options, which include acquisition of new land for the Rail Baltica alignments, will have effects on the environment. In terms of possible impacts on the environment, it is therefore the establishment of a new railway line (project package 3), that will have the greatest impact, establishing a railway line along existing tracks will have less impact, while the upgrading of an existing railway line will have least impact. (In certain instances an upgrading can even improve the living conditions of certain species.)

Possible environmental impacts on the species and habitat types protected within the Natura 2000 sites are dealt with in general terms as well as section wise in chapter 6 and finally, recommendations regarding e.g. issues needing further attention are presented in chapter 7 and mitigation measures for many of the negative issues are presented in chapter 8.

Objective

Immediate objective

The immediate objective of this environmental assessment is to provide an overview of the potential main problems and conflicts with the network of Natura 2000 sites caused by current and proposed alignments of the Rail Baltica sections.

Strategic Environmental Assessments of national railway development plans and detailed and detailed Environmental Impact Assessments (EIA) will be the responsibility of the relevant national environmental authorities in each of the individual detailed design projects, prepared as parts of the Rail Baltica implementation.

The current assessment serves to highlight the main problems and conflicts caused by a development of the Rail Baltica network. Findings should then be studied in more detail in the EIAs conducted during the detailed design stages of forthcoming specific projects. In this sense, the current assessment should be regarded as a part of the scoping process prior to the detailed design studies.

Also, this environmental assessment, which is part of the feasibility study, will not include evaluations of the effects of the existing railway network on the environment. Existing railway sections, which will possibly become part of the Rail Baltica corridor, or cross through or near designated Natura 2000 sites, as they originally, were aligned through areas with significant natural values.

Information and material

Existing and new alignments

The current options for the Rail Baltica alignment include present as well as new railway corridors. In existing corridors several options for railway upgrading are being considered. The present environmental assessment can not take into account such details, though an overview of the possible environmental consequences are presented.

For new alignments, the current proposals must be considered as drafts, which have not been located precisely. Therefore there is a lack of specific information at this stage concerning their exact location. In the case of the new alignment proposed from Tallinn to Parnü (project package 3 with sub-variant) in Estonia no indication of the precise location of the alignments has been available.

Estonia

The alternatives (project package 3 and sub-variant) to the existing alignment are not described, as their exact location has not been indicated with any preci-

sion on a map. Hence, it is not possible at this stage to make any assessments of the environmental effects hereof.

Summarized information in Estonian on Natura 2000 sites has been received, as well as Standard Data Forms (SDF). As the SDFs are not yet completed, it is at present not possible to carry out an impact assessment on the possible effects the project may have on the Natura 2000 sites.

Latvia

Detailed information has been received on Natura 2000 sites (Standard Data Forms). For protected areas of national importance (national parks and Vidzeme Biosphere Reserve) information is available on the internet.

The possible alignments through and around Riga have not been settled yet. This means that the present environmental assessment does not include an assessment of the possible conflicts with the Natura 2000 sites around Riga. Such an assessment can only be done once the constraints for selecting the optimal alignments have been clarified.

Lithuania

The current proposal (project packages 1-3) suggests establishing new railway lines through the country. An eastern sub-variant is also proposed.

Detailed information has been received on Natura 2000 sites (Standard Data Forms). For protected areas of national importance (national parks, nature reserves, landscape reserves and biosphere reserves) summarized information has been made available.

Poland

The current proposal for aligning the Rail Baltica in Poland suggests that only existing railways will be used and no new alignments are considered at the moment.

Detailed information has been received on Natura 2000 sites (Standard Data Forms), incl. sites on the shadow list, and on protected areas of national importance (national parks, nature reserves, and landscape parks).

Environmental issues

Environmental context

As the main goal of the environmental assessment has been to evaluate possible conflicts with topics governed by the EU Birds and Habitats Directives, the focus of the environmental assessment has been on Natura 2000 sites located in the immediate vicinity of the possible Rail Baltica alignments.

Existing railway lines, likely to be included in the Rail Baltica corridor, do pass through or near designated Natura 2000 sites. Thus, the current railway network does create impacts, to the environment in general, and the Natura 2000 network specifically. The assessment carried out here, as a part of the feasibility study, does not include evaluations of the effects of the existing railway network on the environment. It does, though, include an effort to assess the additional effects to the Natura 2000 network by adding new alignments, tracks or by increasing traffic speed and frequency.

Specific Natura 2000 sites

An overview of affected Natura 2000 sites is given in the table below.

Table H.1 Overview of affected Natura 2000 sites

Section and Project Package (PP)	Type	Existing Natura 2000 sites affected		
		Through	**Along**	**Within 3 km**
EE - Tallinn - EE/LV border (PP1)+PP2	Upgrade	1. Seljamäe 2. Elva-Vitipalu	1. Korvemaa 2. Antu 3. Mustallika 4. Vapramäe 5. Otepää	1. Anija 2. Ohepalu 3. Endla 4. Vooremaa Järved
EE - Tallinn - EE/LV border PP3 + sub-var.	New	Alignment is not yet known		
EE/LV border - Riga PP1 +PP2	Upgrade	1. Ziemelgauja 2. Gauja NP 3. Melturu sils 4. Garkalnes mezi	1. Sedas purvs 2. (Gauja NP)	
EE/LV border - Riga PP3	New	1. Salacas ieleja	1. Randusplavas 2. Piejura	1. Vitrupes ieleja 2. Vidzemes akmenaina jurmala
Riga - LV/LT border PP1+ PP2+PP3	Upgrade			1. Melna ezera purvs 2. Lielupes palienes plavas
Riga - LV/LT border PP2 -Sub- var. via Panevezys	New			1. Dolessala 2. Bauska

Section and Project Package (PP)	Type	Existing Natura 2000 sites affected		
		Through	Along	Within 3 km
LV/LT border - Kaunas PP1+ PP2+PP3	Upgrade + New	1. Geduiunu miskas 2. Neries upe	1. Kauno marios 2. Kauno marios	1. Labunavos miskas
LV/LT border - Kaunas PP2 - Sub- var. via Panevezys	New	1. Neries upe	1. Lepsines miskas 2. Kauno marios 3. Kauno marios	1. Pasiliu pelke
Kaunas - LT/PL border PP1+PP2+PP3	New	1. Nemuno upes pakrantes ir salos tarp Kulautuvos ir Smliniku		1. Kamsoso miskas 2. Roku fortas
LT/PL border - Bialystok PP1+PP2+PP3	Upgrade	1. Dolina Dolnego Bugu 2. Ostoja Nadbuzanska 3. Bagienna Dloina Narwi 4. Narwianskie Bagna 5. Dolina Biebrzy		1. Puszcza Knyszynska 2. Ostoja Knyszynska

Environmental assessment

General environmental constraints

From an environmental perspective any infrastructural development options, which include acquisition of new land for the Rail Baltica alignments, will have major effects on the environment. In terms of possible impacts on the environment, a simple ranking of potential quantitative impacts will look like the following, from "more" to "less" possible impacts (with the main types of possible impacts mentioned):

1. **New alignments/corridor**: Land and land-use (reduction and fragmentation); biodiversity; natural values and cultural heritage; community cohesion (traffic infrastructure; public services etc.); emission of noise and air pollutants (in otherwise less or un-disturbed areas); collision risks due to increased traffic and higher speeds; collision risks with electric lines.

2. **Adding a track within an existing corridor**: Some land and land-use issues; some additional fragmentation; additional emissions caused by increased rail traffic; disturbances from increased traffic; collision risks due to increased traffic and higher speeds; collision risks with electric lines.
3. **Improvements within an existing alignment**: Additional emissions caused by increased rail traffic; disturbances from increased traffic; collision risks due to increased traffic and higher speeds; collision risks with electric lines.

New alignments
The consequences of locating Rail Baltica sections in all new corridors are the most severe from an environmental perspective. The following general types of impacts are likely to be seen by constructing a new railway in any of the four countries:

- **Natural values, habitats and biodiversity**: Fragmentation and reduction of habitats; preventing of local movements and migration of land animals; disturbances/noise; emission of air pollutants (diesel engines); risk of collision with power lines by birds (electric engines);
- **Land use and ownership**: Fragmentation of properties; difficulties in access to land; local traffic infrastructure;
- **Community health and cohesion**: Structure of local traffic infrastructure; emission of noise and air pollutants.

Adding tracks
From an environmental perspective, adding tracks within an existing corridor is much preferable when compared to the option of construction of a new railway within a new corridor. Possible environmental effects of adding tracks to an existing alignment include the following:

- Some land and land-use issues;
- some additional fragmentation;
- additional emissions caused by increased rail traffic;
- disturbances on birds and animals from increased traffic;
- collision risks of birds and animals due to increased traffic and higher speeds;
- collision risks of birds with electric lines.

Improvements within existing alignments
Improvements to the railway system, within the existing alignment and reserved corridor, may be carried out in several ways, depending on the state of the existing railway system. In general, the impacts on the environment will be modest and linked to the following problems:

- Additional emissions caused by increased rail traffic;
- disturbances on birds and animals from increased traffic;
- collision risks of birds and animals due to increased traffic and higher speeds;
- collision risks of birds with electric lines.

Construction and operation
During construction of the Rail Baltica infrastructure, the main environmental issues concerning the environment include:

- the need to establish access roads and works and storage sites within and near the railway corridor;
- the physical impact on habitats and the general environment within the sites and neighbouring the sites;
- disturbances by the increased activities at and near the railway.

During operation, the main environmental issues concerning the environment include:

- the physical impact on the habitats within the sites;
- the additional barriers to an unrestricted movement and migration of species within the sites;
- additional disturbances created by faster and more frequent train traffic.

In areas with a high density of Natura 2000 sites, and other protected areas of major importance, any additional infrastructural elements will eventually cause increased fragmentation of important sites, ecosystems and habitats. Also, more physical constructions will impact the unrestricted movements and migration of animals within and between Natura 2000 sites.

We can conclude that environmental constraints potentially can be a main barrier for implementing some parts of Rail Baltica, but that paying sufficiently attention to the main types of environmental impacts can reduce the overall impacts on the environment. The construction of a new alignment will have the largest impact on the environment followed by adding a track within an existing corridor and improvements within an existing alignment.

It appears that the environmental barriers are most prominent for the alignment option from Kaunas to Warsaw "Via Sokolka".

An overview of the sections and their ranking, given the above simple classification, is given in the table below.

Table H.2 Overview of sections and their ranking, given the above simple classification

Section	Project Package (PP)	Type	Environmental constraints: Ranking of types (explanation given above)
EE: Tallinn - EE/LV border	PP1	-	-
	PP2	Upgrade	3
	PP3 + sub-variant	New line and alignment	1
EE/LV border - Riga	PP1	Upgrade	3
	PP2	Upgrade	3
	PP3	New line and alignment	1
LV: Riga - LV/LT border	PP1	Upgrade	3
	PP2	Upgrade Sub-var: new via Panevezys	3 1
	PP3	New	1
LV/LT border - Kaunas	PP1	Upgrade: to Joniski New: J. to Kaunas	3 +1
	PP2	Upgrade: to Joniski New J. to Kaunas Sub-var: new Panevezys	3+1 1
	PP3	New	1
Kaunas - LT/PL border	PP1	New	1
	PP2	New	1
	PP3	New	1
LT/PL border - Bialystok	P1	Upgrade	3
	P2	Upgrade	3
	P3	Upgrade	3

One important note, to this ranking, is that it can not be seen from the given information exactly which part of the sections proposed to be upgraded will be done as Improvements of existing tracks or Adding a track to the existing.

Impacts on Natura 2000 sites and species

This chapter deals with the possible environmental impacts on the species and habitat types protected within the Natura 2000 sites, in general terms.

The sections 6.3 to 6.9 present the possible environmental impacts foreseen for each of the railway sections, where data is available.

Possible environmental impacts on SPA species
The Special Protection Areas (SPAs) have been designated to protect specific bird species listed in Annex I covered by article 4 of Directive 79/409/EEC.

In general, the impact of railways will have a rather small effect on birds. The impact will be influenced by the following factors:

- Physical design: new railway line or upgrading of existing
- Phases: construction phase and operational phase.

The way, the impact will affect bird species, varies from species to species depending on aspects such as species manoeuvrability (in order to avoid trains in motion), tolerance of disturbance etc.

Physical design
A new railway line passing through a Natura 2000 area may permanently destroy the nesting or foraging area of certain species. The specific impact of the railway line, on each of the bird species, must be judged at species level and will reflect how vulnerable a species is and its behavioural pattern.

In most cases the establishment of a new railway line is not likely to have an effect on the favourable conservation status of the birds listed in annex I, if the railway line is established or upgraded along or near a Natura 2000 site.

Construction phase
The protected birds may be disturbed by the work carried out during the construction phase, if it is carried out during the birds breeding period or in their foraging area, regardless whether the work is in relation to the upgrading or establishing of a new railway line. The disturbance, in connection with establishing a new railway line, will be the greatest relatively, as it will involve more work and thus more disturbance over a longer time.

Operational phase
In general, birds are capable of adapting to the presence of railway lines. Despite this, it must be expected that there will be incidences of bird strikes. There is an increased risk of bird kills and injuries when the frequency and speeds of train traffic increases, especially for low-flying and less manoeuvrable species. If the railway is going to be electrified, the electric lines will constitute an increased risk of bird collisions with the installations. The following species are considered especially vulnerable to train collision and collision with electric lines: Swans, herons, bigger birds of prey, owls.

Despite risks involved, the magnitude of the problem is of a size that may not affect the favourable conservation status of any of the protected species. Mitigative measures should in any case be installed, such as planting of tree belts along the railway, where the risk of collision is greatest, due to frequent local movements of bird species, which have tendencies to collide with traffic, incl. trains.

Possible environmental impacts on SCIs (potential SACs)
The selection criteria for sites eligible for identification as Sites of Community Importance (SCIs) are habitat types and species listed in annex II of Directive 92/43/EEC.

As in the Natura 2000 Standard Data Forms, the protected species are ordered in the following groups: mammals, amphibians and reptiles, fishes, invertebrates and plants. For sake of ease, these groups will also be applied following.

In general, the impact on the species and habitat types, that are the selection criteria of the protected area, will be different from group to group. The impact will be influenced by the following factors:

- Physical design: new railway line or upgrading of existing
- Phases: construction phase and operational phase.

Physical design
Relatively, the smallest effect of a new railway line, on the species and the habitat types that form the selection criteria, is found when the new line is established near or along existing borders of Natura 2000 sites. The largest effect will be seen if the railway is established through an existing Natura 2000 site.

The main problems. related to a railway line running through a Natura 2000 site are:

- Local destruction/reduction of the size of existing areas with the protected habitat types or breeding or foraging areas for protected species.
- Fragmentation of protected habitat types or species meta populations. A fragmentation can have a negative impact, if the meta population is divided by the railway line, so one population (meta population) suddenly becomes two isolated populations. If the number of individuals in each of the two populations is too small, the species in the area may become extirpated/ extinct.

  Mitigation measures by means of fauna passages can be established for certain species. (See mitigation measures).

- Migration path. A new railway line may cross the migration path of species. This may lead to collision with the train in certain instances while in others it may be an impassable barrier for the animals.

  Mitigation measures by means of fauna passages can be made for certain species.

  Where the proposed project consists of an upgrading of the existing railway lines, the establishment of fauna passages may actually improve the current condition of certain species.

Construction phase

The possible impact from the construction phase, on species and habitat types that are the selection criteria for potential SACs, with regards to the upgrading of an existing line, which does not lie within the Natura 2000 site, will in general be minimal for all species and habitat types.

It is assumed that all material, to be used for the upgrading and to be scrapped, will be transported along the existing railway line. Hereby the impact will have little effect on the immediately surrounding habitat (types).

With regards to the establishment of a new railway line, the construction phase may have an impact on several of the protected habitat types and species. First of all, if the new railway line runs through a protected habitat type or breeding/foraging site, these areas will be permanently destroyed. This may not have an affect on the favourable conservation status, but it cannot be determined unless it is investigated at species level.

Following, general comments regarding the construction phase are relevant for both upgrading and establishing of new railway lines within SCIs to be SACs.

<u>Habitat types</u>

If a new railway line is established in a moist habitat type (bog or meadow), it may have a negative impact, unless mitigation measures are taken to ensure, that the condition of the habitat does not change permanently.

<u>Amphibians and reptiles</u>

Amphibians and reptiles may be disturbed during the construction phase and a number of individuals may be killed. Amphibians and reptiles are also known to be sensitive to barriers constituted by railways, especially where it runs upon an embankment - typically across a wetland.

The general habitat condition can in certain cases be improved for certain species of amphibians and reptiles if the southern side of the railway line is kept bare and sunny.

Fishes

Fish may be disturbed by noise, during construction phase, to the extent that they temporarily disappear from the area. In certain cases, the mitigation measure should be taken that the construction phase should be carried out during the period, when the relevant species are not breeding.

Operational phase
Migrating species may be killed by passing trains. Therefore, fauna passages should be established at relevant points for relevant species. Designated habitats and home range areas for animals and birds within the area may disappear or be reduced by the railway.

The railway may constitute a barrier for migrating animals such as otters. Otter (*Lutra lutra*) is particularly sensitive to such ecological barriers, especially where the railway crosses its aquatic habitats, such as rivers, canals, streams and ditches. Even if otters live outside the affected area, and if the railway crosses connecting streams and/or ditches, the otter population may still be disturbed. It should be noted that otter is also listed on the Habitat Directive Annex IV. Hence it is protected both inside and outside designated Natura 2000 areas.

Existing line: Tallinn - Tartu - Valga/Valka or new line: Tallinn - Pärnu (Estonia)

Project Packages:

- PP1: No upgrading of existing railway via Tartu, as it is upgraded to 120 km/h irrespective of the implementation of Rail Baltica.
- PP2: Upgrading of existing railway via Tartu to 160 km/h according to Russian standards (described in this section)
- PP3: Construction of new line based on European standards via Pärnu (the shortest route). (Sub-variant is proposed via Lelle/Pärnu) (No description is given here as the new alignment is not yet in place)

Table H.3 Natura 2000 protected areas within a 6 km corridor of the section (project packages 1 and 2).

Name of site	Site Code	Natura 2000 status	Railway's proximity to site
Anija	EE0010109	Site of Community Importance (SCI) [3]	W3
Korvemaa		Special Protected Area (SPA) [1] Site of Community Importance (SCI) [3]	Along
Ohepalu	EE0020205	Special Protected Area (SPA) [1] Site of Community Importance (SCI) [3]	W3
Äntu	EE0060212	Site of Community Importance (SCI) [3]	Along
Seljamäe	EE0060211	Site of Community Importance (SCI) [3]	Through
Endla	EE0080172	Special Protected Area (SPA) [1] Site of Community Importance (SCI) [3]	W3
Mustallika	EE0080109	Site of Community Importance (SCI) [3]	Along
Vooremaa Järved	EE0080110	Site of Community Importance (SCI) [3]	W3
Vapramäe	EE0080309	Site of Community Importance (SCI) [3]	Along
Elva-Vitipalu	EE0080318	Site of Community Importance (SCI) [3]	Through
Otepää	EE0080401	Special Protected Area (SPA) [1] Site of Community Importance (SCI) [3]	Along

1) SPA: Special Protected Areas; cf. EU Birds Directive of 1979 (79/409/EEC).

2) SAC: Special Areas of Conservation; cf. EU Habitat Directive of 1992 (92/43/EEC).

3) SCI: Sites Eligible Identification as Sites of Community Importance; cf. EU Habitat Directive.

The Standard Data Forms for all 11 above listed Estonian Natura 2000 sites do not contain data. Therefore an analysis on the selection criteria cannot be made.

The new alignment for project package 3, via Pärnu as well as the sub-var. via Lelle, has not been established. Therefore an assessment of the impact project package 3 many have on Natura 2000 sites cannot be made.

Existing Line: Valga/Valka - Valmeria - Riga (Latvia)

Project Packages:

- PP1: Upgrading of existing railway to 120 km/h according to Russian standards (described in this section)
- PP2: Upgrading of existing railway to 160 km/h according to Russian standards (described in this section)
- PP3: New railway line, 200 km/h according to European standards (refer to next section)

Table H.4 Natura 2000 protected areas within a 6 km corridor of the section (project packages 1 and 2).

Name of site	Site Code	Natura 2000 status	Railway's proximity to site
Sedas purvs	LV0526800	Special Protected Area (SPA) [1)] Site of Community Importance (SCI) [3)]	Along
Ziemelgauja	LV0600700	Special Protected Area (SPA) [1)] Site of Community Importance (SCI) [3)]	Through
Gaujas nacionalais parks	LV0200100	Special Protected Area (SPA) [1)] Site of Community Importance (SCI) [3)]	Through
Melturu sils	LV0527800	Site of Community Importance (SCI) [3)]	Through
Garkalnes mezi	LV0527400	Special Protected Area (SPA) [1)] Site of Community Importance (SCI) [3)]	Through

1) SPA: Special Protected Areas; cf. EU Birds Directive of 1979 (79/409/EEC).

2) SAC: Special Areas of Conservation; cf. EU Habitat Directive of 1992 (92/43/EEC).

3) SCI: Sites Eligible Identification as Sites of Community Importance; cf. EU Habitat Directive.

In addition to the Natura 2000 areas mentioned in the table above, there are a number of Natura 2000 areas in the immediate vicinity of Riga. The exact alignment of the railway in Riga is yet to be proposed for which reason the Natura 2000 areas around Riga are not included in this assessment.

Sedas purvs
The Baltic Railway is passing along Sedas purvs.

Sedas purvs is a classified Special Protected Area (SPA) according to the EU Birds Directive (79/409/EEC). It has furthermore been proposed as eligible as Sites of Community Importance (SCI) according to the EU Habitat Directive (92/43/EEC).

30 bird species listed on the Birds Directive Annex I and three regularly occurring migratory bird species not listed on Annex I are reported from the area.

Five designated habitat types (cf the Habitat Directive) are present on the site. The site includes one invertebrate (large white-faced darter (*Leucorrhinia pectoralis*)) listed on the Habitat Directive Annex II.

Ziemelgauja
The Baltic Railway is passing through Ziemelgauja.

Ziemelgauja is a classified Special Protected Area (SPA) according to the EU Birds Directive (79/409/EEC). It has furthermore been proposed as eligible as Sites of Community Importance (SCI) according to the EU Habitat Directive (92/43/EEC).

29 bird species listed on the Birds Directive Annex I are reported from the area.

Nineteen designated habitat types (cf the Habitat Directive) are present on the site. The site includes the following Habitat Directive Annex II species groups:

- Two mammals, including otter (*Lutra lutra*) and pond bat (*Myotis dasycneme*)
- One amphibian, great crested newt (*Triturus cristatus*)
- Six fishes
- Four invertebrates
- Two plants

Gaujas Nacionalais Parks
The Baltic Railway is passing through Gaujas Nacionalais Parks.

Gaujas Nacionalais Parks is a classified Special Protected Area (SPA) according to the EU Birds Directive (79/409/EEC). It has furthermore been proposed as eligible as Sites of Community Importance (SCI) according to the EU Habitat Directive (92/43/EEC).

29 bird species listed on the Birds Directive Annex I and two regularly occurring migratory bird species not listed on Annex I are reported from the area.

26 designated habitat types (cf the Habitat Directive) are present on the site. The site includes the following Habitat Directive Annex II species groups:

- Three mammals, including otter (*Lutra lutra*), bear (*Ursus arctos*) and pond bat (*Myotis dasycneme*)

- One amphibian, great crested newt (*Triturus cristatus*)
- Nine fishes
- Eight invertebrates
- Six plants

Melturu sils
The Baltic Railway is crossing Melturu sils.

Melturu sils has been proposed as eligible as Sites of Community Importance (SCI) according to the EU Habitat Directive (92/43/EEC).

Two designated habitat types (cf the Habitat Directive) are present on the site, including the river itself with its water weeds. The site includes the following Habitat Directive Annex II species groups:

- One fish; lamprey (*Lampetra fluviatilis*)
- One invertebrate; freshwater pearly mussel (*Margaritifera margaritifera*)

Garkalnes mezi
The Baltic Railway is passing through Garkalnes mezi.

Garkalnes mezi is a classified Special Protected Area (SPA) according to the EU Birds Directive (79/409/EEC). It has furthermore been proposed as eligible as Sites of Community Importance (SCI) according to the EU Habitat Directive (92/43/EEC).

Eleven bird species listed on the Birds Directive Annex I are reported from the area.

Two designated habitat types (cf the Habitat Directive) are present on the site. The site includes one plant species (*Pulsatilla patens*) listed on the Habitat Directive Annex II.

New Line: Estonian-Latvian Border - Riga (Latvia)

Project Packages:

- PP1: Upgrading of existing railway to 120 km/h according to Russian standards (refer to previous section)
- PP2: Upgrading of existing railway to 160 km/h according to Russian standards (refer to previous section)
- PP3: New railway line, 200 km/h according to European standards (described in this section)

Table H.5 Natura 2000 protected areas within a 6 km corridor of the section (project package 3).

Name of site	Site Code	Natura 2000 status	Railway's proximity to site
Randu plavas	LV0509100	Special Protected Area (SPA) [1)] Site of Community Importance (SCI) [3)]	Along
Salacas ieleja	LV0302200	Special Protected Area (SPA) [1)] Site of Community Importance (SCI) [3)]	Through
Vitrupes ieleja	LV0530500	Site of Community Importance (SCI) [3)]	< 3 km
Vidzemes akmenania jurmala	LV0508600	Site of Community Importance (SCI) [3)]	< 3 km
Piejura	LV0301700	Special Protected Area (SPA) [1)] Site of Community Importance (SCI) [3)]	Along

1) SPA: Special Protected Areas; cf. EU Birds Directive of 1979 (79/409/EEC).

2) SAC: Special Areas of Conservation; cf. EU Habitat Directive of 1992 (92/43/EEC).

3) SCI: Sites Eligible Identification as Sites of Community Importance; cf. EU Habitat Directive.

In addition to the Natura 2000 areas mentioned in the table above, there are a number of Natura 2000 areas in the immediate vicinity of Riga. The exact alignment of the railway in Riga is yet to be proposed for which reason the Natura 2000 areas around Riga are not included in this assessment.

Randu plavas

The proposed new railway line (alternative P3) is passing through Randu plavas.

Randu plavas is a classified Special Protected Area (SPA) according to the EU Birds Directive (79/409/EEC). It has furthermore been proposed as eligible as Sites of Community Importance (SCI) according to the EU Habitat Directive (92/43/EEC).

Fourteen bird species listed on the Birds Directive Annex I and two regularly occurring migratory bird species not listed on Annex I are reported from the area.

Eleven designated habitat types (cf the Habitat Directive) are present on the site. The site includes the following Habitat Directive Annex II species groups:

- One mammal; otter (*Lutra lutra*)
- One fish; lamprey (*Lampetra fluviatilis*)
- One plant; march angelica (*Angelica palustris*)

Salacas ieleja
The proposed new railway line (alternative P3) is passing through Salacas ieleja.

Salacas ieleja is a classified Special Protected Area (SPA) according to the EU Birds Directive (79/409/EEC). It has furthermore been proposed as eligible as Sites of Community Importance (SCI) according to the EU Habitat Directive (92/43/EEC).

Eleven bird species listed on the Birds Directive Annex I are reported from the area.

Fourteen designated habitat types (cf the Habitat Directive) are present on the site. The site includes the following Habitat Directive Annex II species groups:

- Three mammals, including otter (*Lutra lutra*) and pond bat (*Myotis dasycneme*)
- Nine fishes
- Six invertebrates
- Two plants; agrimony (*Agrimonia pilosa*) and the moss *Dicranum viride*

Vitrupes ieleja
Vitrupes ieleja is located less than three km from the proposed new railway line (alternative P3).

Vitrupes ieleja has been proposed as eligible as Sites of Community Importance (SCI) according to the EU Habitat Directive (92/43/EEC).

Five bird species listed on the Birds Directive Annex I are reported from the area, even though the area is not classified as a Special Protected Area in accordance with the EU Birds Directive (79/409/EEC).

Four designated habitat types (cf the Habitat Directive) are present on the site. The site includes four invertebrate species listed on the Habitat Directive Annex II.

Vidzemes akmenania jurmala
Vidzemes akmenania jurmala is located less than three km from the proposed new railway line (alternative P3).

Vidzemes akmenania jurmala has been proposed as eligible as Sites of Community Importance (SCI) according to the EU Habitat Directive (92/43/EEC).

Eight bird species listed on the Birds Directive Annex I are reported from the area, even though the area is not classified as a Special Protected Area in accordance with the EU Birds Directive (79/409/EEC).

Thirteen designated habitat types (cf the Habitat Directive) are present on the site. The site includes the following Habitat Directive Annex II species groups:

- One mammal; otter (*Lutra lutra*)
- One fish; lamprey (*Lampetra fluviatilis*)
- One plant; Moccasin orchid (*Cypripedium calceolus*)

Piejura
The proposed new railway line (alternative P3) is passing along Piejura.

Piejura is a classified Special Protected Area (SPA) according to the EU Birds Directive (79/409/EEC). It has furthermore been proposed as eligible as Sites of Community Importance (SCI) according to the EU Habitat Directive (92/43/EEC).

Eight bird species listed on the Birds Directive Annex I are reported from the area.

Twelve designated habitat types (cf the Habitat Directive) are present on the site. The site includes the following Habitat Directive Annex II species groups:

- One mammal; otter (*Lutra lutra*)
- Nine fishes
- One invertebrate; large copper butterfly (*Lycaena dispar*)
- Two plants; *Dianthus areanarius ssp. arenareus* and marsh angelica (*Angelica palustris*)

Riga - Jelgava - Joniskis (Latvia and Lithuania)

Project Packages:

- PP1: Upgrading of existing railway to 120 km/h according to Russian standards, western alternative (described in this section)
- PP2a: Upgrading of existing railway to 160 km/h according to Russian standards (described in this section)
- PP2b: New railway line, eastern sub-variant, 160 km/h according to Russian standards (refer to next section)
- PP3: New railway line in the same corridor as the existing railway, 200 km/h according to European standards, western alternative (described in this section)

Table H.6 Natura 2000 protected areas within a 6 km corridor of the section (project packages 1, 2a and 3).

Name of site	Site Code	Natura 2000 status	Railway's proximity to site
Melna ezera purvs (in Latvia)	LV0528700	SPA	< 3 km
Lielupes palienes plavas (in Latvia)	LV0523100	No information available	< 3 km

1) SPA: Special Protected Areas; cf. EU Birds Directive of 1979 (79/409/EEC).

2) SAC: Special Areas of Conservation; cf. EU Habitat Directive of 1992 (92/43/EEC).

3) SCI: Sites Eligible Identification as Sites of Community Importance; cf. EU Habitat Directive.

In addition to the Natura 2000 areas mentioned in the table above, there are a number of Natura 2000 areas in the immediate vicinity of Riga. The exact alignment of the railway in Riga is yet to be proposed for which reason the Natura 2000 areas around Riga are not included in this assessment.

Melna ezera purvs
Melna ezera purvs is located less than 3 km from the existing Baltic Railway.

Melna ezera purvs is a classified Special Protected Area (SPA) according to the EU Birds Directive (79/409/EEC).

11 bird species listed on the Birds Directive Annex I are reported from the area.

Lielupes palienes plavas
Lielupes palienes plavas is located less than 3 km from the existing Baltic Railway.

Information about the environment and the Natura 2000 status of this area has not been provided.

Eastern sub-variant: Riga - Bauska (Latvia)

Project Packages:

- PP1: Upgrading of existing railway to 120 km/h according to Russian standards, western alternative (refer to previous section)
- PP2a: Upgrading of existing railway to 160 km/h according to Russian standard, refer to previous section)
- PP2b: New railway line, eastern sub-variant, 160 km/h according to Russian standards (described in this section)
- PP3: New railway line in the same corridor as the existing railway, 200 km/h according to European standards, western alternative (refer to previous section)

Table H.7 Natura 2000 protected areas within a 6 km corridor of the section (project package, eastern sub-variant 2b).

Name of site	Site Code	Natura 2000 status	Railway's proximity to site
Dolessala	LV0301900	Site of Community Importance (SCI) [3]	< 3 km
Bauska	LV0304100	Site of Community Importance (SCI) [3]	< 3 km

1) SPA: Special Protected Areas; cf. EU Birds Directive of 1979 (79/409/EEC).

2) SAC: Special Areas of Conservation; cf. EU Habitat Directive of 1992 (92/43/EEC).

3) SCI: Sites Eligible Identification as Sites of Community Importance; cf. EU Habitat Directive.

In addition to the Natura 2000 areas mentioned in the table above, there are a number of Natura 2000 areas in the immediate vicinity of Riga. The exact alignment of the railway in and around Riga is yet to be proposed for which reason the Natura 2000 areas around Riga are not included in this assessment.

Dolessala
Dolessala is located less than 3 km from the existing Baltic Railway.

Dolessala has been proposed as eligible as Sites of Community Importance (SCI) according to the EU Habitat Directive (92/43/EEC).

Three designated habitat types (cf the Habitat Directive) are present on the site, including the Dolessa Island in the Daugava River, Riga City. The site includes the following Habitat Directive Annex II species:

- One mammal; otter (*Lutra lutra*)
- One invertebrate; hermit beetle (*Osmoderma eremta*)
- One plant species; Pasqueflower (*Pulsatilla patens*)

Bauska
Bauska is located less than 3 km from the existing Baltic Railway.

Bauska has been proposed as eligible as Sites of Community Importance (SCI) according to the EU Habitat Directive (92/43/EEC).

Three designated habitat types (cf the Habitat Directive) are present on the site. The site includes the following Habitat Directive Annex II species:

- Four fishes; Spined loachb (*Cobitis Taenia),* Bullhead *(Cottus Gobio),* Asp *(Aspius Aspius)* and River lamprey *(Lampetra Fluviatilis).*

Joniskis - Radviliskis - Kaunas (Lithuania)

Project Packages:

- PP1 and PP2a: New railway line, 160 km/h according to Russian standards (described in this section)
- PP2b: New railway line, eastern sub-variant, 160 km/h according to Russian standards (refer to next section)
- PP3: New railway line, 200 km/h according to European standards (described in this section)

Table H.8 Natura 2000 protected areas within a 6 km corridor of the section (project packages 1, 2a and 3).

Name of site	Site Code	Natura 2000 status	Railway's proximity to site
Gedziunu miskas	LIPAKB002	Special Protected Area (SPA) [1)]	through
Labunavos miskas	LIKED0001	Site of Community Importance (SCI) [3)]	<3km
Neries upe	LIVIN0009	Site of Community Importance (SCI) [3)]	through
Kauno marios	LIKAUB008	Special Protected Area (SPA) [1)]	along
Kauno marios	LIKAUB007	Site of Community Importance (SCI) [3)]	along

1) SPA: Special Protected Areas; cf. EU Birds Directive of 1979 (79/409/EEC).

2) SAC: Special Areas of Conservation; cf. EU Habitat Directive of 1992 (92/43/EEC).

3) SCI: Sites Eligible Identification as Sites of Community Importance; cf. EU Habitat Directive.

Gedziunu miskas

The proposed new railway line (western alternative) is passing through Gedziunu miskas.

Gedziunu miskas is a classified Special Protected Area according to the EU Birds Directive (79/409/EEC).

Thirteen bird species listed on the Birds Directive Annex I are reported from the area.

Labunavos miskas

Labunavos miskas is located less than 3 km from the proposed alignment of the Baltic Railway.

Labunavos miskas has been proposed as eligible as Sites of Community Importance (SCI) according to the EU Habitat Directive (92/43/EEC).

No habitat types, cf the Habitat Directive, have been identified in the area.

The site is habitat for three invertebrate species listed on the Habitat Directive Annex II. The species are all butterflies.

A new railway, which is not in physical contact with the Natura 2000 area, is not likely to cause impacts on the butterflies.

Neries upe
The proposed alignment of the Baltic Railway is crossing the river Neries upe.

Neries upe has been proposed as eligible as Sites of Community Importance (SCI) according to the EU Habitat Directive (92/43/EEC).

One designated habitat type (cf the Habitat Directive) is present on the site, namely the river itself with its water weeds. The site includes the following Habitat Directive Annex II species groups:

- One mammal (otter (*Lutra lutra*))
- Four fishes
- One invertebrate

Kaunos marios (Site code: LIKAUB008)
The proposed alignment of the Baltic Railway is passing along Kaunos marios (Site code: LIKAUB008).

Kaunos marios (Site code: LIKAUB008) is a classified Special Protected Area according to the EU Birds Directive (79/409/EEC).

Fourteen bird species listed on the Birds Directive Annex I are reported from the area, most of which are breeding in the area.

Kaunos marios (Site code: LIKAUB007)
The proposed alignment of the Baltic Railway is passing along Kaunos marios (Site code: LIKAUB007).

Kaunos marios (Site code: LIKAUB007) has been proposed as eligible as Sites of Community Importance (SCI) according to the EU Habitat Directive (92/43/EEC).

Eight designated habitat types (cf the Habitat Directive) are present on the site, mainly forested areas. The site includes the following Habitat Directive Annex II species groups:

- Two mammals (otter (*Lutra lutra*) and pond bat (*Myotis dascynema*))
- One fish (asp (*Aspius aspius*))
- One invertebrate (hermit beetle (*Osmoderma eremite*))

Eastern sub-variant: Bauska - Panevezys - Kaunas (Latvia and Lithuania)

Project Packages:

- PP1 and P2a: New railway line, 160 km/h according to Russian standards (refer to previous section)
- PP2b: New railway line, eastern sub-variant, 160 km/h according to Russian standards (described in this section)
- PP3: New railway line, 200 km/h according to European standards (refer to previous section)

Table H.9 Natura 2000 protected areas within a 6 km corridor of the section (project package sub-variant 2b).

Name of site	Site Code	Natura 2000 status	Railway's proximity to site
Lepsynes miskas	LIPAS0001	Site of Community Importance (SCI) [3)]	along
Pasiliu pelke	LIPAN0005	Site of Community Importance (SCI) [3)]	< 3 km
Neries upe	LIVIN0009	Site of Community Importance (SCI) [3)]	through
Kauno marios	LIKAUB008	Special Protected Area (SPA) [1)]	along
Kauno marios	LIKAUB007	Site of Community Importance (SCI) [3)]	along

1) SPA: Special Protected Areas; cf. EU Birds Directive of 1979 (79/409/EEC).

2) SAC: Special Areas of Conservation; cf. EU Habitat Directive of 1992 (92/43/EEC).

3) SCI: Sites Eligible Identification as Sites of Community Importance; cf. EU Habitat Directive.

Lepsynes miskas
The proposed alignment is passing along Lepsynes miskas.

Lepsynes miskas has been proposed as eligible as Sites of Community Importance (SCI) according to the EU Habitat Directive (92/43/EEC).

Two designated habitat types (cf the Habitat Directive) are present on the site, both forest types. No species listed on the Habitat Directive Annex II have been identified for the area.

A railway alongside the Natura 2000 area is not likely to cause significant impacts on conservation status of the two designated habitat types in the areas.

Pasiliu pelke
Pasiliu pelke is located less than 3 km from the proposed alignment of the Baltic Railway.

Pasiliu pelke has been proposed as eligible as Sites of Community Importance (SCI) according to the EU Habitat Directive (92/43/EEC).

No habitat types, cf the Habitat Directive, have been identified in the area.

The site is habitat for an invertebrate species listed on the Habitat Directive Annex II, namely the butterfly *Euphydryas aurinia*.

A new railway, which is not in physical contact with the Natura 2000 area, is not likely to cause impacts on the butterfly.

Neries upe
Refer to section 8.3.

Kaunos marios (Site code: LIKAUB008)
Refer to section 8.4.

Kaunos marios (Site code: LIKAUB007)
Refer to section 8.5.

Kaunas - Trakiszki (Lithuania and Poland)
Project Packages:

- PP1, PP2 and PP3: New railway line, 200 km/h according to European standards

Table H.10 Natura 2000 protected areas within a 6 km corridor of the section (Project packages 1, 2 and 3)

Name of site	Site Code	Natura 2000 status	Railway's proximity to site
Kamsos miskas	LTKAU0003	SCI	W3
Roku fortas	LIKAU0012	SCI	W3
Nemuno upes pakrantes ir salos tarp Kulautuvos ir Smlininku	LIKAUB001	SPA	Through

Kamsos miskas
Kamsos miskas is located less than 3 km from the proposed alignment of the Baltic Railway.

Kamsos miskas has been proposed as eligible as Sites of Community Importance (SCI) according to the EU Habitat Directive (92/43/EEC).

Only the invertebrate *Cucujus cinnaberinus* has been identified in the area.

Roku fortas
Roku fortas is located less than 3 km from the proposed alignment of the Baltic Railway.

Roku fortas has been proposed as eligible as Sites of Community Importance (SCI) according to the EU Habitat Directive (92/43/EEC).

Only the two bats: *Barbastella barbastellus* and *Myotis dasycneme* have been identified in the area.

Nemuno upes pakrantes ir salos tarp Kulautuvos ir Smlininku
Nemuno upes is crossed by the proposed alignment of the Baltic Railway.

Nemuno upes is a classified Special Protected Area according to the EU Birds Directive (79/409/EEC).

Three bird species listed on the Birds Directive Annex I are reported from the area, all are breeding in the area.

Trakiszki - Suwalki - Elk - Bialystok - Warsaw (Poland)

Project Packages:

- PP1: Upgrading the existing railway to 120 km/h according to European standards.
- PP2 and PP3: Upgrading the existing railway to 160 km/h according to European standards

Table H.11 Natura 2000 protected areas within a 6 km corridor of the section (Project packages 1, 2 and 3)

Name of site	Site Code	Natura 2000 status	Railway's proximity to site
Puszcza Knyszyńska	PLB 200003	SPA	< 3 km
Ostoja Knyszyńska	PLH 200006	Data Form missing	< 3 km
Dolina Biebrzy	PLC 200001	Special Protected Area (SPA) [1)] Site of Community Importance (SCI) [3)]	Through
Dolina Dolnego Bugu	PLB 140001	Special Protected Area (SPA) [1)]	Through
Ostoja Nadbużańska	PLH 140011	SCI	Through
Bagienna Dolina Narwi	PLH 200001	Special Protected Area (SPA) [1)]	Through
Narwienskie Bagna	PLH 200002	SCI	Through

1) SPA: Special Protected Areas; cf. EU Birds Directive of 1979 (79/409/EEC).

2) SAC: Special Areas of Conservation; cf. EU Habitat Directive of 1992 (92/43/EEC).

3) SCI: Sites Eligible Identification as Sites of Community Importance; cf. EU Habitat Directive.

Puszcza Knyszyńska
Puszcza Knyszyńska is located less than 3 km from the existing Baltic Railway.

Puszcza Knyszyńska is a classified Special Protected Area according to the EU Birds Directive (79/409/EEC).

37 bird species listed on the Birds Directive Annex I are reported from the area, all are breeding in the area.

Ostoja Knyszyńska
Ostoja Knyszyńska is located less than 3 km from the existing Baltic Railway.

Information about the environment and the Natura 2000 status of this area has not been provided.

Dolina Biebrzy
The Baltic Railway is passing through Dolina Biebrzy.

Dolina Biebrzy is a classified Special Protected Area (SPA) according to the EU Birds Directive (79/409/EEC). It has furthermore been proposed as eligible as Sites of Community Importance (SCI) according to the EU Habitat Directive (92/43/EEC).

38 bird species listed on the Birds Directive Annex I and five regularly occurring migratory bird species not listed on Annex I are reported from the area.

15 designated habitat types (cf the Habitat Directive) are present on the site, mainly including bogs, meadows, lakes, alkaline fens and bog woodlands. The site includes the following Habitat Directive Annex II species groups:

- Five mammals
- Two amphibians/reptiles
- Five fishes
- Three invertebrates
- Six plants

Dolina Dolnego Bugu
The Baltic Railway is passing through Dolina Dolnego Bugu.

Dolina Dolnego Bugo is a classified Special Protected Area according to the EU Birds Directive (79/409/EEC).

There are 39 bird species listed on the Birds Directive Annex I and 61 regularly occurring migratory bird species not listed on Annex I are reported from the area.

Ostoja Nadbuźańska
The Baltic Railway is passing through Ostoja Nadbuźańska.

Ostoja Nadbuźańska is a classified Special Area of Conservation according to the EU Habitat Directive (92/43/EEC).

There are 16 designated habitat types (cf the Habitat Directive) present on the site. The site includes the following Habitat Directive Annex II species groups.

- Three mammals (Wolf (*Canis lupus*), beaver (*Castor fiber*))
- Three amphibians/reptiles (Fire-bellied toad (*Bombina bombina*), European pond turtle (*Emys orbicularis*) and Great crested newt (*Triturus cristatus*))
- Ten fish (including brook lamprey (*Lampetra planeri*) and Ukrainian brook lamprey (*Eudontomyzon mariea*))
- Two invertebrates (Large Copper (*Lycaena dispar*) and River mussel (*Unio crassus*))
- Two plants ((*Angelica palustris*) and (*Thesium ebracteatum*))

Bagienna Dolina Narwi
The Baltic Railway is passing through Bagienna Dolina Narwi.

Bagienna Dolina Narwi is a classified Special Protected Area according to the EU Birds Directive (79/409/EEC).

There are 28 bird species listed on the Birds Directive Annex I and eight regularly occurring migratory bird species not listed on Annex I are reported from the area.

Narwienskie Bagna
The Baltic Railway is passing through Narwienskie Bagna.

Narwienskie Bagna is a classified Special Area of Conservation according to the EU Habitat Directive (92/43/EEC).

There are 9 designated habitat types (cf the Habitat Directive) present on the site. The site includes the following Habitat Directive Annex II species groups.

- Two mammals (Beaver (*Castor fiber*) and Otter (*Lutra lutra*))
- Two amphibians/reptiles (Fire-bellied toad (*Bombina bombina*) and Great crested newt (*Tritutus cristatus*))
- Five fish (including Ukrainian brook lamprey (*Eudontmyzon mariea*) and Weather fish(*Misgurnus fossilis*))
- Two invertebrates (Large Copper (*Lycaena dispar*) and False ringlet (*Coenonympha oedippus*))

Recommendations

Missing information

Currently, the proposed new alignments (project package 3 and sub-variant) in Estonia are not defined well enough to allow a detailed assessment of the impact, they may have on the species and habitat types protected by the Natura 2000 sites. Consequently, it must be emphasised that for this specific part of the project this impact assessment remains of a preliminary nature.

It is not possible to make an impact assessment for any part of the proposed new railway line in Estonia (project package 3), due to the fact that physical alignment is still not defined. Not alone does this have consequences for the possible impact on Natura 2000 sites in Estonia, but it is also uncertain how this influences the environment around possible connections with the railway line in Latvia.

This report does not include an assessment of the possible consequences that the project packages (1-3) may have on annex IV species of the EC Habitats Directive. This directive states that any species listed in annex IV must be protected, whether inside or out side a Natura 2000 site border.

In principle, it should be know for each species protected by a Natura 2000 site, what their status is (Endangered, Rare etc.) Only based on this type of detailed information is it possible to judge whether the project will have an effect on each species' favourable conservation status.

Standard Data Forms (SDF) on Natura 2000 sites from Estonia are at present not complete, therefore the basis for carrying out an impact assessment on the selection criteria of the Natura 2000 sites here is at present premature.

EIAs in detailed design projects

EIAs to be conducted, as a part of the detailed design process for preparing individual Rail Baltica projects, must include the detailed information found in the SDFs, as well as necessary, supplementary field work.

In this section, recommendations are given for issues of particular importance to be studied in more detail in the EIAs, which will be conducted in the detailed design projects to be prepared in the process of implementing the Rail Baltica system.

Fragmentation of the Natura 2000 network
The existing railway lines, which may become a part of the Rail Baltica system, do impact designated Natura 2000 sites, as they were constructed through areas with significant natural values, later to be designated as Natura 2000 sites. The environmental effects of the railways in or in the immediate vicinity of Natura 2000 sites should be further studied, in the perspective of having more and faster rail traffic going through these sites, on a regular basis. Also, any construction work, taking place inside Natura 2000 site, must be assessed carefully and a proposal for an Environmental Management Plan governing the construction work should be formulated.

In particular, new or upgraded railways warrant closer assessment in the EIA studies, regarding the aspects of the cumulative effects of more traffic, noise and perhaps habitat fragmentation within Natura 2000 sites, which are crossed by the railway or which lie in the immediate vicinity of the railway.

Also, railway sections, which pass near Natura 2000 sites, may influence the ability for species to move or migrate between the particular Natura 2000 site and neighbouring areas and sites. The principle of ecological corridors has become widely recognized and now forms an official part of the national nature management regulation in Poland and Lithuania. Thus, the EIAs must assess the presence and function of ecological corridors - designated or not designated - for their possible influence on safeguarding species inside the Natura 2000 sites.

Mitigation

A mitigation plan should establish mitigation measures for the possible design of new railway sections, as well as the construction phase and the operational phase.

Design phase

Mitigation measures, for the optimal design of new railway sections, should be based on environmental optimisation and prepared during the planning phase. Obviously, this includes considerations of how it is possible, to the greatest extent possible, to avoid that the railway line passes through protected areas. At this stage, it is also important that, where conflict areas are found, an analysis of the different disadvantages should be made, to ensure that the solving of one issue does not create a new.

Construction phase

Below is given an overview of mitigation measures relevant for the construction phase in SPAs and SCIs (SACs)

SPAs
Choice of construction period: The construction period should - as far as possible - not be carried out during the annex II species breeding period. Disturbance of protected breeding birds may be reduced by avoiding construction works during the breeding seasons of the vulnerable birds. The EIAs for the detailed design projects should include studies to identify specific nesting areas that could potentially be disturbed by construction works, and where construction works activities such as access roads, storage places etc. should be avoided. Possible restrictions of this kind in the construction work periods, should be included as criteria in the tender documents for upgrading of the railway.

SCIs (Potential SACs)
The spatial and temporary extent of construction sites and temporary access roads should be kept to a minimum within protected areas and should - to the extent possible - avoid areas where protected plant species grow. Temporary groundwater lowering should be avoided - or kept to as short periods as possible - in areas where vulnerable and threatened plant species grow. In such cases, the water level must be raised as soon as possible, after the work is completed, in order not to alter the hydrology, and thus the floral composition permanently.

The EIAs, for the detailed design projects, should include mapping of the location of critical occurrences of protected plant species, in the potential construction work areas. Where protected plant species grow alongside the railway, the construction zone should be made as narrow as possible. Instructions in this regards should be included in the tender documents for upgrading the railway.

Special measures should be taken to avoid spills and pollution of the streams. Conditions should be specified in the tender documents for the construction works.

Operational phase

SCIs

The exact location of railway lines may have to be adjusted or modified in order to avoid permanent destruction or diminishing of designated habitat types within Natura 2000 areas. Thus, once the overall alignment has been chosen, and the detailed design projects are under way, the EIA must point out particular vulnerable and threatened parts of the affected Natura 2000 sites and other protected areas, where a adjustment of the precise location of the railway line is necessary.

The risk of increased kills, of less manoeuvrable bird species, may be reduced by establishing protective planting (trees and high scrubs of local species and genotypes) alongside the railway, in connection with upgrading of the Baltic Railway. Bird species, which are vulnerable to collision risks, include the heavy birds such as; swans, herons and bigger birds of prey.

Establishment of fauna passages, where a particular risk of collision with larger animals or threats to vulnerable or rare species, can be mitigated by enabling safe crossings out of level with the railway, should be established. Fauna passages must be tailored to accommodate relevant species for each Natura 2000 site.

Otter and fish passageways should be established, where the railway crosses a river, a canal, a major ditch or a stream, where otters live. In addition to a waterway under the railway, the otter requires under-rail embankments on both sites of the waterway, so that it can walk along the watercourse under the railway. The embankment must be designed in such a way that there are at all times - even at spring-thaw and after heavy rains - at least 0.5 m dry pathway on both sites of the waterway. If there are no dry embankments, the otter will prefer to cross the railway. Experiences from other projects have shown that the establishment of otter passageways in connection with roads and railways are imperative in order to maintain the local conservation status of otters.

Appendix 1

Appendix 1 presents a table summarising information from the Natura 2000 Standard Data Forms (STD). The table is divided into connections (C) and sections (S) as given in the project documents.

The data presented in the table is given for each Natura 2000 site within a 6 km corridor of the railway line, (where the line is known and data is available):

- Proposed action, (i.e. is it an upgrading of an existing railway line or is it the establishment of a new).
- Proximity to Natura 2000 site. Here following categories are used; railway line runs through, railway line runs along and railway line is found within a 6 km corridor.
- Name and Site Code. The name of the Natura 2000 site and the designated Site Code is given.
- Natura 2000 Site indication: I.e. is the site a Special Protection Area (SPA), a Special Area of Conservation (SAC) or a site proposed eligible as a Site of Community Importance (SCI).
- Annex I birds. I.e. birds listed on Annex I of the Birds Directive 79/409/EEC
- (Regularly occurring) Migratory Birds not listed on Annex I of Directive 79/409/EEC
- Annex I Habitat types: Habitat types listed in Annex I of Directive 92/43/EEC
- Annex II Mammals: Mammals listed in Annex II of Directive 92/43/EEC
- Annex II Amphibians and Reptiles: Amphibians and Reptiles listed in Annex II of Directive 92/43/EEC
- Annex II Fishes: Fishes listed in Annex II of Directive 92/43/EEC
- Annex II Invertebrates: Invertebrates listed in Annex II of Directive 92/43/EEC
- Annex II Plants: Plants listed in Annex II of Directive 92/43/EEC

Table H.12 EE: Tallinn - EE/LV border. Project Packages (1) +2

Pro-posed action	Prox-imity to Natura 2000 site	Name & Site Code	Natura 2000 Site indica-tion[1]	Annex I Birds	Migrat-ing birds (not listed on an-nex I)	Annex I Habitat types	Annex II Mammals	Annex I Amphibi-ans and Reptiles	Annex II Fishes	Annex II Invertebrates	Annex II Plants
Up-grade	W3	Anija EE0010109	SCI			No data	No data	No data	No data	No data	No data
Up-grade	Along	Korvemaa	SPA/ SCI	No data	No data	No data	No data	No data	No data	No data	No data
Up-grade	W3	Ohepalu EE0020205	SPA/ SCI	No data	No data	No data	No data	No data	No data	No data	No data
Up-grade	Along	Äntu EE0060212	SCI			No data	No data	No data	No data	No data	No data
Up-grade	Through	Seljamäe EE0060211	SCI			No data	No data	No data	No data	No data	No data
Up-grade	W3	Endla EE0080172	SPA/ SCI	No data	No data	No data	No data	No data	No data	No data	No data
Up-grade	Along	Mustallika EE0080109	SCI			No data	No data	No data	No data	No data	No data
Up-grade	W3	Vooremaa Järved EE0080110	SCI			No data	No data	No data	No data	No data	No data
Up-grade	Along	Vapramäe EE0080309	SCI			No data	No data	No data	No data	No data	No data
Up-grade	Through	Elva-Vitipalu	SCI			No data	No data	No data	No data	No data	No data
Up-grade	Along	Otepää	SPA/ SCI	No data	No data	No data	No data	No data	No data	No data	No data

Table H.13 EE: Tallinn - EE/LV border. Project Packages 3 - New - alignment not known / EE/LV border - Riga Project Packages 1+2

Pro-posed action	Proximity to Natura 2000 site	Name & Site Code	Natura 2000 Site indica-tion[1]	Annex I Birds	Migrating birds (not listed on annex I)	Annex I Habitat types	Annex II Mammals	Annex I Amphibians and Rep-tiles	Annex II Fishes	Annex II Invertebrates	Annex II Plants
Upgrade	Along	Sedas purvs LV0526800	SPA/ SCI	30	3	5	1355 Lutra lutra	-	-	1042 Leucorrhinia pector-alis	-
Upgrade	Through	Ziemelgauja LV0600700	SPA / SCI	29	-	19	1355 Lutra lutra 1318 myotis dasycneme	1166 Tritu-rus cristatus	1099 Lampetra fluviatilis 1106 Salmo salar 1130 Aspius aspius 1134 Rhodeus sericeus amarus 1149 Cobitis taenia 1163 Cottus gobio	4	2
Upgrade	Through/ Along	Gaujas na-cionalais parks LV0200100	SPA / SCI	29	2	26	1355 Lutra lutra 1354 Ursus arctos 1318 Myotis dasycneme	1166 Tritu-rus cristatus	1095 Petromyzon marinus 1096 Lampetra planeri 1099 Lampetra fluviatilis 1103 Alosa fallax 1106 Salmo salar 1130 Aspius aspius 1149 Cobitis taenia 1163 Cottus gobio	1029 Margaritifera Margari-tifera 1032 unio crassus 1037 Ophiogiomphus Cecilia 1042 Leucorrhinia pector-alis 1052 Euphydryas maturna 1082 Graphoderus bilinea-tus 1084 Osmoderma eremite 1926 Stephanopachys linearis	6
Upgrade	Through	Melturu sils LV0527800	SCI	-	-	2	-	-	1099 Lampetra fluviatilis	1029 Margaritifera Margari-tifera	-
Upgrade	Through	Garkalnes mezi LV0527400	SPA / SCI	11	-	2	-	-	-	-	1

Table H.14 EE/LV border - Riga Project Package 3

Pro-posed action	Proximity to Natura 2000 site	Name & Site Code	Natura 2000 Site indica-tion[1]	Annex I Birds	Migrating birds (not listed on annex I)	Annex I Habitat types	Annex II Mammals	Annex I Amphibians and Reptiles	Annex II Fishes	Annex II Invertebrates	Annex II Plants
New	Along	Randus plavas LV0509100	SPA / SCI	14	2	11	1355 Lutra lutra	-	1099 Lampetra fluviatilis	-	1
New	Through	Salacas ieleja LV0302200	SPA / SCI	11		14	1355 Lutra lutra 1318 Myotis dasycneme	-	1095 Petromyzon marinus 1096 Lampetra planeri 1099 Lampetra fluviatilis 1103 Alosa fallax 1106 Salmo salar 1134 Rhodeus sericeus amarus 1149 Cobitis taenia 1163 Cottus gobio 2522 Pelecus cultratus	1013 Vertigo geyeri 1014 Vertigo angustior 1032 unio crassus 1037 Ophiogomphus Cecilia 1042 Leucorrhinia pectoralis 1084 Osmoderma eremite	2
New	W3	Vitrupes ieleja LV0530500	SCI	5	-	4	-	-	-	1015 Vertigo genesii 1032 unio crassus 1060 Lycaena dispar 4058 Helicigona lapicida	-
New	W3	Vidzemes ak-menaina jurmala LV0508600	SCI	8	-	13	1355 Lutra lutra	-	1099 Lampetra fluviatilis	-	1

Pro-posed action	Proximity to Natura 2000 site	Name & Site Code	Natura 2000 Site indica-tion[1]	Annex I Birds	Migrating birds (not listed on annex I)	Annex I Habitat types	Annex II Mammals	Annex I Amphibians and Reptiles	Annex II Fishes	Annex II Invertebrates	Annex II Plants
New	Along	Piejura LV0301700	SPA / SCI	8	-	12	1355 Lutra lutra	-	1095 Petromyzon marinus 1099 Lampetra fluviatilis 1103 Alosa fallax 1106 Salmo salar 1130 Aspius aspius 1134 Rhodeus sericeus amarus 1149 Cobitis taenia 1163 Cottus gobio 2522 Pelecus cultratus	1060 Lycaena dispar	2

Table H.15 LV: Riga - LV/LT border Project packages 1+2+3

Pro-posed action	Proximity to Natura 2000 site	Name & Site Code	Natura 2000 Site indica-tion[1]	Annex I Birds	Migrating birds (not listed on annex I)	Annex I Habitat types	Annex II Mammals	Annex I Amphibians and Reptiles	Annex II Fishes	Annex II Invertebrates	Annex II Plants
LV: Riga - LV/LT border Project packages 1+2+3											
Upgrade	W3	Melna ezera purvs (234) LV0528700	SPA	12	2						
Upgrade	W3	Lielupes palienes plavas (192) LV0523100				Missing SDF					
LV: Riga - LV/LT border Project package 2- sub-var.											
New	W3	Dolessala LV0301900	SCI			3	1355 Lutra lutra	-	-	1084 Osmoderma eremit	1477 Pulsatilla patens
New	W3	Bauska (39) LV0304100	SCI			3	-	-	1099 Lampetra fluviatilis 1130 Aspius aspius 1149 Cobitis taenia 1163 Cottus gobio	-	-

Table H.16 LV/LT border - Kaunas Project packages 1+2+3

Pro-posed action	Proximity to Natura 2000 site	Name & Site Code	Natura 2000 Site indica-tion[1]	Annex I Birds	Migrating birds (not listed on annex I)	Annex I Habitat types	Annex II Mammals	Annex I Amphibians and Reptiles	Annex II Fishes	Annex II Invertebrates	Annex II Plants
New	Through	Geduiunu miskas LTpakb002	SPA	13	-	-	-	-	--	-	-
New	Along	Labunavos miskas LTked0001	SCI	-	-	-	-	-	-	1052 Euphydryas maturna 1059 maculinea teleius 1060 Lycaena dispar	-
New	Through	Neries upe LTvin0009	SCI	-	-	1	1355 Lutra lutra	-	1106 Salmo salar 1130 Aspius aspius 1149 Cobitis taenia 1163 Cottus gobio	1037 Ophiogomphus cecilia	-
New	Along	Kauno marios LTkaub008	SPA	14	-	-	-	-	-	-	-
New	Along	Kauno marios LTkaub0007	SCI	-	-	8	1355 Lutra lutra 1318 Myotis dasycneme	-	1130 Aspius aspius	1084 Osmoderma eremite	-

Table H.17 LV/LT border - Kaunas Project package 2- sub-var.

Pro-posed action	Proximity to Natura 2000 site	Name & Site Code	Natura 2000 Site indica-tion[1]	Annex I Birds	Migrating birds (not listed on annex I)	Annex I Habitat types	Annex II Mammals	Annex I Amphibians and Reptiles	Annex II Fishes	Annex II Invertebrates	Annex II Plants
New	Along	Lepsines miska LTpas0001	SCI	-	-	2	-	-	-	-	-
New	W3	Pasiliu pelke LTpan0005	SCI	-	-	-	-	-	-	1065 Euphydryas aurinia	-
New	Through	LTvin0009									
New	Along	LTkaub008									
New	Along	LTkaub0007									

Table H.18 Kaunas - Trakiszki Project package 1+2+3

Pro-posed action	Proximity to Natura 2000 site	Name & Site Code	Natura 2000 Site indica-tion[1]	Annex I Birds	Migrating birds (not listed on annex I)	Annex I Habitat types	Annex II Mammals	Annex I Amphibians and Reptiles	Annex II Fishes	Annex II Invertebrates	Annex II Plants
New	W3	Kamsos miskas LTKAU0003	SCI			-	-	-	-	1086 Cucujus cinnaberinus	
New	W3	Roku fortas LIKAU0012	SCI			-	1308 Barbastella barbastellus 1318 Myotis dasycneme				
New	Through	Nemuno upes pakrantes ir salos tarp Kulautuvos ir Smlininku LIKAUB001	SPA	3	-						

Table H.19 Trakiszki - Bialystok (Poland) Project packages 1+2+3

	Proximity to Natura 2000 site	Name & Site Code	Natura 2000 Site indication[1]	Annex I Birds	Migrating birds (not listed on annex I)	Annex I Habitat types	Annex II Mammals	Annex I Amphibians and Reptiles	Annex II Fishes	Annex II Invertebrates	Annex II Plants
Trakiszki - Bialystok (Poland) ***Project packages 1+2+3***											
Upgrade	W3	Puszcza Knyszyńska PLB 200003	SPA	37	-						
Upgrade	W3	Ostoja Knyszyńska PLH 20006				Missing SDF					
Upgrade	Through	Dolina Biebrzy PLC 200001	SPA / SCI	38	5	15	1308 Barbastella barbastella 1318 Myotis dasycneme 1337 Castor fiber 1352 Canis lupus 1355 Lutra lutra	1166 Triturus cristatus 1188 Bombina bombina	1130 Aspius aspius 1134 Rhodeus sericeus amarus 1145 Misgurnus fossilis 1149 Cobitis taenia 2484 Eudontomyzon mariae	1052 Hypodryas maturna 1060 Lycaena dispar 4038 Lycaena helle	3
Upgrade	Through	Dolina Dolnego Bugu PLB 140001	SPA	39	61	-	1337 Castor fiber 1355 Lutra lutra	1188 Bombina bombina 1220 Emys orbicularis	1124 Gobio albipinnatus 1130 Aspius aspius 1134 Rhodeus sericeus amarus 1145 Misgurnus fossilis 1146 Sabanejewia aurata 1149 Cobitis taenia 1163 Cottus gobio	-	3

	Proximity to Natura 2000 site	Name & Site Code	Natura 2000 Site indication[1]	Annex I Birds	Migrating birds (not listed on annex I)	Annex I Habitat types	Annex II Mammals	Annex I Amphibians and Reptiles	Annex II Fishes	Annex II Invertebrates	Annex II Plants
Trakiszki - Bialystok (Poland) ***Project packages 1+2+3***											
Upgrade	Through	Ostoja Nadbużańska PLH 140011	SCI			16	1337 Castor fiber 1352 Canis lupus 1355 Lutra lutra	1166 Triturus cristatus 1188 Bombina bombina 1220 Emys orbicularis	1124 Gobio albipinnatus 1096 Lampetra planeri 1130 Aspius aspius 1134 Rhodeus sericeus amarus 1145 Misgurnus fossilis 1146 Sabanejewia aurata 1149 Cobitis taenia 1163 Cottus gobio 2484 Eudontomyzon mariae 4009 Phoxinus percnurus	1032 Unio crassus 1060 Lycaena dispar	2
Upgrade	Through	Bagienna Dolina Narwi PLH 200001	SPA	28	8	-	-	-	-	-	-
Upgrade	Through	Narwianskie Bagna PLH 200002	SCI			9	1337 Castor fiber 1355 Lutra lutra	1166 Triturus cristatus 1188 Bombina bombina	1130 Aspius aspius 1134 Rhodeus sericeus amarus 1149 Cobitis taenia 2484 Eudontomyzon mariae 1145 Misgurnus fossilis	1060 Lycaena dispar 1071 Coenonympha oedippus	-

NB: All sites eligible for identification as Sites of Community Importance (SCIs) are only proposed and not confirmed.