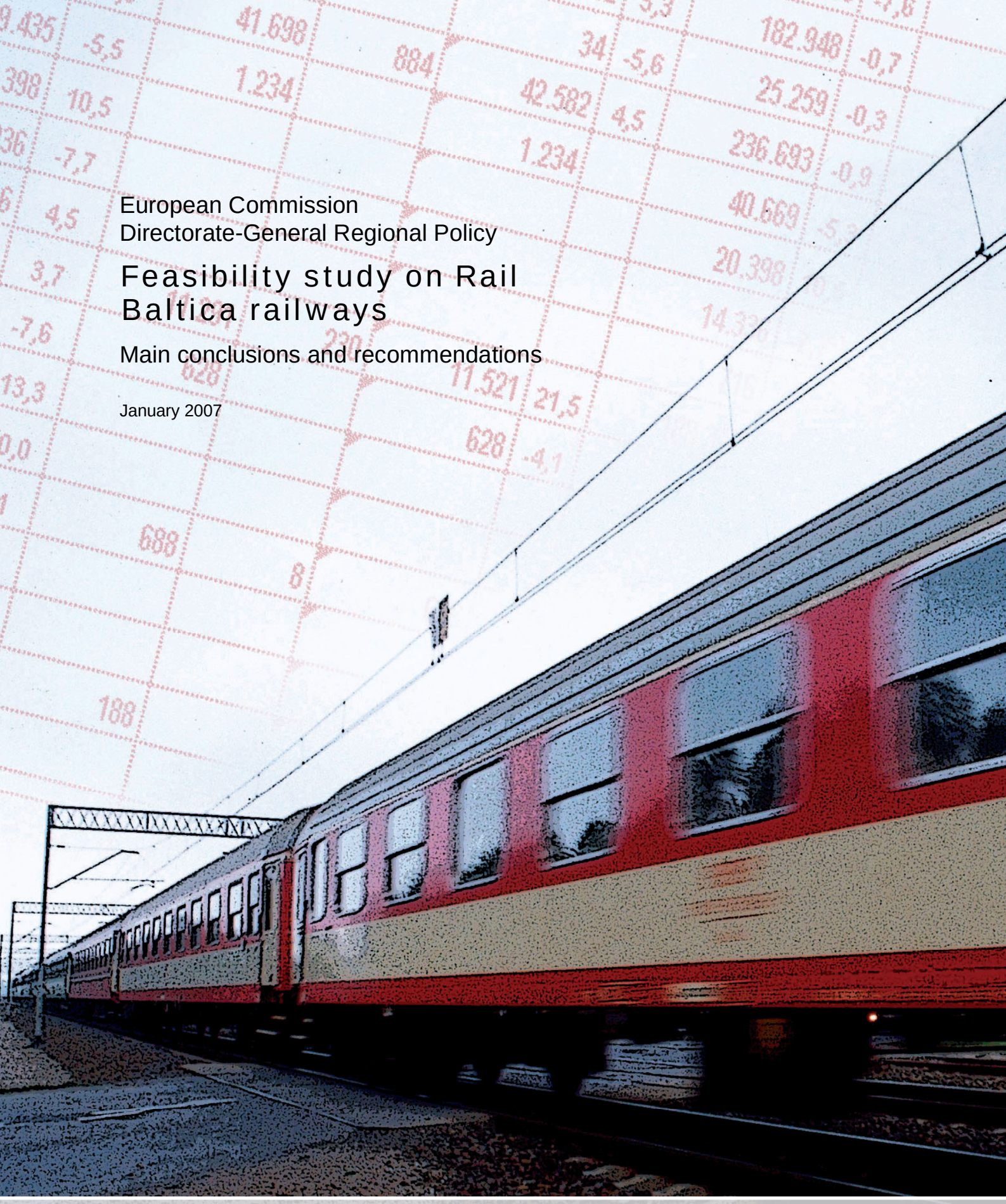

European Commission
Directorate-General Regional Policy

Feasibility study on Rail Baltica railways

Main conclusions and recommendations

January 2007

COWI

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1 Main conclusions and recommendations

A strategic study of the Rail Baltica railways has been conducted in the period November 2005 - December 2006 on the request of the European Commission, Directorate-General Regional Policy. The objective of the pre-feasibility study has been to assess strategically the overall need and potential for developing Rail Baltica and to provide recommendations for project implementation of the most suitable development option in terms of alignment, technical standards and organisation.

The concept of Rail Baltica refers to the imaginative, strategic and sustainable north-south rail project connecting Tallinn in Estonia - via Latvia and Lithuania - with Warsaw in Poland. Despite the fact that Rail Baltica is one of the TEN-T priority projects, it has become clear that very little specific planning and analysis has been made for the project in the countries.

Other ongoing studies are also addressing issues of relevance for making decisions on the development of Rail Baltica, such as the EC INTERREG IIIB study "*Rail Baltica – Transnational Integration through Coordinated Infrastructure and Regional Development".* The goals are to analyse the Rail Baltica railway link in terms of spatial planning and regional development and to raise the awareness in the Baltic Sea region of the benefits of attractive railway connections.

1.1 Rail Baltica - policy and planning context

Rail Baltica is identified as priority project no. 27 of the Trans-European Transport Network in Europe as specified in the Decision number 884/2004/EC amending the Community guidelines for the development of the TEN-T. This Decision was adopted by the European Parliament and the Council in April 2004. Rail Baltica is part of the Corridor I, which also consists of Via Baltica (road component) and Branch A to Kaliningrad (Via Hanseatica).

Presently, the Baltic States make little use of rail transport for north-south bound international passenger and freight transport. The existing north-south network is of poor quality. The level of service and the speed is low and there are barriers for interoperability with the rest of the EU due to differences in standards, especially different gauges.

A vision and strategy for the Baltic Sea region was elaborated by the countries in the region in the early 1990s and the idea of Rail Baltica first appeared in 1994 in the joint political document *Vision and Strategies around the Baltic Sea 2010* as an important element for spatial development in the Baltic Sea region. The latest update of the document was made in 2001. Later, on 15 September 2003 the Rail Baltica Co-ordination Group (representing Poland, Lithuania, Latvia and Estonia) agreed on the key aspects to be considered in future studies of Rail Baltica investments. And most recently, a *Declaration of Intent* was signed on 27 March 2006 by the transport ministers of the four project countries and Finland.

The main idea behind Rail Baltica is to develop high-quality connections for passenger and freight transport between the Baltic States and Poland, as well as between the Baltic States and other EU countries through the hub Warsaw. Improved rail lines will result in more efficient land-bound connections between the Baltic and the Nordic countries (particularly Finland) and in the long run potentially further to Central Asia. Improved rail links will benefit the environment, contribute to alleviate congestion on the European road network, increase the accessibility of the Baltic States and potentially improve conditions for accelerated regional development in the countries involved.

A good and cost-effective transport system is a pre-condition for maintaining high economic growth and improving the European integration.

1.2 Economic development and future demand for transport

The project countries have presently high levels of economic growth due to i.a. the increased economic integration with the rest of the EU and, consequently, the transport sector experiences a rapid growth in traffic.

The future size of and type of demand for transport depends, on the one hand, on the economic and demographic development in both the Rail Baltica countries and the other European countries and, on the other hand, on the type and quality of transport services provided. The supply of services is linked to i.a. the investments made in the transport sector and the European policy framework with regard to financing/charging, harmonisation, environmental sustainability and regional development.

The overall future demand for transport is estimated in a complex European trade and traffic model forecasting system including the whole of Europe. The future north-south rail traffic in the Baltic States is related to the overall demand for transport, but very specifically to the transport services which can be offered. The future demand for rail services on Rail Baltica is analysed for a situation without real improvements of the rail infrastructure in the north-south corridor compared to today[1]. Traffic analyses are then made for specific devel-

[1] The remaining transport infrastructure is assumed to be improved according to existing investment plans in the countries. This is called the *reference situation*

opment options/investment packages to calculate the change in traffic patterns when implementing these options.

1.3 Range of development options

The outline plan for the Trans-European Transport Network provides an indicative routing of a Rail Baltica corridor and forms the basis for identifying possible alignments for Rail Baltica. A number of alignment options and technical development options have been discussed in the countries, and together the combinations make up more than 20 development options.

A screening of the combinations of options was conducted considering the following criteria: preliminary investment cost estimates, preliminary assessment of traffic potential, environmental issues and the need to consider both Russian and European gauge standard solutions. Three main investment packages were selected for economic and financial analysis.

1.3.1 Package 1: Design speed of minimum 120 km/h

Package 1 represents a solution, which secures a minimum design speed of 120 km/h from Tallinn to Warsaw.

The package describes a situation where Russian standards are maintained in Estonia, Latvia and Lithuania - except from the section from Kaunas to the Lithuanian/Polish border where a new line with European standards (not electrified) is constructed according to already agreed standards. The package includes the construction of a 185 km partly new and more direct line from Joniskis via Radviliskis to Kaunas. Alternatively, the existing line could be upgraded/extended. This option is considered a sub-variant in Package 1.

This package requires that a re-loading station or logistics centre be established in the Kaunas region.

Figure 1.1 Graphical presentation of Package 1

Note: The section from Kaunas to the Polish/Lithuanian border is not electrified in Package 1.

1.3.2 Package 2: Design speed of minimum 160 km/h

The second package reflects a rather ambitious plan for implementing Rail Baltica. It includes a north-south connection providing a design speed of at least 160 km/h.

The package also includes the construction of a new line from Kaunas to the Lithuanian/Polish border based on European standards (not electrified). It requires that a re-loading station or logistics centre be established in the Kaunas region.

The main option includes the construction of a new and more direct line from Joniskis via Radviliskis to Kaunas, but as for Package 1, a sub-variant is considered, based on upgrading of the existing line between these cities.

Another sub-variant is also considered where a new line is constructed from Riga - via Bauska and Panevezys - to Kaunas.

Figure 1.2 Graphical presentation of Package 2

Note: The section from Kaunas to the Polish/Lithuanian border is not electrified in Package 2.

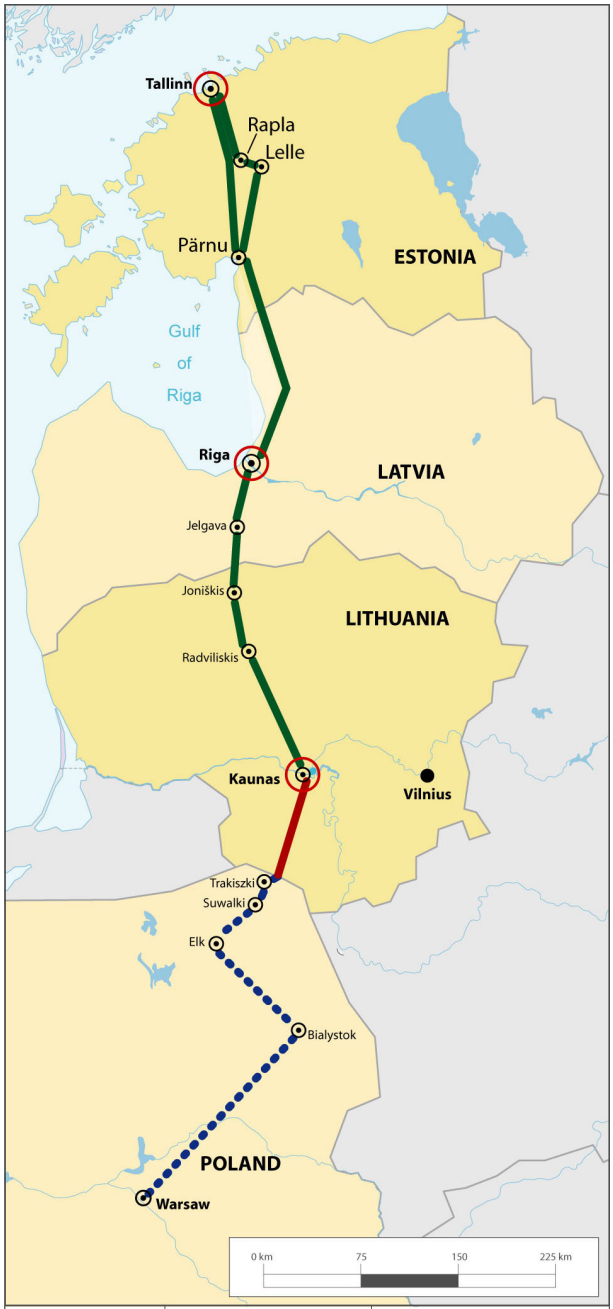
1.3.3 Package 3: European gauge standard

The third package reflects the most ambitious plan for implementing Rail Baltica. The package is based on the European gauge standard on all north-south sections.

The alignment between Tallinn and Riga will run via Pärnu (the shortest route), while the section between Riga and Kaunas will run via Radvilikis (the shortest route). From Kaunas to the Lithuanian/Polish border a new line is constructed with a design speed of 200 km/h. The Polish part of the link (via Elk) is upgraded to 160 km/h and the section from Bialystok to the Lithuanian/Polish border is electrified.

Investment package 3 includes 2 sub-variants. One variant is to construct a new line via Lelle/Pärnu instead of a direct link from Tallinn to Pärnu, while the second sub-variant considers the consequences of no further electrification.

Figure 1.3 Graphical presentation of Package 3



Note: The section from Kaunas to the Polish/Lithuanian border is electrified in Package 3. The second sub-variant is no electrification north of Bialystok.

1.4 Analysis of three investment packages

The three investment packages have been analysed with respect to the consequences for passenger and freight transport and compared to a situation without investments in the Rail Baltica corridor, the *reference situation*. The financial and economic feasibility of the packages compared to the reference situation has been assessed and an environmental screening performed.

1.4.1 Traffic analysis

Traffic has been modelled for a network covering the EU and the surrounding countries to the East such as Belarus and Russia. Hence, the effects of improving the infrastructure of the Rail Baltica are analysed for the whole network.

Passenger traffic
The current passenger transport flows have the following characteristics:

- Particularly in Latvia and Estonia, the market share of the rail mode is at a remarkably low level
- International rail passenger transport flows along the Rail Baltica corridor are negligible and road transport is predominant
- The only section of Rail Baltica with a substantial passenger rail flow is the line between Warsaw and Bialystok

The implementation of investment package 1 is expected to increase the passenger transport flows along the Rail Baltica corridor, which is induced both by modal shifts and by changes in the route choice. Furthermore, the implementation of investment package 1is expected to result in a moderate increase in the passenger demand on the lines feeding the Rail Baltica corridor, such as Liepaja – Jelgava or Klaipeda – Siauliai. The impacts in the southern part of Rail Baltica are more prominent than in the northern part of the corridor. One reason for this is that the section Tartu – Tallinn is expected to be upgraded, independently of the investment options under examination. In 2034 around 1.9 million passengers per year are expected between Bialystok and Elk, 1.2 million are expected to be carried across the Polish/Lithuanian border, while 1.5 million passengers per year are forecasted on the new line between Kaunas and Radviliskis.

The investments of package 2 are expected to result in a further increase in demand in the southern part of the Rail Baltica corridor. On the new line between Kaunas and Radviliskis, the annual passenger transport volume is expected to amount to 1.6 million passengers per year in 2034.

The forecasted passenger transport volumes on Rail Baltica for investment package 3 tend to be slightly lower than in investment package 2. Relatively modest rail passenger volumes are expected on the new rail link Riga – Pärnu – Tallinn. The forecasted passenger volumes on these sections amount to 0.3 to 0.5 million passengers per year in 2034.

Freight traffic
Although being relatively small countries in size, density and economy compared to other EU countries and neighbours, the Baltic States' networks accommodate significant flows of international and transit freight traffic. In this respect, Poland serves to a major extent as transit country for Baltic goods flows to and from the rest of the EU25 and non-EU countries in the south-eastern part of Europe. Generally, large rail freight flows in the countries are strongly oriented in the east-west direction (except in Estonia).

The implementation of investment package 1 shows that a moderate shift of approximately 1.5 million tonnes from road to rail can be expected in the future.

The implementation of investment package 2 will only slightly improve the operational speeds of freight trains compared to the speeds of investment package 1, as the freight trains can only to a limited degree make use of the potential for higher speeds. The Rail Baltica traffic will in some sections share the tracks with quite intensive east-west traffic, which goes towards the Baltic ports. The transport flows generated in investment package 2 are to a large extent similar to that of investment package 1.

The railway network after implementation of investment package 3 is different, because the whole Rail Baltica line will have the same gauge standard and much transshipment of goods will be avoided. The operational speed will be relatively high and the alignment will be more direct. With a properly functioning Rail Baltica freight train service (i.e. premium trains) more than 4 million tonnes could be shifted from road to rail. With implementation of a competitive pricing policy the effect could be even higher. Finland-bound traffic could be one of the major candidates for this additional modal shift.

1.4.2 Investment costs

The infrastructure costs of implementing Rail Baltica are shown below. The table shows the estimated investment costs (construction, necessary equipment, acquisition), which are considered absolutely necessary for the implementation of the three main investment packages and investment package 3 without further electrification. The cost estimates do not include the costs of reconstruction in cities or new terminals as such works will be part of larger schemes with much wider aims than that of Rail Baltica. Furthermore, the capital costs of rolling stock are included as a capital cost element of rolling stock and not as part of the infrastructure investment costs below.

Table 1.1 Infrastructure investment costs (million €, 2006 price level)

	Package 1	Package 2	Package 3	Package 3 without electrification
Investment costs	979	1,546	2,369	1,830

Note: VAT and taxes are not included.

The cost assessment shows that the costs of electrification account for a rather large share of the costs for implementing package 3. Upgrading of the existing line in Lithuania north of Kaunas compared to the construction of a new line will reduce the investment costs by about €150 million.

Given that the project is in the early stage of the planning process and few details therefore are available on the investment packages, the assessment is subject to large uncertainties.

The pure construction costs are expected to remain relatively constant in real prices over time, but the costs for land acquisition are highly uncertain due to a number of factors, including uncertainties about the future legislation on expropriation. The cost assessment shows, however, that the costs of land only account for a minor share of total investment costs.

1.4.3 Financial and economic assessment

Both the financial and economic viability of the investment packages has been analysed. The analyses have been carried out as an incremental analysis, i.e. an evaluation of the investment packages compared to the reference scenario. The assessments cover all four countries as a whole and include all effects on the entire rail network in the four countries and thus not only the affects on the Rail Baltica line.

The **financial analysis** gives an overview of the financial flows of investment, the operating costs and the revenues over the lifetime of the project and it calculates the financial internal rate of return on the total investment (FIRR/C) and the own capital (FRR/K) assuming that the EU grants equal 60% of the total investments costs. The financial analysis focuses on the costs and revenues from the perspective of the following three agents:

1 The infrastructure manager

2 The operator of passenger trains

3 The operator of freight trains

Table 1.2 Results of the financial analysis (NPV in million €)

	Inv. package 1	Inv. package 2	Inv. package 3
Rail manager			
Financial NPV (FNPV)	-10	-109	-274
FIRR on own capital (FRR/K)	4.7%	3.4%	2.6%
Rail operator, passengers			
Financial NPV (FNPV)	-26	-105	-96
Rail operator, freight			
Financial NPV (FNPV)	33	39	70

Note: The financing gap is in all packages higher than 60% of investment costs. No firm estimate of a likely EU contribution is available, but 60% are considered a realistic assumption.

The financial analysis shows a mixed picture where none of the investment packages are dominating. The different financial perspectives are consequently associated with different investment package preferences.

Compared to the main result of investment package 3, the sub-variant without electrification improves the financial result of the rail manager to an IRR of 3.4%.

With the current assumptions and traffic analyses, none of the investment packages seem to be financially viable for the rail manager assuming funding from EU grants equal to 60% of the total investments costs, so the funding gap is in all packages more than 60% of the investment costs. From the rail manager's perspective, investment package 1 is the most attractive option, while investment package 3 is the least attractive option. A higher revenue from access charges in packages 2 and 3 compared to package 1 cannot outweigh the higher investment costs.

For the rail operator running passenger trains none of the investment packages or sub-variants are financially viable. This means that additional public subsidies will be required to sustain the passenger services, which the traffic demand analyses anticipate. Investment package 1, however, gives the lowest net loss.

All investment package variants are financially viable for the rail operator running freight trains. Most profitable is investment package 3 and least attractive is investment package 1. However, taking into account the considerable uncertainty, the results are almost identical for the three main investment packages.

It should be stressed that the above conclusions heavily depend on the applied assumption that the fares and infrastructure access charges are kept at current levels in real prices. Furthermore, there is uncertainty about the rail manager's actual maintenance costs and the operator's actual operation and maintenance costs.

The **economic analysis** encompasses more than just the considerations of the financial returns of the project, such as user benefits and external costs (air pol-

lution, CO_2 emissions and accidents), but most of the project data on costs and benefits are provided by the financial analysis. The economic results of the cost-benefit analysis are presented in terms of the net present value (NPV), the internal rate of return (IRR) and the benefit-cost ratio (B/C ratio).

Table 1.3 Results of the economic analysis (NPV in million €)

	Inv. package 1	**Inv. package 2**	**Inv. package 3**	**Inv. package 3 without electrification**
Economic NPV	1,044	1,304	1,496	1,856
Economic IRR	13.3%	10.8%	9.0%	10.9%
B/C ratio	2.8	2.3	1.9	2.5

The economic analysis shows that all three investment packages are economically beneficial.

Measured as NPV, package 3 has the best result, followed by package 2 and finally package 1. When looking at the IRR and the B/C ratio, however, the best result is obtained for package 1, then package 2 and finally package 3. However, if electrification is not a part of package 3, the calculated internal rate of return will be at the same level as for package 2.

Hence, the most preferable solution will depend on the available investment capital and the return on alternative investments.

The largest benefit of the investments is time savings for passengers. The applied values for time savings follow the recommendations made in recent EU research, but are high compared with the values normally used in the countries. If such national values are applied, the economic feasibility of all packages will be *significantly reduced,* but the packages will still be economically viable (IRRs for the three packages are 7.7%, 5.3% and 6.3%, respectively).

Time savings for freight and an increased revenue from rail fares for the rail operators are also substantial benefit contributors.

The time savings for passengers in packages 1 and 2 are valued to more than the investment costs. The times savings for freight add to the benefit in all packages. However, especially in package 3, the time savings for freight are high, due to the reduced waiting time for transhipment between the Russian and European gauge.

The increased revenue for the rail operator is caused by an increase in the number of passenger-km and tonnes-km and an increase in the fares. The increase in revenues is not accompanied by a similar reduction in the fares for the transport users.

The effects on external costs are of limited size. All three packages have a positive net benefit from externalities, which both comes from savings as a result of fewer road accidents and reduced air pollution. Finally, there is a small net benefit from reduced CO_2 emissions.

1.4.4 Environmental assessment

From an environmental perspective, any infrastructural development option, which includes 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 (package 3) that will have the greatest impact. Establishing a railway line along the existing tracks will have less impact, while the upgrading of an existing railway line will have the least impact. (In certain instances, an upgrading can even improve the living conditions of certain species.)

All investment packages will, on the other hand, reduce air pollution and CO_2 emissions from transport due to the shift from road to rail.

It can be concluded that environmental constraints can potentially be a main barrier for implementing some parts of Rail Baltica, but that paying sufficient 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".

Strategic environmental assessments 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.

1.5 Recommended development and investment strategy

Economic results

All three investment packages are considered economically - but not financially - feasible. None of theme is clearly dominant, although package 1 provides the highest return on investments and must be considered the economically most robust option. So strategically, it *has to be decided if the development of Rail Baltica shall be implemented by improving and modernising the existing broad gauge system or as a new independent rail system with European gauge*.

The economic results point in the same direction for all three main investment packages and the IRRs are almost at the same level. Package 1 has a moderately higher IRR than packages 2 and 3 without electrification, and the two latter ones have IRRs at the same level. Therefore, it is strongly recommended to

consider if electrification in package 3 could be excluded and a decision on this matter be postponed until electrification is considered more broadly for the rail networks in the countries.

Financial considerations
There are clear limitations on the funding available for investments in Rail Baltica from both national budgets, from the Cohesion Fund and the TEN-T budget in the coming period 2007-2013. Furthermore, railway infrastructure investments in Europe have, in general, had difficulties in attracting private risk capital due to the often large uncertainty associated with these investments. Rail Baltica is not assessed to be a realistic candidate in the short to medium term for involving private capital to take on revenue risks. The willingness and ability to commit the necessary public funds for investments in Rail Baltica in the coming years are a key factor.

In order to improve the financial situation for both rail operators and rail infrastructure managers, it is - independently of the choice of investment option - recommended to carry out specific analyses to assess if present rail access and rail tariffs are optimal for infrastructure managers, rail operators and users, respectively.

Rail passenger operations may not be financially feasible, so in order to realise the estimated increase in rail transport, the countries need to have the will to subsidise the operators within the current EU legislation framework.

Dual gauge operations
The main advantages of a European gauge solution is the interoperability and compatibility with the European network, which will increase the potential for transport market liberalisation and the availability of infrastructure components at more competitive prices.

The main disadvantages of a European gauge solution is that it will become an "isolated system" in the national networks and it will be incompatible with the important freight transport from outside the EU and with the main part of the national networks. Dual gauge operations in national networks servicing both conventional freight and passenger transport are avoided in other countries for both cost and operational reasons, so experience with such dual systems are limited and they will not facilitate the optimisation of operations.

The interoperability with the existing network could be improved by establishing additional reloading stations or logistics centres similar to that in the Kaunas region. Costs arising from operating a dual system are complicated to assess at an overall level, but are probably underestimated in the analyses, especially in relation to logistic centres.

Management and organisation
The four project countries have well established co-ordination arrangements, so there is a basis for creating a coherent management structure for the implementation of agreed development plans.

Joint development is mandatory for the implementation of especially package 3, which requires very detailed coherent planning and management among the countries to agree on all technical specifications and alignments - and, very importantly, on the timing for the construction of the various sections, which also means close coordination on financing plans. The trans-national management is recommended to be done in a dedicated organisational structure involving staff from all involved countries. Such a structure needs to be guided by a policy committee, which has the power to make the necessary decisions in the process.

The requirements for integrated planning and financing will be considerably lower when developing packages 1 and 2 compared to package 3, as sections in these packages can be developed more independently, as long as clear long-term goals for the north-south line are agreed.

The first recommended step is to agree on:

- a plan for the detailed feasibility studies, environmental impact studies etc, which need to be carried out
- a process for making decisions

Furthermore, a strong focus is recommended on maintaining or improving the attractiveness of north-south rail transport in the coming 5-10 years' developing period in order to ensure that there is a good basis for utilising the investments made in Rail Baltica when they are completed.

Risk issues
The following issues are considered the most important risks elements, which can influence both investment costs and timing:

- Investment costs escalation is a major risk
- Traffic demand is a major risk
- Lack of experience with dual gauge operations
- Environmental risks may be high
- National planning risks may be high
- Trans-national co-ordination risk may be high
- Lack of funding may also be a risk issue

Generally, all types of risks increase from package 1 to package 2 and again from package 2 to package 3, due to the increase in the scale and complexity of the options.

1.6 Implementation of development strategy

Choice of action
As no development option is dominant in economic terms, a trans-national agreed strategy for development of and investing in Rail Baltica needs to balance:

- The economic efficiency of investments
- Funding constraints
- The risk awareness
- The technical consistency within rail networks
- The transport and regional policy priorities
- Environmental considerations

The least costly investment package (1) has the highest IRR and B/C ratio and it is assessed to be the most robust solution, which can be developed further over time in pace with the development in the demand. Furthermore, it is the fastest and least complicated option to implement, but it will offer limited benefits to freight transport.

The most ambitious and costly package (3) is assessed to be the option, which has the highest risks on all parameters, but it is also the option, which has the highest ability to divert freight transport from road, and if more restrictions on road transport are introduced in the future, it provides the best solution to deal with this.

A successful implementation of any of the analysed development options will be a means to realise a long-term development vision: *to change Rail Baltica from an imaginative and policy-driven European project to a strategic and sustainable, but pragmatic north-south rail corridor providing cost-effective transport services for the countries involved in pace with the development of the demand for such services.*

In order to maintain the north-south railway connection as a realistic transport option in the short to medium term, it is recommended that investments are made as fast as possible.

Combining the robustness in economic and financial terms with the financial constraints and the risk profiles, investment package 1 or its sub-variant seem to be a sound choice, which can be further developed over time in pace with the growth in traffic.

Implementation
Implementation of the preferred investment package can naturally be made in different ways depending on the preferred tender strategy and the management capacity in the countries. It is assessed that implementation plans for the three investment packages will be in the range of minimum 4 years and up to 8.5 years after the delivery of this feasibility report, say 1 January 2007. This will

of course require that no time be wasted in the planning processes, so the suggested timing range is likely to be optimistic.

The main uncertainties are related to the length of the various periods where decisions have to be made by the national governments and the European Commission, and to the capacity to manage many activities at the same time. The construction phase will obviously be longer for investment package 3 than the much simpler package 1.

Step-by-step implementation
Obviously, a European gauge system will have to be developed from south to north in order to make sense, but if Rail Baltica is developed by improving the existing broad gauge system, it is recommended that detailed studies are used to identify the most optimal sequence of investments in the network.

The current analysis shows that it could prove to be optimal to give first priority to:

- Sections around the major cities, as a significant share of the benefits is linked to regional transport
- Sections, which are also used for east-west transport, as this accounts for a large share of rail transport in the project countries

Furthermore, it could prove to be optimal to begin upgrading the existing infrastructure in the north, as traffic volumes are higher in the northern part of the corridor.