Rail Baltica
Coordinated by RB Rail

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railistics

Feasibility Study of Pärnu Rail Freight Terminal in the context of the Rail Baltica Global Project

Final Report

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List of Abbreviations

AADT	Average annual daily traffic intensity
BaU	Business as Usual
BP	Business Plan
CBA	Global Cost-Benefit Analysis
CEF	Connecting Europe Facility
CIS	Commonwealth of Independent States
CNC	Core network corridors
ENPV	Economic Net Present Value
ERR	Economic Rate of Return
EY	Ernst & Young Baltic Ltd
FNPV	Financial Net Present Value
FRR	Financial Rate of Return
GDP	Gross domestic product
GT	Gross Tonnage
HGV	Heavy Goods Vehicle
IM	Infrastructure Manager
LDz	Latvijas dzelzceļš
MoM	Minutes of the Meeting
OU	Rail Baltic Estonia
PPP	Public-Private Partnership
RB	Rail Baltica
RBGP	Rail Baltica Global project

RBPT	Rail Baltica Pärnu Intermodal Terminal
RBR	RB Rail AS
RU	Railway Undertaking
SIA	Eiropas Dzelzceļa līnijas
TEN-T	Trans-European transport network
VoT	Value of Time

Executive Summary

The main tasks of this study according to the signed contract and ToR has been to prepare a feasibility study for a rail freight terminal in Pärnu or surrounding areas.

"Feasibility" means in this context:

1. To define the expected transport flows until the year 2055 and the resulting volumes to be handled at the terminal.
2. To evaluate potential locations for the terminal and to define the requirements regarding space, layout, functions/connectivity and equipment;
3. To determine the economic viability resulting from the costs and benefits (financial and socio-economical)

The result of the study is that a terminal in Pärnu is feasible. However, some preconditions are important to be mentioned. The overall Rail Baltica Project needs to be an open access environment and fully integrated into the European corridor development to allow most efficient railway freight transport. This will allow operators to offer the lowest and most competitive prices for services. The fierce competitive situation with current trucking and logistics services will lead to a high pressure on all railway companies in their performance and efficiency.

The study has identified the demand and its forecast for the rail freight sector in Estonia and in particular the catchment area for Pärnu. The demand is feasible for a terminal to be built.

It further evaluates options for locations that have been identified as most suitable over the course of the study. The consultant has taken three of these options and considered them in more technical and financial detail to determine the feasibility of them by means of a Cost-Benefit Analysis.

The Consultant has carried out the tasks in accordance with the Terms of Reference, namely, demand forecast and traffic analyses, study of the freight sector in and around Pärnu, and the identification and assessment of potential options. In this feasibility the consultant developed traffic forecasts and demand analysis in line with the Rail Baltica Global Project, identified risks to the project and carried out a sensitivity analysis. This report documents the work carried out and prepares the foundations for future work in developing an intermodal freight terminal in Pärnu.

As a fundamental remark it is important that any type of terminal in the region of Pärnu will have a strong local function and less "HUB-functionality". The HUB's for intermodal business on Rail Baltica are much more likely to be located in Muuga and/or Salaspils. The main reason is the location at railway crossings with Russian and European gauge and the bigger local market, attracting more direct services. In Pärnu the local market is limited and no changeover to Russian gauge seems technically feasible after the current connection is abandoned.

The terminal therefore might become driven by the local industry or there might be cooperation with other terminals to initiate feeder services or multi-stop services. Both to connect the local volumes with the higher number of direct connections from the respective HUB. With such feeder of multi-stop services also Pärnu will be connected to most other locations where multimodal trains will be set-up on Rail Baltica.

The terminal location itself was ideally located closed to the industrial areas in Pärnu to minimise last-mile transport efforts and in direct connection with Rail Baltica. However, the location south of the city was also considered valuable when combined with industrial siding for future activities. The CBA shows that the economic and financial differences are limited. The final decision needs to consider traffic planning and city planning. Both locations should be considered as options during design phase of RB to limit the additional costs related to a later connection.

In order to ensure that comparisons can effectively be made across the three options a decision was made to ensure that the terminal layouts are similar to one another and that the demand and traffic forecasts remain the same across all options. This is valid due to the almost similar locations and accessibility of all options.

From the analysis it has been found that all three options are technically feasible. Options 2 and 5 located in Pärnu and Rabaküla respectively have an advantage over Option 1 also located in Pärnu. From these two, Option 5 has an advantage over Option 2; however, this is slight and not enough to categorically say that this is the best overall option out of the three. The definite option will need to be made at a later stage taking into account discussions with involved stakeholders along with the wishes of a future terminal operator as to their preferred option.

As it is not determined now, who will invest and operate the terminal the decision might also be up to company related reasons. The combination of more than only intermodal activities seemed promising. A terminal in itself is difficult to be operated in an economically feasible manner without added value services included.

Further investigations have been carried out into the role that a terminal in Pärnu will play with regards to the Rail Baltica Global Project and in particular the interactions of this terminal with those in Muuga and Salaspils. It is expected that Pärnu will be of high regional importance, will command a relatively large catchment area and will be offering connecting services to the other terminals. Over the timeframe assessed it is also expected that the initial loading will be supported through induced loads. While it is expected that competition will exist between these three terminals for some loads, it is not however expected that it will cannibalise either Muuga or Salaspils. There is a potential for cooperative arrangements to be put in place between these terminals, however these will need to be defined at a later stage when operators define their interest in starting services.

1. Project Context

The main tasks of this study according to the signed contract and ToR has been to prepare a feasibility study for a rail freight terminal in Pärnu or surrounding areas.

"Feasibility" means in this context:

1. To define the expected transport flows until the year 2055 and the resulting volumes to be handled at the terminal.
2. To evaluate potential locations for the terminal and to define the requirements regarding space, layout, functions/connectivity and equipment;
3. To determine the economic viability resulting from the costs and benefits (financial and socio-economical)

It is important to define now the most suitable future location and connection for a freight terminal and to find volumes and commodities that from today's perspective will use this terminal for rail transportation purposes. This study has provided these options based on the current traffic and demand utilising interviews with stakeholders which have provided some forecast results. The reservation of the terminal area has been one of the main results of the study. The layout within the terminal will be recommended but will be subject to adjustment according to the traffic demand when the terminal is constructed.

For the terminal to be suitably located the connection to the line needs to be integrated in current planning to avoid future expensive adjustments of the signalling and perhaps the alignment. For the terminal, a "station" is required where trains can enter and exit the line. This station should be combined with previously foreseen stations and "exit-points" of the Rail Baltica if possible. The existing stations have been analysed according to their current planning status regarding their usability as a "station" for the freight terminal.

Within the ToR a number of fundamental questions are put forward which have been answered in Chapter 12. These have been adjusted slightly to remove repeating questions and include:

- Is there sufficient freight flow potential at all? If yes, how much, what type of cargo and to which directions?
- Is the cargo volume sufficient to organise train services? If yes which type of train services might be considered for terminal operations?

- Does the projected cargo volume provide sufficient feasibility of the terminal? What are the key functional, technical, and governance criteria which contribute to the feasibility of the terminal most?
- What is the suggested location of the terminal? Shall the terminal development be staged? If yes, what are the stages?
- What are the benefits for the industry and logistics service providers? In terms of money, time, safety, reliability, etc?
- What are the benefits for the society? Explain them in a tangible way.
- What are the benefits for Rail Baltica - does the terminal add value for Rail Baltica or cannibalise the main terminals?

These questions have been answered using an overall methodology developed for this project that includes discussions with local actors, statistical analyses, assessment of best practices, discussion on operating procedures.

2. Socio-Economic overview of Pärnu

2.1. Pärnu and Pärnu County economic situation and influential companies

Pärnu county is an economically balanced region in the South-West Estonia (see Figure 1) with a comprehensive range of industries. Foreign investments and new businesses with up-to-date technologies have enhanced job creation and higher competitiveness of the businesses in the international market. Several enterprises of Pärnu region stand out as the best in Estonia, which makes them reliable business partners for companies all over the world. Economic activity has been successful in a number of fields having greatly influenced the region's prosperity[1]. With the 2025 development plan Pärnu has set its focus on specific areas, including among others, the development of wood and metal industry.[2] These two industries are highly relevant in regard to RBPT and the future freight flows towards Central Europe.

Figure 1: Pärnu in the Baltic region[3]

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[1] http://investinparnu.com/en/why-parnu-region/parnu-economics/
[2] https://www.riigiteataja.ee/aktilisa/4270/9201/2012/Parnu2025a2.pdf
[3] Maa-amet, OpenStreetMap

Pärnu region in other figures:

- Location: South-West part of Estonia
- Area: 4807 km^2 (11% of the territory of Estonia)
- Population: 82 300 (87% Estonians, 9% Russians)
- Regional Centre: Town of Pärnu (39 700 inhabitants)
- Natural resources: Timber, peat, gravel, dolomite, clay
- Distances from Pärnu by road (Tallinn 129 km, Riga 189 km, Helsinki 210 km, Vilnius 469 km).

According to the interviewed representatives from the Pärnu City Government and Pärnu Development Centre, the interest in Rail Baltica is large – from the passenger perspective the line will open a lot of new options, but it will also have an important role for the future freight flows. Regarding RBPT, the city has a strong preference for the terminal to be located in the area of the current freight station/terminal whereas the county prefers the location further to the south in Rabaküla.

According to Statistics Estonia, GDP per capita at 2016 was the highest in Harju County – 145% of the Estonian average. Harju County was followed by Tartu and Pärnu counties, where GDP per capita amounted to, respectively, 94% and 67% of the Estonian average. Pärnu County GDP consists mainly of services, industry and construction and less agriculture, forestry and fishing (see Figure 2)[4].

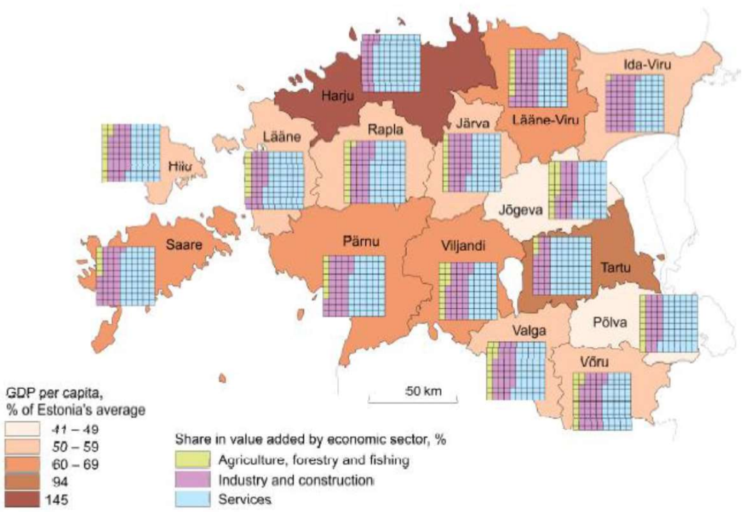


Figure 2: Estonia`s GDP by county, 2016[5]

[4] Statistics Estonia 2017, https://www.stat.ee/news-release-2017-134
[5] Statistics Estonia 2017, https://www.stat.ee/news-release-2017-134.

Pärnu region is economically balanced with a comprehensive range of industries. The largest private enterprises in Pärnu are Wendre AS, Valmos OÜ and Note Pärnu OÜ. Wendre AS's[6] turnover was 131m EUR in 2017 and the company employs 914 people. Valmos OÜ's[7] turnover was 13,5m EUR in 2017 and the company employs 230 people. Pärnu OÜ's[8] turnover was 45,3M EUR in 2017 and the company employs 258 people. The production and wholesale companies with highest turnover and possible interest of using Rail Baltica Pärnu Intermodal Terminal (RBPT) in the future are presented in Table 1.

[6] www.wendre.ee; Estonian Tax and Customs Board, https://www.emta.ee/et/kontaktid-ja-ametist/maksulaekumine-statistika/tasutud-maksud-kaive-ja-tootajate-arv.
[7] www.valmos.ee; Estonian Tax and Customs Board, https://www.emta.ee/et/kontaktid-ja-ametist/maksulaekumine-statistika/tasutud-maksud-kaive-ja-tootajate-arv.
[8] www.note.eu; Estonian Tax and Customs Board, https://www.emta.ee/et/kontaktid-ja-ametist/maksulaekumine-statistika/tasutud-maksud-kaive-ja-tootajate-arv.

Table 1: TOP production and wholesale companies in Pärnu county who are possible users of RBPT[9]

Name	Field of activity	Total taxes paid 2017 (EUR)	Total turnover 2017 (EUR)
WENDRE AS	Textile industry	7 134 095	130 973 962
SCANFIL OÜ	Electronics industry	3 749 362	96 811 272
AQ LASERTOOL OÜ	Electronics industry	2 950 805	53 786 598
NOTE PÄRNU OÜ	Electronics industry	1 508 498	45 395 448
LAESTI, AS	Wood and forest industry	333 924	24 790 242
TULUNDUSÜHISTU EESTI PUIDUMÜÜGIKESKUS	Wood and forest wholesale	53 781	23 955 541
SÄÄSTKE, OÜ	Production of wooden elements	1 393 055	19 419 214
TORI TIMBER OÜ	Wood and forest industry		18 575 979
TOOTSI TURVAS, AS	Production of peat	938 912	18 254 610
ECOBIRCH AS	Production of wooden elements	603 167	18 120 481
REIDENI PLAAT AS	Production of wooden elements	2 091 850	17 228 759
BILLERUDKORSNÄS ESTONIA OÜ	Production of wooden elements		16 225 580
JAPS M.V.M., AS	Production of fish	354 162	13 772 704
VALMOS, OÜ	Production of wooden elements	910 898	13 503 265
BALTIC PACK EST, AS	Production of packing materials	1 535 922	13 129 318
PREAB, AS	Production of furniture	1 027 518	12 798 303
GRANIIDIKESKUS OÜ	Wholesale of quarried materials, aggregate etc.	1 216 755	12 719 668
METSÄ WOOD EESTI AS	Production of wooden elements		2 659 616
RUUKKI PRODUCTS AS	Production of metal products	3 508 633	98 379 129
SKANO FURNITURE FACTORY OÜ	Production of furniture	531946	3 767 047
SKANO FIBREBOARD OÜ	Production of furniture	537 225	12 116 286
SKANO FURNITURE OÜ	Production of furniture	95 576	1 770 435

[9] Estonian Tax and Customs Board, https://www.emta.ee/et/kontaktid-ja-ametist/maksulaekumine-statistika/tasutud-maksud-kaive-ja-tootajate-arv.

Statistics Estonia collects data about the export and import volumes by counties and commodity groups based on SITC nomenclature[10]. The top six commodity groups exported most by Pärnu companies are presented in Figure 3. The most exported commodity group (by tonnage) by companies located in Pärnu county is group 32 "Coal, coke and briquettes", which includes also the peat and peat production. As there are a lot of local peat production companies, it can be assumed that most of this commodity group consists of peat.

Over the last 10 years the importance of commodity group 24 "Cork and wood" has increased remarkably. The commodity groups that include export of furniture, wood manufactures, fish, iron and steel also play an important role in the export volumes. Based on the information provided by the interviewed metal companies, the exported iron and steel products are mainly roof elements, metal constructions and other type of metal products.

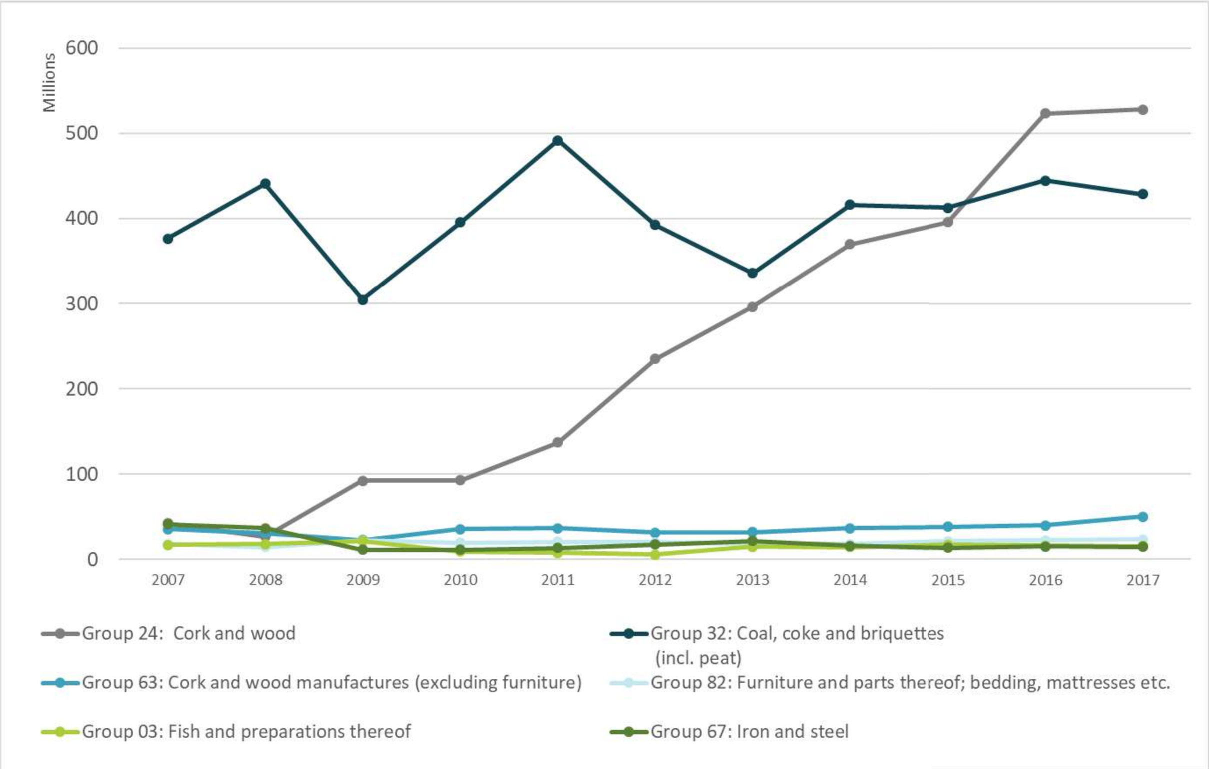


Figure 3: TOP commodity groups exported by companies located in Pärnu County during the period 2007 – 2017 (net weight, kg)[11]

[10] The commodity groups are defined based on the SITC nomenclature: http://metaweb.stat.ee/view_xml.htm?id=4436257&siteLanguage=en
[11] The commodity groups are defined based on the SITC nomenclature

The most imported commodity group (by tonnage) by companies located in Pärnu county is crude fertilizers and crude minerals. The net weight has been varied a lot between different years. The quantity of other top commodity groups has been quite stable over the years (see Figure 4). The most significant import article within the crude mineral's commodity group is granite chippings which is imported from the Scandinavian countries and is used for road construction in Estonia. Granite chippings are preferred in road construction as it is more durable compared to limestone chippings.

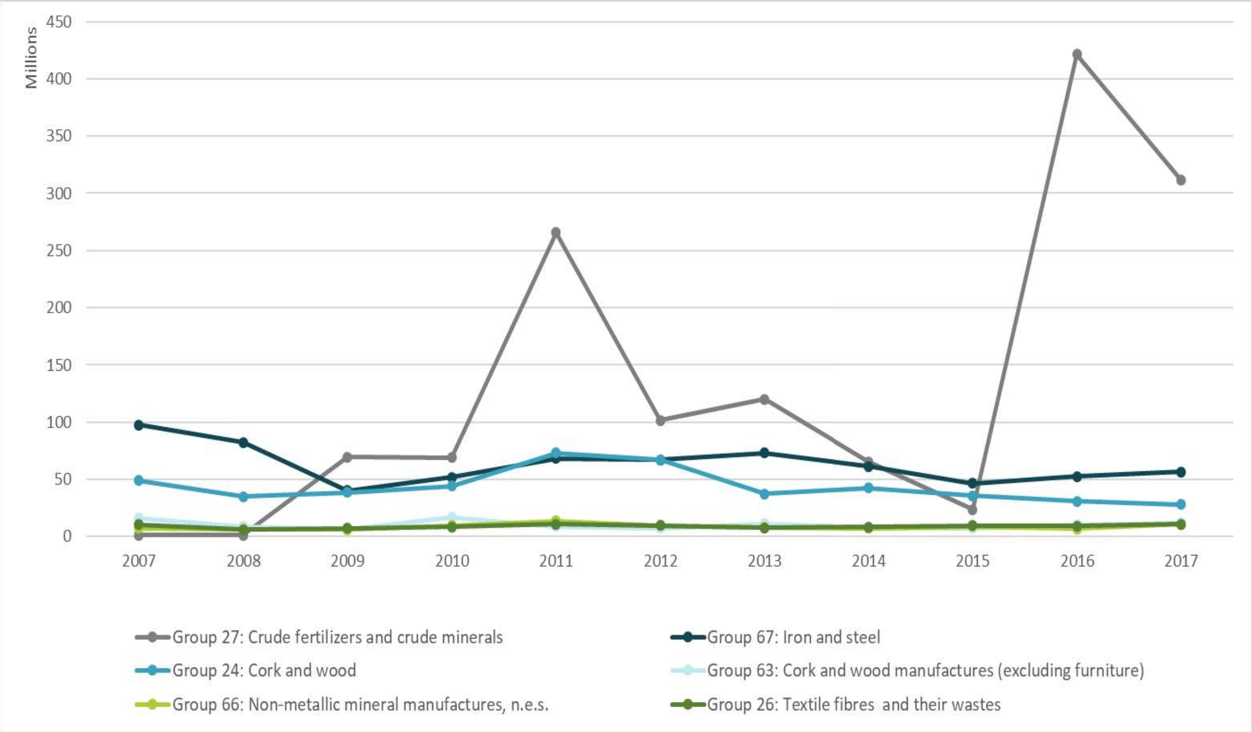


Figure 4: TOP commodity groups imported by companies located in Pärnu County during the period 2007 – 2017 (net weight, kg) [12]

[12] The commodity groups are defined based on the SITC nomenclature.

2.2. International multimodal transport corridors passing through Pärnu County

Via Baltica, officially known as European route E67, is connecting Estonian capital Tallinn with Polish capital Warsaw, passing through Pärnu County. It is the most important highway between the Baltic States; in addition it is an essential traffic route from Finland and Russia to Central Europe and back. The final stretch between Tallinn and Helsinki is to be crossed by ferry.

The distance from Tallinn to Warsaw is about 970 km. The road is mostly two-lane highway and the entire distance can be covered in less than 24 hours.

Significant flows of exports from Pärnu region and e.g. South-Estonia pass through the Port of Pärnu which lies at the mouth of the Pärnu River. In recent years, the port has developed into an important regional harbour for south-western and southern Estonia. The airport in Pärnu is located three km from the city centre and is based on a former military airfield.

An effective and well-running transport infrastructure is essential to maintain the EU's competitiveness and wealth. The TEN-T and CEF Regulations[13] (1315-1316/2013) define the strategic guidelines and technical parameters for the European transport development for 2030 (core network) and 2050 (comprehensive network). The highest strategic level consists of nine core network corridors (CNC). The catchment area of Rail Baltic Pärnu Intermodal Terminal includes directly one CNCs: The North Sea-Baltic corridor.

Rail Baltica is an important part of the Trans-European Transport Network project. It is aimed at integrating the Baltic States into the European railway network. The project involves five European Union countries: Lithuania, Latvia, Estonia and, indirectly, Finland and Poland. The rail line will connect Tallinn, Pärnu, Riga, Panevėžys, Kaunas and Vilnius.

Rail Baltica is more than just a connector of the Baltic States to Europe. It also serves as an alternative route to Finland and the Commonwealth of Independent States (CIS). According to the Rail Baltica Global Cost-Benefit Analysis (CBA) carried out by Ernst & Young Baltic Ltd (EY), it is estimated that approximately 57 % of all cargo on the new railway will be in transit – first, consisting of Finland's trade with the rest of the EU and, second, composed of transhipment between the rest of the EU and the CIS. The TEN-T strategy means access to the 1435 mm railway network for the Baltic region. This would make the entire region more competitive.

[13] The European Parliament and of the Council, https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=uriserv:OJ.L_.2013.348.01.0001.01.ENG.

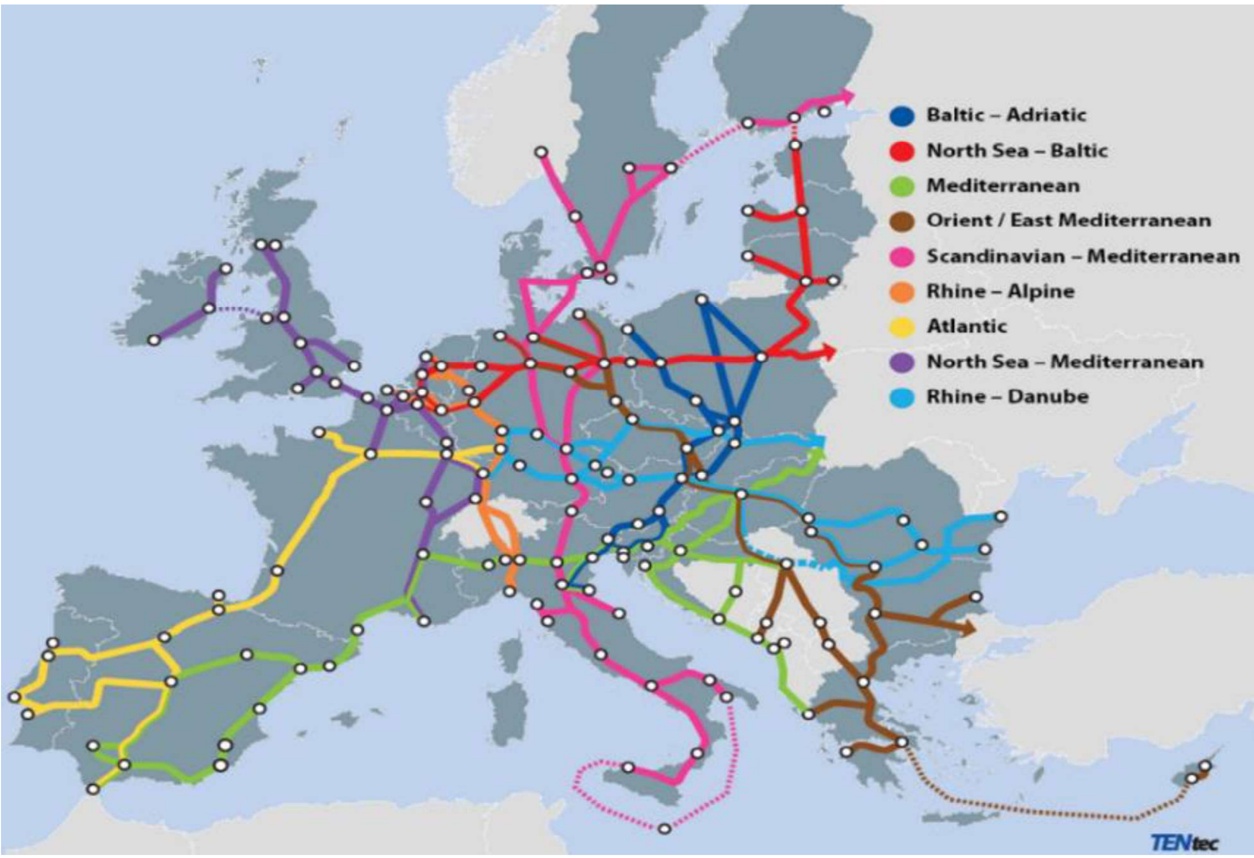


Figure 5: Map of TEN-T routes[14]

With a gauge of 1520mm most of the railway system in the Baltic States is incompatible with the rest of Europe. This makes direct rail linkage between the Central and Eastern Europe regions complicated and relatively expensive due to the transhipment required. Also, the current infrastructure does not allow sufficient fast passenger and freight speeds in the North-South direction. Rail Baltica aims to bridge these gaps by eliminating this critical missing link in the European railway network and integrating the Baltic States into the European rail logistics ecosystem, thereby also strengthening the functioning of the Single European Market.

The Rail Baltica project aims to ensure a safe, fast and high-quality connection between the Baltic States and the major economic, administrative and cultural centres of Western Europe. Interoperability with the European 1435mm gauge networks is an important aspect. Also, the symbolic aim of Rail Baltica is to physically reintegrate the former Soviet Baltic states to Europe's transport infrastructure.

[14] European Commission, http://ec.europa.eu/transport/infrastructure/tentec/tentec-portal/site/maps_upload/SchematicA0_EUcorridor_map.pdf

2.3. Role of Pärnu Port as the logistics centre

One of the central players in the Pärnu area is the Port of Pärnu. For the future terminal the port is also a potential source and destination of freight volumes. For that reason, the next chapter describes the role of the port in more detail.

AS Pärnu Port is an enterprise that manages the Port of Pärnu. Pärnu Port is located in the southwestern part of Estonia at the mouth of the Pärnu River, and in recent years it has become a significant regional port in southwest and south Estonia. The catchment area of Port of Pärnu is composed of Lääne, Järva, Pärnu, Viljandi, Tartu, Põlva, Võru and Valga counties (see Figure 6). By type Port of Pärnu is a *Service Port*. The port provides all the services by itself as the owner of the main infrastructures, buildings, lifting and transport equipment. The port organises shipping, provides stevedore services and manages the warehouses and territories located in the port.[15]

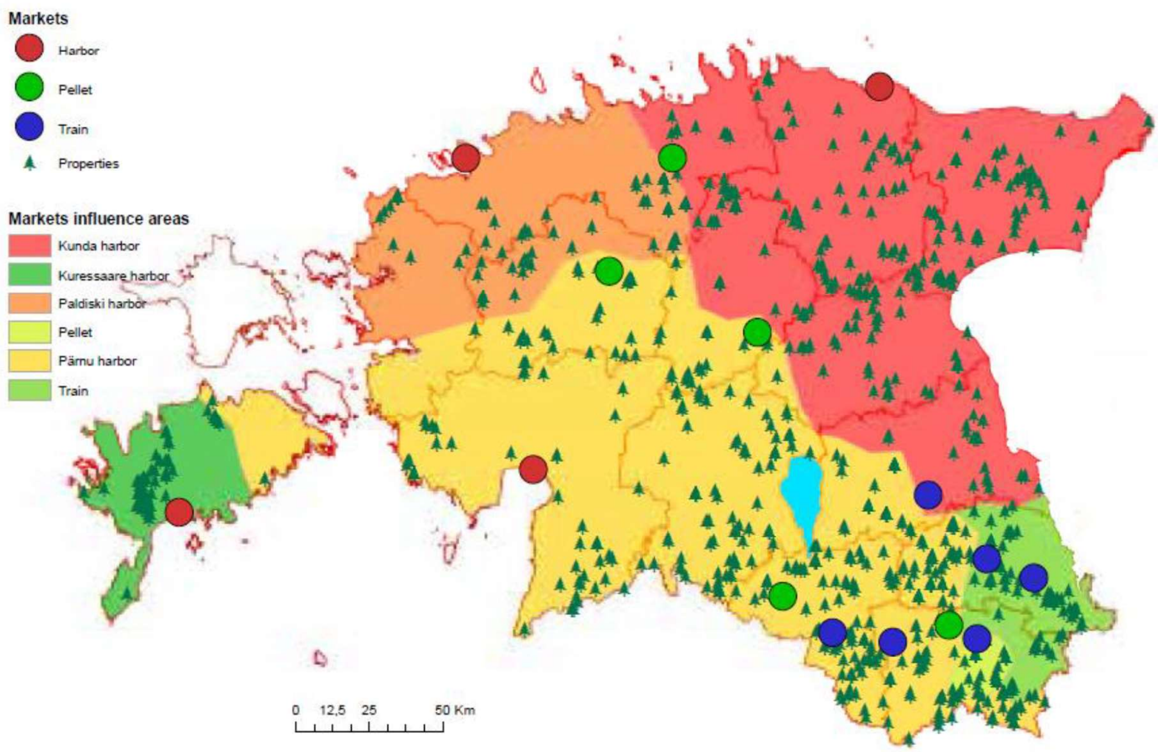


Figure 6: Illustration of the Port of Pärnu catchment area[16]

[15] Port of Pärnu, http://www.parnusadam.eu/en.
[16] HD Forest News, 2016, http://www.hdforest.com/media/HDForest-NEWS-october-2016.pdf.

The total length of the waterway is 6200 m, the declared depth is 7.2 m. The port can receive cargo ships of 140 m in length and 45 m in width. Various landowners are operating in Pärnu port, i.e. AS Pärnu Sadam, AS Pärnu Laevatehas, OÜ Pärnu Stividorid, AS Japs, Riigi Kinnisvara AS, AS Transcom Vara, and, MTÜ Pärnu Jahtklubi.

The port can provide service for four large ships (with a maximum length of 140 m and width of 45 m) or eight medium-sized ships at the same time.[17] The Port of Pärnu consists of seven quays (owned by the landowners shown above) with a total length of 804 meters through subsidiaries and leases[18]:

- General cargo quay no 1 with a total length of 210 m and depth of 6,5 m;
- General cargo quay no 2 with a total length of 187 m and depth of 6.5 m;
- Quay for peat cargo no 3 with a total length of 78 m;
- General cargo quay no 7 of a total length of 55 m and depth of 6 m (with the possibility to use a liquid cargo terminal with a capacity of 2000 m^3);
- General cargo quay number 10 total length 84 m;
- The Jannsen quay no 12 with a total length of 90 m and depth of 6,5 m;
- The Jannsen quay no 13 with a total length of 100 m;
- The Jannsen quay is for packaged goods, especially module houses.

Loading and unloading work is carried out by mobile lifting equipment with lifting capacity up to 10 tonnes. The port has a ferry boat "NICO" with a capacity of 1200 HP, which helps ships in manoeuvring areas. The navigation season is all year round. In winter, Pärnu Bay is covered by ice. Usually the ice period is two up to three months and ice breaking is required to keep the port open.[19]

Pärnu port has a territory of 30 ha where it is possible to load, land and store all general cargo, wood and bulk cargo. A bulk cargo terminal is located In the Old-Pärnu terminal that has a capacity for up to 20,000 m^3 of peat. The loading of peat is carried out by grabbing directly from the quay, where loaders have previously loaded peat from a warehouse. Wood pellet warehouses

[17] The length of large ships is 140 m and width is 18 m, small ships length is 90 m and width is 15 m.
[18] Port of Pärnu, Handbook, Pärnu Sadam AS, kk nr 1-4/43 Juhtimiskäsiraamat 2018_v5_20.04.2018.pdf.
[19] Port of Pärnu, http://www.parnusadam.eu/en.

with a capacity of up to 60,000 tonnes are also available as are the round-up storage areas which have a total capacity of up to 500,000 m^3.[20]

2.4. Total freight flows passing through Port of Pärnu

During the last 20 years the Port of Pärnu has developed significance as a local regional export-import port, with a record turnover of 2m tonnes. The average turnover of the last five years is 1.76m tonnes yearly. About 90% of the cargo is of export, import is mainly aggregates. According to the Port of Pärnu, the majority of all raw materials and processing industry exported from Estonia leave through different ports. This consists of up to 45% of the all Estonian forest resources and up to 65% of the all Estonian peat resources.[21]

Table 2 provides an overview of the different cargo flows from 2012-2016. Between 2012 and 2017, the total cargo flow increased by almost 317 thousand tonnes (1655 thousand tonnes in 2012 to 1,972 thousand tonnes in 2017), which is an increase of 20%. It is important to mention that ship calls into Port of Pärnu decreased -0,4% during years 2015/2016, but vessels Gross Tonnage (GT) and cargo flow increased. This means that vessels can carry more cargo per trip and sea transport is more efficient year by year.

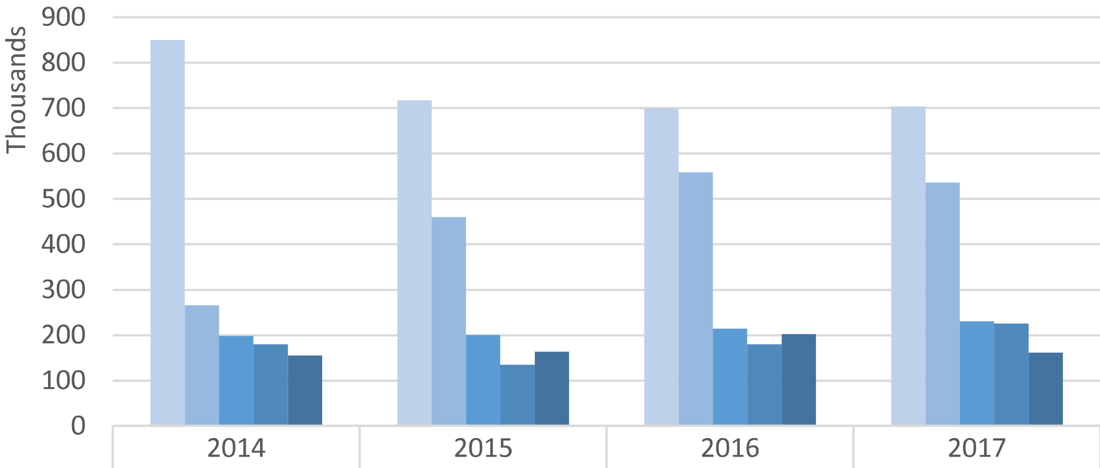
Table 2: Ship calls in Port of Pärnu, GT and cargo flow tonnes, 2012–2016[22]

Year	2012	2013	2014	2015	2016	Change % 15/16
Ship calls	526	523	516	499	497	-0,4 %
Vessels GT	1 712 435	1 754 380	1 776 964	1 764 203	1 878 144	+7 %
Cargo, tonnes	1 655 534	1 696 937	1 738 148	1 802 221	1 914 308	+6 %

The commodity showing the biggest increase in flows during the last five years (2012-2017) is wood pellets 351,645 tonnes (an increase of 291%), peat 115,309 tonnes (an increase of 100%),

[20] Port of Pärnu, Handbook, Pärnu Sadam AS, kk nr 1-4/43 Juhtimiskäsiraamat 2018_v5_20.04.2018.pdf.
[21] Port of Pärnu, http://www.parnusadam.eu/en.
[22] Port of Pärnu, Oliver Einmann "Port of Pärnu hinterland importance in region" (2017).

peat packs 56,288 tonnes (an increase of 511%), and module houses from 0 in 2012 to 353 houses in 2017 (see Figure 7).[23]



	2014	2015	2016	2017
Round timber	850448	717400	699849	703884
Wood pellet	266021	460188	558571	535957
Peat	198169	200299	214248	230739
Wood chips	179920	134597	179830	225509
Aggregates	155407	164091	202400	161755

Round timber Wood pellet Peat Wood chips Aggregates

Figure 7: Port of Pärnu main cargo flows in tonnes, years 2014-2017[24]

[23] Port of Pärnu, http://www.parnusadam.eu/en.
[24] Port of Pärnu, http://www.parnusadam.eu/en.

3. Pärnu County freight flows

This section presents the most important features and trends by commodities and transport modes based on the feedback of the interviews from regional entrepreneurs, companies and organisations. The interviewed stakeholders and companies are detailed in Annex 5 – Interviewed Stakeholders. Pärnu County cargo flow destination and origin countries and transport modes as of 2018 are presented in Table 3 at the end of this subchapter.

The section is structured by commodity types (wood, agricultural products, electronics, textiles, steel and machinery) to immediately show the relevance for an eventual layout of a terminal and for the likelihood of railway as a transport solution.

3.1. Wood

Inbound commodities are mostly raw materials e.g. round timber. The selection of the transport mode by interviewed companies from the Pärnu and Pärnu County, total Estonia, Finland and Latvia is most commonly road transport. In some cases, road transport is combined with sea transport. The raw material used by the wood industry is of local origin mostly (marginally from neighbouring countries) and wholly transported via road. However, some of the interviewed companies are widely using for example Ropax and/or Ro-Ro ferries from Finland to Estonia combined with road transport. These companies' raw material cargo flow (plywood veneers) is up to 20 trailers weekly and is estimated to increase up to 40 trailers weekly in the future.

The selection of the transport mode for outbound goods (i.e. products that are transported from the interviewed companies to Estonia or elsewhere) is more complex. The products can be divided into three categories:

1. volume-intensive and cheap goods (e.g. round timber, wood logs, wood chips),
2. volume-intensive and average-priced or expensive goods (e.g. wooden modular houses and pulp), and,
3. small shipments and/or expensive to USA and China (e.g. environmentally friendly furniture veneer). For instance, in regard to the modular houses market, producers are forecasting strong increase of the DIY (Do-It-Yourself) production.

The first category is dependent on the cost of transport. Due to this sea transport is most efficient. Cargo destination is usually Scandinavian countries e.g. Finland and Sweden. However other products such as wood pellets go also to Denmark, Holland, United Kingdom, and Belgium for electricity power plants. Wood chips which is one of the cheapest commodities exported is not exported no further than Germany because of its price-sensitivity due to the light weight.

The second category is dependent on different transport parameters, primarily cost and transport time. As they are volume-intensive, they need transport modes, which are able to carry large volumes (e.g. sea and rail transport). For example, companies that are currently producing wooden modular houses use combination of trailers and sea transportation. However, as the products are at least of an average price, they are not that price-sensitive to the cost of transport and can accommodate more expensive modes (e.g. road and rail) as it would result in shorter transport times. According to an interviewee, in these circumstances rail transport becomes competitive when the distance exceeds 1000 km. This category of products potentially can use RBPT. A module houses producer mentioned that in the future they see increase in the module bathrooms cargo flow to the Holland market. All interviewed companies highlighted the importance of the railway transport cost and the costs of the total logistics chain. This also includes services provided by Pärnu Intermodal Terminal. The total transport cost should be competitive with transport modes used today e.g. trucks and sea transport, the actual use of the terminal is only a theoretical possibility.

The third category is dependent on transit time and flexibility. Expensive wood products tend to have smaller shipments and a wider reach of destinations. As a result, these products are suited for road transport because it is flexible both in terms of minimum volumes needed for transport (for sea and rail, a company either has to order a full ship/train or extend delivery times by waiting for potential consolidation with other companies) and in the choice of the transport route. For example, one of the interviewed furniture veneer producers manages by itself all transport and deliveries directly to the client together with partners.

According to the feedback from the interviewed companies there are cargo flows of wood production (furniture veneer, veneer, glulam boards, paper pulp, wood chips, round timber) taking place all year round to the Central Europe and Germany. For example, wood granules are exported from Port of Pärnu to France, Holland and Belgium electricity power plants. According to an interviewed company, there could also be potential cargo flows of round timber and sawn timber for Rail Baltica and Pärnu Intermodal Terminal to Germany for wood production companies in the future, as well as an increase in module bathrooms cargo flow to the Holland market.

Based on the abovementioned points it can be stated that wood as one of the main products of the region definitely has to be part of the terminal planning. The different types of wood will need a flexible layout and loading unloading facilities. A certain share of wood products might even be containerised in future and thus relevant for intermodal services. A further connection to Muuga port might be reasonable for some wood transport chains. One of the interviewed companies pointed out that they would require capacity to handle long products (up to 13m) and for train transport they would prefer to use either trailers on platforms which makes handling faster or containers that can be loaded from the side.

3.2. Agricultural products

The selection of the transport mode for outbound goods (grain) is simple. The grain is collected from Estonia and transported by trucks directly to quay line. The main parameter is the cost of transport – due to the volume-intensive and cheap nature of the product. There is no special warehouse in the Port of Pärnu for servicing grain flows such as can be found in the Port of Tallinn and Port of Sillamäe. Grain is seasonal commodity. Most of the export grain goes out from Estonia through northern Estonian ports. There are two reasons for this. In Muuga harbour, Port of Tallinn it is possible to load grain into big ships and secondly, total road transport and logistics is cheaper because it is usually easier to find cargo back for trucks e.g. aggregate.

Secondly, the selection of the transport mode for another agriculture outbound goods (peat) is almost the same as grain. Peat is mostly collected from local producers and transported by trucks to Port of Pärnu. From there peat is exported by sea to Sweden, Holland, France, Germany, Spain, United Kingdom and Belgium. The peat total throughput of the Port of Pärnu in 2017 was 769,131 m^3 or 230,739 tonnes. From the total amount, 300,739 m^3 or 70,000 tonnes was packed peat.

Nevertheless, there are exceptions. The interviewees highlighted that a certain quantity of minority goods, which need flexible transport mode (door to door) comparing to regular logistics are usually transported by trucks. However, an interviewed company exporting around 7000 tonnes of ecograin annually to South-West Europe indicated a clear interest in using rail transport. In general, companies operating in the field of agriculture stated that there is a potential for using Rail Baltica together with RBPT if railway price together with total transport chain price is competitive compared to today’s road and sea transport. The actual use of the terminal is only a theoretical possibility by today.

3.3. Electronics

Selection of transport mode for inbound goods (electronics components) is firstly dependent on price, transport time and reliability. This is mostly explained by three factors:

1) due to the high value of goods, companies want to optimise their working capital,
2) electronics are often used as an input for other goods and therefore need-based and fast transport is required, and
3) there are no big warehouses in the region of Pärnu. Due to the considerations for speed and reliability, the industry mostly uses plane and road transport (including the use of courier services).

The current selection of transport mode for outbound transport mode is mostly plane and truck. The interviewed electronics companies acknowledged, however, that in the future the goods nomenclature will be wider and there will be reasonable warehousing solutions for additional goods flow on pallets together with potential intermodal terminal, also rail transport from Pärnu to Europe is a potential alternative.

3.4. Textiles

Selection of a transport mode for textiles is firstly dependent on price, reliability and transport time. According to one interviewed company, they are organising all transport by themselves together with partner logistics companies. Every day up to 25 trucks with trailers are sent out. Mostly outbound cargo goes into Scandinavia, up to 40% to Finland and Sweden. Other big export destination countries are France, the United Kingdom, the Benelux countries, USA and Canada. A part of the export supply chain goes by trucks through Klaipeda logistics centre.

3.5. Steel and machinery

The steel and machinery industries are not at high production rates in the Pärnu region, but the sector's development has picked up over the past years. Furthermore, the development of metal industry is one of the aims in Pärnu city development strategy until 2025.[25] The existing companies in the Pärnu region are mainly focused on producing metal constructions and machinery both for the Estonian market as well with an export outlook to the Scandinavian

[25] https://www.riigiteataja.ee/aktilisa/4270/9201/2012/Parnu2025a2.pdf

(mainly Finland and Sweden) and the European markets. However, there is also a large steel elements producer (e.g. for roofing) in the region.

Currently the metal products and machinery are transported by truck transport combined with sea transport if the products are exported to the Scandinavian market. Some of the interviewed companies expressed dissatisfaction with the road conditions and would be highly interested in transferring their goods to the Rail Baltica railway. This means also using the RBPT for storing goods. According to them, for some locations where sea transport cannot be used, they are only using road transport as there is no other alternative.

However, the interest in using Rail Baltica railway for exporting was not uniform among the metal companies in the Pärnu region. As some of their production is too small to be transferrable to railway, they would continue using road transport. For some, also the combination of speed and price of road transport and no need to reload cargo is a key factor for choosing to keep their products being transported by road. One of the interviewed companies indicated interest in using rail transport only if they could use it for cargo with an end destination in south-eastern Europe (e.g. Bulgaria). However, the demand for such destinations is project-based and a continuous demand cannot be guaranteed.

Rail Baltica railway is also of interest for the Estonian Military Forces who would use the railway for transporting military machinery. Currently the flows have not been frequent, but some countries, e.g. France have preferred transporting their machinery by rail. Currently this means unloading and then loading equipment in Lithuania which results in an increased time and price. The interest of the military forces is to transport heavy machinery which may be too heavy for road transport. When transporting heavy machinery by rail, it also sets special requirements for the mobile ramps. More specifically, they would need heavy duty ramps, 13 000 m^2 parking space and the turning space which would allow a turning radius of 31 m.

Transporting military equipment would also set special security requirements, e.g. the trains cannot stop on the way which means the transportation should take place at night-time. If the equipment can be stored in RBPT, it could be transported further to Tapa and Southern Estonian military bases.

3.6. Transport modes for Pärnu Country freight flows

The selection of transport mode for inbound freight is mostly sea transport and truck, and less often (a few times in a month) plane and truck. In addition, some amount comes from China by railway through Poland or Germany and goes further by truck. Import comes mostly from Asia, especially China. Some amounts of import come from Turkey and South Europe by sea transport and truck. Imported containers are 100% coming through Port of Tallinn.

The interviewed acknowledged, however, that in the future potential rail transport together with potential Pärnu Intermodal Terminal, together with reasonable warehousing solutions would be an interesting solution for transport from Pärnu to Europe and widen logistics providers for outbound and inbound.

Table 3: Pärnu County cargo flow destination and origin countries, transport modes (2018)

	Outbound Goods								Inbound Goods						
	Round timber, wood logs, pellet, wood chips	Module houses, veneer, saw material, glulam boards, paper pulp	Environmentally friendly furniture veneer, DIY production	Grain	Peat	Electronics and electronics components	Textiles	Steel and machinery	Round timber, wood logs, pellet, wood chips	Module houses, veneer, saw material, glulam boards, paper pulp	Environmentally friendly furniture veneer, DIY (Do-It-Yourself) production	Electronics and electronics components	Textiles	Steel and machinery	
Latvia		Truck		Truck		Truck			Truck		Truck	Truck	Truck		**Latvia**
Lithuania		Truck		Truck									Truck		**Lithuania**
Poland		Truck		Truck		Truck						Truck	Truck		**Poland**
Czech Republic												Truck			**Czech Republic**
Finland	Truck & sea	Truck & sea		Truck & sea		Truck & sea	Truck & sea	Sea transport	Sea & truck	Sea & truck	Sea & truck	Sea & truck		Sea & truck	**Finland**
Sweden	Truck & sea	Truck & sea			Truck & sea	Truck & sea	Truck & sea	Sea transport		Sea & truck				Sea & truck	**Sweden**
Norway		Truck & sea		Truck & sea		Truck & sea		Sea transport							**Norway**
Denmark	Truck & sea			Truck & sea		Truck								Sea & truck	**Denmark**
Germany		Truck		Truck & sea	Truck & sea	Truck		Truck				Truck		Truck	**Germany**
Belgium	Truck & sea			Truck & sea	Truck & sea		Truck	Truck							**Belgium**
Holland	Truck & sea			Truck & sea	Truck & sea		Truck	Truck						Truck	**Holland**
France	Truck & sea			Truck & sea	Truck & sea		Truck	Truck							**France**
United Kingdom	Truck & sea			Truck & sea	Truck & sea	Truck & air	Truck & sea								**United Kingdom**
Spain					Truck & sea							Sea & truck			**Spain**
Portugal		Truck & sea													**Portugal**
Italy						Truck						Sea & truck			**Italy**
Switzerland						Truck									**Switzerland**
USA			Truck & sea			Truck & air	Truck & sea								**USA**
South Korea		Truck & sea													**South Korea**
China			Truck & sea									Railway & truck	Railway & truck; Sea & truck		**China**
Canada							Truck & sea								**Canada**
Russia									Truck						**Russia**
Middle-East												Air & truck			**Middle-East**

4. Future transportation development and potential international partnership networks in Pärnu

Pärnu freight terminal's prospective position in logistics chains will depend on the future transport development. There are several international, EU level as well as regional changes which altogether will have an effect on Pärnu freight terminal's functioning. As shown in the Muuga multimodal freight terminal analysis[26], the future transport development will most likely improve the rail sector, whereas the road transportation will be on a decline.

There are several measures implemented by the EU which will have an effect on transport and freight flows:

- Adoption of new regulative directives for CO^2;
- Regulative directives for CO^2 for trucks;
- Regulative directives for CO^2 for ships;
- Tax on traffic congestion;
- Internationalisation of transport external costs;
- Road taxation for heavy vehicles;
- Employer costs related to workers' social security.

There are also several factors, which may have a positive effect on road transportation:

- Introduction of electric trucks;
- Development of platooning;
- Use of road-rail vehicles.

Currently rail transport is costlier compared to road transport for certain relations, however, due to the pressure of EU environmental policies and different measures implemented, this situation will likely change within the next ten years. The main reason for the low competitiveness of rail

[26] Civitta, DB Engineering and Consulting (2018) Analysis of the technological and spatial needs of the multimodal freight terminal Rail Baltica at Muuga Harbour (MCTRB), WP1 report.

transport for cargo is the incompatibility of railway systems, but with new railway lines and increasing compatibility with the existing ones, rail is expected to become a more competitive means of transport.

Based on the feedback from the interviewed major entrepreneurs, companies and organisations within the wood, agriculture, consumer goods, electronics and logistics industry, the most important future features, trends and changes are presented below.

4.1. Wood

None of the wood industry interviews foresees changes in ODs. One of the interviewees stated that a growing market is Holland, while another interviewee mentioned that for them the growing market is in USA. This producer is forecasting strong increase of the DIY (Do-It-Yourself) production. Whereas some companies predict a 10% increase in the production volumes, some others only forecast a few years ahead. Rail provides the producers also flexibility should the production volumes suddenly increase, and a required amount of trucks cannot be guaranteed to fulfil the deliveries.

Entrepreneurs and companies indicated that they would first like to know how RBPT is working, i.e. what is the service speed, costs level etc. One product group in the category potential for rail is module bathrooms. Estonian State Forest Management Centre (RMK) foresees that Rail Baltica will open new markets also in Central Europe and there will most likely be a swift change in the exported goods – while unprocessed wood will remain mostly in Estonia, more wood products will be exported as the business capacity of Estonian wood companies will increase.

The Estonian State Forest Management Centre (RMK) additionally brought out the potential of the existing national railway to provide transportation to and from Port of Pärnu in case RBPT had specific loading conditions for bulk commodity. Namely, Eesti Energia (state owned energy company) could transport waste from the oil shale mining (gangue) from Narva to Pärnu and it could be sent further towards Central Europe. Currently, around 17 million tonnes oil shale is mined annually and approx. half of it is waste. From Pärnu, they could load wood chips from the region and transport it to Narva. This means that the trains would not return to Narva empty and the wood chips from Pärnu region could be used within Estonia. To store the waste in Pärnu, a large area is required.

Biorefinery

In 2017, Est-For Invest announced that they would be interested in developing a biorefinery in Estonia with one of the potential locations in Pärnu county. As of November 2018, the project has been stalled to wait for a more favourable investment environment.[27] However, this project is brought out as example of a potential project to exemplify the possibility of other large-scale projects which may take place in the region in the near future, and which may have a significant impact for the cargo flows on Rail Baltica Railway.

The planned biorefinery would have used approx. 3 million m^3 of local pulpwood and woodchips annually. This would have been combined by:

- Paper pulp total 2,3M m^3, from which by RB ca 0,7M m^3 (from Latvia, Lithuania, Poland);
- Chip wood total 1,0M m^3, from which by RB 0,3M m^3 (from Latvia, Lithuania, Poland);
- Chemicals total 0,1M tons, from which by RB 0,05M t (from Central Europe).

The outbound freight was estimated to be approximately 0,75M tons of cellulose, from whish around half a million tonnes would have been exported to Belgian/Dutch/Germany harbours, some also the Central European customers. In total there was estimated to be additional 1,5M tonnes of freight on Rail Baltica and each cargo type would have required a specific type of wagon. In addition, the biorefinery would have required a special siding directly to its factory so the direct access to Rail Baltica railway could be provided with no additional need for loading/unloading in the freight terminal.

4.2. Agriculture

None of the agriculture industry interviews foresee major changes in ODs. By the interviewed important peat producer and exporter modal shift to rail can occur in some amounts for peat from Estonia. The same company has also experience in using railway in Scandinavia and Belarus for sending peat to ports. Another company has interest in using rail transport for transporting ecograin to the Southwestern Europe. Again, entrepreneurs and companies are waiting how the potential Pärnu RB Intermodal Terminal will start working, and what the service speed, costs level etc. will be.

[27] http://biorefinery.ee/en/contemporary-biorefinery-to-wait-for-more-favourable-investment-environment/

4.3. Consumer goods

The largest company in the consumer goods industry in the Pärnu region is producing textiles. The representative of this textile company acknowledged that in the future potential rail transport together with potential RBPT, together with reasonable warehousing solutions would be an interesting solution for transport from Pärnu to Europe and widening logistics providers for outbound and inbound. The biggest player in the future will be e-commerce, which has influence already today for productions and sales. The relevance of e-commerce is increasing globally and the increase in the Finnish and Swedish retail business will also impact cargo flows on RB and RBPT. In addition, the interviewed textile company is developing cooperation together with e-commerce conglomerate Amazon. There is a possibility that Amazon will build up company business in Scandinavia.

The development of the e-commerce has been stormy in recent years worldwide and especially in China. Online shopping is one of the most popular online activities worldwide, but the usage varies by region - in 2016, e.g. an estimated 19% of all retail sales in China occurred via internet. The same year, e-retail sales accounted for 8.7% of all retail sales worldwide. This figure is expected to reach 15.5% in 2021. In 2016, retail e-commerce sales worldwide amounted to 1.86 trillion US dollars[28].

In Estonia, companies such as Omniva and Febest Europe Distribution together with international e-commerce giants like AliExpress, eBay and S.F. Express are developing additional warehousing capacity especially for e-commerce[29]. Preparation of post-hubs in order to accelerate transportation of e-commerce goods for clients in Europe and Russia. According to this strategy, the e-store will send the most popular items, like mobile phones etc. to the warehouse in advance. As a client in Europe files an order, she/he gets the item from Estonia in two days, instead of having to wait for 30 days for a parcel all the way from China.

Currently, blooming e-commerce also supports container flows through ports and container terminals. Usually most of the e-commerce commodities have been shipped out from Asia, especially from China to Europe and USA. The growth of containerisation and transporting goods

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[28] The Statistics Portal 2017, https://www.statista.com/statistics/379046/worldwide-retail-e-commerce-sales

[29] Reimer, A. (2015) Whale of a warehouse in Narva to boost e-trade in Estonia, https://news.postimees.ee/3351167/whale-of-a-warehouse-in-narva-to-boost-e-trade-in-estonia.

in containers has created many challenges for the container terminals. To meet these challenges, the container terminals have to innovate and optimise their logistics processes[30].

According to the Estonian national post service, 90% of the goods originate from China and are transported to Estonia via planes, mostly by special charter flights. The outbound transport is combined – for the Baltic countries, road transport is used as it can provide the needed service time, but for other countries mostly commercial flights are used. Rail Baltica railway can have an advantage for destinations closest in Poland and Germany, however the estimated cargo volumes are small, would not fill up a whole wagon, but need to be transported daily which means that the parcels could not be put on hold until a whole wagon is filled.

However, even if the e-commerce is blooming, an interviewed representative of the Estonian national postal service foresees a significant drop in the levels of orders from 2021 due to the amendments on the European Commission VAT Directive, according to which all goods bought online by EU consumers from sellers outside EU will also be subject to VAT. If it results in the decreased volumes of packages from non-EU countries, it may result in an increase in e-commerce volumes within the EU.

4.4. Electronics

The interviewed electronics company cannot foresee changes in ODs. However, in the very long-term, changes can take place but this is not a reliable forecast at the moment.

The modal shift to rail can occur to a limited extent. The interviewed electronics company is not confident in forecasting shifts. As they said, with a fast and safe and high-quality transport, rail can have an opportunity. The selection of the transport mode for outbound is by today mostly plane and truck. The interviewee acknowledged, however, that in the future if the goods nomenclature is wider and there are reasonable warehousing solutions for additional goods flow on pallets together with potential intermodal terminal also rail transport from Pärnu to Europe will be a potential alternative.

[30] Rashidi, H. and Tsang, E. (2016). Vehicle Scheduling in Port Automation: Advanced Algorithms for Minimum Cost Flow Problems. Second edition, pp. 2-5. ISBN 978-1-4987-3253-6.

4.5. Logistic companies

According to a major local logistics company in the region, RB is a competitor for the company and RB does not bring additional cargo for the company. Only during the building of RB there could be some additional cargo for the logistics company. Another situation will be if RBPT is already built up, there could be an option for the logistics company to be a partner as a terminal operator.

Another major logistics company in the region from abroad sees potential cooperation between RBPT and Salaspils Intermodal Terminal. Latvia Railway foresees potential for international cooperation between RBPT and Salaspils terminal e.g. in containers filled with raw material, wood furniture, for sending goods to Germany etc. Also, vice versa e.g. e-commerce goods from Asia through Duisburg by railway to Latvia (5 days trip) and further to Estonia and to the total region. Additionally, the company foresees potential for Finland exports included more widely Scandinavian exports by railway to Central Europe etc. Important here is networking, service and price level of both intermodal terminals.

In conclusion, there are several international, EU level as well as regional changes which altogether will have an effect on Pärnu freight terminal's functioning and the freight flows moving through RBPT. In addition to the future transportation development, also the potential international partnerships, especially with Northern Latvia, may have an important role for RBPT. In order to determine whether Northern Latvia will constitute a part of the RBPT catchment area, Northern Latvia and its freight flows are analysed next.

4.6. Northern Latvia

Latvia is geographically divided into 6 regions and regarding RBPT two northern regions – Pieriga and Vidzeme – are relevant. However, the capital city Riga and its surrounding municipalities have the highest economical outcomes and Riga region constitutes around 55% of the GDP of Latvia.[31] Currently, the Northern Latvian companies are primarily exporting to Lithuania, Poland, Germany and Central European countries, Scandinavian countries, Italy, and Russia. Vidzeme is the least populated (approx. 200,000 inhabitants) and also the least densely populated (13 people per km^2) region of Latvia.[32] The region is characterised by wood and wood products

[31] http://data1.csb.gov.lv/pxweb/en/ekfin/ekfin__ikp__reg/IKG10_110.px/?rxid=e6c23041-5fde-48b1-973b-d51a289d31d4

[32] https://www.sciencedirect.com/science/article/pii/S1877042815021886

industry and dairy production, but also wholesale trade, production of non-metallic mineral products, mining and quarrying and production of furniture are relevant (see Figure 8).[33] Wood and wood productions is also the area where the highest number (approx. 5000 people in 2016) people are employed. The GDP of Vidzeme region was approx. 1,6 billion euros in 2015 and has regularly constituted around 6-7% of the Latvian GDP since 2010 (see Figure 9).

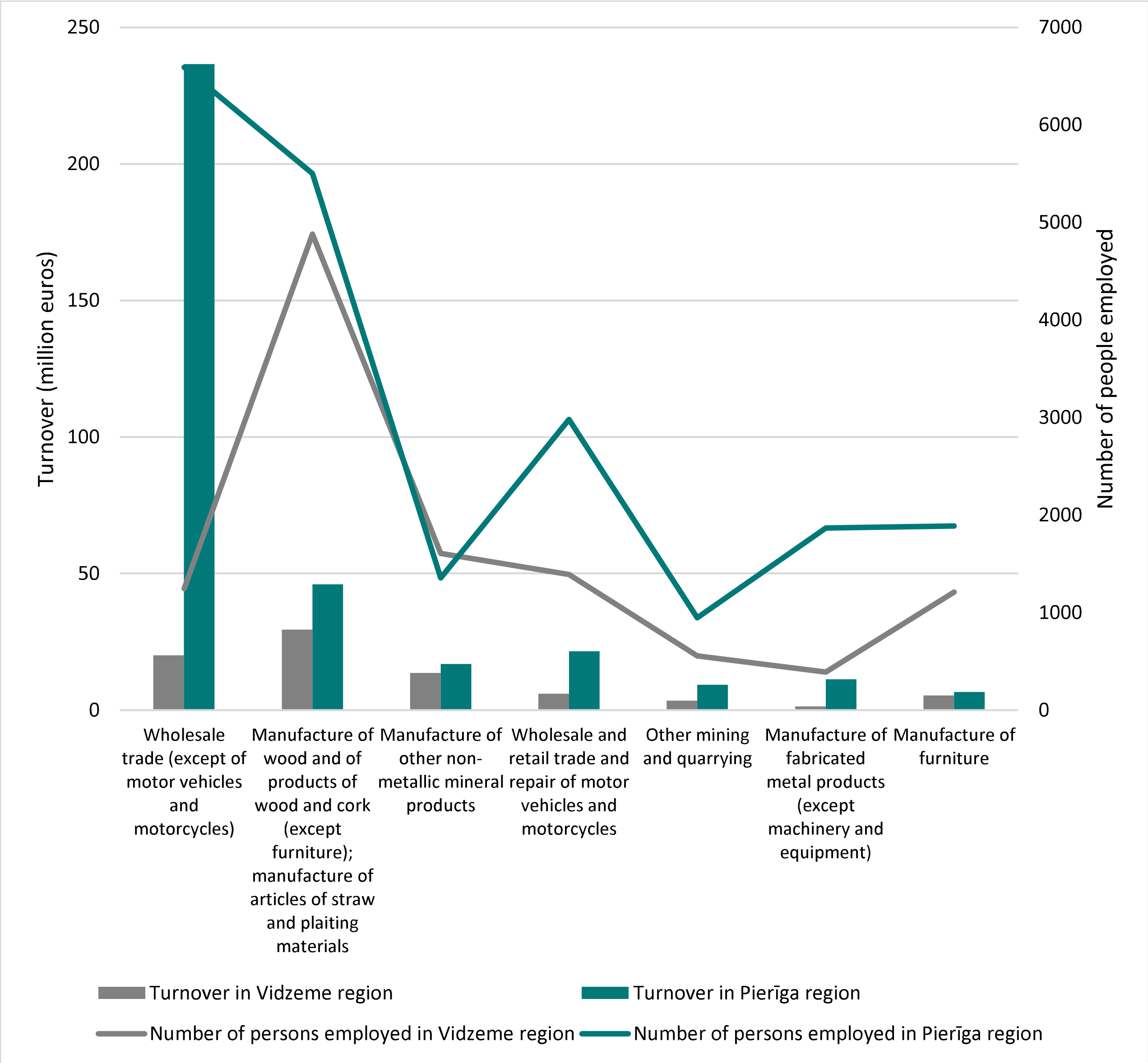

Figure 8. Key entrepreneurship indicators of relevant enterprises in Vidzeme and Pieriga region (2016). Only industries relevant to RB and RBPT are presented.[34]

[33] https://www.makroekonomika.lv/ka-attistas-latvijas-regioni

[34] https://www.csb.gov.lv/en/statistics/statistics-by-theme/enterprises/structural-business-statistics/tables/sbg050/key-entrepreneurship-indicators

The Pieriga region is strongly influenced by the capital city Riga. Wholesale trade is the dominating sector as the turnover of wholesale trade exceeds the turnover of wood and wood and cork production nearly 4 times (236 million euros versus 46 million euros in 2016) and most people are employed in the wholesale trade industry (see Figure 8). Similar to Vidzeme, next to wood and wood and cork products industry, the manufacture of non-metallic mineral products, manufacture of fabricated metal products, mining and quarrying, and manufacture of furniture are leading in the area (see Figure 8). The share of the Latvian GDP is approximately twice as high compared to Vidzeme region, and has constituted around 15% of the Latvian GPD since 2010 (see Figure 9).

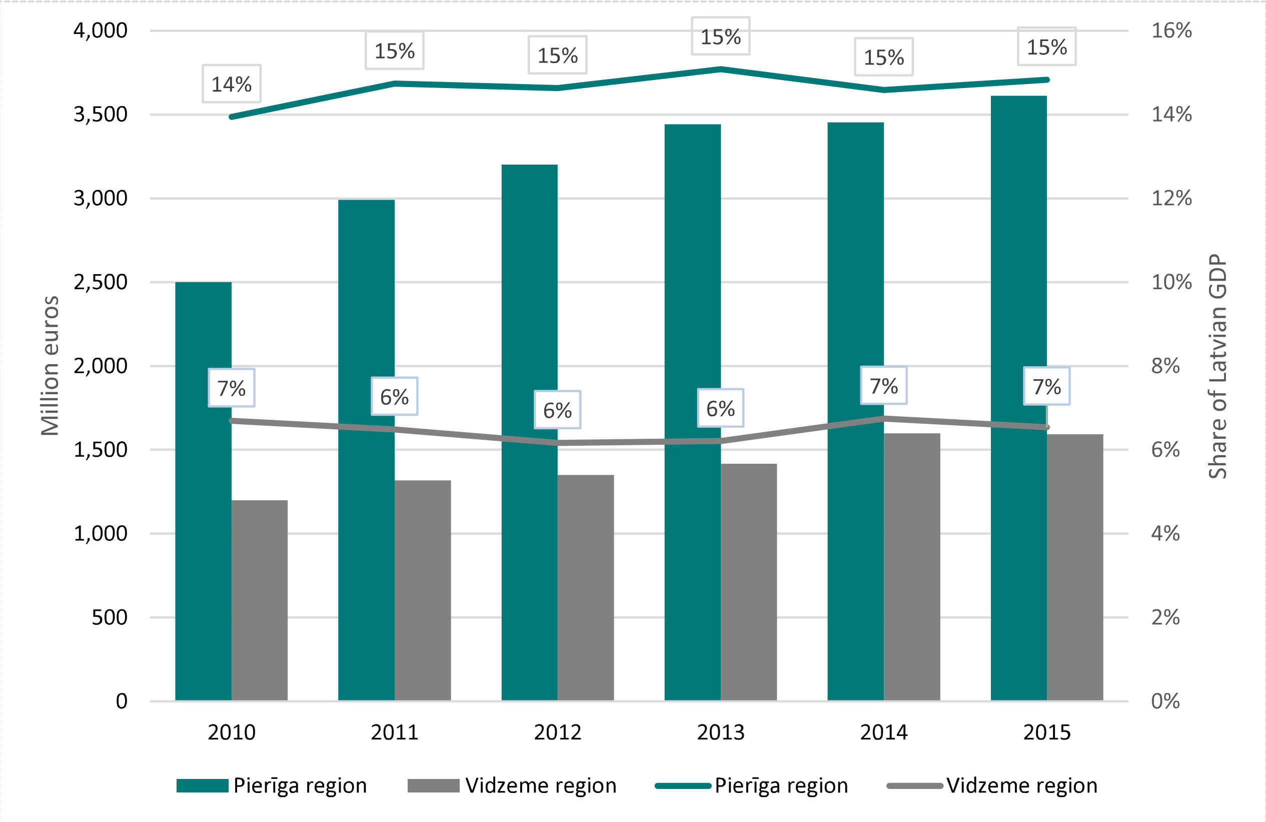

Figure 9. GDP by statistical region and city in Pieriga and Vidzeme region 2010-2015[35]

Several important sites regarding to the Rail Baltica railway and Pärnu Terminal are located in Pieriga region –Salaspils Terminal, Port of Salacgriva and Port of Skulte – which all have a substantial impact on the cargo flows to RBPT. Currently cargo is being shipped from both, and

35 http://data1.csb.gov.lv/pxweb/en/ekfin/ekfin__ikp__reg/IKG10_110.px/?rxid=e6c23041-5fde-48b1-973b-d51a289d31d4

particularly Salaspils terminal serves as a major gateway to further transport to the southern and eastern route as well as to the Baltic sea.

Currently, several Estonian and Latvian companies are storing their freight in terminals either in Salaspils or Salacgriva. Several companies operating in Northern Latvia (e.g. in the wood, construction materials production, or peat industry) explained that as they already have a well-functioning transport route, they would not consider transporting their freight northwards to Pärnu, so it would be transported back to the south again as this would mean increase both in cost and time for transport. The costs would also be increased due to a doubled road toll if the freight is transported from Latvia to Estonia and back. Therefore, the Northern Latvian municipalities are not regarded as part of the RBPT catchment area.

In order to look into the future developments and potential relevance of Latvian Railway to the RBPT, the representative of Latvian Railway was interviewed. "Latvijas dzelzceļš" (LDz) (*Latvian Railway*) is a state-owned Joint-Stock Company. The task assigned to LDz is to manage the railway infrastructure and logistics services within the interests of the national economy of Latvia. LDz manages, maintains and develops the public railway infrastructure in Latvia.

LDz as the manager of public railway infrastructure is indirectly involved also in the international Rail Baltica project. Changes within this project in the nearest future will affect not only Riga Central Station – along with the entry of LDz into new markets of the Asian region, a synergy of railway lines may form with the freight owners providing an effective way for the carriage of goods via Latvia. However, no clear link to the freight flows via Pärnu or the Pärnu region could be determined. This opinion was supported by other international enterprises who have their operations in Estonia as well as Latvia, e.g. in the forest industry.

5. Pärnu Intermodal Terminal catchment area

5.1. Mapping the catchment area

Mapping of the terminal catchment area is extremely complicated and is influenced by different factors. For example, the factors affecting the size and the range of the catchment area are following: distance from the port, transportation price, infrastructure, terminal quality and reputation, cargo handling speed, terminal parameters, selection of modes of transport, competition, skilled workforce, security, and local government activities.

The catchment area is designated as the area to which a terminal provides its services, additionally it could be the area where goods are being collected or disposed in. The collection/delivery of goods from the points of origin or to the place of destination constitutes the flow of traffic through a particular terminal. One of the major aspects regarding the quality of a terminal is therefore how the connection to the final destination, the first or last mile is organised and what are the related costs.

Access to the terminal for Railway Undertakings as well as for trucking companies/agencies incl. the network of roads, as well as the provided handling facilities and infrastructure (loading, unloading, storages, handling etc.), are important for attracting goods and supply chains. In addition, the reputation of the terminal operator, which is determined by the good understanding of clients and their needs, plays a role in the size of the catchment area. The size of the catchment area is also influenced by the choice of mode of transport used for freight transport, for example, is it used by road, rail or ferry. Also, there is competition between companies that provide similar services and handle the same groups of goods. The restrictions imposed by local governments, the regulations also affect the size of the catchment area.

The Pärnu Intermodal Terminal's potential catchment area is potentially of the same size as the catchment area of the port (see Chapter 2.3) consisting of the Pärnu, Viljandi, Lääne, Järva, Tartu, Põlva, Võru and Valga counties. Depending on the commodity the area might be slightly bigger or smaller as the transport possibilities from and to Pärnu are significantly more differentiated compared to the port. The European destinations offered with intermodal services from Pärnu (be it directly or through a hub like Salaspils) will offer new and alternative options.

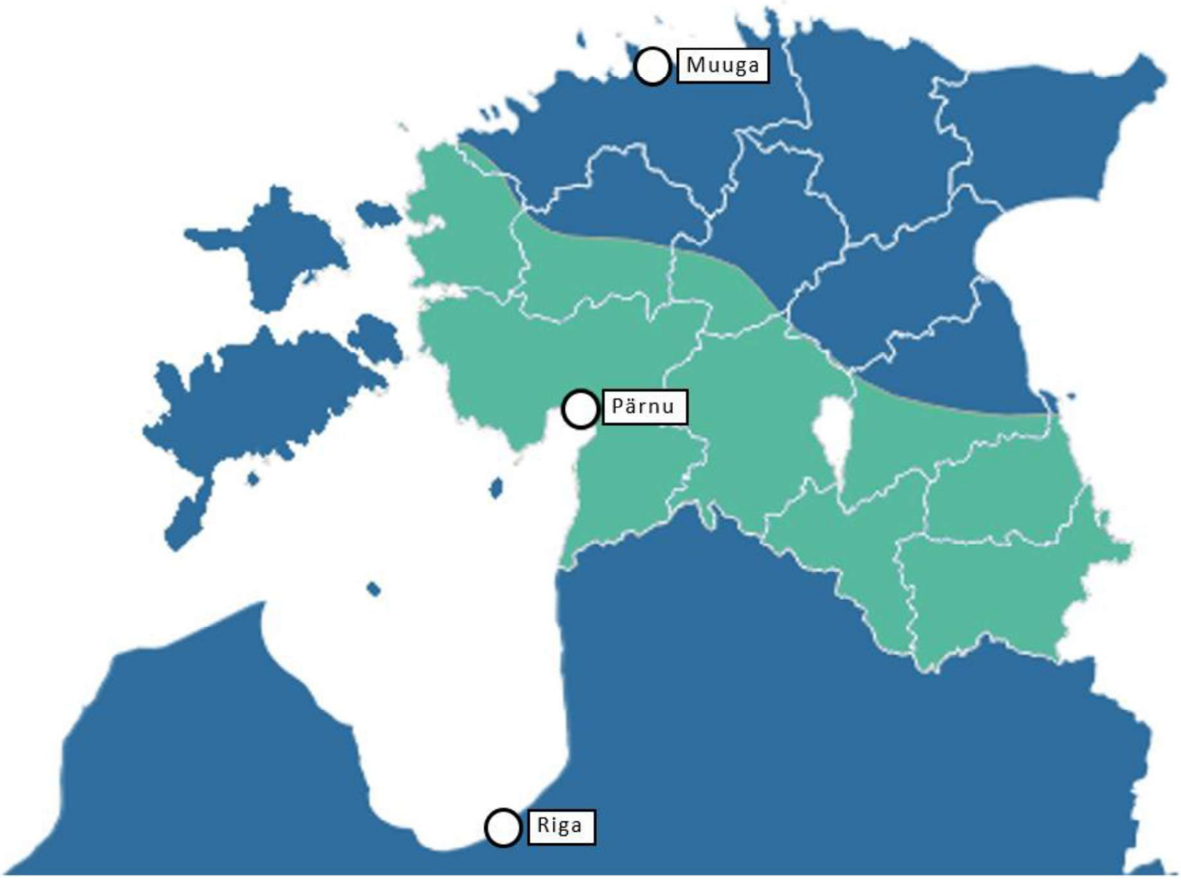

Figure 10. RBPT catchment area[36]

Two of the largest Estonian islands, Hiiumaa and Saaremaa, are not part of the catchment area. Based on the analysis, the primary reason for this is the lack of potential cargo flows which could be suitable for RBPT. For example, the outbound cargo from Saaremaa consists primarily of wood and wood products and is shipped towards Scandinavian countries from Saaremaa harbour.

Rail Baltica as transport infrastructure from and to the intermodal terminal limits the O/D options for the transport services to a North-South route and will let the market primarily focus on the target countries of the trade flows from and to Estonia. Of course, connections to the broad gauge-network are possible but it is not yet clear how likely they are from and to Pärnu.

[36] Civitta Estonia, Maa-amet, OpenStreetMap

5.2. Export and import volumes of the RBPT catchment area

According to the statistics of the Port of Tallinn the volume of RO-RO cargo increased by 11% up to 0,5 million tonnes in 2017 compared to 2016.[37] The Total RO-RO cargo volume was recorded 5,1 million tonnes in 2017.[38]) RO-RO cargo comes from Scandinavia, especially from Finland, and goes to the south through the Port of Tallinn and vice versa. The North-South route of trade flows through Estonia and mainly involves freight flows to and from Finland and the other Baltic states. This represents potential cargo for RBPT. There is an international trend that more bulk cargo and raw material go into containers e.g. fertilizers and round timber. This significantly supports the development of intermodal terminals and containerisation.

Based on the statistics of 2017, the import and export volumes together with main cargo groups of the catchment area are presented in Figure 11 and Figure 12. It should be noted, that the volumes in the figures below are indicative. The import and export volumes presented in the figures show the companies who are registered in the Pärnu region but their operations may take place in other regions in Estonia. On the other hand, as noted before, RBPT may open new possibilities for other enterprises who may open new business lines or change their international logistics chain.

[37] Port of Tallinn, 2017, https://investor.ts.ee/majandusaasta-aruanded.

[38] Port of Tallinn, 2017, https://investor.ts.ee/majandusaasta-aruanded.

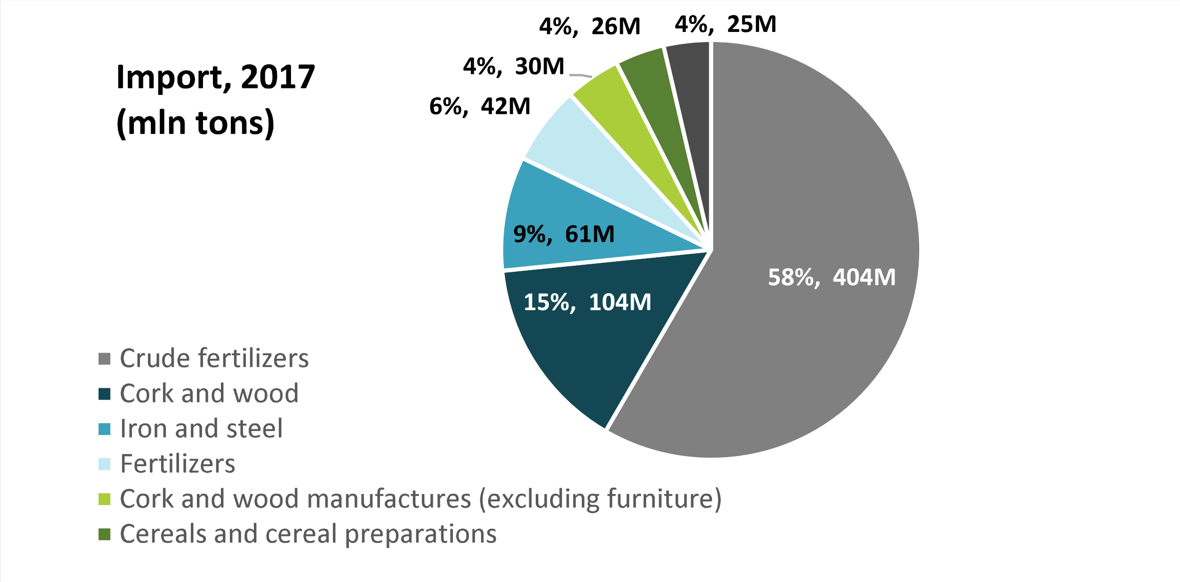

Figure 11: Main commodity types imported by companies operating in the potential Rail Baltica Intermodal Terminal catchment area during year 2017

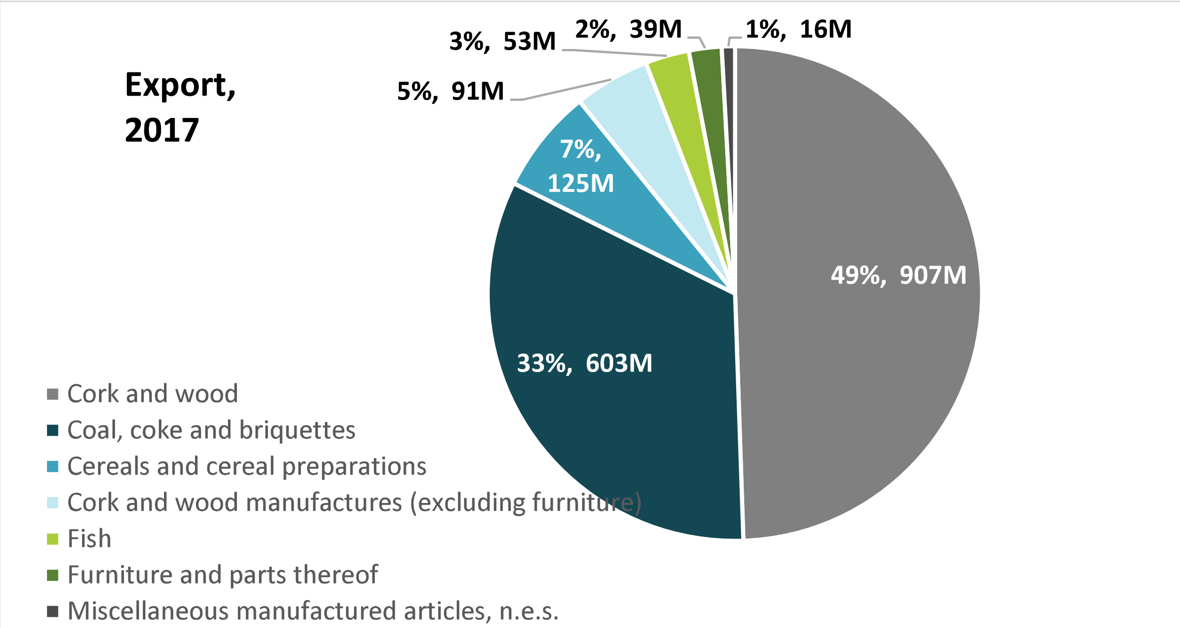

Figure 12: Main commodity types exported by companies operating in the potential Rail Baltica Intermodal Terminal catchment area during year 2017

5.3. Related Terminals

The RBPT catchment area is defined mostly through the geography of cargo movement relevant to the Port of Pärnu. (see also subchapter 5.1) as the analysis showed that there is an existing catchment area of the Port of Pärnu and companies located outside the catchment area prefer Muuga or Salaspils Terminal, other means of transport (not rail transport) or their cargo flows are not on the North-South route.

Three harbours – Pärnu, Kunda and Paldiski have extensive influence to the RBPT catchment area[39] and are thus competing with the location. Pärnu-Riga distance is only 189 km and from Estonian South border even less. Due to this reason, a certain amount of local Estonian export has the potential to use Salaspils directly for outbound and inbound traffic flows. Secondly, distance between Pärnu and Tallinn is only 129 km whereas Pärnu and Sillamäe distance is 219 km and there will be no standard gauge railway connection. Due to this reason, also Port of Tallinn/Muuga Terminal might be a competitive location for intermodal and other commodities. Port of Sillamäe is today a competitor for local export cargo especially round timber, peat and pellet (see Table 4) but will have no relevance for the RBPT.

Beside these locations there are no other locations offering loading and unloading for cargo from today's perspective. However, the options to connect industries directly to the Rail Baltica in future might be a certain competition to the terminal if such a development is related to significant rail transport business. The terminal is definitely a lone standing option for all industries in the area to allow direct rail connection far into the European continent. This option will need to prove its financial viability and the quality compared to other modes of transport (shipping and trucking) but certainly has the chance to succeed.

The ports mentioned above will have less influence on RBPT as the export and import activities are more related to local volumes exported through the Baltic Sea. Shipping will most probably remain cheaper and easier compared to railway solution especially to other Scandinavian countries.

Pärnu port itself also plays an important role for wood but has no facilities for intermodal transport so far and thus cannot be seen as competitor.

[39] Source: HD Forest News, 2016

Table 4: Cargo flow in different ports 2017, tonnes and TEU[40]

Port	Million tonnes	TEU
Port of Tallinn	19,2	215 500
Port of Riga	33,7	445 984
Port of Sillamäe	8,18	N/A*
Port of Pärnu	1,97	N/A*
Paldiski Northern Port	2,55	N/A*

To determine the dynamics with competing terminals, mainly to Salaspils, a closer look into a cooperation model is needed. Most likely Salaspils will have the chance to attract volumes from and to Russia through its direct connection to Moscow on broad gauge. The options for services on standard gauge are most probably bigger in Salaspils than in Pärnu. The option to connect a service from Pärnu directly with Salaspils and thereafter connect to the services offered in Salaspils should be considered to create a higher attractiveness to use Pärnu directly as starting point for transport chains to Europe. The more service destinations are offered from one location the bigger the catchment area and the potential volumes and thus the related business becomes. However, the economic viability of such a connection needs to be determined first.

In addition to Salaspils, three logistic centres - Duisburg, Katowice, Warsaw - have become the main transport and logistics centres. Therefore, their development and processes have an impact also for RBPT. For this reason, these terminals have been regarded as the main potential destination terminals in Chapter 7 where the traffic forecast analysis has been presented.

[40] Port of Tallinn, Port of Riga and Port of Sillamäe. * Port of Sillamäe has Maersk container line ship calls since 19.11.2016. In Port of Pärnu there is no container terminal.

6. SWOT analysis for Pärnu Intermodal Terminal

The following chapter analyses the Pärnu Intermodal Terminal by its internal strengths, weaknesses, and external opportunities and threats (SWOT). The SWOT analysis helps to determine the comparative advantage of RBPT, but also pinpoints to the internal and external factors which need to be addressed or considered when planning the terminal. The summary of the SWOT analysis is presented in Table 5 and the different factors are then further explained.

Table 5: SWOT analysis of Rail Baltica Pärnu Intermodal Terminal, composed by the author

STRENGHTS	WEAKNESSES
1. RB railway potential international network 2. RB potential cargo flow 3. Better (road) connection to companies located in Central or Southern Estonia 4. Political support from Pärnu City Government as well as the Development Centre of Pärnu County	1. Closeness of other already working and potential competitive intermodal inland and port terminals e.g. Salaspils Intermodal Terminal, Riga container terminals, Muuga Container Terminal and Muuga Intermodal Terminal. 2. Modest industry profile in the catchment area 3 Other Estonian ports are increasingly competing for goods exported form Estonia. 4. Unclear business model 5. Potential low utilization rate (effectiveness)
OPPORTUNITIES	**THREATS**
1. Increase in local exporters cargo flow and containerization, e.g. round timber 2. Congestion on roads	1. Fast development of trucks and road transport, e.g. development of Via Baltica, Tallinn-Tartu-Võru-Luhamaa

3. Increase in international cargo flow, e.g. RO-RO between Finland-Estonia 4. Potential terminal will be equipped with modern automated and less hand power using efficient technique 5. Valuable services e.g. filling efficiently containers, trailers, and offering for instance warehousing services, depot for empty containers 6. Potential cooperation with other nearby railway intermodal terminals e.g. Salaspils Intermodal Terminal and Muuga Intermodal terminal	2. Rail Baltica Pärnu Intermodal Terminal cost together with railway transport is too expensive to competitive transport modes e.g. trucks 3. Trucking industry not cooperating 4. Port of Pärnu is a competitor for same cargo flows and commodity groups 5. Competition with RB Salaspils Intermodal Terminal and RB Muuga Intermodal Terminal 6. Other Estonian ports are increasingly competing for goods exported form Estonia. 7. Environmental discussions on location as the potential locations for RBPT are surrounded by nature reserves and may spark disagreements from the locals in the planning or building process.

Trucking industry and road transport

The trucking industry has to date not been very supportive of Rail Baltica. Certain measures need to be put forward to ensure that the trucking industry has a role to play in the future development of the Rail Baltica global project.

The competitive positions of road and rail transport is also impacted by the taxation principles in the potential origin or destination countries. For example, in all three Baltic countries, the railway operator is required to pay fuel tax plus infrastructure fees. The infrastructure fees change yearly. At the same time, road transportation is taxed only by fuel tax (but no infrastructure fees). However, in all countries on the RB route (also since 2018 in Estonia), all heavy goods vehicles that weigh more than 3,5 t and are used on the public road network are required to pay road tax.[41] The tax rate depends on the maximum authorised mass of the heavy

[41] https://www.teetasu.ee/; https://www.lvvignette.eu/

goods vehicle and its trailer, the number of axles, and the emission class of the heavy goods vehicle.[42] In addition, the cost of road transport is expected to increase in the future due to the increased attention and regulations on driver's social rights (see also Chapter 4. The changes in the taxation for rail and road transport as well as other future developments in the transportation sector impact the competitive situation of road and rail transport, and the use of Rail Baltica.

It needs to be kept in mind that the shareholders of combined transport operators are often road forwarding companies. As such they have an important role to play in the future development of Rail Baltica and are a crucial link in the supply chain. This is why, trucking companies need to be invited to participate in the train operations as shareholders. This ensures their inclusion in the long-distance logistics process while providing them capacity and ensuring there is flexibility on the last-mile sections.

Fast development of trucks continues. As of January 2014, all newly registered trucks and buses must comply with the Euro 6 emission standards. By implementing the new guideline, engine manufacturers reduce pollution to a minimum. Under the new standards, the change in emission limits is as far-reaching as all the previous five levels put together. Compared to Euro 5, permissible nitrogen oxide emissions were reduced by 80%. In addition, soot particle emissions of commercial vehicles were cut by 66% in contrast to the previous standard.[43]

Additionally, the development of roads in Estonia continues. For instance, the road forms a dual carriageway of 44 km. The main part is between Tallinn and Kose (37,1 km). The remainder can be found in Mäo (5,9 km) and near Tartu (1 km). The first Estonian highway between Kose and Mäo is planned to be completed in 2022.[44]. Roadwork on the nine-kilometre, 2+1 section of Tallinn-Pärnu Highway (Via Baltica) between Ääsmäe and Kohatu was completed in 2017. New access and maintenance roads and dedicated U-turn areas were built to help improve the highway's integration with local traffic as well as access to roadside properties.[45]

Potential users of RBPT, cargo flows and commodity groups

Entrepreneurs and companies are waiting for the potential Pärnu RB Intermodal Terminal to start working to see firstly the location, but also the speed of service, costs level etc. However, there

[42] https://www.teetasu.ee/

[43] MAN Truck Germany, https://www.innovation.man/en/man-truck-innovations/MAN-Truck-Innovations.html

[44] Wikipedia, 2018, https://en.wikipedia.org/wiki/Estonian_national_road_2

[45] https://news.err.ee/648207/bad-weather-delaying-completion-of-roadwork-on-tallinn-parnu-highway

is a possibility that the local exporters increase the cargo flows, and there can also be an increase in international cargo flows. However, the industries in the catchment area are relatively modest, and see no significant changes in ODs, but do see some increase in the production and export volumes, for example:

- None of the interviewed in the wood industry can see changes in ODs. One product group was mentioned as potential for rail transportation by a company building module wooden houses and this is modular bathrooms.
- None of the respondents in the agricultural industry see significant changes in ODs. By a major producer and exporter of peat modal shift to rail can occur in some amounts for peat transportation from Estonia.
- However, an interviewee in the textile sector admitted that potential rail transport and potential Pärnu Intermodal Terminal with reasonable warehousing solutions would offer a future solution for transporting from Pärnu to Europe and extending the outbound and incoming logistics service providers.
- The company interviewed in the electronics sector is not able to predict changes in ODs. However, in the very long term, the changes may take place, but this is not a reliable forecast at the moment. The modal shift to rail can occur to a limited extent.
- Transport of goods suitable for RB is not dependant on the season. The transport of goods which will be moving through RBPT are mixed goods and do not presume seasonality.

In general, export of goods has increased, however, all of the destination countries are not within the interest of Rail Baltica or RBPT. According to Statistics Estonia, in July 2018, the exports of goods increased by 27% compared to July 2017. In July 2018, the top destination countries of Estonia’s exports were Finland (16% of Estonia’s total exports of goods), Sweden, Latvia (both 9%) and the USA (10%). In July, the biggest share in the exports of goods was held by mineral products (22% of the total exports of goods), electrical equipment (15%), followed by wood and articles of wood (9%). In addition, one of the interviewed companies from Pärnu, for example, have plans to increase production and export e.g. veneer production three times in five years. On the whole, the export of goods from the RBPT catchment area is larger than import (see also subchapter 5.2, and it is expected to remain the same in the future also

Competitors vs cooperation

According to the feedback from the largest Pärnu County, Estonian and regional entrepreneurs, companies and organisations, the majority are pessimistic and the minority are neutral about the Pärnu Intermodal Terminal development. At this early stage Pärnu Intermodal Terminal services, price levels and utilisation rates (effectiveness) are unclear. Some respondents do not want to change the current logistics of goods transportation or see a potential Pärnu Intermodal Terminal as a competitor. Therefore, it is difficult for the interviewees to predict the need for the terminal and its potential success. In addition, the biggest challenge is the closeness of the other already working and potential competitive intermodal inland and port terminals e.g. Salaspils Intermodal Terminal, Riga container terminals, Muuga Container Terminal and Muuga Intermodal Terminal. For instance, the distance between Tallinn and Pärnu is only 129 kilometres. Also, the Port of Pärnu with its port terminals is situated in Pärnu. In logistics, the less lifts the more efficient it is for the total logistics chain and transport of goods. Therefore, for RBPT potential development it is very important to take into consideration these challenges.

According to international best practices, for example, the trend of container transport in the Baltic Sea region is considered. Along with growth in container flows, the capacity of container terminals is increasing at enormous speed in the Baltic Sea region. This, in turn, leads to stronger competition between the ports and terminals in the region. Both container ships and container port facilities are very expensive, hence, it is most desirable to utilise them as intensively as possible. Full utilisation of the available resources and efficient management of operations are two major goals. Under these two goals, many objectives will be achieved such as increasing the port throughput and utilisation.[46]

Table 6 details the capacities of the container terminals in the Baltic Sea region and annual container flows based on the use of terminal capacities in percentage. It can be seen that the usability of container terminals in ports in 2008 was 71.51%, whereas decreased to 56% in 2011. In 2016, container terminal usability was 36.30%. Thus, it is already today that unused terminal capacities in the Baltic Sea region amount to nearly two thirds of total capacities. Therefore, each port and terminal would need serious arguments and expertise, new services, new shipping

[46] Aravindan, S. and Thiruvenkatasamy K. (2016) "An Analysis on the Modelling of Container Terminal Operations", Indian Journal of Science and Technology, Vol 9 (39). ISSN (Print): 0974-6846, ISSN (Online): 0974-5645

calls, innovation and technology with less manpower of how to attract new container flows. The last market feature is very important globally as well as in Europe.[47]

[47] Le-Griffin H.D. and Murphy M. (2006) "Container terminal productivity: experiences at the ports of Los Angeles and Long Beach", NUF Conference.

Table 6: Supply and demand (TEU) at the Baltic Sea container port market.

Year	2008	2011	2016
Baltic Sea container flow	4 999 000	5 882 000	6 104 000
Capacity of terminals	6 990 000	10 505 000	16 508 000
Use of terminal capacities %	71.51	56.00	36.30

By international best practices container terminals utilisation rate is often between 80-85%.[48] Some terminals in Asia are having even 100% utilisation rates. A sustainable utilisation rate of the container terminal capacity is considered to be 80%. This allows for business peaks, valleys and a margin for growth.[49] For container terminal development, results, success and business decisions, utilisation rate is a very important determinant of outcome container terminal usability.[50] All management decisions and strategies are involved in processes related to the use of its assets, reflecting the effect of these decisions on the financial performance of the business.[51] Taking the land utilisation rate as an example, a lower number is often interpreted to be less efficient in a comparison chart.[52]

RBPT processes and services

The RBPT option is to find a reliable, trusted business plan for RBPT. There could be opportunities for a joint venture of public finances (e.g. infrastructure) and the use of terminal through the financing of private companies. High quality and utilisation rate (effectiveness) is also important for terminal services. For a potential terminal, it is important to find valuable services, for example by effectively filling containers, trailers and, for example, warehouse services, by storing empty containers. The international trend is that more bulk cargo also goes into containers e.g. fertilisers and round timber, this supports development of intermodal terminals.

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[48] Sappio, F. Robert. (2007) "Trans Pacific Trade Outlook", "Transpacific Maritime Conference", Shenzhen, China.
[49] The Tioga Group, Inc., (2010), "Prepared for: Cargo Handling Cooperative Program", pp. 8.
[50] Vacca I, Salani M. and Bierlaire M. (2010) "Optimization of operations in container terminals: hierarchical vs integrated approaches", STRC 2010, pp. 1-15.
[51] Soares C.J.M. and Neto H.X.R. (2013) "A model for predictive capacity of a container terminal state: a system dynamics approach", 13th World Conference on Transport Research Selected Proceedings, pp. 3.
[52] Le-Griffin H.D. and Murphy M. (2006) "Container terminal productivity: experiences at the ports of Los Angeles and Long Beach", NUF Conference.

According to interviews with entrepreneurs and organizations and above analysis, Rail Baltica Pärnu Intermodal Terminal has a great potential for cooperation with the following terminals, Salaspils Intermodal Terminal and Muuga Intermodal Terminal. The areas of cooperation are cargo flows, as well as the return and storage of empty containers. One of the most important reasons is that all three are on the potential Rail Baltica rail network, in particular the intermodal terminals. In addition to the above-mentioned terminals, the fast-growing e-commerce sector can potentially be a strong partner for the Rail Baltica Pärnu Intermodal Terminal.

7. Demand Forecast and Traffic Analysis

7.1. Collection of basic information for demand forecasts

Information gathering and forecasting has been carried out based on the available public statistics from different sources, e.g.

- Statistics Estonia,
- The Tax and Customs Board,
- Statistics Latvia,
- Euromonitor,
- EtisPLUS,
- Passport Outlook

The aim of the quantitative analysis has been to determine the current situation as well as the change in the economical or industrial sector within the Pärnu Terminal catchment area. This analysis has also helped to examine the domestic and international trade flows and to identify trade volumes relevant for Pärnu Terminal, commodity groups, origins and destinations for those commodities. Understanding these changes is important for assessing whether the changes in the economic structure or industry can affect trade flows.

Identifying all available statistical data has core importance for forecasting the trade flow demand until 2055. The data in different databases is collected on different bases but will be analysed on mutual grounds, i.e. by commodity groups, cargo types, transport types and mode of transport. The statistical data analysis will look at data back until 2007 in order to understand the change in the last decade.

The preliminary list of data sources of Statistics Estonia which have been analysed are presented in Annex 4 – Statistical data Source and Content

7.2. The Prognosis of Traffic Flows

7.2.1. Methodology

Statistical information that has been gathered over the course of WP1 has been analysed to determine what freight flows can be reasonably expected to be carried on Rail Baltica. This considers the catchment areas that has been defined in Section 5.1. As previously mentioned, the Pärnu Intermodal Terminal's catchment area is potentially of the same size as the catchment area of the port consisting of the Pärnu, Viljandi, Lääne, Järva, Tartu, Põlva, Võru and Valga counties. As such, to determine the freight flows into the terminal, the road connections that link the various regions of the catchment area to the area around Pärnu where the terminal will be situated have to be considered in terms of quality, directness of the route and competing locations such as the terminal in Muuga or Salaspils, or the competing ports in Muuga or Paldiski. Also considered here is the amount of a particular county that is included in the catchment area.

As an example: the entirety of Pärnu County falls within the catchment area, therefore a strong assumption can be made that a good proportion, although not all of the flows from this county that are being transported to central Europe will pass through the terminal at Pärnu and Rail Baltica.

Lääne County shows a contrasting picture. In this case only about 30% of the county falls within the catchment area of the terminal[53]. Added to this is the fact that Lääne county has much better road connections with Riga and Muuga than it does with Pärnu so it is reasonable to assume that the freight flows will tend to move first to Muuga.

The northern extremities of Latvia have been excluded due to the proximity of this area to Salaspils intermodal terminal. This decision has also taken into account the freight direction as well as the tolls for trucks that would need to be included on such traffic.

Using the statistical information available, assumptions have therefore been made focusing on freight flows to EU Countries excluding Scandinavia, Latvia, and Estonia. From the information of freight flows available for last ten years an assessment was made of the largest potential flows in terms of commodity groupings (as put forward in Section 7.2.2) and what proportion of these would pass through the terminal in Pärnu to be carried on Rail Baltica. This has been carried out for all counties that interact with the catchment area.

[53] Based on the division of the counties prior to 2018.

An example of this breakdown for the counties of Pärnu, Rapla, and Lääne is detailed in Table 7 to Table 9. Only commodity groupings with larger volumes (ca. 1500t per year), or in some cases, flows which are well suited to rail transport have been considered.

Table 7: Estimated freight flows to be exported from Pärnu County via Pärnu Terminal

Destination Country	EU_Other				
Origin County	Pärnu				
Sum of Net (Tonnes)					
	Cereals, Fruit and vegetables, Live animals, Textiles, Other raw materials	Miscellaneous articles	Solid Mineral Fuels	Vehicles/ Heavy Machinery	Wood and Cork
2007	3,047	9,523	246,012	1,155	33,172
2008	2,920	7,736	263,589	1,121	22,554
2009	1,823	9,474	225,785	1,168	22,891
2010	1,749	11,924	232,721	1,065	35,177
2011	2,277	13,557	264,300	1,138	79,331
2012	1,371	12,032	301,699	1,107	120,041
2013	2,069	9,598	275,371	1,068	87,290
2014	2,616	7,935	361,057	1,411	58,201
2015	2,462	9,080	342,774	2,128	44,387
2016	2,524	9,557	381,605	2,813	20,482
2017	2,772	7,994	328,581	2,191	38,973
Average moved in assessed period	2,330	9,856	293,045	1,488	51,136
% Through Pärnu Terminal	75%	70%	70%	80%	80%
Total through Pärnu Terminal	1,748	6,899	205,132	1,190	40,909

Table 8: Estimated freight flows to be exported from Rapla County via Pärnu Terminal

Destination Country	EU_Other				
Origin County	Rapla				
Sum of Net (Tonnes)					
	Cereals, Fruit and vegetables, Live animals, Textiles, Other raw materials	Metal products	Solid Mineral Fuels	Vehicles/ Heavy Machinery	Wood and Cork
2007	1,985	11,253	48,370	47	45,301
2008	2,262	9,216	45,450	99	37,098
2009	3,017	5,811	30,068	168	33,231
2010	4,216	8,879	14,485	181	14,581
2011	5,199	3,181	14,789	315	28,987
2012	4,622	1,134	19,421	265	91,287
2013	5,128	934	19,914	280	124,354
2014	5,243	129	27,782	498	92,759
2015	7,415	1,955	14,703	682	42,675
2016	6,486	7,031	16,446	1,573	18,308
2017	7,110	12,468	12,481	1,129	52,656
Average moved in assessed period	4,789	5,635	23,992	476	52,840
% Through Pärnu Terminal	75%	70%	70%	80%	80%
Total through Pärnu Terminal	3,592	3,945	16,794	381	42,272

Table 9: Estimated freight flows to be exported from Lääne County via Pärnu Terminal

Destination Country	EU_Other		
Origin County	Lääne		
Sum of Net (Tonnes)	Column Labels		
Row Labels	Construction Materials	Solid Mineral Fuels	Vehicles/ Heavy Machinery
2007	4,136	29,327	137
2008	2,926	32,705	508
2009	3,485	36,771	226
2010	3,918	36,476	132
2011	4,087	33,125	183
2012	3,750	28,521	-
2013	2,636	19,039	43
2014	2,933	28,799	10
2015	2,409	75,344	207

2016	3,961	58,366	124
2017	3,364	70,524	196
Average moved in assessed period	3,419	40,818	177
% Through Pärnu Terminal	30%	30%	30%
Total through Pärnu Terminal	1,026	12,245	53

The freight flows identified have been transferred into train-km to calculate the related expected costs to provide rail services serving a new terminal at Pärnu. This allows for the competitiveness of rail services to be compared against road transport while also indicating indicative routes.

To enable this, the freight model used a methodology to "translate" tonnes into concrete trains. The basic assumption for this approach is using the following routes.

Table 10: Import & Export Origin & Destinations with Net Tonnage per train

Import	
Origin	**Tonnage (Net tonnes)**
Katowice	1120
Salaspils	850
Export	
Destination	**Tonnage (Net tonnes)**
Duisburg	1120
Katowice	1120
Warsaw	1120
Salaspils	850

Routes to Duisburg, Katowice, and Warsaw provide direct links to core rail terminals within Europe and, through RailNetEurope's Rail Freight Corridors, further connections to locations in the south of Europe as well as the main ports in Germany, the Netherlands, and Belgium. These will also act as collections points where trains travelling to Pärnu can be bundled. Further to this, these Rail Freight Corridors relate closely with the TEN-T Core Network Corridors and will be the focus of increased investment over the next years thereby further improving performance of services on these lines and increasing accessibility to Pärnu.

The Salaspils – Pärnu option provides an option that can be used as a shuttle service where Salaspils will act as a hub where loads can be bundled or split as required.

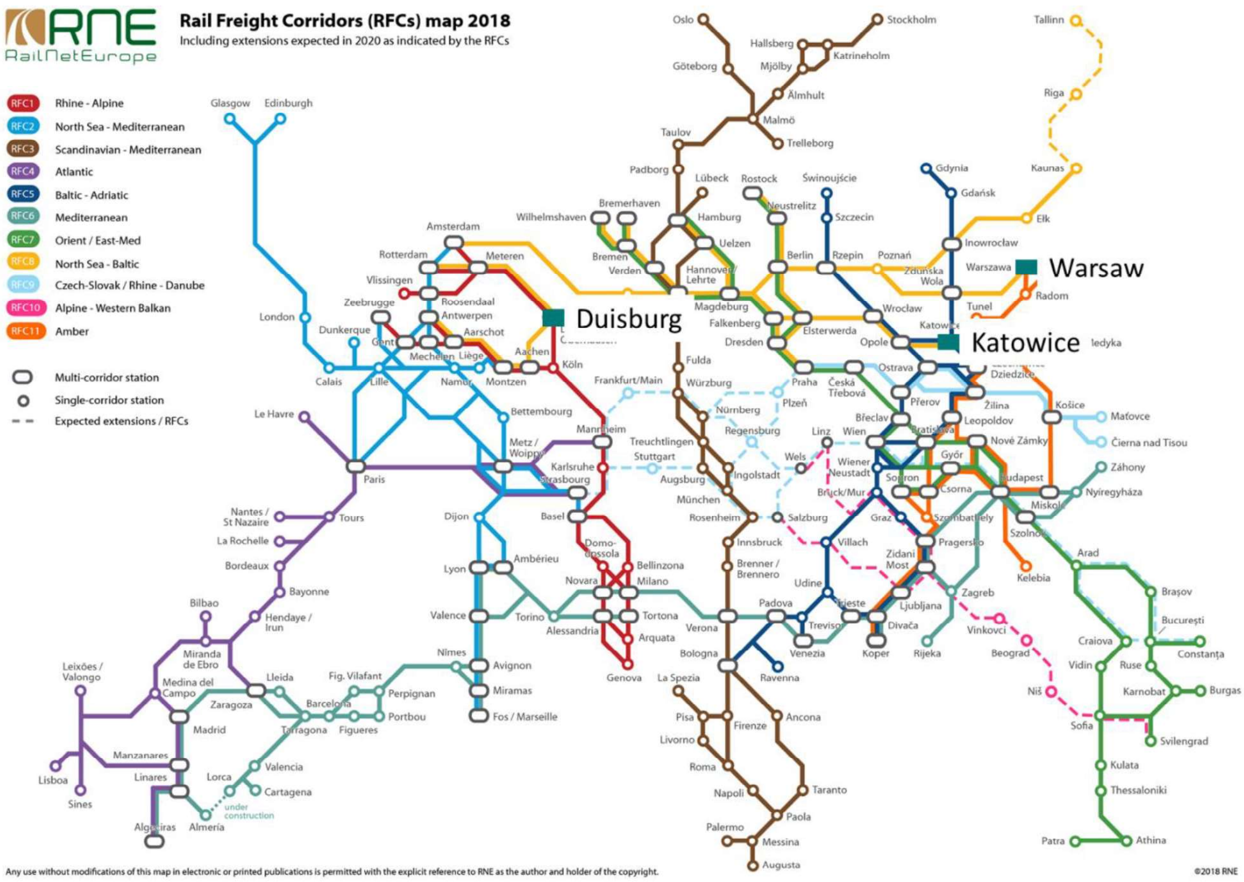


Figure 13: RNE Rail Freight Corridors

7.2.2. Current and forecasted traffic

The current commodity flows within the Pärnu Catchment area can be classified under the following groupings:

- Cereals, Fruit and vegetables, Live animals, Textiles, Other raw materials
- Chemicals, manufacture, storage
- Construction Materials
- Crude and Manufactured minerals, Cement, Lime
- Crude petroleum, petroleum products and gas

- Foodstuffs, Animal food and Foodstuff waste, Oil seeds and Oleaginous fruit and Fats
- Iron ore, Iron and Steel, Non-ferrous Ore and Waste
- Metal products
- Miscellaneous articles
- Natural and Chemical fertilizers
- Solid Mineral Fuels
- Vehicles/ Heavy Machinery
- Wood and Cork

This listing encompasses the main commodities that are available in terms of volume and/or suitability for rail transport.

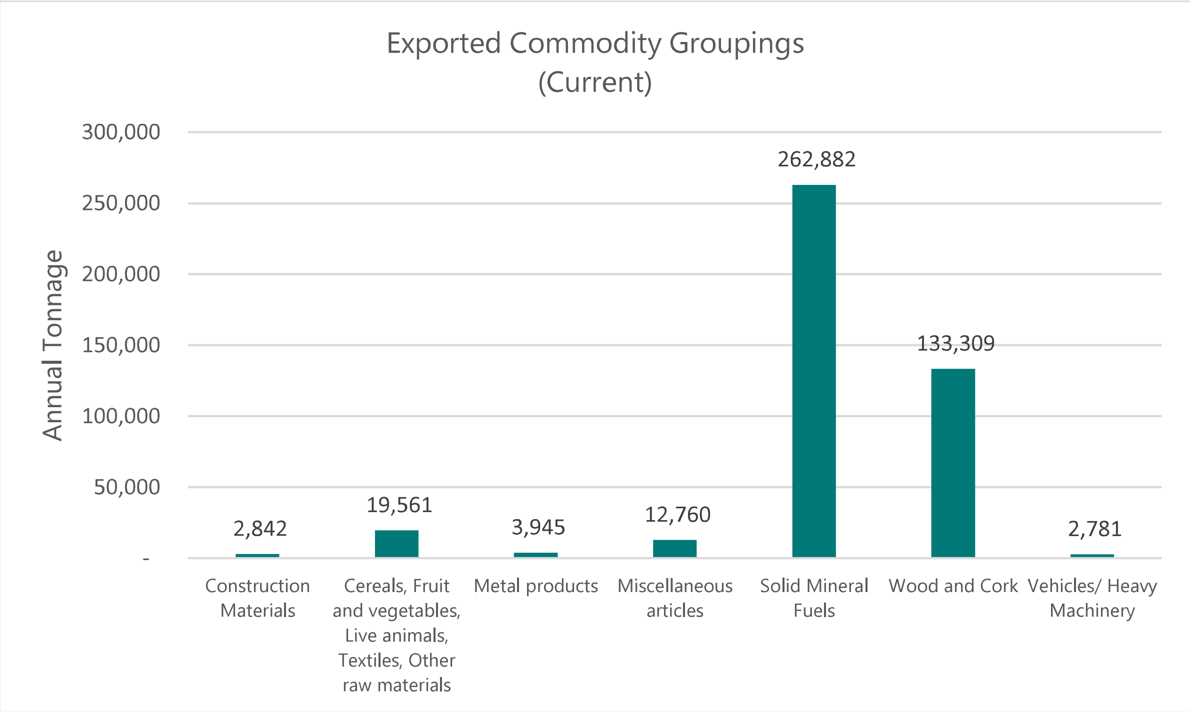


Figure 14: Commodities currently exported from the catchment area

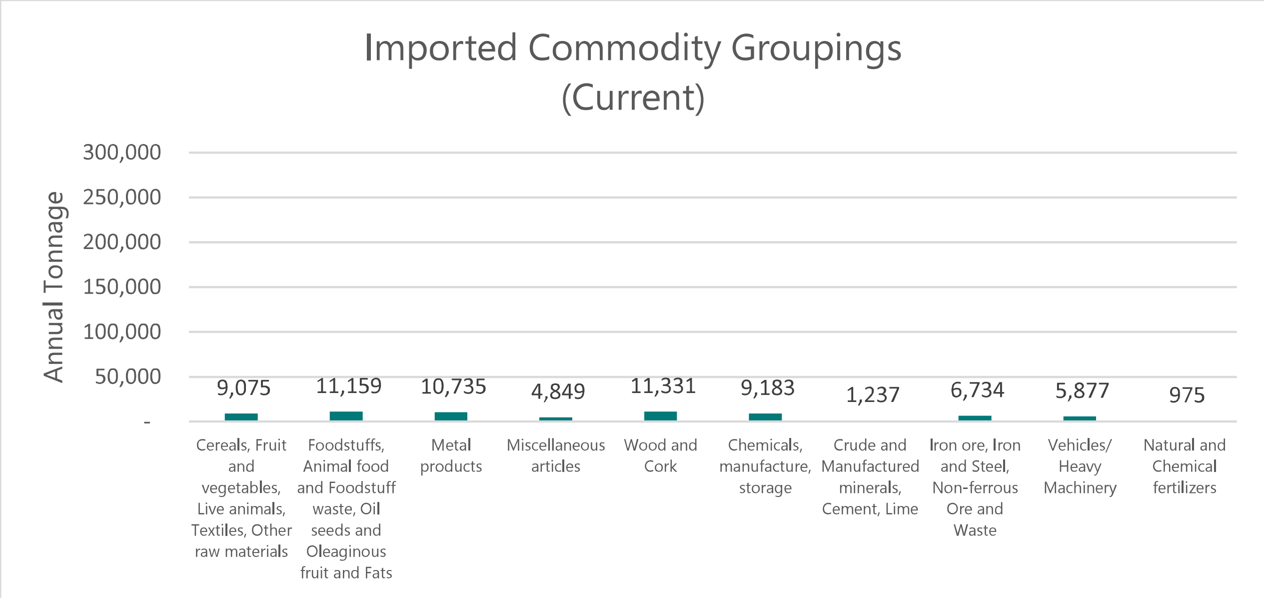


Figure 15: Commodities currently imported into the catchment area

When comparing imported and exported goods a large bias can be seen in favour of the exported goods in terms of the annual tonnage moved. This is reflected in the number of train movements into and out of the terminal. It should be noted that these train movements only take account of direct services to and from the terminal to central Europe and do not take into consideration other operations that may encompass services to Muuga or Salaspils. Such shuttle or indirect services will be decided by the operators and RUs themselves based on their operations model and as such cannot be predicted at this stage.

In terms of exported goods, the commodity groupings of solid mineral fuels along with wood and cork make up the largest share of the annual tonnage. Solid mineral fuels are comprised mostly peat and peat products based on the information available from the Estonian Statistical Office.

Imported goods in contrast show a higher number of commodities but with a lower annual tonnage for each. In this case an assessment has been made on which commodities provide some suitable volumes as well as those which are suitable for transport by rail.

When forecasting future flows an assessment has been made as to how the current flows will react to economic growth, how logistics companies will adjust their current operations and how trade flows will change with the opening of the terminal. This has been assessed until 2055 based on realistic, optimistic, and pessimistic scenarios. Here too an assessment has been made as to what the impact of Induced Flows will be.

Using the current flows as a base point a percentage increase has been added to the total flows in five-year blocks from 2025 to 2055. As containers are expected to make up a large proportion of the traffic through the terminal and grow over the years in line with what is being seen throughout Europe, the growth for individual commodities has not been defined.

It is assumed that Rail Baltica will also induce flows. For the purpose of this simulation it has been assumed that induced flows will not have an impact until approximately 2030 (assuming that the terminal will go into service at the same time as Rail Baltica). With Rail Baltica providing faster, easier, and economic access to and from central Europe, such induced loads can be reasonably expected.

The Realistic forecast is based on the development of the terminal over the years based on information available as well as interviews with stakeholders carried out over the course of the project. A fair assessment of the induced flows has also been included here.

The Pessimistic forecast has its basis in slightly less growth over the time-frame as well as the complete absence of induced flows.

The Optimistic forecast expects a higher growth rate when compared to the realistic option as well as the inclusion of induced flows of the magnitude that could be expected from the like of Est-For that could potentially provide up to two trains themselves per day.

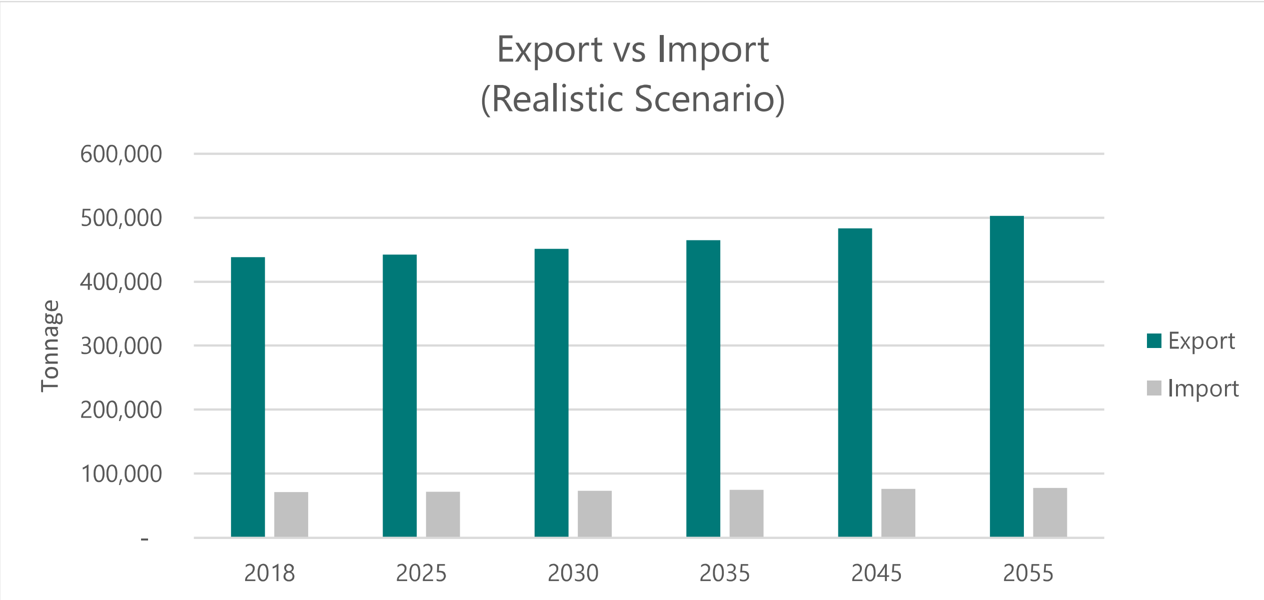


Figure 16: Forecasted Tonnage (Realistic Scenario)

Table 11: Total weekly trains from Pärnu Intermodal Terminal (Realistic Scenario)

Destination	2018	2025	2030	2035	2045	2055
Duisburg	1.96	1.98	2.42	2.49	2.59	2.69
Katowice	1.96	1.98	2.42	2.49	2.59	2.69
Warsaw	1.96	1.98	2.42	2.49	2.59	2.69
Salaspils	2.58	2.60	3.19	3.28	3.41	3.55
Total outgoing Block Trains per week	**8.4**	**8.5**	**10.4**	**10.8**	**11.2**	**11.6**

Table 12: Total weekly trains to Pärnu Intermodal Terminal (Realistic Scenario)

Destination	2018	2025	2030	2035	2045	2055
Duisburg	-	-	-	-	-	-
Katowice	0.64	0.64	0.79	0.80	0.82	0.83
Warsaw	-	-	-	-	-	-
Salaspils	0.84	0.85	1.03	1.06	1.08	1.10
Total incoming Block Trains per week	**1.5**	**1.5**	**1.8**	**1.9**	**1.9**	**1.9**

Table 13: Total weekly trains (Inbound and Outbound – Realistic Scenario)

Total weekly trains	2018	2025	2030	2035	2045	2055
Duisburg	1.96	1.98	2.42	2.49	2.59	2.69
Katowice	2.59	2.62	3.20	3.29	3.41	3.53
Warsaw	1.96	1.98	2.42	2.49	2.59	2.69
Salaspils	3.41	3.45	4.22	4.34	4.49	4.65
Total weekly Block Trains to and from Pärnu	**9.92**	**10.02**	**12.26**	**12.61**	**13.08**	**13.56**

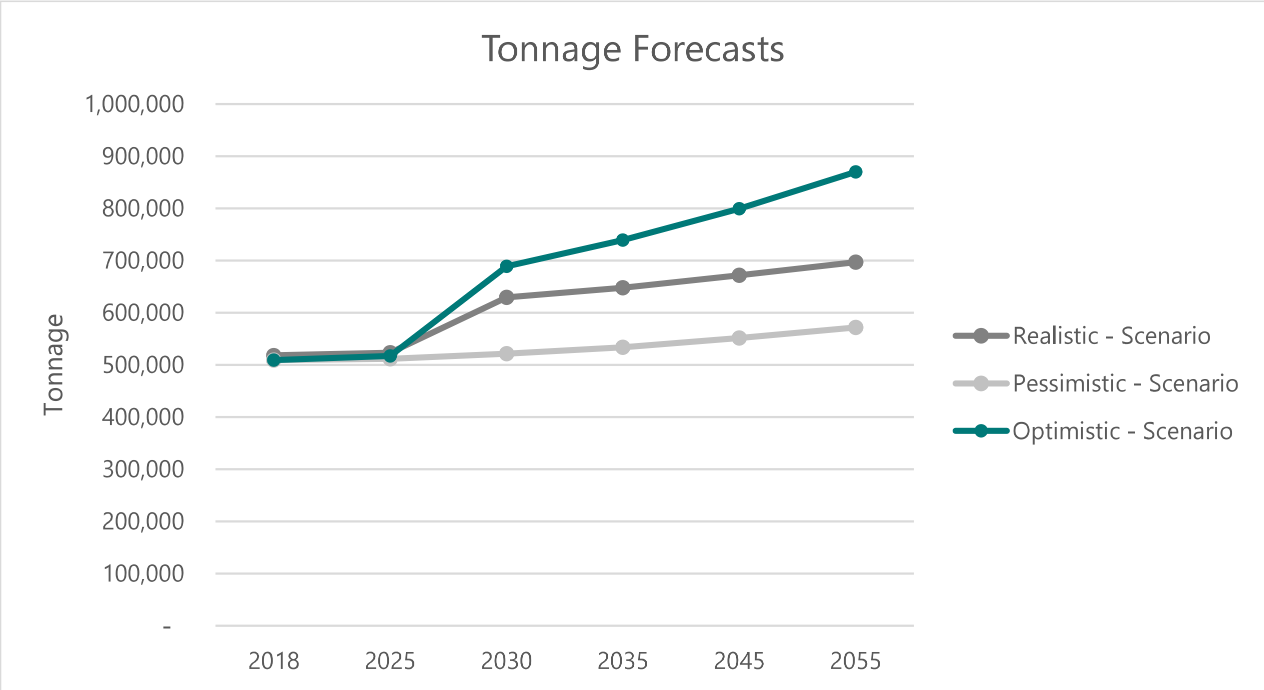


Figure 17: Tonnage forecasts up to 2055

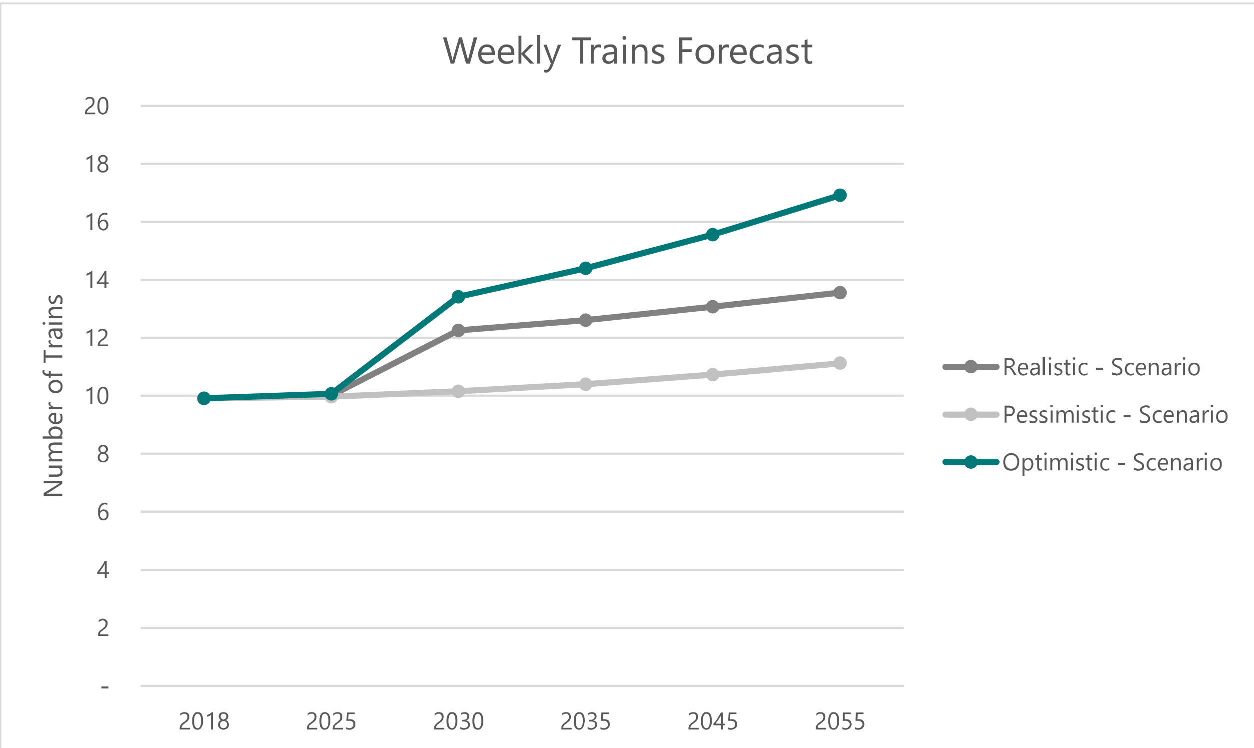


Figure 18: Forecast of trains per week up to 2055

7.2.3. Modal Shift

A cross check for the potential and estimated modal shift has been carried out in terms of the cost of transport as well as the number of vehicles removed from the road based on the forecasted number of trains.

Cost Calculations

Table 13 details the estimated weekly train numbers (the sum of inbound and outbound) that are expected to serve the terminal in the investigated period based on the realistic scenario. Comparative trucking costs have been determined based on a cost per kilometre, varying per country (Table 14). The resulting train costs have been converted into a truck equivalent costs to allow a direct comparison of train costs against road transport to be carried out.

The model shows that routes to Duisburg, Katowice, and Warsaw are all competitive. A shuttle service to Salaspils remains uncompetitive and if put in place in this form would need to be supported by substantial subsidies.

This is not to say that operations between Salaspils, Pärnu, and Muuga could not be made to work given the right circumstances. As an example, routes from Pärnu to Salaspils when combined with operations between Salaspils and Muuga could be feasible if the right operations model is put in place and the operator can ensure maximum efficiency and use of resources. The options in this case are numerous and depend in the end on the operations and business structure of the operators in question. This is also an issue that cannot be fully evaluated at this stage due to the forecasting required and individual variables that can potentially arise.

The positive results of this comparison indicate that rail services are very competitive over the longer distances compared with road transport. With these lower prices will come increased competitiveness leading to an increase the numbers of users and amount of freight carried on rail. This is important not only for a terminal in Pärnu but also for the Rail Baltica Global Project itself as the success of this will be based in part on maximising the utilisation of the overall line in terms of passenger and freight traffic.

Table 14: Trucking costs per route (One-way)[54]

From	Duisburg	Katowice	Warsaw	Pärnu	costs per km (EUR)
To	Pärnu	Pärnu	Pärnu	Salaspils	
Distance km total	1913	1141	838	190	
Distance Germany	615	-	-	-	1.08
Distance Poland	768	611	308	-	0.80
Distance Baltic States	530	530	530	190	0.72
costs (EUR/one way)	**1660.20**	**870.40**	**628.00**	**136.80**	

[54] Source: Freight model developed as part of this Feasibility Study

Table 15: Freight model results

Scenario	From	To	Total train costs per train-km (EUR)	Total train costs per round trip (EUR)	Train Costs per roundtrip (Truck equivalent incl. Terminal & last mile) (EUR)	Costs per truck round trip (EUR)
	Duisburg	**Pärnu**				
2025			10.94	42,395	1,577.63	3,320.40
2035			10.93	42,352	1,576.45	3,320.40
2045			10.86	42,066	1,568.51	3,320.40
2055			10.85	42,031	1,567.53	3,320.40
	Katowice	**Pärnu**				
2025			12.28	32,551	1,304.18	1,740.80
2035			12.28	32,551	1,304.18	1,740.80
2045			12.19	32,312	1,297.55	1,740.80
2055			12.19	32,312	1,297.55	1,740.80
	Warsaw	**Pärnu**				
2025			11.79	21,885	1,007.93	1,256.00
2035			11.79	21,885	1,007.93	1,256.00
2045			11.72	21,768	1,004.66	1,256.00
2055			11.72	21,768	1,004.66	1,256.00
	Pärnu	**Salaspils**				
2025			16.70	6,150	636.52	273.60
2035			16.70	6,150	636.52	273.60
2045			16.70	6,150	636.52	273.60
2055			16.70	6,150	636.52	273.60

Change in Traffic

The Estonian Road Administration indicates the following values for Annual Average Daily Traffic (AADT)[55] of vehicles over 12 metres in length between Pärnu and the Latvian border (Table 16, Figure 19). These figures are broadly in line with the figures put forward in the Rail Baltica CBA report of 2017[56] (1962 HGV per day between Pärnu and Ikla/Ainaži).

Figure 19: AADT of vehicles over 12m[57]

Table 16: AADT over 12m between Pärnu and Latvian Border

AADT between location on Road 4								
Junction of Road 4 and 59	1,834	Junction of Road 4 and 6	1,552	Tahkuranna	1,334	Häädemeeste	1,538	LT Border

[55] Annual average daily traffic is a measure used to count vehicles. Traditionally, it is the total volume of vehicle traffic of a highway or road for a year divided by 365 days.
[56] Source: Rail Baltica Global Project Cost-Benefit Analysis Final Report, 2017, Page 36.
[57] Source: Estonian Roads Administration

Based on the forecasted train numbers and associated TEUs that they carry, the following number of equivalent trucks can be estimated. This is based on a train carrying an average of 71 TEU against a truck that will carry an average of 2 TEU operating 50 weeks per year.

Total weekly trains (Realistic)						
	2018	2025	2030	2035	2045	2055
Duisburg	2.0	2.0	2.4	2.5	2.6	2.7
Katowice	2.6	2.6	3.2	3.3	3.4	3.5
Warsaw	2.0	2.0	2.4	2.5	2.6	2.7
Salaspils	3.4	3.4	4.2	4.3	4.5	4.6
Total trains per week	9.9	10.0	12.3	12.6	13.1	13.6
TEU Per Week	704.1	711.1	870.4	895.2	928.4	962.8
Eq. No. of weekly trucks	352.0	355.6	435.2	447.6	464.2	481.4
Eq. No. of annual trucks	17,602	17,778	21,760	22,381	23,210	24,071

Total weekly trains (Pessimistic)						
	2018	2025	2030	2035	2045	2055
Duisburg	1.96	1.97	2.00	2.05	2.13	2.21
Katowice	2.59	2.60	2.65	2.71	2.79	2.89
Warsaw	1.96	1.97	2.00	2.05	2.13	2.21
Salaspils	3.41	3.43	3.50	3.57	3.68	3.81
Total trains per week	9.92	9.97	10.16	10.40	10.73	11.13
TEU Per Week	704.1	707.6	721.2	738.2	761.9	790.1
Eq. No. of weekly trucks	352.0	353.8	360.6	369.1	380.9	395.1
Eq. No. of annual trucks	17,602	17,690	18,030	18,455	19,046	19,753

Total weekly trains (Optimistic)						
	2018	2025	2030	2035	2045	2055
Duisburg	1.96	1.99	2.65	2.84	3.08	3.37
Katowice	2.59	2.63	3.50	3.76	4.05	4.40
Warsaw	1.96	1.99	2.65	2.84	3.08	3.37
Salaspils	3.41	3.47	4.62	4.95	5.34	5.80
Total trains per week	9.92	10.07	13.41	14.39	15.56	16.93
TEU Per Week	704.1	714.6	952.2	1022.0	1104.4	1201.8
Eq. No. of weekly trucks	352.0	357.3	476.1	511.0	552.2	600.9
Eq. No. of annual trucks	17,602	17,866	23,806	25,550	27,611	30,046

If an assumption of 1,300 AADT per day is taken between Pärnu and the border and this is extrapolated for yearly traffic (based on a six-day week), then the values detailed in Table 17 indicate the amount of trucks that are replaced by rail on this route.

Table 17: Modal Shift per Scenario and Year

Modal Shift per Scenario and Year						
Trucks per day	1,300					
Trucks per year	390,000 based on a 6-day week					
	2018	2025	2030	2035	2045	2055
Realistic	4.51%	4.56%	5.58%	5.74%	5.95%	6.17%
Pessimistic	4.51%	4.54%	4.62%	4.73%	4.88%	5.06%
Optimistic	4.51%	4.58%	6.10%	6.55%	7.08%	7.70%

8. Identification and Assessment of Options

8.1. Methodology

The technical feasibility of the terminal is mainly determined by:

- Location of the area
- Layout of the terminal
- Connection to the mainline
- Connection to roads
- Connection to other services (electricity, water, telecommunications, etc.)
- Level and other geographical aspects (rivers, roads etc.) of the Rail Baltica line
- Environmental restrictions
- Impact on main line railway operations

These aspects need to be considered all together for the evaluation of a technical solution of a terminal in Pärnu. They are also dependent on each other and therefore need to be considered together in the feasibility approach. The final locations have been developed not only based on their geographical location regarding market access (industry locations, road access etc.) but also regarding the rail connection to the main line. The connection itself is an important element as the length and the technical realisation will have a huge impact on the overall costs of the project. However, the connection might be developed in conjunction with and in close proximity to another station (passenger station or workshop) which then limits the costs of the station for the freight terminal itself only to the terminal related costs.

At the same time the distance of this connection point to the Rail Baltica line determines the length of the required connection line. The electrification of this connection line might be a good option to decrease future operations costs for the terminal users.

The design requirements for Rail Baltica are well defined in which the main technical parameters shall correspond to traffic code P2-F1 as per INFTSI (Commission Regulation 1299/2014/EU) and shall have the following main technical Parameters:

- double track, design speed on the main line 249 km/h (Passenger Trains) and 120 km/h (Freight Trains), design speed on side tracks minimum 80 km/h with 100 km/h preferred;
- axle load 25t;
- distance between track centres at least 4.50 m on the main tracks;
- distance between two sided passing loops approximately 50 km and crossovers approximately 25 km but staged according to a train traffic forecast;
- Level crossings are allowed only in areas with no passenger traffic and low speed (40km/h maximum) such as depot, multimodal terminal. Gauge crossing, or mixed gauge tracks are allowed in dedicated freight stations, with speed not exceeding 40 km/h.
- Currently the mainline is foreseen fully fenced
- The signalling system will be based on ERTMS of level at least 2, baseline 3;
- communications system GSM-R with a view to accommodating a new generation railway communications standard that has still to be defined by the EU;
- electrification 2x25 kV AC;
- The design shall be done considering freight train length of 1050m for all infrastructure;
- The design shall be done considering passenger train length of 400m for all infrastructure except the passenger platform which can be designed for 200m;
- height of passenger platforms 550mm;
- Maintenance roads shall be planned inside the station premises to link the facilities to be served, if it is impossible to create access roads from the public network. Maintenance road shall be located at passing loops and stations. Maintenance roads shall be minimum of 3m wide;
- The maximum horizontal and vertical curves are limited to 25,000m and 40,000m respectively;
- For vertical curves, the minimum values on crests and hollows shall be 11,000m and 10,000m respectively;
- Horizontal radii shall be a minimum of 300m;
- The gradient limits shall be as follows;
    - Open line;
        - Nominal gradient limit is 8‰.
        - Gradient higher than 8‰ should be avoided nearby stations and passing loops.
        - Gradient up to 10‰ is accepted and shall not be exceeded as an average value over 1km length of track.
        - Maximum gradient limit is 12,5‰

- Stations
  - The nominal gradient limit is 0‰.
  - The maximum gradient limit is 1,5‰.
  - The exceptional gradient limit is 2,5‰ (for exceptional values use, refer to chapter 1).
  - For regional stations where platform is located at the main track and no coupling operations is possible, gradient limit is 5 ‰.

The design guidelines for Rail Baltica are also well developed, however these will only apply for the areas adjoining the mainline. On the branch line as well as the terminal itself some more flexibility is allowed while also being limited to the practicalities of day-to-day terminal operations. The main requirements for the terminal are that the terminal is long enough to cater the trains, has enough tracks to cope with the traffic volumes, space enough to allow storage and movement of trucks and loading equipment. Within the ToR there was a preference for track lengths of 1050m, however following discussions, this has been reduced to 750m. It is expected that this length will be reasonable for the requirements of Pärnu Terminal. In terms of alignment within the terminal area, radii of 200m have been taken as the minimum. This is technically feasible and suitable for the low speeds to be expected within the terminal. While it falls below the minimum value put forward in the Design Guidelines it provides more flexibility in terms of the layout of the terminal and reduces the space requirements. The Consultant suggests that a concession on the Design Guidelines is sought for these 200m radii.

From an operational point of view, the following basis requirements have been put in place throughout all options investigated. In order to access the freight terminal, suitable infrastructure will be required to allow trains travelling from north or south access. This requires that crossover points are installed to the north and south of the proposed branch. These combined with a siding or sidings parallel to the mainline will allow trains travelling from the north or south to access the siding while reducing interference to mainline operations. Sidings in this case have to be long enough to accommodate a full-length freight train. In these options, 1050m have been utilised where the sidings are required parallel to the mainline. From the sidings an electrified branch line is required to provide access to a freight station where a number of electrified tracks will be available for carrying out train preparation work, brake testing, locomotive changes, shunting etc. The freight station will be connected to the terminal area via a non-electrified line for moving wagons between the station and terminal.

Within the terminal lands themselves an active attempt has been made to keep the terminal design standard throughout the options. The layout as it is provides enough tracks to cater for traffic to and from the terminal while also allowing for enough hard standing for storage of containers, parking, or the storage of bulk goods as necessary. For this type of storage, the construction of dedicated areas is not envisaged and instead this would be achieved through the use of portable concrete dividing barriers. With regards to the other equipment that is required at the terminal, an overview of these is given in Annex 6 – Types of loading equipment required. The construction of this terminal can to some extent be planned or phased. This depends to some extent on the results of a market study that would need to be carried out, however examples of this could include building only a certain number of loading tracks based on the initial traffic forecasts. Further examples can include dedicating more or less area of the terminal to a particular freight type if it is found that this will be the more common type e.g. containers instead of bulk.

Based on this background, six potential options have been developed and discussed over the course of the study, namely:

1. Redevelopment of the existing freight station and terminal (which are currently 1520mm), with access to this from the existing Pärnu Station,
2. Terminal in Rabaküla,
3. Terminal in Kilksama
4. Redevelopment of the existing freight station and terminal with access to this from a new station in the north.
5. Redevelopment of the existing terminal with access to this from Pärnu passenger station (requires changes to the alignment)
6. Redevelopment of Pärnu-Kaubajaam with access to this from Pärnu passenger station (requires changes to the alignment)

From these, and based on discussions with RB Rail AS, Options 1, 2 and 5 have been brought forward for further analysis within the CBA.

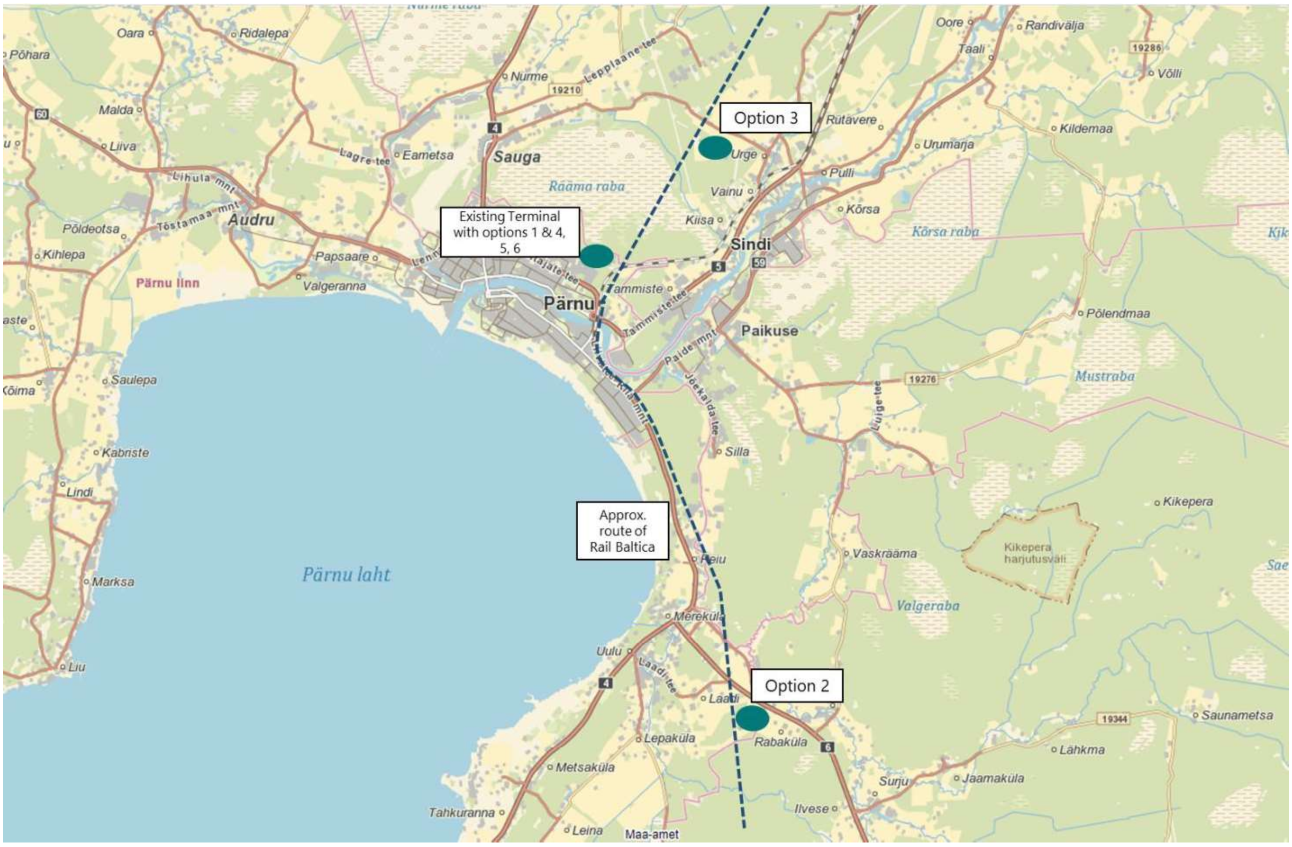


Figure 20: Location of Options

8.2. Option 1: Existing Freight Station (Including Kaubajaam)

8.2.1. Option Description

This is a technically feasible option that foresees the redevelopment of the existing freight station (Pärnu-Kaubajaam – 1520mm) and terminal to serve both the existing 1520mm line and Rail Baltica. This aligns with the desire of Pärnu City's Government to locate any terminal in this area, however there are some space limitations with regards to the length of a terminal that can be constructed in this area. With that said, this is currently a location where rail and terminal operations are being carried out and it is expected that there would be less resistance to new or additional operations being introduced due to the very low density of private dwellings.

This option will see trains diverge from the Rail Baltica mainline at the newly upgraded Pärnu passenger station, cross the Pärnu River and follow the same alignment to the freight station as was formally used by the 1520mm passenger service. Based on current reports, it is understood that the existing bridge will need to be removed and replaced in order to cope with freight trains. Signalling and safety installations are already planned at Pärnu Passenger Station as part of the overall RB Global Project and therefore no additional investments will be needed here to cater for the addition of a freight station.

The existing 1520mm track sections that are currently laid between Pärnu and Pärnu-Kaubajaam will be removed and replaced with 1435mm gauge. The currently proposed alignment of Rail Baltica is on an overpass above the existing 1520mm line, so if the 1520mm is replaced by 1435 the line will be at a suitable clearance for train movements.

Within Pärnu-Kaubajaam three new 1435mm tracks will be laid to allow operations to be carried out as well as to provide parking for passenger trains. Two 1520mm lines laid parallel to these will allow for operations on the 1520mm network to be carried out as required.

From Pärnu-Kaubajaam a new 1435mm line will be laid to serve the existing terminal. The terminal will continue to be served by a 1520mm line laid parallel to the 1435mm line.

The terminal itself will need to be redeveloped to accommodate sidings for 1435mm trains as well as 1520mm trains. A well-designed layout will allow for transhipment between both gauges, a ramp for unloading vehicles (military or civilian), movement of forklifts and loaders etc, storage areas for various commodities etc. The terminal is currently used sporadically for the movement of aggregates by Edelaraudtee AS/Go Rail.

Road access to the current terminal is via Jaama and Kauba Streets and is satisfactory to deal with the current movements. This access route however will be closed in the event that a new terminal is built here. The new terminal will be served by a new access road to the west connecting with Niidu. This further ensures that road traffic crossing the tracks that run between the terminal and Pärnu-Kaubajaam will be kept to a minimum. The current access road will then be reserved for forestry access or emergency access to the terminal.

Land in this area is owned by both the city and State. In the case of the State-owned land some of these plots leased to Edelaraudtee AS until 2072.

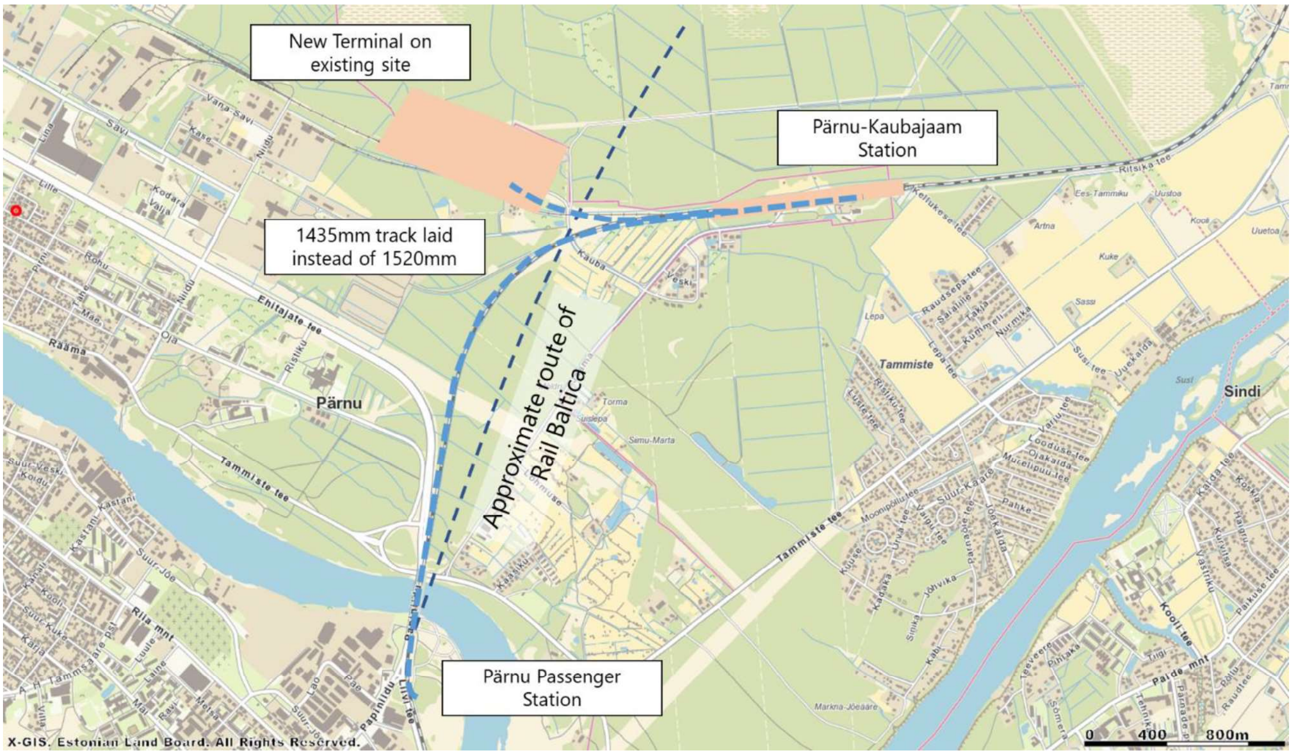


Figure 21: Option 1 - Indicative Layout

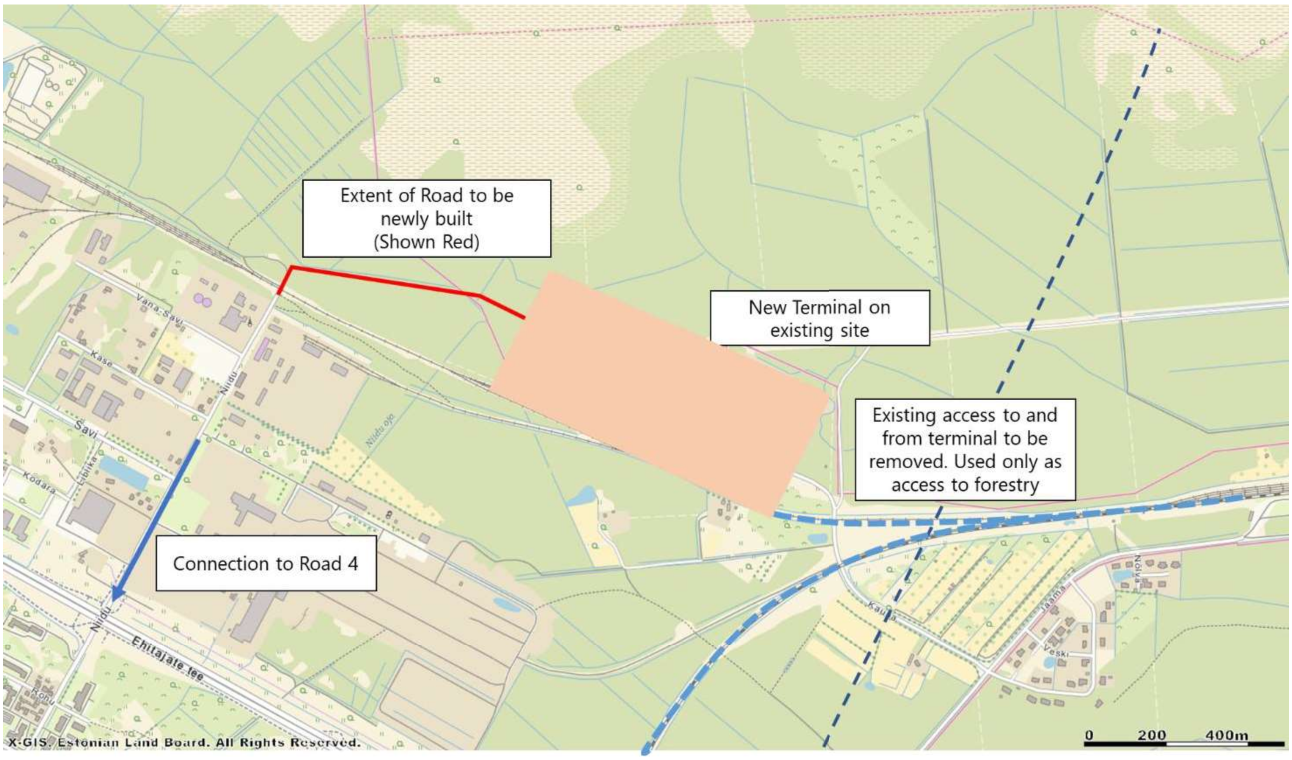


Figure 22: Option 1 – Main Road Infrastructure

8.2.2. Environmental Restrictions[58]

The area to the north of Pärnu-Kaubajaam has some areas that are defined as protections areas for Category II protected bird species. To the north of the existing freight terminal there is an area that is defined as a protection area for Category I protected bird species. To the west of the existing terminal there are areas defined under §23 of the Forest Act, 2006, as being "A key habitat is an area where the probability of the occurrence of narrowly adapted, endangered, vulnerable or rare species is high". As such "The regulation may restrict or prohibit economic activities in a key habitat on the basis of the key habitat protection objective".

These various locations of protection will place some restrictions on the length and width of the newly designed terminal in this area, however an acceptable solution to these is achievable. It is not expected that these will provide restrictions on the development of a terminal in this area.

8.2.3. Service Connections

Due to the nature of its current and former use, as well as the proximity to the nearby industrial area, a terminal developed in this will have ready access to all services required including water (potable and firefighting), foul and surface drainage, telecommunications etc. The provision of these services may require the need for relaying or rerouting the existing services. This will be developed further at the detailed design stage. The foreseen connection point for these is Niidu road.

8.2.4. Option Requirements

Basic requirements for this option:

- At Pärnu Station
  - Reconstruction of the existing rail bridge,
  - Removal of existing 1520mm track and laying of 1435mm track between Pärnu and Pärnu-Kaubajaam,
- At Pärnu-Kaubajaam;
  - The removal of the existing platform and station building,

[58] Note: In Estonia the locations of Category I and II protected species cannot be identified on documentation that will be made public. Nature Conservation Act 2004, §53 Disclosure of information. In this case, reports that are to be made public are considered as Media.

- The removal of some of the 1520mm lines,
- The construction of a new 1435mm line and loops,
- The construction of a new 1435mm line between Pärnu-Kaubajaam and the terminal,
- The rebuilding of an existing 1520mm line as well as loop.

- At the terminal;
    - Construction of new access road to the west connecting to Niidu,
    - The removal of some of the existing 1520mm lines,
    - Construction of 1435mm tracks of appropriate length and number,
    - Construction of a ramp that can potentially serve the 1520mm and 1435mm lines,
    - Placing of concrete surfacing throughout the terminal,
- Other;
    - Construction of an overpass for Rail Baltica to cross the 1520mm and 1435mm lines between Pärnu-Kaubajaam and the freight terminal.

8.2.5. Option Pros and Cons

Technical Pros & Cons	
Pros	**Cons**
Use of existing corridors	Potentially complex construction if a mixed line is implemented within the terminal. It is better if this is avoided as proposed in schematic plans.
Signalling equipment will already be required to cater for Pärnu Passenger station.	Potentially expensive investment to reconstruct the existing 1520 bridge along with the associated maintenance costs.
	This option includes the need for an overpass to be constructed over the 1520mm line along with the required maintenance costs for this.
Relatively simple construction	Space limited – 1050m is not possible in the terminal due to the location of environmentally sensitive areas
Electrification can be maximised	Construction of a new access road is required

Pärnu City Government's preferred option	Construction of an overpass for Rail Baltica to cross 1520mm and 1435mm lines
Operational Pros & Cons	
Pros	**Cons**
Relatively simple operational procedures	Severe impacts on the potential to have passenger services to Lelle. Some initial options could be foreseen: 1) Dual gauge across the bridge so that the 1520mm line remains. This however raises issues that go hand-in-hand with dual gauge operations, 2) Terminate 1520mm passenger services at Pärnu Kaubajaam. 3) Extend Rail Baltica services to Lelle. Configuration of Lelle - Pärnu railway to become part of 1435mm Europewide railway network providing the connection to Rail Baltica railway. This would be a very long-term plan and would reduce the space within Pärnu-Kaubajaam needed for freight operations.
Some potential to extend sidings to customer sites that are located in the industrial area.	Potentially complex operation if a mixed line is implemented within the terminal
Potential to park passenger trains at Pärnu-Kaubajaam when they are not needed.	

8.3. Option 2: Rabaküla

8.3.1. Option description

This is a technically feasible option and is the preferred option from the point of view of the Development Centre of Pärnu County. It has also in the past been raised as the preferred location of private industries (Est-For). Unlike Option 1 there is no predefined location as to where to build a terminal as part of this option. It is expected that it will be in Rabaküla to the south of Road 6. This area is sparsely inhabited with good road access to the Road 6 and Road 4. The land use here is a mixture of farmland and forestry.

From a design point of view there is no immediate difficulties with constructing a terminal here however concerns have been raised regarding flooding under 1 in 100-year conditions. These are discussed further in Section 8.3.2.

Construction of a terminal here will involve the construction of a new station with complete signalling infrastructure. According to the Consolidated Preliminary Technical Design (CPTD) a crossover is already planned at approximately km 22+50. In order to make this option feasible it is proposed to move this signalling infrastructure to the south (ca. km 18+10) so that a loop can be constructed with a branch to a new freight station at approximately km 20+60. It is expected that this loop will have an impact on the EcoDuct at km 19+60, however this will become clearer with more detailed drawings.

Based on the sections that have been provided, the design level is between two and three metres above the existing ground level in this location. As a result, there should be no restrictions in terms of the line gradient between the main line and the terminal and as such the terminal can be constructed close to the main line reducing travel distances.

With interest being shown from the private sector to have access to Rail Baltica from this location, it is proposed to construct the terminal adjacent to a plot reserved for future industrial development and construct a freight station just to the east of both. From the freight station, one branch will serve the terminal and the technical infrastructure will be put in place so that a future branch can be constructed to serve the industrial development. See Figure 23 for more details.

Good road connections ensure that this location is easily accessible, however this will have knock-on effects with regards to traffic in Pärnu. Discussions with Pärnu City Government have highlighted that Liivi Tee to the south of Pärnu is the most trafficked road in the city and further traffic here is not desirable.

The terminal location here has the advantage of direct access to Road 6. As this is a main road with a speed limit of 80km/h to 100km/h special measures may need to be taken when designing the access junction such as left or right-turn lanes. This will need to be clarified with the local roads department during the detailed design stage.

If it is the case that the terminal will be build adjacent to a private industrial facility then it is proposed to construct a new shared access road to access both facilities.

A potential terminal in this location has the advantage that there are few space restrictions so that a full 1050m terminal could in theory be achieved. Additionally, there is more flexibility as to how the terminal can be laid out. However, there is no possibility for transhipment between gauges.

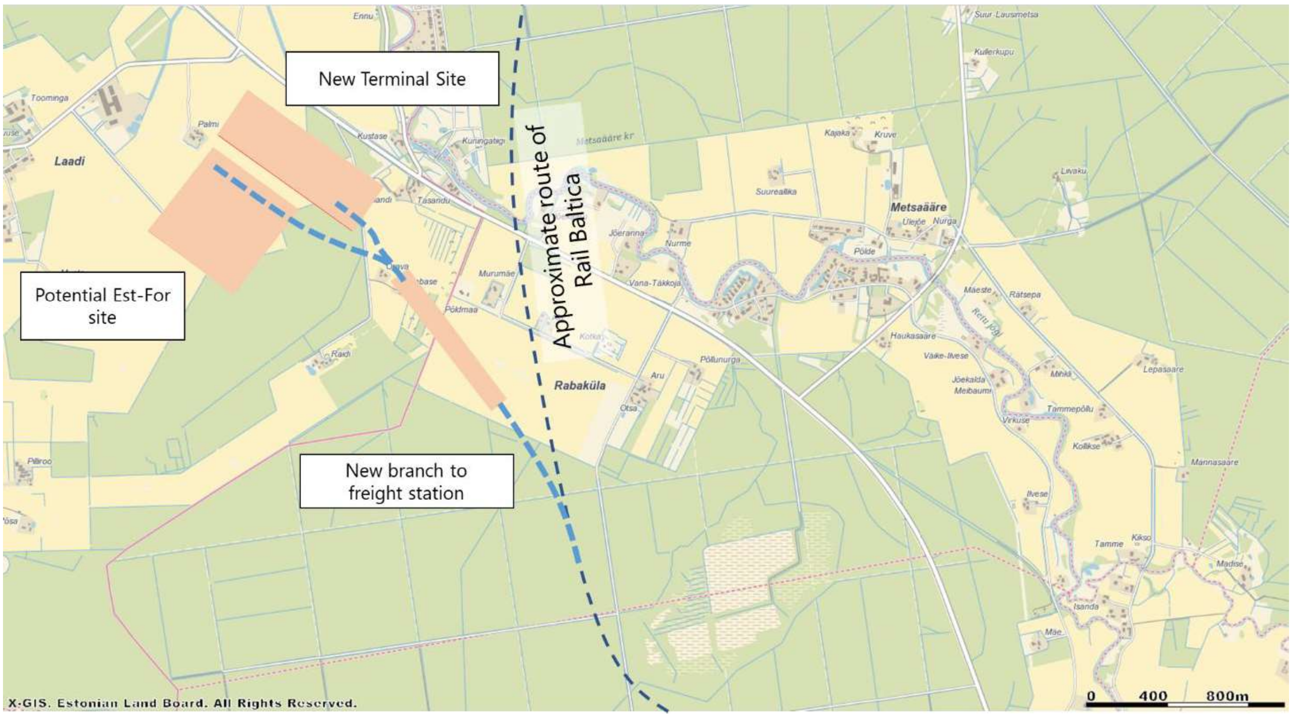


Figure 23: Option 2 - Indicative Layout

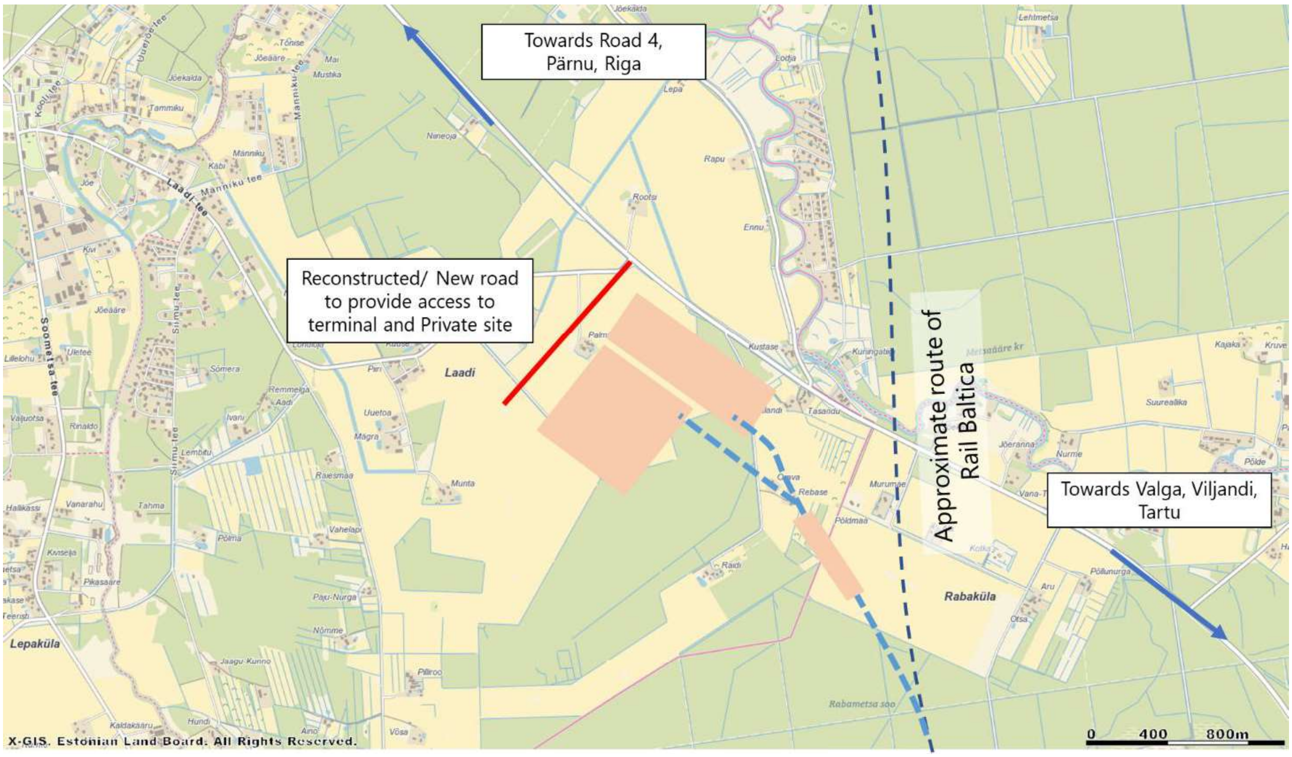


Figure 24: Option 2 – Main Road Infrastructure

8.3.2. Environmental Restrictions

There is a Category I protected bird species resident in this location. This is based on a survey carried out in 2010 at which time only one specimen was registered. This implies that discussions with the Estonia Environment Agency will be required at an early stage and further possible requirements of a bird study and surveys being carried out.

Flooding in this area could be an issue based on information that was ordered from the Estonian Meteorological Service during the Rail Baltica Preliminary Design stage. This area is not classed as a National Level Flood Risk Zone due to the low population however floods here could be relatively severe. Two locations in particular raise concern as detailed in Table 18 and Figure 25.

Further information such as reports that have been carried out and as to the location of and severity of flooding in this area has been sought from the Development Centre of Pärnu County. Based on the information received, no detailed flooding surveys have been carried out. Anecdotal evidence indicated that the area around Laadi Farm is susceptible to spring flooding although this is not an annual occurrence. There are indications of a high water table in this area which have been influenced by drainage in the area. The reason for the spring flooding is however not immediately clear.

As such any future development will need to take this into consideration and carry out all required flood studies to get a full indication as to its extent. Additionally, detailed surveys and design work will be required to obtain accurate investment costs needed to build suitable flood defences. Whether these will be localised attenuation measures on the terminal site or will involve more extensive work to the existing local drainage or to be carried out on Reiu River will need to be determined. It should be noted that Reiu River is considered a special conservation area with Class II protected species. Any work here will require a further environmental study to be carried out (unless this is already covered in studies carried out for the Rail Baltica main line).

Due to the lack of detailed information available at this stage, only estimations for investment costs can be put forward for this location.

Table 18: Locations of possible flooding

Water Body	Coordinates	Water Level (Long-term Average)	Water Level (Maximum)
Reiu jõgi	X 6458600, Y 538162	3.7 m	6.84 m
Reiu jõgi	X 6465558, Y 535916	1.81 m	4.95 m

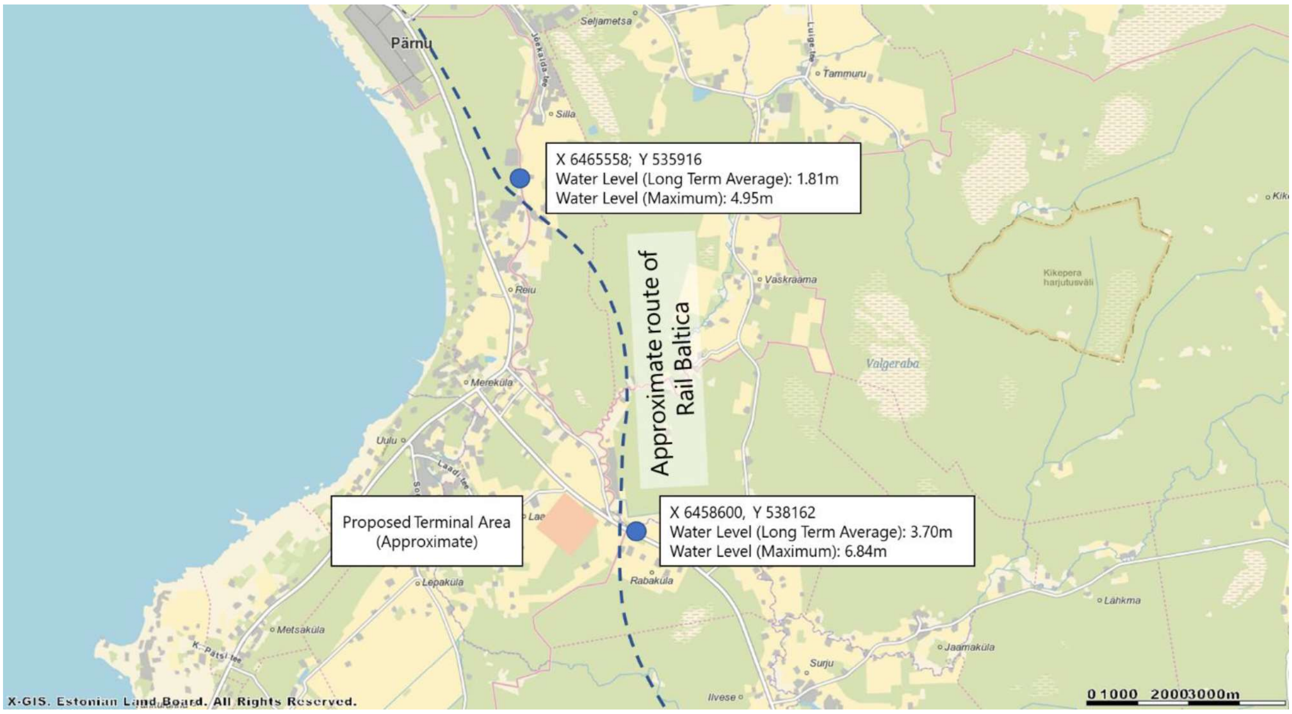


Figure 25: Locations of possible flooding

8.3.3. Service Connections

Due to the sparsely populated nature of this area it is expected that water services will be based on local network schemes with individual sewage treatment units.

The impact of a terminal on these will nevertheless be relatively small due to relatively low number of employees required to operate the terminal (13 staff ± truck drivers, locomotive operators etc).

Further information as to the spare capacity of these have been investigated however at the time of writing, no further information is available.

8.3.4. Option Requirements

Basic requirements for this option:

- At the terminal:
  - Construction/upgrading of access roads to the terminal area,
  - Construction of tracks of appropriate length and number,
  - Construction of a ramp,
  - Placing of concrete surfacing throughout the terminal,
  - Construction of appropriate flood defences
- On the mainline:
  - Construction of a loop
  - Construction of a new branch that will allow access to the freight station
  - Construction of a freight station

8.3.5. Option Pros and Cons

Technical Pros & Cons	
Pros	**Cons**
A technically simple option however complexity will grow with the flood risk.	More traffic on certain roads to the south of the city, against the wishes of Pärnu City Government
More useable space	Quite a distance from the main industrial areas within Pärnu
Use can be made of the existing road connections	Some impact on local residents (this can be potentially limited during the detailed design stage)
Development Centre of Pärnu County's preferred option	The terminal and station are to be built on more expensive farm land
Access to private sidings can also be provided and planned at an early stage	
Operational Pros & Cons	
Pros	**Cons**
Relatively simple operations	No option for transhipment with 1520mm network
Potential of combining operations with private industry	

8.4. Option 5: Existing Freight Station, Terminal West

This option has been introduced as a result of a proposed redesign of Rail Baltica. This redesign involves the lowering of the Rail Baltica alignment so that it follows ground level in the area around the existing terminal as well as Pärnu-Kaubajaam. This is a technically feasible option.

8.4.1. Option Description

In this option access to the terminal will be from the main Rail Baltica line. The main line itself will be adjusted to incorporate two ca. 1000m sidings to the west and a curve leading to the terminal. This will provide the terminal with direct access from the main line while also ensuring enough sidings to carry out shunting operation without influencing the mainline operations.

The terminal layout and developments related to this such as road access etc. will remain similar to that as put forward as part of Option 1.

Signalling for this option should be feasible through that which is already envisaged for Pärnu Passenger Station.

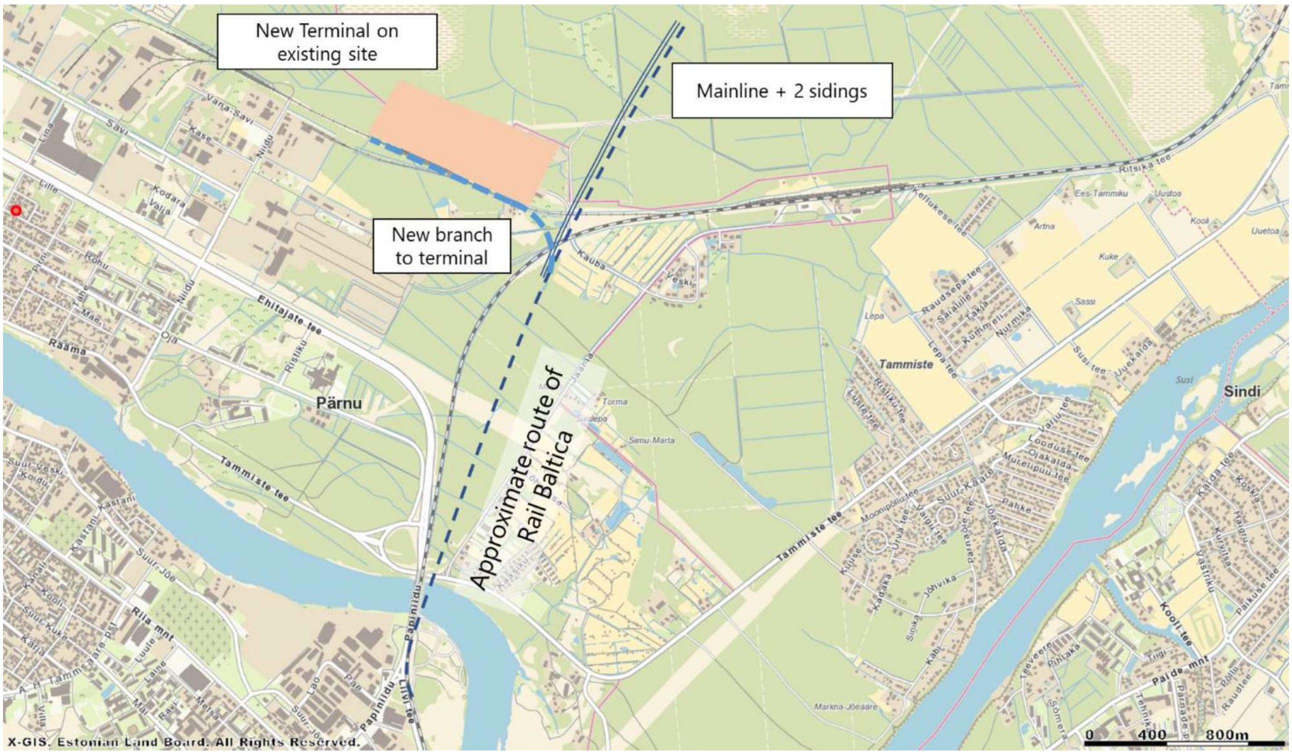


Figure 26: Option 5 - Indicative Layout

8.4.2. Environmental Restrictions

The environmental restrictions that apply to Option 1 apply here again. Restricting the size of the new terminal and associated works to a large an extent as possible ensure that the environmental impact will be limited.

8.4.3. Service Connections

Due to the nature of its current and former use, as well as the proximity to the nearby industrial area, a terminal developed in this will have ready access to all services required including water (potable and firefighting), foul and surface drainage, telecommunications etc. The provision of these services may require the need for relaying or rerouting the existing services. This will be developed further at the detailed design stage. The foreseen connection point for these is Niidu road.

8.4.4. Option Requirements

- At the terminal;
    - Construction of new access road to the west connecting to Niidu,
    - The removal of all of the existing 1520mm lines,
    - Construction of 1435mm tracks of appropriate length and number,
    - Construction of a ramp,
    - Placing of concrete surfacing throughout the terminal,
- On the mainline;
    - Construction of two sidings to the west of the mainline,
    - Construction of a branch to the terminal.

8.4.5. Option Pros and Cons

Technical Pros & Cons	
Pros	**Cons**
Use of existing rail bridge	If the existing bridge cannot be reused then the new RB bridge must become wider to take an extra track
No redesign or construction costs to existing planned RB Bridge (depending on a structural survey that will need to be carried out on the existing road bridge)	Space limited – 1050m is not possible
Electrification can be maximised	Construction of a new access road is required
Pärnu City Government's preferred location option	Some impact on local residents (this can be potentially limited during the detailed design stage)
Use of signalling from Pärnu passenger station and thus no need for a newly built station	Careful design is required to ensure that the construction remains out with the Rääma Raba.
Space availability to locate a maintenance facility in this area	In the case of a maintenance facility, there is some distance between this location and an employee source.
Operational Pros & Cons	
Pros	**Cons**
Relatively simple operational procedures	Cessation of all 1520mm operations

9. Multi Criteria Analysis

When choosing the methodology for an MCA there exist several choices. Based on the characteristics of the project (multi-stakeholder, both quantitative and qualitative criteria, full feasibility dimensions) a MCDA (Multi criteria decision analysis) with weighting and allowing both quantitative and qualitative criteria has been chosen.

The aim of the MCDA has been to establish an overview of all relevant impacts of the project, and assist with choosing the best alternative for the location of this freight terminal.

The following have been considered:

- Key decision makers:
    - RB Rail AS, current project delivery organisation
    - RB Estonia
    - Ministry of Economic Affairs and Communications
    - Ministry of Finance
    - Ministry of the Environment
    - Ministry of Transport
    - EU (possible grant)
- Other key players
    - All municipalities/regional authorities which are impacted by the project (Pärnu City Government, Development Centre of Pärnu County)
    - Representatives of (groups of) private companies impacted by the project (local shippers, Edelaraudtee AS)
    - Representatives of (groups of) the citizens impacted by the project
    - EIB, other financing institutes

As part of the development of the MCA the Rail Baltica Value Engineering document was consulted. The information provided in this was adapted and localised to suit a project such as Pärnu Intermodal Terminal.

9.1. Options Appraised and approach to the MCA

The MCA submitted as part of this final report has been through previous versions that included six different options. Through discussions with project partners these have been reduced to the three options discussed here. These options have additionally been brought forward for assessment in the CBA. These are:

- Option 1: Redevelopment of the existing freight station and terminal
  - In the MCA this has been shortened to "Existing Freight Station V1"
- Option 2: Terminal in Rabaküla
- Option 5: Redevelopment of the existing terminal with direct access from Pärnu Passenger station
  - In the MCA this has been shortened to "Existing Freight Station, Terminal West"

The following criterion have been used to assess the ranking of the alternatives:

- Financial
- Transport Impacts
- Social Impacts
- Technical
- Environmental
- Risks

For each of these main criteria a project specific set of sub-criteria has been developed. These have then been operationalised with appropriate indicators to be expressed either as quantitative or qualitative values. The weighting of these have been defined using the experience of the consortium while taking into consideration experience provided directly by RB Rail AS, wider experience from outside the project as well as input from external stakeholders.

The overall scores of the MCA have been calculated in a four-step approach:

1. A high-low value (on a 0-5 scale) has been assigned to each of the sub-criteria for each of the alternatives. These values have been derived based on the available information as well as site visits.
2. Harmonisation of each of the values to a score on a 0-100 scale
3. Multiply each score with the assigned weights

4. Add up all scores to arrive at the total score of the alternative compared to the other scores.

The outcome of this process is a total score. The highest score indicates the most favourable option.

Table 19: Criteria and weightings for the MCA

Criteria	Weight of criterium	Subcriteria	value	Comment	Sub weights
Financial	0.2	Investment attractiveness for RB Rail/Municipalities/Private investors	Hi-lo	5 = high attractiveness	0.06
		Investment attractivieness for Financing Institutes other private parties	Hi-lo	5 = high attractiveness	0.02
		CAPEX	Hi-lo	5 = low CAPEX	0.03
		Attractivity for obtaining EU grants	Hi-lo	5 = high attractiveness	0.02
		Impact on RBGP competitiveness	Hi-lo	5 = higher impact	0.06
Transport impacts	0.2	Reduction of traffic/congestion on the roads	Hi-lo	5 = high level of reduction	0.06
		Localised traffic increase on some roads	Hi-lo	5 = low level of increase	0.06
		Increased rail capacity utilisation	Hi-lo	5 = high level of increase	0.08
Social impacts	0.1	Welfare distributional impacts	Hi-lo	5 = high impact	0.04
		Number of populace to be displaced	Hi-lo	5 = low number	0.06
Technical	0.1	Dimensions achieved per ToR	Hi-lo	5 = fully achived	0.01
		Distance to main roads	Hi-lo	5 = low distance	0.02
		Possibility to transship (1520/1435)	Hi-lo	5 = high possibility	0.02
		Distance to main line	Hi-lo	5 = low distance	0.02
		Construction/upgarding of roads requirements (during construction/operations phase, for terminal/station)	Hi-lo	5 = none required	0.02
		Compatibility to RB standards (except dimensions)	Hi-lo	5 = full compatibility	0.02
Environmental	0.2	Impacts on landscape	Hi-lo	5 = low impact	0.07
		Impacts on biodiversity	Hi-lo	5 = low impact	0.01
		Impacts on environmentally sensitive areas	Hi-lo	5 = low impact	0.07
		Other impacts not yet quantified	Hi-lo	5 = low impact	0.05
Risks	0.2	Project design risks	Hi-lo	5 = low risk	0.02
		Project construction risks	Hi-lo	5 = low risk	0.02
		Project exploitation risks	Hi-lo	5 = low risk	0.10
		Project external risks	Hi-lo	5 = low risk	0.05
		Climate adaption included	Hi-lo	5 = low risk	0.02

Table 20: Scores applied to each sub-criterion

Criteria	Weight of criterium	Subcriteria	Sub weights	Option 1 Existing Freight Station (V1)	Option 2 Rabaküla	Option 5 Existing Freight Station, Terminal West
Financial	0.2	Investment attractiveness for RB Rail/Municipalities/Private investors	0.06	5	5	5
		Investment attractivieness for Financing Institutes other private parties	0.02	4	4	4
		CAPEX	0.03	1	3	5
		Attractivity for obtaining EU grants	0.02	5	5	5
		Impact on RBGP competitiveness	0.06	5	4	5
Transport impacts	0.2	Reduction of traffic/congestion on the roads	0.06	4	3	4
		Localised traffic increase on some roads	0.06	4	3	4
		Increased rail capacity utilisation	0.08	5	5	5
Social impacts	0.1	Welfare distributional impacts	0.04	3	3	3
		Number of populace to be displaced	0.06	5	3	2
Technical	0.1	Dimensions achieved per ToR	0.01	3	5	3
		Distance to main roads	0.02	5	5	5
		Possibility to transship (1520/1435)	0.02	5	0	0
		Distance to main line	0.02	4	4	4
		Construction/upgarding of roads requirements (during construction/operations phase, for terminal/station)	0.02	4	3	4
		Compatibility to RB standards (except dimensions)	0.02	5	5	5
Environmental	0.2	Impacts on landscape	0.07	4	3	4
		Impacts on biodiversity	0.01	4	3	4
		Impacts on environmentally sensitive areas	0.07	4	4	4
		Other impacts not yet quantified	0.05	4	4	4
Risks	0.2	Project design risks	0.02	4	3	4
		Project construction risks	0.02	4	3	4
		Project exploitation risks	0.10	3	3	3
		Project external risks	0.05	3	3	3
		Climate adaption included	0.02	4	4	4

Table 21: Total score for each option

Criteria	Weight of criterium	Subcriteria		Option 1 Existing Freight Station (V1)	Option 2 Rabaküla	Option 5 Existing Freight Station, Terminal West
Financial	0.2	Investment attractiveness for RB Rail/Municipalities/Private investors		6.0	6.0	6.0
		Investment attractivieness for Financing Institutes other private parties		2.4	2.4	2.4
		CAPEX		0.6	1.8	3.0
		Attractivity for obtaining EU grants		2.4	2.4	2.4
		Impact on RBGP competitiveness		6.0	4.8	6.0
Transport impacts	0.2	Reduction of traffic/congestion on the roads		6.0	4.5	6.0
		Localised traffic increase on some roads		6.0	4.5	6.0
		Increased rail capacity utilisation		8.0	8.0	8.0
Social impacts	0.1	Welfare distributional impacts		4.0	4.0	4.0
		Number of populace to be displaced		6.0	3.6	2.4
Technical	0.1	Dimensions achieved per ToR		0.6	1.0	0.6
		Distance to main roads		2.0	2.0	2.0
		Possibility to transship (1520/1435)		1.5	0.0	0.0
		Distance to main line		2.0	2.0	2.0
		Construction/upgarding of roads requirements (during construction/operations phase, for terminal/station)		1.5	1.1	1.5
		Compatibility to RB standards (except dimensions)		2.0	2.0	2.0
Environmental	0.2	Impacts on landscape		6.6	5.0	6.6
		Impacts on biodiversity		1.3	1.0	1.3
		Impacts on environmentally sensitive areas		6.6	6.6	6.6
		Other impacts not yet quantified		5.5	5.5	5.5
Risks	0.2	Project design risks		1.8	1.4	1.8
		Project construction risks		1.8	1.4	1.8
		Project exploitation risks		10.0	10.0	10.0
		Project external risks		4.6	4.6	4.6
		Climate adaption included		1.8	1.8	1.8
			Total score	97.0	87.2	94.3

9.2. Sensitivity Analysis

Various sensitivity runs have been carried out, based on four different points of view:

1. More importance to societal benefits,
2. More importance to financial and technical aspects,
3. More importance to environmental aspects,
4. More importance to risks.

The sensitivity analysis presents a more robust view of the proposed preferred option.

The results of these are detailed in the following tables.

Table 22: Weightings applied during the sensitivity analysis

Sensitivity Analysis Weighting					
Criteria	Balanced	Socio-economic	Financial-technical	Risks	Environ-mental
Financial	0.2	0.2	0.4	0.1	0.1
Transport impacts	0.2	0.1	0.05	0.1	0.1
Social impacts	0.1	0.5	0.05	0.1	0.1
Technical	0.1	0.1	0.4	0.1	0.1
Environmental	0.2	0.05	0.05	0.1	0.5
Risks	0.2	0.05	0.05	0.5	0.1

Table 23: Sensitivity Analysis Results

Sensitivity Analysis Results						
Option Number	Option Description	Balanced	Socio-economic	Financial-technical	Risks	Environ-mental
1	Score Existing Freight Station (V1)	97.0	97.4	94.0	98.5	98.5
2	Score Rabaküla	87.2	82.5	87.0	90.3	87.9
5	Score Existing Freight Station, Terminal West	94.3	79.9	90.2	94.4	94.4

9.3. MCA Outcome

The MCA shows a clear favourite for Option 1. The second preferred option leans towards Option 5. This preference however must take into account the redesign required of the Rail Baltica alignment.

While there has previously been private interest in Option 2 and the MCA scores are relatively positive, it must be borne in mind that this is no indication as to concrete plans for constructing a new industrial area. However, it does highlight the need for RB Rail AS to bring private companies on-board at an early stage and to bring the development of the terminal and their facility along parallel to one another. This ensures that requirements can be catered for in the most efficient manner possible.

10. Financial and Economic Analyses

10.1. Project costs for the selected options

The methodology and approaches for the evaluation of economic costs and benefits for this project follow the guidelines written in the "Guide to Cost-Benefit Analysis of Investment Projects" published by the European Commission, DG Regional Policy.

The time horizon of this project is calculated as being 30 years (from 2025 until 2055), the residual value has been calculated as the NPV of the financial flows over the remaining lifetime of the terminal (assumed to be 20 years beyond the time horizon or up to 2075). It is assumed that the construction of this terminal will be carried out in parallel to the construction of Rail Baltica and will stand ready for use by the same time as Rail Baltica. As such, it is assumed that the construction of this terminal and related infrastructure on the Rail Baltica main-line will not interfere with the operation of Rail Baltica.

10.1.1. Cost estimation of total investment

In this study the costs consist of the non-recurring investment costs for infrastructure and follow-up costs for infrastructure maintenance. This includes also maintenance costs over the lifetime of the project so that the standard of transport and service offered by the terminal can be maintained. Over the course of carrying out the CBA for the three "new-build" scenarios, the costs for a Business as Usual (BaU) have also been taken into account. In other words, in the CBA the additional costs for investment and maintenance in Options 1, 2, and 5 compared with the BaU Scenario will be used as real costs for these scenarios, in addition to which the additional benefits will be seen as real benefits in such scenarios.

The financing of such infrastructure can potentially be supported through private entities, public entities within Estonia, or external through European Commission funding instruments. How these will develop, which parties will be involved, what share of the investment they will finance, and the form of this support be it through grants or loans is not yet decided. It is true to say that such infrastructure often brings good public sector support and the development of financial instruments should also take this into account. How such private investments will develop is to be decided as a private investor could take over the role of landlord or the role of landlord and operator? This could extend to a role that includes a last mile service put in place by the operator.

Regardless of this, the branch between the terminal and Rail Baltica mainline will come under the investment costs of the Rail Baltica global project itself. One possible exception to this is the case where a larger private company wishes to utilise the branch for their own use in which case there is a strong possibility for a cost sharing agreement to be reached for the construction of the branch.

10.1.2. Follow-up maintenance costs

Maintenance costs for rail infrastructure consist of all costs for maintaining tracks, signalling, telecommunication, catenary systems for the branch lines and freight station in addition to hard surfacing, gate systems, IT systems etc that are to be found in the terminal area itself. The costs are estimated on an annual basis, the amount of the costs in each scenario depends on the concrete infrastructure after construction, traffic volume and the level of operation. There is potential that local roads may see some increase in maintenance requirements due to increased traffic however it is expected that the associated costs of these will be negligible and will be catered for in the existing road infrastructure budget.

The investment and maintenance costs for each scenario are detailed in Table 24. A detailed list of the individual elements in included in Annex 1 – Financial Analysis Results. The prices in these cases have been derived from similar projects throughout Europe.

Table 24: Investment and annual maintenance costs

Cost Element	Option 1 (Mio. €)	Option 2 (Mio. €)	Option 5 (Mio. €)
Terminal			
Acquisition of land / Site clearance	9.16	8.10	8.53
Earthworks	21.89	8.70	1.89
Railway Tracks	4.23	3.24	2.97
Roads, Handling & Storage areas	9.22	9.45	9.48
Structural engineering	0.16	0.16	0.16
Equipment and accompanying measures	2.07	2.07	2.07
Planning Costs	3.92	2.42	1.76
Total Investment Costs (Terminal)	**50.66**	**34.13**	**26.87**
Freight Station			
Acquisition of land / Site clearance	6.50	1.70	4.12
Earthworks	0.36	1.30	2.87
Railway Tracks	6.95	6.37	6.33
Roads	0.08	0.90	0.08
Equipment and accompanying measures	0.18	0.18	0.18
Total Investment Costs (Freight Station)	14.06	10.45	13.58
Total Investment Costs	**67.22**	**47.08**	**42.96**
Annual Maintenance Costs	**0.326**	**0.116**	**0.097**

10.2. Feasibility Analysis

The feasibility of this this project with the three options and its financial situation have been analysed through the economic and financial indicators.

10.2.1. Financial Analysis

The financial analysis has been carried out from the point of view of the eventual terminal operator. As such revenues for the terminal will be generated by the users of the terminal in terms of containers loaded/unloaded, wagons loaded/unloaded containers stored and other such revenue generating activities that can be put in place in parallel to terminal operations.

The main purpose of the financial analysis is to use the project cash flow forecasts to calculate suitable net return indicators and so that the financial situation of the project can be checked. For this purpose, two indicators, namely the financial net present value (FNPV) and financial rate of return (FRR) are recommended by the EU guide[59]. These are calculated in terms of return on the investments cost, FNPV(C) and FRR(C) and return on national capital, FNPV(K) and FRR(K).

The FNPV(C) and the FRR(C), on the total investment cost, measure the performance of the investment independently of the sources or methods of financing. In other words, it can check if the project needs additional external financing. The FRR(C) is calculated considering total investment costs and operating costs as outflows and revenues as an inflow. It measures the capacity of operating revenues to sustain the investment costs.

This calculation contributes to deciding if the project requires additional support: If the FNPV(C) on investment is negative or the FRR(C) is lower than the financial discount rate (4% for this project), then it means that the costs will be not covered by the revenues generated and the project will need support.

Table 25 summarises the main results of these values and ratios with more detailed information given in Annex 1 – Financial Analysis.

Table 25: Result of financial analysis on investment

(Mio. €)	Option 1	Option 2	Option 5
FNPV (C)	-48.40	-23.33	-18.57
FRR (C)	-1.02%	1.01%	1.47%
FNPV (K)	-52.77	-26.46	-21.09
FRR (K)	-1.25%	0.75%	1.23%

With a negative FNPV(C) and an FRR(C) at well below the discount rate, this project does not classify as “revenue-generating”. This means that for the investor, while this project contributes to the national public welfare (proved with the positive ENPV), it is not a financially profitable project. The main reasons for that are the relatively high investment and operating costs combined with the low revenues through terminal usage.

Figure 27 details the results of ENPV and FNPV for all options. The total project effect is

$$ENPV = FNPV + (ENPV - FNPV)$$

in the cases where the ENPV gives addition to the overall economy.

Option 1 has the smallest absolute value in all the scenarios while the signs of respective analysed value for all scenarios are positive.

[59] Guide to Cost-Benefit Analysis of Investment Projects, P. 34, European Commission

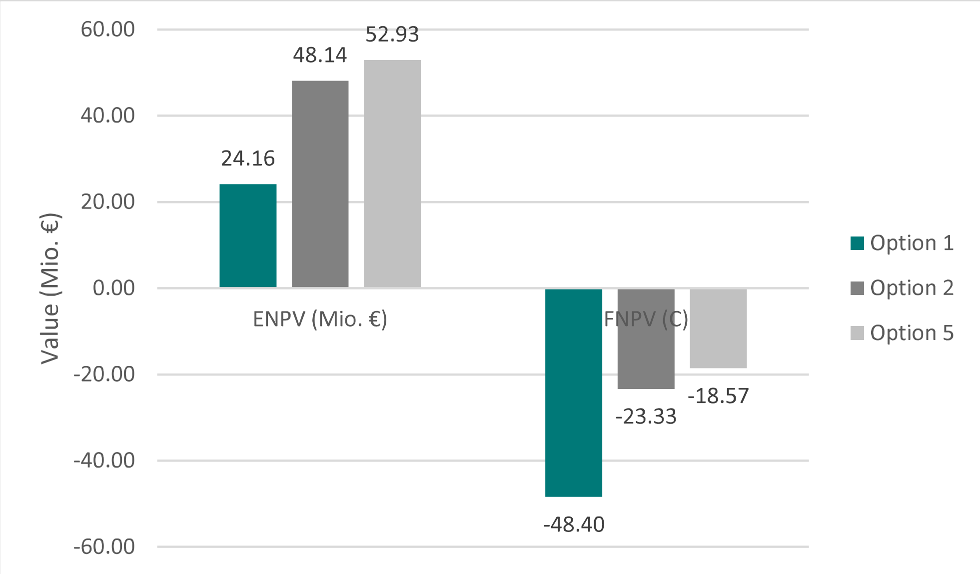


Figure 27: Results of ENPV and FNPV of all scenarios.

10.2.2. Economic Analysis

In line with the ToR, the economic analysis has been carried out for a 30-year time period.

For the economic analysis the two most important indicators are the Economic Net Present Value (ENPV) and the Economic Rate of Return (ERR). The ENPV is defined as the difference between the discounted total social benefits and costs. Generally, if the ENPV is higher than 0, then the project should be considered as economically desirable and, in that case, feasible.

In this case, the other indicator ERR should also be higher than the economic social discount rate (3% for this project). The higher the value of both indicators, the better the economic result of the respective scenario is.

In order to carry out this assessment a number of assumptions were made. These are detailed in Annex 2 – Economic Analysis. Table 26 summarises the main results from the economic analysis.

Table 26: Results of the CBA

(Mio. €)	Option 1	Option 2	Option 5
ENPV (Mio. €)	24.16	48.14	52.93
ERR	4.45%	6.57%	7.18%
B/C Ratio	1.43	2.05	2.24

10.2.2.1. Evaluation of the benefits

The benefits of the three options are measured and calculated in the following terms:

- Time savings for the future users of the terminal and shippers within the catchment area
- Transport cost savings for shippers
- Increased attractiveness for Rail Baltica as a service and Pärnu as a destination
- Increased income in tax revenue
- Air pollution reduction as a result of the shift of freight traffic from road to rail
- CO2 reduction as a result of the shift of freight traffic from road to rail
- Accident reduction as a result of the shift of freight traffic from road to rail
- Further external costs savings as a result of the shift of freight and passenger traffic from road to rail

All these above-mentioned economic benefits of the three options can be summarised in the following categories:

- Changes in consumer´s surplus, represented by the changes in users generalised costs;
- Changes in producer´s surplus (Terminal Operator)
- Reduction of the negative external costs as a result of the shift of freight traffic from road to rail

10.2.2.2. Benefits for the Terminal Operator

This terminal will allow stakeholders the ability to directly serve Pärnu while also lowering the operating costs per train*km. The revenues generated from these terminal users and the revenues generated can be calculated as benefits. Because of the reduced travel and delay time and competitive prices compared with other traffic modes for consumers, there will be an increase of demand in freight traffic, which has been explained in Section 7.2.

The revenues generated in this terminal have been calculated primarily based on the loading and unloading of trains and associated shunting activities with the addition of side revenue generating activities such as:

- Stabling of wagons (short-term/long-term)
- Storage of containers (empty/full, 20'/>20')
- Pressure washing (containers, trailers, trucks, wagons)
- Electricity use for reefer containers

- Light workshop/repair work

The costs for these have been based on a benchmarking of European terminals, namely:

- CLIP Container Terminal, Poland
- Luca Coper, Slovenia
- Port Burgas, Bulgaria
- IMT Plovdov, Bulgaria

Table 27: Forecasted Revenues

(Mio. €)	2025	2035	2045	2055
Revenues	0.94	1.37	2.11	3.41

10.2.2.3. Benefits for the Terminal Customers

Both time saving for shorter transport time and the lower transports costs compared with other traffic modes belong to the consumer´s surplus. To this can be added access to new markets and destinations that previously would not be open to shippers due to prohibitive costs of the transport. For calculation of the consumer´s benefits the so-called "rule of half" cannot be used in this case as both the terminal and Rail Baltica itself are completely new pieces of infrastructure[60].

10.2.2.4. External Cost Savings

Rail transport is proven to be safer and more environmentally friendly than road transport. As these safety and environment issues can be monetarily quantified, the significant benefits through the diverted traffic from road to rail can also be taken into account. The monetary values for all external factors both for passenger and freight and the savings of external costs in each scenario are listed the following table, in which the big difference between rail and road can be seen clearly.

[60] Guide to Cost-Benefit Analysis of Investment Projects, P. 96, European Commission

Table 28: Average external costs 2008 for EU 27 by cost category and transport mode[61]

	Road		Rail
	Light Duty Vehicles	Heavy Duty Vehicles	Freight Transport
Cost Category	€/(1,000 tkm*a)	€/(1,000 tkm*a)	€/(1,000 tkm*a)
Accidents	56.2	10.2	0.2
Air Pollution	17.9	6.7	1.1
Climate change (high)	44.5	9.8	0.9
Climate change (low)	7.6	1.7	0.2
Noise	6.3	1.8	1
Up- and downstream (high)	14.3	3	4.2
Up- and downstream (low)	8.4	1.7	2.4
Nature & Landscape	0.9	0.7	0
Biodiversity losses	0.6	0.5	0
Soil & Water Pollution	1.8	0.8	0.4
Urban Effects	3.1	0.5	0.1
Total (Low Scenario)	102.8	24.6	5.4
Total (high Scenario)	145.6	34.0	7.9

Table 29: Saving of external costs in each scenario

(Mio. €)	2025	2035	2045	2055
Option 1	1.90	6.05	9.62	15.26
Option 2	2.32	6.23	9.81	15.45
Option 5	2.40	6.25	9.83	15.46

10.2.2.5. Non-Quantifiable Benefits

In terms of the background and direction of EU development, this project, along with the Rail Baltica Global Project (RBGP), already makes clear case for EU integration and the opening of the Baltic freight markets. Within Estonia and in particular the terminal's catchment area this project is foreseen to have a positive effect on the regional economic development and corresponds with the increased traffic demand as well as the worldwide trend for environmentally friendly modes of transport.

[61] Source: CE Delft – External Costs of Transport in Europe

Further direct benefits can also be foreseen. The terminal will require a full-time staff. Within this study this is assumed to be 13 individuals. This is expected to be the required number to operate the terminal effectively and is comparable with other efficient terminals in Europe. It is dependent on having a well-trained staff that are able to take on a number of different responsibilities.

In addition to this direct employment, further secondary or induced employment can also be foreseen whether it be through local transport companies shipping to and from the terminal or logistics companies that encounter extra contracts.

It is expected that the development of this terminal will also increase the attractiveness of Pärnu as an investment location. This too may lead to the expansion of existing or creation of new companies in the region that make use of the direct connections that the terminal offers. To these investments will also be added additional employment opportunities.

10.2.2.6. Other financial implications

It is not possible to derive the potential profit or loss associated with the trucking sector as it varies per commodity, destination, operating routes within the various countries, the technology in place etc. It is also the case that in international operations the profit is not made in Estonia and instead in a second or third country.

Similarly to this, the impact of this sector in terms of tax generation is difficult to determine at this stage. It is true to say that with the commencement of rail services on Rail Baltica and a terminal in Pärnu the trucking share towards central Europe will be reduced. This will result in lower revenues for the trucking companies focusing on these routes, however at the same time a change in services can also be expected where instead of trucking companies operating these long-distance services, the focus is more on shuttle services between the terminal in Pärnu and the catchment area. In this case an increase in services can be expected linking the shippers throughout the catchment area with the rail freight services. This shift in service type may also bring increases in efficiencies, fleet utilisation, and customer base.

With regards to developing a terminal in Pärnu, it is important that the trucking sector is included. They too are a crucial element as to the ongoing development of the terminal and should be part of the thought process of developments whether they be included in development options or as intermodal operators.

10.2.3. Summary and selected scenarios

As all of the three analysed scenarios have a positive ENPV and ERR, along with a negative FNPV and an FRR well below the discount rate, theoretically both of these are feasible and need financial support to remain operational. Therefore, one of the scenarios has to be selected in view of their performance indicators.

In some sectors, particularly in transport, the benefits generated by financial cash flows (mainly resulting from the difference in operating and maintenance costs between the baseline case and investment option) could be responsible for the generation of a small minority of total project benefits. In fact, in many transport projects, time savings generate most of the economic benefits. Therefore, the selection of the scenario will be based on the comparison of the economic performance indicators including ENPV and ERR rather than financial performance indicators.

ERR and ENPV calculations often results in the same findings. However, mutually exclusive projects of different size may result in conflicting findings. A higher ERR means more efficient utilisation of resources while a higher ENPV means more benefit. When there is no capital constraint, a higher ENPV project could be selected to ensure the maximum benefit to the public.

Within the options assessed as part of this study, Option 5 has the highest ENPV as well as ERR. It must however be noted that Options 2 and 5 have results that are very close to one another. The main reason for the apparent success of Option 5 is the slightly lower investment costs.

11. Risk Assessment

The positive ENPV value calculated for the project could be interpreted as positive contribution to the welfare of the society in the case where the project is implemented. This argument implies the assumptions employed during calculation of the ENPV are the determinants for project to contribute to the welfare of the society. On the other hand, there are several uncertainties related to the assumptions developed while estimating the economic benefits, which justifies the necessity for a risk assessment on ENPV.

the risk analysis in this report has been carried out in three steps:

- Definition of critical variables and sensitivity analysis
- Definition of probability distribution for critical variables, and,
- Risk analysis on ENPV.

11.1. Sensitivity analysis and Critical Variables

According to the EC CBA Guide, the criteria to be adopted for the choice of the critical variables vary according to the specific project and must be accurately established on a case-by-case basis. As a general criterion, the recommendation to consider those variables or parameters for which an absolute variation of 1% around the best estimate gives rise to a corresponding variation of not less than 1% (one percentage point) in the NPV (i.e. elasticity is unity or greater) as a general criterion.

The risk factors considered in this study are the following:

- Investment costs;
- Operation and maintenance costs;
- Revenues;
- Savings in time costs;
- Savings in external costs;

The above parameters are changed by 1% increments and the following impacts on the FNPV(C) and ENPV are tested. The variables presented above are considered as the main sources of uncertainty towards achievement of the expected results. The aim of the sensitivity analysis is to identify those sources of uncertainty weighing more on the conclusion of the analysis. The resulting impacts of the changed parameters on the FNPV(C) and ENPV are presented below.

Table 30: Sensitivity Analysis - Option 1

	Option 1							
	FRR		FNPV(C)		ERR		ENPV	
	+1% of Variable	-1% of Variable	+1% of Variable	-1% of Variable	+1% of Variable	-1% of Variable	+1% of Variable	-1% of Variable
Investments	-3.52%	3.56%	-1.39%	1.39%	1.04%	-1.05%	2.60%	-2.60%
O&M Costs	-1.89%	1.88%	-0.30%	0.30%	0.20%	-0.20%	0.63%	-0.63%
Revenues	3.62%	-3.63%	0.54%	-0.54%	N/A	N/A	N/A	N/A
Travel Costs	N/A	N/A	N/A	N/A	-0.73%	0.73%	-2.36%	2.36%
Accidents	N/A	N/A	N/A	N/A	-0.09%	0.09%	-0.28%	0.28%
Noise	N/A	N/A	N/A	N/A	0.20%	0.18%	0.65%	0.58%
Air Pollution	N/A	N/A	N/A	N/A	0.12%	0.27%	0.37%	0.86%
Climate Change	N/A	N/A	N/A	N/A	0.00%	0.00%	-0.01%	0.01%

Table 31: Sensitivity Analysis - Option 2

	Option 2							
	FRR		FNPV(C)		ERR		ENPV	
	+1% of Variable	-1% of Variable	+1% of Variable	-1% of Variable	+1% of Variable	-1% of Variable	+1% of Variable	-1% of Variable
Investments	4.94%	--3.99%	-1.98%	1.98%	0.80%	-0.81%	0.90%	-0.90%
O&M Costs	1.62%	-1.62%	-0.48%	0.48%	0.13%	-0.13%	0.24%	-0.24%
Revenues	-3.88%	3.89%	1.13%	-1.13%	N/A	N/A	N/A	N/A
Travel Costs	N/A	N/A	N/A	N/A	-0.59%	0.59%	-1.18%	1.18%
Accidents	N/A	N/A	N/A	N/A	-0.08%	-0.08%	-0.14%	0.14%
Noise	N/A	N/A	N/A	N/A	0.17%	0.17%	0.32%	0.29%
Air Pollution	N/A	N/A	N/A	N/A	0.09%	0.22%	0.18%	0.43%
Climate Change	N/A	N/A	N/A	N/A	0.00%	0.00%	0.00%	0.00%

Table 32: Sensitivity Analysis - Option 5

	Option 5							
	FRR		FNPV(C)		ERR		ENPV	
	+1% of Variable	-1% of Variable	+1% of Variable	-1% of Variable	+1% of Variable	-1% of Variable	+1% of Variable	-1% of Variable
Investments	2.77%	-2.80%	-2.25%	2.25%	0.76%	-0.77%	0.74%	-0.74%
O&M Costs	1.12%	-1.12%	-0.59%	0.59%	0.12%	-0.12%	0.22%	-0.22%
Revenues	-2.76%	2.77%	1.42%	-1.42%	N/A	N/A	N/A	N/A
Travel Costs	N/A	N/A	N/A	N/A	-0.57%	0.57%	-1.08%	1.08%
Accidents	N/A	N/A	N/A	N/A	-0.08%	0.08%	-0.13%	0.13%
Noise	N/A	N/A	N/A	N/A	0.16%	-0.14%	0.29%	0.26%
Air Pollution	N/A	N/A	N/A	N/A	0.09%	0.22%	0.17%	0.39%
Climate Change	N/A	N/A	N/A	N/A	0.00%	0.00%	0.00%	0.00%

Based on the ENPV the only value that can be seen as critical are Investment Costs and Travel Costs which gives a variation of over 1% across the options.

11.2. Switching Values

The switching value of a variable is that value at which a project's FNPV or ENPV becomes zero and indicates the amount by which an element of a project can change in an unfavourable direction before the analysis returns a negative outcome (i.e. negative FNPV or ENPV). The switching values for the critical variables are calculated in relative terms and presented in Annex 3 – Switching Values. A shortened example focusing on the critical values arising from the sensitivity analysis (Investment Costs and Travel Costs) are detailed in Table 33.

From this, the relative switching value for the investment costs is 38%. This can be interpreted that the project will still be economically feasible if the investment costs should be 38% higher than those used in the CBA calculations. In other words, the external benefits promised by the project is large enough to make it economical even in the case of a 38% higher investment volume.

For the project to be financially feasible the investment costs would have to be reduced by 73%. This is required to bring the FRR above the financial discount rate of 4%.

With regards to travel costs, the terminal will remain economically feasible if the benefits from the travel costs would be reduced by 42%.

Table 33: Switching Values Example Table

Example Option 1		
	Financial	Economic
Investment Costs	-73%	38%
Travel Costs	N/A	-42%

11.3. Risk Analysis

Considering the particulars of the project, the following specific risks are considered.

- Project Feasibility & Demand
- Political will
- Public pushback
- Funding Risks
- Planning & Design Risks
- Land acquisition Risks
- Construction Risks

11.3.1. Project Feasibility & Demand

The project feasibility is the basis for the decision-making process as to whether this project should go ahead or not. A major risk that impacts the overall feasibility of this project is a lack of demand. Forecasts carried out for the study have indicated that the terminal will not be revenue generating and will require support but will however bring a positive impact. The forecasts also include a value for induced demand which will come as a result of the opening of this terminal

Mitigation of this is linked to the overall PR strategy of the terminal. This should be in place prior to the opening of the terminal and potential shippers should be aware as to the estimated costs to various destinations. An advertising campaign should be developed in conjunction with the local shippers with a view to selling the advantages of the terminal while also working with suppliers both inside and outside Estonia to open up new routes to increase the amount of outgoing and incoming freight.

11.3.2. Political Will

A risk that is associated with both the Pärnu Intermodal Terminal and the Rail Baltica Global project is the question of political will. While the terminal is a relatively small part of the overall project, political decisions that are made for the global project may have a large impact on the feasibility and overall operation of this terminal. This ranges from decisions regarding Track Access Charges, operational rules, the organisational structure of the infrastructure manager, definition of responsibilities, operating subsidies, the procurement strategy to name just a few.

From a more local perspective, the project enjoys good support from both Pärnu City Government and the Development Centre of Pärnu County

In order to mitigate the risks associated with political will, it is important that Rail Baltica interacts with the local politicians to ensure that the option of a terminal is held in good regard while also working with the national governments to ensure that the various questions that bring uncertainty to the overall global project are clarified in a manner that allows for the most efficient operations.

11.3.3. Funding Risks

Securing sound funds for the project is very important. The funding scheme itself has a bearing on the project's progress. While the RBGP is funded by both state funding and EU funding, it has not been determined to date what the funding structure of this terminal will be. There is a link here to the points raised under the political will of the project in terms of how the overall RBGP will be run and who will be responsible for funding this terminal. This includes if it will be funded by the state alone, with support from the EU or under a PPP scheme.

Linking again to the overall political will of the project, obtaining the funding is reliant on reducing the risks to a minimum. The risks in this case are not only related to the construction of the project itself but in a large part to the uncertainties relating to the overall operation of the line.

11.3.4. Public Pushback

Public pushback is also a risk for this project. If members of the public feel that the development of this terminal will adversely affect them then issues can arise out of this. In the case of this terminal, two of the proposed options are located on existing railway infrastructure within an industrial area. For these, little direct pushback is foreseen however perceived increased traffic may also raise concerns. The third option is located on a greenfield site currently used a farmland. There is potential that this will raise some resistance.

Mitigation in this case comes down to introducing a good PR strategy at an early stage. This should allow full inclusion through transparent processes while also ensuring that the advantages of this terminal to all involved are known.

Over the course of this study the consortium became aware of a campaign in opposition to Rail Baltica[62]. This shows that early interaction with the public is required if it is to be ensured that a complete story is to be provided.

11.3.5. Planning & Design Risks

The various options vary somewhat in the planning and design risks that can be identified at this stage. As Options 1 and 5 are proposed on existing railway facilities the risks here are considered to be somewhat lower. Option 2 on the other hand is located in an area where there is potential for flooding. The follow-on impacts of this can only be determined following the completion of the detailed design at which time these can be fully elaborated.

A further planning and design risks are as a result of the interrelationship that the terminal location and branch has on the vertical and horizontal alignment of Rail Baltica itself. While it is expected that the alignment will remain inside the defined corridor, any changes to this alignment can have a substantial impact on the location of the terminal, the associated construction costs and indeed the overall feasibility of a location.

In order to mitigate these risks, it is imperative that the design of Rail Baltica itself is finalised so that the detailed terminal design can be commenced. To limit the risk of unexpected costs it is important that the requisite studies are carried out in advance such as ground investigations, flood studies etc. While these may show the need for extra work it is important that the costs of these works can be incorporated into the overall design and costings. These are helped by contracting experienced parties to carry out the investigations and overall design.

Very poor results from the various studies may mean that an option has to be disregarded and a secondary option chosen instead.

62 https://www.youtube.com/watch?v=3vDdwB6pErI

11.3.6. Land Acquisition Risks

The land acquisition is one of the basic cost drivers of this project. While the acquisition of land is assumed to be manageable either through a direct purchase or compulsory purchase order, the costs of this land may provide issues.

This is a risk that is difficult to mitigate as land purchase is a requirement to further the project. From the same viewpoint, a fair market value must be paid for the land. An investigation of land prices within the County of Pärnu[63] indicate prices for forestry land, arable land had a maximum value of ca. 1 EUR/m². As the land required for each of these options is currently in use (either industrial or arable) combined with the high profile of the Rail Baltica project, it can be assumed that land costs will reach a premium. For this reason, in calculating the land acquisition costs for each option an additional surcharge has been placed on the unit price for land.

[63] Source: http://www.maaamet.ee/kinnisvara/htraru/Start.aspx for the timeframe January 2017 to September 2018

Table 34: Risk Matrix

Risk	Probability	Impact	Overall Risk	Mitigation	Residual Risk
Project Feasibility & Demand	B	V	High	Fully developed PR and advertising strategy.	Moderate
Political Will	C	IV	Moderate	Interaction with local politics, national governments and the EU.	Low
Funding Risks	B	IV	Moderate	Reducing other risks and concerns to a minimum.	Low
Public Pushback	C	III	Moderate	Fully developed PR strategy, transparent processes, early interaction.	Low
Planning & Design Risks	C	III	Moderate	Carrying out complete studies, employing experienced designers	Low
Land Acquisition Risks	C	II	Moderate	Difficult to mitigate	Moderate

As per the EU CBA guidelines the Risk Matrix is developed as follows:

A Probability (P) or likelihood of occurrence is attributed to each adverse event. Below, a recommended classification is given[64], although in principle other classifications are possible:

A. Very unlikely (0–10 % probability)
B. Unlikely (10–33 % probability)
C. About as likely as not (33–66 % probability)
D. Likely (66–90 % probability)
E. Very likely (90–100 % probability)

To each effect a Severity (S) impact from, say, I (no effect) to VI (catastrophic), based on cost and/or loss of social welfare generated by the project, is given. These numbers enable a classification of risks, associated with their probability of occurrence. Below a typical classification is given Table 35.

[64] This is classification is in line with the provisions of the IPPCC report (http://www.climatechange2013.org/images/uploads/WGIAR5-SPM_Approved27Sep2013.pdf) about the assessed likelihood of an outcome.

Table 35: Risk Severity Classification

Rating	Meaning
I	No relevant effect on social welfare, even without remedial actions.
II	Minor loss of the social welfare generated by the project, minimally affecting the project long run effects. However, remedial or corrective actions are needed
III	Moderate: social welfare loss generated by the project, mostly financial damage, even in the medium-long run. Remedial actions may correct the problem.
IV	Critical: High social welfare loss generated by the project; the occurrence of the risk causes a loss of the primary function(s) of the project. Remedial actions, even large in scope, are not enough to avoid serious damage.
V	Catastrophic: Project failure that may result in serious or even total loss of the project functions. Main project effects in the medium-long term do not materialise.

The Risk Level is the combination of Probability and Severity (P*S). Four risk levels can be defined as follows with the associated colours as detailed in Table 36.

Table 36: Probability/Severity Table

		Severity				
		I	**II**	**III**	**IV**	**V**
Probability	**A**	Low	Low	Low	Low	Moderate
	B	Low	Low	Moderate	Moderate	High
	C	Low	Moderate	Moderate	High	High
	D	Low	Moderate	High	Very High	Very High
	E	Moderate	High	Very High	Very High	Very High

12. Conclusion

12.1. Summary

The fundamental question that had to be answered in this study was if an intermodal terminal in Pärnu is feasible. The answer to this question is yes.

A terminal in Pärnu is technically and economically feasible as it has been proven in the MCA and CBA within this report. Through this report it has been shown that a terminal developed at any of the investigated options will be technically feasible however will require financial support to remain operational. This is supported through the results of the CBA and in particular the financial and economic indicators. In this case the financial indicators showed a negative FNPV and an FRR well below the discount rate (4% for this project). The economic indicators showed a more positive result with both a positive ENPV and ERR. This is not an unusual situation within the European freight sector and is a symptom of the relatively high investment and operating costs combined with the low revenues through terminal usage.

However, the terminal needs to be integrated in several areas of development in the transport sector and in the Rail Baltica Global Project to finally succeed.

The terminal will serve the region around Pärnu and the economy located within the catchment area. The terminal might also attract new business and industry initiatives (induced traffic) which can benefit from efficient transport options via rail transport solutions over Rail Baltica. These options will only be found and defined when the structures of the line regarding access conditions, that determine the costs for railway transport concepts, will be agreed upon and published. This study therefore had to be based on the existing transport flows which are of course not structured according to the new opportunities of Rail Baltica. However, even the existing volumes provide a base-volume that allows the terminal to exist and to be economically viable.

Based on the analysis, it can be concluded that the Pärnu region benefits most from RBPT. Other bordering counties/regions are either influenced by Tallinn and Muuga terminal (regions north from Pärnu), or Salaspils and Riga (regions south or east from Pärnu). The bigger hubs located in the catchment area (e.g. Viljandi) cannot be regarded as significant industrial centres. The larger enterprises in that region operate in such fields which use other transport type (not railway), or they are e.g. forest industry which operate across the region (e.g. Southern Estonia) and which do not have an impact for Viljandi only. Tartu and smaller Southern-Estonian cities (e.g. Võru, Valga, Elva, Põlva) are influenced by Muuga and less also by Salaspils terminal, because of their location (wider transport network is available) and cargo flows from that region.

Pärnu has become the hub for such industries who have a demand for railway transport, e.g. wood products, steel and machinery, peat. For this reason, Pärnu is likely to get the most significant benefit from the development of RB.

The terminal itself will need to be set up in a way that the operations costs for railway undertakings are the lowest possible. In the European rail transport market, it is obvious that only the most efficient railway transport solutions succeed as sustainable offers. A terminal is often a costly and time-consuming element in the transport chain. Smaller terminals in particular, which are not attracting high numbers of trains, will require a very efficient operations approach to attract railway companies to use it. This is also valid for Pärnu Terminal. A terminal development that firstly guarantees easy access and operations structures and an adjustable layout of the terminal that can be further developed was therefore the approach and the recommendation in this study.

The overall costs of the terminal are determined not only by the terminal infrastructure itself but also by the connection to the Rail Baltica mainline. The approach in the study was to limit the investment costs of the terminal by finding synergies in connecting the terminal area with existing (planned) options to enter and exit the mainline. One option is the planed passenger station in Pärnu, another option is through utilising already planned operational points near Pärnu. Both options provide the station-infrastructure, signalling and switches that allow a comparably easy connection of the terminal. A separated connection to the mainline requires a new “station” with all signalling and switches to be built and thus dramatically increases the overall investment need.

The location of the terminal has been analysed in-depth based on several criteria (defined in the MCA and the CBA). The locations finally do not differ significantly in quality and costs. The quality of a location that is closer to the existing (small scale) industry and that allows lower last-mile costs had to be compared with a location that allows larger industries to settle close-by and to induce new volumes to use the line. The larger industry (Est-For) withdrew from their plans for now, so that the local industry would provide the core volumes. In combination with the advantage of the maintenance facility for Rail Baltica infrastructure, a terminal is therefore recommended to be located north of the Pärnu river. For large industries interested in using Rail Baltica, a separate discussion on potential entry points is required.

The usage of the terminal from today's perspective is a mix of direct trains to European destination and shuttle trains to hubs of intermodal services, especially Salaspils as the next hub. It cannot be forecasted how operators will serve the transport market when the line will have opened. The main issue to succeed in attracting services to use the terminal will be the overall competitiveness of the transport chain. The intermodal operators (be it Baltic operators or from any other European countries makes no difference) will need to find basic volumes to start services. They calculate with an uptake curve of up to one year until such services will economically viable. However, they need to see the opportunities in finding enough volumes and in competing successfully with other transport modes, mainly road transport. Therefore, the costs of the terminal operations and services are crucial to be kept low.

Operations concepts will have to be developed and offered to attract transport flows in using the terminal and the Rail Baltica in total. Most likely these concepts will concentrate on the major destination and origins in the Baltic countries first. For that reason, the concept of a feeder-service to a hub such as Salaspils is a reasonable assumption to connect Pärnu terminal with several transport options into Europe. It is less reasonable that Muuga terminal will be connected in that way as all volumes touching the North of Estonia will most likely direct use services from and to Muuga. A direct connection from and to Pärnu might be feasible if a minimum of volumes can be found for a certain long-distance destination. In this study three options for such direct trains were defined. These are competitive to trucking and would be reasonable in terms of logistics chain. Which one of them (or another one) finally will be realised needs to be left to the market.

The terminal itself will at a minimum, provide transhipment services for containers. In a first stage of low volumes this can be offered with just a track and a paved area beside it. With growing volumes, the service might be extended to two or more tracks (see layout options). It also might be extended to serve other commodities and types of goods. Beside the pure transhipment some additional services might be interesting for the customers. First of all, the shunting and train operations within the terminals should be offered in an efficient way. These services will have to be conducted with a diesel locomotive (or hybrid or other modern technologies available). The service might be combined with the requirements for the maintenance facility which is planned in the same region. For this reason, the study recommends to place both, the maintenance facility and the terminal in the one location. Other services can be related to the loading units. The storage of empty and full units, a repair service, eventual information chains and paper work to be conducted as an agency and logistics services such as storage of goods might be options but are fully depending on the usage of the terminal and the type of clients. The area foreseen provide all those kinds of options.

The terminal planning today shall mainly concentrate on the efficient connection to the mainline. This needs to be guaranteed now and integrated into the Rail Baltica Global Project plans. It is much more difficult to connect a terminal when the mainline is finished and installed.

The area available should be kept for the terminal purpose and not changed in function or occupation. The terminal itself should be constructed only when the line is fully completed and usable into Europe. The investment might need public support (as with the line itself and many terminals Europewide) to support private initiatives and to decrease the handling costs provided to the market. The CEF policy provides the options to apply for funding as the terminal is directly connected to the North-Sea-Baltic-Corridor. If other public funding options will be available needs to be discussed in a later stage however these could involve Public-Private Partnerships (PPP) or a mixture of PPP and EU funding. Further sources of funding may also include the national or local governments acting alone or in conjunction with private parties. The involvement of private partners in such a terminal can be further divided into whether will be involved only in the role of ownership receiving rental income or whether they will take on an owner-operator role.

As mentioned previously in the summary, this terminal is expected to require support or subsidies to remain in operation. Based on the realistic scenario, to remain positive from the economic point of view the weekly train numbers detailed in Table 37 are required. This is based on a scenario where there is no growth in train numbers over the forecasted period (up to 2055). This is the point at which the ENPV falls below zero.

Table 37: Minimum train numbers for terminal to remain economically positive

Option Number	Minimum weekly train numbers
Option 1	10.1
Option 2	7.3
Option 3	6.8

As the main conclusion the terminal in Pärnu is a reasonable option for an access point for intermodal volumes to utilise the Rail Baltica in future. The long-time frame until the RBGP will be finished does not allow to define a concrete operations concept nor a volume estimation today. However, the overall freight volumes as of today and the logistics chain development and its competitive situation create a promising basis for the location of Pärnu to foresee such a terminal. To react properly to potential upcoming changes in commodity, operations concepts, technologies used etc. the area should be kept free and the layout should be decided only when knowing more about the concrete plans of operators.

12.2. Questions answered

A number of fundamental questions are put forward in the ToR which can now be answered. These have been adjusted slightly to remove repeating questions.

12.2.1. Is there sufficient freight flow potential at all? If yes, how much, what type of cargo and to which directions?

Yes, while the definite location cannot be determined, relatively accurate assumptions can be made as to where loads will be transferred either to other rail services or to other modes.

The main commodity groupings that show promise and where growth is forecasted have been listed in Section 7.2.2. The analyses that have been carried out based on information provided from the Estonian Statistics Office as well as through interviews with relevant companies show a range of interesting destinations including the Benelux countries, France, Germany, Poland, and destinations to southern Europe. Within the modelling exercises carried out as part of this study a focus was placed on Duisburg, Katowice, and Warsaw. These would act as a natural stop on the way to any of the abovementioned countries and act as a hub where wagons can be exchanged and trains rebuilt as necessary. These cities are also located on various Rail Freight Corridor hubs ensuring that the performance of the routes will increase in the coming years due to the focused investment of the EU and national governments in terms of rail transport. Section 7.2.2 provides information on the expected train numbers to each destination for the realistic scenario until 2055. In summary the total train numbers grow from approximately 10 to 14 trains per week over the forecasted period.

12.2.2. Is the cargo volume sufficient to organise train services? If yes which type of train services might be considered for terminal operations?

There are sufficient volumes in this area to warrant train services. While it is expected that much of these loads will be containerised or multimodal, a good share of bulk transport, in particular from the forest sector, is also expected. While it is not expected that this terminal will be serviced by a large number of trains, this in some respects is also dependent on the individual operations plans that Railway Undertakings put in place such as combining visits to Pärnu with visits to Muuga or Salaspils. These are dictated by the overall freight flow situation to Latvia, Estonia, and Rail Baltica in general and cannot be determined at this stage.

12.2.3. Does the projected cargo volume provide sufficient feasibility of the terminal? What are the key functional, technical, and governance criteria which contribute to the feasibility of the terminal most?

A terminal in this location in or around Pärnu is feasible, however this is subject to certain requirements. It is expected that both the terminal in Muuga and Salaspils will provide competition to this terminal and as such it is vital for the terminal in Pärnu to offer a feasible, attractive, efficient and price effective alternative to each of these competing terminals. It is imperative that the costs for this terminal are kept as low as possible, turnaround times are reduced to a minimum, and that good service is ensured.

It needs to be ensured that the correct technical equipment is in place. This ranges from digital technology for registering containers and wagons to the more "standard" equipment of reach stackers, forklifts, cranes etc. Potential equipment to maintain onsite has been discussed over the course of the study and is included again in Annex 6 – Types of loading equipment required.

In addition to this the terminal needs to be designed and laid out in such a way that commodities can be properly served. This means that in addition to storage space for containers consideration should be given to moveable or flexible storage units that can be used for bulk goods such as pulp, wood pellets, stone etc. This can be simply managed by having appropriate concrete dividers placed on the site that can be moved as required providing various storage volumes. The advantage of this is that such dividers are realtively easily removed or adjusted to cater for changes in volumes over time.

At this stage it cannot be said who will operate the terminal, whether it will fall under RB Rail, will be under the control of the national railway operators or will be run by private operators. Regardless, this should be organised with a view to minimising costs and should therefore be as lean as possible.

12.2.4. What is the suggested location of the terminal? Shall the terminal development be staged? If yes, what are the stages?

As mentioned previously, the results from the CBA do not favour any one option above another. Purely from point of view of efficiency in terms of reusing existing infrastructure as well as avoiding flooding risks it can be said that Option 5 is ranked slightly higher than Option 2. This is however completely dependent on the final alignment that is chosen for the section north of Pärnu where it interacts with the existing 1520mm line.

Owing to the relatively low number of trains that this terminal is expected to serve, a train services plan is not required at this stage as this will be driven by the operators serving the terminal and their internal operational plans.

As mentioned previously in the risks chapter an advertising campaign should be put in place prior to the beginning of operations so that shippers and potential customers can be made aware of the terminal, the services it provides, and the advantages that it brings. Based on the initial responses from this a determination can be made as to how the terminal can be phased. If it is found that more space is needed for container storage and handling then this can be included at an early stage. If it turns out that the initial shippers will be focusing more on bulk commodities then suitable adjustable storage space can be put in place as required.

The layouts provided as part of this study further allow for the number of tracks installed at the initial stage to be tailored to suit. These layouts provide capacity for the optimistic number of trains as detailed in Section 7.2.2. If it is found from market research that less will be needed to suit the operating plans in the early phases of the terminal then only the required number needs to be built without adverse effects on the terminal operation. This can be as little as two parallel tracks within the terminal that allow loading and appropriate shunting movements to be carried out. This will most likely suit the requirements for the initial years of all forecasted scenarios. Regardless of the type of operations, the development of the freight station is a requirement to ensure that mainline operations are not adversely impacted by terminal operations.

12.2.5. What are the benefits for the industry and logistics service providers? In terms of money, time, safety, reliability, etc?

Any terminal that is developed in the Pärnu region will allow fast and direct access to the markets of central Europe. Based on the modelling carried out as part of this study, this will be achieved at a rate that is competitive to the road sector. Due to the nature of rail transport and the average speeds that can be achieved, trains departing Pärnu Terminal would be able to reach Duisburg in just over 40 hours assuming there are no delays incurred due to operational issues or infrastructure problems. This time and cost savings feed directly back into the revenues for the industry players and allow them to get their products to the market faster.

From the point of view of safety, there is no comparison with the road sector. Through rail services shippers' goods will be transported via a much safer method when compared to road. This is more so important for the transport of oversized goods and dangerous goods.

The reliability of the rail sector is sometimes a weakness. Often times this is due to infrastructural issues. With that said however, as Rail Baltica will be a new-build line a very low number of issues are expected from the infrastructural point of view at least for the Baltic sector of the corridor. Similarly, on sections through Poland and Germany it can be expected that the reliability effecting infrastructure issues should be reduced in the coming years due to ongoing and planned projects aimed at improving the infrastructure in these countries.

12.2.6. What are the benefits for the society? Explain them in a tangible way.

The overall benefits for society are usually non-monetary and relate often to the potential savings in terms of the environmental, social, and economic level.

Usually the main environmental and social benefits represent greenhouse gas emissions, pollution and noise savings, but other benefits can be defined in relation to the improvement of the global quality of life of a city or country (for example related to congestion). In addition to this, time savings can also be quantified, transport, the impacts of delivery times on total transport cost are known and very important in transport management

The environmental side of this is becoming an important social issue. Of particular relevance to a terminal is the question of noise and emissions. Based on the modelling carried out as part of this study in terms of the numbers of wagons transported per year and the modal shift that will be expected, the number of trucks on the road and the related noise emissions from these are expected to significantly reduced.

Of additional interest here will be the release of Particulate Matter (PM_{10} and $PM_{2.5}$). With the addition of train services and the overall reduction of truck movements further beneficial effects from the lowering of these values will be experienced.

The issue of road safety can also be raised here. Rail is statistically proven to be a much safer transport mode when compared to road transport. In Germany for example, research published by the German Pro-Rail Alliance[65] and the ACV (Automobile-Club Transport)[66] show that rail freight transport is 42 times safer than HGVs when transporting dangerous goods[67]. Similar research from the UK[68] indicated that HGVs are nearly five times more likely than cars to be involved in fatal collisions on minor roads, and almost four times more likely on motorways. Across all road types HGVs are almost three times more likely to be involved in fatal collisions than cars.

This trend is repeated throughout Europe highlighting the benefits of rail freight transport over road in terms of accidents and deaths and showing that all measures that can be used to reduce road traffic will have a beneficial societal effect.

The economy in the country and in the region will benefit further from the transport options available and/or also from new added value chains arising from the intermodal transport services. Engagement in the terminal and transhipment activities or even in transport itself such as wagons, intermodal equipment or even traction devices for rail services are additional economic opportunities beside the improvements of the overall logistics and supply chains.

In terms of employment opportunities, the terminal is foreseen to create 13 new roles. These will be in terms of direct employment at the terminal, however due to the increased attractiveness of this area for investment it can also be assumed that local business will expand or new businesses will be created developing further opportunities in secondary manufacturing businesses as well as in local transport and logistic companies.

The local areas will benefit further from getting a competitive edge and allowing further development of businesses. Rail Baltica is likely to have a positive effect for the society at large, both because of the cargo as well as the passenger flows and the improved

[65] www.allianz-pro-schiene.de

[66] https://www.acv.de/

[67] https://www.allianz-pro-schiene.de/en/press-releases/comparison-of-transport-modes-trains-safer-than-buses-and-cars/

[68] http://www.freightonrail.org.uk/FactsFigures-safety.htm

mobility of people. The opening of this line will create more business opportunities, which increases the number of jobs in the region, raises income, raises the real estate value, improves the life quality, increases the number of residents, advances tourism, and reduces ecological footprint. This point of view has been reflected in discussions with Pärnu City Council.

12.2.7. What are the benefits for Rail Baltica - does the terminal add value for Rail Baltica or cannibalise the main terminals?

It is expected that Pärnu will act as a local satellite whereas Muuga and Salaspils will take on the form of central hubs. If all three terminals are running at an optimum efficiency it is not expected that one terminal will cannibalise the others. With that said however, numerous scenarios can be developed such as where Muuga is not offering a competitive service and as a result Pärnu gains more traffic. The reverse is also true where Pärnu is not preforming and Muuga or Salaspils gain customers. Another interesting scenario is that cooperation agreements are put in place where three terminals work together in order to maximise train loadings. This can be based on feeder services, long-distance services or a mixture of these.

Rail Baltica is at its most efficient when usage of its available capacity is maximised. The maximisation of capacity usage is key to ensuring that the investments are worthwhile, while also providing an important revenue stream for the Infrastructure Manager(s) through Track Access Charges.

The construction of a terminal in or around Pärnu provides a further entry point for suppliers to access Rail Baltica and the further advantages that this brings i.e. direct connection to the European marketplace and further onward connections to other main destinations within Europe through the Rail Freight Corridors. As mentioned previously, while this terminal will be in competition with Muuga and Salaspils it is also expected that this will be a stand-alone development which will have its own catchment area to serve.

Annex 1 – Financial Analysis Results

Option 1

Option 1							
Internal Rate of Return from the Investment (Constant prices base year, in EUR)							
Serial year on the project	**1**	**2**	**3**	**4**	**14**	**24**	**34**
Calendar year	**2022**	**2023**	**2024**	**2025**	**2035**	**2045**	**2055**
Incremental Income				941,763.01	1,370,059.29	2,109,336.30	3,414,849.72
Total operating revenue	-	-	-	941,763.01	1,370,059.29	2,109,336.30	3,414,849.72
Residual value							25,451,772.08
Incremental O&M costs				694,013.13	799,526.39	1,053,356.86	1,542,063.78
Total operating costs	-	-	-	694,013.13	799,526.39	1,053,356.86	1,542,063.78
Costs for constructions and equipment	10,199,069.10	55,926,714.92	2,280,957.67	863,832.67			
Costs for replacement							
Total investment costs	10,199,069.10	55,926,714.92	2,280,957.67	863,832.67	-	-	-
Total outflows	10,199,069.10	55,926,714.92	2,280,957.67	1,557,845.80	799,526.39	1,053,356.86	1,542,063.78
Net cash flows	-10,199,069.10	-55,926,714.92	-2,280,957.67	-616,082.79	570,532.89	1,055,979.44	27,324,558.02
NPV (FNPV_C)	-48,397,625.24						
IRR (FIRR_C)	-1.02%						
Discounting rate	4.00%						

Internal Rate of Return from the Capital (Constant prices base year, in EUR)							
Serial year on the project	**1**	**2**	**3**	**4**	**14**	**24**	**34**
Calendar year	**2022**	**2023**	**2024**	**2025**	**2035**	**2045**	**2055**
Incremental Income	-	-	-	941,763.01	1,370,059.29	2,109,336.30	3,414,849.72
Residual value							25,451,772.08
Total operating revenue	-	-	-	941,763.01	1,370,059.29	2,109,336.30	28,866,621.80
Incremental O&M costs	-	-	-	694,013.13	799,526.39	1,053,356.86	1,542,063.78
Financial costs- interest for loan							
Total national public co-financing	11,056,776.72	59,470,065.40	2,393,477.67	863,832.67			
Private equity							
Loans reimbursements							
Total costs	11,056,776.72	59,470,065.40	2,393,477.67	1,557,845.80	799,526.39	1,053,356.86	1,542,063.78
Net cash flows	-11,056,776.72	-59,470,065.40	-2,393,477.67	-616,082.79	570,532.89	1,055,979.44	27,324,558.02
NPV (FNPV_K)	-52,766,431.69						
IRR (FRR_K)	-1.25%						
Discounting rate	4.00%						

Option 2

Option 2 Internal Rate of Return from the Investment (Constant prices base year, in EUR)							
Serial year on the project	**1**	**2**	**3**	**4**	**14**	**24**	**34**
Calendar year	**2022**	**2023**	**2024**	**2025**	**2035**	**2045**	**2055**
Incremental Income				941,763.01	1,370,059.29	2,109,336.30	3,414,849.72
Total operating revenue				941,763.01	1,370,059.29	2,109,336.30	3,414,849.72
Residual value							28,306,498.34
Incremental O&M costs				483,957.37	589,470.64	843,301.11	1,332,008.02
Total operating costs	-	-	-	483,957.37	589,470.64	843,301.11	1,332,008.02
Costs for constructions and equipment	7,111,177.48	38,102,832.06	1,932,024.68	601,161.28			
Costs for replacement							
Total investment costs	7,111,177.48	38,102,832.06	1,932,024.68	601,161.28	-	-	-
Total outflows	7,111,177.48	38,102,832.06	1,932,024.68	1,085,118.65	589,470.64	843,301.11	1,332,008.02
Net cash flows	-7,111,177.48	-38,102,832.06	-1,932,024.68	-143,355.65	780,588.65	1,266,035.19	30,389,340.04
NPV (FNPV_C)	-23,330,909.46						
IRR (FIRR_C)	1.01%						
Discounting rate	4.00%						

Internal Rate of Return from the Capital (Constant prices base year, in EUR)							
Serial year on the project	**1**	**2**	**3**	**4**	**14**	**24**	**34**
Calendar year	**2022**	**2023**	**2024**	**2025**	**2035**	**2045**	**2055**
Incremental Income	-	-	-	941,763.01	1,370,059.29	2,109,336.30	3,414,849.72
Residual value							28,306,498.34
Total operating revenue	-	-	-	941,763.01	1,370,059.29	2,109,336.30	31,721,348.06
Incremental O&M costs	-	-	-	483,957.37	589,470.64	843,301.11	1,332,008.02
Financial costs- interest for loan							
Total national public co-financing	7,713,375.08	40,624,142.46	2,044,544.68	601,161.28			
Private equity							
Loans reimbursements		0	0	0			
Total costs	7,713,375.08	40,624,142.46	2,044,544.68	1,085,118.65	589,470.64	843,301.11	1,332,008.02
Net cash flows	-7,713,375.08	-40,624,142.46	-2,044,544.68	-143,355.65	780,588.65	1,266,035.19	30,389,340.04
NPV (FNPV_K)	-26,461,475.05						
IRR (FRR_K)	0.75%						
Discounting rate	4.00%						

Option 5

Option 5							
Internal Rate of Return from the Investment (Constant prices base year, in EUR)							
Serial year on the project	**1**	**2**	**3**	**4**	**14**	**24**	**34**
Calendar year	**2022**	**2023**	**2024**	**2025**	**2035**	**2045**	**2055**
Incremental Income				941,763.01	1,370,059.29	2,109,336.30	3,414,849.72
Total operating revenue	-	-	-	941,763.01	1,370,059.29	2,109,336.30	3,414,849.72
Residual value							28,560,575.27
Incremental O&M costs				465,261.95	570,775.21	824,605.68	1,313,312.60
Total operating costs	-	-	-	465,261.95	570,775.21	824,605.68	1,313,312.60
Costs for constructions and equipment	5,702,856.87	35,192,383.48	1,829,416.59	529,557.62			
Costs for replacement							
Total investment costs	5,702,856.87	35,192,383.48	1,829,416.59	529,557.62	-	-	-
Total outflows	5,702,856.87	35,192,383.48	1,829,416.59	994,819.57	570,775.21	824,605.68	1,313,312.60
Net cash flows	-5,702,856.87	-35,192,383.48	-1,829,416.59	-53,056.56	799,284.07	1,284,730.62	30,662,112.39
NPV (FNPV_C)	-18,574,261.92						
IRR (FIRR_C)	1.47%						
Discounting rate	4.00%						

Internal Rate of Return from the Capital (Constant prices base year, in EUR)							
Serial year on the project	**1**	**2**	**3**	**4**	**14**	**24**	**34**
Calendar year	**2022**	**2023**	**2024**	**2025**	**2035**	**2045**	**2055**
Incremental Income	-	-	-	941,763.01	1,370,059.29	2,109,336.30	3,414,849.72
Residual value							28,560,575.27
Total operating revenue	-	-	-	941,763.01	1,370,059.29	2,109,336.30	31,975,424.99
Incremental O&M costs	-	-	-	465,261.95	570,775.21	824,605.68	1,313,312.60
Financial costs- interest for loan							
Total national public co-financing	6,178,662.85	37,208,127.40	1,941,936.59	529,557.62			
Private equity							
Loans reimbursements							
Total costs	6,178,662.85	37,208,127.40	1,941,936.59	994,819.57	570,775.21	824,605.68	1,313,312.60
Net cash flows	-6,178,662.85	-37,208,127.40	-1,941,936.59	-53,056.56	799,284.07	1,284,730.62	30,662,112.39
NPV (FNPV_K)	-21,092,314.27						
IRR (FRR_K)	1.23%						
Discounting rate	4.00%						

CAPEX – Option 1

Note: Unit prices are based on internal databases using price benchmarking across Europe.

		Terminal			Station			Total
Position	Dimension	Volume	Unit price (EUR)	Total	Volume	Unit price (EUR)	Total	Total costs (EUR)
Land acquisition								
Land acquisition / lease								
Land acquisition / lease over 10 years	[m²]	250000.00	3.00 €	7,500,000.00 €	188000.00	3.00 €	5,640,000.00 €	13,140,000.00 €
Site clearance								
Removing existing installations	[m²]	62500.00	7.00 €	437,500.00 €	18800.00	7.00 €	131,600.00 €	569,100.00 €
Removing existing pipes and cables	m	1137.50	12.00 €	13,650.00 €	2350.00	12.00 €	28,200.00 €	41,850.00 €
Removing existing rails	m	4550.00	20.00 €	91,000.00 €	9400.00	20.00 €	188,000.00 €	279,000.00 €
Removing sleepers	Piece	7580.00	15.00 €	113,700.00 €	15670.00	15.00 €	235,050.00 €	348,750.00 €
Removing switches	Piece	11.00	1,500.00 €	16,500.00 €	10.00	1,500.00 €	15,000.00 €	31,500.00 €
Removing existing foundations, lighting, buffers etc	lump sum	1.00	25,000.00 €	25,000.00 €	1.00	25,000.00 €	25,000.00 €	50,000.00 €
Bushes and trees clearing	lump sum	1.00	10,000.00 €	10,000.00 €	1.00	10,000.00 €	10,000.00 €	20,000.00 €
General / Construction site equipment								
Construction site Setup	lump sum	1.00	746,723.82 €	746,723.82 €	1.00	163,895.80 €	163,895.80 €	910,619.62 €
Construction site Clearance	lump sum	1.00	187,000.00 €	187,000.00 €	1.00	41,000.00 €	41,000.00 €	228,000.00 €
Traffic safety, barrier, lightning during the construction period	lump sum	1.00	20,000.00 €	20,000.00 €	1.00	20,000.00 €	20,000.00 €	40,000.00 €
Costs land acquisition				9,161,074			6,497,746	15,658,820

Earthwork								
Soil removal and moving/storage	m^3	50,000	15	750,000	-	15	-	750,000
Fill to base and frost protection layer	m^3	46,900	18	844,200	14,100	18	253,800	1,098,000
Disembarking Ramp	lump sum	1	300,000	300,000				300,000
Bridge Upgrade	lump sum	1	10,000,000	10,000,000				10,000,000
1520m Overpass	lump sum	1	10,000,000	10,000,000				10,000,000
Earthworks for Terminal access track	m^3				5,680	18	102,240	102,240
Costs earthwork				21,894,200			356,040	22,250,240
Railway Tracks								
New Tracks								
Tracks 1520 non-electrified	m	1,680	700	1,176,000	-	700	-	1,176,000
Tracks 1435 non-electrified	m	3,810	700	2,667,000	-	700	-	2,667,000
Tracks 1435 electrified (Main Line)	m				-	2,000	-	-
Tracks 1435 electrified (Terminal Access)	m				5,680	1,000	5,680,000	5,680,000
Delivery and installation of fixed buffer stop	Piece	4	10,000	40,000	-	6,000	-	40,000
Installation of walkway	m	2,250	15	33,750	1,500	15	22,500	56,250
Switches								
Switches installation 1520	Piece	-	104,000	-	2	104,000	208,000	208,000
Switches installation 1435 (Normal)	Piece	3	104,000	312,000	10	104,000	1,040,000	1,352,000
Switches installation 1435 (High-speed)	Piece							
Switches installation 1435 (High-speed curved)	Piece							
Costs railway tracks				4,228,750			6,950,500	11,179,250

Roads, Handling & Storage areas								
Handling and storage areas								
Substructure construction, gravel base course	m^3	66,750	30	2,002,491				2,002,491
Hydraulically bound base course	m^2	267,000	25	6,675,000				6,675,000
Traffic and pre-storage areas								
Substructure construction, gravel base course	m^3	1,080	30	32,400				32,400
Create surface pavement, access road / driveways	m^2	3,600	60	216,000				216,000
Produce drainage channels and edgings	m	5,000	35	175,000				175,000
Fire access								
Provide a paved access for the fire brigade	m	300	400	120,000	300	250	75,000	195,000
Costs roads, handling & storage areas				9,220,891			75,000	9,295,891
Structural engineering								
On-site facilities	Piece	1	160,000	160,000				160,000
Costs structural engineering				160,000			-	160,000
Equipment and accompanying measures								
IT connections	lump sum	1	25,000	25,000				25,000
Lighting Columns	Piece	500	2,200	1,100,000	82	2,200	180,400	1,280,400
Weigh bridge	Piece	1	50,000	50,000				50,000
Fences and gates	m	2,500	100	250,000				250,000

Gate System	Piece	2	7,500	15,000				15,000
OCR IN-Gate and OCR-Out Gate Portal	Piece	1	300,000	300,000				300,000
CCTV	Piece	1	150,000	150,000				150,000
Terminal Operation System	lump sum	1	180,000	180,000				180,000
Costs equipment and accompanying measures				2,070,000			180,400	2,250,400
Total construction and operating costs				46,734,915			14,059,686	60,794,601
Planning costs (10% of construction and equipment costs)				3,923,491	Included in terminal costs			3,923,491
Total costs (Terminal + Station) area				50,658,406			14,059,686	64,718,092

CAPEX – Option 2

Note: Unit prices are based on internal databases using price benchmarking across Europe.

		Terminal			Station			Total
Position	**Dimension**	**Volume**	**Unit price (EUR)**	**Total**	**Volume**	**Unit price (EUR)**	**Total**	**Total costs (EUR)**
Land acquisition								
Land acquisition / lease								
Land acquisition / lease over 10 years	[m^2]	250,000	3	7,500,000	48,500	3	1,455,000	8,955,000
Site clearance								
Removing existing installations	[m^2]	-	7	-	-	7	-	-
Removing existing pipes and cables	m	-	12	-	-	12	-	-
Removing existing rails	m	-	20	-	-	20	-	-
Removing sleepers	Piece	-	15	-	-	15	-	-
Removing switches	Piece	-	1,500	-	-	1,500	-	-
Removing existing foundations, lighting, buffers etc	lump sum	-	25,000	-	-	25,000	-	-
Bushes and trees clearing	lump sum	1	10,000	10,000	1	10,000	10,000	20,000
General / Construction site equipment								
Construction site Setup	lump sum	1	453,590	453,590	1	175,116	175,116	628,706
Construction site Clearance	lump sum	1	114,000	114,000	1	44,000	44,000	158,000
Traffic safety, barrier, lightning during the construction period	lump sum	1	20,000	20,000	1	20,000	20,000	40,000
Costs land acquisition				8,097,590			1,704,116	9,801,706

Earthwork								
Soil removal and moving/storage	m^3	200,000	15	3,000,000	38,800	15	582,000	3,582,000
Fill to base and frost protection layer	m^3	300,000	18	5,400,000	36,400	18	655,200	6,055,200
Disembarking Ramp	lump sum	1	300,000	300,000				300,000
Bridge Upgrade	lump sum							
1520m Overpass	lump sum							
Earthworks for Terminal access track	m^3				3,580	18	64,440	64,440
Costs earthwork				8,700,000			1,301,640	10,001,640
Railway Tracks								
New Tracks								
Tracks 1520 non-electrified	m	-	700	-	-	700	-	-
Tracks 1435 non-electrified	m	4,100	700	2,870,000	-	700	-	2,870,000
Tracks 1435 electrified (Main Line)	m				750	2,000	1,500,000	1,500,000
Tracks 1435 electrified (Terminal Access)	m				3,580	1,000	3,580,000	3,580,000
Delivery and installation of fixed buffer stop	Piece	2	10,000	20,000				20,000
Installation of walkway	m	2,250	15	33,750	2,250	15	33,750	67,500
Switches								
Switches installation 1520	Piece	-	104,000	-	-	104,000	-	-
Switches installation 1435	Piece	3	104,000	312,000	8	104,000	832,000	1,144,000
Switches installation 1435 (High-speed)	Piece				1	173,000	173,000	173,000
Switches installation 1435 (High-speed curved)	Piece				1	250,000	250,000	250,000
Costs railway tracks				3,235,750			6,368,750	9,604,500

Roads, Handling & Storage areas								
Handling and storage areas								
Substructure construction, gravel base course	m^3	68,808	30	2,064,240				2,064,240
Hydraulically bound base course	m^2	275,300	25	6,882,500				6,882,500
Traffic and pre-storage areas								
Substructure construction, gravel base course	m^3	900	30	27,000				27,000
Create surface pavement, access road / driveways	m^2	3,000	60	180,000				180,000
Produce drainage channels and edgings	m	5,000	35	175,000				175,000
Fire access								
Provide a paved access for the fire brigade	m	300	400	120,000	3,580	250	895,000	1,015,000
Costs roads, handling & storage areas				9,448,740			895,000	10,343,740
Structural engineering								
On-site facilities	Piece	1	160,000	160,000				160,000
Costs structural engineering				160,000			-	160,000
Equipment and accompanying measures								
IT connections	lump sum	1	25,000	25,000				25,000
Lighting Columns	Piece	500	2,200	1,100,000	82	2,200	180,400	1,280,400
Weigh bridge	Piece	1	50,000	50,000				50,000
Fences and gates	m	2,500	100	250,000				250,000
Gate System	Piece	2	7,500	15,000				15,000

OCR IN-Gate and OCR-Out Gate Portal	Piece	1	300,000	300,000				300,000
CCTV	Piece	1	150,000	150,000				150,000
Terminal Operation System	lump sum	1	180,000	180,000				180,000
Costs equipment and accompanying measures				2,070,000			180,400	2,250,400
Total construction and operating costs				31,712,080			10,449,906	42,161,986
Planning costs (10% of construction and equipment costs)				2,421,208	Included in terminal costs			2,421,208
Total costs (Terminal + Station) area				34,133,288			10,449,906	44,583,194

CAPEX – Option 5

Note: Unit prices are based on internal databases using price benchmarking across Europe.

		Terminal			Station			Total
Position	**Dimension**	**Volume**	**Unit price (EUR)**	**Total**	**Volume**	**Unit price (EUR)**	**Total**	**Total costs (EUR)**
Land acquisition								
Land acquisition / lease								
Land acquisition / lease over 10 years	[m²]	250,000	3	7,500,000	112,259	3	3,367,770	10,867,770
Site clearance								
Removing existing installations	[m²]	62,500	7	437,500	11,226	7	78,581	516,081
Removing existing pipes and cables	m	700	12	8,400	1,855	12	22,260	30,660
Removing existing rails	m	2,800	20	56,000	7,420	20	148,400	204,400
Removing sleepers	Piece	4,670	15	70,050	12,370	15	185,550	255,600
Removing switches	Piece	5	1,500	7,500	11	1,500	16,500	24,000
Removing existing foundations, lighting, buffers etc	lump sum	1	25,000	25,000	1	25,000	25,000	50,000
Bushes and trees clearing	lump sum	-	10,000	-	1	10,000	10,000	10,000
General / Construction site equipment								
Construction site Setup	lump sum	1	324,821	324,821	1	198,908	198,908	523,729
Construction site Clearance	lump sum	1	82,000	82,000	1	50,000	50,000	132,000
Traffic safety, barrier, lightning during the construction period	lump sum	1	20,000	20,000	1	20,000	20,000	40,000
Costs land acquisition				8,531,271			4,122,969	12,654,240

Earthwork								
Soil removal and moving/storage	m^3	50,000	15	750,000	89,807	15	1,347,108	2,097,108
Fill to base and frost protection layer	m^3	46,900	18	844,200	84,200	18	1,515,600	2,359,800
Disembarking Ramp	lump sum	1	300,000	300,000				300,000
Bridge Upgrade	lump sum							
1520m Overpass	lump sum							
Earthworks for Terminal access track	m^3				652	18	11,736	11,736
Costs earthwork				1,894,200			2,874,444	4,768,644
Railway Tracks								
New Tracks								
Tracks 1520 non-electrified	m	-	700	-	-	700	-	-
Tracks 1435 non-electrified	m	2700	700	1,890,000	-	700	-	1,890,000
Tracks 1435 electrified (Main Line)	m				2,331	2,000	4,662,000	4,662,000
Tracks 1435 electrified (Terminal Access)	m				652	1,000	652,000	652,000
Delivery and installation of fixed buffer stop	Piece	1	10,000	10,000				10,000
Installation of walkway	m	2250	15	33,750	750	15	11,250	45,000
Switches								
Switches installation 1520	Piece	-	104,000	-	-	104,000	-	-
Switches installation 1435	Piece	10	104,000	1,040,000	3	104,000	312,000	1,352,000
Switches installation 1435 (High-speed)	Piece				4	173,000	692,000	692,000
Switches installation 1435 (High-speed curved)	Piece							
Costs railway tracks				**2,973,750**			**6,329,250**	**9,303,000**

Roads, Handling & Storage areas								
Handling and storage areas								
Substructure construction, gravel base course	m^3	68,759	30	2,062,755				2,062,755
Hydraulically bound base course	m^2	275,100	25	6,877,500				6,877,500
Traffic and pre-storage areas								
Substructure construction, gravel base course	m^3	1,080	30	32,400				32,400
Create surface pavement, access road / driveways	m^2	3,600	60	216,000				216,000
Produce drainage channels and edgings	m	5,000	35	175,000				175,000
Fire access								
Provide a paved access for the fire brigade	m	300	400	120,000	300	250	75,000	195,000
Costs roads, handling & storage areas				9,483,655			75,000	9,558,655
Structural engineering								
On-site facilities	Piece	1	160,000	160,000				160,000
Costs structural engineering				160,000			-	160,000
Equipment and accompanying measures								
IT connections	lump sum	1	25,000	25,000				25,000
Lighting Columns	Piece	500	2,200	1,100,000	82	2,200	180,400	1,280,400
Weigh bridge	Piece	1	50,000	50,000				50,000
Fences and gates	m	2,500	100	250,000				250,000
Gate System	Piece	2	7,500	15,000				15,000

OCR IN-Gate and OCR-Out Gate Portal	Piece	1	300,000	300,000				300,000
CCTV	Piece	1	150,000	150,000				150,000
Terminal Operation System	lump sum	1	180,000	180,000				180,000
Costs equipment and accompanying measures				2,070,000			180,400	2,250,400
Total construction and operating costs				25,112,876			13,582,063	38,694,939
Planning costs (10% of construction and equipment costs)				1,761,288	Included in terminal costs			1,761,288
Total costs (Terminal + Station) area				26,874,164			13,582,063	40,456,227

Maintenance Costs

Element to be Maintained	Rate		Element to be Maintained	Rate
Earthwork			**Fire access**	
Bridge Upgrade	1%		Provide a paved access for the fire brigade	1%
1520m Overpass	1%		**Structural engineering**	
Railway Tracks			Manufacture car counters	1%
Tracks 1520 non-electrified	1%		Office container integrated in car counter if necessary	2%
Tracks 1435 non-electrified	1%			
Tracks 1435 electrified (Terminal Access)	1%		**Equipment and accompanying measures**	
Switches			IT connections	3%
Switches installation 1520	1%		Lighting Columns	1%
Switches installation 1435	1%		Weigh bridge	3%
Handling and storage areas			Fences and gates	2%
Substructure construction, gravel base course	1%		Gate System	Included in Fences and Gates
Hydraulically bound base course	1%		OCR IN-Gate and OCR-Out Gate Portal	1%
Substructure construction, gravel base course	1%		Terminal Operation System	Included in Purchase Cost
Create surface pavement, access road / driveways	1%			

Annex 2 – Economic Analysis

Assumptions

Transport Costs[69]		
Unit cost per ton-km by *Road*	EUR/ton-km	0.07064
Unit cost per ton-km by *Rail*	EUR/ton-km	0.02351
Unit cost per ton-km by *Intermodal*	EUR/ton-km	0.06557
Intermodal/road costs ratio	%	90%
Average tons/HGV	ton	24
Average tons/train	ton	1814

Noise Costs[70]		
HGV, rural, dense, day	EUR/1000 vkm	0.7
HGV, rural, dense, day share	%	10%
HGV, rural, dense, day	EUR/1000 vkm	1.5
HGV, rural, thin day share	%	70%
HGV, rural, dense, night	EUR/1000 vkm	1.3
HGV, rural, dense, night share	%	5%
HGV, rural, thin, night	EUR/1000 vkm	2.6
HGV, rural, thin night share	%	15%
HGV average	EUR/1000 vkm	1.575
Train, rural, dense, day	EUR/1000 vkm	29.9
Train rural, dense, day share	%	10%
Train rural, thin, day	EUR/1000 vkm	57.8
Train rural, thin day share	%	40%
Train rural, night	EUR/1000 vkm	97.7
Train rural, night share	%	50%
Train average	EUR/1000 vkm	74.96

Accident Costs[70]		
	Road	Rail
in EUR/vkm	12.6794292	0.21132
in EUR/tkm	0.52830955	0.00012

[69] Author Experience
[70]https://ec.europa.eu/transport/sites/transport/files/handbook_on_external_costs_of_transport_2014_0.pdf

Shadow Prices	
SW =(1-t)*(1-u)	
Social Security	33.00%
Pension	2.00%
Unemployment (u)	2.40%
SW =(1-t)*(1-u)	0.6344

Air Pollution Costs[70]		
	Road	**Rail-Electric**
in €ct/trainkm		42.16273478
in €ct/vkm	9.86050726	
in EUR/tkm	0.410854469	0.080920

Nature/ Landscape costs[71]		
	Road	Rail
in EUR/tkm	0.0007	-

Biodiversity costs[71]		
	Road	Rail
in EUR/tkm	0.0005	-

Soil & Water pollution costs[71]		
	Road	Rail
in EUR/tkm	0.001	0.0004

Type of Insurance[72]			
	Paid by employer	Paid by employee	Total
Social Security contributions	33.00%	0.00%	33.00%
Funded Pension contributions	0.00%	2.00%	2.00%
Unemployment	0.80%	1.60%	2.40%
Total	33.80%	3.60%	37.40%

[71] CE Delft, Handbook for External Costs of Transport in Europe - Update Study for 2008
[72] https://home.kpmg.com/xx/en/home/insights/2014/04/Estonia-other-taxes-levies.html

Vkm Costs for different engine types and Load classifications[71]						
Vehicle	Category	EURO-Class	Urban €ct/vkm	Suburban €ct/vkm	Interurban €ct/vkm	Motorway €ct/vkm
Rigid HGV	<=7,5 t	EURO 0	15.421	7.739	5.631	5.865
		EURO I	8.472	4.766	3.750	4.095
		EURO II	6.927	4.566	3.815	4.078
		EURO III	6.148	3.750	2.922	3.069
		EURO IV	3.829	2.473	2.129	2.127
		EURO V	3.650	2.296	1.194	0.835
		EURO VI	1.660	0.586	0.266	0.235
	7,5 - 12 t	EURO 0	20.473	12.394	9.417	9.263
		EURO I	12.969	7.601	5.709	5.595
		EURO II	10.463	7.240	5.774	5.674
		EURO III	9.103	5.900	4.541	4.312
		EURO IV	5.417	3.870	3.172	3.037
		EURO V	5.166	3.585	1.827	1.175
		EURO VI	1.829	0.736	0.339	0.261
	12 - 14 t	EURO 0	22.468	13.812	10.318	9.829
		EURO I	14.351	8.509	6.239	5.915
		EURO II	11.594	8.142	6.340	5.995
		EURO III	10.139	6.796	5.060	4.578
		EURO IV	5.987	4.401	3.478	3.183
		EURO V	5.483	3.885	2.008	1.302
		EURO VI	1.824	0.726	0.339	0.288
	14 - 20 t	EURO 0	29.029	17.816	12.837	11.579
		EURO I	18.315	10.863	7.668	6.964
		EURO II	14.464	10.380	7.867	7.150
		EURO III	12.997	8.780	6.377	5.534
		EURO IV	7.295	5.541	4.336	3.848
		EURO V	7.382	5.613	3.036	1.697
		EURO VI	2.095	0.980	0.441	0.307
	20 - 26 t	EURO 0	31.778	19.965	14.170	12.182
		EURO I	23.826	14.345	9.961	8.624
		EURO II	18.922	13.607	10.111	8.820
		EURO III	16.303	11.215	8.138	7.079
		EURO IV	9.080	7.113	5.560	4.875
		EURO V	8.314	6.313	3.330	1.967
		EURO VI	2.113	0.976	0.472	0.349
	26 - 28 t	EURO 0	33.421	21.022	14.984	12.842
		EURO I	24.953	15.096	10.494	8.991
		EURO II	19.876	14.247	10.552	9.122
		EURO III	16.918	11.617	8.400	7.184
		EURO IV	9.354	7.326	5.707	5.006
		EURO V	8.445	6.348	3.326	2.050
		EURO VI	2.126	0.983	0.483	0.362
	28 - 32 t	EURO 0	38.163	24.168	17.389	14.865
		EURO I	28.471	17.414	12.267	10.504

Vkm Costs for different engine types and Load classifications[71]						
Vehicle	Category	EURO-Class	Urban €ct/vkm	Suburban €ct/vkm	Interurban €ct/vkm	Motorway €ct/vkm
		EURO II	22.752	16.362	12.218	10.554
		EURO III	19.072	13.348	9.695	8.253
		EURO IV	10.691	8.538	6.707	5.623
		EURO V	8.491	6.198	3.267	2.304
		EURO VI	2.104	0.947	0.507	0.412
	>32 t	EURO 0	39.248	25.114	17.709	14.809
		EURO I	29.793	18.127	12.484	10.460
		EURO II	23.674	16.996	12.478	10.586
		EURO III	19.870	13.905	10.057	8.422
		EURO IV	10.877	8.725	6.791	5.758
		EURO V	8.525	6.288	3.429	2.278
		EURO VI	2.091	0.935	0.495	0.437

Results

Option 1			
Benefits from	**Unit Price (if, applicable)**	**Total Value**	**% of total benefits**
VoC Savings	0.0653 EUR/ton-km	60,394,058.56 €	55.63%
Reduction of Accident Costs	0.00010566 EUR/ton-km	7,288,270.51 €	6.71%
Reduction of Noise Costs	74.96 EUR/1000 ton-km	-870,339.28 €	-0.80%
Reduction of Air Pollution Costs	0,045046 EUR/ton-km	6,308,261.46 €	5.81%
Reduction of Climate Change Costs	0,002046 EUR/ton-km	156,782.04 €	0.14%
Residual value	EUR	35,288,892.82 €	32.50%
Total benefits	EUR	108,565,926.11 €	100.00%

Option 2			
Benefits from	**Unit Price (if, applicable)**	**Total Value**	**% of total benefits**
VoC Savings	0.0653 EUR/ton-km	60,394,058.56 €	55.07%
Reduction of Accident Costs	0.00010566 EUR/ton-km	7,288,270.51 €	6.65%
Reduction of Noise Costs	74.96 EUR/1000 ton-km	-870,339.28 €	-0.79%
Reduction of Air Pollution Costs	0,045046 EUR/ton-km	6,308,261.46 €	5.75%
Reduction of Climate Change Costs	0,002046 EUR/ton-km	156,782.04 €	0.14%
Residual value	EUR	36,391,783.00 €	33.18%
Total benefits	EUR	109,668,816.29 €	100.00%

Option 5			
Benefits from	**Unit Price (if, applicable)**	**Total Value**	**% of total benefits**
VoC Savings	0.0653 EUR/ton-km	60,394,058.56 €	55.02%
Reduction of Accident Costs	0.00010566 EUR/ton-km	7,288,270.51 €	6.64%
Reduction of Noise Costs	74.96 EUR/1000 ton-km	-870,339.28 €	-0.79%
Reduction of Air Pollution Costs	0,045046 EUR/ton-km	6,308,261.46 €	5.75%
Reduction of Climate Change Costs	0,002046 EUR/ton-km	156,782.04 €	0.14%
Residual value	EUR	36,489,942.66 €	33.24%
Total benefits	EUR	109,766,975.94 €	100.00%

Pärnu - Railway Terminal (Option 1)							
Benefits	**Value in EUR (discounted)**	**2022**	**2023**	**2025**	**2035**	**2045**	**2055**
VoC Savings	60,394,058.56			1,424,132.42	2,443,706.55	3,936,448.86	6,337,521.77
Reduction of *Accident Costs*	7,288,270.51			278,115.74	364,984.43	401,926.64	442,362.75
Reduction of *Noise Costs*	-870,339.28			-37,875.14	-45,700.62	-44,635.31	-43,570.68
Reduction of *Air Pollution Costs*	6,308,261.46			180,753.84	280,010.09	390,335.98	543,829.52
Residual value	156,782.04			4,492.36	6,959.22	9,701.19	13,516.04
Total inflow	35,288,892.82			0	0	0	88,225,067.36 €
Costs	108,565,926.11	-	-	1,849,619.23	3,049,959.66	4,693,777.37	95,518,726.75
Economic Investments							
Economic costs for replacement	61,067,201.66	9,641,951.57	51,860,275.83	753,296.64			
Economic O&M costs	0.00						
Nature/Landscape costs	16,172,581.11			612,336.45	705,432.12	929,389.92	1,360,582.13
Biodiversity costs	13,383.83			383.493797	594.079380	828.150719	1,153.808080
Soil & Water costs	9,559.88			273.924141	424.342415	591.536228	824.148629
Total outflow	11,471.86			328.708969	509.210897	709.843474	988.978354
Net cash Flow	75,898,899.50	9,641,951.57	51,860,275.83	1,366,619.22	706,959.75	931,519.45	1,363,549.06
ENPV	24,157,931.34						
ERR	4.45%						
B/C ratio	1.4304						

Pärnu - Railway Terminal (Option 2)							
Benefits	**Value in EUR (discounted)**	**2022**	**2023**	**2025**	**2035**	**2045**	**2055**
VoC Savings	60,394,058.56			1,424,132.42	2,443,706.55	3,936,448.86	6,337,521.77
Reduction of *Accident Costs*	7,288,270.51			278,115.74	364,984.43	401,926.64	442,362.75
Reduction of *Noise Costs*	-870,339.28			-37,875.14	-45,700.62	-44,635.31	-43,570.68
Reduction of *Air Pollution Costs*	6,308,261.46			180,753.84	280,010.09	390,335.98	543,829.52
Residual value	156,782.04			4,492.36	6,959.22	9,701.19	13,516.04
Total inflow	36,391,783.00			0	0	0	90,982,381.42
Costs	109,668,816.29	-	-	1,849,619.23	3,049,959.66	4,693,777.37	98,276,040.82
Economic Investments							
Economic costs for replacement	42,187,834.93	6,726,371.60	35,425,877.19	524,236.68			
Economic O&M costs	0.00						
Nature/Landscape costs	12,465,805.38			427,001.63	520,097.31	744,055.10	1,175,247.31
Biodiversity costs	13,383.83			383.493797	594.079380	828.150719	1,153.808080
Soil & Water costs	9,559.88			273.924141	424.342415	591.536228	824.148629
Total outflow	11,471.86			328.708969	509.210897	709.843474	988.978354
Net cash Flow	53,627,307.87	6,726,371.60	35,425,877.19	952,224.44	521,624.94	746,184.63	1,178,214.25
ENPV	48,137,250.49						
ERR	6.57%						
B/C ratio	2.0450						

Pärnu - Railway Terminal (Option 5)							
Benefits	**Value in EUR (discounted)**	**2022**	**2023**	**2025**	**2035**	**2045**	**2055**
VoC Savings	60,394,058.56			1,424,132.42	2,443,706.55	3,936,448.86	6,337,521.77
Reduction of *Accident Costs*	7,288,270.51			278,115.74	364,984.43	401,926.64	442,362.75
Reduction of *Noise Costs*	-870,339.28			-37,875.14	-45,700.62	-44,635.31	-43,570.68
Reduction of *Air Pollution Costs*	6,308,261.46			180,753.84	280,010.09	390,335.98	543,829.52
Residual value	156,782.04			4,492.36	6,959.22	9,701.19	13,516.04
Total inflow	36,489,942.66			0	0	0	91,227,788.45
Costs	109,766,975.94	-	-	1,849,619.23	3,049,959.66	4,693,777.37	98,521,447.84
Economic Investments							
Economic costs for replacement	37,927,698.61	5,388,041.15	32,446,975.42	461,795.43			
Economic O&M costs	0.00						
Nature/Landscape costs	12,135,894.17			410,506.43	503,602.10	727,559.89	1,158,752.11
Biodiversity costs	13,383.83			383	594.079380	828.150719	1,153.808080
Soil & Water costs	9,559.88			273.924141	424.342415	591.536228	824.148629
Total outflow	11,471.86			328.708969	509.210897	709.843474	988.978354
Net cash Flow	49,065,256.06	5,388,041.15	32,446,975.42	873,287.98	505,129.73	729,689.42	1,161,719.04
ENPV	52,928,688.74						
ERR	7.18%						
B/C ratio	2.2372						

Annex 3 – Switching Values

Option 1 Financial Switching values		
Variables	Switching values of the variables	Value (in %)
Investments	Minimum increasing before NPV<0	already < 0
	Minimum increasing before IRR<4%	already < 4%
	Minimum decreasing before NPV>0	72%
	Minimum decreasing before IRR>4%	73%
Income	Minimum increasing before NPV>0	184%
	Minimum increasing before IRR>4%	187%
	Minimum decreasing before NPV<0	already < 0
	Minimum decreasing before IRR<4%	already < 4%
O&M costs	Minimum increasing before NPV<0	already < 0
	Minimum increasing before IRR<4%	already < 4%
	Minimum decreasing before NPV>0	331%
	Minimum decreasing before IRR>4%	338%
Traffic	Minimum increasing before NPV>0	184%
	Minimum increasing before IRR>4%	187%
	Minimum decreasing before NPV<0	already < 0
	Minimum decreasing before IRR<4%	already < 4%

Option 1 Economic Switching values		
Variables	Switching values of the variables	Value (in %)
Investments	Minimum increasing before ENPV<0	38%
	Minimum increasing before ERR<3%	39%
	Minimum decreasing before ENPV>0	already > 0
	Minimum decreasing before ERR>3%	already > 3%
Economic O&M costs	Minimum increasing before ENPV<0	158%
	Minimum increasing before ERR<3%	170%
	Minimum decreasing before ENPV>0	already > 0
	Minimum decreasing before ERR>3%	already > 3%
Benefits from VoC savings	Minimum decreasing before ENPV<0	42%
	Minimum decreasing before ERR<3%	46%
	Minimum increasing before ENPV>0	already > 0
	Minimum increasing before ERR>3%	already > 3%
Benefits from Costs of Accidents reducing	Minimum decreasing before ENPV<0	352%
	Minimum decreasing before ERR<3%	377%
	Minimum increasing before ENPV>0	already > 0
	Minimum increasing before ERR>3%	already > 3%
Benefits from Costs of Noise reducing	Minimum increasing before ENPV<0	2945%
	Minimum increasing before ERR<3%	3147%
	Minimum decreasing before ENPV>0	already > 0
	Minimum decreasing before ERR>3%	already > 3%
Benefits from Costs of Air pollution reducing	Minimum decreasing before ENPV<0	406%
	Minimum decreasing before ERR<3%	411%
	Minimum increasing before ENPV>0	already > 0
	Minimum increasing before ERR>3%	already > 3%
Benefits from Costs of Climate change reducing	Minimum decreasing before ENPV<0	16347%
	Minimum decreasing before ERR<3%	17535%
	Minimum increasing before ENPV>0	already > 0
	Minimum increasing before ERR>3%	already > 3%

Option 2 Financial Switching values		
Variables	Switching values of the variables	Value (in %)
Investments	Minimum increasing before NPV<0	already < 0
	Minimum increasing before IRR<4%	already < 4%
	Minimum decreasing before NPV>0	50%
	Minimum decreasing before IRR>4%	50%
Income	Minimum increasing before NPV>0	89%
	Minimum increasing before IRR>4%	88%
	Minimum decreasing before NPV<0	already < 0
	Minimum decreasing before IRR<4%	already < 4%
O&M costs	Minimum increasing before NPV<0	already < 0
	Minimum increasing before IRR<4%	already < 4%
	Minimum decreasing before NPV>0	209%
	Minimum decreasing before IRR>4%	208%
Traffic	Minimum increasing before NPV>0	89%
	Minimum increasing before IRR>4%	88%
	Minimum decreasing before NPV<0	already < 0
	Minimum decreasing before IRR<4%	already < 4%

Option 2 Economic Switching values		
Variables	Switching values of the variables	Value (in %)
Investments	Minimum increasing before ENPV<0	111%
	Minimum increasing before ERR<3%	108%
	Minimum decreasing before ENPV>0	already > 0
	Minimum decreasing before ERR>3%	already > 3%
Economic O&M costs	Minimum increasing before ENPV<0	410%
	Minimum increasing before ERR<3%	409%
	Minimum decreasing before ENPV>0	already > 0
	Minimum decreasing before ERR>3%	already > 3%
Benefits from VoC savings	Minimum decreasing before ENPV<0	85%
	Minimum decreasing before ERR<3%	84%
	Minimum increasing before ENPV>0	already > 0
	Minimum increasing before ERR>3%	already > 3%
Benefits from Costs of Accidents reducing	Minimum decreasing before ENPV<0	701%
	Minimum decreasing before ERR<3%	700%
	Minimum increasing before ENPV>0	already > 0
	Minimum increasing before ERR>3%	already > 3%
Benefits from Costs of Noise reducing	Minimum increasing before ENPV<0	5868%
	Minimum increasing before ERR<3%	5809%
	Minimum decreasing before ENPV>0	already > 0
	Minimum decreasing before ERR>3%	already > 3%
Benefits from Costs of Air pollution reducing	Minimum decreasing before ENPV<0	810%
	Minimum decreasing before ERR<3%	820%
	Minimum increasing before ENPV>0	already > 0
	Minimum increasing before ERR>3%	already > 3%
Benefits from Costs of Climate change reducing	Minimum decreasing before ENPV<0	32573%
	Minimum decreasing before ERR<3%	32796%
	Minimum increasing before ENPV>0	already > 0
	Minimum increasing before ERR>3%	already > 3%

Option 5 Financial Switching values		
Variables	Switching values of the variables	Value (in %)
Investments	Minimum increasing before NPV<0	already < 0
	Minimum increasing before IRR<4%	already < 4%
	Minimum decreasing before NPV>0	44%
	Minimum decreasing before IRR>4%	46%
Income	Minimum increasing before NPV>0	70%
	Minimum increasing before IRR>4%	72%
	Minimum decreasing before NPV<0	already < 0
	Minimum decreasing before IRR<4%	already < 4%
O&M costs	Minimum increasing before NPV<0	already < 0
	Minimum increasing before IRR<4%	already < 4%
	Minimum decreasing before NPV>0	171%
	Minimum decreasing before IRR>4%	173%
Traffic	Minimum increasing before NPV>0	76%
	Minimum increasing before IRR>4%	72%
	Minimum decreasing before NPV<0	already < 0
	Minimum decreasing before IRR<4%	already < 4%

Option 5 Economic Switching values		
Variables	Switching values of the variables	Value (in %)
Investments	Minimum increasing before ENPV<0	135%
	Minimum increasing before ERR<3%	135%
	Minimum decreasing before ENPV>0	already > 0
	Minimum decreasing before ERR>3%	already > 3%
Economic O&M costs	Minimum increasing before ENPV<0	463%
	Minimum increasing before ERR<3%	454%
	Minimum decreasing before ENPV>0	already > 0
	Minimum decreasing before ERR>3%	already > 3%
Benefits from VoC savings	Minimum decreasing before ENPV<0	93%
	Minimum decreasing before ERR<3%	91%
	Minimum increasing before ENPV>0	already > 0
	Minimum increasing before ERR>3%	already > 3%
Benefits from Costs of Accidents reducing	Minimum decreasing before ENPV<0	770%
	Minimum decreasing before ERR<3%	748%
	Minimum increasing before ENPV>0	already > 0
	Minimum increasing before ERR>3%	already > 3%
Benefits from Costs of Noise reducing	Minimum increasing before ENPV<0	6452%
	Minimum increasing before ERR<3%	6191%
	Minimum decreasing before ENPV>0	already > 0
	Minimum decreasing before ERR>3%	already > 3%
Benefits from Costs of Air pollution reducing	Minimum decreasing before ENPV<0	890%
	Minimum decreasing before ERR<3%	871%
	Minimum increasing before ENPV>0	already > 0
	Minimum increasing before ERR>3%	already > 3%
Benefits from Costs of Climate change reducing	Minimum decreasing before ENPV<0	35815%
	Minimum decreasing before ERR<3%	35308%
	Minimum increasing before ENPV>0	already > 0
	Minimum increasing before ERR>3%	already > 3%

Annex 4 – Statistical data Source and Content

No	Source	Database code	Database	Main indicators	Available timeframe[73]	Comments
1.	Statistics Estonia	TC121	Transport of goods and freight turnover of transport enterprises by type of transport	6 types of transport; transport of goods, freight turnover; incl. international traffic	2001-2018	Road transport data for 2017 are estimated based on the data of the statistical activity ''Transport of goods by road''. Road freight vehicles registered in the Traffic Register of the Road Administration which are not older than 25 years and have a loading capacity of over 3,500 kg are observed. The revised data is published upon adding data for the following period. The quantity of total freight in tonnes may be double as in case of domestic freight the same quantity of freight may be carried to the destination by several railway enterprises if one of them carries the freight on the public railway and the other on non-public railway. That is the reason why it is recommended, in order to characterise the quantity of the freight carried, to use the indicator freight turnover which indicates the volume of work (in tonne-kilometres) made while carrying the freight.
2.	Statistics Estonia	TC1813	Sea containers moving in ports (1997-2014)	Road transport; Railway transport, exported full and	1997-2014	The data for 2014 not available.

[73] Data availability as of 1 August 2018.

				empty containers, Imported full and empty containers		
3.	Statistics Estonia	TC1812	Transport of sea containers through ports	Total containers, exported and imported containers, exported and imported transit	1997-2017	The data from 2014 on exported containers and imported containers with transit containers.
4.	Statistics Estonia	TC180	Transport of goods through ports by group of goods	20 different types of goods; outgoing and incoming goods, outgoing and incoming transit	1993-2018	The tonnage of goods carried includes packaging but excluding the tare weight of containers or ro-ro units.
5.	Statistics Estonia	TC185	Loading and unloading of goods in Estonian ports	Loading, unloading, months	1991-2018	Since 2004 the tare weight of containers and ro-ro units are excluded.
6.	Statistics Estonia	TC175	Goods transport through main Estonian ports by cargo type	6 ports; 6 cargo types; unloaded and loaded goods	2010-2018	The tonnage of goods carried includes packaging but excludes the tare weight of containers or ro-ro units.
7.	Statistics Estonia	TC534	Goods carried by road by type of cargo	9 different types of cargo (e.g. liquid bulk); freight in thousand	2009-2017	-

				tonnes, national and international transport		
8.	Statistics Estonia	TC528	Goods carried by road by group of goods	20 different groups of goods; freight in thousand tonnes; freight turnover in thousand tonne-km; incl. international traffic	2008-2017	Data presented according to Standard goods classification for transport statistics, 2007 (NST 2007).
9.	Statistics Estonia	TC1414	Transport of containers by rail transport	Transported goods in thousand tonnes; empty and full containers; freight turnover of full containers; export, import, (export/import) transit; containers transported in Estonia	2003-2017	Changes in the 2009 container transport volumes concerning goods imported from and exported to foreign countries and those concerning transit goods can be explained by the closure of Tallinn cargo terminal and by the operation of Vaivara terminal as transit terminal. The data on freight turnover of full containers for 2003-2009 are too uncertain for publication.
10.	Statistics Estonia	TC183	Freight traffic on railways by group of goods	(Domestic) freight, transit, outgoing and incoming goods; 20	2009-2018	Data presented according to Standard goods classification for transport statistics, 2007 (NST 2007). The quantity of total freight in tonnes may be double as in case of domestic freight the same quantity of freight may be carried to the

				different groups of goods		destination by several railway enterprises if one of them carries the freight on the public railway and the other on non-public railway. That is the reason why it is recommended, in order to characterise the quantity of the freight carried, to use the indicator freight turnover which indicates the volume of work (in tonne-kilometres) made while carrying the freight.
11.	Statistics Estonia	TC1422	Freight traffic on railways	Freight in thousand tonnes and in thousand tonne-km	1991-2018	The quantity of total freight in tonnes may be double as in case of domestic freight the same quantity of freight may be carried to the destination by several railway enterprises if one of them carries the freight on the public railway and the other on non-public railway. That is the reason why it is recommended, in order to characterise the quantity of the freight carried, to use the indicator freight turnover which indicates the volume of work (in tonne-kilometres) made while carrying the freight.
12.	Statistics Estonia	FT04	Exports and imports by administrative unit	22 administrative units, value in euros, number of enterprises; exports; imports	2004-2017	-
13.	Statistics Estonia	FT061	Exports, imports and balance of services by administrative unit	Export, import, balance; 22 administrative units	2013-2018	The services data are based on data collected and processed by Eesti Pank (central bank of Estonia).

Annex 5 – Interviewed Stakeholders

List of interviewed stakeholders and companies.

No	Position	Company
1.	Marketing Manager	Wendre
2.	Logistics Manager	Wendre
3.	Business Development Manager	Note Pärnu
4.	Supply Chain Manager	Note Pärnu
5.	Member of Management Board	Port of Pärnu
6.	CEO	Ecobirch AS
7.	CEO	SCA Eesti Metsad AS
8.	Member of Management Board	Hardest Woodline OÜ
9.	Marketing Manager	LDz Cargo
10.	Logistics Manager	Metsä Wood
11.	CEO	Harmet
12.	Managing Director / Board Member	Valmos OÜ
13.	Member of Management Board	Tootsi Turvas AS
14.	Head of Development Department	Port of Tallinn/ Saaremaa Harbour
15.	Head of Department	ERAA
16.	Support Command	Estonian Defence Forces
17.	Head of the Planning Department	Pärnu city government
18.	Deputy Mayor	Pärnu city government

No	Position	Company
19.	Head of the Development Centre of Pärnu county	Development Centre of Pärnu County
20.	Logistics, environment and quality manager in the Baltics	Ruukki AS
21.	Logistics and sales manager	Graniidikeskus OÜ
22.	Manager of the timber marketing department	State Forest Management Centre (RMK)
23.	Postal and Customs Services Department	Omniva
24.	Member of Board	Est-For Invest
25.	Sales manager (East and Central Europe)	Skano
26.	Member of Board	Etem Pärnu OÜ
27.	Strömberg OÜ	Strömberg OÜ
28.	Quality and logistics specialist	Welmet OÜ
29.	Manager	JU Metall OÜ
30.	Sales manager	Valmieras Stikla Šķiedra AS (LV)

In addition, information collected in the Muuga multimodal freight terminal (MCTRB) analysis in 2016-2017 was used if the interviewed companies had presented a clear interest or disinterest in the Rail Baltica railway as a new means for transport for their freight flows, or clear interest in Pärnu as a location to store their goods before transporting it further. The companies and stakeholders whose statements provided within MCTRB are used within this study are the following:

- Wood industry: Graanul Invest, Palmako, Pata (LV)
- Metal industry: AQ Lasertool
- Agriculture and food industry: Viciunai (LT)
- Grain, fertilizers and chemicals: Baltic Agro
- Associations: Woodhouse Association (EE), Logistics and Expeditors Association (EE)

Annex 6 – Types of loading equipment required

As mentioned previously the commodities that will be moved through the terminal define what wagons will be utilised as well as what loading equipment is required. While calculating the currently imported and exported goods from the catchment area the following commodity groupings were identified as providing useable quantities of freight. These were selected as the quantities led to a suitable number of wagons/containers or, where the flows were lower, the commodity was suited to being transported by rail, although this may be spot traffic.

The groupings, associated wagon type, and loading equipment are as follows:

Table 38: Commodity groups, wagon types and expected equipment requirements

Commodity grouping	Freight type	Wagon type	Loading equipment
Cereals, Fruit and vegetables, Live animals, Textiles, Other raw materials	Pallets	Container wagon, Pocket wagon, Box wagon	Reach stacker, Fork lift
Chemicals, manufacture, storage	Liquid bulk, powder,	Container wagons, Tank wagon, Silo wagon	Compressor, Pump, Reach stacker (tank/silo containers)
Solid Mineral Fuels	Pallets, dry bulk	Container wagon, Pocket wagon, Box wagon, Hopper wagons	Reach stacker, Fork lift, Front loader, Mobile conveyor belts, Excavators
Construction Materials	Pallets, dry Bulk	Container wagon, Pocket wagon, Box wagon, Hopper wagons, Flat wagons	Reach stacker, Fork lift, Front loader, Mobile conveyor belts, Excavators
Crude petroleum, petroleum products and gas	Liquid bulk, Pallets	Tank wagon, Container wagon, Pocket wagon	Compressor, Reach stacker, Fork lift, Pumps
Foodstuffs, Animal food and Foodstuff waste, Oil seeds and Oleaginous fruit and Fats	Pallets	Container wagon, Pocket wagon, Box wagon, Covered hopper wagons	Reach stacker, Fork lift, Conveyor belts
Iron ore, Iron and Steel, Non-ferrous Ore and Waste	Dry Bulk	Hopper wagon, Open wagon	Front loader, Excavators, Mobile conveyor belts
Metal products	Pallets, dry bulk	Container wagon, Pocket wagon, Box wagon, Flat wagons	Reach stacker, Fork lift
Miscellaneous articles	Pallets	Container wagon, Pocket wagon, Box wagon	Reach stacker, Fork lift, Crane
Natural and Chemical fertilisers	Pallets, dry bulk	Container wagon, Pocket wagon, Box wagon, Hopper wagon	Reach stacker, Fork lift, Mobile Conveyor belts
Vehicles/Heavy Machinery	-	Special Wagons	Ramp

			Specialist lifting equipment (for ad-hoc use)
Wood and Cork	Dry bulk, pallets	Container wagon, Pocket wagon, Wood transporter	Reach stacker, Fork lift, Grabber cranes

Other Potential equipment

Numerous new innovations have come on the market in the last years. Of particular interest here are those that allow the transport of trailers directly on trains. These include examples such as Modalohr, Cargo Beamer, Nikrasa, Mega Swing by Kockums. Each of these come with advantages and disadvantages and require either specialist terminals to be constructed (at both the origin and destination terminals) for example with Modalohr and Cargo Beamer, or require specialist equipment at the loading and unloading site such as with Nikrasa or specialist wagons such as in the case of Kockums.

While these can provide quicker loading and unloading times, they also require heavy investment in the terminal, rolling stock, or both. A short summary of these technologies is given in the following table.

Table 39: Other potential Equipment

Technology	Modalohr	Cargo Beamer	Nikrasa	Mega Swing
Capacity per wagon	2	1	2	2
Maximum trailer weight (t)	38	44	40	48.5
Number of wagons per 700m train	19	35	20	20
Number of trailers per 700m train	38	35	40	40
Additional terminal investments	Lifting and swivelling system in the track bed	Gate module with lane, loading lane, parking lane and horizontal handling equipment	Reach Stacker or Gantry Crane	No additional transhipment equipment necessary
Time for loading and unloading	40 minutes to load and unload a Modalohr train	15 min per wagon depending on the availability of equipment	approx. 10 min loading and unloading of a wagon (depending on the availability of handling equipment)	15 min per wagon (loading and unloading)

Investment costs (wagon)	EUR 375,000	EUR 150,000 – 180,000	EUR 140,000	EUR 220,000

Figure 28: Example of a Modalohr terminal[74]

Figure 29: Example of a Cargo Beamer Terminal[75]

[74] Source: lohr.fr
[75] Source: www.zukunft-mobilitaet.net

Figure 30: Example of the Nikrasa System[76]

Figure 31: Example of the Mega Swing system[77]

These technologies in Table 39 are given as examples of the direction in which new developments are going and it is not expected that these would be rolled out as part of a terminal in Pärnu due to the costs involved (infrastructure or wagons) or the limited networks that exist for these technologies.

Technology that shows more potential for a terminal in Pärnu and in particular for the commodities that will be moved through this terminal (wood, pulp, chippings) include examples

[76] Source: www.txlogistik-nikrasa.eu
[77] Source: www.zukunft-mobilitaet.net

such as the Innofreight containers. These are specially designed containers that allow for the containerisation of commodities while also allowing quick loading and unloading.

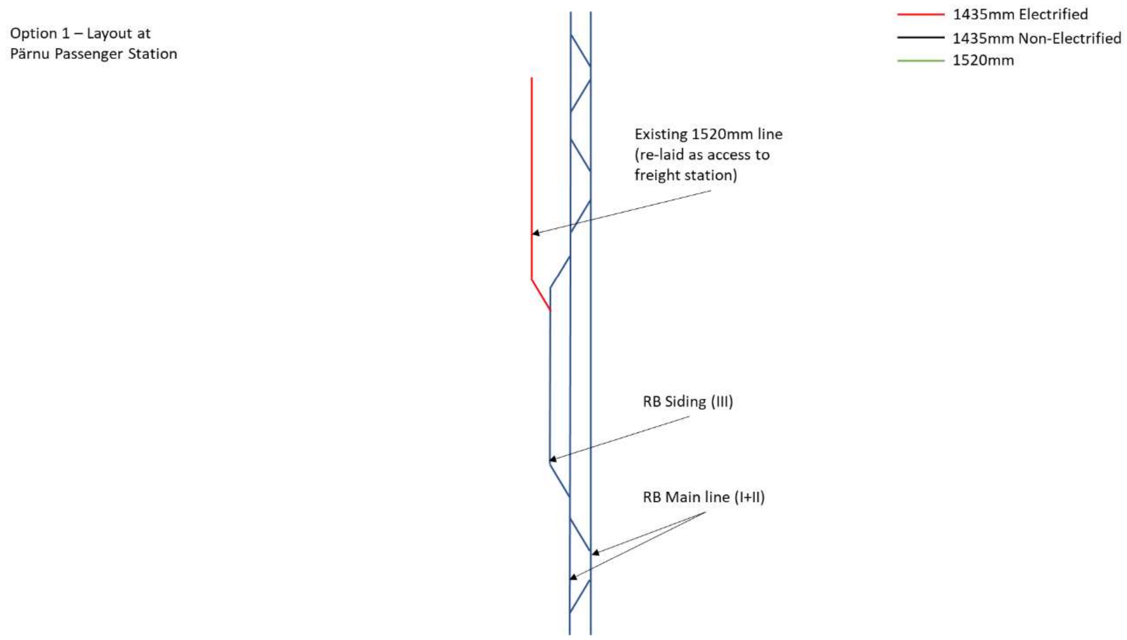
Figure 32: Unloading Innofreight containers with a forklift[78]

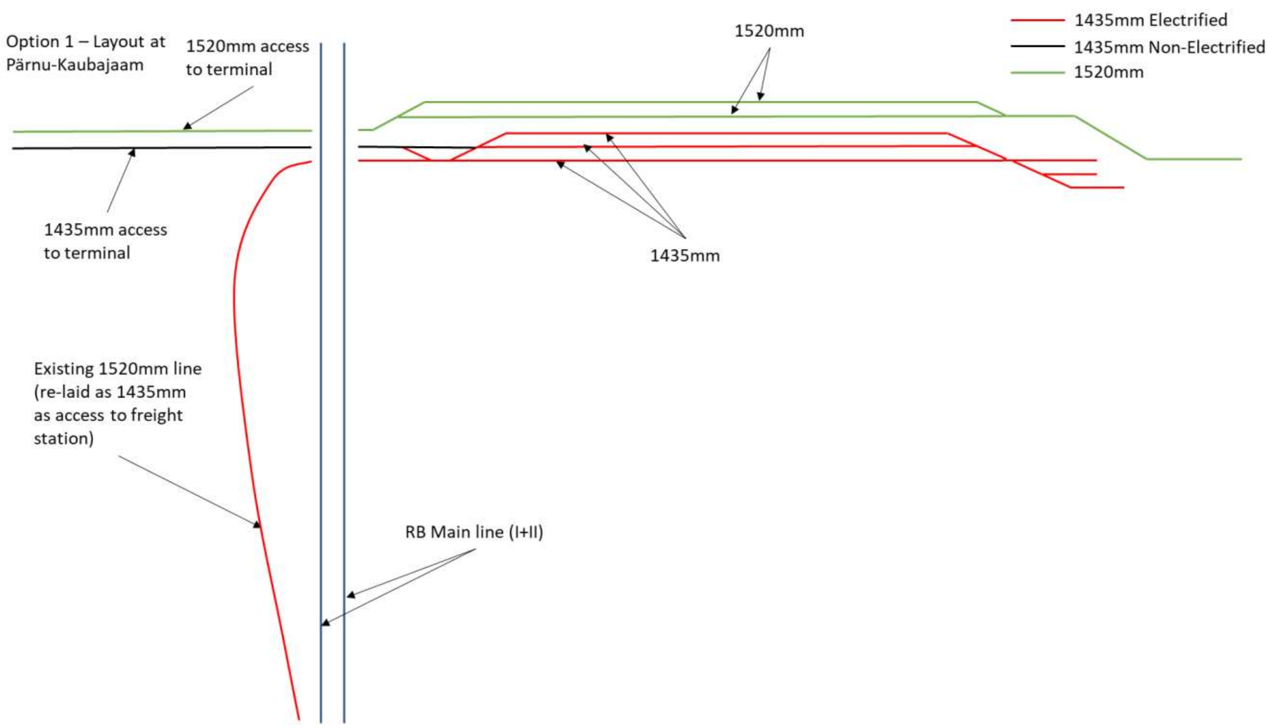
Such innovations allow for full containerisation of these types of commodities while also improving the intermodality of them and ensuring that customers who do not have a direct rail connection can be more easily reached while reducing the need for loading and unloading at intermediate points. This solution also reduces the amount of equipment required at the terminal to the minimum. In this case, only a front loader and forklift are required.

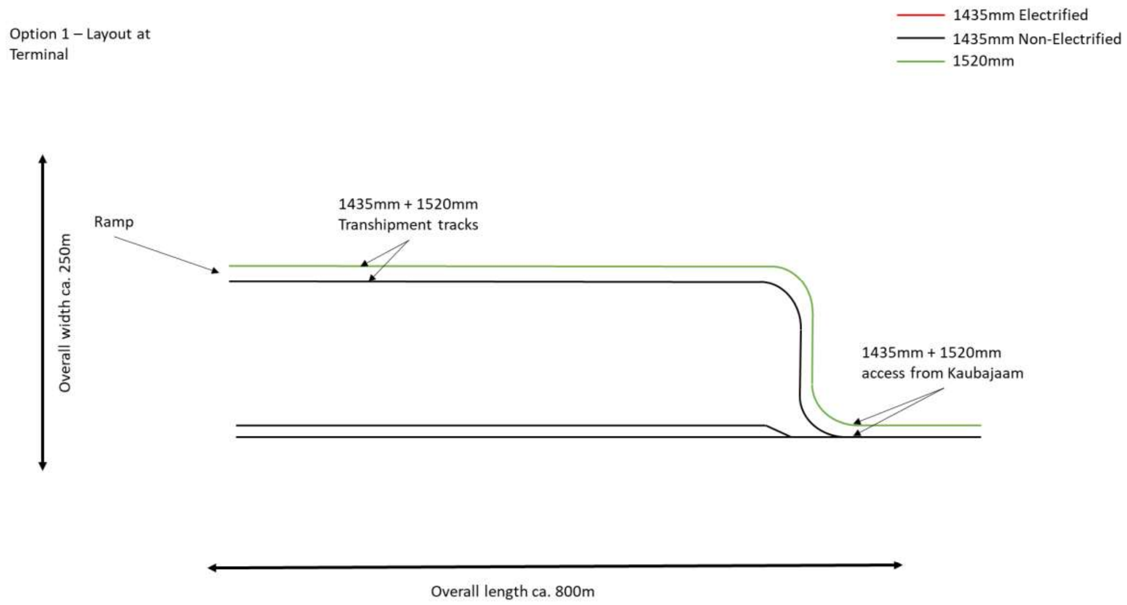
[78] Source: www.verkehrsrundschau.de

Annex 7 – Schematic Drawings

Option 1



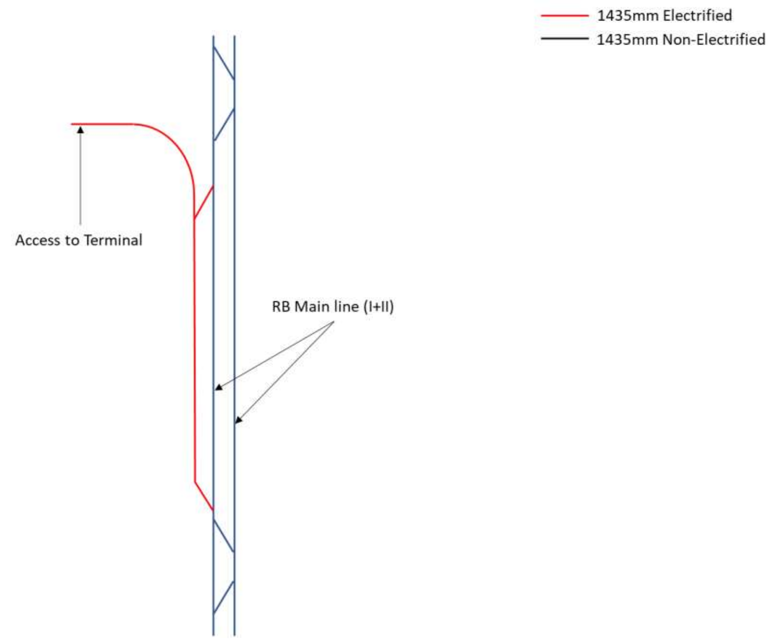




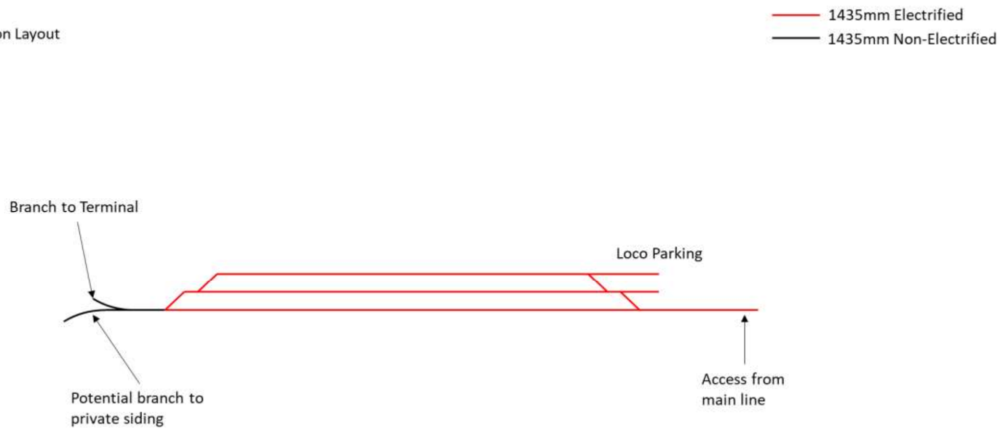
Option 1 – Layout at Terminal
1435mm Electrified
1435mm Non-Electrified
1520mm
Overall width ca. 250m
Ramp
1435mm + 1520mm
Transhipment tracks
1435mm + 1520mm
access from Kaubajaam
Overall length ca. 800m

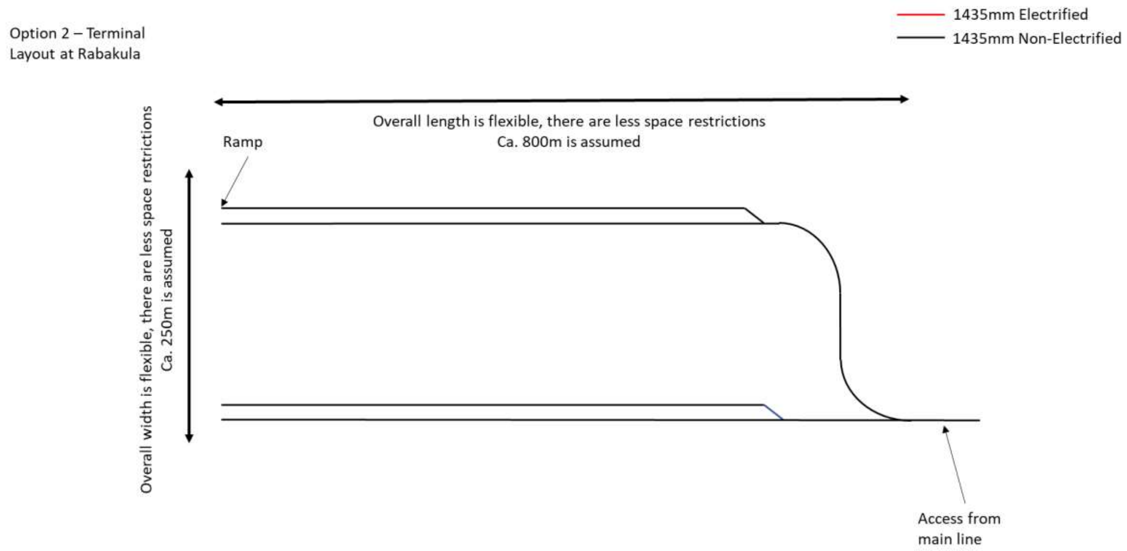
Option 2

Option 2 – Branch Layout
at Rabakula

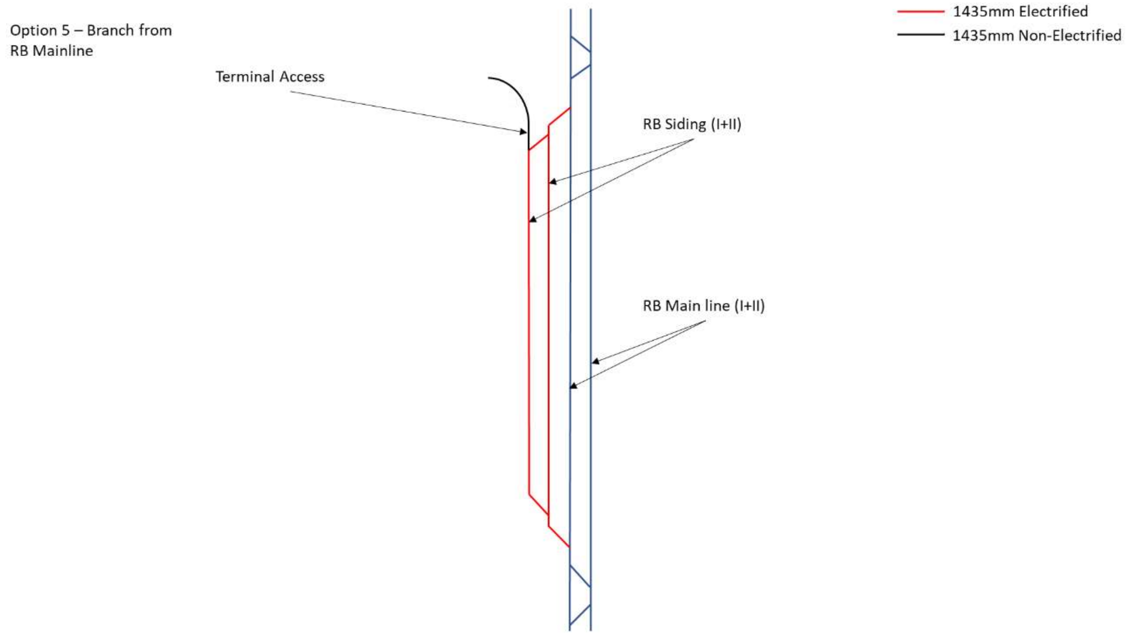


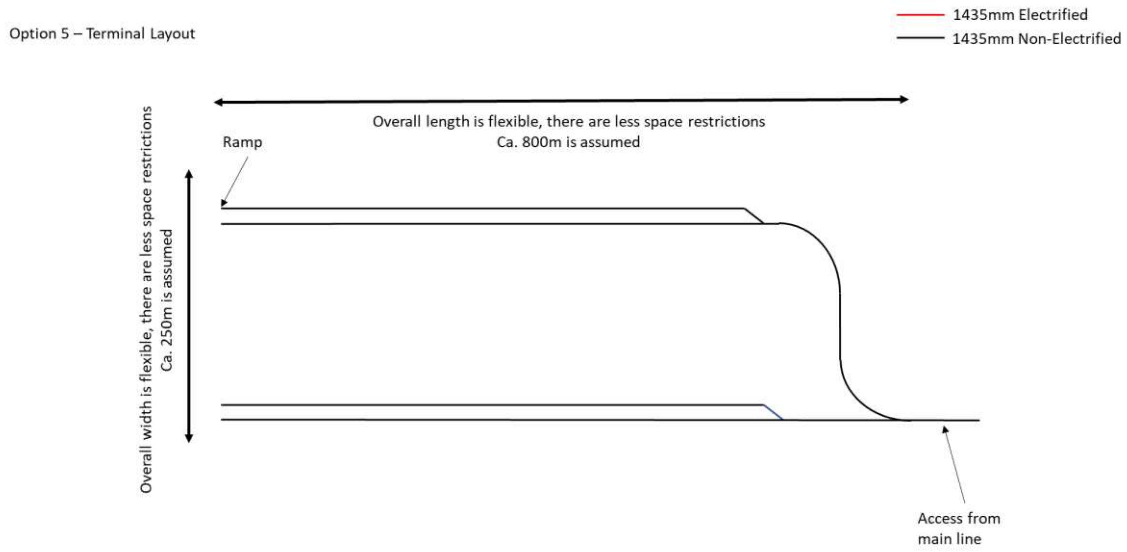
Option 2 – Station Layout
at Rabakula




Option 2 – Terminal
Layout at Rabakula
1435mm Electrified
1435mm Non-Electrified
Overall length is flexible, there are less space restrictions
Ca. 800m is assumed
Overall width is flexible, there are less space restrictions
Ca. 250m is assumed
Ramp
Access from
main line

Option 5


Option 5 – Branch from RB Mainline
Terminal Access
RB Siding (I+II)
RB Main line (I+II)
1435mm Electrified
1435mm Non-Electrified


Option 5 – Terminal Layout
1435mm Electrified
1435mm Non-Electrified
Overall length is flexible, there are less space restrictions
Ca. 800m is assumed
Ramp
Overall width is flexible, there are less space restrictions
Ca. 250m is assumed
Access from main line

Annex 8 – Drawings and Plans