KUNDA SADAM

PORT AREA MASTER PLAN 2020 - 2035

In co-operation with parallel master plan project of Port of Loviisa

This is a **REFEC** – program project
Reinforcing Eastern Finland-Estonia Transport Corridor

Interreg Central Baltic

EUROPEAN UNION
European Regional Development Fund

refec.fi

EP LOGISTICS
PLANNING AND CONSULTING

PORT AREA MASTER PLAN 2020-2035

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SUMMARY

This Masterplan brings together the development needs and plans of the current port management company AS Kunda Sadam, bringing in also the refined ideas, which have been thought of over the past some 25 years of port operations. The port development plans of a commercial port would be futile without traffic plans and there Port of Kunda is working with the Finnish port of Loviisa. Both ports are now actively planning to create a direct RoRo-service between these two ports to serve so called Refec-corridor area, located on the east side of these two countries.

Port of Kunda is an active port serving for industrial clients located in Estonia, Finland Sweden and other Baltic Sea countries. These clients come from forest industry companies, bio energy and construction business companies. There are also needs for the chemcals, for which there are the Baltic Tank tank farm located within the port area. This Masterplan work started with interview of the Port management and owners.

The management of the port addressed the consultant with the needs on nautical sector, need for additional berths and future terminal area developments. Also the development alternatives were needed to be developed and proposals for future expansion areas in order to have constructive negotiations with town director, county decision makers and with prospective clients. The rail connection and development needs were also addressed in a meeting with Eesti Raudtee directors. The port development is also nationally a significant endeavour and as the Eastonian transportation strategy is currently under preparation by the Economic Affairs and Communications of Estonia, the timing of the Kunda Master plan could not be better.

The Port of Kunda, the fifth largest marine cargo terminal in Estonia has an important role in the economy and has managed to grow in recent year by 8 % . The port serves the economy providing wood and wood chip and Estonian stone, gravel and sand maritime transportation and trading possibilities, which in 2018 reached 1,6 million tonnes. The port does not work without people or companies and they all create National product for Estonia. The port like any asset should be developed and under the Estonian BMLG new ownership, the port is strongly committed to invest in and to develop this terminal for the future logistics needs of the region. There is a cement factory in Kunda, a pulp mill with expansion possibilities nearby and plenty of estates for the development. There are also unutilized natural resources in close proximity, namely phosphorite deposits and the oil shale deposits further east from the Kunda sadam.

The port is not alone. The local community, the town of Kunda supports the port development actively. Yet there is a need for larger, Lääne level and even national development will and deeds. The Rail track to the port should be completed, as currently it is just 3 km away but to bring it to port it requires some 9 km of new track and further there is a need to procure the now private rail branch of 16 km to the hands who could invest and develop the rail up to the standards of current safe rail transportation.

This study highlights and prioritises the development tasks, seen by the port, reviewed by the consultant and required by the growing trade. The Kunda port has vessels to load and a role to play in national economy.

TERMS AND ABBREVIATION

Air draft	The clearance which vessel or part of the vessel needs pass clear a defined air hanging obstackle, such as bridge, airborne powercable or weather shed sill.
Beam	Beam, ships width
Berth	Place in port where a vessel is moored and carries out her cargo operations.
Bog	Wetland with acid peaty soil, typically dominated by peat moss.
Brakish water	Water which has salinity less than seawater but higher than fresh water. Whole Baltic sea is more or less brakish water area.
Break Bulk	General Cargo, are goods that must be loaded individually, and not in inter-modal containers nor in bulk as with oil or grain.
CD	Charted Datum, A chart datum is the level of water that charted depths displayed on a nautical chart are measured from. A chart datum is generally a tidal datum; that is, a datum derived from some phase of the tide. Common chart datums are lowest astronomical tide and mean lower low water
Coaming	See hatch coaming
Density	In mariners terminology means the water or salinity or liquid density. How much it weighs per m3. Commonly in port it is used to define water where ship floats or seawater or fresh water or in between (brakish water) and how much in between. The density typically varies between 1,025-1,000. It can change few thousands in same berth and on berths in river estuaries it can change a lot almost instantly. In Port of Kunda it is about 1,004-1,006
Depth	Usually understood as depth of water, distance from surface to bottom. With ship it means also the side height, height of ships side from keel plate level to weather deck level. Used for cargo gear and access gangway outreach check calculations.
Dolphin	A mooring or rope attaching point surrounded by water, usually formed by pressing 3-5 piles to seafloor next to eachother and then prepared above the surface top end for intended use.
Draft	Draft is vessels draft, it is the distance from the water surface where the lowest part of the floating vessel is. To illustrate this term and previously mentioned term depth. The vessels draft has to be less than the depth of submerged obstacle in order to pass clearly over the obstackle. This applies to moving vessel and to most cases of moored, anchored or tied next to cargo vessel under cargo operations (NAABSA exception).
FinEst Link	Initiative to construct a tunnel and the rail connection between Helsinki and Tallinn for passengers and Cargo. The cost estimate is 14-20 billion EUR. Investment decisions have not been made and schedule has not been confirmed but estimates have indicated that it could be operational in 2050. There are other initiatives for the same connection, such as *FinEst Bay Area Project, Ankurtunnel and Hyperloop Talsinki* developments. These initiatives

	indicate much faster implementation time and investment costs of 15 / 7-8 Billion EUR.
Geared	Vessel with onboard lifting gear to handle cargo.
GoF	Gulf of Finland, bay area between Estonia and Finland.
Handysize	Cargoships of 15 000-40 000 DWT
Hatch coaming	The edge of cargo hold opening, usually the highest point the lifted unit has to pass on the way from hold to quay or vice versa.
Lm	Lane meter, measurement used with RoRo-vessels, used to show, what is the capacity of a RoRo-vessel to load normal roadworthy cargo, expressed in meters.
Large handysize	40 000 – 50 000 DWT cargo vessel
Mire	A wetland area or ecosystem based on peat.
Permissable load	Design load, which defines how much load a cargo gear, hoist, deck, tank top or pier or yard surface can safely wihtstand without deformation or structural damage.
Panamax	Bulk or breakbulk cargo ships with dimensions less than old lock chamber of old Panama canal. This refers usually to bulk carrier of 65 000 – 75 000 DWT.
Supramax	Larger handysize vessels, less than 60 000 DWT
TPC	Tons per centimetre, how many tons are needed to sink or lift a vessel by one centimetre. This number is vessel, liquid and draft specific and helpful in small change calculations.
LOA	Length Over All, the largest length of a vessel. Useful in many situations, such as mooring berth planning and port planning.
Outreach	Term used in relation to cargo gear and vessel operations, both with landside and with onboard cargo gear. It is the furthest point distance away of crane/cargo gear from the ships side/berth interface where a cargo can be placed to or lifted from, to land side (ships gear) and to seaside (when about the shore based cargo handling machine).
RDF	Refuse Derived Fuel is is a relatively crude material, produced by shredding pre-sorted municipal solid waste (MSW)
Silt	Fine sand, clay, or other material carried by running water and deposited as a sediment, especially in a channel or harbour.
Slurry	A mixture of drybulk solid and liquid, usually water. Materials are mixed to make it easy to transfer drybulk solids by pumping the slurry through pipeline. Especially handy solution where other temporary arrangements are not viable such as pumping of silt from dredging area to harbour area to be reclaimed. It is also used in mining industry.

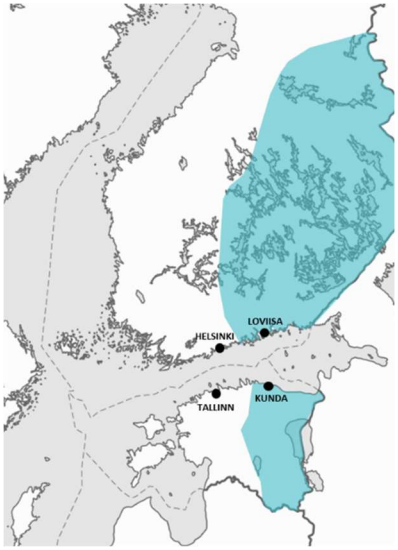
SRF	Solid Recovered Fuel (SRF)on the other hand, is a much more refined resource, produced to a defined quality specification. Usually manufactured from pre-sorted commercial and industrial (C&I) waste
SWL	The safe working load limit of a cargo handling machine or mooring equipment.

THE REFEC PROGRAM

REINFORCING EASTERN FINLAND-ESTONIA TRANSPORT CORRIDOR

The heavy vehicle traffic (trucks and trailers) on ferries over the Gulf of Finland has been increasing since the 1990's and the trend is estimated to continue. There are two ferry routes between Finland and Estonia (Helsinki-Tallin and Hanko-Paldiski).

Remarkable part of this heavy vehicle traffic takes place between Eastern Finland and Eastern Estonia, and further southwards. The solution to activate the Eastern Finland – Eastern Estonia corridor would be to establish a ferry connection between ports of Loviisa (FI) and Kunda (EE). This connection is practically in direct north-south axis (54 sea miles). Moreover, there is no Russian territorial water in between.



Picture 1 The REFEC-corridor area.

The project aims at reinforcing the establishment of Eastern Finland-Eastern-Estonia transport corridor. The project outputs are focused mainly on concrete measures to support Loviisa-Kunda ferry connection.
This includes port operative and investment planning, roadmap to comply the needed licenses and regulatory requirements, best practice transferred from similar connections in the BSR, ferry scheduling and route option plans, business model(s) with potential shipping companies, marketing plan and events to promote the connection.

Furthermore the cargo potential of the corridor is analysed and the impact of the developed corridor is verified (reduced travel time, volume using the corridor and Loviisa-Kunda connection).

In addition to the faster and more fluent transports between eastern parts of Finland and Estonia there are other beneficiaries of the activated transport corridor. The traffic to/from Eastern Finland that uses Via Baltica would benefit from more direct connections as well. Another major advantage is relieving the pressure of growing heavy traffic (traffic jams, emissions, noise, dust) in the city centres of Tallinn and Helsinki. The decreased mileage in transports means also less CO2 emissions.

The Centre for Maritime Studies is the lead partner in REFEC. The other partners are the town of Loviisa, Port of Kunda and Posintra Ltd. The REFEC project budget is 0,73 Million € which is mostly financed from ERFD (Interreg Central Baltic Programme) and the rest 21,8 % is from the partners. The Refec project runs from 1st December 2017 until the 31st May 2020. This Masterplan was carried out from March-August, 2019.

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1 INTRODUCTION

Port of Kunda is the 5th largest commercial seaport of Estonia and the eastern most one with direct access to other Refec-corridor ports straight north on the Finnish coast. The port handels some 200 vessels annually and some 1,4-1,6 million tonnes of of solid bulk, liquid bulk and general cargoes. Port has plans to develop a direct daily RoRo-service between Kunda and Port of Loviisa. This new liner service is a natural continuation of more than 700 years of active trading across the Gulf of Finland exercised by communities in both coastal areas.

Port of Kunda has history back to year 1805, when the realm of the region, the Russian tsar Alexander I gave order to build the Port of Kunda.

In 1812, a customs office was established there through which salt, herring and coal, later on even tobacco, ironware, etc. could be imported and timber, grain and spirits were exported. Sawmills were built next to the Kunda River and their products were shipped to fast developing cities such as London and other European destinations.

In 1823, the Port of Kunda was transferred into the ownership of Thomas Chayhills & Son. In 1869, John Girard de Soucanton, the owner of the Kunda Manor decided to build in Kunda the third cement plant of Russia. In total, four cement plants have been built in Kunda during its history, the latest thereof produces cement even now.

The cement was marketed mainly in St. Petersburg and Moscow, and in both cases it was shipped by sailing vessels from Kunda to St. Petersburg. The main import goods included coal which was mainly used for heating the cement plant. In the 1860s, the rail network of the port was connected to the cement plant in order to facilitate the growing cement and coal transport.

In 1870, the St.Petersburg-Tallinn railway was completed, and in 1896 the Rakvere-Kunda railway branch. In in 1913 already 4/5 of the visits to the port were made by steamships. The transhipment of the goods took place in the roadsteads. The first world war, brought independence for Estonia. Early 20’s and 30’s were turbulent years, first recovery from great war and then the great recession. Consequently the role of Kunda decreased rapidly and it was not used from 1940 until the 1994.

When the AS Kunda Nordic Tsement was established in 1992, it started to develop the Kunda port. During the construction of the port, a new 2,8 km long Uus-Sadama road, bridge across the river of Kunda, breakwater pier and two cargo berths were built. In 2000, the third cargo berth was built. The channel was deepened in order to allow entry to the port. The channel’s length is 1,2 nautical miles, depth 10,5 meters and width 70 metres. The depth of water in the port basin is up to 9,3 meters depending on the berth. In 1994 the port was opened as Kunda Nordic Tsement’s port for cement and klinker export.

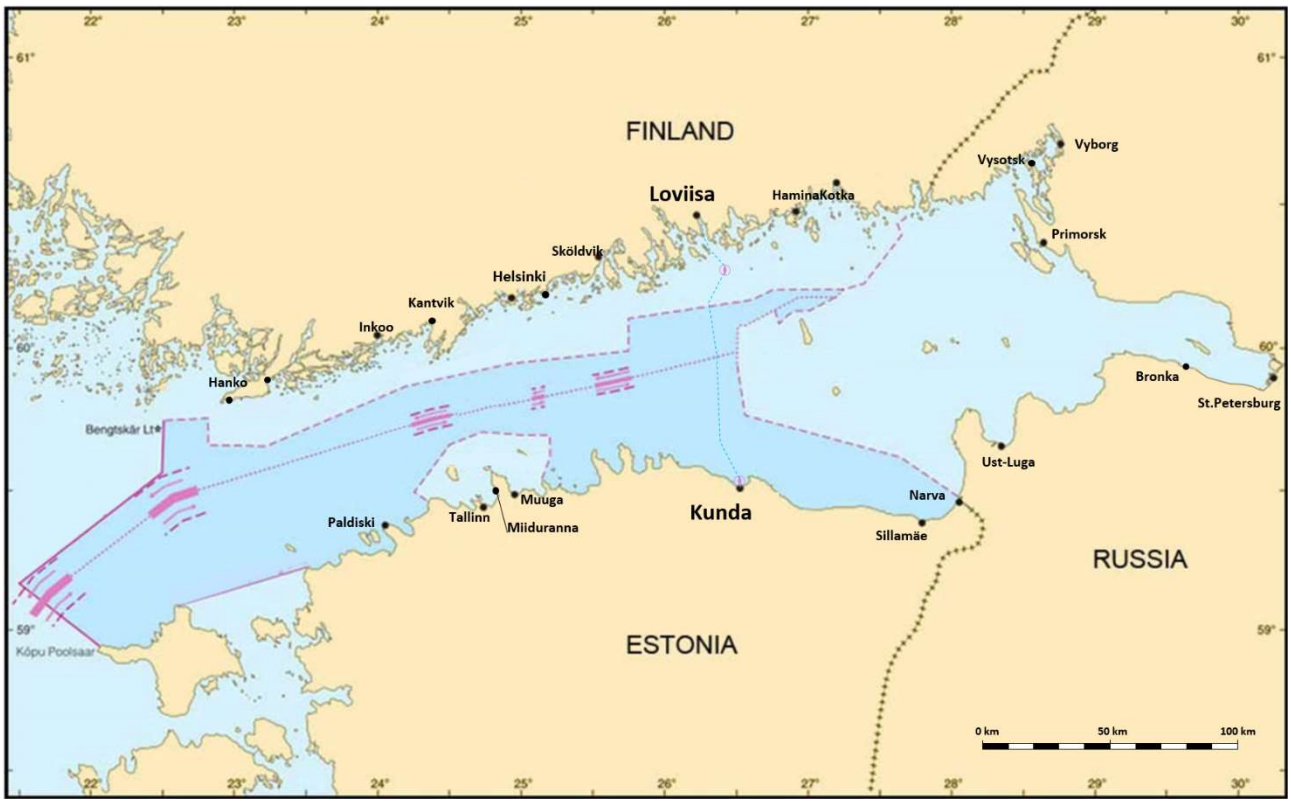
In 1999, the HeidelbergCement Group acquired the majority shareholding in AS Kunda Nordic Tsement. In 2014, the Port of Kunda celebrated its 20th year of operation. In late 2018 the Kunda Nordic Tsement AS, owned by the Heidelberg Group and Kunda Sadam AS, a company owned by Baltic Maritime Logistics Group signed and agreement for the transfer of the port of Kunda to an organizationally Independent Enterprice.

2 CURRENT STATUS

2.1 General

Port of Kunda just celebrated it's 25 th year in operations, yet the port has been around for more than 200 years. The Kunda Tsement used the port more than 24 years beforrecent transaction of the owners, the Heidelberg Group and Estonian BMLG. Port of Kunda, constructed by Kunda Nordic Tsement AS in 1994 and amongst the seven Estonian ports handling more than mln tons of cargo annually, has handled 1,4 up to 1,8 mln tons of solid bulk, liquid bulk and general cargoes in the previous five years.

The port has four berths for vessels with draught of 7,0 m to 8,5 m and LOA of 150 m. There are some 400 to 600 vessel calls per year, which make 1,5 to 1,8 million tonnes of solid bulk, liquid bulk and general cargo movements over the pier. The typical vessel is a small coaster of less than 5 000 DWT, yet the Port of Kunda is capable to accommodate visits of some 18 000 DWT bulk carriers and 7 500 DWT tankers.



2.2 BMLG and Port of Kunda

On the beginning of 2019 Port of Kunda started its first year as an independent organization. The transaction process started in September 2018 as the Nordic Tsement AS, a company owned by HeidelbergCement Group, and Kunda Sadam AS, a company owned by Baltic Maritime Logistics Group, signed an agreement for the transfer of the port of Kunda to an organizationally independent enterprise. Baltic Maritime Logistics Group, a concern founded in 2000 and operating in 10 countries with sales over 143 mln euros, is engaged in the logistics sector.

2.3 Kunda, Industrial town

Town of Kunda is an active Industrial town in Viru-Nigula Parish, in Estonia, located on the coast of the Gulf of Finland. The population in 2017 consisted of 3125 inhabitants. The largest companies are the pulp mill (AS Estonian Cell), the cement factory (AS Kunda Nordic Tsement) and the port (Kunda Sadam AS). Kunda was granted official borough rights on May 1, 1938. The next large town is Rakvere, some 25 km SW from Kunda with population of 16 000 inhabitants. Kunda is located 100 km due East from Tallinn.

2.4 Effective port terminal with Industrial heritage

The port of Kunda has been developed for and the port's current customer base have their origins in industrial world. That is visible in the efficient port layout, efficient way to work with cargo commodities and the approach by the stevedoring arm of the port to provide cargo handling when the client need's it. The industrial clients have been actively trading and this year of 2019 is expected to be a record year.

Picture 2 Old water mill next to rapids of the Kunda river.

The industrial heritage is both an advantage and can be a bit challenging for the port development. One major advantage comes from local community which usually give their fullest support to port, companies operating in the port and for the decision made by the port. In industrial port there is usually a good understanding, what are the needs of the port. The local community have clear picture what port, companies and employment opportunities mean to local households, to small businesses and crocery stores, healthcare and other services.

Picture 3 Busy working with vessels on each berth, view over the basin in March 2019.

Challenging circumstances may develop when there are conflicting interest over the development or priority of development, both within the port area and business but also over the needs of development on the infrastructure leading to port area and housholds next to those arteries.

The port and the port company, are living things, such as almost everything on this planet. The changes can be slow or fast but changes take place all the time. It may be challenging to keep in pace what is happening in maritime industry, what the implications in general are and what the implication of change are to local port. Therefore it also important to keep the local community aware of the industry to get the understanding and support when it is needed.

2.5 Masterplan objectives

The objective of the project is to prepare a master plan 2020-2035 document for the Port of Kunda. The project takes advantage of the expertise of the Port owners and management of the Kunda Port, the previous port Director and of the electronic and written material provided by the client. Initial information were deepend by interviews with a few stakeholders, port users and discussions with the port management.

The project develops a traffic forecast with slightly different development scenarios. The masterplan seeks to combine different possibilities and future plans together in order to give the management a third party view of the port development decision making. The master plan shall include a list of port consultants recommendations for future tasks and ideas about sequencing them together in operatively constructive and effective steps. Additionally the masterplan reviews the connections to three modes of transport network and development recommendations regarding them.

2.6 Methodology

2.6.1 Consultant assignment for the task

The asssignment was defined to follow the eight step project program with the following additional definitions, changes or additions.

1. Initial information and analyses. The client supplies the consultant with a significant amount of and relevant information for project use.

2. The consultant shall develop proposals for development alternatives to be developed further along with the project program.

3. The development needs and targets by the clients representatives were gathered in a few initial meetings. Among the concerns were the nautical readiness of the basin for the RoRo-traffic planned with port of Loviisa under the Refec-program, the refurbishment needs of berth no.3 and the capacity of the road leading to the port.

4. City plan check was reviewed with the company management. There are currently areas licenced for expansion, but the areas shall be extended based on port owners and managements further plans. The early plans of land use were sounded with a named city plan authority assigned into this project as EP's resource.

5. The key users' meeting was conducted with a direct approach. The long term port director used a good day in Kunda Port with Consultant. Additionally the new owners brieffed to the ideas of future development. The liquid terminal operator and the national rail operator were interviewed in two separate meetings.

6. Traffic forecasts and development scenarios were developed (included in this report)

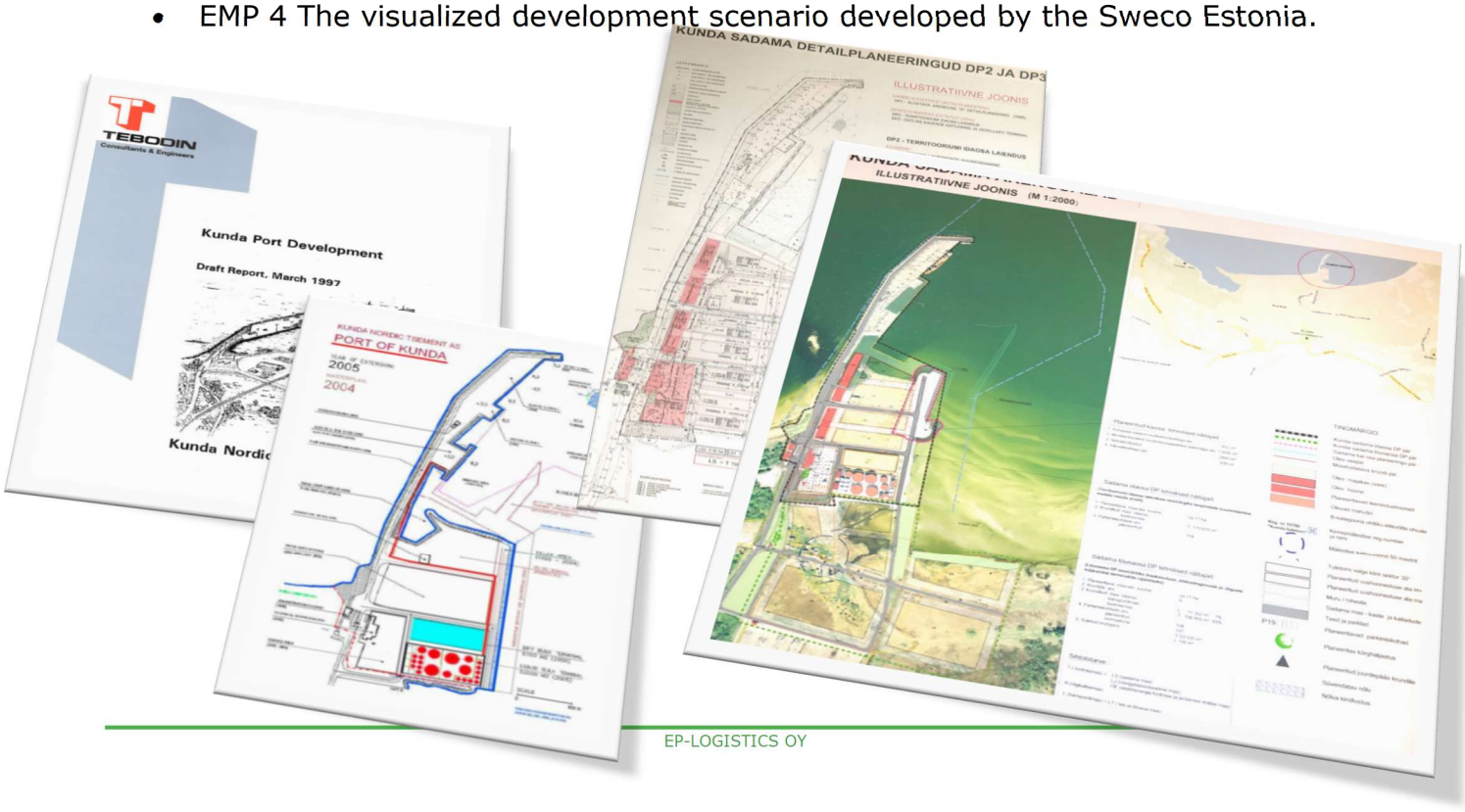
7. Reports and comments of the port users, possibilities on the transport market sectors as seen by the consultant.

8. Reporting and masterplan CAD-drawing(s).

2.7 Notes from earlier development plans

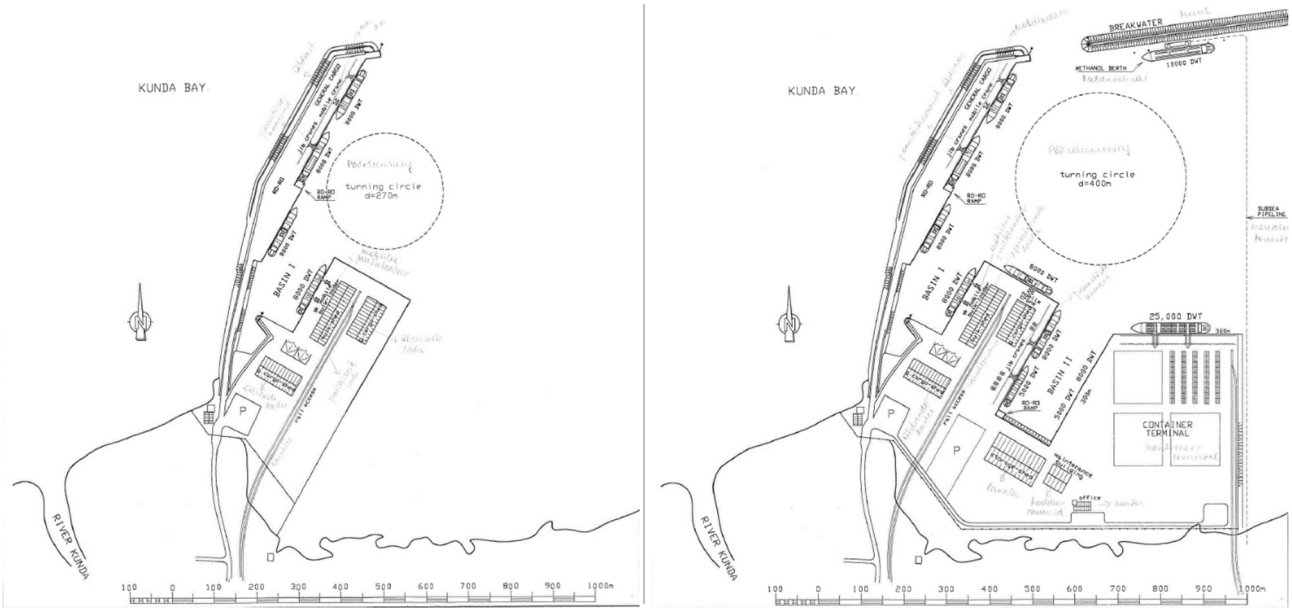
The modern development of Port of Kunda can be seen to have a starting year of 1992, when the Kunda Tsement started to develop the port, to be opened two years later in 1994. Regarding that modern time period, the consultant received information about three different, earlier masterplan (EMP) phases as follows.

- EMP 1 The Tebodin Masterplan report, March 1997.
- EMP 2 The map on the 3rd floor meeting room, illustrating the Post DP1 (1998) phases of DP2 and DP3.
- EMP 3 version found in TRIK-project.
- EMP 4 The visualized development scenario developed by the Sweco Estonia.



EMP 1 Tebodin -97

The earliest of the plans, the EMP 1, the Tebodin plan projects port development in several stages, starting with market survey, technical feasibility study. The project was later expanded with financials, projected by investment costs, revenue forecasts, production and overhead projections and financing costs projections. Underlying traffic forecast of development from 900 thousand tonnes in 1998 to 2,9 million tonnes by 2011. With sensitivity analysis the traffic projection was between 2,1-4,9 million tonnes in 2010.



Picture 4 The development phases III and IV, as planned in 1997-1998. Please note the railway to new southerly berth area and at IV stage widened 400 m turning basin.

The thorough work makes good progress development alternatives and recommendations. On infrastructure the report sees the lack of railway a major thing to be corrected. The yard development has been planned to take advantage of geological contours and not to go deep into the south area. **In a 1997-1998 study, the fairway deepening plans goes down to CD -13,1 m for the channel and CD -12,1 at the extended, Ø 400 m turning basin. The nautical wave modelling makes a recommendation for sea wall construction.**

EMP 2 DP2 and DP 3, 1998

The map on the 3rd floor meeting room, illustrates the Post DP1 (1998) phases of DP2 and DP3. The analyzis of these plans is a bit futile on the basis of one photograph, but if something should be stated, it is the more detailed and perharps considered designs of the adjacent landside terminal area. This plan also proposes the expansion of the berth yard area, behind kai 2 and 3 and then to fill the the space between platforms of kai places 3-4, to create more even berth. Creates a pier berth from current shore side landfill, to be the next step for the earlier plan, defined easterly expansion of quay area.

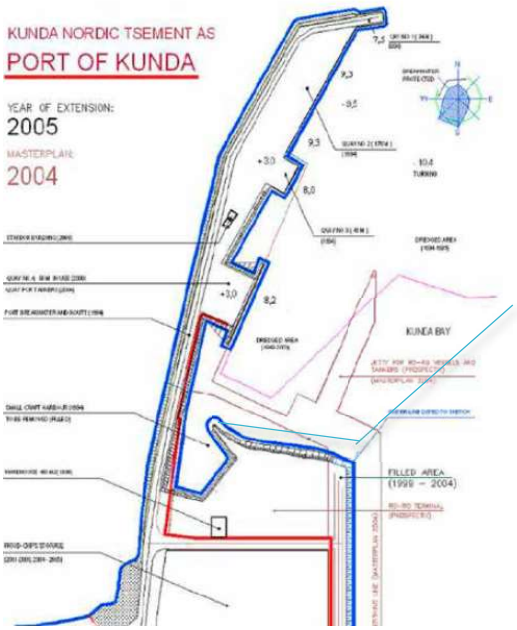
EMP 3 2004, 2005. This was found to be referred to in TRIK-hanke (TRIK-project) document. The plan defines the expansion areas and schedules the expansion of new berths to be created in the 2005 extension. The plan shows the new basin to be dredged and the prospect of Jetty quay, in parallel to current berth no.4. [Consultants comment

to this is that the mouth to area between berth no 4. and planned new jetty quay perhaps numbered as no.6., should be opened for three main reasons.

First, the opening would follow the depth contours more and would by that way reduce the investment costs.

Second, by opening the entrance to the basin, it would make a big difference for vessels coming to berths 4, (5) and 6, as the approach phase is the phase where the captain and the pilot are looking to have more manoeuvering space to come alongside.

At third advantage comes from the berth length. A more angeled berth line makes it possible to accommodate a longer vessel between the end of the basin and the turning circle, the point which may become valuable in the future.



Picture 5 The 2004 Masterplan, EMP3 here, plans the basin extension by jetty pier but the parallel alligning with berth no. 4 makes it too constraint for the approaching vessels.

EMP 4 The visualized RoRo-development with recreational center.

These plans are based on the extensive landfill and reclaiming for just one RoRo-berth, on the easterly corner of the expansion area. With limited background material received one could refer to this as visually colourful.

The planned recreational center to be located within Kunda industrial port is not recommended by this 2019 Master plan. The earlier coloured map shows the plans on the top of satellite picture and is considered to be the latest of all the earlier masterplans shown to the consultant.

There are positive aspects on this plan, namely the development of the landside areas but with the lighthouse and the community development, one creates a possible conflict of interest between the inhabitants and the industrial development and operative working environment.

This, if not addressed to, may bring in working hours restrictions, which is not favoured buy the industrial clients, or by the current terminal operators working with round wood at the moment. This working readiness attitude of stevedores are considered to be one of the competitive advantages of Estonian ports.

The turquoise line proposes more practical alignment of possible jetty pier. The opening would follow the depth contours better, give more manouvering space and give room for longer vessel berth place before the turning circle.

Picture 6 The EMP 4 is the latest master plan released.

3 MARKET AND OPERATING ENVIRONMENT

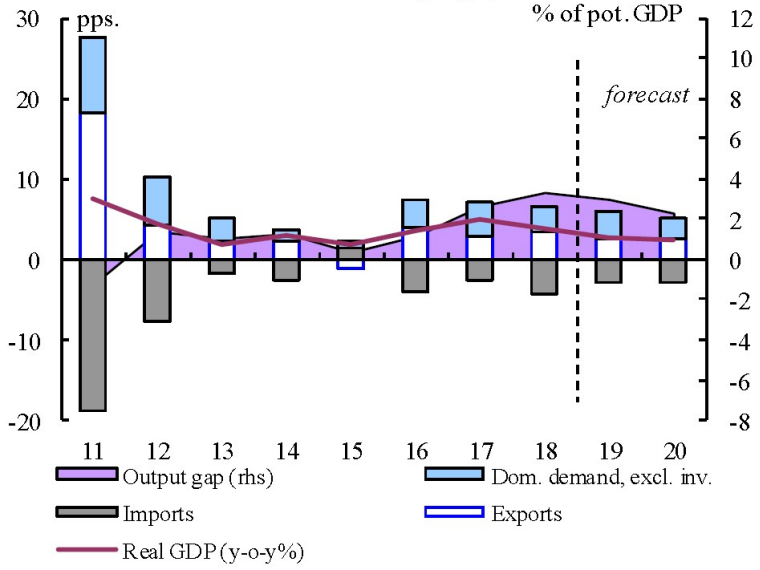
3.1 Outlook to world economy according to IMF, July 18th 2019

Global growth remains subdued. Global growth is forecast at 3,2 % percent in 2019, picking up to 3,5 % in 2020 (0.1 percentage point lower than in the April WEO projections for both years). GDP releases so far this year, together with generally softening inflation, point to weaker-than-anticipated global activity.

3.2 Estonian economical forecast according to European Economic Forecast - Institutional paper 102, may 2019. EU DG for Economic and Financial Affairs

Strong broad-based growth is expected to continue in 2019, as domestic demand remains buoyant. With a labour market close to full employment and moderating inflation, increasing real incomes will uphold private consumption. Private investment is set to pick up, especially in machinery and equipment. The headline budget balance and the structural fiscal position are to remain in deficit.

Graph II.6.1: **Estonia - Real GDP growth and contributions, output gap**



Graph 1 Estonia - Real GDP growth. Source: European Economic Forecast Institutional paper 102, may 2019. EU DG for Economic and Financial Affairs

In 2018, Estonia's export volume increased by 4,3 %. In particular, the export of services related to information and communication technologies (ICT) grew significantly throughout the year, while manufacturing exports accelerated in the fourth quarter. Sustained competitiveness in niche markets is expected to deliver export growth in 2019 as well, but the weaker external outlook will inevitably weigh on growth. Overall, the combination of moderating external demand and sustained internal demand is forecast to result in GDP growth of 2,8 % 2019 and 2,4 % in 2020. As this is slightly below potential growth, it should lead to a slight decline in the output gap.

Labour market surprises on the upside supported by immigration, employment grew by 1,2 % in 2018, from already historically high employment and activity levels. Short-term labour supply increased further, alleviating labour shortages in construction, manufacturing, and in services related to ICT. This helped companies expand production and export volumes. The labour market is expected to operate at close to full capacity in 2019 and 2020. As this is likely to maintain wage pressures, there is a heightened risk of eroding competitiveness. However, wage growth is forecast to abate in line with slowing inflation and economic output, especially in 2020. The general government headline deficit turned out weaker than budgeted at 0,6 % of GDP in 2018. The negative surprise came from a faster-than expected growth in spending, particularly on social

spending programmes and investment. On the whole, revenues met budgetary projections, with a shortfall in excise taxes compensated by stronger revenues from labour taxes.

Table 1 Main features of country forecast, Estonia. Source: European Economic Forecast Institutional paper 102, may 2019, EU DG for Economic and Financial Affairs

Table II.6.1:

Main features of country forecast - ESTONIA

	2017			Annual percentage change					
	bn EUR	Curr. prices	% GDP	99-14	2015	2016	2017	2018	2019	2020
GDP		23.6	100.0	3.7	1.9	3.5	4.9	3.9	2.8	2.4
Private Consumption		11.8	50.1	3.8	4.4	4.4	2.6	4.7	4.0	2.9
Public Consumption		4.7	19.9	2.2	3.0	2.2	0.6	0.3	1.1	0.7
Gross fixed capital formation		5.8	24.4	4.8	-7.6	2.9	12.5	3.3	4.8	4.0
of which: equipment		2.2	9.5	4.9	-16.1	5.4	27.7	-4.6	6.5	5.8
Exports (goods and services)		18.1	76.5	6.4	-1.4	5.2	3.5	4.3	3.4	3.4
Imports (goods and services)		17.0	72.0	6.6	-1.7	5.5	3.6	6.1	3.9	3.8
GNI (GDP deflator)		23.1	98.0	3.6	2.6	3.4	5.2	3.6	2.8	2.5
Contribution to GDP growth:	Domestic demand			4.2	0.9	3.4	4.3	3.2	3.4	2.6
	Inventories			0.1	0.2	1.1	-0.3	2.1	-0.3	0.0
	Net exports			-0.5	0.2	0.0	0.1	-1.1	-0.3	-0.2
Employment				0.0	2.9	0.3	2.7	1.2	0.6	-0.1
Unemployment rate (a)				10.2	6.2	6.8	5.8	5.7	5.7	5.7
Compensation of employees / head				8.9	3.3	6.3	6.9	8.8	6.1	5.6
Unit labour costs whole economy				5.0	4.3	3.0	4.7	6.1	3.9	3.0
Real unit labour cost				-0.1	3.2	1.5	0.8	1.4	0.6	0.3
Saving rate of households (b)				4.8	10.9	10.5	11.6	11.3	11.0	11.7
GDP deflator				5.1	1.0	1.5	3.9	4.6	3.3	2.7
Harmonised index of consumer prices				3.9	0.1	0.8	3.7	3.4	2.4	2.2
Terms of trade goods				0.7	0.2	1.0	0.9	0.0	0.1	0.2
Trade balance (goods) (c)				-11.8	-4.3	-3.5	-3.5	-3.7	-4.1	-4.3
Current-account balance (c)				-6.0	1.8	1.8	3.2	1.5	1.4	1.4
Net lending (+) or borrowing (-) vis-a-vis ROW (c)				-4.4	3.9	2.8	4.2	2.7	2.6	2.7
General government balance (c)				0.3	0.1	-0.3	-0.4	-0.6	-0.3	-0.5
Cyclically-adjusted budget balance (d)				-0.4	-0.1	-0.9	-1.7	-2.2	-1.7	-1.5
Structural budget balance (d)				-	0.2	-0.8	-1.7	-2.2	-1.7	-1.5
General government gross debt (c)				6.2	9.9	9.2	9.2	8.4	8.5	8.5

(a) as % of total labour force. (b) gross saving divided by adjusted gross disposable income. (c) as a % of GDP. (d) as a % of potential GDP.

Note : Contributions to GDP growth may not add up due to statistical discrepancies.

The general government balance is projected to remain in deficit, at 0,3 % of GDP in 2019, as the cooling economic environment slows down the growth of the tax base and budgetary expenditures continue increasing. In particular, social expenditures are set to grow relatively rapidly due to an indirect link to overall wage growth with a lag of about one year. Wages in the public sector are projected to grow rapidly.

Based on a no-policy-change assumption, expenditure pressures should ease in 2020, as the expenditure programmes of the previous government come to an end (social spending, wage hikes for teachers and healthcare workers, public investment projects).

The current forecast does not include any potential fiscal measures of the new government for 2020, given that detailed plans are not yet known. Since the economy is forecast to slow further in 2020, the budget deficit is projected at 0,5 % of GDP. The structural balance is estimated to show a more substantial deficit of around 2 % of GDP in 2019 and 2020. Public debt is forecast to remain low at 8,5 % of GDP in 2020. Source. https://ec.europa.eu/info/publications/economic-and-financial-affairs-publications_en.

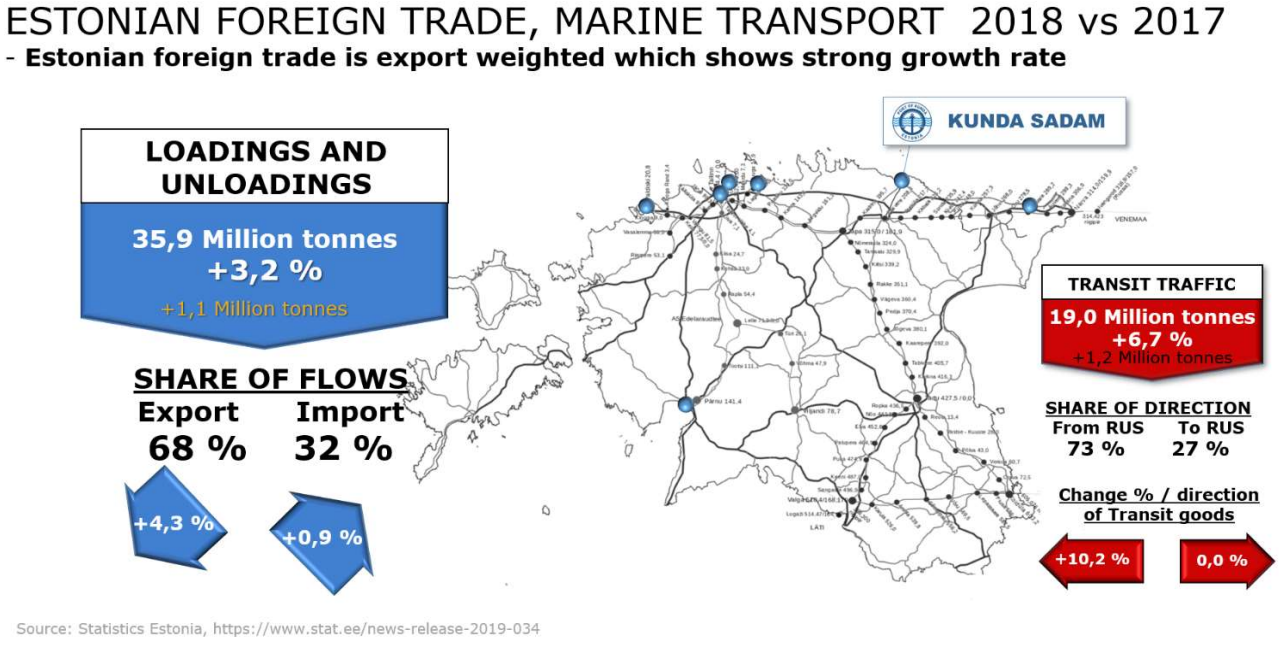
Picture 7 Port of Muuga, managed by the Port of Tallinn, the largest Port operating company of Estonia. Source ERR News

4 CARGO TRANSPORT DEVELOPMENT

4.1 Cargo volumes in Estonia, 2018

In 2018 Estonian ports handled 35,9 million tonnes of cargoes in 2018, marking a 3 % increase compared to the previous year, while freight shipment by rail increased 2 % on year to 27.8 million tonnes.

Loading of goods in Estonian ports totaled 24,5 million tonnes, accounting for nearly two thirds of ports' trade volume, while freight unloaded totaled 11.4 million tonnes. Compared to 2017, the figures increased by 4 % and 1%, respectively. Having reached the last decade's peak in 2011, trade volume started to fall and in five years, it decreased nearly 30 %. Starting from 2017, trade volumes have started to increase evenly both via ports as well as on the public railway.



Graph 2 Estonian foreign trade transports by sea 2018 vs 2017.

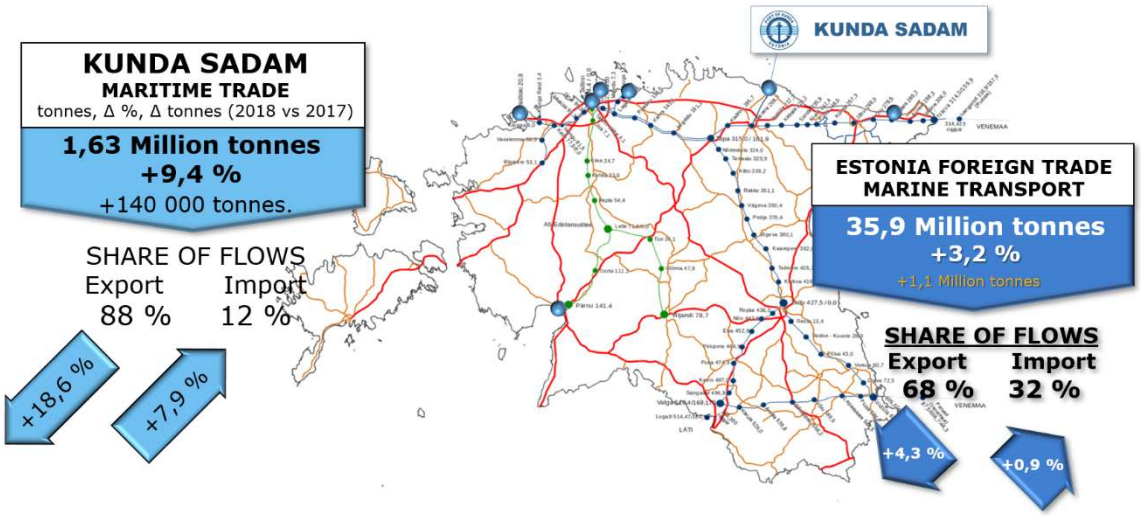
Picture 8 Estonian Railways, the freight division now called Operail, carries most of the cargo on Estonian railway network. Here in ITJ picture, locomotives with old ER colours. Picture International Tranport Journal (ITJ).

Of freight transportation by rail, domestic shipments totaled 17 million tonnes, accounting for the largest share, 60 %, and marking a decrease of 5 % in a year. Freight transportation by public railway reached 13,5 million tonnes in 2018, 80 % of which were international shipments.

Transit shipments totaled 9,1 million tonnes. Freight transport by rail is mainly up due to an increase in transit shipments, which is larger compared to 2017 by a fifth. Shipment of imported goods was up 3 % and export shipments grew 10 %

4.2 Kunda perspective, cargo volumes in Estonia, 2018

KUNDA SADAM VS ESTONIAN PORTS, CARGO MOVEMENTS 2018 vs 2017



Source: Statistics Estonia, https://www.stat.ee/news-release-2019-034

Graph 3 Marine cargo movements in the Port of Kunda (Kunda Sadam) and development cargo traffic in Estonian ports 2018 vs 2017.

In Estonia, port industry is heavily segmented. The most of the traffic is handled through five ports (Tallinn port, Muuga Harbour, Paldiski South harbour, Paljassaare harbour and Saarenmaa Harbour). All of them are managed by the Port of Tallinn, where some 67 % of all Estonian marine tonnage were handled in 2018. The port of Sillamäe loaded 22 % of goods, Parnu and Kunda handled 5,8 % and 4,5 % respectively.

Table 2 Volumes of marine cargo transport of Estonian ports 2018

Ports	**2017**	**2018**	**Change**
AS Tallinna Sadam	19 180	20 608	7,4%
AS Sillamäe Sadam	8 180	8 002	-2,2%
Paldiski Pohjasadam	2 550	2 840	11,4%
AS Parnu Sadam	1 970	2 090	6,1%
Kunda Sadam	**1 500**	**1 630**	**8,7%**
AS Saarte Liinid	860	940	9,3%
AS Miiduranna Sadam	110	31	-71,8%
TOTAL	**34 350**	**36 141**	**5,2%**

Source: Estonian Port Association.

4.3 Port of Kunda cargo segments

Kunda port, like Estonian ports in genetral are heavily biased for exports, 88 % of handeled tonnes were exports and 12 % were imports in 2018. There were no transit cargo. Liquid bulk accounted 5,1 % of total volume in 2018.

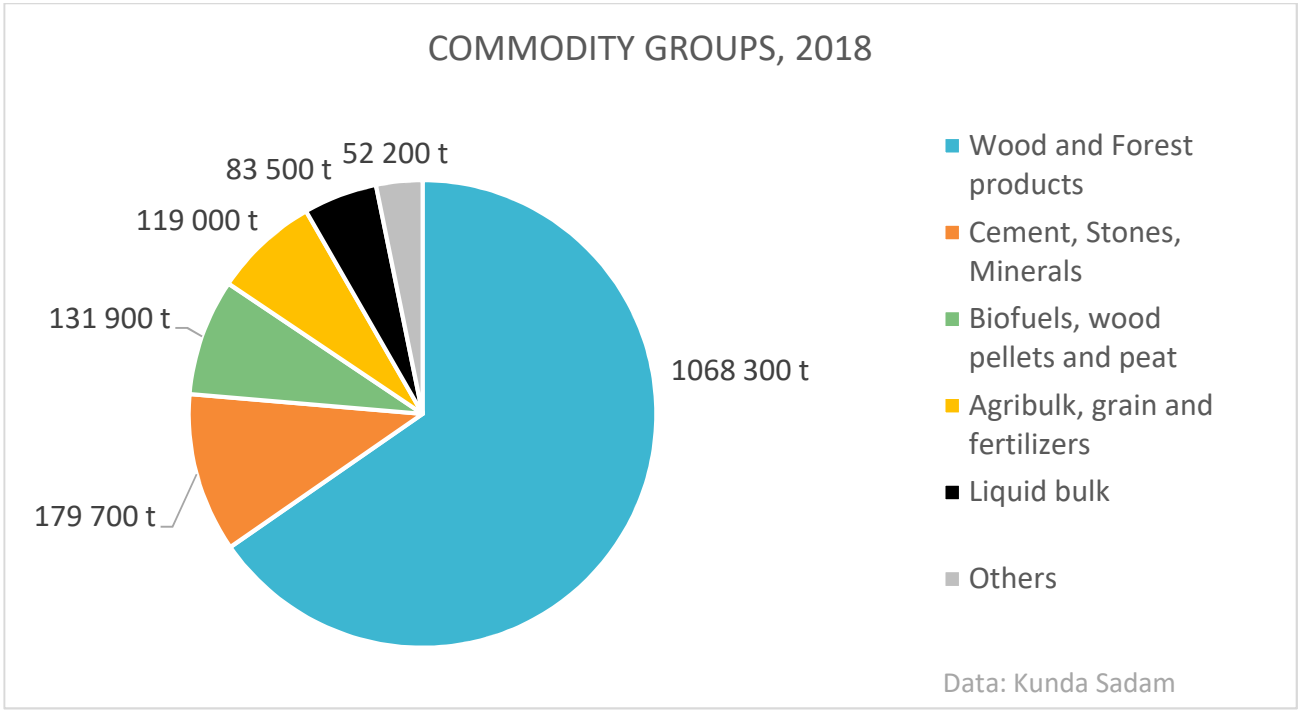


Figure 1 Cargo segments of Port of Kunda, 2018.

While figuring the industry sectors behind Kunda traffic, the commodities can be divided into 6 categories. The forest industry sector is by far the largest, 65 % of the traffic. Yet a large part of the biofuel can be regarded as forest product, when the sector accounts almost ¾ of the ports traffic. Cement makes 11 % and agribulk 7 %.

On the next page, there are the commodities listed on a graph to show the cargo handling in detail in 2018.

4.4 Port of Kunda cargo movements 2015-2018

Over the last years with Kunda Tsement, the cargo development from 2015 to 2018 has been relatively stable and has grown by 15 % over the period mentioned. There have not been major new cargo groups or drastic drop in volumes, naturally some but they usually offset each others.

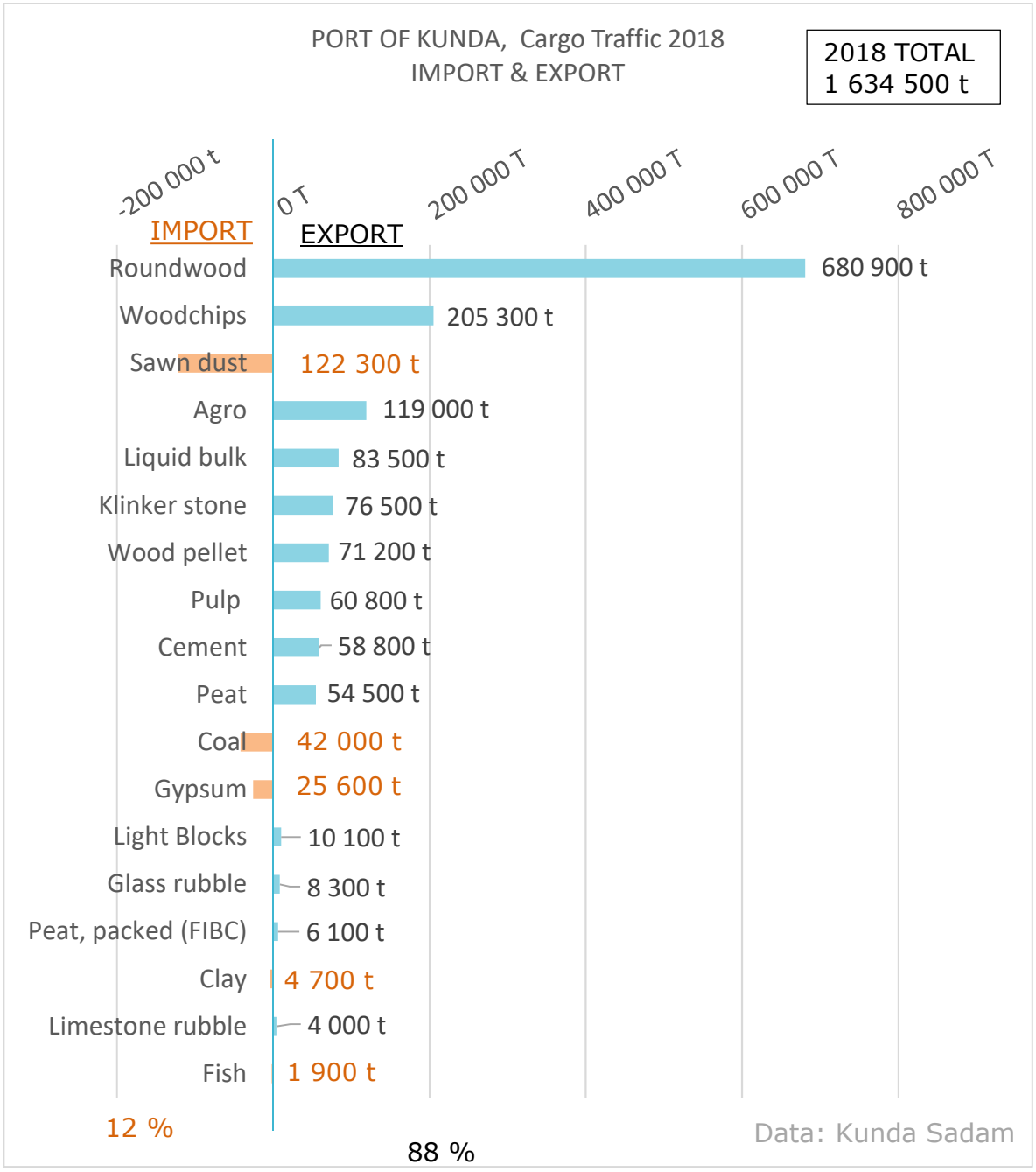


Figure 2 Kunda traffic is mostly export by direction. Traffic growth average has been some 4,9 % over a 3 year period.

The Kunda cargo groups are some 2/3rd of wood and forest products and if biofuel were fully from the forest product sector, then 73 % are coming from forest product sector. The port is working for export cargoes mostly and there are no transit goods handled.

4.5 Regional trade with forest products 2017

While working with transport industry in North Europe, Scandinavia and Baltic countries, the forest industry defines many things on the market. There is hardly any sector on cargo transportation spectrum, which would be outside the effects and economy defined by the forest product goods.

The regional trade form the base load for trucks, cargo vessel and handling companies, which would othervice be working with much more lean and scattered market possibilities. This applies to wood, wood products but also to finished products and the ingredients such as liquid bulk and chemicals used to produce the forest industry products.

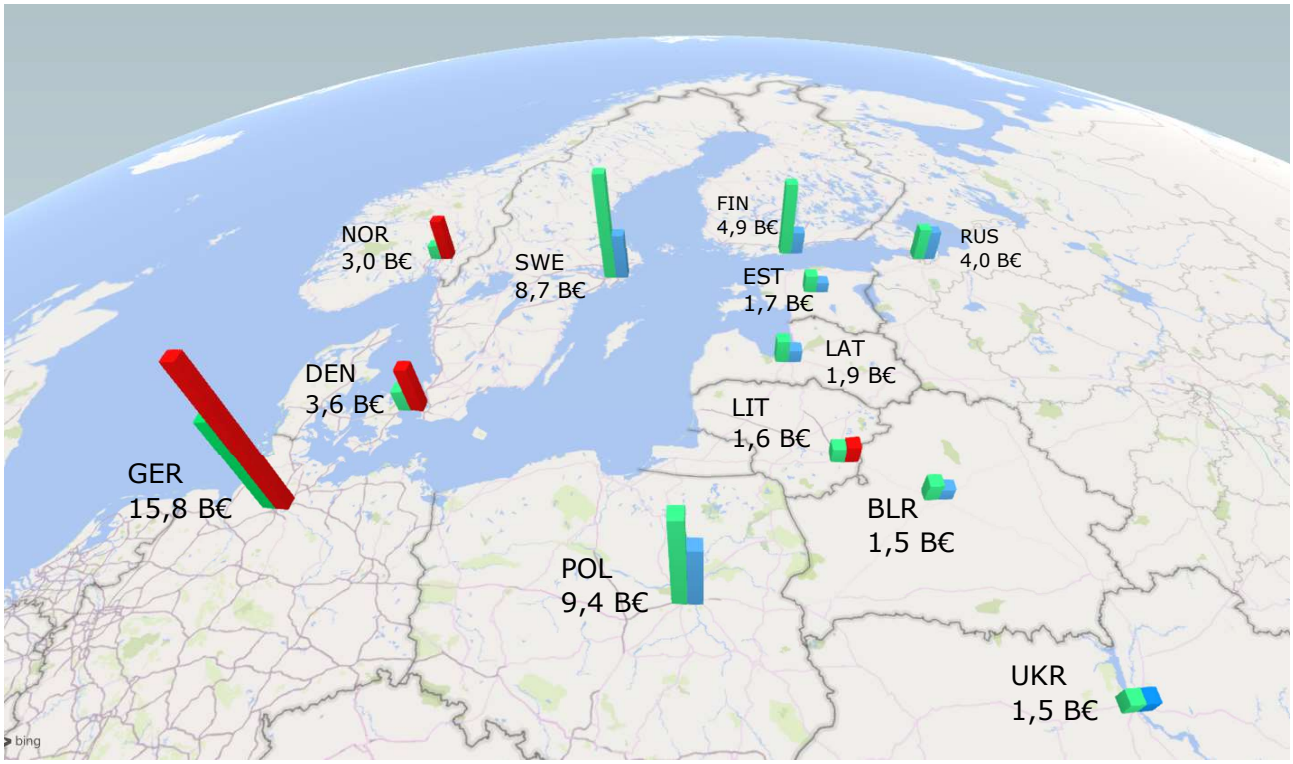
In these two ports, both in Port of Kunda and Port of Loviisa, the wood products and related commodities such as liquid bulks, wood pellets, half of the biofuels form by far more than half of all of the commodities handled in the port. In Kunda they accounted 1,2 Million tonnes (75 %) and in Loviisa 0,4 Million tonnes (51 %) of the traffic in 2018.

According to WITS, the World Bank trade statistic, worldwide wood trade for the countries of Belarus, Denmark, Estonia, Finland, Germany, Latvia, Lithuania, Norway, Poland, Russia, Sweden and Ukraine is annually a 145 Billion € foreign trade business. What is most remarkable is the volume of regional trade, the export and import of forest products between these countries, that was worth of 57,6 Billion € in 2017.

On the next page there is a graphic to illustrate the bilateral trade going on between these north European and Nordic countries. The graph shows only the bilateral, combined regional foreign trade between these countries with wood products. For instance the total worldwide foreign trade of wood of Estonia was 2 514 Million € in 2017. Out of that, 87 % were traded between Estonia and European and central Asian countries. Out of the total, 1 736 Million € (69 %) were traded between Estonia and the 11 named countries.

Picture 9 Wood and wood products form some 2/3 of the port cargo volumes. Source: Port of Kunda.

Regional foreign trade with wood, wood products in 2017



Map 1 The regional trade in EUR between the nations around Baltic sea basin (Belarus, Denmark, Estonia, Finland, Germany, Latvia, Lithuania, Norway, Poland, Russia, Sweden and Ukraine). In 2017 it was worth of 57,6 Billion Euros. This bilaterally counted, combined wood trade formed 39 % of their total foreign trade with wood products of these nations. The green bar shows the imports of wood products of each country from all these mentioned nations and blue bar of exports, if exports are bigger than imports. The deficit on imports has been shown with red bar, a country is a net importer.

Data Source: WITS, Worldbank [1]

Table 3 Wood product trade between named 12 countries, 2017. Figures in (000).

Foreign trade of wood, wood products between countries around Baltic sea in 2017								
Country	**IMP/EXP**	**Value (€)**	**Country**	**IMP/EXP**	**Value (€)**	**Country**	**IMP/EXP**	**Value (€)**
Belorussia	BLR IMP	583 300 €	**Germany**	GER IMP	10 445 900 €	**Poland**	POL IMP	3 984 100 €
	BLR EXP	916 000 €		GER EXP	5 317 900 €		POL EXP	5 405 100 €
Denmark	DEN IMP	2 500 000 €	**Latvia**	LAT IMP	680 300 €	**Russia**	RUS IMP	1 907 600 €
	DEN EXP	1 102 600 €		LAT EXP	1 189 400 €		RUS EXP	2 088 100 €
Estonia	EST IMP	669 000 €	**Lithuania**	LIT IMP	875 500 €	**Sweden**	SWE IMP	2 921 500 €
	EST EXP	1 066 700 €		LIT EXP	724 500 €		SWE EXP	5 781 000 €
Finland	FIN IMP	1 166 500 €	**Norway**	NOR IMP	2 286 100 €	**Ukraine**	UKR IMP	758 600 €
	FIN EXP	3 754 600 €		NOR EXP	761 300 €		UKR EXP	691 400 €

[1] https://wits.worldbank.org/CountryProfile/en/Country/SWE/Year/2015/TradeFlow/Import/Partner/All/Product/44-49_Wood

4.6 Berths and basin for calling vessels

Today there are 3 berths to be used for cargo operations, 3 are for general cargo and dry bulk. Out of those 3 berths, the no.4 is a multipurpose berth, capable to handle tanker vessels calling at Baltik Tank Kunda terminal. The numbering of berths run from 1-4. The berth no.1 is a short service berth, mainly used to accommodate the 1968 Karlshamn built, 61 DWT and 2200 h.p. (1640 kW) Tug boat ***Kunda***.

Table 4 Port of Kunda berths for vessels

Quay no.	Length (m.)	Depth (m.)	LOA (m.)	Draft (m.)	Cargo
1	34	7.5	35	7.0	Used as a TUG berth
2	172	9.3	150	8.5	LoLo, Bulk, GC
3	35	8.0	120	7.5	LoLo, Bulk, GC
4	103	8.2	120	7.4	LoLo, RoRo, Tankers, Bulk, GC

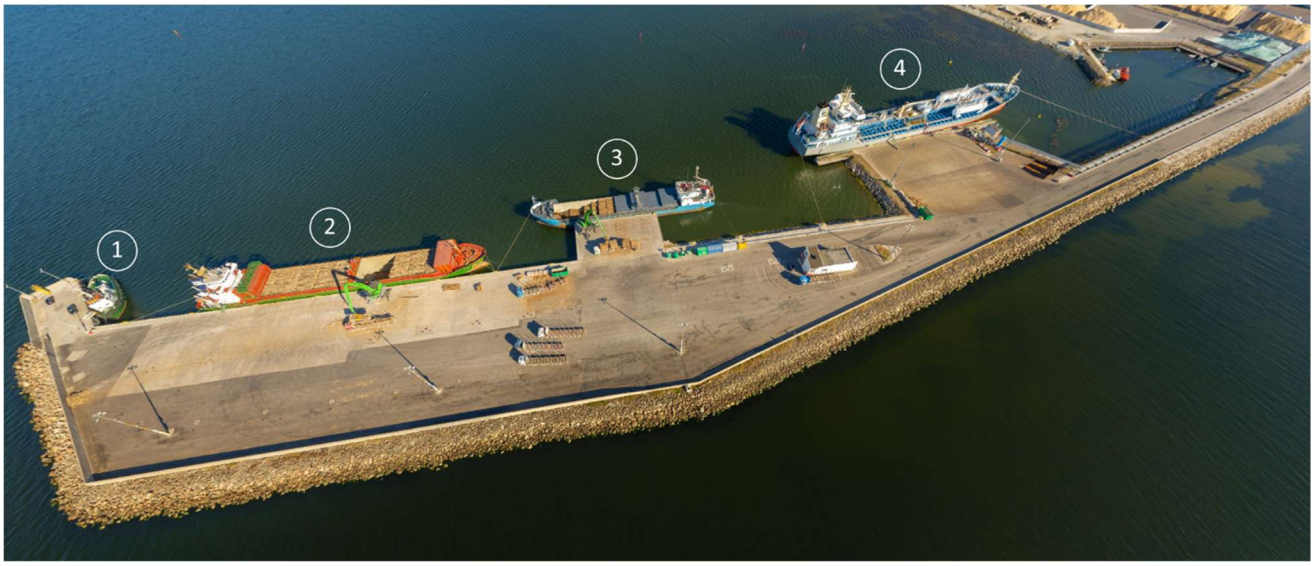
Source: Guide to port entry

The turning basin has a diameter of 280 m, minimum depth is 10.0 m for vessels of LOA 135 m. Vessels with 8.5 m draft or LOA 135-150 m with 8.0 m draft.

There is an inner service basin for small crafts and for the pilot launch, which has been stationed at Kunda. This has a positive effect on availability and response time of Pilots.

The stevedoring company has a good selection of material handling machines for the goods handled on the port area. On the pictures on this page, there are efficient material handling machines of Sennbogen make on berth area of Kunda,

Picture 10 In 2018, there were 61 000 tons of pulp passing through the Port of Kunda.



Picture 11 The four berths and inner service basin visible in this aerial picture of Port of Kunda. Source: Port of Kunda.

4.7 Resources and other important details

RESOURCES	**2019**	**2035**	
• Fairway	8,5 m	11,0 m	Pilot boarding point
• Pilotage distance	6,5 NM	6,5 NM	N 59˚ 38,0' E 016˚ 29,5'
• Turning basin Ø	280 m	330 m	
	LOA 135m, 8.5m		
	LOA 150m, 8.0m		
• Defining vessel size (l, b, d)	150 m 30 m 8,5 m	220 m 32,0 m	11,0 m
• Usable vessel size, approx.	DWT 12 000	DWT 35 000	
• Tanker size, approx.*	DWT 10 000	DWT 15 000	

BERTHS, today, *future*	**2019 l, LOA, draft**	**2035 LOA, draft**	
- 1	34 / 35 / 7,0 m		*Future, RoRo & LoLo quay*
- 2 LoLo, bulk, general	172 / 150 / 8,5 m	114 / 11,0 m	LoLo quay
- 3 LoLo, bulk, general	35 / 120 / 7,5 m	135 / 11,0 m	*Future, RoRo & LoLo quay*
- 4 LoLo, RoRo, tankers	103 / 120 / 7,4 m	170 / 8,4 m	LoLo, RoRo, tankers
- 5 Barge quay, biofuel quay		*180 / 8,0 m*	*New barge pier & yard*
- 6 New bulk and tanker quay		*150 / 9,0 m*	*New tanker & bulk quay*

LIFTING MACHINERY **	**2019**	**2035**	
• Mobile cranes	3 units		Material handling machinery type

HANDLING MACHINERY**	**2019**	**2035**	
• Front end loaders			Operator has on site
• Fork lift trucks			Operator has on site
• Terminal tractors			

WAREHOUSES & YARD**	**2019**	**2035**
• Warehouses	12 000 m2	36 000 m2 (***
• Yard area	80 430 m2	181 000 m2 (***
• Tank capacity	52 000 m3	75 000 m3 (***
• Truck scale		

RAILCONNECTION to Estonian rai network at Kunda town, 3 km away, private rail operator **Kunda Trans AS**

International Airport, Tallinn	109 km

ROAD CONNECTION

Tallinn	111 km
St.Petersburg	266 km
Tartu	162 km
Riga	379 km
Vilna	672 km
Minsk	791 km
Warsaw	1065 km
Kiev	1308 km

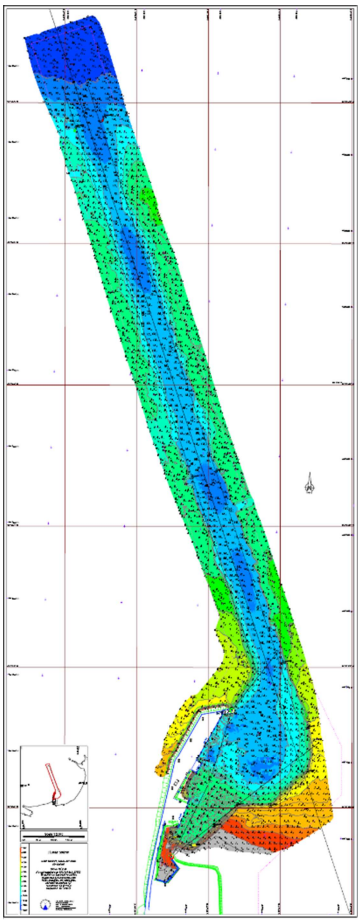
COMMODITY GROUPS: Roundwood, sawn wood, wood chips, wood pellets, sawn dust, pulp, cement, biofuel, coal, peat, agribulk, fertilizers, FIBC, IBC, Stones, gravel, sand, klinker stone, limestone, liquid bulk, gypsum, glass rubble, RDF, SRF, lime, salt, fish

RoRo-traffic to Port of Loviisa to be started in 2020

* Tanker size limited today Max LOA 120 m, draft 7,4 m.
** Additional machinery according to cargo handling need will be complemented on need to use basis

4.8 Nautical access to the port

The Port of Kunda Kunda Laht (59°32'N., 26°32'E.) is entered between Toolse Neem and Ulluneeme, 3,5 miles ENE. This bay is sheltered from S and E winds. The E and S shores are low and covered with trees, meadows, and swamps. A limestone ridge rises steeply about 1 mile S of the head of the bay. The Kunda river flows toward the bay through this ridge. Several cement works, with tall chimneys, stand on an area of high ground near the river bank, about 1.5 miles inland. A prominent mill is situated about 1.5 miles SE of the head of the bay. Extensive reefs front the shores and for the most part are covered at HW. In the E part of the bay, the depths are more uniform and small vessels are able to approach within 0,8 mile of the shore.



Picture 12 The 10,4 m deep entrance channel to Port of Kunda basin. Source: Port of Kunda

4.9 Fairway

Pilots board in position 59°38.0'N, 26°29.5'E, about 6 nautical miles from the port. The entrance channel is 70m wide and has a depth of 10,4 m. It is indicated by a lighted range and marked by buoys. Pilotage is compulsory for all foreign foreign vessels navigating through Tallin, Vainmameri, Parnu, and Sillamae. Pilots for Estonian ports as well as Deep Sea are provided by Esti Loots (Estonian Pilots).

4.10 Elements, weather, winter and ice

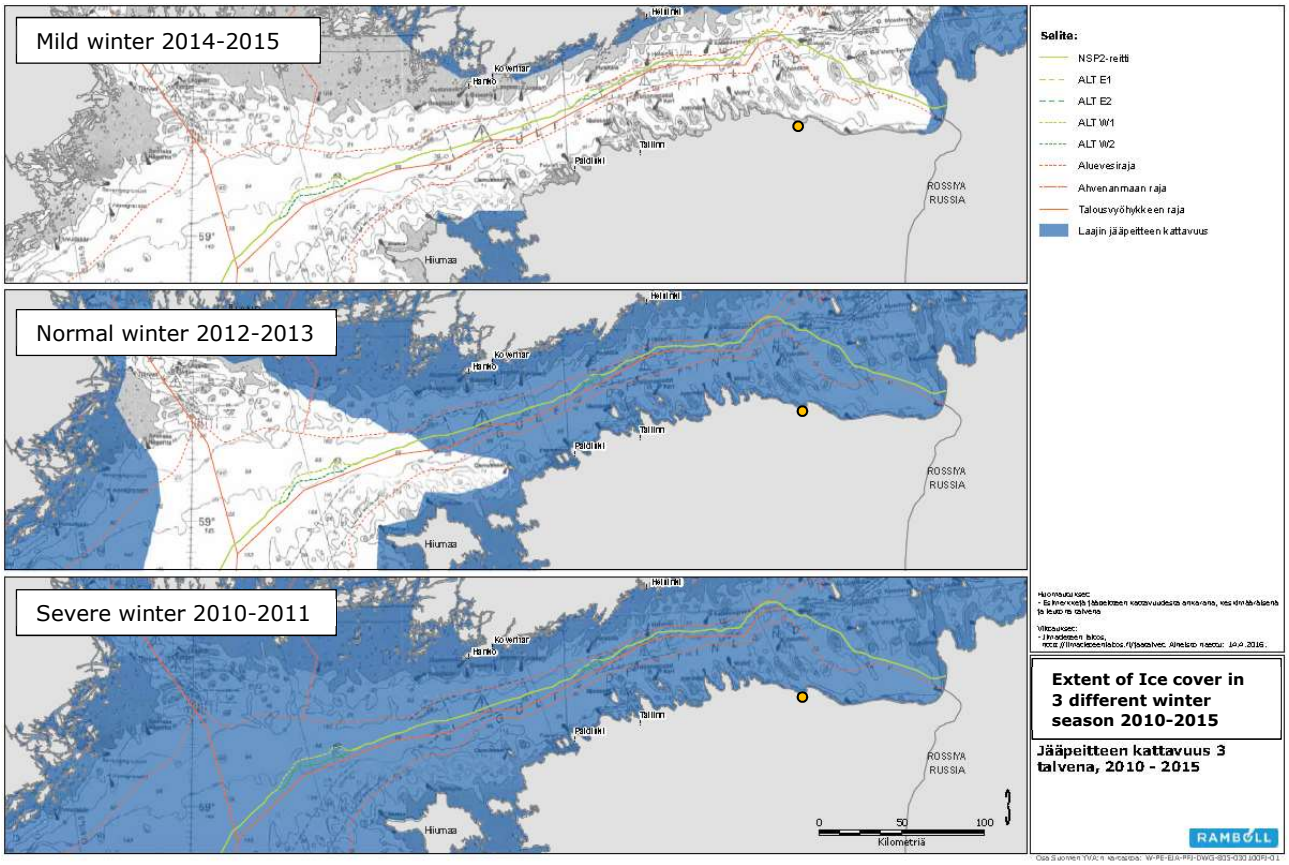
The port lies in the northern part of the temperate climate zone and in the transition zone between maritime and continental climate. Because Estonia (and all of Northern Europe) is continuously warmed by maritime air influenced by the heat content of Gulf stream on the northern Atlantic Ocean, it has a milder climate despite its northern latitude.

The weather statistics of Town of Kunda show an annual daily mean temperature of 5,7°C and in summer of some 17,1°C and in winter daily mean of –4,8°C. The extremes are another chapter, in summer the weather can climb up to 34,4°C and in winter down to -33°C. Regional seasons can be very different from year to year.

Table 5 Kunda weather statistics. Source: Wikipedia/Estonian weather service.

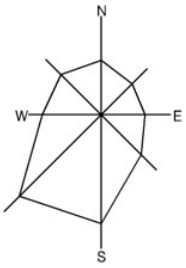
Climate data for Kunda, Estonia (1981–2010) [hide]													
Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
Record high °C (°F)	9.6 (49.3)	11.1 (52.0)	15.8 (60.4)	27.6 (81.7)	29.7 (85.5)	30.1 (86.2)	33.4 (92.1)	34.4 (93.9)	29.0 (84.2)	21.2 (70.2)	11.7 (53.1)	11.4 (52.5)	34.4 (93.9)
Average high °C (°F)	−1.4 (29.5)	−1.8 (28.8)	2.1 (35.8)	8.6 (47.5)	14.7 (58.5)	18.4 (65.1)	21.5 (70.7)	20.3 (68.5)	15.2 (59.4)	9.6 (49.3)	3.3 (37.9)	0.1 (32.2)	9.2 (48.6)
Daily mean °C (°F)	−3.8 (25.2)	−4.8 (23.4)	−1.3 (29.7)	4.1 (39.4)	9.6 (49.3)	14.0 (57.2)	17.1 (62.8)	15.9 (60.6)	11.3 (52.3)	6.6 (43.9)	1.2 (34.2)	−2.2 (28.0)	5.7 (42.3)
Average low °C (°F)	−6.4 (20.5)	−7.8 (18.0)	−4.5 (23.9)	0.4 (32.7)	5.0 (41.0)	9.6 (49.3)	12.6 (54.7)	11.8 (53.2)	7.8 (46.0)	3.8 (38.8)	−1 (30)	−4.5 (23.9)	2.2 (36.0)
Record low °C (°F)	−32.7 (−26.9)	−33 (−27)	−24.4 (−11.9)	−13 (9)	−5.2 (22.6)	−0.2 (31.6)	2.9 (37.2)	2.7 (36.9)	−3.4 (25.9)	−9.8 (14.4)	−19.7 (−3.5)	−24 (−11)	−33 (−27)
Average precipitation mm (inches)	39 (1.5)	26 (1.0)	28 (1.1)	25 (1.0)	39 (1.5)	71 (2.8)	67 (2.6)	82 (3.2)	60 (2.4)	62 (2.4)	50 (2.0)	38 (1.5)	587 (23.1)
Average relative humidity (%)	86	85	81	76	73	76	78	81	82	83	86	86	81
Source: Estonian Weather Service[2][3][4]													

The Gulf of Finland can get frozen and usually freezes to some extent every year. The extent of typical ice formation on the GoF area can be seen from the EIA document of the NS2 gas pipeline ice map section as follows.



Map 2 Map of ice formation in different winters over the Gulf of Finland area, as presented in public document, the EIA report of the NS2 gas pipeline by Ramboll

For the port operations the ice does not have big impact on prepared shipping but it gradually prolongs the transit times of vessels, increase the freight rates as more fuel is needed for the same passage. In normal and severe winter Kunda harbour tug, the Kunda is used for the port area ice breaking. On winter season there are two months, namely February and March when the ice may affect shipping, but there are also winter seasons when the ports over the GoF area are almost ice free.



Picture 13 The prevailing wind comes from SW. Source: Kunda Linna Uldplaneering

The earlier studies noted the seasonal ice but placed more weight for the effective wave protection. The current seawall on west side of the pier seems to be upgraded since the Tebodin masterplan, but the wave protection east of the fairway has not been built. As most of the expansion plans end with recommended expansion direction to be towards E and NE, those new quays will be exposed to waves penetrating into the harbour basin. This affects adversely to vessel operations and increases the erosion of quay structures. **It is recommended that these seawall and breakwater recommendations will be considered with next major port development phase where dredging and reclaiming activities take place.**

4.11 The Industrial plants near Port of Kunda

The port of Kunda owes most of its development to what it is today, to industrial company the AS Kunda Cement, which reactivated the old industrial port in late 1990's. The industrial companies have usually a large spectrum of commodities flowing both inbound and outbound during normal operations. Also while developing the plant, the industrial company seeks the easiest and most cost effective way to carry out the transportation needs.

Picture 14 The Kunda Nordic cement factory at foreground and the Estonian Cell pulp mill on the right, across the Kunda river. Picture by the AS Kunda Nordic Cement.

4.12 Kunda Nordic Cement

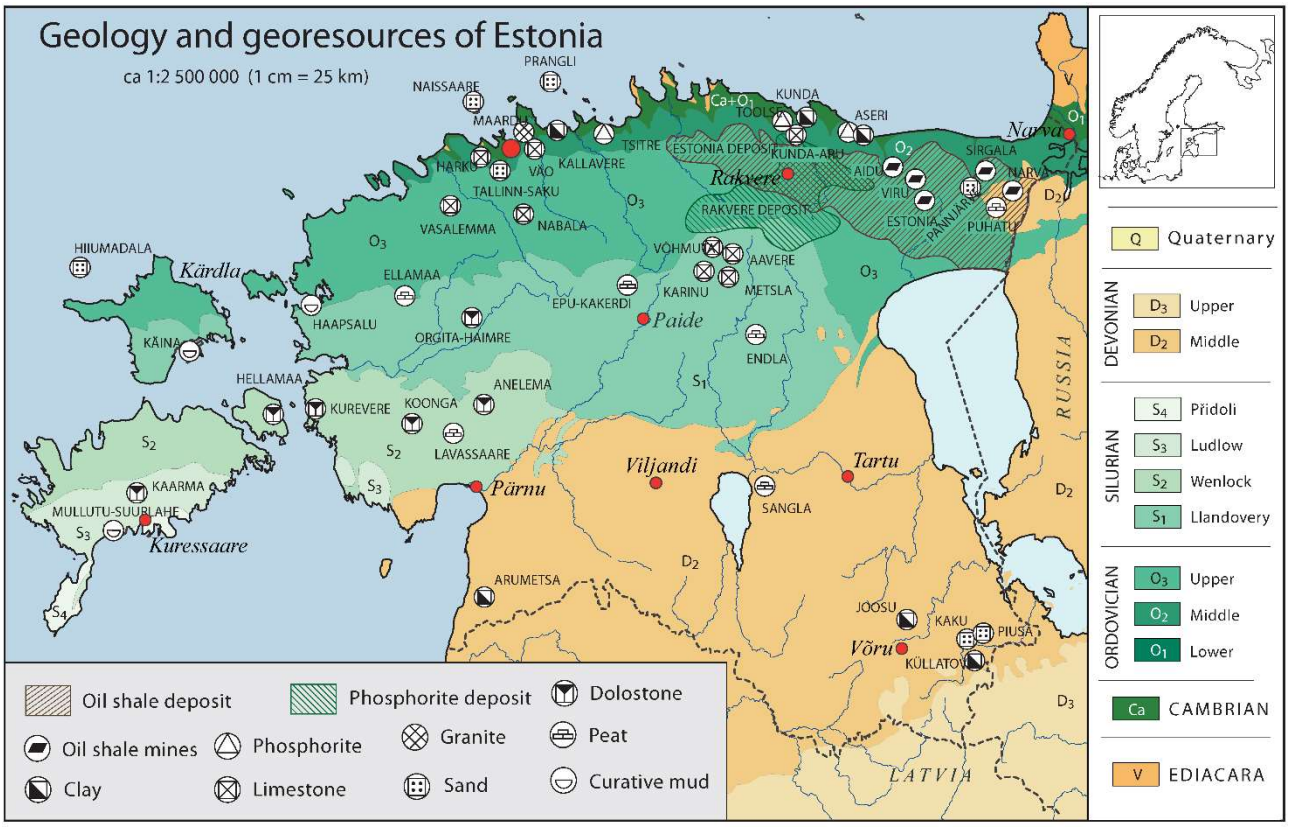
While the mill has more than 100 years history in Kunda, it is actually the third cement factory on this location, taking advantage of this deposit of high quality limestone. The company makes a 50 million EUR turnover, invested 1,6 Million EUR in 2018 and sold some 600 000 tonnes of Cement and clinker in 2018. The closest railway line of the port is at the factrory area, just 3 km from the ports gate. The railway line is operated by a private rail operator, the Kunda Trans AS.

4.13 Estonian Cell Pulp Mill

The largest foreign direct investment of all time in Estonia, the Estonian Cell plant has been in operation since 2006. The mill makes pulp with some 140 000 tonnes per year and demands some 440 000 m³ of aspen pulpwood for making it. There is industrial land available next to the Estonian Cell Kunda plant.

4.14 Estonian geological possibilities for Port of Kunda

While estimating the cargo potential for the Port of Kunda, the georesources are worth to be reviewed. The Estonian geological resources consist mostly of mineral, stone and sand like deposits and oil shale, which all are exploited up to 30 Million tonnes per year. Oil shale is used domestically and other minerals are used in domestic and foreign construction market.



Map 3 Distribution of main deposits of useful minerals, shown on the background of the geological map of Estonia. Estonian georesources in the European context, Rein Raudsepp.

4.15 Estonian geological potential in cargo perpective

The assessment of geological resources lifts three most important deposits to be shale oil, phosphorite and peat, of which of the first one and last one are already used.

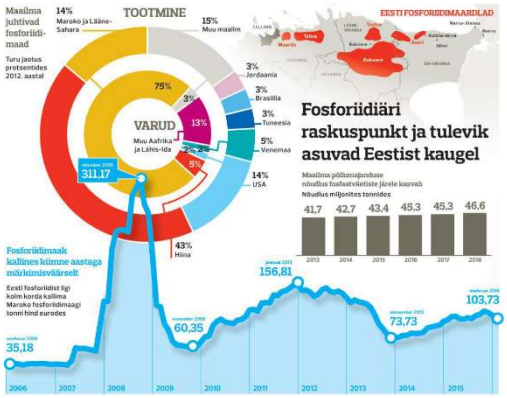
1. **oil shale**. the Estonia deposit is the largest commercially exploited and best-studied oil shale deposit in the world (Kattai et al. 2000)

2. **phosphorite**. the Rakvere deposit (well studied but not exploited) is the largest phosphorite deposit in Europe (Raudsep 1982; Puura 1987)

3. **peat**. Estonia is considered as a country richest in peatlands in North Europe, with 9836 bogs and mires covering a total of one million hectares (about 22% of the Estonian territory), and more than 300 registered peat deposits.

The oil shale is found mostly in east Estonia, at Ida-Viru Maakond area, where there are five mines in operation. Wide scale exploitation can also bring oilshale or residue transportation opportunities to port of Kunda in the future but is not considered very likely.

This is due to international controversy over the fossil fuels and therefore somewhat negative circumstances for the new developments with oil shale. Also the main depostis and current users are located more east from Kunda and perhaps do not need a port for the domestic transportation needs.



Graph 4 Reporting of phosphorite price hike, 2016 by Postimees.

Phosphorite is another matter. Despite the fact that phosphorite has a controversial history in Estonia, there are such large deposits, some 3 billion tonnes deposits, the largest in Europe. As they are located next to Rakvere at the Pandivere highground area, just behind Kunda port, it is important to be covered here in this Masterplan. The Estonian newspapers have followed the phosphorite world prices and providing a platform for the debate should the phosphorite deposits exploited and is the general public ready for the phosphorite development.

Table 6 Estonian georesources in the European context, Rein Raudsepp 2008.

Table 2. Extraction of useful minerals in 2005.2006 and the amount of registered reserves/resources as of 01.01.2007

USEFUL MINERALS		Extraction		Reserves /resources of Useful minerals as of 01.01.2007		
Please note: All figures in thousands		2005	2006	Mineable Reserves		Submarginal mineral resources (Est. categories Tp + Rp)
				Proved reserves (Estonian category Ta)	Inferred mineral resources (Est. category Ra)	
Oil shale		11 310 t	11 977 t	1 129 200 t	268 600 t	3 502 700 t
Phosphorite		0 t	0 t	0 t	0 t	2 935 700 t
Limestone	Limestone for cement	335 m3	344 m3	9 400 m3	87 900 m3	51 300 m3
	• Technological limestone	86 m3	84 m3	14 500 m3	40 000 m3	73 400 m3
	• Construction limestone	1 922 m3	2 344 m3	110 500 m3	304 000 m3	236 200 m3
Dolostone	Technological dolostone	155 m3	128 m3	12 600 m3	83 500 m3	0 m3
	• Decorative dolostone	2 m3	2 m3	2 900 m3	21 500 m3	1 400 m3
	• Construction dolostone	260 m3	378 m3	32 900 m3	98 800 m3	83 500 m3
Crystalline	Building stone	0 m3	0 m3	1 245 100 m3	1 723 900 m3	0 m3
Clay	Clay for cement	37 m3	139 m3	15 500 m3	11 200 m3	489 000 m3
	• Ceramic clay	152 m3	149 m3	10 600 m3	236 200 m3	13 400 m3
Gravel		1 157 m3	1 265 m3	32 000 m3	76 500 m3	15 000 m3
Sand	Technological sand	54 m3	51 m3	3 400 m3	4 000 m3	2 100 m3
	• Construction sand	2 070 m3	2 949 m3	165 600 m3	457 200 m3	168 400 m3
Mud	(seamud)	1 t	1 t	1 356 t	0 t	1 667 t
Peat		1 074 t	1 257 t	217 000 t	822 700 t	561 000 t

The peat is third of the natural resource. It is already exploited and transported through port of Kunda. As the demand of wood is likely to increase in years to come

due to several reasons (New pulp mills in Nordic countries, shift from fossil fuels to wood and biofuels and new development of wood distilling to biodiesel etc.) the peat is also expected to be affected and it's use as a biofuel is also likely to increase.

4.16 Railroad network and Kunda

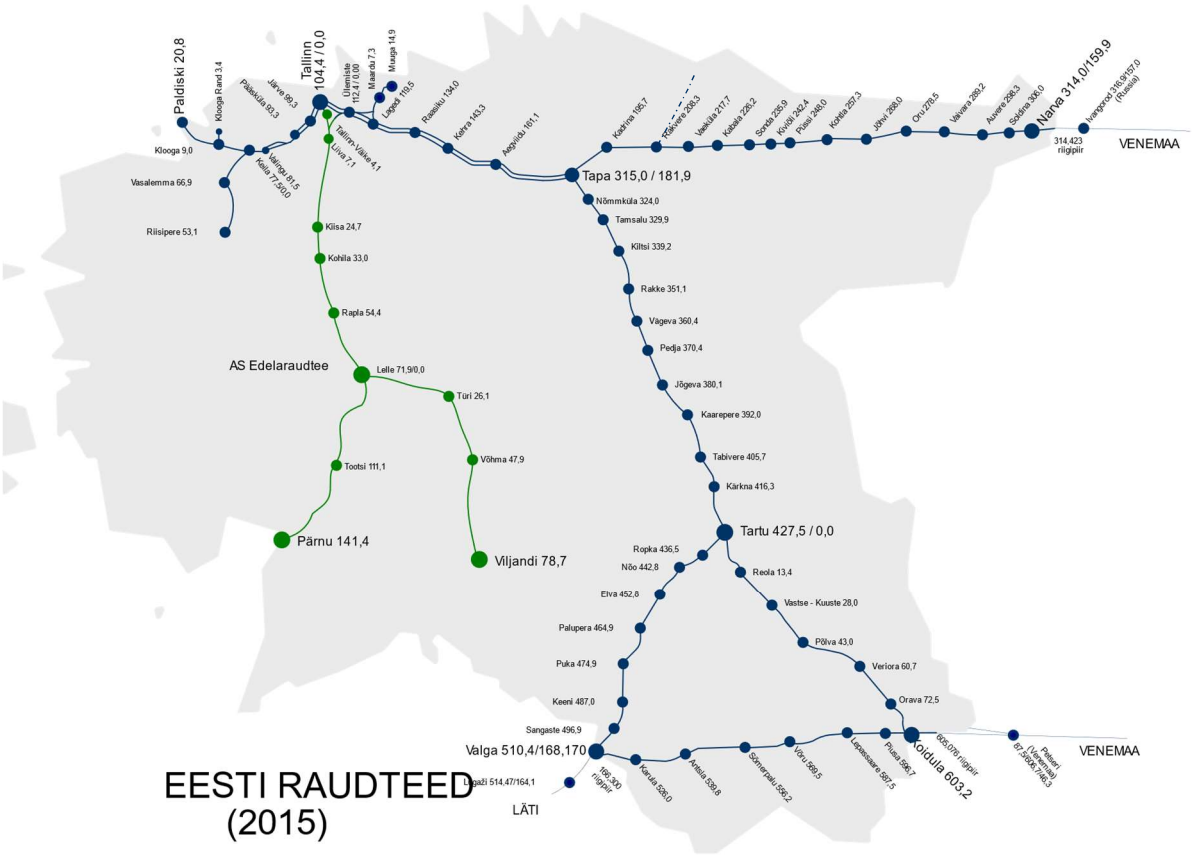
The Estonian railway network consists of 1200 km of railway track, of which of 900 km is in public use. Track from Rakvere (when departing from Kunda, the Rakvere is the first national network station) to Kunda is a private and owned and managed by the Kunda Trans AS.

The Estonian railway network is owned by the state-owned company AS Eesti Raudtee and the private company Edelaraudtee Infrastruktuuri AS. These railway network infrastructure operators provide all railway network services for railway operators running freight and passenger services.

AS Eesti Raudtee provides approximately 800 kilometres of track, of which 107 kilometres is double track and Edelaraudtee Infrastruktuuri AS maintains 298 kilometres of track which consists of 219 kilometres of main line and 79 kilometres of station line. The electrified sections are Tallinn centered tracks sections to Paldiski, Riispere and Aegviidu and they account of 133 km of the network.

Rakvere–Kunda track is 19 km long. It was built in 1896, this line connects the industrial town of Kunda to the Tallinn–Tapa–Narva mainline. The line is owned and operated by private company Kunda Trans AS.

Picture 15 Oil Shale Cargo train near Ahtme 2007. Source: Wikipedia



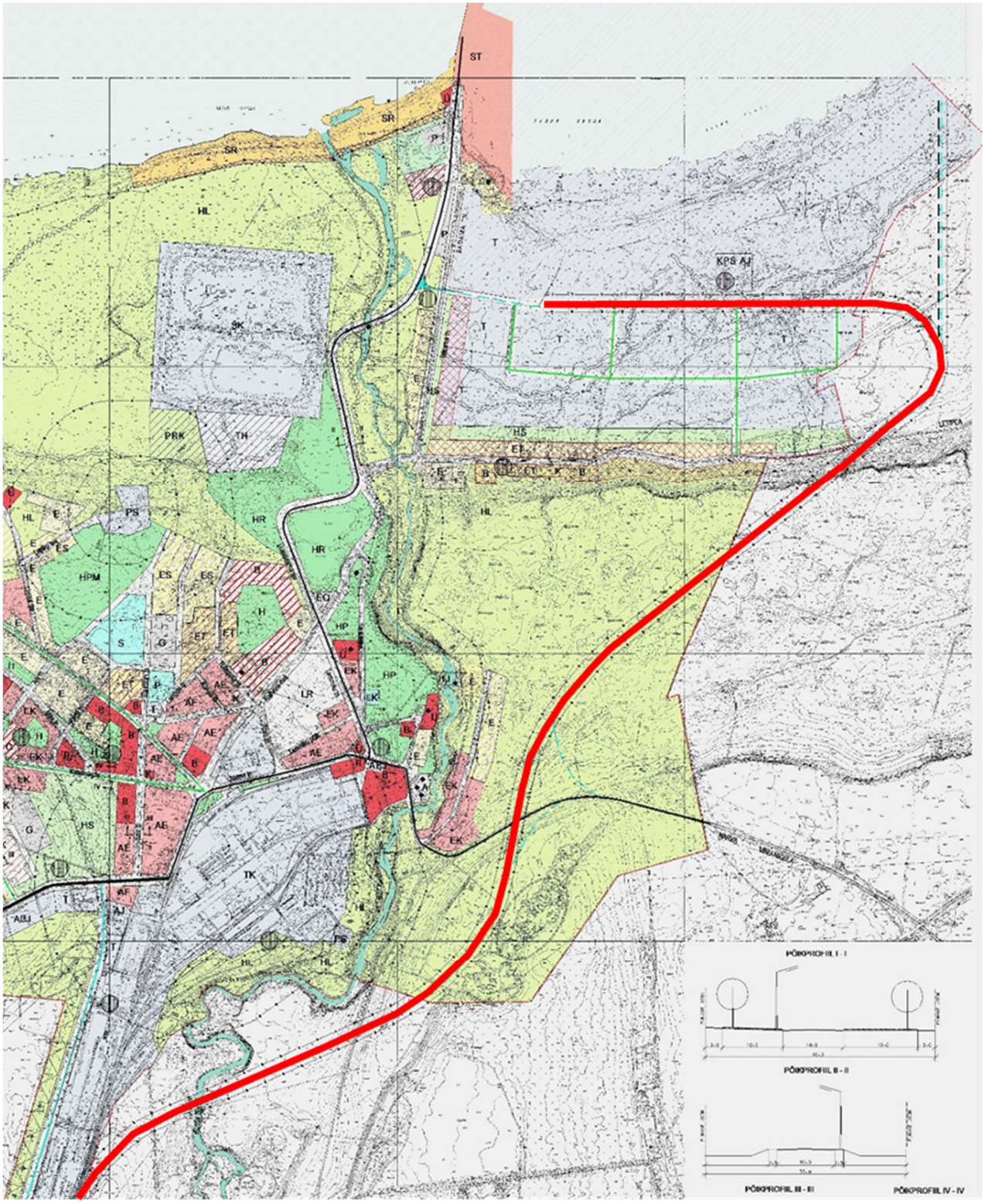
Map 4 The railway map of Estonia. Here the private brach from Rakvere to Kunda Cement factory, has been marked with a faint dashed line.

4.17 Rail access between Kunda town and port

There is not a direct rail connection from town to port area. The reasons behind this may be that the previous industrial port owner was located so close to the port, that there was no need for rail for their own export or import use. Also the ground level height differences of some 40-60 m running as a ridge in parallel with the coast line does not enable a direct routing from town to port area for a railway track.

The earlier railway plans have schetced the track to be taken over the ridge, north of the current Estonian Cell plant with NE direction. Then when the shore side 3-5 m ground level has been reached, rail would take wide turn towards the port area at the area 2 km East of the port.

The railway when built shall be planned based on thorough geological survey data. The layout should be planned so that the wide turn of the track East of the port area is far enough east to enable future bulk yard development and few of some 1,2-2,0 km railway tracks at port.



Kuva 1 The railway routing plan in the Kunda town plan (Kunda Linna Üldplaneeringu Korrektuur 1999) received for the project. The plan is from pre Estonian Cell era, but succeeds to show the early plans to take the rail to the port area. On the same year the more recent map shows the estate for plant and this rail plan has been abandoned. Here the rail makes an impossibly steep descent and tight turn to industrial port area. the operating track at port area is also too.

As the Estonian Cell plant was constructed, the Uldplaneering maps received do not show the railway route to the Kunda port area. The new routing needs a thorough geological survey on the town area and railway planning based on the results received.

In this Masterplan, the consultant took the freedom to assess the possible railway route down to the port area, behind the logistics development estates there on coastal plain.

On the following areal phograph, there has been outlined the routing down to the costal plain, which here follows the highground level of some 45 m high, as it used to be with the uldplaneering 1999 drawing, before the rail will be taken down to the ridge with long and gradual descent.

Kuva 2 The proposed rail route to the coastal plains, next to port area follows the Uldplaneering draft of 1999 but takes the rail further east to get more distance for descent and space for wider turn. The picture shows also the harbour basin proposal with east side breakwater.

The project team visited at Eesti Raudtee and had a good, constructive discussion with two decision makers in late June. The discussion delt with different track management related issues and note for the possible port track was made concerning the axle weight and the length of sidings. The current infrastructure in Estonia has been made for 32 tons axle load, which can be high but at least 25 to 28 tons should be used. The sidings should be at least 1050 m in length.

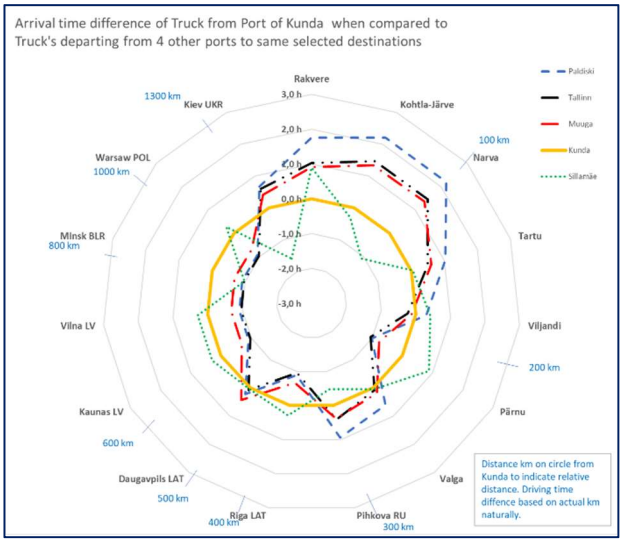
5 RORO-LINER SERVICE DEVELOPMENT

For example, RoRo-ports of Paldiski and Hanko may have shortest sea transportation distance to continental new car terminals and yet they are located on the direct axis to the largest consumer market of both countries, Estonia and Finland. They have an advantage for new car imports. RoRo-ports of Helsinki and Tallinn are within the greatest consumer markets of both countries and have an advantage to suit best for serving these markets.

Despite the fact that the main consumer areas have been located next to Tallinn and Helsinki, there are other destinations in both countries and in countries behind the following border further away and those can be served by the liner service calling in other ports along the gulf of Finland.

Do these ports have advantage due to their geographical location, or on other hand, do they have significant disadvantage when compared to alternative ports?

Driving time by truck (70 km/h) from port to selected destinations						
	Kunda		Truck driving time comparison.			
Port	Distance	Driving	Paldiski	Tallinn	Muuga	Sillamäe
Rakvere	28 km	0,4 h	1,8 h	1,0 h	0,9 h	0,9 h
Kohtla-Järve	54 km	0,8 h	2,2 h	1,5 h	1,3 h	-0,3 h
Narva	108 km	1,5 h	2,2 h	1,5 h	1,4 h	-1,1 h
Tartu	151 km	2,2 h	1,0 h	0,5 h	0,6 h	0,0 h
Viljandi	176 km	2,5 h	0,3 h	-0,2 h	-0,1 h	0,4 h
Pärnu	203 km	2,9 h	-1,0 h	-1,1 h	-0,8 h	0,9 h
Valga	236 km	3,4 h	0,6 h	0,1 h	0,2 h	0,0 h
Pihkova RU	307 km	4,4 h	0,9 h	0,4 h	0,4 h	-0,5 h
Riga LAT	378 km	5,4 h	-0,9 h	-1,0 h	-0,7 h	0,3 h
Daugavpils LAT	504 km	7,2 h	0,2 h	0,1 h	0,4 h	0,0 h
Kaunas LV	644 km	9,2 h	-0,9 h	-1,0 h	-0,7 h	0,3 h
Vilna LV	671 km	9,6 h	-0,9 h	-1,0 h	-0,7 h	0,3 h
Minsk BLR	861 km	12,3 h	-0,9 h	-1,0 h	-0,7 h	-1,0 h
Warsaw POL	1 065 km	15,2 h	-0,9 h	-1,0 h	-0,7 h	0,3 h
Kiev UKR	1 318 km	18,8 h	0,7 h	0,6 h	0,4 h	-1,6 h



Picture 16 The land side driving time advantage for Port of Kunda in relation to other RoRo-Ports located on the Estonian coastline.

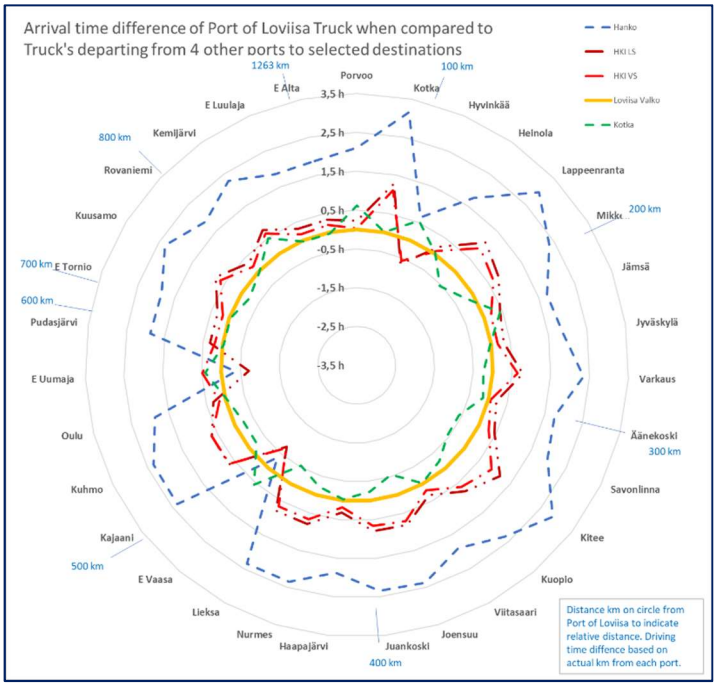
On left there are distance of various destinations from Port of Kunda and truck driving time respectively. Then columns with -1,6 h – 2,2 h shows the driving time differenece to same destination from each RoRo-port besides Kunda. For instance Viljandi shows 176 km distance from Kunda and driving time of 2,5 hours with speed of 70 km/h.

The Tallinn column shows -0,2 h, which means it takes 12 minutes (-0,2 x 60 min) less driving time from Tallinn to Viljandi than from Kunda. On Sillamae column, Viljandi shows that it takes 24 min (0,4 x 60 min) more time to drive from Sillamäe to Viljandi than from Kunda port.

On the right side diagram there is only the driving time difference indicated, Kunda is the fixed yellow arrival time of Kunda to each destination. The time difference of trucks from other ports has been shown with coloured, dashed lines.

The table shows that Port of Kunda has land side truck driving time advantage to nearby destinations but as the driving time gets longer, the difference and significance of it get's smaller, being around or less than one hour to Warsaw or Kiev*[2].

Driving time by truck (70 km/h) from port to selected destinations						
Määränpää	Loviisa	Truck driving time comparison to Kunda truck arrival time				
Etäisyys	ajomatka	Loviisa	Hanko	HKI LS	HKI VS	Kotka
Porvoo	39 km	0,6 h	2,1 h	0,2 h	0,0 h	0,6 h
Kotka	46 km	0,7 h	3,2 h	1,3 h	1,1 h	0,0 h
Hyvinkää	104 km	1,5 h	0,6 h	-0,7 h	-0,6 h	0,6 h
Heinola	125 km	1,8 h	1,8 h	0,2 h	0,1 h	0,0 h
Lappeenranta	150 km	2,1 h	3,0 h	1,1 h	0,9 h	-0,5 h
Mikkeli	177 km	2,5 h	2,3 h	0,8 h	0,6 h	-0,2 h
Jämsä	203 km	2,9 h	1,7 h	0,4 h	0,2 h	0,4 h
Jyväskylä	249 km	3,6 h	1,9 h	0,3 h	0,2 h	-0,0 h
Varkaus	266 km	3,8 h	2,3 h	0,8 h	0,6 h	-0,2 h
Äänekoski	300 km	4,3 h	1,8 h	0,2 h	0,1 h	-0,1 h
Savonlinna	305 km	4,4 h	2,0 h	0,4 h	0,3 h	-0,6 h
Kitee	325 km	4,6 h	2,9 h	1,2 h	0,9 h	-0,5 h
Kuopio	338 km	4,8 h	2,3 h	0,8 h	0,6 h	-0,2 h
Viitasaari	345 km	4,9 h	1,9 h	0,3 h	0,2 h	-0,0 h
Joensuu	382 km	5,5 h	2,4 h	0,8 h	0,7 h	-0,5 h
Juankoski	397 km	5,7 h	2,3 h	0,8 h	0,7 h	-0,2 h
Haapajärvi	435 km	6,2 h	1,9 h	0,3 h	0,2 h	-0,0 h
Nurmes	464 km	6,6 h	2,3 h	0,8 h	0,7 h	-0,2 h
Lieksa	475 km	6,8 h	2,3 h	0,8 h	0,7 h	-0,5 h
E Vaasa	475 km	6,8 h	-0,4 h	-0,7 h	-0,7 h	0,6 h
Kajaani	505 km	7,2 h	2,3 h	0,7 h	0,7 h	-0,2 h
Kuhmo	541 km	7,7 h	2,3 h	0,7 h	0,7 h	-0,2 h
Oulu	588 km	8,4 h	1,9 h	0,3 h	0,2 h	-0,0 h
E Uumaja	594 km	8,5 h	-0,4 h	-0,7 h	0,5 h	0,4 h
Pudasjärvi	670 km	9,6 h	1,9 h	0,3 h	0,2 h	-0,0 h
E Tornio	716 km	10,2 h	1,9 h	0,3 h	0,2 h	-0,0 h
Kuusamo	752 km	10,7 h	2,3 h	0,8 h	0,6 h	-0,2 h
Rovaniemi	790 km	11,3 h	1,9 h	0,3 h	0,2 h	-0,0 h
Kemijärvi	841 km	12,0 h	2,3 h	0,7 h	0,6 h	0,5 h
E Luulaja	846 km	12,1 h	1,9 h	0,3 h	0,2 h	-0,0 h
E Alta	1 263 km	18,0 h	1,9 h	0,3 h	0,2 h	-0,0 h



Picture 17 The land side driving time advantage for Port of Loviisa in relation to other RoRo-Ports located on the Finnish coastline.

Picture 17 shows there are distance of various destinations from Port of Loviisa and truck driving time respectively. Then columns with -0,7 h – 3,0 h shows the driving time differenece to same destination from each RoRo-port besides Loviisa. For instance Hyvinkää shows 104 km distance from Loviisa and driving time of 1,5 hours with speed of 70 km/h. The Hanko column shows 0,6 h, which means 36 minutes (0,6 x 60 min) more driving time than from Loviisa.

On following column, HKI LS shows that it takes 42 min (-0,7 x 60 min) more to drive from Loviisa to Hyvinkää than from Helsinki West harbour. On the right side diagram the there is only the driving time difference indicated, Loviisa is the fixed yellow arrival time of Loviisa to each destination.

The time differnce of trucks from other ports has been shown with coloured, dashed lines.

The Kunda port has absolute advantage to Rakvere, Kunda has almost the best location for the Tartu, Valga and Daugavapils, when only Sillamäe provides the same driving time as Kunda has.

[2] The destination Kiev from Estonia is behind two BCP crossings and therefore the actual times here should be viewed as a distance references only. The BCP process time can divert traffic to BCP's in more remote location in order to bypass congestion or poorly performing BCP.

For destinations more east, the Sillamäe port offers 0,5-1,5 h advantage to Kunda when comparing the distance/average driving speed calculated values. However, the BCP process time can eat the advantage very efficiently.

When looking at the port's geographical advantage on a transportation corridor, one has to widen the perspective, to include also the destinations beyond the sea leg and the sea leg also. On the following table there is a similar comparison of Finnish ports, the Port of Loviisa, which is part of the Refec corridor development. How it's location is compared to other port alternatives on Finnish coast along the GoF.

On the Finnish side of the Refec corridor, Loviisa offers similar situation as Port of Kunda on the Estonian coast. The distance and driving time to destinations located east of the country, on the Refec corridor is shorter than from the current RoRo-ports except Port of Kotka, which does not have similar direct roro-crossing over the GoF as there are in Tallinn – Helsinki and Paldiski-Hanko route. Loviisa is also well located in relation to capital region consumer base when compared access to same market from other ports. Even the Hyvinkää area can be competitive, the truck departing from Loviisa reaches the Hyvinkää just 40 to 50 minutes later than the truck leaving from port of Helsinki.

For concluding marks about the location of the Kunda and Loviisa ports, they do not provide significant location based disadvantage when compared to ports located in the capital cities. On the other hand, both ports can compete with the capital roro-market if need be. Both can offer the service time which is less than hour longer than with the truck departing from capital port. The most important aspect is that as the distance from any of these roro-ports increases, the differences in driving times is so small that both, i.e. Kunda and Loviisa ports can provide a competitive starting point for goods crossing the GoF along the Refec corridor.

Nautical considerations

The land side distance on both countries is important but not crucial one alone. As the client is looking at overall door to door transportation time, the chain has to be evaluated as a whole, land side leg - sea leg - land side leg. Another dimension would be the frequency, but we do not check that factor here. It is well known that the volumes are on the capital-capitall route and there the clien can find the best sailing frequency on the GoF.

The map of GoF on page no.8, shows the coastal cities and the territorial water limits of three nations. The nautical distance between most of the current crossing RoRo-routes are almost the same and provide about the same crossing time. Out of the planned RoRo-service, the Kunda-Loviisa Route can provide equally competitive crossing time for the trucks on Refec Corridor area and the total door to door time is acceptable.

There has been ideas to include towns like Kotka or Siillamae to towns to be served but both named towns and each individually would change the crossing time significantly. This happens as the crossing vessel can not enter into Russian territorial waters and this would mean at least 1,5 hours longer crossing time. Also the TRIK-project [3] concluded the the freight potential between Kotka and Kunda would not be significant.

Service considerations

Liner service client priorities are somewhat different from typical tramp vessel client as they are looking for standardized product to be available as advertised and consumed when client needs it as similar as possible every time. There are six key expectations the user of liner service companies values most and they can be presented in following order.

- **Freight cost** the charge of service, including addtionals
- **Frequency of sailing**, plays a big role as the liner service forms a part of the production chain and is an essential part in maintaining a lean inventory.
- **Transit time Door to Door**
- **Reliability of timekeeping**
- **Reliability of Administration,** Invoicing correctly, preferably once. Claim handling should be efficient
- **Space availability**

To build a RoRo-service commercially and establish its presence, is a long term endeavour and it takes some time.

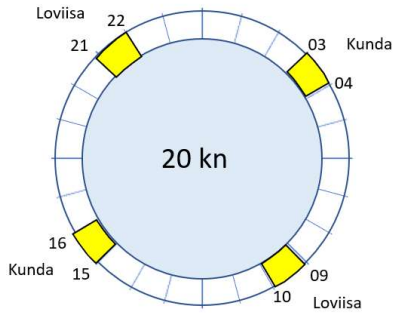
[3] TRIK-PROJECT, (Original name TRIK-HANKE) studied the freight potential between Kotka-Kunda and Kronstad triangular route in 2013.

5.1 RoRo-Development with Port of Loviisa

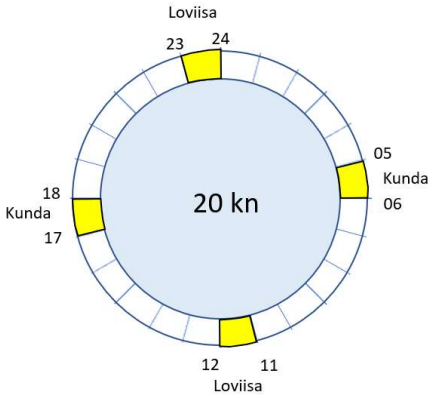
The crossing over the Gulf of Finland defines few steps or operative tresholds on that route. The distance enables two crossings over the GoF but the vessel speed has to be 17 knots or more, still then the turnaround is roughly one hour. If the vessel is faster, let's say 24 knots vessel, one can try to lenghthen one of the crossings (for the night stay in one port) by 1-3 hour, still making three other crossing in 4-5 hours time.

Underneath are some considerations of crossings and port call with yellow markings.

Southbound, from Loviisa
- Morning sailing, to morning Warsaw
- Late evening sailing, afternoon Latvia



Southbound, from Loviisa
- Noon sailing, noon Warsaw
- Midnight sailing, morning Kunda and following morning in Kiev



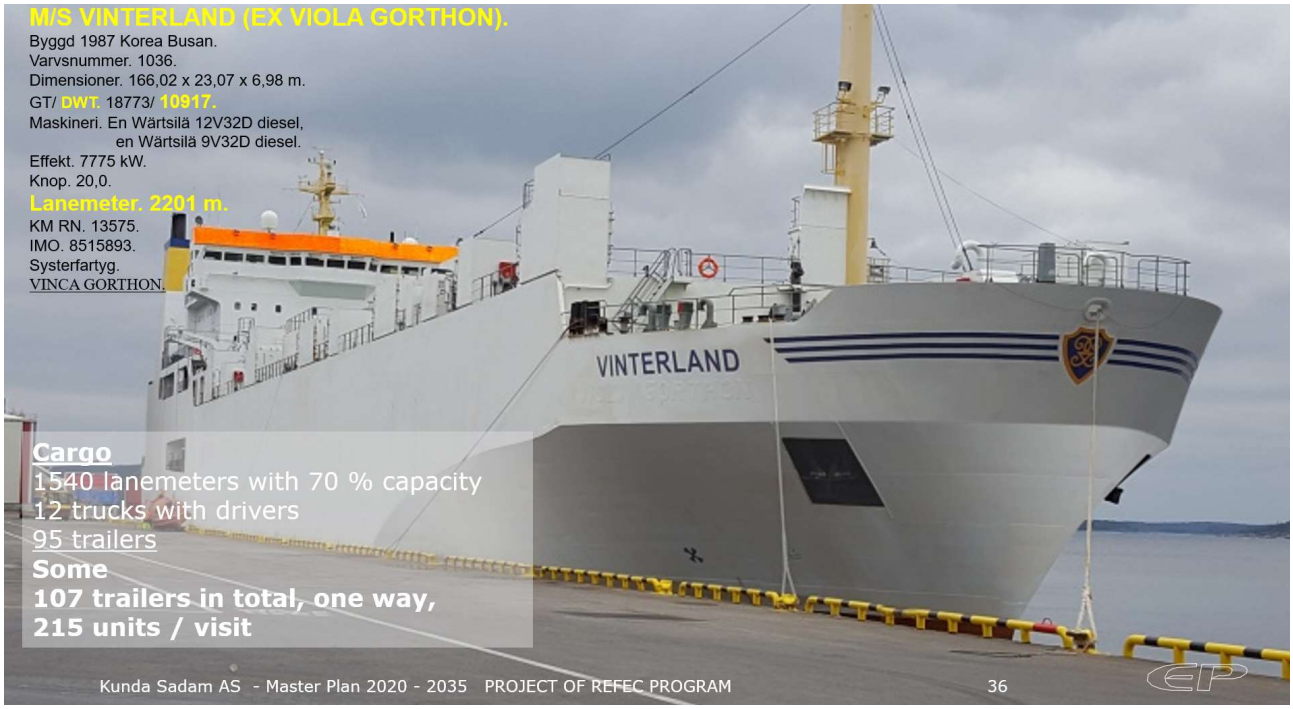
Northbound, from Kunda
- Early morning sailing, evening Rovaniemi
- Afternoon sailing, morning Rovaniemi

Northbound, from Kunda
- Morning sailing, next morning to Alta, Norway
- Evening sailing, over night to Joensuu, Kajaani

5.2 RoRo-development considerations

The traffic basics for both ports can be approached from different angles, so that the first consideration would be the traffic volume or the traffic compositions that would be carried. Here a functional and vessel size approach has been selected. The vessel size which could be set for this route could start with a smaller, having some 1500 lanemeters (lm), but if we look the tonnage making fast turnaround and which are on the market and yet competing with shortsea passenger ferries or ropaxes, one soon ends up with vessel size around 2000 lm.

Picture 18 Some of the equipment needed for RoRo-Handling, Terminal Tractor (TT) on each picture, in middle there is the goose neck, TT handling cable reels on a Mafi plaform with goose neck. Pictures: Kalmar Global, Mafi and Terberg.



For example the latest GoF addition, on Vuosaari Muuga route is Mv Finnbo Cargo with 2000 lm vessel[4]. The other vessels which were considered here under this project were the 1853 lm Mv Finnhawk and 2201 lm Mv Vinterland (picture above). When the 2000 lm is selected for port space defining vessel, the land side parking takes some more than rightly squeezed cargo onboard, then at least the space of 2200 lm is needed for the cargo to be loaded.

What comes to cargo to be discharged, the requirement is that everything should be possible to discharge but if the authorities want to check everything, there should be this 2200 m available also. Underneath there is an approach picture of the port gate area, which can be equipped to be adequate to fulfil the ISPS and access control demands of haulage companies. Additionally there is a scale needed for SOLAS weighing, on the East side, nex to the Stevedores quarters complex.

On the next page, after the street view there is a brief study over the port area for the fast turnaround arrangement of a RoRo-vessel and how to provide working conditions to other vessels and cargoes at the same time. The picture shows that it will be tight but not impossible. The early start can be accommodated with current resources as the RoRo-bert will be constructed. But as the traffic volumes increase there should be more capacity created both inside the gate area but also for the cargo quing in. Space is needed for cargo to be inspected if Customs want to hold the whole southbound convoy for thorough check before releasing them to Estonian road network.

[4] LOA 179.95, b 25.0, Draft 6.5 m, Speed 23 kn, Lm 2000, Pax 300, beds 214. Crew 47, Built in 2000, by Astilleros Espanoles, Sevilla, Spain, price (NEW) USD 65 m, GT 24 046 / 22 152, NT 6 645, DWT 7477. Lm = lane meters.

Picture 19 Port of Kunda Gate. The gate area is quite well equipped for the RoRo-Traffic. One should consider gate system, such as OCR, RFID based access control and CCTV system.

The port road view towards the berts 1-4 is presented above. The Road ahead should be reserved for RoRo-traffic and a new road for the berths 3 and 4 should be built by reclaiming the right shoreline section to take the port vehicle traffic to east side of the pipeline bridge

Picture 20 Overall capacity for the RoRo-service has beeen checked and it seems that it does not yet be adequate for the RoRo-Vessel traffic. The additions have been indicated in picture above, where the left green area and the right one show the berth extension works excecuted. The root of the pier extension would enable the port to work with other vessels regardless the RoRo-actions at the end. Rebuilding the berth no.3 and larger yard would bring the RoRo-quay area to a suffcient level for twice per day gathering of trucks, both inbound and outbound vehicles

5.3 Some Cargo groups with RoRo-vessel.

Cargo type	Loading port	Arrives or wants arrive hrs before	Discharging port	Moves or requests to move hrs after	Notes
Trucks with drivers	Drives itself onboard	As late as possible	Drives out by itself	As soon as possible	Urgent
Trailers, driver and truck waits for the unit	Stevedore loads with TT	During the day - before sailing time	Stevedore with TT	As soon as possible	Urgent
Buses, with or without passengers	Drives itself onboard	As late as possible	Drives out by itself	As soon as possible	Urgent
Route passenger with vehicle	Drives in by itself	As late as possible	Drives out by itself	As soon as possible	Urgent
Trailers	Stevedore with TT	During the day - before sailing time	Stevedore with TT	According to clients capacity and need	
Other wheeled cargo units, vehicle dealers cars etc.	Stevedore loads	During the day - before sailing time	Stevedore drives outv	According to clients capacity and need	
Vehcles or other construction machinery	May need to wait for special truck	During the day - before sailing time	Stevedore drives out	According to clients capacity and need	
Boats, construction elements, sub assembly units	Can be flexible or demanding	During the day - before sailing time	May require or seek port storage time	According to clients capacity and need	Important, do it well, stays with you. Damage or steal, the reputation affects to other cargoes as well
Akward units	Can be flexible or	During the day - before	Can be flexible,	According to agreement	Nothing better

	demand-ing	sailing time the sailing time	May re-quire or seek port storage time		
Casettes, mafis	Steve-dore loads with TT	Gradually according to each traded and agreed commodity group	Steve-dore with TT	collected and secured before voy-age and to be transfer to storage after the voyage	Fill up cargo, or important depending on overall com-mitment
Other goods	Seeks for special service, pays for special service	Gradually according to each traded and agreed commodity group	Seeks for special service, pays for special service	According to clients ca-pacity and need	Special clients
IMO DG units, trailers, con-tainers, tanktainers on wheels, chassis, trail-ers, on pallets	One should work to be capa-ble to handle these cargo groups DG,s	During the day - before sailing time	Steve-dore drives out	According to clients ca-pacity and need	Industry would be happy if this service can ac-cept IMO's

Picture 21 Some RoRo-Cargo groups around Transfennica ConRo-Vessel. The casettes and mafies are stored in "attack"-position on WH on back of the picture.

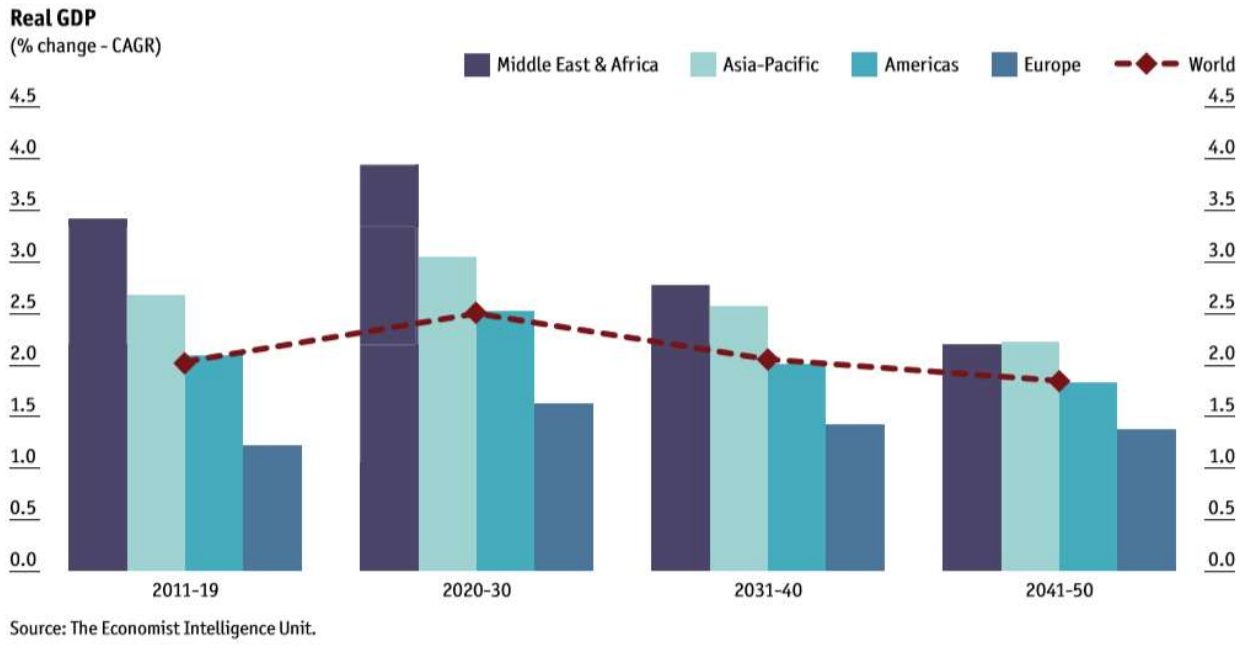
6 DEVELOPMENT SCENARIOS

The crystal ball can be hard to find, but there are certain ways to make things easier in forecasting of cargo traffic. In Port of Kunda there are certain ways to categorize traffic, to make the process more simple and generalize things but still creating scenarios to accommodate assumed or possible changes in 17 years time ahead.

The base of general port traffic estimate is the GDP development. Currently the latest is the IMF forecast for Euro area, released on week 30, 2019. It shows the revised GDP forecast for 2019 and 2020. The remaining years are hard to develop, many respected forecasting institutions give just general figures but who can blame for that. The prevailing economic uncertainty is expected to continue and the general GDP forescast predcicts quite modest growth for years to come.

The prevailing assumption is about 1,5 % GDP rate and that has been used here. How it effects trade volumes, there has been some relationships between GDP rate and tonnage recorded in port tonnage turnover. That is usually used as follows: tonnage is 2 x the GDP rate. That does not apply to all commodity groups, not to unitized transport and does not accommodate sudden chages such as establishment of new shipping line or new port, where with one port one should think the zero sum game and chages can be different from GDP change.

The base scenario has been formed by first segmenting groups according to pie graph earlier into 6 basic cargo group. Each group has been estimated how they behave



Graph 5 The long term GDP growth pedictions by the Economist Intelligence unit.

differently from the 2 x GDP development. What are the expectations in Kunda of around GoF area. The recent forest product trends predict that the regional trade with products but also with round wood and other raw materials may stagnate to one percent growth rate for few years ahead. Another trend will be the biofuel development, which has been

estimated here to grow 1, 3 or 5 times the forecasted GDP growth, depending on the economic scenario.

The larger global trends underline the shift to renewables to be swift so that in 2050 half of the global energy used comes from renewable energy sources (today only 8,4 %). By the 2040, the population will be above 9 billion and the energy consumption has increased up to 30 % from today's level.

6.1 Structure of forecasts

In this scenario the case has been looked like no other than GDP conveyed trade growth takes place in Kunda port. This is a baseline case, not the worst one, as the following scenario looks in to down turning economy. The third economic condition is the good economy case, worked through those 6 commodity groups individually.

In basic case, the annual GDP follows the IMF 7/2019 and the Economist long term predictions. The other commodities follow the GDP rate by multiplying that with 2 in general, and with 3 regarding the biofuel development, which is expected to be much higher due to prevailing trends but here excessive predictions has been tried to be avoided.

In Low economy case the overall GDP rate follows the IMF and The Econimist rates but the multipliers such as 1 for forest products, liquid bulk and other commodities. The low trend follows the "Japanese economy" path, which can be assumed to be experienced here in northern Europe for the next 20 years due to structural changes in economy, digitalisation and changing consuming habits.

In Good economy cases the multipliers are 2,5 in general and 5 for the biofuel. Even though the biofuel figure is high, it is not considered unrealistic with the real term growth for biofuels starts from 131 k.t. and reaches to 450 k.t., which cannot be considered to be a miraculous volume change in 17 years time.

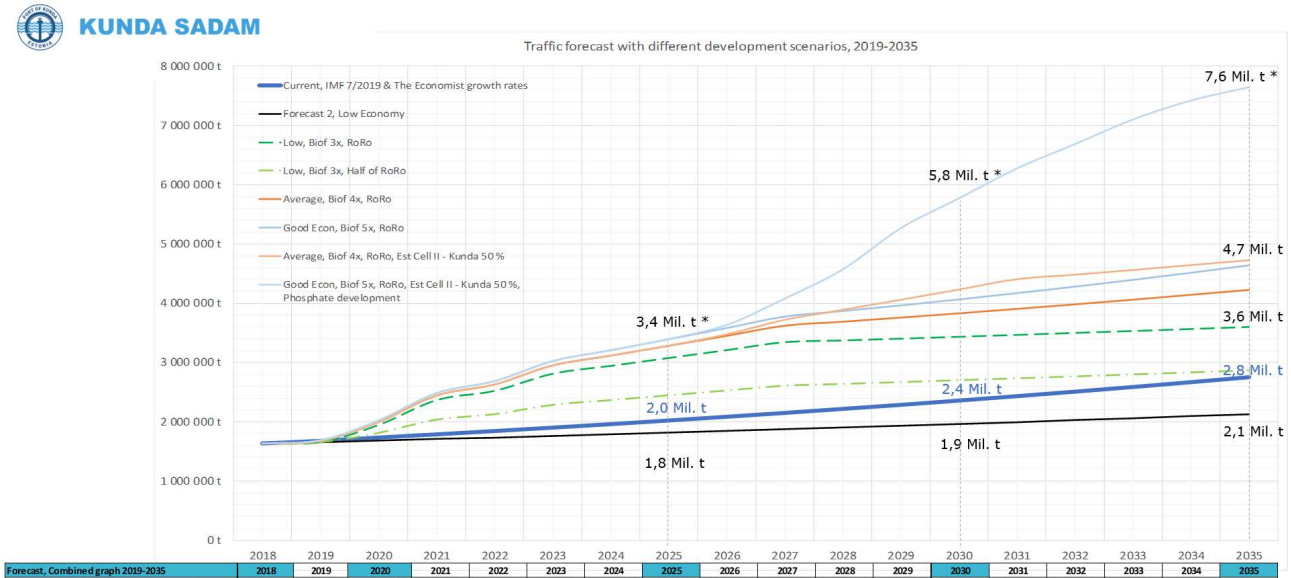
These were the basic underlying base loads. Then there are the add-on's to be considered. The RoRo-traffic volumes, which are not formed here by the basic economy derivables as such, are on the maket already, driving through different routes now. The RoRo-vessel would carry some 290 000 tons of cargo on first year in 2020, 440 000 t on next year with two daily calls on each end.

Then there could be other tonnage changing decisions, which are not even on the crystal ball but those have been included in these scenarios to show what they could mean in Port of Kunda. Those are the Eastonian Cell Investment, called here as Estonian Cell II. There are additional estates next to current pulp mill and here it has thought that it could be decided in early of 2020's and by 2025 it could be visible in port tonnage and by 2031 it had reached the full volumes, half of the all volumes, 500 000 t (Inbound and otbound) would go through he Kunda port.

The last forecasting leap has been taken with phosphorite. The deposits are large and only time will tell, did Estonia develop the deposit and started to trade with it or is it still considered to be such an environmental hazard. What comes to Kunda and possible phosphorite development, it needs a new loading facility. Here in this development plan,

the fairway down to 11,0 m (bottom in 13 m) has been used and related vessel size would be a 35 000 DWT carrier.

More reasonable could be the jetty type protruding quay, like the Sillamäe started with or more shelterd outer roadsted created harbour basin, to accommodate vessels of Panamax size. Here it has been assumed that there will be a national incentive and Estonia will develop the export facility with international partner. The first 200 000 t will be shipped in 2027 with kunda 10 m fairway and vessel size of 25 000 DWT. The following year the phosphorite shipments reach 500 000 tonnes and a million tonnes by 2029 as the terminal is gradually becoming fully operational.



Forecast, Combined graph 2019-2035	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035
Current, IMF 7/2019 & The Economist growth rates	1 635 000 t	1 679 000 t	1 735 000 t	1 789 000 t	1 845 000 t	1 903 000 t	1 962 000 t	2 024 000 t	2 087 000 t	2 152 000 t	2 220 000 t	2 289 000 t	2 361 000 t	2 436 000 t	2 512 000 t	2 591 000 t	2 673 000 t	2 757 000 t
Forecast 2, Low Economy	1 635 000 t	1 656 000 t	1 682 000 t	1 708 000 t	1 733 000 t	1 759 000 t	1 787 000 t	1 815 000 t	1 843 000 t	1 872 000 t	1 901 000 t	1 932 000 t	1 963 000 t	1 995 000 t	2 028 000 t	2 061 000 t	2 094 000 t	2 129 000 t
Low, Biof 3x, RoRo	1 635 000 t	1 656 000 t	1 945 000 t	2 364 000 t	2 521 000 t	2 809 000 t	2 942 000 t	3 075 000 t	3 208 000 t	3 342 000 t	3 371 000 t	3 402 000 t	3 433 000 t	3 465 000 t	3 498 000 t	3 531 000 t	3 564 000 t	3 599 000 t
Low, Biof 3x, Half of RoRo	1 635 000 t	1 655 800 t	1 813 600 t	2 035 700 t	2 126 900 t	2 284 200 t	2 364 100 t	2 444 500 t	2 525 400 t	2 606 600 t	2 635 900 t	2 666 800 t	2 698 200 t	2 730 200 t	2 762 700 t	2 795 800 t	2 829 500 t	2 863 700 t
Average, Biof 4x, RoRo	1 635 000 t	1 679 000 t	1 997 000 t	2 445 000 t	2 632 000 t	2 953 000 t	3 117 000 t	3 284 000 t	3 452 000 t	3 622 000 t	3 690 000 t	3 759 000 t	3 831 000 t	3 906 000 t	3 982 000 t	4 061 000 t	4 143 000 t	4 227 000 t
Good Econ, Biof 5x, RoRo	1 635 000 t	1 690 000 t	2 023 000 t	2 485 000 t	2 688 000 t	3 026 000 t	3 209 000 t	3 395 000 t	3 585 000 t	3 779 000 t	3 872 000 t	3 968 000 t	4 069 000 t	4 175 000 t	4 285 000 t	4 400 000 t	4 520 000 t	4 646 000 t
Average, Biof 4x, RoRo, Est Cell II - Kunda 50 %	1 635 000 t	1 679 000 t	1 997 000 t	2 445 000 t	2 632 000 t	2 953 000 t	3 117 000 t	3 285 000 t	3 477 000 t	3 722 000 t	3 890 000 t	4 059 000 t	4 231 000 t	4 406 000 t	4 482 000 t	4 561 000 t	4 643 000 t	4 727 000 t
Good Econ, Biof 5x, RoRo, Est Cell II - Kunda 50 %, Pho	1 635 000 t	1 690 000 t	2 023 000 t	2 485 000 t	2 688 000 t	3 026 000 t	3 209 000 t	3 398 000 t	3 635 000 t	4 079 000 t	4 572 000 t	5 268 000 t	5 769 000 t	6 275 000 t	6 685 000 t	7 100 000 t	7 420 000 t	7 646 000 t

* Phosphorite is a huge opportunity, yet, berth capacity has not been sufficiently addressed in current plans to support phosporite, also fairway deepening needs to be studied more thoroughly

6.2 Intial scenario 0+ future

In 0+ scenario the first years follow the IMF forecast until the 2020. After that estimates the GDP growth to be 1,5 % as in the Economist magazines long term development document. There is no RoRo or any other new cargo group present in this forecast. It gives traffic forecast of 3,1 % throughout the period until **2035, where the traffic is 2,76 million tonnes**. This has been indicated with thicker blue line.

6.3 Sc 2: Low economy, Stagnated economy

This shows the cargo development with 1,6 % growth rate on average (there can be much worse years, but average has been shown. The low economy ends in **2,1 million tonnes in 2035.** The development has been described with black line.

6.4 Sc 3: Low economy, biofuel development, RoRo traffic

This scenario starts with RoRo-line start in 2020, gradually increasing cargo quantities and frequency to 2 calls per day. Volumes in **2035 would be 3,6 million** tonnes and the path has been expressed with darker green dashed line.

6.5 Sc 4: Low economy, biofuel development, half of RoRo traffic

This is the lean RoRo development, less successful than in the previous case. The RoRo-traffic does not built up, despite best efforts and marketing work. The RoRo-volumes are half of the previous one, barely justifying one call per day, perhaps with smaller vessel to minimize losses. **The total traffic in 2035 would be 2,86 million tonnes**. The annual volume is barely larger than with the 0+ case. The development path has been indicated with pale green dashed and dotted line.

6.6 Sc 5: Average economy, RoRo-traffic

This scenario shows the good development of RoRo-line and follows the 0+ line in parallel path. **The traffic in 2035 would be 4,2 million tonnes**. The path has been marked with darker orange line.

6.7 Sc 6: Good economy, RoRo-traffic

Here the higher volumes come by better economy. **The cargo traffic by 2035 would be 4,65 million tonnes**. The path shown with darker light blue line.

6.8 Sc 7: Average economy, RoRo-traffic, EC-II kunda 50 %

The economy follows the 0+ path. The Roro-traffic would start, the Estonian cell II will start in 2025. The traffic volume would be 4,7 million tonnes by 2035. The development has been shown with paler orange line.

6.9 Sc 8: Good economy, RoRo-traffic, EC-II kunda 50 %, Phosphorite development by 2026.

The Phosphorite becomes a national project and Kunda will be developed rapidly. The Estonian Cell expands and EC II will channel half of the traffic through the Kunda port. By 2035 the combined volumes of basic traffic, successful RoRo-traffic, forest products and phosphorite exports make some 7,5 million tonnes cargo volume. The development has been indicated with a pale line, but perhaps it stands out on its own and these colour eplanations are not needed with Sc 8.

6.10 Conclusions

There are good cargo prospects with Kunda port but there are also needs to built up the infrastructure to be ready to cope with the future traffic. Most importantly there are the needs for the RoRo-traffis. At the same time export capacity of biofuels should be improved by constructing new barge quay. On the landside the rail connection would be in the interests of the port owners, of local community and of Estonia as country as well. The rail access to industrial sites and to costal plain behind Port of Kunda, would bring the port to new scale and timber and smaller, specialty bulks, both dry and wet bulk flows could be seen traded through Kunda quays.

The national interest with phosphorite development should be kept in mind. One political climate may not develop it but another one may see that it is good for the country and economy as general. Therefore the east side of the basin should be reserved for this kind of phosphorite development.

6.11 FinEst Link

In the late 2017 and early 2018, the Finnish Estonian ministerial task group became public and informed about Helsinki Tallinn assignment, known as **the FinEst Link.**

Overall the project is very similar to Channel tunnel project, where three parallel tunnels are running under the seabed and providing access for passenger and cargo with shuttle trains. This tunnel FinEst Link could be the longest in world under the seabed, 1,87 times the length of the Channel tunnel.

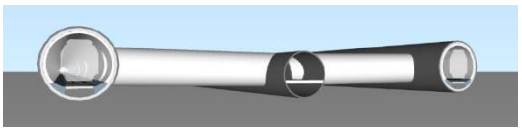


Figure 3 Finest Link plans for 3 tunnels, 2 for shuttle trains, 3rd for service. Source: FinEst Link presentation.

Cost estimate of FinEst link is 14-20 billion EUR. Investment decisions have not been made and schedule has not been confirmed but estimates have indicated that it could be operational in 2050.

Besides the **FinEst Link**, there are other initiatives for the same connection, such as **FinEst Bay Area Project**, **Ankurtunnel** and **Hyperloop Talsinki** developments they indicate much shorter implementation time and costs about the same or significantly less than earlier mentioned estimate.

The main question here is what are the predicted effects of the tunnel fort the shipping and cargo transport?

The FinEst task group made thorough study and surveyd the effect with similar tunnels and bridge initiatives and came into following conclusions:

THE TRAFFIC DEVELOPMENT ESTIMATE OVER THE GoF 2016, 2050

Scen 0, Helsinki Tallinn 2016 Maritime cargo 3,8 mtpa

Scen 0+ Helsinki Tallinn 2050, (with Rail Baltica) Maritime cargo 6,9 mtpa

Scen FL Finest Link 2050, Cargo Crossings, Tunnel & Marine 8,4 mtpa
Tunnel cargo 4,2 mtpa
Maritime cargo 4,2 mtpa

These estimates follow the pattern experienced with the earlier examples of Channel tunnel and Swedish Danish bridge. Today there are 83 ferry departures per day across the English channel and 49 train departures. The tunnel absorbs some of the traffic previously transported by ships but at the same time it also generates new economic activity and increases trade.

Cargoes, unitised cargo and vehicles which do stay with maritime transport can be named as follows:

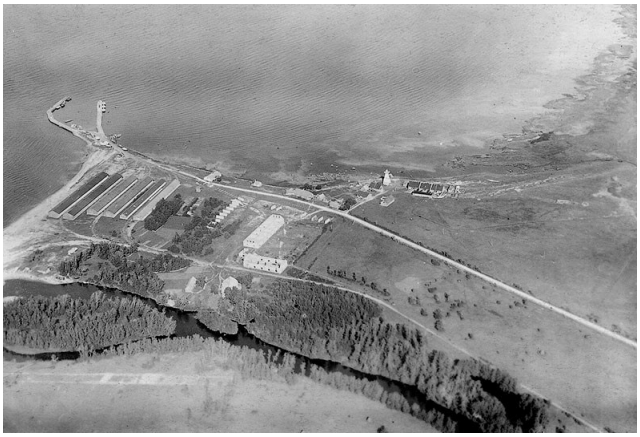
- Bulk products, both dry and liquid bulk with lesser value and in large quantities
- Breakbulk goods which find better economies of scale with maritime transport
- Unitized cargoes, some IMO goods which are not accepted to tunnel
- Hazardous goods in bulk or in intermediate containers¨
- Awkward units
- Heavy vehcles
- Project cargoes
- Some recyckled cargoes, which may not be accepted into tunnel

The conclusion about the tiunnel project effects are that it will attract some of the unitised traffic and passengers crossing the GoF currently with ferries. However, there are commodities, cargo groups and passengers still seeking to use ferry connection over the GoF.

7 DEVELOPMENT PLANS

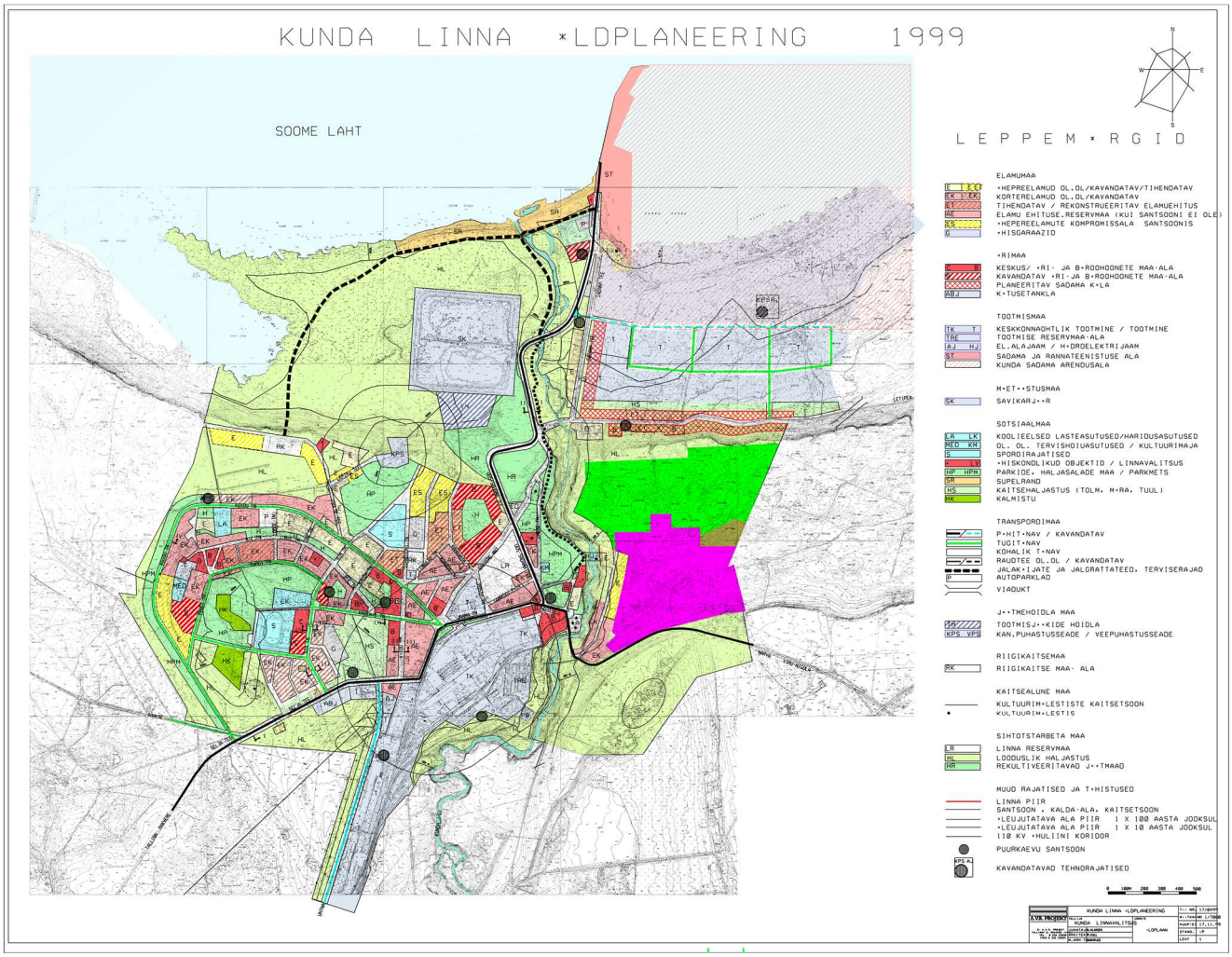
7.1 General

Current berth provide berthing place for 3 commercial vessels at the same time, which together with size range available do set a ports operating glass roof to be in total of some 5 - 6 million tonnes per annum and it means some 3,5 million tonnes with tankers and 2,0 million tonnes with dry cargo vessel. Higher lifts can be achieved but then the port becomes congested, earlier on land side and gradually by seaside. Then the rates for shippers gradually deteroriate as the owners will put a premium for waiting time expected.



Picture 22 Port of Kunda in 1930. Picture: Port of Kunda

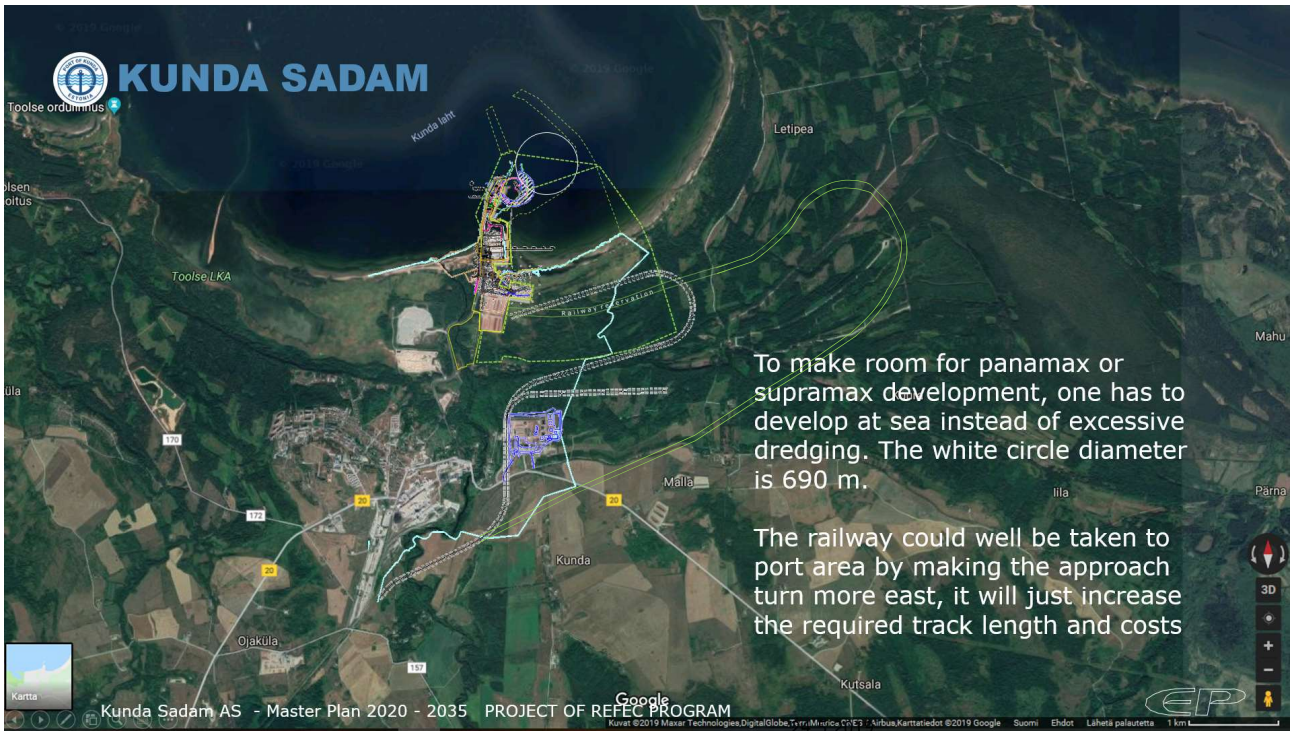
The first thing to do before anything is to conduct thorough seaside, landside and pier condition geological survey. This is essential to have before planning anything further as it makes a huge difference in structures,



their foundations, in cost of dreging, quay construction needs, in all structural possibilities which can be utilized.

Operatively the old Masterplans have suggested to dredge the whole basin next to the tanker berth no.4. That may be a good Idea but one has to get more clear picture about the geology of the basin and about the dredging costs.

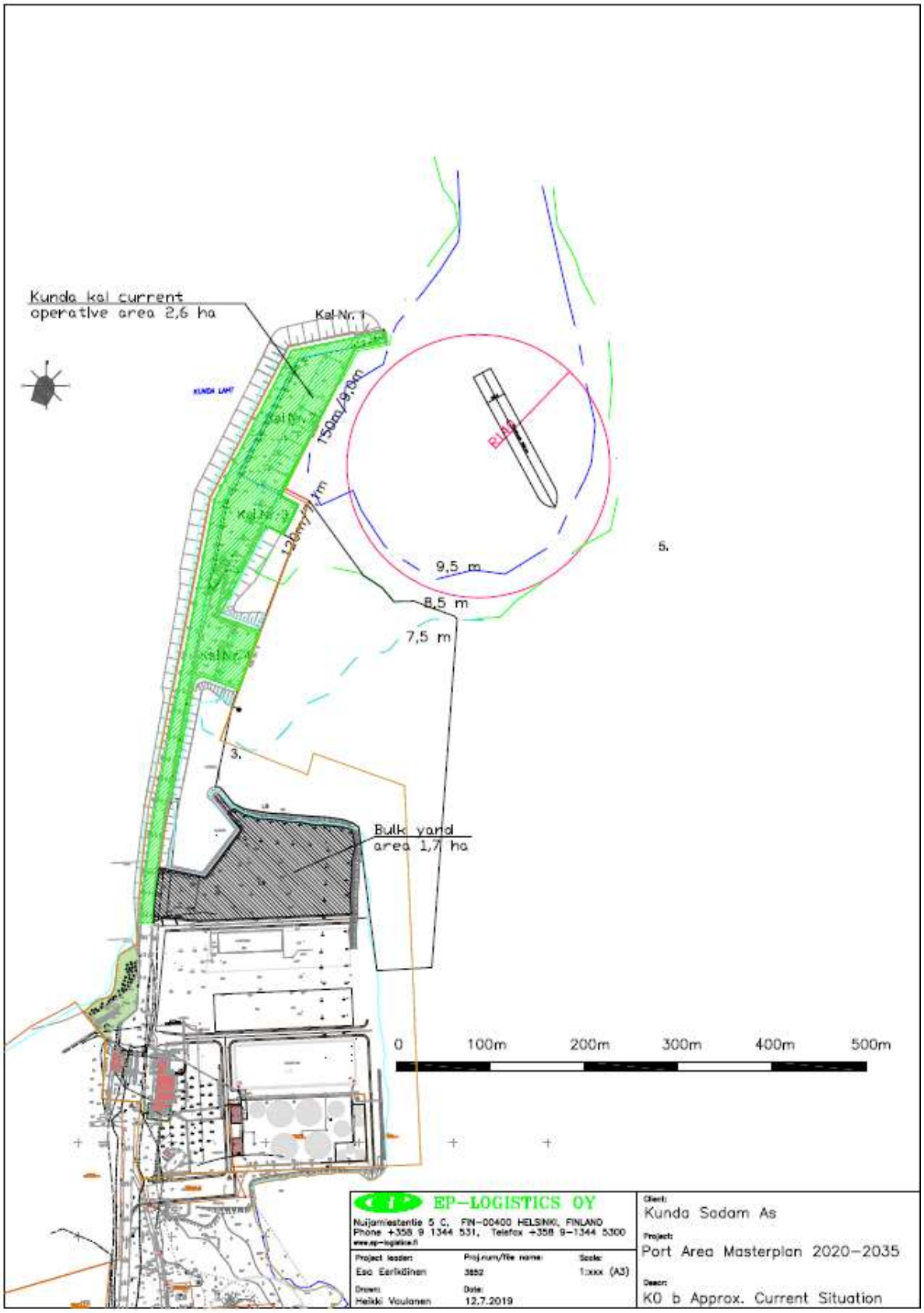
The survey should be conducted a good distance further away as the future may arrive sooner than expected. This refers to possible phosphorite development. This may be done in co-operation with the Town, as they have a mutual interest for industrial development of the Town area. The point is to be ready with the rough geological plans and costing if a current client needs more logistic yard for timber exercises, if the railway construction becomes viable, if the Estonian cell decides to expand or the national project of phosphorite edges forward. Then some idea about the geology would be good and give better position in industrial development in relation to the rival port.



Picture 23 Here in this google map sketch there are two layout ideas for the rail, just to show the approach to the logistic and industrial areas next to the port. On the coastal plains area, the

In addition to geologic survey, one should make preparation needed on the permit process for making the port ready for the construction projects. On the development pictures the yellow permitted area limit has been indicated. Currently it is so tightly applied and approved that it allows the maintenance construction of berth 3. And a new barge quay no. 5 to be constructed but not dredging. The change of permitted marine construction limit should be one of the first priorities of the port management in the near future.

7.2 K-0 Current situation



Picture 24 Currennt situation in Port of Kunda. Yellow line marks the area where construction projects and changes are straight forward to excecute.

The current layout has been presented on CAD picture on previous page. The development needs can be set based on different priorities but regardless the traffic sector, the quay condition is one of the first priority, and the other priorities can be defined through earning capacity assessment with associated costs.

The development needs have been listed as follows.

- Geological survey, berth structural assessment, causeway area and to be barge quay area survey. In relation to future activities, one should survey the logistics areas and make early plans for the railway construction.
- Construction permit application process should be initiated
- Kai no.3 renovation and RoRo-berth construction
- Pump house/transformer/shed to be relocated if possible
- Roro area definitions, gate function definition and RoRo-process definition.
- Gate and access control system additions should be planned and procured
- Barge quay construction for wood and bifuel exports
- Dredging of the barge quay basin and the turning circle
- More quay capacity by lengthening the pier to NNE and by widening the Pier. Further one should widen the root of the causeway to make the RoRo-berth traffic and the other work machinery traffic possible at the same time.
- One should consider to develop a QM system such as ISO 14001:2015 or some other sustainability management program.

The need for geological survey is self explaining, it must be the basis for all construction planning and cost assessment to be done. The plans should then be prepared with detailed project planning in order to submit a EIA application for construction projects in the future.

As the two ports, port of Kunda and Loviisa are both developing a connecting RoRo-Service, then the port development needs for the RoRo-vessel should be first to be checked.

In Kunda there is a need of RoRo-berth, a proper RoRo-ramp. The ramp should have a width of 27 meters and it should be planned into the root of the berth no.4, when the berth no. 3 will be dismanteled. At the same time there should be a new quay wall to be constructed on the area where kai.3 structures are about to be removed and for the bank between the current kai 3 and 4.

For the roro development need there are very limited space available for the vehicles queuing to the ship and for the trucks released from the RoRo-vessel which have not yet been released to exit from the port area. The ideal case would be that only the capacity of RoRo-cargo to be loaded to the ship should be accounted for but the authorities may require the parking space for exit cargo available as well.

With early scetches of RoRo-capacity, (Ramp built and necessare pier widening done, the in port area capacity would be as follows. Northbound (Loviisa) 1420 m and Southbound 1320 m. The figures may be different but that gives an idea about current space constraints. **Note that the root of the pier area, the causeway section needs the widening for the Ports loading capacity and for the safety and capacity of combined RoRo-, LoLo- and Tanker operations**.

7.3 Vessel size and development on nautical side

The vessel size if generally related directly to vessels draught. There are exceptions but the hydrodynamics do set the optimum relationship between, draught, beam and LOA and cagi capacity. For to port of Kunda, the vessel sizes with current and possible future drafts can be defined as follows.

Table 7 Kunda vessel size with certain development stages

Vessel size according to draught	**Vessels Draught**	**Fairway Turning circle**	**Vessels LOA (***	**Vessels Approximate DWT**
Current depth, Turnin Circle 280 m circle limita-tions	8,5 m	280 m	135 m	Bulk 16 000 GC 11 000 Tanker *7 000* *RoRo* 11 000
Depth according to turning	8,0 m	280 m	150 m	Bulk 18 000 GC 12 500 Tanker 7 000 RoRo 11 000
Future, larger turning circle, 320 m	8,5 m	320 m	210 m	Bulk 18 000 GC 12 500 Tanker 7 000 RoRo 12 000
Future deepr fair-way for 10 m draft	10,0 m	330 m	220 m	Bulk 25 000 GC 18 000 Tanker 15 000 RoRo 14 000
Future deeper fairway for 11 m draft	11,0 m	330 m	220 m	Bulk 35 000 GC 22 500 Tanker 15 000 RoRo 14 000
Future deepr fair-way for 12 m draft	12,0 m	330 m	220 m	Bulk 47 000 GC 32 000 Tanker 15 000 RoRo 14 000

Note (* with either with tug boat assistance and requirements defined by the port. The indicated vessel sizes are approximate and vessel type specific. There may be larger vessels by tonnage on the market to sail in less than indicated draft of brakish water or vice versa. The RoRo-tonnage are mostly less than 14 000 DWT when trading in Baltic sea ports.

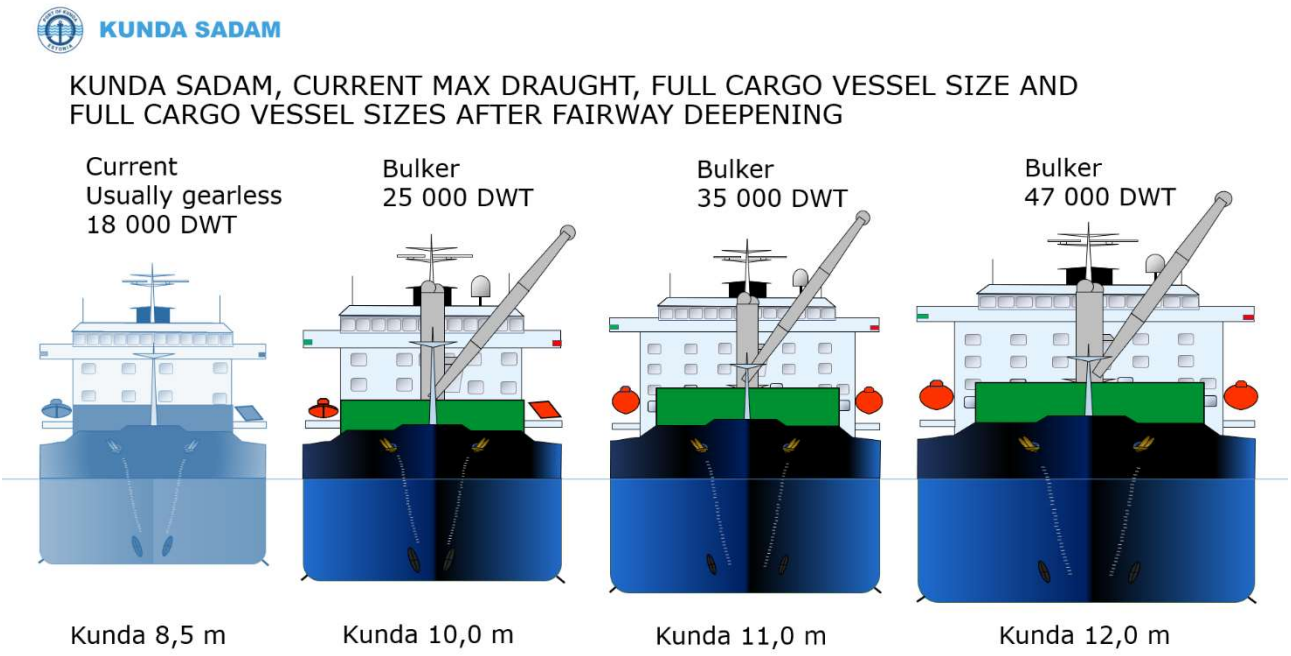
In current situation the Baltic tank has noted that previously they handled tanker ves-sels of 6000 DWT in Kunda, today the vessels are typically 8-10 000 DWT. On the following page, there are some tankers that have been trading on Baltic Sea area.

Table 8 Selected tankers from ship registry to indicate dimensions

Some examples of **tankers** with certain DWT, LOA and draught					
ALCEDO	NN	TELLUS	NN	TERNHOLM KIISLA	NN
6400 DWT	8 000 DWT	9181 DWT	10 000 DWT	14 796 DWT 14750 DWT	20 000 DWT
113,7 m	110 m	124,50 m	133,00 m	141,20 m 139,75 m	150,00 m
7,0 m	7,5 m	8,12 m	7,00 m	9,0 m 9,0 m	10,0 m

The tankers and dry bulk carriers are very much alike, their block coefficients are about the same and the power to DWT is about the same. Some vessel types have been designed to combine both liquid and dry bulk cargoes, but that is just to explain the similarity of the types.

For the port of Kunda, the fairway deepening would mean vessel size increase. These examples underneath are examples how much a meter and half, or meter or two meters would mean. The vessels are examples and different sizes of bulk carriers are on the market. This just shows that by deepening the fairway from 8,5 m draft vessel to 11,0 m draft vessel, the possible vessel size will be doubled by that investment.



Picture 25 The fairway deepening and vessel size development in port of Kunda.

7.4 Turning and the turning basin

The calling vessel has to turn, either on arrival or on departure. The turning needs a suitable area where to turn and turning itself will be perfomed differently depending on vessel size, vessels characteristic, engine and thruster resources, engine and thruster condition, ships loading conditions, weather conditions, status of other elements (Ice, current etc.), and masters skill to turn in constraint space. Port may also set certain rules for the turning, what vessels can turn without assistance and what assistance is compulsory (number of Tugs).

Table 9 The turning circle diameter and LOA relationship with vessels performing turn, either by leaning to a fixed structure (dolphin or quay corner), turning with tug or turning without outside assistance.

LOA	Current basin Ø 280 m	Basin with 10 m additional dist. Ø 290 m	Basin with 20 m additional dist. Ø 300 m	Basin with 30 m additional dist. Ø 310 m	Basin with 40 m additional dist. Ø 320 m	Basin with 50 m additional dist. Ø 330 m
With dolphin	230 – 250	240 - 260	250 - 270	260 - 280	270 - 290	275 – 300
With Tug **By /1,5**	140 – 185 186 m	145 -190 193 m	150 - 200 200 m	155 - 205 206 m	160 - 215 213 m	165 - 225 220 m
Without outside assistance	70 – 140 rec min 95 m	72,5 – 145 rec min 97 m	75 – 150 rec min 100 m	77,5 - 155 rec min 103 m	80 m - 160 rec min 106 m	82,5 – 165 rec min 110 m

The port of Kunda has a turning basin of 280 m for vessels with draft less than 8,0 m. That is suitable for the current vessel size in Kunda port and it is usable for the vell powered and thruster equipped RoRo-vessel. Still the concern about future vessel sizes and the adequacy of the turning area is well justified.

When vessel becomes larger, the engine power will be relatively weaker and the response time can slower, making the turning movements less precise. Yet, yesterdays large vessels are todays average vessels and have their thrusters, sometimes even on both ends as they can save both time and money for the shipowwners.

For the Port of Kunda, it will be recommended to increase the turning circle diameter according further expansion plans, up to 330 m, which would enable the large handysize vessel to turn, first with tug boat assistance and then when the vessel and the captain becomes famialiar with the port and port knows the vessels performerance, then the vessel can make the turn without tug's assistance. Naturally the mentioned element before the table can make an exception and port may still then requiretug boat assistance to be used.

7.5 Fairway development

Currently the Kunda fairway provides access for vessels with 8,5 m of draught and 150 m in length. The tankers have been limited to 7,4 m draught and 120 m in length. The limiting factors are the faiway depth, which transforms to maximum vessel sizes according to their naval design optimum relationships to be some 18 000 DWT tonnes. The turning basin with current diameter of 280 m with 10,0 m minimum depth, which limits the vessel size 150 m / 8,0 m or 135 m / 8,5 m, which cannot be exceeded without harbour masters approval.

What the fairway deepening will enable, to provide in return for the investments made? The fairway deepening enables the visits of larger vessels and larger vessels can be loaded to utilize vessels design draught in full. This in turn provides significant savings in transportation costs as the economies of scale functions at it's best in maritime transport of bulk goods.

In port of Kunda the deepening of fairway will increase the bulk vessel size as it has been illustrated in picture underneath.

By dredging the fairway from 8,5 meters to 11,0 meters, the vessel size for the Kunda port can be almost doubled, from 18 000 DWT to 35 000 DWT. This reduces the freight rate to almost in half but the overall transportation cost savings are not that big as there are other cost components to remain the same.

The fairway deepening works can also provide combined benefits of other simultaneously executed infrastructure projects of the port. Depending on amount of works planned, the geolocial characteristics of sea floor soil and land side soil type, scale of both works and requirements set for the structures to be created, there are benefits to synchronize the works on both dredging, reclaiming and filling land side development areas.

The ideal case would be to plan to match the material transfer needs so that dredging masses can be utilized in creating new yard for the future. Sometimes the loose sediment can be pumped to a pool which has strong banks to contain the masses pumped

Picture 26 View from causeway road, towards Pilot launch berth.

into. That needs stronger layers on top later on but it is an effective way to move soil in form of slurry from harbour basin or fairway to new terminal yard.

This plan of coordinated material movements usually contributes to cost reductions and best environmental outcome and smallest possible footprint to surrounding community.

The essential steps to be taken before the faiway deepening project

- Make proper and thorough geological survey, both on approach fairway, habour basin area, adjacent areas and land side of the port territory and preferably on the adjacent areas with land owners approval.
- Plan according to results from geological survey to accommodate contributing characteristics and to avoid non current areas
- Plan to combine and balance different, contradicting mass movements
- Plan to have alternative development paths
- Be forward thinking in environmental permit processes and in construction permits
- If surplus of good soilmaterial, plan to stock it for future needs or to sell and finance the core project with it
- Plan for few development steps ahead in
    - pier foundations, establish the quay wall elements to depth of next, or depth after the next or depth sought after two deepening stages in following decades to come. It pays off in future if same earlier quay wall can be utilized in next deepening phases without rebuilding the quay wall in following deepening projects.
    - of yard area grey water capacity,
    - transformer capacities and
    - for the permissible load levels on berths, yards and access roads
- Look for most economical solutions overall and operatively efficient solution
- Aim for lowest possible investment and operative costs
- Plan to implement in steps
- Plan to create new cash flow areas and berths as early as possible
- Plan to sustain economic down turns and sustain hostile market reactions

Picture 27 New quay walls for the new container berth in Port of Rauma, waiting to be installed and on the right, the completed quay. The height of elements is 15 meters. Source: Konepörssi/Rauman Satama Ltd. https://www.koneporssi.com/uutiset/lisaa-satamalaituria-raumalla/

7.6 Further actions, road development proposals

As the consultan was asked for, the recommendations for the road areas leading to the port has been addressed in the following. These are just early recommendations where similar cases have been presented for the port management, while both the port and town were growing out of their earlier footprints.

New Industrial road to area.

First about the arrival road. Now even the new port road comes through the town area and there is pretty heavy but patiently moving truck traffic to mills on the area. Could there be a possibility to take a new port road combining the industrial activities along the same road, and perhaps even the railwayline into the same path, clearly away from the current urban town structures?

The road could divert from road no 20 at Ojaküla and go south of the Kunda Cement estate, then directly to Kunda, (next to Estonian Cell) or to Malla, Simunamae and the to port area.

The idea is just an outsiders proposal to be checked, as it would provide better circumstances for the both, inhabitants (employees of port, pulp mill and cement factory) and industries wishing to work and develop 24/7. This proposal may be shot down by geological reasons, height differences, construction costs or land owners reasons, but if the phosporite or other port trafficwill start roll with much higher volumes than Kunda sees today, then the early ringroad approach can save from many disputes.

Town road maintenance needed

The road leading from Kunda port to town of kunda is sufficient for the traffic. The pavement should be repaved both between town and within town roads. In current conditions it eats the vehicle conditions, cause chassis wear and tear more than well paved road and eats tyres more.

The T-Junction next to Axela Kunda tankla

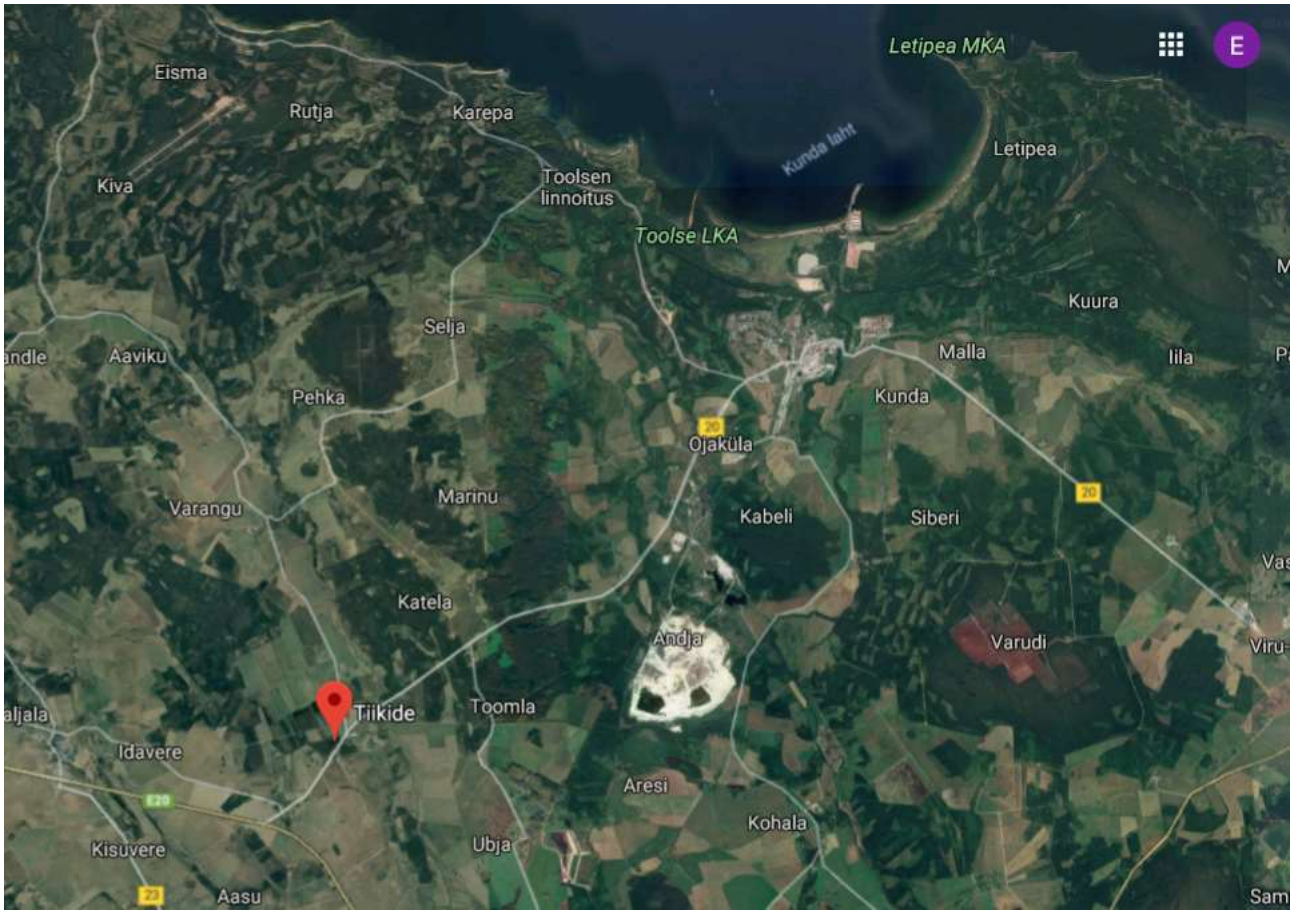
The T-junction in the town should be developed to perhaps roundabout type crossing. When the port traffic will increase this will be crossing for heavy traffic where pulp mill trucks meet the port trucks.

That should be reconsidered and perhaps the solution would be roundabout, lights with sensor coils/movement sensors etc.

That would increase the safety of heavy traffic as they do cross at town area. Here it is good to remind about the proposal to have totally new industrial road to pulp mill and to port, coming from the south.

Picture 28 The crossing of port road and Jaama road should be developed for higher capacity and for improved pedestrian, car and truck safety.

7.7 Tiikide area, Essu park 13 km from Kunda port



Picture 21 Tiikide area, There are some areas along the road no 22, where local pedestrians, especially younger ones tend to stay for longer time, wait for the bus and cross the road. There are higher risk of accident, which no one does not want to happen.

The Kunda port has an territory and the road leading to is a public road. It is fair to say legally the distant development needs are not to be concerned about, yet other kind of ideas can be developed. Those times this consultant has visited in Port of Kunda, every time, there has been children crossing the road or waited bus at the Tiikide area bus stops, some 13 km away from port.

In addition to Kunda Sadam, there are also other heavy industries located nearby such as the Kunda Cement and the Estonian cell. Large truck traffic is generated also by the traffic of the two large tennats in Port of Kunda area.

It would be good if these heavy industries togher with the town would seek ways how to make the crossings next to school area or next to major buss stop as safe as possible for children and local inhabitants. These traffic islands have improved safety but perhaps further consideration could be useful to make the crossings 100 % safe.

Picture 29 Even the google street view has catched the situation as it has unfolded to this random visitor in 2019.

8 MASTERPLAN STEPS

The Kunda port area is working with full swing and when all three berths are in active use, it is difficult to make any construction work, maintenance or expansion work without temporary negative effects to cargo volumes. The following preliminary plan is seeking to form a step by step list where each step could be small enough not to disturb traffic significantly. Yet, providing new earning possibilities after each step has been taken. Later on there are certain investment phases, which do not directly provide clear new berth capacity but through improved functionality, savings can be achieved through improved operative efficiencies.

This listing is preliminary as the information about structures, soil and geology, prevented more thorought estimates. One site knowing constructor agreed that the next step should be the thorough geological survey over the area.

Durinng the cource of this study, the information about works conducted in 1990's shows that the dimensioning and construction has been done on industrial standards. The argument has been made as often the dimensioning and construction is made just for the imminent need and the structure does not stand the wear and tear well over time. All ports need some maintenance and those needs provide good opportunities to take the needed development actions, as the maintenance tasks have time and date to be carred out.

Masterplan steps listing describes the development steps.

K-0 Current situation

K-1 Berth no. 3 upgrade and RoRo 2. Construction
Applying for future construction area, Yellow contour on CAD pictures

K-2 New Barge quay (new Kai 5.), Dredging and turning circle expansion

K-3 (Kai 1 extension), dredging and extending of turning basin

K-4 Second roro ramp construction, No 1, Pier tip extension for vehicle turning

K-5 Quay Area enlargement

K-5 b Quay Area enlargement variation of previous if expansion to west not allowed

K-LD Logistics Area development. The widecauseway fils with attention to marshland and creek water on ground area.

K-Rail, Future development. Logistics area development, railway line and phosphorite development

The steps have been tabelled on the following page and visualised on the next page comparing graphics. The drawings of each phase have been compiled in the attachments section, where the case numberin may slightly different from this section.

Table 10 Masterplan steps in table format

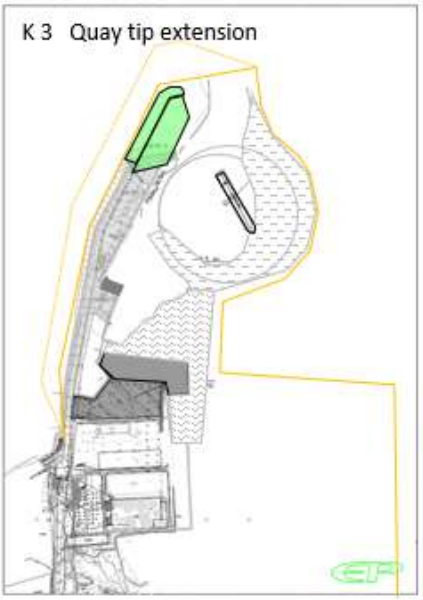
Development Phase	*New earnings available*	*Note*
K-0 Current	Working with RoRo-dev.	Need for berth no.3 renovation
K-1 RoRo-berth, Kai 3 reshape	Yes, through RoRo-traffic 2020- but same time experiencing loss of LoLo capacity through daily occupied quay space	Plans of RoRo with K-3, is a balancing between overall capacity and capacity constraints for another mode of traffic. Perhaps one should consider to larger project at once, to go directly through K-2 to K-5.
K-2 New Barge quay	Yes, Through new quay	Important for wood loading capacity and cost efficiency
K-3 Quay lenthening	Yes, More LoLo capacity	Provides more quay space for combined RoRo- and LoLo-operations
K 4 RoRo-2	Not actually but improves quay area operations	Also vessel placement will have more choises for the Harbour Master
K-5 Quay Area enlargement	Not as such, operative efficiency may bring savings	Improves operative space and functionality
K-5b Quay Area enlargement	Variant if not allowed to expand to west at the root of the quay	The minimal version of the causeway, if the expansion to west side will not be approved
K-LD	Yes, through tenants and their traffic.	The wide sections to be made to settle for long time. The creek water and marshland conditions to be addressed.
K-RAIL, FUTURE DEV	Yes, through tenants and their traffic.	Future phosphorite and / or other geological terminal development. Here rail path follows the Uldplaneering 1999 drawing. Fort future and for town area housing separation purposes, much wider approeach should be considered

K 0 Current

K 1 New RoRo-berth, Kai 3 reshape
Application of new water
construcion permit area

K 2 New barge quay, dredging and
extension of turning basin,
tug berth at pilot basin mouth

K 3 Quay tip extension

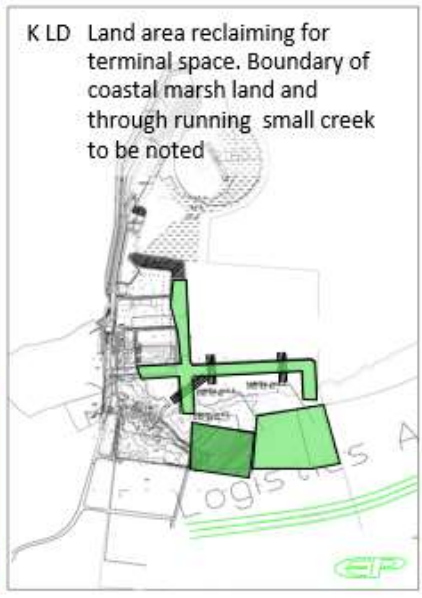


K 4 RoRo-2 and quay tip area
enlargement

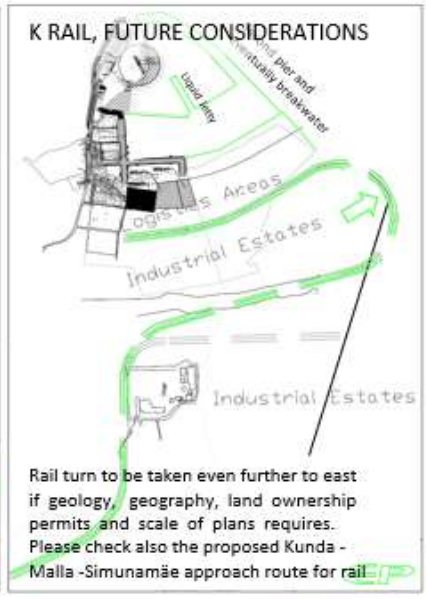
K 5 Quay area enlargement for
wider working area, large var.

K 5b Quay area enlargement for
wider working area, small var.

K LD Land area reclaiming for
terminal space. Boundary of
coastal marsh land and
through running small creek
to be noted



K RAIL, FUTURE CONSIDERATIONS



Rail turn to be taken even further to east
if geology, geography, land ownership
permits and scale of plans requires.
Please check also the proposed Kunda -
Malla -Simunamäe approach route for rail

9 CONCLUSIONS

The port development is working with need, the money, business development, good estimates and success in business. Well timed development actions together with targeted marketing may fill the capacity as it will be taken into use. Cautious approach is also good to have for the rainy day. The general pier and berth arsenal can accommodate vessels day in and day out but special structures are harder to justify when the user sails out for the last time.

The Kunda development should start with the kai 3. renovation and by constructing the new quay wall for the place where the platform 3 wil be removed and extend the wall from kai 2. Until the root of Kai 4., where the RoRo-ramp should be built. All this can be done with current environmental construction permit.

While planning for the imminent construction, the new extended permitted port construction area should be processed and applied without any unnecessary delay. For the permit application, one probably work with the local authorities as well. It would be good to get them aquinted with port development plan and to get their support for the development. Get them to drive road improvements, new plants to vicinity and to work for the rail connection.

The RoRo-development is a big endeavour. All reports underline the thin cargo flows but when it succeeds, it can create 1,5-2 million tonnes addition to existing traffic flows with two daily departures and some 70 % vessel capacity utilization. The port has to work like a clock, it may take long before the clients stay with the route but they can disappear very fast due to service anomalities and due to competitors actions.

These plans end up after 5 steps to have 4-5 berths for calling vessels and barges. Here the 5th berth has been counted by taking two vessels or barges visitin at the barge quay. The larger pusher barges or LoLo -vessels may occupy the 5th Kai by one visitor, but still 4-5 Kai's for the cargo movements can lift the Kunda sadam as 3rd largest terminal in Estonia by cargo Volume. Therefore one should plan for the larger and higher capacity units even with the barge quay.

The loadbearing characteristics should be addressed in each phase of the development. The RoRo-ramp built for windmill generators, or pulp mill expansion project cargoes, will bring the loads to Kunda instead of Sillamae or Muuga. When defining the loads on quay edge on each berth, it should be strengthened for LHM 550, for 450 tonnes on quays edge. And all the causeways should be defined to support the driving of such unit. What comes to reachstackers, there are large loghandlers for timber handling and their front axle load can be more than 100 tonnes. All new berths should be strengthened for their movements. This applies to all reclaiming in logistics area. There should be heavy load yards and routes for heavy project goods.

10 RECOMMENDATIONS FOR THE FUTURE DEVELOPMENT

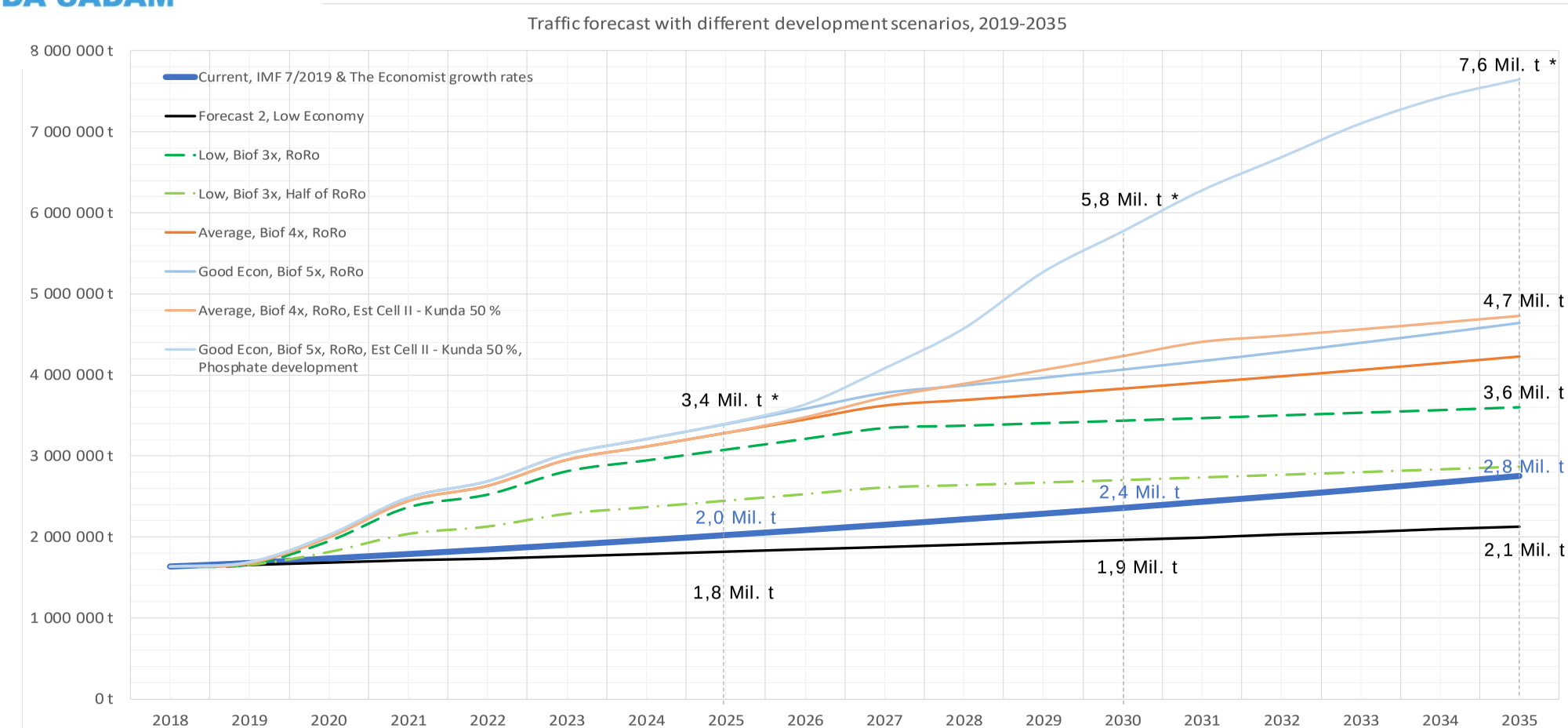
There are several development issues to be addressed beyond the development steps list earlier. Here are some of the things to be addressed or which should be addressed with the infrastructure and vessel traffic development tasks, the management will be working with in the future.

- Access control system
- Line scanning camera for truck hig def condition management purposes
- Road development with the town
- Railway development
- National transport strategy
- Neighbourghood buy out an lease back policy
- One should work with town to develop the T-crossing for higher capacity
- Deeper tanker berth only at 2nd berth construction phase
- One should not consider a isolated offshore liquid terminal without access road as presented by Tebodin. The 1997 drafted plan forgets the need to vist at loading vessel and the winter conditions to make it difficult in certain times of a year by boat or over the Ice. If the East side breakwater structure would be connected to shore at east side of the basin, by building a causeway to support pipe rack and conveyor bridge with phosphorite, then the liquid berth on east side of the basin is recommended.

Picture 30 Business as usual, Winter day in Port of Kunda 2019

Appendix 1:
Forecast graph and table

KUNDA SADAM



Forecast, Combined graph 2019-2035	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035
Current, IMF 7/2019 & The Economist growth rates	1 635 000 t	1 679 000 t	1 735 000 t	1 789 000 t	1 845 000 t	1 903 000 t	1 962 000 t	2 024 000 t	2 087 000 t	2 152 000 t	2 220 000 t	2 289 000 t	2 361 000 t	2 436 000 t	2 512 000 t	2 591 000 t	2 673 000 t	2 757 000 t
Forecast 2, Low Economy	1 635 000 t	1 656 000 t	1 682 000 t	1 708 000 t	1 733 000 t	1 759 000 t	1 787 000 t	1 815 000 t	1 843 000 t	1 872 000 t	1 901 000 t	1 932 000 t	1 963 000 t	1 995 000 t	2 028 000 t	2 061 000 t	2 094 000 t	2 129 000 t
Low, Biof 3x, RoRo	1 635 000 t	1 656 000 t	1 945 000 t	2 364 000 t	2 521 000 t	2 809 000 t	2 942 000 t	3 075 000 t	3 208 000 t	3 342 000 t	3 371 000 t	3 402 000 t	3 433 000 t	3 465 000 t	3 498 000 t	3 531 000 t	3 564 000 t	3 599 000 t
Low, Biof 3x, Half of RoRo	1 635 000 t	1 655 800 t	1 813 600 t	2 035 700 t	2 126 900 t	2 284 200 t	2 364 100 t	2 444 500 t	2 525 400 t	2 606 600 t	2 635 900 t	2 666 800 t	2 698 200 t	2 730 200 t	2 762 700 t	2 795 800 t	2 829 500 t	2 863 700 t
Average, Biof 4x, RoRo	1 635 000 t	1 679 000 t	1 997 000 t	2 445 000 t	2 632 000 t	2 953 000 t	3 117 000 t	3 284 000 t	3 452 000 t	3 622 000 t	3 690 000 t	3 759 000 t	3 831 000 t	3 906 000 t	3 982 000 t	4 061 000 t	4 143 000 t	4 227 000 t
Good Econ, Biof 5x, RoRo	1 635 000 t	1 690 000 t	2 023 000 t	2 485 000 t	2 688 000 t	3 026 000 t	3 209 000 t	3 395 000 t	3 585 000 t	3 779 000 t	3 872 000 t	3 968 000 t	4 069 000 t	4 175 000 t	4 285 000 t	4 400 000 t	4 520 000 t	4 646 000 t
Average, Biof 4x, RoRo, Est Cell II - Kunda 50 %	1 635 000 t	1 679 000 t	1 997 000 t	2 445 000 t	2 632 000 t	2 953 000 t	3 117 000 t	3 285 000 t	3 477 000 t	3 722 000 t	3 890 000 t	4 059 000 t	4 231 000 t	4 406 000 t	4 482 000 t	4 561 000 t	4 643 000 t	4 727 000 t
Good Econ, Biof 5x, RoRo, Est Cell II - Kunda 50 %, Pho	1 635 000 t	1 690 000 t	2 023 000 t	2 485 000 t	2 688 000 t	3 026 000 t	3 209 000 t	3 398 000 t	3 635 000 t	4 079 000 t	4 572 000 t	5 268 000 t	5 769 000 t	6 275 000 t	6 685 000 t	7 100 000 t	7 420 000 t	7 646 000 t

* Phosphorite is a huge opportunity, yet, berth capacity has not been sufficiently addressed in current plans to support phosporite, also fairway deepening needs to be studied more thoroughly

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Interviewed persons

Aleksander Nikolajevits, Kunda Sadam AS

Erik Laidvee (Juhatuse Esimees) and
Artur Raichman (Business Development manager), Eesti Raudtee AS.

Antti Laaksonen and Merikse Syväoro, Baltic Tank Oy

Appendix 3:
Development steps

Kunda kai current
operative area 2,6 ha

Kai Nr. 1

Kai Nr. 2

Kai Nr. 3

Kai Nr. 4

KUNDA LAHT

150m / 9,0m

120m / 7,1m

R14

9,5 m

8,5 m

7,5 m

3.

5.

Bulk yard
area 1,7 ha

LS

0 100m 200m 300m 400m 500m

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Project leader:	Proj.num/file name:	Scale:
Esa Eerikäinen	3652	1:xxx (A3)
Drawn:	Date:	
Heikki Vaulanen	12.7.2019	

Client:
Kunda Sadam As

Project:
Port Area Masterplan 2020-2035

Descr:
K0 b Approx. Current Situation

Kai Nr. 1

Kai Nr. 2

Kai Nr. 3

Kai Nr. 4

KUNDA LAHT

Removed old quay platform

New RoRo berth

290m/9,0m

130m/8,0m

9,5 m

8,5 m

7,5 m

R14

3.

T/R

LS

POS. 6

0 100m 200m 300m 400m 500m

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Drawn:	Date:	
Heikki Vaulanen	12.7.2019	

Client:
Kunda Sadam As

Project:
Port Area Masterplan 2020-2035

Descr:
K1 New RoRo Ramp/ Kai 3 demol.

Brkw extension
straight L 175m
Whole L 250m

1.

New Kai Nr. 1
LxB 50 x 135m
A 7900m²
Quay Wall 175m

Kai Nr. 1

KUNDA LAHT

Kai Nr. 2

412 m/9,0m

Kai Nr. 3

R165

R150

9,5 m

8,5 m

7,5 m

New barge kai Nr 5
length 190 m

Kai Nr. 4

Dredging area 5,6 ha

Dredging area 2,41 ha

Kai Nr. 5

Additional kai area 1,1 ha

Bulk yard
area 1,7 ha

0 100m 200m 300m 400m 500m

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Drawn:	Date:	
Heikki Vaulanen	12.7.2019	

Client:
Kunda Sadam As

Project:
Port Area Masterplan 2020-2035

Descr:
K2 kai 1 extension, new barge kai

Kai Nr. 1

Kai Nr. 2

Kai Nr. 3

Kai Nr. 4

Kai Nr. 5

KUNDA LAHT

390m/9,0m

R165

R150

9,5 m

8,5 m

7,5 m

Dredging area 5,6 ha

Dredging area 2,41 ha

0 100m 200m 300m 400m 500m

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Project leader: Esa Eerikäinen

Proj.num/file name: 3652

Scale: 1:xxx (A3)

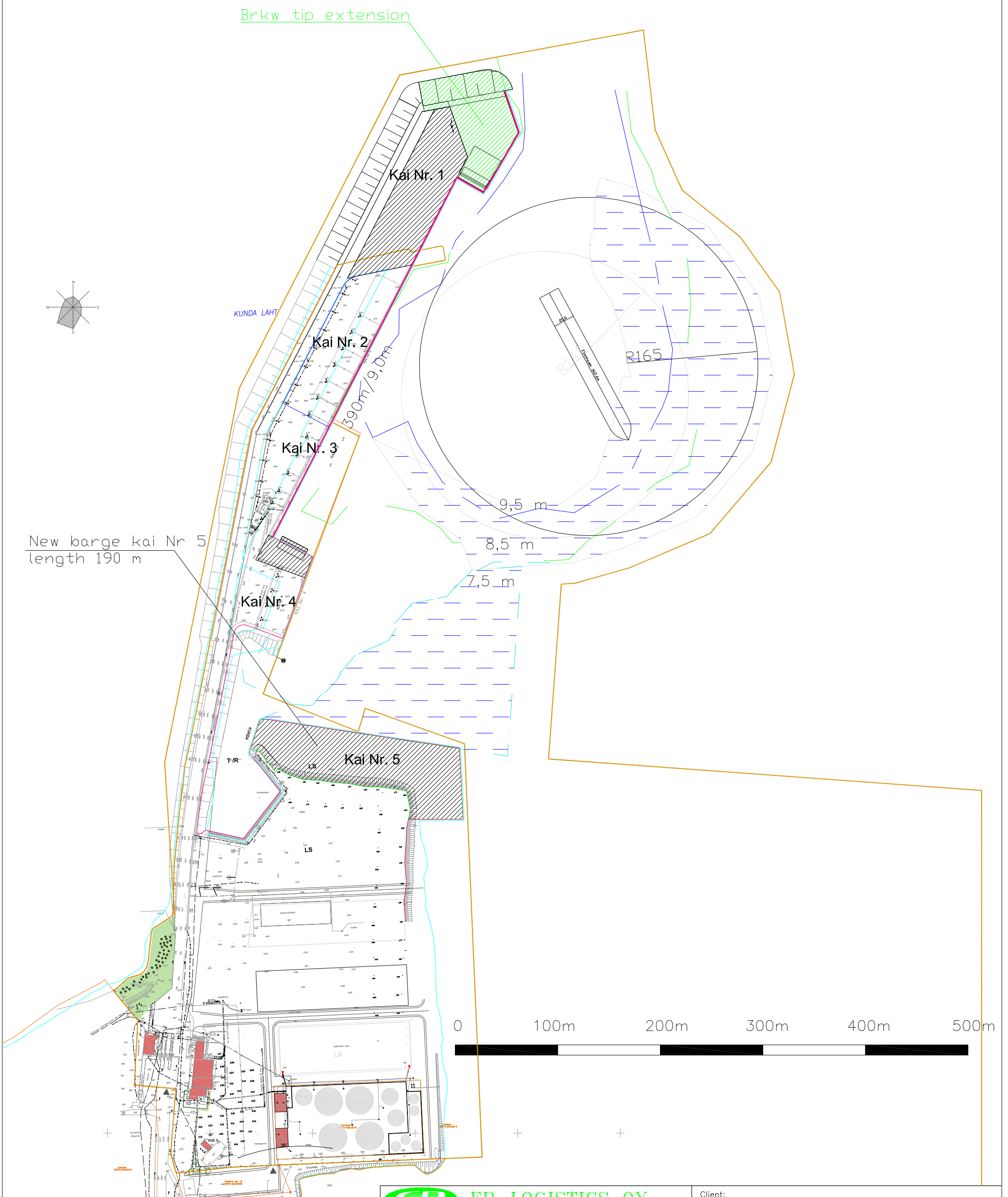
Drawn: Heikki Vaulanen

Date: 12.7.2019

Client: Kunda Sadam As

Project: Port Area Masterplan 2020-2035

Descr: K3 dredging of turning c. & basin



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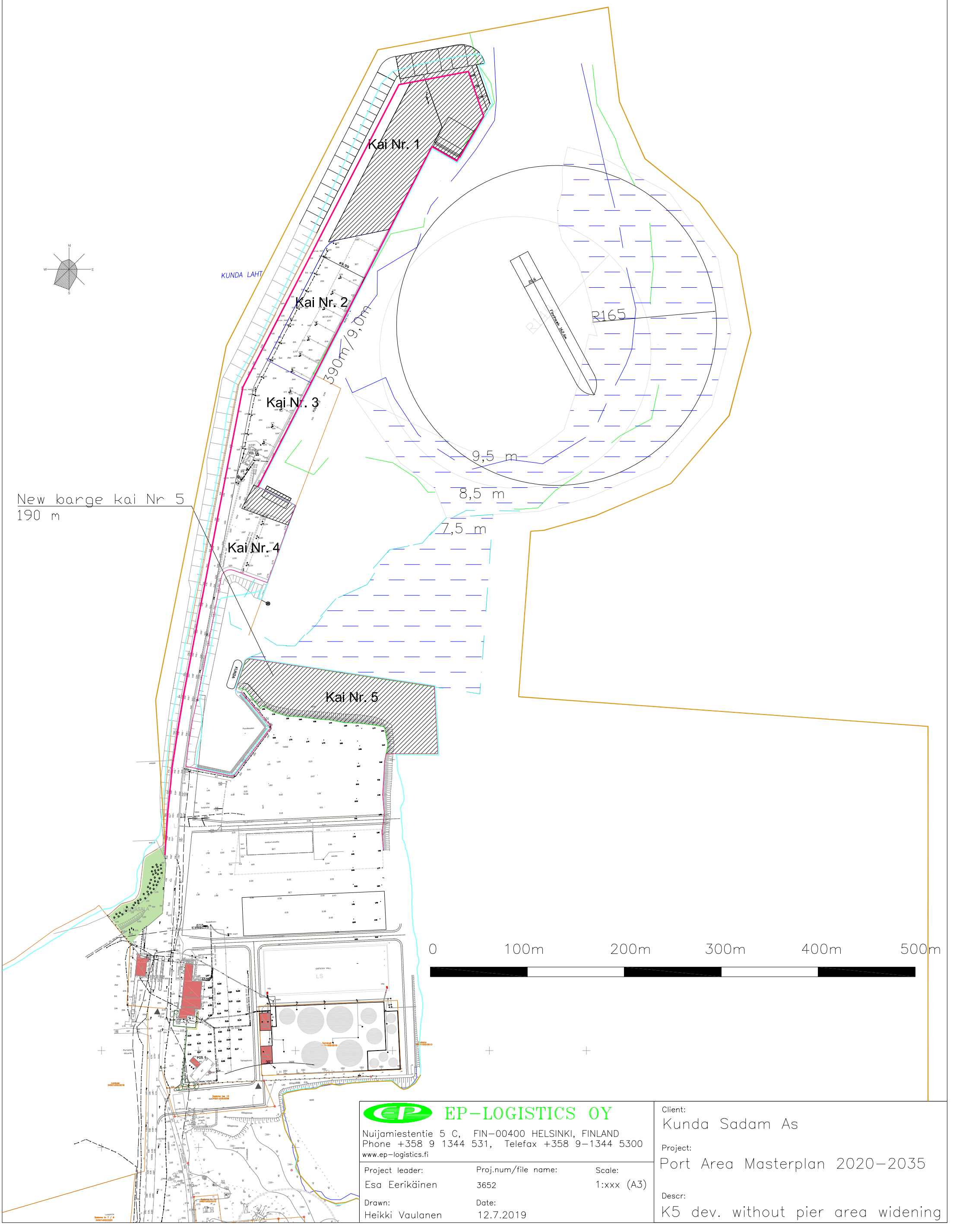
Drawn:	Date:	
Heikki Vaulanen	12.7.2019	

Client:
Kunda Sadam As

Project:
Port Area Masterplan 2020-2035

Descr:
K4 2nd RoRo & pier tip extension



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Drawn:	Date:	
Heikki Vaulanen	12.7.2019	

Client:
Kunda Sadam As

Project:
Port Area Masterplan 2020-2035

Descr:
K5 dev. without pier area widening

Kunda kai operative
area 3 ha

New barge kai Nr 5
190 m

Kai Nr. 1

Kai Nr. 2

Kai Nr. 3

Kai Nr. 4

Kai Nr. 5

KUNDA LAHT

390m/9,0m

R165

9,5 m

8,5 m

7,5 m

0 100m 200m 300m 400m 500m

EP-LOGISTICS OY
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www.ep-logistics.fi

Project leader:	Proj.num/file name:	Scale:
Esa Eerikäinen	3652	1:xxx (A3)
Drawn:	Date:	
Heikki Vaulanen	12.7.2019	

Client:
Kunda Sadam As

Project:
Port Area Masterplan 2020-2035

Descr:
K5b dev.without pier area widening

Kunda kai operative
area 7,7 ha

Kai Nr. 1

Kai Nr. 2

Kai Nr. 3

Kai Nr. 4

Kai Nr. 5

103,5

390m/9,0m

54,8

9,5 m

8,5 m

7,5 m

KUNDA LAHT

0 100m 200m 300m 400m 500m

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Esa Eerikäinen	3652	1:xxx (A3)
Drawn:	Date:	
Heikki Vaulanen	12.7.2019	

Client:
Kunda Sadam As

Project:
Port Area Masterplan 2020-2035

Descr:
K6 extensive pier area

Kunda kai operative
area 7,7 ha

Kai Nr. 1

Kai Nr. 2

Kai Nr. 3

Kai Nr. 4

Kai Nr. 5

103,5

390m/9,0m

9,5 m

8,5 m

7,5 m

54,8

Kai area 1,1 ha

Bulk yard
area 1,7 ha

KUNDA LAHT

0 100m 200m 300m 400m 500m

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Drawn:	Date:	
Heikki Vaulanen	12.7.2019	

Client:
Kunda Sadam As

Project:
Port Area Masterplan 2020-2035

Descr:
K6 b extensive pier area widening

Kunda kai operative
area 7,7 ha

Kai Nr. 1

Kai Nr. 2

Kai Nr. 3

Kai Nr. 4

Kai Nr. 5

103,5

390m/9,0m

9,5 m

8,5 m

7,5 m

KUNDA LAHT

0 100m 200m 300m 400m 500m

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Client:
Kunda Sadam As

Project:
Port Area Masterplan 2020-2035

Descr:
K7 widened with narrow access

Kunda kai operative
area 6,6 ha

Kai Nr. 1

Kai Nr. 2

Kai Nr. 3

Kai Nr. 4

Kai Nr. 5

103,5

390m/9,0m

9,5 m

8,5 m

7,5 m

19,0

18,4

Kai area 1,1 ha

Bulk yard
area 1,7 ha

KUNDA LAHT

0 100m 200m 300m 400m 500m

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Heikki Vaulanen	12.7.2019	

Client:
Kunda Sadam As

Project:
Port Area Masterplan 2020-2035

Descr:
K7 b with narrow access area

Kunda kai operative
area 7,7 ha

Kai Nr. 1

103,5

Kai Nr. 2

390m/9,0m

Kai Nr. 3

9,5 m

8,5 m

7,5 m

Kai Nr. 4

Kai Nr. 5

KUNDA LAHT

0 100m 200m 300m 400m 500m

Tank farm expansion
area 0,5 ha

Logistics yard 3
area 2,2 ha

Logistics yard 2
area 4,0 ha

Logistis yard 2
area 3,9 ha

LS

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Heikki Vaulanen	12.7.2019	

Client:
Kunda Sadam As

Project:
Port Area Masterplan 2020-2035

Descr:
K8 Future Logistics Area Dev.

Kunda kai operative
area 7,7 ha

Kai Nr. 1

103,5

Kai Nr. 2

390m/9,0m

Kai Nr. 3

9,5 m

8,5 m

7,5 m

Kai Nr. 4

Kai Nr. 5

KUNDA LAHT

Proposed pressure bank
reclaiming area 4,7 ha

0 100m 200m 300m 400m 500m

Tank farm expansion
area 0,5 ha

Logistics yard 3
area 2,2 ha

Logistics yard 2
area 4,0 ha

Logistis yard 2
area 3,9 ha

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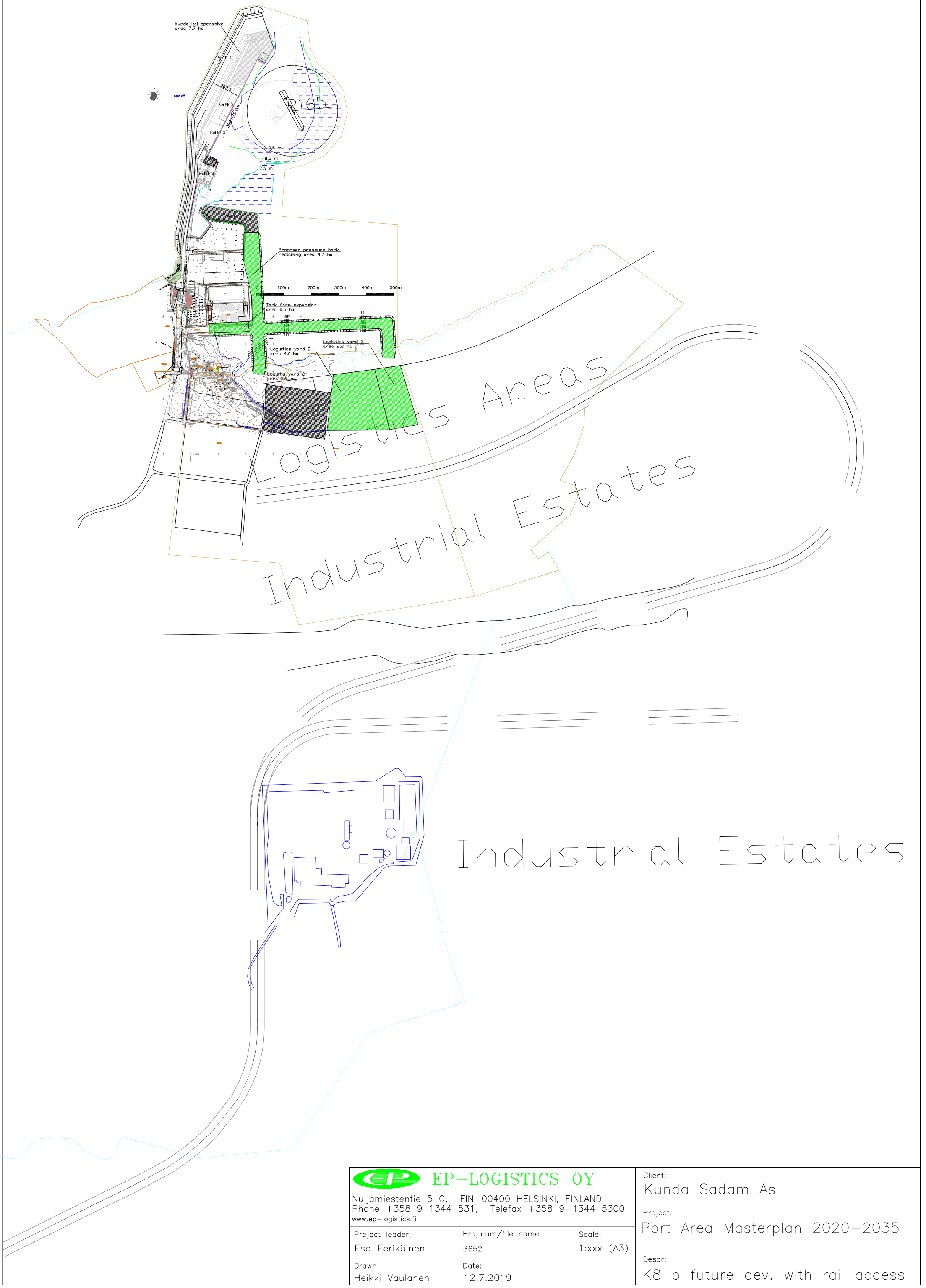
Drawn:	Date:	
Heikki Vaulanen	12.7.2019	

Client:
Kunda Sadam As

Project:
Port Area Masterplan 2020-2035

Descr:
K8 b future logistics area dev.



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Drawn:	Date:	
Heikki Vaulanen	12.7.2019	

Client:
Kunda Sadam As

Project:
Port Area Masterplan 2020-2035

Descr:
K8 b future dev. with rail access

KUNDA SADAM

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