No.

Japan International Cooperation Agency (JICA)
Ministry of Transport and Communications (MOTC)
Klaipeda State Seaport Authority (KSSA)

KLAIPEDA

The Study on The Port Development Project in The Republic of LITHUANIA

FINAL REPORT

MAIN REPORT

Volume IV

Appendices

September 2004
Nippon Koei Co., Ltd.

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04-25

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EXCHANGE RATE

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THE PORT DEVELOPMENT PROJECT
IN THE REPUBLIC OF LITHUANIA

VOLUME IV
APPENDICES

CONTENTS Page

APPENDIX H ALTERNATIVE PORT EXPANSION PLANS

APPENDIX I SAMPLE PRINCIPLE OF COMPENSATION FOR REAL ESTATE DEVALUATION

APPENDIX A COMPARISON OF THE PORT TERRITORIES OF BALTIC PORTS

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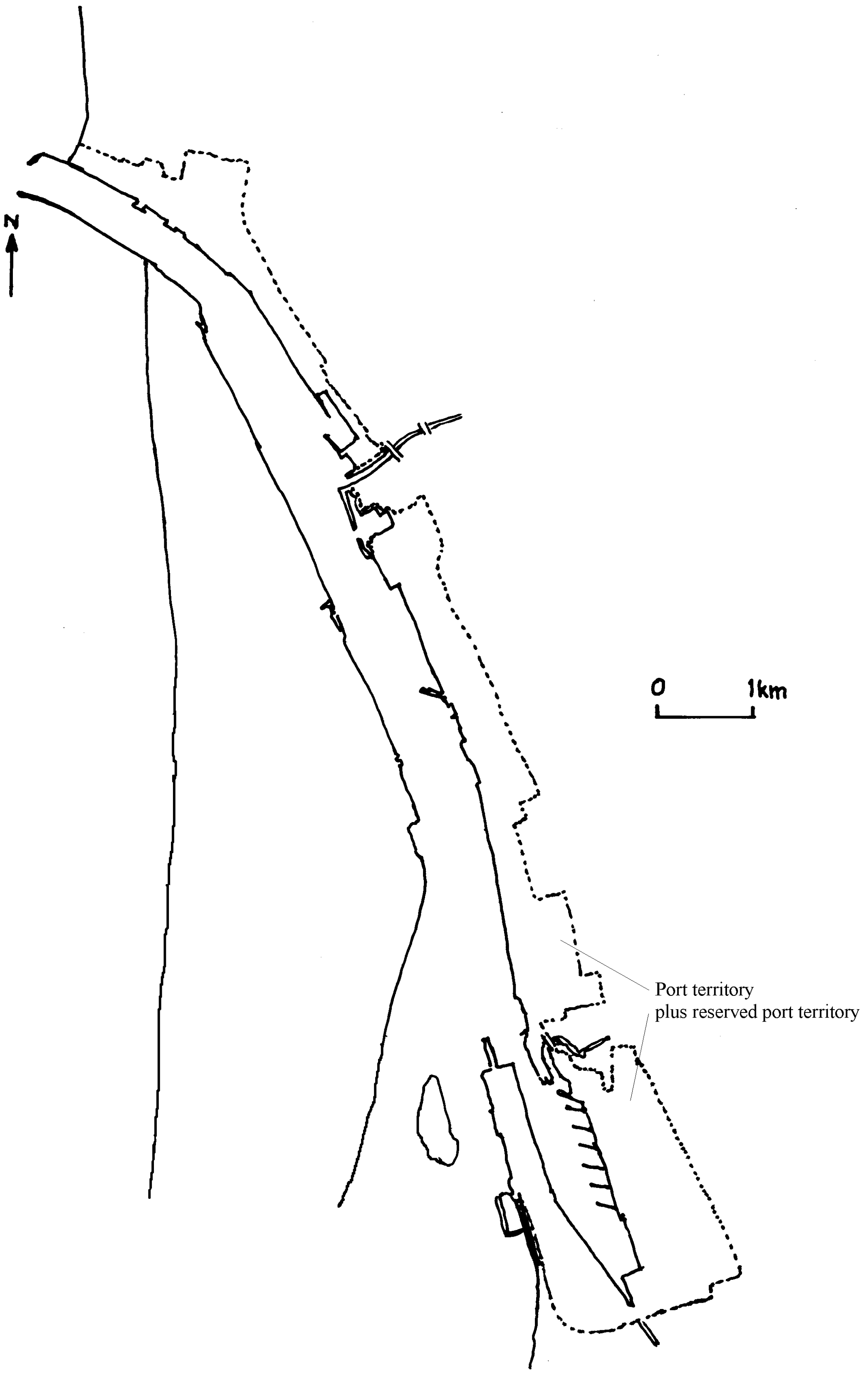
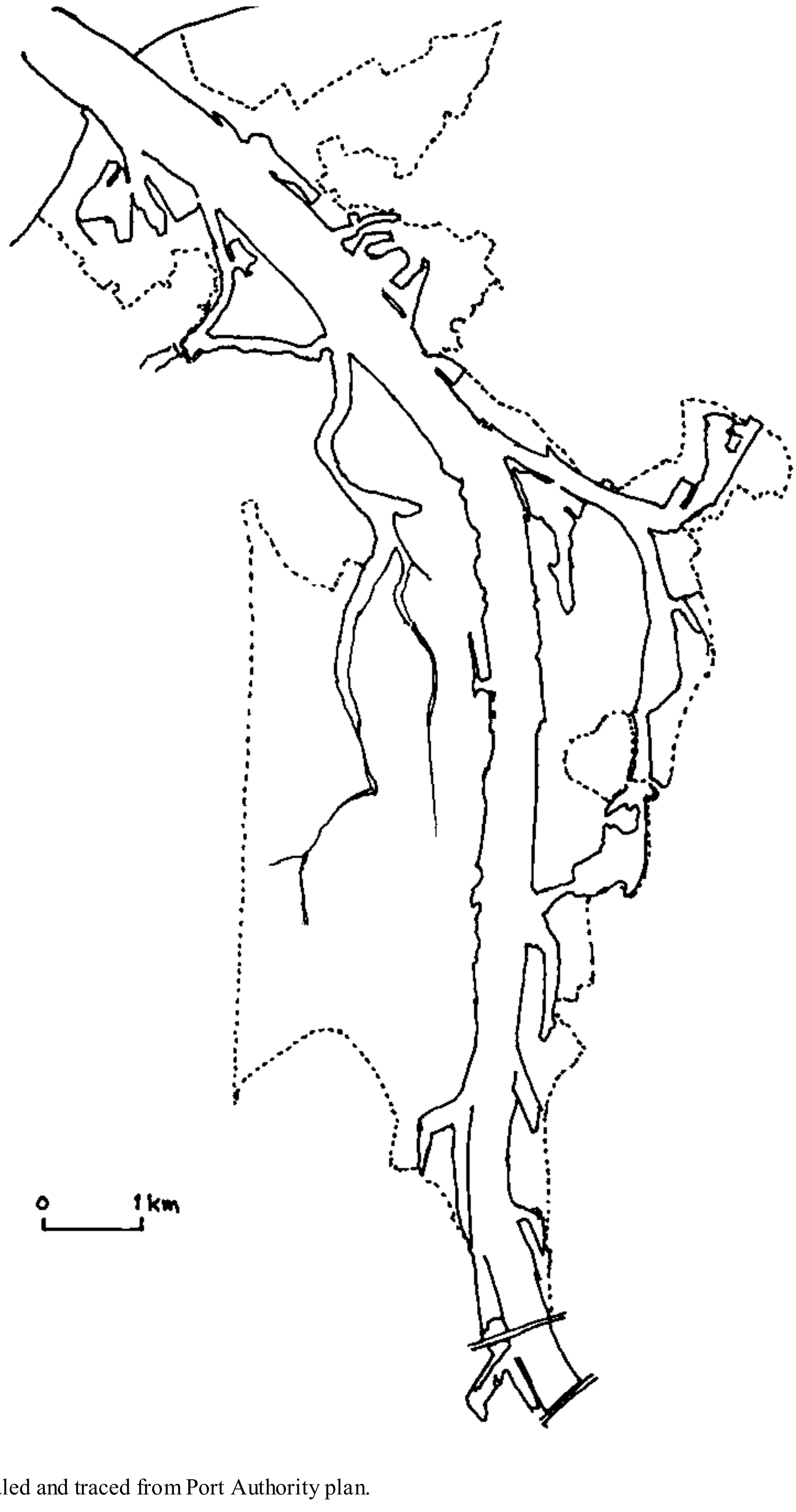
Plans of the ports of the Baltic States and Russia, drawn to the same scale for easy comparison.



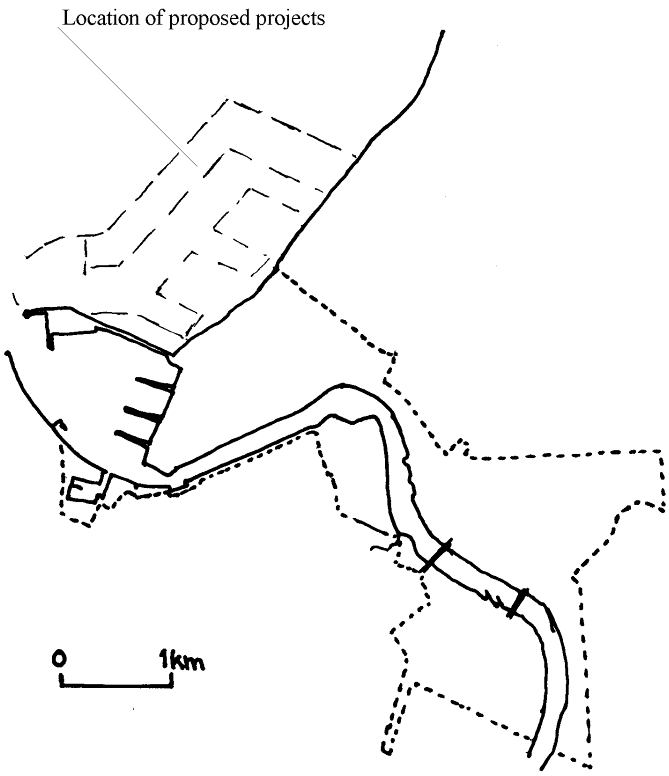
Source: Scaled and traced from Port Authority plan

Figure A.1 Klaipeda Port Territory



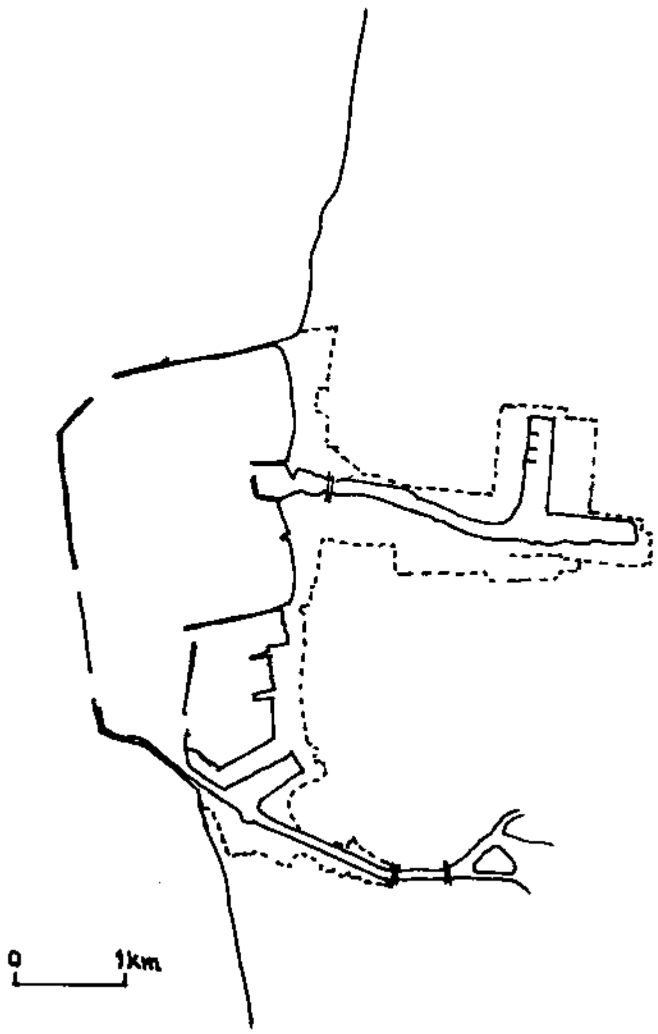
Source: Scaled and traced from Port Authority plan.

Figure A.2 Freeport of Riga Territory



Source: Scaled and traced from Port Authority plan.

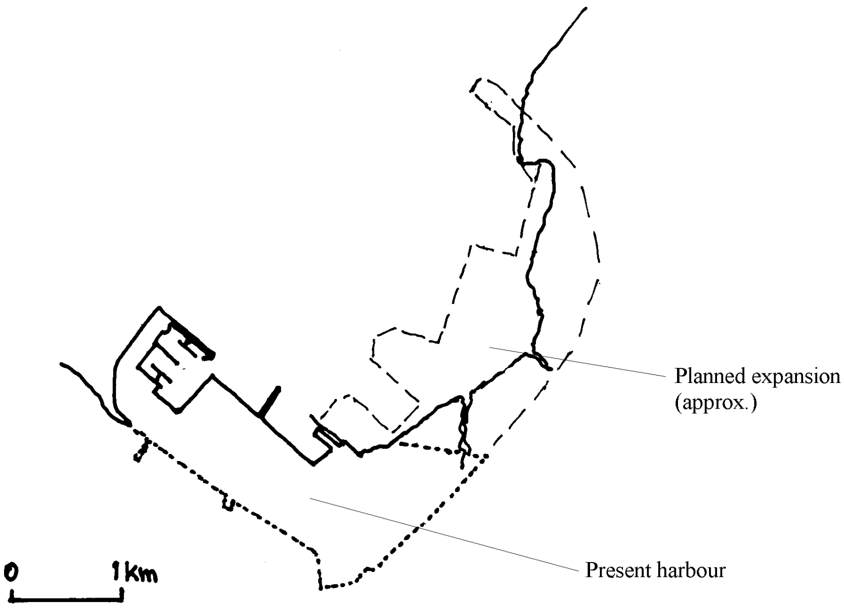
Figure A.3 Port of Ventspils Territory



Source: Scaled and traced from Port Authority plan.

Figure A.4 Port of Liepaja Territory

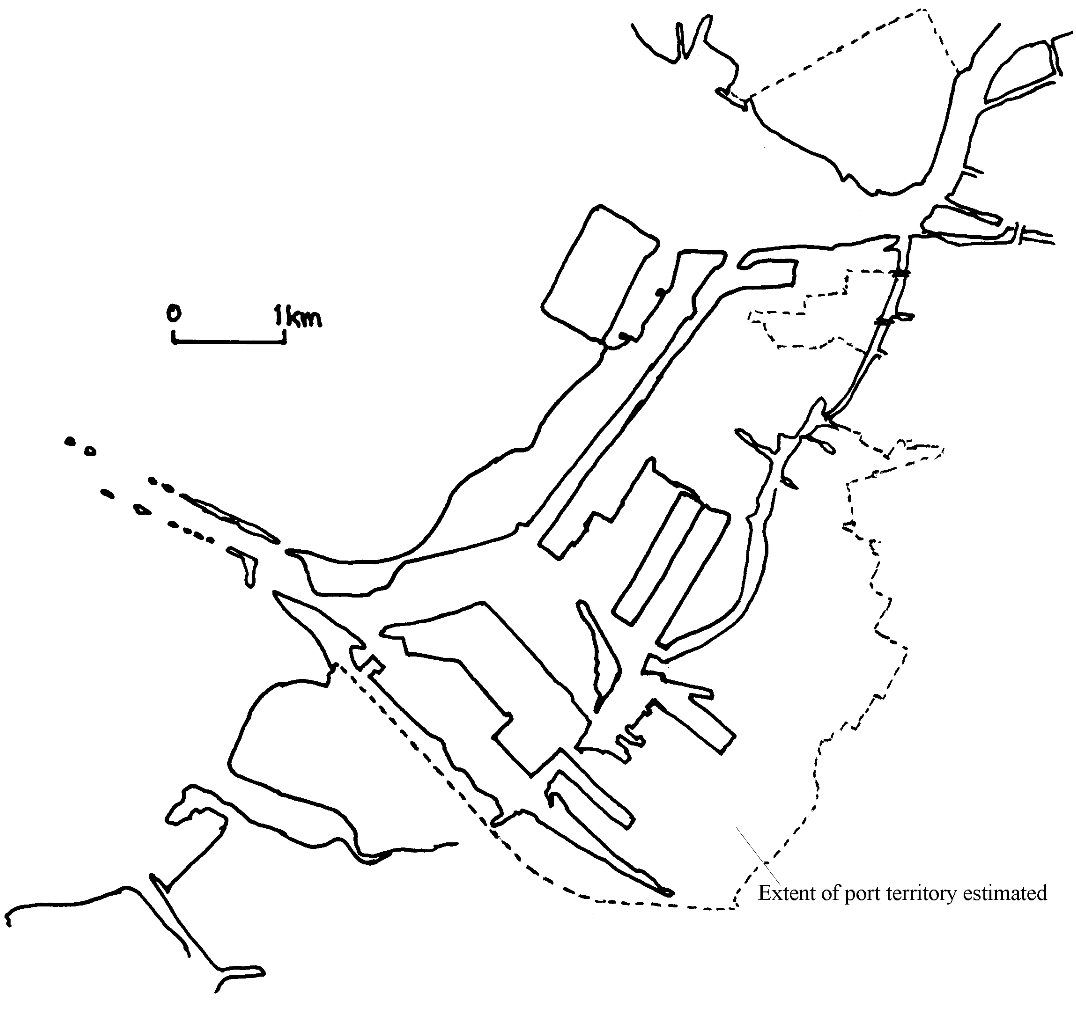
Tallin Old City Harbour



Muuga Port

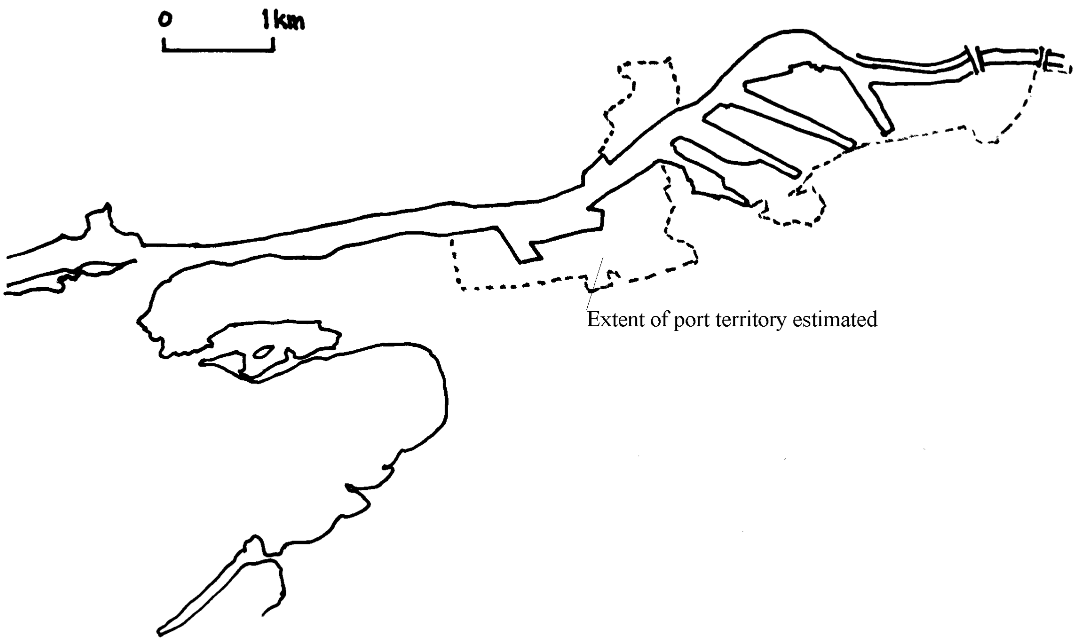
Source: Scaled and traced from Port Authority plans.

Figure A.5 Ports of Tallinn Territories



Source: Scaled and traced from City maps.

Figure A.6 Ports of St Petersburg Territory



Source: Scaled and traced from Port Authority plan and City map.

Figure A.7 Port of Kaliningrad Territory

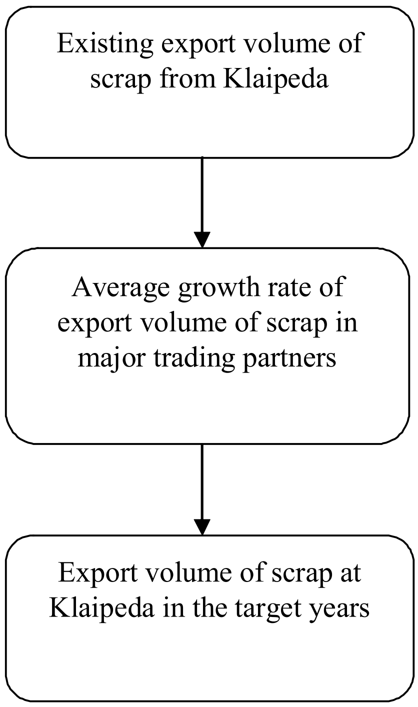
APPENDIX B TRAFFIC FORECAST

APPENDIX B TRAFFIC FORECAST

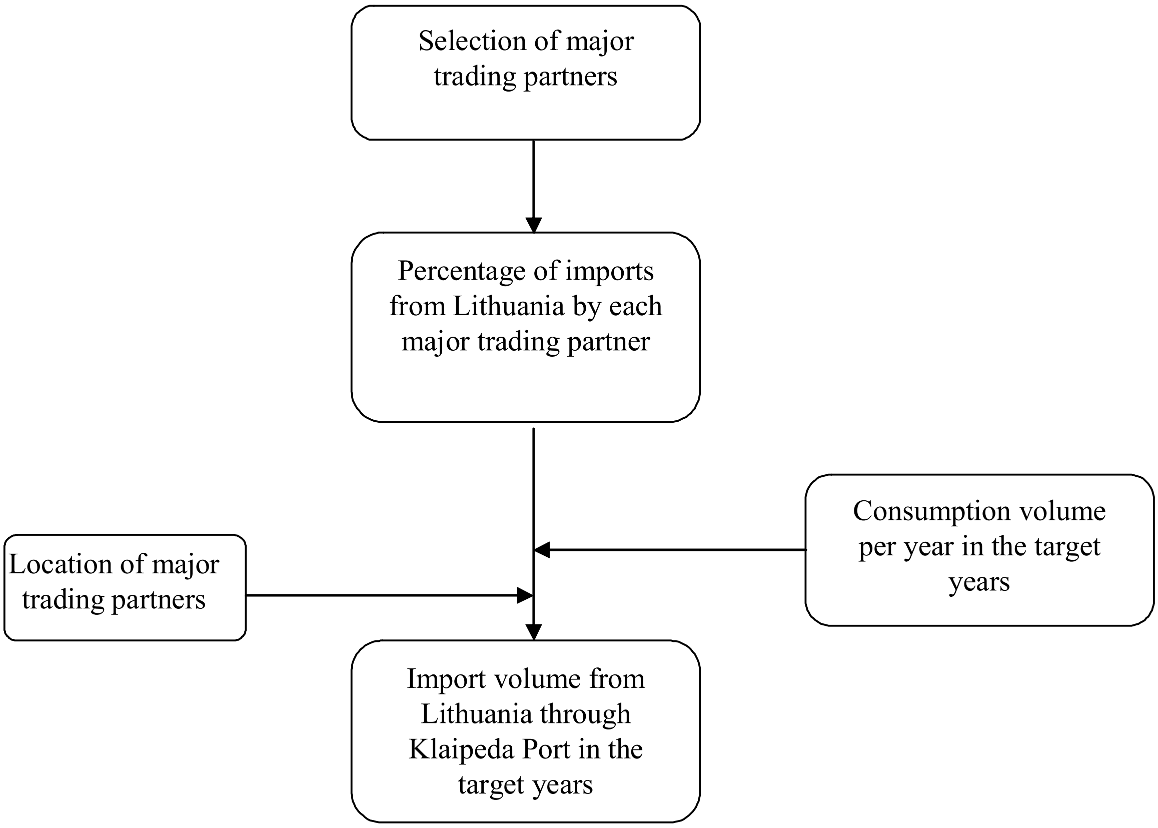
B.1 Flow chart of cargo forecast

B.1.1 Forecast of Lithuanian cargoes by commodity

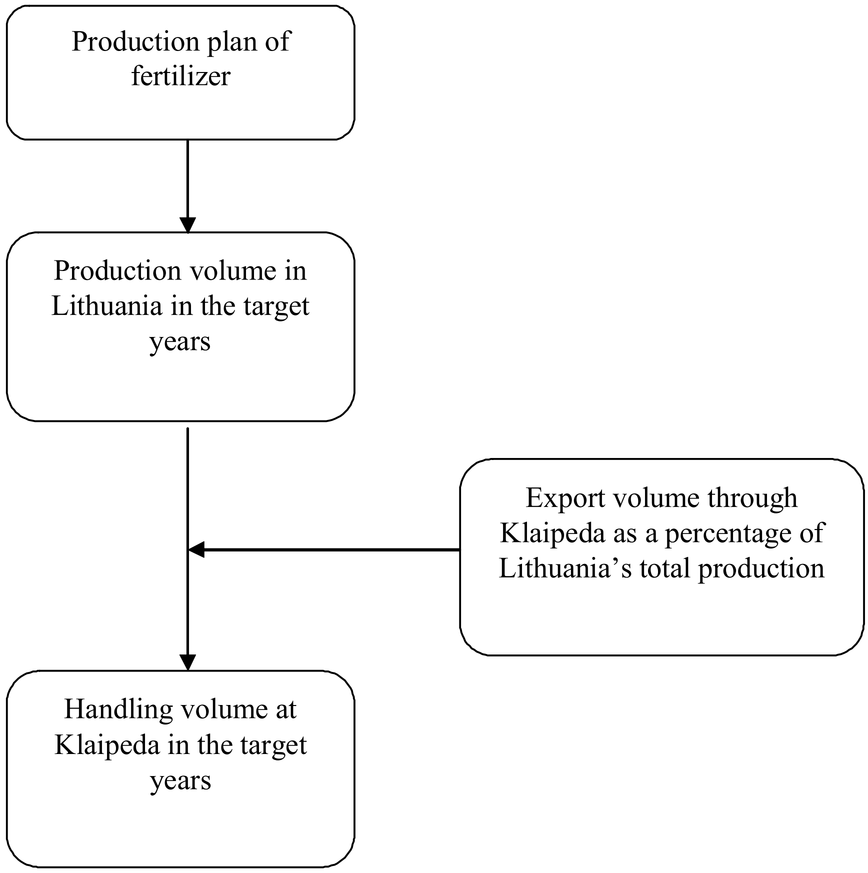
(1) Scrap for export



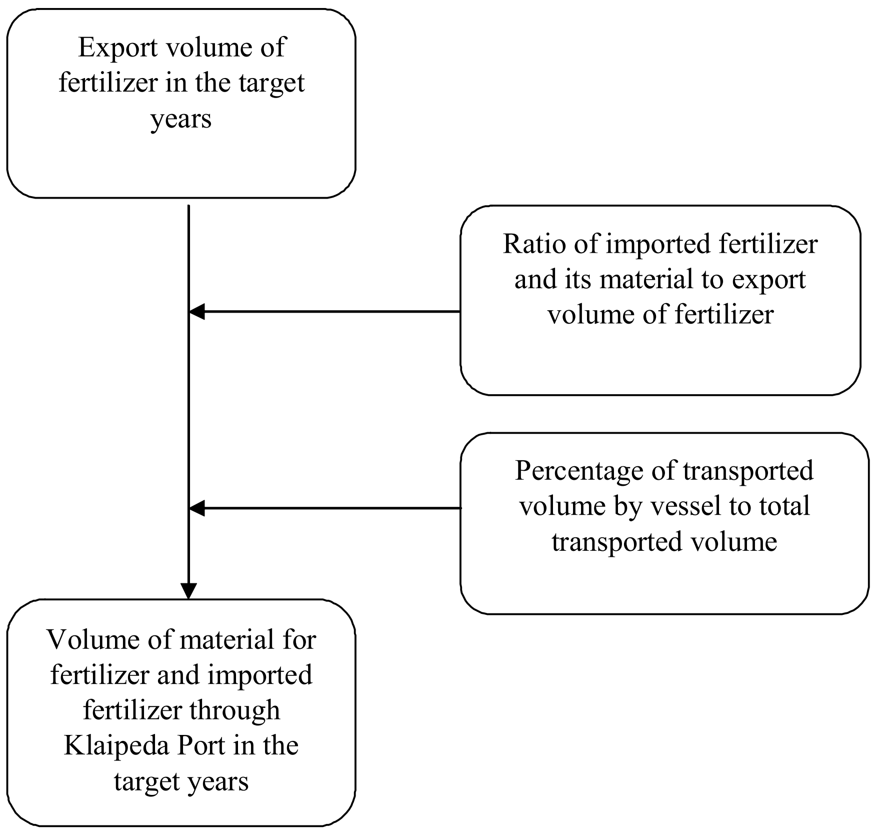
(2) Export Fertilizer (Case 1)



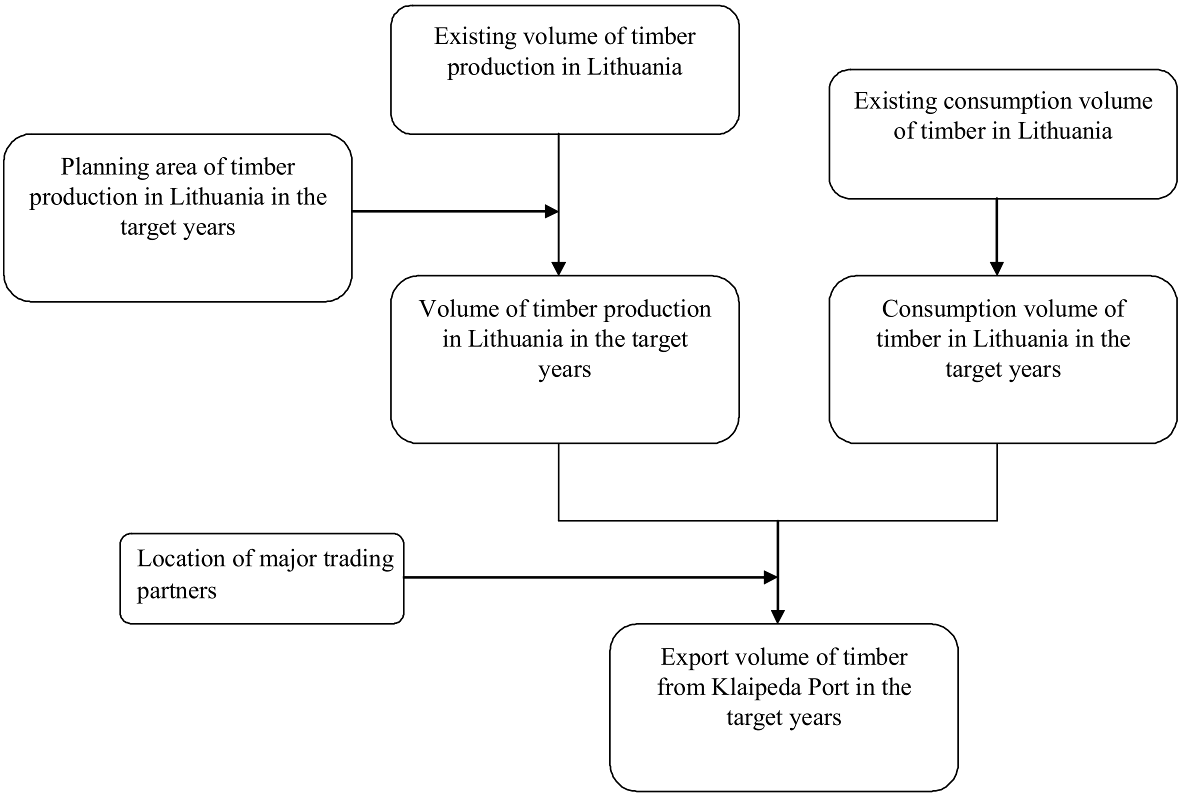
(3) Export Fertilizer (Case 2)



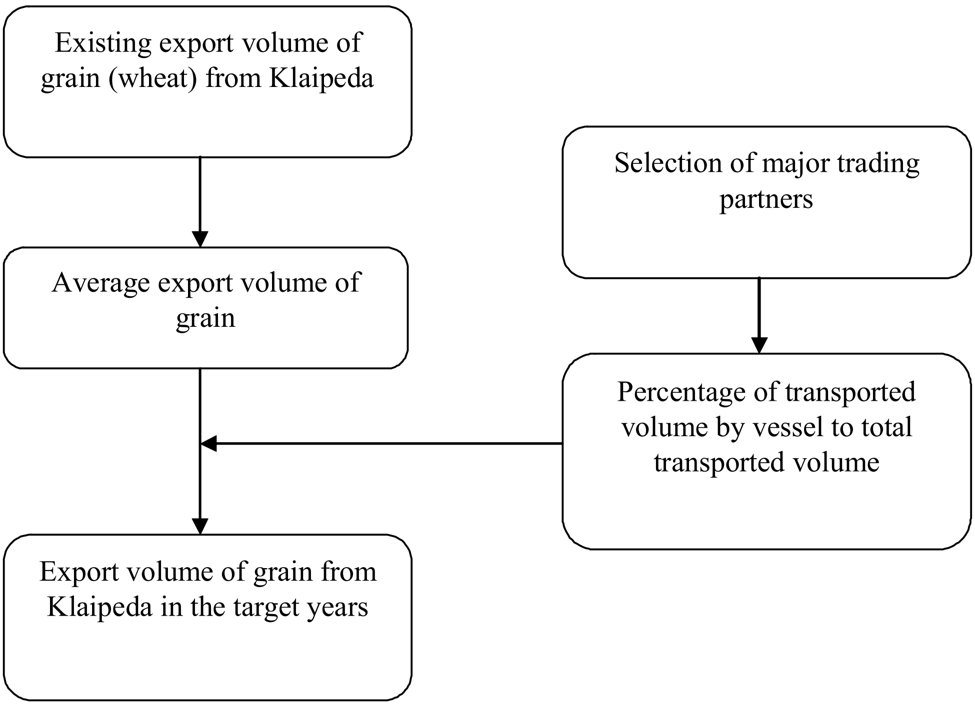
(4) Import Fertilizer



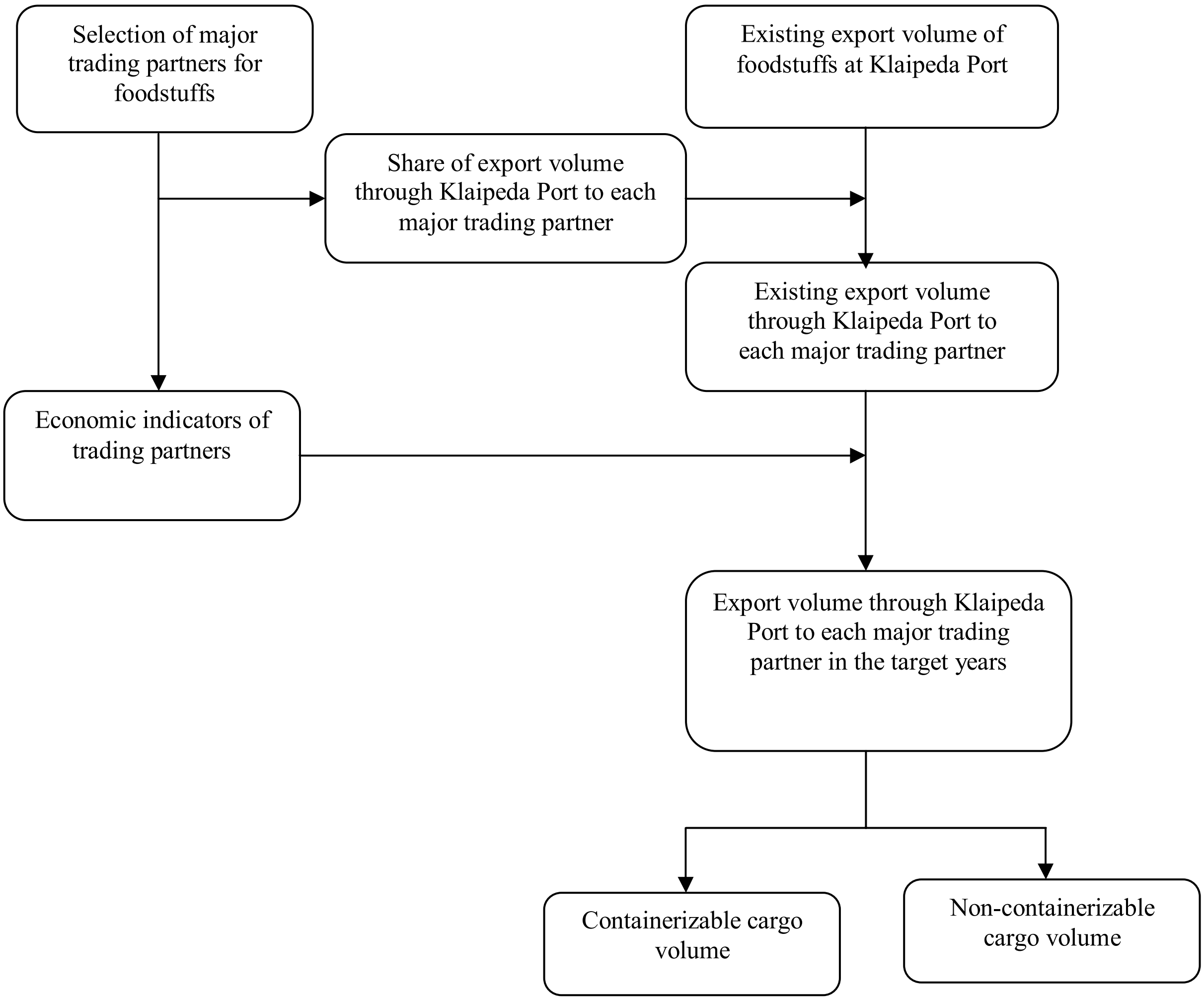
(5) Timber and timber products for export



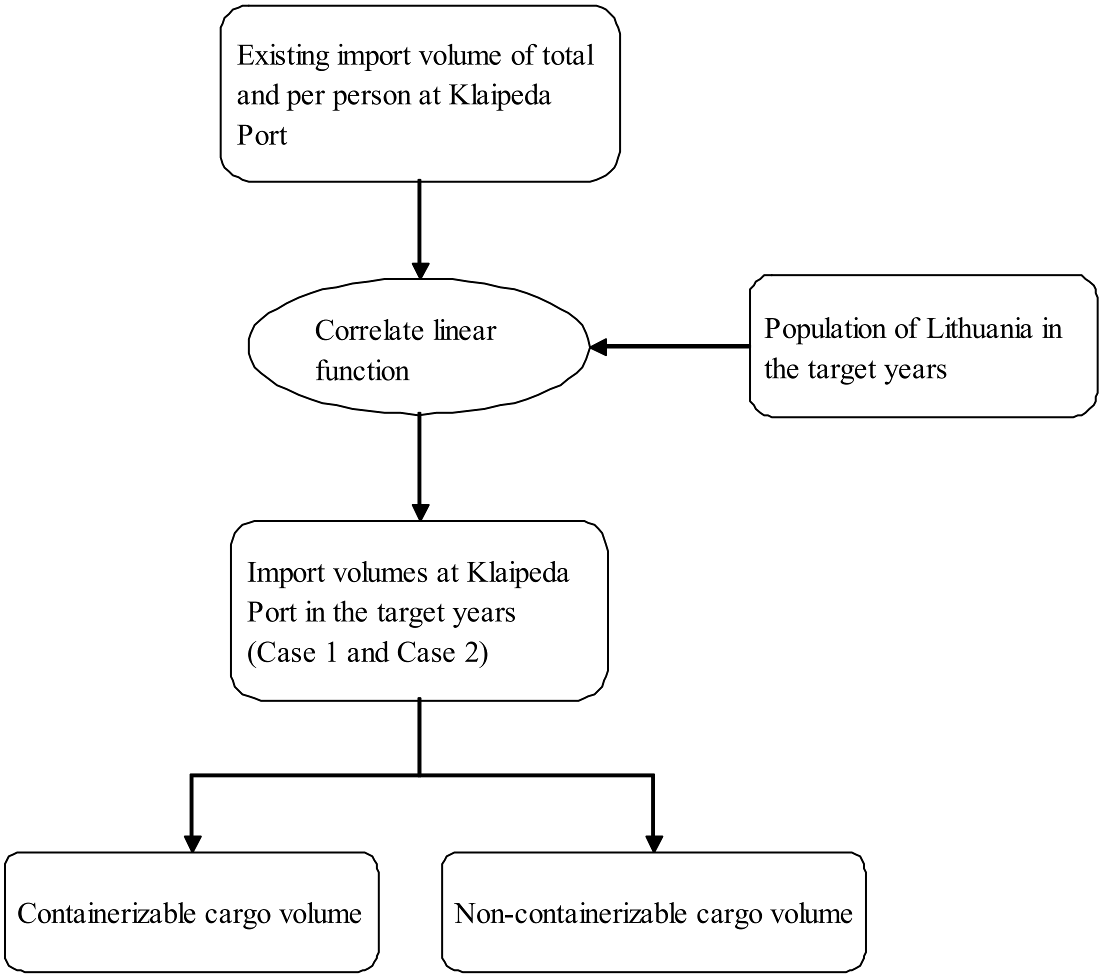
(6) Grain for export



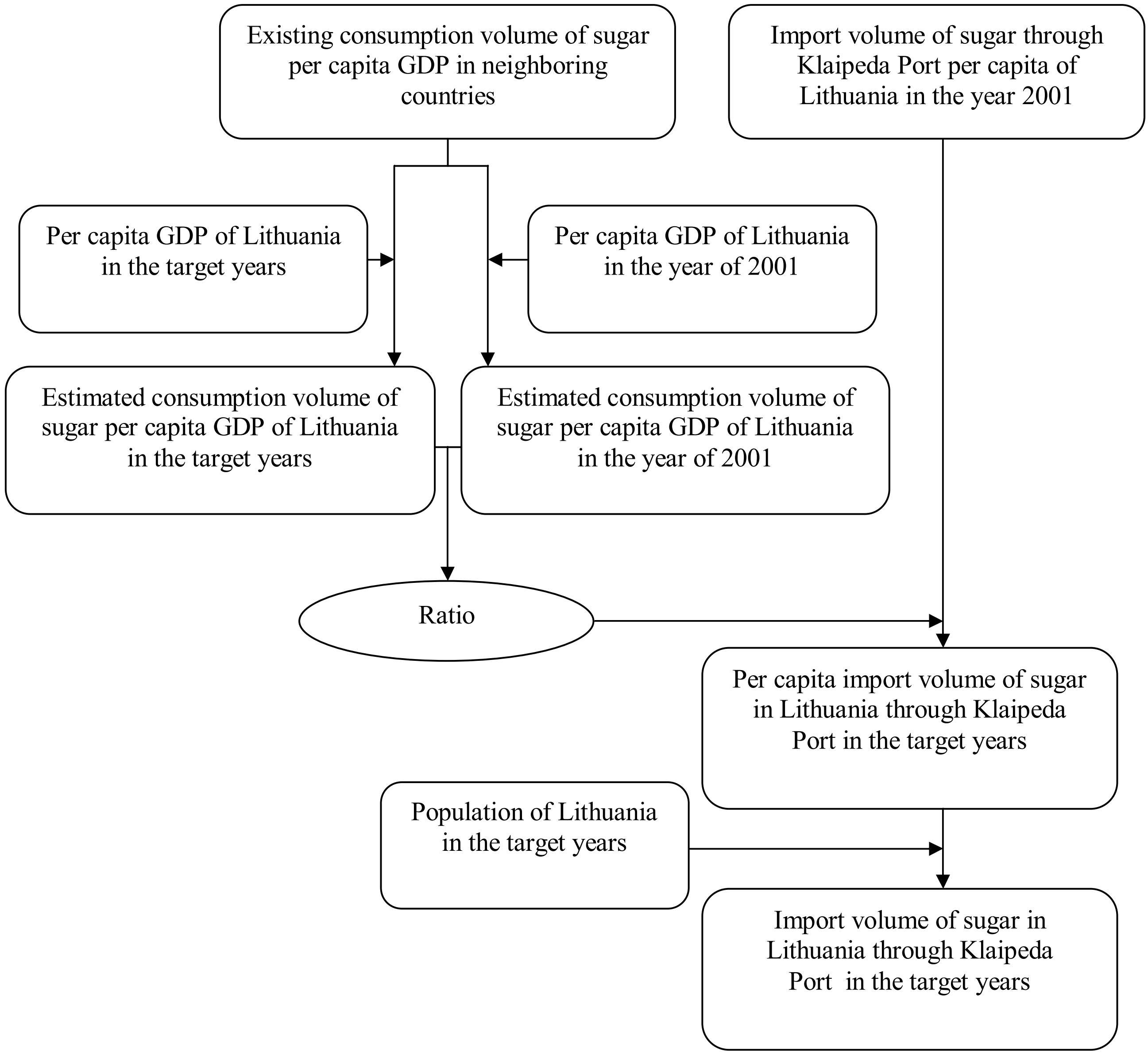
(7) Foodstuffs for export



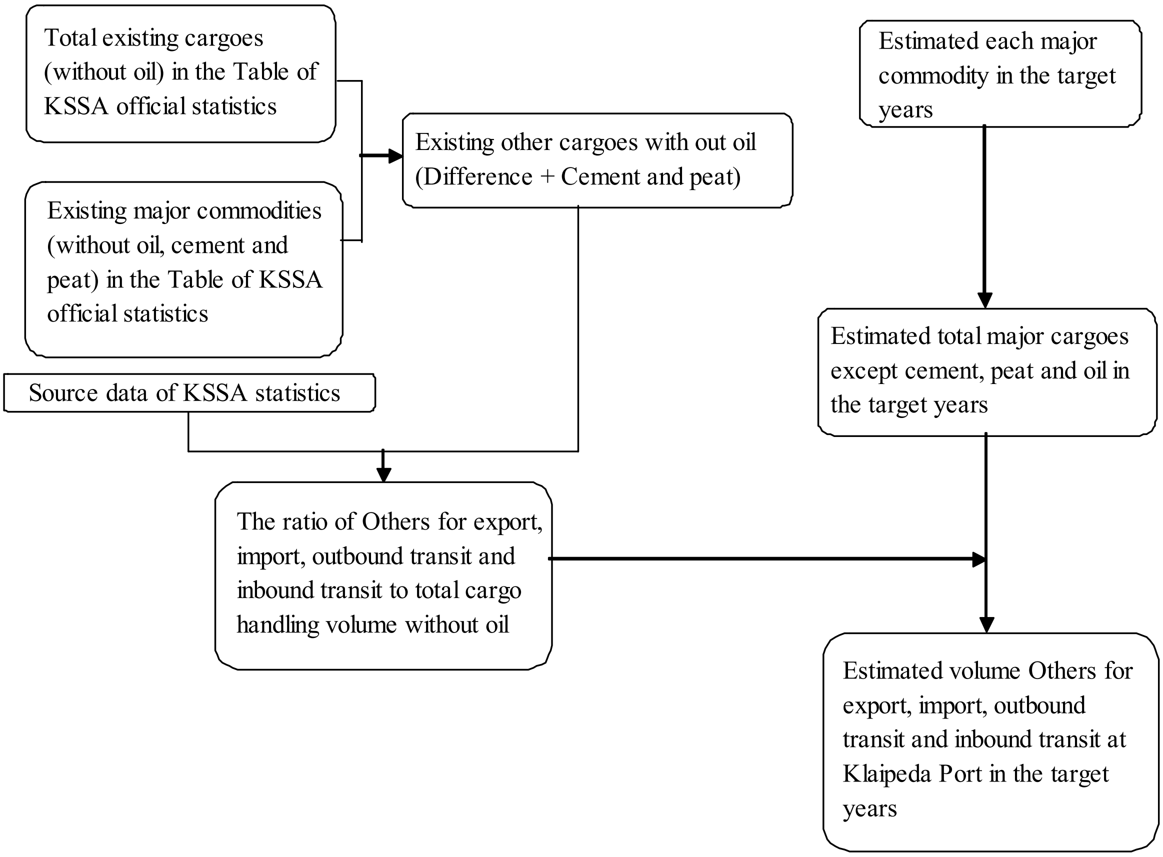
(8) Import foodstuffs except sugar



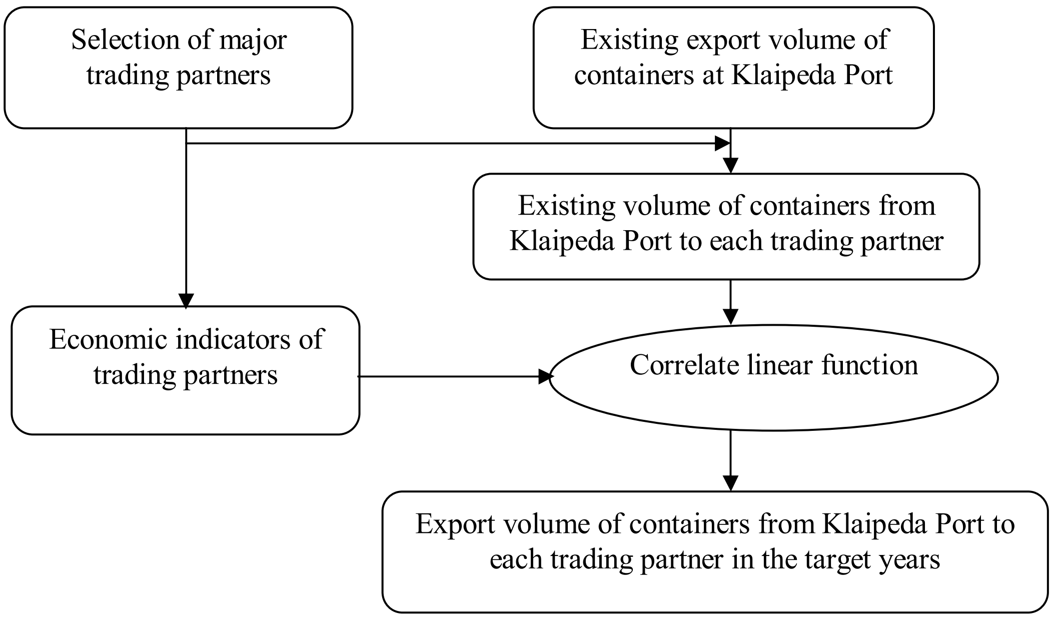
(9) Sugar for import



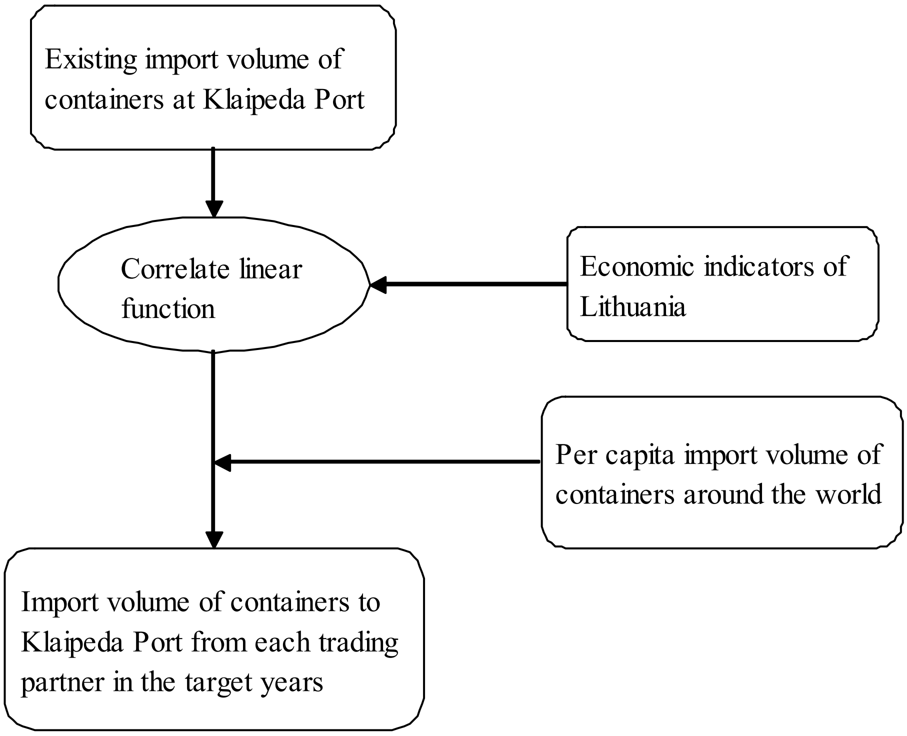
(10) Others



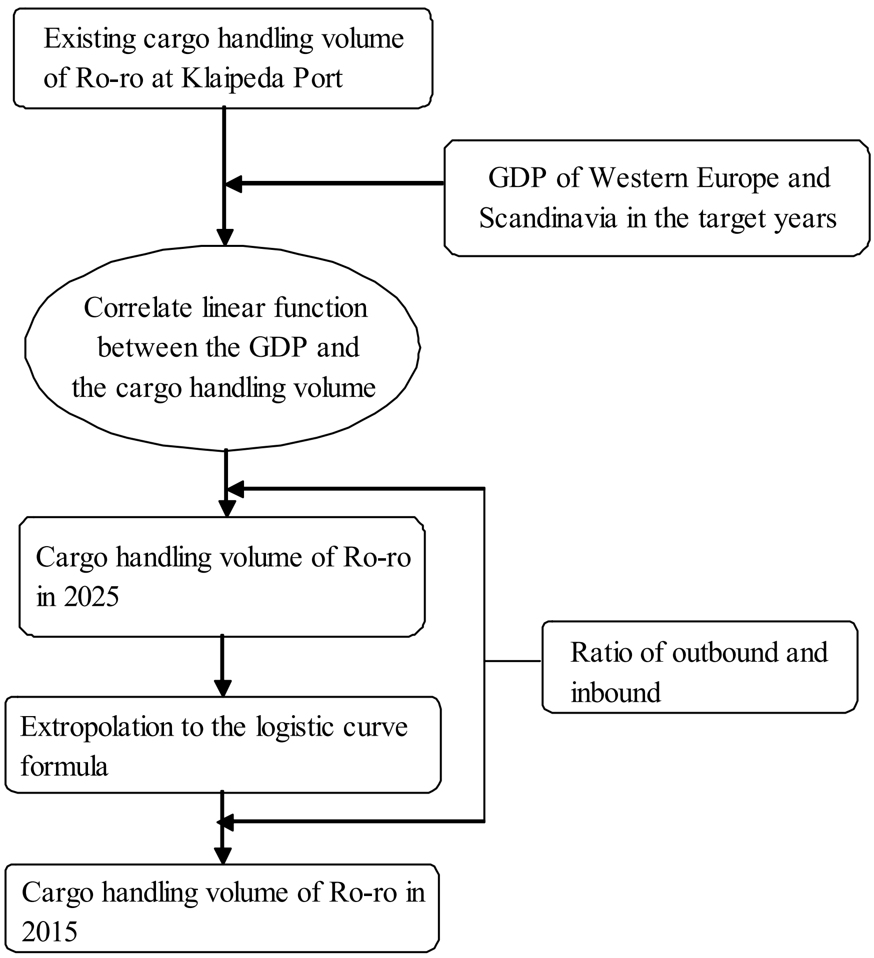
(11) Container for export



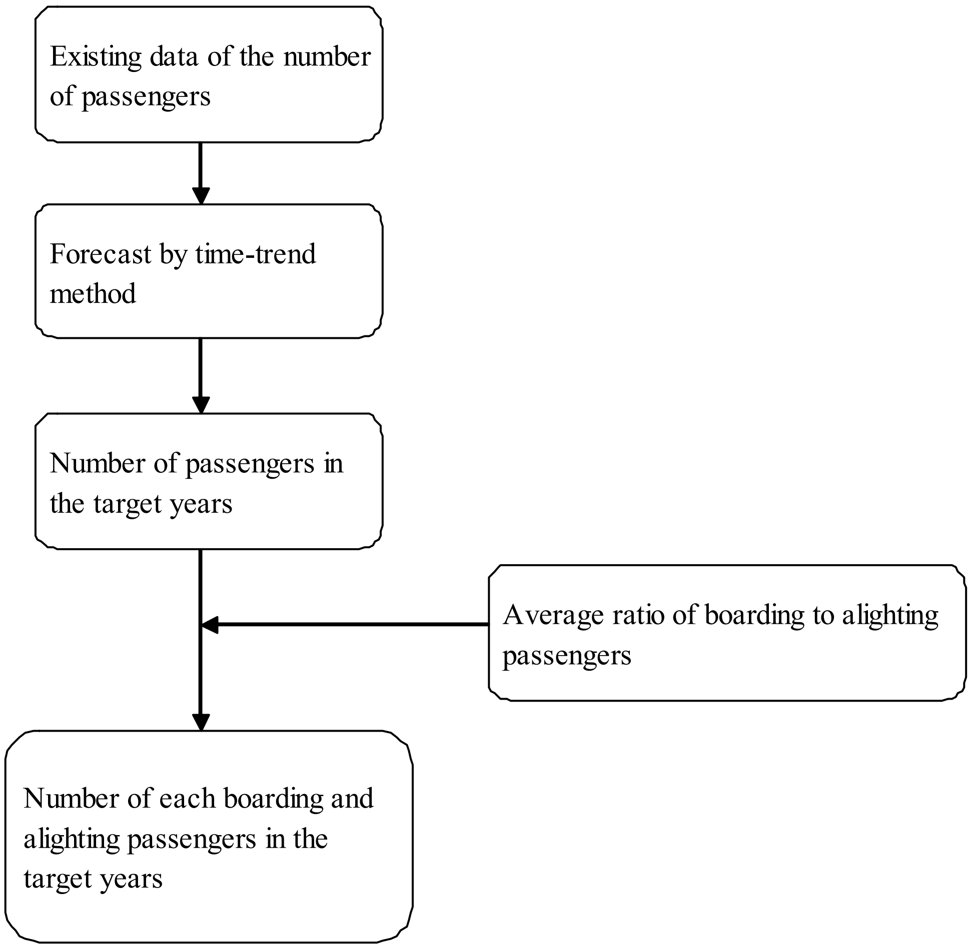
(12) Container for import



(13) Ro/Ro

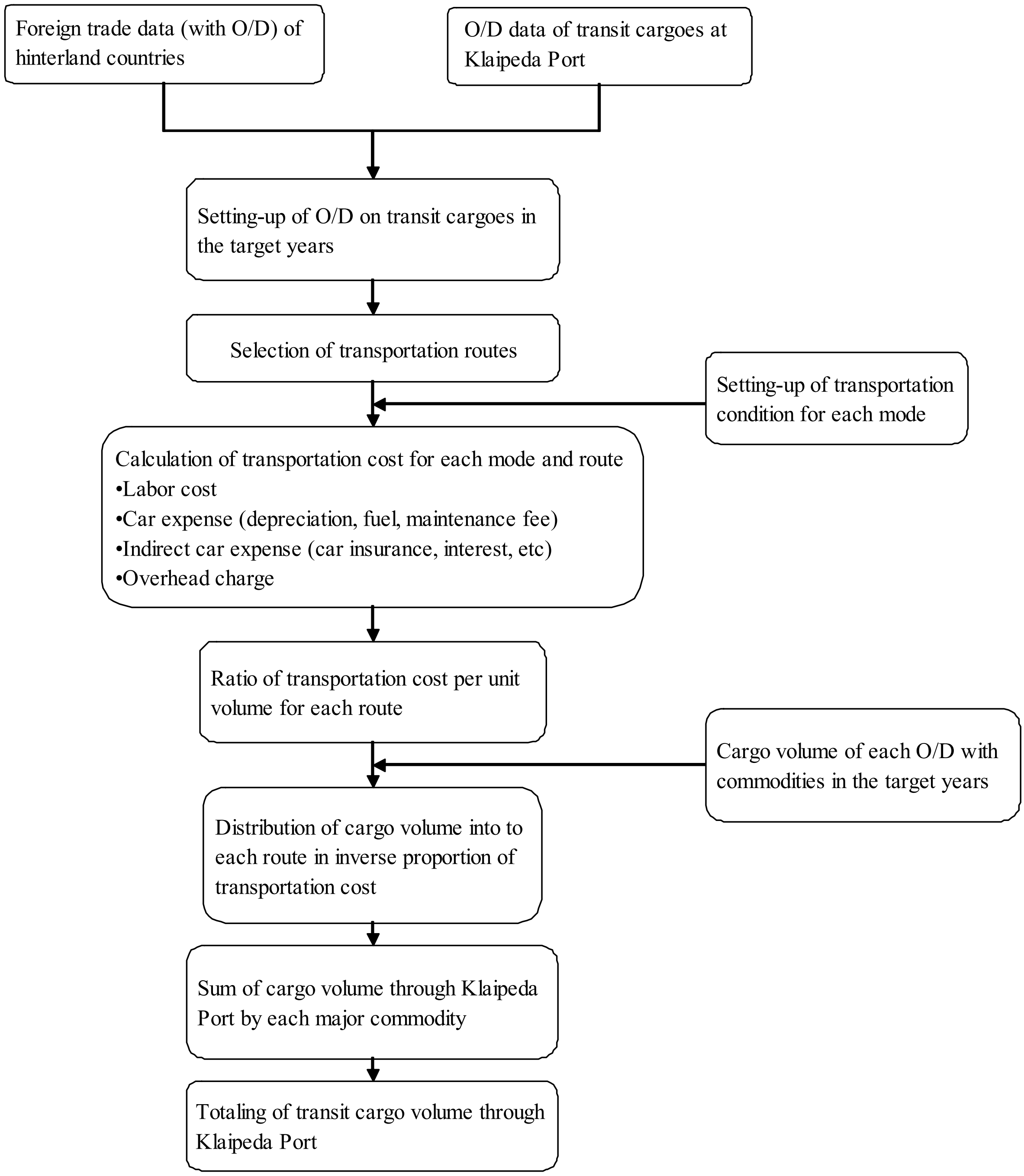


(14) Passengers



B.1.2 Forecast of transit cargoes at Klaipeda Port

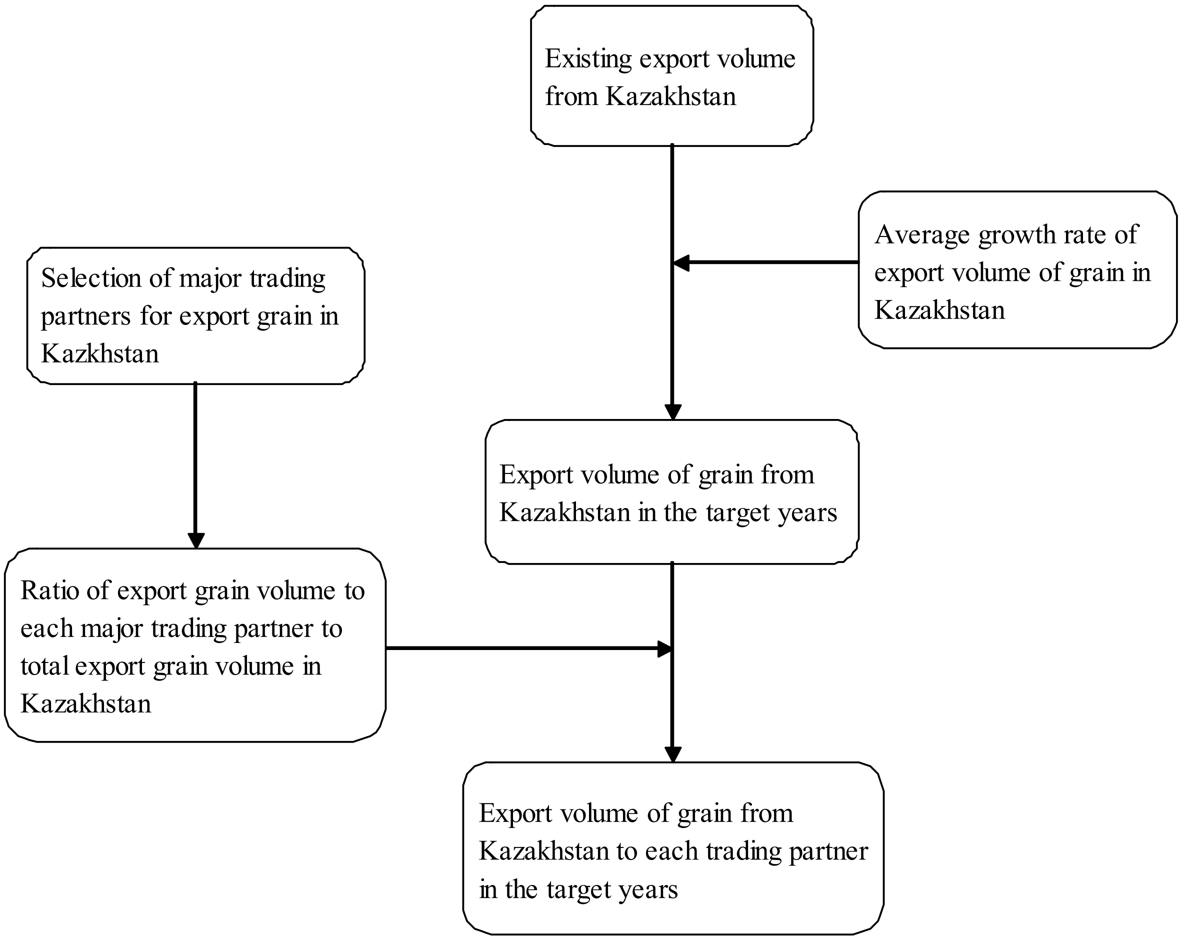
(1) Forecast procedure of transit cargo volumes for each commodities except oil in the target years



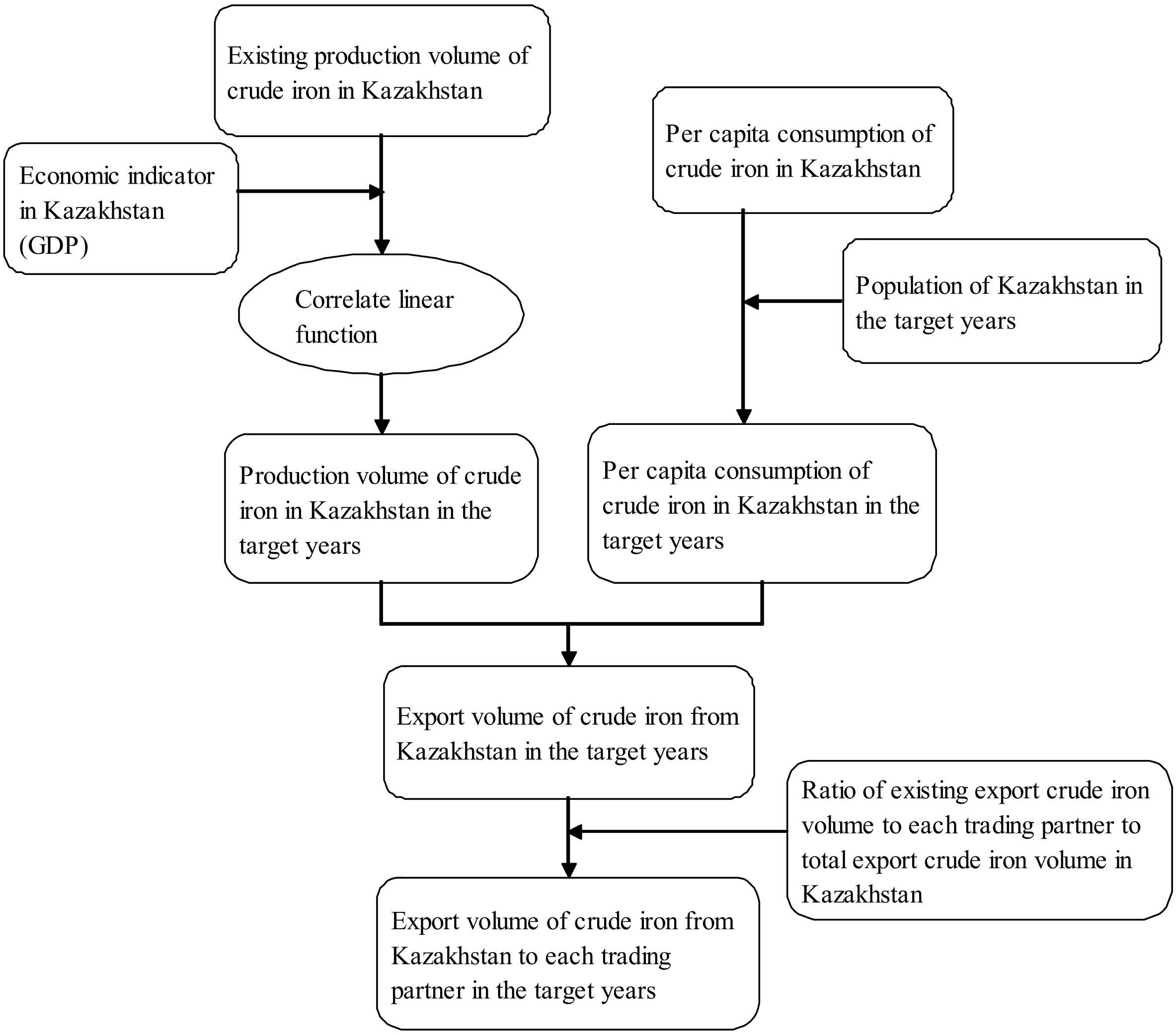
(2) Fore cast of foreign trade cargo volume in hinterland countries by major transit cargo commodities at Klaipeda Port

1) Kazakhstan

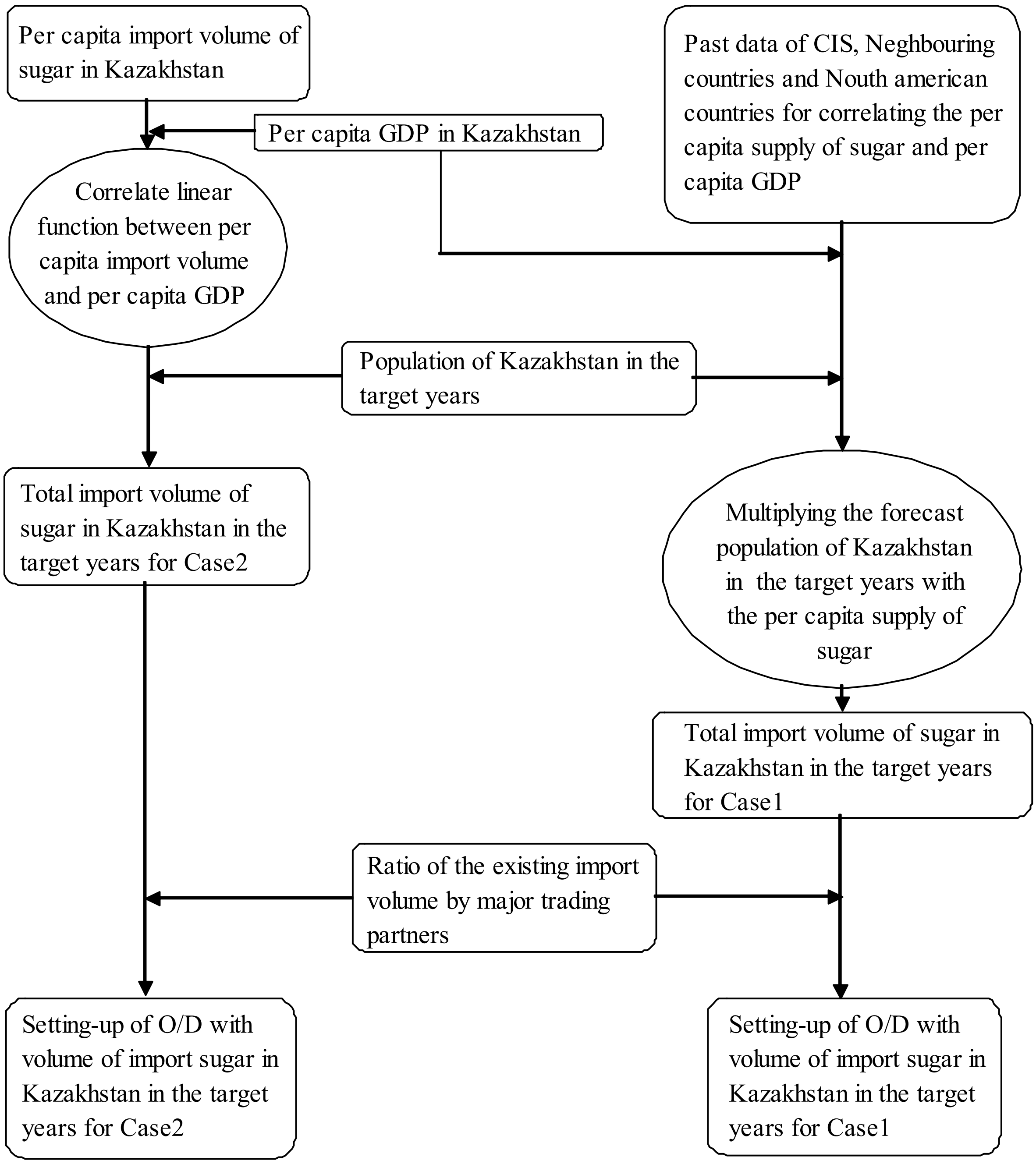
* Export grain



* Export crude iron

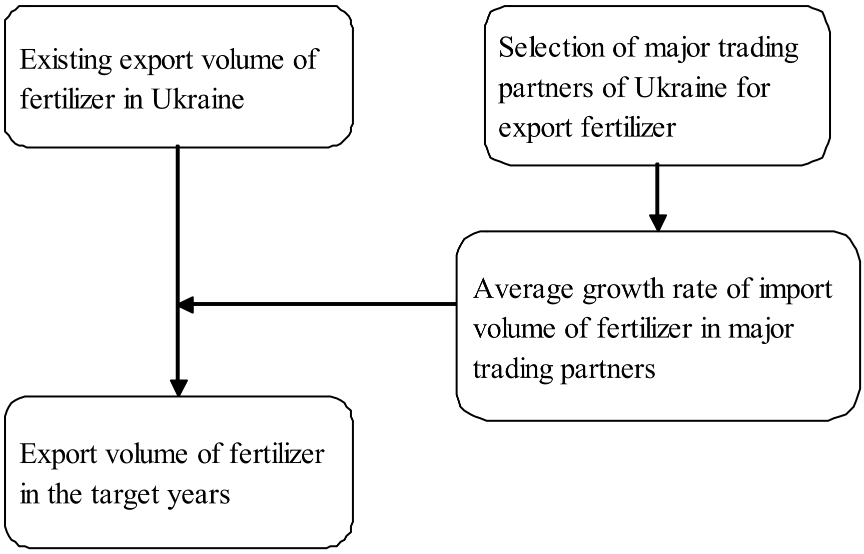


* Import sugar

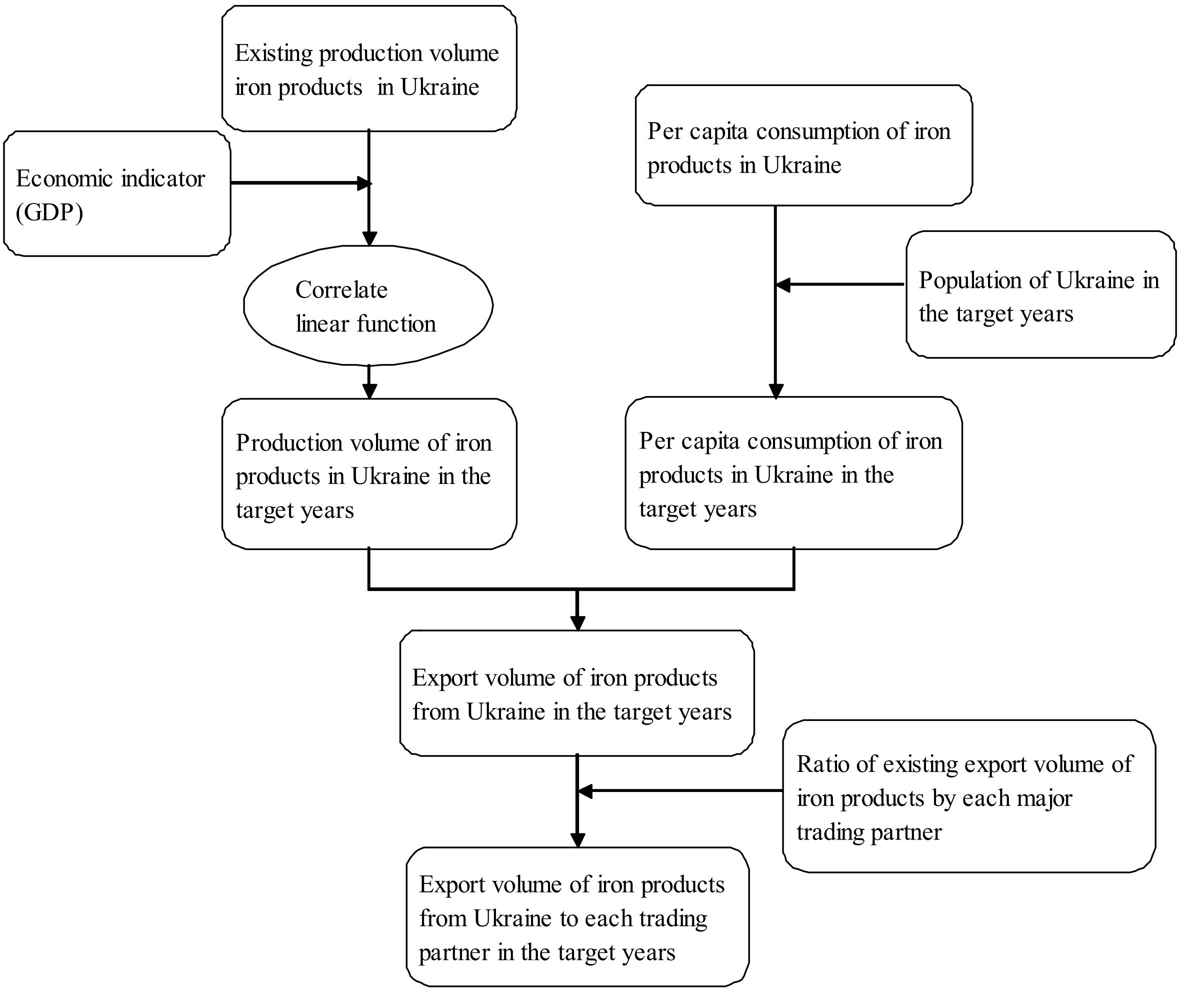


2) Ukraine

* Fertilizer for export

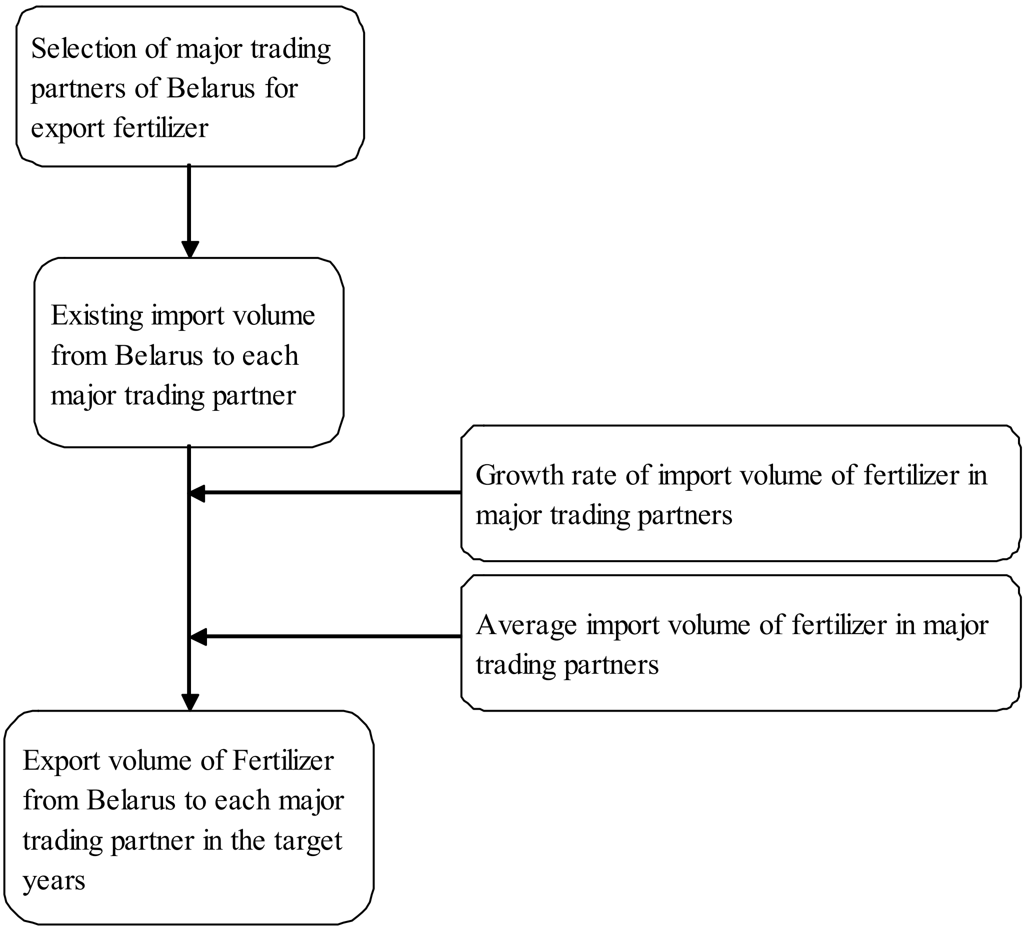


* Export iron products (Crude iron, semi-finished and finished steel products)

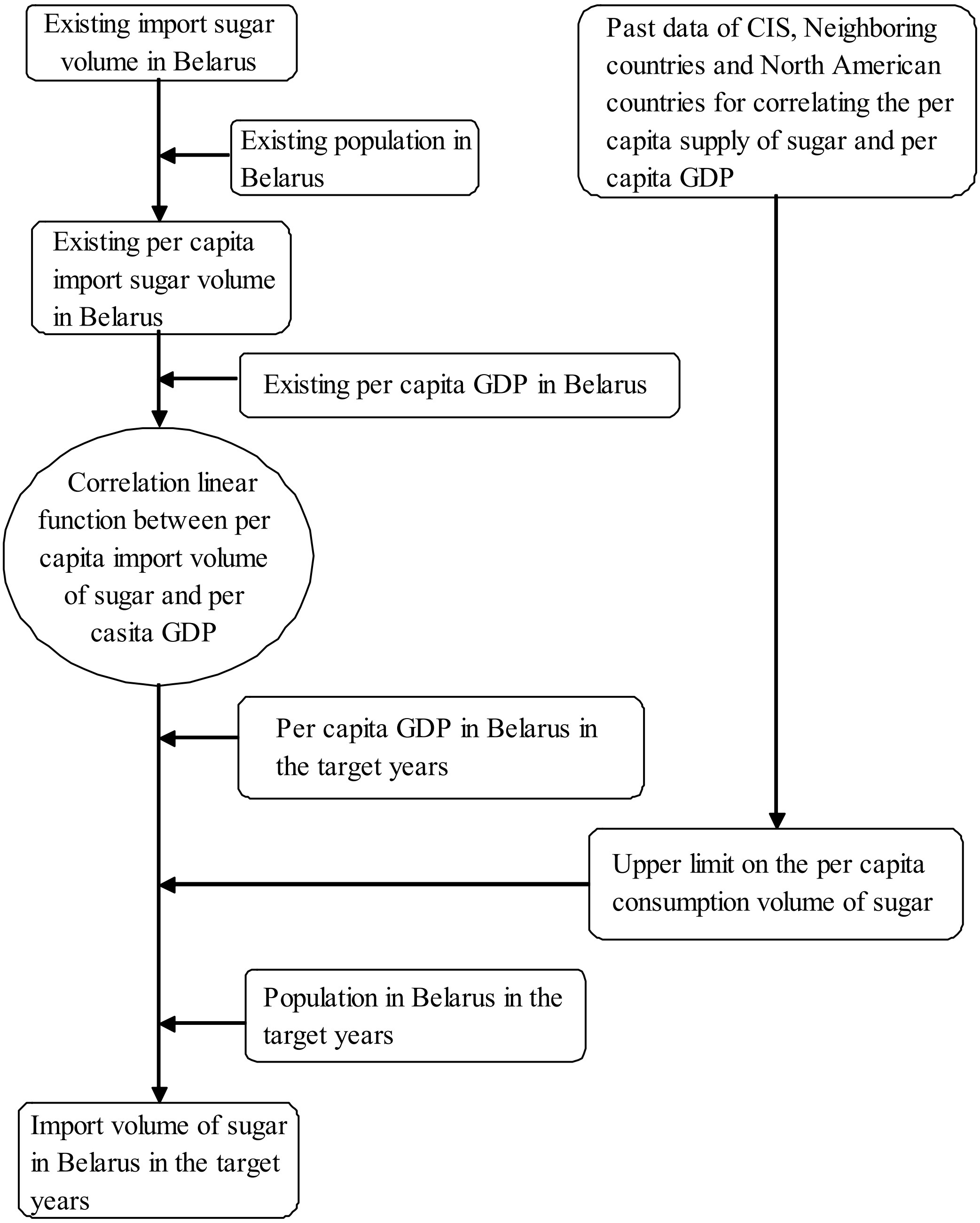


3) Belarus

* Fertilizer for export



* Sugar for import



B.2 For example distribution of transportation volume for sugar into each major route from Cuba to Kazakhstan (Transit cargo)

1 Estimated import cargo volume from Cuba for sugar in Kazakhstan in 2025

Low Case: 383 thousand tons-------- L
High Case: 458 thousand tons-------- H

2 Distribution of transportation volume for sugar into each major route from Cuba to Kazakhstan

Route / Origin / Via / Destination	Havana (Cuba) | Liepaja Astana (Kazakhstan)	Havana (Cuba) | Ventpils Astana (Kazakhstan)	Havana (Cuba) | Tallinn Astana (Kazakhstan)	Havana (Cuba) | St.p. burge Astana (Kazakhstan)	Havana (Cuba) | Klaipeda Astana (Kazakhstan)	Havana (Cuba) | Kaliningrad Astana (Kazakhstan)	Havana (Cuba) | Riga Astana (Kazakhstan)	Havana (Cuba) | Rostov Astana (Kazakhstan)	Total	Unit
Transportation cost (a)	2,495.468	2,497.786	2,695.956	2,556.220	2,473.616	2,440.246	2,640.615	2,099.114		¥/ton
(b) = 1/(a)	0.0004007	0.0004004	0.0003709	0.0003912	0.0004043	0.0004098	0.0003787	0.0004764	0.0032324	-
Ratio of (b)	0.1239733	0.1238582	0.1147539	0.1210269	0.1250684	0.1267787	0.1171588	0.1473818	1	-
Low case 2025: (b) x L	47.5	47.4	44.0	46.4	47.9	48.6	44.9	56.4	383	1000 tons
High case: (b) x H	56.8	56.7	52.6	55.4	57.3	58.1	53.7	67.5	458	1001 tons

3 For example, calculation of tentative transportation cost of sugar (bulk) from Cuba to Kazakhstan via Rostov Port for distribution of transportation volume to each major route

Distance:	Havana-Rostov	6500 sea miles,	Rostov-Astana	3200Km
Transportation mode:	Havana-Rostov	Sea transportation,	Rostov-Astana	Railway

Transportation cost for Railway (tentative)

Condition:	Depreciation period of locomotives and wagons: 20 years	Residual value of depreciation: 10 %	
	Number of wagons per train: 30 wagons	Number of crew per train: 2 persons	Number of shifts: 1.5 shifts/day
	Capacity of a wagon: 55 tons	Average load factor: 60 %	Average speed of train: 60 Km/h
	Working ratio for locomotive: 0.9	Working ratio for wagon: 0.79	
	Load condition : From Rostov to Astana : loaded	From Astana to Rostov : empty	
	Consumption of fuel: 0.15 Km/little		
	Interest of long term loans: 4.52%		
(1) Transportation cost:	1132.7 thousand yen/trip		
Contents:	Labor cost for trains operation, Depreciation cost of locomotives and wagons, Fuel cost, Maintenance and repair cost for locomotives and wagons interest of long term loans for purchase of the locomotive		
(2) In-direct cost :	205.9 thousand yen/trip		
Contents:	Office operating expenses, Sundry cost		
(3) Cargo handling cost:	Because the difference is not so large for each route, cargo handling costs was not appropriated in this forecast.		
Total cost (1)+(2) =	1338.6 thousand yen/trip (1352 yen/ton)		

Sea transportation cost (tentative)

Condition:	DWT: 40000	Depreciation period: 15 years	Residual value of depreciation: 10 %
	Speed: 14 knot	Capacity: 35400tons	Total voyage day: 23 days (including mooring day at Rostov)
(1) Vessel cost	24958 thousand yen/one voyage		
Contents:	Chartered vessel cost including Depreciation cost, crews cost, fuel cost, interest of long term loans for purchase of vessel, office operation expenses and others.		
(2) Cargo handling cos	1505 thousand yen/vessel (for unloading port)		
Contents:	Depreciation cost of cargo handling equipment, labor cost, maintenance & repair cost, fuel cost, Interest of long term loans for purchase of of cargo handling equipment		
Total cost (1)+(2) =	26463 thousand yen/voyage (748 yen/ton)		

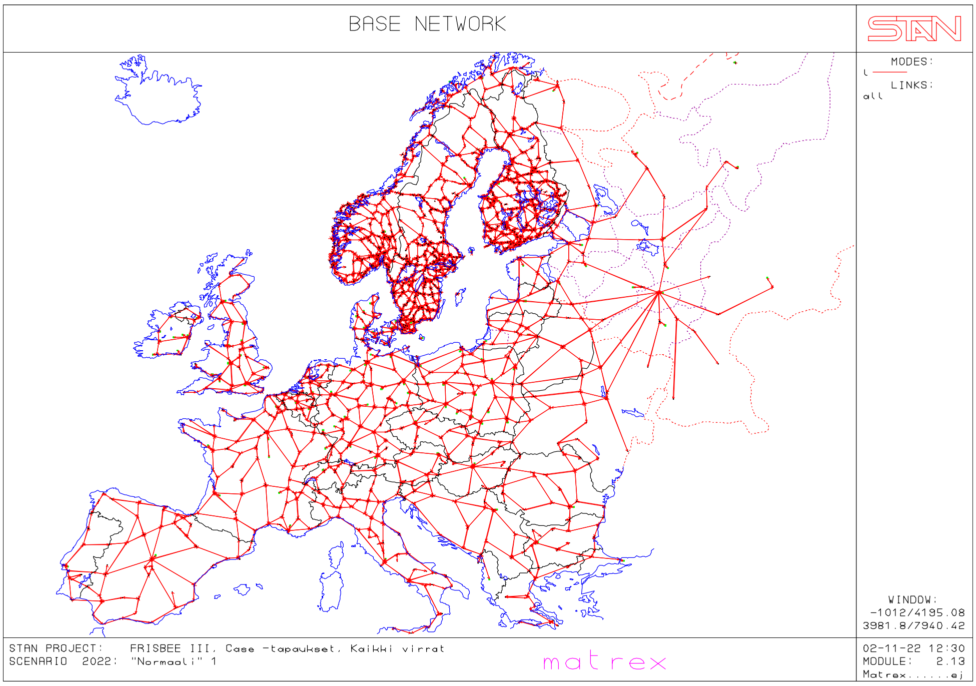
Total transportation cost per ton : 2100 yen/ton (Detailed calculation by electronic computer : 2,099.114 yen/ton)

B 2 Assessment of Transport Network Changes

B 2.1 Introduction

During the course of the study investigations were made with a transport firm in Helsinki, Finland about the suitability of using a traffic model to assess the impact of changes to the transport network on traffic movements. It was known that the firm had built a road/rail traffic model as part of the EU TACIS study Improvement of Traffic Flows on TEN's Corridors II & IX, and was used on that study to test the impact of transport improvements. That study was referred to in Section 1.2.4 of Part I of the main report.

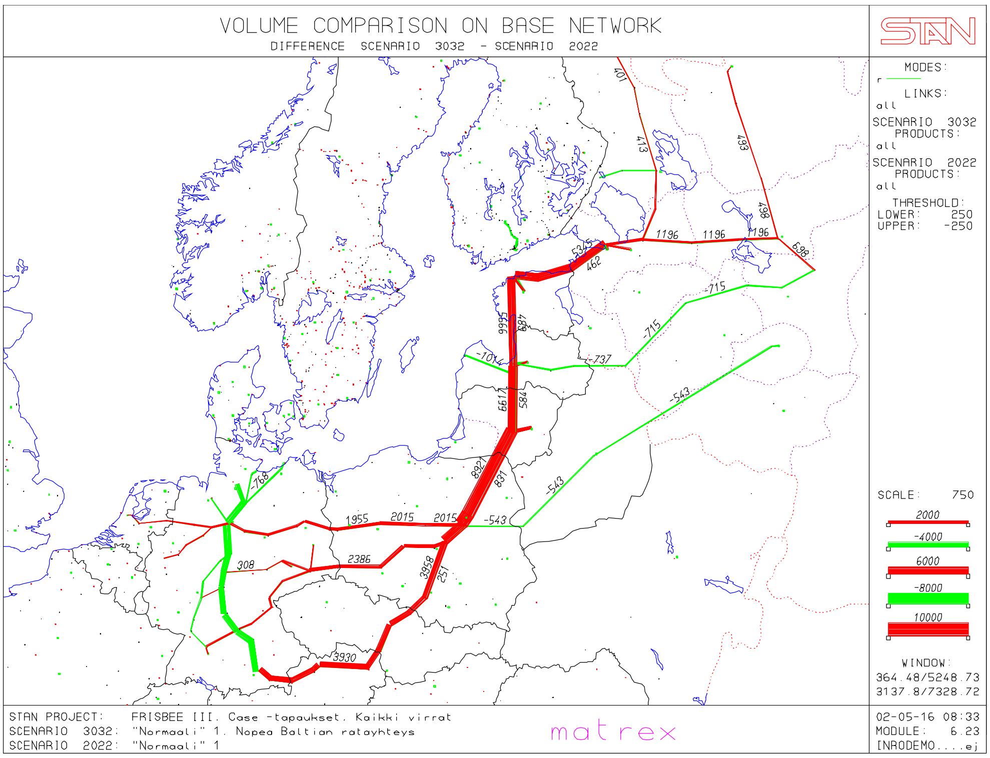
Discussions with the Helsinki firm revealed that a newer traffic model had been built which incorporates Western Europe, Scandinavia, and a zonal system of western Russia. This is called the Freight Transport Model in Europe and Russia (with the acronym FRISBEE), the initial purpose of which was to investigate detailed traffic movements between Finland and Russia. It is built in STAN which is a variant of the EMME2 transport planning software used widely around the world. A base network map illustrating the road network and zonal system can be found in Figure B 2.1-1 below. Similar networks for the railway system and for shipping patterns are also included.



Source : Matrix Oy, Finland.

Figure B 2.1-1 Illustration of FRISBEE Model Road Network

The model is able to show forecast traffic volumes along route links for a variety of different scenarios. An example of one of the previous demonstration runs was to assess the possible traffic volumes on improvements to the north/south Baltic Rail connection. This is illustrated in Figure B 2.1-2 below.



Source : Matrix Oy, Finland.

Figure B 2.1-2 Demonstration Run of Possible Changes to Baltic Rail Traffic

Discussions have been held with the firm and a visit was made to Helsinki to investigate using the model to test how demand would be affected by changes to the transport network and to the economic climate. Six scenarios were defined :-

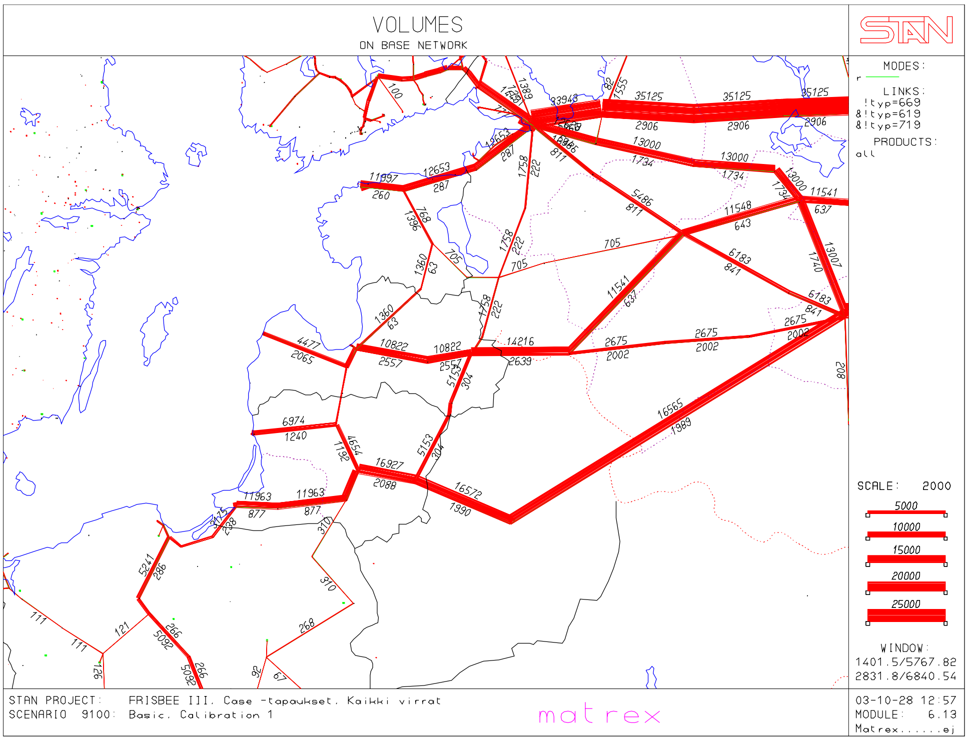
1. With and without the Russian preferential railway tariff to/from Russian ports
2. Reduction in border crossing delays with the accession of the Baltic States and Poland to the EU next year
3. How far Poland is a bottleneck to transit traffic due to its poor roads and transit permit restrictions
4. How planned transport improvements in the Baltic States will redistribute traffic flows
5. The impact of the growth in Gross Domestic Product up to the year 2015
6. The impact of Ust Luga and Primorsk on port capacity at St. Petersburg.

The FRISBEE model produces a series of geographical "plots" illustrating the magnitude of traffic flows by different modes. For the "base case" scenario separate plots were produced for "rail", "road" and "sea" and are illustrated below. For the six scenarios "differences" plots were produced showing how traffic volumes increase (shown in red) or decrease (shown in green) in relation to the "base". "Differences" plots were produced for those modes with distinct changes in traffic volumes.

Whilst the FRISBEE model concentrated on traffic flows to/from Russia the "differences" plots show how traffic patterns will alter for each of the six scenarios. It was not possible within budgetary and time constraints to adapt the model significantly to include other traffic flows to/from the Baltic States and other CIS countries, but it is considered that these would change in a similar way. Russia is clearly the major economic power in the region and its economy is growing significantly and its importance will increase. Russia's planned membership of the World Trade Organisation (currently planned for 2007) will also liberalise trade flows throughout the region which have been artificially disturbed by the introduction of the preferential railway tariffs to/from Russian port in August 2001.

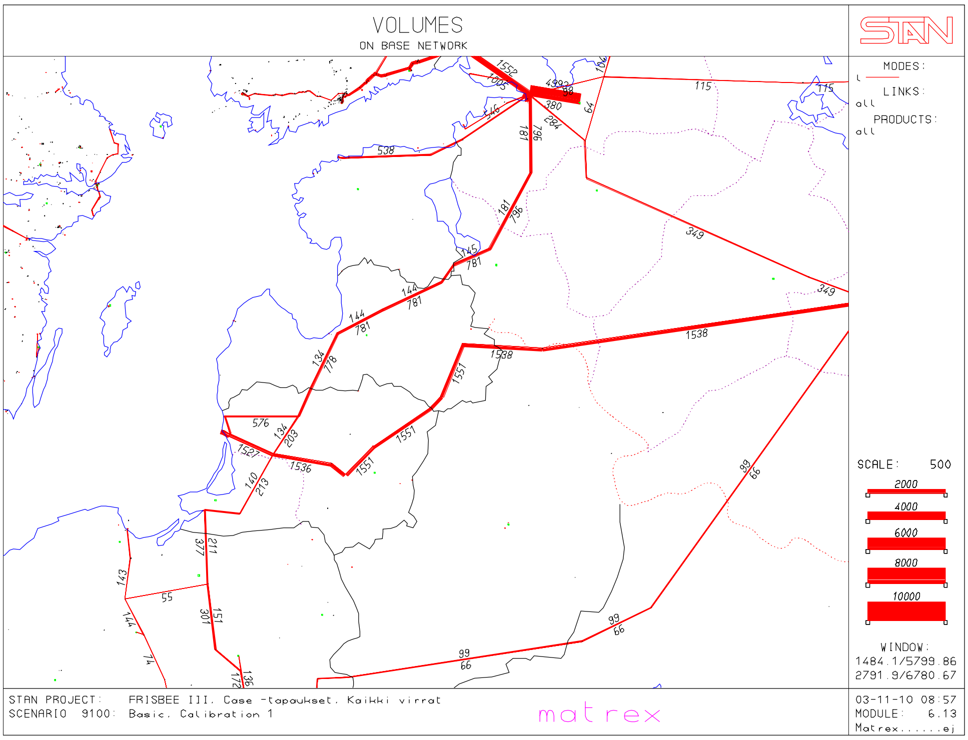
When interpreting the volumes shown on the plots traffic "travels on the right" i.e. on north/south flows the right hand number represents northbound traffic and left hand number the southbound traffic; for east/west flows the lower number represents the eastbound traffic and the upper number westbound traffic. Traffic flows are shown in thousands of tons.

B 2.2 Base Traffic Flows



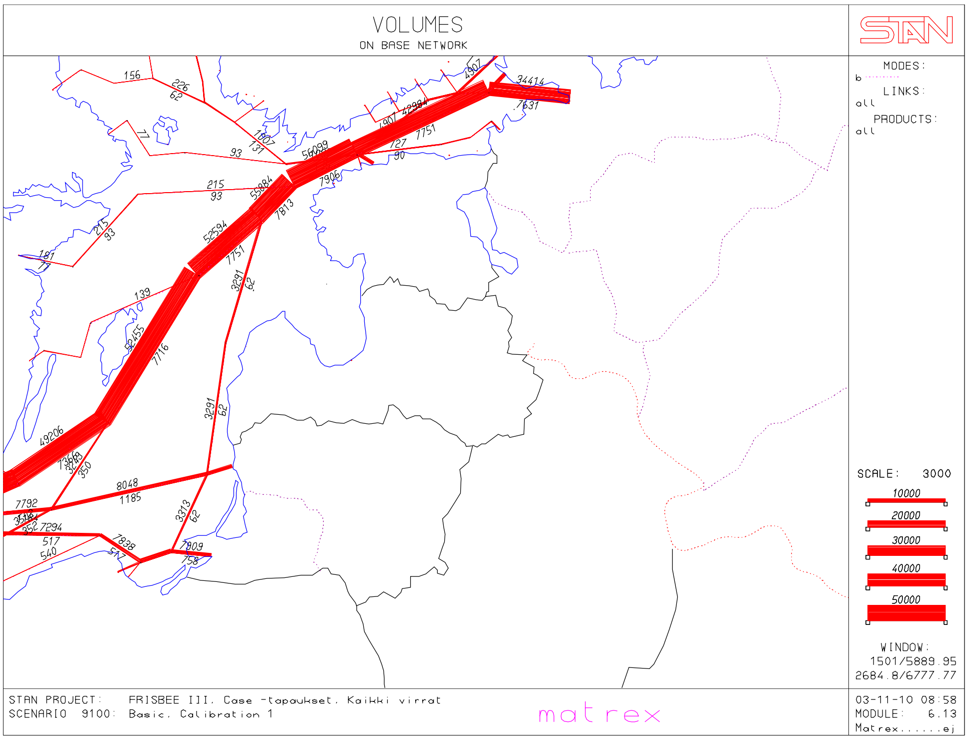
Source : Matrix Oy, Finland.

Figure B 2.2-1 Base Case : Rail Traffic Flows (Units : 000 tons)



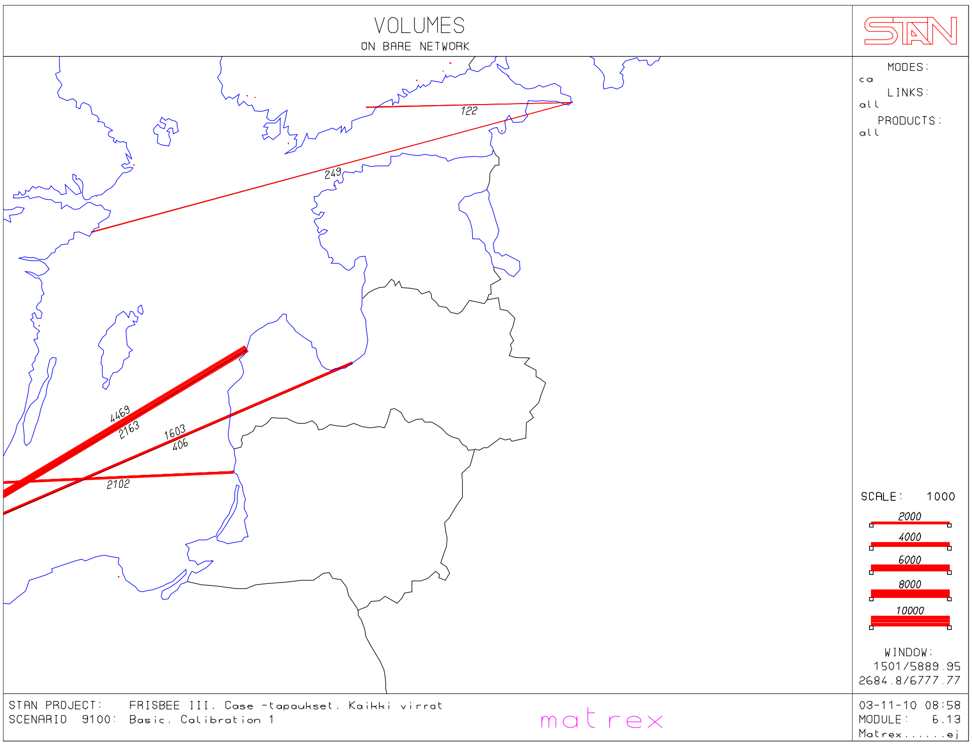
Source : Matrix Oy, Finland.

Figure B 2.2-2 Base Case : Road Traffic Flows (Units : 000 tons)



Source : Matrix Oy, Finland.

Figure B 2.2-3 Base Case : Sea Traffic Principal Flows (Units : 000 tons)



Source : Matrix Oy, Finland.

Figure B 2.2-4 Base Case : Sea Traffic Secondary Flows (Units : 000 tons)

The Base Case scenario consists of four separate plots and show the main freight flows volumes to/from Russia across the Baltic States. These consist of overland rail and road movements and two sea plots which represent the principal and secondary shipping movements. The latter mainly involves ferry services and traffic to/from Latvian ports.

The Base Case scenario was calibrated using 2000/2001 data and establishes the basis devoid of any of the factors contained in the six scenarios. It is against this Base Case that the six scenarios are tested to see how traffic levels change as a result of each of the factors tested. These are represented in "differences" plots by mode for each of the six scenarios, the results of which are described below.

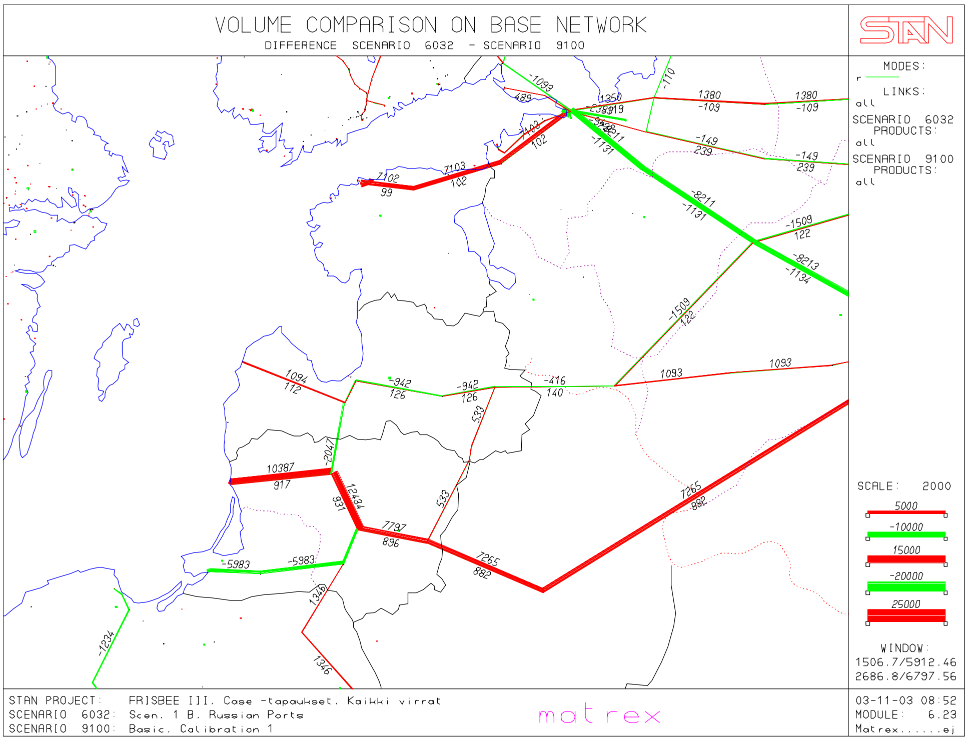
In the Base Case the main rail traffic flows are :-

- From Siberia through to St. Petersburg and on to Tallinn
- From northern Russia through to Riga and Ventspils
- From Moscow area to Kaliningrad and Klaipeda
- From Moscow area to St. Petersburg.

Road traffic flows are much lower as rail traffic carries the principal freight traffic to/from Russia and because of the distances involved. The principal road flows are local traffic to St. Petersburg and to Tallinn, and long distance traffic between Klaipeda and both St. Petersburg and Moscow.

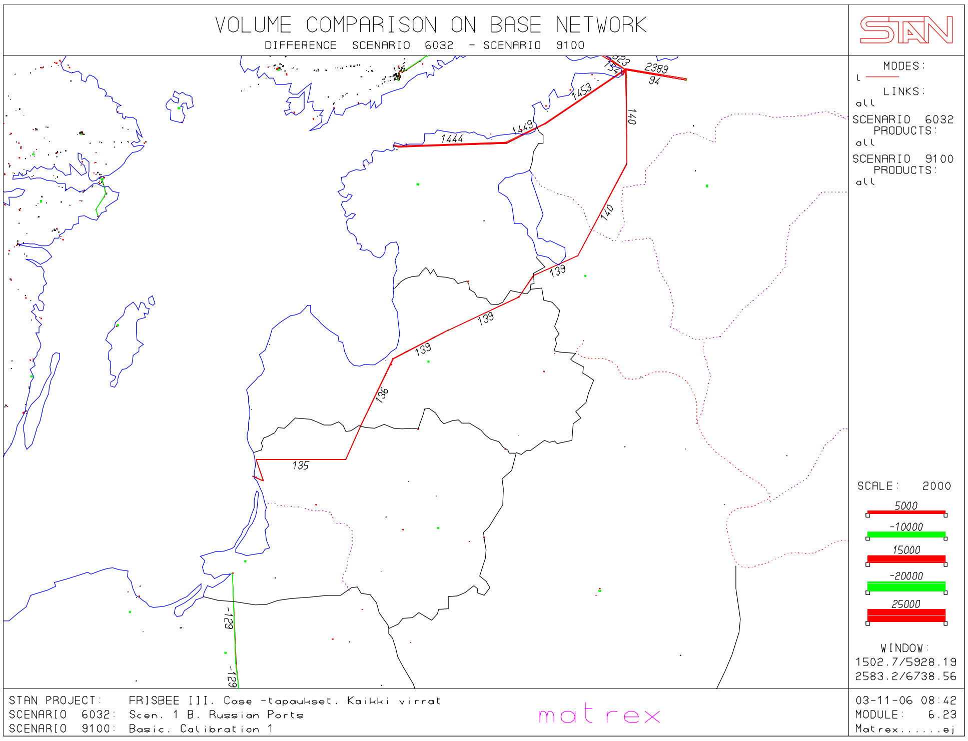
The principal sea traffic flow is along the Baltic to/from the Russian ports of St. Petersburg, Primorsk and Vyborg, and Tallinn in Estonia. This main traffic flow is supplemented by additional traffic movements to/from the other Eastern Baltic ports of Kaliningrad, Klaipeda, Ventspils and Riga.

B 2.3 Scenario 1 (Russian Railway Tariffs)



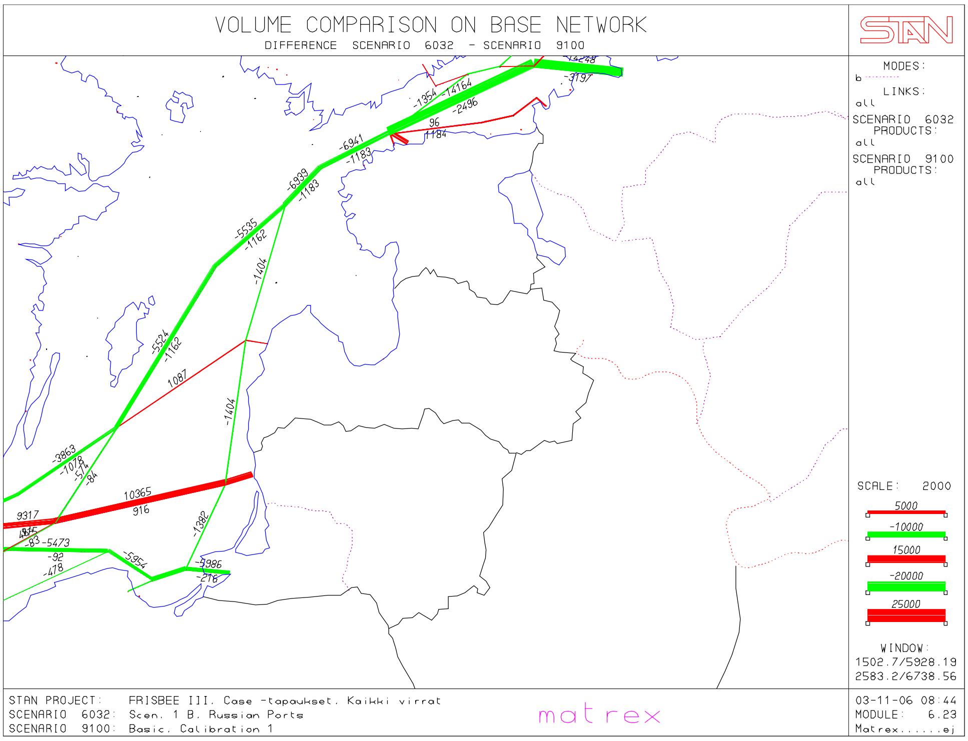
Source : Matrix Oy, Finland.

Figure B 2.3-1 Difference from Base Case : Rail Traffic Flows (Units : 000 tons)



Source : Matrix Oy, Finland.

Figure B 2.3-2 Difference from Base Case : Road Traffic Flows (Units : 000 tons)



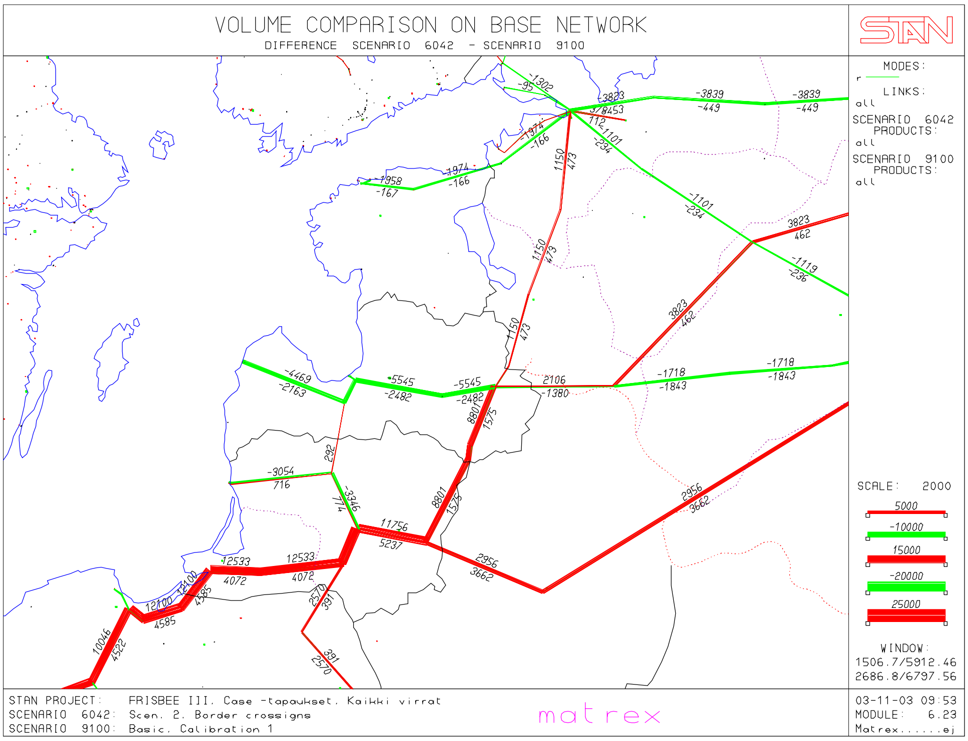
Source : Matrix Oy, Finland.

Figure B 2.3-3 Difference from Base Case : Sea Traffic Flows (Units : 000 tons)

The results of this scenario show that the removal of the preferential Russian railway tariff will divert railway traffic away from the ports of Kaliningrad and St. Petersburg towards the Baltic States ports, in particular Klaipeda and Tallinn. There will be corresponding large reductions in sea traffic to/from the two Russian ports and large increases to/from Klaipeda and Tallinn, plus a smaller increase to/from Ventspils. The Russian railway tariff also has a small affect of transferring some traffic from rail to road haulage between St. Petersburg and Klaipeda.

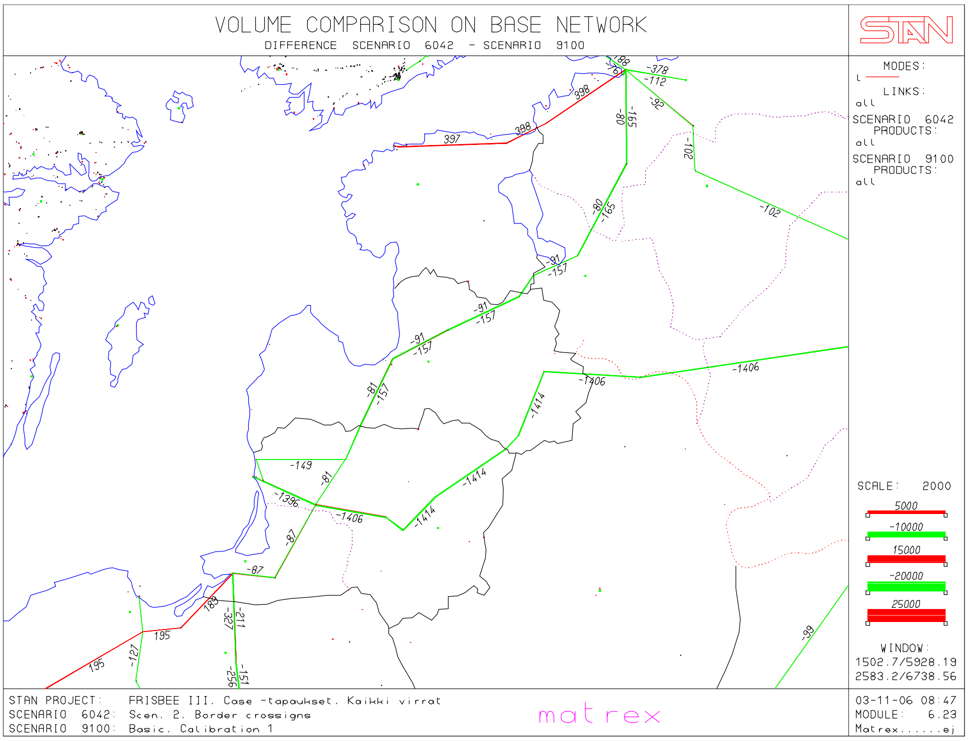
These results are consistent with what happened with the introduction of the preferential tariffs in 2001 and illustrate what could happen to restore the natural balance of traffic flows with their removal. Their removal will be a requirement of Russia joining the World Trade Organisation.

B 2.4 Scenario 2 (Reduction in Border Crossing Delays)



Source : Matrix Oy, Finland.

Figure B 2.4-1 Difference from Base Case : Rail Traffic Flows (Units : 000 tons)

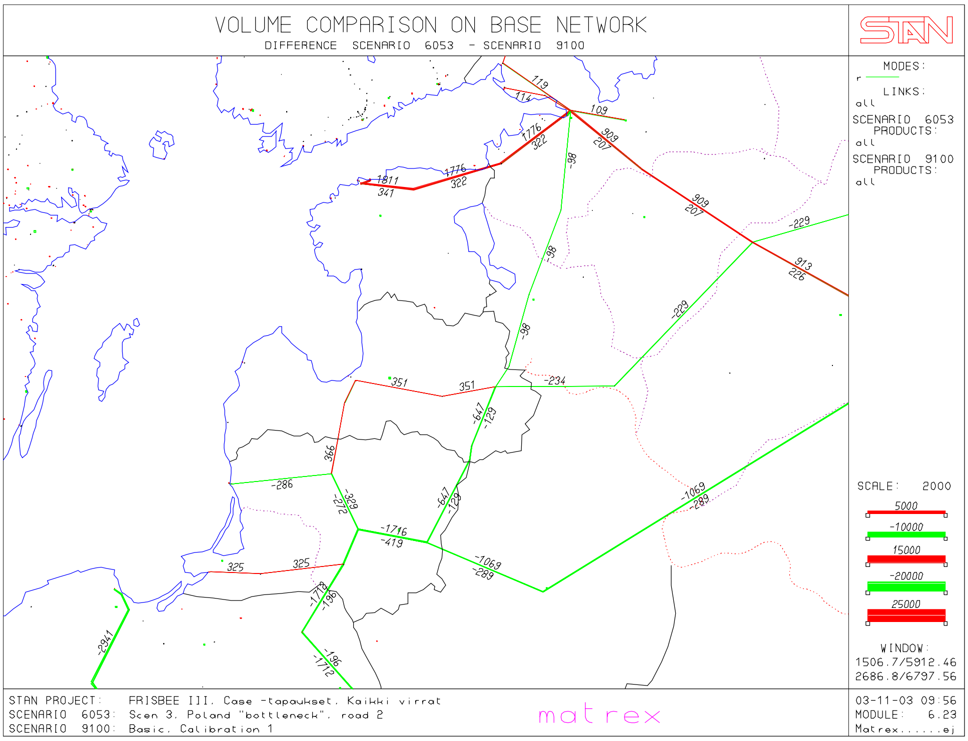


Source : Matrix Oy, Finland

Figure B 2.4-2 Difference from Base Case : Road Traffic Flows (Units : 000 tons)

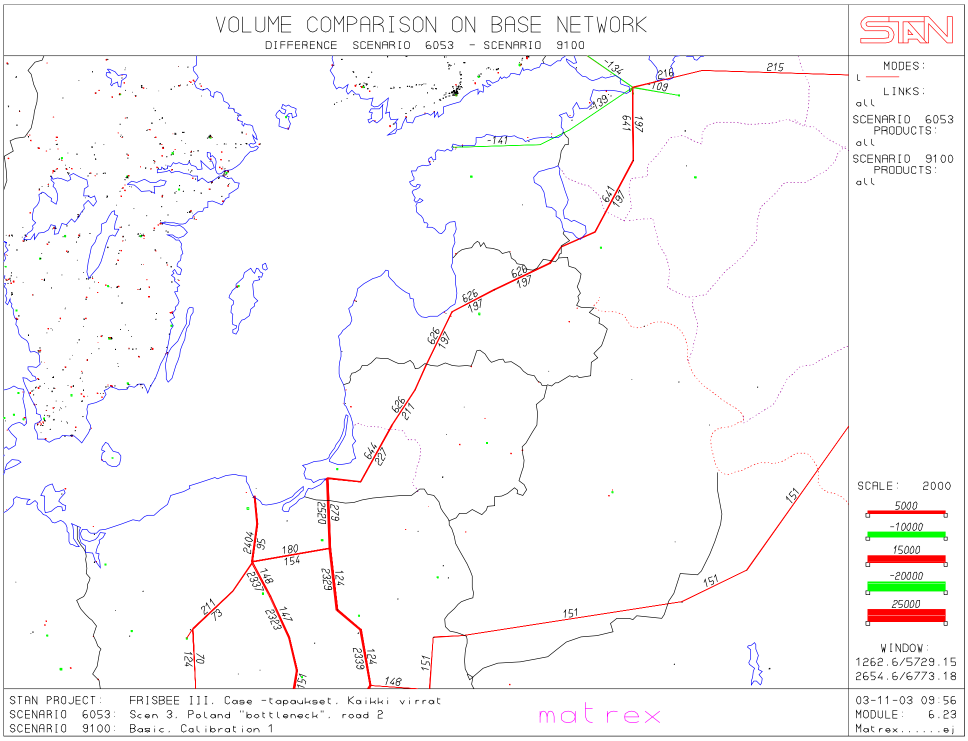
The results of this scenario show that reducing the border crossings between the Baltic States and Poland can have a significant impact on redistributing traffic flows, especially for rail traffic where border delays are longer than for road trucks. Rail traffic to/from Tallinn, Ventspils and Klaipeda all experience a loss of traffic (especially Ventspils). There is a shift in traffic away from St. Petersburg and a significant increase in transit traffic through Lithuania and Kaliningrad to Poland, both from Lativa and from Russia (Via Belarus). With a significant reduction in rail border delays there is also some transference from road to rail, leading to a small reduction in road traffic flows between Klaipeda and Moscow/St. Petersburg.

B 2.5 Scenario 3 (Polish Bottleneck)



Source : Matrix Oy, Finland.

Figure B 2.5-1 Difference from Base Case : Rail Traffic Flows (Units : 000 tons)

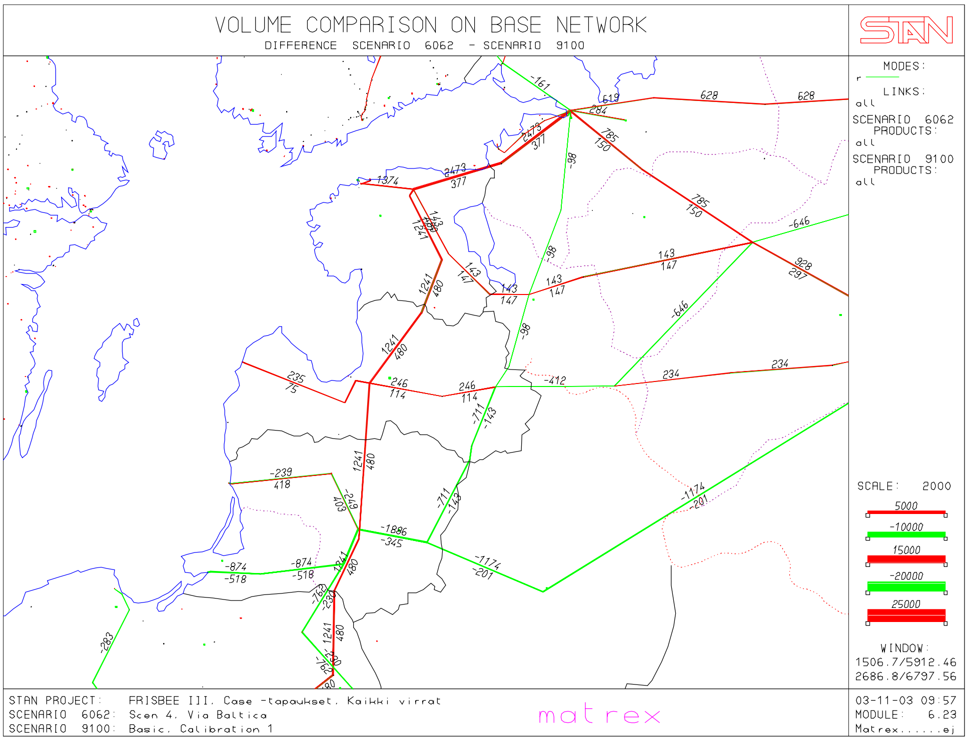


Source : Matrix Oy, Finland

Figure B 2.5-2 Difference from Base Case : Road Traffic Flows (Units : 000 tons)

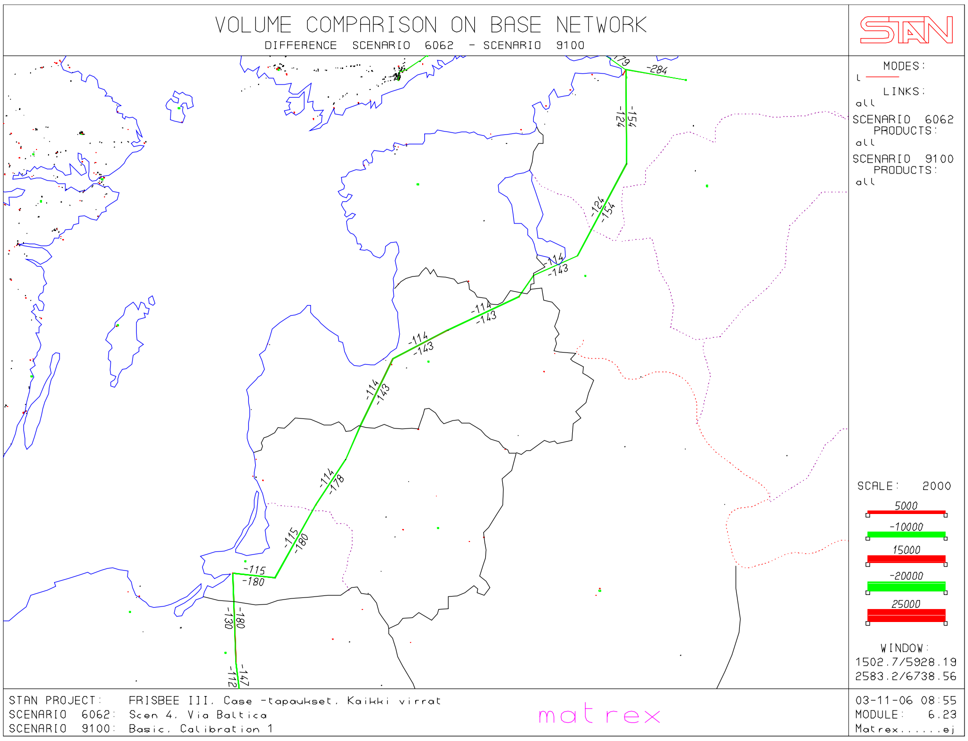
The net impact of reducing the Polish road bottleneck will be to reduce the operating cost of trucks across Poland. This will lead to a switch in some traffic flows from rail to road between Moscow/St. Petersburg and Poland. In addition, there will be a switch of some traffic away from overland rail movements to use the Baltic ports of Gdansk/Gdynia (Poland) and Kaliningrad (Russia) to serve the industrial centres in the south of Poland by road.

B 2.6 Scenario 4 (Transport Improvements)



Source : Matrix Oy, Finland

Figure B 2.6-1 Difference from Base Case : Rail Traffic Flows (Units : 000 tons)

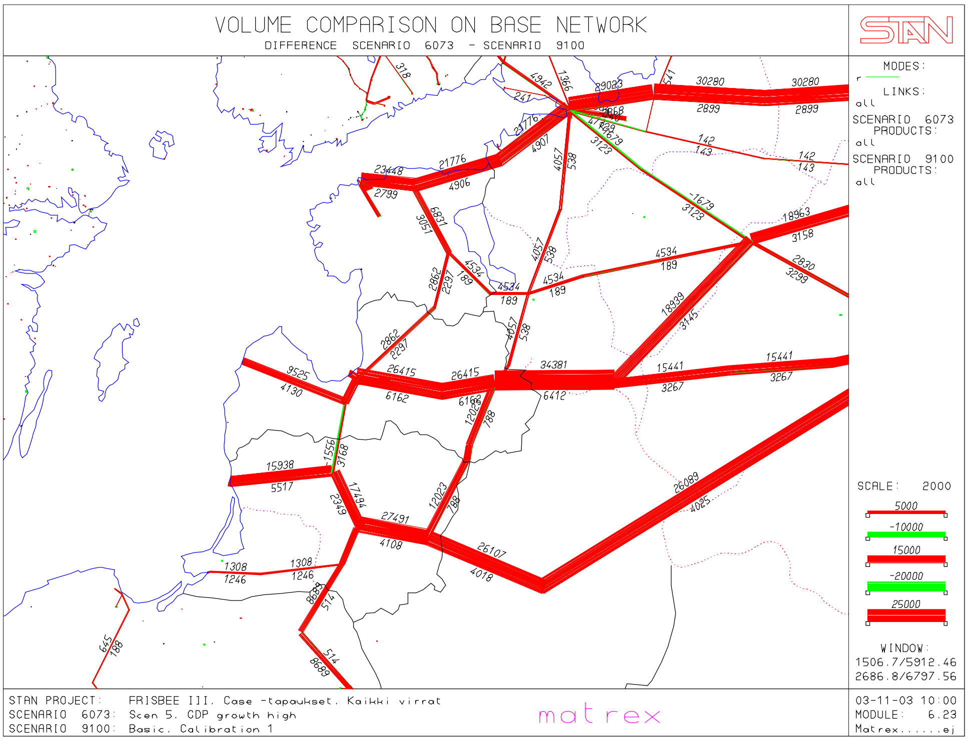


Source : Matrix Oy, Finland

Figure B 2.6-2 Difference from Base Case : Road Traffic Flows (Units : 000 tons)

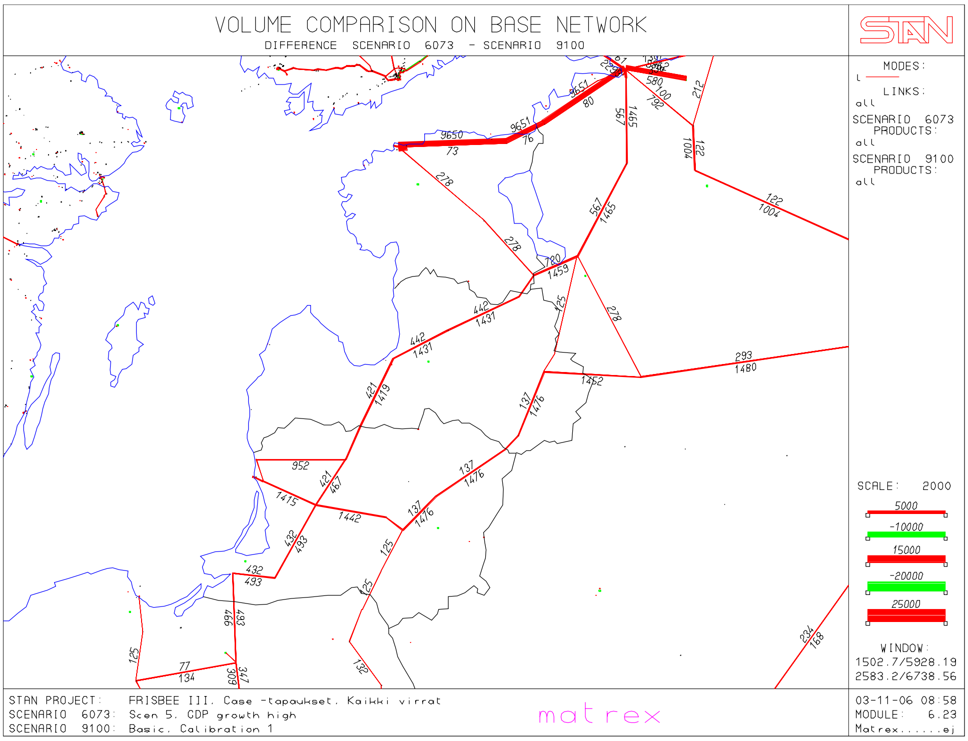
The main transport improvements which will affect the Baltic States will be the Via Baltica road improvements (currently underway) and the proposal for equivalent Via Baltica rail improvements from the Polish border through to Tallinn. These changes lead to a complex series of redistributions in rail traffic. There would appear to be significant level of rail traffic between St. Petersburg and Poland which will use this new rail link (and a corresponding reduction in road traffic). Offsetting this is a reduction in rail traffic from Moscow to Kaliningrad (via Minsk). Some of the Baltic Ports such as Tallinn and Ventspils experience a net increase in traffic. Klaipeda experiences a small increase in import traffic and a small decrease in export traffic. None of the changes, however, are very large.

B 2.7 Scenario 5 (Gross Domestic Product Growth to 2015)



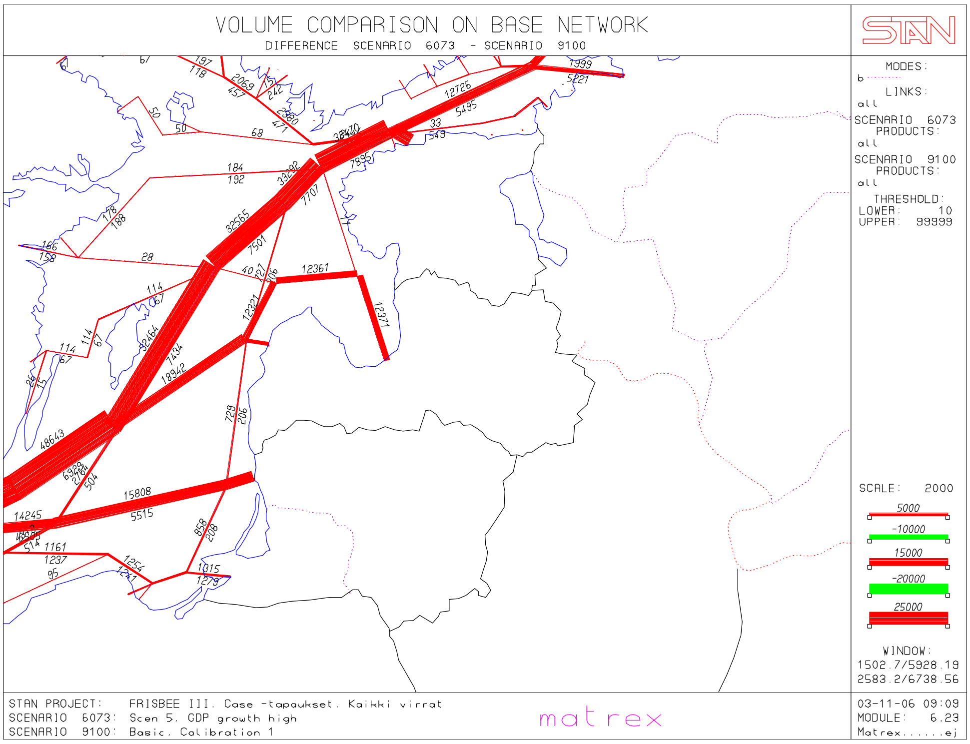
Source : Matrix Oy, Finland

Figure B 2.7-1 Difference from Base Case : Rail Traffic Flows (Units : 000 tons)



Source : Matrix Oy, Finland

Figure B 2.7-2 Difference from Base Case : Road Traffic Flows (Units : 000 tons)

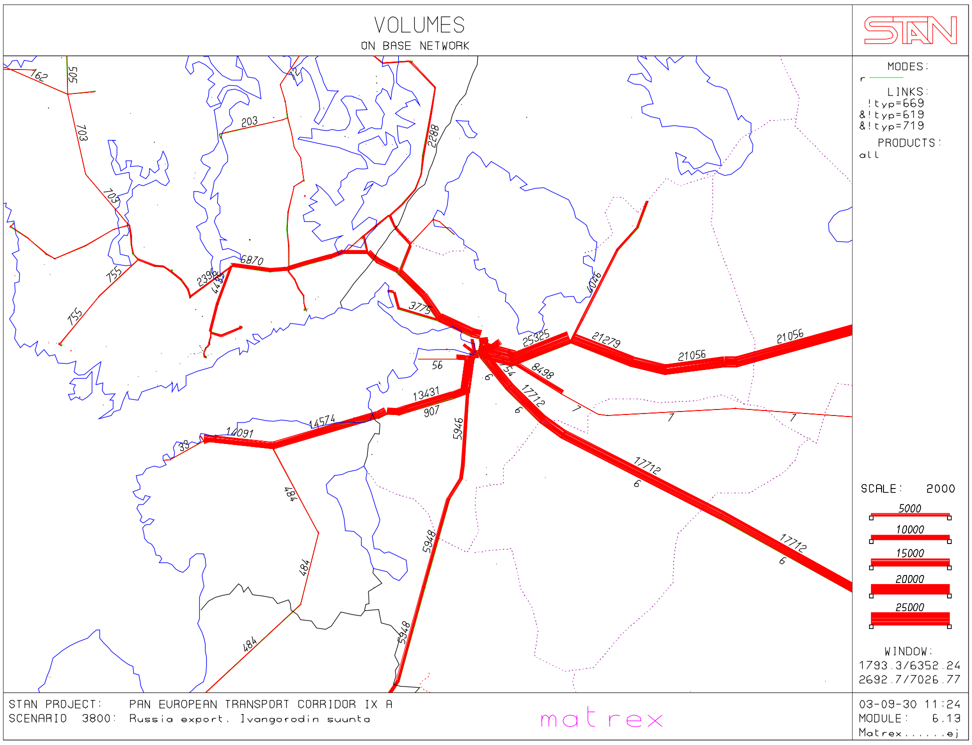


Source : Matrix Oy, Finland

Figure B 2.7-3 Difference from Base Case : Sea Traffic Flows (Units : 000 tons)

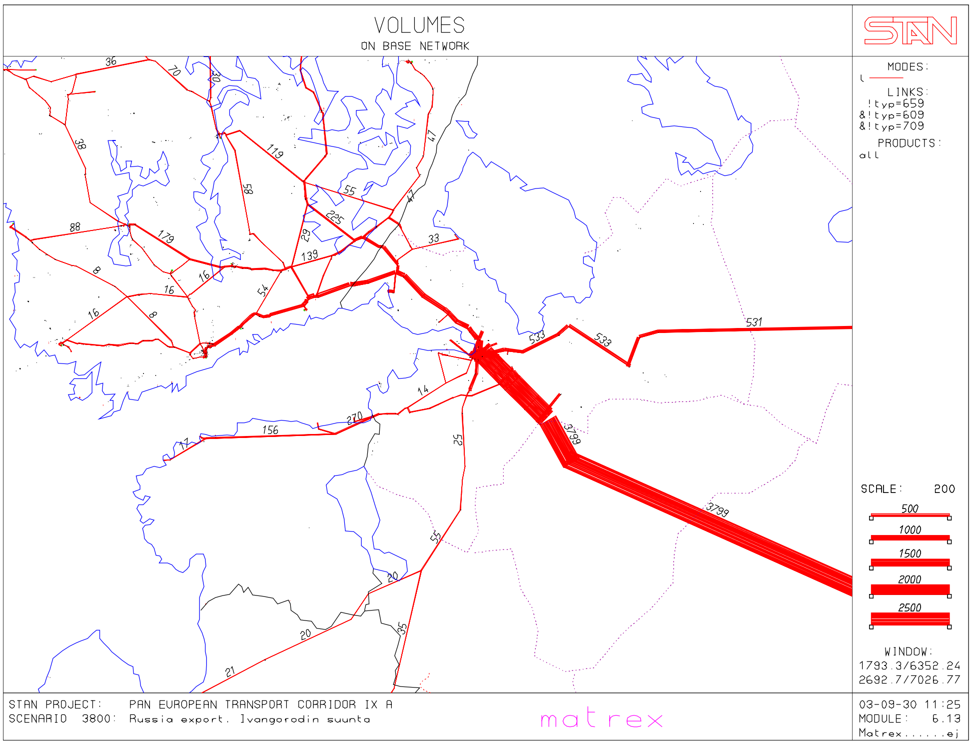
As expected, the increase in GDP (using the optimistic high growth scenario) has the largest single affect on traffic flows. The affect of the lower growth scenario was also tested but was only marginally smaller. The pattern of traffic flows (especially rail) is broadly similar to the Base Case scenario but volumes of rail traffic on the principal routes increase significantly. Traffic through the principal Baltic ports (St. Petersburg, Tallinn, Riga, Ventspils, and Klaipeda) all increase significantly. Traffic through Kaliningrad increases by a smaller amount. Road traffic flows also increase, with the largest growth on the short route between Tallinn and St. Petersburg.

B 2.8 Scenario 6 (St. Petersburg Ports)



Source : Matrix Oy, Finland

Figure B 2.8-1 Difference from Base Case : Rail Traffic Flows (Units : 000 tons)



Source : Matrix Oy, Finland

Figure B 2.8-2 Difference from Base Case : Road Traffic Flows (Units : 000 tons)

The development of the ports around St. Petersburg is illustrated in the following data showing existing traffic levels along with planned future capacity, and the target year for this expansion.

Table B 2.8-1 Russian Port Capacities

Port	2002 Traffic	Planned Capacity	Target Year
St. Petersburg	41.3 Million Tons	60 Million Tons	2010
Ust Luga *	Minimal	35 Million Tons	2010
Primorsk **	12.0 Million Tons	42 Million Tons	2010

* General cargo port
** Only oil and oil products

With the development of Ust Luga some bulk cargos e.g. coal will be transferred away from St. Petersburg port, allowing St. Petersburg to expand other growing traffics such as containers. Container traffic at St. Petersburg has grown very significantly and the port handled 457,000 TEU in 2002 compared with 202,000 TEU in 1998. Primorsk has been developed over the last few years and its Phase One capacity of 12 million tons has been reached. Phase Two expansion is planned as is an associated refinery. Most of the oil products, however, will reach the port by pipeline rather than by rail.

As show by the road and rail plots the development of St. Petersburg and the associated transport networks will lead to significant increases in both rail and road traffic. There are significant increases in rail traffic flows from Siberia and from Moscow, and to Tallinn. The principal increase in road traffic is from Moscow. Road and rail traffic therefore increases as capacity expands but this is primarily affected by the increased demand for traffic through the ports.

B 2.9 Conclusions

Whilst it is recognised that these results, concentrating on traffic flows to/from Russia, do not provide the full picture of freight flows through the Baltic States, the scenarios tested by using the FRISBEE model do reveal how traffic patterns are likely to react to the factors within each scenario. From this is clear that it is GDP growth which leads to the most significant overall increase in traffic levels. Individual factors which will have significant affects on local traffic flows through the ports are the removal of the preferential Russian railway tariffs, the reduction in border crossing delays on accession to the European Union, and the localised growth in traffic to/from St. Petersburg as a result of the developments in port capacity in the area.

APPENDIX C   DESIGN OF RAILWAY AND ROAD STRUCTURE

APPENDIX C DESIGN OF RAILWAY AND ROAD STRUCTURE

C.1 Design of Railway Structure

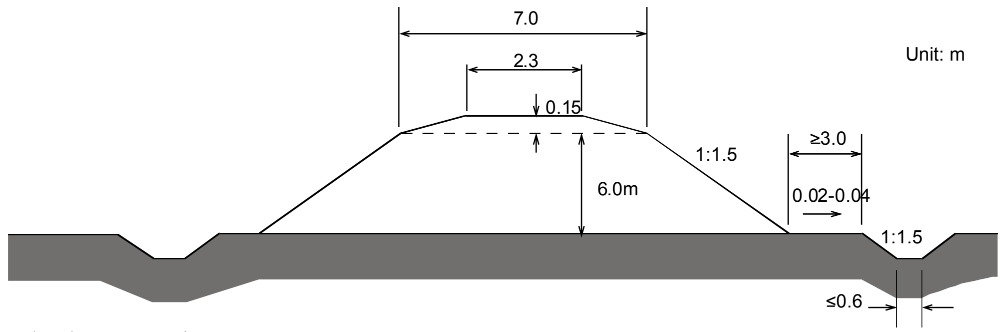
Railway alignment and structures for the Short-Term and Master Plan are based on the Lithuanian Railway standard and regulations. The Technical Provisions of Railway Usage, Techninio Gelezinkeliu Naudojimo NUOSTATAI and Construction and rolling stock clearance diagrams for the USSR railways of 1520 (1524) mm gauge GOST 9238-83 has been mainly applied for the engineering design for railway structures. The major track geometry is shown in Table C.1.1. Major performance and specifications of locomotives are shown in Table C.1.2. The typical cross section of embankment and cutting is shown in Figure C.1.1 and typical cross section of subgrade is shown in Figure C.1.2. Construction and rolling stock gauges are shown in Figure C.1.3 and C.1.4.

Table C.1.1 Track Structure

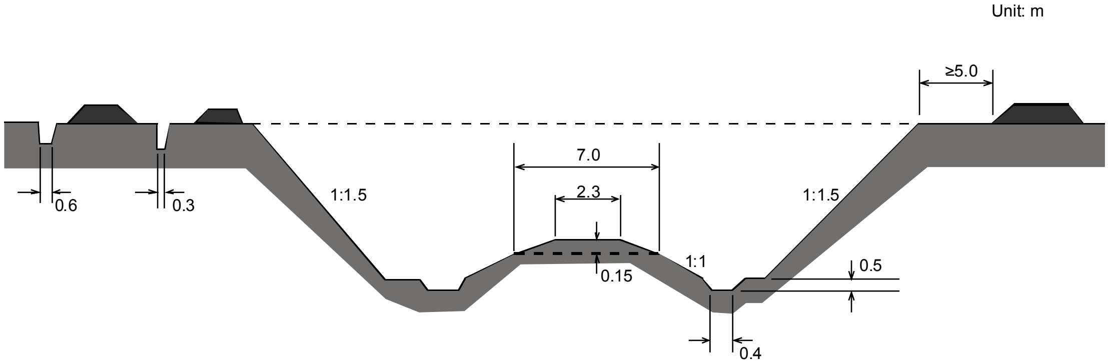
Item	Description
Gauge	1,520 mm
Minimum Curve Radius	Main Track: 2,000 m (800 m: complicated condition) Siding, Access Track: 200 m Station, Yard: Straight (1,500 m: complicated condition)
Maximum Grade	Main Track: 15/1000 Siding, Access Track: 20/1000 Station, Yard: 1.5/1000
Type of Rail	R65 or UIC60 – 25m
Sleeper	Concrete / Wood Sleeper
Sleeper Space	500mm, 2,000 unit/km on straight track 543mm, 1,840 unit/km on curved section (less than R=350 m)
Ballast	Depth 350 mm (under the sleeper) Depth 200 mm (sand under the ballast)
Superelevation	Maximum: 150 mm ($C=12.5QV^2/R$)
Type of Switch	Main Track: 1/11 Marshalling Yard: 1/9 (1/6 symmetrical turnout: complicated condition)
Distance between Track Centers	Main Track: 4.1 m (more than three tracks: 5.0 m) Station, Yard: 4.8 m

Table C.1.2 Major Performance and Specifications of Locomotive

Item \ Type of Locomotive	2M62	M62	CME3 (Shunting)	TEM2 (Shunting)
Axle arrangement	2 x Co-Co	Co-Co	Co-Co	Co-Co
Engine power (kW)	2 x 1,470	1,470	994	883
Maximum speed (km/h)	100	100	95	100
Weight (ton)	240	116.5	123	120
Axle load (ton)	20	19.4	20.5	20
Electric transmission	DC/DC	DC/DC	DC/DC	DC/DC
Continuous tractive effort (kN)	2 x 19.5	20.0	23.0	21.0
Maximum height (mm)	4,615	4,615	-	5,115
Maximum width (mm)	2,950	2,950	2,950	2,950
Length (mm)	17,550 x 2	17,550	-	16,970
Wheel base (mm)	4,200	4,200	4,200	4,200
Wheel diameter (mm)	1,050	1,050	1,050	1,050



Embankment Section



Cutting Section

Figure C.1.1 Typical Cross Section of Embankment and Cutting

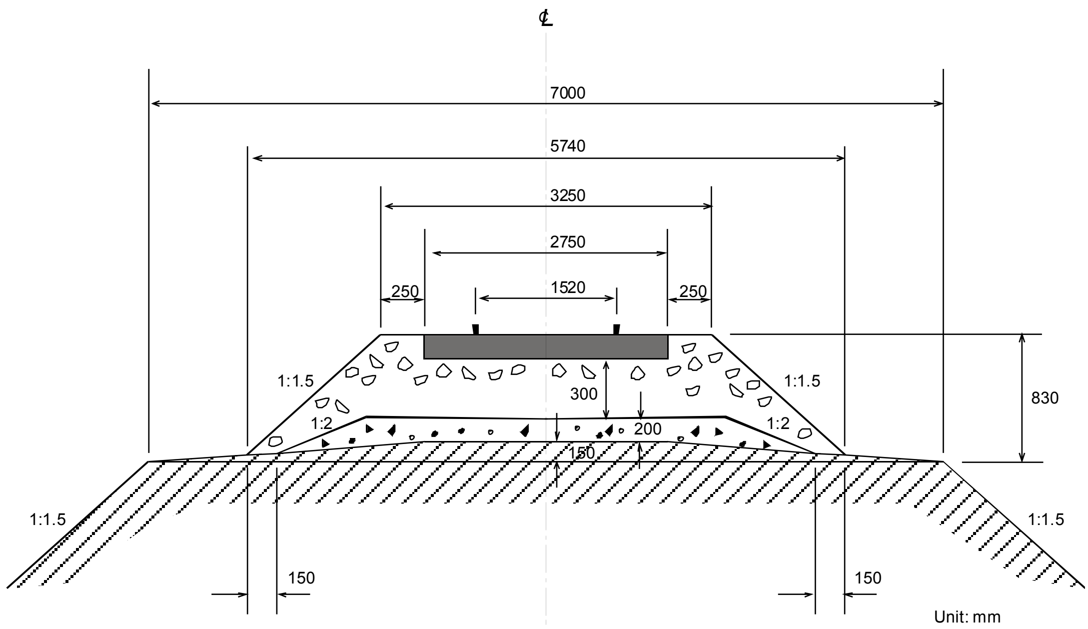
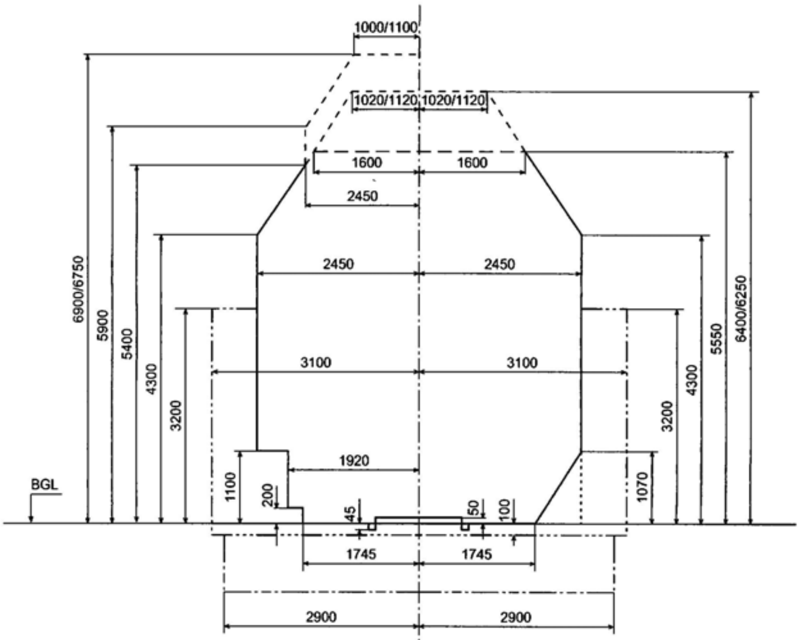


Figure C.1.2 Typical Cross Section of Subgrade



Line of the distance to the bridges, tunnels, galleries, platforms, floorings of the crossings, signalling facilities located in their vicinity.

Line of the distance to the facilities and equipment, which is not electrified.

Line of the distance to the buildings, facilities and equipment (except the supports of the bridges, structural elements of the tunnels, galleries, platforms), located at the external side of the outer ways of stages and stations as well as at the tracks located separately at the stations.

Line which should not be exceeded by any kind of equipment within the stages and useful length of the tracks within stations except engineering facilities, floorings of the crossings, signalling facilities and centralization and blocking equipment located in their vicinity.

Line of the distance to the basements of the building and supports, underground wires, cables, pipelines and other facilities.

Line of the distance to the structural elements of the tunnels, railings on the bridges, viaducts, and other engineering facilities.

Figure C.1.3 Construction Gauge

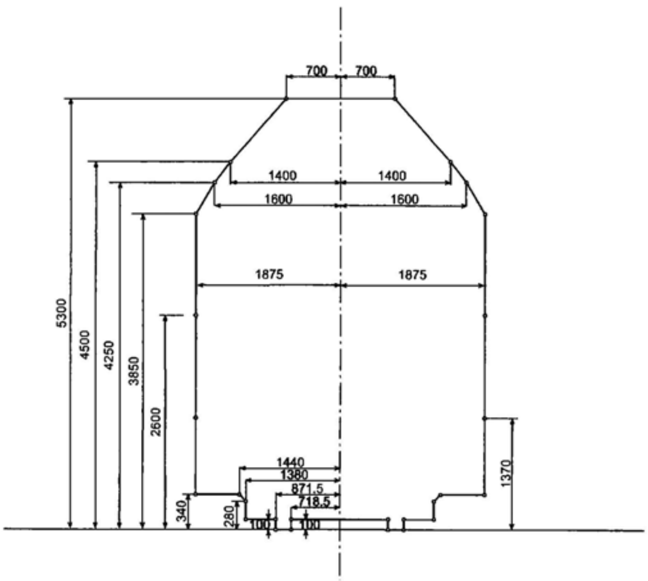


Figure C.1.4 Rolling Stock Gauge

C.2 Design of Road Structure

Typical cross sections at grade and flyover are shown in Figure C.1.5 and Figure C.1.6.

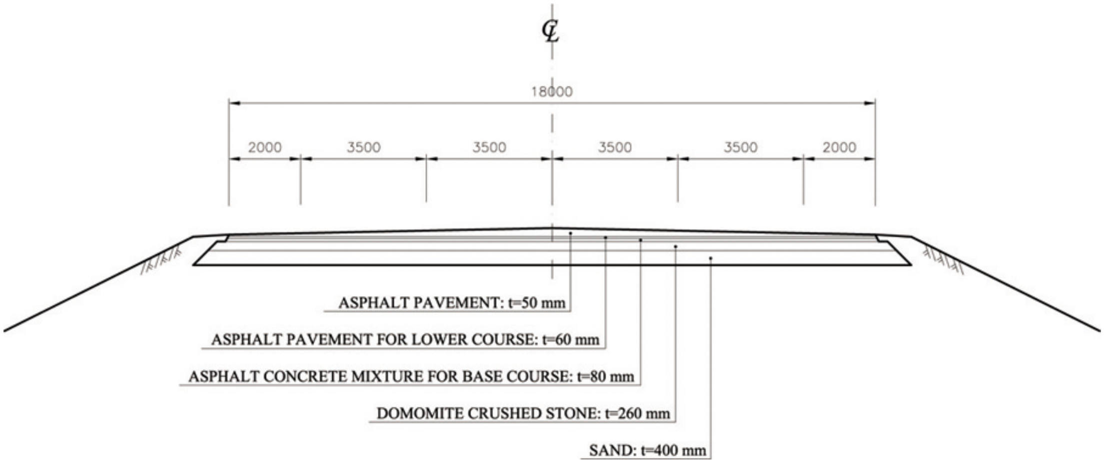


Figure C.1.5 Typical Cross Section of Access Road

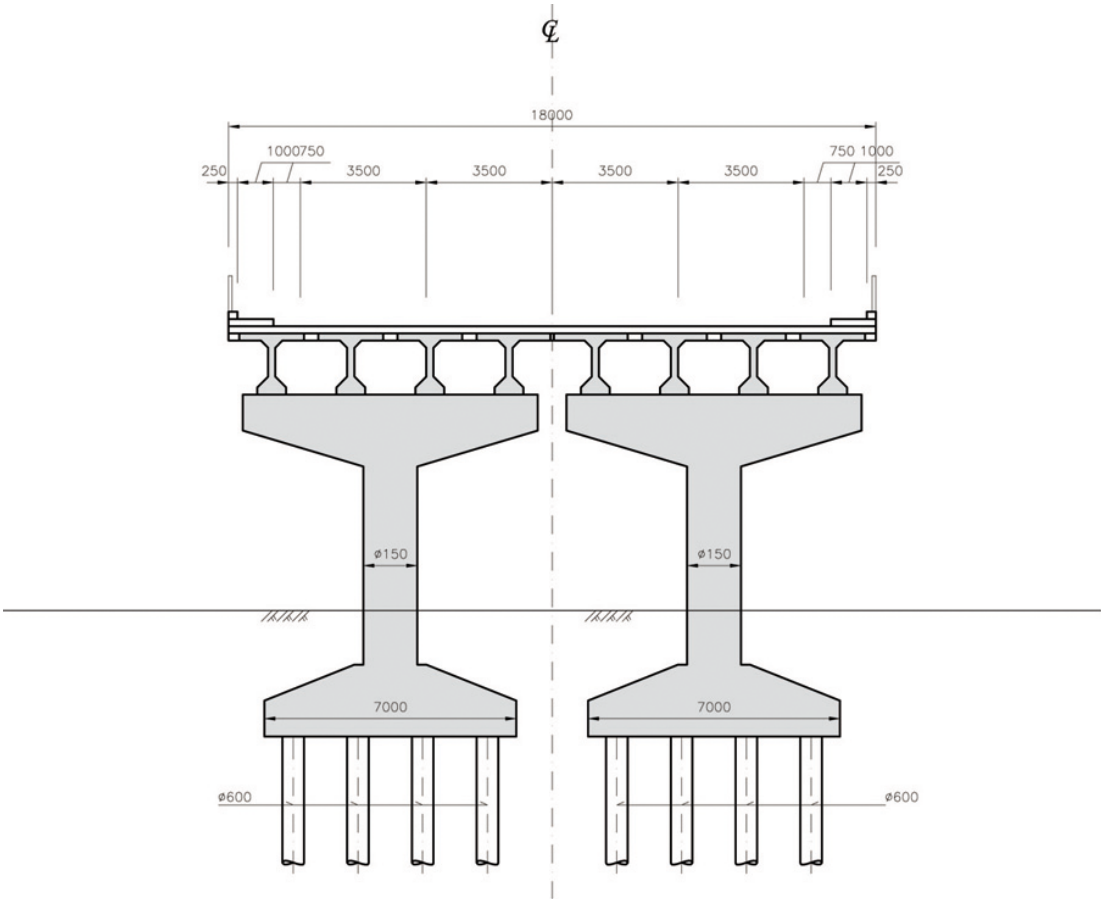


Figure C.1.6 Typical Cross Section of Flyover

APPENDIX D ECONOMIC AND FINANCIAL ANALYSIS

APPENDIX D ECONOMIC AND FINANCIAL ANALYSIS

D.2 Financial Analysis

D.2.1 Comparison of Alternatives of the Phased Outer Port Development Project Corresponding to the Master Plan

(1) Purpose of the Comparison

The entire project proposed in the Master Plan with the target year 2025 could be divided into the first and second phases. In this case, the Outer Port Development Project in the Short-Term Plan proposed in Chapter 3 is considered to be the first phase component. Then, the second phase component could be envisaged by deducting the first phase component from the entire project in the Master Plan

Even though the scope of the financial evaluation in this study is confined to assess the first phase component based on the Short-Term Plan without extending to the entire project composed of the first and the second project component, a question has been raised whether the west and north breakwaters, and the north revetment proposed in the Mater Plan should be constructed in the first phase without postponing to the second phase to avoid to construct the temporary north breakwater in the first phase and to demolish it in the second phase in view of economic construction of the entire project.

To reply the above question on the entire project on the Master Plan basis regarding the timing of the construction of the west and north breakwaters, the financial evaluation has been done through the comparison between the two alternatives shown below.

(2) Alternatives

The following two alternatives, viz. “Alternative M-1” and “Alternative M-2”, have been compared taking account of the time value of money:

“Alternative M-1”:

First Phase (Operations: 2015, construction 2009 – 2014, see Fig. II.3.4-1. in Section 3.4.5):

- To construct a portion of the entire west breakwater,
- To construct a temporary north breakwater,

Second Phase (Operations: 2025, construction 2019 – 2024):

- To construct the remaining portion of the entire west breakwater,
- To construct the north breakwater,
- To construct the north revetment
- To demolish the temporary north breakwater constructed in the first phase,

“Alternative M-2”:

First Phase (see Fig, D.2.1):

- To construct the entire west breakwater,
- To construct the north breakwater,
- To construct the north revetment,

Second Phase:

- Not to construct any breakwaters and revetment facing the outer sea

(3) Construction Costs

Construction costs of the two alternatives have been estimated excluding the costs common in the two cases such as the cost for the south breakwater as shown in Table D.2.1. Hence, in the table only the difference in costs in the respective phases, viz. the first phase (2015) and the second phase (2025) between the two alternatives is shown.

Table D.2.1 Construction Costs of Phased Outer Port Development Project on the Master Plan Basis in Alternatives M-1 and M-2

(Unit : '000 EURO)

Alternative	Construction Item	First Phase (2015)		Second Phase (2025)	
		Length (m)	Amount	Length (m)	Amount
M-1	West Breakwater			780	25,148
	North Breakwater			600	16,835
	North Breakwater (Temporary)	500	13,676		
	North Revetment			700	8,934
	Total for Construction Cost		13,676		50,917
	Total including E/S & VAT		17,106		63,687
M-2	West Breakwater	780	25,148		
	North Breakwater	600	16,835		
	North Revetment	700	8,934		
	Total for Construction Cost		50,917		
	Total including E/S & VAT		63,687		

Note (1): Estimated by JICA Study Team

Note (2): Figures in the parenthesis of the phases show the respective starting years of operations followed by construction periods

Note (3): Construction periods of the first and second phases have been assumed to be 2009 – 2014 and 2019 – 2024, respectively.

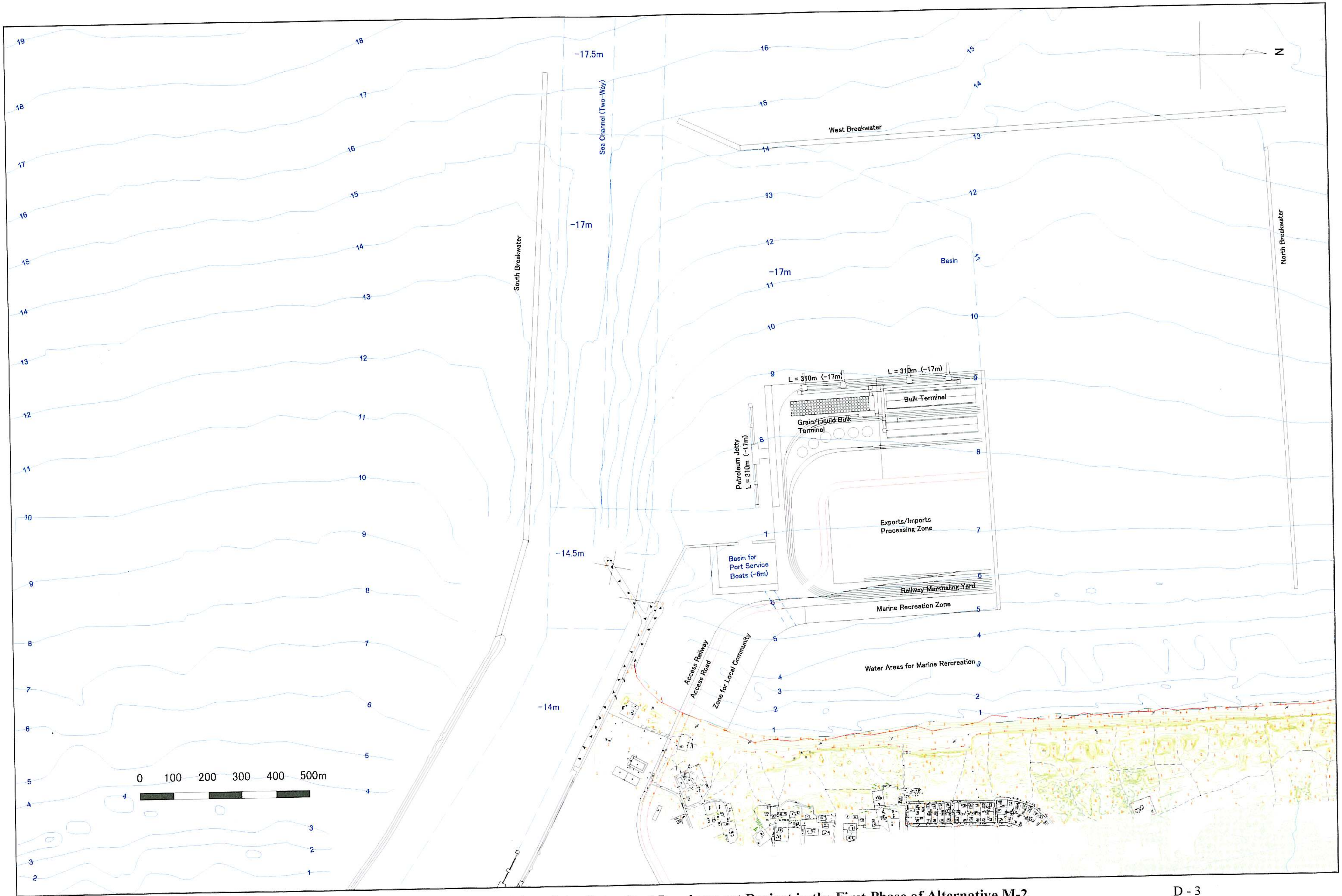


Figure D.2.1 Facility Layout Plan of the Outer Port Development Project in the First Phase of Alternative M-2

(4) Comparison between the Two Alternatives

Since the revenues to be generated from the two alternatives will be the same, in the comparison between the two alternatives extending from the first phase to the second phase, the respective construction costs shown in the preceding paragraph (3) (see Table D.2.1) have been compared using so-called “the Minimum Cost Method”. Taking account of the time value of money, the estimated costs have been discounted to the present value (PV). Discount rate has been assumed in the range of approximately 3% - 7% considering the current market interest rate on the long-term basis. The resulting difference between the two alternatives (subtracting the present value of Alternative A from Alternative B) is shown as follows:

Discount rate	Difference in the present value (Base year 2009, unit: million EURO)
1%	-7.1
3%	+2.1
5%	+8.5
7%	+13.0

As indicated in the resulting figures, Alternative M-1 is judged to be more economical than Alternative-2 in the condition of the discount rate in the range of 3% - 7%. Hence, it is preferable to construct the west breakwater extending from the first phase and to the second phase. On the other hand, it is also preferable to construct the north breakwater in the second phase, not in the first phase. Alternative M-2 could be justified if the discount rate is less than 3% (see Fig.D.2.2).

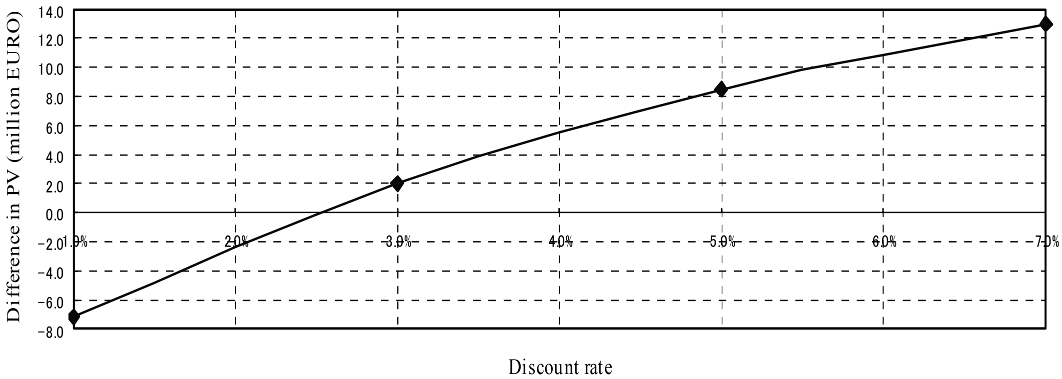


Figure D.2.2 Study on the Phased Outer Port Development Project in the Short-Term Plan

(1) Purpose of the Study

Even though the scope of the financial evaluation in this study is confined to assess the project in the Short-Term Plan with the target year of 2015 (hereinafter referred to as “Alternative S-1” and equal to the first phase component of Alternative M-1), without envisaging a target year earlier than 2015, a question has been raised whether “Alternative S-1” could be further divided into two phased components, viz. the first phase and the second phase components with financial viability.

To reply the above question on the project in the Short-Term Plan, FIRR analysis has been done through working out an additional alternative with two phased components as shown below.

(2) Additional Alternative

The following additional alternative (hereinafter referred to as Alternative S-2) has been worked out as the object of the financial assessment::

"Alternative S-2":

First Phase (Operations: 2010, construction 2004 – 2009, see Fig, D.2.2):

- To construct the entire south breakwater,
- To construct a portion of west breakwater,
- To construct the petroleum jetty (Berth No.1)
- To dredge the entire planned area of the sea channel
- To dredge a portion of planned basins

Second Phase (Operations: 2015, construction 2009 – 2014,):

- To construct the remaining portion of the project

(3) Construction Costs

Construction costs of the Alternative S-2 have been estimated and shown in Table D.2.2. together with Alternative S-1 for reference. As to the costs in the second phase in the table, only the difference in costs between the two alternatives is shown.

Figure D.2.3 Facility Layout Plan of the Outer Port Development Project in the First Phase of Alternative S-2

Table D.2.2 Construction Costs of Phased Outer Port Development Project on the Short-Term Plan Basis in Alternatives S-1 and S-2

(Unit : EURO)

Alternative	Description	First Phase (2010)		Second Phase (2015)	
		Amount	Cost	Amount	Cost
S-1	South Breakwater (m)			1,380	44,994
	West Breakwater (m)			1,020	38,117
	Berth No. 1 (-17m) - Petroleum (L.S.)			1	5,000
	Dredging Hard Clay and Dumping Offshore (cu. m)			180,000	972
	Navigation Aid (L.S.)			1	2,867
	Total for Construction Cost				91,950
	Total including E/S & VAT				115,011
S-2	South Breakwater (m)	1,380	44,994		
	West Breakwater (m)	800	25,845	220	12,272
	Berth No. 1 (-17m) - Petroleum (L.S.)	1	5,000		
	Dredging Sand and Dumping Offshore (cu. m)	3,000,000	6,394		
	Dredging Hard Clay and Dumping Offshore (cu. m)	50,000	292	130,000	680
	Navigation Aid (L.S.)	1	2,867		
	Total for Construction Cost		85,391		12,952
	Total including E/S & VAT		106,807		16,201

Note (1): Estimated by JICA Study Team

Note (2): In the second phase, only the difference in costs between the two alternatives is shown in the above table

Note (3): Construction costs in the second phase (2015) of Alternative S-2 have been estimated by subtracting the costs of the first phase (2010) of Alternative S-2 from the costs of Alternative S-1 excluding "dredging sand and dumping offshore" that are originally included.

Note (4): Figures in the parenthesis of the phases show the respective starting year of operations followed by construction periods

(4) Results of the FIRR Analysis on Alternative S-2

1) Calculation of the FIRR (Base Case)

The resulting FIRR of Alternative S-2 of the Outer Port Development Project is 7.1% (see Table D.2.3).

2) Sensitivity Analyses

In order to see if the Project is still financially viable when some factors vary, the following cases have been tested as sensitivity analyses:

Case A: The total cost (cash outflow) increase by 5% and the revenue (cash inflow) decrease by 5%

Case B: The total cost increase by 10% and the revenue decrease by 10%

The resulting FIRRs of the Alternative S-2 in Cases A and B in the above sensitivity analyses are 6.3% and 5.4%, respectively.

3) Evaluation

The resulting FIRR of Alternative S-2 of the Outer Port Development Project is 7.1%, and narrowly exceeds the Government target of 7% mentioned in Section 6.2.2. The alternative, however gives insufficient protection against violent waves possibly penetrating to the petroleum jetty from NW direction due to non-existence of the north breakwater with a fear of disaster when maneuvering a petroleum tanker.

Table D.2.3 Summary of FIRR Calculation (Base Case of Alternative S-2)

Unit: '000 EURO

No.	Year	Initial Investment Costs	Management/Operations and Maintenance Expenses						Renewal Investment Costs	Salvage Values	Cost Total (Out)	Revenue Total (In)	In-Out	Net Present Value (NPV)
			Maintenance Dredging	Infra-structures/ buildings	Equipment	Fuel and Utilities	Labor Costs	General and Administra-tive Costs						
1	2004	1,454									1,454		-1,454	-1,454
2	2005	1,454									1,454		-1,454	-1,365
3	2006	17,554									17,554		-17,554	-15,466
4	2007	36,490									36,490		-36,490	-30,177
5	2008	31,668									31,668		-31,668	-24,582
6	2009	20,421									20,421		-20,421	-14,879
7	2010	2,234									3,398		-3,398	-2,324
8	2011	26,974									28,137	2,375	-25,761	-16,537
9	2012	56,063									57,226	4,750	-52,476	-31,619
10	2013	48,654									49,818	7,126	-42,692	-24,145
11	2014	76,166									77,329	9,501	-67,828	-36,008
12	2015		190	2,865	364	364	824	613			5,220	21,903	16,682	8,313
13	2016		190	2,865	364	364	824	613			5,220	24,218	18,997	8,885
14	2017		190	2,865	364	364	824	613			5,220	27,453	22,233	9,761
15	2018		190	2,865	364	364	824	613			5,220	29,716	24,495	10,094
16	2019		190	2,865	364	364	824	613			5,220	31,978	26,758	10,350
17	2020		190	2,865	364	364	824	613			5,220	34,240	29,020	10,536
18	2021		190	2,865	364	364	824	613			5,220	36,503	31,282	10,660
19	2022		190	2,865	364	364	824	613	1,107		6,327	38,765	32,437	10,376
20	2023		190	2,865	364	364	824	613			5,220	41,027	35,807	10,751
21	2024		190	2,865	364	364	824	613			5,220	43,289	38,069	10,729
22	2025		190	2,865	364	364	824	613			5,220	43,289	38,069	10,070
23	2026		190	2,865	364	364	824	613			5,220	43,289	38,069	9,452
24	2027		190	2,865	364	364	824	613			5,220	43,289	38,069	8,872
25	2028		190	2,865	364	364	824	613			5,220	43,289	38,069	8,328
26	2029		190	2,865	364	364	824	613	1,107		6,327	43,289	36,962	7,590
27	2030		190	2,865	364	364	824	613			5,220	43,289	38,069	7,337
28	2031		190	2,865	364	364	824	613			5,220	43,289	38,069	6,887
29	2032		190	2,865	364	364	824	613			5,220	43,289	38,069	6,464
30	2033		190	2,865	364	364	824	613			5,220	43,289	38,069	6,068
31	2034		190	2,865	364	364	824	613			5,220	43,289	38,069	5,695
32	2035		190	2,865	364	364	824	613			5,220	43,289	38,069	5,346
33	2036		190	2,865	364	364	824	613	1,107		6,327	43,289	36,962	4,872
34	2037		190	2,865	364	364	824	613			5,220	43,289	38,069	4,710
35	2038		190	2,865	364	364	824	613		-17,120	-11,899	43,289	55,189	6,409
Total		319,133	5,035	74,102	8,748	8,748	19,772	14,701	3,321	-17,120	436,439	958,894	631,496	0

Source: JICA Study Team

FIRR = 6.5%