CHAPTER 11 PORT ENGINEERING STUDY

11.1 Design Manual, Standards and Codes

The design manual on "Recommendations of the Committee for Waterfront Structures, (EAU 1996 - Harbours and Waterways)" has been basically applied for the structural design of marine facilities. In addition, internationally accepted manuals such as the British Standard, Shore Protection Manual, and Japanese Design Manual have also been used.

11.2 Design Criteria

11.2.1 Water Level

The datum of elevations used for the engineering design is referred to as the Baltic Sea Level (BSL), which is equal to the mean sea water level at the Baltic Sea. The water levels in the Baltic Sea and Klaipeda Strait have been analysed by the Lithuanian Energy Institute. The data of water levels are tabulated below together with their return periods. This indicates the range of water levels in the Klaipeda Strait is larger than those in the Baltic Sea.

Table 11.1 Maximum and Minimum Water Levels in Baltic Sea and Klaipeda Port

(unit : mm BSL)

Return Period		1 year	2 years	5 years	10 years	50 years
Baltic Sea	Maximum	+48	+80	+100	+115	+126
	Minimum	-18	-20	-26	-41	-58
Klaipeda Strait	Maximum	+45	+85	+110	+124	+162
	Minimum	-50	-68	-77	-83	-97

Source : Lithuanian Energy Institute

11.2.2 Design Waves

The offshore design waves have been determined for a return period of 50 years and wave directions outlined below. Estimated nearshore design waves for the corresponding marine structures are also listed in Table 11.2.

Wave Direction	Wave Height	Wave Period
SW	5.6 m	8.5 sec
WSW	5.9 m	8.5 sec
W	7.3 m	9.5 sec
WNW	5.6 m	8.5 sec
NW	4.9 m	7.5 sec

Table 11.2 Design Waves at Each Location

Offshore Wave Direction/ Location	WSW		W		WNW	
	Wave Height	Incidental Angle	Wave Height	Incidental Angle	Wave Height	Incidental Angle
DW-1	5.6 m	247°	6.7 m	272°	5.6 m	289°
DW-2	5.4 m	250°	6.4 m	270°	5.1 m	270°
DW-3	5.5 m	249°	6.5 m	270°	5.1 m	270°
DW-4	5.6 m	252°	5.9 m	270°	5.2 m	270°
DW-5	3.8 m	270°	4.9 m	270°	4.1 m	284°
DW-6	2.0 m	270°	3.5 m	270°	3.7 m	283°
DW-7	1.8 m	270°	3.1 m	270°	3.2 m	283°
DW-8	5.2 m	270°	6.5 m	270°	5.5 m	285°
DW-9	4.3 m	270°	4.5 m	271°	4.3 m	283°
DW-10	2.4 m	250°	2.8 m	250°	1.9 m	250°
DW-11	2.1 m	235°	2.6 m	235°	1.4 m	235°
DW-12	1.2 m	225°	1.4 m	225°	0.7 m	225°

Source : Estimate by the JICA Study Team

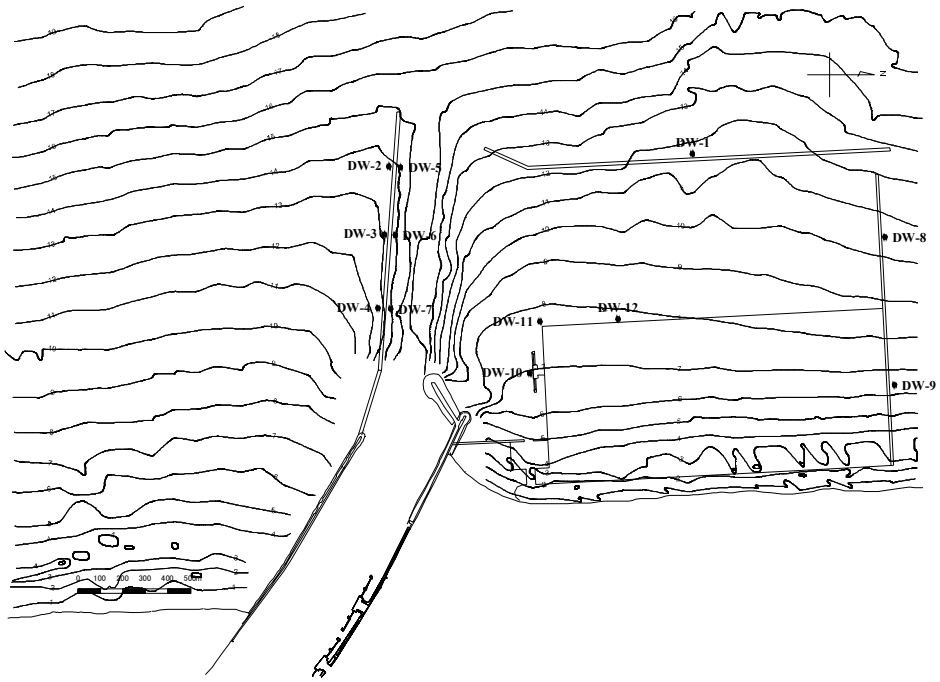


Figure 11.1 Locations for Design Wave Analysis

11.2.3 Seismic Load

The seismic disturbance is reported to be extremely small around Klaipeda. Considering the local conditions and safety for structural stability, the seismic coefficient has been determined at 0.05 (kh) for structural design.

11.2.4 Ice and Snow Loads

As Klaipeda is located in the 2nd snow region, the design snow load is assumed as 0.75 KN/m^2. The minimum ice load is adopted as 250 KN/m^2.

11.2.5 Subsoil Condition

The subsoil at the outer port area is composed of three stratum, namely a Holocene stratum in the upper part, a Pleistocene Limnic stratum in the middle, and a Pleistocene Glacial stratum in the lower part.

a) Holocene Stratum – Upper Stratum

This stratum has a thickness of 4 to 7 m and consists of loose silty sand with shells, organic matter and gravel. The standard penetration test produced N-values of 20 to 40.

b) Pleistocene Limnic Stratum – Middle Stratum

This stratum has a thickness of 0.5 to 6.5 m and consists of silty clay with occassional gravel. The penetration N-value is about 30 to 40. About 75% to 90% of soil particles in this layer are clay and silt, thus it is not suitable for use as reclamation fill.

c) Pleistocene Glacial Stratum – Lower Stratum

This stratum is represented by the layer No. 20. It consists of sandy clay with a low plasticity mixed with gravel and cobble. This layer is very hard with an N-value of about 80, and is mainly composed of silt and clay having 50-60% soil particles.

For structural design, the soil characteristics for each layer have been determined as follows:

Table 11.3 Soil Parameters for Preliminary Design

Stratum	N-Value	Dry Bulk Density	Int. Friction Angle	Cohesion
Upper Stratum	20 to 40	1.8 t/m^3	30°	-
Middle Stratum	30 to 40	1.8 t/m^3	22°	100 KN/m^2
Lower Stratum	Over 50	2.0 t/m^3	32°	200 KN/m^2

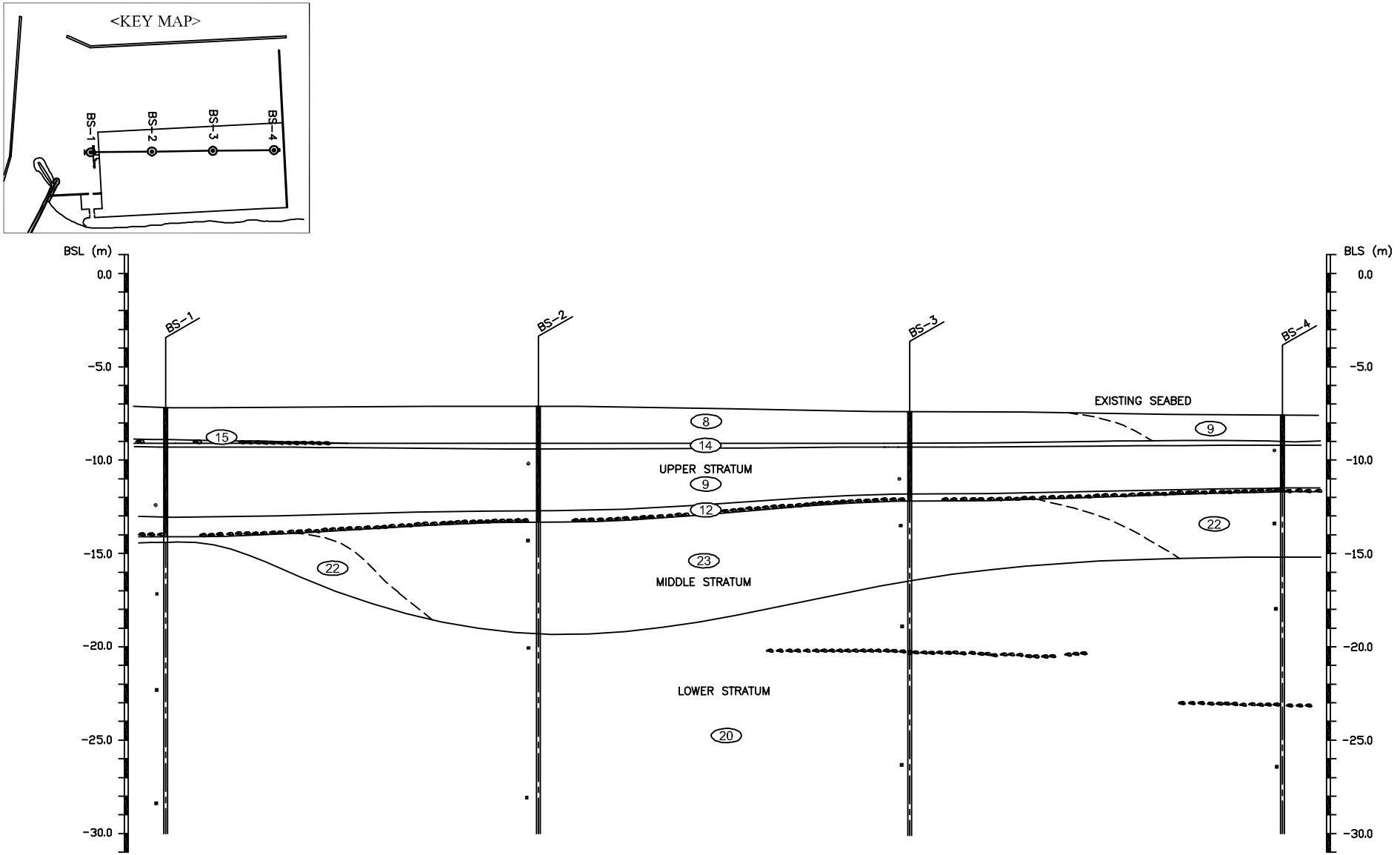


Figure 11.2 Subsoil Profile at Outer Port Area (Scale V: 1/300, H: 1/7500)

11.3 Design of Breakwaters

11.3.1 Selection of Structural Type of Breakwaters

The outer port will be protected by three breakwaters namely:

- West Breakwater,
- South Breakwater, and
- North Breakwater.

The West Breakwater will be placed at a water depth of -15 m to -12.5 m, and the head portion of the South and North Breakwaters will be located at -16.5 m and -14 m, respectively. Judging from the design wave (6.7 m) and subsoil conditions, a gravity-type breakwater would be the optimum solution in terms of economy and stability. Therefore the following gravity structures have been evaluated:

- Rock Mound-Type with Tetrapods,
- Rock Mound-Type with Accropods, and
- Caisson-Type

11.3.2 Crest Elevation of Breakwater

The crest elevations of breakwaters have been set at 0.6 times the significant wave height above high water levels, allowing overtopping waves.

11.3.3 Size of Armour Block

Armour blocks should be sized in weight to withstand the design wave forces. The size of armour rock has been determined as below using the formula of Hudson.

Table 11.4 Required Sizes of Armour Concrete Block and Rock for Trunk Portion

	Depth	Design Wave Height	Primary Cover Layer		Secondary Cover Layer
			TETRAPOD	ACCROPOD	
West Breakwater	-15 to -12 m	6.7 m	40 t	9.0 m^3 (22 t)	4 to 7 t Rock
South Breakwater	-15 to -13 m	4.7 m	16 t	3.0 m^3 (7 t)	1 to 3 t Rock
North Breakwater	-14 to -12 m	4.7 m	16 t	3.0 m^3 (7 t)	1 to 3 t Rock
	-12 to -9 m	4.3 m	12.5 t	2.5 m^3 (6 t)	1 to 3 t Rock

The stability analysis has been conducted for each caisson-type breakwater by applying the design wave corresponding to its location. Table 11.5 shows the sizes of the proposed caisson boxes.

Table 11.5 Required Caisson Boxe Sizes for Trunk Portion

	Depth	Design Wave Height	Caisson Size (Width x Length x Height)
West Breakwater	-15 to -12 m	6.7 m	18 m x 18 m x 12 m
South Breakwater	-15 to -13 m	4.7 m	12 m x 12 m x 12 m
North Breakwater	-14 to -10	4.7 m	12 m x 12 m x 9 m

The sizes of toe concrete blocks and toe protection concrete blocks, both of which are required to protect rock mound from scouring action by waves, have been determined as shown in Table 11.6.

Table 11.6 Required Toe Concrete Block and Toe Protection Block

	Depth	Toe Concrete Block	Toe Protection Armour Block
West Breakwater	-15 to -14m	42.3 t	16 t
	-13 m	37 t	16 t
South Breakwater	-15 m	37 t	6 t
	-14 to -13 m	24.8 t	6 t
North Breakwater	-14 to -13 m	37 t	12 t
	-12 to -10 m	24.8 t	12 t

11.3.4 Standard Section of Breakwaters

The required cross-sections of rock-mound breakwaters with armour concrete blocks of TETRAPOD and ACCROPOD, and concrete caisson box have been determined based on the design criteria established in the previous Sections. The typical cross-sections of the West Breakwater at the trunk portion are shown in Figures 11.3, 11.4 and 11.5.

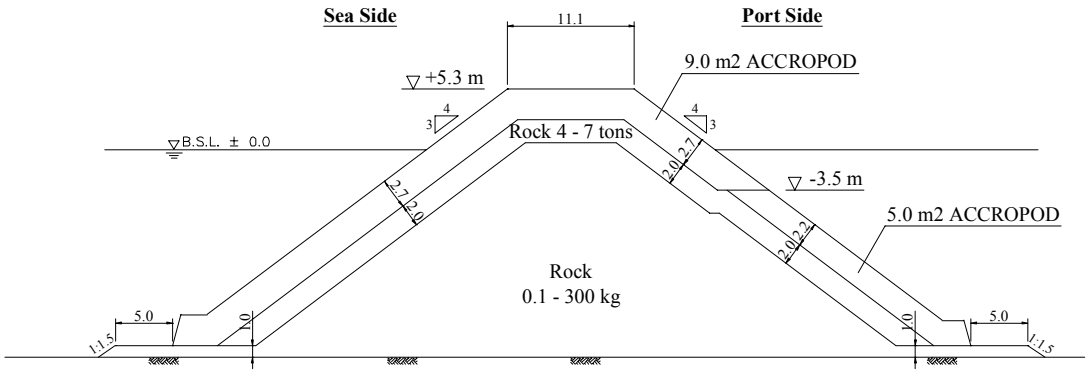


Figure 11.3 Rock Mound-Type West Breakwater with TETRAPOD (Trunk Portion)

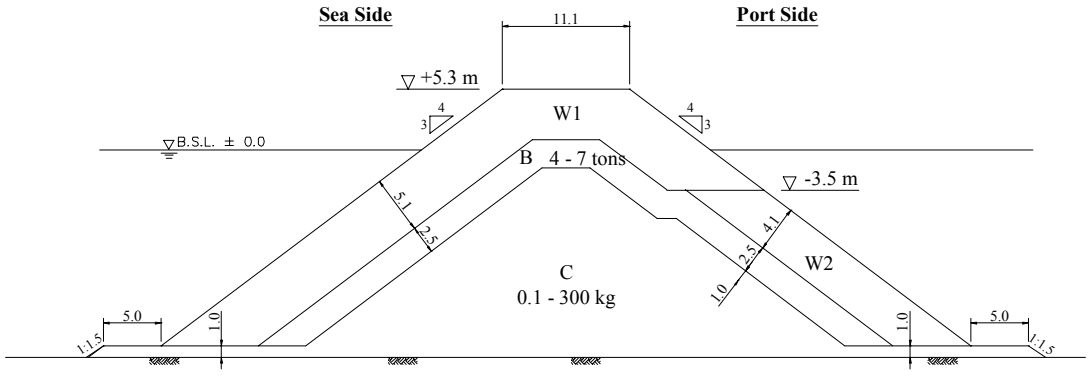


Figure 11.4 Rock Mound-Type West Breakwater with ACCROPOD (Trunk Portion)

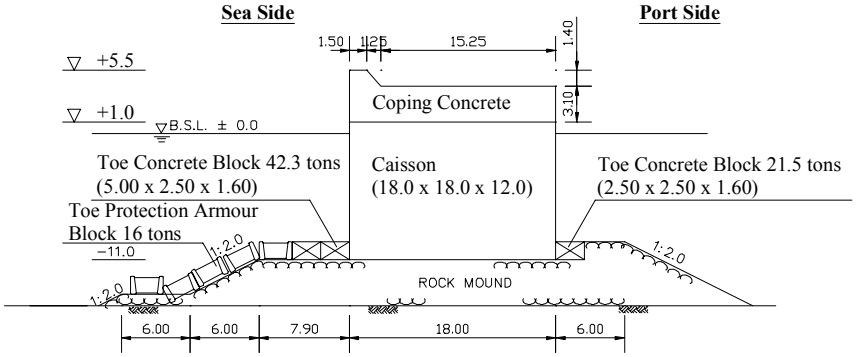


Figure 11.5 Caisson-Type West Breakwater (Trunk Portion)

11.3.5 Selection of Breakwater Structures

The cost comparison of three alternatives for the West Breakwater, as presented in Figure 11.6, shows that the rock mound-type with ACCROPOD would be the most economical structure for water depths between -16 m to -12 m. As the natural water depths are in the range of –13 m to –14 m, the ACCROPOD-armored breakwater has been selected for the West Breakwater.

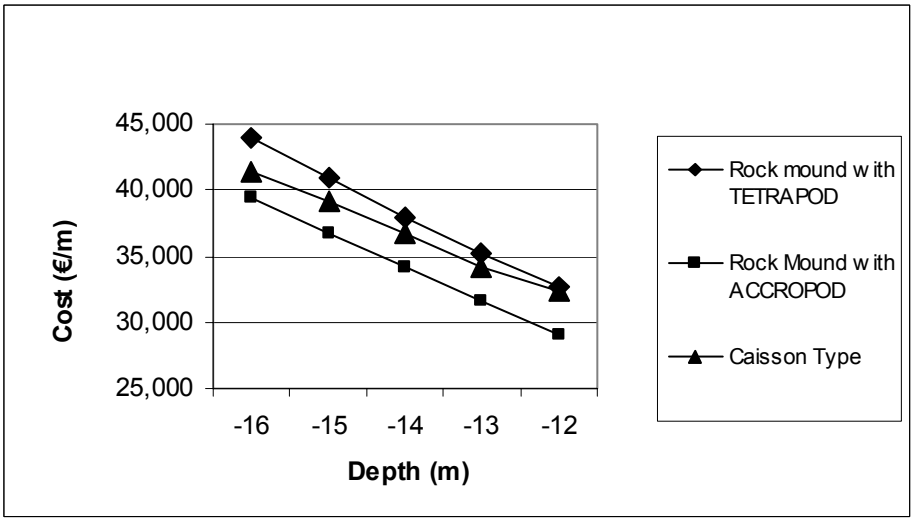


Figure 11.6 Comparison of Cost for Alternatives of West Breakwater

Similarly, the cost comparison for the South Breakwater has been undertaken with the caisson-type selected for sections deeper than -15 m, and the rock mound-type for sections shallower than -15 m.

For the North Breakwater, similar comparisons have been made and the rock mound-type with ACCROPOD was found to be the most economical for all water depths.

11.4 Design of Quay Wall

11.4.1 Design Parametres

(1) Ship Characteristics

The berth structures have been designed to receive the maximum size of vessels expected in the outer port. Details of the maximum vessels docking in the port are outlined below.

Table 11.7 Design Vessel Size for Berths of Outer Port

Berth	Vessel Size	LOA	Breadth	Draft
Berth No. 1 - Petroleum Jetty	109,000DWT	244 m	42.3 m	14.9 m
Berth No. 2 - Grain Bulk	123,000DWT	266 m	40.6 m	15.4 m
Berth No. 3 – Fertilizer	123,000DWT	266 m	40.6 m	15.4 m
Berth No. 4 – Fertilizer	74,000DWT	225 m	32.3 m	13.5 m
Berth No. 5 – General Cargo	74,000DWT	225 m	32.3 m	13.5 m
Berth No. 6 - Container	4,800TEU	294 m	32.2 m	13.5 m

(2) Surcharge and Live Load

The surcharge and live loads on each berth have been determined following EAU and taking account of operational conditions for each berth. The live loads from cranes and cargo handling equipment have been assumed as below in Table 11.8 considering the commodities handled and operational method.

Table 11.8 Surcharge and Live Loads

Berth	Crane Load	Uniform Load (Normal)
Berth No. 1	Oil Loading/Unloading Arm	10 KN/m^2
Berth No. 2	Grain Loader 1,500 t/hr, Unloading Pipe for Liquid Bulk	Apron 10KN/m^2, Yard 50 KN/m^2
Berth No. 3	Loader 2,500 t/hr, Level-ruffing Crane 40 t	50 KN/m^2
Berth No. 4	Loader 2,500 t/hr, Unloader 1,000 t/hr Level-ruffing Crane 40 t	50 KN/m^2
Berth No. 5	Level-ruffing Crane 40 t	50 KN/m^2
Berth No. 6	Gantry Crane	Apron 20 KN/m^2, Yard 50KN/m^2

(3) Elevation of Quay Wall

The top elevation of berth structures has been set at +3.0 m except for Berth No. 1, where the elevation of the platform has been set at +5.0 m. This exceeds the crest elevation of extreme waves expected near the port entrance.

(4) Mooring Forces

Bollards should be installed along the berth front to withstand the mooring forces corresponding to the displacement tonnage of design vessels listed in Table 11.9.

Table 11.9 Line Pull Force of Bollard

Ship Displacement	Line Pull Force
Up to 100,000 ton	1,000 KN
Up to 200,000 ton	1,500 KN
Over 200,000 ton	2,000 KN

11.4.2 Structural Type of Quay Wall

Considering the shipping, geological, operational and construction conditions, optimum structural types have been selected as below.

(1) Structural Type for Berth No. 1

At Berth No. 1, a sandy layer mixed with gravel and cobble exists below the dredging elevation of -17.0 m planned for the port basin. To receive various sized oil tankers, a dolphin-type structure would be the most suitable and economic. The size distribution and detailed ship particulars of tankers calling at Berth No. 1 is not known. Therefore, it has been assumed that they would be in the range of 30,000 DWT to 110,000 DWT. Figure 11.7 shows a plan and front view of Berth No. 1.

(2) Structural Type for Berths No. 2 to No. 6

The quayside depth of Berths No. 2 and No. 3 is -17.0 m and for Berths No. 4 to No. 6 is -15.0 m. The subsoil conditions are advantageous for a gravity-type structure, but will cause some difficulty in constructing multi-storied concrete block structures. As such, a caisson-type structure has been selected as a representative structure for a gravity-type wharf. In addition to gravity-type structures, a relieving platform structure has been selected as an alternative for comparative analysis. The proposed cross-sections of relieving platform-type structures and caisson-type structures are shown in Figures 11.8 to 11.11.

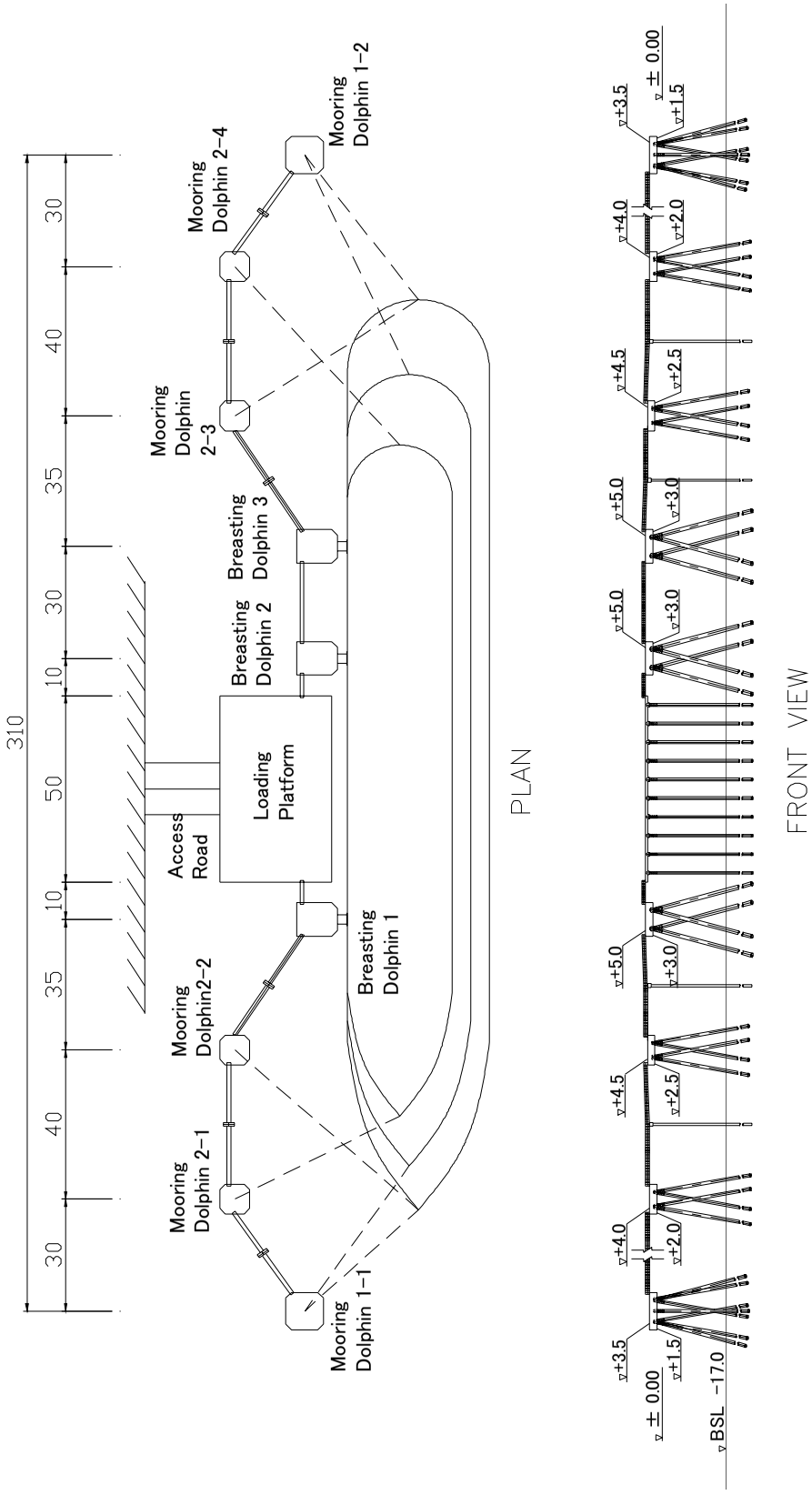


Figure 11.7 Plan and Front View of Berth No. 1

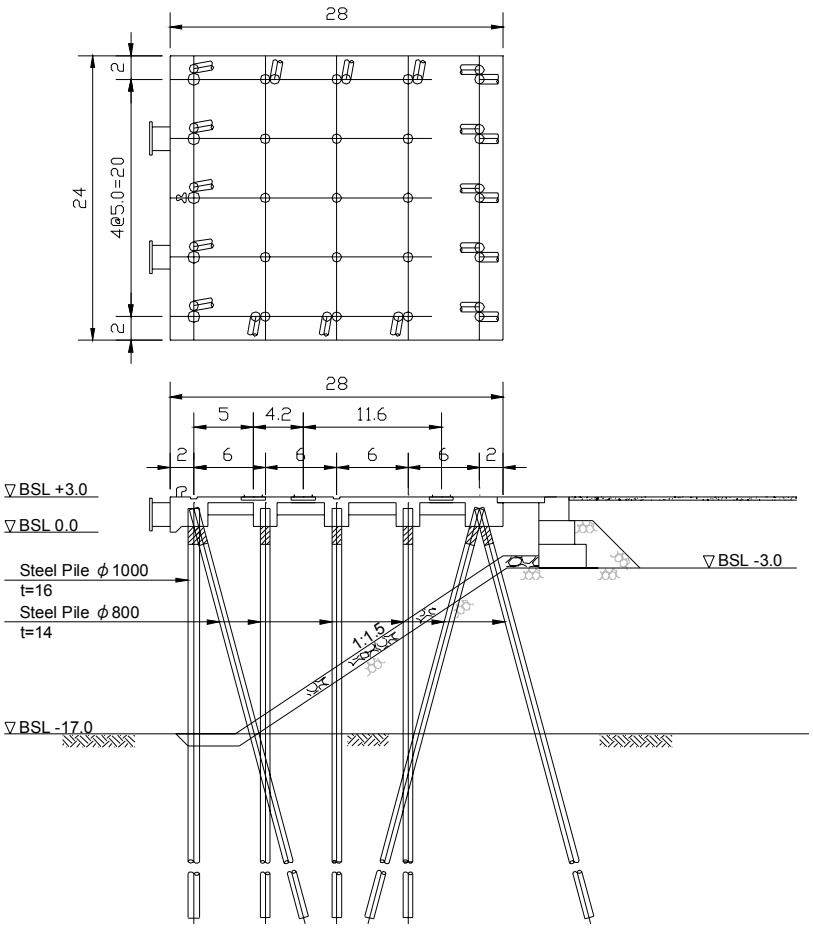


Figure 11.8 Cross-Section of Relieving Platform-Type Structure (Berth No. 2)

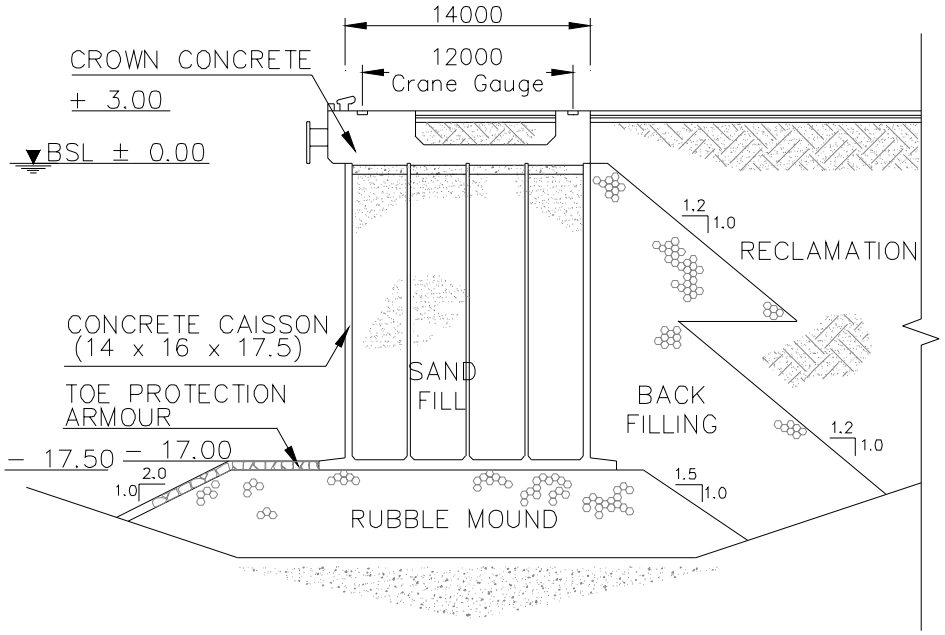


Figure 11.9 Cross-Section of Caisson-Type Structure (Berth No. 2)

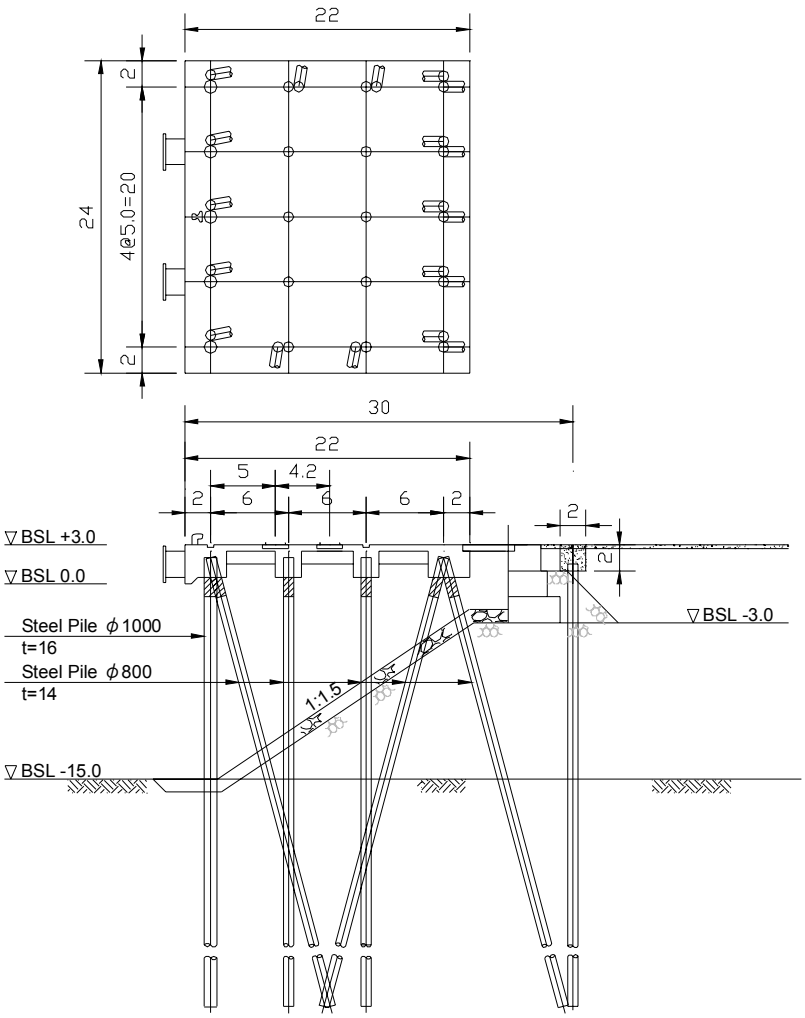


Figure 11.10 Cross-Section of Relieving Platform-Type Structure (Berth No. 6)

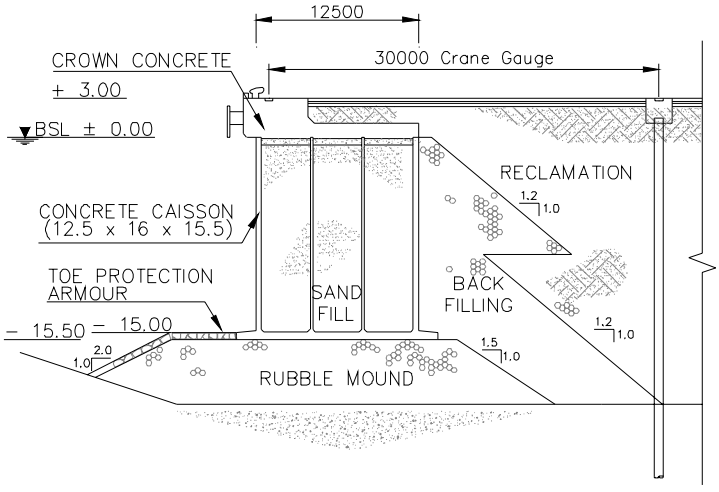


Figure 11.11 Cross-Section of Caisson-Type Structure (Berth No. 6)

11.5 Design for Railway and Road

11.5.1 Railway

The design of railway alignments and structures has, in principle, followed 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 have also been applied for the engineering design of railway structures. The major track geometry is summarized in Table 11.10.

Table 11.10 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)
Super-elevation	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 Centres	Main Track: 4.1 m (more than three tracks: 5.0 m) Station, Yard: 4.8 m

Source : Technical Provision of Railway Usage

Major performance and specifications of a locomotive are listed in Table 11.11.

Table 11.11 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

Source : Lithuanian Railways Figures and Facts

A typical cross-section of sub-grade is shown in Figure 11.12, and construction and rolling stock gauges are shown in Figures 11.13 and 11.14.

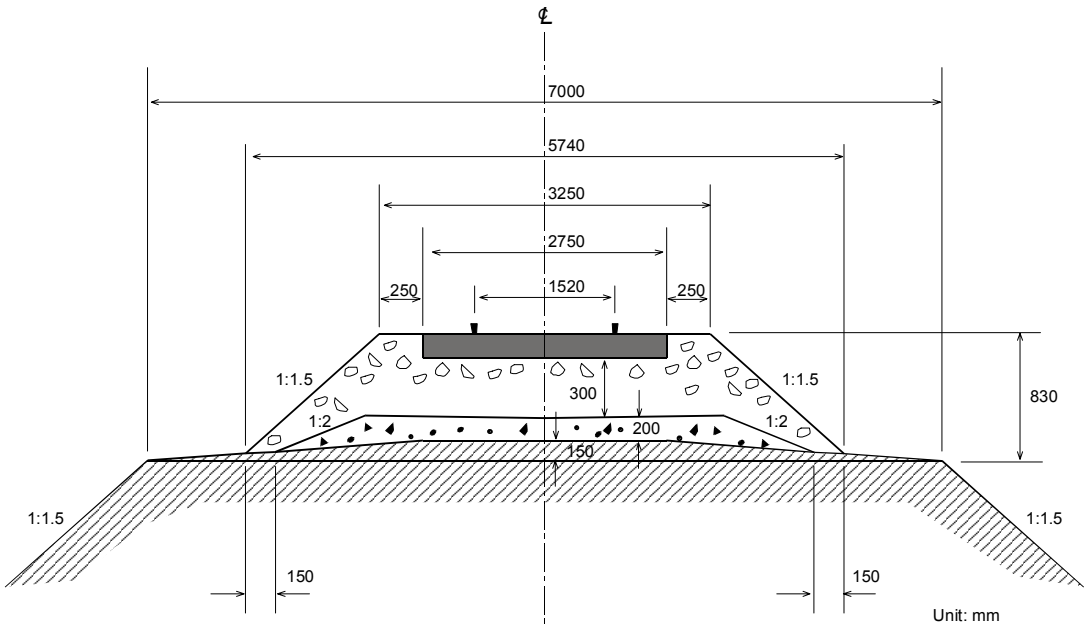
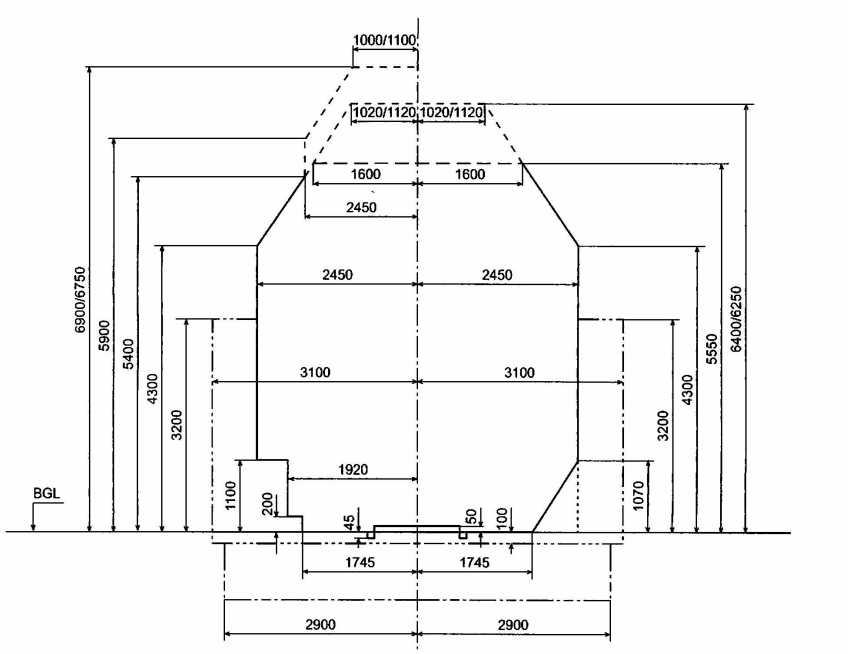


Figure 11.12 Typical Cross-Section of Subgrade



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 11.13 Construction Gauge

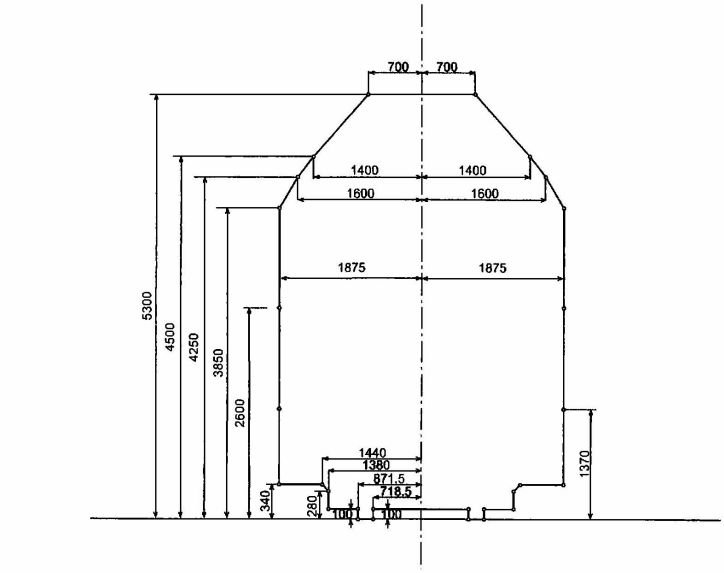


Figure 11.14 Rolling Stock Gauge

11.5.2 Road Structure

An access road from the public road to the outer port area will be required. The port service roads will need a flyover bridge at the crossing point with the railway yard, which will be located on the shoreside of the outer port area. The roads have been designed with four-lanes to accommodate future demand of port-related traffic. Typical cross-sections at grade and flyover are shown in Figures 11.15 and 11.16.

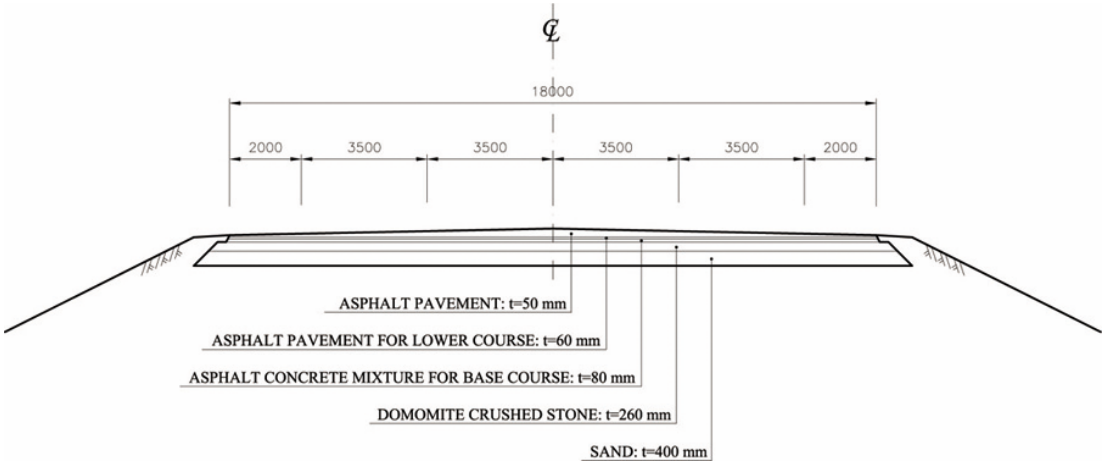


Figure 11.15 Typical Cross-Section of Access Road

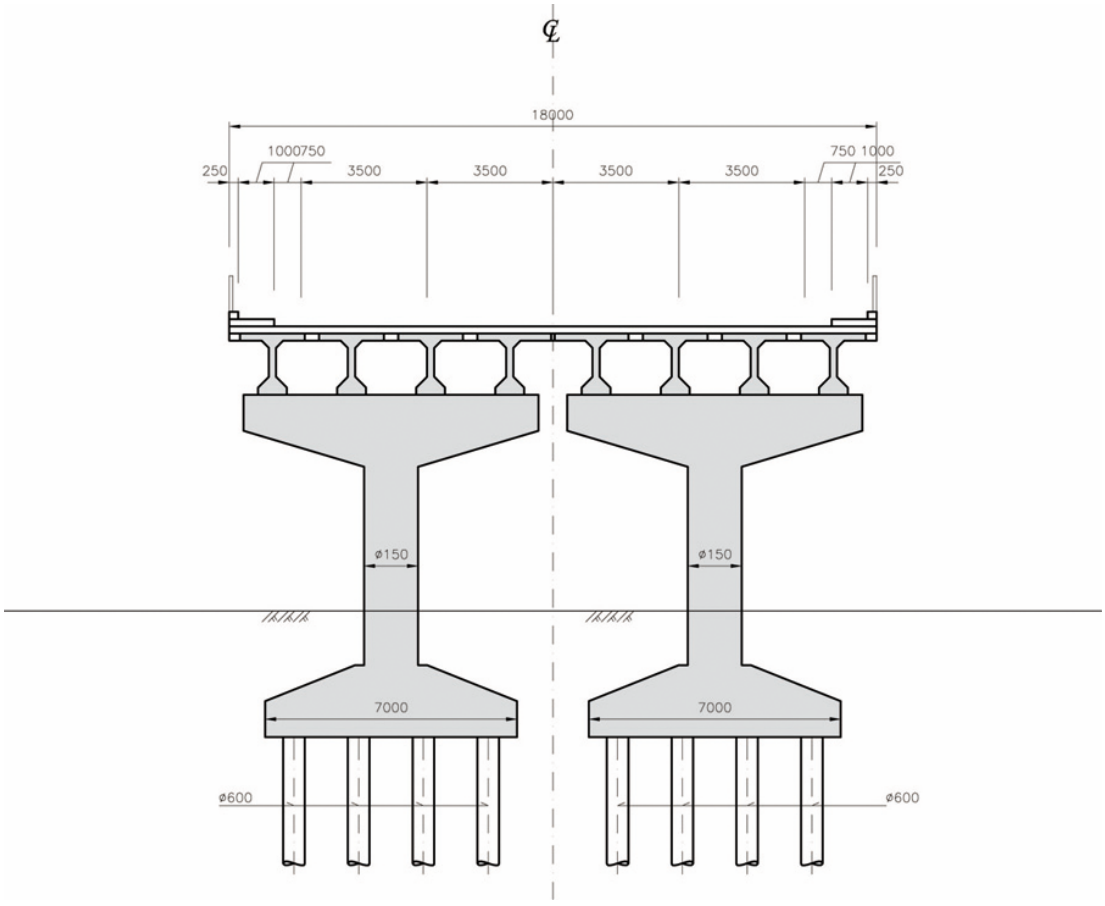


Figure 11.16 Typical Cross-Section of Flyover

CHAPTER 12 PROJECT IMPLEMENTATION PROGRAM

12.1 Major Work

The scope of the construction works for the Short-term Development and Master Plans are summarized below:

		Short-term Development Plan (Year 2015)	Master Plan (Year 2025)
1.	Offshore Facilities		
1.1	Breakwaters		
	West Breakwater	1,020 m	1,800 m
	South Breakwater	1,380 m	1,380 m
	North Breakwater	500 m	500 m
1.2	Dredging and Reclamation		
	Dredging Sand and Reclamation	6,730,000 m^3	8,740,000 m^3
	Dredging Hard Clay and Dumping	180,000 m^3	180,000 m^3
	Reclamation Fill	300,000 m^3	1,200,000 m^3
1.3	Quay Facilities		
	Berth No. 1 (Dolphin-Type)	310 m (-17.0 m)	310 m (-17.0 m)
	Berth No. 2 (Caisson-Type)	310 m (-17.0 m)	310 m (-17.0 m)
	Berth No. 3 (Caisson-Type)	310 m (-17.0 m)	310 m (-17.0 m)
	Berth No. 4 (Caisson-Type)	-	260 m (-15.0 m)
	Berth No. 5 (Caisson-Type)	-	260 m (-15.0 m)
	Berth No. 6 (Caisson-Type)	-	330 m (-15.0 m)
	Transition Part	50 m (-9 to -17 m)	50 m (-10 to -15 m)
1.4	Revetments		
	North Revetment	700 m	700 m
	South Revetment	460 m	460 m
	South-East Revetment	300 m	300 m
	East Revetment	1,000 m	1,850 m
1.5	Basin for Port Service Boats		
	Wharf	400 m (-6.0 m)	400 m (-6.0 m)
1.6	Removal of Existing North Breakwater	220 m	220 m
2.	Onshore Facilities		
2.1	Road and Pavement		
	Concrete Pavement for Apron	18,600 m^2	44,100 m^2
	Asphalt Pavement for Port Service Roads	47,000 m^2	57,000 m^2
	Container Yard Pavement	-	132,000 m^2
	Flyover Bridge with Approach	1 unit	1 unit

2.2	Railway		
	Port Area	8.2 km	13.3 km
	Access Railway (Pauoscio Yard-Port)	2.5 km	2.5 km
	Improvement of Pauoscio Yard	6.5 km	9.3 km
2.3	Drainage and Water Supply	1 lot	1 lot
2.4	Electrical Work	1 lot	1 lot
3	Cargo Handling Facilities		
3.1	Shore Crane	3 units	10 units
3.2	Belt Conveyor System	400 m	1,300 m
3.3	Yard Equipment	1 lot	1 lot
3.4	Rail Transfer Crane	-	4 units
3.5	Miscellaneous Buildings	1 lot	1 lot

12.2 Construction Cost

12.2.1 Basis of Cost Estimate

Based on the unit rates and collected contract price of recent construction works in the port, assessment of construction cost of the outer port for the Master Plan has been carried out. The construction cost has been estimated under the following conditions:

Construction costs are composed of direct and indirect costs, including 6% engineering cost, 18% value added tax, and 10% contingencies

Foreign exchange rates were assumed as at the end of January 2004 at:

1 Euro = 3.44 Litas = 130 Japanese yen = 1.238 US$

Estimated costs were expected expenses of KSSA, concessionaires, and state Government

12.2.2 Project Costs

The total project costs of the Short-term Development Plan and Master Plan have been estimated at 355 million Euros and 638 million Euros respectively.

Table 12.1 Estimated Project Cost

	Short-term Plan	Master Plan
Outer Port	350 million Euros	633 million Euros
Southern Access railway Improvement	5 million Euros	5 million Euros
Total	355 million Euros	638 million Euros

The itemized project costs are tabulated in Tables 12.2 and 12.3.

Table 12.2 Estimated Project Cost of Short-Term Development Plan

(Unit : EURO)

Description	Unit	Quantity	Unit Rate	Amount
Mobilization Cost of Floating and Heavy Equipment	sum			**500,000**
West Breakwater - Rock Mound	sum			**38,117,000**
South Breakwater - Caisson or Rock Mound	sum			**44,994,000**
North Breakwater - Rock Mound	sum			**13,676,000**
Dredging and Reclamation	sum			**14,659,000**
Quay Facilities				
Berth No. 1 (-17m) - Petroleum	L.S	1	5,000,000	5,000,000
Berth No. 2 (-17m) - Grain Bulk	m	310	48,300	14,973,000
Berth No. 3 (-17m) - Fertilizer	m	310	50,500	15,655,000
Transition Part	m	50.0	48,400	2,420,000
			Sub Total	**38,048,000**
Navigation Aid	sum			**2,867,000**
Revetments	sum			**27,543,000**
Basin for Port Service Boats	sum			**2,916,000**
Removal of Existing North Breakwater	sum			**4,618,000**
Road and Pavement	sum			**11,975,000**
Drainage & Water Supply	sum			**3,000,000**
Electrical Work	sum			**3,000,000**
Railway				
Port Area Railway	L.S			5,830,000
Access Railway from Pauoscio Yard to Port	L.S			1,700,000
Pauoscio Yard Improvement	L.S			4,320,000
	L.S			**11,850,000**
Cargo Handling System and Storage	sum			**36,585,000**
Total for Construction Cost				**254,348,000**
Engineering Cost (6%)				**15,261,000**
Total excluding VAT				**269,609,000**
VAT (18%)				**48,529,620**
Total including VAT				**318,138,620**
Contingencies (10%)				**31,813,862**
Grand Total				**349,952,000**

Table 12.3 Estimated Project Cost of Master Plan

(Unit : EURO)

Description	Unit	Quantity	Unit Rate	Amount
Mobilization Cost of Floating and Heavy Equipment	sum			**700,000**
West Breakwater - Rock Mound	sum			**63,265,000**
South Breakwater – Caisson or Rock Mound	sum			**44,994,000**
North Breakwater - Rock Mound	sum			**16,835,000**
Dredging and Reclamation	sum			**21,178,000**
Quay Facilities				
Berth No. 1 (-17m) - Petroleum	L.S	1		5,000,000
Berth No. 2 (-17m) – Grain Bulk	m	310	48,300	14,973,000
Berth No. 3 (-17m) - Fertilizer	m	310	50,500	15,655,000
Berth No. 4 (-15m) – Bulk	m	260	44,100	11,466,000
Berth No. 5 (-15m) - General Cargo	m	260	44,100	11,466,000
Berth No. 6 (-15m) - Container	m	330	43,600	14,388,000
Transition Part	m	50.0	38,600	1,930,000
			Sub Total	**74,878,000**
Navigation Aid	sum			**3,395,000**
Revetments	sum			**35,053,000**
Basin for Port Service Boats	sum			**2,916,000**
Removal of Existing North Breakwater	sum			**4,618,000**
Road and Pavement	sum			**15,976,000**
Drainage & Water Supply	sum			**5,000,000**
Electrical Work	sum			**5,000,000**
Railway				
Port Area Railway				12,130,000
Access Railway from Pauoscio Yard to Port				1,700,000
Pauoscio Yard Improvement				10,450,000
			Sub Total	**24,280,000**
Cargo Handling System and Storage	sum			**141,845,000**
Total for Construction Cost				**459,933,000**
Engineering Cost (6%)				**27,595,980**
Total excluding VAT				**487,528,980**
VAT (18%)				**87,755,216**
Total including VAT				**575,284,196**
Contingencies (10%)				**57,528,420**
Grand Total				**632,813,000**

12.3 Implementation Program of Key Projects

12.3.1 Implementation Schedule of Short-term Development

As explained earlier in this study report, the Short-term Development Plan comprises the KSSA's already implemented or planned projects as well as the Key Projects that have been idenified through the JICA Study. The former ones iuclude the re-construction of Berths Nos. 82-89, the channel dredging, re-arrangement of storage areas, etc. The latter ones are the Outer Port Development and the Southern Access Railway Improvement. All the projects of the Short-term Development should be implemented in a timely manner in order to run the Port efficiently without causing port traffic congestion. The overall implementation program of the Short-term Development is shown in Figure 12.1, where various kinds of pre-constuction works are also proposed, inclusive of EIA, financial arrangements and selection of operators.

12.3.2 Implementation Schedule of the Key Projects

The Outer Port Development Project should be completed by 2014, and the Southern Access Railway Improvement Project by 2011. The durations of the both projects, including necessrary period for engineering design, selection of the contractors, and construction period have been estimated at 5.5 years and 2 years as shown in Figure 12.2 and 12.3.

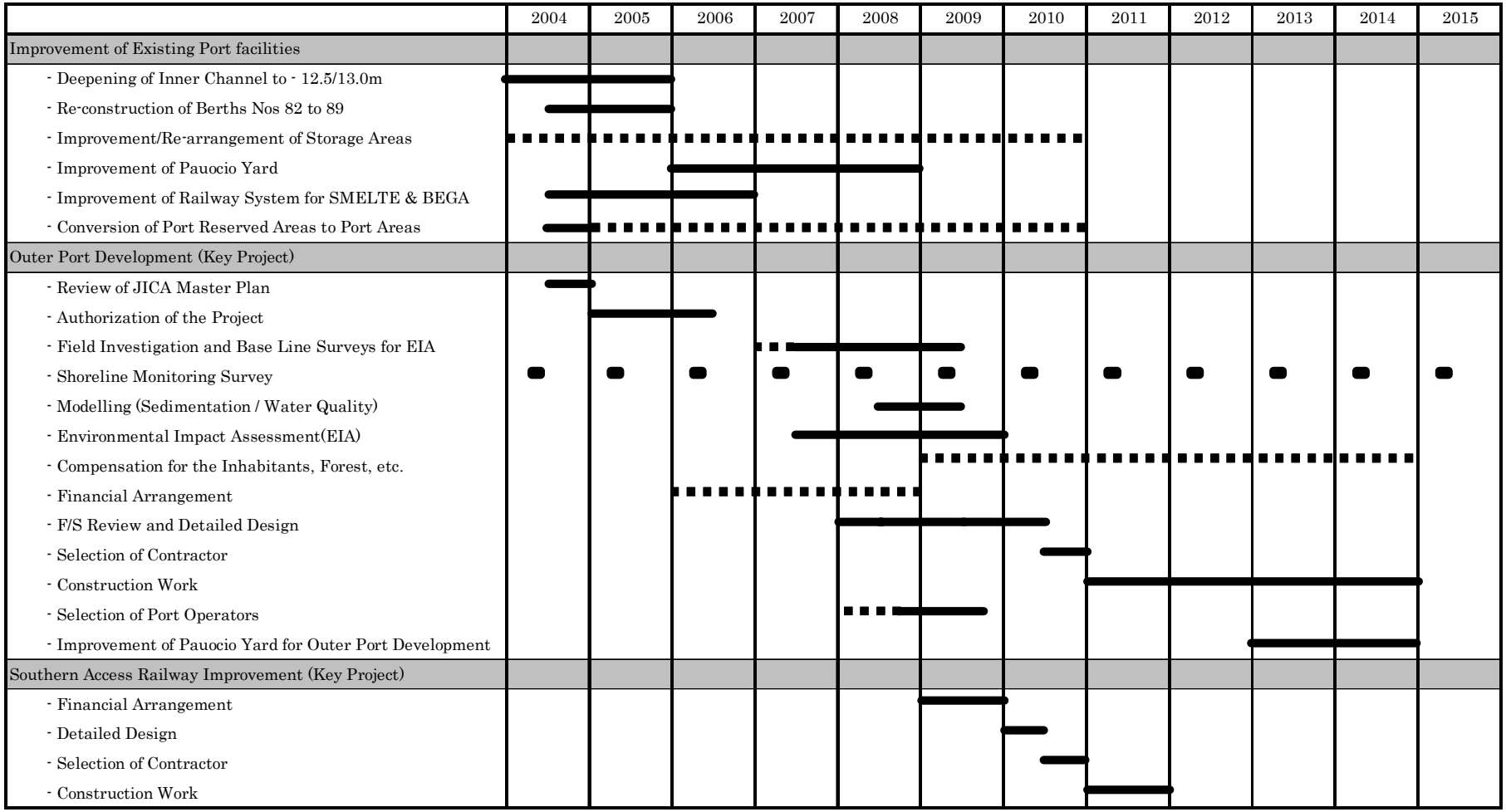


Figure 12.1 Implementation Schedule for Short-term Development

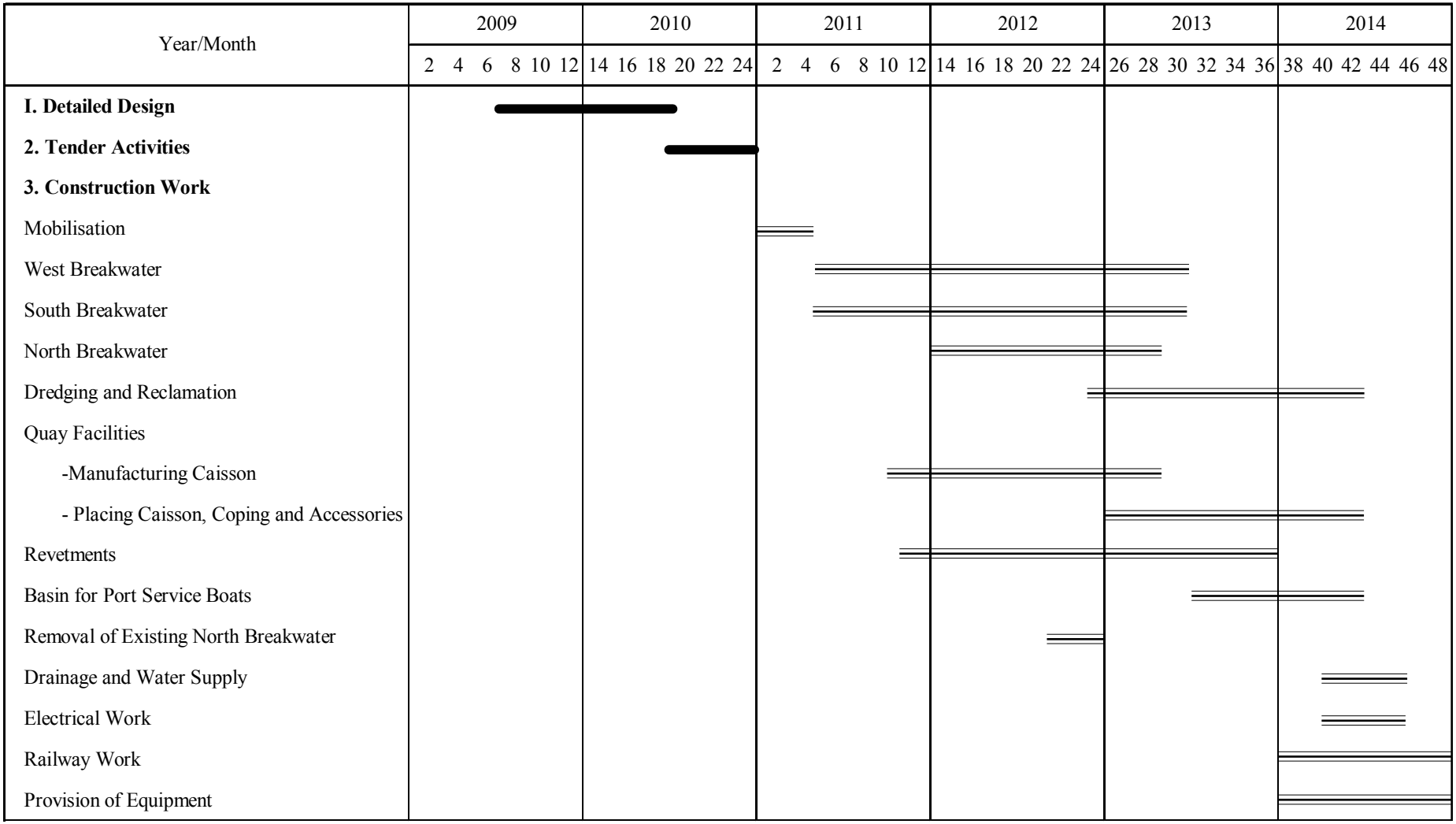


Figure 12.2 Implementation Schedule for Outer Port Development

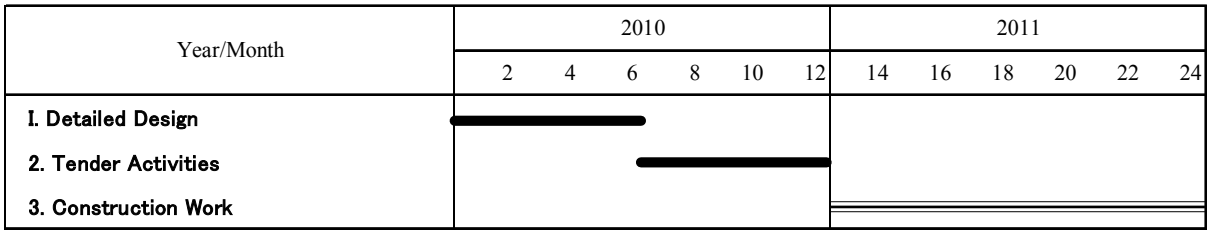


Figure 12.3 Implementation Schedule for Southern Access Railway Improvement Project

CHAPTER 13 INITIAL ENVIRONMENTAL EXAMINATION (IEE)

13.1 General

An Initial Environmental Examination (IEE) was conducted during the first stage of the Study in order to:

- Screen the project to determine the type of environmental analysis required;
- Scope the environmental analysis, that is define the nature of the work necessary;
- Evaluate the environmental impacts of each option considered for development of the port, and indicate which are preferred on environmental grounds.

The work involved the following main activities:

- Review of environmental conditions in the area that may be affected by the port development;
- Identification of any sensitive or valuable features, so that options can be developed that minimise environmental damage;
- Preliminary assessment of the impacts of development options, their significance and the potential to mitigate negative impacts;
- Determining preferences between options based on the significance of impacts and the ease with which mitigation can be provided.

13.2 The Existing Environment

13.2.1 Data Sources

Data on the environment in and around the port was collected from five main sources:

- Results of routine monitoring by Government agencies (KSSA, Ministry of Environment Klaipeda Region, MoE Centre of Marine Research);
- Reports of EIA studies produced for engineering projects in the Port;
- Scientific papers published by university and research institute staff;
- Human environment data from Klaipeda Public Health Centre and other Government-produced statistics and data;
- Surveys carried out for this Study to collect physical and chemical data in the water and sediments of the coast, channel and lagoon.

13.2.2 Key Environmental Features in and around Port Development Areas

The analysis of existing conditions shows that Klaipeda Port is very important in the economy of the country and a major influence on the life of the city, and is also in an area of considerable environmental importance and sensitivity. Key features are:

- The Curonian Spit in the west, which has internationally important landscapes, culture and ecology, and is a designated National Park and World Heritage Site;
- The Channel between the Spit and the Port, through which commercially exploited and rare fish, and internationally important birds migrate each year;

- The village of Melnrage and the Baltic coast in the north, which are used for recreation and tourism by local people and visitors;
- Klaipeda City in the east, where commercial and residential areas are located close to the port with little or no buffer in places;
- Land immediately south of the port is a groundwater protection zone as it contains boreholes from which water is extracted to supply the city;
- The Curonian Lagoon in the south is a fish spawning ground, a resting and over-wintering site for birds, a tourist attraction and supports a commercial fishery.

The port is therefore surrounded on all sides by areas and features that are of local, national and international importance, which are sensitive in different ways and to varying degrees to damage and disturbance. Proposals to expand the the port therefore need to be developed and implemented with a great deal of sensitivity to environmental considerations to prevent damage and disturbance to important assets.

So that options for Port expansion could be developed by considering environmental factors, a preliminary analysis was carried out of the environmental sensitivity of the main potential development sites. This indicated the following:

- Malku Bay and land to the east is the preferred site for future port development on environmental grounds. It is within the existing port boundary, includes areas reserved for port use that are currently unoccupied, and contains the most polluted sediment and one of the most polluting industries (ship repair), both of which could be cleaned and/or removed as part of new expansion plans;
- Development at the two other sites within the port is not feasible. There is insufficient space for on-land facilities near the Dane River and there are houses and other buildings nearby. Land reserved for port use around the Smeltale River has been developed for housing and some has been earmarked for recreational development, so it would be difficult to reclaim the area for Port expansion;
- Development at the west of the ferry terminal would be difficult because it is close to the boundary of the National Park and the likely Natura 2000 site and in the EU development is prohibited both within and near to such sites. The MoE are also concerned that further dredging in the south of the port could increase the ingress of saline water into the Lagoon and damage its fragile ecology;
- Development at Melnrage would also be difficult as the area is used for recreation by local people and visitors, attracted by the beach and landscape, and residents of Melnrage have invested in supporting infrastructure and new housing. A large development here would be visible for long distances and would detract from the beauty of the landscape to the north towards the resort of Palanga and in the south on the popular beaches of the Curonian Spit.

13.3 Proposed Port Development Options

On the basis of these factors and issues relating to the other fields involved in the Study (economics, financial, engineering, planning, legal, etc), seven options for developing the port were proposed at three locations, and two others were included as possible future options because of their potential for providing environmental improvements. These are summarised as follows:

Table 13.1 Proposed Port Development Options

No	Name	Location	Main Features (approx dimensions)
A	Inner-Port New	West of Ferry Terminal	0.8 km^2 reclaimed area; 0.9 km^2 basin dredged to -14 m; 125 m wide approach channel west of Kiaules Nugara, dredged to -14 m; 5 or 6 berths at front of reclaimed area; road and rail access from Port nearby
B1	Outer-Port Alt-1	Melnrage 1	1 km^2 reclaimed area; 2 km^2 basin dredged to -15 and -17 m, protected by 3 km breakwaters; approach channel dredged to -17.5 m; 6 berths; road and rail access by new routes, with bridges across the beach if necessary. Options differ in dimensions of reclaimed area and layout of structures and facilities
B2	Outer-Port Alt-2	Melnrage 1	
B3	Outer-Port Alt-3	Melnrage 1	
D	Potential Future Development 1	Adjacent to Dane River	Removal of contaminated sediments in enclosed harbours; clean up of on-land contamination and facilities; removal of polluting industry; reallocation of land for cleaner uses
E	Potential Future Development 2	Western Ship Repair	
F	Inner-Port Rehab 1	Selected areas	Reorganisation and refurbishment of existing facilities; provision of new cargo handling and storage; may extend quay areas by reclamation; will dredge KLASCO and Bega berths to -12.5 and -14.5
G	Inner-Port Rehab 2		
H	Inner-Port Rehab 3		

13.4 Environmental Impacts of Port Development Options

The environmental impacts of the four main options were then assessed in broad terms, and the results are summarised in the table below. The second column shows the most frequent impacts of port developments in coastal and estuarine areas, and the text in each cell explains whether this option would produce this impact (during construction and when the new port is operating). The cells are coloured to indicate the likely significance of each impact, and the final two rows explain the overall conclusions regarding the impacts of each scheme and indicate whether or not they are recommended on environmental grounds.

13.5 Conclusions

The assessment shows that there are clear preferences between options based on the environmental impacts they are likely to produce. These preferences and their reasons are summarised below, with key measures that should be included in any further development of the options, to mitigate impacts that could be significantly negative.

- The **Inner-Port Rehabilitation** options would be environmentally acceptable;
- They should not have adverse impacts when the facilities are refurbished, and the upgraded operations will provide a modern, clean port and working environment;

- **Potential Future Development** is the environmentally preferred option;
- It would remove the most polluted areas of sediment (Laivite, Baltija and Malku Bay harbours), and the most contaminating industries (shipbuilding and repair);

Table 13.2 Main potential environmental impacts of proposed port development options

	IMPACT	INNER-PORT		OUTER-PORT		POTENTIAL FUTURE		REHABILITATION	
		CONSTRUCTION	OPERATION	CONSTRUCTION	OPERATION	CONSTRUCTION	OPERATION	CONSTRUCTION	OPERATION
PHYS	Changes in patterns of erosion and sedimentation	May occur: channel is narrow, muddy	Could affect Spit and Kiaules Nugara	Weak drift currents. Changes not likely	Changes could occur over time	Small changes from harbour dredging	Small change: silt settles in harbours	Small reclamation and dredging	Small changes from channel dredging
	Physical changes at sites where materials are extracted	Needs large amount of rock and infill	Not Relevant	Needs large amount of rock and infill	Not Relevant	Small amounts of building materials	Not Relevant	Small amounts of building materials	Not Relevant
CHEMICAL	Dredging: turbidity plumes; polluted sediment disturbed	Large quantity; mud, strong current	Will need frequent dredging	Significant if plume affects Spit beaches	Avoid dredging in summer holidays	Highly polluted. Must contain plume	Removes polluted sediment, industry	Channel is not heavily polluted	Small maintenance dredging in future
	Reclamation: turbidity plumes, polluted sediment disturbed	Overflow from large reclamation	Not Relevant	Large area. Plume must avoid beaches	Not Relevant	Not Relevant	Not Relevant	Small reclamation	Not Relevant
	Pollution from spills of fuel or chemicals kept on site or cargo	Must avoid. Spit & lagoon vulnerable	Must avoid. Spit & lagoon vulnerable	Must avoid damage to beaches and Spit	Must avoid damage to beaches and Spit	No vulnerable areas nearby	Must avoid future pollution	No vulnerable areas nearby	Improved facilities: reduced pollution
ECOLOGY	Benthos: removed by dredging and reclamation	Large areas, but no known rare species	Frequent dredging, but no rare species	Large areas, but no known rare species	No known rare or important species	Few inhabitants in polluted harbours	Little dredging in future	No rare/important species in channel	No rare/important species in channel
	Fish: impeded migration, loss of breeding or feeding grounds	Large construction in a narrow channel	No known effect of present port activity	Dredging will avoid key migration times	Operational area is outside channel	No major works in channel	No known effect of normal port activity	Dredging will avoid key periods	No known effect of normal port activity
	Birds: decreases because of disturbed breeding or feeding	Kiaul Nugara, Spit reedbeds very close	Kiaul Nugara, Spit reedbeds very close	No important bird sites nearby	No important bird sites nearby	No important bird sites nearby	No important bird sites nearby	No important bird sites nearby	No important bird sites nearby
	Damage of habitats or species in or near protected areas	More saline water will enter lagoon	Edge of spit and island could erode	Unlikely to affect protected areas	Unlikely to affect protected areas	No important habitats nearby	No important habitats nearby	No important habitats nearby	No important habitats nearby
	Increased habitat/biodiversity; port water used as fish nursery	Little colonisation: too much activity	Should provide fish and benthos habitat	Little colonisation: too much activity	Should provide fish and benthos habitat	Dredging will deter colonisation	Should provide fish and benthos habitat	No new aquatic habitat created	No new aquatic habitat created
HUMAN	Need to acquire land, property and/or relocate residents	Some land is needed for facilities	Not Relevant	Some land needed for road & railway	Not Relevant	No new land required	Not Relevant	No new land required	Not Relevant
	Disruption and disturbance by transport of materials & cargo	No major settlement nearby	No major settlement nearby	Major disturbance at Melnrage	Ongoing Melnrage disturbance	Avoid disturbing port & landfill route	Normal operation, so no disturbance	Avoid disturbing port & landfill route	Normal operation, so no disturbance
	Disruption of normal activity through loss of access to site	Site is not used at present	Site is not used at present	Temporary loss of recreation area	Permanent loss of recreation area	Remove present operators amicably	New non-polluting operations installed	Planning will avoid disrupting port	Improved operation and environment
	Disturbance by noise and dust	No inhabitants nearby	No inhabitants nearby	Likely to disturb Melnrage residents	Some noise will be heard at Melnrage	Increases not noticeable in port	Should not increase above normal level	Increases not noticeable in port	Improved operation will reduce levels
	Visual disturbance, permanent changes to landscape	Activities blend into port landscape	Port landscape moves into lagoon	Site visible along coast and Melnrage	Site visible along coast and Melnrage	Activities blend into port landscape	New facilities will improve port scene	Activities blend into port landscape	New facilities will improve port scene
	Increased employment and improved socio-economics	Jobs available in local workforce	Improve trade, jobs national economy	Jobs available in local workforce	Improve trade, jobs national economy	Jobs available in local workforce	Little change in numbers of jobs	Jobs available in local workforce	Little change in numbers of jobs
	MITIGATION	Significant economic and social benefits but difficult to avoid negative effects on Kiaules Nugara, National Park & Lagoon		Significant economic and social benefits but changes in landscape and disturbance in Melnrage will be highly detrimental		Major environmental benefits from removal of polluted sediment and industry		Few impacts. Some environmental benefits from improving operations and facilities	
	CONCLUSION	Not acceptable because of potential impacts in and near protected area		Not recommended, but economic benefits may outweigh negative landscape impacts		Recommended because of major improvements in port environment		Acceptable. No major benefits or adverse impacts	

KEY: Highly Negative; Negative; Not Significant; Positive; Highly Positive

- This will remove the main sources of pollution in the port and substitute new less damaging operations that will significantly improve the port environment;
- If this option is selected, harbour entrances must be sealed when sediment is removed, to prevent contaminated water or sediment polluting the main channel;

- The **Inner-Port New** option would not be acceptable on environmental grounds because of the negative ecological impacts it is likely to produce;
- Dredging south of the existing port would allow more saline water into the lagoon, damaging its fragile ecology by removing present inhabitants and allowing marine species to colonise from the Baltic;
- Major dredging and reclamation in a narrow channel could also cause adjacent banks to erode, which could affect important habitats in and near the National Park, including reedbeds, fish nurseries and bird feeding areas;

- The **Outer-Port** option is not recommended on environmental grounds, because of its highly negative impacts on the landscape by converting an area of natural coast used for recreation by local people, into a large industrial port;
- The Outer-Port would be highly visible in Melnrage, on beaches to the north, and on the Curonian Spit, an area which has been designated as a National Park and UNESCO World Heritage Site because of its landscape beauty;
- It is difficult to envisage how such a development could be made less obtrusive, as screening would impede sea views, and even planting of trees would not be in keeping with a coastal landscape;
- Visitors to the Curonian Spit make a significant contribution to the local economy, so there could be further negative impacts if numbers were to decline;
- Decisions as to whether to propose this option should also consider the benefits that a new port could bring, by increasing trade and Government revenue, which could improve social and economic conditions throughout the country;
- A new port would also generate employment locally, which could improve social conditions and stimulate the economy of Klaipeda.

CHAPTER 14 ENVIRONMENTAL IMPACT ASSESSMENT STUDY

14.1 General

A study for Environmental Impact Assessment (EIA) was conducted on the Short-Term Plan in order to:

- Determine how the Short-Term Plan would affect the environment when it is constructed and when the completed schemes are operating;
- Identify measures to mitigate (reduce to acceptable levels) any negative environmental impacts, so that these can be included in the Plan.

The study area for the EIA was the area directly affected by the Short-Term Plan, and the surroundings where the development could be visible and/or audible. This is:

- The beach, sea and land at Melnrage I, within a radius of 1 km from the edges of the proposed outer port development;
- The proposed new rail route at the south of the port, and land 500 m on either side.

The study for EIA involved the following:

- Existing environmental conditions in the study area were determined from the detailed description of the port and its surroundings presented in the IEE, and from additional data collected during the EIA;
- A description of the proposed developments was prepared from information provided by the Port Planning experts of the JICA Study Team;
- The potential impacts of each development during construction and when they are operating were identified by visualising the development superimposed on the existing environment, and considering how they would interact;
- Significance of impacts was assessed by reference to national and international criteria (eg water quality standards, legal designations) and using expert judgement from a knowledge of the effects of similar developments elsewhere;
- Measures to mitigate negative impacts were devised and discussed with Planning and Engineering experts of the JICA Study Team to ensure that they were technically feasible and cost-effective.

14.2 Southern Access Railway Improvement

The proposed scheme for the Southern Access Railway Improvement comprises the following:

(1) Construction of Additional Access Track in South Zone

- Track: 4.1 km
- Turnout: 2 sets
- Embankment: 2.4 km
- Reinforced concrete bridge: 20 m
- Level crossing facility: 4 locations (automatic crossing control with barrier)
- Signalling facility: 1 unit

(2) Construction of New Yard in Smelte Territory

- Track: 3.7 km
- Turnout: 11 sets

14.3 Outer Port Development at Melnrage

The main element of the Short Term Plan is to build the first phase of the Outer Port Development proposed by the Master Plan. This comprises approximately 40% of the total structure, and will consist of the following:

- Reclaimed land of approximately 52 ha, including the main port area and a land access portion;
- Breakwaters of 2.9 km length, along the northern, western and southern sides of the development;
- Navigation channel (300 m wide and 17.5 m deep) and turning basin (600 m in diameter and 17 m deep);
- New road and rail lines will branch from existing routes east of Melnrage, and run south of the village and across the land access onto the main port area.

The following facilities will be provided to handle cargoes predicted to 2015:

- Petroleum Jetty (Berth No 1), 17 m deep, dolphin structure, handling oil products;
- Grain Terminal (Berth No 2), 17 m deep, 310 m long, caisson structure for handling grain and UAN solution, equipped with a loader (1500 ton/h) and storage silos (110,000 ton capacity);
- Multi-purpose Terminal (Berth No 3), 17 m deep, 310 m long, caisson structure for handling general/break-bulk cargo, equipped with 2-level ruffing cranes, 3 ha of open storage, and a 1.2 ha warehouse;
- A single track rail line will run from Pauoscio marshalling yard, through Giruliai Forest, then south of Melnrage and onto the port across the small reclaimed area;
- Road access will be via a new 2 km four-lane highway alongside the new rail line, from the P.Lideikio and G. Plentas Street junction, around the south of Melnrage;
- The port will also include a 6 m deep basin on the southern side, for service boats;
- The bay between the reclaimed area and Melnrage beach will be provided to Klapieda Municipality for use in public recreation, which may include a marina;
- Some of the reclaimed land adjacent to this bay will also be for Municipality use.

14.4 Environmental Impacts of Proposed Developments

The table below summarises the environmental asessment of the two schemes. Columns 1 and 4 show the most frequent impacts of new rail and port developments, and the text in each cell explains whether this development would produce this impact (during construction and when the scheme is operating). The cells are coloured to indicate the likely significance of each impact, and the final two rows explain the overall conclusions regarding the effects of each scheme and indicate whether or not they are recommended on environmental grounds.

Table 14.1 Main Environmental Impacts of the Developments Proposed by the Short Term Plan

	IMPACT	RAILWAY IMPROVEMENT		IMPACT	NEW OUTER PORT	
		CONSTRUCTION	OPERATION		CONSTRUCTION	OPERATION
PHYS	Physiographic changes caused by bridges, tunnels, cuttings	Topography is mostly flat; new line is adjacent to existing track	No major structures or physiographic changes	Changes in patterns of erosion and sedimentation	Weak sediment transport currents so changes not likely	Silt may collect on north side & coast elsewhere could erode
	Secondary impacts: landslips, soil erosion, reduced aquifers	No major structures required, so no risk of secondary impacts	No major structures so no risk of related impacts	Physical changes at sites from where materials are extracted	Dredgings used for reclamation Rock imported from overseas	Not Relevant
CHEMICAL	Dust blown from worksites and soil washed into rivers/aquifers	No major earthworks, so little risk of dust or soil runoff	Not Relevant	Dredging: turbidity plumes, polluted sediment disturbed	No impact if dredged material is pumped into reclaimed area	Avoid dredging in summer to prevent plume affecting beach
	Atmospheric pollution from locomotives burning diesel fuel	Only small increases in rail traffic delivering materials	Route is open and windswept so pollutants will be dispersed	Reclamation: turbidity plumes, polluted sediment disturbed	Problematic if plume affects nearby beaches in summer	Not Relevant
	Pollution from spills of fuel or chemicals kept on site, or cargo	No fuel or other toxic materials stored on site	Low speed line and new controls should avoid accidents	Pollution from spills of fuel or cargo, or dust blown from site	Fuels stored responsibly. Site dust should not reach Melnrage	Spills prevented by modern facilities and strict procedures
ECOLOGY	Loss of habitat, animals, plants along rail route	No important species or habitats along proposed route	Losses not significant because habitats/species not important	Benthos: animals killed by dredging and reclamation	Will destroy many animals, but none are known to be rare	Maintenance dredging will kill animals, but none are rare
	Disturbance causing animals to leave areas near rail route	No important species or habitats along proposed route	Losses not significant because habitats/species not important	Fish: impeded migration, loss of breeding or feeding grounds	Dredging will avoid key migration times	Port area is outside channel, so migration should be unaffected
	Reductions in plant and animal populations severed by rail line	No important species or habitats along proposed route	Losses not significant because habitats/species not important	Birds: decreases because of disturbed breeding or feeding	No known important bird sites nearby	No known important bird sites nearby
	Damage of habitats or species in or near protected areas	Route does not pass through or near protected areas	Route does not pass through or near protected areas	Damage of habitats or species in or near protected areas	Unlikely to affect protected area on Curonian Spit	Unlikely to affect protected area on Curonian Spit
	Species colonise undisturbed areas near and between tracks	Construction disturbance will prevent colonisation	No large areas near or between tracks suitable for colonisation	Increased habitat/biodiversity; port water used as fish nursery	Disturbance will prevent significant colonisation	New benthos, herring eggs on rock; water may be fish nursery
HUMAN	Need to acquire land, property and/or relocate residents	Government own land in port and adjacent to existing line	Not Relevant	Need to acquire land, property and/or relocate residents	Sea bed owned by State. Some land needed for road & railway	Not Relevant
	Decrease in value of real estate because of presence of rail line	Value of reserved territory may rise if it needs to be purchased	Land outside port is mainly low value so no major impact	Decrease in value of real estate because of presence of port site	Value of property in Melnrage may begin to fall	Values could fall (port) or rise (recreational developments)
	Disruption and disturbance by transport of materials & cargo	Could affect port road and rail transport, and local road traffic	Level crossings will minimise disruption of road traffic	Disruption and disturbance by transport of materials & cargo	Most materials brought by sea. Reclamation by dredged sand	South of Melnrage disturbed by increased lorry and rail traffic
	Disruption of normal activity through loss of access to site	Land not used in south. Could disrupt activities in port	Land in south not used. Port activity will be reorganised	Disruption of normal activity through loss of access to site	Loss of access to Melnrage beach (south) and breakwater	New recreational area created between port and beach
	Disturbance by noise, vibration and dust	Housing is only near centre of route. Temporary disturbance	Residents near Smeltale River likely to be disturbed long term	Disturbance by noise and dust	Unlikely to affect Melnrage as new port is 300m offshore	Port noise may be heard on shore occasionally
	Visual disturbance, permanent changes to landscape	Site is flat, mainly uninhabited and industrial in character	New line is not highly visible: mainly industrial background	Visual disturbance, permanent changes to landscape	Site highly visible along coast to N and S and in Melnrage	Natural landscape lost. Quiet area changed to recreation site
	Increased employment and improved socio-economics	May create some jobs, but many need experience/training	Better cargo handling, trade, improved national economy	Increased employment and improved socio-economics	Local people employed; local firms supply goods & services	Improved trade, new jobs, improved national economy
	CONCLUSION	Minor negative impacts can be mitigated by careful planning, liaison with port and householders, and compensating residents		CONCLUSION	Significant economic and social benefits but changes in landscape, coastline and Melnrage property values could be very detrimental	
	RECOMMENDATION	Fewer economic benefits than outer port, but scheme can go ahead without negative environmental impacts, so it is recommended		RECOMMENDATION	Not recommended, but economic needs & benefits may outweigh negative impacts and possible opposition from Melnrage residents	

KEY: Highly Negative | Negative | Not Significant | Positive | Highly Positive

14.4.1 Southern Access Railway Improvement

(1) Construction Stage

The assessment above shows that the new rail line can be built without causing major negative impacts on the environment. This is mainly because the southern half of the route is adjacent to an existing line and the area is flat so there will be no major earthworks or building of new structures, and there are few sensitive receptors nearby such as houses, businesses, nature reserves or other important sites.

(2) Operation Stage

When the scheme is operating there is only likely to be one negative impact:

- Noise from the increased rail traffic could disturb residents in the inhabited area between Kalnupes and Varnenu Streets, and in the village south of Smeltale River.

This can be mitigated by:

- Monitoring noise levels and consulting residents to determine whether they are being disturbed;
- Erecting noise barriers adjacent to the line if necessary and offering sound proofing to residents, such as providing double-glazed windows.

14.4.2 Outer Port Development

(1) Construction Stage

The site of the outer port development is much more sensitive as the area is used for local recreation, is less than 1 km from one of Lithuania's most important landscape, tourism and nature sites, and is 600 m from Melnrage, which has 1,500 residents. Impacts of this development are therefore more significant and less easy to mitigate.

Measures have been included in the Plan to address several of the negative impacts of the construction phase identified by the IEE (by sourcing rock from overseas, and using dredged material for reclamation), so these should not now be significant. The remaining issues where there could be negative impacts are as follows:

- Plumes of turbid water overflowing from the reclamation site could discourage people from using nearby beaches if these areas were affected in the summer;
- Oil, fuel and other chemicals used on site could pollute adjacent beaches and sea areas if they were spilled;
- Fish stocks and biodiversity could decrease if the construction site prevents fish migrating along the coast and into the lagoon to breed, or if young fish are unable to use the Melnrage coast as a nursery ground where they grow into adults;
- Any birds overwintering at the north of the Spit or nesting there in the spring could be disturbed by the noise or visibility of the construction activities;
- Melnrage could be considered a less desirable living area because of the presence of a large construction site, so the value of land and property may decrease;
- The site will be visible over a long length of coastline which is heavily used for recreation by local people and visitors, and includes the Curonian Spit, which is a World Heritage Site because of the beauty of its landscape.

The first four impacts can be mitigated as follows:

- The overflow weir should be located at the north-west corner of the reclamation site to deflect turbidity plumes away from the coast and the beaches on the Spit;
- The reclamation operation should be planned to avoid the main holiday months of July and August, so that beaches are not affected during this key period;
- Any chemicals used on site should be stored in areas protected by concrete floors and bunds, and procedures should be enforced to prevent any spillage;
- Surveys should be carried out to determine the importance of the Melnrage coast in fish migration, spawning and as a nursery, and to plan mitigation by artificial re-stocking and/or provision of financial compensation to fishermen if necessary;
- Surveys should also be conducted to determine whether birds overwinter or breed on the north of the Spit, and if so to plan action to avoid disturbance in critical periods, for example by restricting noise-producing activities.

It has not been possible however to devise measures to mitigate the other two impacts.

If property values declined in Melnrage this would be highly negative for residents, particularly those who have invested in large houses, or businesses aimed at visitors to the area. Property values are determined by many factors that cannot be influenced by a construction project, such as the economic health of an area, public perceptions, etc, so it is not feasible to mitigate this impact within the context of this project.

Impacts on the landscape will also be very negative because the construction site and the permanent changes it causes as the port is built, will detract from the beauty of the area and may reduce visitor numbers, affecting the local economy. It is not appropriate to screen the site by surrounding it with large wooden boards or earth embankments, so again no mitigation is proposed.

There would also be positive impacts during construction as it will be a large operation so there should be many opportunities for local people to be employed in the workforce, and for local businesses to provide services. This should increase spending and stimulate the local economy.

(2) Operation Stage

Measures included in the project have also reduced the significance of many impacts of the operating port. These include locating the road and rail access routes to the south of Melnrage village, and providing a small bay between the port and Melnrage beach that can be used for local recreation. Remaining issues that need further action are as follows:

- Although only small quantities of sand are transported along the coast by littoral drift, mathematical modelling suggests that in the long term sediment could collect in the “shadow region” for waves at the north-eastern corner of the new port. This could limit the supply of sediment to the coastline in the north, so beaches between Melnrage II and Karkle could erode;
- Water quality will need to be high in the inshore bay if it is to be suitable for recreation, and this could be difficult to maintain because water will only be exchanged slowly with seawater from outside, by the very limited tidal action;

- Sediment accumulation at the mouth of the bay could make the recreation area less attractive, and could reduce water quality by further limiting flushing;
- Cargoes to be handled in the new port would pollute the water if spilled, so KSSA will need to ensure that operators work to the highest environmental standards;
- Residents in the south of Melnrage will be disturbed by noise from the port-related road and rail traffic on the new routes around the south of the village.

The issue of sedimentation needs to be studied further as this could be highly negative if it caused erosion and instability farther along the coastline. This will require:

- Mathematical modelling to determine the pattern and timescale of sedimentation inside and around the new basin, to predict the impact on coastal morphology, and to devise and estimate the cost of remedial actions, such as building rock groynes, artificial headlands and beach nourishment schemes if necessary;
- Long-term monitoring of sediment levels around the new port and on nearby beaches and dunes, and design of a strategy to artificially maintain sediment levels in all such locations if necessary.

The other issues will not cause major negative impacts, and can be addressed by straightforward actions. These are:

- Studies to predict water quality in the recreational area, and to design remedial measures (such as artificial flushing and/or aeration) if necessary;
- KSSA should require operators to follow procedures accredited to ISO 14001, and should expand the role of KSSA environmental experts to include regular inspections of the new port to ensure that procedures are applied;
- KSSA environmental experts should also conduct pollution risk assessments in the new port area and establish a contingency plan to treat any spillages;
- Levels of traffic noise in the south of Melnrage should be predicted and discussed with residents, who should be offered sound-proofing and financial compensation if appropriate. A buffer of evergreen trees should be planted north of the road.

There should also be highly positive impacts when the new port area is operating as the aim of providing this facility is to increase Lithuania's trade and generate new Government revenue, which could provide major benefits throughout the country if it were used to improve education, healthcare, social security, transport, etc. In Klaipeda the new port would provide substantial new employment, improving socio-economic conditions and stimulating the local economy.

The port should also provide ecological benefits because the new rock and concrete surfaces will be colonised by a greater diversity of species than are present in the soft sediments naturally present in the area, and will also provide additional egg-laying areas for herring, which use the breakwaters at present. The protected waters of the new basin might also provide a nursery for certain fish if water quality remains good.

There are two unresolved issues. The first relates to the plan to provide a bay between the port and Melnrage beach plus adjacent land on the new port site where Klaipeda Municipality may develop public recreation facilities. Residents able to use the facilities, or who will gain new business from the increase in visitors should be in favour of these proposals. However people who value the peace and tranquillity of the area may be less enthusiastic. The impact on property values is also uncertain as

housing is generally less expensive in the vicinity of a port and more expensive near recreation sites. Both aspects therefore need to be investigated further, by:

- Consulting Melnrage residents regarding the port and recreational developments, and amending the proposals if necessary to address important public concerns;
- Conducting a study to predict the impact of the developments on real estate values and to recommend measures to compensate residents if necessary.

The final issue relates to the impact of the outer port on the landscape. Measures incorporated in the scheme to address this issue include planting trees on the eastern side and other landscaping to screen the port from view.

14.5 Conclusions

If the measures recommended in the report are implemented, it should be possible to build and operate the new rail line in the south of the port without significant negative impacts on the environment. However the outer port development is at a much more sensitive location, so impacts are more significant and less easy to mitigate. During the construction period most impacts can be avoided by straightforward measures. However there are two impacts that could be highly negative, which cannot be mitigated. These are:

- Melnrage will be a less desirable living area because of the presence of the construction site, so during this period, property values would be expected to fall;
- The construction site will be visible over a long length of coast that is important for recreation, and this will detract from the beauty of the area and may reduce visitor numbers and affect the local economy.

When the new port is operating, further measures will be necessary to mitigate negative impacts, and other issues need to be studied in more detail, as indicated above. One issue that cannot be adequately mitigated is the impact of the operating port on the landscape. Despite proposed screening and landscape improvement measures the outer port will be visible from beaches in the north and on the Curonian Spit in the south. As this is a World Heritage Site because of the beauty of its landscape, the deterioration of this landscape must be a significant negative impact.

The operating port would produce significant economic benefits, by providing new employment locally, and generating increased trade and Government income, which could bring major improvements throughout the country if the revenue were used to improve education, healthcare, social security, transport, etc.

14.6 Future EIA Requirements

(1) General

The above EIA was carried out according to JICA Environmental Guidelines, and has resulted in the inclusion of many mitigation measures in the plans for development of the port, which will reduce their environmental impacts. A further EIA will be required when the development is designed in detail, as features may change as the project evolves, and further information (on construction methods, sources of material, etc) will become available. This will follow the Lithuanian law on EIA, which was revised in 2000 to comply with EU requirements. Lithuanian procedures include

aspects that are not required by JICA Guidelines, so the EIA will differ in some respects from the study conducted to date. The main differences are that:

- The Lithuanian EIA system involves participation by the public (inhabitants, NGOs and other interest groups), and public opinion is sought during initial screening, and in public hearings when the EIA report is prepared;
- Lithuanian law requires formal screening to determine the type of analysis required, and scoping to identify the likely impacts of a development, which are then investigated in the EIA. These aspects are decided by the Competent Authority (Ministry of Environment), who seek views of "relevant parties of the EIA" (government institutions for health, fire-prevention, cultural assets, agriculture, economic development, municipal administrations and the public);
- Lithuanian law requires consideration of alternatives (locations, scales of project, processes or equipment, operating conditions and timings, waste discharges, traffic management). These must include at least the proposed option, the most environmentally sound alternative, and the no action option;
- The Lithuanian system aims to integrate environmental matters into the planning of a development, and to take early action to prevent and avoid environmental damage, rather than devising technical measures to reduce negative impacts later;
- Special techniques are used for impact analysis, which in this case would include mathematical modelling of shoreline changes that may occur once the outer port is built, and modelling to predict the quality of water in the proposed recreation area;
- EIAs are normally carried out by a team of specialists, which in this case would include experts in coastal processes and geomorphology, water quality, fish ecology, landscape and visual impacts, noise, real estate, tourism and recreation, and socio-economics, as well as EIA and public consultation and participation.

(2) EIA Programme

Lithuanian law stipulates the maximum time that the parties are given to repond in each stage and this indicates that the process lasts a maximum of 95 working days if the development undergoes screening (plus 15 additional days if documents have to be resubmitted), and 75 days if screening is not required (again plus 15 days if necessary: Table 14.2). However this does not take into account the time taken for the developer or consultants to conduct the EIA and prepare documents, and particularly the time required to collect survey data. An overall programme for the EIA of the proposed port developments, as shown in Figure 14.1, should therefore involve the following:

- A total period of approximately 2.5 years, from commencement of baseline data collection to receipt of official project approval, if granted;
- This would include an initial baseline survey period of up to two years, so that sufficient data can be collected to determine seasonal and annual variations (eg for fish migration and bird breeding);
- Mathematical modelling and collection of existing data should also be conducted in the initial period;
- The EIA should commence with screening by the Ministry of Environment after around 1.5 years, allowing a year to complete the EIA if necessary;

- Contacts with the Ministry and other key stakeholders (including the public) should be made during the initial period so that the parties are informed about and engaged in the process from the beginning;
- The EIA and detailed design work should begin at around the same time, so that design information can be provided to the environmental team, and results of the EIA regarding impacts and mitigation can be incorporated into the design.
- Reports from all relevant previous work (including this study), should be provided to EIA consultants and scheme designers on appointment, so that they are informed early of the issues and mitigation that need to be included in the designs.

Table 14.2 Time allowed by law for the varous parties to respond to each aspect of the Lithuanian EIA process

Procedure	Maximum Duration (working days)	Responsible Body
Screening: determining whether EIA or screening is required	20	Competent Authority
Scoping: providing conclusions on the EIA programme	10 (+5 if EIA programme is resubmitted)	EIA Parties
Scoping: ratification of EIA programme	10	Competent Authority
Consultation: Presenting EIA report to the public	10	Developer
Providing conclusions on the EIA report and the possibility of the development going ahead	20 (+10 if EIA report is resubmitted)	EIA Parties
Making a justified decision on whether the development may be implemented at this site	25	Competent Authority

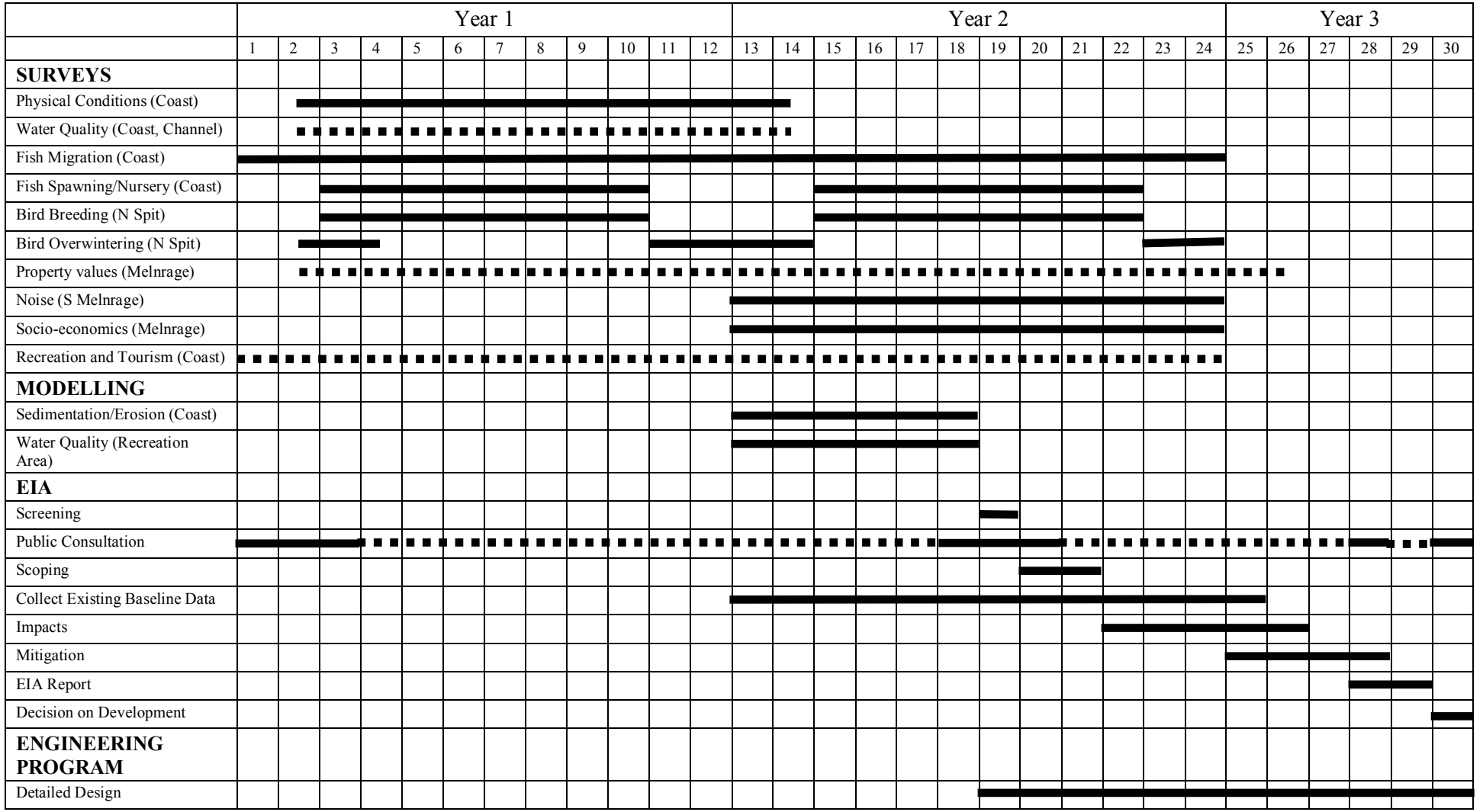


Figure 14.1 Suggested programme for EIA study to be conducted during detailed design of the Short Term Development Plan

CHAPTER 15 CONCLUSIONS AND RECOMMENDATIONS

15.1 Conclusions

On the basis of the JICA Study on the Lithuanian Port, the following conclusions have been reached.

(1) Geographically, Lithuania occupies a strategic location on the eastern edge of the Baltic Sea, north of Poland and Kaliningrad (Russia). To expand the East-West seaborne trade and sustain the country's economic growth, Klaipeda, as a gateway port of Lithuania, should build up its port capacity and upgrade service level. Otherwise, it will not survive the competition with rival ports in the Eastern Baltic Sea.

(2) The annual increase at Klaipeda represents an additional 3.6 million tons from 1997-2002 despite losing 3.3 million tons of general cargo, mainly steel traffic because of Russia's preferential railway tariff. Klaipeda Port handled 20 million tons of cargo in 2003, and is operating at 66% of capacity, causing no serious operational issue at present. However, it is obvious that the Port will not be able to handle the traffic demands of 37.9 million tons in 2015 and 48.6 million tons in 2025.

(3) As the port expansion inside the existing port area has been found to be environmentally negative in terms of fresh water conservation, and rather limited in space of the port basin. Instead, the outer port development has been proposed in the north of the existing port entrance. The new port area (outer port) will built by reclamation offshore of the Melnrage beach, and accommodate a total of six port terminals capable of receiving Baltmax-type or Panamax-type vessels, including 1-petroleum jetty, 1-grain berth, 2-fertilizer berths, 1-general cargo berth, 1-container berth in the stage of Master Plan and the first three terminals in Short-Term Development.

(4) Among the Short-Term Development Plans, two project components have been selected as the Key Projects, including the first-phase development of outer port and the railway improvement in the southern part of the existing port. The total construction costs of the Key Projects have been estimated at 355 million Euros, and the time requirements for their implementation will be 5.5 years, including pre-construction services.

(5) The financial viability of the Key Projects has been evaluated as a whole through parameters of Financial Internal Rate of Return (FIRR) and the Ratio Analysis. The FIRR has been estimated at 7.5% for the base case, and 5.6% in the worst case (cost increase 10% and revenue decrease 10%). The estimated figure of 7.5% exceeds the Government's target rate of profitability (7%), and the worst figure of 5.6% is above international loan rates (2.84%), so that the financial soundness of the projects has been justified. The economic evaluation has also been conducted by use of EIRR. As a result, EIRR has been estimated at 12.6%, which is in an agreeable range, so the economic feasibility of the projects has also been confirmed.

(6) In the environmental aspect, it has been evaluated that the Southern Access Railway Improvement Project would cause no fatal impact, while the Outer Port Development at Melnrage would less desirable due to damage to surrounding

natural landscape, fall of property values nearby and likely beach changes to the north. Therefore, it has been concluded that adequate measures should be taken to prevent these negative impacts.

15.2 Recommendations

Taking into account of the above conclusions, the JICA Study Team has made the following recommendations.

(1) Lithuania should follow the transport policy of EU, and KSSA should maintain details of its relations with the state and keep proper accounts. Outwardly, KSSA should encourage cross-border transport services like Viking Project, and strive for normalization of Russian preferential railway tariff together with EU and international trading organizations in order to regain the past share of transit traffic through Klaipeda Port.

(2) Klaipeda Port should maintain the position of a landlord port with independent and autonomous terminals. To this end, the Law on Klaipeda Port should remain fundamentally intact except for some revisions, including Land Lease Contract. Land lease rates progressively should be increased as and when possible under the existing leases to reflect market values. The involvement of MOTC should be only to ensure the correctness of procedures, including those to ensure the competence and suitability of the negotiators.

(3) It would be necessary to develop an outer port development to meet the growing traffic demands and to satisfy the shipping needs. Nevertheless, prior to proceeding to this stage, the existing potential capacity of Klaipeda Port should be fully utilized by renovating seaside and landside facilities, including expansion of storage areas and access railway lines. To this end, KSSA should take earlier actions to convert the land use from “reserved” to “port”.

(4) For the smooth implementation of the outer port development, KSSA should undertake various kinds of preparatory works. Firstly, the concept of the proposed master plan should be authorized in the state plan in full coordination with the City Plan of Klaipeda and the Lithuanian Railway, where basic development policy near Melnrage region should be harmoniously crystallized. The land use plan around and further north of the region should be concreted so as not incur cause land issues in the future.

(5) KSSA should monitor the movements of cargo traffic at Klaipeda Port and also the commercial activities of rival ports. Once the symptom of traffic congestions as estimated in the Study has been noticed or urgent needs for receiving Baltmax-type vessels has been fully confirmed by terminal operators, KSSA should take a quick action to initiate the first phase of the outer port development. All terminal development in the outer port should be undertaken in close cooperation with the prospective terminal operators. Selection of terminal operators should therefore take place openly in advance of development.

(6) The KSSA should upgrade the port traffic management system (PTMS). To compete with rival ports in the east Baltic Sea, the KSSA should upgrade marketing activities jointly with terminal operators. The information on the future port development, including a new outer port, should be widely publicized

initially to ensure that all prospective operators are aware of the intended development.

(7) The responsibility and obligation in the field of investment, operation and maintenance of railways in and around the Port area are not clear. To ensure an efficient railway handling, the laws relevant to railway clauses should be upgraded more clearly. Furthermore, it is advisable for KSSA to collect "Railway Infrastructure Fee" to maintain the access railway efficiently and sustain a reliable and sound financial position.

(8) For successful implementation of the outer port development in front of the Melnrage area, KSSA should undertake environmental procedures as proposed in the EIA, where KSSA should maintain the same level of environmental conservation as those adopted for the City Plan of Klaipeda.