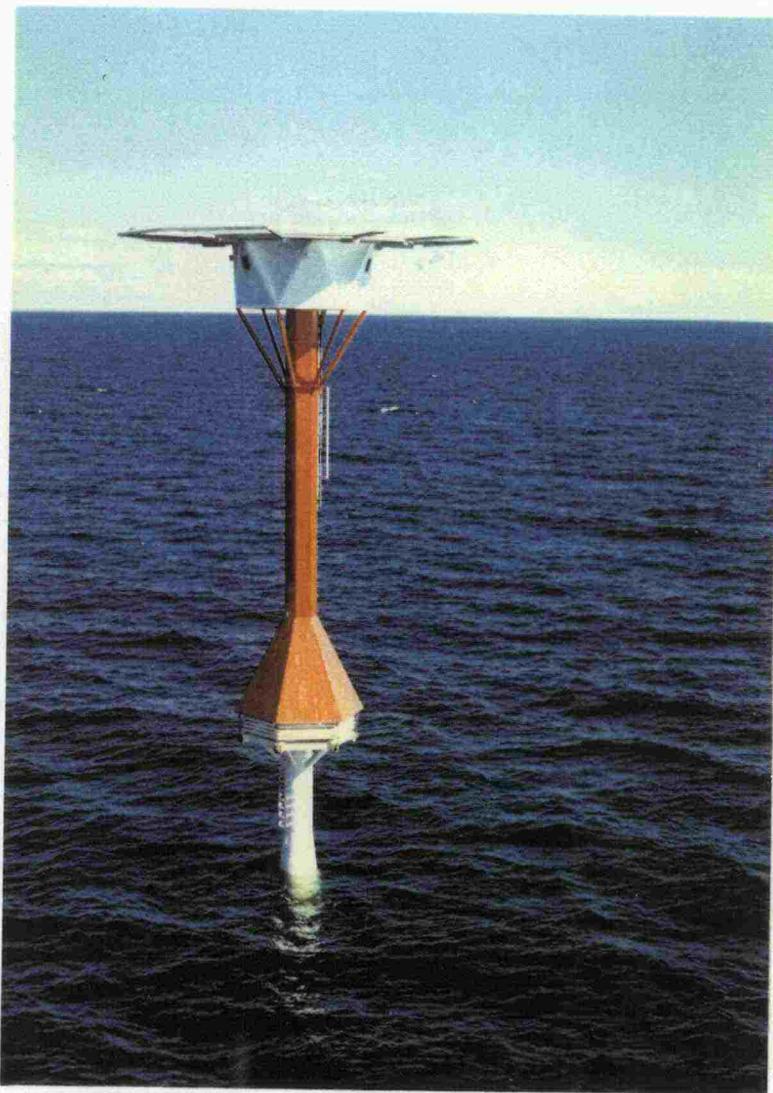


WATERWAYS PROGRAM 1993-2002

ABSTRACT



National Board
of Navigation

Waterways Department
Helsinki 1993

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1. INTRODUCTION

The waterway duties of the National Board of Public Roads and Waterways were transferred to the National Board of Navigation in 1990. Consequently, the National Board of Navigation's new ten year program - Waterways Program 1993-2002 - includes the sea routes as well as inland waterways.

The Waterways program is part of the operational planning system, in which this long-term plan (10 years) creates the basis for more specific level plans, i.e. operational and financial plans (4 years) and the budget proposals (1 year). In respect of the waterway construction work, it is intended to provide a setting for the operational and financial planning of the Ministry of Transport and Communication.

The Waterways program aims to present, in concrete form, the funding and the measures, which according to the general strategy and operational plan of the National Board of Navigation, are required in order to maintain and improve the profitability of the national economy of transports and the safety of the water traffic. The examination of the investment program per project is limited to the largest projects. Smaller projects, that could be of major importance locally, are presented under one total figure.

Additionally, the funding of the investment program includes separate navigational aids work, and studies and plans related to waterways and navigational aids.

In general, our waterways are well-marked and the technical criteria for waterways meet the international norms. On the other hand, our difficult and demanding conditions for building and maintaining waterways, and for navigating, require the continuous development and maintenance of waterways.

In addition to safety, the advantages of water traffic are low transport costs as well as a considerably lower energy consumption per transport than other transport modes.

The rapid and major changes during recent years in Finland as well as elsewhere in the world have made the process of compiling projections more complex than before. In the future, it may be impossible to make projections based on past developments; rather, various scenarios might be needed. Dozens of different national or international factors could be listed that might shatter the projection.

The general, central views of the waterways can, however, be projected as follows:

- The need to deepen the waterways is decreasing overall.
- The possible changes in industrial raw material import needs could, on the other hand, increase the needs of the waterways.
- The national energy policy may possibly set increasing demands on the depths and safety of waterways.
- The transit traffic is expected to increase and become more diverse in the near future.

2. DEVELOPMENT AND MAGNITUDE OF WATERWAY MAINTENANCE FUNDING

The waterway network including its equipment and structures requires certain on-going measures in order for it to meet the demands of economical and safe transportation. These measures are called waterway maintenance, which is divided into planning, developing, and maintenance. Closely related to waterway maintenance is traffic management, which, among others, includes icebreaking, pilotage and canal usage.

At the beginning of the 1970's, the level of investments for sea routes was at its highest, i.e. FIM 120-130 million annually. The lowest level of investments for sea routes was at the end of the 1980's and the beginning of the 1990's. In 1991 the amount appropriated for sea route investments was FIM 41.3 million.

The funding level of inland waterways has been about FIM 15-30 million annually since the latter half of the 1970's. In 1991, FIM 15 million was appropriated for inland waterways. In addition to this, FIM 75 million was appropriated to build the Keitele Canal.

According to the calculations of the Ministry of Transport and Communication, the State's traffic route investments were FIM 3.18 billion in 1991. Of that amount, 3.8% was appropriated for the sea routes and inland waterways' work (including the Keitele Canal).

According to the port survey conducted in conjunction with the Waterways program, Finnish ports invested a total of more than FIM 600 million per year between 1986 and 1991.

Diagram 2.1 Appropriations for sea routes between 1970 and 1991.

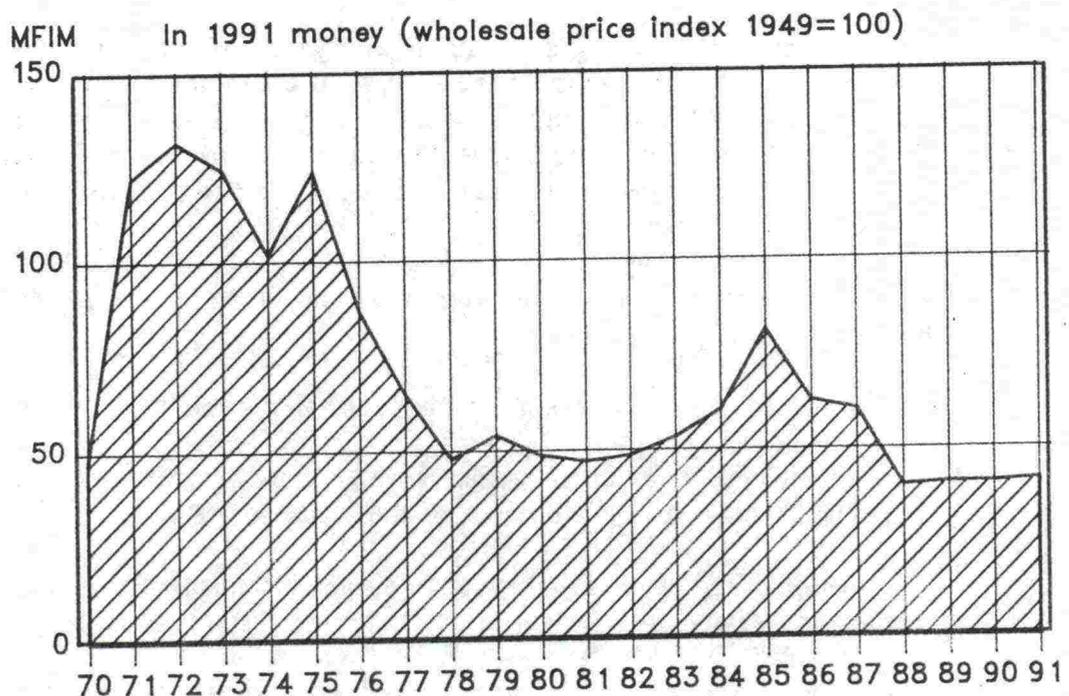


Diagram 2.2 Appropriations for inland waterways between 1970 and 1991.

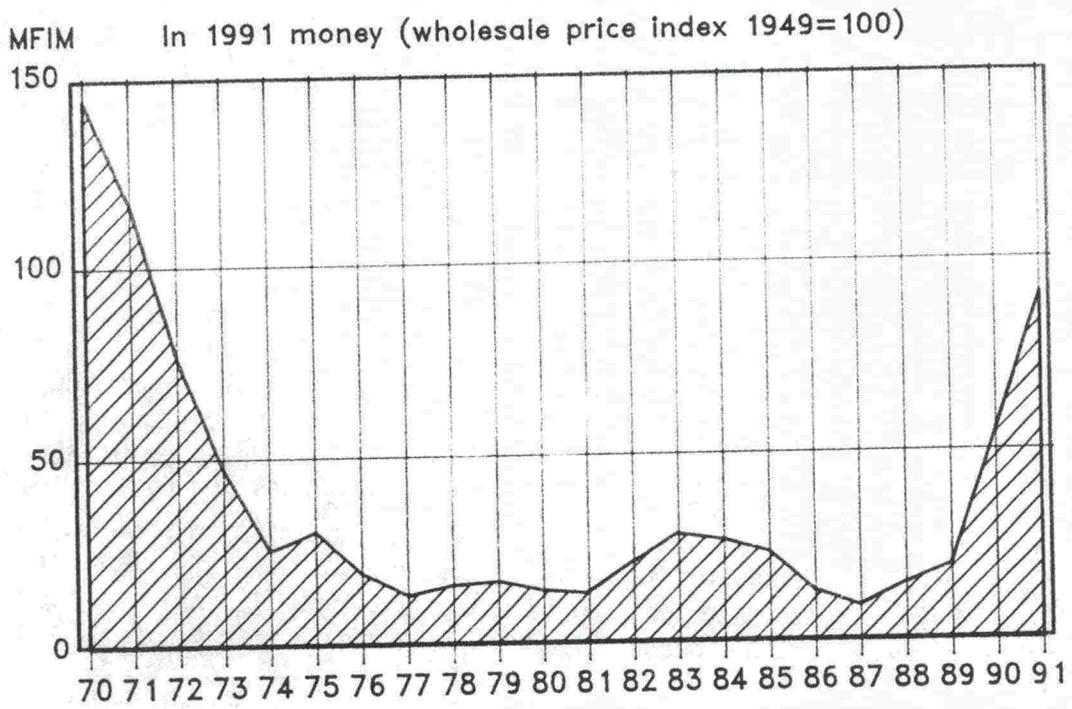
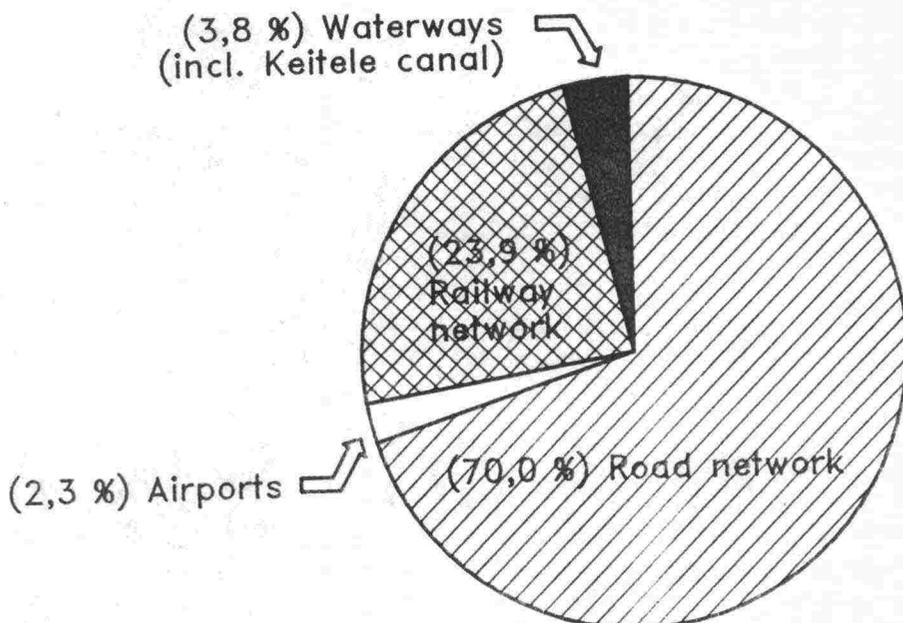


Diagram 2.3 State traffic route investments in 1991



3. DEVELOPMENT OF VESSEL TRANSPORTS AND VESSEL TRAFFIC

3.1 Sea transports and foreign trade

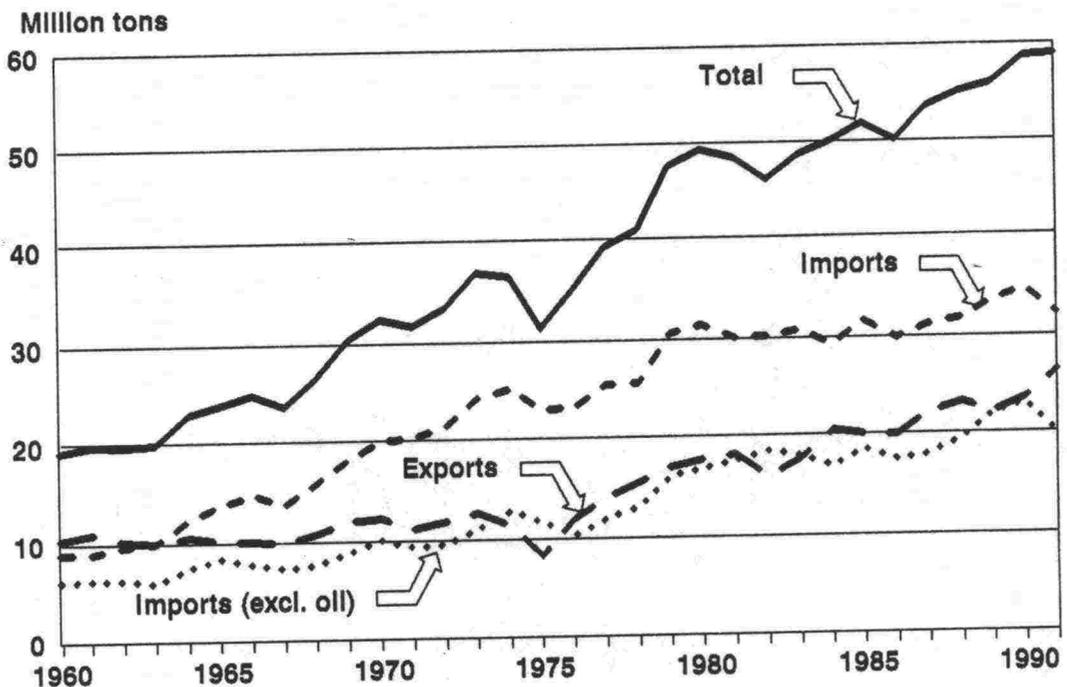
Sea transports make up a significant share of Finland's foreign trade transports. Between 1970 and 1991 the total share of sea transports for imported and exported goods averaged 84.6%. In 1991 this share was 85.8%.

The value of imported goods shipped by sea in 1991 totalled FIM 72.5 billion (81.3% of the value of all imports) and the value of exported goods was FIM 80.4 billion (84.6%).

3.2 Development of foreign sea transports and sea traffic

Diagram 3.1 illustrates the development of imports and exports shipped by sea between 1960 and 1991. From the diagram it can be observed that the development of sea transports has clearly been in an upward direction, and the development has been almost linear. Between 1981 and 1991 the average growth in sea transports was 3.7% in exports and 0.7% in imports. In 1991 imports accounted for 32.3 million tons and exports 26.6 million tons. In 1992, imports decreased slightly to approximately 32 million tons, while exports, on the other hand, increased to almost 28 million tons.

Diagram 3.1 Development of foreign sea transports between 1960 and 1991 (including transit traffic)



Transit traffic accounted for 4.5 million tons (7.6%) of the foreign sea transports in 1991. In 1992 the amount of transit traffic dropped slightly to 4.1 million tons.

As stated above, the development of sea transports has been growing almost linearly. Based on the growth trend, the amount of imports by the year 2000

would be 36.7 million tons (an increase of a 4.4 million tons), and the amount of exports would be 33.1 million tons (an increase of 6.5 million tons), or a total of just under 70 million tons.

After a very long period of time (more than 20 years), the growth in sea transports will probably slow. The primary factors behind this are the slowing in the growth of productivity, changes in the age structure of the population, and an increase in the level of refinement of exports.

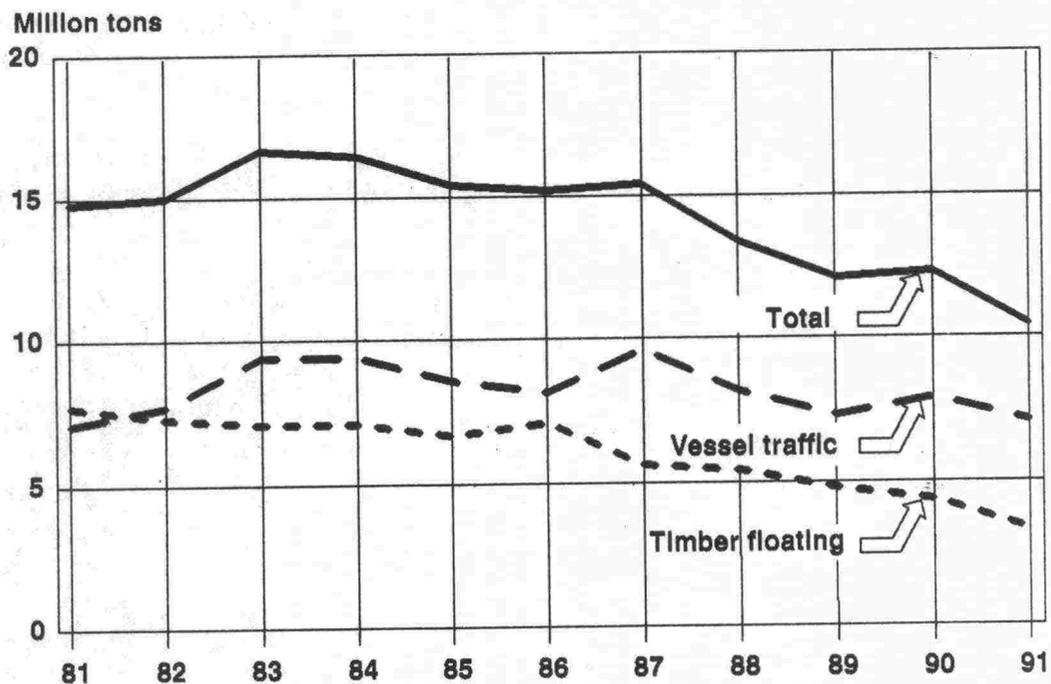
The amount of foreign vessel traffic has not increased like the transported tonnage amounts. On the one hand this has meant growth in vessel sizes and on the other growth in the amount of cargo (volumetric efficiency). In 1991 the amount of foreign vessel traffic of all ports combined was about 51,500 vessels.

3.3. Development of domestic water traffic

Diagram 3.2 illustrates the development of domestic water traffic transport amounts between 1981 and 1991. The amount of vessel transports has been slightly decreasing. This is largely due to developments in the amount of fuel distribution traffic. In 1991 the amount of vessel transports was about 7 million tons, of which 3.7 million tons (53%) was accounted for by fuel. In 1991 the domestic vessel transports share of the total sea transports was about 11%.

The amount of raw wood timber floating has also been declining. In 1991 the amount of timber floating was 3.4 million tons.

Diagram 3.2 Development of domestic water traffic transports between 1981 and 1991



4. WATERWAYS, PORTS AND TRAFFIC

4.1 Waterways

The total length of sea routes marked on nautical charts and equipped with navigational aids is about 7,700 km. The total length of inland waterways is about 6,600 km. According to draft, the waterways can be divided as follows:

Sea routes	Draft (m)	Waterwaylength (km)
Main merchant shipping waterways	≥8.0	1800
Other merchant shipping waterways	4.0-7.9	3300
Shallow coastal waterways	<4.0	2600
<u>Inland waterways</u>		
Main channels of Saimaa	≥4.0	775
Shallow inland waterways	<4.0	5800

In 1991 there were about 24,000 navigational aids maintained by the State, about 3,600 of which were lighted navigational aids.

The waterway network includes 36 canals without locks, two of which are coastal. The Saimaa Canal's eight locks and the Keitele Canal's five locks as well as 24 separate canals with locks are included in the inland waterways network. The whole waterways network also includes about 40 movable bridges.

The deepest waterways (15.3 m) lead to Kotka's deep-water harbor, Sköldvik, and Pori's deep-water harbor, and 13.0 m waterways to Inkoo, Hanko and Naantali.

Table 4.1 presents the amount of vessel traffic goods and the number of foreign traffic passengers per draft of waterways leading to ports. The figures on the table include both sea routes and inland waterways. The data on transport amounts for the harbor parts differs somewhat from the sea traffic statistics.

Table 4.1 Distribution of vessel transports according to waterway drafts

Waterway draft m	Accumulative share of transports %	Total amount of transports 1000 t	Crude oil and fuels 1000 t	Bulk loads 1000 t	Other 1000 t	Foreign traffic passengers 1000 pers.
>12,0	35,1	24261	17631	4853	1777	733
11,0-11,9	44,5	6485	404	3845	2236	75
10,0-10,9	68,6	16647	3308	4552	8787	2683
9,0- 9,9	82,9	9903	1583	3166	5154	1158
8,0- 8,9	93,4	7219	577	4583	2059	0
7,0- 7,9	95,3	1316	60	163	1093	7123
6,0- 6,9	96,5	850	2	842	6	0
5,0- 5,9	96,6	17	0	15	2	0
4,0- 4,9	99,8	2227	18	1047	1162	593
3,0- 3,9	99,9	85	0	0	85	0
<3,0	100,0	71	0	69	2	0

In 1991 about 83% of vessel transports occurred via those ports or portions of ports whose drafts were 9.0 m or more. More than 95% of goods was transported in waterways with drafts of more than 7.0 m. Those ports with drafts of less than 7.0 m can be considered of having rather low national significance. A considerable part of the shallow ports are industrial ports that are, however, locally or regionally important.

4.2 Sea routes and ports

Table 4.2 shows the sea port traffic data for 1991.

Table 4.2 Sea port traffic, 1991

Port	Imports to Finland 1000 t	Exports from Finland 1000 t	Transit traffic 1000 t	Coastal traffic 1000 t	Total transports 1000 t	Foreign passenger traffic 1000 pers.	Foreign vessel arrivals ea.
1 Hamina	652	2039	1652	489	4832	15	1007
2 Kotka	1314	2534	2025	253	6126	23	1777
3 Loviisa	313	435	-	-	748	0	208
4 Isnäs	1	5	-	-	6	-	10
5 Tolkkinen	2	99	-	-	101	-	71
6 Sköldvik	8749	2814	-	3379	14942	-	679
7 Sipoonlahti	30	-	-	-	30	-	10
8 Helsinki	4170	2403	3	970	7546	4943	5657
9 Kantvik	304	6	-	2	312	-	53
10 Inkoo	1171	30	-	13	1214	-	122
11 Pohjankuru	-	27	-	-	27	-	19
12 Tammisaari	10	-	-	-	10	-	12
13 Skogby	1	-	-	-	1	-	1
14 Lappohja	0	282	-	-	282	-	120
15 Koverhar	933	96	-	16	1045	-	196
16 Hanko	393	843	9	1	1246	-	554
17 Förby	7	25	-	-	32	-	15
18 Salo	12	1	-	15	28	-	15
19 Uskela	0	-	-	-	0	-	1
20 Taalintehdas	1	125	-	-	126	-	130
21 Kemiö	29	25	-	12	66	-	31
22 Mjösund	17	-	-	-	17	-	12
23 Parainen	327	23	-	451	801	-	96
24 Turku	989	882	6	225	2102	2643	2412
25 Naantali	2593	780	-	924	4297	733	1156
26 Maarianhamina	51	54	-	139	244	2180	3588
27 Eckerö	4	2	-	-	6	568	846
28 Färjsund	-	85	-	-	85	-	70
29 Uusikaupunki	631	750	-	159	1540	21	815
30 Rauma	1075	2288	92	29	3484	-	994
31 Eurajoki	46	3	-	-	49	-	21
32 Pori	899	1043	-	158	2100	-	649
33 Merikarvia	1	23	-	-	24	-	21
34 Kristiinankaup.	327	28	-	-	355	-	33
35 Kaskinen	8	192	-	0	200	-	106
36 Vaasa	453	257	-	432	1142	1073	799
37 Pietarsaari	463	503	-	58	1024	85	328
38 Kokkola	558	889	722	530	2699	75	403
39 Kalajoki	10	92	-	-	102	-	66
40 Raahe	4	34	-	-	38	-	19
41 Rautaruukki	3557	716	-	217	4490	-	508
42 Oulu	338	447	-	669	1454	-	321
43 Haukipudas	0	-	-	-	0	-	2
44 Kemi	502	925	-	380	1807	4	459
45 Tornio	111	81	-	8	200	-	81
Total	31056	21886	4509	9529	66980	12363	24493

Coastal traffic summarized partly doubly.

4.3 Inland water ports and traffic

Vessel traffic is mainly conducted through the Saimaa Canal and main channels of the Saimaa Lake. In 1991 1.5 million tons of goods passed through the Saimaa Canal.

Table 4.3 Imports, exports and domestic transports via Saimaa ports in 1991

Ports	Imports to Finland 1000 t	Exports from Finland 1000 t	Transit traffic 1000 t	Domestic traffic 1000 t	Total transports 1000 t	Foreign vessel arrivals ea.
Lappeenranta	132	126	-	24	282	356
Imatra	152	180	-	36	368	278
Joutseno	133	53	-	12	198	132
Ristiina	4	1	-	-	5	3
Savonlinna	13	-	-	16	29	16
Varkaus	143	173	-	13	329	211
Kuopio	11	80	-	16	107	76
Siilinjärvi	5	8	-	19	32	7
Kitee	13	89	-	-	102	74
Joensuu	4	122	-	60	186	84
Uimaharju	0	-	-	13	13	3
Taipalsaari	-	-	-	210	210	-
Enonkoski	-	-	-	210	210	-
Nurmes	-	-	-	20	20	-
Riistavesi	-	-	-	10	10	-

With the reduction in floating, raw wood barge transports have increased with the shift from floating to barges. The increase in barge transports set new challenges for the waterway network, and, for example, the construction of loading places will become important.

Completion of the Keitele Canal will improve the operational requirements for floating and it will create the possibility of starting barge traffic in the Kymijoki watercourse.

5. WATERWAY IMPROVEMENT JUSTIFICATIONS

5.1 Waterway improvement needs

The improvement needs of the waterways are mainly aimed at deepening the waterways on the basis of transport-economic, and increasing the safety of the waterways (widening the waterways, altering the direction, improving the navigational aids, etc.).

Designing the Waterways program was initiated in the autumn of 1991 starting with a questionnaire sent to Finland's commercial and industrial ports. The port authorities were asked to report their needs (with justification) for the waterways that the State should fulfill during the program period.

A similar questionnaire on waterway needs was sent to our country's shipping companies, to certain industrial companies with a key interest in waterways, to log floating companies, to different maritime organizations, and to maritime districts.

There were a total of twenty project proposals for sea routes of a suitable size for the Waterways Program. Of the twenty, the National Board of Navigation had made transport economics profitability calculations.

Preliminary waterway plans and cost estimates were compiled by the Waterways Department of the National Board of Navigation for the proposed projects of the Program.

5.2 Calculation principles of transport economics profitability

The expenditure savings of vessel transports per category of goods achieved by deepening the waterway is estimated as beneficial in the transport economics profitability calculations. Balancing the transport expense savings are the State's waterways investments and the port investments immediately related to waterway improvement.

In the profitability reports of the Waterways Program's proposed projects, an interest rate of 6% and 4% were utilized for a period of 25 years.

In addition to the transport economics, as a basis to include a certain project in the program and implementation schedule, other factors were also taken into consideration, such as the preparedness of the port authority, waterway safety and technical readiness.

In the calculation based on traffic predictions, the predicted growth in the number of transports is presumed to continue to the year 2005. After this, the transport amounts of the year 2005 are used as the constant in the calculation.

Project profitability was also calculated using the average traffic figures from 1984 to 1991. The projects have been classified based on the ratio of costs/benefits.

6. WATERWAY PROJECTS AND PROJECT PROPOSALS 1993-2002

6.1 Sea route projects

The investment plan for the 1993-2002 program period consists of specific sea route projects as well a group of projects called general projects made up of unspecified projects. The program outline thus includes the following main categories:

A Waterways for commercial traffic

1. Waterway projects under construction
2. New waterway projects suggested
3. Separate aids to navigation

B Shallow coastal waterways

1. Waterways for commercial traffic (e.g. timber floating, fishing and barge traffic)
2. Waterways for small crafts

C Survey and design

D Miner dredging and aids to navigation works

E Repairs for aids to navigation

F Waterways for connection vessel traffic in the archipelago

According to the current budget allocation, project groups A and B will be financed under waterway works sub-item 31.30.77 and project groups C-F under the sub-item 31.30.21 of the Board's operating budget.

The Program is based on the results of the completed charting of needs and project reports; and the Program does not include separate reserves for possible entirely new sea route projects that may appear during the program period. The program can be considered a frame for future measures and for planning and financing them. It is clear that as needs and conditions change during the program period, the project program must be adjusted regarding, e.g. the timing of projects or by admitting possibly entirely new projects into the program.

Table 6.1 Sea route investments, 1993-2002 (FIM millions)

PROJECT	COST EST.	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002
SEA ROUTES											
A) Main waterways for commercial traffic											
1) Projects under construction											
Parainen channel 7,5 m	22,0	3,5									
Mäntyluoto channel 10,0 m	26,0	8,0									
Tornio channel 8,0 m	20,0	10,0	10,0								
2) New waterway projects suggested:											
Uskela channel 4,0 m	2,5	2,5									
Rauma channel 10,0 m	75,0		14,0	24,0	24,0	13,0					
Hamina channel 11,5 m	26,0			6,0	10,0	10,0					
Kihti-Maarianhamina channel	6,0			6,0							
Lappohja channel 10,0 m	1,0				1,0						
Tolkkinen channel 8,5 m	6,5					3,0	3,5				
Naantali channel 14,3 m	25,0					10,0	10,0	5,0			
Loviisa channel 9,5 m	17,0						12,0	5,0			
Kaskinen channel 9,0 m	5,0						5,0				
Isokari-Kajakulma channel	9,0						5,0	4,0			
Uusikaupunki, Hepokari channel 8,0 m	9,5							9,5			
Uusikaupunki, Kemira channel 12,0 m	52,0							8,5	22,0	15,0	6,5
Pietarsaari channel 10,0 m	28,0								10,0	18,0	
Kokkola channel 13,0 m	115,0										25,5
Waterways for commercial traffic, total		24,0	24,0	36,0	35,0	36,0	35,5	32,0	32,0	33,0	32,0
3) Separate aids to navigation		-	-	3,0	3,0	3,0	3,0	3,0	3,0	3,0	3,0
B) Shallow coastal waterways											
1) Waterways for commercial traffic											
		-	3,0	3,0	3,0	3,0	3,0	3,0	3,0	3,0	3,0
2) Waterways for small crafts											
		-	1,0	2,0	2,0	2,0	2,0	2,0	2,0	2,0	2,0
TOTAL		24,0	28,0	44,0	43,0	44,0	43,5	40,0	40,0	41,0	40,0
SEA ROUTE WORK											
Survey and design		3,6	4,0	4,0	4,0	4,0	4,0	4,0	4,0	4,0	4,0
Minor dredging and aids to navigation works		13,7	9,0	9,0	9,0	9,0	9,0	9,0	9,0	9,0	9,0
Repairs for aids to navigation		0,7	2,0	2,0	2,0	2,0	2,0	2,0	2,0	2,0	2,0
Channels for archipelago traffic		0,5	1,0	1,0	1,0	1,0	1,0	1,0	1,0	-	-
TOTAL		18,5	16,0	15,0	15,0						
SEA ROUTES, TOTAL		42,5	44,0	60,0	59,0	60,0	59,5	56,0	56,0	56,0	55,0

To implement all of the sea route projects of the Waterways Program according to Table 6.1 would require an annual average funding of FIM 55 million, i.e. the funding needed for the entire program period of 1993-2002 is about FIM 550 million. Of this sum, the share of specified merchant shipping projects is about FIM 320 million.

6.2 Inland waterways projects

Table 6.2 Inland waterway investments, 1993-2002 (FIM millions)

PROJECT	COST EST.	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002
<u>Projects under construction</u>											
Improvements to Tampere-Hämeenlinna waterway	5,0	1,2	1,1	1,1	1,2						
Improvements to Heinävesi ship and timber floating waterway	6,5	1,7									
Improvements to Saimaa's main channels	10,4	2,0	2,1	2,1							
Remote control equipment for main locks	11,0	1,5	1,5	1,5	1,5	2,0	2,0				
Self-service use of canal locks - Pielavesi-Keitele route - Heinävesi and Juojärvi routes - Kuopio-Iisalmi route	17,0	2,3	3,5	2,7	2,0	2,0	1,5		1,5	1,5	
<u>New projects</u>											
Improvements to Saimaa Canal	24,0	0,5	2,5	2,5	2,5	2,0	2,0	2,0	2,0	2,0	2,0
Improvements to Neituri Canal	5,0		2,0	2,0			1,0				
Renovation of Haapakoski and Vuonteensalmi bridges	10,0			5,0	5,0						
Improvements to Valkeakoski - Längelmäki waterway	5,0						2,5	2,5			
Construction of Kimola Canal	35,0						4,0	8,5	11,5	11,0	
Construction of waterways for timber transport	6,0			2,0	2,0	2,0					
Remote control of Pielisjoki locks and bridges	6,0					2,0	2,0	2,0			
Construction of Kutila Canal	21,0										11,0
Various waterway works including waterways for small crafts	18,0		2,0	2,0	2,0	2,0	2,0	2,0	2,5	2,5	2,5
<u>Survey and design</u>	18,0		2,0	2,0	2,0	2,0	2,0	2,0	2,0	2,0	2,0
TOTAL	188,9	9,2	16,7	22,9	18,2	14,0	19,0	19,0	19,5	19,0	17,5

6.3 CONCLUSION

The waterway network will not expand during the program period. The majority of the projects are aimed at improvements to the existing waterways.

According to the financial and operational plan of the National Board of Navigation, the funding outlines will not - at least in the near future - reach the level proposed in the program unless funding can be increased as illustrated in table 6.3:

Table 6.3 Funding outlines of waterways development projects, 1993-1997

FIM million	Budget		Operational financial plan		
	1993	1994	1995	1996	1997
Specific sea route projects:					
Parainen channel	6,5				
Mäntyluoto channel	8,0				
Rauma channel		10,0	17,5	17,7	13,0
Tornio channel	10,0	10,0			
Hamina channel					11,0
Total	24,5	20,0	17,5	17,7	23,0
Funding need in program (Specific projects)	(24,0)	(24,0)	(36,0)	(35,0)	(36,0)
Inland waterways	8,7	8,1	8,7	8,8	7,6
Funding need in program	(9,2)	(16,7)	(22,9)	(18,2)	(14,0)

The guidelines for waterways development according to the outlook at this moment are presented in the Waterways Program of the National Board of Navigation. The program is based on project-specific profitability calculations and on general maintenance and developmental needs of waterways.

In Finland, where transport distances are long, particular attention must be paid on transport and traffic costs.

Water traffic is of vital importance to Finland, and it is utilized under relatively difficult conditions. Implementing the Waterways Program investments would secure and promote the operational requirements of water traffic and thus would improve the competitiveness of Finland's trade and industry.

THE MOST IMPORTANT WATERWAYS IN FINLAND

SEA CHANNELS

-  sea channel
- 9,0 draught in meters
- [9,0] draught (under construction)
- (9,0)  draught (under planning)

INLAND WATER CHANNELS

-  $t \geq 4,2$
-  $4,2 > t \geq 2,4$
-  $2,4 > t$
-  boat route
-  bundle floating channel
-  river floating channel
-  lock
-  bundle lift

 NATIONAL BOARD OF NAVIGATION
waterways department

