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Transport of Dangerous Goods in Finland in 2002

Project part-financed by the European Union
(European Regional Development Fund) within
the BSR INTERREG III B Neighbourhood Programme

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TRANSPORT OF DANGEROUS GOODS IN FINLAND IN 2002

Five-year report

Project part-financed by the European Union (European Regional Development Fund) within the BSR INTERREG III B programme

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Acronyms

ADR	The European Agreement concerning the International Carriage of Dangerous Goods by Road
BC Code	Code of Safe Practice for Solid Bulk Cargoes
CSO	The Central Statistical Office of Finland
EU	European Union
IBC Code	International Code for the Construction and Equipment of Ships Carrying Dangerous Chemicals in Bulk
IGC Code	International Code for the Construction and Equipment of Ships Carrying Liquefied Gases in Bulk
IMDG Code	International Maritime Dangerous Goods code
INF Code	Code fort he Safe Carriage of Packaged Irradiated Nuclear Fuel, Plutonium and High-Level Radioactive Wastes on Board Ships
MARPOL	International Convention for the Prevention of Pollution from Ships
MoU	Memorandum of Understanding
RID	Regulations concerning the International Carriage of Dangerous Goods by Rail
SOLAS	International Convention for the Safety of Life at Sea
UN	United Nations
VAK-laki	The Finnish Act on Transport of Dangerous Goods (Laki vaarallisten aineiden kuljetuksesta)

1 INTRODUCTION

This report has collected the data of Dangerous Goods transported in Finland in the year 2002. It includes information on dangerous goods road transport as well as rail and maritime transport. This publication is five-year report of dangerous goods transport prepared by Finnish Ministry of Transport and Communications. Ministry has published similar reports also in 1987, 1992 and 1997.

This report is part of the Safe and Reliable Transport Chains of Dangerous Goods in the Baltic Sea Region –project. DaGoB-project aims at improving the co-operations between public and private stakeholders related to DG transport in the BSR by connecting the stakeholders on different levels, providing up-to-date information on cargo flows, supply chain efficiency and risks related to DG transport.

DaGoB produces a survey of dangerous goods flows in the Baltic Sea Region (BSR) and provides an overview of related incidents and accidents in the region. Selected dangerous goods supply chains will be modelled including detailed process descriptions. Finally, DaGoB analyses and discusses key problems on selected cases and offers recommendations for remedial actions.

This report is Finnish part of the dangerous goods flows survey and works also as an example to other partner countries. During the DaGoB-project the national reports of other partner countries will also be produced. Some countries may not be able to provide as detailed report as this one, but the data presented in the different country reports should however be comparable. A survey of dangerous goods flows in the Baltic Sea Region will be made by aggregating these national reports into one.

2 LEGISLATION

Regulations concerning dangerous goods transport are much based on international agreements and EU legislation. Dangerous goods transport regulations are constantly being amended to improve safety and to keep up with science and technical development.

The most essential regulations of the dangerous goods transport are included in the Finnish Act on Transport of Dangerous Goods (719/1994) (VAK-laki). It is a skeleton law, which has all the essential regulations of the different transport modes included. Detailed regulations are given in the separate amendments of each different transport mode.

The Finnish Act on Transport of Dangerous Goods is not however applied nor in the bulk transport of dangerous goods in the maritime and inland waterway traffic, neither in the transport of liquid bulk and gas by tankers. Tanker regulations are assembled in the maritime law (674/1994) and in the law concerning prevention of water pollution caused by ships (300/1979).

2.1 Road and Railroad Transport of Dangerous Goods

Regulations given according to the transport of dangerous goods in road and railroad are based on the international ADR agreement and RID regulations as well as on corresponding EU Directives.

Besides the Finnish Act on Transport of Dangerous Goods, also Decree of the Council of State on the Transport of Dangerous Goods by Road and Rail (194/2002 and 195/2002) are applied in the road and rail transport. These regulations have clauses about dangerous goods classes, packagings, containers, tanks, shipping documents, transport, loading, vehicles, route restrictions of road transport, safe handling of coaches in the railway yards, detailed responsibilities of different parties taking part in road or rail transport, authorities supervising the transportation and about incident reporting. Detailed regulations is to be found in Decree of Ministry of Transport and Communications on the Transport of Dangerous Goods by Road and Rail (277/2002 and 278/2002) and especially in their annexes.

2.2 Maritime Transport of Dangerous Goods

In maritime transport of dangerous goods the regulations given from transport of bulk and parcelled goods are conformed. MARPOL convention, binding Finland, includes regulations about transportation of petroleum and oil products to prevent the water pollution (MARPOL annex I), transportation of liquid chemicals (annex II) as well as transportation of marine pollutants (annex III).

International agreement on Safety of Life at Sea (SOLAS) from the year 1974 includes chemical tanker code (IBC-Code) and gas tanker code (IGC-Code), which regulate the structure and equipment of these tankers (Regulation 244/1982). In bulk cargoes the BC-Code, which includes instructions about the safe transportation of bulk cargo, is applied.

IMDG-Code, which is part of SOLAS agreement, includes regulations about the classification of goods, transport packages and tanks, and their markings as well as shipping documents and notifications. INF-Code includes regulations about general cargo transportation of irradiated nuclear fuel, plutonium and some radioactive waste (Regulation 666/1998).

In addition, Finnish Maritime Administration gives more accurate regulations and instructions about applying these rules in the maritime transport. If transporting packaged dangerous goods in ro-ro ships in the Baltic Sea, Gulf of Bothnia, Gulf of Finland and in mouth of the Baltic Sea it has to be done by the rules and conditions of Memorandum of Understanding (MoU) for the Transport of Packaged Dangerous Goods on Ro – Ro Ships in the Baltic Sea. MoU has been enforced by the decision of the Finnish Maritime Administration.

2.3 Other Regulations

In addition to those previous regulations, there are also regulations about dangerous goods safety advisors, driving authorisation of hauliers and road transport controlling, pressure equipment, tanks and packagings for dangerous goods transport as well as compulsory notifications of dangerous goods or marine pollutant in maritime transport.

3 TRANSPORT DATA

3.1 Transport by road

In the case of transportations by road, this report covers dangerous goods of classes 1 – 6.2, 8 and 9 where the volume of material transported at any one time exceeds the “exemption limit”.

The report was carried out by sending a questionnaire to companies which, due to their field of activity, were either known or assumed to be sending and/or receiving dangerous goods. The data collected covered the dangerous goods dispatched from a company in the form of road transportations, and those of the company’s incoming transportations arriving from abroad, over the course of 2002. In the questionnaire, companies were asked to state the goods transported, their transportation classification, and the mode and route of transportation. The scope of the questionnaire was restricted to transportations where the volume sent at any one time exceeds the “exemption limit” (MTC Decree 277/2002, annex A paragraph 1.1.3.6).

The target groups included member companies of Kemianteollisuus ry (Chemical Industry Federation of Finland), Metsäteollisuus ry (Finnish Forest Industries Federation), Teknisen kaupan liitto (Association of Finnish Technical Traders) and Öljy- ja Kaasualan Keskusliitto (Finnish Oil and Gas Federation). The questionnaire was sent to 736 companies. The number of replies received was 528 (72%). 161 of the replies stated that dangerous goods were transported by road (above the exemption limit). 89 replies stated that the transportations did not exceed the exemption limit, while 269 replies stated that the company did not transport dangerous goods at all. All companies of major importance from the viewpoint of the report replied to the questionnaire. Only a few companies of statistical significance completely failed to respond.

The data received from the companies furnished the basis for elaboration of the total volume of dangerous goods transported, volumes by transportation class, and also tonne-kilometres and transportation routes. In distribution operations, transportation routes are often estimated. This is particularly the case with transportation classes 2 (gases) and 3 (liquid fuels). In cases where the transportation route was not known, a route optimisation programme was used in the route map.

The report excluded transportations in the Åland Islands and transportations which took place under supervision of the defence forces. Radioactive materials (class 7) remained outside the scope of the questionnaire, since the most important transportations of these are always known to the authorities and it is not appropriate to state the volume of these transportations in mass units. According to the Radiation and Nuclear Safety Authority (STUK), each year in Finland about 20 000 packages containing radioactive material are transported using the various means of transportation. The majority of these consist of medicines, plus measuring instruments for research establishments and industry.

3.2 Transport by rail

The data on rail transportations was obtained from the Rail Administration. This is based on VR Cargo's freight data. The report includes the total volume of dangerous goods transported by rail, volumes by transportation class, and also tonne-kilometres and transportation routes.

3.3 Transport by ship

The data on transportations by ship was obtained from the Maritime Administration. This is based on the data notified by ports, and on the Maritime Administration's statistics. The report includes total volumes of bulk and general cargo transported, and the distribution of this between different ports.

4 DANGEROUS GOODS COVERED BY THE REPORT

“Dangerous good” means a good which, because of its danger of explosion, fire or radiation, toxicity, corrosiveness or other similar characteristic may cause harm to humans, to the environment or to property.

4.1 Road and rail

Dangerous goods are classified as follows:

- Class 1 Explosives
- Class 2 Gases
- Class 3 Flammable liquids
- Class 4.1 Flammable solids, self-reactive substances and solid desensitised explosives
- Class 4.2 Substances liable to spontaneous combustion
- Class 4.3 Substances which in contact with water emit flammable gases
- Class 5.1 Oxidising substances
- Class 5.2 Organic peroxides
- Class 6.1 Toxic substances
- Class 6.2 Infectious substances
- Class 7 Radioactive material
- Class 8 Corrosive substances
- Class 9 Miscellaneous dangerous substances and articles

Within the various different classes, each transported substance has its own title and four-digit UN number. For example the title of caustic soda is “UN 1824 Sodium hydroxide solution”. For more details on classifications see section 5, “Dangerous goods: transportation classes”.

4.2 Sea

Chemicals which are dangerous in terms of their marine pollutant characteristics are broken down in accordance with Annex II of the MARPOL Convention (“noxious liquid substances carried in bulk”) into classes A, B, C and D. Class A is the most polluting of the marine environment, while class D comprises substances which have only limited danger characteristics.

Chemicals which are regarded as being harmless to the marine environment when released in small quantities are listed in appendix III to Annex II. These substances may pollute the sea in large quantities, but no release regulations have been set for them.

Transportations of oil are broken down into transportations of crude oil and those of oil products.

In this report, solid bulk cargo is restricted to chemically dangerous substances, i.e. substances mentioned in Annex B of the BC code. Many products which may cause oxygen depletion in closed-off areas are not listed.

In general cargo transportations, substances are broken down in accordance with the IMDG code into transportation classes equivalent to those in land transportations (classes 1 – 9). Packaged dangerous goods which pollute the marine environment (as per Annex III of the MARPOL Convention) are labelled in accordance with the IMDG code as “marine pollutants” or “severe marine pollutants”.

5 TRANSPORT OF DANGEROUS GOODS BY ROAD

In 2002, the total volume of dangerous goods transported by road was 12.3 million tonnes. According to the report, the growth in comparison to 1997 was about 2.7 million tonnes. Only some of this amount can be regarded as representing genuine growth in the volume transported. Over the course of the questionnaire which formed the basis of this road transportation report, it became apparent that the companies answering the questionnaire had studied the questionnaire more thoroughly than in the past, and that the answers were more exact. Presumably one reason for this is the development of electronic recording systems in companies in the area of logistic functions. The introduction of the safety adviser system in 2000 has in turn increased Dangerous Goods Transport expertise in companies, and consequently the questionnaire reached the desk of the right person more quickly.

According to the Central Statistical Office of Finland, the volume of dangerous goods transported in 2002 was 15.7 million tonnes, and the share of the total volume of goods in road transport represented by dangerous goods was 4% (Road Traffic haulage statistics 2002). The CSO's results are based on a sampling study carried out by statistical methods. Data on lorry use during two consecutive study days was collected by a quarterly postal questionnaire, using a questionnaire form similar to the driver's log. In part, the discrepancy with this present Ministry of Transport and Communications report can be explained by the different ways of collecting data. The CSO's statistics are based on data obtained from haulage companies, where a given volume of freight can be repeated a number of times when the same consignment is transported by a number of haulage companies.

5.1 Total volume transported by road

In 2002 the total volume of road transportations of dangerous goods was 12.3 million tonnes. Figure 1 shows the total volumes of road transportations in 1987, 1992, 1997 and 2002.

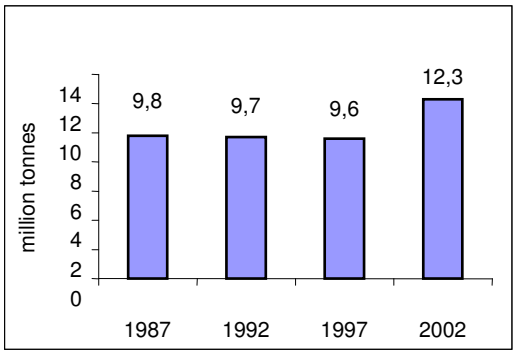


Figure 1 Total volume of dangerous goods transported by road (million tonnes) during 1987, 1992, 1997 and 2002.

In 2002 the largest proportion of transportations were those of class 3 (flammable liquids), at about 67%. Next largest was class 8 (corrosive substances), with a share of about 15%. Class 2 (gases), class 5.1 (oxidising substances) and class 6.1 (toxic substances) each had a share of about 5%. The share of dangerous goods belonging to class 9 was just under 2%. The total share of all other dangerous goods was below 1%. The distribution of all classes of goods is shown in Figure 2.

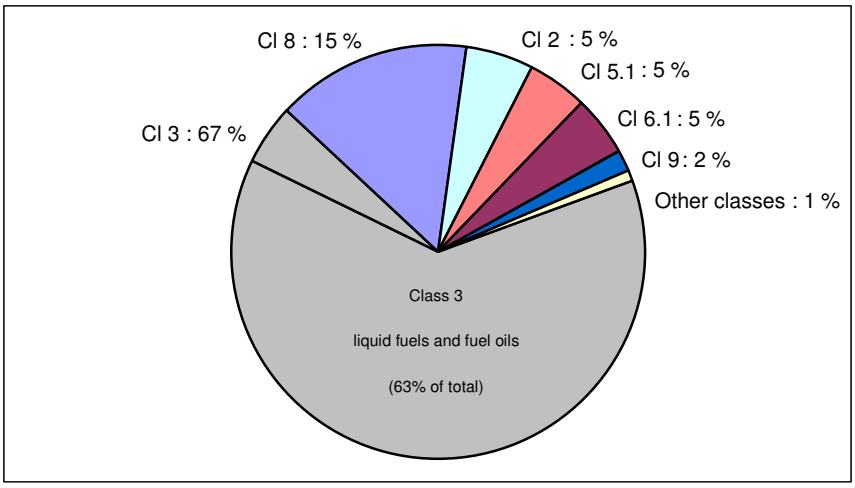


Figure 2 Distribution (%) of road transportations of dangerous goods during 2002.

Table 1 shows the volumes of road transportations by transportation class, and their shares of the total volume.

Table 1 Total volume of road transportations in 2002 (tn).

Transportation class	Transportation volume	Share of total volume
	(tn)	(%)
1	10 251	0.08
2	647 390	5.26
3	8 294 004	67.45
4.1	56 581	0.46
4.2	2 112	0.02
4.3	6 903	0.06
5.1	591 778	4.81
5.2	15 006	0.12
6.1	581 625	4.73
6.2	19	0.00
8	1 877 945	15.27
9	213 771	1.74
Total	12 297 385	100.00

Figure 3 shows the distributions of the classes of goods during 1987, 1992, 1997 and 2002.

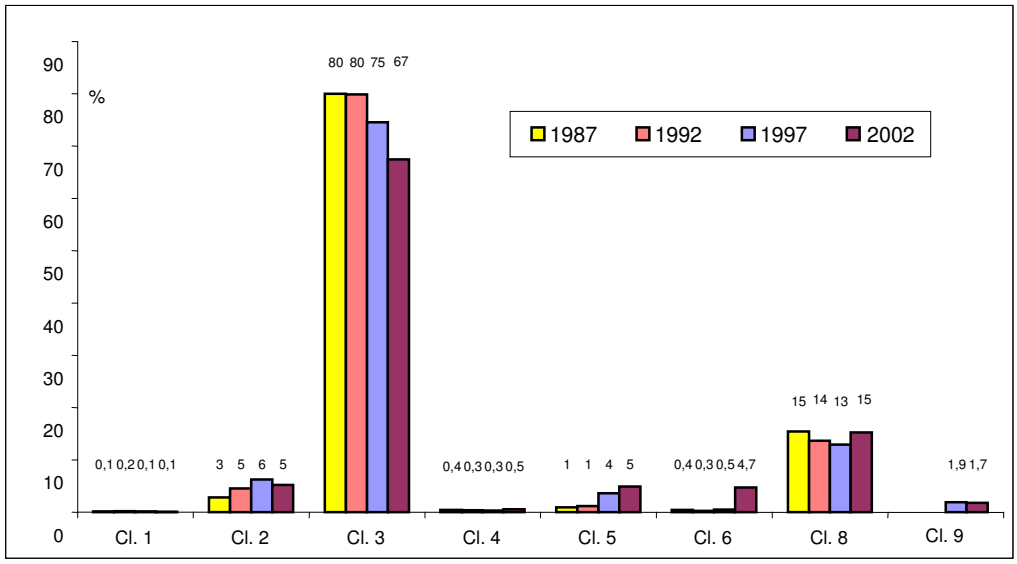


Figure 3 Distribution (%) of road transportations of dangerous goods by transportation class during 1987, 1992, 1997 and 2002.

5.2 Distribution of goods within classes in road transport

Table 2 brings together data on the transportation volumes of substances belonging to the various transportation classes. The classes are divided into subcategories on the basis of substance characteristics. Also included in the table are the transportation volumes of certain single substances, as in previous reports. The distribution of goods is presented in more detail in sections 6.2.1–6.2.8 below.

Table 2 Road transportation: volumes (tn) and share (%) of total volume for different transportation classes during 2002.

Transport-ation classes	Classification	Transport-ation volume	Share of total volume of class	Share of total transportation volume
		(tn)	(%)	(%)
1	Danger class 1.1	9 939	97	0.08
	Danger class 1.3	172	2	0.00
	Danger class 1.4	140	1	0.00
	Total class 1	10 251	100	0.08
2	2.1 Flammable gases	180 644	28	1.47
	2.2 Non-flammable, non-toxic	419 717	65	3.41
	2.3 Toxic gases	47 029	7	0.38
	Total class 2	647 390	100	5.26
	Single substances:			
	- Ammonia	321	0,05	0.00
	- Sulphur dioxide	39 329	6	0.32
	- Chlorine	6 230	1	0.05
	- Liquefied gas	157 318	24	1.28
3	Liquid fuels and fuel oils	7 734 235	93	62.89
	Other	559 769	7	4.55
	Total class 3	8 294 004	100	67.45
4.1, 4.2 and 4.3	Class 4.1	56 581	86	0.46
	Class 4.2	2 112	3	0.02
	Class 4.3	6 903	11	0.06
	Total classes 4.1, 4.2 and 4.3	65 596	100	0.53
	Single substance:			
	- Sulphur (class 4.1)	46 680	71	0.38
5.1 and 5.2	Class 5.1	591 778	98	4.81
	Class 5.2	15 006	2	0.12
	Total classes 5.1 and 5.2	606 784	100	4.93
	Single substances:			
	- Chlorates (5.1)	358 788	59	2.92
	- Hydrogen peroxide solutions (5.1)	214 635	35	1.75
6.1 and 6.2	Class 6.1	581 625	100	4.73
	Class 6.2	19	0	0.00
	Total classes 6.1 and 6.2	581 644	100	4.73
	Single substances:			
	- Phenol (6.1)	24 840	4	0.20
	- Monochloracetic acid (6.1)	16 800	3	0.14
8	Acidic substances (codes C1 - C4)	803 576	43	6.53
	Basic substances (codes C5 - C8)	963 934	51	7.84
	Other	110 435	6	0.90
	Total class 8	1 877 945	100	15.27
	Single substances:			
	- Sulphuric acid	509 432	27	4.14
	- Sodium hydroxide	281 630	44	6.68
9	Marine pollutants (M6- M7)	78 766	37	0.64
	Other	135 005	63	1.10
	Total class 9	213 771	100	1.74
Total		12 297 385		100

5.2.1 Class 1: Explosives

The share of the total transportation volume represented by class 1 was 0.08%. The total volume of class 1 transported by road was 10 251 tonnes; of this, the largest part consisted of substances of danger class 1.1 (97%). The share of danger class 1.3 was 2%, while that of 1.4 was 1%. According to the report, no substances of danger classes 1.2, 1.5 and 1.6 were transported at all. The distribution is shown in Figure 4.

Transportations of explosives consisted mainly of devices intended for quarrying and fireworks.

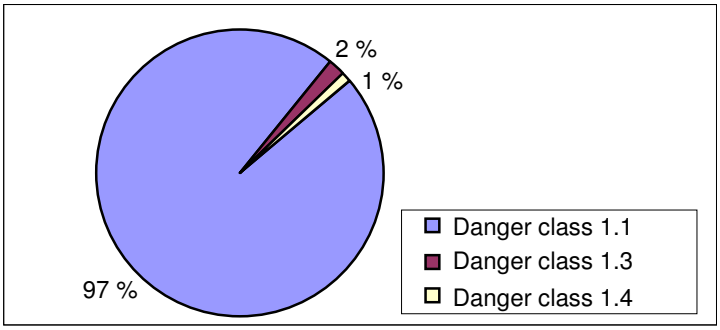


Figure 4 Distribution (%) of road transportations of explosives (class 1).

5.2.2 Class 2: Gases

The share of the total transportation volume represented by class 2 was 5%. The total volume of class 2 transported by road was 647 390 tonnes, of which over half was non-flammable, non-toxic gases (65%). The share of flammable gases was 28%, and that of toxic gases was 7%. The distribution is shown in Figure 5.

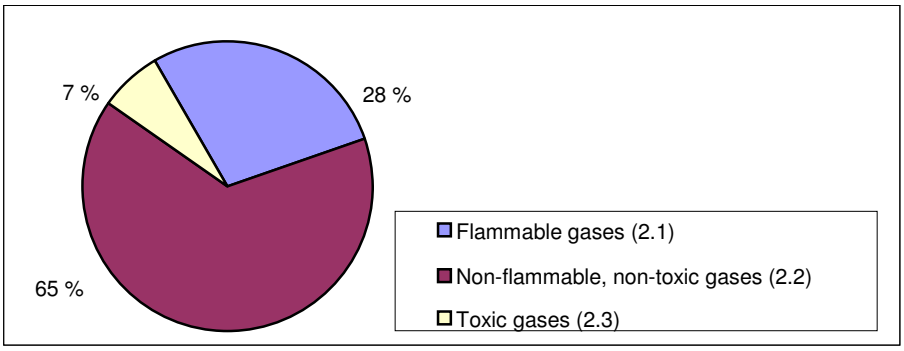


Figure 5 Distribution (%) of road transportations of gases (class 2).

The largest group transported was liquefied gases; their share of class 2 transportations was 24%. The share of frozen liquid oxygen was 19%. Frozen liquid nitrogen and carbon dioxide both had a share of 13%.

5.2.3 Class 3: Flammable liquids

The share of the total transportation volume represented by class 3 was 67%, in total 8 294 004 tonnes.

Almost all class 3 substances (99.7%) were flammable liquids, with no subsidiary risk (classification codes F1 and F2). The rest were toxic flammable liquids (0.2%, FT1) and other flammable liquids (0.1%, FC and FTC).

The majority of class 3 transportations (93%, i.e. 7 734 235 tonnes) consisted of liquid fuels and fuel oils (petrol, diesel oil, light and heavy fuel oil, paraffin, jet fuel). The remaining 7%, i.e. 559 769 tonnes, consisted of e.g. styrene (22%), resin solution (15%), methanol and ethanol solution (together, 9%) and paints and printing inks (together, 6%). The distribution is shown in Figure 6.

Liquid fuels and fuel oils accounted for 63% of all transported dangerous goods.

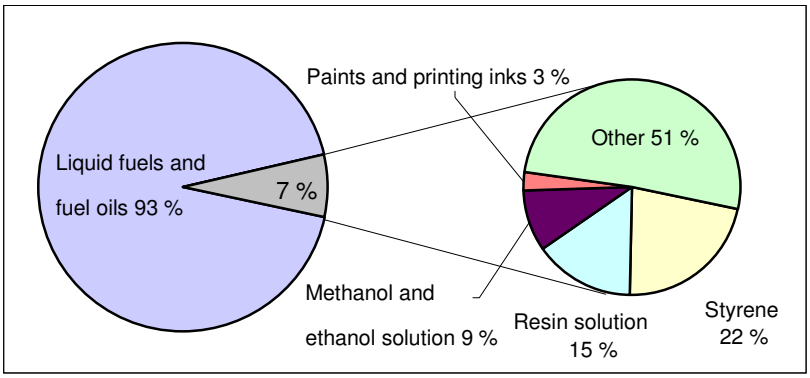


Figure 6 Distribution (%) of road transportations of flammable liquids (class 3).

5.2.4 Classes 4.1, 4.2 and 4.3

The total volume of classes 4.1 (flammable solids, self-reactive substances and solid desensitised explosives), 4.2 (substances liable to spontaneous combustion) and 4.3 (substances which in contact with water emit flammable gases) transported by road was 65 596 tonnes; of this, 71% was class 4.1 (sulphur).

The share of road transportations represented by class 4.1 was 0.5%, in total 56 581 tonnes. The majority of class 4.1 consisted of flammable organic (15%, classification code F1) or inorganic (84%, F3) substances, with no subsidiary risk. The remaining 1% were desensitised solid explosives (D) and self-reactive substances (SR1).

The combined share of the total transportation volume represented by classes 4.2 and 4.3 was small (<0.1%).

The total volume of class 4.2 transported was 2 112 tonnes. The majority of class 4.2 consisted of organic (11%, S2) or inorganic (82%, S4) solids with no subsidiary risk. The remaining 7% were inorganic corrosive solids (SC4).

The total volume of class 4.3 transported was 6 903 tonnes. The majority of class 4.3 consisted of solids with no subsidiary risk (91%, W2), and the remaining 9% were toxic solids (WT2) and flammable corrosive substances (WFC).

5.2.5 Class 5.1 (oxidising substances) and class 5.2 (organic peroxides)

The total volumes of classes 5.1 and 5.2 transported by road were 606 785 tonnes, of which the majority (98%) consisted of class 5.1 substances. Out of the volume of classes 5.1 and 5.2 transported by road, the share of chlorates belonging to class 5.1 was 59% and that of hydrogen peroxide solutions was 35%.

The share of the total transportation volume represented by class 5.1 was 5%, in total 591 778 tonnes. Of these oxidising substances, 63.5% were oxidising solid (O1) and liquid (O2) substances with no subsidiary risk. 36% of these substances were corrosive liquids (OC1). The remaining 0.5% were toxic (OT2) and corrosive (OC2) solids.

The share of the total transportation volume represented by class 5.2 was 0.1%, in total 15 006 tonnes. Of these organic peroxides, 10% did not require temperature control (P1) while 90% required such control (P2).

5.2.6 Class 6.1 (toxic substances) and class 6.2 (infectious substances)

The total volume of classes 6.1 and 6.2 transported by road was 581 644 tonnes; class 6.1 substances accounted for almost all of these.

The share of the total transportation volume represented by class 6.1 was 5%, in total 581 625 tonnes. In class 6.1 the share of highly toxic substances was 1% (packaging group I); that of toxic substances, 13% (II); and that of slightly toxic substances, 86% (III). The distribution of class 6.1 is shown in Figure 7.

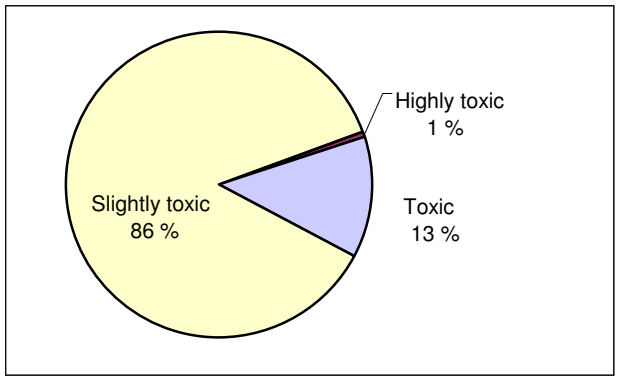


Figure 7 Distribution (%) of class 6.1 road transportations.

The majority of class 6.1 consisted of organic (11%, T1) or inorganic (83%, T4) liquids, with no subsidiary risk. Toxic organic liquids (TC1) were 3%, and organic solids with no subsidiary risk were 2%. The remaining 1% consisted of various toxic substances (T5, T6, T7, TF1, TC4 and TFC).

The share of the total transportation volume represented by class 6.2 was insignificant, a total of 19 tonnes. All the infectious substances were wastes.

5.2.7 Class 8: Corrosive substances

The share of the total transportation volume represented by class 8 was 15%, in total 1 877 945 tonnes. Of these class 8 transportations, the share of highly corrosive substances was 0.5% (packaging group I); that of corrosive substances, 91% (II); and of slightly corrosive substances, 8.5% (III). The distribution of class 8 is shown in Figure 8.

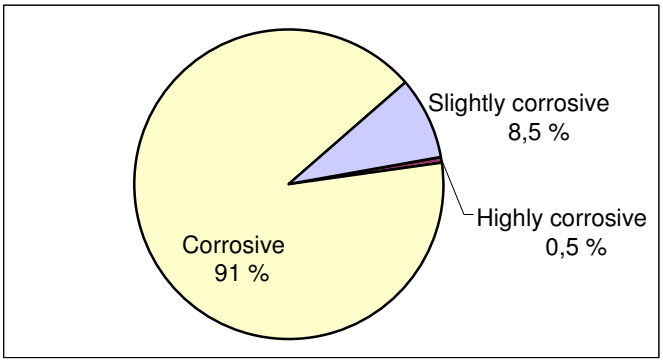


Figure 8 Distribution (%) of class 8 road transportations

Class 8 consisted of acidic substances 43% (classification codes C1–C4), basic substances 51% (C5–C8) and others (3%, C9–C10) with no subsidiary risk. The remaining 3% were highly corrosive substances (C11, CF1, CO1 and CT1).

In class 8, sodium hydroxide represented a share of 44%. That of sulphuric acid was 27%; that of hydrochloric acid, 8%; that of formic acid, 3%; and that of ferric chloride solution, 3%. The remaining 15% were various corrosive substances.

5.2.8 Class 9: Miscellaneous dangerous substances and articles

The share of the total transportation volume represented by class 9 was just under 2%, in total 213 771 tonnes. Marine pollutants (classification codes M6 – M7) represented almost 37% of class 9 transportations. The share of substances releasing flammable gases (M3) was 45%, that of liquids at a raised temperature (M9) 18%. The share of polychlorated biphenyl (M2) was insignificant. The distribution of class 9 is shown in Figure 9.

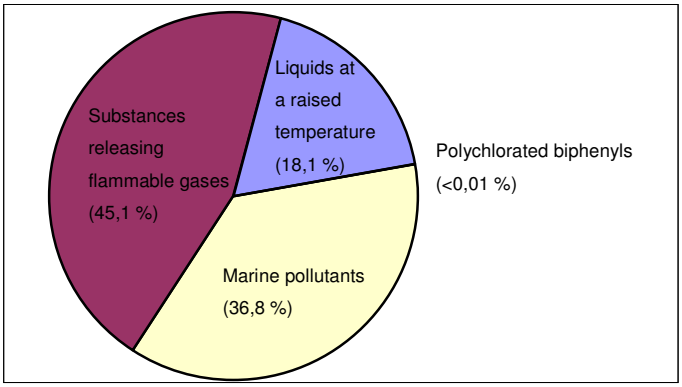


Figure 9 Distribution (%) of class 9 road transportations.

5.3 Road transport: equipment

The study investigated how substances are transported. In terms of their mode of transport, road transportations are divided as follows:

1) transportations taking place by tanker vehicle
2) transportations in UN containers, detachable containers and tank containers
3) other transportations (single consignment transportations in vats, in packages etc. plus bulk transportations).

The majority of transportations were carried out in tanker lorries (88%). Table 3 shows a summary of the modes of transport employed, by transportation class.

Table 3 Modes of transport of road transportations in 2002.

Transportation class	Tanker vehicle (1)	Detachable container / tank container (2)	Other (3)
	(%)	(%)	(%)
1	0	0	100
2	80	1	19
3	97	1	2
3 excluding liquid fuels and fuel oils	57	9	34
4.1	83	0	17
4.2	0	56	44
4.3	0	34	66
5.1	78	2	20
5.2	0	0	100
6.1	13	83	4
6.2	0	0	100
8	86	2	13
9	23	15	62
Total	88	5	7
Total exc. liquid fuels and fuel oils	67	14	19

5.4 Road transport: tonne-kilometres and average transportation journeys

The total accumulated figure for road transportations of dangerous goods was about 1.7 billion tonne-kilometres. Table 4 shows tonne-kilometres by class; their shares of the total performance; and average transportation journeys.

Table 4 Tonne-kilometres and share of total performance of the various transportation classes of road transportations, and average transportation journeys in 2002.

Transportation class	Transportation performance	Share of total performance	Average transportation journey (Road traffic haulage statistics 2002)
	(million tonne-km)	(%)	(km)
1	5.0	0.29	69
2	158.0	9.22	193
3	973.3	56.80	133
4.1	17.3	1.01	
4.2	10.5	0.61	
4.3	5.5	0.32	300
5.1	98.0	5.72	
5.2	15.4	0.90	173
6.1	99.4	5.80	
6.2	0.0	0.00	189
7	-		-
8	272.5	15.90	147
9	58.6	3.42	127
Total	1713.5	100	137

In terms of tonne-kilometres, the share of the total performance represented by flammable liquids (class 3) was 56.8%; that of corrosive substances (class 8), 15.9%; and that of gases (class 2) 9.2%. The shares of class 5.1 and of class 6.1 were in both cases just under 6%. The share of class 9 was 3.4%, and that of class 4.1 about 1%. The share of other classes was insignificant.

According to the CSO, the share of the entire transportation performance represented by dangerous goods was 8% (tonne-kilometres) (Road traffic haulage statistics 2002).

In transportations by road, the transportation journeys for dangerous goods are longer than average. According to the CSO, in 2002 the average transportation journey for dangerous goods was 137 kilometres, while in the case of all goods it was 48 kilometres (Road traffic haulage statistics 2002).

Explosives (class 1) had the shortest average transportation journey, about 70 km. The longest average transportation journey, 300 km, was in classes 4.1, 4.2 and 4.3. The average transportation journeys of all other classes were 100–200 km.

5.5 Road transport: regional distribution and main transportation routes

In distribution operations, the transportation routes are often estimates. This is particularly the case in transportations of gases (class 2) and fuels (class 3). Where the transportation route is not known, a route optimisation program is used in the route maps.

Visual maps of transportation routes are enclosed (maps T1–T13). The transportation route entries illustrate the average volume transported in a week. For these maps, the annual transportation volume has been divided by 52; the unit is tonnes/week.

Table 5 Main road transport routes of Dangerous Goods

Transportation class	Sections of road
Class 1	Hanko – Lohja
	Helsinki – Lohja
	Lohja – Riihimäki – Lahti – Jyväskylä – Oulu – Tornio
Class 2	Espoo / Helsinki – Porvoo – Mäntsälä – Hyvinkää
	Nurmijärvi – Riihimäki – Tampere – Ikaalinen
	Harjavalta – Huittinen – Forssa
	Oulu – Kemi – Tornio
Class 3	Espoo / Helsinki – Porvoo – Mäntsälä – Lahti – Heinola
	Porvoo – Kouvola and Kotka
	Helsinki – Hämeenlinna
	Pori – Turku / Naantali – Salo
Class 4.1	Pori – Riihimäki – Mäntsälä – Porvoo
Class 4.2	Kotka – Kouvola – Mikkeli – Varkaus
Class 4.3	Mäntsälä – Lahti – Mikkeli – Varkaus
	Hamina – Imatra
Class 5.1	Pori – Huittinen
	Imatra – Lappeenranta – Luumäki
	Oulu – Kokkola
	Oulu – Jyväskylä
Class 5.2	Oulu – Pulkkila
Class 6.1	Helsinki – Tampere
Class 6.2	Helsinki – Riihimäki – Hämeenlinna
Class 8	Pori – Forssa
	Turku – Aura
	Lempäälä – Valkeakoski
	Imatra – Lappeenranta – Luumäki
	Lahti – Kouvola
	Pietarsaari – Kokkola
Class 9	Helsinki – Harjavalta
	Turku – Naantali
	Tampere – Korpilahti
Total (except class 3)	Helsinki – Pori
	Helsinki – Tampere
	Imatra – Lappeenranta – Kouvola – Lahti – Riihimäki – Forssa
	Jyväskylä – Äänekoski
	Uusikaarlepyy – Kokkola – Oulu – Kemi

6 TRANSPORT OF DANGEROUS GOODS BY RAIL

In 2002 the total volume of dangerous goods transported by rail was 6.1 million tonnes. According to the report, the fall in comparison to 1997 was about 2.3 million tonnes. Following 1997 there was a reduction in transportations, with the total volume transported varying between 5.8 and 6.9 million tonnes during the years 1998–2002. Figure 10 shows the total volumes for the years 1997–2002.

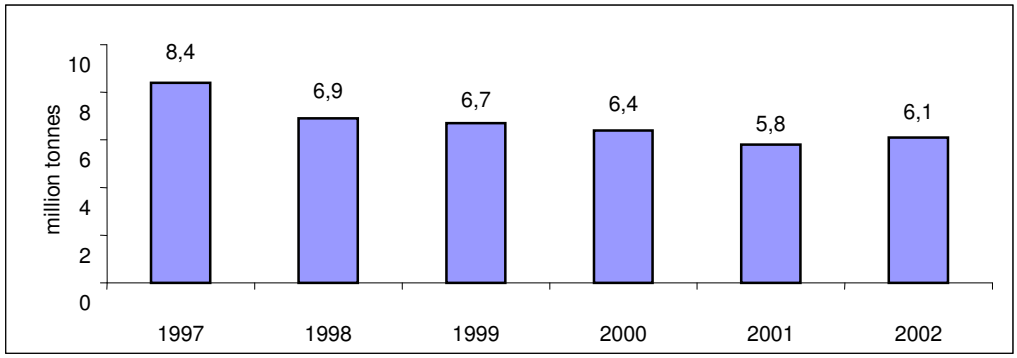


Figure 10 Total volumes of rail transportations of dangerous goods (million tonnes) during 1997–2002.

6.1 Total volume transported by rail

In 2002 the total volume of dangerous goods transported by rail was 6.1 million tonnes.

In 2002 the majority of transportations consisted of class 3 (flammable liquids), at about 69%. The next largest classes transported were class 8 (corrosive substances) at 15% and class 2 (gases) at 11%. The share of class 5.1 (oxidising substances) was 2%. Class 4.1 and class 6.1 (toxic substances) both had a share of about 1%. The total share of other dangerous goods was below 1% (classes 1, 4.3 and 9). The distribution of all classes of goods is shown in Figure 11.

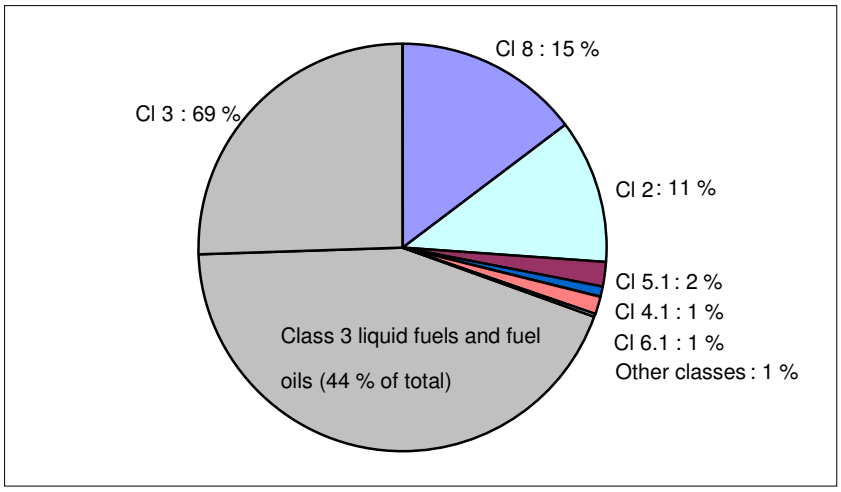


Figure 11 Distribution (%) of rail transportations of dangerous goods during 2002.

Table 5 shows the volumes of rail transportations by transportation class, and their shares of the total volume. Figure 12 shows the distributions of the classes of goods during the years 1998–2002. The changes in transportation volumes by goods class are given in more detail in sections 7.2.1–7.2.9 below.

Table 6 Total volume of rail transportations in 2002 (tn).

Transportation class	Transportation volume (tn)	Share of total volume (%)
1	133	0.00
2	692 999	11.40
3	4 217 983	69.38
4.1	53 893	0.89
4.2	0	0
4.3	3 367	0.06
5.1	121 695	2.00
5.2	0	0
6.1	71 587	1.18
6.2	0	0
7	0	0
8	899 563	14.80
9	17 907	0.29
Total	6 079 127	100.00

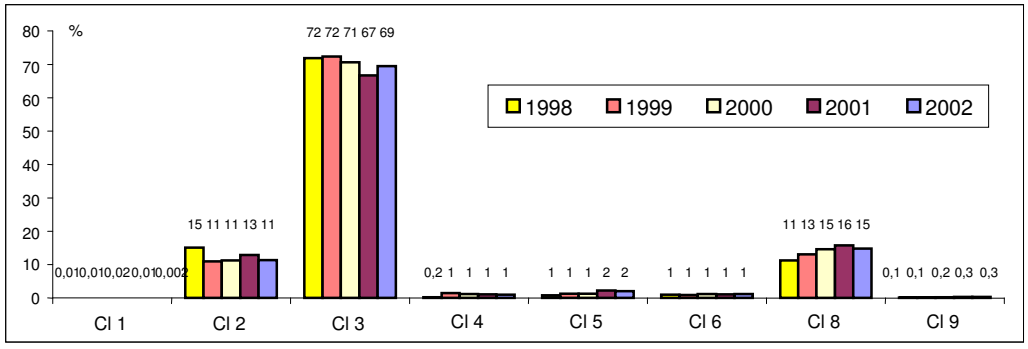


Figure 12 Distribution (%) of rail transportations of dangerous goods by transportation class, in years 1998–2002.

6.2 Distribution of goods within classes in rail transport

Table 6 brings together data on the transportation volumes of substances belonging to the various transportation classes. The classes have been divided into subcategories on the basis of substance characteristics. The table also shows the transportation volumes of certain single substances. The distribution of substances is presented in more detail in sections 7.2.1–7.2.9 below.

Table 7 Volumes of rail transportations of various transportation classes (tn) and share (%) of total volume during 2002.

Transport-ation classes	Classification	Transport-ation volume	Share of total volume	Share of total transportation volume
		tonnes	(%)	(%)
1	Danger class 1.1	126	95	0.00
	Danger class 1.2	2	1	0.00
	Danger class 1.3	5	4	0.00
	Total class 1	133	100	0.00
2	2.1 Flammable gases	369 881	53	6.08
	2.2 Non-flammable, non-toxic	7 213	1	0.12
	2.3 Toxic gases	315 905	46	5.20
	Total class 2	692 999	100	11.40
	Single substances:			
	- Ammonia	306 932	44	5.05
	- Sulphur dioxide	7 919	1	0.13
3	Oil products, liquid fuels and fuel oils	2 663 794	63	43.82
	Other	1 554 189	37	25.57
	Total class 3	4 217 983	100	69.38
4.1, 4.2 and 4.3	Class 4.1	53 893	94	0.89
	Class 4.2	-	-	-
	Class 4.3	3 367	6	0.06
	Total classes 4.1, 4.2, 4.3	57 260	100	0.95
5.1 & 5.2	Class 5.1	121 695	100	2.00
	Class 5.2	-	-	-
	Total classes 5.1 and 5.2	121 695	100	2.00
	Single substances:			
	- Chlorates (5.1)	58 094	64	1.28
	- Hydrogen peroxide solutions (5.1)	27 651	23	0.45
6.1 & 6.2	Class 6.1	71 587	100	1.18
	Class 6.2	-	-	-
	Total classes 6.1 and 6.2	71 587	100	1.18
	Single substances:			
	- Phenol (6.1)	30 959	43	0.51
7	Total class 7	-	-	-
8	Total class 8	899 563	100	14.80
	Single substances:			
	- Phosphoric acid	472 380	53	7.77
	- Sulphuric acid	276 600	31	4.55
	- Nitric acid	34 090	4	0.56
9	Marine pollutants (M6- M7)	13 479	75	0.22
	Other	4 428	25	0.07
	Total class 9	17 907	100	0.29
Total		6 079 127		100

6.2.1 Class 1: Explosives

The share of the total transportation volume represented by class 1 was insignificant (<0.01%). The total volume of class 1 transported by rail was 133 tonnes, the majority of which consisted of substances of danger class 1.1 (95%). The share of danger class 1.2 was 1%, while that of danger class 1.3 was 4%. According to the report, there were no transportations of substances of danger classes 1.4, 1.5 and 1.6 at all. The distribution is shown in Figure 13.

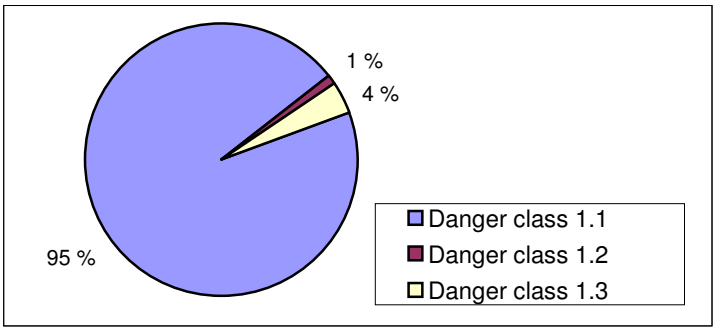


Figure 13 Distribution (%) of rail transportations of explosives (class 1).

Figure 14 shows total transportation volumes for class 1 during 1998–2002.

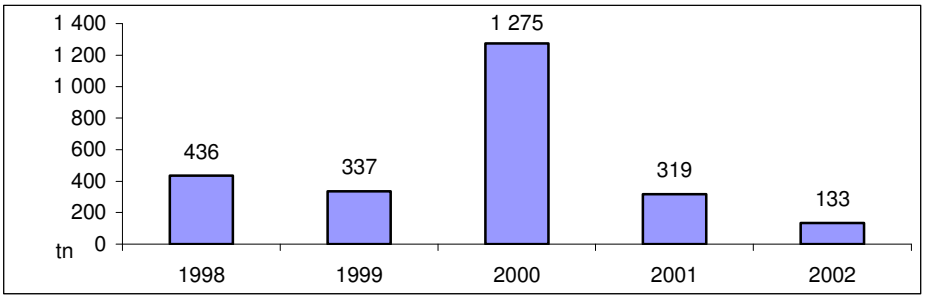


Figure 14 Class 1 railway transportations (tn) during 1998–2002.

6.2.2 Class 2: Gases

The share of the total transportation volume represented by class 2 was 11%. The total volume of class 2 transported by rail was 692 999 tonnes; this was almost totally split between flammable gases (53%) and toxic gases

(46%). The share of non-flammable, non-toxic gases was 1%. The distribution is shown in Figure 15.

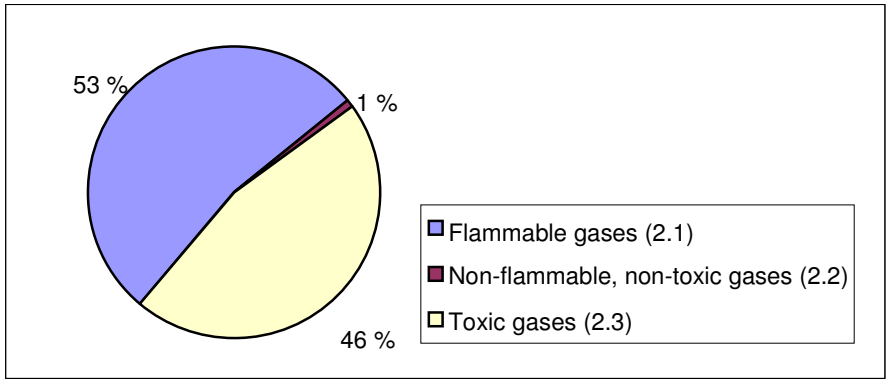


Figure 15 Distribution (%) of rail transportations of gases (class 2).

The most transported gas was ammonia, with a share of 44%. Figure 16 shows class 2 transportation volumes during 1998–2002.

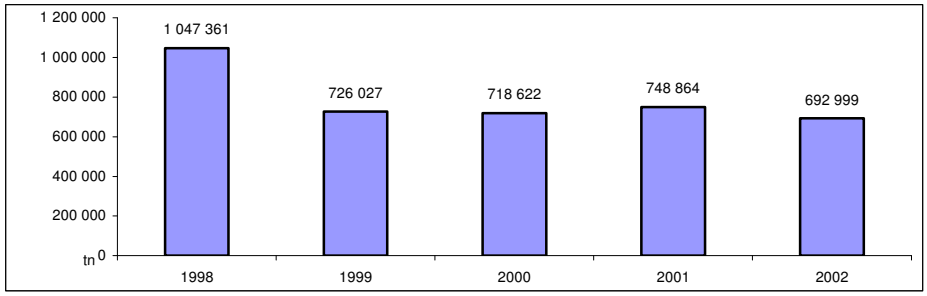


Figure 16 Class 2 rail transportations (tn) during 1998–2002.

6.2.3 Class 3: Flammable liquids

The share of the total transportation volume represented by class 3 was 69%, in total 4 217 983 tonnes.

Of the class 3 substances, 38% were highly dangerous (packaging group I) and 36% were dangerous substances (II). The share of substances causing a slight danger (III) was 26%.

The majority of class 3 substances (63%, i.e. 2 663 794 tonnes) consisted of oil products, liquid fuels and fuel oils. The remainder were alcohols (18%), styrene (5%), xylenes (4%) and other combustible liquids (10%). The distribution is shown in Figure 17.

Liquid fuels and fuel oils plus oil products accounted for 44% of all dangerous goods transported by rail.

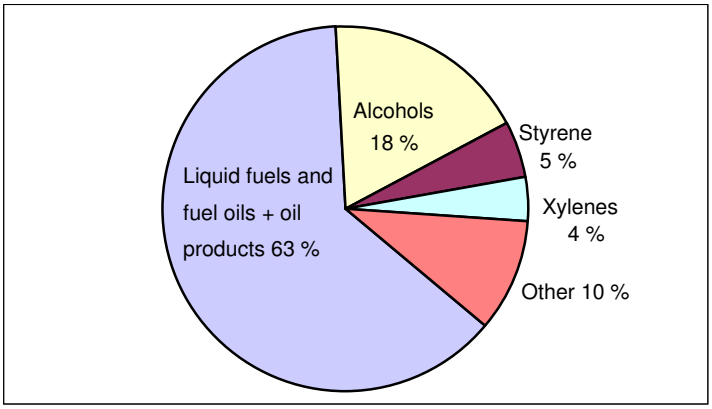


Figure 17 Distribution (%) of rail transportations of flammable liquids (class 3).

Figure 18 shows class 3 transportation volumes during 1998–2002.

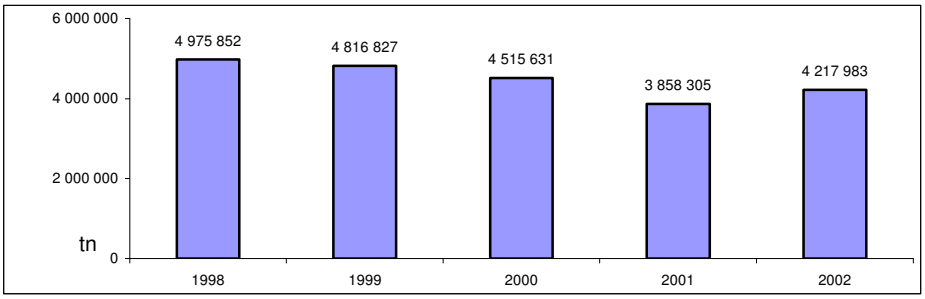


Figure 18 Class 3 rail transportations (tn) during 1998–2002.

6.2.4 Classes 4.1, 4.2 and 4.3

The total volume of class 4.1 (flammable solids, self-reactive substances and solid desensitised explosives) and class 4.3 (substances which in contact with water emit flammable gases) transported by rail was 57 260 tonnes. No class 4.2 substances liable to spontaneous combustion were transported by rail at all.

The share of the total transportation volume represented by class 4.1 was just under 1%, a total of 53 893 tonnes. The share of the total transportation

volume represented by class 4.3 was insignificant (<0.1%), a total of 3 367 tonnes.

Figure 19 shows the transportation volumes of classes 4.1, 4.2 and 4.3 during 1998–2002.

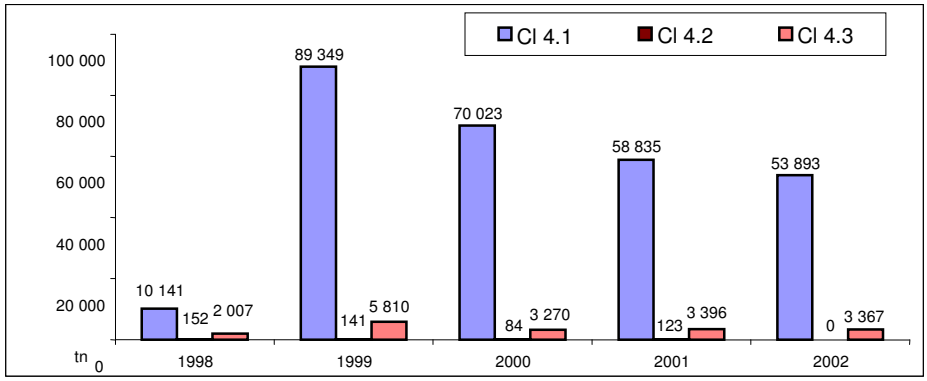


Figure 19 Rail transportations of classes 4.1, 4.2 and 4.3 (tn) during 1998–2002.

6.2.5 Class 5.1 (oxidising substances) and class 5.2 (organic peroxides)

The total volume of class 5.1 transported by rail was 121 695 tonnes; its share of the total transportation volume was 2%. No class 5.2 organic peroxides were transported by rail at all.

Chlorates represented 64% of class 5.1 substances, and hydrogen peroxide solutions 23%.

Figure 20 shows the total transportation volumes of classes 5.1 and 5.2 during 1998–2002.

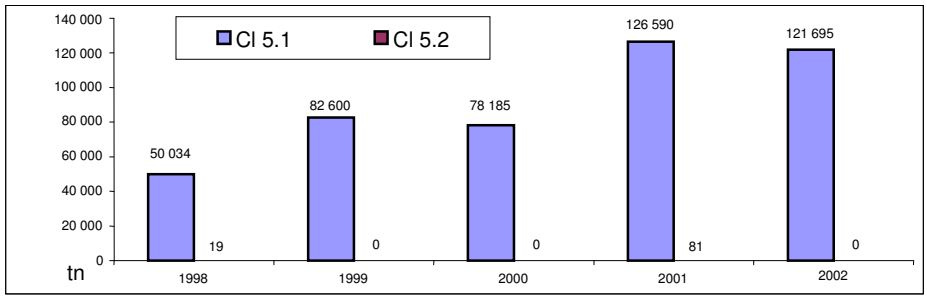


Figure 20 Rail transportations of classes 5.1 and 5.2 (tn) during 1998–2002.

6.2.6 Class 6.1 (toxic substances) and class 6.2 (infectious substances)

The share of the total transportation volume represented by class 6.1 was somewhat over 1%, a total of 71 587 tonnes. No class 6.2 infectious substances were transported by rail at all.

In class 6.1, the share of highly toxic substances was 1% (packaging group I); that of toxic substances, 49% (II); and that of slightly toxic substances, 50% (III). The distribution of class 6.1 is shown in Figure 21. The share of class 6.1 transportations represented by phenol was 43%.

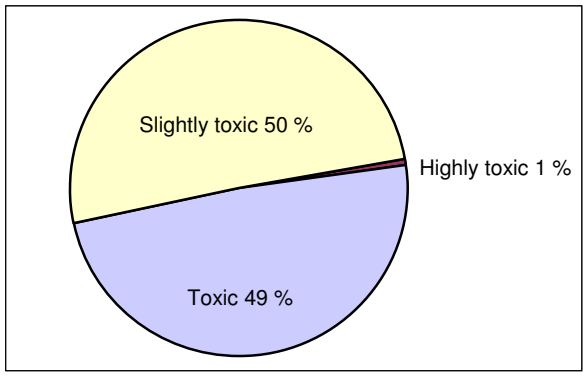


Figure 21 Distribution (%) of class 6.1 rail transportations.

Figure 22 shows class 6.1 transportation volumes during 1998–2002. No class 6.2 infections substances were transported by rail at all during 1998–2002.

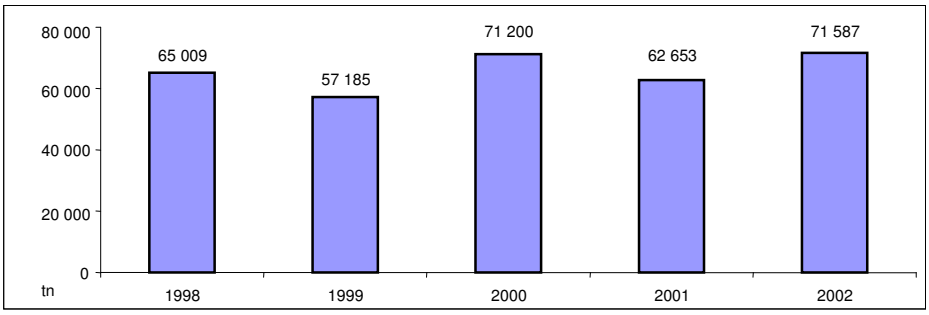


Figure 22 Class 6.1 railway transportations (tn) during 1998–2002.

6.2.7 Class 7: Radioactive material

No class 7 radioactive materials were transported by rail at all during 1998–2002.

6.2.8 Class 8: Corrosive substances

Class 8's share of the total transportation volume was 15%, a total of 899 563 tonnes. The share of class 8 transportations represented by highly corrosive substances was 4% (packaging group I); that of corrosive substances, 43% (II) and that of slightly corrosive substances, 53% (III). The distribution of class 8 is shown in Figure 23.

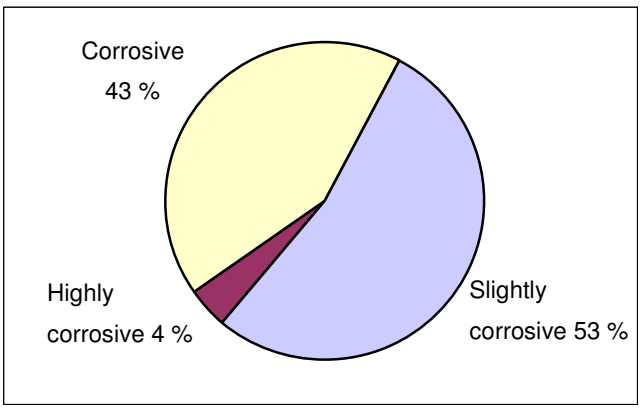


Figure 23 Distribution (%) of class 8 rail transportations.

In class 8, phosphoric acid represented a share of 53%. The share of sulphuric acid was 31%; that of nitric acid, 4%; and that of acetic acid, 3%. The remaining 9% were other corrosive substances. Figure 24 shows class 8 transportation volumes during 1998–2002.

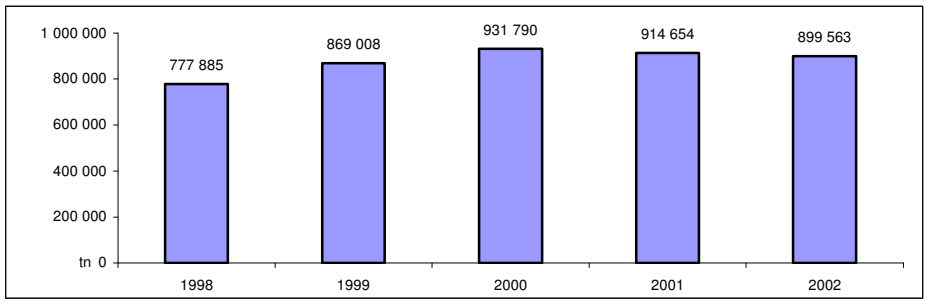


Figure 24 Class 8 transportation volumes (tn) during 1998–2002.

6.2.9 Class 9: Miscellaneous dangerous substances and articles

Class 9's share of the total transportation volume was small (0.3%), a total of 17 907 tonnes. In class 9 the share of marine pollutants (classification codes M6 – M7) was 75%. Figure 25 shows class 9 transportation volumes during 1998–2002.

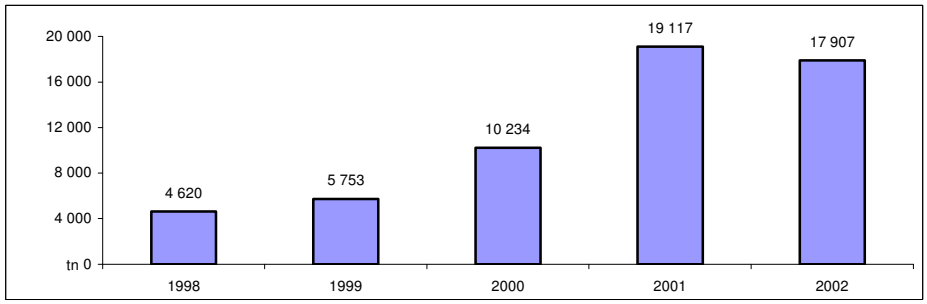
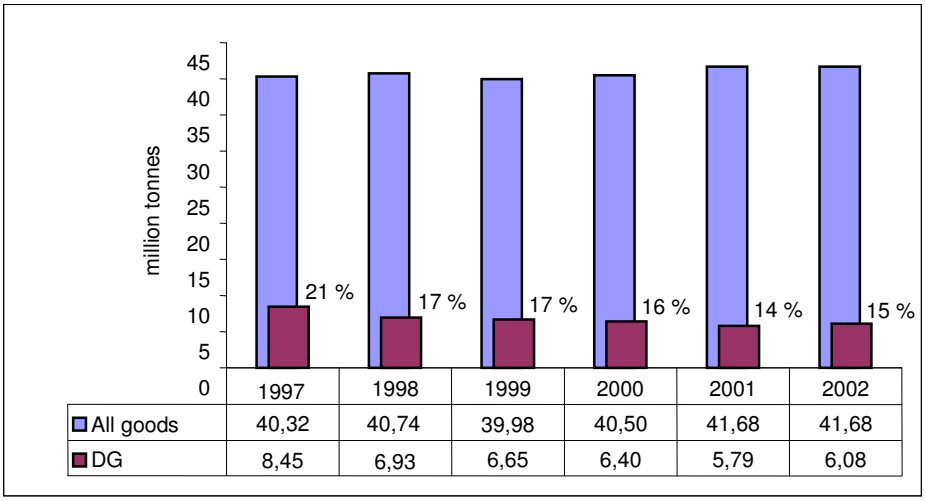


Figure 25 Class 9 railway transportations (tn) during 1998–2002.

6.3 Total transportations by railway

According to the Rail Administration, in 2002 about 41.7 million tonnes of freight were transported by rail in Finland in 2002 (Finnish Railway Statistics 2003). Thus the share of this total volume represented by dangerous goods

was about 15%. Figure 26 shows the equivalent data for the years 1997–2002.



	1997	1998	1999	2000	2001	2002
All goods	40,32	40,74	39,98	40,50	41,68	41,68
DG	8,45	6,93	6,65	6,40	5,79	6,08

Figure 26 Railway freight transport volumes (million tonnes) during 1997–2002 (DG=transportations of dangerous goods).

6.4 Rail transport: tonne-kilometres and average transportation journeys

In railway transportations of dangerous goods, the total accumulated volume was about 1.6 billion tonne-kilometres. Table 7 shows tonne-kilometres by class; their share of the total performance; and average transportation journeys.

Table 8 Tonne-kilometres of railway transportations of the various transportation classes, their share of the total performance, and average transportation journeys during 2002.

Transportation class	Transportation performance	Share of total performance	Average transportation journey
	(million tonne-km)	(%)	(km)
1	0.1	0.01	635
2	247.7	15.60	331
3	930.2	58.60	268
4.1	1.5	0.09	226
4.2	-	-	-
4.3	0.1	0.00	252
5.1	21.7	1.36	225
5.2	-	-	-
6.1	20.5	1.29	320
6.2	-	-	-
7	-	-	-
8	357.9	22.55	366
9	7.9	0.50	466
Total	1 587.6	100	307

In tonne-kilometres, the share of the total performance represented by flammable liquids (class 3) was 58.6%; that of corrosive substances (class 8), 22.6%; and of gases (class 2) 15.6%. The share of class 5.1 and of class 6.1 was slightly over 1% in both cases. The share of other classes was insignificant.

The average transportation journey of all classes was 307 km. The lengths of transportation journeys varied depending on the class involved. Explosives (class 1) had the longest average transportation journey, over 600 km. The next longest average transportation journey, 466 km, was in class 9. The average transportation journeys of classes 2, 6.1 and 8 were between 300–400 km. The average transportation journeys of classes 3, 4.1, 4.3 and 5.1 were between 200–300 km.

6.5 Rail transport: regional distribution and main transportation routes

The majority of rail transportations of dangerous goods proceeded between Vainikkala – Kouvola, from which point the transportations split up on routes leading to the ports of Hamina, Kotka and Sköldvik.

Maps which visually depict rail transportation routes are enclosed (maps R1–R10). The weekly volume in tonnes has been obtained by dividing the entire year's transportation volume by 52.

Table 9 Main rail transport routes of Dangerous Goods

Transportation class	Sections of rail	Transportation volume (tn/week)
Class 1	Hanko – Haapajärvi	
	Pohjoinen – Vainikkala	
Class 2	Vainikkala – Kouvola	c. 10 000
	Kouvola – Lahti – Riihimäki	c. 9 500
	Riihimäki – Sköldvik	c. 6 000
	Riihimäki – Toijala	c. 5 000
Class 3	Vainikkala – Kouvola	c. 73 000
	Kouvola – Lahti – Riihimäki – Sköldvik	36 000–40 000
	Kouvola – Hamina	27 000–40 000
	Kouvola – Kuopio	2 000–3 000
Class 4.1	Ports: Ykspihlaja, Mäntyluoto, Helsinki	
	Border stations: Vainikkala, Niirala	
Class 4.3	Hanko – Rautaruukki	
Class 5.1	Tornio – Oulu	c. 1 000
	Oulu – Kontiolahti – Joensuu – Uimaharju	c. 500
Class 6.1	Vainikkala – Kouvola	c. 1 000
	Kouvola – Kotka / Hamina	300–800
	Kouvola – Riihimäki – Tampere – Rauma	350–400
Class 8	Uusikaupunki – Turku – Tampere	4 500–5 500
	Harjavalta – Tampere	c. 4 700
	Tampere – Kuopio – Iisalmi – Kokkola	7 000–8 000
Class 9	Kokkola – Tampere	c. 200
	Helsinki – Tampere	100–200
Total	Vainikkala – Kouvola	
	Kouvola – Kotka / Hamina	
	Kouvola – Lahti – Riihimäki – Sköldvik	

6.6 International rail transportations

In 2002 a total of 4.6 million tonnes of dangerous goods were transported by rail in traffic between Finland and Russia, representing 76% of all rail transportations of dangerous goods. Table 8 shows the volumes of dangerous goods transported via Niirala and Vainikkala, by transportation class.

Table 10 Rail transportations between Russia and Finland (tn) during 2002.

Transportation class	From Russia to Finland	From Finland to Russia	Traffic between Finland and Russia (total)	Share of total volume in class
	(tn)	(tn)	(tn)	(%)
1	5	2	7	5
2	606 448	692	607 140	88
3	3 900 555	6 922	3 907 477	93
4.1	8 690	3 898	12 588	23
4.2	-	-	-	-
4.3	-	-	-	-
5.1	411	4 944	5 355	4
5.2	-	-	-	-
6.1	59 262	-	59 262	83
6.2	-	-	-	-
7	-	-	-	-
8	32 316	8 760	41 076	5
9	1 682	2 145	3 827	21
Total	4 609 369	27 363	4 636 732	

7 TRANSPORT OF DANGEROUS GOODS BY SHIP

7.1 Total volume of transportations by ship

In 2002 the total volume of transportations of dangerous goods by ship was 39.2 million tonnes. Imports represented 64% of this, and exports 36%. According to the report, the growth in transportations by ship in comparison to 1997 was about 5 million tonnes (15%). Table 9 shows total transportation volumes by ship, and the change in comparison to the volumes transported during 1997. Figure 27 shows the distribution of transportations by ship.

Table 11 Transportations by ship during 2002 and comparison with transportations during 1997.

Transportation class	Transportation volume	Share of total volume	Change in comparison to 1997	
	(tn)	(%)	(tn)	(%)
Bulk:				
Gases	377 651	1.0	+37 839	+ 11
Chemicals	4 905 873	12.5	+1 794 816	+ 56
Crude oil and oil products	25 757 761	65.7	+2 998 515	+ 13
Solid bulk	7 413 088	18.9	-138 766	- 2
General cargo (IMDG)	726 734	1.9	+274 009	+ 61
Total	39 181 107	100.00	+4 966 413	+ 15

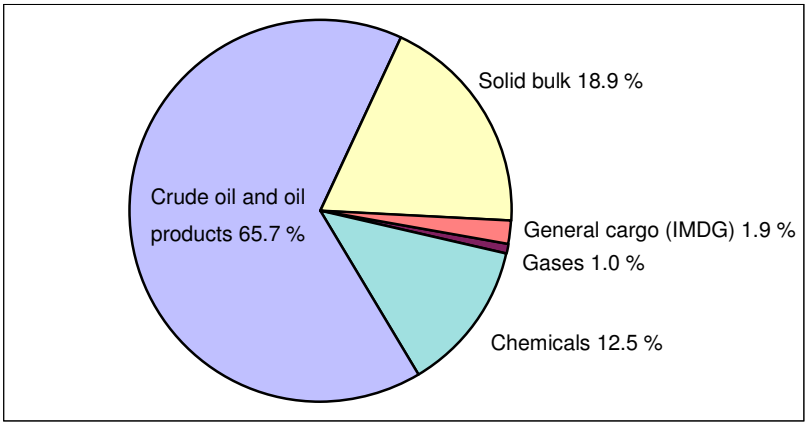


Figure 27 Distribution (%) of transportation of dangerous goods by ship during 2002.

7.2 Transportations by ship: bulk cargo

The total volume of bulk transportations was 38.5 million tonnes, representing 98.1% of all transportations of dangerous goods by ship. Import accounted for 65% of bulk transportations. Table 10 shows the import and export figures for bulk transportations broken down into gases, chemicals, crude oil and oil products plus solid bulk.

Table 12 Volume (tn) and distribution (%) of bulk transportations in 2002.

Bulk	Import	Export	Total volume (import + export)	Share of bulk transportations
	(tn)	(tn)	(tn)	(%)
Gases	293 297 (78%)	84 354 (22%)	377 651	1
Chemicals	1 014 524 (21%)	3 891 349 (79%)	4 905 873	13
Crude oil and oil products	16 598 846 (64%)	9 158 915 (36%)	25 757 761	67
Solid bulk	6 897 397 (93%)	515 691 (7%)	7 413 088	19
Total	24 804 064 (65%)	13 650 309 (35%)	38 454 373	100

7.2.1 Gases

The share of bulk transportations represented by gases was 1%, in total 0.4 million tonnes. The volume imported was about 290 000 tonnes, and that exported about 84 000 tonnes.

The majority of gases were flammable gases, about 86%. About 13% were toxic gases; the share of non-toxic, non-flammable gases was less than 1%. The gases transported were mainly propane, vinyl chloride, ammonia, ethene and butadiene.

7.2.2 Chemicals

The share of bulk transportations represented by chemicals was 13%, in total 4.9 million tonnes. The volume imported was about 1.0 million tonnes, and that exported about 3.9 million tonnes.

In Table 11 the chemicals are broken down according to their marine pollutant properties in accordance with annex II of the MARPOL Convention (dangerous liquid substances transported as bulk cargo). The majority consisted of MARPOL class D substances (59%). The share of class C was 21%; that of class B, 8% and that of class A, 1%. The share of the substances referred to in annex II, appendix III of the MARPOL Convention was 11%.

Table 13 Transportations by ship of liquid chemicals in 2002.

Chemicals (MARPOL-class)	Import	Export	Total volume (import + export)	Share of chemical transport-ations
	(tn)	(tn)	(tn)	(%)
Class A “major hazard, serious harm”	2 883 (6%)	43 867 (94%)	46 750	1
Class B “hazard, harm”	101 862 (25%)	308 229 (75%)	410 091	8
Class C “minor hazard, minor harm”	188 667 (18%)	837 738 (82%)	1 026 405	21
Class D “recognizable hazard, minimal harm”	698 030 (24%)	2 205 538 (76%)	2 903 568	59
appendix III “other liquid substances”	23 082 (4%)	495 977 (96%)	519 059	11
Total	1 014 524 (21%)	3 891 349 (79%)	4 905 873	100

The most transported chemicals were ethylene glycol, methanol and sodium hydroxide solution. Table 12 lists the chemicals most handled in ports.

Table 14 Chemicals most handled in ports.

Chemicals	Total volume (import + export) (tn)	MARPOL-class
Ethylene glycol	1 195 700	D
Methanol	669 424	D
Sodium hydroxide solution	511 945	D
Phenol	349 898	C
Acetone	318 937	Appendix III
Phosphoric acid	257 824	D
Sulphuric acid	306 369	C
Styrene monomer	209 997	B
Xylene	175 393	C
Methyl tri-butyl ether	160 545	D

7.2.3 Crude oil and oil products

The share of bulk transportations represented by crude oil (10.4 million tonnes) and oil products (15.3 million tonnes) was 67%, in total about 25.8 million tonnes.

The import figure for crude oil was 10.3 million tonnes, while about 0.1 million tonnes were exported and the import figure for oil products was 6.3 million tonnes, while about 9 million tonnes were exported.

According to the Maritime Administration's statistics, Finland's internal traffic in oil was about 4 million tonnes.

7.2.4 Solid bulk

The share of bulk transportations represented by solid bulk was 19%, in total 7.4 million tonnes. Import accounted for 6.9 million tonnes of this, and export 0.5 million tonnes.

Coal (94%) accounted for the majority of solid bulk, totalling almost 7 million tonnes. In second place (3%) was quicklime, with a total of about 0.2 million tonnes.

7.3 Transportations by ship: general cargo

The share of all transportations by ship represented by general cargo (IMDG transportations) was only about 2%, in total 726 734 tonnes, which was split

almost equally between import and export. The volume imported was 383 073 tonnes (53%) and that exported 343 661 tonnes (47%).

Table 13 shows volumes of general cargo transported by ship, by transportation class.

Table 15 IMDG transportations during 2002, and comparison with transportations during 1997.

Transportation class (IMDG)	Import	Export	Total volume (import + export)	Share of IMDG transportations	Change in comparison to 1997
	(tn)	(tn)	(tn)	(%)	(%)
1	8 949 (93%)	689 (7%)	9 638	1.33	+ 80
2	38 487 (64%)	21 331 (36%)	59 818	8.23	+ 73
3	132 591 (53%)	115 871 (47%)	248 462	34.19	+ 104
4.1, 4.2, 4.3	10 867 (61%)	6 884 (39%)	17 751	2.44	- 17
5.1, 5.2	44 381 (44%)	55 686 (56%)	100 067	13.77	+ 28
6.1, 6.2	31 256 (64%)	17 337 (36%)	48 593	6.69	+ 13
7	50 (68%)	24 (32%)	74	0.01	- 74
8	77 380 (59%)	54 527 (41%)	131 907	18.15	+ 46
9	39 112 (35%)	71 312 (65%)	110 424	15.19	+ 92
Total	383 073 (53%)	343 661 (47%)	726 734	100	+ 61

The largest category of general cargo transported in 2002 was class 3 (flammable liquids) at about 34%. The next largest was class 8 (corrosive substances) with a share of about 18%. The share of class 9 was 15%. The combined share of class 5.1 (oxidising substances) and class 5.2 (organic peroxides) was just under 14%. Class 2 (gases) represented a share of about 8%. The combined share of class 6.1 (toxic substances) and class 6.2 (infectious substances) totalled just under 7%. The combined share of classes 4.1, 4.2 and 4.3 came to about 2.5%, and that of class 1 (explosives) to just over 1%. The share of class 7 (radioactive substances) was insignificant (0.01%).

Transportations of ***explosives (class 1)*** totalled about 9 600 tonnes. The majority of this was import, about 8 900 tonnes. The volume exported was about 700 tonnes.

Transportations of ***gases (class 2)*** totalled about 59 800 tonnes. The volume imported was about 38 500 tonnes, and that exported about 21 300 tonnes.

Transportations of ***flammable liquids (class 3)*** totalled about 248 500 tonnes. The volume imported was about 132 600 tonnes, and that exported about 115 900 tonnes.

Transportations of ***class 4.1, 4.2 and 4.3 substances*** totalled about 17 800 tonnes, of which import accounted for 10 900 tonnes and export about 6 900 tonnes.

Transportations of ***class 5.1 and 5.2 substances*** totalled about 100 100 tonnes, of which import accounted for about 44 400 tonnes and export about 55 700 tonnes.

Transportations of ***toxic (class 6.1) and infectious substances (class 6.2)*** totalled about 48 600 tonnes, of which import accounted for about 31 300 tonnes and export about 17 300 tonnes.

Transportations of ***radioactive material (class 7)*** totalled about 74 tonnes, of which import accounted for about 50 tonnes and export about 24 tonnes.

Transportations of ***corrosive substances (class 8)*** totalled about 131 900 tonnes, of which import accounted for about 77 400 tonnes and export about 54 500 tonnes.

Transportations of ***miscellaneous dangerous substances and articles (class 9)*** totalled about 110 400 tonnes, of which import accounted for 39 100 tonnes and export about 71 300 tonnes.

7.4 Transportations by ship: equipment

The majority (about 79%) of transportations by ship were carried out in tanker vessels (transportations of gases, liquid chemicals, oil products and crude oil). The share of solid bulk was about 19%. The share of packaged substances was just under 2%.

7.5 Transportations by inland waterway

According to the report, inland waterway transportations were carried out via three inland water ports only. At Varkaus, Savonlinna and Lappeenranta a total of 111 131 tonnes were transported. These transportations consisted entirely of solid bulk.

7.6 Transportations by ship: regional distribution and ports

The enclosed maps give a visual picture of the volumes of transportation by ship and the distribution of these transportations between different ports (maps M1–M5). The transportation volumes represent annual transportations. The figures on the maps are not quite exact: the volumes transported have been rounded for the maps. The unit is the tonne/year.

In terms of volumes transported (import + export) the largest ports in order of size were Kilpilahti, Naantali, Kotka, Helsinki, Pori, Rautaruukki and Hamina. All of these handled over a million tonnes of dangerous goods in 2002.

The largest importing ports (over a million tonnes per annum) were Kilpilahti, Naantali, Rautaruukki, Helsinki and Pori. The largest exporting ports were Kilpilahti, Kotka, Hamina and Naantali.

Gases were imported mainly via the ports of Kilpilahti and Tornio. Export took place from the ports of Kilpilahti, Hamina and Uusikaupunki. (See map M1)

Chemicals: the most important importation ports were Uusikaupunki, Kilpilahti, Rauma and Pietarsaari (import over 0.1 million. tn/p.a). Kotka was the largest export port (export over 1.8 million tonnes) which had no import of chemicals at all. Over 0.1 million tonnes of chemicals were also exported from Hamina, Kilpilahti, Kokkola, Pori and Uusikaupunki. (See map M2)

Crude oil and oil products: the majority of these were transported via the ports of Kilpilahti (total transportations 16.6 million tonnes), Naantali (total 3.8 million tonnes) and Hamina (total 1 million tonnes). (See map M3)

Solid bulk (94% coal) was transported primarily via the ports of Rautaruukki (total transportations 17.3 million tonnes) and Pori (total 1.3 million tonnes). Over 0.4 million tonnes were also imported via Helsinki, Naantali, Kristiinankaupunki, Inkoonen and Vaasa. (See map M4)

IMDG transportations: the majority of these were carried out via the ports of Helsinki, Turku and Naantali. (See map M5)

8 DISTRIBUTION OF DANGEROUS GOODS BY CLASS IN THE VARIOUS FORMS OF TRANSPORTATION

Table 15 shows the distribution of dangerous goods by class in road and railway transportations, in general cargo transportations by ship and in air transportations.

Table 16 Distribution by class of transportations by road, rail, ship (IMDG) and air.

Transportation class	Road transportations	Rail transportations	General cargo transportations by ship (IMDG)	Air transportations
	(%)	(%)	(%)	(%)
1	0.08	0.00	1.33	7.3
2	5.26	11.40	8.23	14.6
3	67.45	69.38	34.19	
4.1	0.46	0.89		28.9
4.2	0.02	0		0
4.3	0.06	0.06	2.44	0.4
5.1	4.81	2.00		0.5
5.2	0.12	0	13.77	0
6.1	4.73	1.18		0.8
6.2	0.00	0	6.69	0.9
7	(not included in report)	0	0.01	16.1
8	15.27	14.80	18.15	6.3
9	1.74	0.29	15.19	24.9
Total	*100*	*100*	*100*	*100*

In all forms of transportation, the largest share was that of transportations of flammable liquids (class 3). In transportations by road and by rail, the distribution between different classes of goods was similar. In contrast to the situation with land transportations, class 9 substances accounted for a large proportion of IMDG and air transportations. Radioactive material accounted for a considerable share of air transportations, as did classes 5.1 and 5.2 in the case of IMDG transportations.

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ANNEX 1 DANGEROUS GOODS CLASSES

Other than class 1, 2, 5.2, 6.2 and 7 substances and class 4.1 self reactive substances has defined packing group based on their danger characteristics:

- Packing group I: High danger substances;
- Packing group II: Medium danger substances; and
- Packing group III: Low danger substances.

Following definitions of Dangerous Goods classes has been taken from the Recommendations on the Transport of Dangerous Goods, published by the United Nations (2005).

Class 1 - Explosives

Definitions and general provisions

Class 1 comprises:

a) Explosive substances (a substance which is not itself an explosive but which can form an explosive atmosphere of gas, vapour or dust is not included in Class 1), except those that are too dangerous to transport or those where the predominant hazard is appropriate to another class;
b) Explosive articles, except devices containing explosive substances in such quantity or of such a character that their inadvertent or accidental ignition or initiation during transport shall not cause any effect external to the device either by projection, fire, smoke, heat or loud noise; and
c) Substances and articles not mentioned under (a) and (b) which are manufactured with a view to producing a practical, explosive or pyrotechnic effect. Transport of explosive substances which are unduly sensitive or so reactive as to be subject to spontaneous reaction is prohibited.

Definitions

For the purposes of these Regulations, the following definitions apply:

a) Explosive substance is a solid or liquid substance (or a mixture of substances) which is in itself capable by chemical reaction of producing gas at such a temperature and pressure and at such a speed as to cause damage to the surroundings. Pyrotechnic substances are included even when they do not evolve gases;
b) Pyrotechnic substance is a substance or a mixture of substances designed to produce an effect by heat, light, sound, gas or smoke or a combination of these as the result of non-detonative self-sustaining exothermic chemical reactions;
c) Explosive article is an article containing one or more explosive substances.

Divisions

Class 1 is divided into six divisions as follows:

a) Division 1.1 Substances and articles which have a mass explosion hazard (a mass explosion is one which affects almost the entire load virtually instantaneously);
b) Division 1.2 Substances and articles which have a projection hazard but not a mass explosion hazard;
c) Division 1.3 Substances and articles which have a fire hazard and either a minor blast hazard or a minor projection hazard or both, but not a mass explosion hazard. This division comprises substances and articles: (i) which give rise to considerable radiant heat; or (ii) which burn one after another, producing minor blast or projection effects or both;
d) Division 1.4 Substances and articles which present no significant hazard This division comprises substances and articles which present only a small hazard in the event of ignition or initiation during transport. The effects are largely confined to the package and no projection of fragments of appreciable size or range is to be expected. An external fire shall not cause virtually instantaneous explosion of almost the entire contents of the package;
e) Division 1.5 Very insensitive substances which have a mass explosion hazard This division comprises substances which have a mass explosion hazard but are so insensitive that there is very little probability of initiation or of transition from burning to detonation under normal conditions of transport;

f) Division 1.6 Extremely insensitive articles which do not have a mass explosion hazard This division comprises articles which contain only extremely insensitive detonating substances and which demonstrate a negligible probability of accidental initiation or propagation.

Class 2 - Gases

Definitions and general provisions

A gas is a substance which:

a) At 50 ℃ has a vapour pressure greater than 300 kPa; or
b) Is completely gaseous at 20 ℃ at a standard pressure of 101.3 kPa.

The transport condition of a gas is described according to its physical state as:

a) Compressed gas – a gas which when packaged under pressure for transport is entirely gaseous at -50 ℃; this category includes all gases with a critical temperature less than or equal to -50 ℃;
b) Liquefied gas – a gas which when packaged under pressure for transport is partially liquid at temperatures above -50 ℃. A distinction is made between: High pressure liquefied gas – a gas with a critical temperature between -50 ℃ and +65 ℃, and Low pressure liquefied gas – a gas with a critical temperature above +65 ℃;
c) Refrigerated liquefied gas – a gas which when packaged for transport is made partially liquid because of its low temperature; or
d) Dissolved gas – a gas which when packaged under pressure for transport is dissolved in a liquid phase solvent.

The class comprises compressed gases, liquefied gases, dissolved gases, refrigerated liquefied gases, mixtures of one or more gases with one or more vapours of substances of other classes, articles charged with a gas and aerosols.

Divisions

Substances of Class 2 are assigned to one of three divisions based on the primary hazard of the gas during transport.

a) Division 2.1 Flammable gases. Gases which at 20 °C and a standard pressure of 101.3 kPa: (i) are ignitable when in a mixture of 13 per cent or less by volume with air; or (ii) have a flammable range with air of at least 12 percentage points regardless of the lower flammable limit. Flammability shall be determined by tests or by calculation in accordance with methods adopted by ISO (see ISO 10156:1996). Where insufficient data are available to use these methods, tests by a comparable method recognized by a national competent authority may be used;
b) Division 2.2 Non-flammable, non-toxic gases. Gases which: (i) are asphyxiant - gases which dilute or replace the oxygen normally in the atmosphere; or (ii) are oxidizing - gases which may, generally by providing oxygen, cause or contribute to the combustion of other material more than air does; or (iii) do not come under the other divisions;
c) Division 2.3 Toxic gases. Gases which: (i) are known to be so toxic or corrosive to humans as to pose a hazard to health; or (ii) are presumed to be toxic or corrosive to humans because they have an LC50 value equal to or less than 5000 ml/m3 (ppm).

Gases and gas mixtures with hazards associated with more than one division take the following precedence:

a) Division 2.3 takes precedence over all other divisions;
b) Division 2.1 takes precedence over Division 2.2.

Gases of Division 2.2, other than refrigerated liquefied gases, are not subject to these Regulations if they are transported at a pressure less than 280 kPa at 20 °C.

Class 3 - Flammable Liquids

Definition and general provisions

Class 3 includes the following substances:

a) Flammable liquids

b) Liquid desensitized explosives

Flammable liquids are liquids, or mixtures of liquids, or liquids containing solids in solution or suspension (for example, paints, varnishes, lacquers, etc., but not including substances otherwise classified on account of their dangerous characteristics) which give off a flammable vapour at temperatures of not more than 60 ℃, closed-cup test, or not more than 65.6 ℃, open-cup test, normally referred to as the flash point. This class also includes:

a) Liquids offered for transport at temperatures at or above their flash point; and
b) Substances that are transported or offered for transport at elevated temperatures in a liquid state and which give off a flammable vapour at a temperature at or below the maximum transport temperature.

Liquids with a flash point of more than 35 ℃ which do not sustain combustion need not be considered as flammable liquids for the purposes of these Regulations. Liquids are considered to be unable to sustain combustion for the purposes of these Regulations (i.e. they do not sustain combustion under defined test conditions) if: (a) They have passed a suitable combustibility test (b) Their fire point according to ISO 2592:2000 is greater than 100 ℃; or (c) They are water miscible solutions with a water content of more than 90% by mass. Liquid desensitized explosives are explosive substances which are dissolved or suspended in water or other liquid substances, to form an homogeneous liquid mixture to suppress their explosives properties.

Table Hazard grouping based on flammability

Packing group	Flash point (closed-cup)	Initial boiling point
I	--	≤ 35 °C
II	< 23 °C	> 35 °C
III	≥ 23 °C ≤ 60 °C	> 35 °C

Class 4 - Flammable Solids; Substances Liable to Spontaneous Combustion; Substances which in Contact with Water Emit Flammable Gases

Definitions and general provisions

Class 4 is divided into three divisions as follows:

a) Division 4.1 Flammable solids. Solids which, under conditions encountered in transport, are readily combustible or may cause or contribute to fire through friction; self-reactive substances which are liable to undergo a strongly exothermic reaction; solid desensitized explosives which may explode if not diluted sufficiently;
b) Division 4.2 Substances liable to spontaneous combustion. Substances which are liable to spontaneous heating under normal conditions encountered in transport, or to heating up in contact with air, and being then liable to catch fire;
c) Division 4.3 Substances which in contact with water emit flammable gases. Substances which, by interaction with water, are liable to become spontaneously flammable or to give off flammable gases in dangerous quantities.

Division 4.1 - Flammable solids, self-reactive substances and solid desensitized explosives

Division 4.1 includes the following types of substances:

a) Flammable solids
b) Self-reactive substances and
c) Solid desensitized explosives.

Division 4.1 Flammable solids

Definitions and properties

Flammable solids are readily combustible solids and solids which may cause fire through friction. Readily combustible solids are powdered, granular, or pasty substances which are dangerous if they can be easily ignited by brief contact with an ignition source, such as a burning match, and if the flame spreads rapidly. The danger may come not only from the fire but also from toxic combustion products. Metal powders are especially dangerous because of the difficulty of extinguishing a fire since normal extinguishing agents such as carbon dioxide or water can increase the hazard.

Division 4.1 Self-reactive substances

Definitions and properties

For the purposes of these Regulations: Self-reactive substances are thermally unstable substances liable to undergo a strongly exothermic decomposition even without participation of oxygen (air). Substances are not considered to be self-reactive substances of Division 4.1, if:

a) They are explosives according to the criteria of Class 1;
b) They are oxidizing substances according to the classification procedure for Division 5.1 except that mixtures of oxidizing substances which contain 5.0% or more of combustible organic substances shall be subjected to the classification procedure defined in Note 3;
c) They are organic peroxides according to the criteria of Division 5.2;
d) Their heat of decomposition is less than 300 J/g; or
e) Their self-accelerating decomposition temperature (SADT) is greater than 75 °C for a 50 kg package.

The decomposition of self-reactive substances can be initiated by heat, contact with catalytic impurities (e.g. acids, heavy-metal compounds, bases), friction or impact. The rate of decomposition increases with temperature and varies with the substance. Decomposition, particularly if no ignition occurs, may result in the evolution of toxic gases or vapours. For certain self-reactive substances, the temperature shall be controlled. Some self-reactive substances may decompose explosively, particularly if confined. This characteristic may be modified by the addition of diluents or by the use of appropriate packagings. Some self-reactive substances burn vigorously.

Division 4.1 Solid desensitized explosives

Definition

Solid desensitized explosives are explosive substances which are wetted with water or alcohols or are diluted with other substances, to form a homogeneous solid mixture to suppress their explosive properties. Substances that: (a) have been provisionally accepted into Class 1 according to Test Series 1 and 2 but exempted from Class 1 by Test Series 6; (b) are not self-reactive substances of Division 4.1; (c) are not substances of Class 5; are also assigned to Division 4.1.

Division 4.2 - Substances liable to spontaneous combustion

Definitions and properties

Division 4.2 includes: (a) Pyrophoric substances, which are substances, including mixtures and solutions (liquid or solid), which even in small quantities ignite within five minutes of coming in contact with air. These are the Division 4.2 substances are the most liable to spontaneous combustion; and (b) Self-heating substances, which are substances, other than pyrophoric substances, which in contact with air without energy supply are liable to self-heating. These substances will ignite only when in large amounts (kilograms) and after long periods of time (hours or days). Self-heating of substances, leading to spontaneous combustion, is caused by reaction of the substance with oxygen (in the air) and the heat developed not being conducted away rapidly enough to the surroundings. Spontaneous combustion occurs when the rate of heat production exceeds the rate of heat loss and the auto-ignition temperature is reached.

Division 4.3 - Substances which in contact with water emit flammable gases

Definitions and properties

Certain substances in contact with water may emit flammable gases that can form explosive mixtures with air. Such mixtures are easily ignited by all

ordinary sources of ignition, for example naked lights, sparking handtools or unprotected light bulbs. The resulting blast wave and flames may endanger people and the environment. The test method referred to in 2.4.4.2 is used to determine whether the reaction of a substance with water leads to the development of a dangerous amount of gases which may be flammable. This test method shall not be applied to pyrophoric substances.

Class 5 - Oxidizing Substances and Organic Peroxides

Definitions and general provisions

Class 5 is divided into two divisions as follows:

a) Division 5.1 Oxidizing substances. Substances which, while in themselves not necessarily combustible, may, generally by yielding oxygen, cause, or contribute to, the combustion of other material. Such substances may be contained in an article;
b) Division 5.2 Organic peroxides. Organic substances which contain the bivalent -0-0- structure and may be considered derivatives of hydrogen peroxide, where one or both of the hydrogen atoms have been replaced by organic radicals. Organic peroxides are thermally unstable substances, which may undergo exothermic self-accelerating decomposition. In addition, they may have one or more of the following properties: (i) be liable to explosive decomposition; (ii) burn rapidly; (iii) be sensitive to impact or friction; (iv) react dangerously with other substances; (v) cause damage to the eyes.

Division 5.1 - Oxidizing substances

Oxidizing solids

Assignment of packing groups

Solid oxidizing substances are assigned to a packing group according to the test procedure in the Manual of Tests and Criteria, in accordance with the following criteria:

a) Packing group I: any substance which, in the 4:1 or 1:1 sample-to-cellulose ratio (by mass) tested, exhibits a mean burning time less than the mean burning time of a 3:2 mixture, by mass, of potassium bromate and cellulose;
b) Packing group II: any substance which, in the 4:1 or 1:1 sample-to-cellulose ratio (by mass) tested, exhibits a mean burning time equal to or less than the mean burning time of a 2:3 mixture (by mass) of potassium bromate and cellulose and the criteria for packing group I are not met;
c) Packing group III: any substance which, in the 4:1 or 1:1 sample-to-cellulose ratio (by mass) tested, exhibits a mean burning time equal to or less than the mean burning time of a 3:7 mixture (by mass) of potassium bromate and cellulose and the criteria for packing groups I and II are not met;
d) Not Division 5.1: any substance which, in both the 4:1 and 1:1 sample-to-cellulose ratio (by mass) tested, does not ignite and burn, or exhibits mean burning times greater than that of a 3:7 mixture (by mass) of potassium bromate and cellulose.

Oxidizing liquids

Assignment of packing groups

Liquid oxidizing substances are assigned to a packing group according to the test procedure in the

Manual of Tests and Criteria, in accordance with the following criteria:

a) Packing group I: any substance which, in the 1:1 mixture, by mass, of substance and cellulose tested, spontaneously ignites; or the mean pressure rise time of a 1:1 mixture, by mass, of substance and cellulose is less than that of a 1:1 mixture, by mass, of 50% perchloric acid and cellulose;
b) Packing group II: any substance which, in the 1:1 mixture, by mass, of substance and cellulose tested, exhibits a mean pressure rise time less than or equal to the mean pressure rise time of a 1:1 mixture, by mass, of 40% aqueous sodium chlorate solution and cellulose; and the criteria for packing group I are not met;
c) Packing group III: any substance which, in the 1:1 mixture, by mass, of substance and cellulose tested, exhibits a mean pressure rise time less than or equal to the mean pressure rise time of a 1:1

mixture, by mass, of 65% aqueous nitric acid and cellulose; and the criteria for packing groups I and II are not met;

d) Not Division 5.1: any substance which, in the 1:1 mixture, by mass, of substance and cellulose tested, exhibits a pressure rise of less than 2070 kPa gauge; or exhibits a mean pressure rise time greater than the mean pressure rise time of a 1:1 mixture, by mass, of 65% aqueous nitric acid and cellulose.

Division 5.2 - Organic peroxides

Properties

Organic peroxides are liable to exothermic decomposition at normal or elevated temperatures. The decomposition can be initiated by heat, contact with impurities (e.g. acids, heavy-metal compounds, amines), friction or impact. The rate of decomposition increases with temperature and varies with the organic peroxide formulation. Decomposition may result in the evolution of harmful, or flammable, gases or vapours. For certain organic peroxides the temperature shall be controlled during transport. Some organic peroxides may decompose explosively, particularly if confined. This characteristic may be modified by the addition of diluents or by the use of appropriate packagings. Many organic peroxides burn vigorously. Contact of organic peroxides with the eyes is to be avoided. Some organic peroxides will cause serious injury to the cornea, even after brief contact, or will be corrosive to the skin.

Class 6 - Toxic and Infectious Substances

Definitions

Class 6 is divided into two divisions as follows:

a) Division 6.1 Toxic substances. These are substances liable either to cause death or serious injury or to harm human health swallowed or inhaled or by skin contact;

b) Division 6.2 Infectious substances. These are substances known or reasonably expected to contain pathogens. Pathogens are defined

as micro-organisms (including bacteria, viruses, rickettsiae, parasites, fungi) and other agents such as prions, which can cause disease in humans or animals.

Division 6.1 - Toxic substances

Definitions

For the purposes of these Regulations:

- LD50 (median lethal dose) for acute oral toxicity is the statistically derived single dose of a substance that can be expected to cause death within 14 days in 50 per cent of young adult albino rats when administered by the oral route. The LD50 value is expressed in terms of mass of test substance per mass of test animal (mg/kg).
- LD50 for acute dermal toxicity is that dose of the substance which, administered by continuous contact for 24 hours with the bare skin of albino rabbits, is most likely to cause death within 14 days in one half of the animals tested. The number of animals tested shall be sufficient to give a statistically significant result and be in conformity with good pharmacological practice. The result is expressed in milligrams per kg body mass.
- LC50 for acute toxicity on inhalation is that concentration of vapour, mist or dust which, administered by continuous inhalation to both male and female young adult albino rats for one hour, is most likely to cause death within 14 days in one half of the animals tested. A solid substance shall be tested if at least 10% (by mass) of its total mass is likely to be dust in a respirable range, e.g. the aerodynamic diameter of that particlefraction is 10 microns or less. A liquid substance shall be tested if a mist is likely to be generated in a leakage of the transport containment. Both for solid and liquid substances more than 90% (by mass) of a specimen prepared for inhalation toxicity shall be in the respirable range as defined above. The result is expressed in milligrams per litre of air for dusts and mists or in millilitres per cubic metre of air (parts per million) for vapours.

Assignment of packing groups

Substances of Division 6.1, including pesticides, are allocated among the three packing groups according to their degree of toxic hazard in transport as follows:

a) Packing group I: Substances and preparations presenting a very severe toxicity risk;
b) Packing group II: Substances and preparations presenting a serious toxicity risk;
c) Packing group III: Substances and preparations presenting a relatively low toxicity risk.

In making this grouping, account shall be taken of human experience in instances of accidental poisoning and of special properties possessed by any individual substance, such as liquid state, high volatility, any special likelihood of penetration, and special biological effects. In the absence of human experience the grouping shall be based on data obtained from animal experiments. Three possible routes of administration shall be examined. These routes are exposure through:

a) Oral ingestion;
b) Dermal contact; and
c) Inhalation of dusts, mists, or vapours.

When a substance exhibits a different order of toxicity by two or more of these routes of administration, the highest degree of danger indicated by the tests shall be assigned. The criteria to be applied for grouping a substance according to the toxicity it exhibits by all three routes of administration are presented in the following paragraphs. The grouping criteria for the oral and dermal routes as well as for inhalation of dusts and mists are as shown in the following table.

Table Grouping Criteria for Administration through Oral Ingestion, Dermal Contact and Inhalation of Dusts and Mists

Packing group	Oral toxicity LD50 (mg/kg)	Dermal toxicity LD50 (mg/kg)	Inhalation toxicity by dusts and mists LC50 (mg/l)
I	≤ 5.0	≤ 50	≤ 0.2
II	> 5.0 and ≤ 50	> 50 and ≤ 200	> 0.2 and ≤ 2.0
III	> 50 and ≤ 300	> 200 and ≤ 1000	> 2.0 and ≤ 4.0

Division 6.2 - Infectious substances

Definitions

For the purposes of these Regulations:

- Infectious substances are substances which are known or are reasonably expected to contain pathogens. Pathogens are defined as micro-organisms (including bacteria, viruses, rickettsiae, parasites, fungi) and other agents such as prions, which can cause disease in humans or animals.
- Biological products are those products derived from living organisms which are manufactured and distributed in accordance with the requirements of appropriate national authorities, which may have special licensing requirements, and are used either for prevention, treatment, or diagnosis of disease in humans or animals, or for development, experimental or investigational purposes related thereto. They include, but are not limited to, finished or unfinished products such as vaccines.
- Cultures are the result of a process by which pathogens are intentionally propagated. This definition does not include human or animal patient specimens.
- Patient specimens are human or animal materials, collected directly from humans or animals, including, but not limited to, excreta, secreta, blood and its components, tissue and tissue fluid swabs, and body parts being transported for purposes such as research, diagnosis, investigational activities, disease treatment and prevention.
- Genetically modified micro-organisms and organisms are micro-organisms and organisms in which genetic material has been

purposely altered through genetic engineering in a way that does not occur naturally.

- Medical or clinical wastes are wastes derived from the medical treatment of animals or humans or from bio-research.

Class 7 - Radioactive Material

Definition of Class 7

Radioactive material means any material containing radionuclides where both the activity concentration and the total activity in the consignment exceed the values specified. The following radioactive materials are not included in Class 7 for the purposes of these Regulations:

a) Radioactive material that is an integral part of the means of transport;
b) Radioactive material moved within an establishment which is subject to appropriate safety regulations in force in the establishment and where the movement does not involve public roads or railways;
c) Radioactive material implanted or incorporated into a person or live animal for diagnosis or treatment;
d) Radioactive material in consumer products which have received regulatory approval, following their sale to the end user;
e) Natural material and ores containing naturally occurring radionuclides which are either in their natural state, or have only been processed for purposes other than for extraction of the radionuclides, and which are not intended to be processed for use of these radionuclides provided the activity concentration of the material does not exceed 10 times the values specified;
f) Non-radioactive solid objects with radioactive substances present on any surfaces in quantities not in excess of the limit set out in the definition for “contamination”.

Class 8 - Corrosive Substances

Definition

Class 8 substances (corrosive substances) are substances which, by chemical action, will cause severe damage when in contact with living tissue, or, in the case of leakage, will materially damage, or even destroy, other goods or the means of transport.

Assignment of packing groups

Substances and preparations of Class 8 are divided among the three packing groups according to their degree of hazard in transport as follows:

a) Packing group I: Very dangerous substances and preparations;
b) Packing group II: Substances and preparations presenting medium danger;
c) Packing group III: Substances and preparations presenting minor danger.

Allocation of substances listed in the Dangerous Goods List to the packing groups in Class 8 has been made on the basis of experience taking into account such additional factors as inhalation risk and reactivity with water (including the formation of dangerous decomposition products). New substances, including mixtures, can be assigned to packing groups on the basis of the length of time of contact necessary to produce full thickness destruction of human skin in accordance with the criteria. Liquids, and solids which may become liquid during transport, which are judged not to cause full thickness destruction of human skin shall still be considered for their potential to cause corrosion to certain metal surfaces in accordance with the criteria.

A substance or preparation meeting the criteria of Class 8 having an inhalation toxicity of dusts and mists (LC50) in the range of packing group I, but toxicity through oral ingestion or dermal contact only in the range of packing group III or less, shall be allocated to Class 8.

Packing groups are assigned to corrosive substances in accordance with the following criteria:

a) Packing group I is assigned to substances that cause full thickness destruction of intact skin tissue within an observation period up to 60 minutes starting after the exposure time of three minutes or less;

b) Packing group II is assigned to substances that cause full thickness destruction of intact skin tissue within an observation period up to 14 days starting after the exposure time of more than three minutes but not more than 60 minutes;
c) Packing group III is assigned to substances that: (i) cause full thickness destruction of intact skin tissue within an observation period up to 14 days starting after the exposure time of more than 60 minutes but not more than 4 hours; or (ii) are judged not to cause full thickness destruction of intact skin tissue but which exhibit a corrosion rate on steel or aluminium surfaces exceeding 6.25 mm a year at a test temperature of 55 °C.

Class 9 – Miscellaneous Dangerous Substances and Articles

Definitions

Class 9 substances and articles (miscellaneous dangerous substances and articles) are substances and articles which, during transport present a danger not covered by other classes. Genetically modified micro-organisms (GMMOs) and genetically modified organisms (GMOs) are micro-organisms and organisms in which genetic material has been purposely altered through genetic engineering in a way that does not occur naturally.

Assignment to Class 9

Class 9 includes, inter alia:

a) environmentally hazardous substances which are not covered by other classes;
b) elevated temperature substances (i.e. substances that are transported or offered for transport at temperatures equal to or exceeding 100°C in a liquid state or at temperatures equal or exceeding 240°C in a solid state);
c) GMMOs or GMOs which do not meet the definition of infectious substances but which are capable of altering animals, plants or microbiological substances in a way not normally the result of natural reproduction. They shall be assigned to UN 3245. GMMOs

or GMOs are not subject to these Regulations when authorized for use by the competent authorities of the Governments of the countries of origin, transit and destination.

Environmentally hazardous substances (aquatic environment)

General definitions

Environmentally hazardous substances include, inter alia, liquid or solid substances pollutant to the aquatic environment and solutions and mixtures of such substances (such as preparations and wastes). The aquatic environment may be considered in terms of the aquatic organisms that live in the water, and the aquatic ecosystem of which they are part1. The basis, therefore, of the identification of hazard is the aquatic toxicity of the substance or mixture, although this may be modified by further information on the degradation and bioaccumulation behaviour.

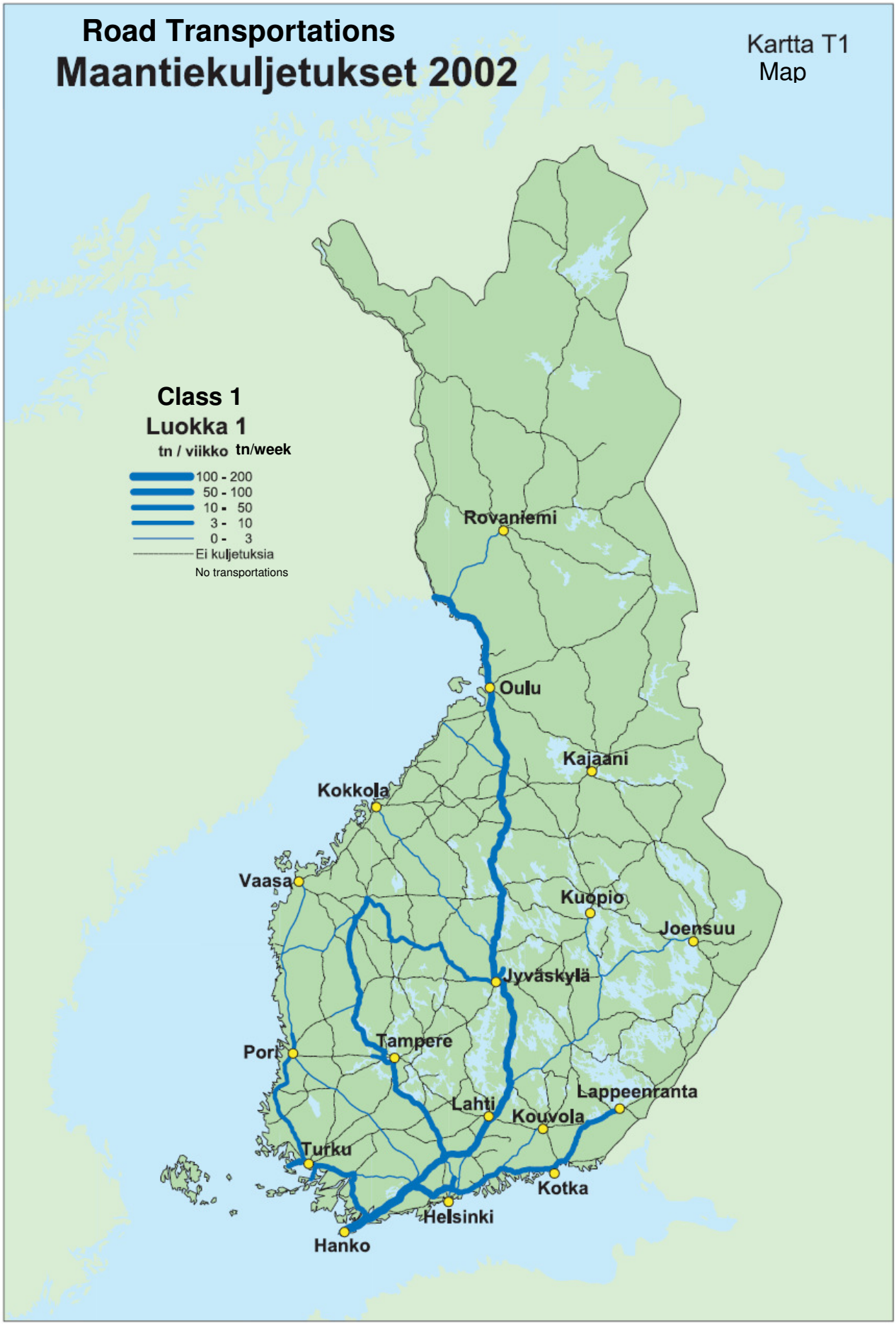
Definitions and data requirements

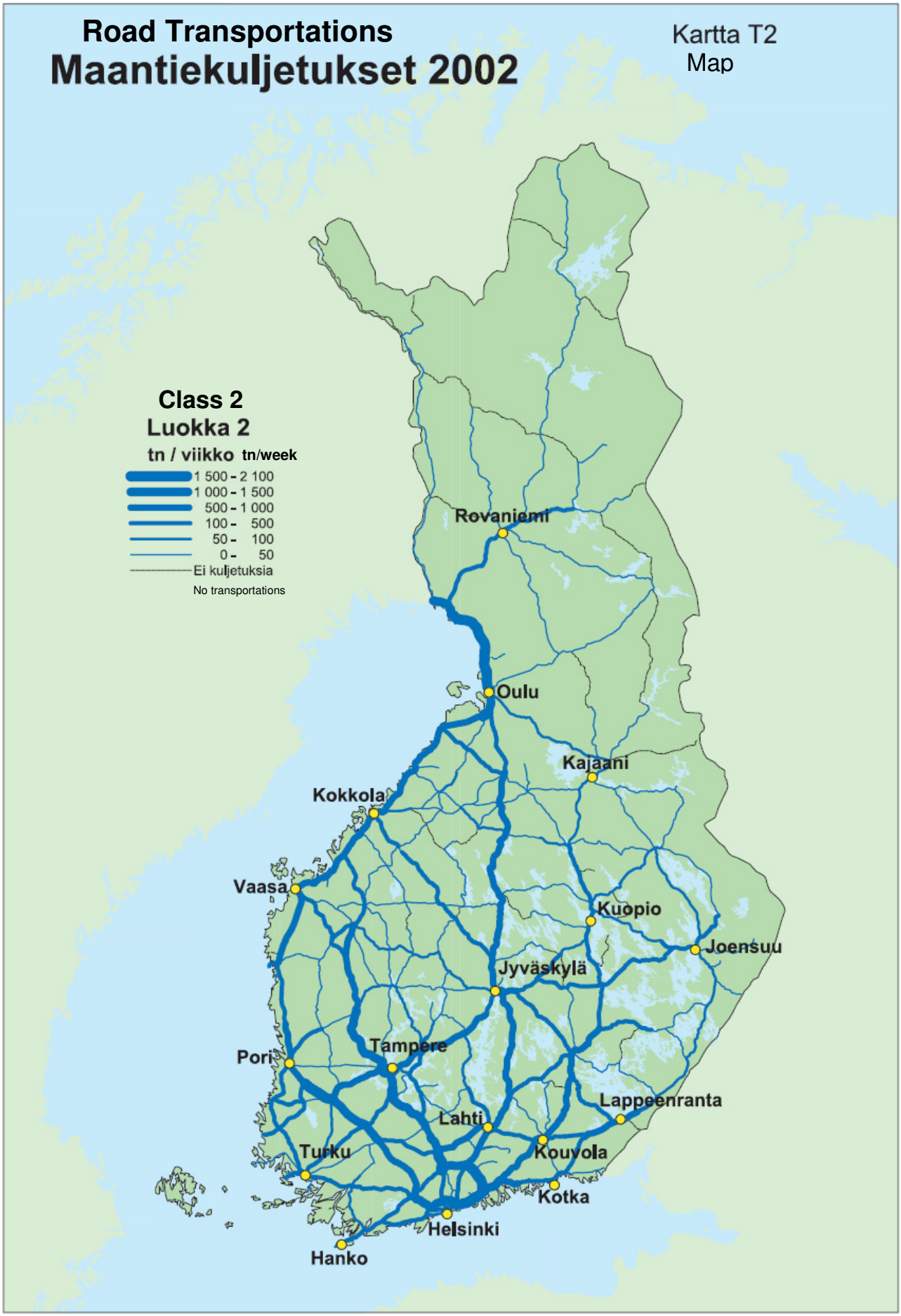
The basic elements for classification of environmentally hazardous substances (aquatic environment) are:

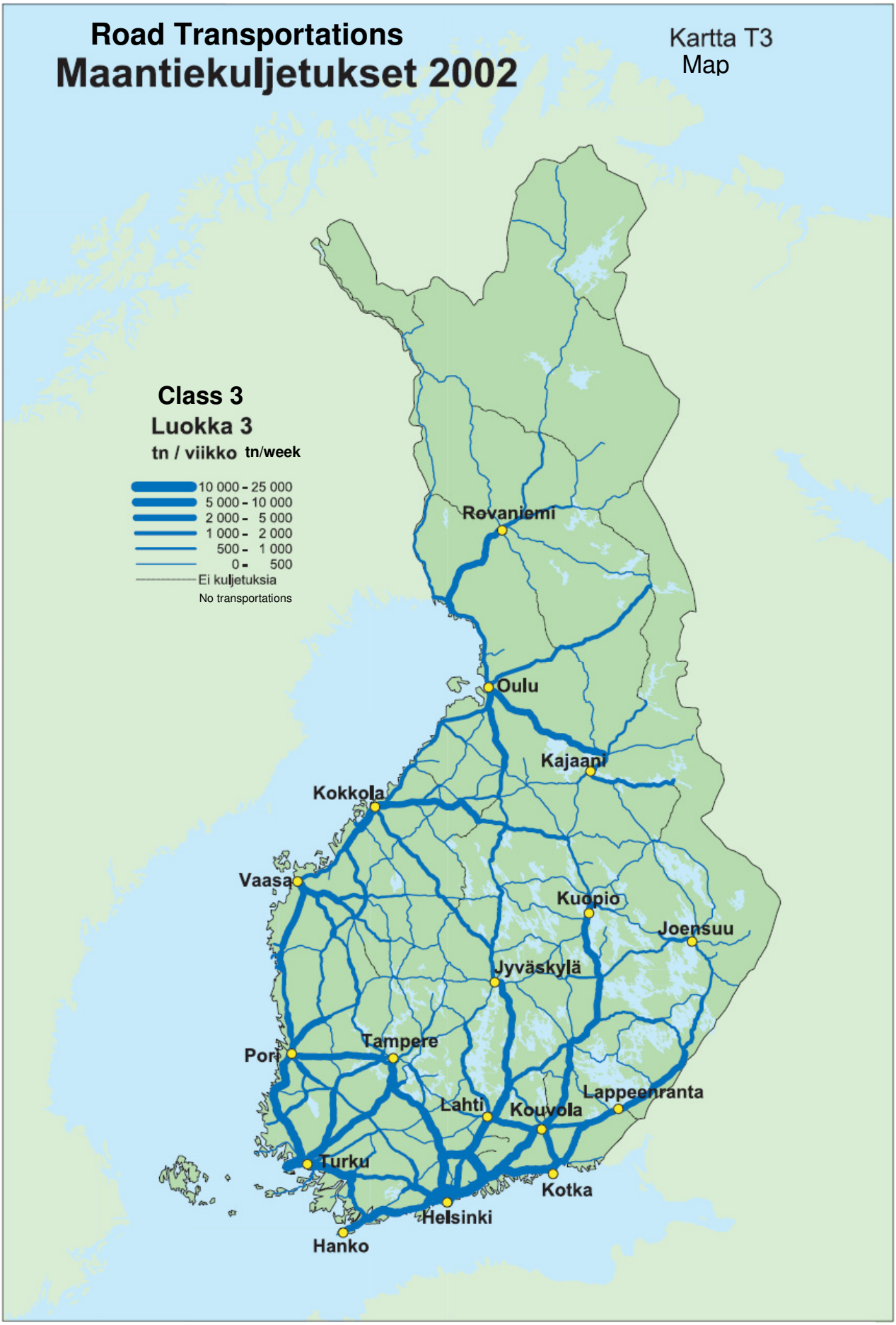
- acute aquatic toxicity;
- potential for or actual bioaccumulation;
- degradation (biotic or abiotic) for organic chemicals; and
- chronic aquatic toxicity.

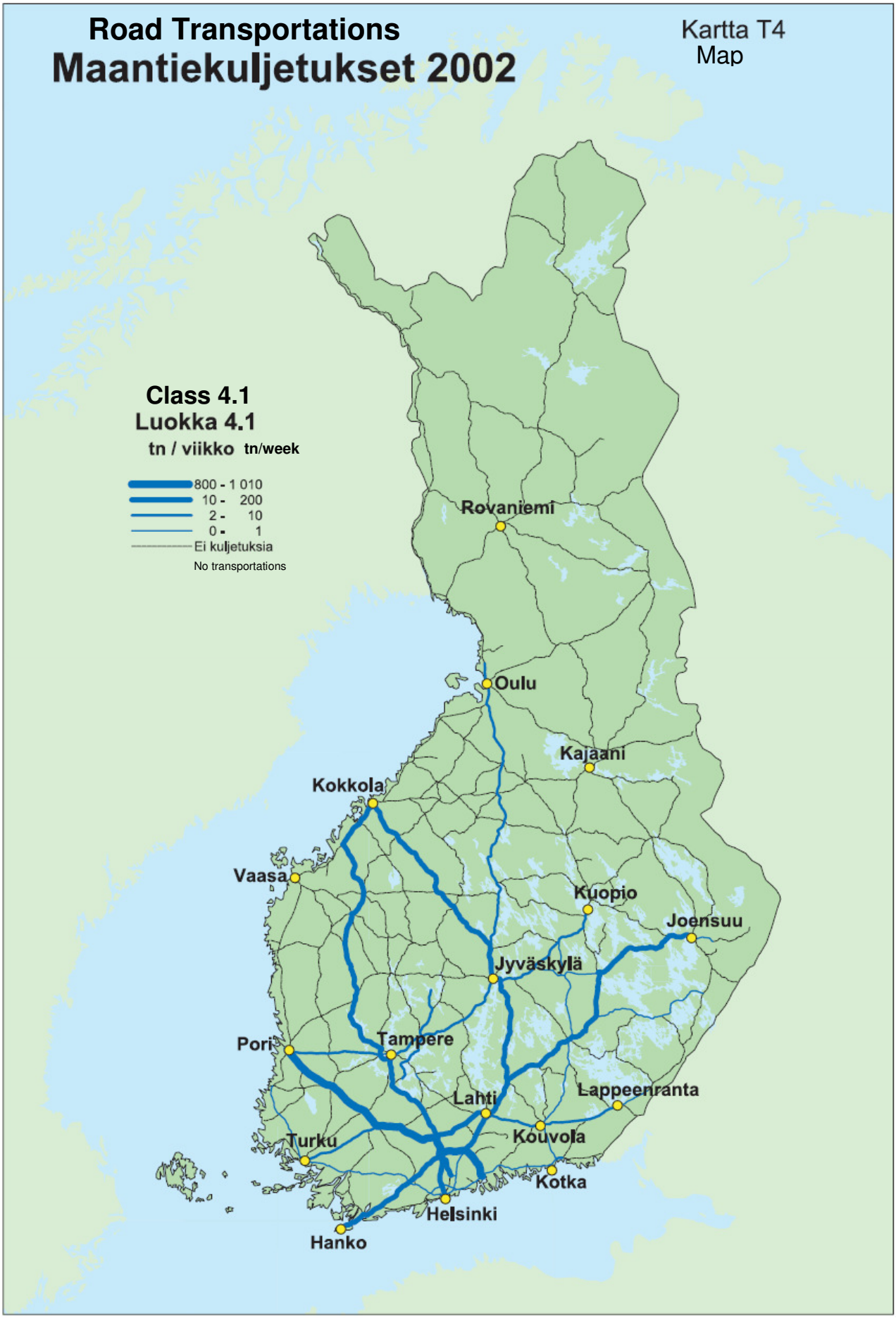
While data from internationally harmonised test methods are preferred, in practice, data from national methods may also be used where they are considered as equivalent. In general, freshwater and marine species toxicity data can be considered as equivalent data and are preferably to be derived using OECD Test Guidelines or equivalent according to the principles of Good Laboratory Practices (GLP). Where such data are not available, classification shall be based on the best available data.

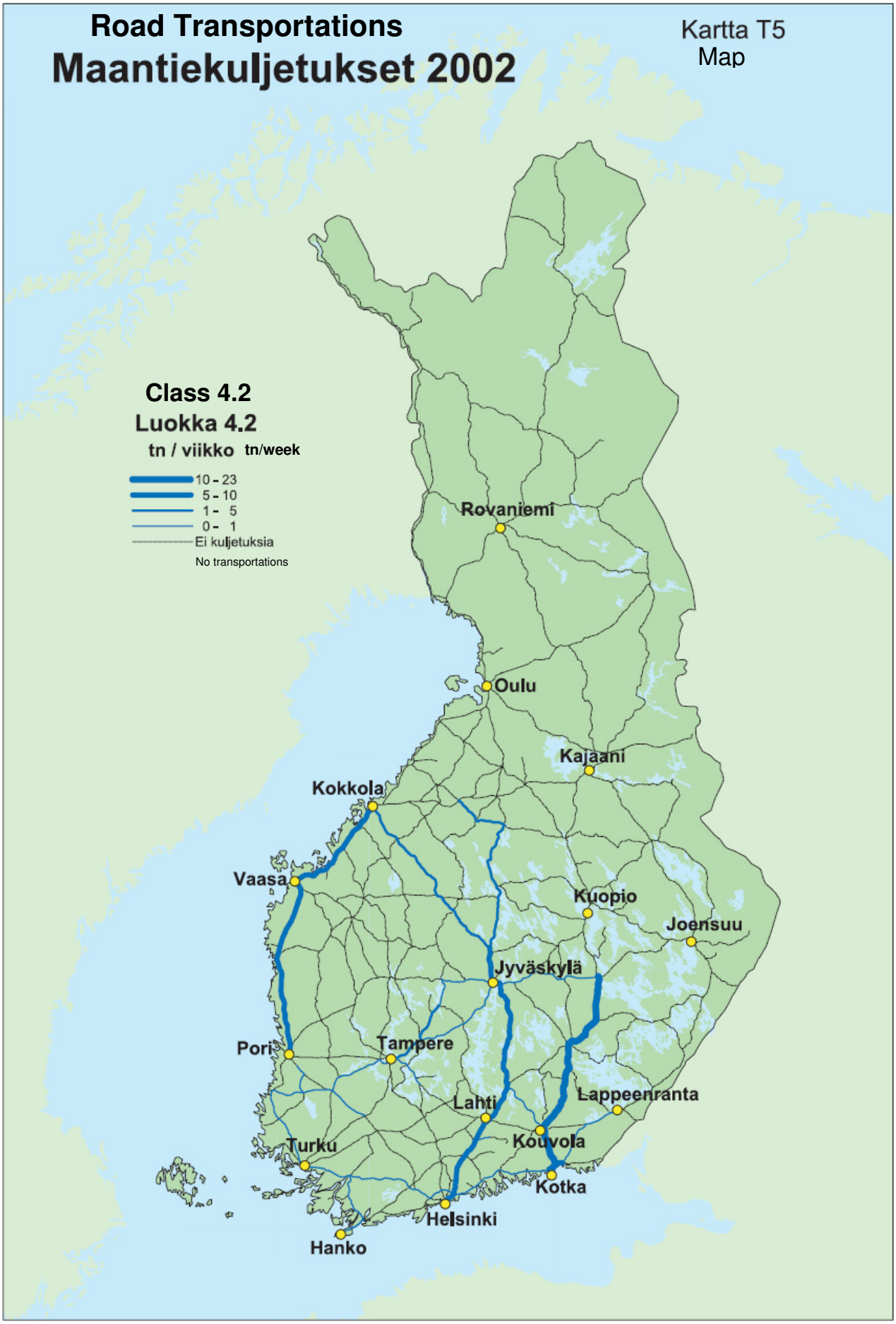
ANNEX 2 MAPS

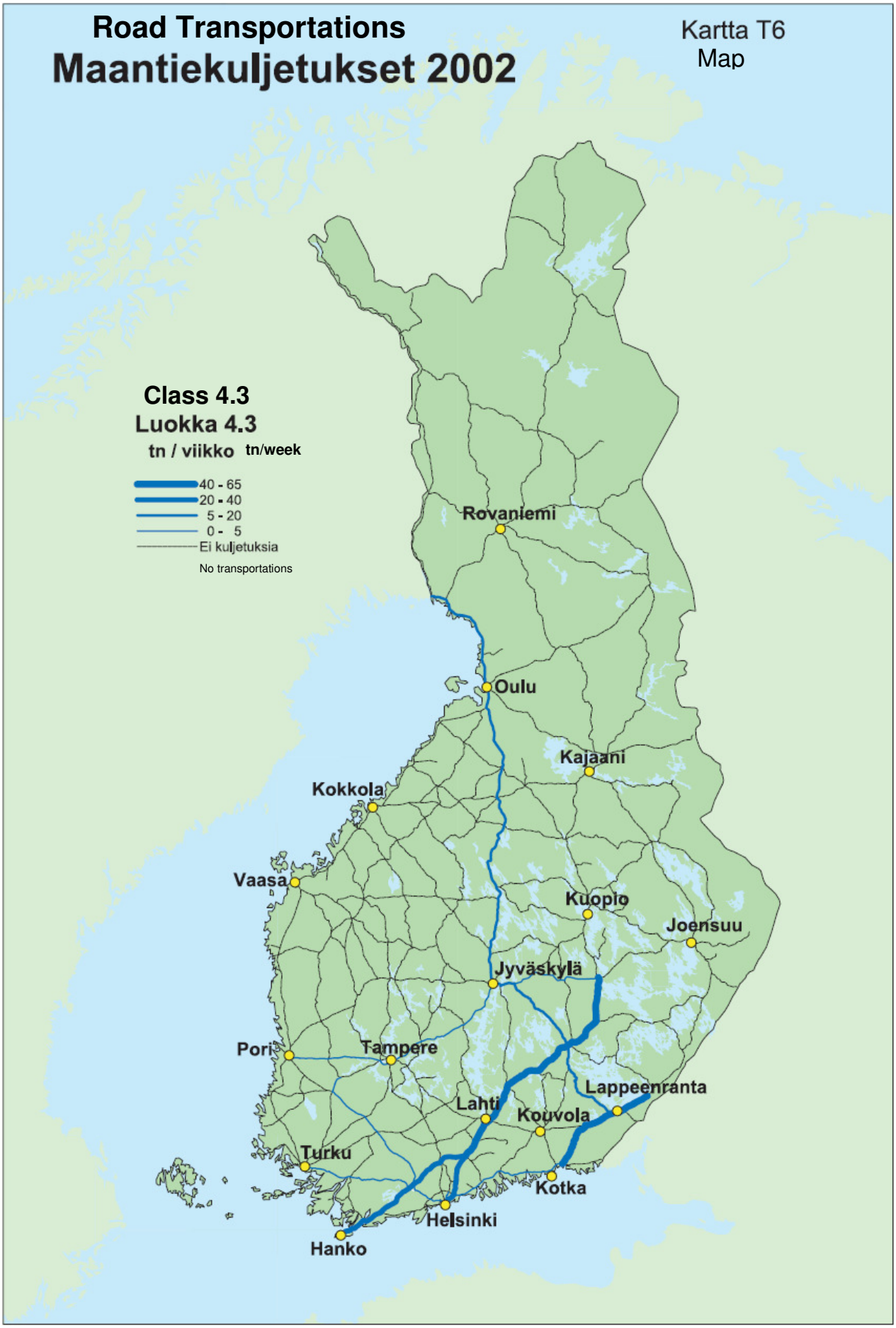

Road Transportations
Maantiekuljetukset 2002
Kartta T1
Map
Class 1
Luokka 1
tn / viikko tn/week
100 - 200
50 - 100
10 - 50
3 - 10
0 - 3
Ei kuljetuksia
No transportations
Rovaniemi
Oulu
Kajaani
Kokkola
Vaasa
Kuopio
Joensuu
Jyväskylä
Tampere
Pori
Lahti
Lappeenranta
Kouvola
Turku
Kotka
Helsinki
Hanko

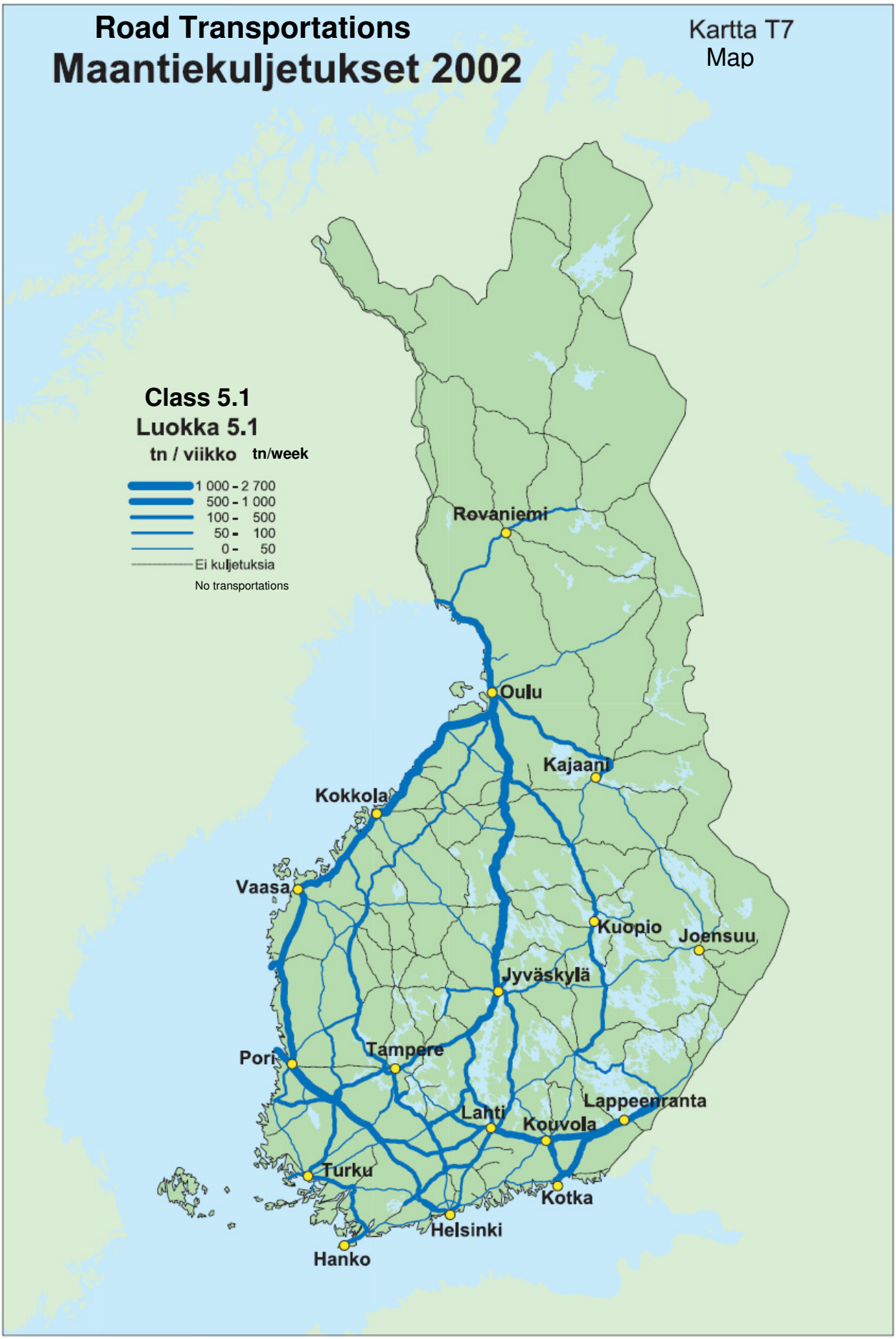

Road Transportations
Maantiekuljetukset 2002
Kartta T2
Map
Class 2
Luokka 2
tn / viikko tn/week
1 500 - 2 100
1 000 - 1 500
500 - 1 000
100 - 500
50 - 100
0 - 50
Ei kuljetuksia
No transportations
Rovaniemi
Oulu
Kajaani
Kokkola
Vaasa
Kuopio
Joensuu
Jyväskylä
Tampere
Pori
Lappeenranta
Lahti
Kouvola
Turku
Kotka
Helsinki
Hanko

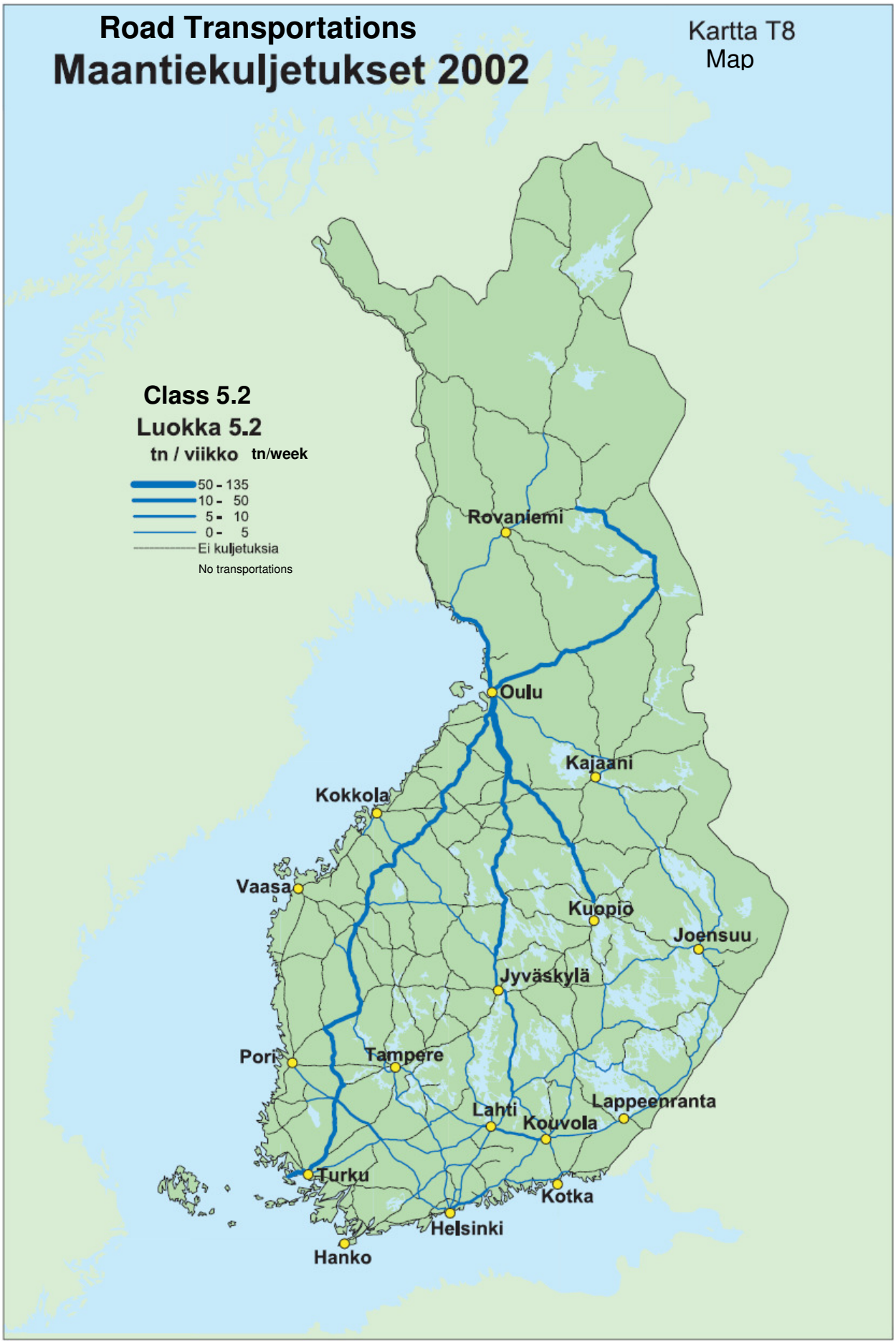

Road Transportations
Maantiekuljetukset 2002
Kartta T3
Map
Class 3
Luokka 3
tn / viikko tn/week
10 000 - 25 000
5 000 - 10 000
2 000 - 5 000
1 000 - 2 000
500 - 1 000
0 - 500
Ei kuljetuksia
No transportations
Rovaniemi
Oulu
Kajaani
Kokkola
Vaasa
Kuopio
Joensuu
Jyväskylä
Tampere
Pori
Lahti
Kouvola
Lappeenranta
Turku
Kotka
Helsinki
Hanko

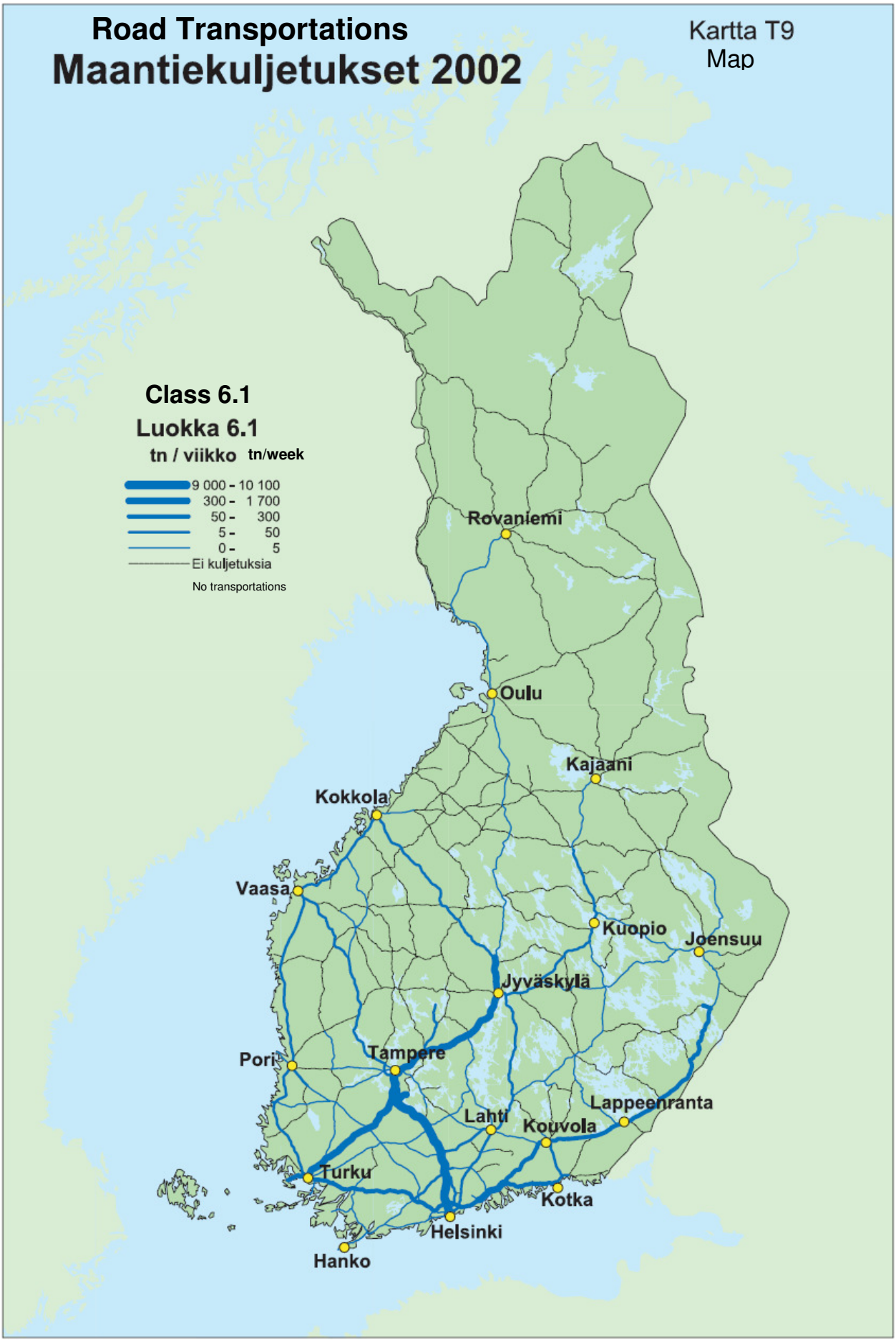

Road Transportations
Maantiekuljetukset 2002
Kartta T4
Map
Class 4.1
Luokka 4.1
tn / viikko tn/week
800 - 1 010
10 - 200
2 - 10
0 - 1
Ei kuljetuksia
No transportations
Rovaniemi
Oulu
Kajaani
Kokkola
Vaasa
Kuopio
Joensuu
Jyväskylä
Pori
Tampere
Lahti
Lappeenranta
Turku
Kouvola
Kotka
Helsinki
Hanko


Road Transportations
Maantiekuljetukset 2002
Kartta T5
Map
Class 4.2
Luokka 4.2
tn / viikko tn/week
10 - 23
5 - 10
1 - 5
0 - 1
Ei kuljetuksia
No transportations
Rovaniemi
Oulu
Kajaani
Kokkola
Vaasa
Kuopio
Joensuu
Jyväskylä
Pori
Tampere
Lahti
Lappeenranta
Kouvola
Turku
Kotka
Helsinki
Hanko


Road Transportations
Maantiekuljetukset 2002
Kartta T6
Map
Class 4.3
Luokka 4.3
tn / viikko tn/week
40 - 65
20 - 40
5 - 20
0 - 5
Ei kuljetuksia
No transportations
Rovaniemi
Oulu
Kajaani
Kokkola
Vaasa
Kuopio
Joensuu
Jyväskylä
Pori
Tampere
Lappeenranta
Lahti
Kouvola
Turku
Kotka
Helsinki
Hanko


Road Transportations
Maantiekuljetukset 2002
Kartta T7
Map
Class 5.1
Luokka 5.1
tn / viikko tn/week
1 000 - 2 700
500 - 1 000
100 - 500
50 - 100
0 - 50
Ei kuljetuksia
No transportations
Rovaniemi
Oulu
Kajaani
Kokkola
Vaasa
Kuopio
Joensuu
Jyväskylä
Pori
Tampere
Lahti
Lappeenranta
Kouvola
Turku
Kotka
Helsinki
Hanko


Road Transportations
Maantiekuljetukset 2002
Kartta T8
Map
Class 5.2
Luokka 5.2
tn / viikko tn/week
50 - 135
10 - 50
5 - 10
0 - 5
Ei kuljetuksia
No transportations
Rovaniemi
Oulu
Kajaani
Kokkola
Vaasa
Kuopio
Joensuu
Jyväskylä
Pori
Tampere
Lahti
Lappeenranta
Kouvola
Turku
Kotka
Helsinki
Hanko


Road Transportations
Maantiekuljetukset 2002
Kartta T9
Map
Class 6.1
Luokka 6.1
tn / viikko tn/week
9 000 - 10 100
300 - 1 700
50 - 300
5 - 50
0 - 5
Ei kuljetuksia
No transportations
Rovaniemi
Oulu
Kajaani
Kokkola
Vaasa
Kuopio
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Jyväskylä
Pori
Tampere
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Kouvola
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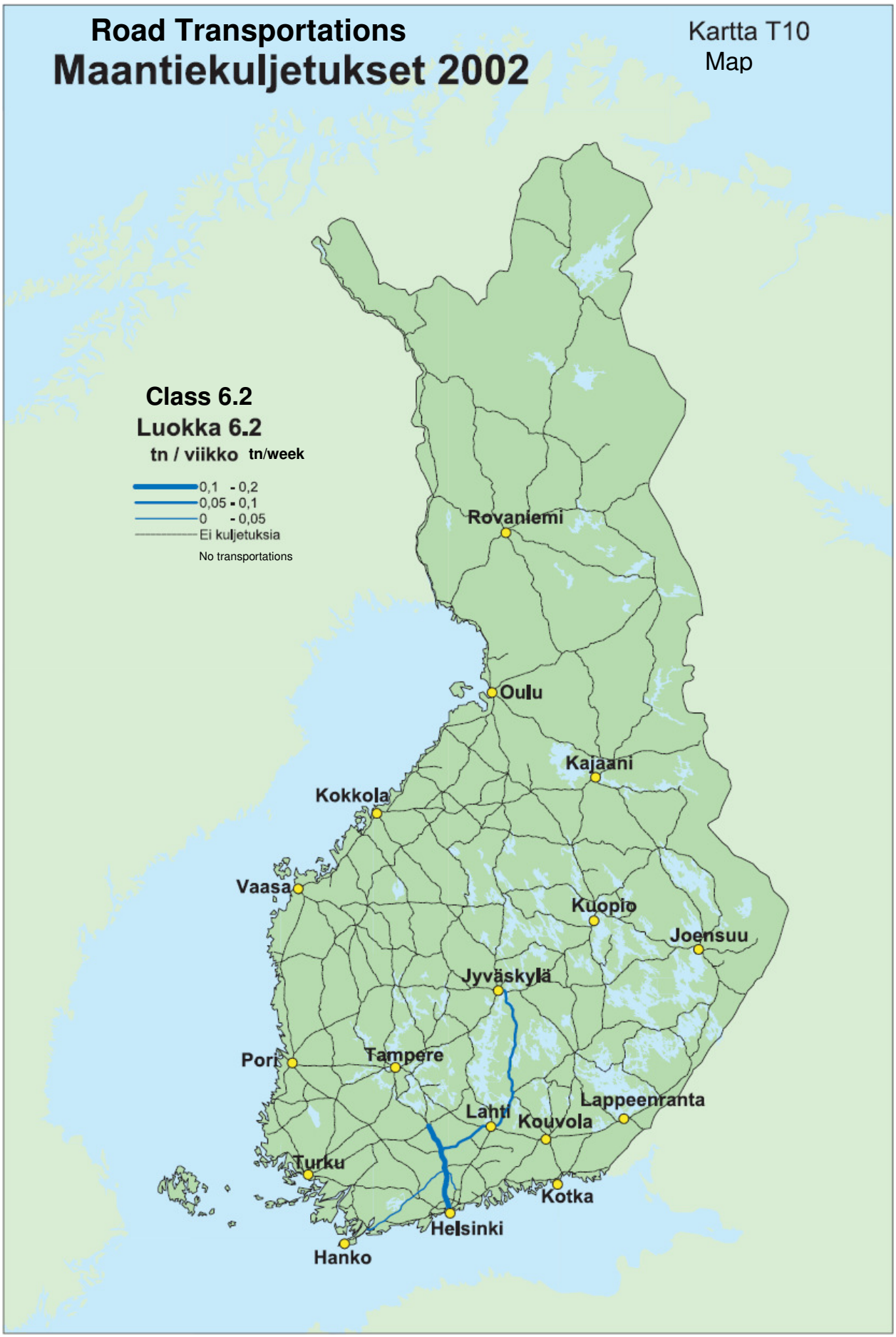
Hanko


Road Transportations
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Kartta T10
Map
Class 6.2
Luokka 6.2
tn / viikko tn/week
0,1 - 0,2
0,05 - 0,1
0 - 0,05
Ei kuljetuksia
No transportations
Rovaniemi
Oulu
Kajaani
Kokkola
Vaasa
Kuopio
Joensuu
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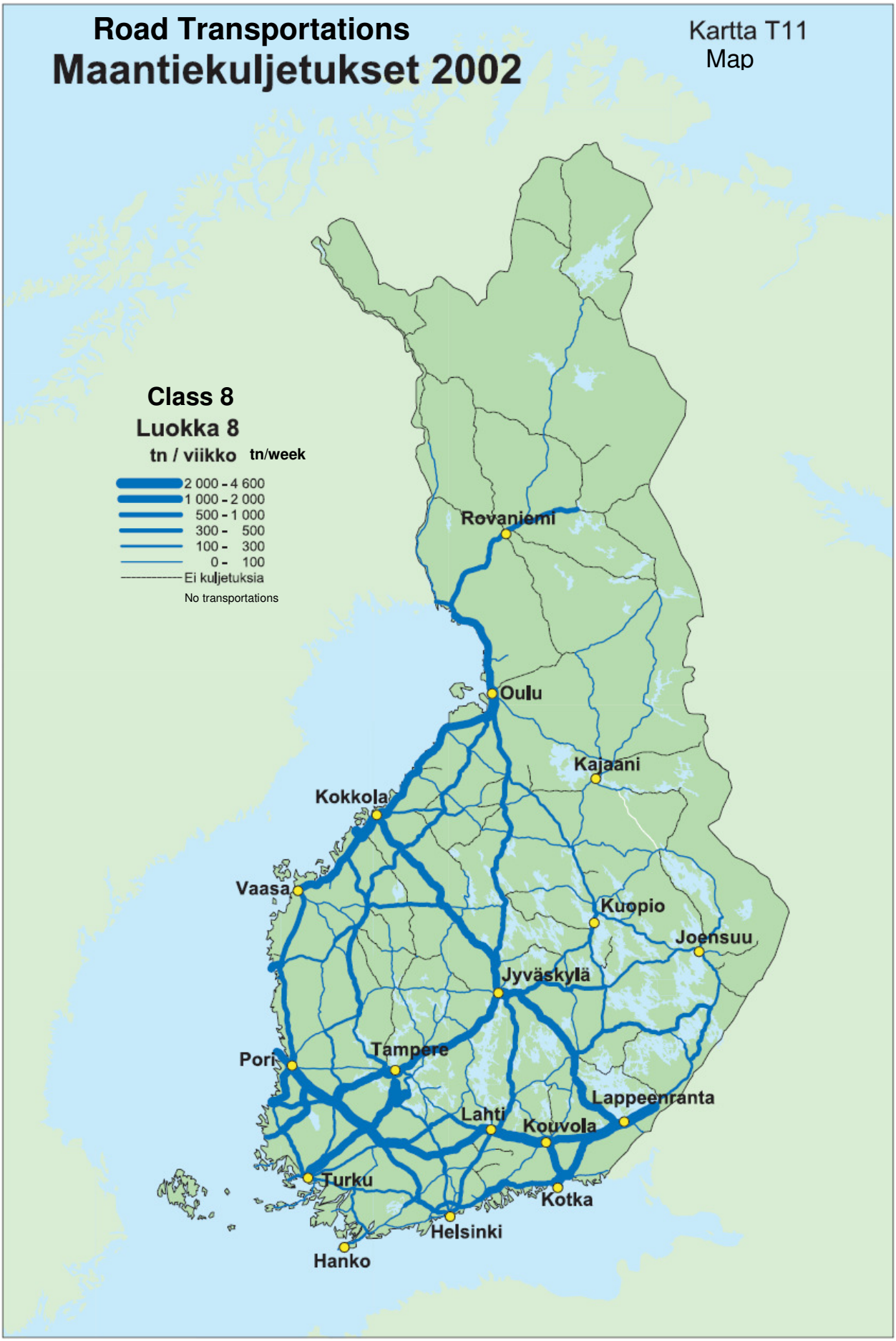
Road Transportations
Maantiekuljetukset 2002
Kartta T11
Map
Class 8
Luokka 8
tn / viikko tn/week
2 000 - 4 600
1 000 - 2 000
500 - 1 000
300 - 500
100 - 300
0 - 100
Ei kuljetuksia
No transportations
Rovaniemi
Oulu
Kajaani
Kokkola
Vaasa
Kuopio
Joensuu
Jyväskylä
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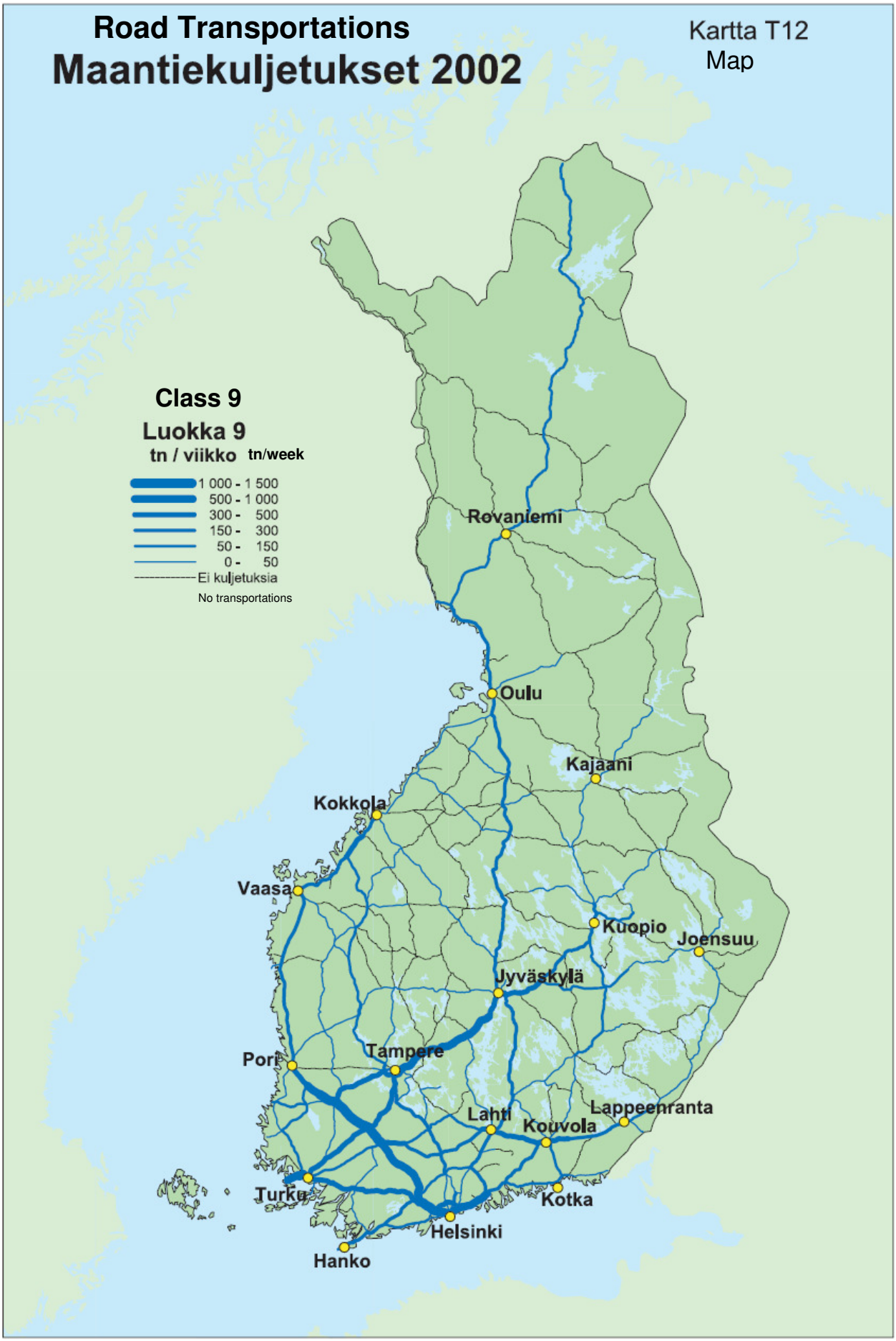
Road Transportations
Maantiekuljetukset 2002
Kartta T12
Map
Class 9
Luokka 9
tn / viikko tn/week
1 000 - 1 500
500 - 1 000
300 - 500
150 - 300
50 - 150
0 - 50
Ei kuljetuksia
No transportations
Rovaniemi
Oulu
Kajaani
Kokkola
Vaasa
Kuopio
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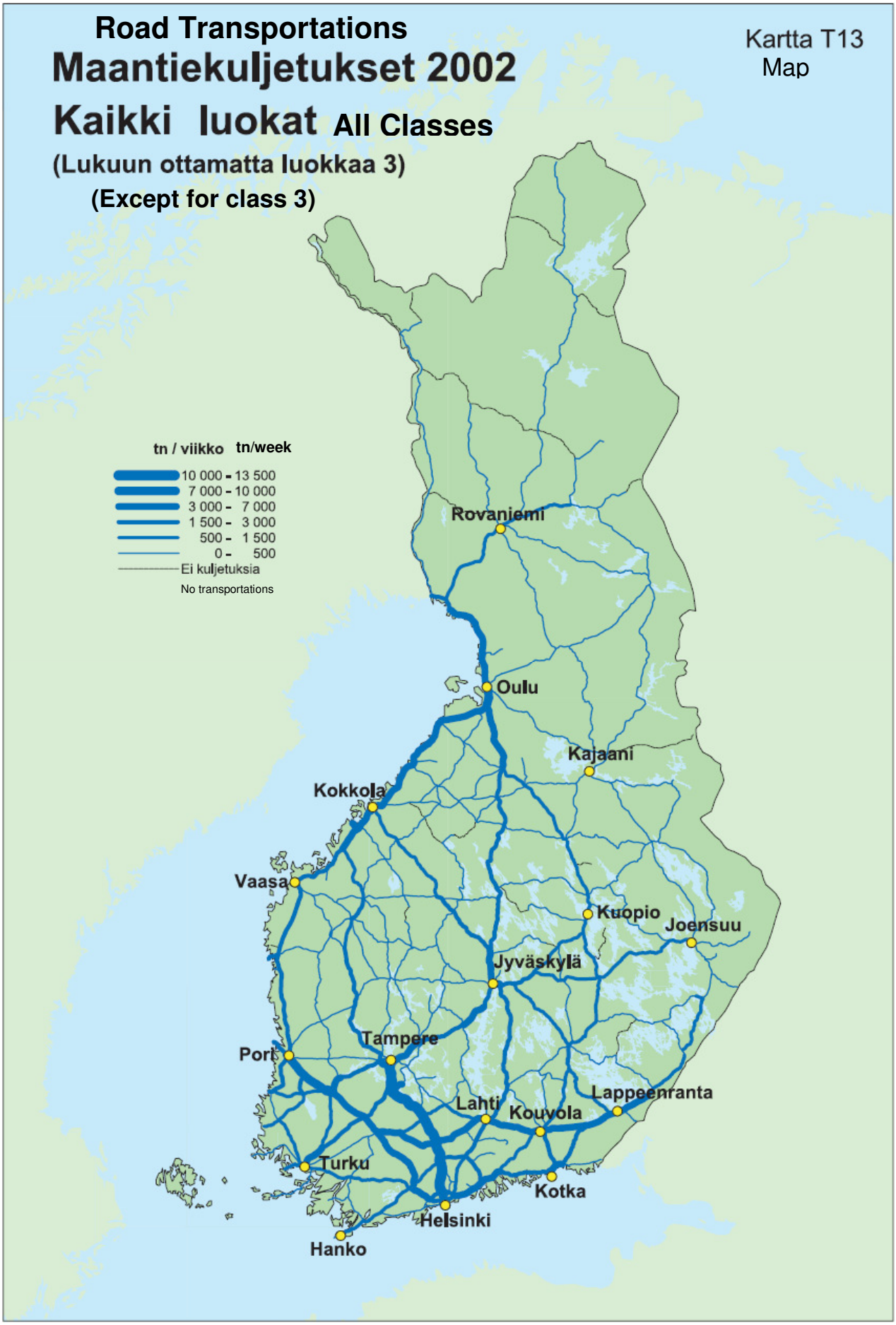
Road Transportations
Maantiekuljetukset 2002
Kaikki luokat All Classes
(Lukuun ottamatta luokkaa 3)
(Except for class 3)
Kartta T13
Map
tn / viikko tn/week
10 000 - 13 500
7 000 - 10 000
3 000 - 7 000
1 500 - 3 000
500 - 1 500
0 - 500
Ei kuljetuksia
No transportations
Rovaniemi
Oulu
Kajaani
Kokkola
Vaasa
Kuopio
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Jyväskylä
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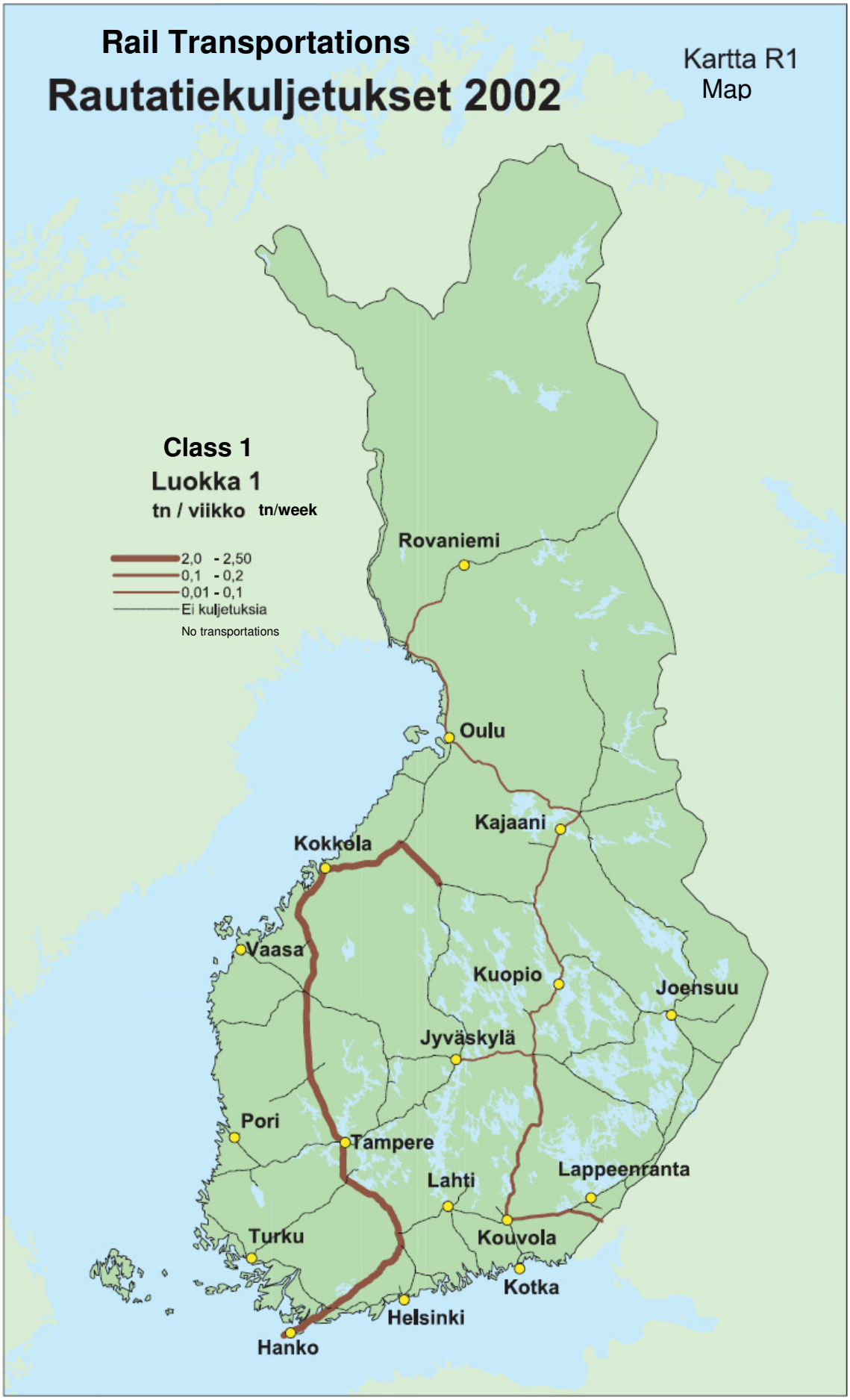
Rail Transportations
Rautatiekuljetukset 2002
Kartta R1
Map
Class 1
Luokka 1
tn / viikko tn/week
2,0 - 2,50
0,1 - 0,2
0,01 - 0,1
Ei kuljetuksia
No transportations
Rovaniemi
Oulu
Kajaani
Kokkola
Vaasa
Kuopio
Joensuu
Jyväskylä
Pori
Tampere
Lahti
Lappeenranta
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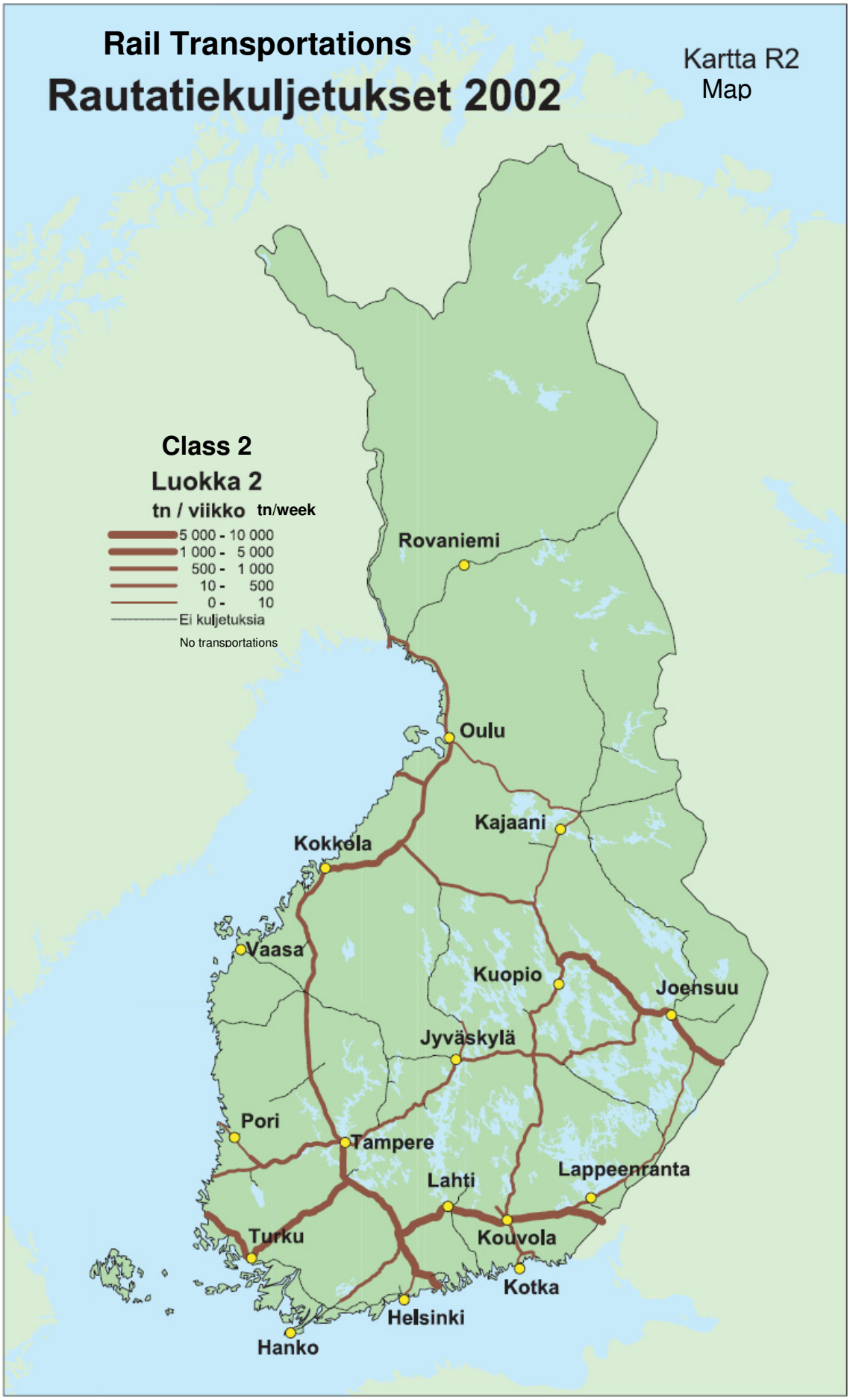
Rail Transportations
Rautatiekuljetukset 2002
Kartta R2
Map
Class 2
Luokka 2
tn / viikko tn/week
5 000 - 10 000
1 000 - 5 000
500 - 1 000
10 - 500
0 - 10
Ei kuljetuksia
No transportations
Rovaniemi
Oulu
Kajaani
Kokkola
Vaasa
Kuopio
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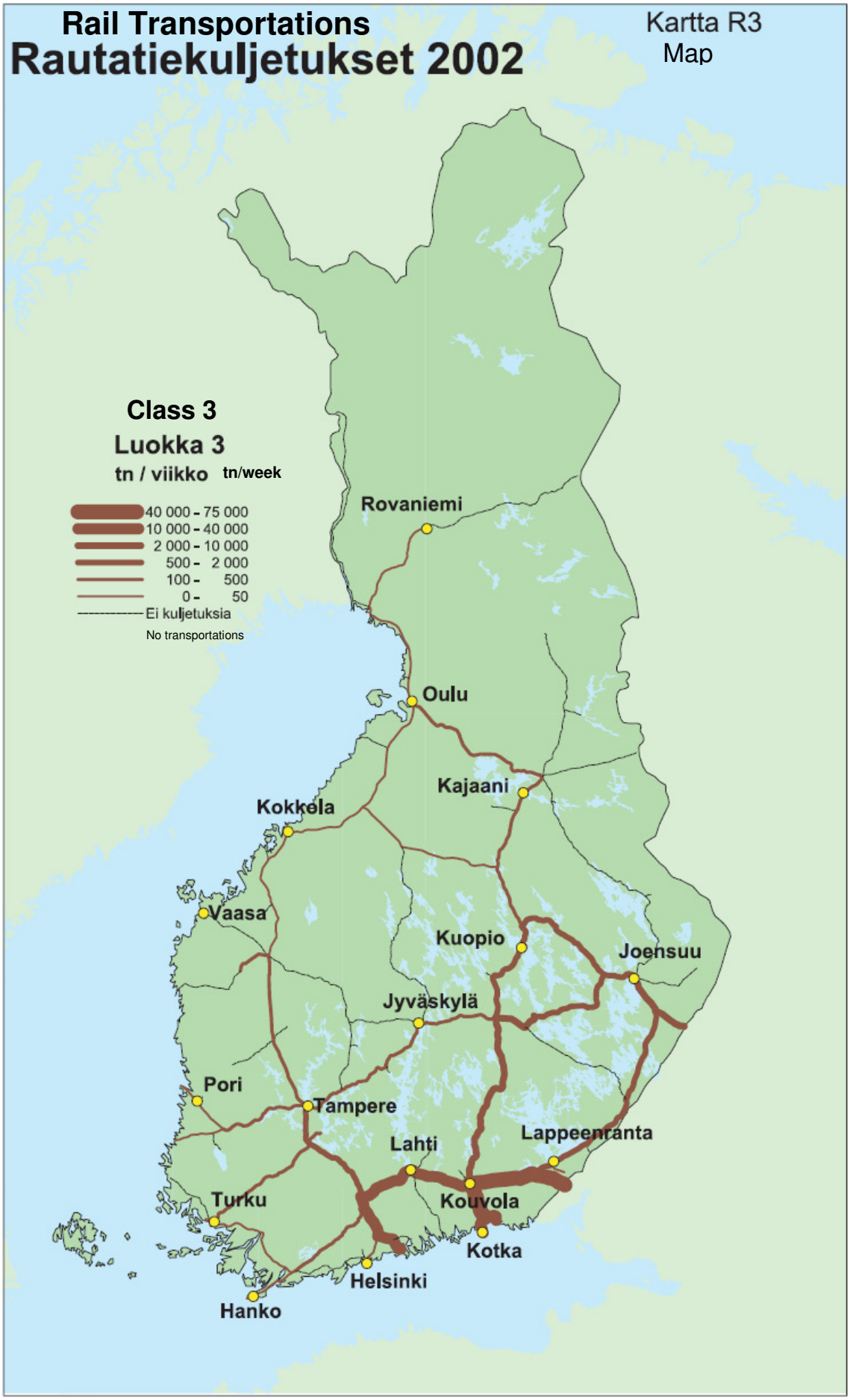
Rail Transportations
Rautatiekuljetukset 2002
Kartta R3
Map
Class 3
Luokka 3
tn / viikko tn/week
40 000 - 75 000
10 000 - 40 000
2 000 - 10 000
500 - 2 000
100 - 500
0 - 50
Ei kuljetuksia
No transportations
Rovaniemi
Oulu
Kajaani
Kokkola
Vaasa
Kuopio
Joensuu
Jyväskylä
Pori
Tampere
Lahti
Lappeenranta
Turku
Kouvola
Kotka
Helsinki
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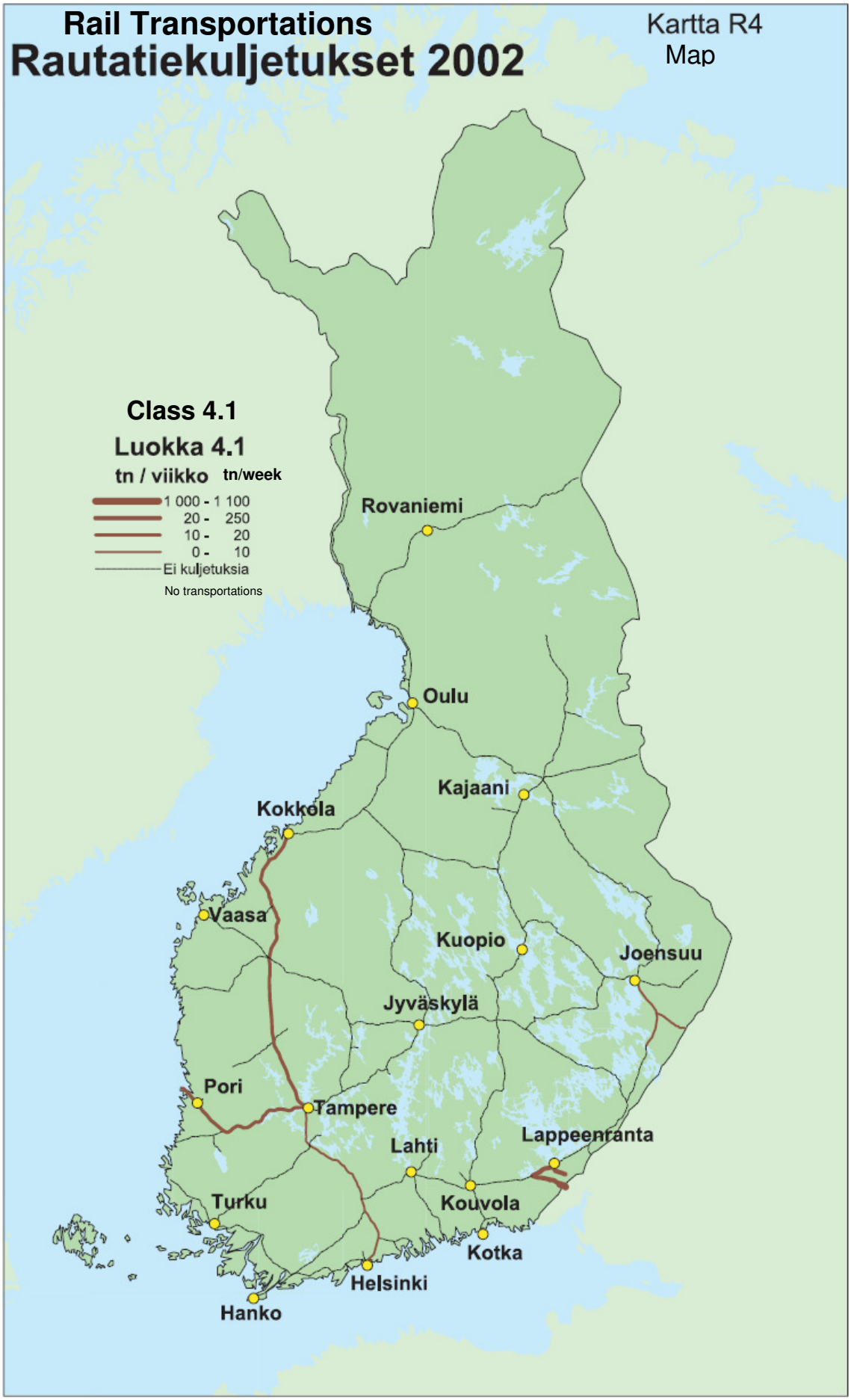
Rail Transportations
Rautatiekuljetukset 2002
Kartta R4
Map
Class 4.1
Luokka 4.1
tn / viikko tn/week
1 000 - 1 100
20 - 250
10 - 20
0 - 10
Ei kuljetuksia
No transportations
Rovaniemi
Oulu
Kajaani
Kokkola
Vaasa
Kuopio
Joensuu
Jyväskylä
Pori
Tampere
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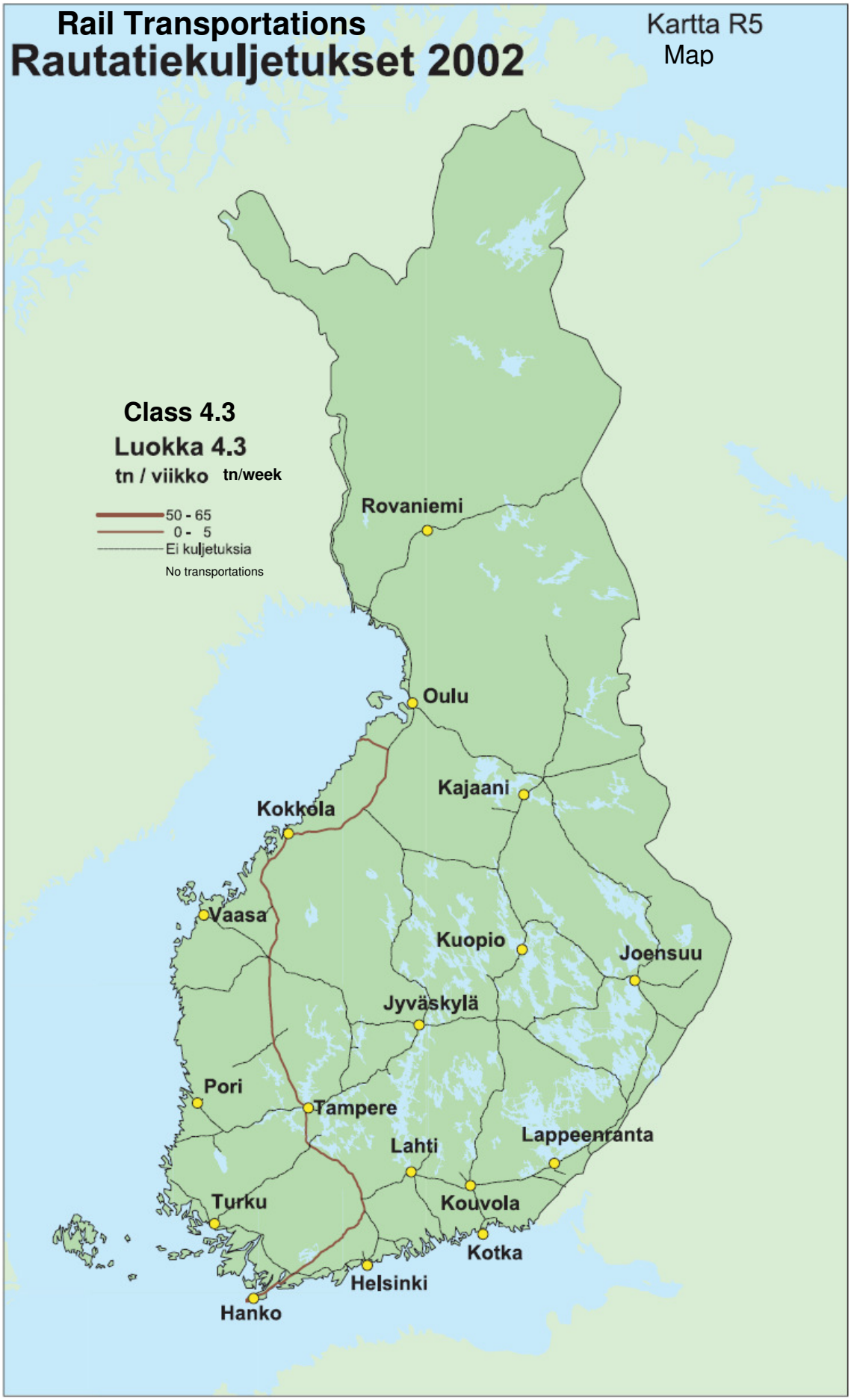
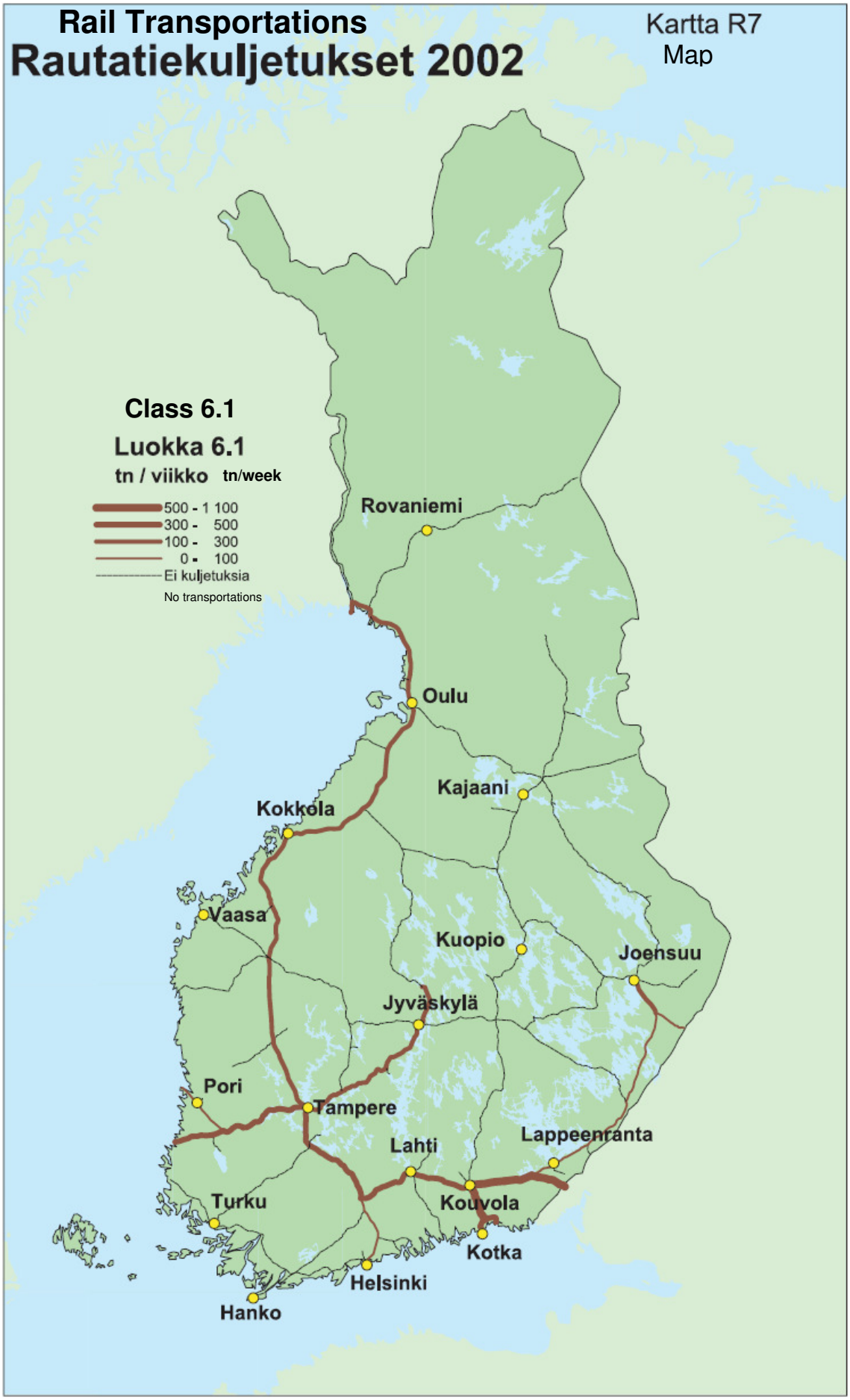
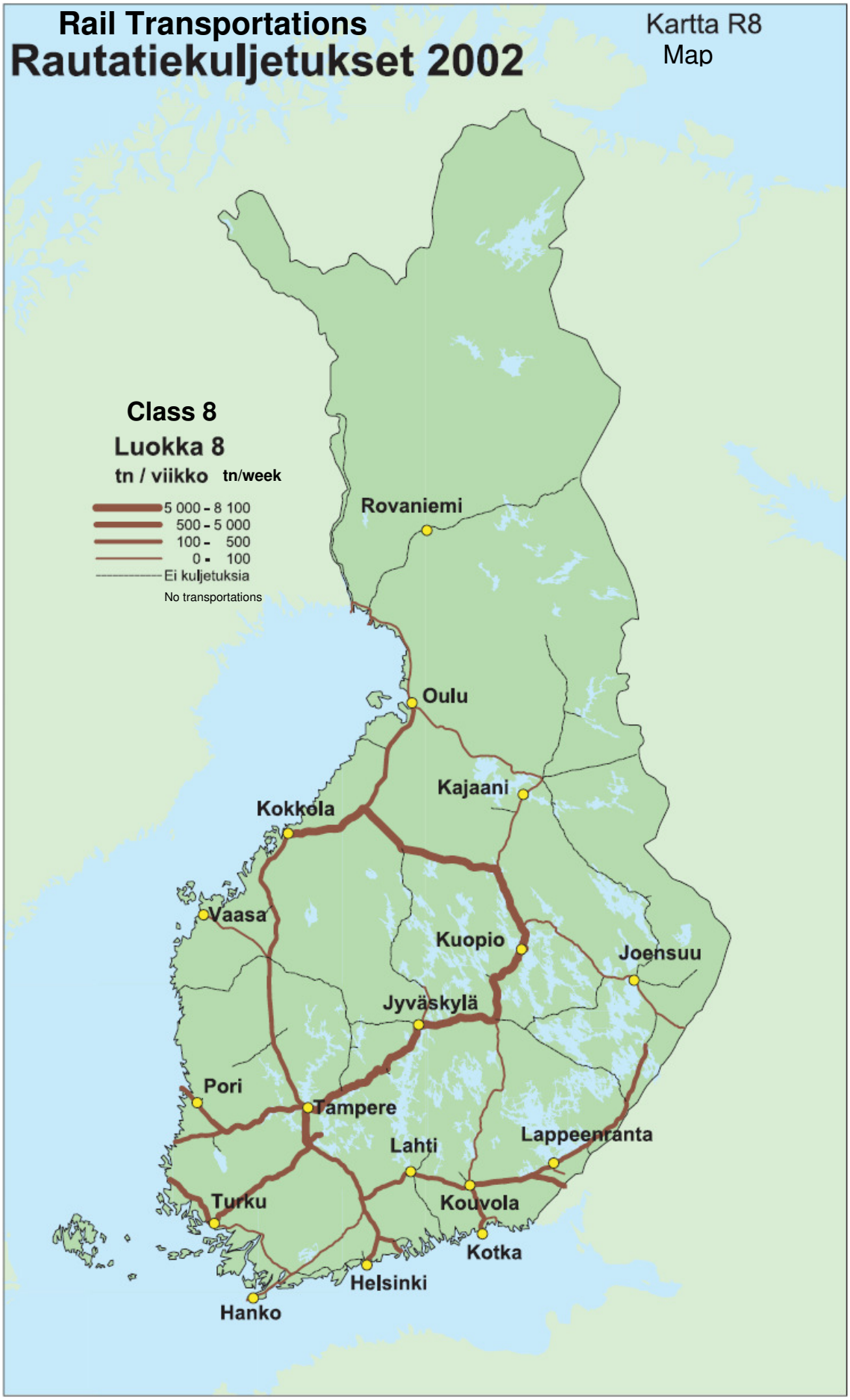
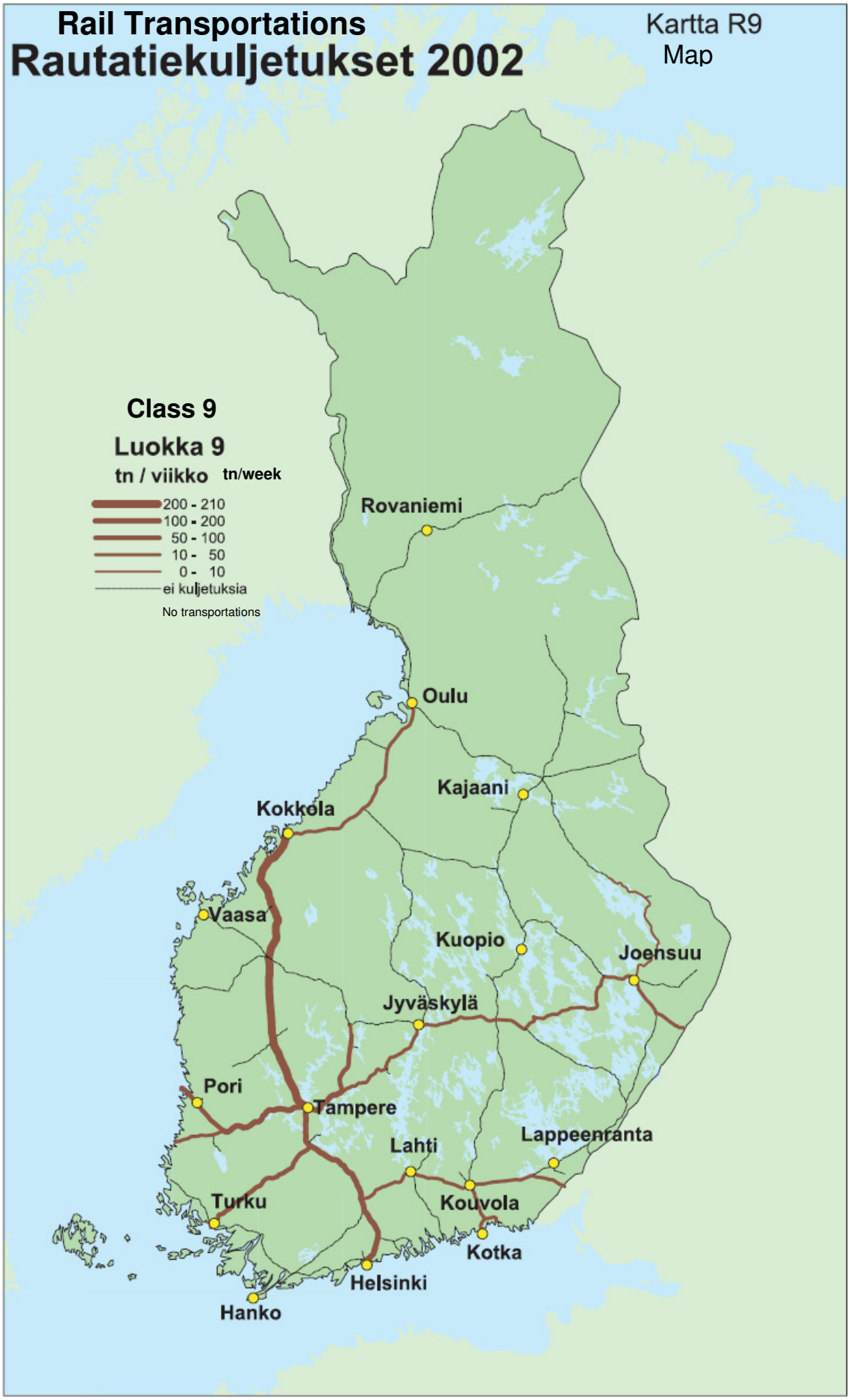
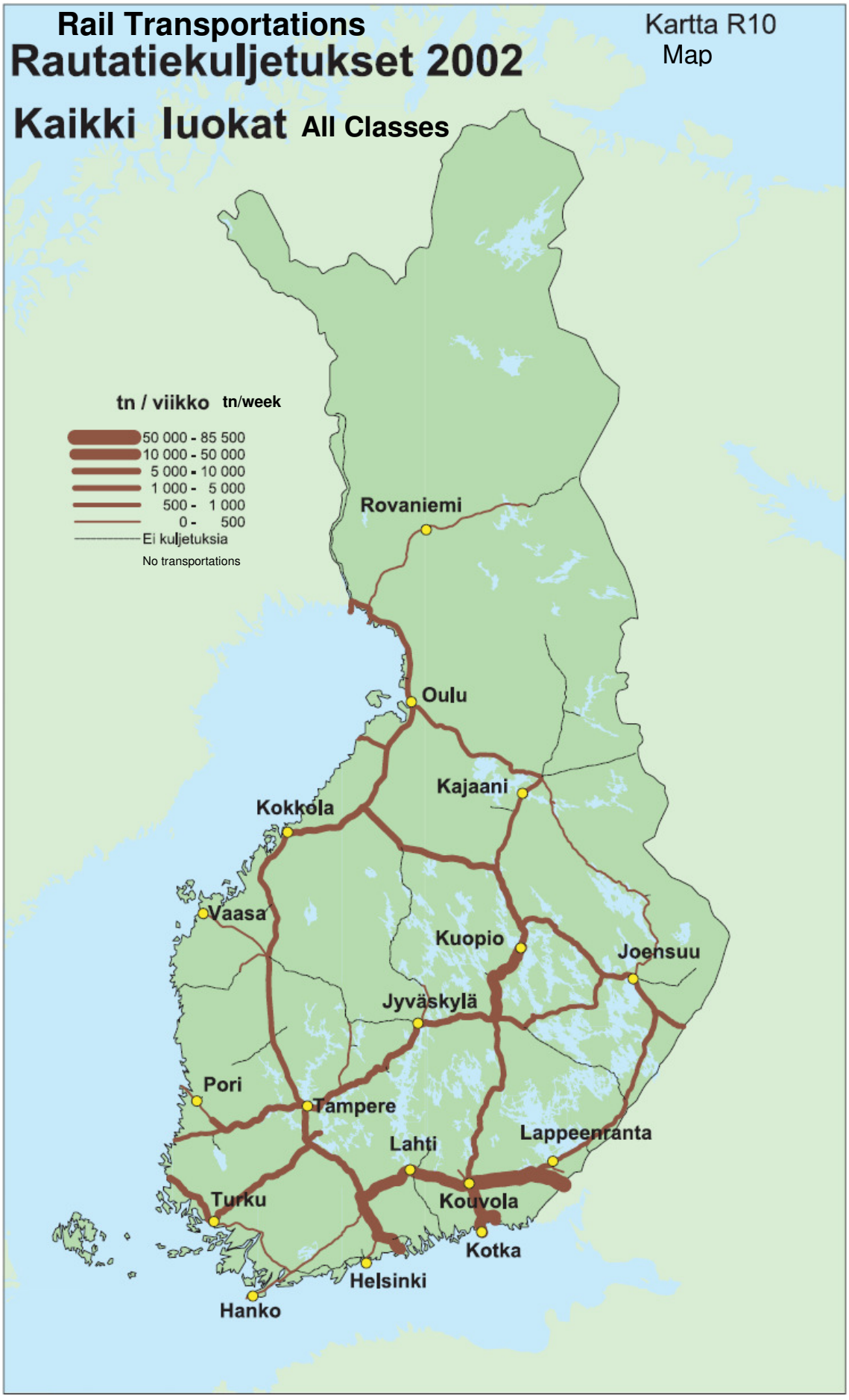

Rail Transportations
Rautatiekuljetukset 2002
Kartta R5
Map
Class 4.3
Luokka 4.3
tn / viikko tn/week
50 - 65
0 - 5
Ei kuljetuksia
No transportations
Rovaniemi
Oulu
Kajaani
Kokkola
Vaasa
Kuopio
Joensuu
Jyväskylä
Pori
Tampere
Lahti
Lappeenranta
Turku
Kouvola
Kotka
Helsinki
Hanko

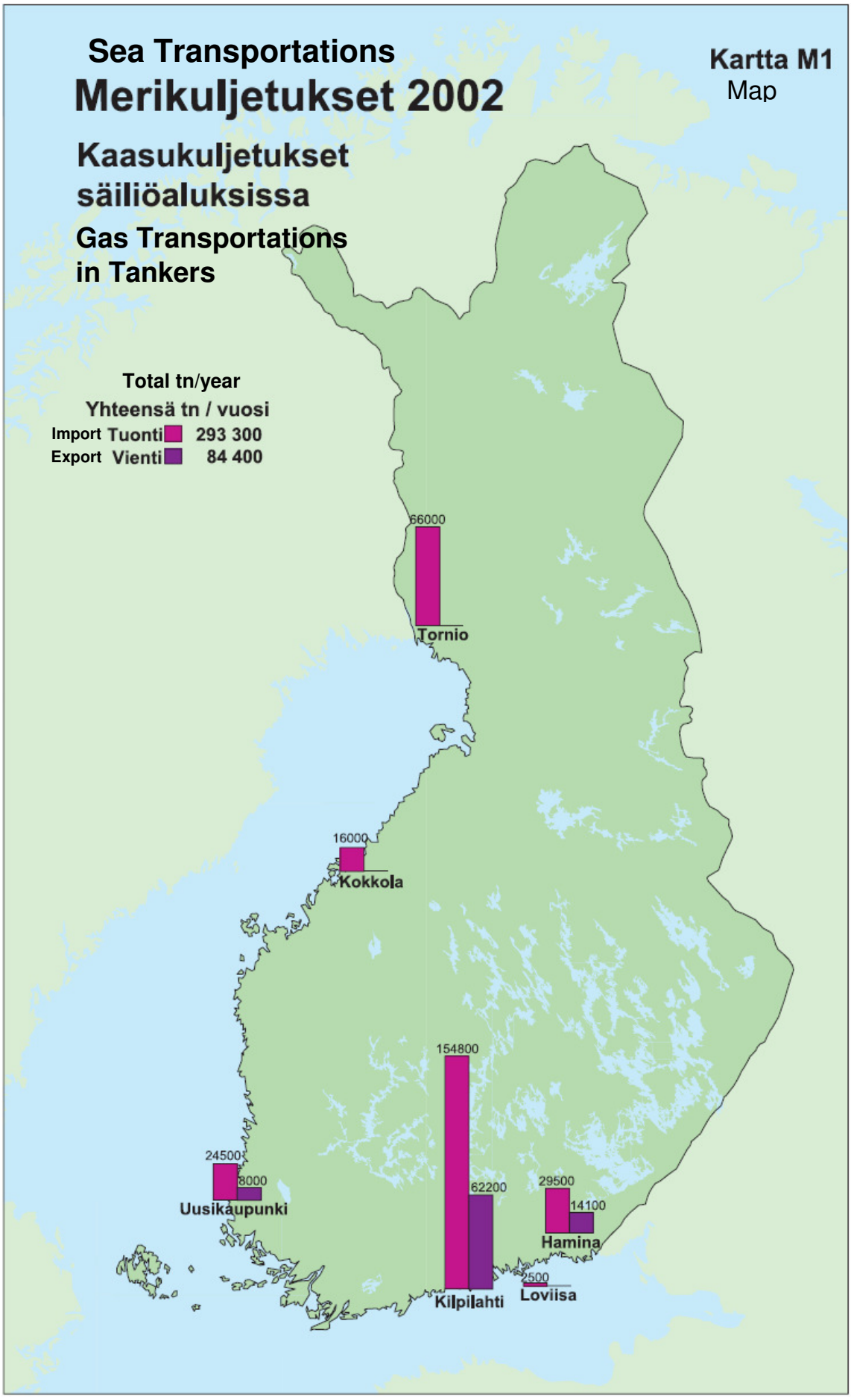

Rail Transportations
Rautatiekuljetukset 2002
Kartta R6
Map
Class 5.1
Luokka 5.1
tn / viikko tn/week
500 - 1 350
100 - 500
10 - 100
0 - 10
Ei kuljetuksia
No transportations
Rovaniemi
Oulu
Kajaani
Kokkola
Vaasa
Kuopio
Joensuu
Jyväskylä
Pori
Tampere
Lahti
Lappeenranta
Turku
Kouvola
Kotka
Helsinki
Hanko

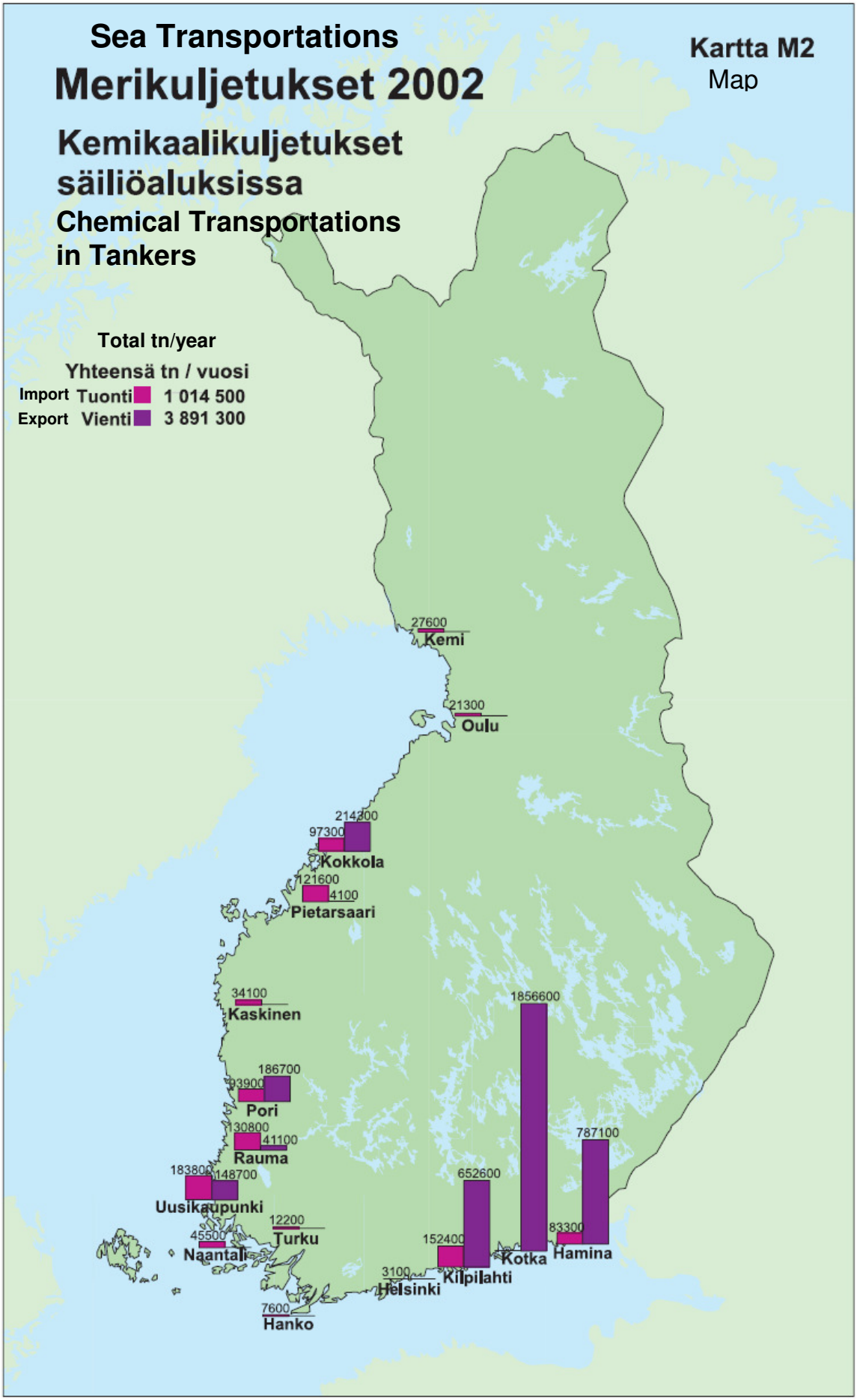

Rail Transportations
Rautatiekuljetukset 2002
Kartta R7
Map
Class 6.1
Luokka 6.1
tn / viikko tn/week
500 - 1 100
300 - 500
100 - 300
0 - 100
Ei kuljetuksia
No transportations
Rovaniemi
Oulu
Kajaani
Kokkola
Vaasa
Kuopio
Joensuu
Jyväskylä
Pori
Tampere
Lahti
Lappeenranta
Turku
Kouvola
Kotka
Helsinki
Hanko

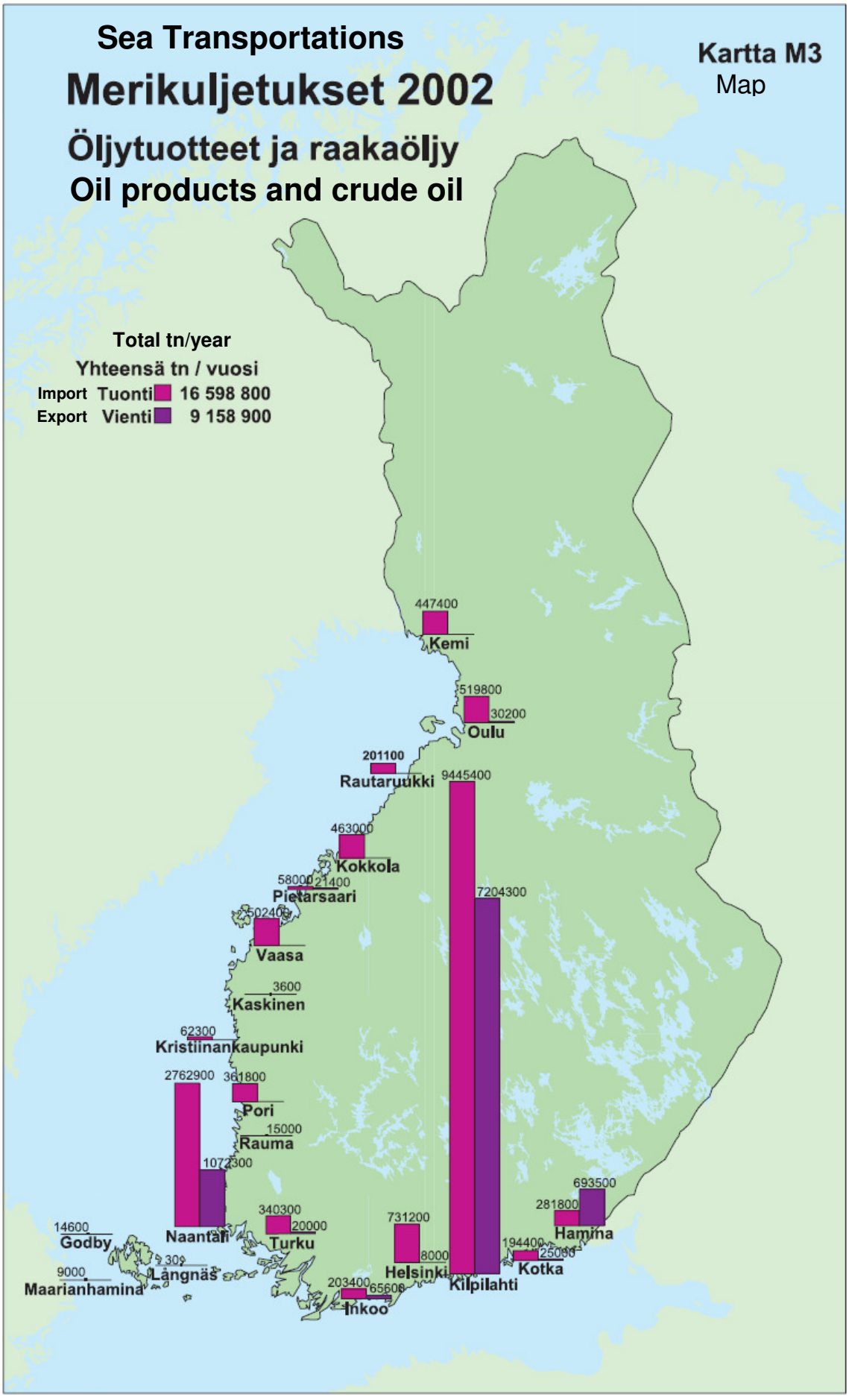

Rail Transportations
Rautatiekuljetukset 2002
Kartta R8
Map
Class 8
Luokka 8
tn / viikko tn/week
5 000 - 8 100
500 - 5 000
100 - 500
0 - 100
Ei kuljetuksia
No transportations
Rovaniemi
Oulu
Kajaani
Kokkola
Vaasa
Kuopio
Joensuu
Jyväskylä
Pori
Tampere
Lahti
Lappeenranta
Turku
Kouvola
Kotka
Helsinki
Hanko

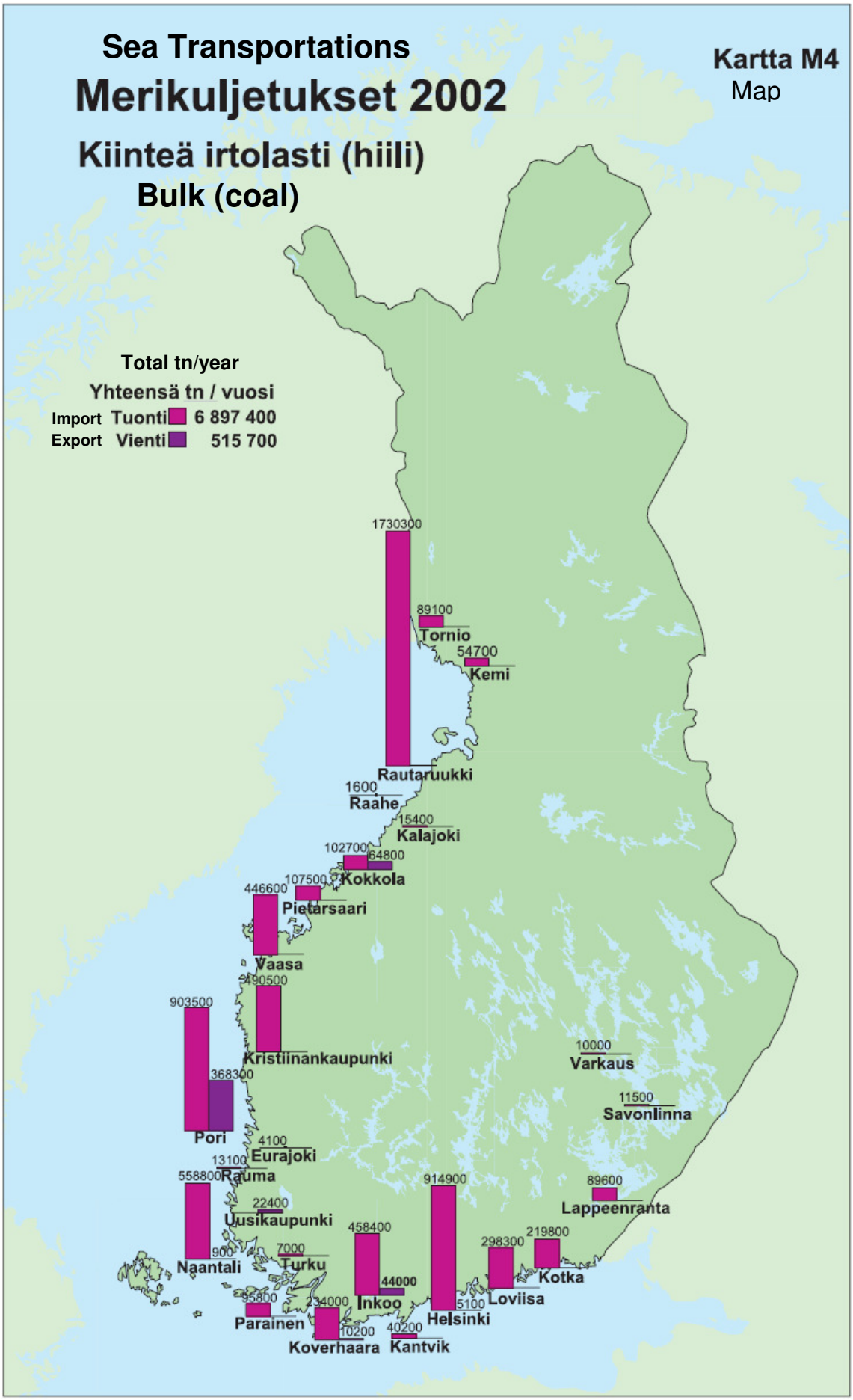

Rail Transportations
Rautatiekuljetukset 2002
Kartta R9
Map
Class 9
Luokka 9
tn / viikko tn/week
200 - 210
100 - 200
50 - 100
10 - 50
0 - 10
ei kuljetuksia
No transportations
Rovaniemi
Oulu
Kajaani
Kokkola
Vaasa
Kuopio
Joensuu
Jyväskylä
Pori
Tampere
Lahti
Lappeenranta
Turku
Kouvola
Kotka
Helsinki
Hanko

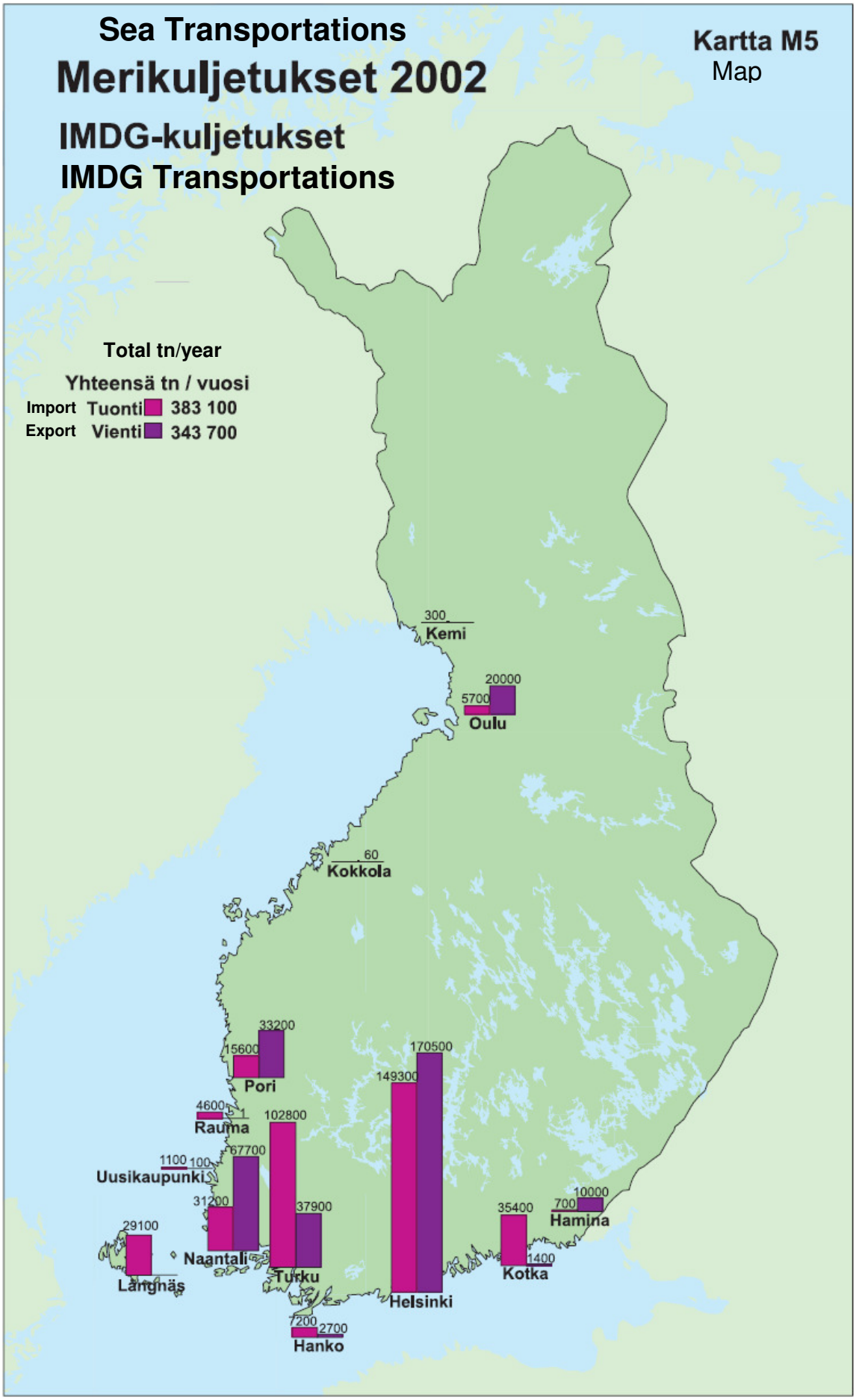

Rail Transportations
Rautatiekuljetukset 2002
Kartta R10
Map
Kaikki luokat All Classes
tn / viikko tn/week
50 000 - 85 500
10 000 - 50 000
5 000 - 10 000
1 000 - 5 000
500 - 1 000
0 - 500
Ei kuljetuksia
No transportations
Rovaniemi
Oulu
Kajaani
Kokkola
Vaasa
Kuopio
Joensuu
Jyväskylä
Pori
Tampere
Lahti
Lappeenranta
Turku
Kouvola
Kotka
Helsinki
Hanko


Sea Transportations
Merikuljetukset 2002
Kartta M1
Map
Kaasukuljetukset
säiliöaluksissa
Gas Transportations
in Tankers
Total tn/year
Yhteensä tn / vuosi
Import Tuonti 293 300
Export Vienti 84 400
66000
Tornio
16000
Kokkola
154800
62200
24500
8000
Uusikaupunki
29500
14100
Hamina
500
Kilpilahti
Loviisa


Sea Transportations
Merikuljetukset 2002
Kartta M2
Map
Kemikaalikuljetukset säiliöaluksissa
Chemical Transportations in Tankers
Total tn/year
Yhteensä tn / vuosi
Import Tuonti 1 014 500
Export Vienti 3 891 300
27600
Kemi
21300
Oulu
214300
97300
Kokkola
121600
4100
Pietarsaari
34100
Kaskinen
1856600
186700
93900
Pori
30800
41100
Rauma
787100
183800
148700
Uusikaupunki
652600
12200
45500
Turku
Naantali
152400
Kotka
83300
Hamina
3100
Helsinki
Kilpilahti
7600
Hanko


Sea Transportations
Merikuljetukset 2002
Öljytuotteet ja raakaöljy
Oil products and crude oil
Kartta M3
Map
Total tn/year
Yhteensä tn / vuosi
Import Tuonti 16 598 800
Export Vienti 9 158 900
447400
Kemi
519800
30200
Oulu
201100
Rautaruukki
9445400
463000
Kokkola
58000
21400
Pietarsaari
7204300
502400
Vaasa
3600
Kaskinen
62300
Kristiinankaupunki
2762900
361800
Pori
15000
Rauma
1077300
693500
281800
Hamina
14600
Godby
340300
20000
Turku
731200
194400
25000
Kotka
9000
Maarianhamina
8000
Helsinki
203400
65600
Inkoo
Kilpilahti
Naantali
Långnäs


Sea Transportations
Merikuljetukset 2002
Kiinteä irtolasti (hiili)
Bulk (coal)
Kartta M4
Map
Total tn/year
Yhteensä tn / vuosi
Import Tuonti 6 897 400
Export Vienti 515 700
1730300
89100
Tornio
54700
Kemi
Rautaruukki
1600
Raahe
15400
Kalajoki
102700
64800
Kokkola
446600
107500
Pietarsaari
Vaasa
490500
903500
Kristiinankaupunki
368300
Pori
4100
Eurajoki
13100
Rauma
558800
22400
Uusikaupunki
900
Naantali
7000
Turku
458400
44000
Inkoo
95800
234000
Parainen
Koverhaara
10200
40200
Kantvik
914900
Helsinki
5100
298300
219800
Kotka
Loviisa
89600
Lappeenranta
10000
Varkaus
11500
Savonlinna


Sea Transportations
Merikuljetukset 2002
IMDG-kuljetukset
IMDG Transportations
Kartta M5
Map
Total tn/year
Yhteensä tn / vuosi
Import Tuonti 383 100
Export Vienti 343 700
300
Kemi
20000
5700
Oulu
60
Kokkola
33200
15600
Pori
4600
1
Rauma
102800
67700
1100
100
Uusikaupunki
31200
37900
29100
Naantali
Turku
Langnäs
170500
149300
Helsinki
35400
1400
Kotka
10000
700
Hamina
200
2700
Hanko

Transport of Dangerous Goods comprises a wide variety of commodities governed by international conventions, which together with supplementing EU and national regulation are mostly implemented in the Baltic Sea Region. This report is part of the Safe and Reliable Transport Chains of Dangerous Goods in the Baltic Sea Region -project. This project aims at improving the co-operations between public and private stakeholders related to DG transport in the BSR by connecting the stakeholders on different levels, providing up-to-date information on cargo flows, supply chain efficiency and risks related to DG transport.

This report is the Finnish part of the dangerous goods flows survey and works also as an example to other partner countries. During the DaGoB-project the national reports of other partner countries will also be produced.

This report includes data on transport of dangerous goods by road, rail and sea in Finland in 2002. Altogether 12.3 million tonnes of dangerous goods were transported by road. A majority of the amount took place in the Provinces of Southern and Western Finland. Transport by rail amounted to 6.1 million tonnes. Rail routes that were mostly used were the ones from Vainikkala through Kouvola to Kotka, Hamina and Kilpilahti. The largest group in road and rail transport were inflammable liquids (nearly 70%). The second largest group were corrosive substances (15%) and the third largest gases (by road 5%, by rail 11%).

In 2002 transport of dangerous goods by sea amounted to altogether 39.2 million tonnes, of which bulk goods amounted to 0.7 million tonnes (c. 2%). The busiest ports were Kilpilahti, Naantali, Kotka, Helsinki, Pori, Rautaruukki and Hamina. Petroleum and oil products (66%) formed the largest transportation groups.

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