UNITED NATIONS **E**

Economic and Social Council

Distr.
GENERAL

TRANS/WP.5/2005/16
7 June 2005

Original: ENGLISH

ECONOMIC COMMISSION FOR EUROPE

INLAND TRANSPORT COMMITTEE

Working Party on Transport Trends and Economics
(Eighteenth session, 15-16 September 2005,
agenda item 2(b))

MONITORING OF DEVELOPMENTS RELEVANT FOR THE PAN-EUROPEAN TRANSPORT CORRIDORS AND AREAS

Infrastructure bottlenecks and missing links

Transmitted by the Governments of Finland, Georgia and Lithuania

FINLAND

Rail bottlenecks in Finland

On the Nordic triangle there are two bottlenecks in the Finnish rail network.

1. Section Kerava-Riihimäki

The section is a double track line with mixed traffic. The average number of daily trains in 2003 was 196. Capacity problems exist on weekdays during commuting times. There is a need to increase the number of commuter trains but it cannot be done because the existing infrastructure is in full use (conflict mainly between commuter and long distance passenger trains).

Using the shortcut line Kerava-Lahti in 2006 will partly solve the problem when some of the long distance trains will change their route.

2. Section Lahti-Luumäki

This section is also a double track line with mixed traffic. The average number of trains in 2003 was only 65-70 per day but the capacity problem is caused by the alteration of train speeds and unexpected changes in Russian border crossing freight trains. Capacity problems exist mainly during the daytime and partly seasonally.

There is a need to start running fast trains between Helsinki and St. Petersburg (Russian Federation) that is expected to intensify the situation. The Russian side is also extending border crossing freight trains by up to 1,060 metres which will cause extra shunting needs on the Finnish side because of the lack of such long tracks in Finnish yards. At the moment, the needed investments (passing tracks, etc.) are being studied as well as the implementation of PPP-model.

Bottlenecks on Finnish E-roads

Interpreting the word "bottleneck"

"Bottleneck" is a common phrase when referring to shortcomings in the transport system. The definition of the situation behind the word is, however, far from accurate. UNECE documents highlight the difficulties in establishing more clear criteria for bottlenecks. The item has also been discussed in the relevant organs of the European Commission (DG TREN) and the Commission of European Directors of Roads (CEDR).

Other words used in discussion areas are e.g. "congestion", "lack of capacity" and "deficiency in traffic conditions". How do we understand each expression? Would the grading scale be in connection with the purpose for appraisal? (Daily traffic guidance and information, or needs assessment for major investments.)

In future, there should be more discussion on a European level and harmonization of determinations regarding desired and accepted levels of service in the transport system. The criteria in the questionnaire (and the background paper from 1994) are quite vague and might give too many bottlenecks, provided that bottlenecks are understood as congestions the drivers would like to avoid even when it meant taking a somewhat longer route.

The Finnish answer to the questionnaire (roads) is based on discussions and studies in a working group under CEDR. The theory is briefly described below.

Some theory of capacity related problems - one suggested determination

Once the full capacity of a section of road has been reached, the continuous flow of traffic changes into the "Stop-and-Go" phase and eventually comes to a complete standstill. Over a period of time, this means that vehicles increasingly become a hindrance to each other and the drivers' ability to select their driving speed is limited. These stages of congestion occur with varying regularity and for different lengths of time. The degree of congestion is usually perceived very differently by road users and is always compared with the reference situation of "free-flowing traffic". The loss of time involved is usually considered more serious than can actually be proven.

There is no uniform, generally accepted definition of bottlenecks. It is agreed, however, that bottlenecks are a consequence of some form of congestion, but the definition of the exact traffic conditions involved in traffic congestion has not yet been agreed.

Several factors may cause congestion on the road network. Some are caused by exceptional factors that may be unpredictable. This kind of temporary congestion normally dissolves itself after a short period of time.

Regular congestion refers to capacity-related traffic jams which come about if the traffic demand exceeds - usually temporarily, but regularly - the capacity of a section of road. In principle, this sort of congestion cannot and will not be completely avoided in the future without adding capacity or changing the traffic routes.

The theoretical basis for the identification and evaluation of congestion is the relationship between traffic flow (veh/h) and average speed (km/h) in a cross-section. Once being determined (i.e. measured) for a specific type of road and cross-section, the Flow-Speed-curve can be used to derive reliable information about the quality level of the traffic flow from actual speed data measured later. The relationship between traffic flow and average speed indicates the point at which the traffic flow becomes unstable or comes to a complete standstill.

On motorways, congestion generally occurs when traffic exceeds approximately 1,800 veh/h per lane (urban sections) and 1,900 veh/h per lane (rural sections). The speed of traffic flow drops under 75 km/h.

For 2-lane roads, the driving pattern is different from that of motorways. Overtaking may become difficult even with a rather limited amount of traffic. The indicators can be maximum traffic flow and average speed at maximum flow.

It is important to note, that congestion on 2-lane roads can be caused by many other reasons than traffic flow due to the characteristics of 2-lane roads. The speed first only diminishes slowly as traffic flow builds up. Suggested criteria could be that congestion occurs if the speed falls below 75% of the speed under free flow conditions for 2-lane roads. In Finnish experience the capacity of 2-lane roads is about 1,800-2,100 veh/hour in both directions together. The share of directions could be 30/70.

If, for a specific road section, congestion events over a year exceed a certain determined number of hours per year, the section may be called a bottleneck. One suggested determination for "bottleneck" is a section where the speed of vehicles falls below the threshold value for more than 200 hours per year.

Bottlenecks on the Finnish E-roads

Finland is lucky to have overall moderate traffic volumes on the main road network. Tourist traffic is not a special problem. Most heavy peak hours on roads near urban areas occur when people are travelling to and from work and, in summer rural areas, during weekends when people visit their summer cottages in southern and central Finland.

The length of the E-road network is 4260 km. The network is managed for the Government by the Finnish Road Administration; in addition to this there are some 25 km city streets on E-routes to centres and harbours in Helsinki, Turku and Vaasa.

The E-road network (State owned) consists of:

- 670 km motorway or other 2+2 -lane road
- 3,590 km 2-lane road

No 3-lane roads exist, only extra lanes with limited length for overtaking.

Motorways or other 2 + 2 -roads seldom have bottlenecks. In the Helsinki area only 35 km of these have more than 40,000 veh/day, but less than 60,000 veh/day. The only section worth mentioning is on E18 the Helsinki Ring near the airport, but even there measures alleviating the bottleneck problem will be ready this year (grade separation for at-grade junctions, extra lanes for public transport). There is, however, still some work left for the future.

On a suburban ring road, the daily variation of traffic is quite "flat". On the Helsinki ring the ADT is 54,0000 veh/day. The 200th peak hour in one direction is 5% = 2,700 veh/h, which is quite well managed by a 2-lane carriageway if no at-grade junctions exist.

On 2-lane roads there are, or will become some congestion problems. The lower value in the questionnaire, 8,000 veh/day, seems however not to establish any bottlenecks worth mentioning. Although shoulders on Finnish roads are narrow, the road geometry is mainly good and road side land use on rural sections sparse.

About 230 km of 2-lane roads have traffic of more than 10,000 veh/day. A more regular congestion/lowered speed with slightly over 10,000 volumes may result only if the 200th peak hour is more than 11-12% of ADT and the road geometry is not very good.

When planning programmes for capacity measures on the road network, ADT 8000-12,000 veh/day is a relevant indicator. For daily traffic management and the so-called "regular bottleneck" the ADT should be over 12,000 veh/day unless there are no other causes jamming the traffic. About 125 km of 2-lane E-roads in Finland have traffic of at least 12,000 veh/day. The main objects with experienced problems are:

- E12 Tampere ring road
- E18 Turku - Helsinki, middle section Muurla-Lohja
- E18 Hamina, partly city street.

See more details in the summary table, where these objects are collected under the title "clear bottlenecks today".

Sections with upgrading work taking place this year are excluded.

Even on the following 2-lane sections the ADT is over 12,000. They are close to regional centres with a "flatter" daily traffic curve. The bottlenecks have not yet experienced very tight or

longer times. Short congestion peaks appear mostly when going to work before 8 a.m. and going home after 4 p.m. (especially on Fridays in summertime when people go to their summer cottages). In the table, these are under the title "shorter/lighter bottlenecks".

- E08 north of Turku (Raisio-Masku)
- E08 north of Pori
- E08 through Vaasa (Sepänkylä)
- E63 shortly after Tampere
- E75 south of Jyväskylä (Vaajakoski)
- E75 north of Jyväskylä (Tikkakoski).

On the E18 border crossing towards the Russian Federation (Vaalimaa) there is a real bottleneck at least for heavy traffic. It may take hours to cross the border. This depends, however, on border control processes not on road traffic arrangements. Street connections to Helsinki and Turku/Naantali harbours may also be felt as bottlenecks, but they are not analysed here. (See "bottleneck on border" in the table.)

In the completed questionnaire table, the column "capacity" refers, on the one hand, to maximum capacity per hour; it depends a.o. the road geometry and density of accessing roads. On the other hand, it is referred to as the threshold value of flowing daily traffic; it depends also on the traffic pattern and known variations at each section.

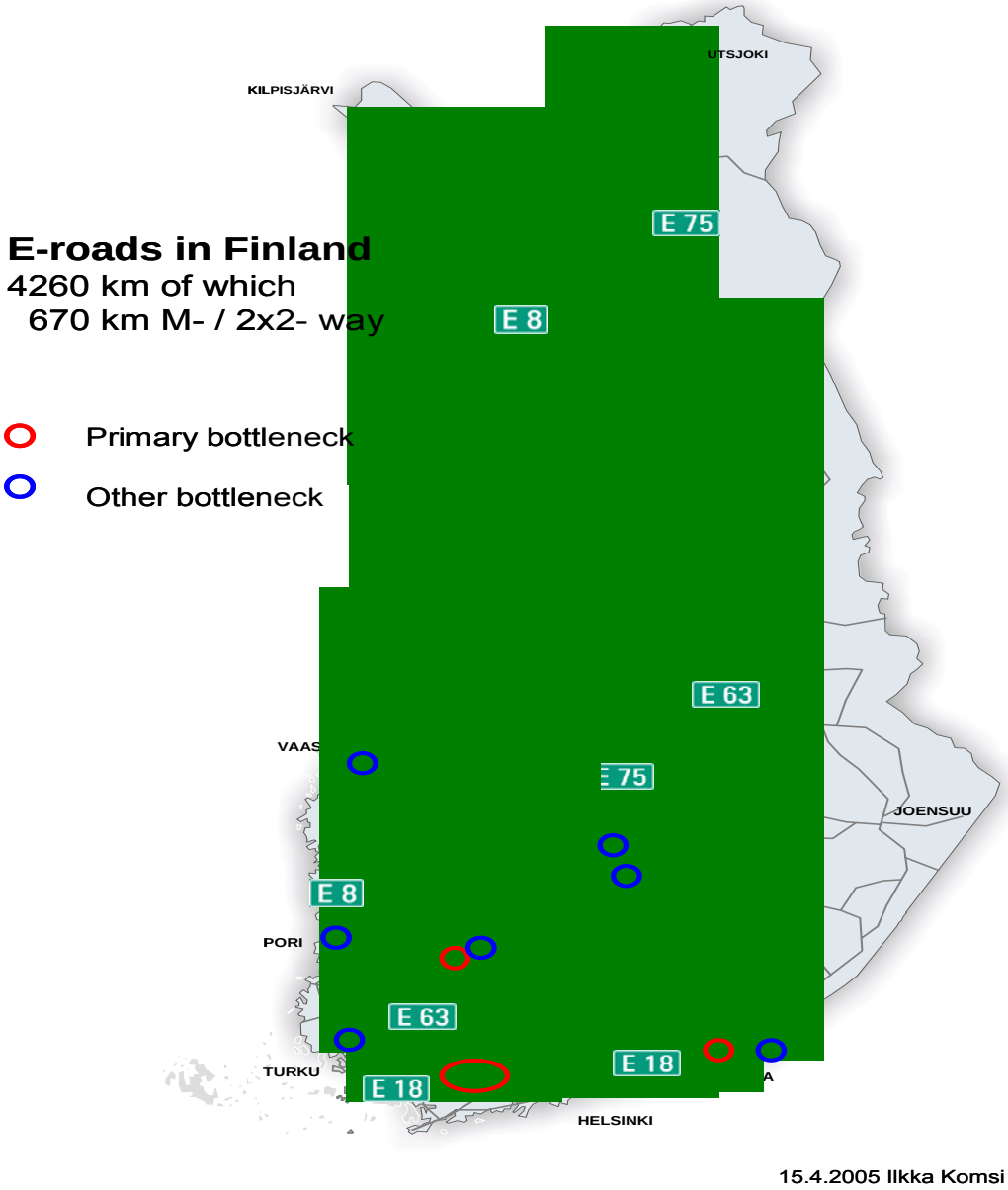
General questions

As already mentioned, motorways and other 2 -carriageway roads with grade separated interchanges do not establish bottlenecks in Finland. Possible problems close urban areas are/will be solved by extra lanes.

On 2-lane roads the main strategy is to upgrade some roads to motorway or other 2 x 2 - standards. In many cases, problems will be alleviated by adding passing lanes, restriction of minor access roads and some upgrading of road geometry.

In some temporary cases, guiding/recommendation to other routes can be used. No road tolls have been planned. It was not considered necessary to restrict heavy vehicles at certain times.

Note: The tables on the following pages will be in English only.


E-roads in Finland
4260 km of which
670 km M- / 2x2- way
Primary bottleneck
Other bottleneck
KILPISJÄRVI
UTSJOKI
E 75
E 8
E 63
VAAS
E 75
JOENSUU
E 8
PORI
E 63
E 18
TURKU
E 18
HELSINKI
15.4.2005 Ilkka Komsi

State	Mode of transport	Route	Section	Traffic loading	Capacity	Extent of action		Operational by year
						Subject	Kind	
1	2	3	4	5	6	7	8	9
FINLAND	**ROAD TRANSPORT**	A. Clear bottlenecks today:						
		E 12	Tampere ring (western by-pass)	10,000-22,000 veh/day (2-lane road)	2,100 veh/h 16,000/day	Upgrading to 2 x 2 motorway	21 km	2011
		E 18	Turku-Helsinki, part Muurla-Lohja	10,500-12,300 veh/day (2-lane road)	1,800 veh/h 12,000/day	Substituting by new 2 x 2 motorway	60 km	2009
			Helsinki-Russian border, City of Hamina	12,000-13,000 veh/day (2-lane road, partly street)	1,200 veh/h 12 000/day	New by-pass, 2 x 2 motorway	15 km	2012
		B. Shorter/lighter bottlenecks:						
		E 08	Turku-Pori, part Raisio-Masku	12,000-14,000 veh/day (2-lane road)	2,000 veh/h 13,000/day)	Upgrading to 2 x 2 road	7 km	> 2010
			Pori-Vaasa, nort of Pori	13,000 veh/day (2-lane road)	2,100 veh/h 13,000/day	New 2-lane road for trunk traffic	4 km	> 2010
			Vaasa-Oulu north of Vaasa	15,000 veh/day (2-lane road, traffic lights)	2,100 veh/h 14,000/day	New by-pass of Sepänkylä	7 km	2010
		E 63	Tampere-Jyväskylä east of Tampere	13,000-18,000 veh/day (2-lane road)	2,100 veh/h 14,000/day	Upgrading to 2 x 2 road	8 km	>2010
		E 75	Lahti-Jyväskylä south of Vaajakoski	17,000 veh/day (2-lane road)	2,000 veh/h 14,000/day	Upgrading to motorway	3 km	>2010
			Jyväskylä-Oulu north of Jyväskylä	13,000 veh/day (2-lane road)	2,100 veh/h 13,000/day	Upgrading to 2 x 2 road	9 km	>2010
		C. Bottleneck on border:						
		E 18	Helsinki-Russian border, Vaalimaa border station	3,100 veh/day, of which 800 heavy veh	Heavy veh may delay >24 h	Problem is the control procedure. No solution by road investments.		

State	Mode of transport	Route	Section	Traffic loading	Capacity	Extent of action		Operational by year
						Subject	Kind	
1	2	3	4	5	6	7	8	9
FINLAND	INLAND WATERWAYS	E60-11	The Saimaa Canal/Vyborg – Mälkiä Lock	2.4 million tons/year		Restrictions in the use occur. Canal is closed during mid-winter.	Ice hinders traffic on the canal.	Prolonging of the traffic season is under examination. Decision of the realization has not been made yet.
			Mälkiä Lock – Kuopio/Straight of Kyrönsalmi in the city of Savonlinna	Approx. 1.5 million tons/year		Limited cross-section of the fairway section.	The fairways section does not meet needs of the traffic and the standards. This creates a safety hazard and causes delays to the traffic.	Plans are ready. Decision of the realisation has not been made yet.

GEORGIA

Intensity of road usage has recently increased in Georgia, leading to traffic congestion on some sectors of the road network of international importance. These sectors are:

(a) Tbilisi-Khashuri, Zestafoni-Samtredia and Kobuleti-Sarpi of Tbilisi-Poti-Sarpi-Border of Turkey, and

(b) Tbilisi-Marneuli of Tbilisi-Marneuli-Guguti- Border of Armenia.

Traffic intensity on these sectors at an overnight range is up to 5,000 – 15,000. Further increases in intensity are foreseen, and road capacity will not be able to meet the capacity of traffic.

Rehabilitation of the above-mentioned road sectors will be financed from the State budget in the near future within existing parameters only. Up to US$ 350 million of investments is required for modernization of these motorways in order to meet growth of traffic volume.

State	Mode of transport	Route	Section	Traffic loading	Capacity	Extent of action			Operational by year
						Subject	Kind	Finance	
1	2	3	4	5	6	7	8	9	10
LITHUANIA	ROAD TRANSPORT	IXB Corridor	Southern by-pass of Vilnius between E85 and E28	E85 – 25000 E28 – 6500	15,000	Construction of southern by-pass steering aside transit transport	Construction of road 25 km.	€49.2 million	2010
		A12 (IA Corridor)	Riga–Kaliningrad 180.5 – 187.9 km.	1,800	1,500	Construction of eastern by-pass of Panemunė	Construction of road with the bridge over the Nemunas river 7.40 km.	€7.2 million	2010
		A12 (IA Corridor)	Riga – Kaliningrad	3,800	4,000	Construction of by-pass	Construction of road 18.50 km.	€11.6 million	2015
		A6 E262	Kaunas – Zarasai – Daugpils	5,000	4,000	Construction of Jonava by-pass	Construction of road 13 km.	€8.1 million	2009
		A6 E262	Kaunas–Zarasai – Daugpils	3,800	4,000	Construction of Ukmergė by-pass	Construction of road 8 km.	€5.8 million	2015
		A6 E262	Kaunas–Zarasai – Daugpils	3,000	4,000	Construction of Utena northern by-pass	Construction of road 9 km.	€5.8 million	2015
		A6 E262	Kaunas–Zarasai – Daugpils	1,000	1,500	Construction of Zarasai southern by-pass	Construction of road 7.55 km.	€4.3 million	2010
		A9 E272	Panevėžys – Šiauliai	8,000	7,000	Reconstruction into I category	Construction of second road lane 15.90 km.	€4.3 million	2009
		A7 E28 (IXD Corridor)	Marijampolė – Kybartai	1,000	1,500	Construction of Virbalis and Kybartai	Construction of road 10 km.	€9.3 million	2010

State	Mode of transport	Route	Section	Traffic loading	Capacity	Extent of action			Operational by year
						Subject	Kind	Finance	
1	2	3	4	5	6	7	8	9	10
LITHUANIA	RAILWAYS	Corridor IX B	Vilnius – Kaišiadorys	93 trains/day	95 +31/51 + 31	Modernization of the tele-communications, increasing of traffic loading to 115 trains/day	Fibred optical cable system, Transmission system based on SDH including network synchronizations, Telecommunication network management system, PBX's in a network, telephones and subscribes connection.	€1.6 million	2002-2004
			Radviliškis – Šiauliai	64 trains/day	350 +13/172 + 13	Modernization of the tele-communications, increasing of traffic loading to 78 trains/day	Fibred optical cable system, Transmission system based on SDH including network synchronizations, Telecommunication network management system, PBX's in a network, telephones and subscribes connection.		
			Šiauliai – Klaipeda	42 trains/day	21 +6/21 + 6	Modernization of the tele-communications, increasing of traffic loading to 51 trains/day	Fibred optical cable system, Transmission system based on SDH including network synchronizations, Telecommunication network management system, PBX's in a network, telephones and subscribes connection.		
			Šiauliai – Klaipeda	42 trains/day	21 +6/21 + 6	Modernization of Signalling and Power supply, increasing of traffic loading to 51 trains/day	Design, manufacture, installation and commissioning. Will be required to perform all works included in Tender Dossier in connection with modernization of signalling, power supply and telecommunications systems on section. Modern technologies are to be used while implementing the project and the compatibility between existing and new systems is to be ensured including all safety aspects and compliance with requirements for ISPA financed projects.	€28.5 million	2004-2006

State	Mode of transport	Route	Section	Traffic loading	Capacity	Extent of action			Operational by year
						Subject	Kind	Finance	
1	2	3	4	5	6	7	8	9	10
LITHUANIA	RAILWAYS	Corridor IX B	Kaišiadorys - Radviliškis	37 trains/day	31 + 9/31 + 9	Modernization of power supply, increasing of traffic loading to 45 trains/day	Renovation of 135 km 10/0.4 kV power supplies line. The works also include renovation and installation of 15 diesel power stations, renovation and installation of 29 transformers, construction and installation of one new masonry power station building. All 10kV switchgear and 0.4kV switchboards at the stations shall be replaced with modern equipment using vacuum breaker types in the 10kV switchgear and circuit breakers in the low voltage switchboards to reduce the need for fuses.		
			Kaišiadorys – Klaipeda	44 trains/day	21 + 6/21 + 6	Elimination of crossings (road overpasses building, increase in traffic loading to 54 trains/day	Elimination of crossings (road overpasses building	€104 million	2010-2015
			Kaišiadorys – Šiauliai	49 trains/day	31 + 9/31 + 9	Tracks modernization for speed up to 160 km/h, increase in traffic loading to 56 trains/day	Tracks modernization for speed up to 160 km/h	€108 million	2009-2015

State	Mode of transport	Route	Section	Traffic loading	Capacity	Extent of action			Operational by year
						Subject	Kind	Finance	
1	2	3	4	5	6	7	8	9	10
LITHUANIA	RAILWAYS	Corridor IX B	Kaišiadorys – Radviliškis	37 trains/day	31 + 9/31 + 9	Electrification of sections, increase in traffic loading to 45 trains/day	Electrification of sections	€70 million	2010-2015
			Palemonas - Gaižiūnai	8 trains/day	26 + 4/26 + 4	Electrification of sections, increasing in traffic loading to 10 trains/day			
			Radviliškis – Klaipeda	48 trains/day	31 + 9/31 + 9	Electrification of section, increase in traffic loading to 58 trains/day	Electrification of sections	€77 million	2010-2015
		Corridor IX D	Kaišiadorys – Kybartai	50 trains/day	27 + 8/27 + 8	Modernization of Tele-communications, increase in traffic loading to 62 trains/day	Fibred optical cable system, Transmission system based on SDH including network synchronization, Telecommunication network management system, PBX's in a network, telephones and subscribes connection.	€3.08 million	2005-2006
			Vilnius – Kybartai	65 trains/day	27 + 8/27 + 8	Elimination of crossings (road overpasses building), increase in traffic loading to 82 trains/day	Elimination of crossings (road overpasses building)	€50 million	2005-2008

State	Mode of transport	Route	Section	Traffic loading	Capacity	Extent of action			Operational by year
						Subject	Kind	Finance	
1	2	3	4	5	6	7	8	9	10
LITHUANIA	RAILWAYS	Corridor IX D	Kena – Kybartai	64 trains/day	27 + 8/27 + 8	Tracks modernization for speed up to 160 km/h, Increase in traffic loading to 79 trains/day	Tracks modernization for speed up to 160 km/h	€89.7 million	2005-2008
		Corridor IXB IXD	Kena – Kybartai, Radviliškis - Šiauliai	64 trains/day 64 trains/day	27 + 8/27 + 8 350 + 13/172 + 13	Modernization of Signalling and Power supply, Increase in traffic loading to 79 trains/day Modernization of signalling and power supply, Increase in traffic loading to 78 trains/day	Modernization of signalling and power supply	€81 million	2006-2008
				59 trains/day 50 trains/day		Extension of tracks length up to 1,050 m, Increase in traffic loading to 73 trains/day on Corridor IXB, 62 trains/day on Corridor IXD	Extension of tracks length up to 1,050 m	€25 million	2005-2006

State	Mode of transport	Route	Section	Traffic loading	Capacity	Extent of action			Operational by year
						Subject	Kind	Finance	
1	2	3	4	5	6	7	8	9	10
LITHUANIA	**RAILWAYS**	Corridor IX B IX D E – 75 (I)		59 trains/day 50 trains/day 27 trains/day		Modernization of radio system, Increase in traffic loading to 73 trains/day on Corridor IXB, 62 trains/day on Corridor IXD, 34 trains/day on Corridor E-75(I)	Modernization of radio system	€52 million	2005-2008
						Hot boxes axles detector modernization, increase in traffic loading to 73 trains/day on Corridor IXB, 62 trains/day on Corridor IXD, 34 trains/day on Corridor E-75(I)	Hot boxes axles detector modernization	€12 million	2004-2006
		Corridor (Rail Baltica)	State border with Poland - Kaunas			Construction of new standard gauge	Construction of new standard gauge	€300 million	After 2010
		Corridor (Rail Baltica)	Kaunas – state border with Latvia			Construction of new standard gauge	Construction of new standard gauge	€500 million	After 2014

State	Mode of transport	Route	Section	Traffic loading	Capacity	Extent of action			Operational by year
						Subject	Kind	Finance	
1	2	3	4	5	6	7	8	9	10
LITHUANIA	**RAILWAYS**	Other lines	Stasylos – Vilnius	15 trains/day	33 + 6/33 + 6	Infrastructure renovation of main tracks links, Increase in traffic loading to 18 trains/day	Infrastructures renovation of main tracks links	€109 million	2004-2006
			Kužiai – Mažeikiai	19 trains/day	24 + 2/24 + 2	Infrastructures renovation of main tracks links, Increase in traffic loading to 23 trains/day			
			Klaipėda – Pagėgiai	8 trains/day	15 + 2/15 + 2	Infrastructures renovation of main tracks links, Increase in traffic loading to 10 trains/day			
			Kaunas station	45 trains/day	97 + 21/134+ 21	Reconstruction of Kaunas tunnel, Increase in traffic loading to 56 trains/day	Reconstruction of Kaunas tunnel (1.3 km length)	€3.2 million	2004-2005
			Kena station	64 trains/day	127 + 18/ 127 + 18	Reconstruction of Kena border station	Reconstruction of Kena border station	€41 million	1999-2006
			Klaipėda node	43 trains/day (Klaipėda station)	76/76 (Klaipėda station)	Development of Klaipeda railway node	Development of Klaipeda railway node	€9 million	2005-2006
			Vilnius node	140 trains/day (Vilnius station)	152/173 (Vilnius station)	Development of Vilnius node	Development of Vilnius node	€11 million	2004-2006

Note : Line capacity breakdown: odd freight trains plus passenger trains/even freight trains plus passenger trains

State	Mode of transport	Route	Section	Traffic loading	Capacity	Extent of action			Operational by year
						Subject	Kind	Finance	
1	2	3	4	5	6	7	8	9	10
LITHUANIA	INLAND WATERWAY TRANSPORT	E 41 Klaipėda – Curonian Lagoon-river Nemunas-Kaunas (277.9 km)	Klaipėda - Jurbarkas	–	Boat's draught-1.5m; width– 0 m, length-100 m	Navigation improvement through deepening and subsequent regulation, equalization of depth to 1.5 m.	–	approx. €22.6 million	2005–2014
			Jurbarkas - Kaunas	–	Boat's draught – 1.2 m; width – 8 m, length -100 m				
