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SIXTH FRAMEWORK PROGRAMME

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SUSTAINABLE DEVELOPMENT, GLOBAL CHANGE & ECOSYSTEMS

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RETRACK

REorganization of Transport networks by advanced RAil freight Concepts

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SIXTH FRAMEWORK PROGRAMME

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1 Introduction

1.1 Objective

The RETRACK project is applying an innovative rail freight service concept to the movement of rail freight across Europe. This is being achieved through the design, development and implementation of a commercial trans-European rail freight service along the rail corridor between the North Sea ports of Rotterdam (Netherlands) and Antwerp (Belgium) (Netherlands) and Constanza (Romania) on the Black Sea. The project aims to secure a significant modal shift of cargo from road to rail and to create an effective and scalable rail freight corridor between high demand regions in Western Europe and new high growth regions in Central and Eastern Europe.

The overall objectives of the RETRACK project are to conduct research, develop, commission and implement pan-European privately operated rail freight demonstration services (to achieve the EU key objective: modal shift to rail) between Rotterdam, The Netherlands and Constanza, Romania through Germany, Austria and Hungary. This implied at least four border crossings if the entire route was to be used. The route serves major port and industrial complexes in Belgium, Luxembourg and The Netherlands (together with options to North German ports), major industrial areas in Germany and Austria and links to major cities in Hungary and Romania with new port potential in the latter as a longer term source of traffic.

The RETRACK pilot rail freight demonstration service has operated since February 2010 with demonstration costs partially supported (under FP6) by the EU. It will continue until April 2012. The objective of Work Package 9 is to evaluate the RETRACK pilot freight train service in relation to the degree of attainment of business and EU-policy objectives.

The objective of Task 9.5, of which this deliverable presents the results, is to determine the impact of the improvement of rail freight on an European scale, using existing EC-wide models.

This Deliverable presents the results of the modelling work.

1.2 Organisation of the report

The next chapter describes the methodology; the models used, the building of scenarios and calculation of project scenarios. The results of the model runs are presented in chapter 3. Finally, in chapter 4 a number of conclusions are drawn.

2 Methodology

2.1 Introduction

This chapter describes the determination of the different project scenario's and the modeling of the modal split. The study does not focus on the prediction results itself, but on the effects of improvements on the modal split. Therefore, the focus will be the comparison of project scenarios.

In this chapter the quantification of the impact and the definition of the project scenarios are given first. After that, a description of the model calculations is given.

2.2 Base year data

First of all an appropriate base year has to be chosen. ETIS-BASE, the transport database constructed for the European Commission, is a database containing transport matrices, socio-economic data, external effects and input data for the European Transport Network model.

The base year of ETIS-BASE is the year 2000, therefore it contains data for the 25 EU member states and the EEA countries. The West-European countries are regionalized to the NUTS2 level, where the East-European countries are given at the country level (NUTS0).

The new transport database ETIS-Plus has base year 2005 and contains data for the 27 EU member states and all countries they transport to. Almost all countries in the database are regionalized to NUTS2 level, both Western and Eastern countries. Also the 2005 network data contains updated infrastructural information. Furthermore, it contains the same regionalization as the datasets. Therefore, for this analysis the chosen base year will be 2005.

2.3 European trend scenario

To evaluate the impact of RETRACK on the European rail freight transport on a long term, it is decided to take the year 2030 as the time horizon. The transport volumes in 2030 are calculated by using the TRANS-TOOLS model. Based on the European trend scenario 2030 scenario calculations have been made, not only for rail transport, but for all European freight flows. These freight flows are input for the modal split module.

Starting point of the European trend scenario are the trends and policies of the 27 Member States were for the situation by the end of 2006. From there on an average economic growth of about 2.2% to 2030 is assumed. The population is expected to slightly increase until 2020, after which the population is kept constant. The European trend scenario is also based on an high oil price development. For more information about the European trend scenario used in this evaluation, see the report 'European energy and transport – trends to 2030 – update 2007' from the European Commission.

2.4 Quantification of the impact

On the RETRACK-corridor an improvement of the rail performance in terms of waiting times, the level-of-service and reliability is established. Deliverable D 9.8 provides an overview of the border waiting times in 2011 and 2020. They give an average waiting time as well as a minimum and maximum. Most important figures are summarised in table 2.1 and 2.2 below.

Table 2.1: border waiting times at the RETRACK corridor

RETRACK corridor			
	2011		2020
Border	Maximum	Average	Average
NL-D			0,5 hours
D-AT	21 hours	2,5 hours	2,5 hours
AT-H	28 hours	6 hours	2,5 hours
H-RO	30 hours	7 hours	2,5 hours

Table 2.2: border waiting times at other borders

Other borders			
2011		2011	
Border	Average	Border	Average
F-CH	0,5 hours	CH-IT	2 hours
F-IT	0,5 hours	D-PL	4 hours
NL-B	0,5 hours	F-ES	4 hours
B-F	1 hours	ES-P	n/a
IT-AT	1 hours	PL-CZ	n/a

As the tables show, the average waiting times in 2011 on the RETRACK corridor are respectively 0.5 hour at the NL-DE border, 2.5 hours at the DE-AT border, 6 hours at the AT-HU border and 7 hours at the HU-RO border. However, the maximum waiting times up to 30 hours are causing serious unreliability. This reliability can cause modal shift towards other modes than rail. It is not possible to use an average waiting time and a variation of the waiting time as a stochastic parameter as input to the transport model. Therefore the maximum waiting time will be used in a separate project scenario to evaluate the incentive to modal shift as a result of the unreliability.

As becomes clear from the data, the improvement of RETRACK means a reduction of the 6 and 7 hours waiting time per border crossing to 2.5 hours both. This comes down to a reduction of 42% and 36% respectively. In order to answer the question what the effect of RETRACK could be on total European rail freight transport if the same improvements are made all over Europe, assumptions have to be made. It is assumed that the border waiting times all over Europe will improve by 40% due to RETRACK measures, except for border waiting times that are already 2.5 hours or less. These borders are assumed to be that efficient already that an improvement of 40% is not possible to establish. These waiting times are kept constant.

The third effect of RETRACK that is evaluated is the improvement of the level-of-service on top of the reduction of the border resistance. Here the same assumptions concerning the border resistance are used. Improvement of the level-of-service is evaluated using a reduction of the cost per ton kilometer for rail by 10% and an increase of the average rail speed by 10%.

Below a short description of the project scenarios is given.

2.5 Project scenarios

Based on the different factors as described above project scenarios can be defined to evaluate the impact of RETRACK with. A reference situation and three project scenarios are defined.

Reference situation 2030

In order to be able to evaluate the effects of RETRACK a reference situation has to be defined to compare with. As the reference situation the 2030 data are used. In this case no other effects than the European trend growth towards 2030 are taken into account. The border resistances and level-of-service are assumed to be the same as in 2011. The average waiting times per border in 2011 are used for the border resistances, see also D9.8.

Project scenario 1: Unreliability

With this project scenario the effects of unreliability due to variation in the border waiting times are evaluated. In the reference situation the average waiting times at the border is used, here the border resistance is the maximum time observed. By calculating the modal split effect of this project scenario conclusions can be drawn about which part of the European rail freight flows is affected by this unreliability and has an incentive to shift to another mode.

Project scenario 2: Reduction of the border resistance

In this project scenario the effect of RETRACK is evaluated in terms of reduction of the border resistance. In 2020 the border waiting times on the RETRACK corridor are expected to decrease to a 2.5 hours per border, where it was 6 hours average at the AT-HU border and even 7 hours average at the HU-RO border in 2011. This is a reduction of 36% to 42%. With this project scenario insight in the effects of introducing the RETRACK approach to all European rail freight transport is evaluated. Therefore, this scenario is based on the assumption that all border waiting times of more than 2.5 hours will be reduced with 40% with regard to the average 2011 border waiting times.

Project scenario 3: Increasing level-of-service

RETRACK also causes an increase in the level-of-service, in terms of costs and speed. To evaluate this influence on the European rail freight transport this project scenario includes an decrease of the cost per ton kilometer for rail by 10% and an increase of the average rail speed also by 10%. The border resistance will be taken the same as in project scenario 2, that is, reduced border waiting times by 40%.

2.6 Modal split module

The 2030 projections and the project scenarios are input to the modal split module with which the modal shift effects are calculated. This is done for all the European freight transport per road, rail and inland waterway shipping, as well as for the international flows only. The international flows are the flows to be most affected by the border resistance and changes in the level-of-service.

The modal split module has been calibrated per commodity group and calculates changes in the modal shares based on the generalized transport costs. These generalized costs contain costs components related to distance, time and fixed costs. The value of time per commodity group differs, because some products are more time sensitive than others, and therefore the modal choice can vary per commodity group. The border resistance in terms of waiting times is incorporated in the generalized costs by changes in the time component. In this case the generalized costs are affected by changes in the level-of-service via the increase of the average speed, which is related to time and distance, and the decrease of costs per ton kilometer which is distance related.

After the modal split, per commodity group an assignment to the network is made to calculate the effects on the ton kilometers and to visualize the results.

2.7 Determination of environmental impacts

Based on the ton kilometres calculated with the modal split module, the impacts per project scenario on the emissions are determined. Distinction has been made between CO_2-emission and the pollutants SO_2, NO_x and $PM_{2,5}$.

3 Calculation results

3.1 Base scenario

Table 3.1 presents for the base year 2005 the total flows per NSTR-1 per mode (rail, road and IWW), expressed in tonnes.

Table 3.1 Total flows, per NSTR, 2005 per mode, all flows

NSTR	Tons Rail	%	Tons Road	%	Tons IWW	%
Agricultural Products	39.326.546	6,7%	522.494.541	89,7%	20.810.507	3,6%
Foodstuffs	14.299.658	1,6%	845.224.477	96,0%	21.357.891	2,4%
Solid Mineral Fuels	95.566.976	43,4%	83.800.862	38,1%	40.680.769	18,5%
Petroleum Products	105.000.543	28,7%	229.193.290	62,7%	31.384.258	8,6%
Ores And Metal	86.468.156	33,7%	123.756.357	48,2%	46.568.226	18,1%
Iron Steel Metals	33.711.368	12,5%	224.014.119	82,8%	12.707.757	4,7%
Minerals	72.147.066	2,6%	2.610.649.128	94,3%	84.532.835	3,1%
Fertilizers	5.848.109	6,0%	82.480.049	84,0%	9.904.963	10,1%
Chemicals	23.987.604	5,5%	389.033.983	89,0%	23.881.918	5,5%
Other, vehicles, machinery	18.608.891	1,1%	1.678.516.994	97,1%	32.265.919	1,9%
Total	494.964.918	6,5%	6.789.163.799	89,2%	324.095.042	4,3%

For the year 2030, the model calculations have resulted in the following figures for the tons for all transport flows per transport mode (rail, road, IWW) per NSTR-1:

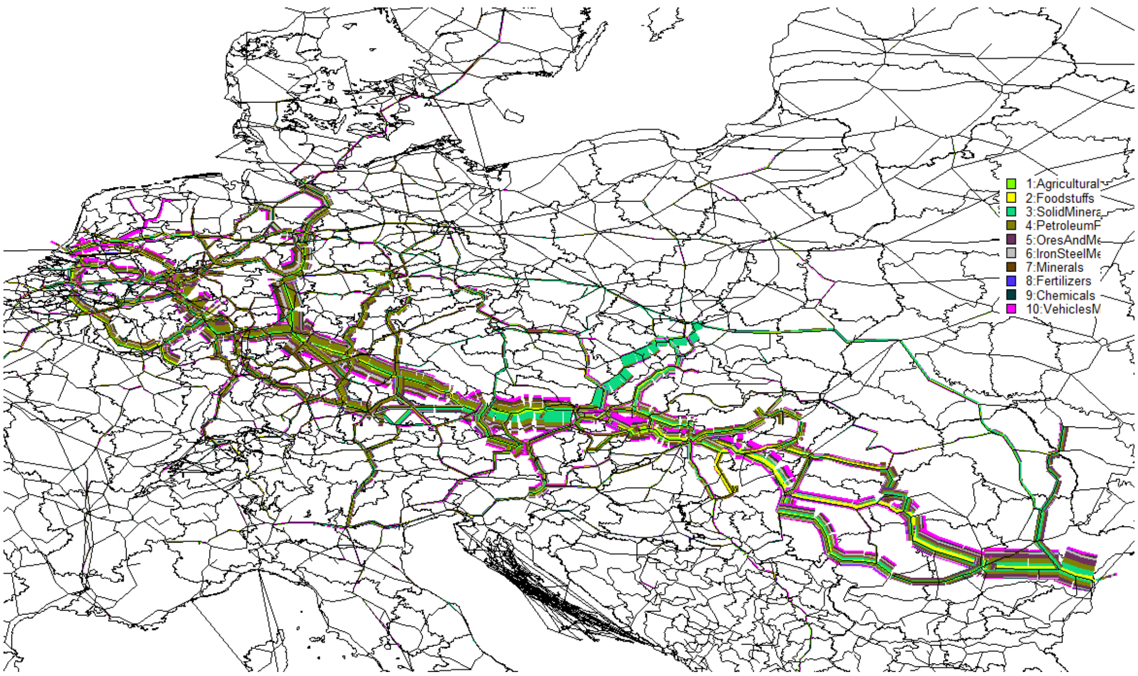
Table 3.2 Total flows, per NSTR, Per Mode, Base scenario, all flows

NSTR	Tons Rail	%	Tons Road	%	Tons IWW	%
Agricultural Products	106.317.090	9,1%	1.031.621.972	88,0%	34.664.769	3,0%
Foodstuffs	37.580.154	2,3%	1.559.389.353	95,6%	34.251.140	2,1%
Solid Mineral Fuels	199.976.312	48,8%	150.475.445	36,7%	59.564.793	14,5%
Petroleum Products	280.655.949	42,6%	299.576.097	45,5%	78.622.708	11,9%
Ores And Metal	128.748.214	38,3%	153.924.604	45,8%	53.763.648	16,0%
Iron Steel Metals	73.800.901	13,6%	432.871.747	79,9%	35.312.862	6,5%
Minerals	143.494.867	3,2%	4.225.899.734	93,9%	130.476.454	2,9%
Fertilizers	12.733.552	7,2%	146.588.425	82,8%	17.643.235	10,0%
Chemicals	61.978.524	6,7%	795.515.498	86,6%	61.586.767	6,7%
Other, vehicles, machinery	56.302.857	1,5%	3.648.553.338	95,7%	108.765.244	2,9%
Total	1.101.588.420	7,8%	12.444.416.212	87,9%	614.651.619	4,3%

The overall modal split is clearly in favour of road transport, with a share of almost 90 % of the total transport in tons in 2005 and 88 % in 2030. The share of rail increases from 6,5 to 7,8 %.

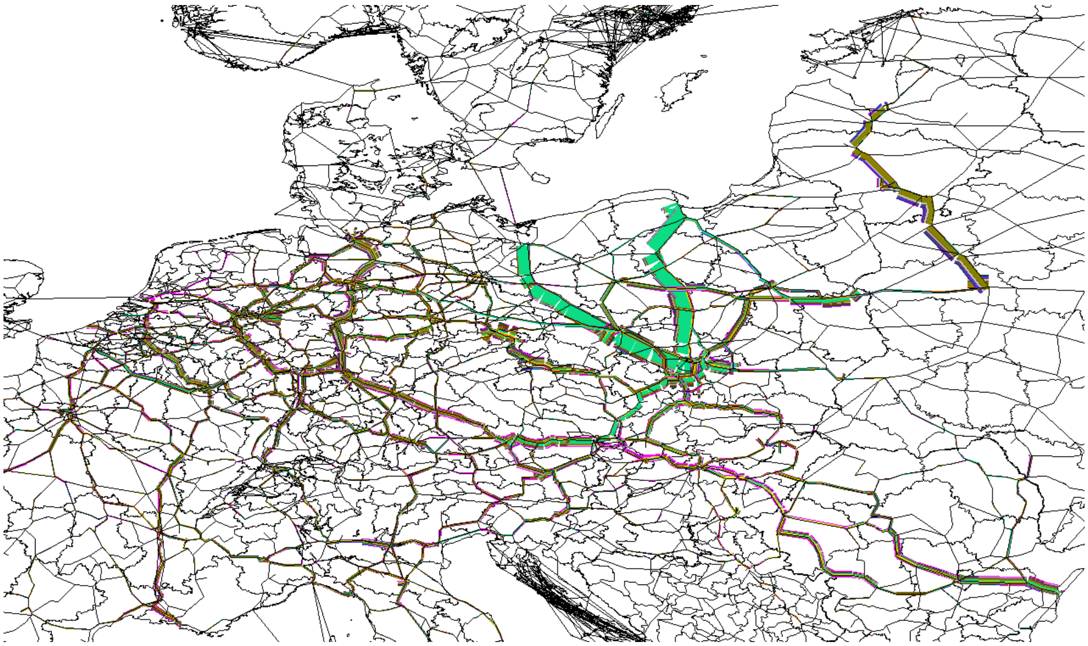
A selection of flows (NSTR-1) on the RETRACK corridor has been made in the database, which is presented in the plot of figure 3.1. This selection is based on the OD-matrix of TRANS-TOOLS for the 2030 base scenario. All origins and destinations that use one or more links on the RETRACK corridor have been drawn in this plot.

Figure 3.1 Flows on the RETRACK Corridor, per NSTR, Base scenario 2030



In figure 3.2 the total rail flows (national and international) on the network are plotted.

Figure 3.2 All flows, per NSTR, Base scenario



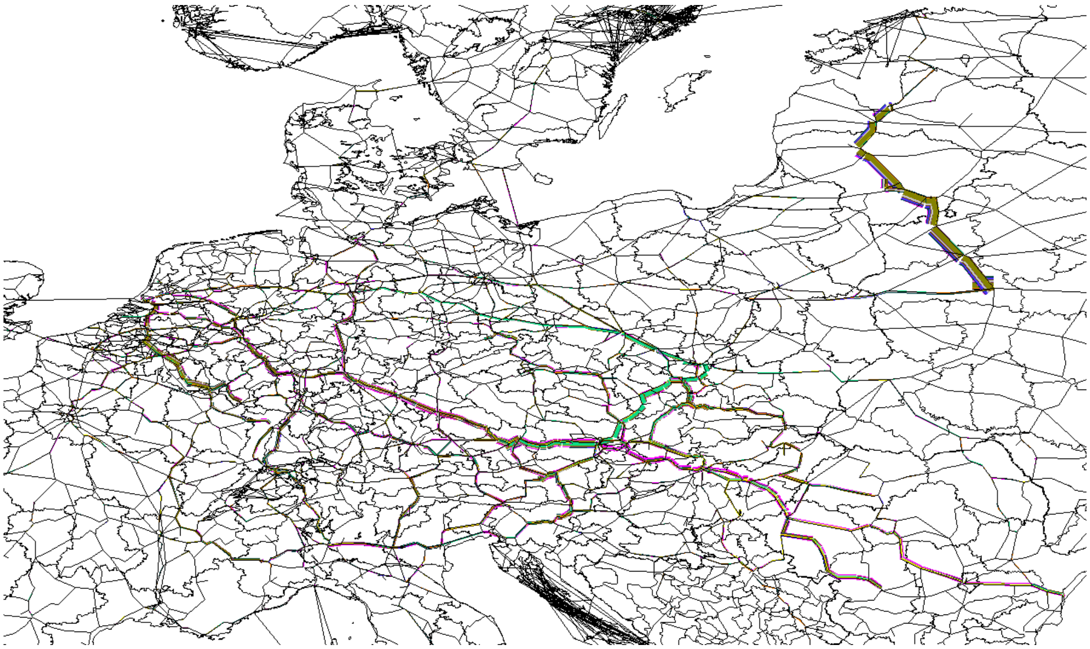
For international, cross border flows, the total number of tons transported per mode per NSTR is presented in table 3.3:

Table 3.3 Total flows, per NSTR, Per Mode, Base scenario 2030, International flows

NSTR	Tons Rail	%	Tons Road	%	Tons IWW	%
Agricultural Products	35.145.256	15,2%	173.957.521	75,0%	22.828.035	9,8%
Foodstuffs	15.840.977	7,7%	169.112.238	82,5%	20.033.136	9,8%
Solid Mineral Fuels	41.542.733	42,7%	14.279.958	14,7%	41.494.654	42,6%
Petroleum Products	79.547.182	53,3%	26.108.240	17,5%	43.605.173	29,2%
Ores And Metal	31.759.161	31,0%	25.134.242	24,5%	45.579.923	44,5%
Iron Steel Metals	37.016.472	19,6%	124.020.234	65,7%	27.643.054	14,7%
Minerals	32.589.753	12,4%	174.553.617	66,1%	56.738.256	21,5%
Fertilizers	6.181.298	18,8%	15.286.962	46,4%	11.469.088	34,8%
Chemicals	25.561.448	9,0%	214.186.616	75,7%	43.306.449	15,3%
Other, vehicles, machinery	28.024.370	3,3%	737.449.266	86,6%	86.227.657	10,1%
Total	333.208.650	13,8%	1.674.088.893	69,6%	398.925.425	16,6%

The share of rail and inland waterway transport is much higher in the case of international transport, due to the longer distances. In tons, the share of international rail is almost twice as high as in all transport. The total share of international transport however is only approximately one third of the total transport in Europe. Figure 3.3 presents a plot of the international rail flows in Europe, for the base scenario 2030.

Figure 3.3 International flows, per NSTR, Base scenario



3.2 Modal shift per project scenario

The following tables present the modal shift of the different project scenarios, calculated with TRANS-TOOLS and the modal split module. The following abbreviations are used in the table:

BASE: Base scenario 2030

DB: Reduction of border resistance

LOS: Increase level of service

UNR: Decrease of reliability

Table 3.4 gives an overview of the modal split per scenario for all flows.

Table 3.4: Modal split per mode per project scenario, all transport 2030

NSTR	BASE rail	DB rail	LOS rail	UNR rail	BASE Road	DB road	LOS Road	UNR road	BASE IWW	DB IWW	LOS IWW	UNR IWW
Agricultural Products	9,1%	9,1%	9,6%	9,1%	88,0%	88,0%	87,5%	88,0%	3,0%	3,0%	2,9%	3,0%
Foodstuffs	2,3%	2,3%	2,5%	2,3%	95,6%	95,6%	95,4%	95,6%	2,1%	2,1%	2,1%	2,1%
Solid Mineral Fuels	48,8%	48,8%	49,8%	48,8%	36,7%	36,7%	35,9%	36,7%	14,5%	14,5%	14,4%	14,5%
Petroleum Products	42,6%	42,6%	44,3%	42,6%	45,5%	45,5%	43,9%	45,5%	11,9%	11,9%	11,8%	11,9%
Ores And Metal	38,3%	38,3%	39,3%	38,3%	45,8%	45,8%	44,9%	45,8%	16,0%	16,0%	15,9%	16,0%
Iron Steel Metals	13,6%	13,6%	14,3%	13,6%	79,9%	79,9%	79,2%	79,9%	6,5%	6,5%	6,5%	6,5%
Minerals	3,2%	3,2%	3,5%	3,2%	93,9%	93,9%	93,6%	93,9%	2,9%	2,9%	2,9%	2,9%
Fertilizers	7,2%	7,2%	7,6%	7,2%	82,8%	82,8%	82,4%	82,8%	10,0%	10,0%	9,9%	10,0%
Chemicals	6,7%	6,7%	7,2%	6,7%	86,6%	86,6%	86,1%	86,6%	6,7%	6,7%	6,7%	6,7%
Other, vehicles, machinery	1,5%	1,5%	1,6%	1,4%	95,7%	95,7%	95,6%	95,8%	2,9%	2,9%	2,8%	2,9%
Total	**7,8%**	**7,8%**	**8,2%**	**7,7%**	**87,9%**	**87,9%**	**87,5%**	**87,9%**	**4,3%**	**4,3%**	**4,3%**	**4,3%**

For all transport, the impact on the modal split is very limited for the decreased border and unreliability scenarios, whereas the increased level of service has a small (app. 0,5 %) positive impact on the share of rail transport. The impact is higher when the focus is on international transport, as can be seen in the next table, 3.5:

Table 3.5: Modal split per mode per project scenario, international transport 2030

NSTR	BASE rail	DB rail	LOS rail	UNR rail	BASE Road	DB road	LOS road	UNR road	BASE IWW	DB IWW	LOS IWW	UNR IWW
Agricultural Products	15,2%	15,2%	16,0%	15,1%	75,0%	75,0%	74,2%	75,0%	9,8%	9,8%	9,8%	9,8%
Foodstuffs	7,7%	7,7%	8,2%	7,7%	82,5%	82,5%	82,1%	82,5%	9,8%	9,8%	9,7%	9,8%
Solid Mineral Fuels	42,7%	42,7%	43,4%	42,7%	14,7%	14,7%	14,3%	14,7%	42,6%	42,6%	42,3%	42,6%
Petroleum Products	53,3%	53,3%	54,7%	53,3%	17,5%	17,5%	16,3%	17,5%	29,2%	29,2%	29,0%	29,2%
Ores And Metal	31,0%	31,0%	31,8%	31,0%	24,5%	24,5%	23,8%	24,5%	44,5%	44,5%	44,3%	44,5%
Iron Steel Metals	19,6%	19,6%	20,5%	19,6%	65,7%	65,7%	64,9%	65,8%	14,7%	14,7%	14,6%	14,7%
Minerals	12,4%	12,4%	13,2%	12,3%	66,1%	66,1%	65,3%	66,2%	21,5%	21,5%	21,5%	21,5%
Fertilizers	18,8%	18,8%	19,2%	18,8%	46,4%	46,4%	46,1%	46,4%	34,8%	34,8%	34,8%	34,8%
Chemicals	9,0%	9,0%	9,7%	9,0%	75,7%	75,7%	75,0%	75,7%	15,3%	15,3%	15,3%	15,3%
Other, vehicles, machinery	3,3%	3,4%	3,6%	2,9%	86,6%	86,5%	86,3%	86,9%	10,1%	10,1%	10,1%	10,1%
Total	**13,8%**	**13,9%**	**14,5%**	**13,7%**	**69,6%**	**69,5%**	**69,0%**	**69,7%**	**16,6%**	**16,6%**	**16,5%**	**16,6%**

The impact of the decreased border resistance on the modal shift is very limited. An explanation for this is the relative low importance of speed for most commodities, particularly those that are generally transported by rail. Reliability and level of service are more important than speed. For that reason the scenario ‘unreliability’ was introduced. As can be seen in the table, the impact of this scenario is high in the NSTR-commodity 9: other, general cargo.

The highest impact is due to the level-of-service scenario, in which border resistance reduction is combine with decrease of costs and increase of speed. The increase of rail in international transport compared to the base scenario is 5 %.

The next figures 3.4 to 3.6 give a graphic presentation of the changes of the rail freight flows for the three scenarios for international transport. In red the volume reduction compared to the base scenario is expressed, green shows the volume increase compared to the base scenario.

Figure 3.4 Changes in flow: Decreased border versus Base

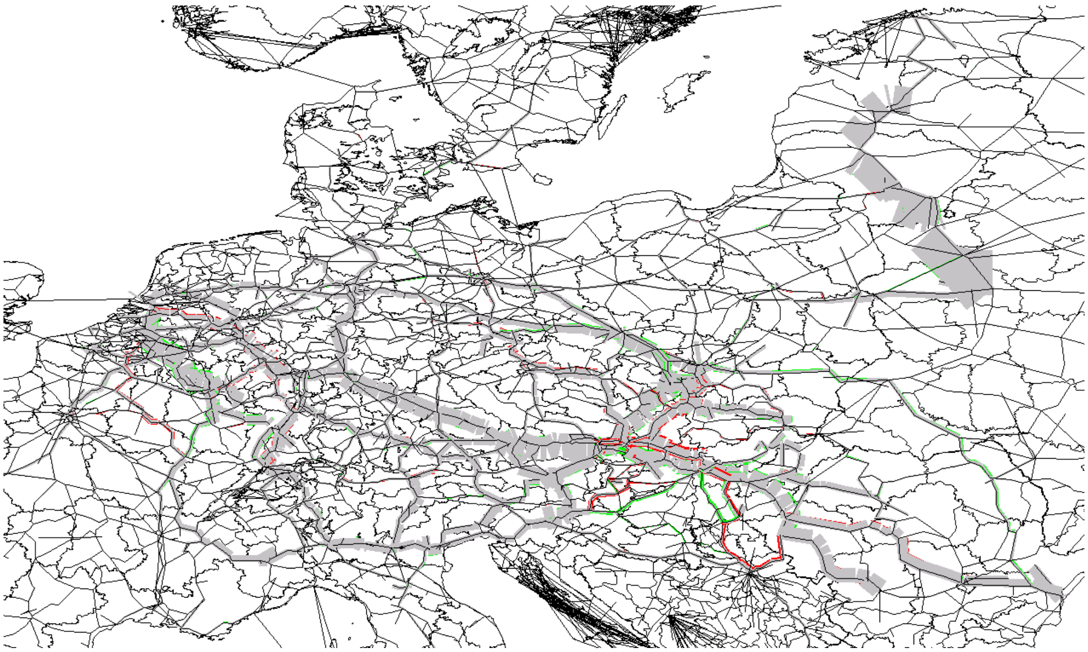


Figure 3.5 Changes in flow: Unreliability versus Base

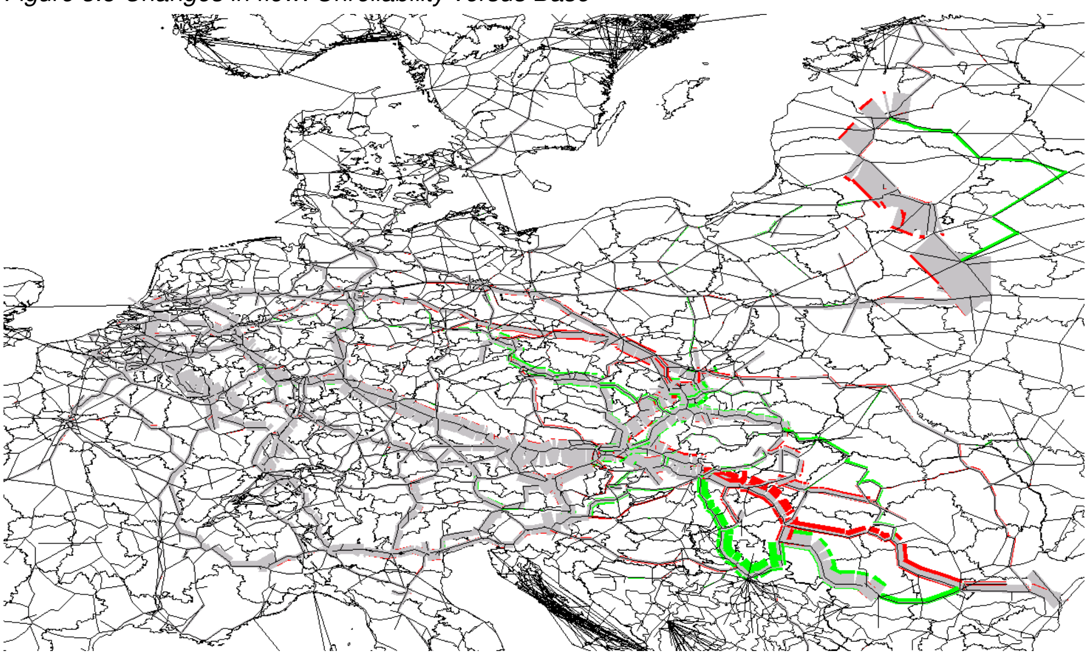
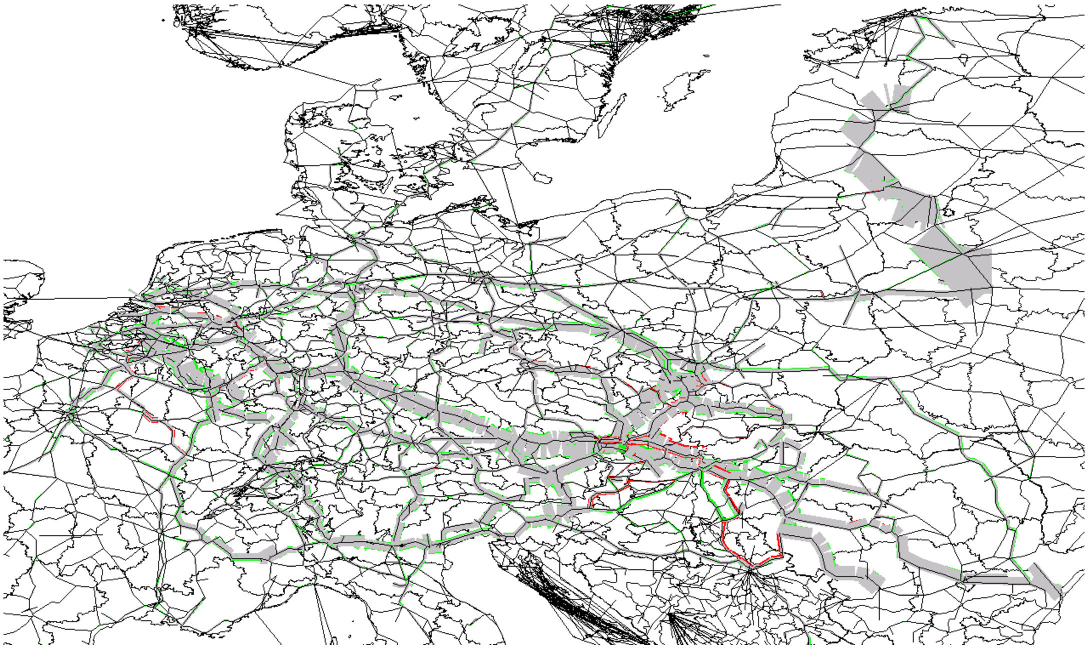


Figure 3.6 Changes in flow: Increased LOS compared to Base



3.3 Ton kilometers

The tons transported over the network result in a total of ton kilometers. This information is necessary input for the calculations of the environmental impacts of a modal shift. These are presented in paragraph 3.4.

Table 3.6 presents for the two flows (all transport and international transport) the total number of ton kilometers per project scenario.

Table 3.6 Total ton kilometers per project scenario

	All transport	International transport
Base		
Road	18.991.703.171.215	4.759.027.261.580
Rail	2.337.911.381.045	1.000.876.251.536
IWW	1.117.428.468.546	825.039.959.907
Total	*22.447.043.020.806*	*6.583.943.473.023*
Decreased borders		
Road	18.988.914.182.331	4.756.414.246.945
Rail	2.339.057.929.433	1.002.405.455.726
IWW	1.117.360.758.352	824.975.219.468
Total	*22.445.332.870.116*	*6.583.794.922.139*
Unreliability		
Road	19.006.753.719.520	4.773.256.620.874
Rail	2.338.264.310.112	998.640.558.569
IWW	1.117.542.115.641	825.139.376.647
Total	*22.462.560.145.273*	*6.597.036.556.090*
Increased Level of Service		
Road	18.889.769.145.744	4.717.047.529.498
Rail	2.477.030.206.975	1.053.580.280.983
IWW	1.108.991.805.952	820.507.349.972
Total	*22.475.791.158.671*	*6.591.135.160.453*

The share of ton kilometers in international transport is approximately 30 % of the total transport. Increased level of service leads tot an increase of the share of rail transport. The figures on ton kilometers are needed in order to calculate the environmental impacts of the different project scenarios.

3.4 Environmental impacts

The following emissions are incorporated in the calculations:

- Affecting the greenhouse impact:
  - CO_2

Affecting the air quality:
  - SO_2
  - $PM_{2,5}$
  - NO_x

Emission factors per ton kilometer are provided in the STREAM study. Table 3.7 gives an overview of the emission factors that are used in the calculations of the environmental impacts.

Table 3.7: Emission factors used (grams per ton kilometer)

Emission factors WTW 2020 bulk and general cargo g/tkm	Road (truck>20 t, motorway)	Train (medium, electric)	IWW (Rhine Herne CEMT IV)
CO_2	122,0	8,3	36,0
SO_2	0,0840	0,016	0,025
$PM_{2,5}$	0,00760	0,00044	0,01300
NO_x	0,490	0,010	0,380

Table 3.8 gives an overview of the calculation results of the emissions per project scenario for the international transport flows.

Table 3.8 Environmental impacts per project scenario, international transport

Base		ton-km	CO2 (kg)	SO2 (kg)	PM2,5 (kg)	NOx (kg)
	Road	4.759.027.261.580	580.601.326	399.758	36.169	2.331.923
	Rail	1.000.876.251.536	8.307.273	16.014	440	10.009
	IWW	825.039.959.907	29.701.439	20.626	10.726	313.515
	Total	*6.584.943.473.023*	*618.610.037*	*436.398*	*47.335*	*2.655.447*
Decreased borders						
	Road	4.756.414.246.945	580.282.538	399.539	36.149	2.330.643
	Rail	1.002.405.455.726	8.319.965	16.038	441	10.024
	IWW	824.975.219.468	29.699.108	20.624	10.725	313.491
	Total	*6.583.794.922.139*	*618.301.611*	*436.202*	*47.314*	*2.654.158*
Unreliability						
	Road	4.773.256.620.874	582.337.308	400.954	36.277	2.338.896
	Rail	998.640.558.569	8.288.717	15.978	439	9.986
	IWW	825.139.376.647	29.705.018	20.628	10.727	313.553
	Total	*6.597.036.556.090*	*620.331.042*	*437.560*	*47.443*	*2.662.435*
Increased Level of Service						
	Road	4.717.047.529.498	575.479.799	396.232	35.850	2.311.353
	Rail	1.053.580.280.983	8.744.716	16.857	464	10.536
	IWW	820.507.349.972	29.538.265	20.513	10.667	311.793
	Total	*6.591.135.160.453*	*613.762.780*	*433.602*	*46.980*	*2.633.682*

Table 3.9 summarises the impacts and gives the relative impact, expressed in % change compared to the base scenario.

Table 3.9 Relative impact two project scenario's international transport

	Base	Decreased borders	%	Increased Level of Service	%
Ton km total	6.584.943.473.023	6.583.794.922.139	-0,02%	6.591.135.160.453	0,09%
Ton km road	4.759.027.261.580	4.756.414.246.945	-0,05%	4.717.047.529.498	-0,88%
Ton km rail	1.000.876.251.536	1.002.405.455.726	0,15%	1.053.580.280.983	5,27%
Ton km IWW	825.039.959.907	824.975.219.468	-0,01%	820.507.349.972	-0,55%
CO_2	618.610.037	618.301.611	-0,05%	613.762.780	-0,78%
SO_2	436.398	436.202	-0,05%	433.602	-0,64%
$PM_{2,5}$	47.335	47.335	0,00%	46.980	-0,75%
NO_x	2.655.447	2.654.158	-0,05%	2.633.682	-0,82%

The increased level of service as determined in this project scenario will lead to a substantial (>5%) increase of the rail freight transport in Europe. This will lead to a decrease of emissions of greenhouse gasses and pollutants of between 0,6 and 0,8 %.

The impact of the decrease of border resistance alone will lead to a marginal impact on the ton kilometres of rail freight (0,15 %) and the emissions of pollutants and CO2 (between 0 and 0,05%).

4 Conclusive remarks

It has been possible to calculate the impact of the improvement of rail freight services, using EC-wide models. The TRANS-TOOLS model, the modal split module and the network and OD-data of ETIS (ETIS-plus and BASE) have been used to determine the future freight volumes in 2030 per NSTR and transport mode. Three project scenarios have been distinguished and for each scenario the modal shift and environmental impacts have been calculated.

The overall impact of RETRACK is the highest for international freight flows. The influence of the waiting times at the border is very limited. The influence of (un)reliability seems to be bigger, but it is extremely difficult to model reliability in a quantitative manner. The highest impact is caused by the combination of time and costs reduction, as calculated in the level-of-service-scenario. An increase of app. 5 % of the rail freight transport in Europe can be expected when costs decrease with 10 %, speed increases with 10 % and border waiting times decrease with 40 %. This will lead to a decrease of emissions of greenhouse gasses and pollutants of between 0,6 and 0,8 %.

References

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