Fehmarn Belt Forecast 2002

Reference Cases,
Supplement to Final Report of April 2003

November 2003

FTC Fehmarnbelt Traffic Consortium

TABLE OF CONTENTS **PAGE**

1 PREFACE 4

2 SUMMARY 5

2.1 Common Assumptions 2015 5

2.2 Transport Cost Variables 5

2.3 Results, Reference Case A 6
2.3.1 Passenger Traffic 6
2.3.2 Freight Traffic 8

2.4 Results, Reference Case B 9
2.4.1 Passenger Traffic 9
2.4.2 Freight Traffic 11

2.5 Comparison of Reference Cases A and B – Fehmarn Belt Traffic 12

3 FORECAST METHOD 14

3.1 Common Assumptions 2015 14

3.2 Reference Cases Ferry Supply 2015 14

3.3 Reference Cases Infrastructure Supply 2015 16

4 REFERENCE CASE FORECASTS 17

4.1 Transport Cost Variables 17

4.2 Reference Case A 17
4.2.1 Transport User costs 18
4.2.2 Passenger Traffic 18
4.2.3 Freight Traffic 25

4.3 Reference Case B 30
4.3.1 Transport User costs 30
4.3.1 Passenger Traffic 31
4.3.3 Freight Traffic 37

4.4 Comparison of Reference Cases A and B – Fehmarn Belt Traffic 42

APPENDICES 1

Reference Case B without fixed link 9
Passenger Traffic 9

1 PREFACE

The *Bundesministerium für Verkehr, Bau- und Wohnungswesen* (Berlin) and *Trafikministeriet* (Copenhagen) have asked the Fehmarnbelt Traffic Consortium (FTC) for a traffic demand forecast for Reference Cases – that are forecasts for a situation without a Fehmarn Belt fixed link and thus for a situation with continued ferry traffic between Rødby and Puttgarden - for the year 2015. In order to assess the impact of the establishment of a fixed link across Fehmarn Belt, it is necessary to compare the traffic flows in the situations with and without a fixed link.

The three FTC partners have done the work:

BVU – Beratergruppe für Verkehr und Umwelt GmbH, Freiburg (BVU)
Carl Bro a|s, Glostrup (CB) – leading partner
Intraplan Consult GmbH, München (ITP).

The working period was from April 2003 to November 2003.

This report documents the work and its results and shall be seen as a supplement to the report “Fehmarn Belt Forecast 2002, final report, April 2003”. Thus, this report will focus on the **differences** between the Reference Cases and the Base Cases.

Detailed results of the forecasts and supplemental evaluations are documented in the Appendices.

The traffic demand forecasts for the Fehmarn Belt performed in 2002 are an update of the traffic forecasts documented by the FTC in a report in 1999.

In this report, the German/Danish rule of using ‘,’ (comma) as the decimal character in numbers and a ‘.’ (point) to separate thousands has been applied.

2 SUMMARY

2.1 Common Assumptions 2015

The differences in assumptions between the Reference Cases – that is with continued ferry service - and the Bases Cases – that is with a Fehmarn Belt fixed link - refer to the ferry supply and the infrastructure.

The basic assumptions regarding socio economic development such as GDP, car ownership, population etc. are the same as for the Bases Cases. As regards user transport costs, two sets of assumptions have been defined for Reference Case A and B, respectively. These are the same as the assumptions regarding the development of transport user costs in the Base Cases.

The basic assumption is that in 2015 the ferry traffic between Rødby and Puttgarden is maintained with the same frequencies as today, but a higher capacity due to reconstruction of the ferries (proving the ferries with an extra deck), and on the ferry connections across the Baltic Sea there is a moderate expansion compared to today. These expansions consist of an additional frequency on the Gedser – Rostock service and an additional frequency on the Trelleborg – Rostock fast ferry service.

The main differences in the assumptions on infrastructure between the Reference Cases and the Base Cases concern the railways. As far as bus and air traffic are concerned, the assumed infrastructure is the same in the Reference Cases and the Base Cases. For the roads, though, it is assumed that Oldenburg – Heiligenhafen is widened to 4 lanes, while Heiligenhafen – Puttgarden is 2 lanes.

For the railways the Reference Cases do not include Fehmarn Belt hinterland connections, except for some investments in the route via Sønderjylland and Schleswig

2.2 Transport Cost Variables

As for the two Base Cases two different sets of basic assumptions have been applied in order to test the effects of (1) the *Bundesverkehrswegeplanung Integration* assumption with the changes about low-cost airlines and (2) an extrapolation of the assumptions of the 1999 Fehmarn Belt forecasts including important changes. For rail freight, different assumptions are used for transport speed, reliability and combined transport.

With these two sets of cost assumptions and the common assumptions used for the Base Cases forecasts have been run for the year 2015, named Reference Case A and Reference Case B, respectively.

2.3 Results, Reference Case A

2.3.1 Passenger Traffic

Table 2.1 shows the total passenger flows between Denmark / Scandinavia and the continent by mode for the base year 2001, the 2015 Reference Case A and the 2015 Base Case A. For comparison, the 1999 forecast for 2010 Reference Case is shown, too.

Main mode	1.000 Passengers/year	Modal Split percent
Base Year 2001		
Rail	854	3,6%
Car	8.498	35,5%
Bus	2.739	11,4%
Air	9.905	41,4%
Walk-on	1.929	8,1%
Total	**23.925**	**100,0%**
1999 Forecast for 2010 Reference Case		
Rail	1.069	3,3%
Car	10.612	33,1%
Bus	3.388	10,6%
Air	13.905	43,4%
Walk-on	3.085	9,5%
Total	**32.059**	**100,0%**
Reference Case A 2015		
Rail	1.181	3,4%
Car	11.204	32,1%
Bus	3.009	8,6%
Air	17.077	49,0%
Walk-on	2.395	6,9%
Total	**34.866**	**100,0%**
Base Case A, 2015		
Rail	1.537	4,4%
Car	12.042	34,2%
Bus	2.973	8,4%
Air	16.823	47,7%
Walk-on	1.850	5,3%
Total	**35.225**	**100,0%**

Table 2.1: Total number of trips between Denmark/Scandinavia and the Continent by mode Reference Case A and Base Case A, 2015

It can be seen that the new forecast results in a higher number of passenger trips and a different distribution on modes than the 1999 forecasts. Especially the air traffic has a much higher proportion of the total number of trips between Denmark/Scandinavia and the Continent in the new Reference forecast than in the 1999 forecast, due to the introduction of low fare routes. In the Base Case A, the proportion of trips with cars and rail is higher than in the Reference Case A as a result of their greater competitiveness in a situation with a fixed link. The total number of passenger trips in 2015 is nearly the same for Reference Case A and the Base Case A.

Table 2.2 presents the Fehmarn Belt traffic for the Reference Case A and Base Case A compared with the observed traffic in 2001. In the Reference Case, the largest change compared to 2001 is expected in rail passengers that increase their share from 5,5% to 8,4%. This is due to shorter travel time for the trains, especially the night trains through Sønderjylland / Schleswig, due to some improvements in the infrastructure. From the table it can be seen, that the number of person cars per day in 2015 is about 2.600 higher with a fixed link than with continued ferry service, corresponding to more than 50% more cars per day.

	Base Year 2001		**Reference Case A, 2015**		**Base Case A, 2015**		**Difference between Base Case A and Reference Case A, 2015**	
passengers/year	abs.	percent	abs.	percent	abs.	percent	abs.	percent
Rail passengers	352.000	5,5%	638.000	8,4%	1.497.000	15,3%	859.000	134,6%
Car passengers	4.058.000	63,6%	4.781.000	63,4%	6.598.000	67,7%	1.817.000	38,0%
Bus passengers	1.248.000	19,6%	1.423.000	18,8%	1.658.000	17,0%	235.000	16,5%
Walk-on pass.	718.000	11,3%	711.000	9,4%	0	0,0%	711.000	-100%
Passengers/year	**6.376.000**	**100,0%**	**7.553.000**	**100,0%**	**9.753.000**	**100,0%**	**2.200.000**	**29.1%**
Passengers/day	**17.468**		**20.693**		**26.721**		**6.028**	
Cars/day	3.718		4.995		7.496		2.551	51,6%
Buses/day	88		112		129		17	15,2%

Table 2.2: Fehmarn Belt traffic, Reference Case A and Base Case A, 2015

Table 2.3 shows the contribution from different steps in the forecast, compared to the Base Case A. The table shows that most of the changes compared to the Base Case are caused by redistribution of trips between Fehmarn Belt and other routes.

1.000 passengers / year	**Car passengers/ year**	**Bus passengers/ year**	**Rail passengers/ year**
Base Case A	**6.598**	**1.658**	**1.497**
contribution from			
modal split change	-235	72	-191
induced traffic	-547	-34	-160
change of destination choice	-43	-2	-13
change of route choice	-992	-271	-495
total effects	-1817	-235	-859
Reference Case A	**4.781**	**1.423**	**638**

Table 2.3: Contribution from different steps of the forecast. Reference Case A, 2015, 1.000 passengers / year.

2.3.2 Freight Traffic

The total freight flows by road and rail between Denmark/Scandinavia and the continent are presented in table 2.4. It is in the model assumed that the total freight flows between Scandinavia and the Continent are the same with and without the fixed link across Fehmarn Belt. This table also shows the modal distribution of all freight (except sea freight) for the base year 2001, the Reference Case A forecast and the Base Case A forecast for 2015. As can be seen from the table, the modal distribution in the Reference Case and the Base Case is nearly the same. Compared to 2001, percentage of freight on rail is higher in 2015, due to the railway friendly assumptions in Case A.

Tons or vehicles/year Mode	**1.000 t**	**1.000 Vehicles**	**1.000 t percent**
Base Year 2001			
Road	23.034	1.502	77,8%
Rail conventional	5.579	277	18,8%
Rail combined	999	102	3,4%
Total	**29.612**	**1.881**	**100,0%**
Reference Case A, 2015			
Road	31.650	2.174	68,9%
Rail conventional	12.270	627	26,7%
Rail combined	2.003	193	4,4%
Total	**45.923**	**2.994**	**100,0%**
Base Case A, 2015			
Road	31.315	2.155	68,2%
Rail conventional	12.587	645	27,4%
Rail combined	2.021	194	4,4%
Total	**45.923**	**2.994**	**100,0%**

Table 2.4: Total freight flows between Denmark/Scandinavia and the continent by mode, Reference Case A and Base Case A, 2015, 1.000 tons or vehicles/year

Table 2.5 summarises by mode the freight using the Fehmarn Belt. In Base Case A, the total traffic in tons is 9,1% higher than in the Reference Case A. For vehicles, the differences are 8,1% for road traffic and 8,5% for rail traffic. The growth rates show, that road transport increases by 40 - 50 percent from 2001 to 2015 depending on the case, whereas rail freight grows by 120 -140 percent.

As stated in the note under table 2.5, the Reference Case lists rail freight routed via the Great Belt. Only in the Base Case with a fixed link the rail freight is routed via Fehmarn Belt.

	Base Year 2001		Reference Case A, 2015		Base Case A, 2015		Difference between Base Case A and Reference Case A, 2015	
Mode	**freight 1.000 t**	**1.000 vehicles**	**freight 1.000 t**	**1.000 vehicles**	**freight 1.000 t**	**1.000 vehicles**	**freight 1.000 t**	**1.000 vehicles**
Road	4.434	274	5.952	382	6.426	413	474	31
Rail	4.447*	255*	9.881*	562*	10.843	610	962	48
Total	**8.881**	**529**	**15.833**	**944**	**17.269**	**1.023**	**1436**	**79**

* These transports are routed via the Great Belt

Table 2.5: Fehmarn Belt freight transport, Reference Case A and Base Case A, 2015, 1.000 tons or vehicles/year

2.4 Results, Reference Case B

Reference Case B differs from A in the user costs assumptions. The assumptions chosen represent the values that were used with the 1999 forecasts in order to allow a comparison between the Base Case A assumptions, which in many respects represent a more environment-friendly transport policy, with the more conservative assumptions used with the 1999 forecasts.

2.4.1 Passenger Traffic

Table 2.6 shows the total passenger flows between Denmark / Scandinavia and the continent by mode for the base year 2001, the 1999 Reference forecast, the 2015 Reference Case B and the 2015 Base Case B.

Main mode	1.000 Passengers/year	Modal Split percent
Base Year 2001		
Rail	854	3,6%
Car	8.498	35,5%
Bus	2.739	11,4%
Air	9.905	41,4%
Walk-on	1.929	8,1%
Total	**23.925**	**100,0%**
1999 Forecast for 2010 Reference Case		
Rail	1.069	3,3%
Car	10.612	33,1%
Bus	3.388	10,6%
Air	13.905	43,4%
Walk-on	3.085	9,5%
Total	**32.059**	**100,0%**
Reference Case B 2015		
Rail	1.067	3,0%
Car	11.587	32,5%
Bus	2.974	8,3%
Air	17.619	49,5%
Walk-on	2.395	6,7%
Total	**35.642**	**100,0%**
Base Case B 2015		
Rail	1.423	4,0%
Car	12.422	34,5%
Bus	2.938	8,2%
Air	17.361	48,2%
Walk-on	1.855	5,1%
Total	**35.999**	**100,0**

Table 2.6: Total number of trips between Denmark/Scandinavia and the Continent by mode Reference Case B and Base Case B, 2015

As in Case A, the forecast for Reference Case B results in a higher number of passenger trips and a different distribution on modes than the 1999 forecasts. Especially the air traffic has a much higher proportion due to the introduction of low fare routes. The total number of passenger trips in 2015 is nearly the same for Reference Case B and the Base Case B.

Table 2.7 presents the Fehmarn Belt traffic for the Reference Case B and Base Case B compared with the observed traffic in 2001. In the Reference Case B, the largest change is expected in Walk-on passengers that decrease their share from 11,3% to 9,3%. Compared with the Base Case B, the Reference Case B shows smaller shares for rail and car passengers; partly due to the fact that the Reference Case includes a number of walk-on passengers, which is not the case in the Base Case B. From the table can be seen, that the number of person cars per day in 2015 is about 2.550 higher with a fixed link than with continued ferry service, corresponding to an increase in the number of cars by a little less than 50% from Reference Case B to Base Case B.

	Base Year 2001		Reference Case B, 2015		Base Case B, 2015		Difference between Base Case B and Reference Case B, 2015	
passengers/year	abs.	percent	abs.	percent	abs.	percent	abs.	percent
Rail passengers	352.000	5,5%	560.000	7,3%	1.386.000	15,3%	826.000	147,5%
Car passengers	4.058.000	63,6%	4.949.000	64,9%	6.809.000	67,7%	1.860.000	37,9%
Bus passengers	1.248.000	19,6%	1.404.000	18,4%	1.638.000	17,0%	234.000	16,7%
Walk-on pass.	718.000	11,3%	711.000	9,3%	0	0,0%	-711.000	-100%
Passengers/year	**6.376.000**	**100,0%**	**7.624.000**	**100,0%**	**9.833.000**	**100,0%**	**2.209.000**	**29,0%**
Passengers/day	**17.468**		**20.888**		**26.940**		**6.052**	
Cars/day	3.718		5.238		7.786		2.548	48,6%
Buses/day	88		112		129		17	15,2%

Table 2.7: Fehmarn Belt traffic, Reference Case B and Base Case B, 2015

Table 2.8 illustrates the contribution from different steps in the forecast calculation, compared to the Base Case B. Just as in Base and Reference Cases A, far the greatest effect stems from the redistribution of trips between other routes and Fehmarn Belt.

1.000 passengers / year	**Car passengers/ year**	**Bus passengers/ year**	**Rail passengers/ year**
Base Case B	**6.809**	**1.638**	**1.386**
Contribution from:			
modal split change	-240	72	-187
induced traffic	-556	-34	-157
change of destination choice	-44	-2	-12
change of route choice	-1020	-270	-470
total effects	-1860	-234	-826
Reference Case B	**4.949**	**1.404**	**560**

Table 2.8: Contributions from different steps of the forecast, Reference Case B 2015, 1.000 passengers/year

2.4.2 Freight Traffic

Table 2.9 shows total freight flows by road and rail between Denmark/Scandinavia and the continent. It is assumed that the total freight flows between Scandinavia and the Continent are the same with and without the fixed link across Fehmarn Belt. This table also shows the modal split (except sea freight) for the base year 2001, the Reference Case B forecast and the Base Case B forecast for 2015.

Mode Tons or vehicles/year	1.000 t	1.000 Vehicles	1.000 t percent
Base Year 2001			
Road	23.034	1.502	77,8%
Rail conventional	5.579	277	18,8%
Rail combined	999	102	3,4%
Total	**29.612**	**1.881**	**100,0%**
Reference Case B, 2015			
Road	35.736	2.365	77,8%
Rail conventional	8.340	429	18,2%
Rail combined	1.847	182	4,0%
Total	**45.923**	**2.976**	**100,0%**
Base Case B, 2015			
Road	35.381	2.348	77,0%
Rail conventional	8.677	446	18,9%
Rail combined	1.865	182	4,1%
Total	**45.923**	**2.976**	**100,0%**

Table 2.9: Total freight flows between Denmark/Scandinavia and the continent by mode, Base Case B, 2015, 1.000 tons or vehicles/year

As can be seen from the table the modal distribution in the base year, the Reference Case and the Base Case is nearly the same.

Table 2.10 summarises the freight transports using the Fehmarn Belt. In Base Case B, the total traffic in tonnes is 9,5% higher than in the Reference Case B. For vehicles, the differences are 8,4% for road traffic and 9,1% for rail traffic. Road transport increases by 50 - 65 percent from 2001 to 2015 depending on the case, whereas rail freight grows by 70 –85 percent.

As stated in the note under table 2.10, the Reference Case lists rail freight routed via the Great Belt. Only in the Base Case with a fixed link, the rail freight is routed via Fehmarn Belt.

	Base Year 2001		Reference Case B, 2015		Base Case B, 2015		Difference between Base Case B and Reference Case B, 2015	
Mode	freight 1.000 t	1.000 vehicles	freight 1.000 t	1.000 vehicles	freight 1.000 t	1.000 vehicles	freight 1.000 t	1.000 vehicles
Road	4.434	274	6.665	417	7.206	452	541	35
Rail	4.447*	255*	7207*	430*	7.983	469	776	39
Total	**8.881**	**529**	**13.872**	**847**	**15.189**	**921**	**1.317**	**74**

* These transports are routed via the Great Belt

Table 2.10: Fehmarn Belt freight transport, Reference Case B and Base Case B, 2015, 1.000 tons or vehicles

2.5 Comparison of Reference Cases A and B – Fehmarn Belt Traffic

Reference Case B with its lower car user costs and lower air fares than Reference Case A will generate more car and air passengers, while the number of rail passengers will be smaller.

The main results for the calculated Fehmarn Belt traffic are shown in table 2.11.

Vehicles/day	Reference Case A	Reference Case B	Difference %
Cars	4.945	5.238	5,9%
Buses	112	112	0%
Lorries	1.047	1.142	9,1%
Average daily traffic (vehicles/day)	6.104	6.492	6,4%
Rail Freight wagons	1.595[1]	1.178[1]	-26,2%
Passenger trains pr day	8	8	0

Table 2.11: Fehmarn Belt traffic, Reference Cases A and B, 1.000 vehicles/day

The greatest differences occur in freight traffic, especially in the number of rail freight wagons due to the lower road user costs assumed in Case B and the more effective train operation in Case A. The total number of road vehicles - especially lorries - is higher in Reference Case B as a consequence of the lower car user costs and higher rail passenger costsForecast preparation

[1] These transports are routed via the Great Belt

3 FORECAST METHOD

As this report shall be regarded as a supplement to the report “Fehmarn Belt Forecast, final report, April 2003”, this report will not mention a number of issues that are dealt with in the above-mentioned report. This includes among other things the forecast models and the model calibration for 2001. Information on these issues can be found in chapters 3 and 4 in the above-mentioned report.

This chapter will focus on **the differences** in assumptions between the Reference Cases and the Base Cases as far as 2015 is concerned.

3.1 Common Assumptions 2015

The differences in assumptions between the Reference Cases and the Base Cases refer to the ferry supply and the infrastructure.

The basic assumptions regarding socio economic development such as GDP, car ownership, population etc. are the same in the Reference Cases as in the Base Cases. As regards user transport costs, two sets of assumptions have been defined for Reference Case A and B, respectively. These are the same as the assumptions regarding the development of transport user costs in the Base Cases.

3.2 Reference Cases Ferry Supply 2015

The basic assumption is that in 2015 the ferry traffic between Rødby and Puttgarden is maintained with the same frequencies as today, but a higher capacity due to reconstruction of the ferries (improving the ferries with an extra deck), and on the ferry connections across the Baltic Sea there is a moderate expansion compared to today. These expansions consist of an additional frequency on the Gedser – Rostock service and an additional frequency on the Trelleborg – Rostock fast ferry service.

The key figures defining the ferry supply for 2015 are shown in table 2.1. The figures that differ from the assumptions for the Base Cases are shown in **bold**.

The ferry connections offering railway transport are marked as such. It may be noted that the possibility of a railway ferry service between Gedser and Rostock, which has been mentioned recently, has not been included in the forecasts.

In the forecasts for the Reference Cases the ticket fares are assumed to be equal to the present ferry fares in fixed prices. A passenger car is assumed to pay € 46 and a lorry € 259 for a one-way trip on Rødby – Puttgarden in 2015 (price level 2002).

As far as the number of passenger trains between Hamburg and Copenhagen is concerned, 8 trains per day in total (both directions together) are assumed in the Reference Cases.

Appendix 4 shows the travel time for transport between Hamburg and Copenhagen in 2001, the Reference Cases 2015, and the Base Cases 2015.

	Frequency departures /day	**Travel time** minutes	**Pass. Fare**[2] €	**Freight fare**[3] €	**Railway** R
Denmark-Norway					
Frederikshavn-Oslo	1	540	210	446	
Frederikshavn-Larvik/Moss	2	300	210	551	
Hirtshals-Oslo	1	750	210	551	
Hirtshals-Kristianssand	3-4	170-240	210	541	
Hanstholm-Egersund/Bergen	1	990	355	940	
Copenhagen-Oslo	1	960	631	no info	
Germany-Norway					
Kiel-Oslo	1	1.140	422	878	
Denmark-Sweden					
Frederikshavn-Göteborg	5	210	111	380	
Frederiksh. - Göteborg FF	2	120	128	n.a.	
Grenå-Varberg	3	270	111	396	
Helsingør-Helsingborg HH	36	20	29	99	
Helsingør-Helsingborg Scand	55	20	31	116	
Rønne-Ystad	2	150	120	270	
Rønne-Ystad FF	3	80	85	n.a.	
Øresundsbron	bridge	11	17-30	92	R
Germany-Denmark					
Rødby-Puttgarden Ferry	**48**	**52**	**46**	**259**	**(pass.)R**
Gedser-Rostock	**10**	120-145	82	259	
Rønne-Sassnitz	0,7	210	151	348	
Rønne-Mukran	1	210	151	348	
Havneby-List	6	55	43	161	
Germany-Sweden					
Kiel-Göteborg	1	840	418	540	
Travemünde-Malmö	2	540	100	375	
Travemünde-Göteborg	1	900	n.a.	499	
Travemünde-Trelleborg TT	2	450	189	n.a.	
Travemünde-Trelleborg Scand	2	480	n.a.	562	
Rostock-Trelleborg TT	3	360	189	n.a.	
Rostock-Trelleborg TT FF	**5**	180	189	n.a.	
Rostock-Trelleborg Scand	3	360	115	464	(freight) R
Sassnitz-Trelleborg	5	225	88	348	R
Germany-Finland					
Lübeck-Helsinki	0,25	1.980	1.177	1.250	
Rostock-Hanko	0,86	1.320	421	1.142	
Rostock-Helsinki	0,43	1.500	340	n.a.	
Poland					
Copenhagen-Swinoujscie	0,7	540	128	480	
Copenhagen-Trelleborg-Gdansk	0,5	1.080	142	n.a	
Rønne-Swinoujscie	0,14	360	177	480	
Swinoujscie-Ystad	2	390-480	227	604	(freight) R
Gdynia-Karlskrona	1	630	278	n.a.	

Table 3.1: Key information for ferries, 2015.
FF= fast ferry, HH = HH Line, TT= TT Line, Scand = Scandlines, n.a. = transport not available, no info = no information available

[2] One-way fare for a passenger car and 4 persons incl. cabin where applicable, 2002 prices
[3] One-way fare excl. VAT for a trailer/semi-trailer incl. handling charge where applicable, 2002 prices

3.3 Reference Cases Infrastructure Supply 2015

The main differences in the assumptions on infrastructure between the Reference Cases and the Base Cases concern the railways. As far as bus and air traffic are concerned, the assumed infrastructure is the same in the Reference Cases and the Base Cases. For the roads, though, it is assumed that Oldenburg – Heiligenhafen is widened from 2 to 4 lanes, while Heiligenhafen – Puttgarden is 2 lanes.

For the railways the Reference Cases do not include Fehmarn Belt hinterland connections, except for some investments in the route via Sønderjylland and Schleswig. In details, there are the following differences in the assumed infrastructure in 2015:

Basic Infrastructure Rail - Continent

No upgrading Lübeck - Puttgarden

Neumünster – Bad Oldesloe: double track electrified and max speed 120 km/h

Basic Infrastracture Rail - Nordic Countries

No electrification Ringsted – Rødby
No upgrading Orehoved – Rødby to double track

Double tracks all the way from Kolding to the border electrified and max speed 160 km/h

4 REFERENCE CASE FORECASTS

4.1 Transport Cost Variables

As for the two Base Cases two different sets of basic assumptions have been applied in order to test the effects of (1) the *Bundesverkehrswegeplanung Integration* assumption with the changes about low-cost airlines and (2) an extrapolation of the assumptions of the 1999 Fehmarn Belt forecasts including important changes. For rail freight, different assumptions are used for transport speed, reliability and combined transport.

With these two sets of cost assumptions and the common assumptions used for the Base Cases forecasts have been run for the year 2015, named Reference Case A and Reference Case B, respectively.

4.2 Reference Case A

The user costs assumptions are shown in table 4.2.1. These are exactly the same assumptions as used in Base Case A.

4.2.1 Transport User costs

Cost Item	Case A Assumptions
1 Car	
World crude oil price	+33 %
(No policy item, but relevant for fuel price)	
Mineral oil tax rates	+68 %
Total fuel price	+56 %
Specific fuel consumption	-26 %
Fuel costs (price * consumption)	**+15** %
Road user fees	
- Toll road fees	in some countries
- General mileage-related fees passenger cars	no charge/km but vignettes in some countries
User costs	**+15 %**
2 Lorry	
Total fuel price	+50 %
Specific fuel consumption	-9 %
Fuel costs (price * consumption)	+36 %
Truck highway toll in Germany	0,20 €/km
Truck highway toll in Denmark	0
Productivity	+18%
User costs	**-4 %**
3 Rail	
User costs passengers	**-30 %** in private long-distance traffic
User costs freight (productivity improvement and/or subsidies)	**-18 %**
4 Bus user costs	**no change**
5 Air	
Price impact of productivity (in general)	decrease
Price differentiations (Yield-Management-Systems)	more differentiation
Impacts of competition / alliances	increase
Landing / Take-off charges / Passenger handling charges	stronger increase
Implementation of kerosine tax	no change
Changes of international treaties that prevent kerosine taxation	no change
Implementation of VAT on international flights	yes
Implementation of VAT on international flights from Denmark	no
User costs	**9 %** (average) **25 % lower** on low-cost routes

Table 4.2.1: Overview user costs assumptions, Reference Case A
Growth rates relate to the period 1997-2015, all cost items are in constant prices

4.2.2 Passenger Traffic

The following tables and graphs summarise the Reference Case A forecast for 2015. The 2001 data represent the results of the latest model calibration and constitutes, therefore, the base year for the forecasts. For comparison, the reference case 2010 from the 1999 forecast is shown, too.

Main mode	1.000 Passengers/year	Modal Split percent
Base Year 2001		
Rail	854	3,6%
Car	8.498	35,5%
Bus	2.739	11,4%
Air	9.905	41,4%
Walk-on	1.929	8,1%
Total	**23.925**	**100,0%**
1999 Forecast for 2010 Reference Case		
Rail	1.069	3,3%
Car	10.612	33,1%
Bus	3.388	10,6%
Air	13.905	43,4%
Walk-on	3.085	9,5%
Total	**32.059**	**100,0%**
Reference Case A 2015		
Rail	1.181	3,4%
Car	11.204	32,1%
Bus	3.009	8,6%
Air	17.077	49,0%
Walk-on	2.395	6,9%
Total	**34.866**	**100,0%**
Base Case A, 2015		
Rail	1.537	4,4%
Car	12.042	34,2%
Bus	2.973	8,4%
Air	16.823	47,7%
Walk-on	1.850	5,3%
Total	**35.225**	**100,0%**

Table 4.2.2: Total number of trips between Denmark/Scandinavia and the Continent by mode Reference Case A and Base Case A, 2015

It can be seen that the new forecast results in a higher number of passenger trips and a different distribution on modes than the 1999 forecasts. Especially the air traffic has a much higher proportion of the total number of trips between Denmark/Scandinavia and the Continent in the new Reference forecast than in the 1999 forecast, due to the introduction of low fare routes. In the Base Case A, the proportion of trips with cars and rail is higher than in the Reference Case A as a result of their greater competitiveness in a situation with a fixed link. The total number of passenger trips in 2015 is nearly the same for Reference Case A and the Base Case A.

Trip Purpose	Base year 2001		Reference Case A 2015		Base Case A 2015	
1.000 passengers/year	abs.	percent	abs.	percent	abs.	percent
commuter work	16	0,1%	37	0,1%	109	0,3%
shopping	348	1,5%	305	0,9%	347	1,0%
business	5.991	25,0%	8.213	23,6%	8.371	23,8%
holidays (>8 days)	9.420	39,4%	12.731	36,4%	12.736	36,2%
day excursion	780	3,3%	1.253	3,6%	1.472	4,2%
short holiday (≤8 days)	3.540	14,8%	5.645	16,2%	5.647	16,0%
visit friend/relatives	2.699	11,3%	5.179	14,9%	5.238	14,9%
weekend commuting	700	2,9%	893	2,6%	966	2,7%
ferry excursion	431	1,8%	610	1,7%	339	1,0%
Total	**23.925**	**100,0%**	**34.866**	**100,0%**	**35.225**	**100,0%**

Table 4.2.3: Purpose distribution for passenger trips, Reference Case A and Base Case A, 2015

Compared with the base year, the Reference Case shows moderate changes with slight increases in day excursions, short holidays and private visits in the relative distribution by trip purpose. Except for ferry excursion, of course, the relative distribution by trip is nearly the same in the Reference Case A and the Base Case A 2015.

1.000 passenger trips/year		Mode					
between:	and:	Rail	Car	Bus	Air[1]	Walk-on	Total
Germany	E.Denmark[2]	510	3.835	1.396	1.376	1.189	8.306
Germany	Sweden	265	3.017	663	2.162	771	6.878
Germany	Norway	14	1.006	151	1.104	31	2.306
Germany	Finland	4	225	28	520	69	846
W.Europe[3]	E.Denmark[2]	172	568	151	3.703	0	4.594
W.Europe[3]	Sweden	80	984	271	4.019	0	5.354
W.Europe[3]	Norway	5	521	70	1.674	0	2.270
W.Europe[3]	Finland	1	99	18	975	0	1.093
E.Europe[4]	E.Denmark[2]	47	158	54	565	56	880
E.Europe[4]	Sweden	75	592	152	644	279	1.742
E.Europe[4]	Norway	7	133	45	189	0	374
E.Europe[4]	Finland	1	66	10	146	0	223
Germany total		793	8.083	2.238	5.162	2.060	18.336
W. Europe total		258	2.172	510	10.371	0	13.311
E. Europe total		130	949	261	1.544	335	3.219
East Denmark[2] total		729	4.561	1.601	5.644	1.245	13.780
Sweden total		420	4.593	1.086	6.825	1.050	13.974
Norway total		26	1.660	266	2.967	31	4.950
Finland total		6	390	56	1.641	69	2.162
Total		**1.181**	**11.204**	**3.009**	**17.077**	**2.395**	**34.866**

Table 4.2.4: Aggregated passenger flows, Reference Case A, 2015, two way totals, trips/year

[1] Traffic to and from Copenhagen, Oslo and Stockholm airports only. [2] Traffic by Baltic Sea ferries only, i.e. mainly with relation to Eastern parts of Denmark. [3] Western Europe: Benelux, France, Spain, Portugal, Switzerland, Austria, Italy, UK and Ireland, Greece, Turkey. [4] Eastern Europe: Poland, Baltic countries, CIS, Czech Republic, Slovakian Republic, Hungary, Ex-Yugoslavia, Romania, Bulgaria.

Table 4.2.4 shows the aggregated Origin/Destination (O/D) flows for the Reference Case A. The traffic to and from Denmark (east of the Great Belt) and Sweden to and from the continent is almost equal in size, they account for approximately 40 percent each of the total traffic across the Baltic Sea.

The next table presents the Fehmarn Belt traffic for the Reference Case A and Base Case A compared with the observed traffic in 2001. In the Reference Case, the largest change compared to 2001 is expected in rail passengers that increase their share from 5,5% to 8,4%. This is due to shorter travel time for the trains, especially the night trains through Sønderjylland / Schleswig, due to some improvements in the infrastructure. From the table it can be seen, that the number of person cars per day in 2015 is about 2.600 higher with a fixed link than with continued ferry service, corresponding to more than 50% more cars per day.

	Base Year 2001		**Reference Case A, 2015**		**Base Case A, 2015**		**Difference between Base Case A and Reference Case A, 2015**	
passengers/year	abs.	percent	abs.	percent	abs.	percent	abs.	percent
Rail passengers	352.000	5,5%	638.000	8,4%	1.497.000	15,3%	859.000	134,6%
Car passengers	4.058.000	63,6%	4.781.000	63,4%	6.598.000	67,7%	1.817.000	38,0%
Bus passengers	1.248.000	19,6%	1.423.000	18,8%	1.658.000	17,0%	235.000	16,5%
Walk-on pass.	718.000	11,3%	711.000	9,4%	0	0,0%	711.000	-100%
Passengers/year	**6.376.000**	**100,0%**	**7.553.000**	**100,0%**	**9.753.000**	**100,0%**	**2.200.000**	**29.1%**
Passengers/day	**17.468**		**20.693**		**26.721**		**6.028**	
Cars/day	3.718		4.995		7.496		2.551	51,6%
Buses/day	88		112		129		17	15,2%

Table 4.2.5: Fehmarn Belt traffic, Reference Case A and Base Case A, 2015

In table 4.2.6 the percentage growth per mode from 2001 to 2015 for the Reference Case A and for the Base Case A is shown. The growth, of course, is much higher in the Base Case with a fixed link than in the Reference Case with continued ferry supply.

	Reference Case A 2015	**Base Case A 2015**
	percent growth from 2001	percent growth from 2001
Rail passengers	81,3%	325,3%
Car passengers	17,8%	62,6%
Bus passengers	14,0%	32,9%
Walk-on pass.	-1,0%	-100,0%
Passengers/day	**18,5%**	**53,0%**
Cars/day	33,0%	101,6%
Buses/day	27,3%	46,6%

Table 4.2.6: Fehmarn Belt traffic, Reference Case A and Base Case A, growth from 2001 to 2015

In table 4.2.7 the number of passengers crossing the Baltic Sea by surface transport is summarised for the base year 2001, the Reference Case A forecast and the Base Case A.

Traffic/year	1.000 Passengers Total	Rail pass.	1.000 Cars	Percent Of cars
Base Year 2001				
Norway/Sweden-Jylland	873	-	244	9,5%
Oslo/Göteborg-Germany	1.056	-	175	6,8%
Fehmarn Belt	6.376	352	1.357	52,9%
Other Denmark-Germany	1.172	-	195	7,6%
Finland/Sweden-Germany	2.175	73	396	15,4%
Denmark/Sweden-Poland	863	-	198	7,7%
Total	**12.515**	**425**	**2.565**	**100,0%**
Reference Case A, 2015				
Norway/Sweden-Jylland	1.227	20	358	8,8%
Oslo/Göteborg-Germany	1.311	-	245	6,0%
Fehmarn Belt	7.553	638	1.823	44,6%
Other Denmark-Germany	2.226	410	457	11,2%
Finland/Sweden-Germany	3.429	113	926	22,7%
Denmark/Sweden-Poland	1.190	-	276	6,7%
Total	**16.936**	**1.181**	**4.083**	**100,0%**
Base Case A, 2015				
Norway/Sweden-Jylland	980	-	301	6,8%
Oslo/Göteborg-Germany	1.181	-	213	4,8%
Fehmarn Belt	9.753	1.497	2.736	61,7%
Other Denmark-Germany	1.867	18	278	6,2%
Finland/Sweden-Germany	2.598	22	640	14,4%
Denmark/Sweden-Poland	1.181	-	271	6,1%
Total	**17.560**	**1.537**	**4.439**	**100,0%**

Table 4.2.7: Number of passengers and cars by ferry corridors, Reference Case A and Base Case A, 2015[4], traffic/year

The resulting numbers of rail passengers and cars are illustrated in figures 4.2.1 and 4.2.2.

[4] The total number of trips in table 4.2.7 does not exactly match the total passenger flows according to table 4.2.4 because 4.2.4 includes trips using the land border between Germany and Denmark. This applies to all similar tabulations of forecast results in this report

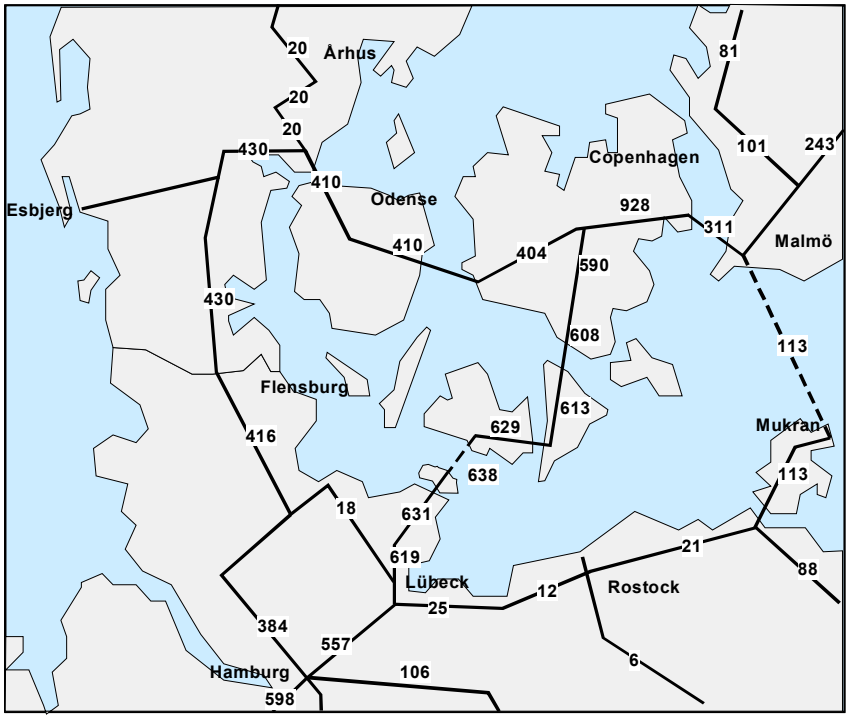


Figure 4.2.1: Number of passengers on major links of the railway system, Reference Case A, 1.000 passengers/year

Table 4.2.8 shows the contribution from different steps in the forecast, compared to the Base Case A.

	Car passengers/ year	Bus passengers/ year	Rail passengers/ year
Base Case A	**6.598**	**1.658**	**1.497**
contribution from			
modal split change	-235	72	-191
induced traffic	-547	-34	-160
change of destination choice	-43	-2	-13
change of route choice	-992	-271	-495
total effects	-1817	-235	-859
Reference Case A	**4.781**	**1.423**	**638**

Table 4.2.8: Contribution from different steps of the forecast. Reference Case A, 2015, 1.000 passengers/ year.

The table shows that most of the changes compared to the Base Case are caused by redistribution of trips between Fehmarn Belt and other routes.

Figure 4.2.2 shows the number of person cars by ferry line.

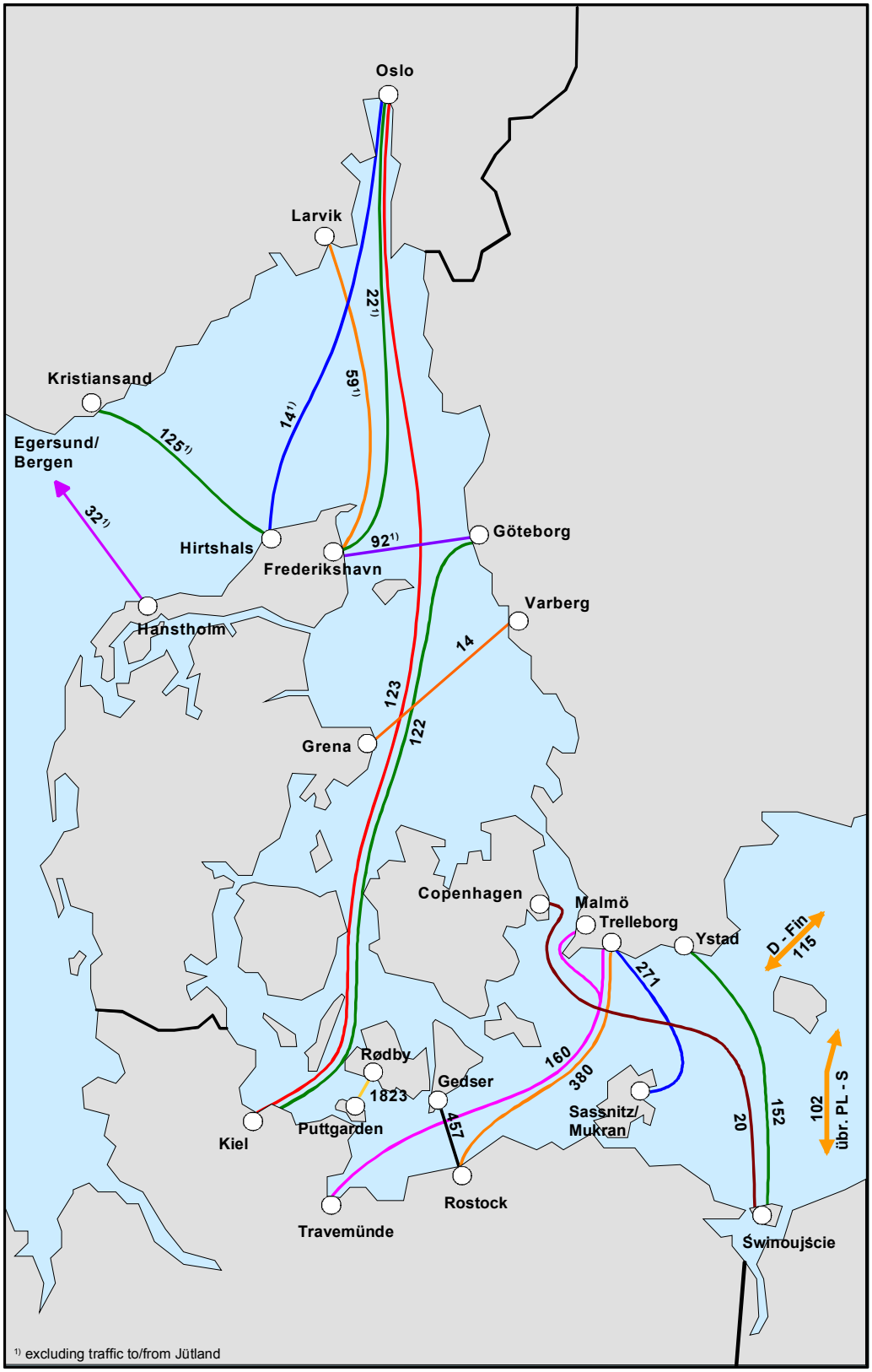


Figure 4.2.2: Number of person cars by ferry line, Reference Case A, 2015, 1.000 cars /year

4.2.3 Freight Traffic

In this section, the results of the freight forecast, Reference Case A, are presented. As the total freight flows of commodities and the geographical distribution in 2015 in the Reference Case and the Base Case are the same, this section will focus on the results, where there are differences between the Reference Case and the Base Case in 2015.

The total freight flows by road and rail between Denmark/Scandinavia and the continent are presented in table 4.2.9. It is assumed that the total freight flows between Scandinavia and the Continent are the same with and without the fixed link across Fehmarn Belt. This table also shows the modal distribution of all freight (except sea freight) for the base year 2001, the Reference Case A forecast and the Base Case A forecast for 2015. As can be seen from the table, the modal distribution in the Reference Case and the Base Case is nearly the same.

Tons or vehicles/year Mode	**1.000 t**	**1.000 Vehicles**	**1.000 t**
Base Year 2001			
Road	23.034	1.502	77,8%
Rail conventional	5.579	277	118,8%
Rail combined	999	102	3,4%
Total	**29.612**	**1.881**	**100,0%**
Reference Case A, 2015			
Road	31.650	2.174	68,9%
Rail conventional	12.270	627	26,7%
Rail combined	2.003	193	4,4%
Total	**45.923**	**2.994**	**100,0%**
Base Case A, 2015			
Road	31.315	2.155	68,2%
Rail conventional	12.587	645	27,4%
Rail combined	2.021	194	4,4%
Total	**45.923**	**2.994**	**100,0%**

Table 4.2.9: Total freight flows between Denmark/Scandinavia and the continent by mode, Reference Case and Base Case A, 2015, 1.000 tons or vehicles/year

Table 4.2.10 summarises by mode the freight using the Fehmarn Belt. In Base Case A, the total traffic in tonnes is 9,1% higher than in the Reference Case A. For vehicles, the differences are 8,1% for road traffic and 8,5% for rail traffic. The corresponding growth rates are shown in table 4.2.11. Road transport increases by 40 - 50 percent from 2001 to 2015 depending on the case, whereas rail freight grows by 120 -140 percent.

As stated in the note under table 4.2.10, the Reference Case lists rail freight routed via the Great Belt. Only in the Base Case with a fixed link the rail freight is routed via Fehmarn Belt.

	Base Year 2001		Reference Case A, 2015		Base Case A, 2015		Difference between Base Case A and Reference Case A, 2015	
Mode	freight 1.000 t	1.000 vehicles	freight 1.000 t	1.000 vehicles	freight 1.000 t	1.000 vehicles	freight 1.000 t	1.000 vehicles
Road	4.434	274	5.952	382	6.426	413	474	31
Rail	4.447*	255*	9.881*	562*	10.843	610	962	48
Total	**8.881**	**529**	**15.833**	**944**	**17.269**	**1.023**	**1436**	**79**

* These transports are routed via the Great Belt

Table 4.2.10: Fehmarn Belt freight transport, Reference Case A and Base Case A, 2015, 1.000 tons or vehicles/year

Mode	Reference Case A	Base Case A
Road	39,4%	50,7%
Rail	120,4%	139,2%
Total	**78,4%**	**93,4%**

Table 4.2.11: Fehmarn Belt freight transport, growth rates from 2001 to 2015 Reference Case A and Base Case A

The distribution of freight traffic by ferry corridor is summarised in table 4.2.12 and illustrated in figures 4.2.3 and 4.2.4 on pages 28 and 29.

Annual traffic	1.000 t			1.000 Lorries	No. of Trains
	Road	**Rail**	**Total**		
	Base Year 2001				
Norway/Sweden-Jylland	1.496	-	1.496	87	-
Oslo/Göteborg-Germany	2.258	-	2.258	140	-
Fehmarn Belt	4.434	-	4.434	274	-
Other Denmark-Germany	995	-	995	62	-
Finland/Sweden-Germany	12.036	2.131	13.032	826	3.361
Denmark/Sweden-Poland	1.686	-	1.686	104	-
Total	**22.905**	**2.131**	**24.336**	**1.493**	**3.361**
	Reference Case A, 2015				
Norway/Sweden-Jylland	2.019	-	2.019	126	-
Oslo/Göteborg-Germany	3.000	-	3.000	197	-
Fehmarn Belt	5.952	-	5.952	382	-
Other Denmark-Germany	1.434	-	1.434	92	-
Finland/Sweden-Germany	16.626	4.393	21.019	1.205	6968
Denmark/Sweden-Poland	2.451	-	2.451	158	-
Total	**31.482**	**4.393**	**35.875**	**2.160**	**6.968**
	Base Case A, 2015				
Norway/Sweden-Jylland	1.958	-	1.958	124	-
Oslo/Göteborg-Germany	2.909	-	2.909	192	-
Fehmarn Belt	6.426	10.843	17.269	413	20.346
Other Denmark-Germany	1.324	-	1.324	86	-
Finland/Sweden-Germany	16.162	3.765	19.927	1.175	5.940
Denmark/Sweden-Poland	2.366	-	2.366	153	-
Total	**31.145**	**14.608**	**45.753**	**2.143**	**26.286**

Table 4.2.12: t freight and vehicles by ferry corridors, Reference Case A and Base Case A, 2015[5], annual traffic

[5] The total number of tonnes in table 4.2.12 does not exactly match the total freight flows according to table 4.2.9 because 4.2.9 includes flows using the land border between Germany and Denmark

Figure 4.2.3: Number of freight trains/year by ferry line / routed via the Great Belt Reference Case A, 2015

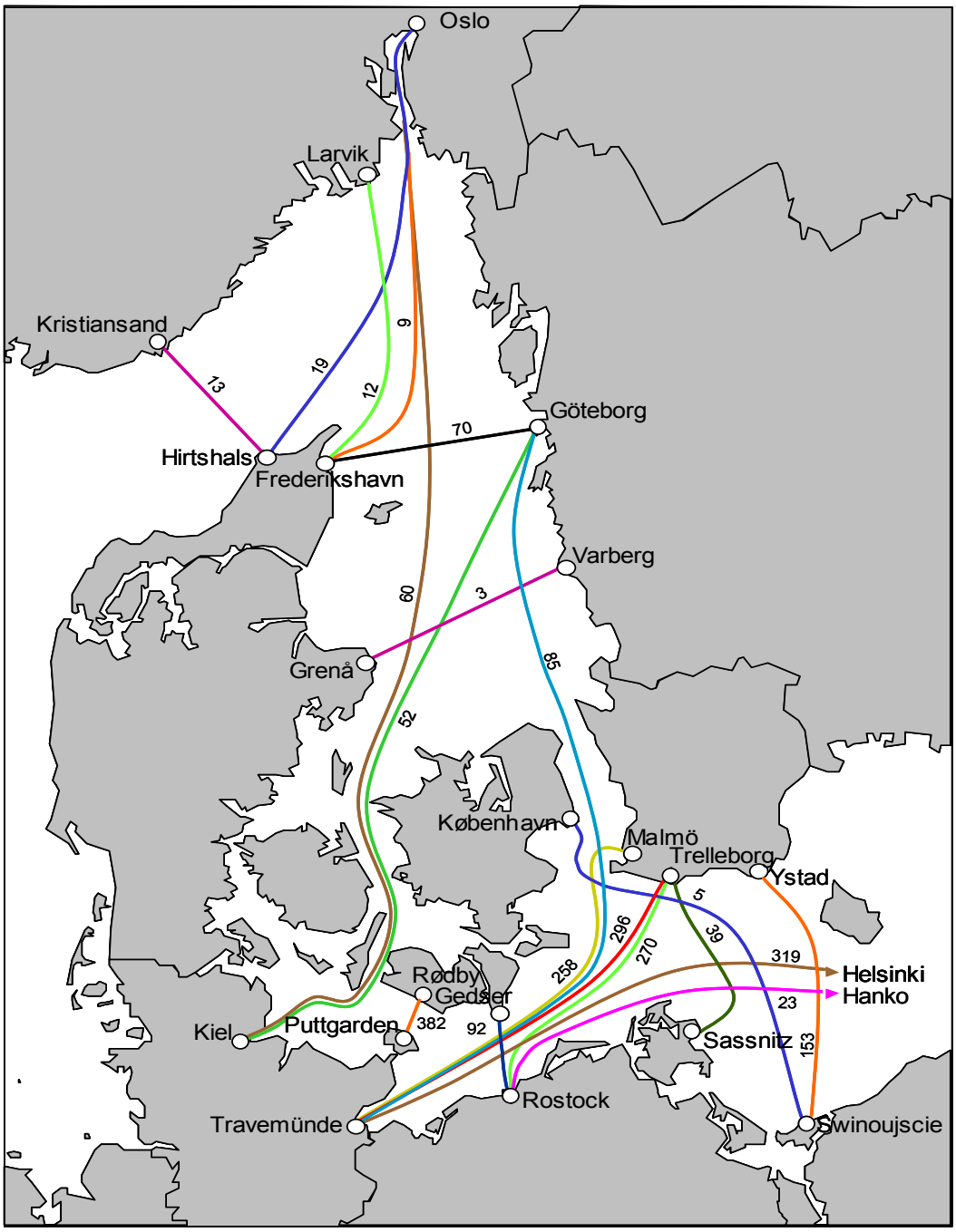


Figure 4.2.4: Number of lorries by ferry line, Reference Case A, 2015, 1.000 lorries/year

4.3 Reference Case B

Reference Case B differs from A in the user costs assumptions. The assumptions chosen represent the values that were used with the 1999 forecasts in order to allow a comparison between the Base Case A assumptions, which in many respects represent a more environment-friendly transport policy, with the more conservative assumptions used with the previous forecasts. The user costs assumptions for Reference Case B are shown in table 4.3.1. These are exactly the same assumptions as used in Base Case B.

4.3.1 Transport User costs

Cost Item	**Case B Assumptions**
User costs	
1 Car	
World crude oil price (no policy item, but relevant for fuel price)	0 %
Total fuel price	+15 %
Specific fuel consumption	-22%
Fuel costs (price * consumption)	**-10%**
Road user fees	
- Toll road fees	in some countries
- General mileage-related fees passenger cars	no charge/km but vignettes in some countries
User costs	**-10 %**
2 Lorry	
Total fuel price	+15 %
Specific fuel consumption	no change
Fuel costs (price * consumption)	
Truck highway toll in Germany	0,15 €/km
Truck highway toll in Denmark	0
Productivity	+14%
User costs	**-6 %**
3 Rail	
User costs passengers	**no change**
User costs freight	**no change**
4 Bus	
User costs	**no change**
5 Air	
User costs	**no change** **25 % lower** on low-cost routes

Table 4.3.1: Overview of transport user cost assumptions for Base Case B

All other assumptions except the assumptions for rail freight are the same in Reference Case A and B. For rail freight, an increased efficiency is assumed in Case A compared to Case B.

4.3.1 Passenger Traffic

The following tables and graphs summarise the Reference Case B forecast for 2015.

Main mode	1.000 Passengers/year	Modal Split percent
Base Year 2001		
Rail	854	3,6%
Car	8.498	35,5%
Bus	2.739	11,4%
Air	9.905	41,4%
Walk-on	1.929	8,1%
Total	**23.925**	**100,0%**
1999 Forecast for 2010 Reference Case		
Rail	1.069	3,3%
Car	10.612	33,1%
Bus	3.388	10,6%
Air	13.905	43,4%
Walk-on	3.085	9,5%
Total	**32.059**	**100,0%**
Reference Case B 2015		
Rail	1.067	3,0%
Car	11.587	32,5%
Bus	2.974	8,3%
Air	17.619	49,5%
Walk-on	2.395	6,7%
Total	**35.642**	**100,0%**
Base Case B 2015		
Rail	1.423	4,0%
Car	12.422	34,5%
Bus	2.938	8,2%
Air	17.361	48,2%
Walk-on	1.855	5,1%
Total	**35.999**	**100,0**

Table 4.3.2: Total number of trips between Denmark/Scandinavia and the Continent by mode Reference Case B and Base Case B, 2015

As in Case A, the new forecast for Case B results in a higher number of passenger trips and a different distribution on modes than the 1999 forecasts. Especially the air traffic has a much higher proportion due to the introduction of low fare routes. The total number of passenger trips in 2015 is nearly the same for Reference Case B and the Base Case B.

Compared with the base year, Reference Case B shows moderate changes with slight increases in day excursions, short holidays and private visits in the relative distribution by trip purpose. Except for ferry excursion, of course, the relative distribution by trip is nearly the same in the Reference Case B and the Base Case B in 2015, cf. table 4.3.3.

Trip Purpose	Base year 2001		Reference Case B 2015		Base Case B 2015	
1.000 passengers/year	abs.	percent	abs.	percent	abs.	percent
commuter work	16	0,1%	37	0,1%	109	0,3%
shopping	348	1,5%	311	0,9%	353	1,0%
business	5.991	25,0%	8.257	23,2%	8.415	23,4%
holidays (>8 days)	9.420	39,4%	12.945	36,3%	12.950	36,0%
day excursion	780	3,3%	1.331	3,7%	1.551	4,3%
short holiday (≤8 days)	3.540	14,8%	5.838	16,4%	5.838	16,2%
visit friend/relatives	2.699	11,3%	5.396	15,1%	5.454	15,2%
weekend commuting	700	2,9%	917	2,6%	990	2,8%
ferry excursion	431	1,8%	610	1,7%	339	0,9%
Total	**23.925**	**100,0%**	**35. 642**	**100,0%**	**35.999**	**100,0%**

Table 4.3.3: Purpose distribution for passenger trips, Reference Case B and Base Case B, 2015

Table 4.3.4 shows the aggregated O/D flows for the Reference Case B. The traffic to and from Denmark (east of the Great Belt) and Sweden to and from the continent is almost equal in size, they account for approximately 40 percent each of the total traffic across the Baltic Sea.

1.000 passenger trips/year		Mode					
between:	and:	Rail	Car	Bus	Air[1]	Walk-on	Total
Germany	E.Denmark[2]	473	4.027	1.377	1.442	1.189	8.508
Germany	Sweden	241	3.111	656	2.252	771	7.031
Germany	Norway	8	1.022	151	1.145	31	2.357
Germany	Finland	2	230	28	540	69	869
W.Europe[3]	E.Denmark[2]	161	577	150	3.796	0	4.684
W.Europe[3]	Sweden	67	999	269	4.120	0	5.455
W.Europe[3]	Norway	0	529	69	1.716	0	2.314
W.Europe[3]	Finland	0	100	18	995	0	1.113
E.Europe[4]	E.Denmark[2]	42	163	53	593	56	907
E.Europe[4]	Sweden	68	622	149	671	279	1.789
E.Europe[4]	Norway	5	138	44	197	0	384
E.Europe[4]	Finland	0	69	10	152	0	231
Germany total		724	8.390	2.212	5.379	2.060	18.765
W. Europe total		228	2.205	506	10.627	0	13.566
E. Europe total		115	992	256	1.613	335	3.311
East Denmark[2] total		676	4.767	1.580	5.831	1.245	14.099
Sweden total		376	4.732	1.074	7.043	1.050	14.275
Norway total		13	1.689	264	3.058	31	5.055
Finland total		2	399	56	1.687	69	2.213
Total		**1.067**	**11.587**	**2.974**	**17.619**	**2.395**	**35.642**

Table 4.3.4: Aggregated passenger flows, Reference Case B, 2015, two way totals, 1.000 trips/year

[1] Traffic to and from Copenhagen, Oslo and Stockholm airports only. [2] Traffic by Baltic Sea ferries only, i.e. mainly with relation to Eastern parts of Denmark. [3] Western Europe: Benelux, France, Spain, Portugal, Switzerland, Austria, Italy, UK and Ireland, Greece, Turkey. [4] Eastern Europe: Poland, Baltic countries, CIS, Czech Republic, Slovakian Republic, Hungary, Ex-Yugoslavia, Romania, Bulgaria.

Table 4.3.5 presents the Fehmarn Belt traffic for the Reference Case B and Base Case B compared with the observed traffic in 2001. In the Reference Case B, the largest change is expected in Walk-on passengers that decrease their share from 11,3% to 9,3%. Compared with the Base Case B, the Reference Case B shows smaller shares for rail and car passengers; partly due to the fact the Reference Case includes a number of walk-on passengers, which is not the case in the Base Case B. From the table it can be seen, that the number of person cars per day in 2015 is about 2.550 higher with a fixed link than with continued ferry service, corresponding to a little less than 50% more cars per day.

	Base Year 2001		**Reference Case B, 2015**		**Base Case B, 2015**		**Difference between Base Case B and Reference Case B, 2015**	
passengers/year	abs.	percent	abs.	percent	abs.	percent	abs.	percent
Rail passengers	352.000	5,5%	560.000	7,3%	1.386.000	15,3%	826.000	147,5%
Car passengers	4.058.000	63,6%	4.949.000	64,9%	6.809.000	67,7%	1.860.000	37,9%
Bus passengers	1.248.000	19,6%	1.404.000	18,4%	1.638.000	17,0%	234.000	16,7%
Walk-on pass.	718.000	11,3%	711.000	9,3%	0	0,0%	-711.000	-100%
Passengers/year	**6.376.000**	**100,0%**	**7.624.000**	**100,0%**	**9.833.000**	**100,0%**	**2.209.000**	**29,0%**
Passengers/day	**17.468**		**20.888**		**26.940**		**6.052**	
Cars/day	3.718		5.238		7.786		2.548	48,6%
Buses/day	88		112		129		17	15,2%

Table 4.3.5: Fehmarn Belt traffic, Reference Case B and Base B, 2015

The next table shows the growth per mode in percentages from 2001 to 2015 for the Reference Case B and the Base Case B. The growth, of course, is much higher in the Base Case with a fixed link than in the Reference Case.

	Reference Case B 2015	**Base Case B 2015**
	percent growth from 2001.	percent growth from 2001
Rail passengers	59,1%	293,8%
Car passengers	22,0%	67,8%
Bus passengers	12,5%	31,3%
Walk-on pass.	-1,0%	-100,0%
Passengers/day	**19,6%**	**54,2%**
Cars/day	40,9%	109,4%
Buses/day	27,3%	46,6%

Table 4.3.6: Fehmarn Belt traffic, Reference Case B and Base Case B, growth from 2001 to 2015

The number of passengers crossing the Baltic Sea by surface transport modes is summarised in table 4.3.7, and the number of rail passengers and person cars are illustrated in figures 4.3.1 and 4.3.2 on pages 35 and 36.

Traffic/year	1.000 Passengers Total	Rail pass.	1.000 Cars	Percent Of cars
Base Year 2001				
Norway/Sweden-Jylland	873	-	244	9,5%
Oslo/Göteborg-Germany	1.056	-	175	6,8%
Fehmarn Belt	6.376	352	1.357	52,9%
Other Denmark-Germany	1.172	-	195	7,6%
Finland/Sweden-Germany	2.175	73	396	15,4%
Denmark/Sweden-Poland	863	-	198	7,7%
Total	**12.515**	**425**	**2.565**	**100,0%**
Reference Case B, 2015				
Norway/Sweden-Jylland	1.253	19	366	8,7%
Oslo/Göteborg-Germany	1.339	0	250	5,9%
Fehmarn Belt	7.624	560	1.912	45,2%
Other Denmark-Germany	2.279	384	469	11,1%
Finland/Sweden-Germany	3.529	104	952	22,5%
Denmark/Sweden-Poland	1.208	0	278	6,6%
Total	**17.232**	**1.067**	**4.227**	**100,0%**
Base Case B, 2015				
Norway/Sweden-Jylland	1.003	-	308	6,7%
Oslo/Göteborg-Germany	1.208	-	218	4,7%
Fehmarn Belt	9.833	1.386	2.842	61,9%
Other Denmark-Germany	1.915	16	287	6,3%
Finland/Sweden-Germany	2.684	21	661	14,4%
Denmark/Sweden-Poland	1.199	-	275	6,0%
Total	**17.842**	**1.423**	**4.591**	**100,0%**

Table 4.3.7: Number of passengers and cars by ferry corridors, Reference Case B and Base Case B, 2015[6], traffic/year

Table 4.3.8 illustrates the contribution from different steps in the forecast calculation, compared to the Base Case B.

[6] The total number of trips in table 4.3.7 does not exactly match the total passenger flows according to table 4.3.4 because 4.3.4 includes trips using the land border between Germany and Denmark. This applies to all similar tabulations of forecast results in this report.

	Car passengers/ year	Bus passengers/ year	Rail passengers/ year
Base Case B	**6.809**	**1.638**	**1.386**
Contribution from:			
modal split change	-240	72	-187
induced traffic	-556	-34	-157
change of destination choice	-44	-2	-12
change of route choice	-1020	-270	-470
total effects	-1860	-234	-826
Reference Case B	**4.949**	**1.404**	**560**

Table 4.3.8: Contributions from different steps of the forecast, Reference Case B 2015, 1000 passengers/year

Just as in Base and Reference Cases A, far the greatest effect stems from the redistribution of trips between other routes and Fehmarn Belt.

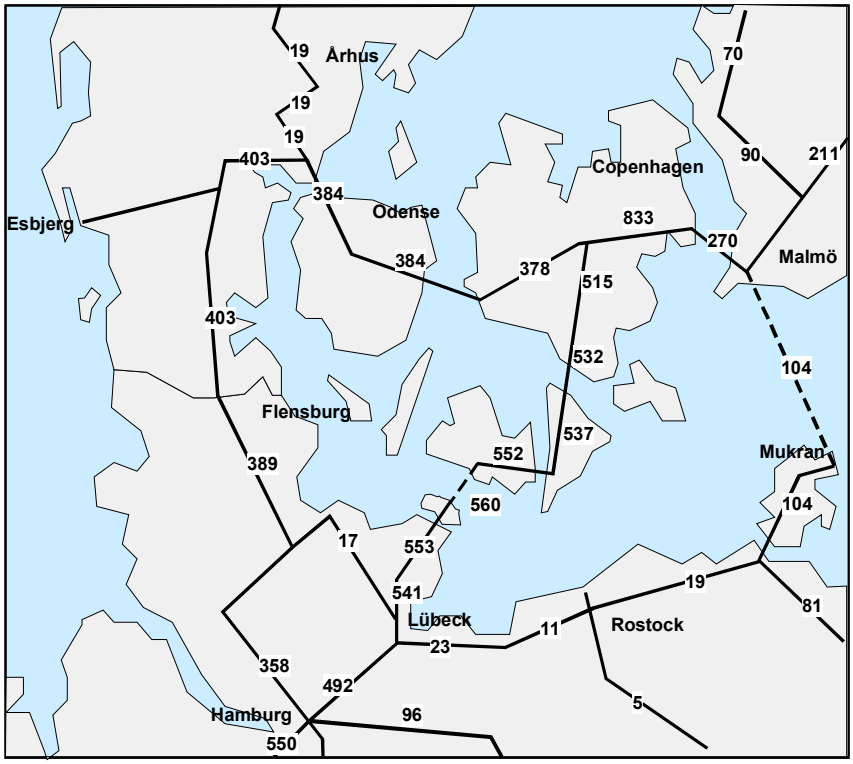


Figure 4.3.1: Number of passengers on major links of the railway system, Reference Case B, 1.000 passengers/year

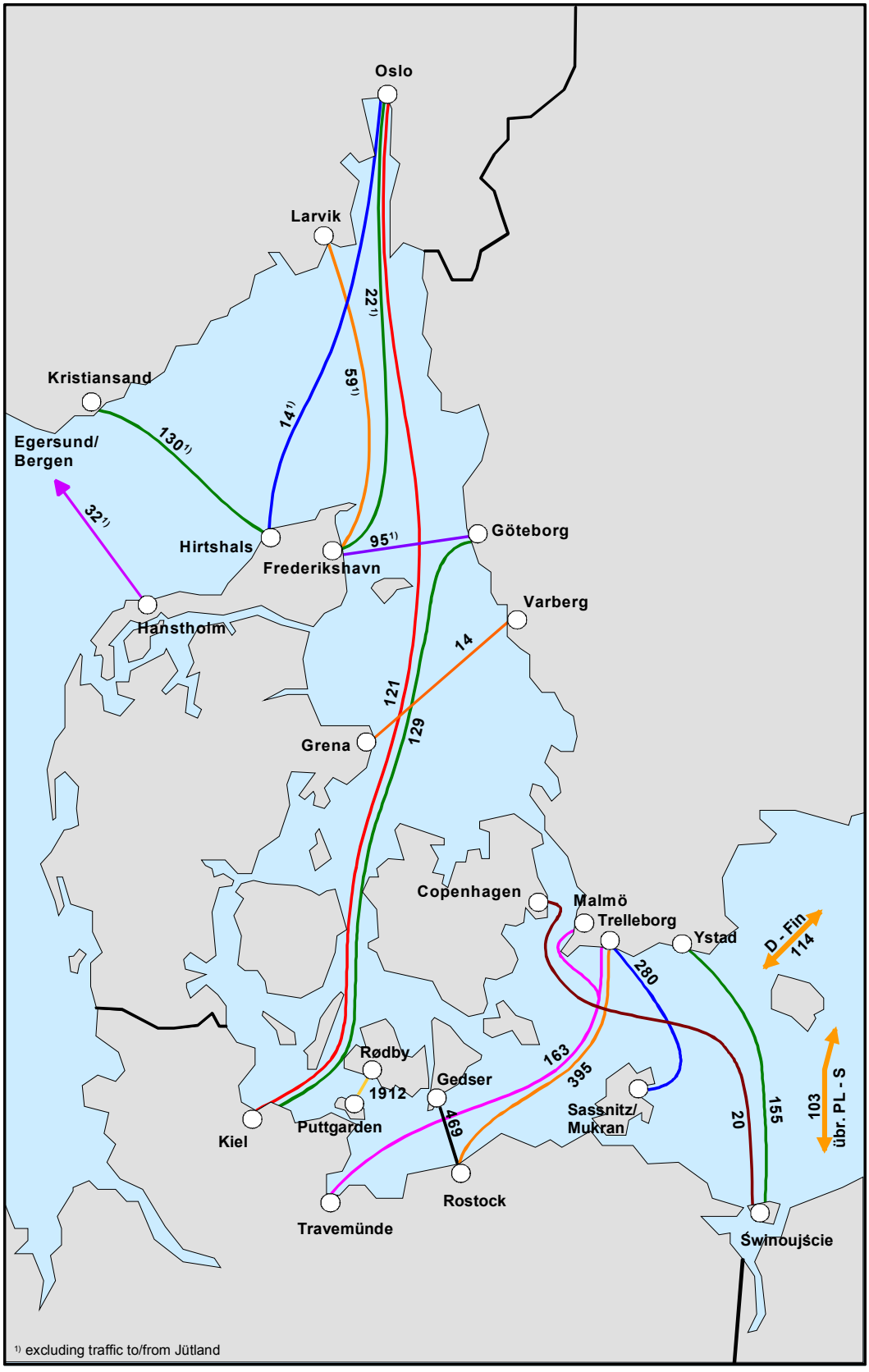


Figure 4.3.2. Number of person cars by ferry line, Reference Case B, 2015, 1.000 cars/year

4.3.3 Freight Traffic

This section presents the results of the freight forecast, Reference Case B. As for case A, this section will focus on the results, where there are differences between the Reference Case B and the Base Case B in 2015.

Table 4.3.9 shows total freight flows by road and rail between Denmark/Scandinavia and the continent. It is assumed that the total freight flows between Scandinavia and the Continent are the same with and without the fixed link across Fehmarn Belt. This table also shows the modal split (except sea freight) for the Base year 2001, the Reference Case B forecast and the Base Case B forecast for 2015.

Mode **Tons or vehicles/year**	**1.000 t**	**1.000** **Vehicles**	**1.000 t** **percent**
Base Year 2001			
Road	23.034	1.502	77,8%
Rail conventional	5.579	277	18,8%
Rail combined	999	102	3,4%
Total	**29.612**	**1.881**	**100,0%**
Reference Case B, 2015			
Road	35.736	2.365	77,8%
Rail conventional	8.340	429	18,2%
Rail combined	1.847	182	4,0%
Total	**45.923**	**2.976**	**100,0%**
Base Case B, 2015			
Road	35.381	2.348	77,0%
Rail conventional	8.677	446	18,9%
Rail combined	1.865	182	4,1%
Total	**45.923**	**2.976**	**100,0%**

Figure 4.3.9: Total freight flows between Denmark/Scandinavia and the continent by mode, Reference Case B and Base Case B, 2015, 1.000 tons or vehicles/year

As can be seen from the table, the modal distribution in the Reference Case and the Base Case is nearly the same.

Table 4.3.10 summarises the freight transports using the Fehmarn Belt. In Base Case B, the total traffic in tonnes is 9,5% higher than in the Reference Case B. For vehicles, the differences are 8,4% for road traffic and 9,1% for rail traffic. The corresponding growth rates are shown in table 4.3.11. Road transport increases by 50 - 65 percent from 2001 to 2015 depending on the case, whereas rail freight grows by 70 –85 percent.

As stated in the note under table 4.3.10, the Reference Case lists rail freight routed via the Great Belt. Only in the Base Case with a fixed link the rail freight is routed via Fehmarn Belt.

	Base Year 2001		Reference Case B, 2015		Base Case B, 2015		Difference between Base Case B and Reference Case B, 2015	
Mode	**freight 1.000 t**	**1.000 vehicles**	**freight 1.000 t**	**1.000 vehicles**	**freight 1.000 t**	**1.000 vehicles**	**freight 1.000 t**	**1.000 vehicles**
Road	4.434	274	6.665	417	7.206	452	541	35
Rail	4.447*	255*	7207*	430*	7.983	469	776	39
Total	**8.881**	**529**	**13.872**	**847**	**15.189**	**921**	**1.317**	**74**

* These transports are routed via the Great Belt

Table 4.3.10: Fehmarn Belt freight transport, Reference Case B and Base Case B, 2015, 1.000 tons or vehicles/year

Mode	**Reference Case B**	**Base Case B**
Road	52,2%	65,0%
Rail	68,6%	83,9%
Total	**78,4%**	**93,4%**

Table 4.3.11: Fehmarn Belt freight transport,growth rates from 2001 to 2015

The distribution of freight traffic by ferry corridor is summarised in table 4.3.12 and illustrated in figures 4.3.3 and 4.3.4 on pages 40 and 41.

	1.000 t			1.000 Lorries	No. of Trains
	Road	**Rail**	**Total**		
Annual traffic	Base Year 2001				
Norway/Sweden-Jylland	1.496	-	1.496	81	-
Oslo/Göteborg-Germany	2.258	-	2.258	140	-
Fehmarn Belt	4.434	-	4.434	274	-
Other Denmark-Germany	995	-	995	62	-
Finland/Sweden-Germany	10.901	2.131	13.032	626	3.361
Denmark/Sweden-Poland	1.686	-	1.686	104	-
Total	**22.205**	**2.131**	**24.336**	**1.487**	**3.361**
	Reference Case B, 2015				
Norway/Sweden-Jylland	2.313	-	2.313	139	-
Oslo/Göteborg-Germany	3.442	-	3.442	217	-
Fehmarn Belt	6.665	-	6.665	417	-
Other Denmark-Germany	1.606	-	1.606	101	-
Finland/Sweden-Germany	18.727	2.980	21.707	1.303	4845
Denmark/Sweden-Poland	2.784	-	2.784	174	-
Total	**35.537**	**2.980**	**38.517**	**2.351**	**4845**
	Base Case B, 2015				
Norway/Sweden-Jylland	2.243		2.243	136	
Oslo/Göteborg-Germany	3.339		3.339	211	
Fehmarn Belt	7.206	7.983	15.189	452	15.645
Other Denmark-Germany	1.484		1.484	93	
Finland/Sweden-Germany	18.218	2.559	20.777	1.275	4.129
Denmark/Sweden-Poland	2.700		2.700	170	
Total	**35.190**	**10.542**	**45.732**	**2.337**	**19.774**

Table 4.3.12: t freight and vehicles by ferry corridors, Reference Case B and Base Case B, 2015[7], annual traffic

[7] The total number of tonnes in table 4.3.12 does not exactly match the total freight flows according to table 4.3.9 because 4.3.9 includes flows using the land border between Germany and Denmark

Figure 4.3.3: Number of freight trains/year, Reference Case B, 2015

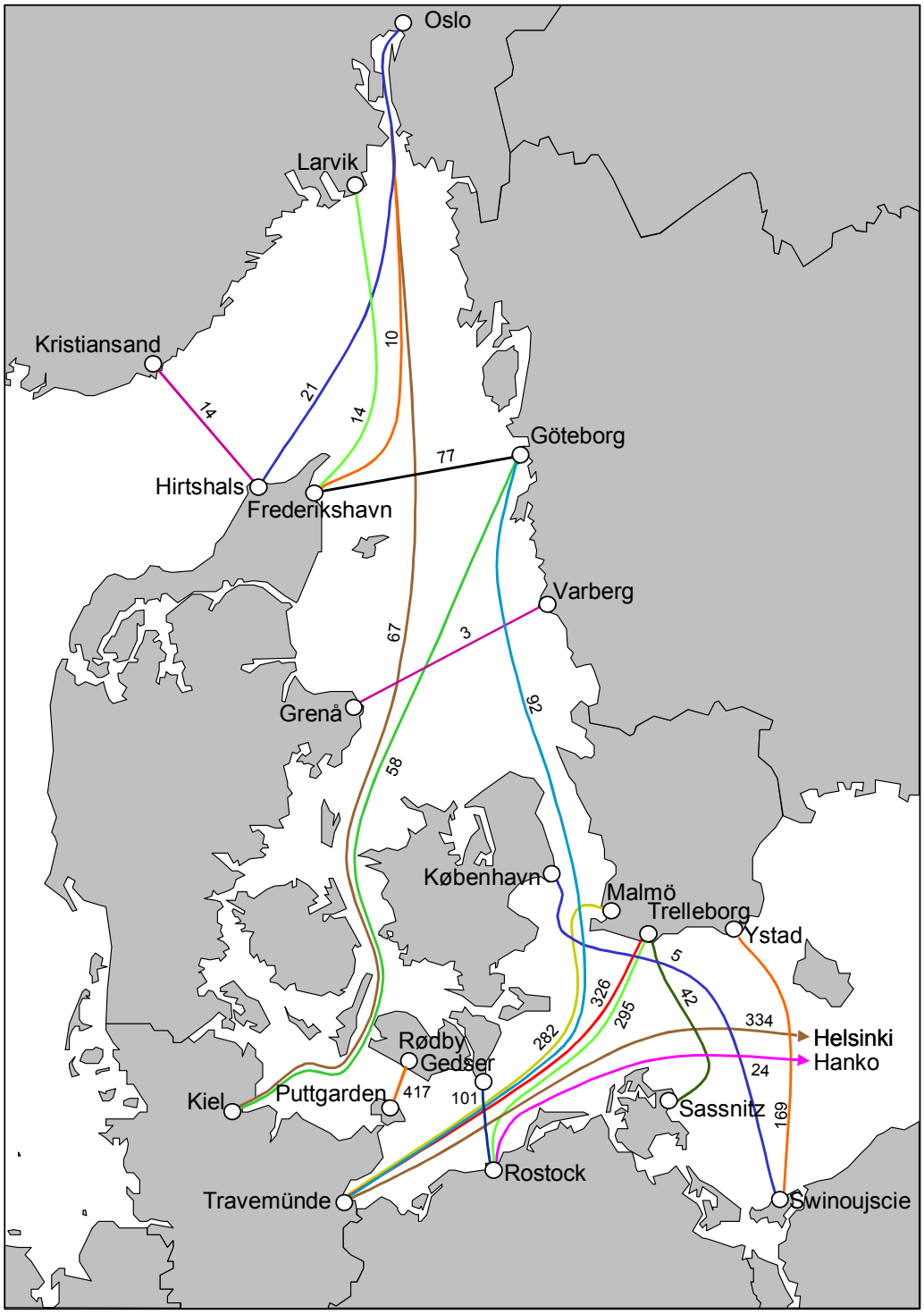


Figure 4.3.4: Number of lorries by ferry line, Reference Case B, 2015, 1.000 lorries/year

4.4 Comparison of Reference Cases A and B – Fehmarn Belt Traffic

Reference Case B with its lower car user costs and lower air fares than Reference Case A will generate more car and air passengers, while the number of rail passengers will be smaller.

The main results for the calculated Fehmarn Belt traffic are shown in table 4.4.1.

Vehicles/day	Reference Case A	Reference Case B	Difference %
Cars	4.945	5.238	5,9%
Buses	112	112	0%
Lorries	1.047	1.142	9,1%
Average daily traffic (vehicles/day)	6.104	6.492	6,4%
Rail Freight wagons	1.595[8]	1.178[8]	-26,2%
Passenger trains per day	8	8	0

Table 4.4.1: Fehmarn Belt traffic, Reference Cases A and B, 1.000 vehicles/day

The greatest differences occur in freight traffic, especially in the number of rail freight wagons due to the lower road user costs assumed in Case B and the more effective train operation in Case A. The total number of road vehicles - especially lorries - is higher in Reference Case B as a consequence of the lower car user costs and higher rail passenger costs.

[8] These transports are routed via the Great Belt

APPENDICES

APPENDIX 1 DETAILED RESULTS PASSENGER TRAFFIC **2**

APPENDIX 2 DETAILED RESULTS FREIGHT TRAFFIC **16**

APPENDIX 3 TABULATION OF FERRY LOAD FIGURES **34**

APPENDIX 4 TRAVEL TIMES BETWEEN COPENHAGEN AND HAMBURG **36**

APPENDIX 1 DETAILED RESULTS PASSENGER TRAFFIC

Reference Case A without fixed link

Passenger Traffic

Main mode	1.000 Passengers/ year	Modal Split percent
Base Case A		
Rail	1.537	4,4%
Car	12.042	34,2%
Bus	2.973	8,4%
Air	16.823	47,7%
Walk-on	1.850	5,3%
Total	**35.225**	**100,0%**
Reference Case A 2015		
Rail	1.181	3,4%
Car	11.204	32,1%
Bus	3.009	8,6%
Air	17.077	49,0%
Walk-on	2.395	6,9%
Total	**34.866**	**100, 0%**

Total number of trips between Denmark/Scandinavia and the Continent by mode, Reference Case A, 2015

Trip Purpose	1.000 passengers/year			
	Base Case A		Reference Case A	
	abs.	percent	abs.	percent
commuter work	109	0,3%	37	0,1
shopping	347	1,0%	305	0,9
business	8.371	23,8%	8.213	23,6
holidays (>8 days)	12.736	36,2%	12.731	36,4
day excursion	1.472	4,2%	1.253	3,6
short holiday (≤8 days)	5.647	16,0%	5.645	16,2
visit friend/relatives	5.238	14,9%	5.179	14,9
weekend commuting	966	2,7%	893	2,6
ferry excursion	339	1,0%	610	1,7
Total	**35.225**	**100,0%**	**34.866**	**100,0**

Purpose distribution for passenger trips, Reference Case A, 2015

1.000 passenger trips/year		Mode					
between:	and:	Rail	Car	Air[1]	Bus	Walk-on	Total
Germany	E.Denmark[2]	510	3.835	1.396	1.376	1.189	8.306
Germany	Sweden	265	3.017	663	2.162	771	6.878
Germany	Norway	14	1.006	151	1.104	31	2.306
Germany	Finland	4	225	28	520	69	846
W.Europe[3]	E.Denmark[2]	172	568	151	3.703	0	4.594
W.Europe[3]	Sweden	80	984	271	4.019	0	5.354
W.Europe[3]	Norway	5	521	70	1.674	0	2.270
W.Europe[3]	Finland	1	99	18	975	0	1.093
E.Europe[4]	E.Denmark[2]	47	158	54	565	56	880
E.Europe[4]	Sweden	75	592	152	644	279	1.742
E.Europe[4]	Norway	7	133	45	189	0	374
E.Europe[4]	Finland	1	66	10	146	0	223
Germany total		793	8.083	2.238	5.162	2.060	18.336
W. Europe total		258	2.172	510	10.371	0	13.311
E. Europe total		130	949	261	1.544	335	3.219
East Denmark[2] total		729	4.561	1.601	5.644	1.245	13.780
Sweden total		420	4.593	1.086	6.825	1.050	13.974
Norway total		26	1.660	266	2.967	31	4.950
Finland total		6	390	56	1.641	69	2.162
Total		**1.181**	**11.204**	**3.009**	**17.077**	**2.395**	**34.866**

Aggregated passenger flows, Reference Case A, 2015, two way totals

[1] Traffic to and from Copenhagen, Oslo and Stockholm airports only. [2] Traffic by Baltic Sea ferries only, i.e. mainly with relation to Eastern parts of Denmark. [3] Western Europe: Benelux, France, Spain, Portugal, Switzerland, Austria, Italy, UK and Ireland, Greece, Turkey. [4] Eastern Europe: Poland, Baltic countries, CIS, Czech Republic, Slovakian Republic, Hungary, Ex-Yugoslavia, Romania, Bulgaria.

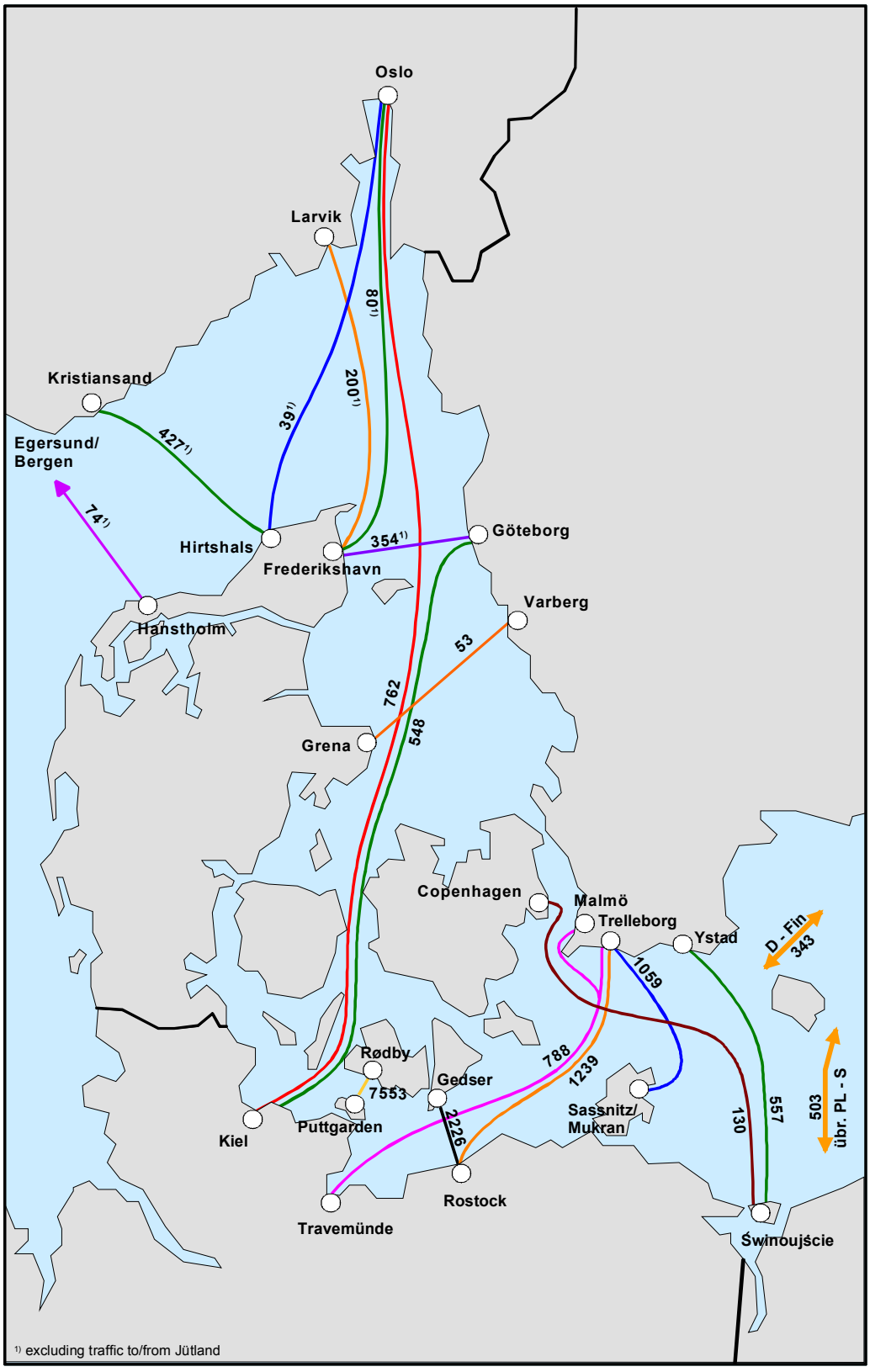
	Base Case A 2015		**Reference Case 2015**		**Change**
in 1.000/year	abs.	percent	abs.	percent	percent change
Rail passengers	1.497	15,3%	638	8,4%	- 57,4%
Car passengers	6.598	67,7%	4.781	63,4%	- 27,5%
Bus passengers	1.658	17,0%	1.423	18,8%	- 14,2%
Walk-on pass.	0	0,0%	711	9,4%	+ 100,0%
Total pass.	**9.753**	**100,0%**	**7.553**	**100,0%**	**- 22,6%**
Cars	2.736		1.823		- 33,4%
Buses	47		41		- 12,8%

Fehmarn Belt traffic, Reference Case A, 2015

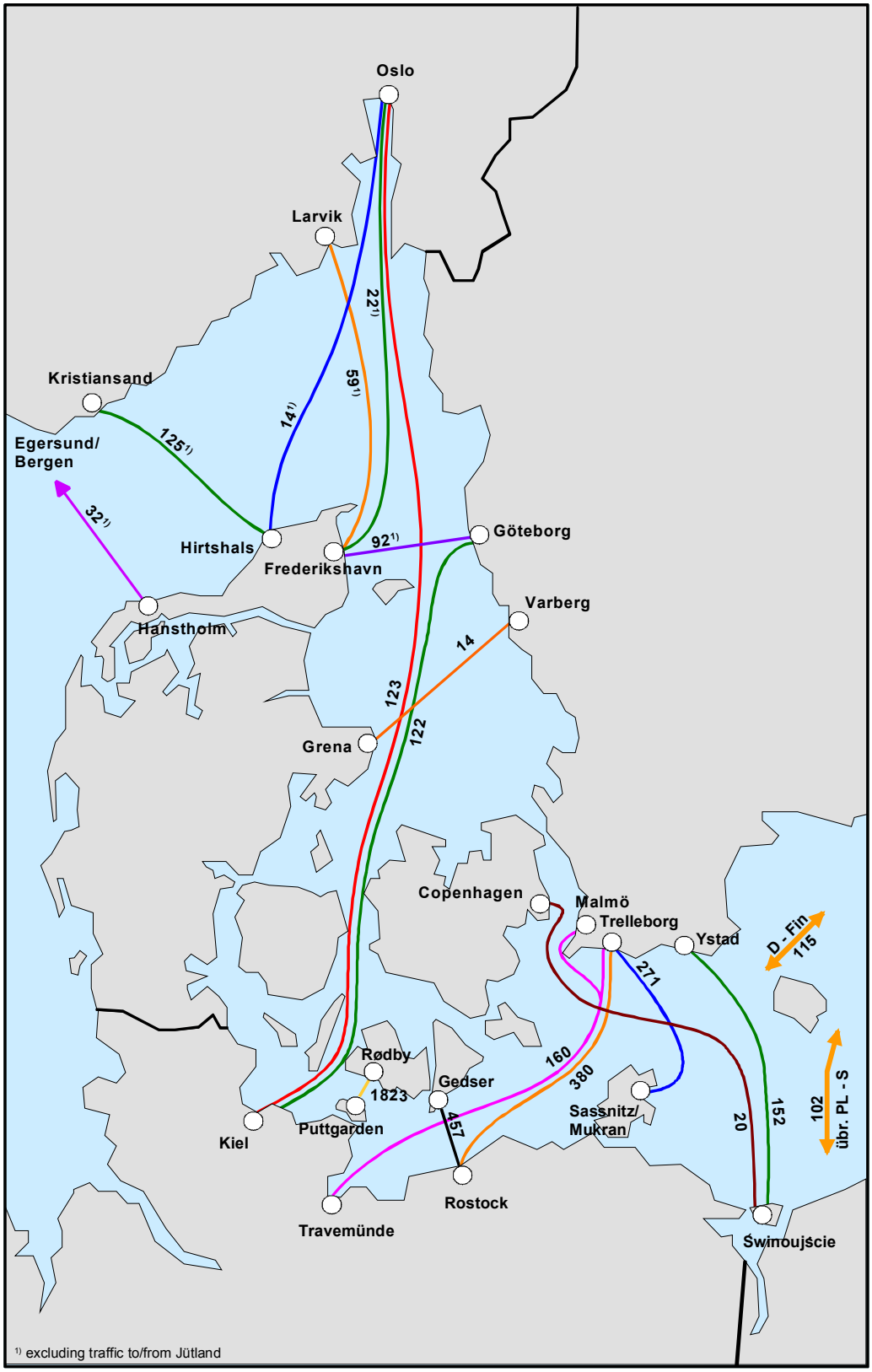
Traffic/Year	**1.000 Passengers Total**	**Rail pass.**	**1.000 Cars**	**% Cars**
	Base Case A 2015			
Norway/Sweden-Jylland	980	-	301	6,8%
Oslo/Göteborg-Germany	1.181	-	213	4,8%
Fehmarn Belt	9.753	1.497	2.736	61,7%
Other Denmark-Germany	1.867	18	278	6,2%
Sweden-Germany	2.598	22	640	14,4%
Denmark/Sweden-Poland	1.181	-	271	6,1%
Total	**17.560**	**1.537**	**4.439**	**100,0%**
	Reference Case A 2015			
Norway/Sweden-Jylland	1.227	20	358	8,8%
Oslo/Göteborg-Germany	1.311	-	245	6,0%
Fehmarn Belt	7.553	638	1.823	44,6%
Other Denmark-Germany	2.226	410	457	11,2%
Sweden-Germany	3.429	113	926	22,7%
Denmark/Sweden-Poland	1.190	-	274	6,7%
Total	**16.936**	**1.181**	**4.083**	**100,0%**

No. of passengers and cars by ferry corridors, Reference Case A, 2015

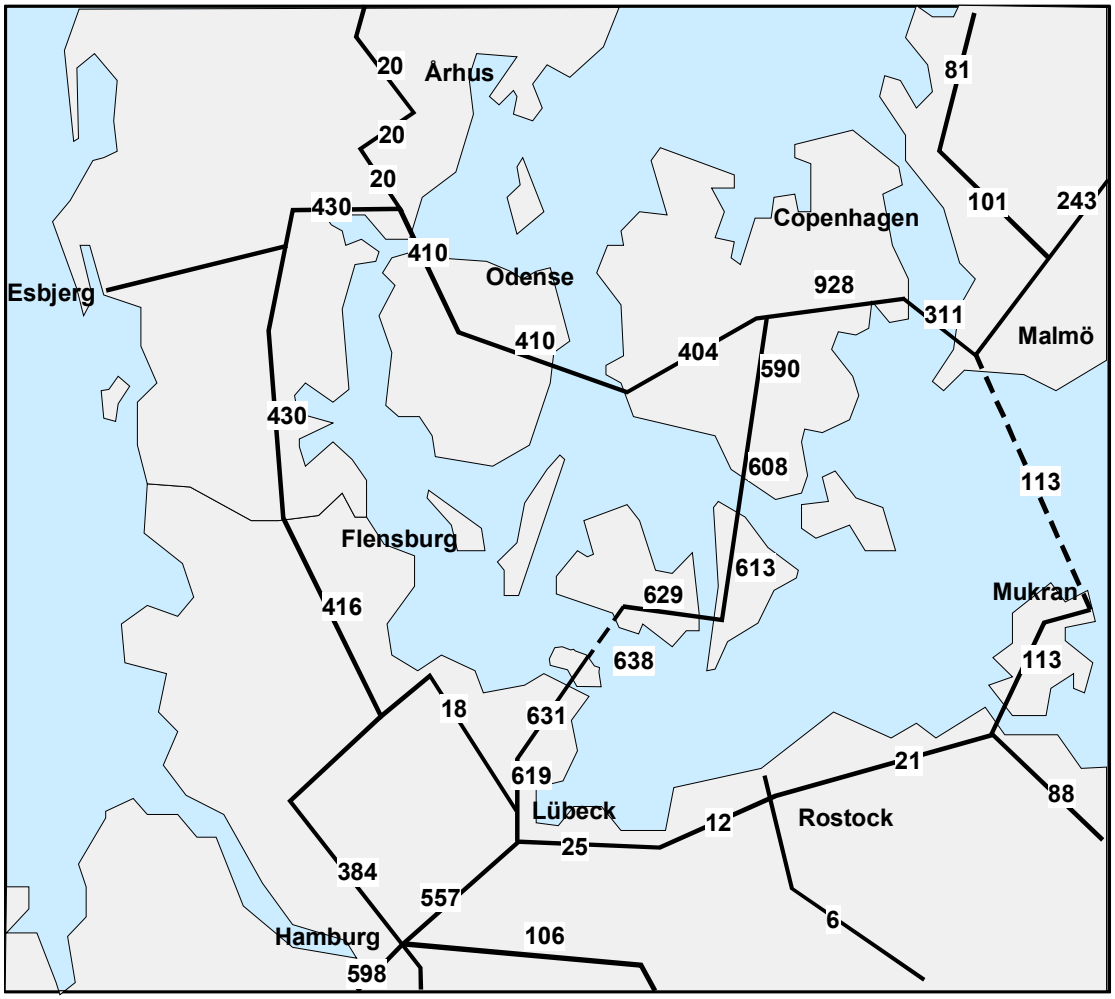
Ferry loads Reference Case A 2015 – total passengers (in 1.000/year, both ways)



Ferry loads Reference Case A 2015 – total cars (in 1.000/year, both ways)



Number of passengers on major links of the railway system, Reference Case A, 2015 (in 1.000 passengers/year, both ways)



	Car 1.000 passengers/ year	Bus 1.000 passengers/ year	Rail 1.000 passengers/ year
Base Case A	**6.598**	**1.658**	**1.497**
contribution from			
modal split change	-235	72	-191
induced traffic	-547	-34	-160
change of destination choice	-43	-2	-13
change of route choice	-992	-271	-495
total effects	-1817	-235	-859
Reference Case A	**4.781**	**1.423**	**638**

Contributions from different steps of the forecast, Reference Case B 2015, in 1000 passengers/year

Reference Case B without fixed link

Passenger Traffic

Main mode	1.000 Passengers/ year	Modal split percent
Reference Case A 2015		
Rail	1.181	3,4
Car	11.204	32,1
Bus	3.009	8,6
Air	17.077	49,0
Walk-on	2.395	6,9
Total	**34.866**	**100,0**
Reference Case B 2015		
Rail	1.067	3,0
Car	11.587	32,5
Bus	2.974	8,3
Air	17.619	49,5
Walk-on	2.395	6,7
Total	**35.642**	**100,0**

Total number of trips between Denmark/Scandinavia and the continent by mode, Reference Case B 2015

Trip Purpose	1.000 passengers/year			
	Reference Case A		Reference Case B	
	abs.	percent	abs.	percent
commuter work	37	0,1%	37	0,1%
shopping	305	0,9%	311	0,9%
business	8.213	23,6%	8.257	23,2%
holidays (>8 days)	12.731	36,4%	12.945	36,3%
day excursion	1.253	3,6%	1.331	3,7%
short holiday (8 days)	5.645	16,2%	5.838	16,4%
visit friend/relatives	5.179	14,9%	5.396	15,1%
weekend commuting	893	2,6%	917	2,6%
ferry excursion	610	1,7%	610	1,7%
Total	**34.866**	**100,0%**	**35.642**	**100,0%**

Purpose distribution for passenger trips, Reference Case B 2015

1.00 passenger trips/year		Mode					
between:	**and:**	**Rail**	**Car**	**Bus**	**Air[1]**	**Walk-on**	**Total**
Germany	E.Denmark[2]	473	4.027	1.377	1.442	1.189	8.508
Germany	Sweden	241	3.111	656	2.252	771	7.031
Germany	Norway	8	1.022	151	1.145	31	2.357
Germany	Finland	2	230	28	540	69	869
W.Europe[3]	E.Denmark[2]	161	577	150	3.796	0	4.684
W.Europe[3]	Sweden	67	999	269	4.120	0	5.455
W.Europe[3]	Norway	0	529	69	1.716	0	2.314
W.Europe[3]	Finland	0	100	18	995	0	1.113
E.Europe[4]	E.Denmark[2]	42	163	53	593	56	907
E.Europe[4]	Sweden	68	622	149	671	279	1.789
E.Europe[4]	Norway	5	138	44	197	0	384
E.Europe[4]	Finland	0	69	10	152	0	231
Germany total		724	8.390	2.212	5.379	2.060	18.765
W. Europe total		228	2.205	506	10.627	0	13.566
E. Europe total		115	992	256	1.613	335	3.311
East Denmark[2] total		676	4.767	1.580	5.831	1.245	14.099
Sweden total		376	4.732	1.074	7.043	1.050	14.275
Norway total		13	1.689	264	3.058	31	5.055
Finland total		2	399	56	1.687	69	2.213
Total		**1.067**	**11.587**	**2.974**	**17.619**	**2.395**	**35.642**

Aggregated passenger flows, Reference Case B 2015, two way totals

[1] Traffic to and from Copenhagen, Oslo and Stockholm airports only. [2] Traffic by Baltic Sea ferries only, i.e. mainly with relation to Eastern parts of Denmark. [3] Western Europe: Benelux, France, Spain, Portugal, Switzerland, Austria, Italy, UK and Ireland, Greece, Turkey. [4] Eastern Europe: Poland, Baltic countries, CIS, Czech Republic, Slovakian Republic, Hungary, Ex-Yugoslavia, Romania, Bulgaria.

	Reference Case A 2015		**Reference Case B 2015**		**Change**
1.000/year	abs.	percent	abs.	percent	percent change
Rail passengers	638	8,4%	560	7,3%	-59,6%
Car passengers	4.781	63,4%	4.949	64,9%	-27,3%
Bus passengers	1.423	18,8%	1.404	18,4%	-14,3%
Walk-on pass.	711	9,4%	711	9,3%	+ 100,0 %
Total pass.	**7.553**	**100,0%**	**7.624**	**100,0%**	**-22,5%**
Cars	1.823		1.912		-32,7%
Buses	41		40		-14,9%

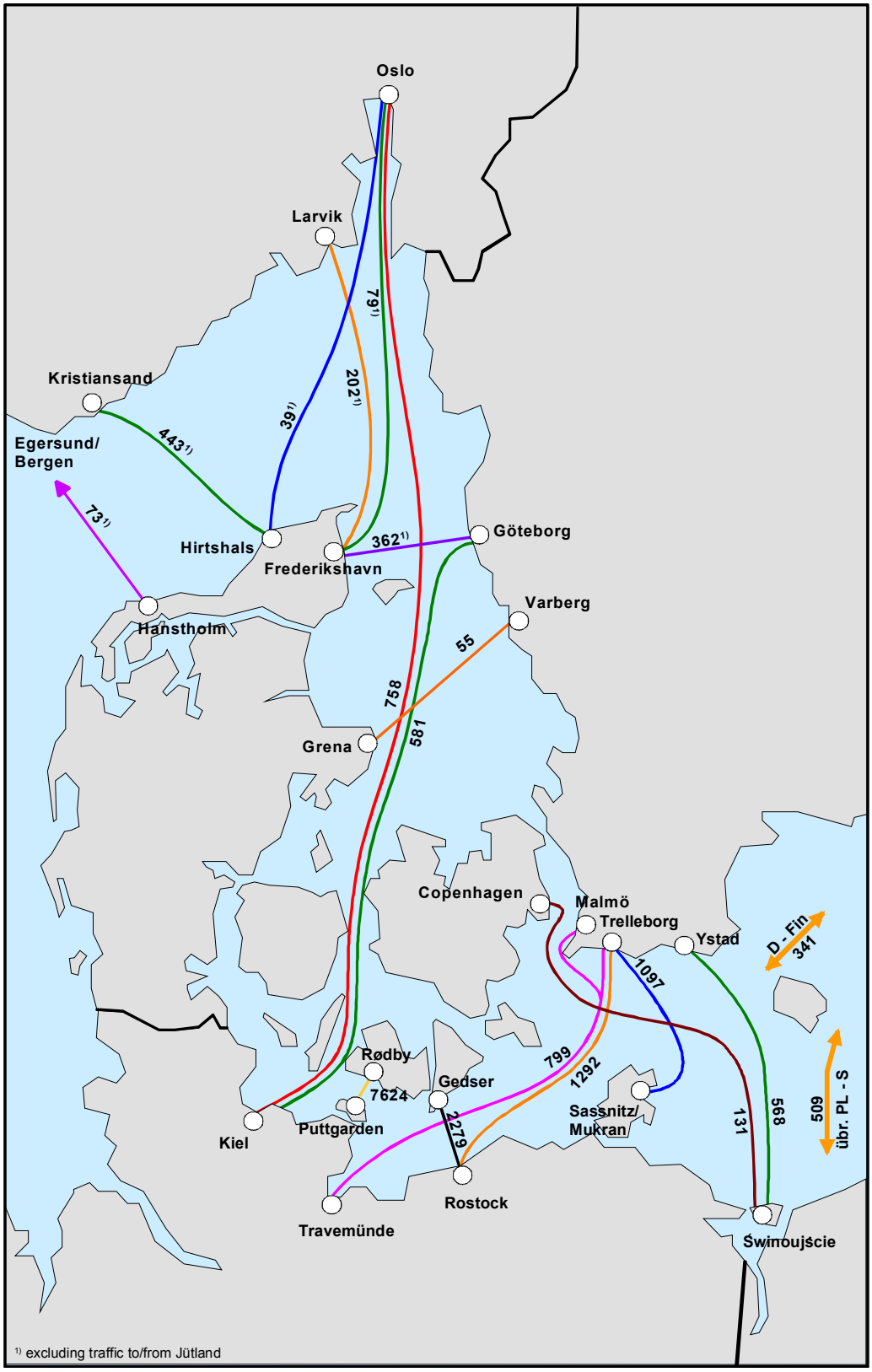
Fehmarn Belt traffic, Reference Case B 2015

	1.000 Passengers		1.000	
	Total	**Rail Pass.**	**Cars**	**Cars %**
	Reference Case A 2015			
Norway/Sweden-Jylland	1.227	20	358	8,8%
Oslo/Göteborg-Germany	1.311	-	245	6,0%
Fehmarn Belt	7.553	638	1.823	44,6%
Other Denmark-Germany	2.226	410	457	11,2%
Sweden*-Germany	3.429	113	926	22,7%
Denmark/Sweden-Poland	1.190	-	274	6,7%
Total	**16.936**	**1.181**	**4.083**	**100,0%**
	Reference Case B 2015			
Norway/Sweden-Jylland	1.253	19	366	8,7%
Oslo/Göteborg-Germany	1.339	0	250	5,9%
Fehmarn Belt	7.624	560	1.912	45,2%
Other Denmark-Germany	2.279	384	469	11,1%
Sweden*-Germany	3.529	104	952	22,5%
Denmark/Sweden-Poland	1.208	0	278	6,6%
Total	**17.232**	**1.067**	**4.227**	**100,0%**

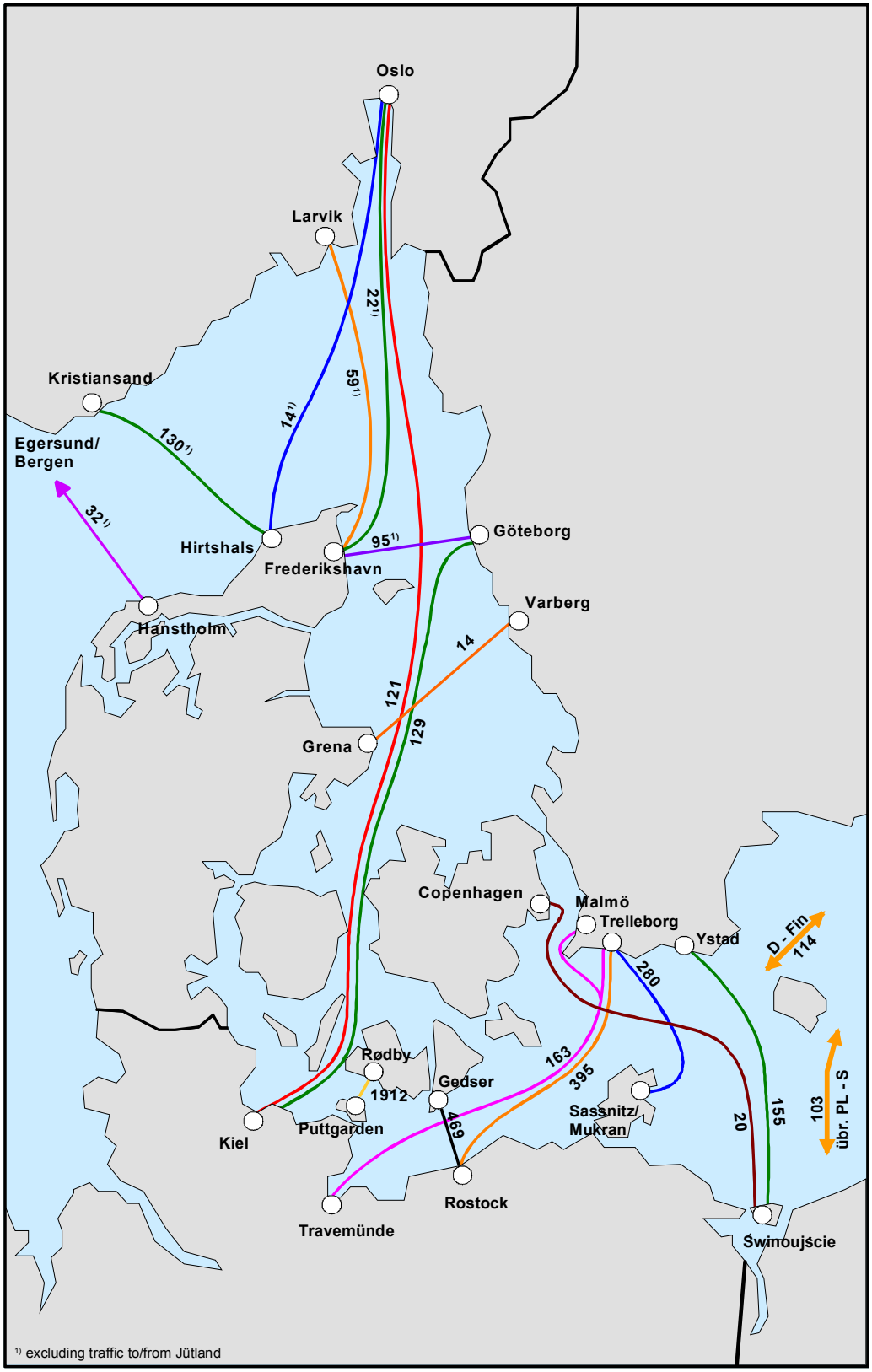
* including Finland

Number of passengers and cars by ferry corridors, Reference Case B 2015, 1.000 passengers or cars per year

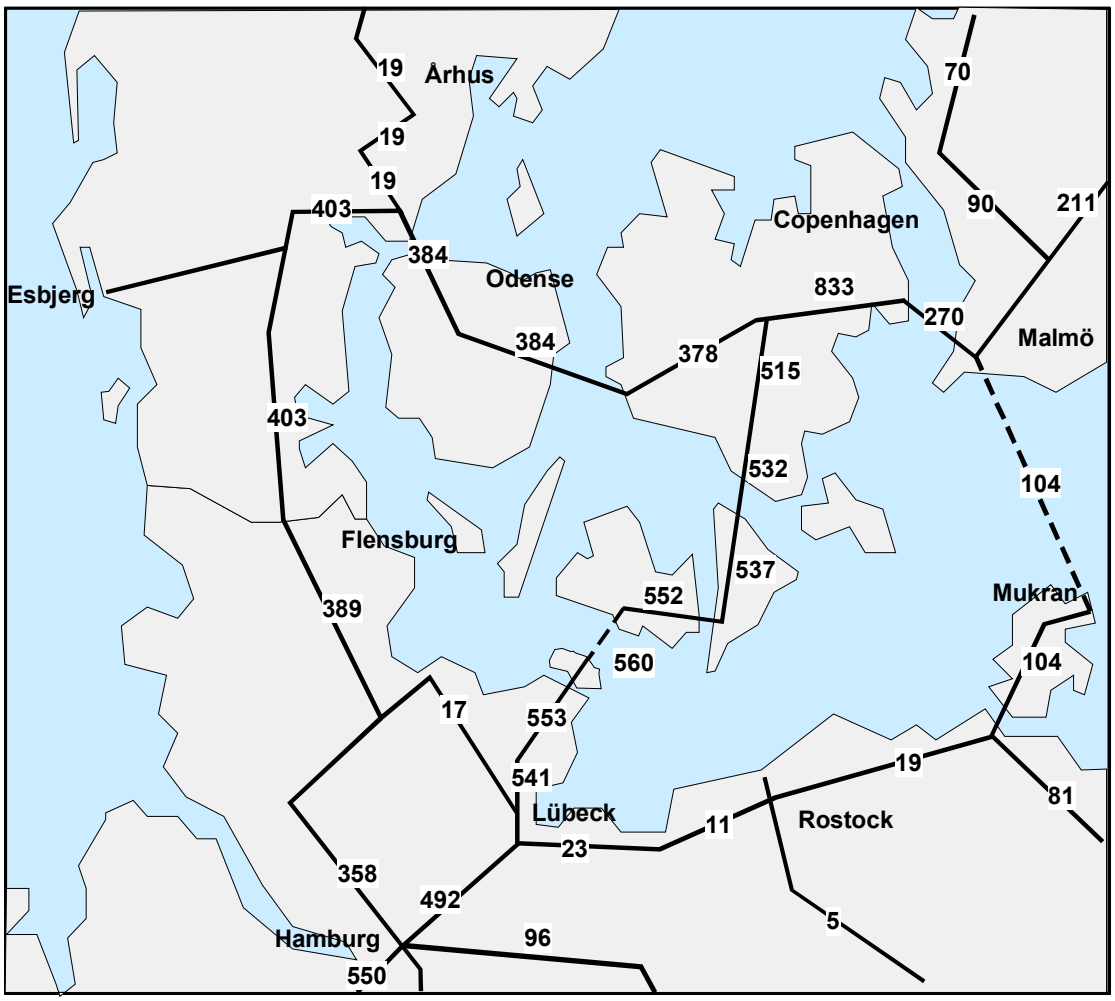
Ferry loads Reference Case B 2015 – total passengers (in 1.000/year, both ways)



Ferry loads Reference Case B 2015 – total cars (in 1.000/year, both ways)



Number of passengers on major links of the railway system, Reference Case B, 2015
(in 1.000 passengers, both ways)



year	Car 1.000 passengers/ year	Bus 1.000 passengers/ year	Rail 1.000 passengers/ year
Base Case B	**6.809**	**1.638**	**1.386**
Contribution from:			
modal split change	-240	72	-187
induced traffic	-556	-34	-157
change of destination choice	-44	-2	-12
change of route choice	-1020	-270	-470
total effects	-1860	-234	-826
Reference Case B	**4.949**	**1.404**	**560**

Contributions from different steps of the forecast, Reference Case B 2015, 1.000 passengers/year

APPENDIX 2 DETAILED RESULTS FREIGHT TRAFFIC

Reference Case A 2015

Volumes [1000 t]				
Commodity group	**Road**	**Rail conv.**	**Rail comb.**	**Total**
0 Cereals, fruits and vegetables	1.165	217	0	1.382
1 Foodstuff and animal fodder	2.814	241	25	3.081
2 Wood and cork, textiles	2.888	1.952	0	4.840
3 Fuels	112	9	0	121
4 Ore, metals	2.117	2.895	0	5.013
5 Building materials	528	206	0	735
6 Fertilizers, chemicals	3.465	1.050	35	4.550
7 Transport equipment and machinery	4.655	580	125	5.360
8 Other manufactured articles	10.001	4.211	28	14.240
9 Paper pulp and waste paper	732	612	0	1.344
10 Miscellaneous articles	3.171	297	1.789	5.257
Total	**31.650**	**12.271**	**2.003**	**45.923**

Performance [mil tkm]				
Commodity group	**Road**	**Rail conv.**	**Rail comb.**	**Total**
0 Cereals, fruits and vegetables	1.612	369	0	1.980
1 Foodstuff and animal fodder	3.915	367	16	4.297
2 Wood and cork, textiles	4.678	3.100	0	7.778
3 Fuels	112	12	0	124
4 Ore, metals	2.705	4.411	0	7.116
5 Building materials	690	341	0	1.032
6 Fertilizers, chemicals	4.524	1.434	47	6.005
7 Transport equipment and machinery	7.091	829	177	8.097
8 Other manufactured articles	13.827	6.267	35	20.129
9 Paper pulp and waste paper	853	874	0	1.727
10 Miscellaneous articles	4.872	539	2.633	8.043
Total	**44.878**	**18.543**	**2.908**	**66.329**

Vehicles [1000]				
Commodity group	**Road**	**Rail conv.**	**Rail comb.**	**Total**
0 Cereals, fruits and vegetables	61	16	0	77
1 Foodstuff and animal fodder	145	18	1	165
2 Wood and cork, textiles	158	81	0	239
3 Fuels	6	0	0	6
4 Ore, metals	125	88	0	212
5 Building materials	27	11	0	38
6 Fertilizers, chemicals	186	45	2	232
7 Transport equipment and machinery	374	90	22	485
8 Other manufactured articles	829	215	1	1.045
9 Paper pulp and waste paper	31	22	0	53
10 Miscellaneous articles	229	43	168	440
Total	**2.172**	**627**	**193**	**2.993**

Modal split 2015 Reference Forecast A by commodity groups

Aggregated relation		2015			
		Road	Rail conv.	Rail comb.	Total
Germany West	Denmark	1.643	675	229	2.547
Germany West	Sweden	8.569	4.387	241	13.197
Germany West	Norway	1.963	422	128	2.513
Germany West	Finland	2.156	16	15	2.188
Germany East	Denmark	165	163	4	331
Germany East	Sweden	1.333	1.209	3	2.545
Germany East	Norway	281	20	14	316
Germany East	Finland	53	0	0	53
West Europe	Denmark	2.809	313	1.171	4.292
West Europe	Sweden	8.052	4.138	194	12.383
West Europe	Norway	1.823	281	1	2.105
West Europe	Finland	334	1	1	336
East Europe	Denmark	403	139	1	543
East Europe	Sweden	1.739	439	1	2.179
East Europe	Norway	275	67	0	342
East Europe	Finland	53	0	0	53

Aggregated freight flows 2015 Reference Forecast A
(in 1000 tons, two way totals)

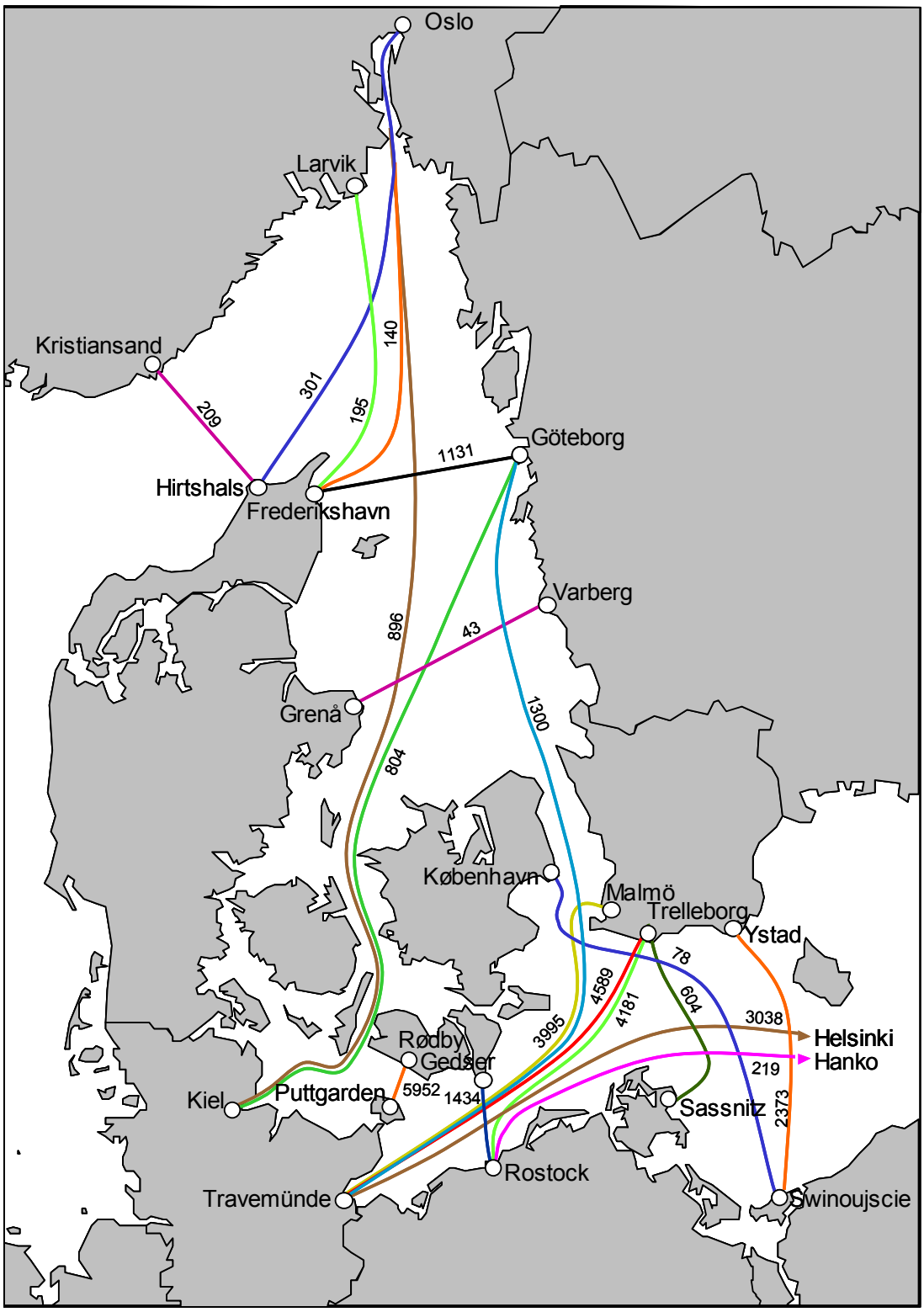
Traffic		2015			
Between	**and**	**Road**	**Rail conv.**	**Rail comb.**	**Total**
Schleswig-Holstein/Hamburg	East Denmark	597	30	67	694
Schleswig-Holstein/Hamburg	Skåne	226	43	5	275
Schleswig-Holstein/Hamburg	Götaland	411	272	13	697
Schleswig-Holstein/Hamburg	Svealand/Norrland/Finland	494	325	2	821
Schleswig-Holstein/Hamburg	Norway	293	113	18	424
Mecklenburg-Vorpommern	East Denmark	29	5	0	34
Mecklenburg-Vorpommern	Skåne	53	15	0	68
Mecklenburg-Vorpommern	Götaland	178	37	0	216
Mecklenburg-Vorpommern	Svealand/Norrland/Finland	194	33	0	226
Mecklenburg-Vorpommern	Norway	43	8	0	51
Niedersachsen/Bremen	East Denmark	252	112	18	382
Niedersachsen/Bremen	Skåne	179	52	0	232
Niedersachsen/Bremen	Götaland	639	242	0	881
Niedersachsen/Bremen	Svealand/Norrland/Finland	561	342	3	906
Niedersachsen/Bremen	Norway	533	16	0	550
Other West Germany	East Denmark	765	528	144	1.438
Other West Germany	Skåne	881	194	36	1.111
Other West Germany	Götaland	3.038	1.019	106	4.163
Other West Germany	Svealand/Norrland/Finland	3.870	1.829	91	5.789
Other West Germany	Norway	1.094	285	109	1.488
Berlin/Brandenburg	East Denmark	44	17	0	61
Berlin/Brandenburg	Skåne	86	35	0	121
Berlin/Brandenburg	Götaland	246	216	0	462
Berlin/Brandenburg	Svealand/Norrland/Finland	222	285	0	506
Berlin/Brandenburg	Norway	63	4	0	67
Other East Germany	East Denmark	121	145	4	270
Other East Germany	Skåne	125	85	0	210
Other East Germany	Götaland	429	225	1	655
Other East Germany	Svealand/Norrland/Finland	278	364	2	644
Other East Germany	Norway	218	17	14	249
Other West Europe	East Denmark	2.809	313	1.171	4.292
Other West Europe	Skåne	1.480	314	17	1.812
Other West Europe	Götaland	3.766	1.563	103	5.432
Other West Europe	Svealand/Norrland/Finland	3.139	2.262	74	5.475
Other West Europe	Norway	1.823	281	1	2.105
Other East Europe	East Denmark	403	139	1	543
Other East Europe	Skåne	229	55	0	284
Other East Europe	Götaland	1.038	210	0	1.249
Other East Europe	Svealand/Norrland/Finland	524	174	1	699
Other East Europe	Norway	275	67	0	342

Freight flows per region 2015 Reference Forecast A
(in 1.000 tons, two way totals)

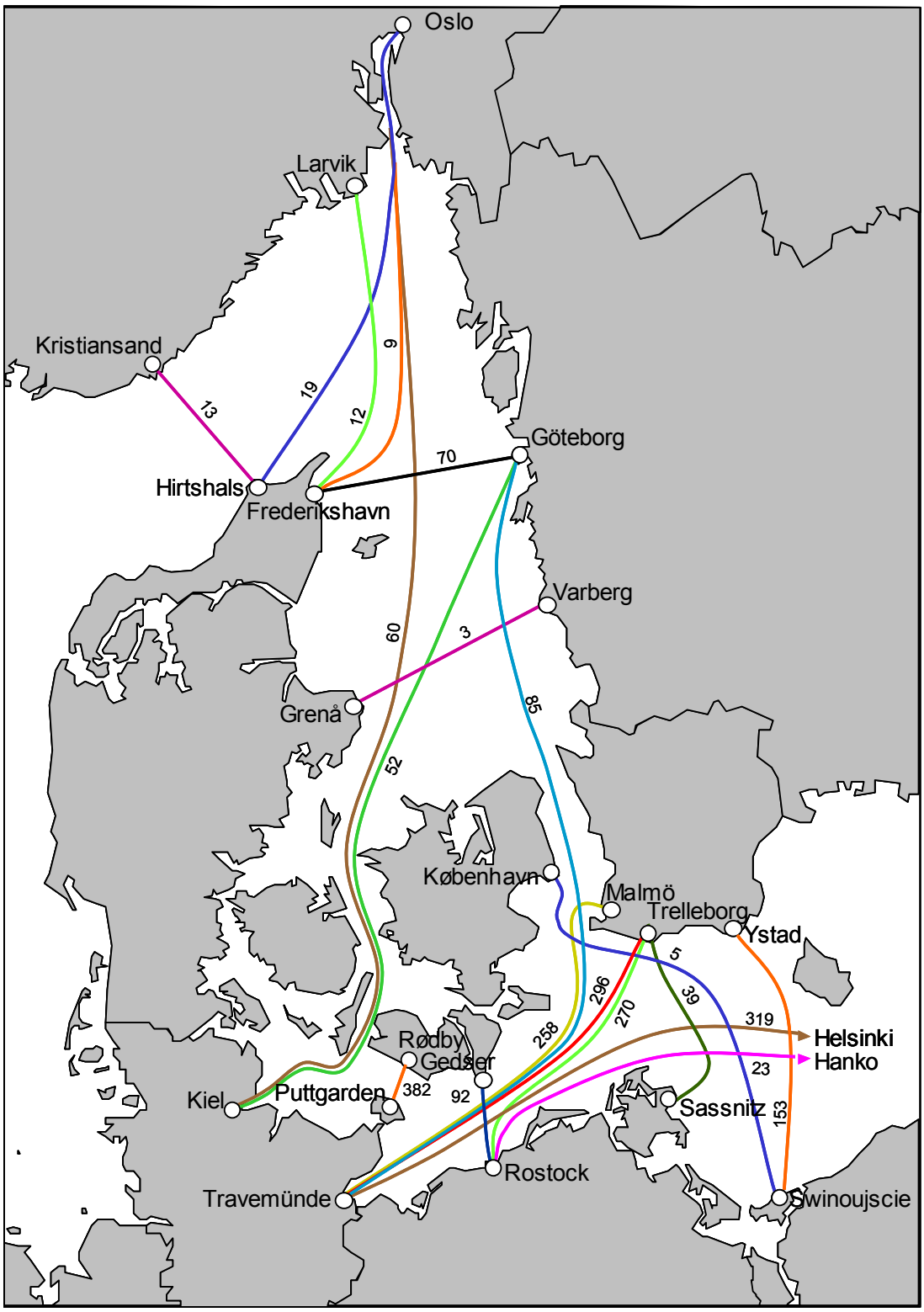
Ferry loads 2015 Reference Forecast A – tons rail (thereof combined)
(in 1.000 tons, two way totals)

**Ferry loads 2015 Reference Forecast A – wagons rail (thereof combined)
(in 1.000, two way totals)**

Ferry loads 2015 Reference Forecast A – trains (two way totals)



Ferry loads 2015 Reference Forecast A – tons road
(in 1.000 tons, two way totals)



Ferry loads 2015 Reference Forecast A – vehicles road (in 1.000, two way totals)

2. REFERENCE FORECAST 2015 CASE B

Volumes [1000 t]				
Commodity group	**Road**	**Rail conv.**	**Rail comb.**	**Total**
0 Cereals, fruits and vegetables	1.293	89	0	1.382
1 Foodstuff and animal fodder	2.935	136	10	3.081
2 Wood and cork, textiles	3.608	1.231	0	4.840
3 Fuels	113	8	0	121
4 Ore, metals	2.621	2.392	0	5.013
5 Building materials	577	158	0	735
6 Fertilizers, chemicals	4.085	450	15	4.550
7 Transport equipment and machinery	4.811	426	124	5.360
8 Other manufactured articles	11.570	2.660	10	14.240
9 Paper pulp and waste paper	807	537	0	1.344
10 Miscellaneous articles	3.317	252	1.688	5.257
Total	**35.736**	**8.340**	**1.847**	**45.923**

Performance [mil tkm]				
Commodity group	**Road**	**Rail conv.**	**Rail comb.**	**Total**
0 Cereals, fruits and vegetables	1.858	122	0	1.980
1 Foodstuff and animal fodder	4.089	202	7	4.297
2 Wood and cork, textiles	6.176	1.603	0	7.778
3 Fuels	113	11	0	124
4 Ore, metals	3.483	3.634	0	7.116
5 Building materials	775	257	0	1.032
6 Fertilizers, chemicals	5.352	632	22	6.005
7 Transport equipment and machinery	7.321	602	174	8.097
8 Other manufactured articles	16.363	3.756	10	20.129
9 Paper pulp and waste paper	975	752	0	1.727
10 Miscellaneous articles	5.106	448	2.489	8.043
Total	**51.610**	**12.017**	**2.702**	**66.329**

Vehicles [1000]				
Commodity group	**Road**	**Rail conv.**	**Rail comb.**	**Total**
0 Cereals, fruits and vegetables	67	6	0	73
1 Foodstuff and animal fodder	152	10	1	163
2 Wood and cork, textiles	184	49	0	232
3 Fuels	6	0	0	6
4 Ore, metals	144	75	0	219
5 Building materials	30	8	0	38
6 Fertilizers, chemicals	213	19	1	233
7 Transport equipment and machinery	390	67	21	479
8 Other manufactured articles	907	136	0	1.043
9 Paper pulp and waste paper	34	19	0	53
10 Miscellaneous articles	239	39	159	437
Total	**2.365**	**429**	**182**	**2.976**

Modal split 2015 Reference Forecast B by commodity groups

Aggregated relation		2015			
		Road	Rail conv.	Rail comb.	Total
Germany West	Denmark	1.745	607	196	2.547
Germany West	Sweden	10.170	2.826	202	13.197
Germany West	Norway	2.139	271	103	2.513
Germany West	Finland	2.176	6	5	2.188
Germany East	Denmark	169	158	4	331
Germany East	Sweden	1.649	894	2	2.545
Germany East	Norway	285	18	13	316
Germany East	Finland	53	0	0	53
West Europe	Denmark	2.967	186	1.140	4.292
West Europe	Sweden	9.401	2.801	182	12.383
West Europe	Norway	1.971	134	0	2.105
West Europe	Finland	336	0	0	336
East Europe	Denmark	436	107	0	543
East Europe	Sweden	1.898	281	1	2.179
East Europe	Norway	291	51	0	342
East Europe	Finland	53	0	0	53

Aggregated freight flows 2015 Reference Forecast B
(in 1.000 tons, two way totals)

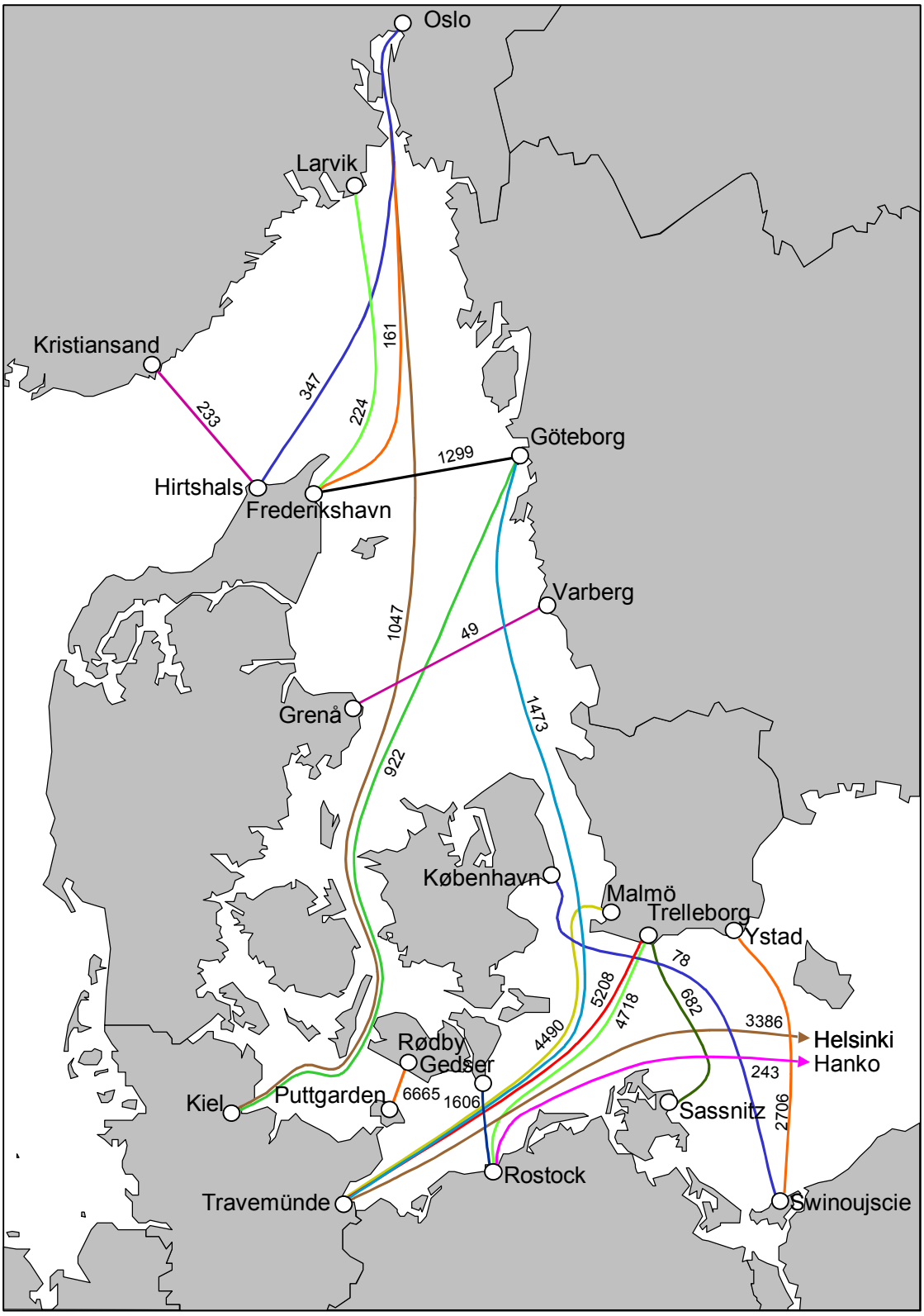
Traffic		2015			
Between	**and**	**Road**	**Rail conv.**	**Rail comb.**	**Total**
Schleswig-Holstein/Hamburg	East Denmark	622	16	56	694
Schleswig-Holstein/Hamburg	Skåne	233	37	5	275
Schleswig-Holstein/Hamburg	Götaland	466	219	11	697
Schleswig-Holstein/Hamburg	Svealand/Norrland/Finland	580	241	1	821
Schleswig-Holstein/Hamburg	Norway	347	63	13	424
Mecklenburg-Vorpommern	East Denmark	29	5	0	34
Mecklenburg-Vorpommern	Skåne	55	13	0	68
Mecklenburg-Vorpommern	Götaland	183	33	0	216
Mecklenburg-Vorpommern	Svealand/Norrland/Finland	197	29	0	226
Mecklenburg-Vorpommern	Norway	49	2	0	51
Niedersachsen/Bremen	East Denmark	263	104	15	382
Niedersachsen/Bremen	Skåne	193	38	0	232
Niedersachsen/Bremen	Götaland	674	207	0	881
Niedersachsen/Bremen	Svealand/Norrland/Finland	697	209	0	906
Niedersachsen/Bremen	Norway	540	10	0	550
Other West Germany	East Denmark	831	481	126	1.438
Other West Germany	Skåne	952	124	35	1.111
Other West Germany	Götaland	3.405	664	95	4.163
Other West Germany	Svealand/Norrland/Finland	4.710	1.019	61	5.789
Other West Germany	Norway	1.202	195	91	1.488
Berlin/Brandenburg	East Denmark	46	15	0	61
Berlin/Brandenburg	Skåne	99	22	0	121
Berlin/Brandenburg	Götaland	309	153	0	462
Berlin/Brandenburg	Svealand/Norrland/Finland	321	185	0	506
Berlin/Brandenburg	Norway	63	4	0	67
Other East Germany	East Denmark	123	143	4	270
Other East Germany	Skåne	129	81	0	210
Other East Germany	Götaland	461	194	1	655
Other East Germany	Svealand/Norrland/Finland	384	259	1	644
Other East Germany	Norway	222	14	13	249
Other West Europe	East Denmark	2.967	186	1.140	4.292
Other West Europe	Skåne	1.576	219	17	1.812
Other West Europe	Götaland	4.292	1.043	98	5.432
Other West Europe	Svealand/Norrland/Finland	3.869	1.539	67	5.475
Other West Europe	Norway	1.971	134	0	2.105
Other East Europe	East Denmark	436	107	0	543
Other East Europe	Skåne	242	42	0	284
Other East Europe	Götaland	1.111	138	0	1.249
Other East Europe	Svealand/Norrland/Finland	597	102	0	699
Other East Europe	Norway	291	51	0	342

Freight flows per region 2015 Reference Forecast B
(in 1.000 tons, two way totals)

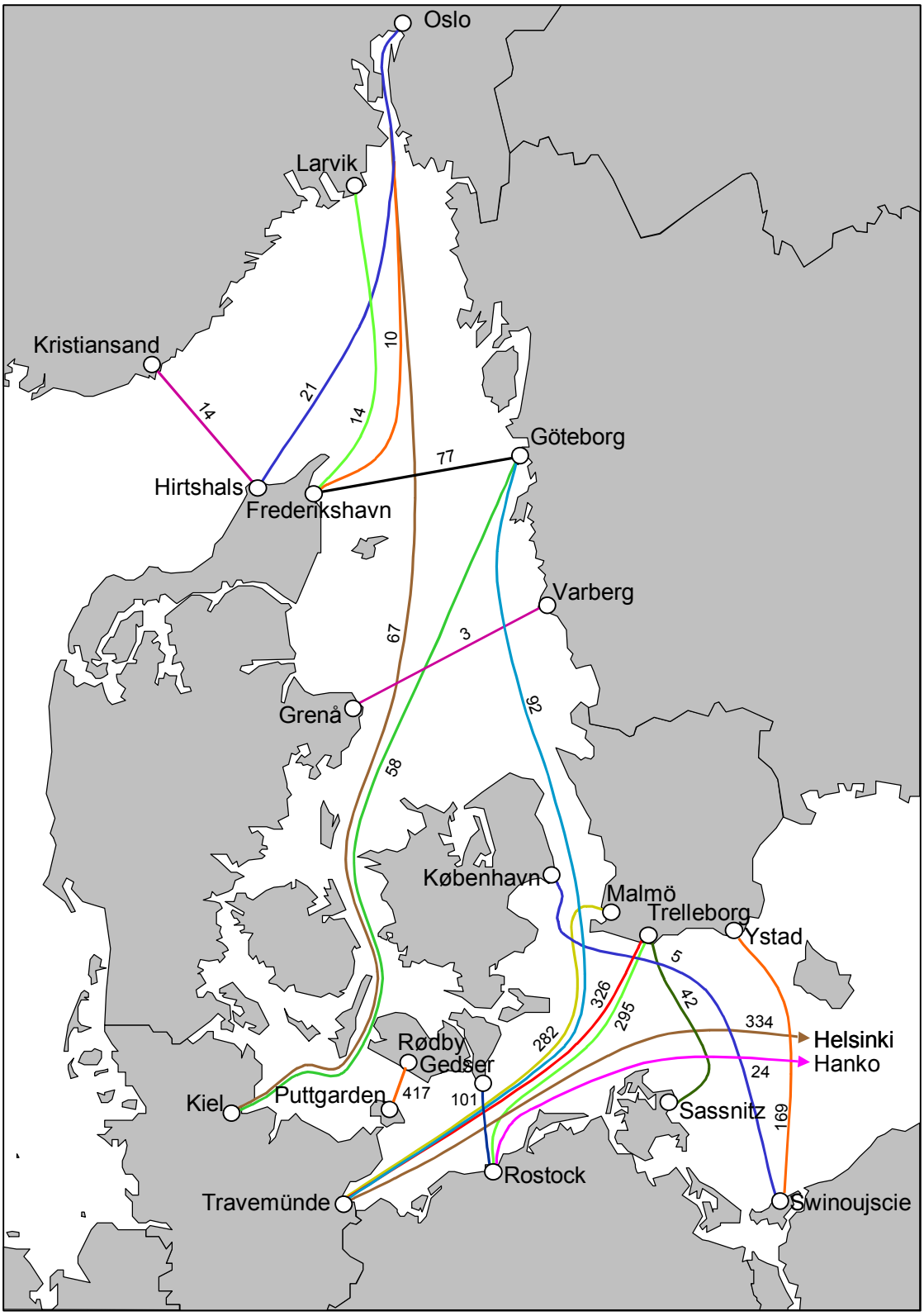
Ferry loads 2015 Reference Forecast B – tons rail (thereof combined)
(in 1000 tons, two way totals)

Ferry loads 2015 Reference Forecast B – wagons rail (thereof combined)
(in 1.000, two way totals)

Ferry loads 2015 Reference Forecast B – trains (two way totals)



Ferry loads 2015 Reference Forecast B – tons road
(in 1.000 tons, two way totals)



Ferry loads 2015 Reference Forecast B – vehicles road (in 1.000, two way totals)

APPENDIX 3 TABULATION OF FERRY LOAD FIGURES

Passenger Traffic

Ferry line		Number of passenger cars, 1000 cars/year				
		2001	Reference Case A	Reference Case B	Base Case A	Base Case B
Hanstholm	Egersund/ Bergen[1)]	18	32	32	31	31
Hirtshals	Kristiansand[1)]	76	125	130	116	121
Hirtshals	Oslo[1)]	10	14	14	13	13
Frederikshaven	Larvik[1)]	37	59	59	47	47
Frederikshaven	Oslo[1)]	17	22	22	20	20
Frederikshaven	Göteborg[1)]	75	92	95	64	66
Grena	Varberg[1)]	10	14	14	10	10
Kiel	Oslo	83	123	121	113	111
Kiel	Göteborg	92	122	129	100	107
Puttgarden	Rodby (Fixed Link				2.736	2.842
Puttgarden	Rodby (Ferry)	1.357	1823	1912		
Travemünde	Trelleborg/ Malmö	74	160	163	67	68
Rostock	Gedser	194	457	469	278	287
Rostock	Trelleborg	145	380	395	252	264
Sassnitz/ Mukran	Trelleborg	114	271	280	209	218
Swinoujscie	Copenhagen	13	20	20	17	17
Swinoujscie	Ystad	108	152	155	152	155
Germany	Finland	64	115	114	112	111
other Poland	Sweden	77	102	103	102	103

1) without traffic to/from Jylland

Freight Traffic

Road Traffic / Lorries:

Road freight (1.000 t/year) and number of vehicles (1.000 vehicles/year)											
Ferry lines		Base year 2001		Ref Case A		Ref Case B		Base case A		Base case B	
		freight	vehicles	freight	vehicles	freight	vehicles	freight	vehicles	freight	vehicles
Hirtshals	Kristiansand	140	8	209	13	233	14	204	13	226	14
Hirtshals	Oslo	222	13	301	19	347	21	293	19	337	21
Frederikshavn	Larvik	143	8	195	12	224	14	189	12	218	13
Frederikshavn	Oslo	104	6	140	9	161	10	136	9	156	10
Frederikshavn	Göteborg	855	50	1.131	70	1.299	77	1.095	68	1.259	75
Grenå	Varberg	32	2	43	3	49	3	41	3	47	3
Kiel	Oslo	651	41	896	60	1.047	67	870	58	1.015	65
Kiel	Göteborg	606	37	804	52	922	58	779	51	895	56
Puttgarden	Rødby	4.434	274	5.952	382	6.665	417	6.426	413	7.206	452
Travemünde	Malmö	2.998	185	3.995	258	4.490	282	3.867	251	4.351	274
Travemünde	Trelleborg	3.379	209	4.589	296	5.208	326	4.442	288	5.046	317
Travemünde	Helsinki	2.040	203	3.038	319	3.386	334	3.004	317	3.346	332
Travemünde	Hanko	147	15	219	23	243	24	216	23	240	24
Rostock	Gedser	995	62	1.434	92	1.606	101	1.324	86	1.484	93
Rostock	Trelleborg	3.037	187	4.181	270	4.718	295	4.049	262	4.574	287
Sassnitz	Trelleborg	435	27	604	39	682	42	584	37	661	41
Swinoujscie	København	48	3	78	5	78	5	68	4	78	5
Swinoujscie	Ystad	1.638	101	2.373	153	2.706	169	2.298	149	2.622	165

Trains:

Rail freight (1.000 t/year) and number of freight trains/year											
Ferry lines		Base year 2001		Ref Case A		Ref Case B		Base case A		Base case B	
		freight	trains	freight	trains	freight	trains	freight	trains	freight	trains
Puttgarden	Rødby							10.843	20.346	7.983	15.645
Rostock	Trelleborg	691	1.102	1.439	2.302	959	1.579	1.234	1.963	824	1.347
Sassnitz	Trelleborg	1.440	2.259	2.954	4.666	2.021	3.266	2.531	3.977	1.735	2.782

APPENDIX 4 TRAVEL TIMES BETWEEN COPENHAGEN AND HAMBURG

Mode	Base year 2001	Reference Cases 2015	Base Cases 2015
Passenger train	4 hours 31 min	3 hours 45 min	2 hours 47 min
Person car	5 hours 16 min	5 hours 08 min	3 hours 55 min
Freight train conventional[1)]	N/A	34 hours 36 min	29 hours 41 min
Freight train combined[1)]	N/A	23 hours 40 min	20 hours 24 min
Lorry[2)]	N/A	10 hours 54 min	10 hours 12 min

Note 1):the transport times are average door-to-door times including loading/unloading, transposition times and waiting times on the goods moved
Note 2): the transport times are average times door-to-door including loading/unloading, waiting times and resting times for the drivers