FERRMED Study of Traffic and Modal Shift Optimisation in the EU

FERRMED CONFERENCE

Presentation of Final Results of the FERRMED Study of Traffic and Modal Shift Optimisation in the EU

Brussels, November 29th 2023

FERRMED

Promotion du Grand Axe Ferroviaire de marchandises
Scandinavie-Rhin-Rhône-Méditerranée Occidentale A.S.B.L

SUMMARY

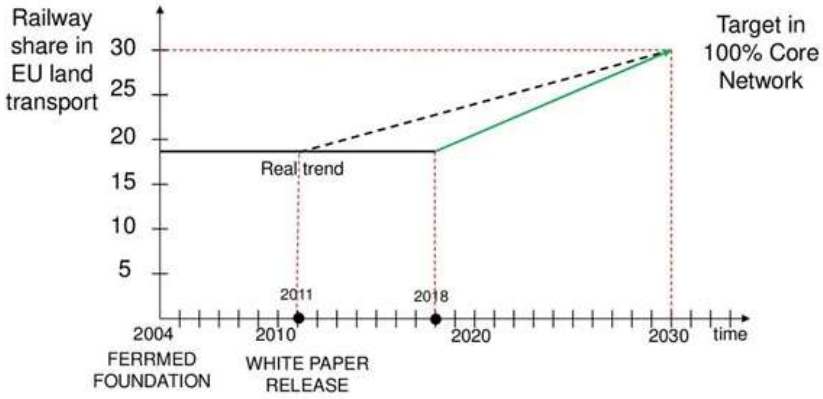
- FERRMED Study Motivation and objectives
- Data collection
- EU Backbone Network determination
- EU Strategic Socioeconomic Hubs
- Forecast Traffic Scenarios
- Impact of traffic scenarios in intermodal terminals and interconnection links
- Actions in interconnection links and terminals
- Main Trans-Eurasian interconnections in the EU

OBJECTIVES OF THE STUDY (I)

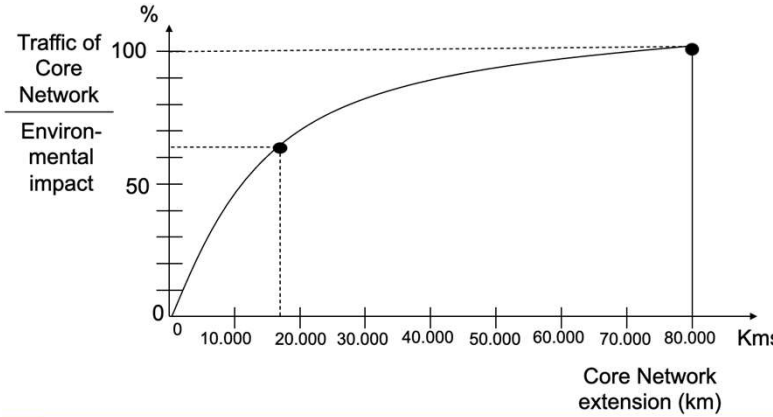
BACKGROUND

- In 2015 transport volume in the EU-28 was **19 billion tonnes** of goods transported **(or 2,385 billion tonne-kilometre)**. In terms of tonne-kilometre, **75% was transported by road, 18% by rail and 7% by barge**.
- The major part (around 55%) of total road freight transport performance was over distances of more than 300km of which, roughly one third, where over more than 1000km.
- The impact of road freight transport on the environment is massive: some **275 million tonnes of CO_2** per annum representing **30% of total GHG emissions of the transport sector** as a whole.

RAILWAY SHARE REAL VERSUS PLANNED



FERRMED APPROACH TO ACHIEVE AT LEAST 65% OF "WHITE PAPER" TARGETS IN 2030



OBJECTIVES OF THE STUDY (II)

The objectives of the study are:

- **To identify current total freight transport by mode** in the main corridors of the EU Core Network (EU Backbone Network);
- **To identify the main logistic hubs in the EU**
- **To define a new integrated Rail-Road system of transport for freight**
- **To propose an Action Plan to achieve the EC (2011) White Paper on Transport Policy targets by 2030** (30 % of inland freight transport over 300 km carried by rail or barge) **and "Green Deal" targets,** in the most heavily used sections of the corridors, covering 65 % of the traffic (tonne-kilometres) related to the EU Extended Core Network.

DATA COLLECTION

Data collection on traffics for interconnection links

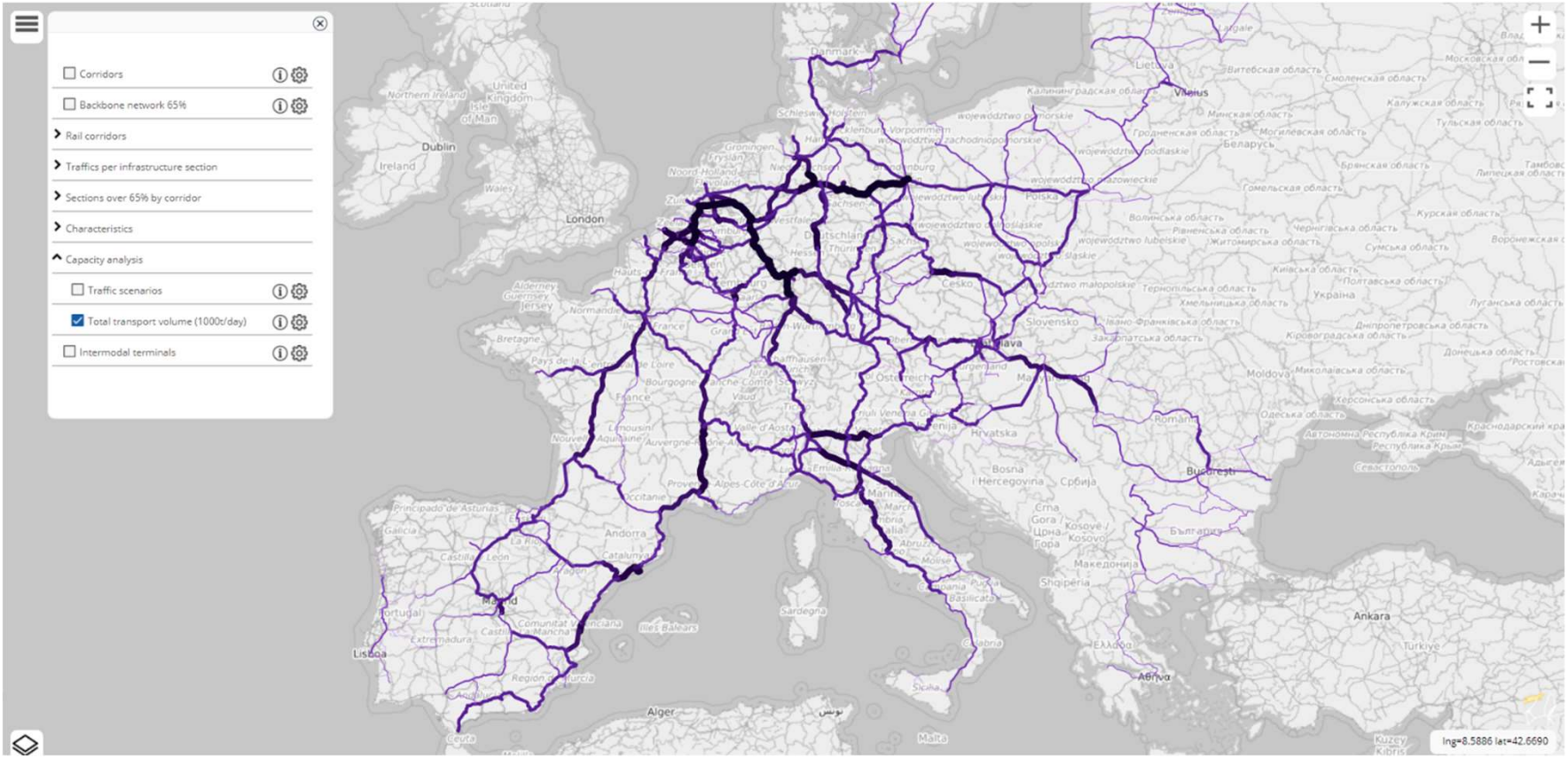
- **Data gathering** from several sources for **year 2015** (sometimes 2018), mainly **UNECE, EUROSTAT, CEDR, OPEN RAILWAY MAP, OPEN STREET MAP** for road and rail
- **Complementary** data obtained from **national sources** wherever necessary (Italian toll motorways association, Croatian national transport model…)
- **Inland waterway** traffic calculated using an **assignment** model based on **origin-destination matrices** obtained from **national sources**
- **Revision of data** by national experts + completion of gaps

DATA COLLECTION

Organisation of data in one comprehensive database

					RAILWAY									ROAD					IWW	TOTALS	
ID	Country	Core corridor	Feeder	Backup	Network ID	FROM	TO	Km	Nº of tracks	Total trains / Day	Passenger Trains / Day	Freight Trains / Day	Railway Tonnes	FROM	TO	Road ID	Trucks	Road tonnes	IWW tonnes	Total tonnes	Total tonne-km
1	FR	MED/NSM	No	No	46	Marseille	Miramas	62	2	86	61	25	19,500	Marseille	Miramas	A-7	5,740	80,360	8,843	108,703	6,739,586
2	FR	MED/NSM	No	No	47	Miramas	Tarascon	39	2	89	61	28	21,840	Miramas	Tarascon	D-17	5,740	80,360	8,843	111,043	4,330,677
3	FR	MED/NSM	No	No	38	Tarascon	Avignon	23	4	102	61	41	31,980	Tarascon	Avignon	D-35/D-2/A-9	20,065	280,910	10,079	322,969	7,428,287
4	FR	MED/NSM	No	No	39	Avignon	Valence	127	4	76	35	41	31,980	Avignon	Valence	A-7	18,602	260,428	10,079	302,487	38,415,849
5	FR	MED/NSM	No	No	40	Valence	Lyon	104	4	189	129	60	46,800	Valence	Lyon	A-7	19,972	279,608	10,079	336,487	34,994,648
6	FR	NSM	No	No	48	Lyon	Macon	71	4	144	72	72	56,160	Lyon	Macon	A-6	14,573	204,022	4,149	264,331	18,767,501
8	FR	NSM	No	No	50	Macon	Dijon	125	4	174	96	78	60,840	Macon	Dijon	A-6	14,573	204,022	4,149	269,011	33,626,375
10	FR	NSM	No	No	55	Dijon	Damblain	110	2	45	4	41	31,980	Dijon	Damblain	A-31	6,015	84,210	2,698	118,888	13,077,680
11	FR	NSM	No	No	56	Damblain	Nancy	106	2	47	6	41	31,980	Damblain	Nancy	A-31	5,979	83,706	2,698	118,384	12,548,704
34	FR	MED	No	No	35	Montpellier	Nimes	57	4	127	89	38	29,640	Montpellier	Nimes	A-9	17,750	248,500	1,540	279,680	15,941,760
36	FR	MED	No	No	36	Nimes	Tarascon	28	4	91	49	42	32,760	Nimes	Tarascon	A-9/A-7	16,200	22,6800	1,540	261,100	7,310,800

DATA COLLECTION

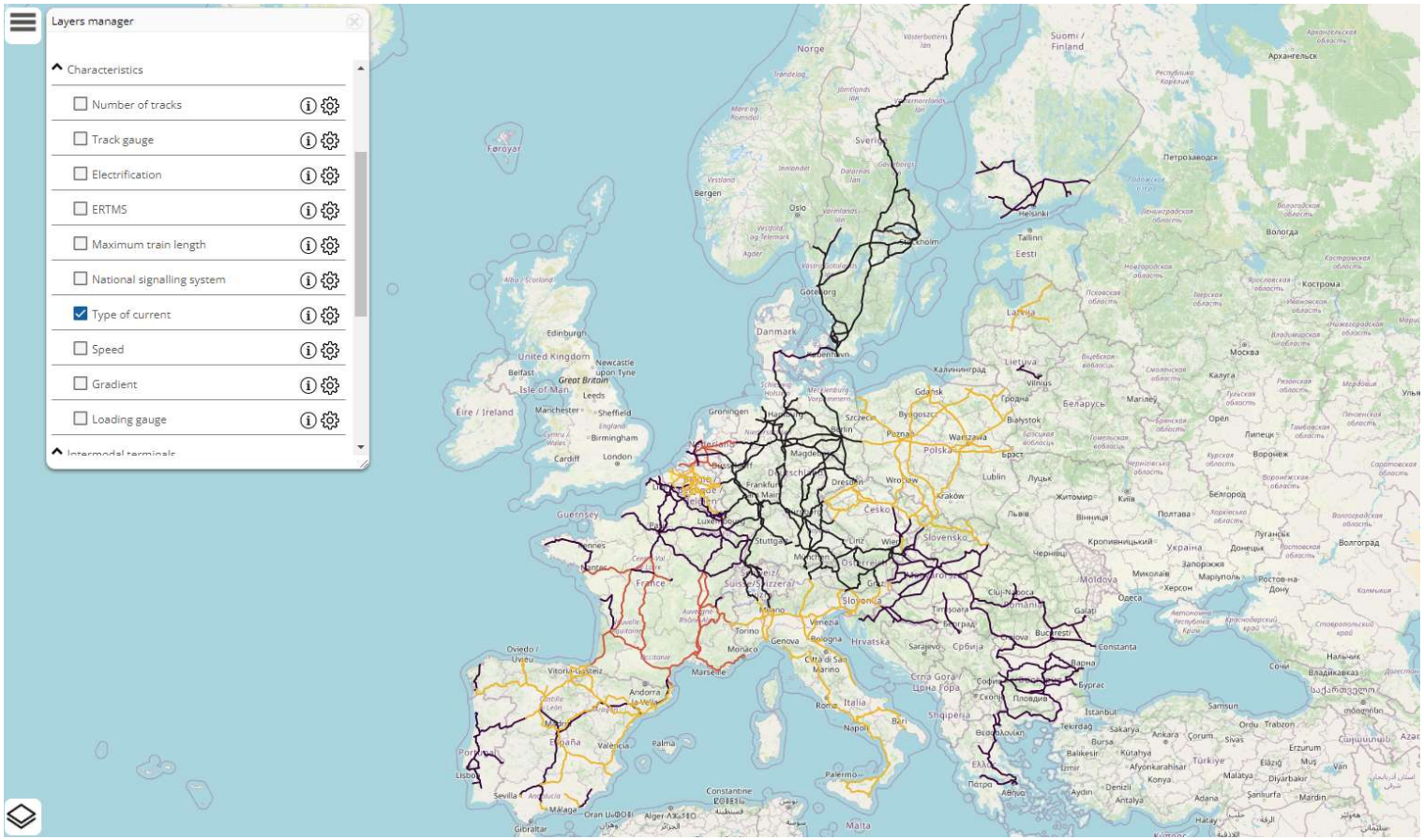


Data organised as an online GIS. Example of total traffic map

Data collection on characteristics for interconnection links

- Length of the trains
- Loading gauge
- ERTMS implementation
- International track gauge
- Number of tracks
- Electrification
- Train Speed acceptance
- Track Gradient
- Operation issues
- Rolling stock issues
- Link section traffic saturation (Bottlenecks)

DATA COLLECTION



Data organised as an online GIS. Example of electrification map

Data collection on terminals

Intermodal Terminals

1. Contact information
2. Modes served
3. Opening hours for load/unload
4. Total terminal area (m²)
5. Configuration: Dead-End / Pass-Through
6. Number and usable length of tracks (m), for loading/unloading
7. Number and usable length of tracks (m), for marshalling/shunting
8. Number of gantry cranes
9. Number of reach stackers
10. Available services

DETERMINATION OF THE EU BACKBONE NETWORK

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EU Core Network (aggregated): **77,240 km**
EU Central Backbone Network: **18,040 km (23,3 %)**
EU Extended Backbone Network: **8,500 km (11 %)**
Backbone Network 65 % threshold: **122,000 tonnes/day**

Country thresholds in 1000 tonnes/day

Austria	116	*Germany*	172	*Finland*	31	*Lithuania*	63	*Portugal*	28
Belgium	180	*Denmark*	119	*France*	128	*Luxembourg*	204	*Romania*	73
Bulgaria	35	*Estonia*	62	*Croatia*	21	*Latvia*	43	*Sweden*	50
Switzerland	155	*Greece*	39	*Hungary*	174	*Netherlands*	213	*Slovenia*	92
Czech Republic	122	*Spain*	100	*Italy*	161	*Poland*	83	*Slovakia*	72

This information is always available on the interactive map by clicking on the bottom left icon:

DETERMINATION OF THE EU BACKBONE NETWORK

- First priority (18,040 km)
- Second priority (8,500 km)
- Third priority (50,700 km)

EU STRATEGIC SOCIO-ECONOMIC HUBS

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To identify and determine the EU hubs, 4 factors were used as a selection criteria: Population, Input-Output flow, GVA and the Combined Index.

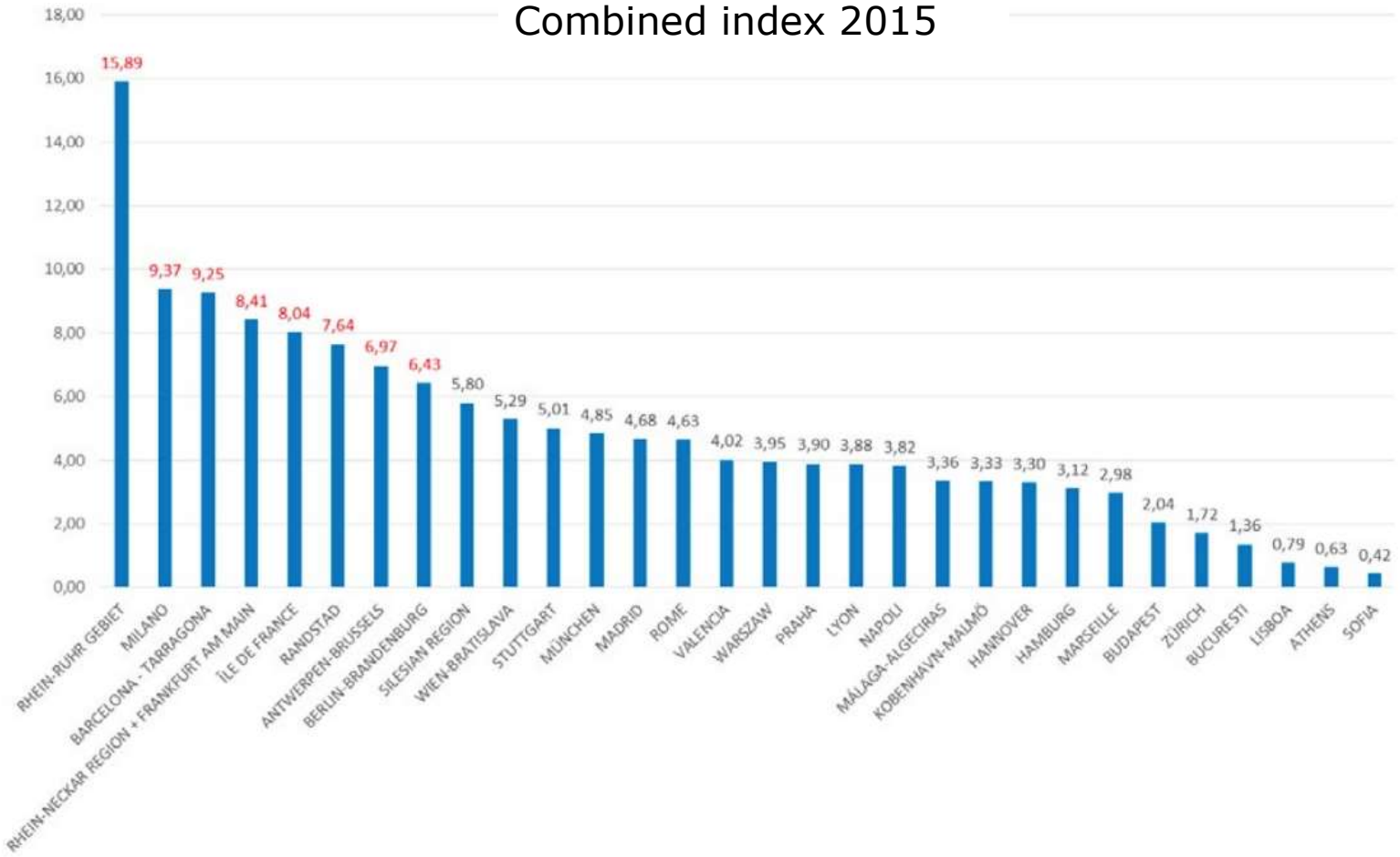
- **Inflows, outflows**: total freight volume handled per day for distances over 300 km resulting from the matrix of flows (based on ETIS+).
- **Manufacturing Gross Value Added (GVA)**: the value added of manufactured goods produced in an area or an economic sector linked to manufacturing activities.
- **Population**: First filter to select the main EU urban agglomerations as candidates to become a Strategic Hub. For the Strategic Hubs, the population of their corresponding urban agglomeration has to exceed the 1 % of the EU population (4.5 m inhabitants). For the EU Interrelated Hubs, their population has to be between 0.5 % and 1 % of the total EU population (2.2 to 4.5 m inhabitants).
- **Combined Index**: value resulting from combining the population, GVA and inflow-outflow values.

EU STRATEGIC SOCIO-ECONOMIC HUBS

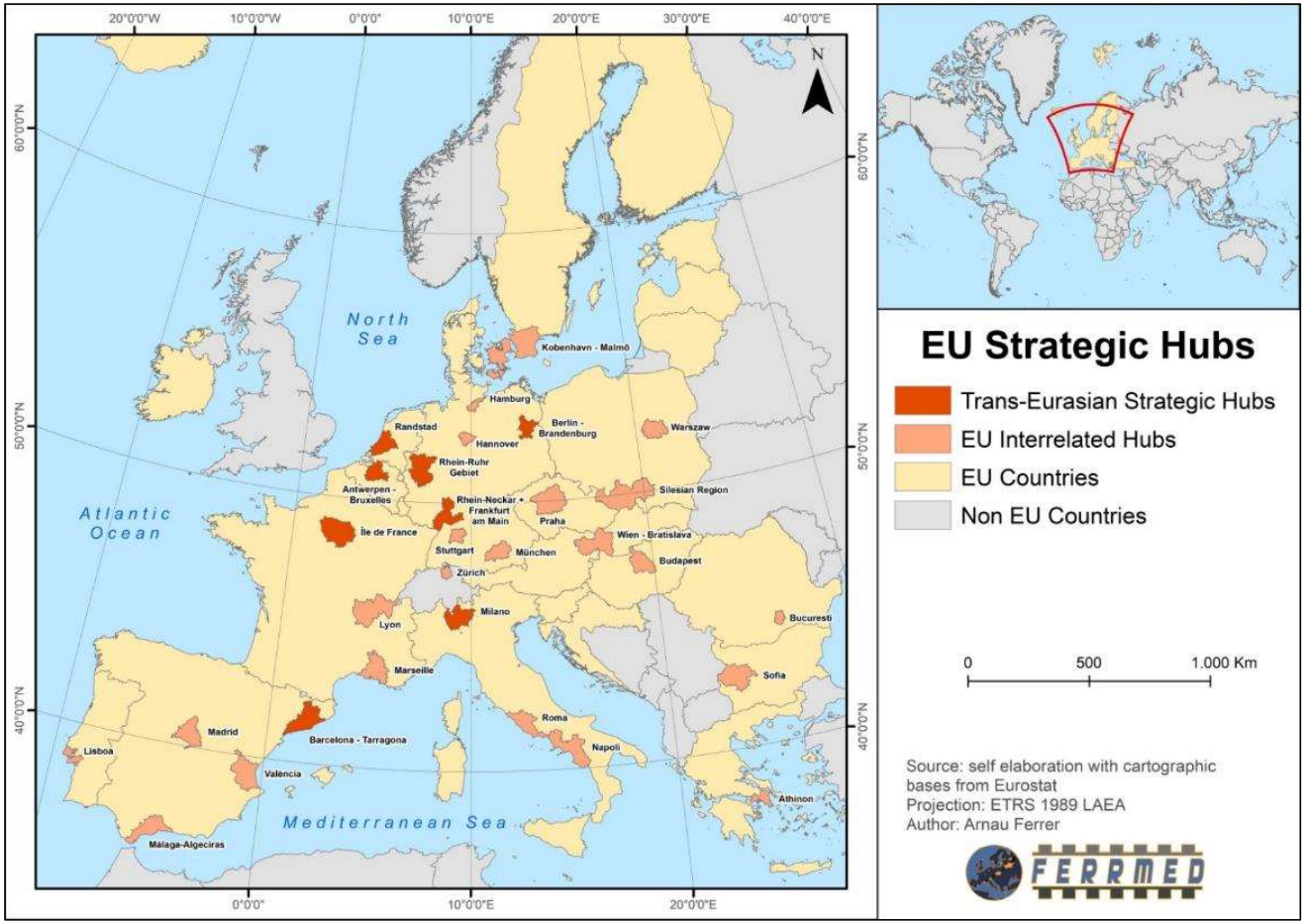
Values weighting

HUB POP	GVA Ind.	INPUT-OUTPUT
1	5	10

HUB NAME	Synthetic index
RHEIN-RUHR GEBIET	15,89
MILANO	9,37
BARCELONA - TARRAGONA	9,25
RHEIN-NECKAR REGION + FRANKFURT AM MAIN	8,41
ÎLE DE FRANCE	8,04
RANDSTAD	7,64
ANTWERPEN-BRUSSELS	6,97
BERLIN-BRANDENBURG	6,43
SILESIAN REGION	5,80
WIEN-BRATISLAVA	5,29
STUTTGART	5,01
MÜNCHEN	4,85
MADRID	4,68
ROME	4,63
VALENCIA	4,02
WARSZAW	3,95
PRAHA	3,90
LYON	3,88
NAPOLI	3,82
MÁLAGA-ALGECIRAS	3,36
KOBENHAVN-MALMÖ	3,33
HANNOVER	3,30
HAMBURG	3,12
MARSEILLE	2,98
BUDAPEST	2,04
ZÜRICH	1,72
BUCURESTI	1,36
LISBOA	0,79
ATHENS	0,63
SOFIA	0,42



EU STRATEGIC SOCIO-ECONOMIC HUBS

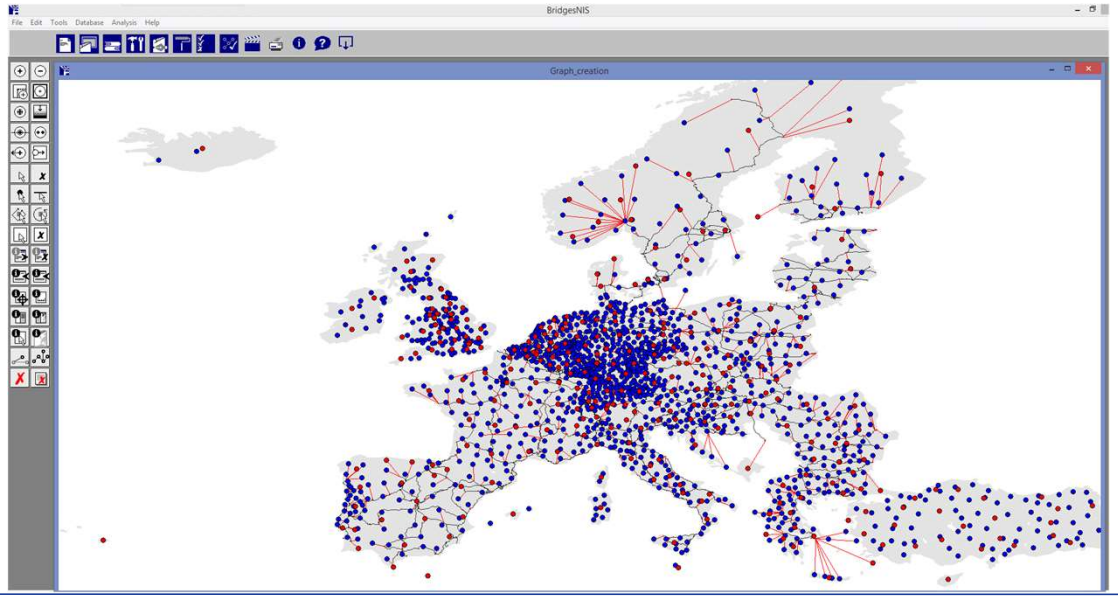


FORECAST TRAFFIC SCENARIOS

Traffic model

We have built a modelling tool based on existing data:

- *Zoning by NUTS3*
- *Network coming from the digitization of sections during the data collection phase*
- *Origin-Destination matrices by mode (road, rail, IWW) coming from ETIS+ project (official ones used by DGMOVE)*



- 1,462 NUTS3
- 318 NUTS2
- 2,600 segments
- 1.5M OD pairs

FORECAST TRAFFIC SCENARIOS

❖ Mid term stagnant (2025)

- The target is **23%** of tonne-km by rail on **average in Europe** and in each **individual country** (as much as possible).

❖ Long term stagnant (2030)

- The target is **30%** of tonne-km by rail on **average in Europe** and in each **individual country** (as much as possible).

❖ Long term (2030) 20% increase

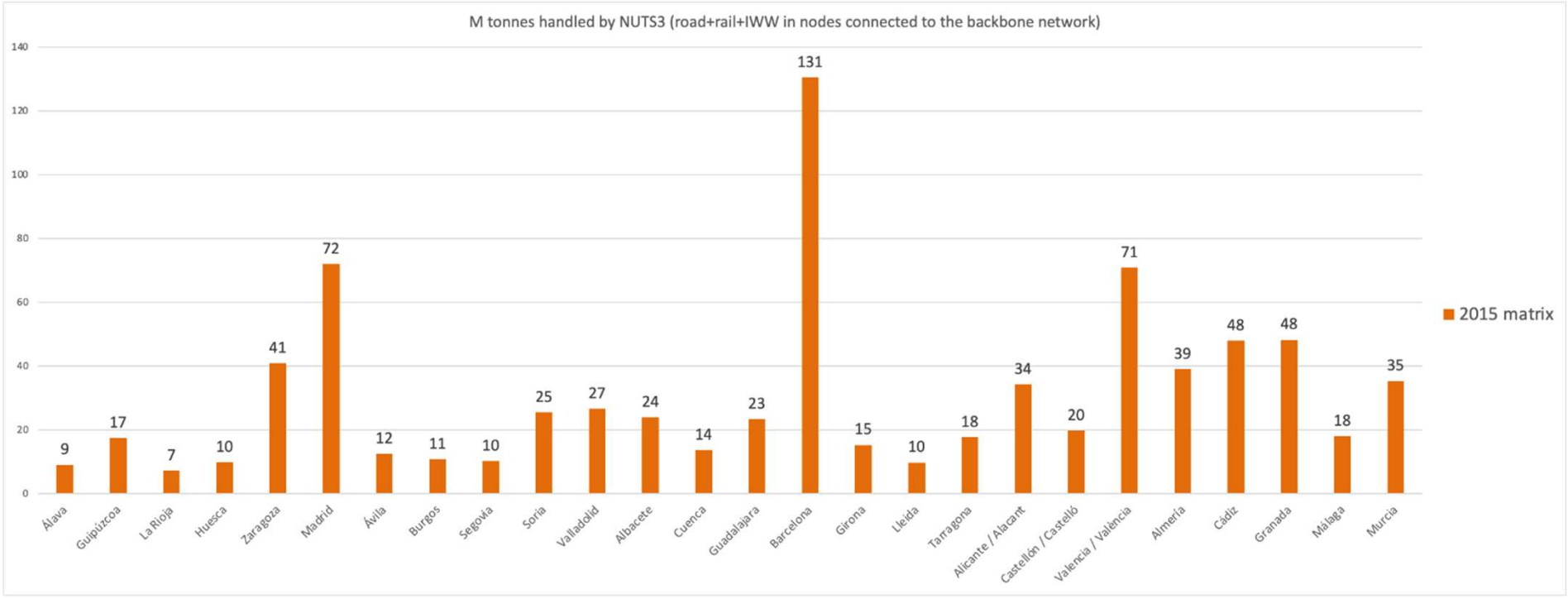
- We start from the 2030 stagnant scenario
- On top of it we add globally 20% traffic in all sections and modes

❖ Long term (2030) +20% with port traffic reequilibrium

- We start from the 2030 +20% scenario
- The assumption that the increase of traffic in the Mediterranean – Eurasian route in the future will be: 20% on the Northern basin and 80% on the Southern basin, until reaching approximately a 60/40 share north/south

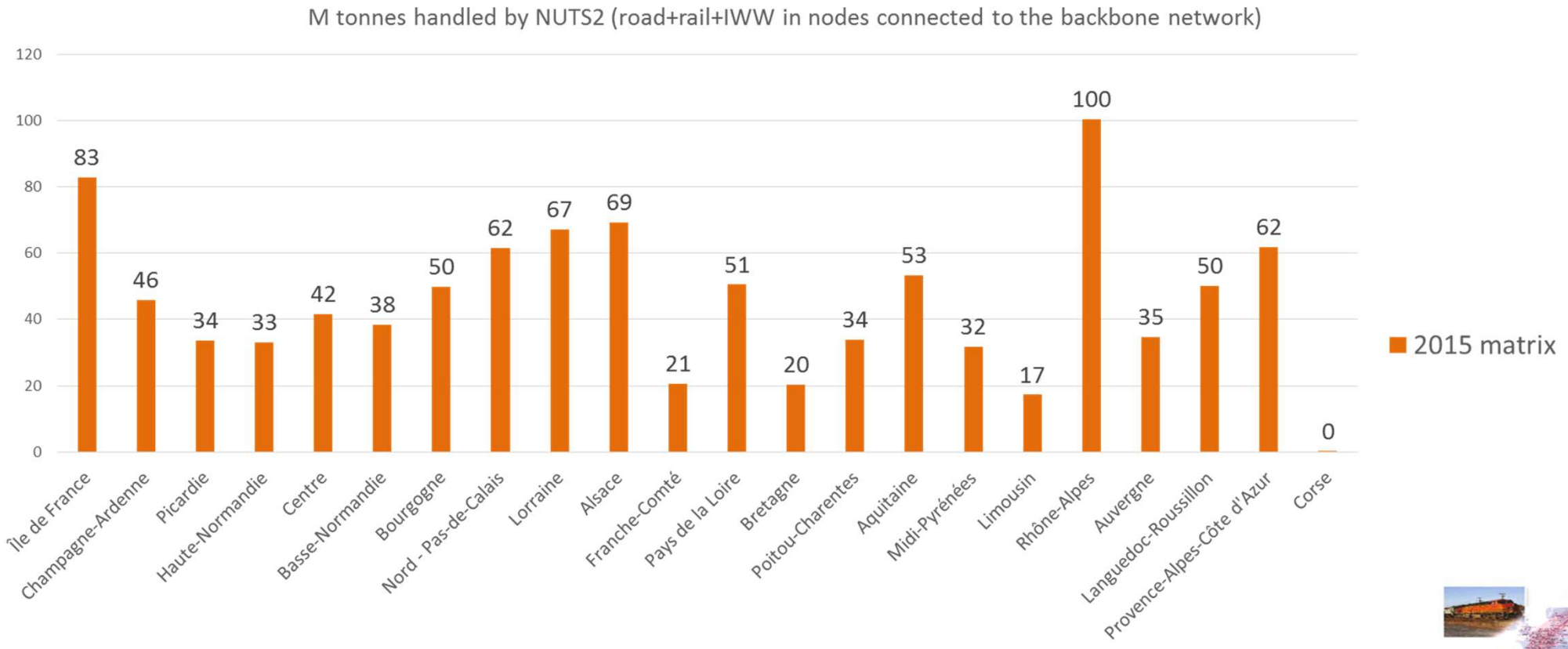
Example of model results: SPAIN (NUTS3)

(Over 300km)

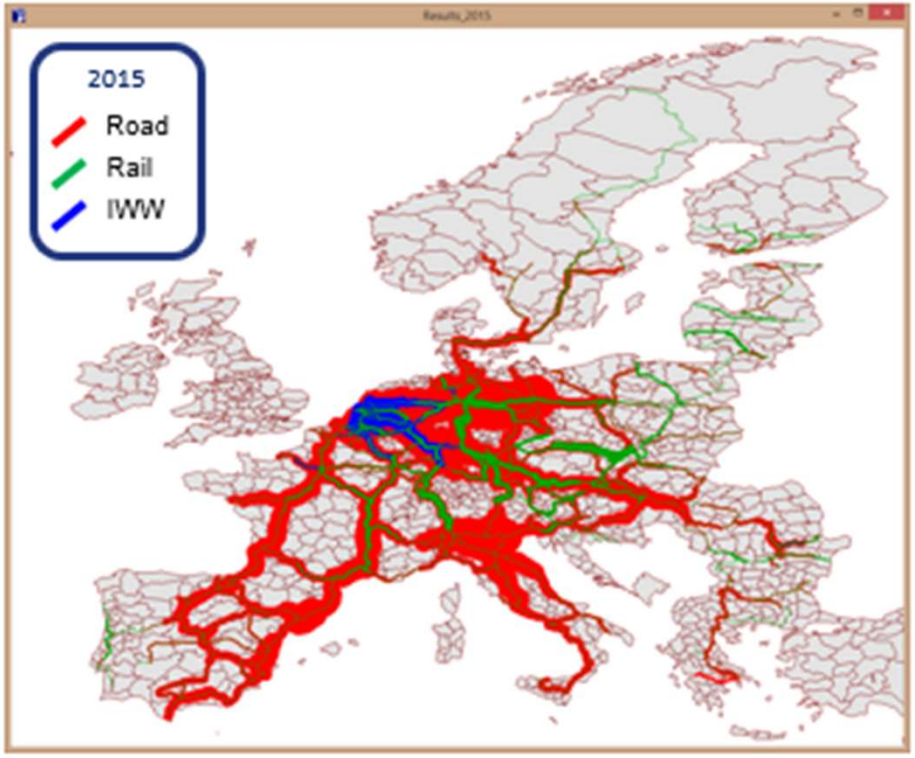


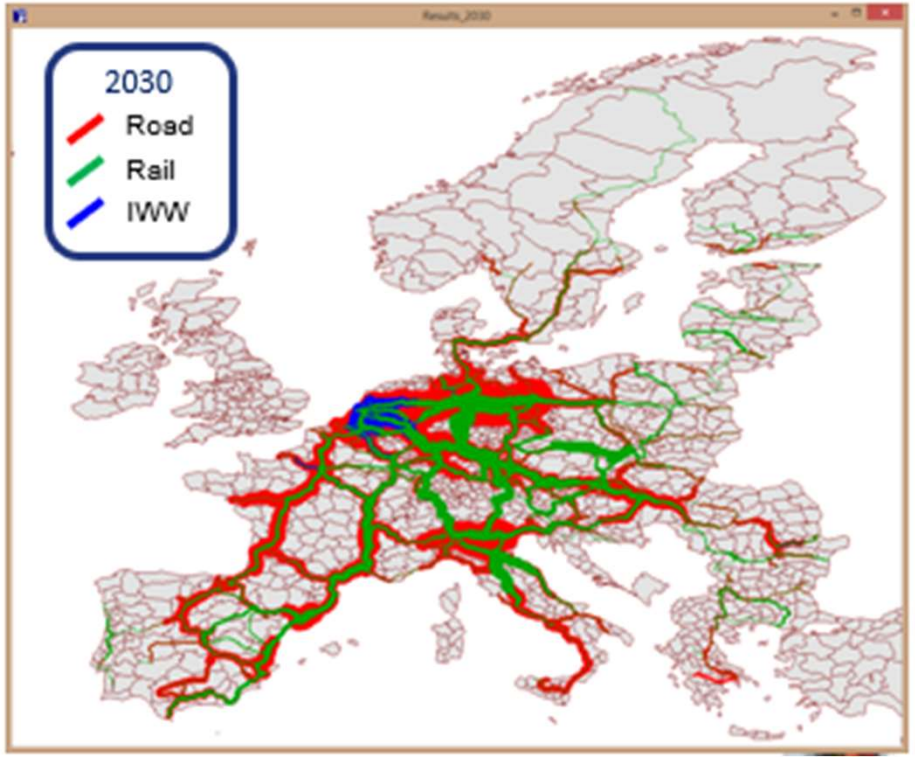
Example of model results: FRANCE (NUTS2)

(Over 300km)



Example of model results: traffic assignment maps





IMPACT OF TRAFFIC SCENARIOS IN INTERMODAL TERMINALS AND INTERCONNECTION LINKS

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BOTTLENECK ANALYSIS				ACTUAL TRAFFIC 2015			FORECAST TRAFFIC 2025			FORECAST TRAFFIC 2030			FORECAST TRAFFIC 2030 (Δ 20 %)			FORECAST TRAFFIC 2030 (Δ 20 %) + PORT REEQUILIBRIUM (60/40)		
FROM	TO	Km	Nº of tracks	Passenger Trains / Day	Freight Trains / Day	Total trains / Day	Passenger Trains / Day	Freight Trains / Day	Total trains / Day	Passenger Trains / Day	Freight Trains / Day	Total trains / Day	Passenger Trains / Day	Freight Trains / Day	Total trains / Day	Passenger Trains / Day	Freight Trains / Day	Total trains / Day
Marseille	Miramas	62.1	2	61	25	**86**	67	34	**101**	76	38	**114**	76	46	**122**	76	66	**142**
Miramas	Tarascon	38.5	2	61	28	**89**	67	29	**97**	76	30	**106**	76	36	**112**	76	63	**138**
Tarascon	Avignon	23.2	4	61	41	**102**	67	60	**127**	76	75	**151**	76	90	**166**	76	124	**199**
Avignon	Valence	127.0	4	35	41	**76**	39	75	**113**	43	100	**144**	43	121	**164**	43	153	**197**
Valence	Lyon	104.4	4	129	60	**189**	142	93	**235**	160	119	**278**	160	142	**302**	160	174	**334**
Lyon	Macon	71.0	4	72	72	**144**	79	96	**175**	89	117	**206**	89	140	**229**	89	168	**258**
Lyon	Bourg en Bresse	70.2	2	30	31	**61**	33	31	**64**	37	31	**68**	37	37	**74**	37	37	**74**
Macon	Dijon	125.0	4	96	78	**174**	106	105	**210**	119	129	**248**	119	155	**274**	119	182	**301**
Bourg en Bresse	Dijon	135.1	2	28	37	**65**	31	37	**68**	35	37	**72**	35	44	**79**	35	44	**79**
Dijon	Damblain	110.0	2	4	41	**45**	4	59	**64**	5	77	**82**	5	93	**98**	5	116	**121**
Damblain	Nancy	106.1	2	6	41	**47**	7	56	**63**	7	72	**79**	7	86	**94**	7	108	**116**
Nancy	Metz	55.2	4	89	55	**144**	98	70	**168**	110	88	**198**	110	105	**215**	110	121	**232**
Metz	Thionville	30.9	4	88	95	**183**	97	105	**202**	109	120	**229**	109	144	**253**	109	155	**264**
Metz	Strasbourg	155.2	4	12	29	**41**	13	31	**44**	15	34	**48**	15	40	**55**	15	45	**60**
Strasbourg	**Basel**	137.0	2	93	29	**122**	102	31	**133**	115	32	**147**	115	38	**154**	115	44	**159**
Metz	Longuyon	64.5	4	4	20	**24**	4	20	**25**	5	21	**26**	5	26	**31**	5	27	**31**
Perpignan	Narbonne	66.2	2	56	25	**81**	62	60	**122**	69	78	**147**	69	93	**163**	69	128	**197**
Narbonne	Montpellier	96.5	2	85	38	**123**	94	70	**164**	105	91	**196**	105	109	**215**	105	150	**255**
Montpellier	Nimes	57.0	4	89	38	**127**	98	67	**165**	110	88	**198**	110	106	**216**	110	146	**256**
Nimes HSL	Lyon HSL	148.3	2	21	0	**21**	23	0	**23**	26	0	**26**	26	0	**26**	26	0	**26**
Nimes	Tarascon	28.1	4	49	42	**91**	54	77	**131**	61	102	**163**	61	123	**184**	61	163	**224**
Valence	Grenoble	97.0	2	45	4	**49**	50	4	**54**	56	4	**60**	56	5	**61**	56	5	**61**
Grenoble	Montmélian	48.3	2	45	4	**49**	50	4	**54**	56	4	**60**	56	5	**61**	56	5	**61**
Lyon	Ambérieu	54.0	2	67	35	**102**	74	41	**115**	83	48	**131**	83	57	**141**	83	65	**148**
Ambérieu	Montmélian	98.2	2	79	35	**114**	87	41	**128**	98	45	**143**	98	55	**153**	98	61	**159**
Portbou / Cerbère	Perpignan	48.0	2	6	5	**11**	7	45	**52**	7	70	**77**	7	84	**91**	7	130	**137**
Thionville	**Bettembourg**	27.2	2	144	76	**220**	158	76	**234**	179	76	**255**	179	91	**270**	179	91	**270**
Dijon	Dole	45.2	2	42	11	**53**	46	11	**57**	52	11	**63**	52	13	**65**	52	13	**65**

By 2030 we assume trains carry at least 700 net tonnes in the Core Network

IMPACT OF TRAFFIC SCENARIOS IN INTERMODAL TERMINALS AND INTERCONNECTION LINKS

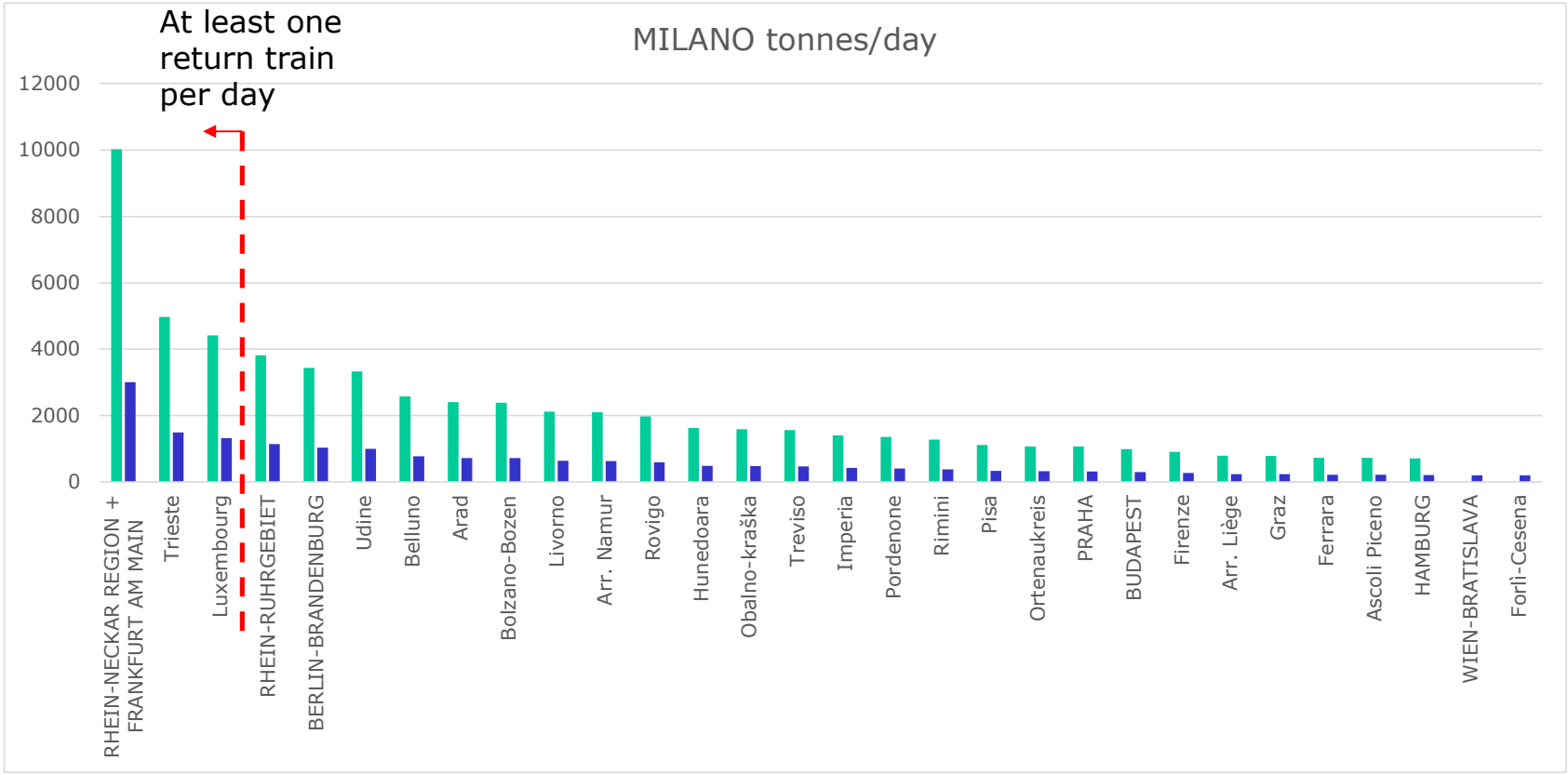
Terminal handling capacity per region (NUTS2/NUTS3): example for Schleswig-Holstein

A	B	C	D	E	F	G
TERMINAL	Global traffic Rail + Road 2015 (30%)	PTP Rail traffic 2015	PTP		FIRRST	
			2030 Rail traffic stagnant	2030 Rail traffic + Δ20%	2030 stagnant	2030 Δ20%
SCHLESWIG-HOLSTEIN	***35.400***	***12.000***	***13200***	***15840***	***22.200***	***26640***
New +FIRRS semi-compact terminal in Tarp (A7)					5.200	5.200
Schwedenkai Port of Kiel			7.140	7.140		
Norwegenkai Port of Kiel (piggyback)					2.880	2.880
UTG Tanklager Kiel (Port of Kiel)			1.275	1.275		
Vossloh Locomotives			50	50		
Kiel Ostuferhafen (Port of Kiel)			5.180	5.180		
Baltic terminal Kiel international (Port of Kiel)			2.380	2.380		
Economic area in Kiel			100	100		
Baltic Rail Gate terminal (Skandinavienkai) (piggyback)					7.920	7.920
Container terminal Lübeck			2.380	2.380		
Logistik Center Seelandkai (piggyback)					2.520	2.520
Lübeck Konstinbahnhof			650	650		
Matsä Bord Deutschland (Schlutupkai)			1.400	1.400		
Covestro (liquid) in Brunsbüttel			1.800	1.800		
Brunsbüttel Ports (coal terminal)			200	200		
Brunsbüttel Ports (cement terminal)			200	200		
Yara (liquid) in Brunsbüttel			900	900		
Total Energies Deutschland in Brunsbüttel			1.300	1.300		
Sasol Deutschland (liquid) in Brunsbüttel			300	300		
New +FIRRST terminal in Neumünster (A7)					8.800	8.800
Cement plant in Lägerdorf			400	400		
Total:			**25.655**	**25.655**	**27.320**	**27.320**
Difference:			**12.455**	**9.815**	**5.120**	**680**

A. Terminal name and location
B. 30% of total daily traffic in 2015
C. Daily Point-to-point rail transport 2015
D. Daily Point-to-point rail transport 2030 and capacity of terminals
E. Daily Point-to-point rail transport 2030+20% and capacity of terminals
F. Additional daily rail transport in 2030 to achieve 30% share
G. Additional daily rail transport in 2030+20% to achieve 30% share

IMPACT OF TRAFFIC SCENARIOS IN INTERMODAL TERMINALS AND INTERCONNECTION LINKS

It is not possible to capture the traffic needed to achieve 30% of rail share with daily Ptp trains:



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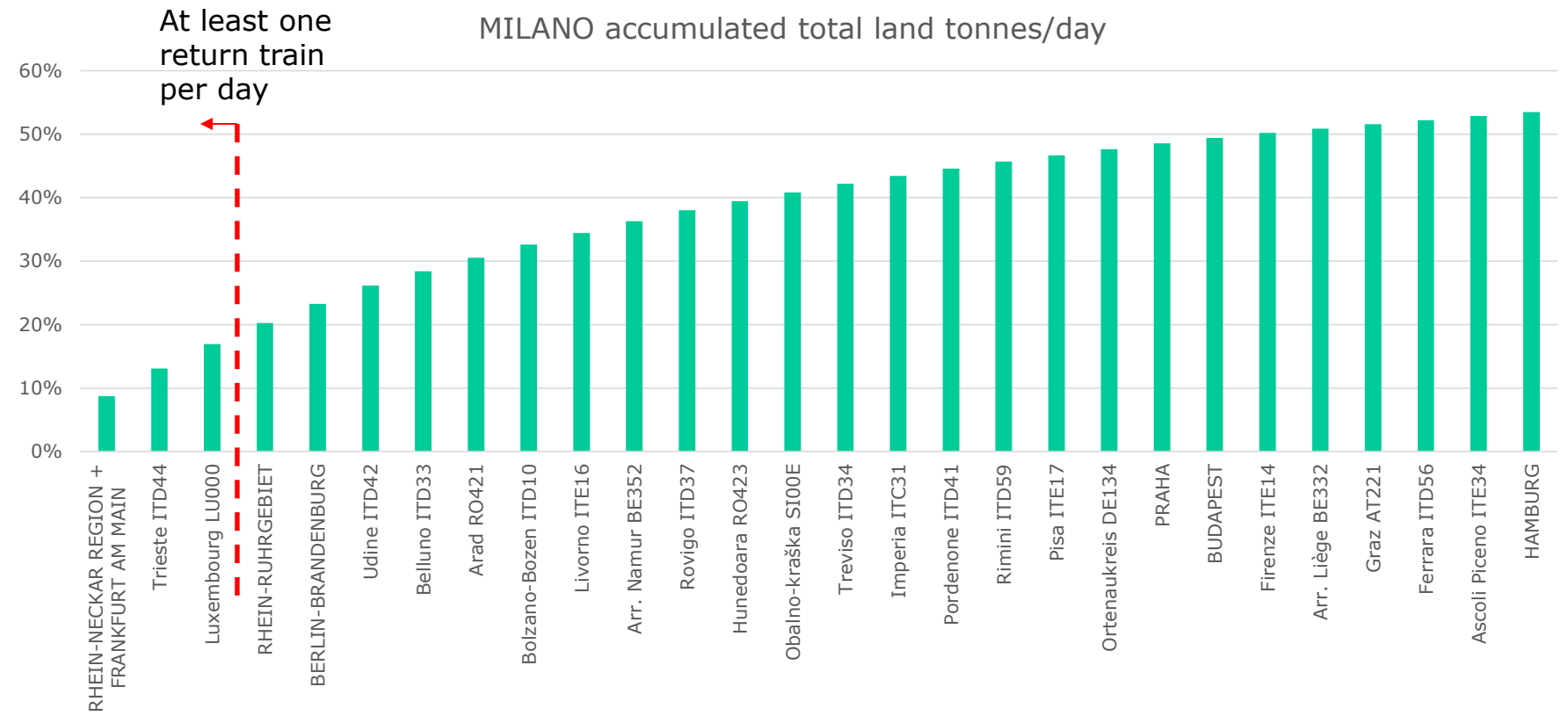

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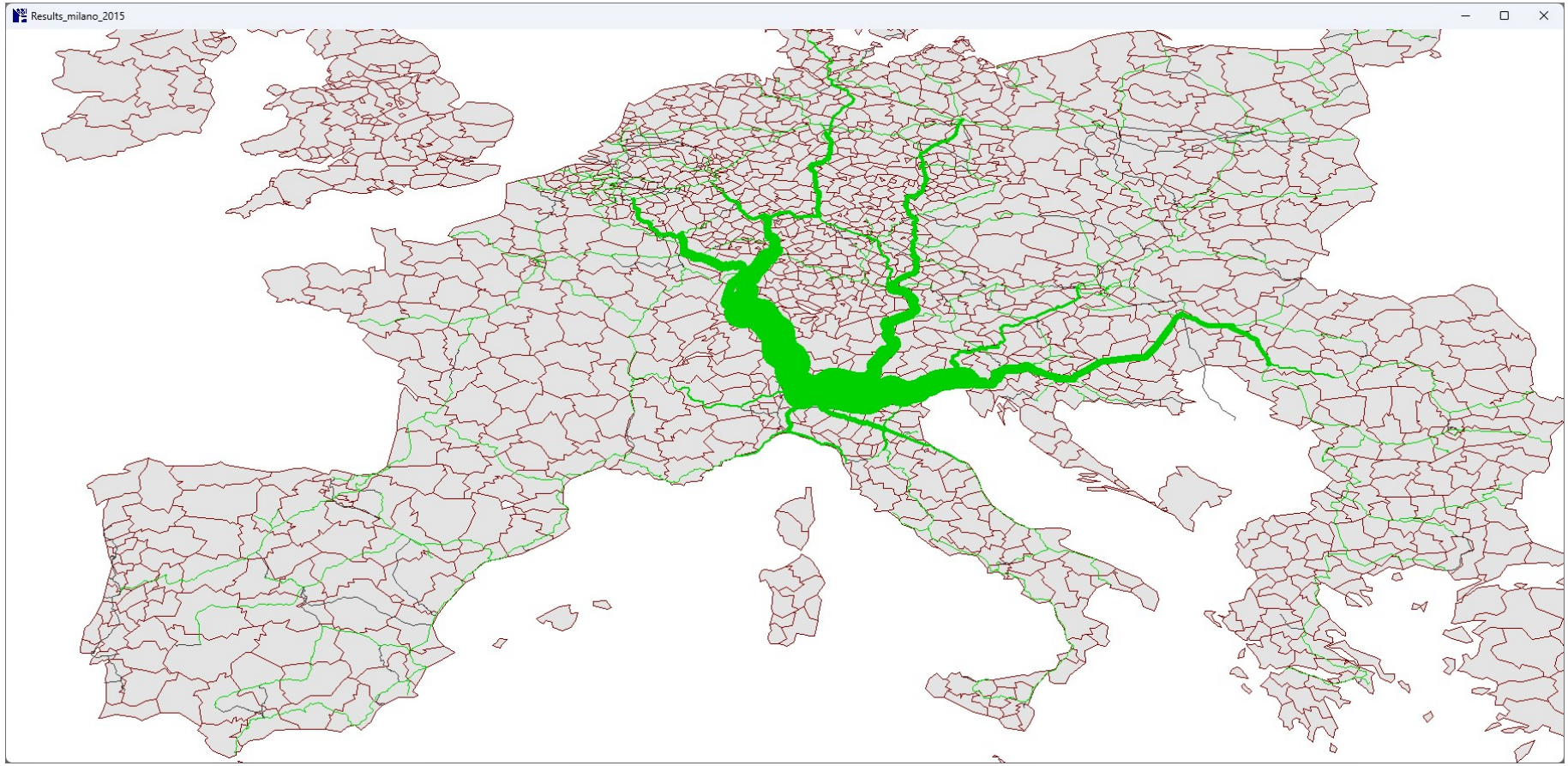

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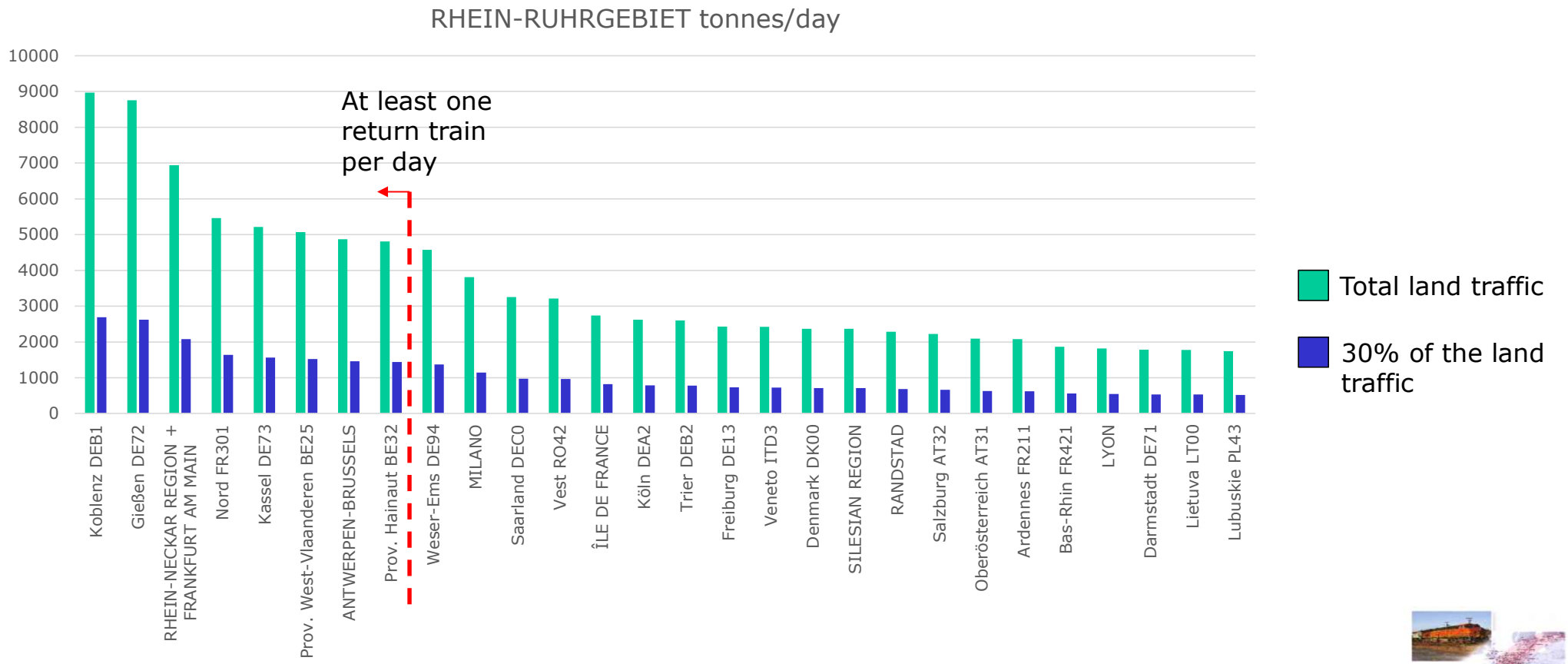

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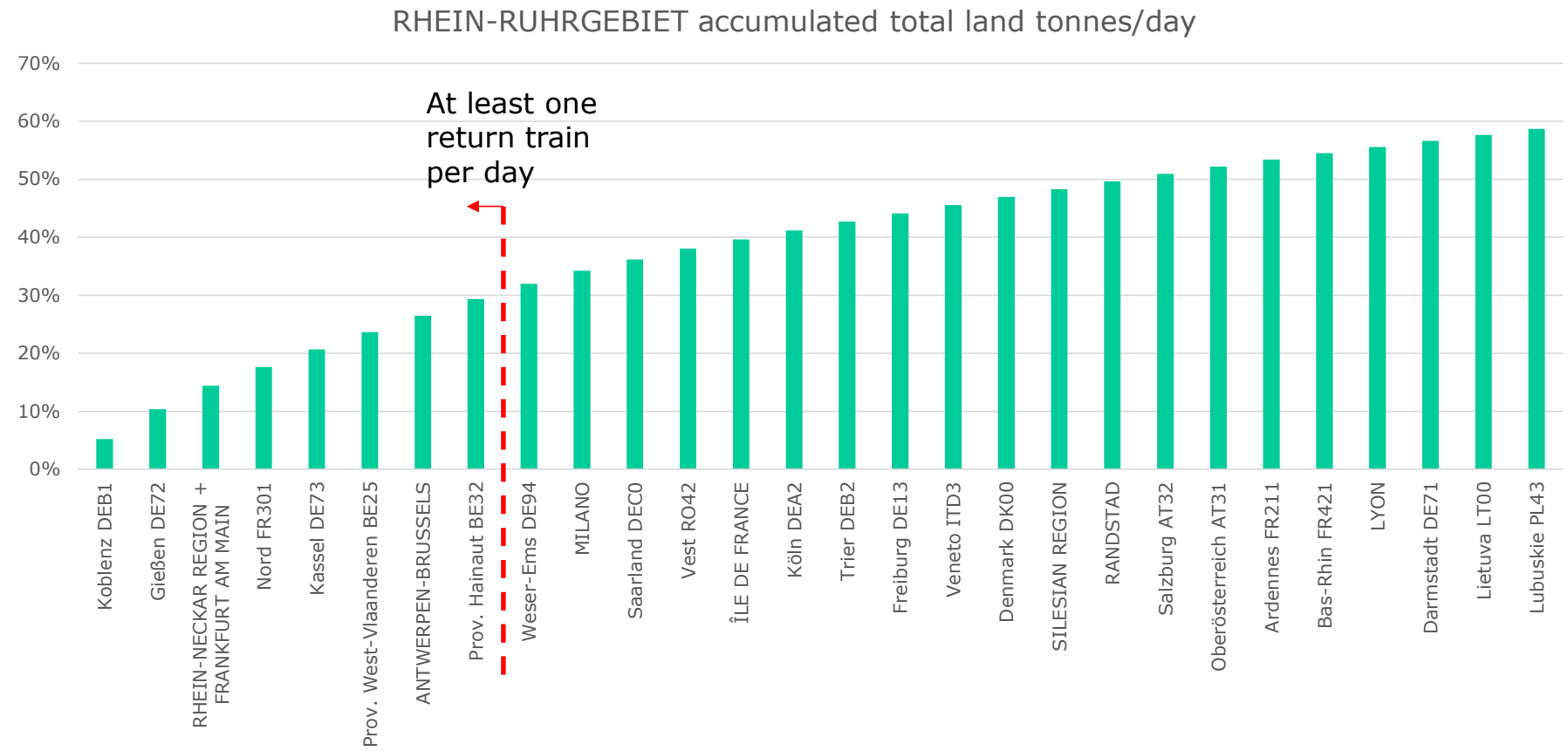

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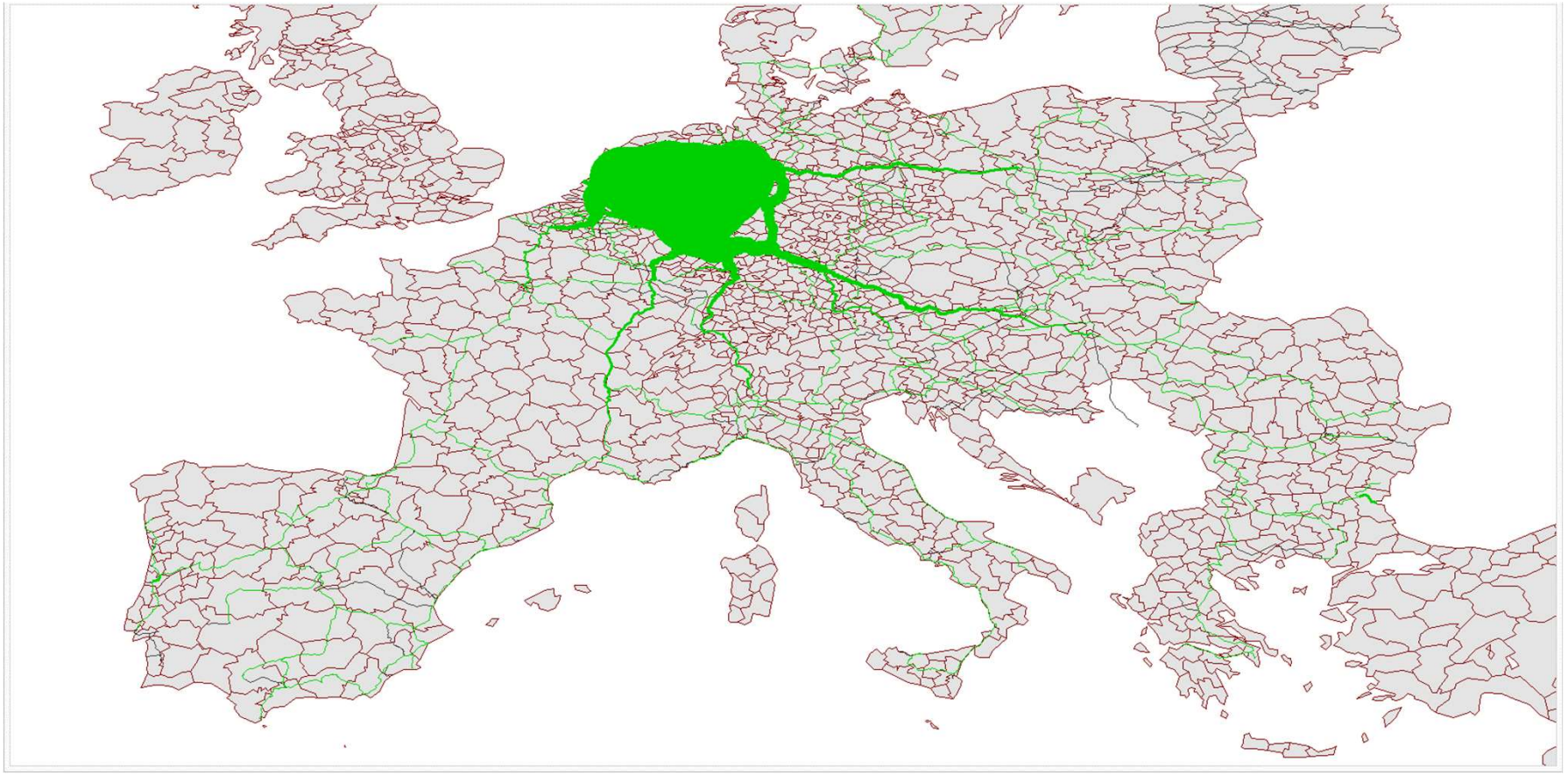

ACTIONS IN INTERCONNECTION LINKS AND TERMINALS

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Analysis of foreseen infrastructure development actions for rail interconnection links and terminals.

Gathering information from existing plans in all Member States:

- Location of the action (assign it to a network section)
- Description of the action (new line, duplication, electrification, ERTMS, P400, train length…)
- Foreseen calendar
- Stated foreseen cost (when available)
- Compute estimation of cost based on the description and unit prices derived from existing literature

Organisation of data and completion of gaps

- Compute estimation of cost based on the description and unit prices derived from existing literature
- Assign a time horizon if it is not stated in the plans
- Classification of time horizons in priorities

ID	Country	From	To	Actions Identified	Priority	Actions proposed by FERRMED	Priority
1064	Italy	Faenza	Castelbolognese	To implement the ERTMS and trains length 740 m	3.1	To add an additional track to avoid forecast bottlenecks	3.1
1064	Italy	Castelbolognese	P.M. Mirandola O.	To implement the ERTMS and trains length 740 m	3.1	To add an additional track to avoid forecast bottlenecks	3.1
1064	Italy	P.M.Mirandola O.	Bologna S. Vitale	To implement the ERTMS and trains length 740 m	3.1	To add an additional track to avoid forecast bottlenecks	3.1
1093	Italy	Quadr./PC Turro	Milano Lambrate	To implement the ERTMS and 740 m trains length	2.2	To construct 4 additional sidings of 1.700 m between Chiasso and Milano Lambrate	3.1
1098	Italy	Brennero (Austrian border)	Fortezza			To construct 2 new siding tracks of 900m in Sterzing	2.2
1098	Italy	Trento	Bivio/PC S.Massimo (Verona)			To construct 2 new siding tracks of 900m in Mori	2.2
1348	Italy	Trofarello	Alessandria			To construct 2 new siding tracks of 900m in Asti	2.2

ACTIONS IN INTERCONNECTION LINKS AND TERMINALS

As a result of the terminal capacity analysis, **425 additional new +FIRRST terminals** are required across the EU (plus Switzerland) to handle the rail traffic increase to achieve a railway share of 30 % over distances of 300 km

Location of +FIRRST new terminals

FERRMED
Promotion du Grand Axe Ferroviaire de Marchandises Scandinavie-Rhin-Rhône Méditerranée Occidentale

Summary of Member State action identified

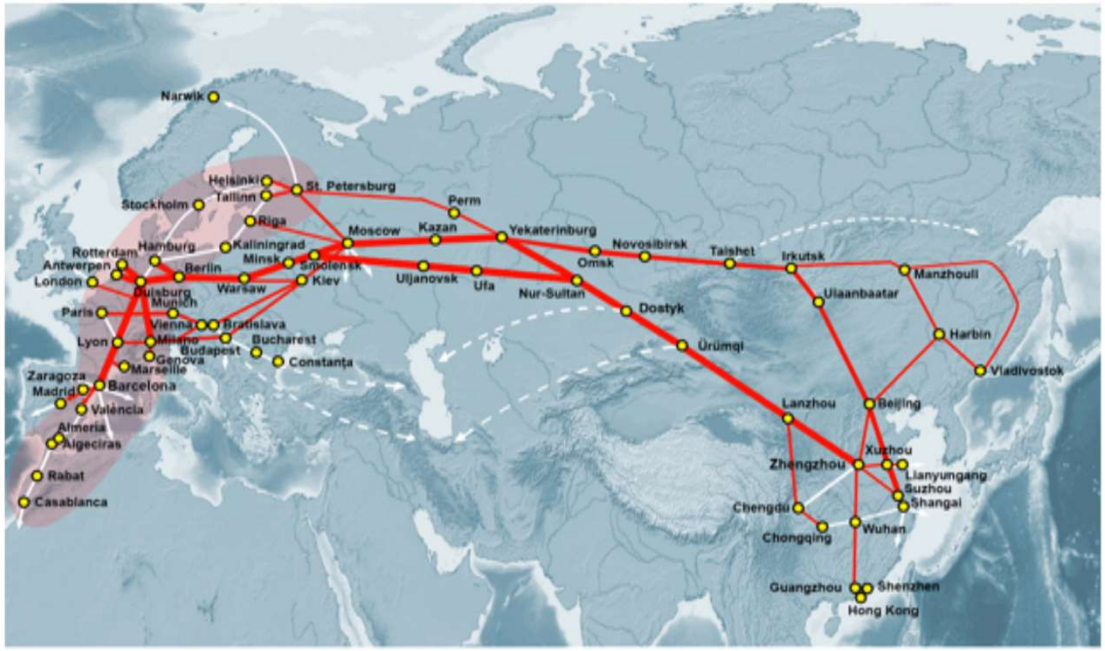
- 12,285 km of new lines
- 44,105 km of upgraded existing lines (ERTMS, P400/410 loading gauge implementation, 25kV AC, and adaptation of the lines for trains up to 740 m long)
- 46 upgraded existing and new terminals
- **Total: €481.9 B.**

Summary of proposed FERRMED actions

- 1,939 km of new lines
- 11,170 km of upgraded existing lines (international track gauge, ERTMS, P410 loading gauge implementation, 25 kV AC and adaptation of the lines for trains up to 740 m long)
- 425 new +FIRRST terminals
- New lines: €31.18 B
- Existing line upgrading: €26.89 B
- New terminals: €11.06 B
- Upgraded terminals: €570 m
- +FIRRST system required rolling stock:
  - Electric locomotives (dual types): 950 units, €3.99 B
  - Multipurpose freight wagons: 19,950 units, €3.59 B
- **Total: €77.27 B.**

MAIN TRANS-EURASIAN INTERCONNECTIONS IN THE EU

TRANS-EUROPEAN RAIL NETWORK ENHANCEMENT



TRANS-EURASIAN MAIN ROUTES

Train length:

1.500m

750m

MAIN ROUTES WITH LONG TRAINS

Brest/Malaszewicze ⇄ Hamburg / Duisburg → Rotterdam, Antwerpen, Mannheim/Basel/Milan/Genoa, Lyon/Marseille/Barcelona

OTHER COMPLEMENTARY MAIN ROUTES

- Ukrainian border – Slawkow – Katowice – Ostrava
- Ukrainian border – Fényeslitke – Budapest – Vienna – Milan – Lyon

FERRMED Study of Traffic and Modal Shift Optimization in the EU

THANK YOU VERY MUCH
FOR YOUR ATTENTION