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Current situation and trends in inland water transport: Revision of the White Paper on efficient and sustainable inland water transport in Europe

The role of inland water transport in Europe and the current status of the E Waterway Network

Note by the secretariat

Mandate

1. This document is submitted in line with cluster 5: Inland Waterway Transport, paragraph 5.1 of the programme of work 2018-2019 (ECE/TRANS/2018/21/Add.1) adopted by the Inland Transport Committee at its eightieth session (20–23 February 2018) (ECE/TRANS/274, para. 123).

2. At its fifty-fifth session, the Working Party on the Standardization of Technical and Safety Requirements in Inland Navigation (SC.3/WP.3) was informed about the ongoing revision of the White Paper on Efficient and Sustainable Inland Water Transport in Europe (the White Paper). The Working Party asked the secretariat to send the draft, when it is finalized, to member States, River Commissions and other stakeholders for comments, and submit the updated document to the sixty-third session of SC.3 for consideration and adoption (ECE/TRANS/SC.3/WP.3/110, paras. 77–78).

3. The annex to this document provides an overview of the role of inland water transport in Europe since the second edition of the White Paper in 2011 and the current status of the E waterway network.[1]

[1] Details and clarifications on the consolidated version of the White Paper can be found in Informal document SC.3 No. 4 (2019).

Annex

Overview of the role of inland water transport in Europe and the current status of the E Waterway Network

I. Introduction

The "White Paper on Efficient and Sustainable Inland Water Transport in Europe" is the third edition of a policy paper on the current situation, trends and challenges in Inland Water Transport (IWT) on European inland waterways of international importance in the region of the Economic Commission for Europe (ECE). Recommendations are made in key areas of pan-European cooperation to promote the development of the sector. Guidance was provided by the Working Party on Inland Water Transport (SC.3) for the draft.

In 1996, SC.3 had reviewed its work on developing a coherent navigable network of inland waterways in Europe. The first "White Paper on Trends in and Development of Inland Navigation and its Infrastructure" (TRANS/SC.3/138) discussed and described the situation on European rivers and canals. With the establishment of the European Agreement on Main Inland Waterways of International importance (AGN), the White Paper can be considered as one of the first steps towards developing a European network of waterways.

In 2006, Transport Ministers at the third pan-European Conference on Inland Water Transport (Bucharest) recognized the necessity to promote IWT as a commercially attractive and environmentally compatible mode of transport through coordinated action. In 2007, an action plan for implementing the decisions of the Bucharest Conference was adopted by the ECE Inland Transport Committee (ITC) (resolution No. 258). ITC commended a general policy document on the advantages of IWT and on its development that should be issued regularly to decrease market fragmentation of IWT in Europe and to establish the principle of free navigation on inland waterways at the pan-European level. ITC called on SC.3 to proceed with preparing the new White Paper in close cooperation with the European Commission, River Commissions and other major stakeholders.

In the second White Paper (ECE/TRANS/SC.3/189), IWT in the ECE region was assessed on the basis of first White Paper for progress or lack thereof in developing the sector. The Working Party on the Standardization of Technical and Safety Requirements in Inland Navigation (SC.3/WP.3) finalized the draft of the main work in February 2011 at its thirty-eighth session and approved it on behalf of SC.3. The final version of the second White Paper was endorsed by the seventy-third session of ITC in March 2011.

This third edition follows from the International Conference on Inland Water Transport (18 and 19 April 2018, Wrocław, Poland) and particularly from the ministerial declaration "Inland Navigation in a Global Setting", which was supported by ITC resolution No. 265 "Facilitating the Development of Inland Water Transport" of 22 February 2019. The overall objective is to assess the current situation of IWT in Europe, review progress since 2011, identify current trends and challenges, and propose recommendations to further promote the transport mode.

II. The Role of Inland Water Transport in European Inland Transport

A. Background

Since the dawn of history, goods and persons were transported on inland waterways, and IWT remains an important and integral part of transport today. Most of the world's population resides in the proximity of river deltas, coastal areas and river estuaries. As such, the use of waterways for the transport of all types of goods remains a desirable option. Even more so, globalization of the world's economy multiplies the total amount of transported goods. The constantly growing share of products and raw materials transported daily to Europe are now delivered from countries all around the globe.

Shipping, in general, which includes the inland waterway sector, is an important pillar on which the world and the European economies rely.

The comparative advantages of IWT in transporting large quantities over longer distances include safety, sustainability, and cost-efficiency in terms of overall transport costs, the energy consumption per ton-kilometre, low rate of accidents and low congestion.

IWT has proven its reliability, and it is environmentally friendly. Emissions from barges per ton-kilometre are lower than that of trains or trucks. On inland vessels, new technologies such as a contemporary drive train and a "clean" and efficient engine could further reduce pollutants. A standard 110 m-long vessel transports around 3,000 metric tons of cargo – more than 200 TEU – or over 100 journeys of a 40-ton truck.[2]

However, the sector lacks a strong advocate to focus the general public and the markets on IWT and its potential. To some extent, this is due to the historically fragmented and diverse structure of shipowners across Europe. Western Europe still lacks any significant domination in the domain of inland water transport and vessels are often individually owned. Entrepreneurs furthermore lack the time and the resources to consider wider policy implications. This is contrary to the situation in the most central and eastern European countries, where large shipping companies usually own the vessels and employ the operating crews.

On the waterway networks of western Europe, IWT is an open navigation market of vessels from numerous European States. Up until 1998, national markets were generally protected and ships that were registered under the flag of any country could only operate within national borders. Two important exceptions were:

- the river Rhine, on which international traffic dates to the signing of the "Convention of Mannheim" in 1868
- the Danube river, where the "Convention regarding the Regime of Navigation on the Danube" regulates free navigation from 1948.

In 1998, the Cabotage Agreement was implemented in the European Union and permits transport on the entire waterway system, irrespective of the member State of registration. At the time, this was not accompanied by a harmonization of the multitude of national rules and regulations. Thus, the flag under which a ship was registered could still have a significant impact on the operations of its owner. IWT was organized and regulated differently in different countries.

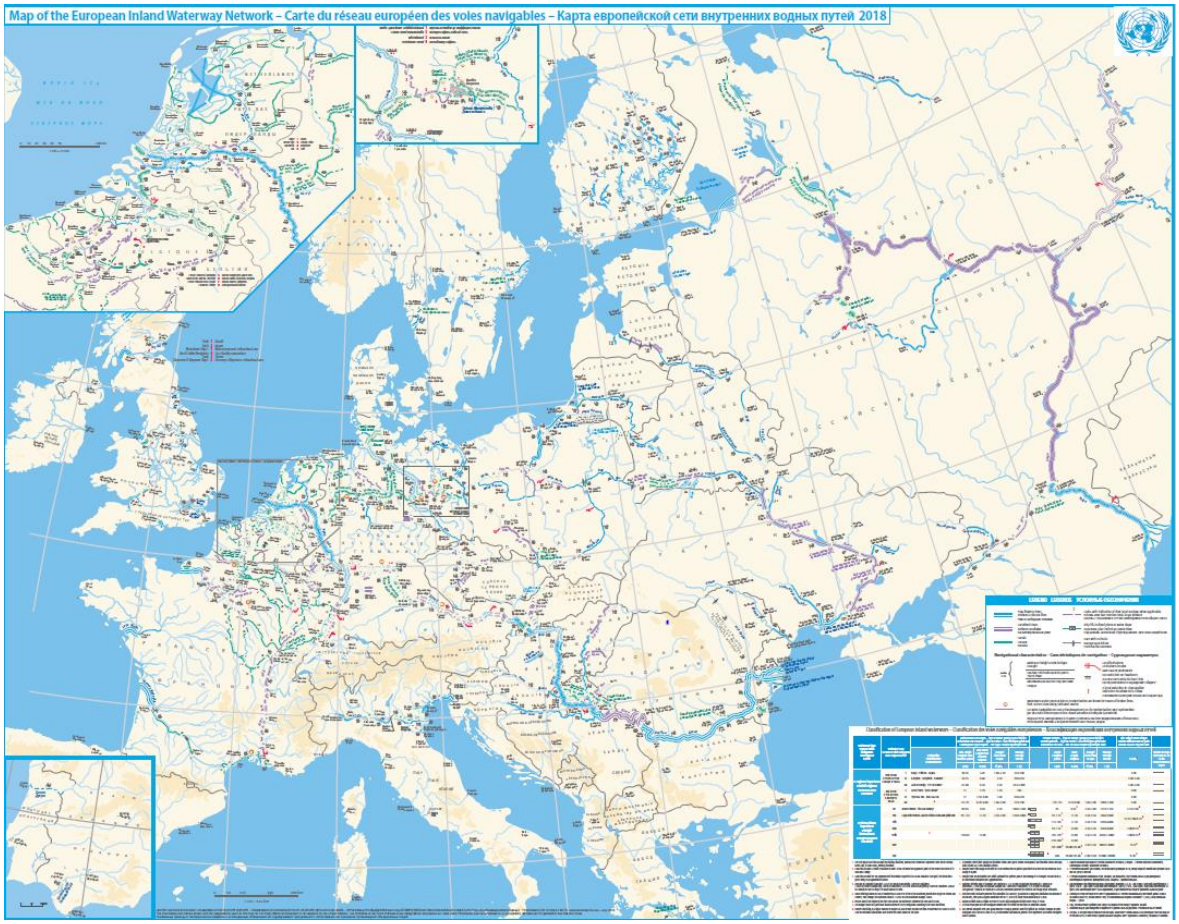
IWT remains a cost-effective, reliable and sustainable mode of transport and could improve the multinational trade-based economic area that is the ECE region.

B. The Performance of Inland Water Transport in the region of the Economic Commission for Europe

The map of E waterway network (2019) is given on figure 1 below.

[2] Bureau Voorlichting Binnenvaart, Types of Vessels, www.bureauvoorlichtingbinnenvaart.nl/assets/files/Scheepstypen%20Engels.pdf.

Figure I
Map of the European Inland Waterway network (2018) [3]



Source: UNECE.

In tables 1 and 2 below, it can be seen that the use of IWT in the inland transport logistics chains is highly dependent on a country's access to a waterway network:

- Some countries do not have access to any waterway network
- Some countries have extensive waterway networks, e.g. Belgium and the Netherlands
- Some countries have accessible waterway networks, but not in all the parts of the country, e.g. France and Germany.

Table 1
Carriage of goods in the ECE region by inland waterway, 2008–2016 [4]
(Million ton-kilometres)

Country	*2008*	*2009*	*2010*	*2011*	*2012*	*2013*	*2014*	*2015*	*2016*
Austria	2 395	2 003	2 376	2 123	2 191	2 353	2 177	…	1 962
Belarus	132	83	110	143	134	84	49	21	21
Belgium	8 746	7 087	9 071	9 251	10 421	10 364	10 451	10 426	10 331
Bulgaria	2 890	5 436	6 048	4 310	5 349	5 366	5 074	5 596	5 477
Croatia	843	727	941	962	772	771	716	879	836
Czechia	28	33	43	42	38	25	27	33	36

[3] UNECE, 2018, www.unece.org/fileadmin/DAM/trans/main/sc3/AGN_map_2018.pdf.

[4] ECE Statistical Database, Carriage of goods by Inland Waterways by Type of Transport, Topic, Country and Year, https://w3.unece.org/PXWeb2015/pxweb/en/STAT/STAT__40-TRTRANS__09-TRInlWater/01_en_TRInlWaterTonKm_r.px/table/tableViewLayout1/.

Country	*2008*	*2009*	*2010*	*2011*	*2012*	*2013*	*2014*	*2015*	*2016*
Finland	80	61	76	90	124	121	135	128	103
France	8 557	8 410	9 115	8 704	8 622	8 849	8 524	8 314	8 135
Germany	64 057	55 497	62 278	55 027	58 488	60 070	5 093	55 315	54 347
Hungary	2 250	1 831	2 393	1 840	1 982	1 924	1 811	1 824	1 975
Italy	…	54	135	144	81	89	64	62	67
Luxembourg	367	279	359	305	290	313	285	235	…
Netherlands	…	35 639	40 285	46 410	47 535	48 600	49 413	48 535	49 399
Poland	1 274	1 020	…	…	127	87	104	83	105
Republic of Moldova	…	1	0	0	0	1	1	0	0
Romania	8 687	11 765	14 317	11 409	12 519	12 242	11 760	13 168	13 153
Russian Federation	62 015	51 835	52 880	58 174	76 274	72 547	69 207	60 259	…
Serbia	1 307	872	875	726	605	701	759	865	…
Slovakia	1 101	899	1 189	931	986	1106	906	741	903
Switzerland	45	41	40	37	50	49	43	47	30
Ukraine	…	2 745	3 837	2 218	312	216	258	284	227
Total	**164 774**	**186 318**	**206 368**	**202 846**	**226 900**	**225 878**	**166 857**	**206 915**	**147 107**

Note: … data not available.
Source: UNECE.

Table 2
Cargo transportation by inland waterways in the ECE region, 2011–2015 [5]
(Thousands of tons)

Country	*2011*	*2012*	*2013*	*2014*	*2015*
Austria	9 943	10 714	10 710	10 122	8 599
Belarus	6 711	4 023	4 486	3 758	2 960
Belgium	17 2906	190 288	187 404	190 303	188 258
Bulgaria	14 448	16 378	16 726	16 922	17 201
Croatia	5 184	5 934	5 823	5 377	6 642
Czechia	911	836	608	802	850
France	68 471	68 170	68 926	65 488	63 094
Germany	221 966	223 170	226 864	228 489	221 369
Hungary	7 175	8 135	7 857	7 825	8 163
Kazakhstan	1 082	1 291	1 107	1 321	1 218
Lithuania	95	89	36	47	68
Luxembourg	8 956	8 506	8 987	8 390	7 107
Republic of Moldova	149	144	...	...	...
Netherlands	345 469	350 069	356 062	366 637	359 898
Poland	3 143	2 574	3 185	5 899	5 036
Romania	29 396	27 946	26 858	27 834	30 020
Russian Federation	125 867	137 488	134 860	119 080	118 120
Serbia	2 146	1 998	...	...	...
Slovakia	8 211	8 242	8 107	7 010	5 721
Switzerland	5 678	7 211	6 830	...	...

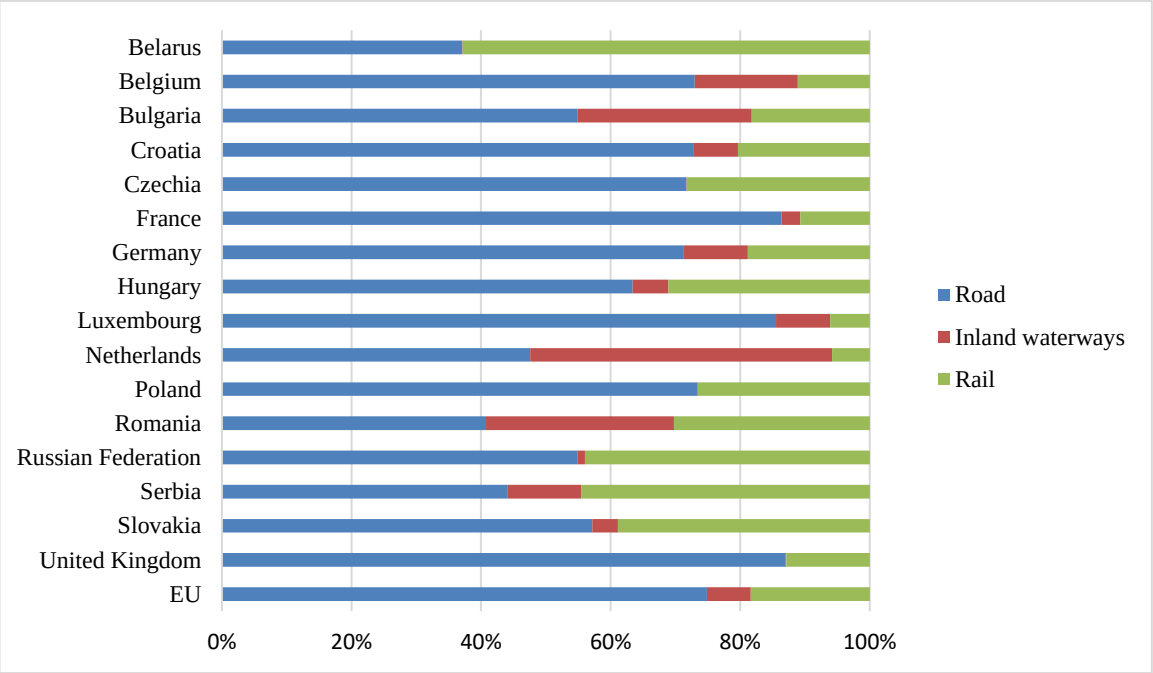
[5] Ibid, p.5.

Country	*2011*	*2012*	*2013*	*2014*	*2015*
Ukraine	9 900	7 800	6 300	6 000	6 400
United Kingdom	3 478	3 693	5 252	5 689	5 594
European Union	526 420	531 452	524 781	552 405	544 712

Note: … data not available.
Source: UNECE.

The share of IWT compared to the other inland transport modes of road and rail is shown in figure 2. The average modal share of transport in many European countries is dominated by road. The countries with the highest share of IWT in their modal split are, in decreasing order, the Netherlands (46.6 %), Romania (29 %), Bulgaria (26 %), Belgium (15.9 %) and Serbia (11.3 %) (data of 2014).

Figure II
Modal split of inland transport modes by cargo turnover in selected countries, 2014 [6]



Source: UNECE.

IWT is a significant share of the modal split where transport has access to rivers and canals. While the total volume of goods transported on inland waterways in the European Union is only 6.2 per cent of the total volume, an average of 25 per cent of inland cargo transport is on the inland waterways of Belgium, Germany and the Netherlands. In the Netherland where the share of IWT in the modal split is the highest, a total of 40 per cent of container transport national inland waterways. Furthermore, an agreement between the seaports of Antwerp in Belgium, Rotterdam and Amsterdam in the Netherlands (ARA range) aims to increase the role of inland water and railway transport for their container terminals by five to ten per cent while reducing the use of road transport.

In northern countries where winters are harsh, transport by water is the only feasible method in the winter months.

As the most cost-efficient mode of transport, developing a more intensive use of IWT has led to a general trend of scaling up of ship size over the last decade. The result is that the total

[6] UNECE Transport Statistics Database, www.eurostat.eu, www.belstat.gov.by, Information and statistics bulletin “Transport of Russia” of the Ministry of Transport of the Russian Federation, https://stats.oecd.org.

gross tonnage of the fleet navigating on the European inland waterways continues to increase, while the number of vessels has decreased.

The capacity of the inland waterway fleet has doubled over the last decade and, in some cases, tripled to meet new demands.

The largest vessels on the Rhine currently are 135 m long and 14, 15, 17 or 22 m wide. These are only operational on the Rhine and the Rhine delta. “Jowi” class are the largest barges on the Rhine today with a load capacity reaching 9,000 tons. Any further growth of these vessels is currently limited by the size of the locks on the upper Rhine in France and Germany, and by those in the Rhine estuary area in Belgium and the Netherlands.

Transportation of goods by water is very cost-effective. The transport of large quantities of goods on a waterway from a seaport factory directly to the customer, e.g. the transport of iron ore from Rotterdam to the steel mills on the lower Rhine, by IWT is unbeatable in terms of costs per ton-kilometre. Additional costs occur during transhipment operations, when the cargo is moved in and out of vessels. The cost of transport is directly related to the amount of transhipment necessary for a shipment from its place of origin to its final destination, as in other modes of transport.

A more active role of inland waterway transport and an increased share in modal split is nonetheless possible and desirable, due to the inherent advantages of IWT. Recognizing the significant advantages of IWT in a balanced transport system, particularly, its safety level, efficiency in terms of energy and costs, low emissions and lack of congestion, thus contributing to the Sustainable Development Goals and to significantly reducing transport and logistics costs, the ministerial declaration “Inland Navigation in a Global Setting” was signed in Wroclaw, Poland on 18 April 2019.[7]

C. Challenges for Inland Water Transport

Increasing interconnectivity of the European waterway systems and of the mobility of vessels and the IWT workforce requires a mutually recognized system of rules and regulations. In contrast to maritime transport, where IMO oversees binding safety and port security regimes, European IWT lacks a highly developed and internationally accepted regime. The main regulatory challenges are:

- Lack of European-wide mandatory standards and extensive national control of the implementation of any IWT-related regulation by the various European countries apart from the regulations of the River Commissions
- Lack of a common language for crews across European waterways
- Shortage of an influx of young personnel into the sector. Skippers normally average over 50 years of age.

Technological developments and a rising awareness of environmental impact has led to a number of technological challenges. In IWT, the average age of vessels remains high and the investment cycles are long. The hull of a barge will easily surpass 100 years and a properly maintained engine lasts decades. Innovations in ship propulsion and ship design, therefore, are slow to be widely implemented. The IWT industry today pursues several innovations. The main ones are greener and more sustainable propulsion systems, River Information Services (RIS) and automation and autonomous sailing:

- New and greener propulsion systems are a persistent and increasingly important subject in the sector. Most of the inland waterway fleet continues to use diesel engines. Liquefied Natural Gas (LNG), hydrogen fuel cells and battery-powered propulsion systems are currently being developed, tested and implemented as alternatives. The success of these systems in the future will highly depend on their reliability, availability, durability and cost. A single substitute for the diesel engine would not be available soon, though a combination of systems on future vessels is possible.

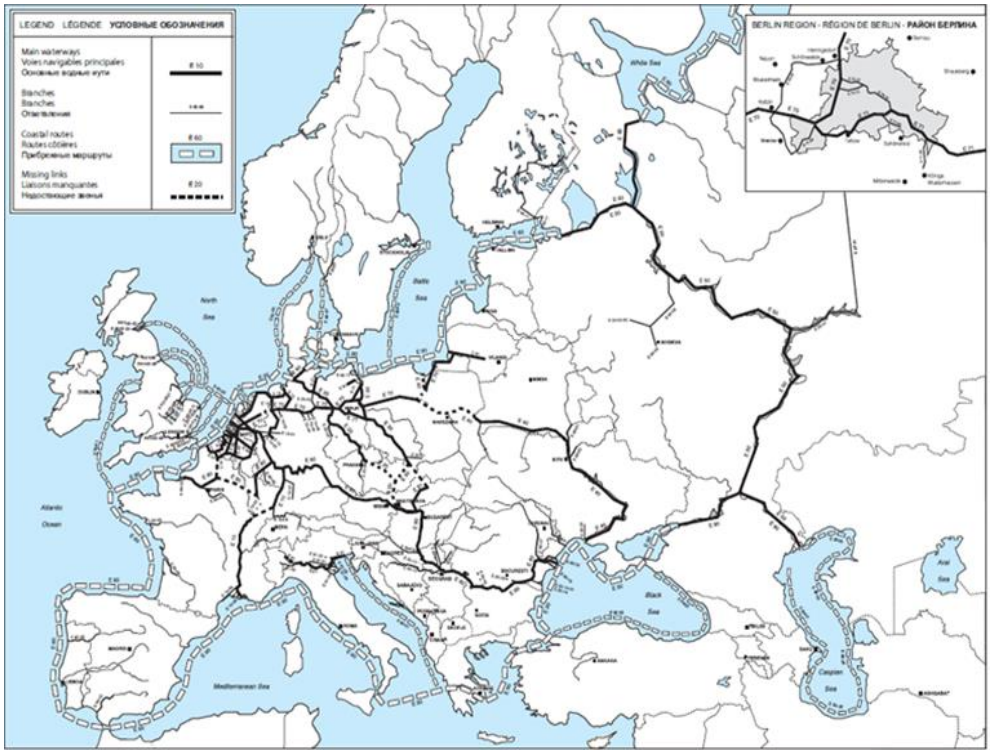
[7] www.unece.org/fileadmin/DAM/Poland_Ministerial_declaration_e__002_.pdf.

- RIS are increasingly integrated for use in the IWT community. RIS is a harmonized and interconnected information system, that provides real time data to users and authorities about the traffic and fairway conditions on a waterway, and about vessel positions and directions. Streamlined planning of vessel movements are, in this way, facilitated on the waterways. RIS not only increases safety on the waterways, but also increases the efficiency of transport across rivers and canals by added functions like RIS corridor management.
- Automation and autonomous sailing are currently widely discussed topics. Different systems are being developed and tested which range from semi-autonomous assistance systems that are already on the market[8] to full autonomy. The degree of automation that will be seen in the near future will highly depend on the technical possibilities and on the demands of politics and insurance.

III. Status of the E Waterway Network

The E waterway network is composed of European inland waterways of international importance, of coastal routes used by river-sea vessels (E 01–E 91) and of ports of international importance on these waterways. These are defined in the European Agreement on Main Inland Waterways of International Importance (AGN) of 19 January 1996 and the annex I. AGN has been ratified by 19 countries as of 2018 (Austria, Belarus, Bosnia and Herzegovina, Bulgaria, Croatia, Czechia, Hungary, Italy, Lithuania, Luxembourg, Netherlands, Poland, Republic of Moldova, Romania, Russian Federation, Serbia, Slovakia, Switzerland and Ukraine).[9]

Figure III
Map of the AGN network [10]



Source: UNECE.

[8] A real-life example is the “Bahnleitungssystem” of the company “Innovative Navigation” in Germany, which was installed in 2008 on the training vessel “Prinses Maxima” of the Maritieme Academie Harlingen.

[9] ECE/RANS/SC.3/2015/1.

[10] ECE map of the E Waterway Network, 2019.

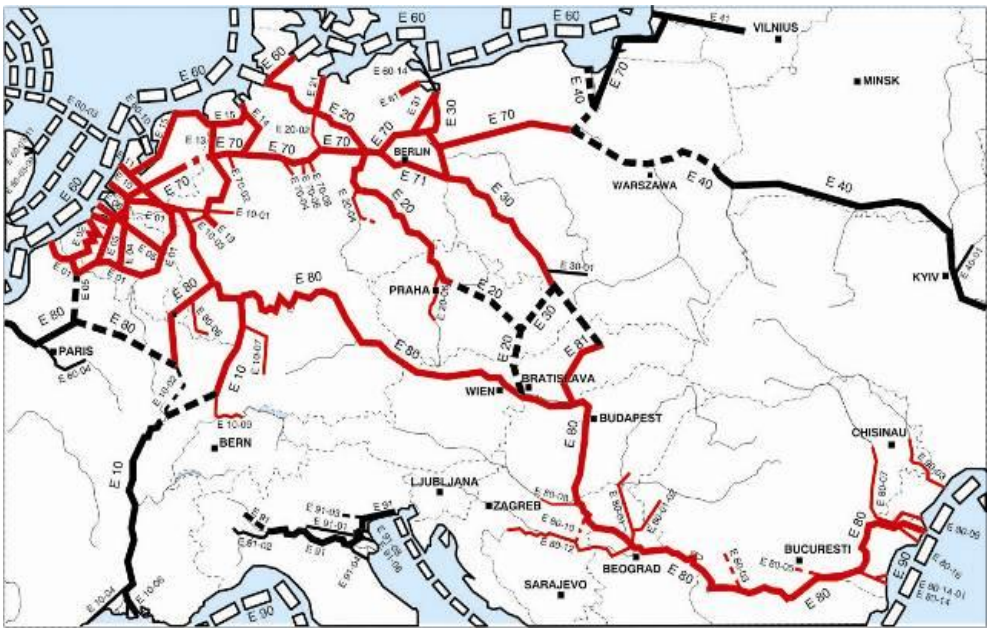
From 1998 to 2016, the total length of the E waterway network grew from 27,711 km to 29,238 km and the share of E waterways that comply with the AGN standards increased from 79 to 83 per cent.[11] Seventy-three per cent are the larger canals and rivers of classes IV to VII, and coastal routes. These waterways accommodate vessels of at least 80 m of length and 9.5 m of width with a loading capacity of around 1,500 metric tons.[12] Only 10 per cent of the AGN network comprises smaller waterways and only smaller vessels. Most of the network is interconnected. The 6.8 per cent of missing links will be discussed below under the separate segments of the E waterway network.

A. The Rhine-Danube network and the central European canal and river network (including the Weser, Elbe and Oder rivers)

The largest European waterway network by length and transport volume is the Rhine-Danube basins (figure 4) and consists of:

- E 10: Rhine, Saône and Rhone and tributaries from Rotterdam to Arles, and the connected canals;
- E 80: axis Le Havre – Koblenz – Mainz – Main-Danube Canal – Danube and tributaries;
- E 70: axis Rotterdam – Berlin – Gdansk, E 20 – Elbe, tributaries and connected canals;
- E 30: Oder River and tributaries.

Figure IV
The Rhine-Danube network [13]



Source: UNECE.

The river basins were completely linked in 1992 with the inauguration of the Rhine-Main-Danube Canal after 30 years of construction. E 10 and E 80 were thus connected. The two river basins represent nearly half of the total length of AGN waterways – 14,360 km of the total 30,177 km – and can accommodate vessels of the larger CEMT classes.

[11] Inventory of Main Standards and Parameters of the E Waterway Network ("Blue Book"), revision 3 (ECE/TRANS/SC.3/144/Rev.3).

[12] European Conference of Ministers, Resolution No.92/2 on new classification of inland waterways, 1992, p. 3.

[13] ECE map of the E Waterway Network, 2019.

The Rhine basin

Infrastructure

The second edition of the White Paper had noted the Rhine basin as the most developed, best maintained and most utilized waterway of the AGN network. Traffic is dense due to the industrial centres along its banks and its advanced infrastructure development. The basin accommodates a significant number of large vessels that are adapted to the needs of the Rhine area industry, which in turn, depends on the flow of goods to and from the Belgian and Dutch ports on the North Sea mouth of the Rhine network.

Ongoing infrastructure projects (see the White Paper, 2011) in the Rhine basin and the linked waterways such as the German canal network aim to increase waterway potential by adapting the existing infrastructure to the changing demands of industry. The renewed Niederfinow ship lift would upgrade the Oder-Havel canal, which is part of the E 40 waterway, to Class Va. Delays in construction prevented operation before 2019.[14]

Increases in traffic and the increased average dimension and weight of vessels have led to plans to replace the large locks and to build a bridge of clearance guaranteed at 5.25 m, on the western (from Marl to Friedrichsfeld) part of the Wesel-Datteln Canal (E 10-01) in northwest Germany. This is one of the two connections between the Rhine and the German canal network. The project should be completed in the 2030s.[15]

The Scharnebeck ship lift on the Elbe Seitenkanal (E 20-02) near Lunenburg, Germany should be replaced for the same reasons. At its inauguration in 1975, the ship lift was the largest in the world – the lock chambers are 100 x 12 m – and insufficient for modern inland vessels. Plans began in 2017 for new lock chambers of 225 × 12.50 m to replace the ship lift. Construction should be between the mid-2020s and the early 2030s.[16]

Upgrading the Mosel river became necessary in the 1990s when the significant traffic increase began. The fairway was first deepened from 2.7 m to 3 m (from 1992 to 1999). Second were several key bottlenecks: the nine single-chambered locks on the German part of the river were each extended with a second lock chamber, and the second, smaller lock chamber of the double locks in Koblenz, where Mosel meets the Rhine, was renewed as part of the German "Bundesverkehrswegeplan".[17]The work on the locks in Zeltingen, Germany and Fankel, Luxembourg were the first of the projects to be completed on the Mosel. The effect is positive on the capacity at two key bottlenecks on the river. Severe delays in traffic also came from regular sightseeing vessels that have priority at these locks. In 2019, work on a second lock chamber in Trier began and second lock chamber in Lehmen was planned.[18]

The Seine-Schelde waterway project had major delays. Construction was scheduled to start in 2019 and end in 2027.[19] Other information is in the section on the Seine-Oise river network below.

The network of Poland spans 3,655 km of navigable waterways,[20] though the share of waterways of international importance (with a minimum of Class IV) is only 6 per cent. The

[14] Nordkurier, June 2018, www.nordkurier.de/brandenburg/neues-schiffshebewerk-niederfinow-soll-2019-eroeffnet-werden-0632233306.html.

[15] Projektinformationssystem (PRINS) zum Bundesverkehrswegeplan 2030, www.bvwp-projekte.de/wasserstrasse/w23/w23.html.

[16] Projektinformationssystem (PRINS) zum Bundesverkehrswegeplan 2030, www.bvwp-projekte.de/wasserstrasse/w12/w12.html.

[17] The development plan of Germany for government-operated infrastructure.

[18] Directorate General for Waterways and Shipping, www.wsa-mosel-saar-lahn.wsv.de/Webs/WSA/Mosel-Saar/DE/Wasserstrassen/Projekte/01_Zweite_Moselschleusen/projekt_1_node.html..

[19] De Binnenvaartkrant, online edition, May 2018, https://binnenvaartkrant.nl/seine-schelde-verbinding-pas-in-2027-klaar.

[20] "Assumptions for the development plans of inland waterways in Poland for 2016–2020 with 2030 perspective", 2014; mgm.gov.pl/wp-content/uploads/2017/11/assumptions-for-the-development-plans-of-inland-waterways-in-poland-for-2016-2020-with-2030-perspective.pdf.

remaining are designated as waterways of regional importance and are below Class IV standards. The major Polish international waterways are those that serve south–north traffic, such as the Oder and Vistula rivers that both discharge into the Baltic Sea.

The Oder-Vistula Lagoon link and the Warsaw-Brest link, which are planned in cooperation with Germany, should expand the E-70 and E-40 waterways. Work began in 2019 to create an east-west connection from the Oder basin to the Vistula basin and beyond. The Vistula is hampered by the general conditions of the waterway.

As already seen in the 2011 White Paper, the infrastructure on the main network interconnection through Poland, east of the river Oder, needs further maintenance.

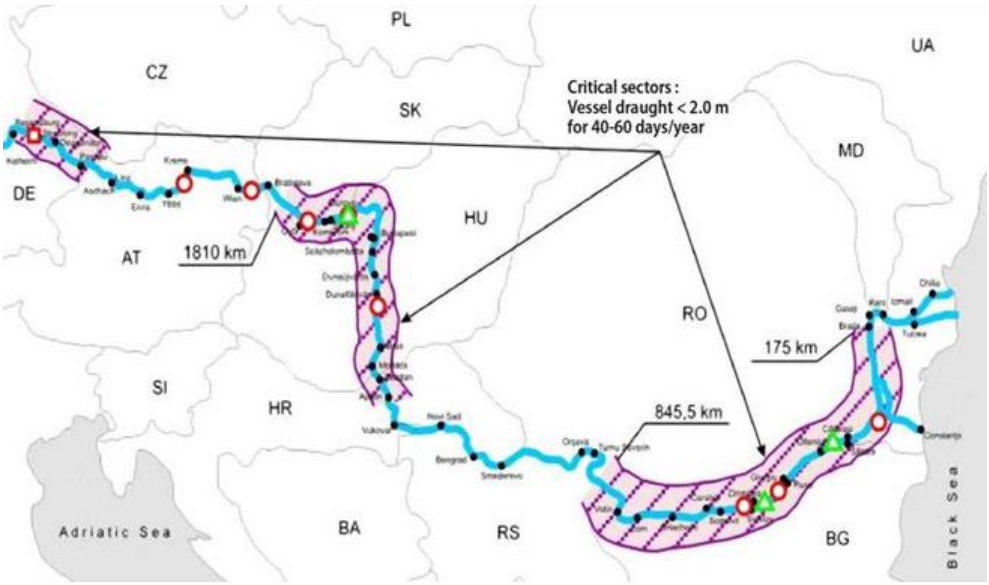
The missing link in the E 70, from Twente to the Mittelland Canal was included in the AGN as a long-term project, but abandoned after feasibility study in 2012. The cost of the new canal was estimated to be approximately €1.3 billion though resulting in an economic advantage of 18 per cent of this sum until 2060.[21]

The Danube basin

Infrastructure

The Danube basin (E 80) covers the Danube and the Sava rivers, and the Danube Canal which connects the Danube with the Black Sea in Constanta (Romania). There is, unlike in the Rhine area, no extensive complementary network of navigable rivers and canals. Navigation on this network is also somewhat more limited than its counterpart in the north due to its sharp river bends and broad sections that tend to create fords and sand bars in the riverbed.[22]

Figure V
Critical sectors for carrying capacity on the Danube [23]



Source: UNECE.

Critical sectors on the Danube are shown in figure 5. A major strategic bottleneck, which limits the loading capacity of larger vessels navigating between the Rhine and the Danube by restricted water depth and low bridge clearances, is the Straubing-Vilshofen stretch of the Danube, close to the confluence with the Main-Danube canal. On this stretch, the river averages two metres in depth for 40 to 60 days a year. Two bridges spanning the fairway a low clearance of five metres (railway-bridge Bogen) and 5.15 metres (Luitpold-bridge

[21] EUREGIO, press release 2013, www.euregio.eu/de/pressemitteilungen/verbindung-zwischen-mittellandkanal-und-twentekanal-nicht-wirtschaftlich.
[22] Danube Commission, www.danubecommission.org/dc/de/die-donauschifffahrt/540-2/.
[23] ECE White Paper, 2011, p. 13.

Passau),[24] and allows the passage of only single-stack containers. The fairway depth of the Danube is a recurring problem on the upper, middle and lower stretches of the river.

Rhine and Danube fleets

The imbalance in infrastructure is notable between the Rhine and the Danube, and in the composition of the fleets. Many of the vessels operating on the Danube river also operate on the Rhine.

In 2017, the Central Commission for the Navigation of the Rhine (CCNR) calculated that the Rhine fleet is composed of over 9,800 vessels.[25] Table 3 shows the CCNR fleet development.

Table 3
Development of the Rhine fleet, 2008–2017 [26]

	Dry cargo fleet		*Tank cargo fleet*		*Pushers and tugs*
Year	*Number of vessels*	*Total carrying capacity, tons*	*Number of vessels*	*Total carrying capacity, tons*	*Number of vessels*
2008	8 249	10 260 000	1 569	2 583 000	1 276
2009	8 203	10 669 000	1 643	2 824 000	1 286
2010	7 952	10 647 000	1 732	3 127 000	1 220
2011	7 980	10 769 000	1 706	3 203 000	1 265
2012	7 776	10 748 000	1 654	3 174 000	1 219
2013	7 618	10 681 000	1 623	3 152 000	1 267
2014	7 464	10 553 000	1 600	3 185 000	1 251
2015	7 323	10 496 000	1 551	3 185 000	1 246
2016	7 136	10 285 000	1 511	3 150 000	1 240
2017	7 092	10 432 000	1 501	3 112 000	1 241

Source: Central Commission for the Navigation of the Rhine.

The Danube Commission reported a total of 3,197 vessels in the Danube fleet in 2016. The development of the fleet is shown in table 4:

Table 4
Development of the Danube fleet, 2013–2016 [27]

	Self-propelled vessels		*Pushed or Towed Barges*		*Pushers and tugs*
Year	*Number of vessels*	*Total carrying capacity (tons)*	*Number of vessels*	*Total carrying capacity (tons)*	*Number of vessels*
2013	446	394 952	2 633	3 024 191	672
2014	439	392 894	2 511	2 887 511	649
2015	451	401 533	2 441	2 834 939	694
2016	418	397 130	2 171	2 578 415	576

Source: Danube Commission.

[24] via donau, List of bridges. www.viadonau.org/fileadmin/content/viadonau/05Wirtschaft/Dokumente/2015-04-06_Brueckenliste_viadonau.pdf.

[25] Central Commission for the Navigation of the Rhine, Annual Report 2018. Inland Navigation in Europe. Market Observation, www.inland-navigation-market.org/en/rapports/2018/q2/5-fleet-2/.

[26] Ibid.

[27] Danube Commission, Danube Navigation Statistics in 2015-2016, Budapest 2017, and Danube Navigation Statistics in 2013–2014, Budapest 2015, www.danubecommission.org/uploads/doc/STATISTIC/en_stat_2015_2016.pdf.

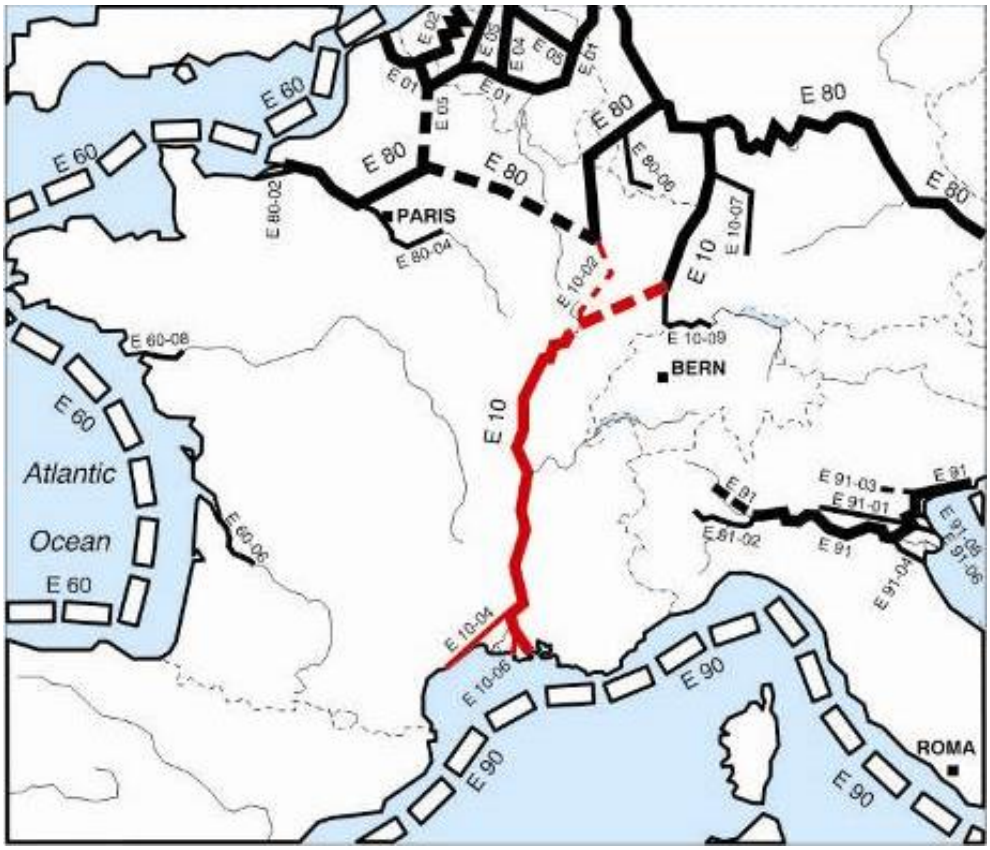
French waterways

Two river basins, the Rhone-Saône and the Seine-Oise, are suitable for vessels of Class IV and above. These are technically connected to the rest of the western European waterway network, but the links from both basins to the Schelde or the Rhine are only accessible for vessels of Class I (Freychinet size). The Freychinet fleet is rather small and old since the last Freychinet types were built in the 1980s. Currently 332 are in active service.[28]

(a) The Rhone-Saône network

The Rhone-Saône network (the southern section of the E 10 waterway, see figure 6 below) is virtually isolated from the rest of the western European interconnected waterway system. The network is 679 km in length and comprises the river Saône, which is navigable for larger vessels from the Auxonne locks in the north to the confluence with the Rhone river in Lyon. The Rhone is navigable from Lyon down to the mouth where it meets the Mediterranean at Fos-sur-Mer (E 10-06) with a side branch, the Rhone-Sète Canal, to the city of Sète, also located on the Mediterranean Sea (E 10-04).

Figure VI
The Rhone-Saône network [29]



Source: UNECE.

Infrastructure

The Rhone-Saône waterway network is characterized by good navigability along the entire stretch from north to south. Five locks on the 218 km-long Saône stretch have a dimension of 180 × 12 m, which allow Class VI traffic, but with limited clearance under the bridges of 3.7 m. The 310 km-long section of the Rhone river from Lyon to Fos-sur-Mer has 12 locks with a dimension of 190 × 11.40 m, and also allows Class V vessels. The clearance under the bridges is six metres and, therefore, significantly more the on the river Saône. The last part

[28] Voies navigables de France, Les chiffres du transport fluvial en 2017, www.vnf.fr/vnf/img/cms/Transport_fluvialhidden/LesChiffresDuTraficFluvial_2017_20180410150714.pdf.

[29] ECE map of the E Waterway Network, 2019.

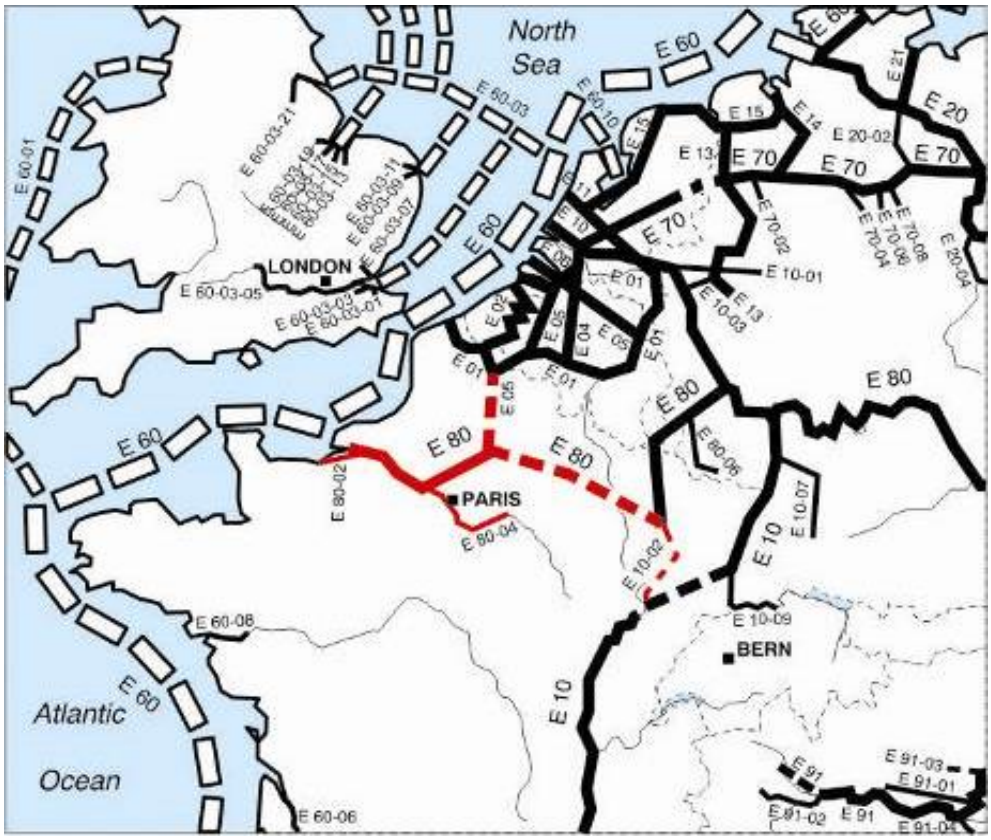
of the network is the Rhone-Sète Canal, which is 99 km long and has only one lock with the dimension of 120 × 8 m, making this waterway only accessible for vessels smaller than Class III. Bridges provide a clearance of five metres and are not a problem for these vessels, if they do not transport more than one layer of containers.

The 2011 White Paper had mentioned plans to create a link to the Seine-Oise network, but these were abandoned some 30 years ago. From the early 1990s, France focused its efforts on creating the Seine-Nord link between the Seine and the Benelux basins, thus abandoning the other projected connections which were the Saône-Mosel and the Saône-Rhine links.

In 2017, 5.2 million tons were transported across the network, or an overall transport performance of 1.1 billion ton-kilometres.[30] The main transport commodities were construction materials and agribulk products.

The second notable waterway network in France is the Seine-Oise river network in the north-west of the country (see figure 7 below). The total length is 632 km. The main E 80 route includes the river Oise from the town of Compiègne to its confluence with the Haute Seine in the north of Paris and the Basse Seine from the north of Paris to its mouth on the Atlantic Ocean at the city of Le Havre.[31] The Oise itself has five locks of 180 × 11.5 m on this stretch, and can accommodate vessels of Class Vb. The Haute Seine, the stretch of the river upstream from the north of Paris to Montereau, has nine locks with a gauge of 180 × 11.5 m, and can also accommodate vessels of Class Vb. However, navigation on a short stretch of the river within the city of Paris is limited to vessels less than 125 metres.

Figure VII
The Seine-Oise network [32]



Source: UNECE.

[30] Voies navigables de France, Le traffic fluvial sur l'année 2017, www.vnf.fr/vnf/img/cms/Transport_fluvialhidden/Trafics_2017_12mois_Internet_20180410171126.pdf.

[31] Voies navigables de France, Carte_bassin_Seine, 2018, www.vnf.fr/vnf/img/cms/Transport_fluvialhidden/Carte_bassin_Seine_fevrier_2018_20180316150407.pdf.

[32] ECE map of the E Waterway Network, 2019.

The connection between the Seine and the Schelde was in construction in 2019. The 107 km long canal will link the river Oise from the town of Compiègne with the Schelde at Cambrai. The canal is planned to accommodate vessels of Class Vb and be equipped with six locks along its route.[33] Initial planning was for project completion in 2016, however, due to various delays, construction work was scheduled to begin in 2019 and the opening is forecast at 2027.[34]

In 2017, 20.7 million tons of freight were transported on the network, making for an overall transport performance of 3.4 billion ton-kilometres.[35] The difference between the overall tons transported, and the ton-kilometre performance compared to the Rhone-Saône basin can be explained by the shorter distances travelled on the Seine-Oise network: due to its shorter overall length and its isolation from the rest of the European waterway network for larger vessels. The main commodities transported are construction materials and agribulk.

B. The Azov-Black-Caspian Seas basin

Infrastructure

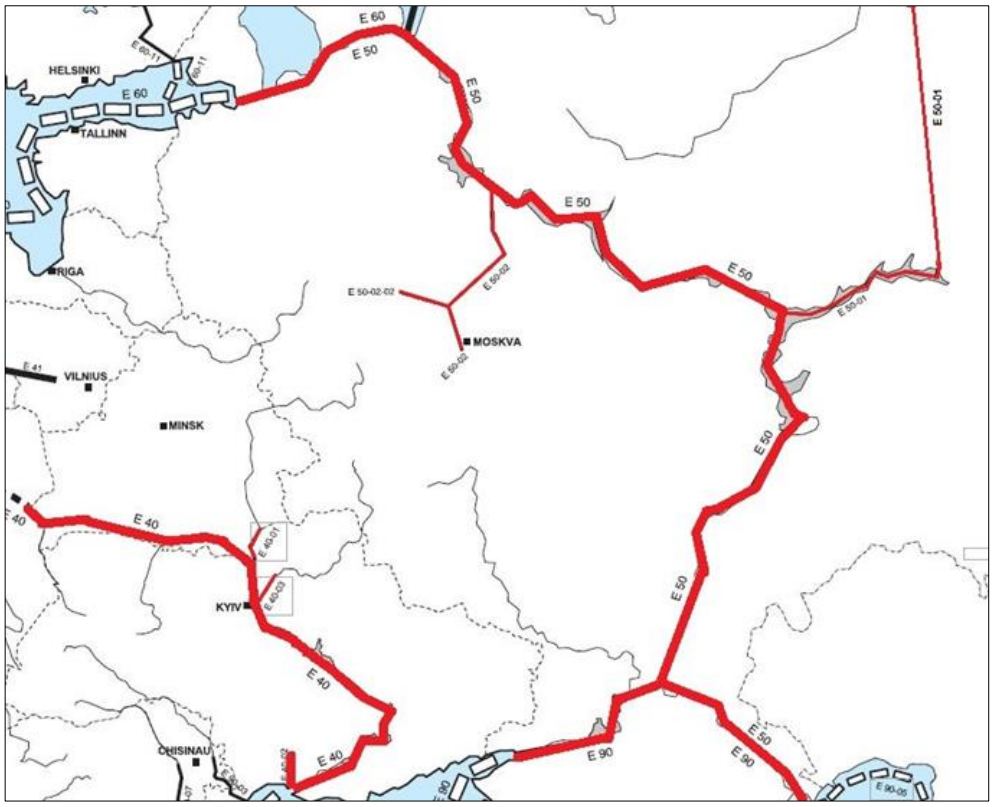
The eastern European inland waterway networks are formed by the E 40 waterway, in the Dnipro river basin (including the river Pripyat and the Dnipro-Bug canal in Ukraine and Belarus) and the E 50 waterway in the Russian Federation (consists of the river basins of the Volga and Don rivers and the Belomorsko-Baltijsky canal) which connects the Black and Caspian Seas with the Baltic Sea (see figure 8). The E 40 is a vast waterway system with a total length of more than 9,000 km. Most of the network is suitable for vessels larger than Class V. While the route from the Black Sea to the Baltic sea via the E 50 is feasible, a direct inland waterway link is not available between the E 40 and the E 50. The E 50 waterway and connected waterways are an integral part of the “Big European Transport Ring” which includes the Main Danube axis (E 80), the Rhine (E 10), the coastal routes of the North Sea, the Kiel Canal and the Baltic Sea (E 60), the waterway system of the Russian Federation from St. Petersburg to the Sea of Azov (E 50) and the coastal routes of the Black Sea (E 90).

[33] Société du canal Seine-Nord Europe, www.canal-seine-nord-europe.fr/Projet.

[34] www.batiactu.com/edito/canal-seine-nord-europe-verra-jour-2027-53563.php.

[35] Voies navigables de France, Le traffic fluvial sur l’année 2017, www.vnf.fr/vnf/img/cms/Transport_fluvialhidden/Trafics_2017_12mois_Internet_20180410171126.pdf.

Figure VIII
The Azov-Black-Caspian Seas Network, includes the Dnipro [36]



Source: UNECE.

Connecting the E 40 with the rest of the AGN network requires the removal of several missing links, including one to the main waterway network of Poland that would create the Baltic-Black Sea waterway. The E 40 and E 41 would then connect to the E 70.

Currently, the E 40 is navigable for larger vessels via the Dnipro river up to the confluence with the river Pripyat. The lower parts of the River Dnipro are suitable for river-sea navigation due to the nature of the river, which is comprised of a series of lakes created by dams of hydroelectric plants up to Kiev. The waterway continues further upstream to the Ukrainian border near Chernobyl, through Belarus to the Dnipro-Bug canal, and to the River Mukhovets at the Polish border near Brest.

The locks and fairways along the E 40 waterway are in need of upgrading or renewal, particularly, the locks on the River Dnipro. Renovations on the locks and increased waterway maintenance works are ongoing. The waterway infrastructure further north, located on the river Pripyat and the Dnipro-Bug canal, also need renovation. Belarus is rebuilding the hydraulic complexes according to Class Va norms. To date, five have been rebuilt, allowing the passage of vessels of up to 110 m in length, 12 m in width and 2.2 m in draught. Three more locks should be renovated and operational in 2021.

If fully navigable, the E 40 waterway would allow freight to be transported from Belarus and Ukraine through Poland to western European countries, and particularly the Nordic countries. Once the main bottlenecks on the Oder-Vistula section are removed and Class Va requirements met, it will be possible to transport freight by river between Western and Eastern Europe, and South Eastern Europe via Poland. It is estimated that about 20 per cent of goods currently carried by rail and about 10 per cent of goods carried by road could be transferred to water transport on that route. With the support of the European Union, a project "Restoration of the E 40 waterway on the Dnieper-Vistula section: from strategy to planning" was initiated in 2013 and a cross-border standing commission was set up in 2014. A feasibility study in 2014 and 2015 determined the optimal technical solution and provided

[36] ECE map of the E Waterway Network, 2019.

general recommendations. The commission drafted road map till 2025, and the next major task is to study possible environmental impacts by means of appropriate environmental assessments.[37]

A new branch of the E 40-01, which will connect a newly built terminal on the Dnipro close to the town of Nizhnie Zhary at the Belarus-Ukrainian border and the mouth of the river Pripyat, was added to the AGN network in 2017.[38] Further work is ongoing, but the end date has not been set. A continuation of the river Bug as E 41 through Poland has not been projected. Vessels that travel north from Brest are restricted to a draft of 0.8 m, and exclude freight transport.[39]

Fleet

The inland fleet of the Azov-Black Sea region comprises the national fleet of the Russian Federation for the E 50, and the fleets of Belarus and the Ukraine for the E 40. In 2015, the inland fleet of the Russian Federation counted 1,520 self-propelled vessels with an average capacity of 1,660 tons, 4,902 pushed barges with an average capacity of 1,460 tons as well as 2,784 push and tow boats.[40]

As of 2014, the Belarusian inland fleet comprised of one self-propelled barge, 147 pushed barges with an average capacity of 769 tons and 72 push and tow boats.[41]

The inland fleet of the Ukraine counted 1,312 vessels in 2016[42], of which 352 operate outside of the E 40 network on the Danube river.[43]

C. The Baltic Sea region network

The Baltic Sea region inland waterway network consists of the yet to be fully developed northern part of the Vistula river (E 40), the Nogat River to the Vistula Lagoon as a part of the E 70, and the Neman River from its mouth into the Baltic Sea in Klaipeda, upstream to the town of Kaunas as the E 41 (figure 9).

Although the idea of connecting the E 40 with the E 70 to create a waterway connection between the Baltic and the Black Seas has been discussed for several years, there are no detailed plans.

[37] ECE/TRANS/SC.3/WP.3/2016/13.

[38] AGN revision 4, www.unece.org/fileadmin/DAM/trans/doc/2019/sc3/ECE-TRANS-120r4efr.pdf.

[39] Inventory of Main Standards and Parameters of the E Waterway Network (“Blue Book”), revision 3 (ECE/TRANS/SC.3/144/Rev.3), p.17.

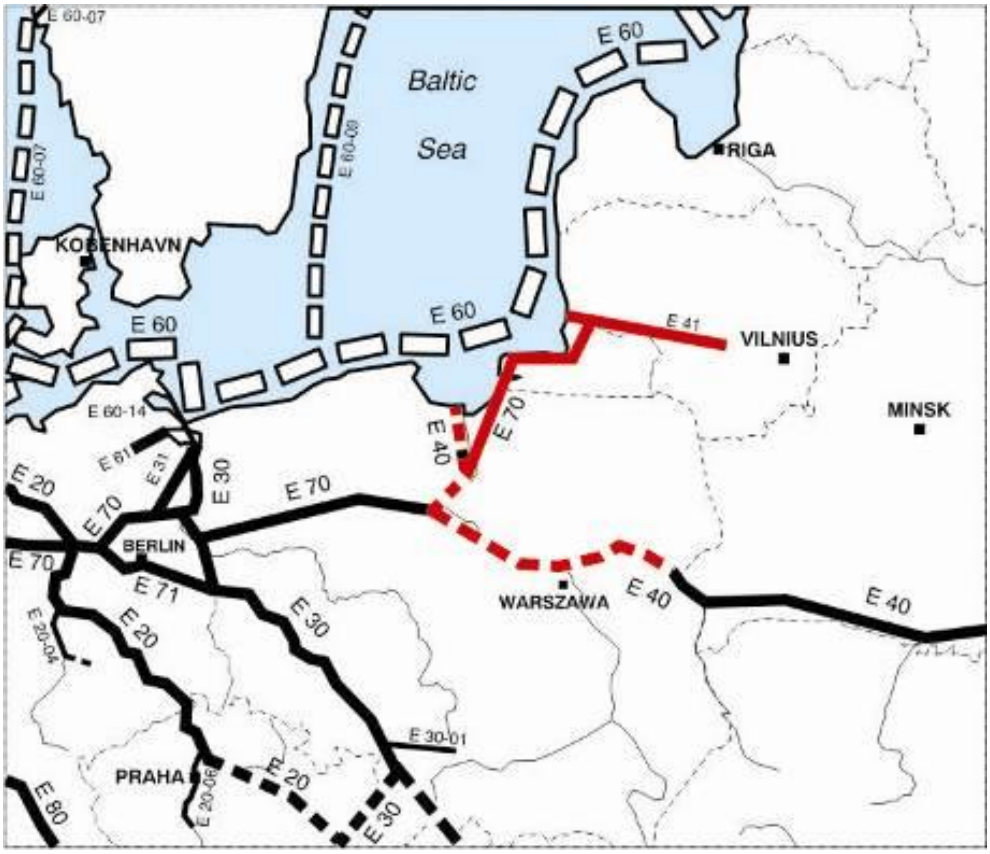
[40] ECE 2018 Inland Transport Statistics for Europe and North America, p. 149, www.unece.org/fileadmin/DAM/trans/main/wp6/publications/2018_INLAND_TRANSPORT_STATISTICS.pdf.

[41] Ibid, p. 141.

[42] Ibid, p. 151.

[43] Danube Commission, Danube Navigation Statistics in 2015-2016, Budapest 2017, p.7, www.danubecommission.org/uploads/doc/STATISTIC/en_stat_2015_2016.pdf.

Figure IX
The Baltic Area network[44]



Source: UNECE.

Planned improvements for navigating the network still focus mainly on the creating a deeper fairway for the Neman River from Klaipeda upstream to the Kaunas dam, which is not equipped with a lock and is therefore ends the navigation on this river. In 2019, the waterway accommodated vessels of 100 x 10 m, though the allowed draught on the lower part of the river from Klaipeda to Jurbarkas is at most 1.20 metres and is even lower on the upper stretch to Kaunas dam.[45]

Fleet

The Baltic area network does not have a dedicated fleet. Vessels registered in Poland usually arrive via the German network. As of 2016, the Polish fleet counted 91 self-propelled vessels with an average capacity of 747 tons, 516 pushed barges with an average capacity of 457 tons and 214 push and towboats.[46]

D. The Czech-Slovak network

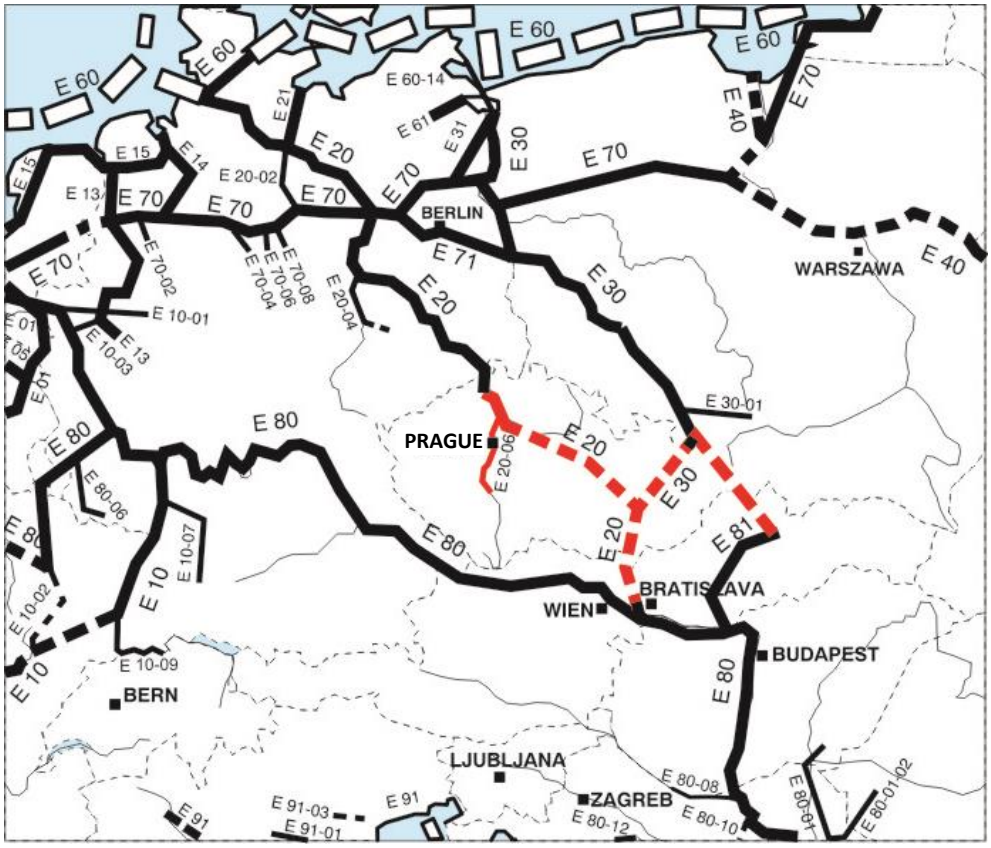
The network comprises the Elbe river (E 20) from the Czech-German Border north of Děčín up to the town of Pardubice and the Vltava River (E 20-06) from its confluence with the river Elbe close to the town of Mělník upstream via Prague to the town of Slapy and three missing links, which which would connect the Danube and the Elbe and Oder basin: the Elbe-Morava-Danube Link extends the E 20 waterway, the Oder–Váh–Danube Link connects the E 30 and E 81, and extends the E 30 waterway between the Morava and the Oder (figure 10).

[44] ECE map of the E Waterway Network, 2019.

[45] Inland waterways of national importance of the Republic of Lithuania, http://vvkd.lt/en/vidaus-vandenu-keliai/.

[46] ECE 2018 Inland Transport Statistics for Europe and North America, p. 147, www.unece.org/fileadmin/DAM/trans/main/wp6/publications/2018_INLAND_TRANSPORT_STATISTICS.pdf.

Figure X
The Czech-Slovak network [47]



Source: UNECE.

None of the planned waterway links are in construction. However, the Ministry of Transport of Czechia launched a feasibility study on the Danube-Oder-Elbe water corridor in July 2016, and in January 2017, the Transport Ministers of Czechia, Poland and Slovakia signed a memorandum of understanding on the construction of the link.[48]

Both Czechia and Slovakia continue works on improving the existing waterways. For the river Elbe, construction works began on the lock and weir system in Děčín for operation in 2021. Restrictions from the low fairway depth between the German border and Ústi-nad-Labem need improvement. Two low-head dams (less than 6 m) and hydropower plants, with locks of 200 × 24 m, are foreseen to make the stretch commercially navigable during low water periods. Further improving the navigation on the Váh river is a priority for Slovakia. An upgrade to a minimum Class V waterway from the confluence with the Danube river in Komarno upstream to Žilina requires renewal of the existing locks and the construction of new locks.

Fleet

As of 2016, the Czech fleet counted 30 self-propelled vessels with an average capacity of 1,033 tons, 103 pushed barges, average capacity of 504 tons, and 74 push and towboats.[49] These vessels are used in domestic traffic, and on the river Elbe up to the seaport of Hamburg and via the German canal network – to the Rhine basin. The Slovak fleet focuses on the transport of goods on the Danube. In 2016, the Slovak fleet was composed of 10 self-propelled vessels with an average capacity of 1,000 tons, 101 pushed barges with an average

[47] ECE map of the E Waterway Network, 2019.

[48] Water Corridor Danube-Oder-Elbe, www.d-o-l.cz/index.php/en/news.

[49] ECE 2018 Inland Transport Statistics for Europe and North America, p. 143, www.unece.org/fileadmin/DAM/trans/main/wp6/publications/2018_INLAND_TRANSPORT_STATISTICS.pdf.

capacity of 1,634 tons and 33 push and tow boats.[50]

E. Coastal routes and connected inland waterways

The main coastal routes are:

- the E 60 waterway
- the E 90 waterway which includes the coastal waterways and connected waterways of the Mediterranean, Black Sea and Caspian Seas
- the connected inland waterways on the Baltic and North Seas, and on the Atlantic Ocean to the Strait of Gibraltar.

The artificial infrastructure of the coastal routes incorporates ship canals into these routes:

- the Nord-Ostzee Canal (E 60) in the north of Germany
- the Corinth Canal (E 90) in Greece.

Isolated inland waterways interconnect by these maritime routes:

- the Guadalquivir estuary in Spain (E 60-02)
- the waterways of the United Kingdom of Great Britain and Northern Ireland are open to sea-going vessels, such as the Thames (E 60-03-05)
- the Humber (E 60-03-21) and the Tyne (E 60-03 and E 60-03-06)
- the Douro in Portugal (E 60-04)
- the Göta Alv in Sweden (E 60-07)
- the Saimaa Canal in Finland (E 60-11)
- the Po in Italy (E 91).

Coastal routes, except for the connected and connecting waterways, are maritime waterways, which precludes system-wide investments on these routes. It is nevertheless significant that investments continue or are planned in order to increase the efficiency or the potential economic benefits of these combined river-sea routes. Some investments appear to concern only maritime traffic, but in reality, may serve shipping throughout the AGN river-sea network. For example, the German Government invested more than €800 million on the Kiel Canal in the next decade on optimization of the fairway of the eastern part of the Kiel from Königsförde to the Kiel locks, deepening of the fairway on the entire length of the waterway, and on constructing a new small lock chamber in Kiel and a new, fifth, lock chamber in Brunsbüttel. The lock chamber was scheduled to be completed in 2021 but has been delayed due to technical problems.[51] Capacity on the waterway should improve and ease navigation.

Other ongoing projects on the coastal network, especially in the Baltic Sea region, include plans to develop inland and river-sea navigation, as provided for in the policy paper "Strengthening Inland Navigation and River-Sea Shipping in Europe and the Baltic Sea Region" that is the outcome of EMMA project.[52] An example is opening the navigation on the Göta Alv river and on the Trollhätte canal specifically to inland barges, and more specifically for a container feeder service from the port of Gothenburg to Trollhätten where, for the moment, freight transport is handled exclusively by short sea navigation vessels.

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[50] Ibid., p. 180

[51] Wasserstraßen- und Schifffahrtsamt Brunsbüttel, Neubau der 5. Schleusenkammer Brunsbüttel und Anpassung des Vorhafens, www.wsv.de/wsa-bb/Investitionsmassnahmen/5_schleuse/5._Schleusenkammer/Allgemeine_Informationen/index.html.

[52] ECE/TRANS/SC.3/WP.3/2019/25.