

THE ITALIAN WATER INLAND TRANSPORT SCENARIO AND MAJOR INLAND PORTS

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Summary: The purpose of this article is to introduce the main Italian inland ports and the principal Italian rivers in the context of the Italian water inland transport. The work, for its big part, is focused on the major Italian idroviary system (Padano-Veneto), showing the most relevant features (connections, canals and related ports).

Key words: inland water transport, inland ports, inland waterways

1. INTRODUCTION

First of all, it is important to precise that the Italian rivers network system is very poor compared with the others European countries. In fact, in Italian soil there aren't so many important waterways involved into European rivers' panorama.

The most important river in Italy is the Po, which is also the only river which can ensure a constant commercial transport and it is in slight expansion in the last years, especially in the area that crosses the Italian region of Lombardy thanks to the dense network of available and navigable canals and tributaries.

The commercial traffic that take place along the Po river interests just Italy and no more European countries.

The goods are unloaded in ports suitable for reception and then sorted by other means of transport (mainly roads) in the areas of destination and interest.

The commercial river traffic in Italy has neither political nor social interest as it occupies a very small and irrelevant slice of the country's economy.

Rather, perhaps what is most considered is the fluvial tourist traffic, as happens for example in the waterways that cross historical and important cities of the nation (like Rome and Florence).

In the Italian territory the most important rivers are essentially three:

- Arno (crosses Florence, Pisa and Livorno);
- Tiber (crosses Rome);
- Po (crosses a lot of historical city in the North of Italy).

Among these three, as already mentioned, the only one that have a real presence of commercial traffic is the Po, while the other two as well as many other Italian rivers (Ticino, Brenta, Piave, Adda, Oglio, Adige, Volturno, Tanaro, Mincio) are navigable only by tourist boats and for short stretches

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of their course since their routes are mostly sloping, therefore in mountainous areas not navigable, rather than in the plains or flat lands.

One aspect that must be considered on Italian soil is the presence of lakes, which are not dealt with in this article. In the areas of Northern Italy, near the Alps, there is a dense presence of lakes (Lake Maggiore, Lake of Garda, Lake of Como) that, thanks to their large quantity of ports, collect for the most part a good percentage of tourist traffic, also towards Switzerland (in Lake Maggiore).

2. THE COMMERCIAL NAVIGATION IN ITALY

The inland navigation network is dotted with a series of infrastructures, such as basins and ports. The first ones are an integral part of the waterways themselves, making it possible to move between different segments from different sea levels, or softening the slope present on the track of a single waterway; the latter constitute the terminals for the ships that transport goods to and from northern Italy.

2.1 PORTS

The waterway network is characterized by a series of public and private ports and docks (used for own goods).

As said before, the main inland ports in Italy are located along the river Po; their activities are based on the storage, transshipment and handling of various transported goods. As it will be described in the following parts of this article, is possible to realize that this kind of ports are not suitable to host huge equipment (cranes, big storage areas, long quays) in comparison with maritime ports, because of their low activity.

They are equipped with minimum means and personnel needed to carry out the different operations.

2.2 NAVIGATION BASINS AND LOCK CHAMBERS

The navigation basins play the fundamental instrumental role of facilitating navigation, smoothing the differences in height, and acting as real "lifts" for the canals. Currently, the entire navigation system of Northern Italy counts as many as 26 basins.

Since 2010 in Italy has been carried out some important projects to modernize and rebuild a lot of navigations basins and lock chambers.

One of the most important project, ended with the inauguration during March 2018, has been the new lock chamber and new basin of Isola Serafini, located along the Po, very close to Cremona. The new basin makes it possible to restore the continuity of the navigation of the Po river upstream of Monticelli d'Ongina, with parameters suitable for boats of the European VA class.



Source: Il giornale del Po, 2018

Fig. 1 - ISOLA SERAFINI BASIN AND LOCK CHAMBER ON PO AND ITS POSITION

2.3 THE LEGISLATION

At national level, the Navigation Code is in force, in which there is a common part with rules that are adapted to both the maritime and the internal environment and a specific regulation attached to the Code dedicated to the administrative regulation of inland navigation.

The General Plan of Transports, with the Law 380/90 has foreseen the realization of the Northern Italian Waterway System (the most important one) representing the fundamental norm on which the current institutional structure of the Italian Waterway System is based. North, which provides that the regions bordering the Po and the connected waterways, gathered in agreement, perform the functions of common interest in the matter of inland navigation. In this framework, through a convention that has been amended several times, it is since 1978 that the Interregional Agreement for Inland Navigation has coordinated the exercise of administrative functions in this area. The Legislative Decree of 31 March 1998, n. 112 subsequently conferred on the Regions (Emilia Romagna, Lombardy, Piedmont and Veneto) the management of the waterway system.

The subjects involved in the construction of the Northern Italian Waterway System are therefore the State, through the competent ministerial structure, and the Regions of Piedmont, Lombardy, Veneto, Friuli Venezia Giulia and Emilia Romagna.

3. THE PADANO-VENETO IDROVIARY SYSTEM



Source: Piano generale del sistema idroviario dell'Italia del Nord , 2016

Fig. 2 - PADANO-VENETO IDROVIARY SYSTEM (VARIOUS CANALS AND PO RIVER)

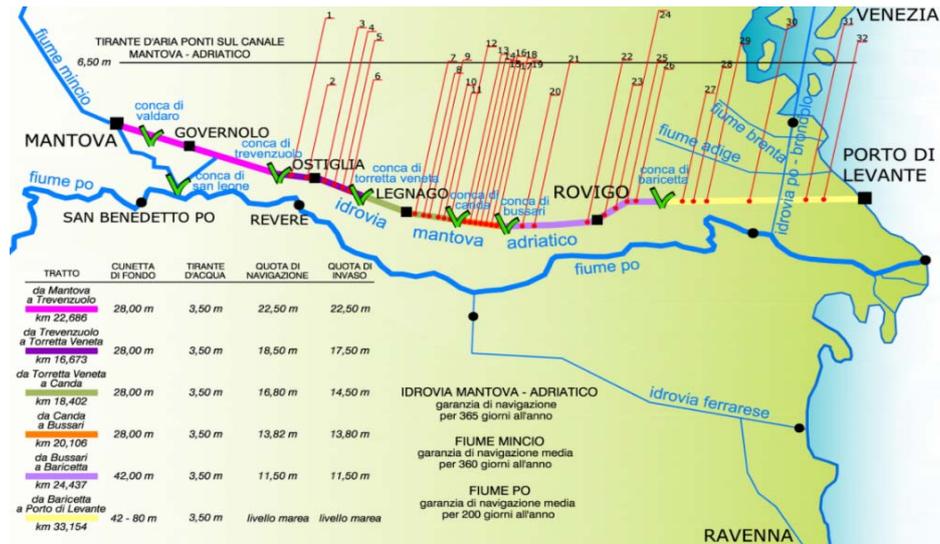
The Padano Veneto water system is composed of West to East from:

- the internal ports of Cremona, Mantua, Rovigo, Boretto and Porto Nogaro (and further other public and private docks along the waterway);
- the Po River and the Mantua - Adriatic Sea channel, the two main temples that connect the sea in synergy with the heart of the Po Valley, with an east-west relationship, where the internal ports are located;
- the Venice lagoon, the Po - Brondolo canal and the Ferrarese waterway, which connect the major waterways to the maritime ports with a north-south trend;
- the maritime ports of the Northern Adriatic, such as Ravenna, Chioggia, Venice, and Trieste.

The Padano-Veneto water network defined by the Decree of the Ministry of Transport and Navigation n. 759 of 25/06/92, provided for by Law 380/90, has an extension of **987,5 km with approved network of 957,5 km (of which 564 km can be used for commercial purposes)** and includes the following waterways:

Padano Veneto waterway system used for commercial purposes (source ARNI 2010)

- The river Po from Cremona to Porto Tolle: 275 km (near the mouth),
- The first section of the MI-CR-PO canal (up to Pizzighettone): 14 km,
- The river Mincio from Mantua to the Po (via Governolo): 20 km,
- Canale Fissero - Tartaro - Canalbianco - Po di Levante (incile): 117 km,
- The Po Channel - Brandolo - Venetian Lagoon: 19 km,
- The Po di Levante: 19 km,
- The Venetian Lagoon (from Chioggia to Venice): 30 km,
- The Ferrarese Idrovia (Pontelagoscuro - Porto Garibaldi): 70 km,
- The Ausa-Corno Canal: 4 km.



Source: Piano generale del sistema idroviario dell'Italia del Nord, 2016
 Fig. 3 - IDROVY MANTUA-ADRIATIC SEA (FISSERO-TARTARO-CANAL BIANCO)



Source: Navigazione porti interni, 2017
 Fig. 4 - PADANO-VENETA NETWORK

It should be noted that the connection between the navigable canals of the Po Valley and Porto Nogaro is guaranteed, as well as by the presence of the Venetian Lagoon. Another 37 km (from Cremona CR to Piacenza PC) will be added now that the basin of Isola Serafini has been built. Furthermore, the Cremona-Milan canal, which today only develops up to Pizzighettone (13-14 km), may in the future constitute an important extension of the waterway system, serving in this way the industrial areas of the Milan hinterland.

The main important ports present along the Po and its idroviary system are:

- Cremona;
- Mantua;
- Banchina Fluviale di Boretto;
- Rovigo;
- Piacenza and Ferrara included in regional programs (but they are not yet working).

All the other ports (less commercial ones and touristic ones) are mentioned with yellow points on the map in figure 5.

4. THE RIVER PO

With its 652 km, the Po is the longest river in Italy: it covers a 71 000 km² basin, bathing four regions and crossing the entire Po Valley. Its course is fed by 141 tributaries and minor streams, it touches 13 provinces and 474 municipalities, affecting a population of 16 million people. The river was born at the foot of Monviso, in the Piedmont Alps, to flow into the Adriatic Sea, through a wide delta, in turn divided into six branches. The Po is also a major attraction for environmental, sports and cultural tourism: its natural value is given by over 60 parks, reserves, equipped areas and natural oasis, all ideal scenarios for cycling, horse riding and river navigation. Internationally, the Po is recognized as the most important Italian fluvial course also in light of the historical, social and economic events of which it was and still is theater.

The Po is a great resource for the local economy. Every year, 5,3 billion cubic meters are taken from groundwater, which becomes 25,1 for surface waters. Today, its waters are used for civil, agricultural and industrial purposes, and electricity is obtained from its power. On its banks is concentrated more than a third of Italian industries and agricultural production, as well as more than half of the livestock. For this reason, also, it is of fundamental importance to guarantee the hydraulic safety of the territory: for this aim the AIPO (Interregional Agency for the Po river) has been established in 2003 and created for the protection, maintenance and safety of the waters of this river.



Source: Piano generale del sistema idroviario dell'Italia del Nord , 2016
 Fig. 5 - COURSE OF PO RIVER

The navigation offer in the Po area consists of 812 km of navigable waterways - which is more extensive than the river as it consists of navigable parts of rivers and tributaries, 12 ports / docks, 15 basins and 111 berths (3 in Piedmont, 39 in Lombardy, 36 in Emilia-Romagna, 33 in Veneto). On board boats, canoes, houseboats and bateau mouches you can see the pristine nature of the Delta Park canals, which can be traveled in many places and often in both directions, without the need for a driving license. The Po Delta can be reached by navigation from Cremona, Venice, and Mantua, with stops in several river cities such as Parma, Padua and Verona. Along the Po River there are 8 parks and 50 naturalistic oases. Each park is in its own special way and in addition to the diversity of fauna and environment it is possible to follow it and discover it in various ways. In navigation, on horseback,

on foot or by bicycle. The activities that can be practiced are many: birdwatching, cycle tourism, trekking, navigation and fishing just to name a few.



Source: Fiumi, Unione Navigazione Interna Italiana , 2017

Fig. 6 - RIVER PO NEAR MANTUA

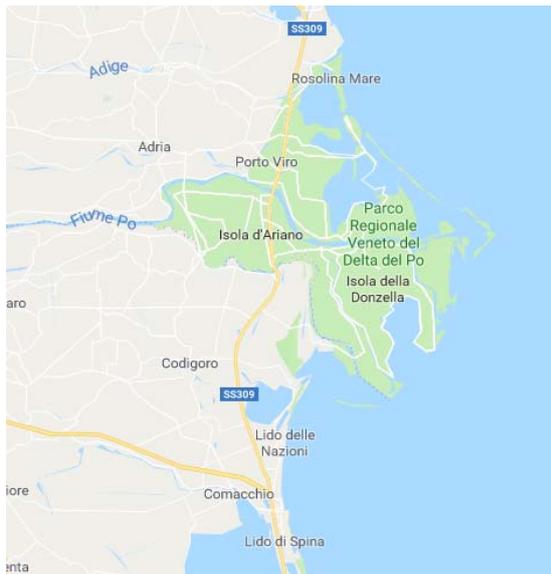
4.1 THE PO DELTA

By delta of the Po we mean the hydraulic system of river branches through which the river Po flows into the Adriatic Sea after its course along the Po Valley. Its current hydraulic structure derives from the consequences of the 1570 earthquake in Ferrara and the Taglio di Porto Viro, a large hydraulic work carried out by the Republic of Venice in 1604.

The delta consists of all the fluvial branches and, reaching a surface area of about 18 thousand hectares. According to this definition the delta of the Po falls entirely in the Province of Rovigo or Polesine and almost entirely occupies the eastern portion (starting from the Po di Goro to the sea) and is also defined as an "active delta".

The delta del Po has been included, since 1999, in the list of Italian heritage sites by UNESCO as an extension of the recognition given to the city of Ferrara in 1995.

The extension of the protected areas of the Park is 120 square kilometers. There are 9 municipalities involved, all in the province of Rovigo: Adria, Ariano in Polesine, Corbola, Loreo, Papozze, Porto Tolle, Porto Viro, Rosolina, Taglio di Po, with a total of over 73 thousand inhabitants of the entire Delta area.



Source: Fiumi, Unione Navigazione Interna Italiana , 2017

Fig 7 - PO DELTA MAP AND PICTURE OF THE MOUTH

5. THE RIVER ARNO AND THE RIVER TIBER

5.1 THE RIVER ARNO AND NAVICELLI CANAL

The Arno has a total length of 241 km, a basin of 8 228 km² and an average estimated annual flow at the mouth of about 110 m³ / s. Born on the southern slope of Mount Falterona, and precisely from the source of Capo d'Arno, in the Tuscan-Romagna Apennines, at an altitude of 1 358 m above sea level, and flows into the Ligurian Sea after passing through Pisa. After 12 km flows with copious waters already around 600 m above sea level thanks to the contributions of the numerous tributaries that descend from the Casentino and Pratomagno.

The source of the Arno, called Capo d'Arno, is located in the municipality of Pratovecchio Stia in the province of Arezzo. Near Montevarchi and San Giovanni Valdarno, the last town in Arezzo, it enters the province of Florence, exiting at San Miniato. From here it flows in the province of Pisa up to the mouth.

Along its path it crosses different cities and different countries; the most important places are: Florence, Empoli, Santa Croce sull'Arno, Pontedera, Cascina and Pisa.

The Navicelli canal is a canal that links Pisa with the port of Livorno; has built between 1563 and 1575. It takes its name from the so-called navicelli, characteristic small-scale Tuscan boats, used for the transport of goods coming from the Pisan plain, from the Bientina lake and from the Empoli area, being the Arno at the time navigable to Porto di Mezzo. This canal is used to transport passengers first (for touristic scopes) and very small amount of good (building materials, agricultural products, etc...) in the port of Livorno to be handled and then sorted in bigger ships.



Source: Il canale Navicelli, la via d'acqua tra Pisa e Livorno, ponte per un gemellaggio? , 2016
Fig. 8 - BEGINNING OF NAVICELLI CANAL AND MAP OF RIVER ARNO

5.2 THE RIVER TIBER

The Tiber (Tevere) is the main river of central and peninsular Italy and passes through Rome; with 405 km it is the third Italian river in length (after the Po and the Adige). Second only to the Po for the extent of the river basin (17 375 km²), with 240 m³ / s of average annual flow to the mouth. It is also the third national waterway (after the Po and the Ticino) for transport volume. It is the first Apennine river in terms of length and reach.

During the period of Roman history and later, the river was of fundamental importance for the traffic of goods; bearing witness to this fact it is important to remember how in the various historical periods many port areas along the river were built for the unloading and loading of the various boats. Nowadays, however, the situation has completely changed.

The development of road and rail transport, the construction over time of as many as 23 damming dams along the entire basin and the gradual burial of the lower river has completely canceled this use (lasted until the mid-nineteenth century), and now river navigation is limited to sports (rowing) and tourism, with boats that run from the end of the nineties along the Roman course of the river.



Source: Tiber river, Tiber island , 2018
Fig. 9 - RIVER TIBER IN ROME AND ITS MAP

6. MAIN IMPORTANT INLAND PORTS IN ITALIAN WATERWAYS

6.1 MANTUA-VALDARO PORT

The Port of Mantua is the most important intermodal center of Eastern Lombardy; it is the natural terminal of the Mantua - Adriatic waterway (Fissero - Tartaro - Canal Bianco). The docks of the port of Mantua are connected to the railway for the transport of goods; the port has warehouses Franchi, Dávid: The Italian water inland transport Scenario and major inland Ports

with wagons for loading and unloading goods that fear humidity. The port yards are coordinated to suppliers of port services equipped for the movement of grains, coils, containers and bulk.

The strategic position of the port of Mantua, intersected by the A22 Brenner highway, places it as a complement to the same direct traffic on the Quadrante Europa in Verona. As part of this system, the port of Mantua, equipped with a railway connection that joins the national line, rises to a trimodal platform of international rank. The railway junction, which connects the port of Mantua to the Mantua - Monselice railway line, has the objective of allowing an easy passage of goods from the transport system over the water to the iron system and vice versa, enhancing the characteristics of intermodality connected to the port, given its fortunate geographical position.

The port is formally established by the Lombardy Region, with regional law n. 1/1983, as a commercial / industrial intermodal water / iron / rubber terminal for the processing, storage and handling of goods.



Source: Il porto di Mantova , 2018

Fig. 10 - MANTUA VALDARO PORT AREA AND CRANE AT WORK

Among the production sectors prevalent in the provinces bordering the Northern Italian Water System is that of a zootechnical type (more than 60% of the agri-food production), which represents the backbone of the agricultural economy. The significant presence of pig farms in the Padana Valley contributes to generating substantial volumes of demand for agro-zootechnical products.

The shipbuilding activity sees the creation of metal boats, both steel and aluminum, with innovative content, carrying out a support action very useful for the economic operators of the sector. The sector also includes skills and technical assistance in the maintenance of commercial vessels used for both freight and passenger transport. Studies and projects are being carried out for the construction, within the port of Mantua, of a dry dock, useful both for new buildings and for the maintenance of professional vessels operating in inland and river navigation.

The logistic district of Mantua has a long tradition of transporting goods deriving from petrochemical transformation products and more generally reworking of goods derived from chemical industrial processes.

This has led to an extensive experience of companies for the logistics of dangerous goods and has allowed the creation in the territory of specialized infrastructures for this type of goods such as ports with pipelines, such as loading ramps for rail transport, such as dedicated areas to the storage and conservation of goods in a safe condition.

Below, are shown some data for Mantua port:

- quay length: 1 465 m,

- draft: 4 m,
- quay capacity: 5 ton/m²,
- port facilities: offices, depots, bridge cranes, cranes, shipyards, exceptional loads, dangerous goods storage,
- total area: 199 300 m² (313 000 m² future expansion),
- offices: 320 m²,
- industrial areas served: 2 850 000 m²
- railway connections: port served by floor tracks - MN-Monselice-VR line connection and VR-MO line.



Source: Il porto di Mantova , 2018

Fig. 11 - PLANIMERTY OF MANTUA VALDARO PORT

6.2 CREMONA PORT

To the west of Cremona lies the westernmost river port of the Po Valley, built around an artificial basin connected to the river Po through a navigation basin. The port is 83 km from Milan, 55 km from Brescia, 100 km from Bergamo, 40 km from Piacenza, 90 km from Pavia. The port of Cremona is located at the beginning of the navigable canal, which reaches, for now, the locality of Pizzighettone with a length of 13-14 km, but it is potentially destined to reach the Milan area. There are storage areas, warehouses and cranes for handling and transporting goods from river transport services that runs between the Adriatic and Cremona. The port is connected to the Pavia-Mantua railway by a 750-meter connection. At the port of Cremona there are also the infrastructures for the mooring of pleasure boats and cruise ships; the latter work mainly in the summer months between the ports of Cremona, Mantua and Venice. A navigation service is also active for tourism purposes along the Adda river between Pizzighettone and Lodi. Some data about Cremona port are reported below:

- vertical dock: 650 m,
- yards: 80 000 m²,
- warehouses: 2 000 m².



Source: Il porto di Cremona on www.cremonacitta.it , 2018

Fig. 12 - CREMONA PORT AREA AND LOCK CHAMBER

6.3 ROVIGO (INTER)PORT

The Interport of Rovigo occupies a strategic position as it overlooks the Fissero-Tartaro Canalbianco navigable canal which flows through the Po di Levante or the Po di Brondolo onto the Adriatic Sea.

The canal is accessible by European sea-going fluvial vessels. The barges used for river transport have a loading capacity of up to 1 800 tons.

The navigable waterway originates from Porto Levante, where the piers were built and through the navigable canal Canalbianco, Tartaro and Fissero reaches up to Mantua with a length of about 170 km. Later, through the basins of San Leone enters the Po to reach the Port of Cremona.

From the waterway it is possible to reach the sea via the Po di Brondolo, which guarantees the connection with the Port of Chioggia.

The port of Marghera (Venice port) can be reached along the navigable stretch of the Venetian Lagoon.

The Rovigo interport area includes an area of about 1 900 000 m².

The company Interporto di Rovigo Spa owns an area of 350 000 m², of which 41 000 m² of warehouses.

Among the logistics operators there is in particular a company that manages a 6 000 m² warehouse with controlled temperature. The area is characterized by the presence of an automated silos warehouse capable of containing 81 000 m³ food-processing bulk. This warehouse allows modal shift from the different transport modes. From barge to truck or from train to truck, the material arriving in large quantities is then shipped to destination with the vehicles.



Source: Trasporto Fluviale Interporto di Rovigo , 2018

Fig. 13 - ROVIGO INTERPORT AREA ALONG CANAL BIANCO

7. CONCLUSIONS

In this article the main topic has been the commercial traffic across the Po river; so, now, it could be reasonable to show some data about the handling goods and some important future prevision about the increase of the inland transportation in this area.

The waterways of the Padano Veneto Waterway System, which are currently operating for goods traffic and for tourist navigation, are as follows:

- Po from Pavia to the sea (there is a regular traffic of goods only in the downstream section of Cremona),
- Cremona - Volta Grimana 245 km,
- river Mincio from Mantua to the Po 21 km,
- Canale Po - Brondolo (from the Po to Chioggia) 19 km,
- Idrovia Litoranea Veneta: from Portegrandi to Isonzo river 127 km (recreational navigation only),
- Canale Milan - Cremona, from Cremona to Pizzighettone 14 km,
- Idrovia Ferrarese (from Pontelagoscuro to Portogaribaldi) 70 km,
- Idrovia Fissero - Tartaro - White Canal - Po di Levante 135 km (from Mantua - to the sea).

All these waterways require, more or less, important measures of accommodation and adaptation.

On the operating part of the Padano Veneto Waterway System, today there is a traffic of goods that, although remaining limited in size and significantly less than in the past, are encouraging signs of development. Today the traffic is almost entirely on the Po, on the channels connecting the Venetian lagoon and on the Fissero - Tartaro - Canalbianco - Po di Levante waterway.

Over the last decade, freight traffic on the waterway system has fluctuated between **500 000 and 1 000 000 t / year**.

However, **inland shipping traffic represents a very low percentage of the national goods movement, i.e. 0.05%, in the first years of 2000. In Europe over the same period it was 10%.**

The planned waterways for the expansion (and the consequent expansion of the handled and storage goods) are:

- Canale Milan - Cremona, between Pizzighettone and Milan;
- Idrovia Ferrara - Ravenna, which is an extension of the already active Ferrovia Hydropower;
- Padua - Venice Canal.

Other waterways can be considered planned, awaiting the need for a feasibility study of the interventions necessary to make them effectively navigable.

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