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Project B:
Danube-Tyrol-Adriatic Sea-Waterway

The ship's passage
A waterway from the Danube to the Adriatic Sea

The Danube-Tyrol-Adriatic Sea-Waterway, a project of the Tirol-Adria Ltd.. is a **transalpine ship's passage of 700 kilometers in length** and connects Passau on the Danube with Venice. It leads from the Danube via the Inn, Adige, Lake Garda, Mincio and Po to the Adriatic Sea **and runs to approximately 88 kilometers in cannal tunnels**.

Rhein-Main-Donau	Nordsee - Schwarzes Meer	3.500 km
Donau-Tirol-Adria-Passage	Donau - Adria	700 km
Wasserstraßen und Kanäle in Deutschland		7.500 km
"	in der EU	30.000 km

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Geography and history

The rivers **Inn** and **Adige** draw deep furrows in the Alps and close each other in the shallow section to **70 kilometers**. Until the mid-19th century both were navigable and were mainly used for carrying goods. There were even plans to tow the ships above the Brenner, to spare the transshipping and cumbersome intermediate transport over land from one river to the other.
An example of such a ship transport on land:
In the year 1438 the Venetians moved 82 warships in just 15 days from the Adige on the ridge at Mori to Lake Garda, to supply the residents of Brescia with military assistance.
With the commissioning of the railway in the second half of the 19th century, freight traffic shifted to rail. Water transport lost due to the sluggish introduction of techincal achievements (steam engines and ships' propeller) rapidly in importance. Yet a century later it is the road, which absorbs the largest share of the rapidly growing goods traffic. The transport on the streets is based on competition and is therefore reliable, fast and flexible, so that concerns can even abstain from stock-keeping. However, the transport needs an extremely huge energy input and increasingly leads to an inevitable environmental problem, so that now again a return to the oldest and most environmentally friendly means of transport, the ship, must take place.

Prerequisites

The main condition for the creation of a navigable link between the Danube and the Adriatic Sea is a water transfer from the catchment area of the Inn into the Adige, combined with the low- and high-water regulation through the water- and weather divide as part of the **Tyrol-Adriatic Sea-Hydro Powerplants**. Such applications were communicated in 2005 to the responsible authorities of Tyrol and South Tyrol, Austria and Italy.

The four sections of the Danube-Tyrol-Adriatic Sea-Passage

1. The INN-PASSAGE:

The Inn rises on the Maloja Pass in the Swiss Engadine, flows through Tyrol and forms between Kufstein and Erl and from the confluence of the Salzach river to the meeting with the Danube the border between Bavaria and Austria.
The ship's passage begins at the mouth of the Danube near Passau. On the 231 kilometers up to Kirchbichl in the Austrian „Unterinntal" (Lower Inn Valley) are 19 dams of power plants to adapt for shipping. Further dams on the remaining stretch to the north portal of the canal tunnel east of Innsbruck could be necessary (see Tyrol Passage).

2. The TYROL-PASSAGE:

As the core of the Danube-Tyrol-Adriatic Sea-Passage the Tyrol-Passage connects the rivers Inn and Adige by a 78 km long underground ship's passage, which crosses the Alps between Innsbruck (Tyrol) and Gargazon (South-Tyrol).

Two canal tunnel with a diameter of 14-15 meters will lead at the height of the Inn east of Innsbruck dead straight and level through the main Alpine ridge and discharge approx. 550 m above sea level at the slope at Gargazon in the Adige Valley. The called tunnel size is necessary so that ships of the EU-class 5 with a width of 11.40 metres can navigate from the Danube to the Adriatic Sea.

A crossing of the Alps to water by means of water power

The water in the canal tunnel will be put in a flow by jets drive, so that the ships will be virtually carried through the tunnel and won't need their own drive. The ship's engine is for the duration of the ride put out of operation, which will solve two problems simultaneously:
a. The problem of water displacement by the ships in the canal.

b. The problem of air pollution in the canal tunnel through the fumes of the engines.

Water jet propulsion for generation of flow

From streams above the canal tunnel water in a possible amount will be drained off and reaches through a rising main in the vertical shaft the cavern between both canal tunnels. From there it will be directly fed to the water jet propulsions in the tunnel, which puts the water in the necessary flow. At the end of the tunnel the water will be led through an arc of 180 degrees in the parallel twin tunnel and will be kept in a flow the same way.

Table of planned water discharges

Einzugsgebiete	km²	Kote	Qmin	Qmittel	Qmax	H	Pmin	Pmittel	Pmax	kWh/anno
Pflerscherbach	25	1250	200	900	2500	700	1.148	5.166	14.350	45.460.800
Ridnaunerbach	50	1200	400	1800	5000	650	2.132	9.594	26.650	84.427.200
Ratschingserb.	32	1250	256	1152	3200	700	1.469	6.612	18.368	58.189.824
Waltenbach	20	1320	160	720	2000	770	1.010	4.546	12.628	40.005.504
WKW Tunnel	**127**	**5020**	**1016**	**4572**	**12700**	-	**5.924**	**26.657**	**74.046**	**228.083.328**
WKW Südportal	-	-	1016	4572	12700	300	2.499	11.247	31.242	98.974.656
Gesamt							**8.423**	**37.904**	**105.288**	**327.057.984**

If the operation of the Danube-Tyrol-Adriatic Sea-Passage or the canal tunnel require further access tunnels or feed pipes, you have to add to the above mentioned discharges the following:

a. South Tyrol: discharges from the Wipp Valley (Eisack), Passeier Valley (Passer) and Penser Valley (Talfer);
b. North Tyrol: discharges from the Gschnitz Valley, Stubai Valley and Wipp Valley.

To complement the direct application of the hydropower electrically operated pumps for the jet propulsion can be used.

Ventilation and access shafts

The above mentioned tunnel to the caverns serve the ventilation of the tunnel and act at the

same time as an access to the cavern and the canal tunnel. Thus we have, in the intervals of the undermined valleys (approximately every 10 km), ventilation and access tunnels.

Separate electricity production to operate the Tyrol-Passage

The waterpower not used for jet propulsion will be used for power production. The callused water is dispatched into the canal tunnel and arrives through the same the south portal. There it recirculates for second use in the power station at the foot of the south portal. The return is into the Adige at Vilpian (250 m above sea level). **In this way you feed the Adige already here with water from the Eisack's catchment area, which leads to a raising of the water level**. In addition, this hydropower's use is more efficient than the natural drainage through the Eisack. At the same time the hydroelectric plant helps to keep the water level in the tunnel and in the lake at the south portal at desired level. The electricity produced in situ secures the operation of the ship lifting facility even during any power outrages in the public network.

Further opportunites for high- and low water regulation

Through the canal tunnel a by-bass from the Inn into the Adige is once more possible, if the Adige does not run high water at the same time. When the power plant on the south portal is also equipped for pumping operation, it can reverse water from the flood leading Adige to the Inn. This facility will serve **primarily** the flood regulation and the needs of inland navigation on the DTA-Passage.

Accumulation of the outbreak rocks on the south portal and creation of a lake hereon

The canal tunnel's outbreak rocks form directly at the tunnel's exit along the mountainside between Gargazon and Vilpian an approximately 300m-high embankment. This is also were the outbreak rocks of the power plant's tunnel and caverns delivered by ship are stored. The simultaneous tunneling from the north and the south demands also at the North portal a similar solution. During the drilling the necessary MSB guide rails will be installed at the tunnel vaults. By this, the access to the drill machines and even the evacuation of the outbreak rocks can happen with the MSB. From the northern portals the removal happens by ship, at the south portals via cable car or conveyor. Thus, truck traffic will be totally avoided. On the plateau an approximately 4 m deep lake will be constructed. Ships emerging from the tunnel can reduce their speed on it and continue through the trough of the ship lifting facility their way to the Adige.
Contrary, vessels pulling into the second tunnel gain momentum on the lake, so that they can run on the canal water and put the engine for the duration of the runnel passage out of operation. Ships operating on the route which do not reach the required speed will be carried by a tractor on the side of the road.

Ship lifting facility at the southern portal

Between the lake at the southern portal of the canal tunnel (550 m above sea level) and the Adige (250 m above sea level) a ship lifting facility is necessary, which can be built in form

of an angular or vertical lift. The ships sail in a trough filled with water, which will be shifted up and down singly or in combination with a second trough as a counterweight. In this way, the lift works almost without external power supply.

Examples of such lifts are to be found in St. Louis / Arzwiller at the Rhine-Marne-canal in France as in Kresnojarsk at the Jenissej (Yenisey) in Siberia. The largest ship lifting facility is currently at the Three Gorges hydropower plant on the Yangtze River. It allows vessels up to 8,000 tons to overcome an altitude difference of 150 m.

It should be recalled that the overcoming of an altitude difference in a single place for the boat ride is more advantageous than many consecutive lock systems along a river.

Hang terrace building between Gargazon and Vilpian (MeBoCity)

On the front side of the embankment on the entire length from the hillside at Gargazon up to the mountainside at Vilpian and the full amount up to the lake on the hillside will a plateau building – similar to how steeply ascending the mountain slope behind – be built.
The lower floors are for manufacturing, storing buildings, offices, rooms for hotel and restaurant industry, trade, crafts and garages. On the ground floor is also the state road Merano-Bolzano. All floors on the back side to the earth bank are open through access roads within the building itself.
On the valley side it is planned in the upper floors to construct terraced housing units.
In this way, we can develop living space and space for commercial use at a traffic wise favorable location without urban sprawl.
For example, MeBoCity offers ideal conditions for a shopping center in South Tyrol, as the state government sought.
The building will be constructed using the material gained from the outbreak of the tunnel construction also as cost-effective stabilisation.

Zero-fare energy from the canal tunnel

In the tunnel are because of the pressure of overlying rock masses higher temperatures, up to 45 degrees C. This heat is used to heat the buildings at the tunnel portals. This way, the provisionally designated settlements MeBoCity and InnCity can be supplied with zero-fare heat from the interior mountains as the temperature in the tunnel would be regulated at the same time. This energy is also available for other applications.
Also for the air conditioning of the City favorable conditions do exist.

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3. The ADIGE-PASSAGE:

The Adige is to be made navigable ex Merano. For this purpose, the flow in some places will be narrowed by weirs, which regulate the required water storage level automatically. The outbreak material of the power plant's tunnel (the portal is planned below Marlinger Bridge) will be removed by ship to Vilpian. With sufficient water level also machinery for the power plant can be delivered this way. The waterway then runs on the Adige, which now runs due to the redirected streams caused by the construction of the canal tunnel more water, to Mori. This route is 85 km long, with an altitude difference of 80 meters, which comes up a gap of one meter each thousand meters. If necessary, also in this section barrages, ship lifting facilities and power plants will be built.

Ex Mori are two paths:

The **first path** leads to the Adige via Verona to the mouth in the Adriatic sea. Here, the water currently diverted for power and industrial plants, would have to flow in the old river bed again. Power plants could be built at the required dams. Railway and road bridges leading across the Adige could be obstacles, so that an evasion to the **second path** – the following described Garda Passage – is advisable:

4. The GARDA-PASSAGE:

This one lends itself due to a switch over in Lake Garda at Mori. The connection between the Adige and Lake Garda is controlled by two nine km long, dead straight and horizontal canal tunnel (as in the Tyrol Passage). On the Garda portal south of the city Torbole a high plateau with an artificial lake, about a hundred metres above lake Garda, will be created with the outbreak of the tunnel materials. A boat lift as described in the section "Tyrol-Passage" connects both Lake Garda and the artificial lake.
The very beautiful location here also speaks for the construction of a terraced hillside

building on the embankment.
Via Lake Garda and the Mincio, expiring at Peschiera in the very south of Lake Garda, the passage leads southeast of Mantua to the **Po** and reaches 265 km (from Mori) south of Venice the **Adriatic Sea**. A large part of this section is already navigable and there are plans for a connection between Milan and Lake Garda with the sea and for a reactivation and adaption of existing marine canals. Even for those reasons we prefer this solution to the first passage via Verona.

High- and low water-regulation in the Adige river, Mincio and Po
In the case of a necessary increase in the water level of the rivers Mincio and Po water from the Adige can be transferred via Lake Garda through the canal tunnel „Adige-Garda“ and at the same time being used in the hydropower station at Torbole / Lake Garda for electricity production. If the water resources in the canal tunnel are insufficient for the production of flow, the jet propulsion will be run with pumps.

VENICE
EUROPE’S SOUTHERN PORTAL AND GATE TO THE WORLD

As a transshipment point of ocean seafaring Venice gains in importance due to its strategic position. Particularly advantageous is the **ship’s passage** for Italy itself and the countries of the eastern Mediterranean, for example Greek or for freight traffic through the **Suez Canal**. The DTA-Passage is the shortest connection to Central Europe. **The detour via Gibraltar and the western coast is more than 4,000 km long, which equals a 7-to-8-day voyage**!

THE EUROPEAN WATERWAY NETWORK

France, Belgium, Holland, Germany and Poland already have a relatively dense waterway network, which is also connected to the Czech Republic and Russia. Through the **Main-Danube-Canal** a connection to Central and Southeast Europe up to the Black Sea was completed, whereby a number of states were embedded into the Central European waterway network and a continuous waterway from the Black Sea to the Baltic and North Sea emerged.

The European dream:
Yet Johann Wolfgang von Goethe dreamed of a connection
between the Main and the Danube.

The connection of the Rhine and the Danube is an old European dream whose realization was tried repeatedly. Johann Wolfgang von Goethe was one of the major protagonists of this idea and said that its completion to see it is worth to “endure another some fifty years”. In fact, he still had must to endure three times fifty years!

The European waterway network does not take only a major expansion from the **Danube-Tyrol-Adriatic Sea-Passage**, but above all an **opening to the south**.
This new north-south-link connects the aforementioned Middle European waterway network to the Mediterranean. It combines economic regions of Germany, Austria and other countries along the Danube as northern Italy, where more than half of the Italian economy volume is settled.

Further European inland will be tapped for environmentally friendly shipping. Barges can carry the transport directly from ocean-going vessels into the country inside (containers). These benefits are also affecting the export from the EU.

Cities and towns near the great rivers Po, Adige, Mincio, Brenta and the canal systems in the Po Valley and beyond to Trieste will be accessible on the waterways directly.

Alongside the inland waterway embarkment points can be developed at favorable positions (at craft and industrial sites and agricultural sites).

Here are two examples:

1. In **Merano**, the northern terminus of the inland waterways on the Adige, offer the military area and the horse racing course in Untermais the perfect location to establish a port facility (“Marina”), which is a considerable enhancement not only to the spa.

Even the excursion boat ride will be one of the most beautiful and most individual ways to learn to know the Adige and let the landscape go by.

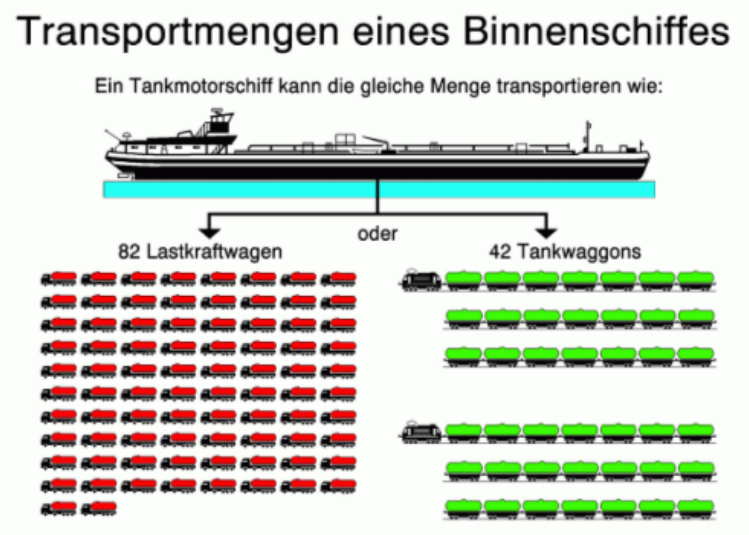
2. **Branzoll** in the South Tyrolean lowlands once formed the endpoint of the Adige shipping, still in the Adige-Port-Association the old rafter tradition still continues. The local railway premises will now become **a hub of a combined ship-rail-road transport**. Therefore, also the trail lines will be involved again more into east/west-direction of the goods traffic. As for the exchange of therefore needed cultural estates between the railway premises and the Adige, offers the area at Frizzi-Au in nearby Pfatten. There is the deposition of spoil material and the creation of fruit and wine crops in excellent position possible.

INLAND TRANSPORTATION:
IMPACT ON ENVIRONMENT, ECONOMY, ENERGY AND TRANSPORT

Some comparisons shall demonstrate the environmental dimension of a shift of freight traffic from roads and highways to the inland navigation:

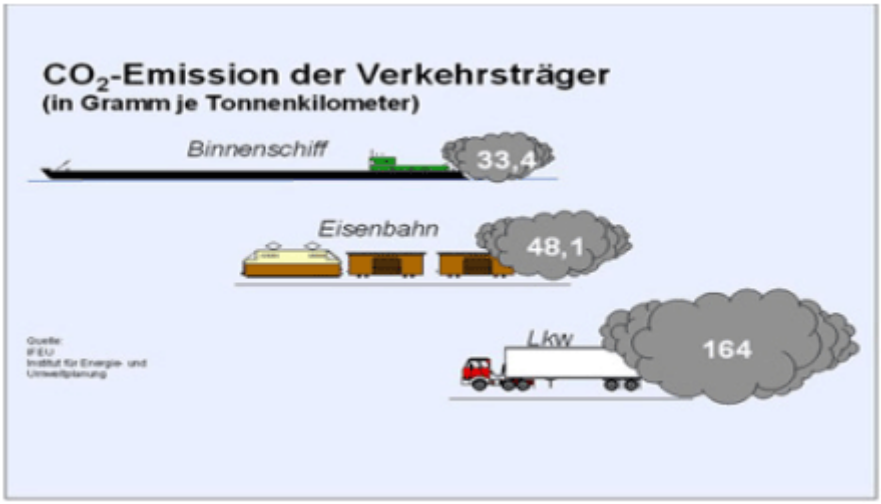
a. Today, on the Po 1 million tons of goods are shipped. But on the currently navigable 500 kilometers could 16 million tons be coped. **Around 5,000 trucks daily the Milan-Venice highway could released with burden.**

b. On a **barge of the EU class V** with a length of 109 m and a width of 11.4 m can be transported about **2,000 tons of goods**, which equals:



c. **The transport system barge/waterway is environmentally friendly, cost effective and safe.**
No other transport mode is in a position to provide the same service as environmentally friendly as this one. A barge is spacious, has a good ratio of payload to dead load, causes relatively low staff costs and needs relativeley little energy for the transport process.

d. The barge has among all transport the lowest specific energy consumption. Accordingly, its share of the pollutant emissions of all freight traffic is marginal.



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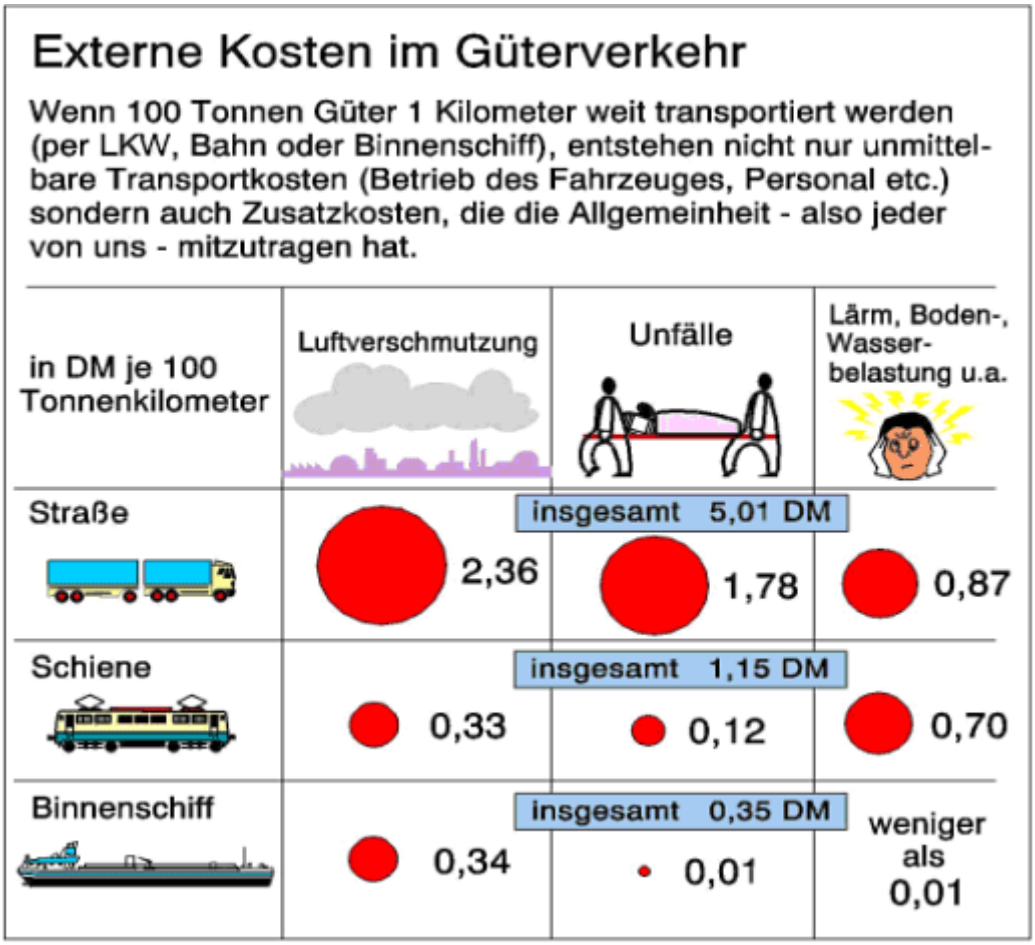
e. The internal noise from the ships is far below the accetable limits, so that noise protection measures at the waterways are superfluous.

f. The inland navigation is marginally involved in water pollution. Accidental spills of water polluting

substances are due the high transport safety rare.



g. An investment of around **€ 300 million** would be used for connecting the city of Milan and **Lake Garda with the sea**. On the other hand, requires the bridge over the strait of Messina investments in the amount of **€ 6 billion**!

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