BRENNER CORRIDOR PLATFORM

# Freight Traffic Study

## Executive Summary

October 2021

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DB NETZE
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BBT

# Brenner Corridor Platform – Freight Traffic Study

**Executive Summary – October 2021**

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# GLOSSARY

AADT – Annual Average Daily Traffic
ABS – Ausbaustrecke (upgraded railway line)
ACT – Accompanied Combined Transport
ARAMIS - Advanced Railway Automation, Management and Information System
AT – Austria
BAU – Business As Usual
BBT – Brenner Base Tunnel
BCP – Brenner Corridor Platform
CAFT – Cross-Alpine Freight Transport
CH – Switzerland
DB Netz AG – Deutsche Bahn AG
DE – Germany
ERTMS – European Rail Traffic Management System
EU – European Union
GDP – Gross Domestic Product
IMF – International Monetary Fund
IT – Italy
NBS – Neubaustrecke (new railway line)
NST - Standard goods nomenclature for transport statistics
ÖBB Infrastruktur AG – infrastructure division of Austrian Federal Railways
PCU – Passenger Car Unit
RFI – Rete Ferroviaria Italiana
Ro-Ro – Roll on-Roll off
TAC – Track Access Charges
TEN-T – Trans European Transport Network
UCT – Unaccompanied Combined Transport
V/C – Volume / Capacity
WL – Wagon Load

# 1 Introduction

This report aims to present the main findings concerning the extension of the study initially carried for the Italian Railway Infrastructure Manager to assess the rail freight market on all Alpine railway crossings in future infrastructure, socioeconomic and policy scenarios.

Specifically, the present BCP study covers the entire Brenner Corridor between München and Verona. The core study area includes Italy, Austria and Germany, but it is further extended to include all EU countries. This report briefly summarises the model system implementation, the main hypotheses assumed for forecasting and the main results for the Central Case and the interim evaluation scenarios.

Further to this introductory section, the report is structured into the following Chapters:

- *Chapter 2 – summarising the main elements of the methodological approach;*
- *Chapter 3 – describing the current status of rail and road infrastructure on the Brenner Corridor;*
- *Chapter 4 – presenting the main future scenario and its specific assumptions;*
- *Chapter 5 – illustrating the results of the main future scenario (BCP Central Case) in terms of transport demand by commodity group, freight volumes at Alpine crossings and traffic on the Brenner Corridor;*
- *Chapter 6 – presenting the results of the main future scenarios in terms of trains, both annual and daily, along the Corridor sections.*

One annex complements the main body of the report:

- *Annex – Summary of the results concerning the interim evaluation scenarios.*

## 2 Summary of the methodological approach

The analysis of the freight transport market on the Brenner Corridor is based on a multi-modal transport simulation model (hereinafter BCP model) owned by RFI and enhanced to fit the purpose of this study.

The study area covered by the transport model extends beyond the Brenner multi-modal freight corridor, including all alternative routes (e.g. routes via Alpine crossings between Italy and Switzerland or Austria, or routes via Passau or Salzburg) and complete itineraries from origin to destination of goods moved across the Alps. Therefore, the core study area includes Italy, Switzerland, Austria and Germany, and it is further extended to cover all EU countries.

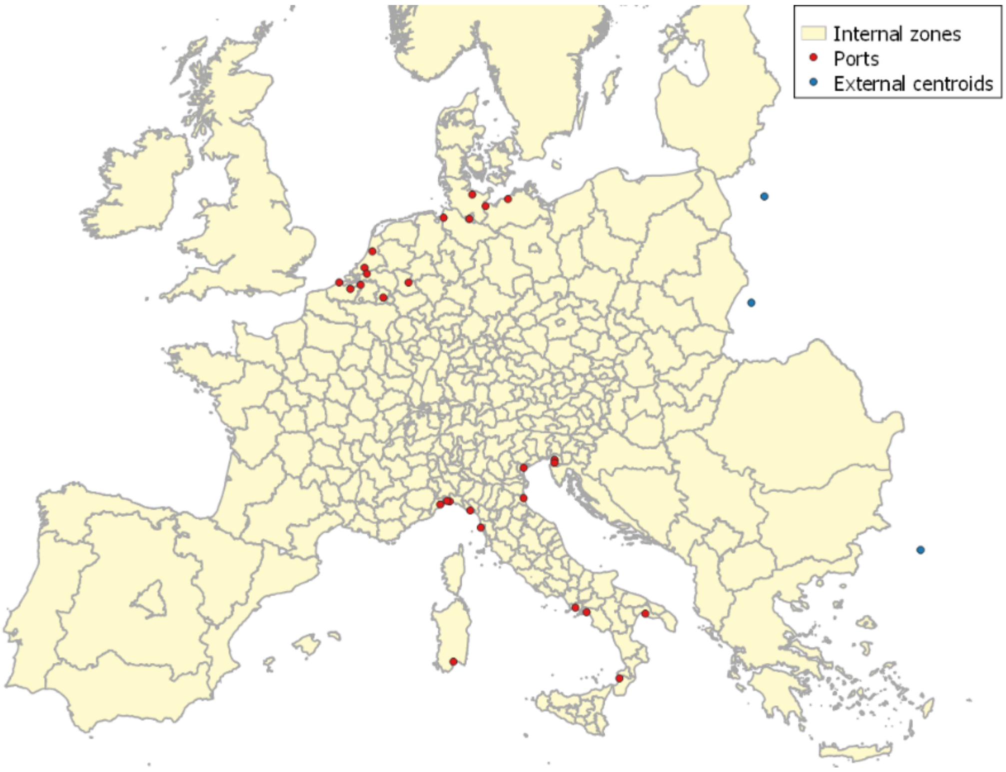



Figure 1 – Zoning system

The BCP transport model classifies freight demand according to the NST 2007 commodity groups. The modelling period is one full year, both on the supply (rail freight services) and the demand side (transport volumes in tonnes).

The overall structure of the model is shown in the diagram below.

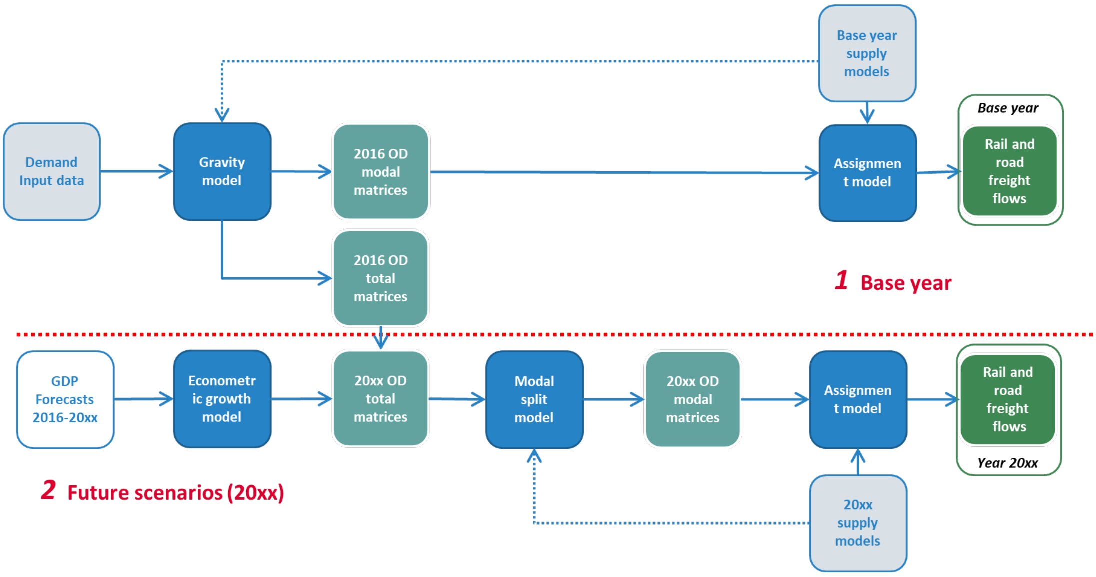



Figure 2 – Model components and forecasting process

Two main transport modes are considered: road and rail. Rail is further divided into three sub-modes, one for each main category of rail wagon and cargo handling technology: Unaccompanied Combined Transport (UCT), Accompanied Combined Transport (ACT or Rolling Highway, ROLA) and Wagonload (or conventional - WL) transport.

The main components of the model are:

- *A gravity demand model to estimate total demand as well as modal matrices at the base year, taking stock of the available statistical data on freight transport and international trade;*
- *An econometric growth model to project the base year total demand to the future time horizons;*
- *A modal split model to define modal shares at the future time horizons based on the performance of each transport mode;*
- *A set of assignment models (one for each mode / sub-mode) to allocate the modal demand matrices to each modal network and then consolidate the outputs on the multimodal base network;*
- *A post-processing model to estimate ACT rail traffic based on road transport volumes on the competing itineraries.*

The moel is built on a quite detailed calculation of transport costs for each different mode of transport. For rail UCT transport, in particular, the modal include cost related to all processes and steps required for the movement of intermodal trasporto units between an origin and a detination, namely: mail rail haulage, road pre-post haulage and terminal handling costs (including transhipment in major rail hubs).

As the previous diagram illustrates, the modelling process is different in the base year and future scenarios. In particular, the gravity demand model is only used to estimate the base year demand, considering all the available statistical sources and each mode's base year transport supply.

When evaluating future scenarios, the total demand is projected to the future time horizons based on growth factors estimated by an econometric growth model for each country pairs (origin-destination cargo relationships) and commodity group. Hence, the model does not consider any feedback effect of changes in the transport performance on the total transport volumes or in its distribution between zones.

The models are calibrated with reference to the base year 2016. All input and validation data concerning transport supply and demand datasets were collected for this base year.

Based on the available data, the model validation focuses on the comparison between observed and modelled freight flows in the following subsections:

- *Alpine crossing between Italy in the South and Austria and Switzerland in the North: CH alpine crossings (Gt. S. Bernard, Simplon, Gotthard, S. Bernardino), Brenner and Tarvis, for rail and road;*
- *Border crossing points between Austria and Germany: Kufstein, Salzburg and Passau Border Crossing Points for rail;*
- *Alpine crossing within Austria: Tauern and Schober passes for road.*

In addition, model results are validated against total and rail demand distribution by commodity group, against data published by CAFT.

# 3 Description of the actual status of the Brenner Corridor

## 3.1 THE BRENNER RAIL CORRIDOR INFRASTRUCTURE

The Brenner Corridor (or the München-Verona line over the Brenner) is a section of the Scandinavian-Mediterranean Core Network and Rail Freight Corridor that connects Italy with Austria and Germany, with a strategic role for the exchange of goods between Southern and Northern Europe.


Figure 3 – Brenner Corridor in the ScanMed Corridor

The railway line between Verona and München has a length of 435 kilometers (Verona - München), on the 7,527 kilometers of the ScanMed Corridor, and involves 3 Countries and 3 Infrastructure Managers. All the corridor is classified as Principal Line, according to the classification of the railway infrastructure adopted by the ScanMed Rail Freight Corridor (RFC).

| | **Country** | **Infrastructure Manager** | **RFC Line Category** | **Track Length** |
|---|---|---|---|---|
| **Verona QE – Brennero-Brenner** | Italy | RFI | Principal Line | 240 |
| **Brennero-Brenner – Kufstein/ Kiefersfelden** | Austria | ÖBB Infrastruktur AG | Principal Line | 110 |
| **Kufstein/ Kiefersfelden – München-Trudering** | Germany | DB Netz AG | Principal Line | 85 |

Table 1 - Brenner Corridor sections

The section is double track with 3 kV DC electrification between Verona and Brennero and 15 kV AC between Brennero and München. The characteristics of the structures allow operating trains with a D4 axle weight (22.5 tonnes per axle), with restrictions (D4L) on the Bolzano-Brenner section. The intermodal gauge standard of the line is P/C 80 on its entire length.

The Italian section is equipped with command and control, and traffic regulation functions are realised by an SCC system. In the Austrian section signalling system is PZB; ERTMS (ETCS L2) has been already deployed, and it is in operation.

The Brenner railway line currently presents significant limitations in terms of gradients and curvature and, consequently level of performance, which requires a reduction in speed and the use of double traction for most freight trains. The most critical section is in northbound direction, between Bronzolo (near Bolzano) and Innsbruck: the performance index[1], which derives from the combination of the tortuosity and the gradient of the section, reaches values above 20, with gradients of 30 per thousand; on this section, the maximum speeds allowed for freight trains are less than 100 km/h, the maximum mass that can be towed in single traction is less than 800 tons, resulting in the need for frequent use of multiple traction.

### 3.2 FREIGHT TRANSPORT DEMAND ON THE BRENNER CORRIDOR

The Brenner Corridor between Verona and München is one of the most heavily travelled freight corridors in Europe, serving a mix of trade lanes including cargo flows between Italy and the rest of Europe (especially Germany and Benelux), between Germany and Austria as well as countries in South-Eastern Europe (Slovenia, Croatia, Serbia, Bulgaria and Turkey) and finally the Austrian domestic demand.

Traffic on the Brenner Corridor includes passengers and freight rail services: long-distance passenger services (both international and domestic) are present in modest numbers. At the same time, there is a significant number of regional passenger and freight trains[2].

The number of freight trains changes during the year and during the week. There are no particular asymmetries in the two directions, even though the gradient conditions of the line are different, as already remarked.

[1] In Italy, each line is associated with a performance index which is dependent on the sum of gradient force and rolling resistance in curves (train resistance). The following table shows the performance index for each value of the train resistance.

| *index* | *resistance (daN/t)* | *index* | *resistance (daN/t)* | *index* | *resistance (daN/t)* |
|---|---|---|---|---|---|
| 1 | 4,5 | 12 | 12 | 23 | 24,6 |
| 2 | 5 | 13 | 12,9 | 24 | 25,7 |
| 3 | 5,5 | 14 | 13,8 | 25 | 27,8 |
| 4 | 6 | 15 | 14,6 | 26 | 29,3 |
| 5 | 6,5 | 16 | 15,8 | 27 | 30,8 |
| 6 | 7 | 17 | 17 | 28 | 32,5 |
| 7 | 7,7 | 18 | 18,4 | 29 | 34,2 |
| 8 | 8,4 | 19 | 19,8 | 30 | 37,5 |
| 9 | 9,2 | 20 | 20,9 | 31 | 40,5 |
| 10 | 10 | 21 | 21,9 | | |
| 11 | 11 | 22 | 22,7 | | |

[2] Passenger traffic was analysed in a separate study.

The table below show the rail volumes on the relevant sections of the Brenner corridor, as estimated in the model and validated against base year data.

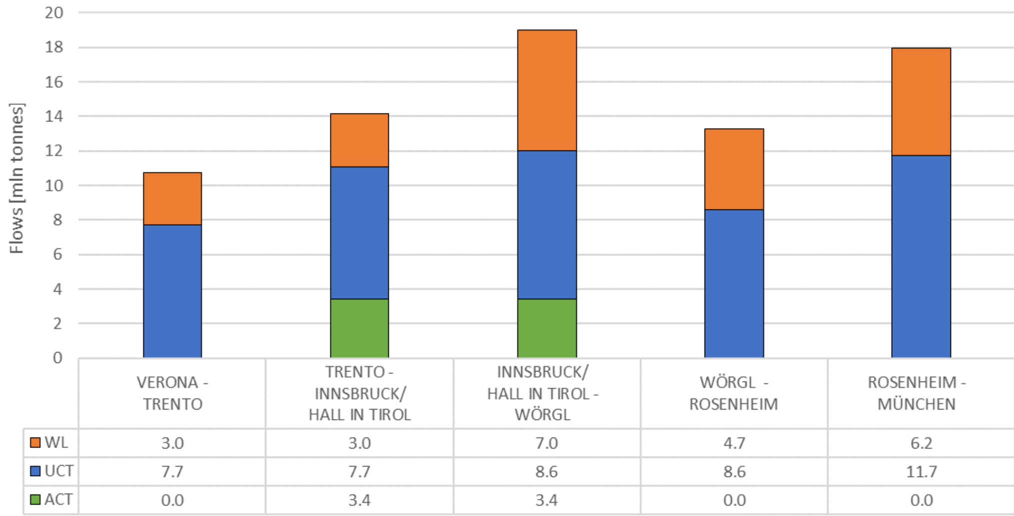



Figure 4 – Annual freight transport flows on the Brenner Corridor in 2016 by train type

As mentioned above, freight flows on the Brenner corridor serve a plurality of trade lanes that, for illustrative purpose, are grouped as follows:

- *AT <->DE via Kufstein, corresponding to the international flows between Austria and Germany via Kufstein border crossing point only, and it is mainly WL traffic (approximately 70%);*
- *AT <–> DE via Salzburg is the trade lane between Austria and Germany via Salzburg border crossing point only and is operated by both WL and UCT services. This trade lane has a primary role in international transport in Europe, interconnecting Germany and Benelux to Slovenia, Croatia and further South-Eastern European countries through the Rhine-Danube and Alpine Western Balkan Rail Freight Corridors; this trade lane only uses the Northern section of the Brenner Corridor within Germany (München-Rosenheim);*
- *AT <–> AT East-West, which includes national Austrian and international flows that primarily use the following itineraries: Itinerary 1: via Hopfgarten to/from Salzburg/Graz/Tauern pass (WL traffic only); Itinerary 2: via both Kufstein border crossing point and Salzburg border crossing point (70% WL traffic and 30% UCT traffic);*

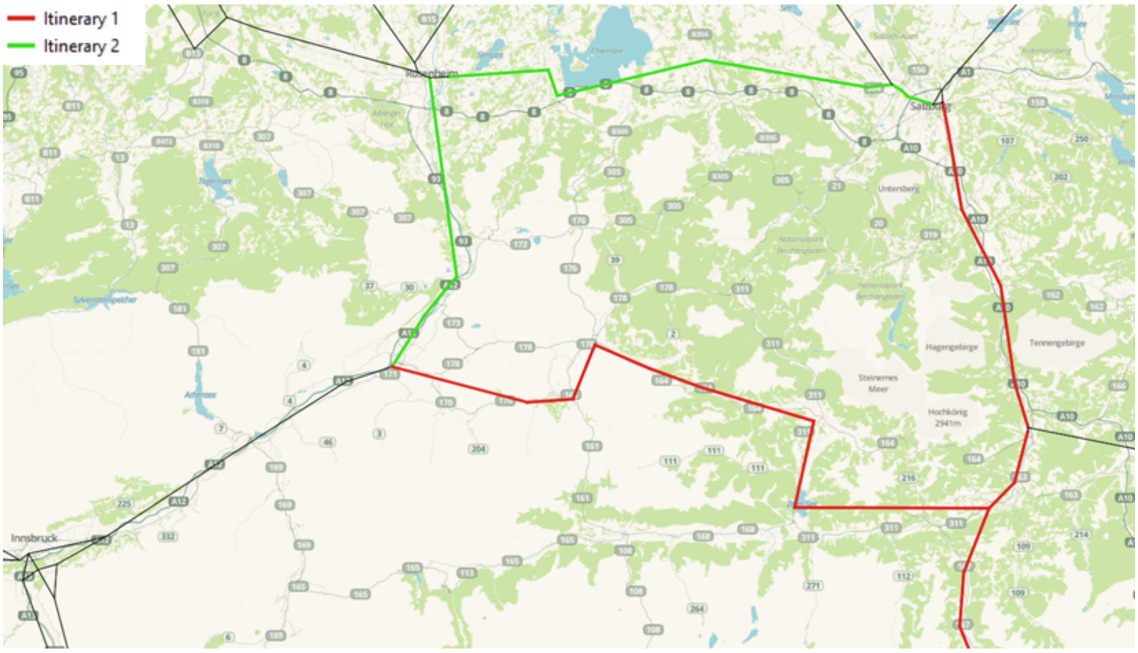



Figure 5 – Itineraries of the "*AT – AT East-West" trade lane*

- *<u>IT <–> DE to/from Trieste</u>, which includes UCT traffic between the Port of Trieste and Germany via the Tarvisio crossing;*
- *<u>IT <–> AT Trento-Wörgl</u>: ACT traffic, corresponding to the ACT flow transported by ROLA rail services currently running between the terminals of Wörgl and Trento and between the terminal of Wörgl and Brennersee;*
- *<u>IT <–> DE via Brenner</u>, which is the most relevant itinerary in terms of tonnes transported along the Brenner Corridor. It includes flows that are originated (or vice versa) in Italy and afterwards cross the IT-AT border crossing point and finally ends in Austria or Germany, especially flows towards ports in Northern Europe (Benelux or Germany mainly). These flows include a majority share of UCT traffic, whilst WL traffic has a marginal share.*

The schematic map below shows the itineraries of the above trade lanes along the Brenner rail corridor.

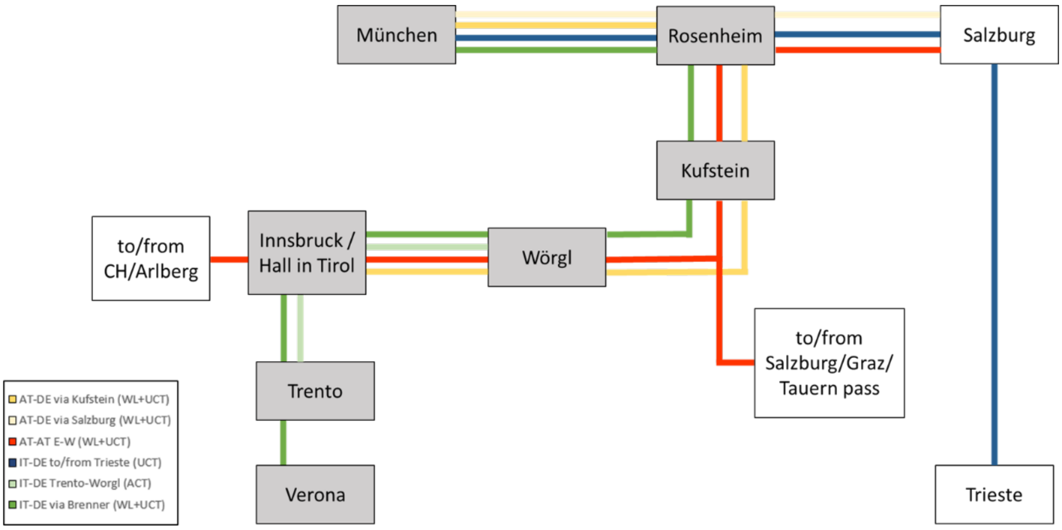
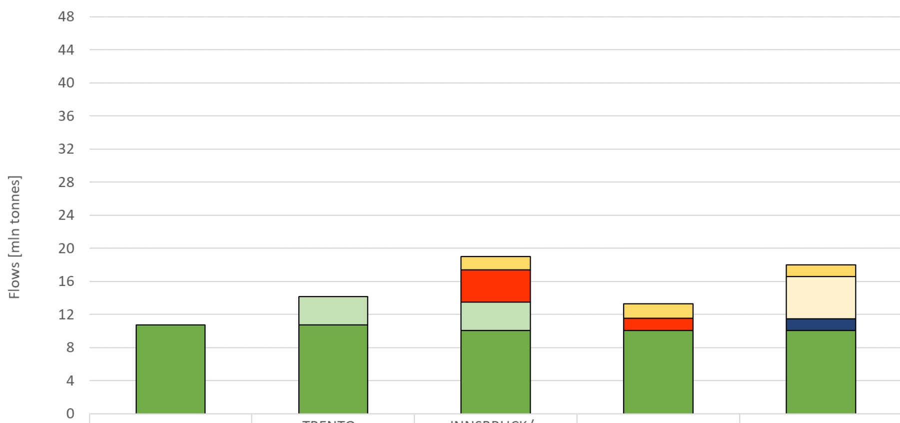



Figure 6 – Scheme of Brenner rail freight flows in 2016




| | VERONA - TRENTO | TRENTO - INNSBRUCK/ HALL IN TIROL | INNSBRUCK/ HALL IN TIROL - WÖRGL | WÖRGL - ROSENHEIM | ROSENHEIM - MÜNCHEN |
|---|---|---|---|---|---|
| AT-DE via Kufstein (WL+UCT) | 0.0 | 0.0 | 1.6 | 1.7 | 1.4 |
| AT-DE via Salzburg (WL+UCT) | 0.0 | 0.0 | 0.0 | 0.0 | 5.1 |
| AT-AT E-W (WL+UCT) | 0.0 | 0.0 | 3.9 | 1.5 | 0.0 |
| IT-DE to/from Trieste (UCT) | 0.0 | 0.0 | 0.0 | 0.0 | 1.5 |
| IT-DE Trento-Worgl (ACT) | 0.0 | 3.4 | 3.4 | 0.0 | 0.0 |
| IT-DE via Brenner (WL+UCT) | 10.7 | 10.7 | 10.1 | 10.1 | 10.0 |

Figure 7 – Rail volumes by traffic components in 2016

The figure below depicts the distribution of the rail transport volumes among the selected components shown in the graph above.

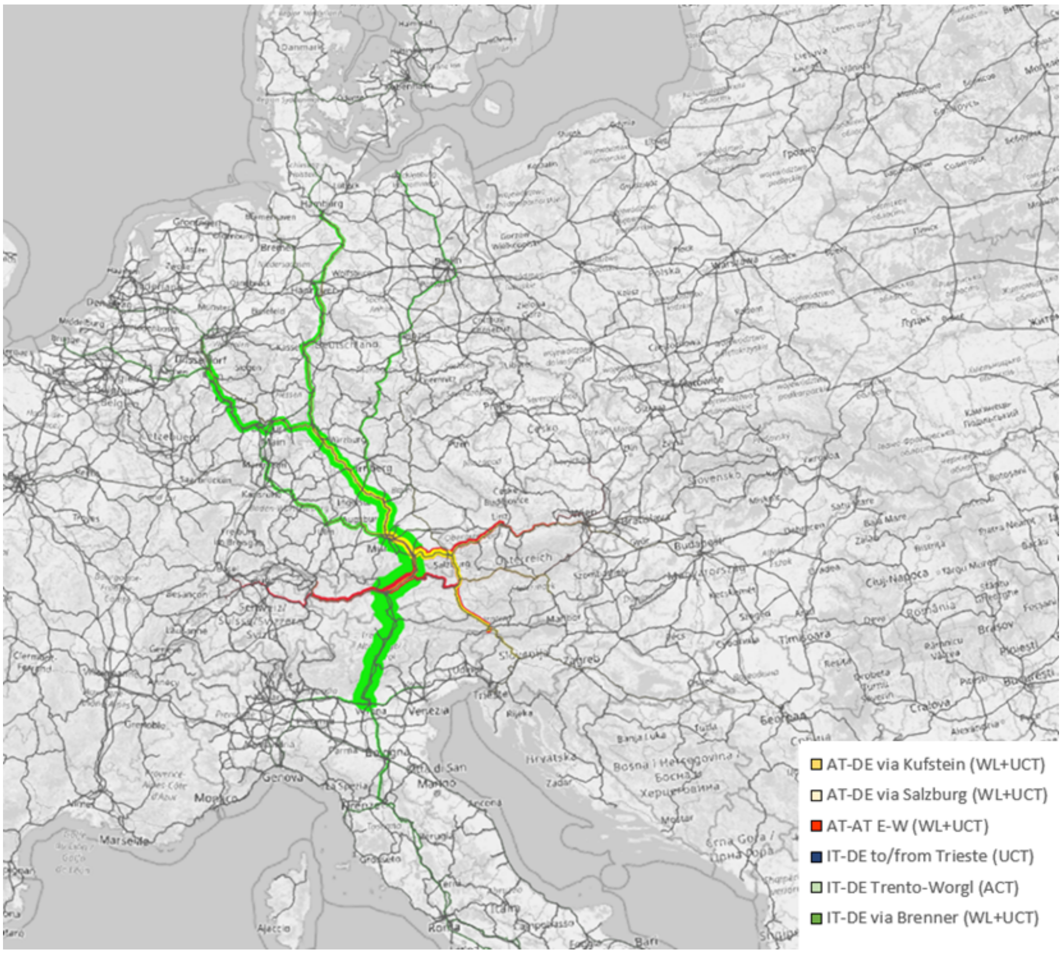



Figure 8 – Rail volumes in 2016

On the basis of the transport volumes shown in the previous figure, the corresponding number of annual trains were estimated, based on average net-net[3] tonnes by type of train. The table below shows the elaborated number of trains for 2016 on the relevant sections of the Brenner corridor.

| *ANNUAL TRAINS* | *2016 ACT* | *2016 UCT* | *2016 WL* | *2016 REGIONAL* | *2016 TOT* |
|---|---|---|---|---|---|
| MÜNCHEN - ROSENHEIM | - | 20,093 | 11,909 | 1,500 | **33,502** |
| ROSENHEIM - SALZBURG | - | 7,368 | 5,677 | 0 | **13,046** |
| ROSENHEIM - WÖRGL | - | 13,455 | 9,055 | 750 | **23,260** |
| WÖRGL - BAUMKIRCHEN | 10,634 | 13,477 | 13,510 | 2,800 | **40,421** |
| BAUMKIRCHEN - FORTEZZA | 10,634 | 12,041 | 5,884 | 250 | **28,809** |
| FORTEZZA - TRENTO | 10,634 | 12,041 | 5,884 | 0 | **28,559** |
| TRENTO - VERONA | - | 12,041 | 5,884 | 0 | **17,925** |

Table 2 - Annual trains in 2016

[3] Net-net weight: weight of the goods transported by rail, excluding both the weight of he train (loco and wagons) and the weight of the intermodal transport unit (ITU).

### 3.3 FREIGHT FLOWS AT THE BRENNER ALPINE CROSSING IN THE CONTEXT OF TRANS-ALPINE TRANSPORT

The Brenner Alpine Crossing is one of the main international multi-modal land connections between Italy and the rest of Europe. As such, it plays a prominent role for the Italian foreign trade and economy.

According to the latest data published by the Alpine Traffic Observatory (ATO), in 2019, 223.5 million tonnes of goods were carried across the Alps, almost the same amount as in 2018. 155.7 million tonnes, almost 70% of the total amount was carried by road. The remaining 30%, or 67.9 million tonnes of freight, were carried by rail.

The large majority of freight crossed the Alps in Austria (139.4 million tonnes or 62% of the total transport volume). French crossings assumed an amount of 46.3 million tonnes and Swiss crossings 37.8 million tonnes; 21% and 17% respectively). The share of Switzerland was 0.8% points lower than in 2018 and the lowest since 1999. The share of Austria was 0.4 percentage points higher than in 2018 and the highest ever. This suggests that more and more transalpine traffic uses Austrian crossings. The modal share of rail on the whole Alpine arc decreased slightly from 31.2% in 2018 to 30.4% in 2019, the lowest level ever recorded. Despite the politically declared intentions, rail has failed to increase its overall market share in transalpine freight traffic over the last 20 years.

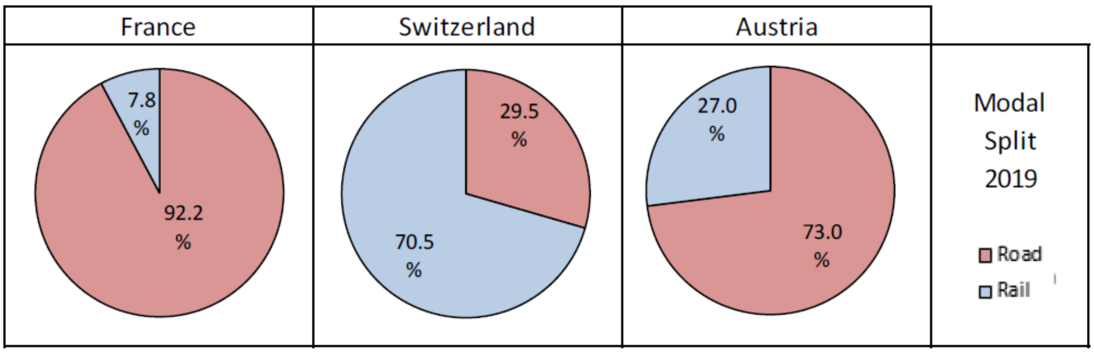



Figure 9 – Modal split of transalpine traffic by country (source. ATO)

In 2019, the Brenner ranked by far first in terms of total transport volume among all Alpine crossings:

- *Road transport crossing the Brenner pass almost reached 40 million tons, almost twice the volume across the second ranking pass of Ventimiglia, registering 20,9 million tons;*
- *Rail transport through the Brenner was 13.8 million tons, ranking second behind the Gotthard; however, this value corresponds only to around a half of the annual combined rail flows crossing the Alpine passes on the Rhine-alpine Corridor (Simplon and Gotthard).*

The tables below compare the flows at the different alpine crossings at the base year adopted in this study (2016) according to the modal aggregation adopted in the network model, where ACT is combined with road. The IT-CH crossings considered are: Simplon and Gotthard (rail); Gd St-Bernard, Simplon, Gotthard and San Bernardino (road). The other IT-AT crossings considered are Tarvis (rail); Reschen and Tarvis (road).

| *ALPINE CROSSINGS* | 2016 – mln tonnes | | | | |
|---|---|---|---|---|---|
| | **ROAD+ACT** | **WL** | **UCT** | **WL+UCT** | **TOTAL** |
| IT-CH CROSSINGS | 13.5 | 8.8 | 18.1 | 26.9 | 40.4 |
| BRENNER | 37.6 | 3.1 | 7.7 | 10.8 | 48.4 |
| OTHER IT-AT CROSSINGS | 19.3 | 5.7 | 2.3 | 8.0 | 28.5 |

Table 3 – Annual million tonnes in 2016. Source: ÖBB Infrastruktur AG

# 4 Scenarios and assumptions for the evaluation of future rail trasport volumes on the Brenner Corridor

## 4.1 DEFINITION OF THE PROGNOSIS SCENARIOS

The transport market forecasts were developed for two time horizons, corresponding to different steps in the implementation of the new Brenner Rail Corridor:

- *Mid-term (2030), when the Brenner Base Tunnel (BBT) and the construction lot 1 Fortezza – Ponte Gardena will be completed and open for traffic, together with single construction lots along the access routes;*
- *Long-term (2040), when the upgrading of the entire Brenner rail corridor will be completed, and the entire new high standard rail line between Verona and München will be open for traffic.*

At each time horizon, the market analysis considers not only the investment on the Brenner corridor, but also all the other planned rail and road investments in the study area, as well as the expected development of rail services between terminals. In addition, for each time horizon, the regional freight rail traffic on the Brenner infrastructure is added to the model results – given that this component is not considered in the transport model. A detailed description of these assumptions is provided in section 4.2.

In the study, for each time horizon, three different evaluation scenarios were analysed, taking into consideration specific assumptions about socio-economic development, transport performance and transport policy measures:

- *Business-as-usual scenario (BAU), which describes the expected "normal" evolution of the transport market in response to changes in the supply side, without considering the impact of the Covid pandemic or changing approaches in transport policies. Therefore, this scenario is based on pre-Covid* *socioeconomic projections and assumes continuity in the modal transport performance and transport policy environment.*

- *Post-Covid scenario, which describes the expected "new normal" market development, taking into account the Covid pandemic, based on recent economic projections, while retaining all other assumptions in line with the BAU;*
- *Policy scenario, which adds to the BAU scenario new significant policy measures for the internalisation of the external costs of transport as well as a further improved rail performance.*

Taking into account the assumptions and results of the three scenarios mentioned above, a fourth scenario (BCP Central Case) was eventually developed based on those assumptions and results. This step has been taken in order to identify the most realistic combination of probable framing circumstances and the resulting outcome. The BCP Central Case scenario describes the expected "new normal" market development, taking into account the Covid pandemic, based on recent economic projections, adding new moderate policy measures for the internalisation of the external costs of transport, as well as a further improved rail performance.

A brief overview of the above three scenarios is presented in the table below.

| **Scenario** | **Socio-economic development** | **Transport systems performance** | **Transport policy measures** |
|---|---|---|---|
| Business as usual (BAU) | Pre-Covid GDP projections | BAU | BAU |
| Post-Covid | Post-Covid GDP projections | BAU | BAU |
| Policy | BAU | Improved rail performance for WL (from 2030) | Significant policy measures aimed at the internalisation of the external costs of transport |
| BCP Central Case (BCP CC) | Post-Covid GDP projections | Improved rail performance for WL (from 2040) | Limited policy measures aimed at the internalisation of the external costs of transport |

Table 4 – Overview of the evaluation scenarios

The results concerning BCP Central Case scenario are presented in chapter 5 and 6, while the main results concerning the BAU, Policy and Post-Covid scenarios are presented in the Appendix.

Finally, it is worth mentioning that capacity of the railway lines has not been taken into account in the present study. Therefore the prognosis is not constrained by the available freight train paths on the infrastructure. Separate studies will indeed deal with the issue of sufficient available capacity.

## 4.2 ASSUMPTIONS CONCERNING TRANSPORT INFRASTRUCTURE AND SERVICES

### 4.2.1 The planned development of the Brenner rail corridor

According to the following table, the Brenner Base Tunnel and its northern and southern access lines are assumed to be operating at the modelled time horizons (2030 or 2040).

| Sections | Countries | Scenario |
|---|---|---|
| Innsbruck bypass | AT | 2030 |
| Brenner Base Tunnel | IT & AT | 2030 |
| Fortezza – P.te Gardena | IT | 2030 |
| Trento bypass | IT | 2030 |
| Verona junction | IT | 2030 |
| Grafing – Radfeld | AT & DE | 2040 |
| Remaining lots from P.te Gardena to Verona | IT | 2040 |

Table 5 – Major rail infrastructure works to upgrade the Brenner Corridor

Clearly, the new line will provide a considerable improvement in the technical parameters of the rail connection over the Brenner, with limited gradient (and therefore no need for double traction) and increased speed for freight trains. In particular, the new line will be developed with a maximum freight train speed of 120 Km/h, a maximum gradient of 12.5‰, a maximum train length of 740 m and a D4 axle load category.

### 4.2.2 Other infrastructure projects

The assumptions concerning the future development of the rail network in Italy, Germany and Austria were based on the review of the national and European transport investment programmes and validated by the Members of BCP.

Additional assumptions were defined for the key countries in the extended study area, namely the South-East of Europe. The primary source used in this analysis is the Alpine-Western Balkan RFC Implementation Plan (and other related documents), complemented with information on the main projects on the TEN-T Core Network Corridors.

The map overleaf shows the location of infrastructure projects considered in future scenarios. As mentioned earlier in this report, the gradient of the existing Brenner corridor requires double traction (i.e. two combined locomotives) to operate trains. Instead, the realisation of the Brenner Base Tunnel (BBT) in addition with the construction lot 1 (Fortezza – Ponte Gardena) will allow operating trains with one locomotive only over the whole corridor alignment. Since the BBT is assumed to be operational in the 2030 scenario (mid-term time horizon), the deactivation of the double traction will coincide. However, this operational improvement is not represented in the figure oveleaf.


Figure 10 – Major infrastructure works to upgrade the railway network

It shall be noted that in 2040 the München – Mühldorf – Salzburg rail line will be upgraded, and a new rail route will be available for freight traffic between München and Salzburg, alternative to the route through the Brenner Corridor (via München – Rosenheim – Salzburg).

Given that the two itineraries will be comparable in terms of performance, two different traffic prognoses are presented for each scenario for the long term (2040) time horizon:

- *Traffic prognosis A – considering the current traffic distribution on the network, i.e without diversion to München – Mühldorf – Salzburg;*
- *Traffic prognosis B – assuming 40% of traffic diverted from München – Rosenheim – Salzburg to München – Mühldorf – Salzburg.*

The aim of these two result sets is to show the specific traffic effect due to the re-routing, which may be relevant for capacity analysis and planning in the norther section of the corridor.

Finally. the traffic forecasts also take into account the planned development of the road infrastructure, including in particular the opening of an additional dynamic lane in some sections of the Brenner motorway in Italy and the Fehmarnbelt Tunnel in the Baltic Sea.

### 4.2.3 Development of rail services

In the future scenarios, the supply of freight trains is expected to increase in response to the growing demand. Any increased supply clearly improves the competitiveness of rail transport, thus contributing to a higher rail market share. Two assumptions are included in each future scenario:

- *A general increase in the frequency of the existing train connections, proportional to the increase in rail demand, which allows reaching an equilibrium between demand and supply;*
- *A specific development of new UCT connections. Given the attractiveness of the new rail infrastructures, new UCT services are expected to be provided by the freight operators in future scenarios between terminals located mainly on the Scan-Med and Alpine-Western Balkans corridors.*

The additional UCT rail services were selected based on planned infrastructure development and expectations about potential traffic growth, complemented with specific analyses on the existing demand and gaps in rail services. In particular, the criteria used to identify gaps in the UCT rail services included: a) the total transport volume of the trade lane, to estimate the potential market for rail; b) a relatively low share of UCT rail transport; c) the lack of direct rail UCT services.

Additional bidirectional train relations were added in the 2030 and 2040 scenarios, along the Scan-Med corridor (between Italy, Austria, Germany and Sweden) and Alpine-Western Balkan corridor (between Germany and Turkey, Bosnia Herzegovina, Bulgaria, Croatia, Serbia, Slovenia).

### 4.2.4 Regional rail freight traffic on the Brenner

The freight transport model includes long-distance rail freight transport only. Therefore, regional freight trains, shown in the table below, are exogenously added to the number of modelled trains to provide an accurate and complete prognosis of rail traffic. These trains are reported separately from the other flows in the results.

| Section | 2016 | 2030 | 2040 |
|---|---|---|---|
| MÜNCHEN - ROSENHEIM | 1,500 | 1,800 | 2,100 |
| ROSENHEIM - SALZBURG | - | - | - |
| ROSENHEIM - WÖRGL | 750 | 1,500 | 1,500 |
| WÖRGL - BAUMKIRCHEN | 2,800 | 2,500 | 2,500 |
| BAUMKIRCHEN - FORTEZZA | 250 | 250 | 250 |
| FORTEZZA - TRENTO | - | - | - |
| TRENTO - VERONA | - | - | - |

Table 6 - Annual regional freight trains on the Brenner Corridor

Among the German regional trains, those operating to/from the private terminal "Logistikpark Wiesböck" in Kiefersfelden were considered and those operating between Rosenheim terminal and München Nord terminal (around 520 trains in 2016). The "Logistikpark Wiesböck" terminal was rebuilt and expanded in 2015, and its traffic developed gradually. Therefore, the estimated regional flows are based on the reported traffic in 2019.

## 4.3 ASSUMPTIONS CONCERNING SOCIO-ECONOMIC, TRANSPORT AND POLICY FRAMEWORKS

### 4.3.1 Economic projections

The economic (GDP) growth rates for the BAU socio-economic scenario are based on national GDP forecasts provided by IMF (data available up to 2025). The following assumptions were also adopted to consider the Covid-19 pandemic effects on growth projections:

- *2020-2021: no growth;*
- *2021-2026: 2020-2025 GDP forecast based on IMF projections;*
- *2027-2030/2040: "Base case socio-economic scenario" growth rates.*

To illustrate the resulting economic projections, the table below shows the growth rates used for each country in the Post-Covid scenario at 2030 and 2040.

| GDP Forecast | | | | | | | | | Base case Scenario from 2027 up to 2030 / 2040 |
|---|---|---|---|---|---|---|---|---|---|
| Country | 2019 | 2020 | 2021 | 2022 | 2023 | 2024 | 2025 | 2026 | |
| Sweden | 530,884 | -4,70% | - | 3,50% | 2,90% | 2,40% | 2,10% | 2% | 1,90% |
| Belgium | 529,665 | -8,30% | - | 5,40% | 2,70% | 2,20% | 1,70% | 1,30% | 1,50% |
| Denmark | 347,031 | -4,50% | - | 3,50% | 2,50% | 2% | 1,70% | 1,70% | 1,60% |
| Finland | 269,327 | -4% | - | 3,60% | 2% | 1,80% | 1,30% | 1,30% | 1,30% |
| Ireland | 398,469 | -3% | - | 4,90% | 4,30% | 3,50% | 2,80% | 2,60% | 2,10% |
| Luxembourg | 71,113 | -5,80% | - | 5,90% | 3,80% | 3,10% | 2,50% | 2,50% | 2,30% |
| United Kingdom | 2.830,76 | -9,80% | - | 5,90% | 3,20% | 1,90% | 1,70% | 1,60% | 1,70% |
| Netherlands | 907,151 | -5,40% | - | 4% | 2% | 1,70% | 1,50% | 1,50% | 1,50% |

| GDP Forecast | | | | | | | | | Base case Scenario from 2027 up to 2030 / 2040 |
|---|---|---|---|---|---|---|---|---|---|
| Country | 2019 | 2020 | 2021 | 2022 | 2023 | 2024 | 2025 | 2026 | |
| **Austria** | **446,309** | **-6,70%** | **-** | **4,60%** | **2,10%** | **1,90%** | **1,70%** | **1,60%** | **1,50%** |
| **Germany** | **3.861,55** | **-6%** | **-** | **4,20%** | **3,10%** | **1,80%** | **1,30%** | **1,20%** | **1,20%** |
| **Italy** | **2.001,47** | **-10,60%** | **-** | **5,20%** | **2,60%** | **1,70%** | **0,90%** | **0,90%** | **0,80%** |
| **Switzerland** | **704,825** | **-5,30%** | **-** | **3,60%** | **2,10%** | **1,40%** | **1,90%** | **1,30%** | **1,60%** |
| EU | 21.623,39 | -7,20% | - | 4,70% | 3,10% | 2,40% | 2% | 1,70% | 1,40% |
| EU27 | 15.621,67 | -7,60% | - | 5% | 3,30% | 2,50% | 2% | 1,60% | 1,30% |

*Source: GDP, current prices (Billions of US Dollars – IMF, 2020*
*Real GDP growth (annual percent change) – IMF, 2020*

Table 7 - GDP forecast for the Post-Covid socio-economic scenario based on IMF data

### 4.3.2 Transport performance assumptions

4.3.2.1 Road cost drivers: travel times on the Brenner motorway and personnel costs

Future travel times on the Brenner motorway

The Brenner motorway axis between Verona and München runs mostly parallel to the rail line. It includes segments of five different motorways with varying number and technical parameters of traffic lanes.

Traffic conditions on the Brenner Motorway Corridor vary significantly by segment, season and time of the day. Still, congestion is recurrent and expected to further increase in the near future, given the continuous traffic growth, not only in long-distance but also in short-distance trips.

The following incremental delays on the München – Verona segment are included in the model at the future time horizons compared to the 2016 base year: + 30 minutes in 2030; and + 50 minutes in 2040. These delays were estimated by analysing traffic volumes and road capacity by motorway sections and considering available data on current travel times and congestion.

Road transport costs

The evolution of road transport costs is driven by several factors, including political and regulatory measures (regulation concerning emissions and alternative fuels, road charging, labour regulations, maximum permitted length of trucks), technological developments (fuel efficiency, truck platooning) and market prices of inputs (fuels, labour).

In the BCP Central Case scenario it is assumed that drivers' hourly operating cost for road transport will grow in line with EU GDP per capita[4]. Given that the model covers the whole Europe, the average GDP per capita growth in Europe was used

[4] Given that the impact of the mentioned EU regulations is limited to road transport, the cost of loco drivers is assumed constant over time.

(1.3% per year, according to the sources adopted in the study). The personnel costs and the corresponding total cost for road transport is shown in the table below.

| Cost item | Unit | 2016 | 2030 | 2040 |
|---|---|---|---|---|
| **Personnel hourly cost** | €/h | 26.4 | 31.6 | 36.0 |
| **Hourly operating cost** | €/vehicle-h | 49.9 | 55.2 | 59.6 |

Table 8 - Road transport hourly operating costs

In terms of total hourly road transport costs (excluding distance-related costs), the expected effect is an increase of +10.5% in the hourly operating cost for 2030; and +19.2% in the hourly operating cost for 2040. It shall be noted that other personnel costs (such as the component for personnel cost for maintenance and repairs and general administrative and management costs) are held constant. The same applies to all road transport costs not related to driving costs.

#### 4.3.2.2 Rail cost drivers: productivity and unit costs

Future rail transport costs are influenced by many factors, many of which, as in the case of road transport, are hardly predictable. The assumptions adopted in this study are limited to marginal productivity gains based on the likely effects of ongoing initiatives, and no disruptive changes are considered. In particular, the assumptions adopted in the BCP Central Case scenario focus on the expected increase in rail productivity for intermodal transport due to the planned development of the infrastructure parameters, which will allow running longer and heavier trains.

The table below shows the estimated average cost reduction due to an increase in train length from 18 up to 21 wagons/train, which was evaluated as a reasonable assumption for an average intermodal train.

| PARAMETER | UNIT OF M. | INTERMODAL TRAIN | |
|---|---|---|---|
| | | **BASE (2016)** | **FUTURE (2030-2040)** |
| Locomotive | - | 1 | 1 |
| Wagons | - | 18 | 21 |
| Total length | M | 569 | 639 |
| Gross weight | t | 1,255 | 1,450 |
| Net load | t | 600 | 700 |
| Train operating costs | | | |
| Fixed operating cost | €/train | 1296 | 1296 |
| Hourly operating costs | €/train-h | 525 | 540 |
| Kilometric operating costs | €/treno-km | According to national TAC | |
| Unit transport costs (train operating costs per net ton) | | | |
| **Fixed operating cost** | **€/t** | **2.2** | **1.9 (-14%)** |
| **Hourly operating costs** | **€/t-h** | **0.9** | **0.8 (-12%)** |

Table 9 - Productivity increase resulting for an increased UCT train length from 18 to 21 wagons

The cost reduction resulting for an increased UCT train length from 18 to 21 wagons is -14% for the fixed transport costs (shunting and train preparation) and -12% for the hourly operating costs, which is the main cost component. Distance-based costs (track access charges and energy) per tonne*km are considered unchanged.

The abovementioned cost reduction resulting from increased productivity are included in the BCP Central Case scenario. This assumption is considered reasonable given that an increase of the reference train length up to the maximum planned standard (740 m) was deemed unrealistic: not all UCT services in the EU will take full advantage of the increased permitted maximum length. However, it shall be noted that productivity gains for intermodal trains might be even higher, taking into account other expected developments such as the revision of the maximum weight restrictions and the increase of loading gauge to P400 on many core routes. However, the above estimate does not consider such effects.

It shall be noted that increases in productivity are also expected for conventional transport and accompanied intermodal transport. For the long-term scenario (2040), assuming that the whole corridor has been empowered (quadrupled), the BCP Central Case scenario includes an 8% increase in productivity for WL. On the contrary, no productivity gains are considered in the transport forecasts for ACT, as it is unclear whether these will be offset by a reduction in operating subsidies.

Staff wages are a relevant component of rail transport costs. However, unlikely for the road transport, rail personnel wages were not assumed to increase in real terms (i.e., above inflation). Revised regulations concerning train operations (such as the number of drivers per locomotive) may contribute in the future to reducing rather than increasing personnel costs for the railway undertakings. Therefore, unitary personnel costs for rail transport are considered constant in real terms.

#### 4.3.2.3 Hinterland rail transport generated by the Port of Trieste

Traffic between Trieste and the Brenner Corridor

Considering the entire Brenner corridor between München and Verona, rail traffic generated by hinterland transport of maritime flows via the ports in Italy is a relevant component. Currently, three ports in North Adriatic are concerned: Ravenna, Trieste and Venice. Out of these, the study focuses on the Port of Trieste, which is the most relevant both now and in perspective.

Rail flows between Trieste and München are currently routed through the Tarvis / Tauern Alpine crossing, via Gorizia, Udine, Villach, Salzburg and Rosenheim. Therefore, this rail traffic currently runs only on the Brenner Corridor's Northern section, between Rosenheim and München.

In 2019, Trieste was the first port by overall maritime traffic in Italy. Looking back to the last 15 years, the total traffic (in terms of tonnes) at the port of Trieste shows steady growth, with significant growth for containers; a moderate growth for Ro-Ro, despite a significant drop in 2019; stable traffic for liquid and solid bulk goods.

Out of the total hinterland transport (i.e., excluding transhipment and pipeline), in 2018 (most recent available statistics), the rail modal share at the port of Trieste was 42%, corresponding to around 6.2 million tonnes, as shown in the following table.

| Type | *Total tonnes* | *Rail tonnes* | *Rail share* |
|---|---|---|---|
| ***Ro-Ro*** | 7,637,768 | 2,922,324 | **38%** |
| ***Container*** | 5,411,020 | 1,833,001 | **34%** |
| ***Liquid Bulk*** | 225,110 | 92,181 | **41%** |
| ***Solid Bulk*** | 1,426,796 | 1,344,033 | **94%** |
| **Total** | **14,700,694** | **6,191,539** | **42%** |

Table 10 - Hinterland transport at the port of Trieste in 2018

An ad hoc procedure was set up to estimate the future evolution of traffic flows at the port of Trieste, taking stock of the available information concerning the existing transport market, with a specific focus on the flows concerning the Brenner Rail Corridor.

The corresponding hinterland volumes by rail were estimated considering the planned developments of the rail last-mile infrastructure, which will significantly improve the efficiency of rail transport. The tables below show the estimated future rail traffic, in terms of both volumes and number of trains.

| Segment | Rail tonnes | | | | |
|---|---|---|---|---|---|
| | 2018 | 2027 | 2030 | 2040 | 2050 |
| **Ro-Ro** | 2,922,324 | 3,643,153 | 3,791,647 | 4,138,845 | 4,319,665 |
| **Container** | 1,833,001 | 3,868,826 | 4,544,151 | 6,439,182 | 7,417,312 |
| **Liquid Bulk** | 92,181 | 116,425 | 116,425 | 116,425 | 116,425 |
| **Solid Bulk** | 1,344,033 | 1,426,796 | 1,426,796 | 1,426,796 | 1,426,796 |
| **Total** | **6,191,539** | **9,055,200** | **9,879,019** | **12,121,248** | **13,280,198** |

Table 11 - Current and foreseen hinterland transport by rail in Trieste

Based on the current origins and destinations of train services operated at the port of Trieste. The rail flows possibly diverted via the Brenner crossing in 2030 or in 2040 include all trains: a) running through the Tarvis crossing; b) transiting through München; c) with destination/origin in Belgium, Luxemburg or Western Germany. The table below shows the results of the analysis, assuming a Business-as-usual evolution. The forecasts vary only slightly according to the scenario analysed (BCP Central Case, Business-as-usual, Post-Covid or Policy).

| Segment | Mid-term (2030) | | | Long-term (2040) | | |
|---|---|---|---|---|---|---|
| | Total trains | Brenner trains | Brenner Tonnes | Total trains | Brenner trains | Brenner tonnes |
| **Ro-Ro** | 5,287 | 3,986 | 2,860,644 | 5,771 | 4,351 | 3,122,590 |
| **Container** | 7,968 | 1,732 | 987,309 | 11,291 | 2,454 | 1,399,042 |
| **Liquid Bulk** | 226 | 113 | 58,215 | 226 | 113 | 58,215 |
| **Solid Bulk** | 2,073 | 0 | 0 | 2,073 | 0 | 0 |
| **Total** | **15,554** | **5,831** | **3,906,167** | **19,361** | **6,918** | **4,579,848** |

Table 12 - Foreseen train flows between Trieste and the Brenner Corridor in 2030 and 2040, via Tarvis / Tauern or Brenner Alpine passes

The last step of this analysis concerns the different rail itineraries connecting Trieste and München (and from here, Germany and the Northern countries). Two alternative routes were considered in this analysis:

- *via Brenner Alpine crossing (Trieste, Verona, Innsbruck, Rosenheim, München);*
- *via Tarvis Alpine crossing (Trieste, Gorizia, Udine, Villach, Salzburg, Rosenheim, München).*

The two itineraries were compared in terms of times, distances and costs, using the BCP transport model, taking into account the planned infrastructure development.

The results show that currently there is a clear cost advantage of the itinerary through the Tarvis Pass. However, in 2030, the two itineraries will have a comparable cost, and in 2040 there will be a cost advantage of the itinerary through the Brenner Pass.

On this basis, the itinerary via Tarvis is retained as the preferred route in the 2030 mid-term scenario, whilst the itinerary via Brenner is considered as the preferred itinerary in the long-term time horizon (2040).

### 4.3.3 Transport policy assumptions

Considering that hypotheses and results should be intended as a common basis for planning activities of the three Countries, the following two medium and long-term transport scenarios were considered:

- *in the medium-term scenario (2030), a first set of measures aiming to internalise environmental costs (Climate Change only) is considered. In addition, a rail subsidy (applied to both UCT and WL) in Germany set at € 1.40 (47% of the Track Access Charge), in line with the existing subsidy, which was introduced after the model's base year (2016);*
- *in the long-term scenario (2040), a wider internalisation of external costs due to road freight transport and related to traffic pollution/emissions (WTT, Climate Change and Air Pollution) and road accidents is foreseen, with additional factors taking into account the vulnerability of the mountain areas located within the study area;*

| Average external and average variable infrastructure costs | Base -2016 €-cent/tkm AT | DE | IT | CH | AVG | Base - 2016 €/km AVG | 2030 €/km AVG | 2040 €/km AVG |
|---|---|---|---|---|---|---|---|---|
| WTT | 0,21 | 0,28 | 0,20 | 0,21 | 0,22 | 0,04 | | 0,04 |
| Climate change | 0,42 | 0,57 | 0,49 | 0,47 | 0,49 | 0,08 | 0,08 | 0,08 |
| Air pollution | 0,92 | 1,07 | 1,11 | 0,92 | 1,00 | 0,16 | | 0,06 |
| Accidents | 2,17 | 1,93 | 1,99 | 2,42 | 2,12 | 0,34 | | 0,14 |
| **Total** | **3,71** | **3,84** | **3,79** | **4,01** | **3,84** | **0,61** | **0,08** | **0,31** |

Air pollution costs:
-30% by 2030
-60% by 2040

Accidents costs:
-40% by 2030
-60% by 2040

Average truck load = 16 ton

| | Proposed measure Base - 2016 | 2030 | 2040 |
|---|---|---|---|
| Taxes (€/km) | 0,2 | 0,24 | 0,36 |
| *Coverage ratio – only environmental costs (%)* | *0%* | *50,0%* | *50,0%* |
| **Total operating costs per kilometre (€/km)** | **0,41** | **0,45** | **0,57** |

Table 13 - internalisation of external costs produced by road freight transport in 2016, 2030 and 2040

# 5 Transport forecasts for BCP Central Case scenario

## 5.1 OVERVIEW

The following sections present the key results of the market analysis in the mid-term time horizon (2030) and long-term time horizon (2040) for the BCP Central Case scenario. In the long term (2040), two different traffic prognoses are presented for each scenario:

- *Traffic prognosis A – considering the current traffic distribution on the network, i.e. without diversion to München – Mühldorf – Salzburg;*
- *Traffic prognosis B – assuming 40% of traffic to be diverted from München – Rosenheim – Salzburg to München – Mühldorf – Salzburg.*

These two result sets aim to show the specific traffic effect due to the rerouting to the newly upgraded München – Mühldorf – Salzburg rail line, making available an alternative rail itinerary between Germany and Austria.

The reported results include:

- *Total freight transport demand in the study area and growth compared to the validated 2016 base year volumes;*
- *Aggregated freight transport demand for the main trade lanes in the study area and modal share;*
- *Freight transport flows for the main Border Crossing Points between Italy, Switzerland and Austria and modal share;*
- *Rail freight volumes by section and rail transport mode (WL, UCT, ACT) along the Brenner corridor, further disaggregated by trade lane.*

It shall be noted that given the modelling structure adopted, in all tables and maps presenting the results by freight mode on the network, rail ACT volumes are aggregated to the road transport mode. Therefore rail volumes only include WL and UCT transport. Rail ACT volumes are instead presented separately in the outputs concerning the Brenner Rail Corridor alone.

The rail traffic results (in terms of annual and daily trains), which are the core output of this study, are presented in Chapter 6.

## 5.2 MID-TERM TIME HORIZON (2030)

Based on the GDP projections, growth rates by commodity group are estimated with the calibrated econometric model. To illustrate the resulting demand volumes, the table overleaf shows the 2016 bidirectional volumes and the growth rates for 2030 by commodity group. As a result, the overall market for freight transport for the main trade lanes in the study area is expected to grow from nearly 220 million tonnes up to nearly 267 million tonnes (+22,2%).

| CAFT | COMMODITY GROUP (CAFT aggregated classification) | 2016 [thou. tonnes] | 2030 / 2016 [growth %] |
|---|---|---|---|
| 1 | Agricultural products | 21,034 | 11.7% |
| 2 | Food products | 26,288 | 27.6% |
| 3 | Fuels | 11,082 | -4.3% |
| 4 | Metal ores and products | 33,342 | 26.6% |
| 5 | Mineral products | 48,050 | 16.7% |
| 6 | Chemicals | 48,485 | 25.6% |
| 7 | Others | 30,119 | 33.2% |
| | **Total** | **218,400** | 22.2% |

Table 14 - Demand growth in the study area - 2030 BCP Central Case

The table below provides the total volumes and the modal share for the main modes at the 2030-time horizon. The flows defined as "Italy - Central and Northern Europe" include the key commercial partner countries generating flows on the CH and AT Alpine crossings.

| TRADE LANE | TOTAL | | ROAD | UCT | WL | ROAD | UCT | WL |
|---|---|---|---|---|---|---|---|---|
| | [thou. tonnes] | 2030 / 2016 [growth %] | [thou. tonnes] | [thou. tonnes] | [thou. tonnes] | [share %] | [share %] | [share %] |
| Italy - Central and Northern Europe | 106,027 | 18.3% | 51,257 | 40,015 | 14,755 | 48.3% | 37.7% | 13.9% |
| Austria (national) | 76,604 | 20.6% | 74,526 | 1,552 | 526 | 97.3% | 2.0% | 0.7% |
| Germany – Austria and South/Eastern Europe | 84,322 | 29.3% | 59,868 | 12,951 | 11,503 | 71.0% | 15.4% | 13.6% |

Table 15 - Modal share for main modes - 2030 BCP Central Case. *Note: the flows shown as* "Italy - Central and Northern Europe" *relate to the following countries: Belgium, the Netherlands, Luxemburg, Germany, Switzerland, Austria, Denmark, Sweden, and Finland.*

From 2016 and 2030, demand change is driven by:

- *Demand growth rates, which are different for each commodity group and each country, and therefore impact also on the total market share of the three main modes, as each mode has its own share per commodity group and O/D pairs;*
- *Modal split, which develops due to the changes in the systematic utility (costs) of each main transport mode, in line with the assumptions and inputs adopted in the BCP Central Case scenario.*

The analysis of the 2030 projections shows that total flows between Italy and Central or Northern Europe (including Germany and Austria) are foreseen to grow by 18.3%. The share of rail demand (WL+UCT) is expected to exceed the share of road demand (also including ACT) transport, driven by the completion of the planned improvement of the rail infrastructure and the gains in rail services productivity. As a result, pure rail share (WL+UCT) increases from 43.3% in 2016 to 51.7% in 2030.

Total flows within Austria are expected to grow by 20.6% and the share between modes remains as in 2016, with a strong prevalence of road (97.3%), given the predominance of short-distance transport.

Lastly, flows between Germany/Austria and South or Eastern Europe will grow by 29.3%. Rail share improves from 24.9% in 2016 to 29.0% in 2030.

The next table shows the modelled transport volumes through the Alpine crossings between IT-CH, the Brenner crossing, and the other crossing between IT-AT (Tarvis and Reschen crossings) for the 2030 scenario, by mode of transport. The 2016-2030 growth rates are also included. As in the current situation, the modal split varies considerably between the main transalpine axes. On the Brenner crossing, road transport is still largely predominant, with only 36% of goods transported by rail.

| *ALPINE CROSSINGS* | 2030 – mln tonnes | | | | |
|---|---|---|---|---|---|
| | **ROAD+ACT** | **WL** | **UCT** | **WL+UCT** | **TOTAL** |
| IT-CH CROSSINGS | 12.8 | 10.6 | 23.2 | 33.7 | 46.5 |
| BRENNER | 37.7 | 3.7 | 17.3 | 20.9 | 58.6 |
| OTHER IT-AT CROSSINGS | 24.8 | 7.8 | 5.1 | 12.8 | 37.6 |

Table 16 - Annual million tonnes in 2030 BCP Central Case

| *ALPINE CROSSINGS* | Growth % (2016-2030) | | | | |
|---|---|---|---|---|---|
| | **ROAD+ACT** | **WL** | **UCT** | **WL+UCT** | **TOTAL** |
| IT-CH CROSSINGS | -7.2% | 19.8% | 27.6% | 25.0% | 14.1% |
| BRENNER | 0.3% | 20.2% | 124.7% | 95.1% | 21.4% |
| OTHER IT-AT CROSSINGS | 28.2% | 36.5% | 122.2% | 61.1% | 31.7% |

Table 17 - Growth between 2016 and 2030 BCP Central Case

The other IT-AT crossing (Tarvis and Reschen) will be interested by the highest growth concerning ROAD+ACT (+28.2%), WL (+36.5%) and UCT (+122.2%), resulting in the crossing with the highest growth overall (+31.7%). This is explained by the higher demand growth expected on the trade lanes between Italy and Eastern European countries.

The table and the map below show the modelled rail volumes by main sections of the Brenner corridor. The München – Rosenheim section is the most heavily used for rail freight transport.

| *ANNUAL $10^3$ TONNES* | *2030 ACT* | *2030 UCT* | *2030 WL* | *2030 TOT* |
|---|---|---|---|---|
| MÜNCHEN - ROSENHEIM | - | 24,283 | 7,763 | **32,045** |
| ROSENHEIM - SALZBURG | - | 6,796 | 3,911 | **10,707** |
| ROSENHEIM - WÖRGL | - | 18,664 | 5,117 | **23,781** |
| WÖRGL - BAUMKIRCHEN | 3,328 | 18,128 | 7,682 | **29,139** |
| BAUMKIRCHEN - FORTEZZA | 3,328 | 17,289 | 3,656 | **24,274** |
| FORTEZZA - TRENTO | 3,328 | 17,289 | 3,656 | **24,274** |
| TRENTO - VERONA | - | 17,289 | 3,656 | **20,945** |

Table 18 - Annual thousand tonnes in 2030 BCP Central Case

| GROWTH % | ACT | UCT | WL | TOT |
|---|---|---|---|---|
| MÜNCHEN - ROSENHEIM | - | 107% | 25% | **78%** |
| ROSENHEIM - SALZBURG | - | 88% | 30% | **62%** |
| ROSENHEIM - WÖRGL | - | 117% | 9% | **79%** |
| WÖRGL - BAUMKIRCHEN | -2% | 111% | 10% | **53%** |
| BAUMKIRCHEN - FORTEZZA | -2% | 125% | 20% | **72%** |
| FORTEZZA - TRENTO | -2% | 125% | 20% | **72%** |
| TRENTO - VERONA | - | 125% | 20% | **95%** |

Table 19 – Total growth in annual thousand tonnes between 2030 BCP Central Case and 2016

Rail volumes on relevant sections of the Brenner corridor are displayed in the figures below and are differentiated by main origin/destination of the flow, as follow:

- *AT <-> DE via Kufstein;*
- *AT <–> DE via Salzburg;*
- *AT <–> AT East-West;*
- *IT <–> DE to/from Trieste: UCT traffic between the Port of Trieste and Germany via the Tarvisio crossing;*
- *IT <–> DE Trento-Wörgl: ACT traffic;*
- *IT <–> DE via Brenner;*

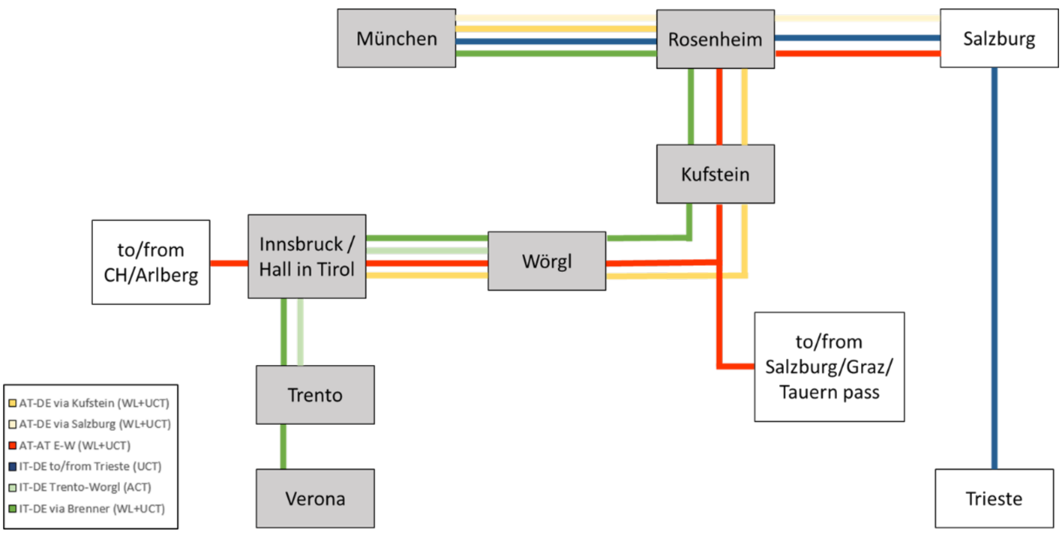
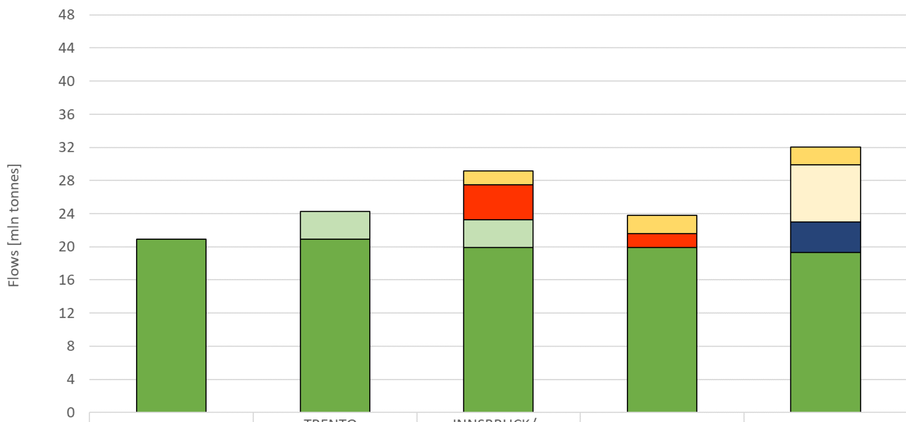



Figure 11 – Scheme of Brenner rail flows in 2030




| | VERONA - TRENTO | TRENTO - INNSBRUCK/ HALL IN TIROL | INNSBRUCK/ HALL IN TIROL - WÖRGL | WÖRGL - ROSENHEIM | ROSENHEIM - MÜNCHEN |
|---|---|---|---|---|---|
| AT-DE via Kufstein (WL+UCT) | 0.0 | 0.0 | 1.6 | 2.2 | 2.1 |
| AT-DE via Salzburg (WL+UCT) | 0.0 | 0.0 | 0.0 | 0.0 | 6.9 |
| AT-AT E-W (WL+UCT) | 0.0 | 0.0 | 4.3 | 1.7 | 0.0 |
| IT-DE to/from Trieste (UCT) | 0.0 | 0.0 | 0.0 | 0.0 | 3.7 |
| IT-DE Trento-Worgl (ACT) | 0.0 | 3.3 | 3.3 | 0.0 | 0.0 |
| IT-DE via Brenner (WL+UCT) | 20.9 | 20.9 | 19.9 | 19.9 | 19.3 |

Figure 12 – Rail flows in thousand tonnes in 2030 BCP Central Case

The figure below depicts the distribution of the rail transport volumes among the selected components shown in the graph above. It shall be noted that the routing of rail services is only indicative, as the precise routing or freight rail services is affected by the paths offered by the IMs and not only by the performance of the available infrastructure.

Volumes through the Brenner crossing run along the RFC Scan-Med to firstly serve the area of München. Significant transport relations also involve Benelux and the North-West of Germany, and particularly the related primary ports as relevant generators/attractors of UCT traffic.

Part of the volumes directed to the North of Germany run though the RFC Orient/East-Med between Berlin and the Port of Rostock, up to Sweden.

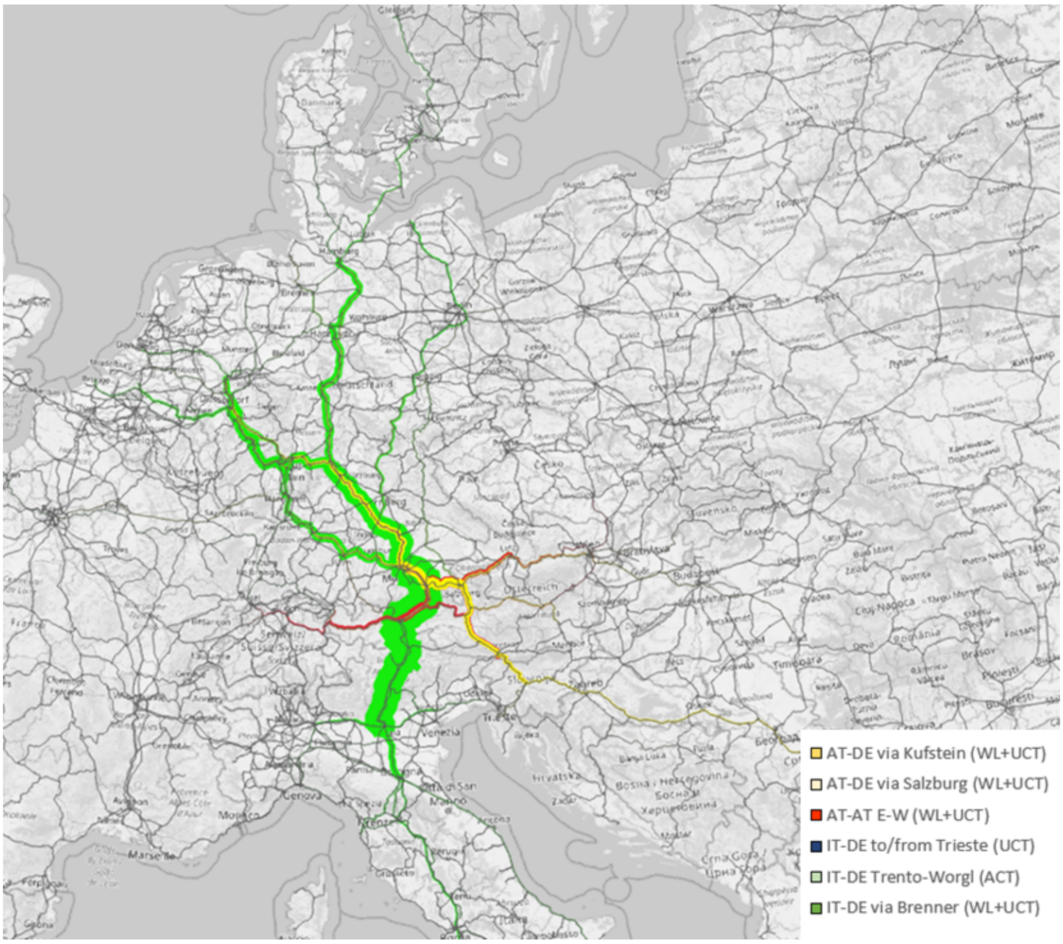



Figure 13 – Rail volumes in 2030 BCP Central Case

In order to understand the contribution of the different drivers included in the model to the expected growth in rail demand at the Brenner Alpine crossing, the following sensitivity tests were undertaken:

- *A DO-NOTHING scenario, developed for comparison purposes only and based on the same socioeconomic assumptions of the BCP CC scenario, without considering any change in the performance of transport systems due to infrastructure investments or performance enhancements (no future projects and no new rail services were taken into account);*
- *Two scenarios where growth is null and the impact of projects are considered, however, in one test this only affects route choice (i.e. the choice of the preferred Alpine crossing), while in the second also modal shift is affected.*

The elaboration of the model outputs for these scenarios allows disentangling each effect. Notwithstanding the approximations due to the non-linearity of the overall model when different effects are combined, the analysis shows that:

- *Growth in UCT rail transport is due to a combination of all drivers (own market growth, route diversion from other crossings and modal shift). It is important to remark that the absolute size of modal shift and route diversion are also influenced by the overall market growth;*

- *Growth in WL rail transport is almost entirely attributed to natural growth of the own market, with minor contributions from other drivers.*

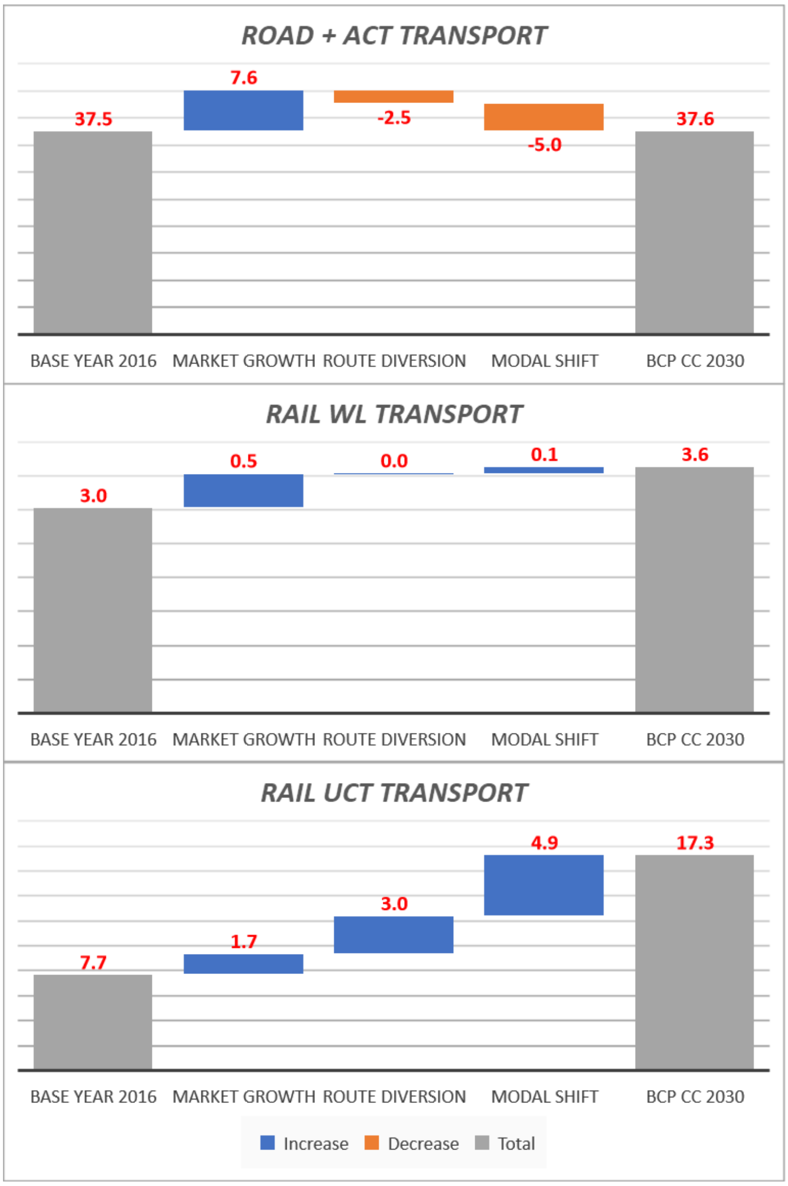



Figure 14 – Growth Analysis for the results on the Brenner Corridor

Finally, the combined effect of route diversion and shift from road to rail is presented geographically, as the difference in transported volume between the DO-NOTHING scenario (as defined above), and the BCP Central Case scenario.

The figure highlights a significant shift to the Brenner Corridor once the construction of the Brenner Base Tunnel and some of the planned construction lots along the access routes are completed. The new Brenner Corridor will attract rail flows that are currently using different paths/axis and flows currently using road mode.

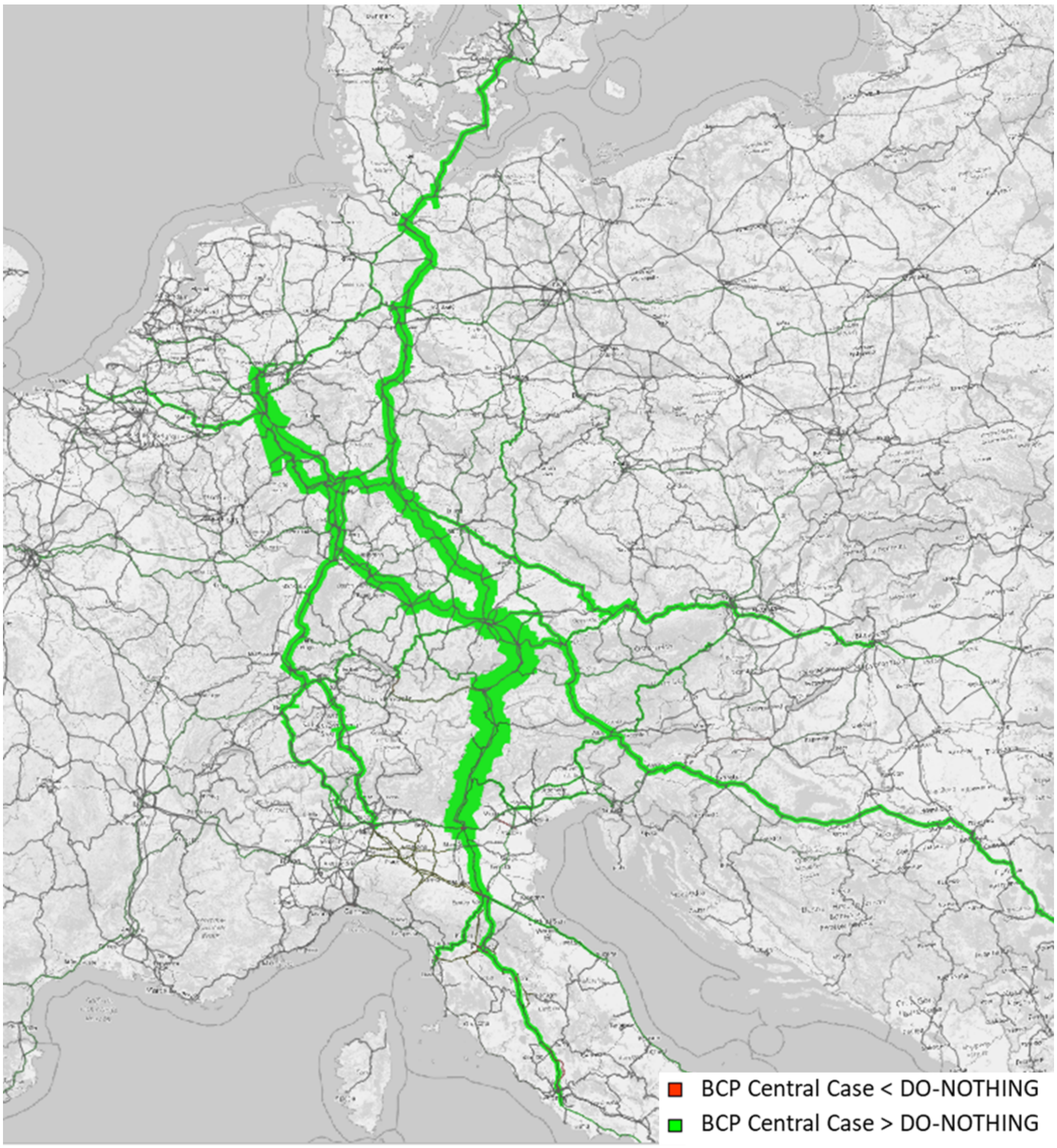



Figure 15 – Differences in rail volumes in 2030 - DO-NOTHING vs BCP Central Case

The map shows that the growth in the Brenner rail corridor by far outpaces the growth on alternative routes, considering the higher performance improvement on this corridor given the completion of the BBT.

It shall be noted that given the overall expected improvement of the rail performance, a relevant diversion in favour of the rail mode occurs not only on the Brenner but also on alternative itineraries. Indeed, the following figure shows the difference between the 2030 DO-NOTHING scenario and the 2030 BCP Central Case scenario in terms of road volumes for the mid-term horizon. In the 2030 BCP Central Case scenario, with the construction of the Brenner Base Tunnel and some of the planned construction lots along the access routes, as well as the other infrastructure included in the mid-term time horizon, there is a decrease in road volumes along the Brenner Corridor compared to the 2030 DO-NOTHING scenario.

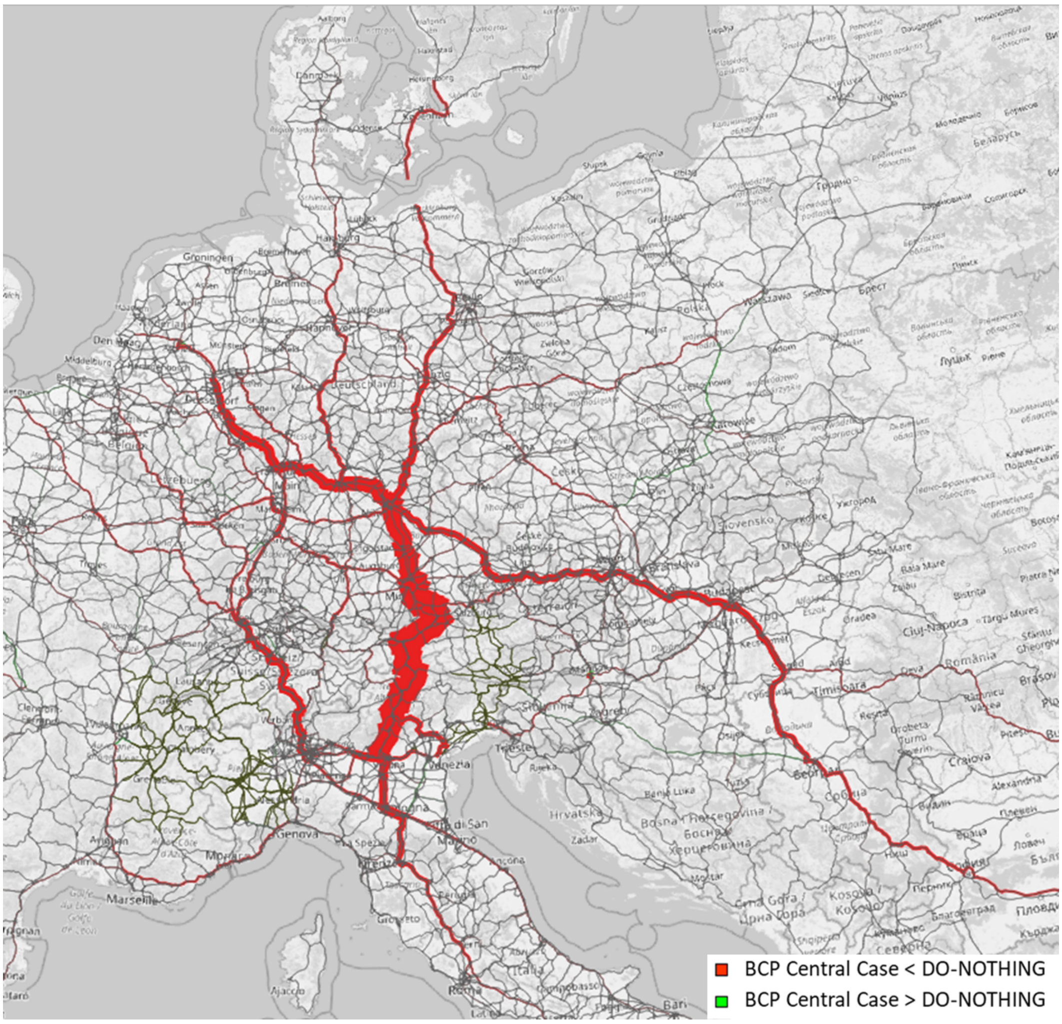



Figure 16 – Differences in road volumes in 2030 - DO-NOTHING vs BCP Central Case

## 5.3 LONG-TERM TIME HORIZON (2040)

Based on the GDP projections, growth rates by commodity group are estimated with the calibrated econometric model. To illustrate the resulting growth projections, the table below shows the 2016 bidirectional volumes and the growth rates for 2040 by commodity group. As a result, the overall demand is expected to grow from nearly 220 million tonnes up to nearly 317 million (+45.0%).

| CAFT | COMMODITY GROUP (CAFT aggregated classification) | 2016 [thou. tonnes] | 2040 / 2016 [growth %] |
|---|---|---|---|
| 1 | Agricultural products | 21,034 | 28.5% |
| 2 | Food products | 26,288 | 58.4% |
| 3 | Fuels | 11,082 | -6.3% |
| 4 | Metal ores and products | 33,342 | 57.8% |
| 5 | Mineral products | 48,050 | 27.5% |
| 6 | Chemicals | 48,485 | 53.7% |
| 7 | Others | 30,119 | 63.4% |
| | **Total** | **218,400** | **45.0%** |

Table 20 - Demand growth in the study area - 2040 BCP Central Case

The table below provides the total volumes and the modal share for the main modes at the 2040 time horizon.

The analysis of the 2040 projections shows that total flows between Italy and Central or Northern Europe are foreseen to grow by 37.1%. The share of rail demand (WL+UCT) is expected to equal the share of road transport, driven by the completion of the planned improvement of the rail infrastructure, the gains in rail services productivity and the effects of the policy measures aimed at transferring goods to more environmentally-friendly means of transport. As a result, rail share grows from 43.3% in 2016 to 57.5% in 2040.

The total flows within Austria are expected to grow by 35.1%, and the share between modes are foreseen to remain almost as they were in 2016, with a substantial prevalence of road transport (97.0%).

Lastly, flows between Germany/Austria and Southern or Eastern Europe will grow by 65.5%. Rail share improves from 24.9% in 2016 to 32.4% in 2040.

| TRADE LANE | TOTAL | | ROAD | UCT | WL | ROAD | UCT | WL |
|---|---|---|---|---|---|---|---|---|
| | [thou. tonnes] | 2040 / 2016 [growth %] | [thou. tonnes] | [thou. tonnes] | [thou. tonnes] | [share %] | [share %] | [share %] |
| Italy - Central and Northern Europe | 122,886 | 37.1% | 52,193 | 52,808 | 17,886 | 42.5% | 43.0% | 14.6% |
| Austria (national) | 85,828 | 35.1% | 83,279 | 1,910 | 639 | 97.0% | 2.2% | 0.7% |
| Germany – Austria and South/Eastern Europe | 107,925 | 65.5% | 72,931 | 17,836 | 17,157 | 67.6% | 16.5% | 15.9% |

Table 21 - Modal share for main modes - 2040 BCP Central Case. *Note: the flows shown as* "Italy - Central and Northern Europe" *relate to the following countries: Belgium, the Netherlands, Luxemburg, Germany, Switzerland, Austria, Denmark, Sweden, and Finland.*

The table shows the modelled transport volumes through the Alpine crossings between IT-CH, the Brenner crossing and the other crossing between IT-AT (Tarvis and Reschen crossings) for the 2040 scenario by mode of transport. The 2016-2040 growth rates are also included.

Overall, the modal split varies considerably between the main transalpine axes. The rail share at the Brenner crossing is expected to balance the share of the road mode, with 50% of goods transported by rail.

| *ALPINE CROSSINGS* | 2040 – mln tonnes | | | | |
|---|---|---|---|---|---|
| | ROAD+ACT | WL | UCT | WL+UCT | TOTAL |
| IT-CH CROSSINGS | 17.3 | 12.6 | 29.0 | 41.6 | 58.8 |
| BRENNER | 33.5 | 4.4 | 29.4 | 33.8 | 67.3 |
| OTHER IT-AT CROSSINGS | 13.8 | 9.6 | 2.0 | 11.7 | 25.4 |

Table 22 - Annual million tonnes in 2040 BCP Central Case

| *ALPINE CROSSINGS* | Growth % (2016-2040) | | | | |
|---|---|---|---|---|---|
| | ROAD+ACT | WL | UCT | WL+UCT | TOTAL |
| IT-CH CROSSINGS | 25.5% | 42.5% | 59.6% | 54.0% | 44.4% |
| BRENNER | -10.7% | 45.6% | 282.0% | 215.0% | 39.5% |
| OTHER IT-AT CROSSINGS | -28.7% | 69.4% | -10.3% | 46.5% | -10.8% |

Table 23 - Growth between 2016 and 2040 BCP Central Case

At this time horizon, the other IT-AT crossing (Tarvis+Reschen) will be interested by a significant decline in road transport. Indeed, to reduce its transport costs, trucks change paths, crossing Italy and Slovenia (Villa Opicina). This detour allows bypassing the area of the Alpine convention, where a higher environmental charge is applied (See section 4.3.3). To a lower extent, a similar effect occurs on the Brenner, where some road traffic is shifted to the alpine crossing via Switzerland, where the road segment associated with higher environmental toll rates is shorter.

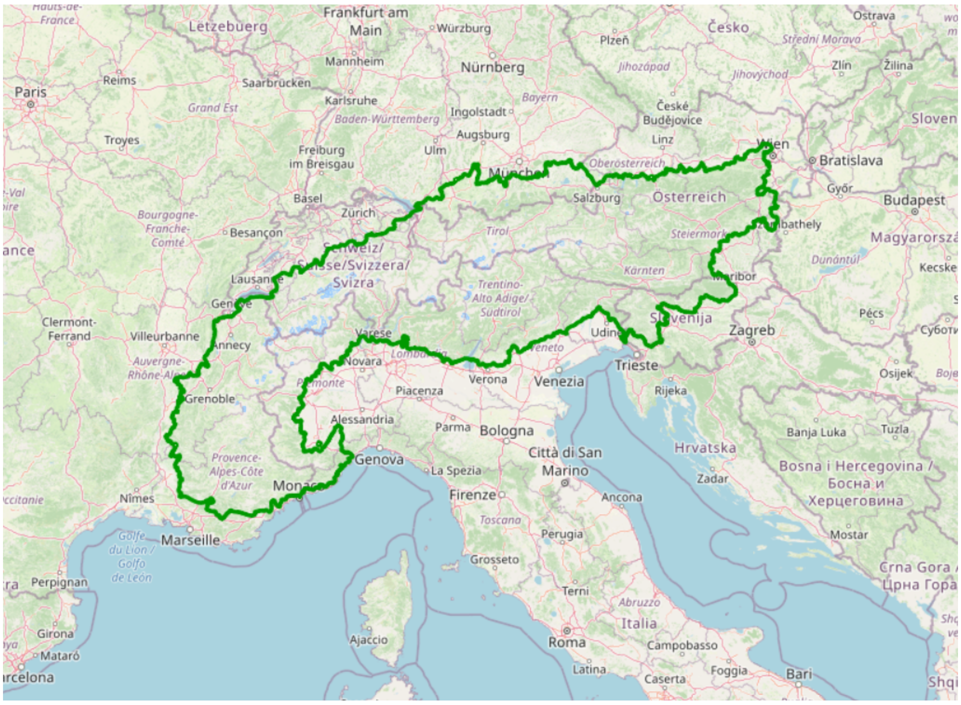



Figure 17 – Perimeter of the Alpine Convention Region

The highest increase in rail UCT is foreseen on the Brenner (282.0%), which is also partially due to the route diversion of UCT rail services between München and the port of Trieste. In consideration of the improved performance of the Brenner Corridor, the paths of these services are assumed to be shifted from the current itinerary (via Tarvis/Tauern) to the Brenner. Therefore, this also explains the expected decline in UCT transport on the other IT-AT crossings.

The table and the map below show the modelled rail volumes on the relevant sections of the Brenner Corridor for both the following scenarios:

- *Traffic prognosis A, without the diversion to München – Mühldorf – Salzburg;*
- *Traffic prognosis B, with the diversion to München – Mühldorf – Salzburg.*

| *ANNUAL $10^3$ TONNES* | *2040 ACT* | *2040 UCT* | *2040 WL* | *2040 TOT* |
|---|---|---|---|---|
| MÜNCHEN – ROSENHEIM | - | 34,671 | 10,186 | **44,857** |
| ROSENHEIM – SALZBURG | - | 5,055 | 5,351 | **10,406** |
| ROSENHEIM – WÖRGL | - | 31,212 | 6,375 | **37,587** |
| WÖRGL – BAUMKIRCHEN | 2,827 | 30,451 | 9,597 | **42,875** |
| BAUMKIRCHEN - FORTEZZA | 2,827 | 29,389 | 4,429 | **36,646** |
| FORTEZZA - TRENTO | 2,827 | 29,389 | 4,429 | **36,646** |
| TRENTO - VERONA | - | 29,389 | 4,429 | **33,819** |

Table 24 - Annual thousand tonnes in 2040 BCP Central Case (Traffic prognosis A - without diversion to München – Mühldorf – Salzburg)

| *GROWTH RATE%* | *ACT* | *UCT* | *WL* | *TOT* |
|---|---|---|---|---|
| MÜNCHEN - ROSENHEIM | - | 195% | 63% | **150%** |
| ROSENHEIM - SALZBURG | - | 40% | 78% | **57%** |
| ROSENHEIM - WÖRGL | - | 263% | 36% | **183%** |
| WÖRGL - BAUMKIRCHEN | -17% | 254% | 37% | **126%** |
| BAUMKIRCHEN - FORTEZZA | -17% | 282% | 46% | **159%** |
| FORTEZZA - TRENTO | -17% | 282% | 46% | **159%** |
| TRENTO - VERONA | - | 282% | 46% | **215%** |

Table 25 - Growth rate in annual thousand tonnes between 2040 BCP Central Case (Traffic prognosis A - without diversion to München – Mühldorf – Salzburg) and 2016

It shall be noted that ACT is a product of transport policy and dependent on actual political frame conditions and subsidies. ACT has been calculated exogenously aside from the model, based on road transport volumes. In 2040 road volumes decrease compared to 2030, causing a reduction in ACT volumes.

| ANNUAL $10^3$ TONNES | 2040 ACT | 2040 UCT | 2040 WL | 2040 TOT |
|---|---|---|---|---|
| MÜNCHEN - ROSENHEIM | - | 32,649 | 8,046 | **40,695** |
| ROSENHEIM - SALZBURG | - | 3,033 | 3,211 | **6,244** |
| ROSENHEIM - WÖRGL | - | 31,212 | 6,375 | **37,587** |
| WÖRGL - BAUMKIRCHEN | 2,827 | 30,451 | 9,597 | **42,875** |
| BAUMKIRCHEN - FORTEZZA | 2,827 | 29,389 | 4,429 | **36,646** |
| FORTEZZA - TRENTO | 2,827 | 29,389 | 4,429 | **36,646** |
| TRENTO - VERONA | - | 29,389 | 4,429 | **33,819** |

Table 26 - Annual thousand tonnes in 2040 BCP Central Case (Traffic prognosis B - with diversion to München – Mühldorf – Salzburg)

| GROWTH RATE% | ACT | UCT | WL | TOT |
|---|---|---|---|---|
| MÜNCHEN - ROSENHEIM | - | 178% | 29% | **126%** |
| ROSENHEIM - SALZBURG | - | -16% | 7% | **-6%** |
| ROSENHEIM - WÖRGL | - | 263% | 36% | **183%** |
| WÖRGL - BAUMKIRCHEN | -17% | 254% | 37% | **126%** |
| BAUMKIRCHEN - FORTEZZA | -17% | 282% | 46% | **159%** |
| FORTEZZA - TRENTO | -17% | 282% | 46% | **159%** |
| TRENTO - VERONA | - | 282% | 46% | **215%** |

Table 27 - Growth rate in annual thousand tonnes between 2040 BCP Central Case (Traffic prognosis B - with diversion to München – Mühldorf – Salzburg) and 2016

Rail volumes on relevant sections of the Brenner Corridor are displayed in the figures below and are differentiated by main Origin/Destination of the flow, as follows:

- *AT <-> DE via Kufstein;*
- *AT <–> DE via Salzburg;*
- *AT <–> AT East-West;*
- *IT <–> DE to/from Trieste: UCT traffic between the Port of Trieste and Germany via the Tarvisio crossing;*
- *IT <–> DE Trento-Wörgl: ACT traffic;*
- *IT <–> DE via Brenner.*

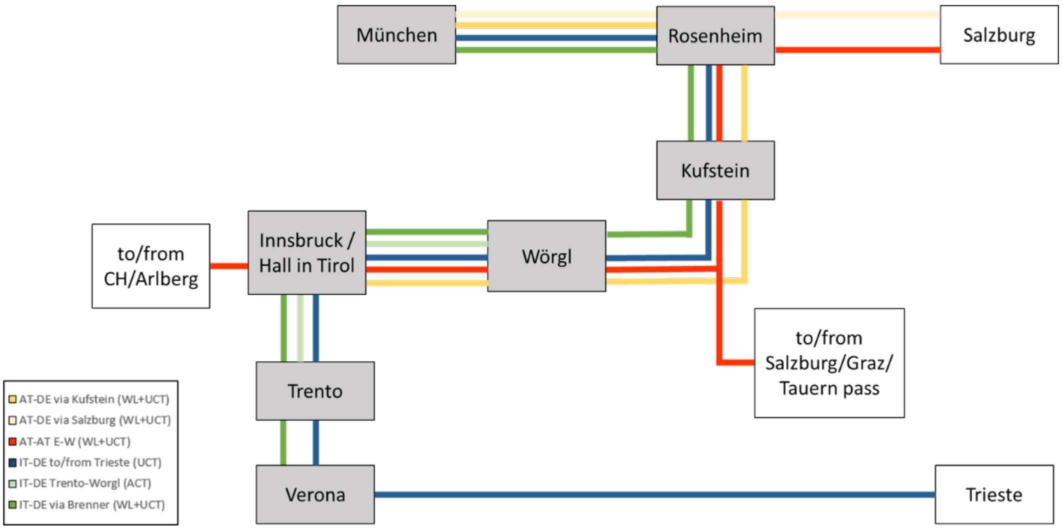
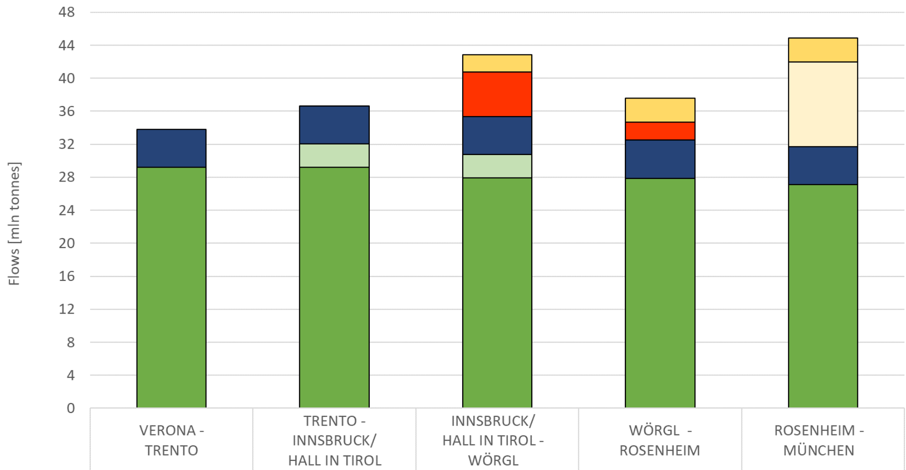
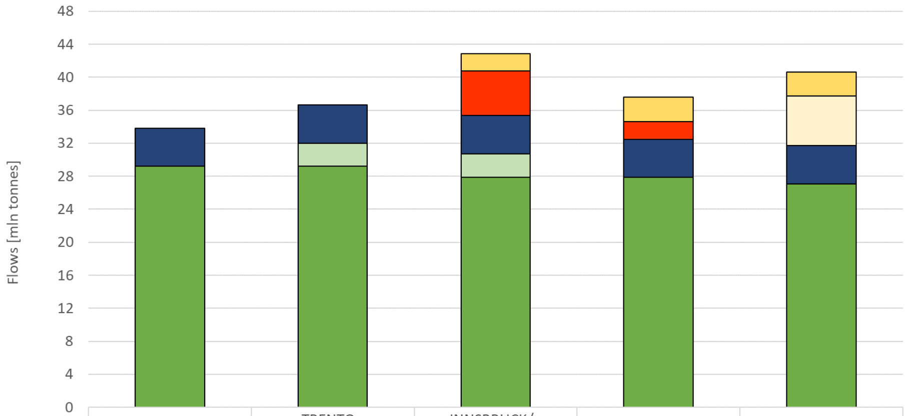



Figure 18 – Scheme of Brenner rail flows in 2040




| | VERONA - TRENTO | TRENTO - INNSBRUCK/ HALL IN TIROL | INNSBRUCK/ HALL IN TIROL - WÖRGL | WÖRGL - ROSENHEIM | ROSENHEIM - MÜNCHEN |
|---|---|---|---|---|---|
| AT-DE via Kufstein (WL+UCT) | 0.0 | 0.0 | 2.1 | 2.9 | 2.9 |
| AT-DE via Salzburg (WL+UCT) | 0.0 | 0.0 | 0.0 | 0.0 | 10.2 |
| AT-AT E-W (WL+UCT) | 0.0 | 0.0 | 5.4 | 2.2 | 0.0 |
| IT-DE to/from Trieste (UCT) | 4.6 | 4.6 | 4.6 | 4.6 | 4.6 |
| IT-DE Trento-Worgl (ACT) | 0.0 | 2.8 | 2.8 | 0.0 | 0.0 |
| IT-DE via Brenner (WL+UCT) | 29.2 | 29.2 | 27.9 | 27.9 | 27.1 |

Figure 19 – Rail volumes by traffic components in 2040 (Traffic prognosis A - without diversion to München – Mühldorf – Salzburg)




| | VERONA - TRENTO | TRENTO - INNSBRUCK/ HALL IN TIROL | INNSBRUCK/ HALL IN TIROL - WÖRGL | WÖRGL - ROSENHEIM | ROSENHEIM - MÜNCHEN |
|---|---|---|---|---|---|
| AT-DE via Kufstein (WL+UCT) | 0.0 | 0.0 | 2.1 | 2.9 | 2.9 |
| AT-DE via Salzburg (WL+UCT) | 0.0 | 0.0 | 0.0 | 0.0 | 6.0 |
| AT-AT E-W (WL+UCT) | 0.0 | 0.0 | 5.4 | 2.2 | 0.0 |
| IT-DE to/from Trieste (UCT) | 4.6 | 4.6 | 4.6 | 4.6 | 4.6 |
| IT-DE Trento-Worgl (ACT) | 0.0 | 2.8 | 2.8 | 0.0 | 0.0 |
| IT-DE via Brenner (WL+UCT) | 29.2 | 29.2 | 27.9 | 27.9 | 27.1 |

Figure 20 – Rail volumes by traffic components in 2040 (Traffic prognosis B - with diversion to München – Mühldorf – Salzburg)

The figure below depicts the distribution of the rail transport volumes among the selected components shown in the graph above.

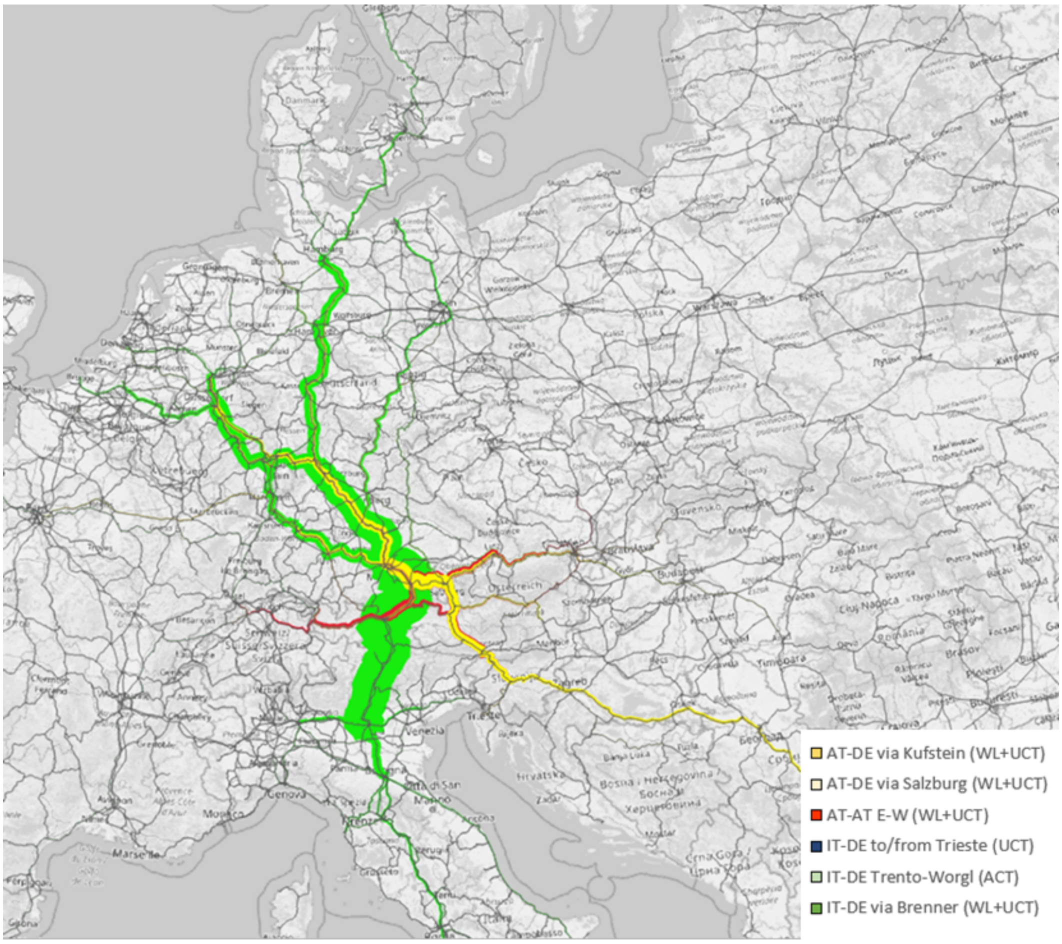



Figure 21 – Rail volumes in 2040 BCP Central Case

# 6 Rail traffic forecasts on the Brenner Corridor

## 6.1 METHODOLOGY AND ASSUMPTIONS TO ESTIMATE DAILY TRAIN TRAFFIC

The number of annual and daily trains per section is one of the key outputs expected from this study, as it serves multiple purpose, such as project communication, analysis and evaluations in different approval procedures (e.g. impact assessment of environmental impacts such as noise modelling), capacity analysis, assessment of the future operating quality (efficient, resilient and safe) and timetable development.

In line with the approach commonly adopted in rail freight studies, the expected number of daily trains per section of the Brenner Corridor is calculated based on the estimated annual transport volumes (in tonnes), divided by the average train load (by train type) and by the number of operational days per year.

The assumptions concerning the average train load area based on the analysis of the most recent data available on the Brenner corridor and assumptions concerning the specific productivity gains on the corridor in the medium and long term. The analysis is undertaken separately by train type (UCT, WL and ACT), to identify specific assumptions for each mode.

The table below summarises the average (bi-directional) train load for UCT, WL, and ACT trains assumed in the study at the different time horizons for the traffic flows on the Brenner Corridor between Verona and Rosenheim.

| Time horizon | ACT | UCT | WL |
|---|---|---|---|
| **2016** | 320 | 639 | 517 |
| **Mid-term (2030)** | 530 | 700 | 560 |
| **Long-term (2040)** | 580 | 715 | 560 |

Table 28 - Average train load for the flows on the Brenner Corridor between Verona and Rosenheim in 2016, 2030 and 2040

Following a similar methodology and based on information provided by ÖBB Infrastruktur AG and DB Netz AG, a specific assumption about train average load was developed for the transport flows entering or leaving the Brenner Corridor in Rosenheim, which are then mainly transported via Salzburg.

| Time horizon | ACT | UCT | WL |
|---|---|---|---|
| **2016** | - | 490 | 530 |
| **Mid-term (2030)** | - | 540 | 575 |
| **Long-term (2040)** | - | 550 | 575 |

Table 29 - Average train load for the flows on the Brenner Corridor entering or leaving the corridor in Rosenheim in 2016, 2030 and 2040

At present, the three countries along the corridor use different definitions to assess and report the number of daily trains on a railway cross section. Indeed, daily train figures are used for diverse purposes and, in absence of harmonisation, different values of the number of operational days that is used as divisor to calculate the daily flows from the annual traffic are in place. In Germany, in the context of the elaboration of the “Bundesverkehrswegeplan”, the mathematical number of operation days per year was defined by 283 based on the analysis of existing and forecasted opening times of terminals. In Austria, based on the analysis of daily train numbers, a divisor of 250 is applied for the current year as well as for forecasts. RFI normally adopts a number of operation days of 260.

The application of these national approaches leads to inconsistent train figures along the corridor, especially at national borders. In consideration of the target to achieve a consistent and coordinated forecast of daily train traffic on the whole Brenner corridor from München to Verona, a unified assumption concerning the number of operational days was developed in this study based on the statistical analysis of the historical distribution of daily train traffic. In particular, it was decided to adopt as a criterion the number of operational days corresponding to a particular quantile of the daily train traffic flows (i.e. the divisor is calculated so that the obtained number of daily trains is not exceeded for the defined % of days in a year).

Based on actual traffic data and operational considerations, the working group opted to apply a quantile of 90% to operations on the Brenner corridor, which corresponds to a mathematical number of operation days of 255 day per year for the whole Brenner corridor from München to Verona.

The tables below show the annual trains on the main sections of the Brenner Corridor in the mid-term and long-term time horizon for the BCP Central Case scenarios.

| ***ANNUAL TRAINS*** | ***2030 ACT*** | ***2030 UCT*** | ***2030 WL*** | ***2030 REGIONAL*** | ***2030 TOT*** |
|---|---|---|---|---|---|
| MÜNCHEN - ROSENHEIM | - | 37,567 | 13,680 | 1,800 | **53,047** |
| ROSENHEIM - SALZBURG | - | 12,585 | 6,801 | - | **19,386** |
| ROSENHEIM - WÖRGL | - | 26,664 | 9,138 | 1,500 | **37,302** |
| WÖRGL - BAUMKIRCHEN | 6,280 | 25,898 | 13,719 | 2,500 | **48,397** |
| BAUMKIRCHEN - FORTEZZA | 6,280 | 24,699 | 6,530 | 250 | **37,759** |
| FORTEZZA - TRENTO | 6,280 | 24,699 | 6,530 | - | **37,509** |
| TRENTO - VERONA | - | 24,699 | 6,530 | - | **31,229** |

Table 30 - Annual trains in 2030 BCP Central Case

| ***ANNUAL TRAINS*** | ***2040 ACT*** | ***2040 UCT*** | ***2040 WL*** | ***2040 REGIONAL*** | ***2040 TOT*** |
|---|---|---|---|---|---|
| MÜNCHEN - ROSENHEIM | - | 52,553 | 17,941 | 2,100 | **72,594** |
| ROSENHEIM - SALZBURG | - | 9,190 | 9,307 | - | **18,497** |
| ROSENHEIM - WÖRGL | - | 43,653 | 11,385 | 1,500 | **56,538** |
| WÖRGL - BAUMKIRCHEN | 4,874 | 42,589 | 17,139 | 2,500 | **67,102** |
| BAUMKIRCHEN - FORTEZZA | 4,874 | 41,105 | 7,910 | 250 | **54,139** |
| FORTEZZA - TRENTO | 4,874 | 41,105 | 7,910 | - | **53,889** |
| TRENTO - VERONA | - | 41,105 | 7,910 | - | **49,015** |

Table 31 - Annual trains in 2040 BCP Central Case (Traffic prognosis A - without diversion to München – Mühldorf – Salzburg)

| ***ANNUAL TRAINS*** | ***2040 ACT*** | ***2040 UCT*** | ***2040 WL*** | ***2040 REGIONAL*** | ***2040 TOT*** |
|---|---|---|---|---|---|
| MÜNCHEN - ROSENHEIM | - | 48,871 | 14,205 | 2,100 | **65,176** |
| ROSENHEIM - SALZBURG | - | 5,514 | 5,584 | - | **11,098** |
| ROSENHEIM - WÖRGL | - | 43,653 | 11,385 | 1,500 | **56,538** |
| WÖRGL - BAUMKIRCHEN | 4,874 | 42,589 | 17,139 | 2,500 | **67,102** |
| BAUMKIRCHEN - FORTEZZA | 4,874 | 41,105 | 7,910 | 250 | **54,139** |
| FORTEZZA - TRENTO | 4,874 | 41,105 | 7,910 | - | **53,889** |
| TRENTO - VERONA | - | 41,105 | 7,910 | - | **49,015** |

Table 32 - Annual trains in 2040 BCP Central Case (Traffic prognosis B - with diversion to München – Mühldorf – Salzburg)

## 6.2 DAILY TRAINS BY BRENNER CORRIDOR SECTIONS

The following tables show the daily trains on the relevant sections of the Brenner Corridor in the mid-term and long-term time horizon for the BCP Central Case scenarios. All further considerations regarding the extension of the infrastructure at the Brenner corridor should be based on the above-derived train numbers. This applies especially for the required capacity studies. Due to different national methods to determine capacity constraints, however, other representations of the estimated yearly train traffic can be used, which, however, widely show the daily load derived here as a result.

| *DAILY TRAINS* | *2030 ACT* | *2030 UCT* | *2030 WL* | *2030 REGIONAL* | *2030 TOT* |
|---|---|---|---|---|---|
| MÜNCHEN - ROSENHEIM | - | 148 | 54 | 8 | **209** |
| ROSENHEIM - SALZBURG | - | 50 | 27 | - | **77** |
| ROSENHEIM - WÖRGL | - | 105 | 36 | 6 | **147** |
| WÖRGL - BAUMKIRCHEN | 25 | 102 | 54 | 10 | **190** |
| BAUMKIRCHEN - FORTEZZA | 25 | 97 | 26 | 1 | **149** |
| FORTEZZA - TRENTO | 25 | 97 | 26 | - | **148** |
| TRENTO - VERONA | - | 97 | 26 | - | **123** |

Table 33 - Daily trains in 2030 BCP Central Case

| *DAILY TRAINS* | *2040 ACT* | *2040 UCT* | *2040 WL* | *2040 REGIONAL* | *2040 TOT* |
|---|---|---|---|---|---|
| MÜNCHEN - ROSENHEIM | - | 207 | 71 | 9 | **285** |
| ROSENHEIM - SALZBURG | - | 37 | 37 | - | **73** |
| ROSENHEIM - WÖRGL | - | 172 | 45 | 6 | **222** |
| WÖRGL - BAUMKIRCHEN | 20 | 168 | 68 | 10 | **264** |
| BAUMKIRCHEN - FORTEZZA | 20 | 162 | 32 | 1 | **213** |
| FORTEZZA - TRENTO | 20 | 162 | 32 | - | **212** |
| TRENTO - VERONA | - | 162 | 32 | - | **193** |

Table 34 - Daily trains in 2040 BCP Central Case (Traffic prognosis A - without diversion to München – Mühldorf – Salzburg)

| *DAILY TRAINS* | *2040 ACT* | *2040 UCT* | *2040 WL* | *2040 REGIONAL* | *2040 TOT* |
|---|---|---|---|---|---|
| MÜNCHEN - ROSENHEIM | - | 192 | 56 | 9 | **256** |
| ROSENHEIM - SALZBURG | - | 22 | 22 | - | **44** |
| ROSENHEIM - WÖRGL | - | 172 | 45 | 6 | **222** |
| WÖRGL - BAUMKIRCHEN | 20 | 168 | 68 | 10 | **264** |
| BAUMKIRCHEN - FORTEZZA | 20 | 162 | 32 | 1 | **213** |
| FORTEZZA - TRENTO | 20 | 162 | 32 | - | **212** |
| TRENTO - VERONA | - | 162 | 32 | - | **193** |

Table 35 - Daily trains in 2040 BCP Central Case (Traffic prognosis B - with diversion to München – Mühldorf – Salzburg)