

# **Brenner Base Tunnel Project – Rails for Europe**

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**Key words:** Traffic, European Infrastructure, Geodetic Framework, Tracks.

## **ABSTRACT**

The Munich-Verona axis is one of the most important traffic corridors in Europe. Due to predictable increase of traffic the planning of traffic corridors is of major importance. For this reason in 1994 the European Council has included the upgrading of the railway line in the list of the 14 TEN (trans-European networks) priority projects. The project is a challenge for all participants to find feasible financing procedures as well as for technicians to scope with technical and geological obstacles. Especially all fields of the surveying profession are highly faced with real challenges to contribute to a successful realization of this ambitious trans-European project.

## **ZUSAMMENFASSUNG**

Die München-Verona Achse stellt eine der bedeutendsten Verkehrswege in Europa dar. Aufgrund der vorhersehbaren Verkehrsströme und der damit verbundenen Problematik für die Verkehrswegeplanung hat der Europäische Rat im Jahre 1994 den Ausbau des Schienennetzes auf dieser Strecke in die Liste der 14 dringendsten Projekte im TEN (Transeuropäisches Verkehrswegenetz) aufgenommen. Dieses Projekt birgt eine Herausforderung an alle Beteiligten einerseits Mittel und Wege für die Finanzierung zu finden und andererseits an die beteiligten Techniker, die zahlreichen technischen und geologischen Schwierigkeiten zu meistern. Speziell alle Zweige des Vermessungswesens sind bei der Planung und Ausführung dieses ehrgeizigen transeuropäischen Vorhabens gefordert.

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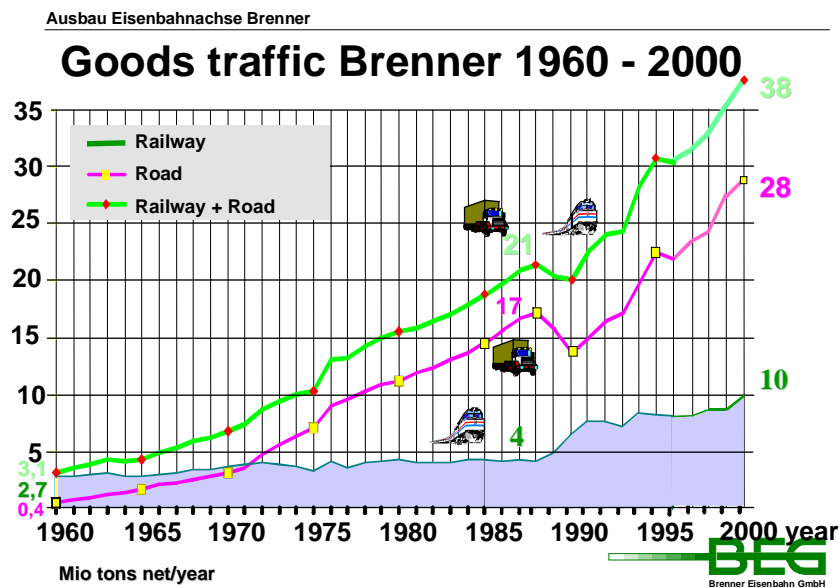
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## 1. INTRODUCTION

The Munich-Verona axis is one of the most important traffic corridors in Europe. Due to predictable increase of traffic the planning of traffic corridors is of major importance. For this reason in 1994 the European Council has included the upgrading of the railway line in the list of the 14 TEN (trans-European networks) priority projects. The project is a challenge for all participants to find feasible financing procedures as well as for technicians to scope with technical and geological obstacles. Especially all fields of the surveying profession are highly faced with real challenges to contribute to a successful realization of this ambitious trans-European project.

## 2. TRAFFIC AND ENVIRONMENT

The Brenner Pass (1350 m) between Italy and Austria is the most important route of trade and traffic connecting Northern and Southern Europe. As a consequence 25 million tons of trade traffic pollute the environment each year, 30% of CO<sub>2</sub>-exhaust being due to car traffic. The enormous traffic causes environmental and social costs running into millions. They are caused by environmental pollution, the greenhouse effect, noise pollution or traffic jams and accidents.



A recently conducted study based on EU-parameters has calculated the environmental and social costs of the major traffic carriers. It has been found that the costs resulting from the

various traffic systems come up to more than 4% of the Gross Domestic Product of all countries of Europe.

In the last few decades road traffic has increased rapidly and disorderedly, much more than rail or air traffic, just because it is the most flexible way of transport which is given preference to by the public.

Road traffic causes a lot of damage which has to be sustained by the public. Over the years this problem has become so serious that the EU is trying to influence the increasing imbalance between road and other traffic carriers, especially railway.

For this reason the distribution criteria of financial means for infrastructure – European Regulation 1655/99 on the long-term granting of financial subsidies for the trans-European networks 2000/2006 to the amount of about 4.6 billion Euro – are based on the principle of getting the various transport carriers into balance.

The future of the traffic in Europe will be the railway, especially if the objectives defined by EU-resolutions to reduce CO<sub>2</sub>-emissions by 10% from 2008 to 2012 are to be attained.

The Brenner base tunnel will be planned in a way that the repercussions on population, environment, and landscape will be as limited as possible during both construction and operating period.

### **3. PROJECT**

The first steps towards the project started in July 1986 in Rome when the governments of Germany, Austria and Italy approved a feasibility study for the Brenner base tunnel. This study has been agreed to be the formal basis for all subsequent preparatory work in 1989.

In 1991 the ministers of Transport of Italy, Austria and Germany instructed the Trilateral Commission to prepare a feasibility study for the northern and southern approaches, a safety planning document for the overall route and an operations simulation model. These investigations for the approaches have been completed in October 1993.

The milestone for the project was set in December 1994 in Essen, when 14 transport infrastructure projects have been given priority as the basis for a common trans-European transport network (TEN projects) by the European Council. A four-track upgrade for the Berlin-Munich-Verona rail corridor is listed as Specific Project No 1. Since 1997 the ministers of Transport and the EU Transport Commissioner promoted the establishment of an EEIG (European Economic Interest Grouping). This Brenner base tunnel EEIG was incorporated in November 1999 in Bozen with the purpose to investigate and plan work for the construction of a railway tunnel beneath the Brenner massif including the links to new or existing approaches. The Partners of this EEIG are the FS Ferrovie dello Stato SpA (Italy) and the BEG Brenner Eisenbahn GmbH (Austria) each with a 50% share.

After a first phase of studies by the BBT EEIG the phase II for the construction of the work has already been started. Phase II of the project defines the following goals:

- Prepare the executive plan of the Brenner base tunnel and attain all necessary authorisations
- Prepare functional, construction and operational standards for every single realization phase
- Deepen the economical analysis and prepare the financial models and/or concession models for the construction of the work
- Study the financial models
- Study operational models.

The step by step upgrading of the Brenner axis aims primarily at eliminating the so-called bottlenecks. The upgrading works of the Lower Inn Valley (Austria) are already in an advanced state. The opening to traffic of the section between Woerl and Innsbruck (Austria) will make the realization of the Brenner base tunnel and the upgrading of the southern access lines more necessary than ever.

In fact the planning of upgrading measures on the southern access lines has to be done at the same time with the project works for the Brenner base tunnel as the Brenner base tunnel alone cannot reach the complete significance in transport if not accompanied by a coherent upgrading of the entire southern access line from Fortezza to Verona (Italy).

For this reason in spring 2001 an agreement between the Minister of Transport and the Autonomous Province Bolzano was signed to define and plan the upgrading measures on the Brenner rail line and the feeder lines on the Italian side. This agreement will enable the planning of the entire Munich-Verona axis and give the start signal to the realization of the tunnel.

#### **4. GEOLOGY**

The research programme of the present project phase has the goal to update the available findings and the results of the feasibility study carried out in 1989 and 1993.



The activities started at the beginning of the year 2000 and will be finished within the end of 2001. Their aim is to determine the most favourable course of the tunnel from a geological/geo-mechanical point of view, allowing an accurate estimate of times, prices and risks related to the construction of the work.

In order to minimize hydro-geological risks for the planning of the tunnel the following studies are being done:

- Geological forecasts on the mountain structure
- Determination of the location of the areas with a minimum underground water circulation
- Determination of the location of the areas with stabile rock formation.

Main goals of the work programme are the elaboration of new geological and tectonic maps of the project area, the realization of nine exploration drillings and of subsequents drill hole tests down to tunnel level in geological key points, hydro-geological surveying and monitoring of all water sources in the entire project area. A geophysical analysis through reflection and refraction seismology as well as gravimetric measurements in less accessible areas will be elaborated. A number of laboratory experiments on cores extracted from the exploration drillings for the analsis of the geo-mechanical behaviour of the rock mass will be carried out.

## 5. SURVEYING

Especially the profession of the surveying is confronted with a number of difficulties due to topographical, technical, geological and administrative diversities within this trans-European project.

A main historical remnant is the gap between the two existing geodetic and reference systems. The reference points for the altitude are both in the Italian sea but they are based on different water levels. This causes a major difference at the Austrian-Italian state border and makes joint evaluations and measurements within both systems impossible. The existing data cannot be implemented into a unique reference system which is needed for the planning.

The solution was found by the establishment of a new UTM-based reference system and fixed points system for the special project purposes. A geodetic frame network of about thirty measurement points was established in collaboration with the Province of Tyrol, the Autonomous Province Bolzano, the Austrian Federal Office for Metrology and Surveying and the Italian Geographic Military Institute. The surveying was carried out using satellite supported GPS. The results of the GPS surveying were used to determine a conversion formula between the two different present reference systems in Italy and in Austria.

The frame network is used as fundament for 200 ground control points covering the entire project area.

For the construction of the Brenner base tunnel it is necessary to elaborate an updated border crossing cartography. Due to different reference systems mentioned above it has been necessary to produce new cartographic maps of the entire area between Innsbruck and Fortezza.

In September 2000 a border-crossing flight was arranged in order to produce aerial images for planning and documentation purposes. The images were additionally used for the production of orthophotos in scale 1:5000. The ground control points have been made visible before the flight and are used for photogrammetric calculation and for referencing terrestrial measurements.

## **6. FINANCING**

One of the main tasks of BBT EWIV is to work out PPP-financing models (private, public, partnership) in which public and private investors join their financial resources to realise a project. In order to make this procedure work it is crucial to develop building and operating concepts favouring private investors.

## **7. CONCLUSIONS**

The Brenner base tunnel EEIG examines the feasibility of the Brenner base tunnel considering future traffic developments.

The analysis and forecasts confirm what someone may already perceive by intuition: a massive increase in goods and passenger traffic through the entire Alpine region in general and along the Brenner axis in particular.

If this means on one hand a positive economic growth from which we all benefit on the other hand it is imperative to make this growth consistent with the needs of the population, environment, security and health.

It is a double commitment: to make sure the economy is running smoothly and to ensure an increase in the quality of life.

It does not happen very often that strategic choices for major infrastructure projects meet relevant needs. The railway Brenner base tunnel with its upgrading of the northern and southern access lines does both: it triggers market growth and gives an opportunity to reduce environmental problems.

In the long-run this infrastructure can be seen as a means of saving. These savings can be measured in monetary terms, not to speak of the quality of life of the population living near the main traffic routes and paying for the lack of planning.

For this and many other reasons the tunnel can be necessary. It is not only a market choice but also an ethical one.

## **BIOGRAPHICAL NOTES**

### **Gerda Scennach, Dipl.-Ing. (MSc)**

Born in 1956, baccalaureat in 1974 in Reutte/Tyrol, Diploma of Commercial College, Innsbruck/Austria July 1975. Study of Geodesy at University, Innsbruck 1975 - 1977 and Vienna Institute of Technology, Vienna/Austria 1977 - 1980. Graduated Dipl.Ing. (MSc) in Geodesy in 1980.

Professional career started in 1981 in the Austrian Federal Office for Metrology and Surveying (BEV), head of a cadastre office from 1983-1997, since 1998 consultant for GI affairs of the EC and for international organizations in the Headquarters of BEV.

Activities in professional bodies:

- Austrian Association for Surveying and Geoinformation (ÖVG), *Member* of the Executive Board since 1998
- Austrian Umbrella Organization for Geographic Information (AGEO), *Foundation member* of the organization, *Secretary-General* of the organization since foundation 1998, re-elected in 2001
- German Association for Surveying (DVW), *Member*
- Comité de Liaison des Géomètres Européens - European Council of Geodetic Surveyors (CLGE), *Secretary General* of the organization since 1998, re-elected in 2001
- International Federation of Surveyors (FIG)
- *Secretary* of Commission 3 (Landinformation) from 1990-1994
- Austrian *Delegate* to Commission 7 (Cadastre) since 1994, *Member* of Working group „Cadastre 2014“ in Commission 7
- *Member* of Task Force on „Under-represented Groups“ in Commission 2



- EuroGeographics, *Member* of project team for establishment of an European Road Database, *Member* of Working Group on GI dissemination in the E-ESDI project
- Working-Group for women's equal rights in the Austrian Ministry of Economics and Labour, *Member* since 1984