



# Models for financing, cost and risk assessment

Major Railway Tunnel Projects  
in Europe

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CHEF DER LANGEN TUNNELS  
CHEFS DE PROJET DES LONGS TUNNELS  
CAPI PROGETTO DELLE GALLERIE LUNGHE  
LONG TUNNEL PROJECT DIRECTORS





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*Edited by Konrad Bergmeister*

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## Preface

The group of ‘Long tunnel project directors’ has drawn up a report on topics concerning financing, costs, timing, and risks, including the controlling and auditing of large railway infrastructure projects in Europe.

On the initiative of the Alptransit Gotthard, namely Peter Zuber (1939 – 2011), of the Lötschberg axis, namely Franz Kilchenmann and of the transnational Alpetunnel GEIE now Lyon–Turin, namely Jean Brulard, the group ‘Project Manager of the Long Railway Alpine Tunnels’ was set up in 1993. From 1999 until 2010 was Peter Teuscher and from 2011 on Konrad Bergmeister the Chairman of the group; as a secretary served the past 20 years Hans-Peter Vetsch and from 2018 on also David Unteregger. The aim was to exchange experiences on similar or identical projects, such as operation, maintenance, safety, costs, and construction technology. Later, the persons responsible for the base tunnel projects at Semmering, Brenner, and Lötschberg as well as those responsible for the Channel Tunnel were included in the group. The formation of this group and the valuable exchange of experience have led to cost-effective, cross-border solutions.

The group has been meeting about twice a year for over 25 years to exchange information and experience. During these meetings, the need to document these issues from the point of view of the countries participating became clear. The aim was to explain the most important framework conditions in building large infrastructure projects and to pass on the knowledge obtained for future projects, so that interested readers can have an overview of the various methods used for funding, cost and risk management, and for auditing and controlling tunnel projects in the various countries.

The individual topics were illustrated, using specific terminology that varies from one project to another, for the following large railway infrastructure projects in the different European states.

---

Austria	Large projects to expand railway stations and stretches, including the Semmering, Koralm, and Brenner Base Tunnels
Germany	Large railway projects, including Stuttgart 21, Wendlingen–Ulm, VDE 8 (Berlin–Nuremberg)
Norway	Large railway projects, with a special focus on the Follo Line Oslo–Ski project
Slovenia	Railway projects with a special focus on the Divača–Koper line
Switzerland	Funding and expansion of rail infrastructure, with special focus on the Lötschberg, Gotthard, and Ceneri Base Tunnels

---

The level of knowledge on the individual topics varies from country to country, and they are therefore not described equally. What is uniformly clear is that public funding for large railway projects must be guaranteed, at the latest, before tendering the main works and up to the end of the project. The funds must be made available according to the progress of the works and in a timely manner.

Cross-border projects require a special level of attention and higher risk coverage because of their complexity. Special focus is paid to the BBT and the TELT.

---

BBT	Brenner Base Tunnel – cross-border project between Austria and Italy
TELT	Tunnel Euralpin Lyon–Turin – cross-border project between France and Italy

---

Also, for a long period, representatives from the Channel Tunnel linking Folkestone, Kent (UK), and Coquelles, Pas-de-Calais (France), and recently from the Fehmarnbelt Tunnel linking the Danish island of Lolland with the German island of Fehmarn participated actively in the meetings.

Cost and risk management requires structured and systematic procedures starting with the earliest project phases. Identifiable risks, looking forward to a certain project date, must be quantified and covered by financing. Also, financial provision must be made for as yet unknown and unforeseen influences. Timing, costing, and risks must be updated regularly (at least once a year), and the pertinent project requirements must also be adjusted and taken into consideration in the financing.

Besides the audits of timing, costing, risks, and activities, reporting is another fundamentally important aspect of large projects. The parties responsible for the project must inform the entire project team, at every level, of the timings, costing, risks, and activities, implement trust-building measures, and actively contribute during the entire construction of the project.

This document, taken into account the information available until June 2019, is meant both for parties responsible for large infrastructure projects and for decision makers, financing stakeholders, project engineers, and project managers as well as for organisations responsible for future projects both in politics and in management.

People involved in tunnelling underpass mountains and overcome barriers, connect cultures/languages, shape countries and bring continents together!

Vienna, July 2021

*Konrad Bergmeister, Chairman*

# 1

## Austria

### 1.1 Introduction

In Austria, with the modernisation and expansion of the rail infrastructure network since around 1990, a structured cost and risk management has been carried out. This has taken account of the fact that with large transport infrastructure projects, due to the complexity, the long implementation period, and the multitude of project participants at the time of the project start, the project content is not fully known. The level of knowledge regarding the total content is developed only in the course of the project preparation, approval procedures, and detailed planning. The cost of such projects can also be quantified sufficiently only as the project develops. Nevertheless, to create and maintain a stable cost framework, the degree of uncertainty is taken into consideration by appropriate risk provisions.

These risk provisions have been classified as unknown (*U*) during the planning phase, since only part of them can be quantified by means of appropriate risk analyses. The establishment of the risk provisions for unknown elements is carried out on the basis of all previous project experience with the help of specific reference values, which take into account the respective project framework conditions.

The requirements for standardised project and cost management, as well as control and reporting, were originally established within Eisenbahn Hochleistungstrecken AG (HL AG) and later further developed within ÖBB Infra AG. For train station projects – such as the new Vienna Central Station and the projects of the Brenner base tunnel (50% owner), the Koralm Railway, and the Semmering base tunnel – the cost and risk management methods presented below will be used.

On the basis of the accumulated experience, a first guideline for the cost and risk determination for transportation infrastructure projects was carried out by the Austrian Society for Geomechanics (ÖGG) in 2005 [1] and the latest version was published in 2016 [2]. This chapter describes how costs, cost control, and risks have been managed within the Austrian Railway company ÖBB and how they are currently approached in Austria.

Sections 1.2–1.7 were written by Dr. Georg Vavrovsky (1.08.1950–16.02.2020) and Dr. Hubert Hager with respect to the ÖGG-Guideline 2006. Section 1.8 was written by Prof. Konrad Bergmeister with respect to the ÖGG-Guideline 2016.

The mentioned ÖBB manuals [3, 5, 9] have been actualized in the meantime and some of their contents have been adapted; although the essential basic statements still apply.

## 1.2 Concept

ÖBB-Infrastruktur AG implements new and expansion projects for the modernisation and improvement of the rail network in Austria. The expansion investments are focused on route development and expansion along the main transport axes, such as the four-track expansion of the Westbahn and Südbahn railway lines, the Koralm Railway, and the Lower Inn Valley Railway, on the modernisation of the railway stations, on local transport projects in the metropolitan areas, and on freight terminals. With regard to content and expression, these projects include a wide range of rail transport projects, with a project portfolio of around 200 projects. In the past few years, the volume of investments has amounted to approximately €1.0–1.3 billion per year. In addition, extensive measures for the modernisation of the control and safety technology (global system for mobile communications – railway [GSM-R], European train control system [ETCS] L2, etc.) as well as for the renewal (reinvestment) of the rail network have been carried out.

The business process of handling investment projects in ÖBB-Infrastruktur AG stipulates that from the start of the planning phase through to handover to the operator, the project responsibility lies with specialised business areas of ÖBB-Infrastruktur AG.

The project responsibility for the planning and/or construction phase is determined on a case-by-case basis with a separate project order of the entire Board of ÖBB-Infrastruktur AG (project client or ÖBB-internal customer) and the project objectives and the time and cost tangents are determined accordingly. With the project order, the business area thus charged (project contractor or constructor) carries full responsibility for the operative building owner tasks, including all the duties of the project management.

## 1.3 Financing

The basis for the financing of ÖBB-Infrastruktur AG is § 47 of the Federal Railways Act (BBG), whereby the federal government must ensure that ÖBB-Infrastruktur AG has sufficient means available to perform its tasks and to maintain its liquidity and its own capital resources, to the extent of conducting the duties of the business plan in accordance with § 42 paragraph 6 of the BBG. This legally regulated commitment from the federal government is specifically implemented in the grant contracts in accordance with § 42 of the BBG.

In accordance with § 42 paragraph 2 of the BBG, the federal government provides grants for the planning, construction, and maintenance of the rail infrastructure. The grant contract to be agreed between the federal government and ÖBB is based on the business plan that is to be produced by ÖBB-Infrastruktur AG. Part of the business plan is the six-year framework plan to be drawn up by ÖBB-Infrastruktur AG, which includes the funds both for the expansion investments (new installation and development) and for maintenance (particularly repair and reinvestment).

The framework plan includes all expansion investments based on project progress. In the preparation of the framework plan, the strategic planning determinations (goal network 2025+) established by the Austrian federal government as a basis for the infrastructure investment must be taken into consideration. The framework plan must be supplemented



each year by one further year and adapted with regard to the current project schedule for the new six-year period.

The framework plan must include all the decision-relevant information for the company, in particular:

- a detailed description of the projects, capacity analyses, and forecasts of the expected traffic growth
- a schedule with project-related planning and building progress
- a current cost estimation, a cost–benefit analysis, and an operating programme
- a description of the achievable quality of the rail infrastructure of the project.

The basis for the entitlement to federal subsidies is the approval of the annual framework plan by the Austrian federal government as well as the grant contract, which has been concluded and which is extended on a yearly basis.

According to the current grant contract, the share for expansion investments and reinvestments that is to be borne by the federal government (without the Brenner base tunnel) is 75% of the annual capital expenditure, for which, taking into account the average useful life, grants in the form of a 30-year annuity subsidy are provided. For the construction of the Brenner base tunnel, the federal government is responsible for 100% of the annual capital expenditure, for which grants in the form of a 50-year annuity subsidy are paid out. The cost contributions, Trans-European-Network (TEN) funds, cross-financing as applicable and, in individual cases, also real estate sales (e.g. for the main station in Vienna) will be deducted from the financing. In accordance with the grant contract, the federal government and ÖBB-Infrastruktur AG must ensure that long-term projects that go beyond the current framework plan period are also included in the following framework plans with the corresponding financial tranches.

The federal government has its long-term obligations arising from the approved framework plans up to the complete funding of investment projects secured in the form of preliminary approval for these financial obligations, prior to the budget. On the basis of the existing grant contract with the federal government, in accordance with the current financial requirements, ÖBB-Infrastruktur AG issues long-term investment bonds to finance ongoing projects.

## 1.4 Cost Calculation

### 1.4.1 Basic Principles of Cost Calculation

As well as high investment values, railway transport infrastructure projects usually involve high risks and involve particularly long-term project processing. The identification and presentation of the project costs must take into account these circumstances with an appropriate system on which to base the project cost control for accurate analyses and targeted control measures.

Within the framework of cost calculation, future developments and costs must be estimated based on the respective level of knowledge. In this context, the monetary valuation of the services to be provided, the development of price changes, and the project risks must be