Konrad Bergmeister (Ed.)

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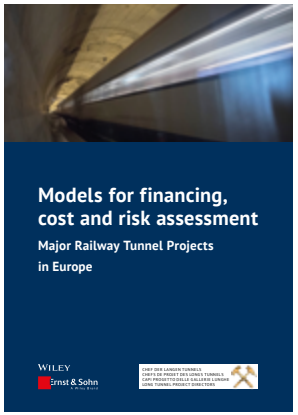

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ABOUT THE BOOK

The „Long Railway Alpine Tunnel Project Managers" group was founded in 1993 on the initiative of the SBB. Initially, the two project managers from the Mont-Cenis (now Lyon-Turin) and Gotthard Base Tunnels were involved. Later, those responsible for the Semmering, Brenner and Lötschberg Base Tunnel projects and for the Channel Tunnel were included in the group, which is now called „Project Managers Long Tunnels". The group has been meeting about twice a year for over 20 years to exchange information and experiences. The composition of this group and the valuable exchange of experience have led to cost-effective and functional solutions.

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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*

Contents

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.

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Germany

2.1 Introduction

The projects VDE 8 (Berlin–Nuremberg), Stuttgart 21, Wendlingen–Ulm, and Karlsruhe–Basel are examples of the major railway projects featuring long tunnels currently being implemented in Germany. Expansion of rail infrastructure in Germany is subject to complex political decision-making processes and funding models. A distinction is drawn between expanding the network with new construction projects (requirements plan projects) and the enhancement of the existing network. This distinction is also reflected in the different sources through which the projects are financed. A single project may combine funding from the national, federal state, or local government levels, as well as European funding and the railway's own resources.

Germany uses the traditional 'Kameralistik' public-sector accounting methodology based on adherence to annual budgets. Currently, public budgets do not capture risk costs in advance, but only when risks materialise.

In the past, various major public projects experienced negative publicity, prompting the then transport minister Peter Ramsauer to appoint a Reform Commission for the Construction of Major Projects. Led by transport minister Alexander Dobrindt, the commission completed its work with a final report published in June 2015, which contained 10 specific recommendations. Nine of them were related to a more cooperative project development based on transparency and truth in the projects. The 10th recommendation was related to the implementation of building information modelling as a tool for more transparency in the projects.

One of the recommendations was for project risk management to be applied from the very earliest stages of the project to identify and quantify project risks at an early stage, to take them into account in funding, and to plan mitigation measures to promptly avert risks and take advantage of opportunities.

The following section describes how costs and risks are currently approached in Germany. It also looks at the recommendations of the working group on costs and risks at the Construction of Major Projects Reform Commission set up by the Federal Ministry of Transport and Digital Infrastructure and examines how these recommendations are being implemented at German Railway (Deutsche Bahn) (DB AG).

This chapter was written by Dipl. Bauingenieur, ETH Zürich, Heinz Ehrbar.

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3

Norway

3.1 Concept, Background, and a Description of the Follo Line Project

The Follo Line (Norwegian: Follobanen) is a 22-kilometer high-speed railway tunnel under construction between Oslo and Ski, Norway. The following chapter was prepared by the project director Anne Kathrine Kalager.

3.1.1 Objective

Effective transportation is a prerequisite for welfare and economic growth. The objective for the transportation policy is to provide an effective, available, safe, and sustainable transportation system that covers the society's need for transportation and enables regional development.

3.1.2 The National Transportation Plan (NTP)

In NTP, the main features of the government's transport policy are presented. The NTP is also a strategic plan for development of the overall state infrastructure for transport by road, rail, air, and sea. The government will pursue an integrated transport policy where the various modes of transport will be viewed within an overall context. The National Transportation Plan (NTP) is an instrument for setting priorities regarding construction, maintenance, and operation of state infrastructure within and between all modes of transport, purchase of transport services, and various types of financing. The NTP will be followed up in the annual fiscal budget proposals and other propositions submitted to the Norwegian parliament (Storting).

In the spring of 2013, the government published its proposal for a new plan covering the period 2014–2023 (NTP 2014–2023). Important issues that were clarified in the document: faster development of the InterCity network, European railway traffic management system (ERTMS) development, and future freight traffic priorities.

The Follo Line will be a part of the development of the InterCity railway line down to the border of Sweden (the Østfold Line) and is a priority project of the current NTP (2014–2023). The status of the development of the InterCity railway network is shown in Figure 3.1.

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Slovenia

4.1 Introduction

Slovenia is situated at the crossroads of the Alps, the Dinaric Alps, the Pannonian Plain, and the Adriatic Sea. Due to its geographical position, it is an important traffic hub in this part of Europe with crossings of traffic flows between north and south, and east and west, as shown in Figure 4.1. Two trans-European transport corridors pass through the country: the Baltic–Adriatic and the Mediterranean corridor.

After the establishment of the autonomous state, investments were primarily made in the construction of motorway connections, but in the recent period Slovenia has been investing – with the help of EU co-financing – considerable funds relative to its size, in upgrading the railway system. This development policy is clearly reflected in the recently adopted Transport Development Strategy and consequently the Resolution on the National Programme by 2030.

The preparation of designs is of great importance for the technically appropriate, high-quality, timely, and cost-effective implementation of projects. In the development of individual projects, the estimation of investment cost is very important. It is prepared on the basis of the available level of technical processing and is used in the preparation of investment documentation. The higher the level of designs, the better the cost estimate, and the more reliable and plausible the investment documentation.

Despite the thorough preparation of designs, it is clear that owing to the nature of construction investments, changes of design can occur, and consequently deviation in estimated costs and the planned deadlines. In large investment projects, risk assessment and the preparation of appropriate mitigating measures is a difficult task, which is important for effective and efficient project management. Therefore, it is necessary to continuously develop and improve the risk assessment procedures, use past experience, exchange best practice, and prepare appropriate risk management specifications and guidelines.

The following chapter has been prepared by Borut Žličar, Tomaž Košič, Marko Žitnik, Nina Kolenc, Aleš Pavšek, Anica Sambolič and Edmund Škerbec.

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Switzerland

Financing, cost controlling, and risk management in the implementation of the New Rail Link through the Alps (NRLA) and future railway infrastructure projects.

5.1 Introduction

The creation of the NRLA (including the Lötschberg, Gotthard, and Ceneri base tunnel projects) is the largest infrastructure project that Switzerland has carried out to date (Figure 5.1).

The NRLA will transform Switzerland into a hub for European high-speed passenger transport. A total capacity of around 70 million net tons will be made available for freight transport on both axes.

This chapter describes how the organisation, financing, costs, and risk management are dealt with. Another focus is the control of performance, deadlines, and costs, as well as change management. All reporting for the NRLA is based on the so-called NCW of the Federal Department of the Environment, Transport, Energy and Communications (DETEC) (as far as new railway infrastructure projects beyond NRLA are concerned, the so-called Richtlinie Umsetzung Bahninfrastruktur-Ausbauten [RUBA] is applied). The NCW has been developed to ensure a uniform approach in the NRLA's project management. The NCW also created the prerequisites for bottom-up reporting at all levels.

This chapter was written by Dipl. Ing. FH Peter Teuscher, Dr. Dieter Schwank, Hans-Peter Vetsch.

5.2 Responsibilities

The parties involved in the project are the Confederation as principal (Confederation/DETEC), the constructors (BLS AlpTransit AG and AlpTransit Gotthard AG), and the operating companies (BLS and SBB).

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6

Brenner Base Tunnel: Transnational Project between Austria and Italy

6.1 Brenner Base Tunnel Project

This chapter was written by Konrad Bergmeister, one of the former CEO's of BBT SE and contains the status of the project until mid-2019. During 2021, both the construction programme and the total cost forecast were updated. However, the results of this update could not be presented in the report.

6.1.1 Project Content: Studies, Planning, Approvals

Studies and planning for the Brenner base tunnel (BBT) started with the feasibility study in 1987/1989. They were continued with the optimisation phase regarding the route, the tunnel, construction methodology, and the overall concept in 1995/1996 and completed between 1999 and 2002 with the preliminary project, and between 2005 and 2008 with the final project and the environmental compatibility project.

The construction of the project was approved in Italy on 31 July 2009 and in Austria on 31 August 2009 (Figure 6.1).

The construction of the exploratory tunnel started on 30 August 2007 in Aica (Alto Adige) and on 4 December 2009 in the Sill Gorge (Innsbruck).

The maximum longitudinal slope in the main sections of the BBT amounts to 6.7‰. Below the two main tunnels and centred between them, a preliminary prospection and exploratory tunnel is being built section by section. The main objective is the prospection of the rock mass, so as to reduce construction risk and optimise construction costs and time [1]. During the operational phase, this tunnel will act as a drainage channel in which supervision and maintenance work can be carried out independently and without interfering with operations in the main tunnels.

The BBT, from Tulfes to Fortezza, is 64 km long. Together with the underground connection to the main station of Innsbruck, the overall length of the underground railway line is 70.15 km. Along the railway line, three emergency stops are located at maximum intervals of 20 km: to the south of Innsbruck, underneath St Jodok, and to the east of Trens. Both freight and passenger trains can travel through the BBT. Once the works are completed, the European signalling system, European Railway Traffic Management System (ERTMS), will be installed. Hopefully, the tunnel will become operational with new European (and transnationally uniform) operational rules.

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7

Lyon–Turin: Transnational Project between Italy and France

7.1 Concept

This chapter contains the status of the project until mid-2019. During 2021, around 80% of the construction work has been, after an European tendering process, assigned.

About 100 km of the 160 km of the whole underground tunnel work is under construction. In 2022, the remaining part of the Montcenis base tunnel will be assigned. This chapter have been written by Lorenzo Brino, Maurizio Bufalini and Alain Chabert.

7.1.1 Objective

The fundamental aim of the project, as mentioned in the conclusions of the French–Italian intergovernmental treaty of 29 January 2001 (ratified by both parliaments in 2002), is to promote an improved balance of different modes of transport, in particular in a sensitive area such as the Alps, while developing the significant advantages offered by rail as a mode of transport, which will not only guarantee trade exchanges between France and Italy by meeting mobility needs but also implement an extremely important modal shift from road to rail transport.

7.1.2 The TEN-T Trans-European Transport Network

The project is the central link of the new Lyon–Turin railway line, which, in its turn, is part of Corridor 3, the Mediterranean Corridor. The project is among the European priority projects, which the Commission has included in the Trans-European rail network and is part of the Trans-European Transport Network (TEN-T) Core Network Corridors, of which it is one of the most important cross-border sections (Figure 7.1).

7.1.3 The Project

The Lyon–Turin Link includes an 'international section' made up of three parts (Figure 7.2):

- the French part, between the area surrounding Saint-Didier-de-la-Tour and Montmélian
- the joint French–Italian part, between Montmélian in France and Chiusa S. Michele in Italy

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Past and Present Participants

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Hanny Azer – DB
Franz Bauer – ÖBB
Claus F. Baunkjær – Femern A/S
Konrad Bergmeister – BBT SE (Chairman of the group since 2011)
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Marko Brezigar – Slovenia
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Raffaele Zurlo – BBT SE

Many members have contributed to the success of this group and the projects. We ask for your tolerance, that we have not been able to explore properly all the names of those involved over the past decades.