Brenner Base Tunnel

THE WAY THROUGH THE MOUNTAIN

Trimble TILOS in action on the Brenner Base Tunnel

Most Italy-bound travelers associate the Brenner, above all, with the long traffic jams that kick off the school vacations – it is the busiest connection between Austria and Italy, after all. However, that is about to change.

Solution

Trimble TILOS Project-Planning Software

Robust scheduling software for linear infrastructure projects that combines time and distance into one graphical view.

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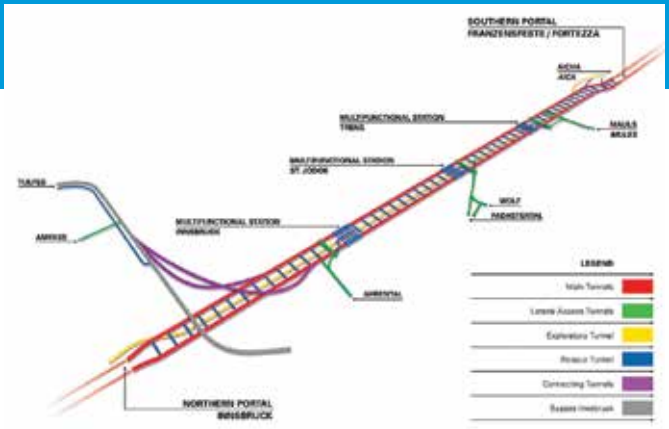
overview

To relieve the most important corridor in Europe, traffic should shift from the highway to the railway. Thus, the Brenner Base Tunnel (BBT) project was born — a conduit between Innsbruck and Franzensfeste by Brixen, planned for completion by 2025. The joint project between Austria and Italy with an estimated budget of more than 10 billion Euros will be the world's second-longest rail tunnel. At a length of 55 kilometers, it will be just short of the Gotthard Base Tunnel. Through the tunnel, the time needed to travel from Innsbruck to Franzensfeste will be reduced from 80 minutes to only 25.



The Brenner Base Tunnel route from Innsbruck to Franzensfeste. (Source: BBT SE)

CONNECTED TIME LOCATION DIAGRAM

Such a mammoth project requires detailed planning to even be feasible. A central element involved is a Time Location Diagram for construction project management, initially created with CAD software for the project submission in 2006. However, it proved too time-consuming over the course of the project, as the information could not be linked with each other according to the precedence diagram method (PDM). Changes in the plan, for example the incorporation of the requirements of a new permit or the allocation of a contract section, required a complete overhaul of the CAD planning.

"This process was tedious and prone to error," explains Stephan Rieder from the project company, Brenner Basistunnel BBT SE. "That's why we looked around for another solution. The choice went to the planning software, TILOS, from Trimble. The software operates very intuitively. Even employees with no former experience, could work with it after only a brief training session. In addition, expenses can be assigned to all processes," elaborates Rieder.

TILOS offers comprehensive functionality for linear construction sites and, among others features, includes an Excel interface. For the setup of the master data, this was especially important. With a resolution of one meter, the profile data, including mountain grades and information on homogenous areas, were available as an Excel databank that could predict the amount of spoils and the planned operating speeds. Based on this data, a detailed construction schedule could be developed through macros-assisted data importation. This schedule could then be used to consider the differing operating speeds required, based on the mountain grades, and determine the appropriate landfills for the amount of spoils.

"A unique characteristic of these types of projects is necessity of histograms for quantity- and time-dependent expenses in the construction process," explains Peter Lenk, TILOS Sales Director at Trimble. "Our planning software outlines the up-to-date capacity of the spoil sites, the time blocks for planning, bidding, execution and implementation, as well as the cost effects at a glance, so that a graphic overview for executives and decision-makers is easy to create."

The largest spoil site for tunnel drilling is located in Padastertal and has a mass of about 7.7 million cubic meters. (Source: BBT SE)

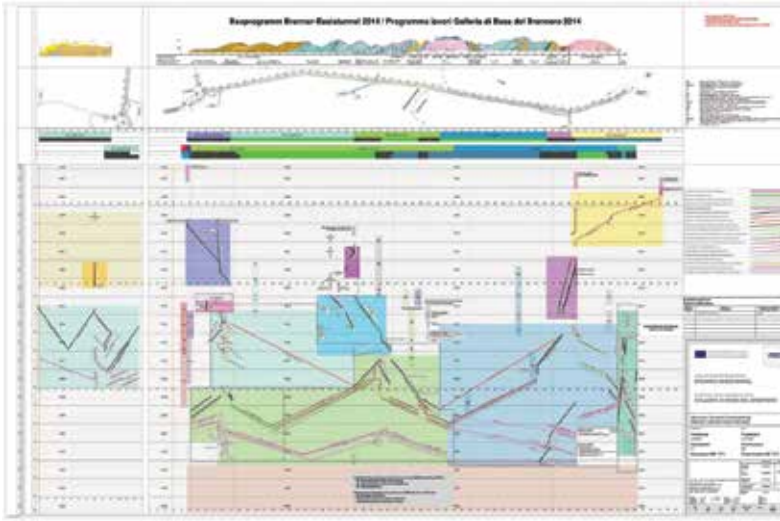
THE THIRD DIMENSION

A unique selling point of TILOS is the integration of the so-called third dimension: the distance, beyond project duration and start/end. Because TILOS takes into consideration the site map and local conditions like disturbed zones, homogenous areas and existing bridges, such factors can be directly included in the construction schedule. The plan illustrates the construction site logistics through the direction, flow and the speed of work. It is also possible to enter route dependency for the purpose of recognizing and reducing overlap in building material transfers. The BBT planners, for example, must draw on multiple spoil sites along the line, where capacities are also included in the project plan. It is thereby possible at any time to plan and follow where the altogether nearly 17 million cubic meters of spoils from the different drilling locations end up.

GENERAL AND DETAILED PLANNING

The planning software has been implemented on different levels for the BBT project. At the very top, the yearly-updated construction program handles the general progress and expense planning. It maps out all construction projects to be erected for the Brenner Base Tunnel project as a Time Location Diagram. As a result, it is possible to very quickly review the planned rate of advancement and demonstrate the total construction duration.

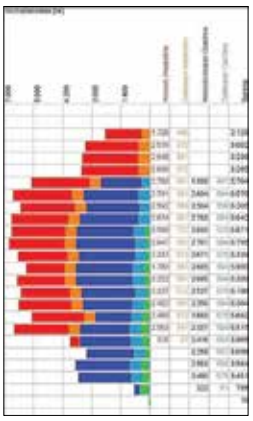
TILOS is also used on the individual contract sections, as well as for the execution. "Through the intelligent coupling of tasks and the integration of machinery capacity data and expenses, some construction sites – right in the bidding phase – can be quickly simulated and different scenarios can be created," states Stephan Rieder. "In this sense, the planners optimize both the construction duration and the expense planning. That's why commissioned planners are required to use TILOS for their construction planning," continues Rieder.



All companies involved in the BBT project are required to use Trimble TILOS for project planning. (Source: Trimble)

In the day-to-day business of individual sites, the Time Location Diagram is especially helpful for controlling and for the documentation of building progress. Likewise, the construction supervision team on site uses TILOS for construction time monitoring. The operations displayed in the Time Location Diagram are encoded with agreed upon prices, so quick cost estimates for the respective contract section are always possible.

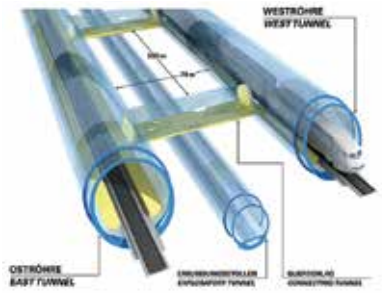
Additionally, the TILOS planning can take into account machinery costs and availability. For example, the BBT project generates high expenses through their tunnel borers that are not based on the work progress, but rather time-dependent. In this case, the planners are able to record the situation through the input of time-dependent expenses as a separate expense type in an individual expense histogram.



Time-dependent expenses are separately recorded in a cost histogram. (Source: Trimble)

ADAPTATION OF THE PLANNING BASED ON GEOLOGICAL FACTORS

The Brenner Base Tunnel is made up of two main single-track tunnels, one running in each direction, with an additional exploratory tunnel below to be used for service access during the operational phase. The main tunnels are connected by perpendicular tubes every 333 meters, which can be used for evacuation. At intervals of about 20 kilometers, a total of three multifunctional stations are also in operation where passengers can leave the tunnel and reach the surface through access paths.



Two main tunnels and an exploratory tunnel below make up the Brenner Base Tunnel. (Source: BBT SE)

The advancement of these multifunctional stations is subject to certain logistical conditions, such as the work safety standards (e.g. ventilation). "With TILOS, we can clearly and easily outline the processes and conditions for completing these emergency stops in the Time Location Diagram," explains Stephan Rieder.

The findings from the advancement of the exploratory tunnel serve to compare and specify the geological assumptions (e.g. homogenous areas) that underlie the planning. The acquired data is integrated in TILOS and, with current, precise information, the construction duration planning is adjusted. These variations can cause repercussions on the scheduling and expenses of all following contract sections, therefore allowances must be made.

RESULTS

Rapid progress in the next main contract sections is possible. The first tunnel borers are already in operation, little by little digging the way for one of Europe's most important transportation projects through the Alps.

Planners, engineers and contractors receive up-to-date and precise information and prognosis for the planning, progress and expenses, so that this huge construction project can be efficiently completed.

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Austria and Italy

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