LVT SYSTEM FOR THE LONGEST RAILWAY TUNNEL IN THE WORLD

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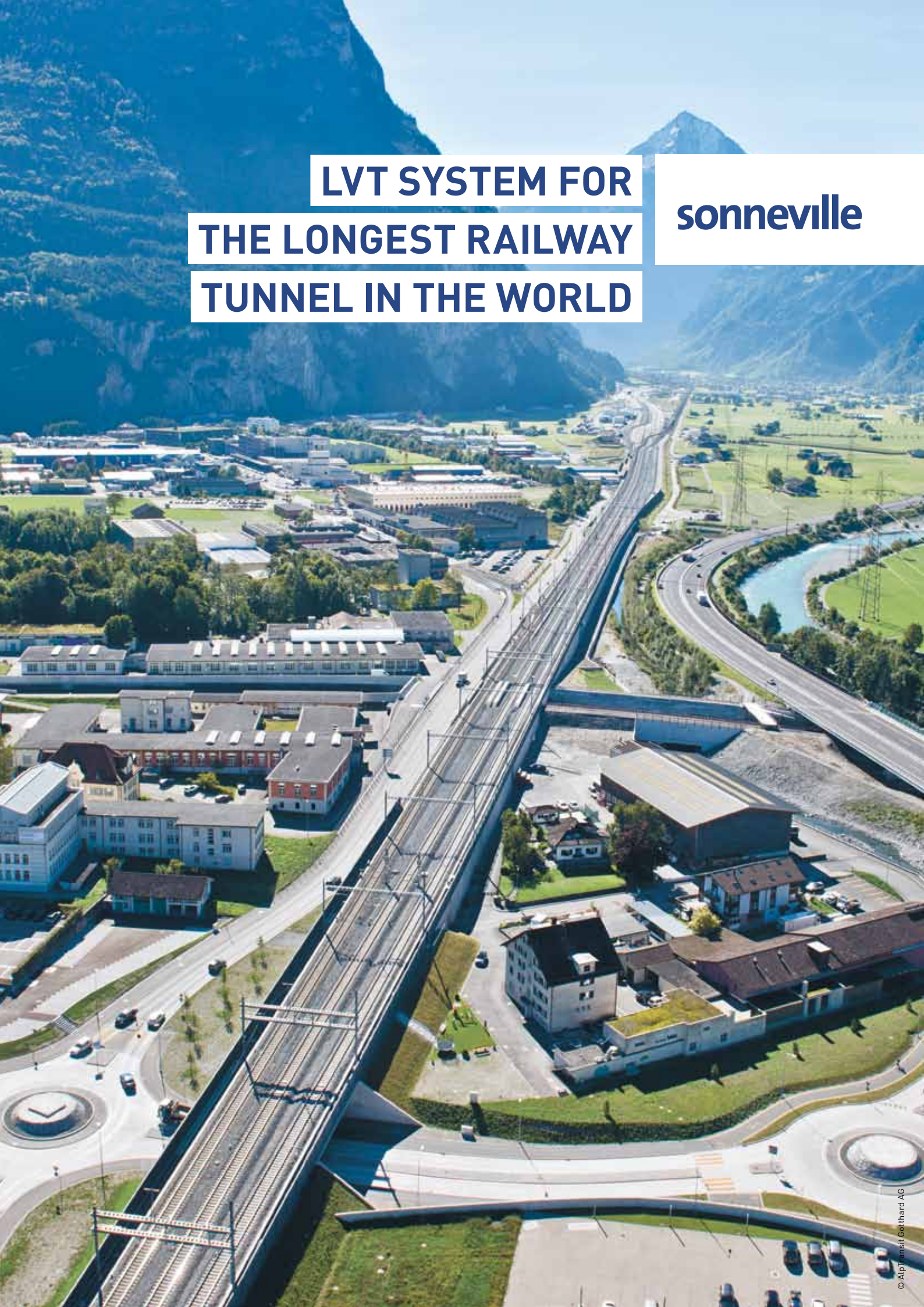
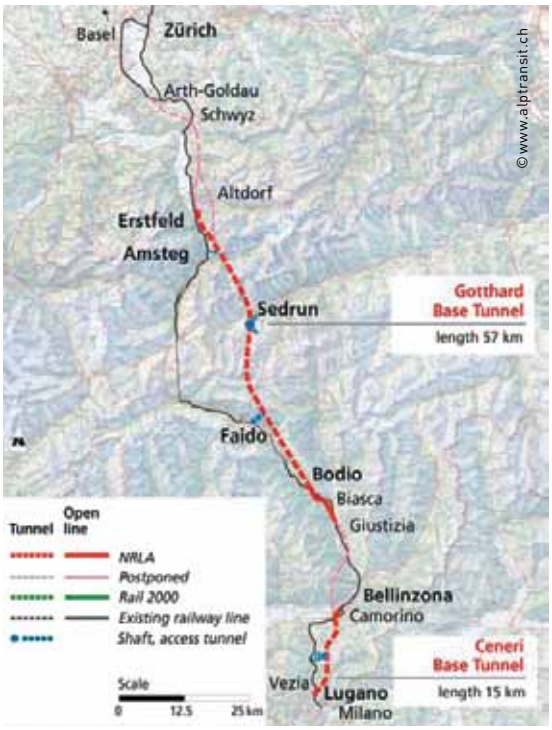


THE LOW VIBRATION TRACK (LVT) SYSTEM FOR GOTTHARD BASE TUNNEL

In December 2016, the world's longest railway tunnel will start its revenue service in the heart of Switzerland.

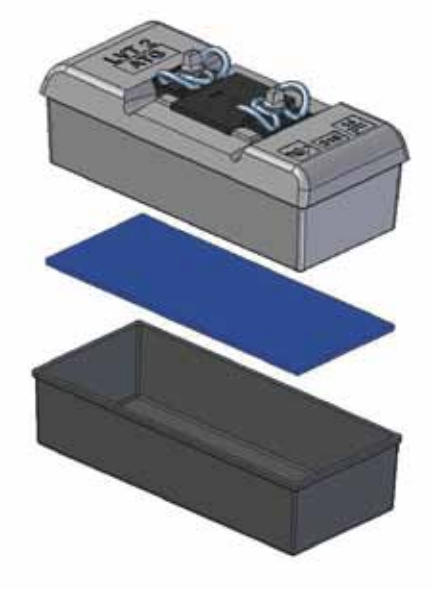
The Gotthard Base Tunnel will provide a faster and better connection between northern and southern Europe, with a construction length of 57 km – two tubes each – providing a new dimension in tunnelling and railway operations in long tunnels. As part of the NEAT (new Alpine transversal) and 2nd Alpine crossing, the Gotthard Base Tunnel connects Erstfeld in the German-speaking and Bodio in the Italian-speaking region and is part of the Rhine-Alpine European railway corridor.

With the start of the Gotthard Base Tunnel's revenue service, the travelling time from Zurich to Milan will be reduced by about one hour, which makes the railway more competitive compared to flights and car travel. Freight traffic will be almost doubled to meet the ambitious Swiss target of limiting the transit freight traffic on the road by 2018.



Exceptional technique for an extraordinary project
For the two tubes of the Gotthard Base Tunnel, the tracks are equipped with the LVT slab track system to meet the strict requirements of the project. Due to the dense geology around the tunnel and more than 2000 m of mountain above it, the climate in the tunnel stays at about 40°C with humidity levels of up to 70 %. All track components were subject to an extensive testing programme to prove their suitability as a result.

The LVT system with its single supports consisting of a concrete block with fastening system, a rubber boot and resilient block pad, customized for the needs of the project, had been selected by the end customer Alptranist Gotthard (ATG) as the most suitable track system to meet the project's requirements.



Most important to the client is the high availability of the tracks, which only can be achieved with a durable track system, capable of withstanding the high requirements in the Gotthard Base Tunnel, which is expected to be 0.5 MGT per day and direction and suitable for high-speed trains with a maximum speed of 250 km/h.

The LVT solution for the Gotthard Base Tunnel
For the Gotthard Base Tunnel the LVT standard application with fastening system W 14, the standard fastening system of Swiss Federal Railways (SBB) for concrete sleepers in ballasted tracks, had been selected, which made it possible to use a well-known and established fastening system in the SBB railway network. On a track section of about 1300 m, for which higher requirements regarding vibration attenuation had been specified, the LVT High Attenuation system was installed to meet these criteria.

The resilient pads in the LVT supports manufactured from engineered polyurethane are customized for the project. Due to the homogeneous static and dynamic track stiffness of the LVT system, durable track quality and a comfortable, smooth train ride is ensured.

With the decoupling of the LVT concrete block from the embedment concrete by the rubber boot, the transmission of vibrations is attenuated and only compression forces are transferred to the embedment concrete on wide base- and side walls of the LVT support, enabling the elimination of reinforcement in the embedment concrete. This provides significant advantages in terms of logistics and eases the track installation, resulting in high installation rates.

Invention of a new production line for LVT blocks
The concrete blocks in the LVT system for the Gotthard Base Tunnel project are manufactured by Vigier Rail Ltd in a new production procedure, invented for the project, working with a late demoulding procedure including high-precision moulds and self-compacting concrete. Due to a high degree of automation of the block production, a continuous, high quality and accuracy of the blocks is achieved.

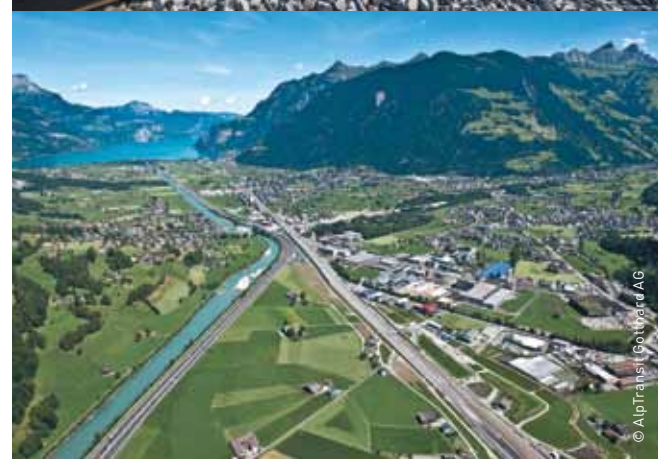
Each material and component used for the production of the LVT concrete blocks as well as for the resilient LVT components is traceable back to its origin and with that, the highest quality standard is achieved.

Vigier Rail has increased its capacity for the production of LVT concrete blocks with the new production line, enabling a constant supply for large-scale slab track projects. In the peak supply period, one complete train loaded with LVT supports left Vigier Rail's factory every three weeks and was handed over either on the north or south workshop area of the Gotthard Base Tunnel, meeting the project's tight supply schedule.

High degree of automation in the installation of the LVT slab track system
On the basis of the trackwork schedule and the timetable stipulated by the JV of Balfour Beatty and Renaissance Construction AG, formerly Alpine, the last of more than 375,000 LVT supports will be installed in the Gotthard Base Tunnel on 31 October 2014, several months ahead of the original schedule. Due to the quicker than expected installation of the complete railway technology, including track installation, the start of revenue service could be brought forward from December 2017 to December 2016.

Every 20 days, 2160 m of LVT slab track could be finished in the Gotthard Base Tunnel, starting with the blank tunnel invert and ending with the finished and cleaned track. The installation of the LVT slab track system allowed a high degree of atomisation using specially designed machines for track construction and a 500-m long concrete train for concrete supply.

The accuracy of the track and consistently high quality attained levels you would expect from a project which ran like "Swiss clockwork". With a median deviation in the track geometry of 0.3 mm, a new dimension in track accuracy has been reached.



The LVT system is a high-performance product suitable for most challenging projects
With the start of revenue service in the Gotthard Base Tunnel, three of the four longest railway tunnels in the world are equipped with the LVT slab track system. Furthermore, in several hundred kilometres of Metro lines the LVT system performs extremely well, and it has a clear advantage in terms of vibration attenuation. Sonneville and Vigier rail offer customized solutions for every project.

Basic data – Gotthard Base Tunnel

Client:	AlpTransit Gotthard Ltd
Contractor:	Transtec Gotthard
Trackwork contractor:	JV Balfour Beatty – Renaissance Construction AG (formerly Alpine)
Construction period:	2009 – 2016
Start of revenue service:	December 2016
Slab track length:	114 km
Slab track solution:	LVT standard system with Vossloh W14 fastening system LVT HA system with Vossloh W14 fastening system

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