An aerial photograph of a town in a mountain valley. A long, elevated railway viaduct with multiple tracks and overhead power lines runs through the center of the town. The viaduct is flanked by residential and commercial buildings. In the background, there are steep, forested mountains under a clear blue sky. A road and a river are also visible in the scene.

**LVT SYSTEM FOR
THE LONGEST RAILWAY
TUNNEL IN THE WORLD**

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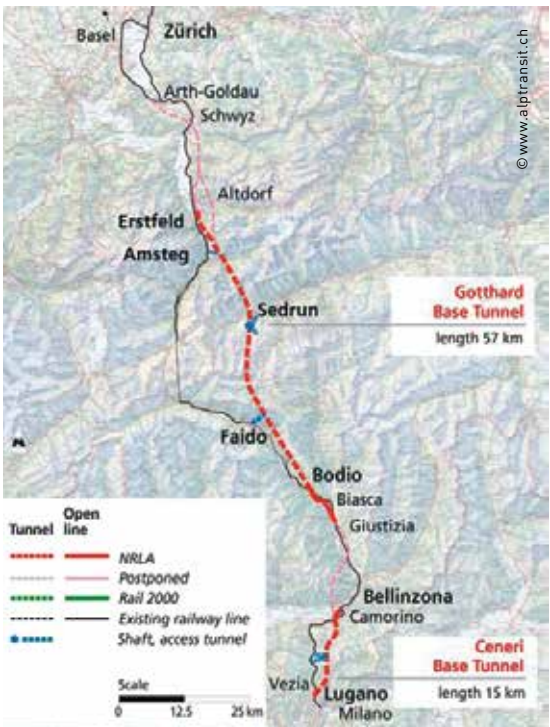


THE LOW VIBRATION TRACK (LVT) SYSTEM FOR GOTTHARD BASE TUNNEL

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 NRLA (New Railway Link through the Alps) 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 air 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.





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 provides significant advantages in terms of vibration attenuation and maintenance.

Basic data – Gotthard Base Tunnel

Client:	AlpTransit Gotthard
Contractor:	Transtec Gotthard
Trackwork contractor:	JV Balfour Beatty Rail – Heitkamp Construction Swiss
Construction period:	2009–2016
Start of revenue service:	June 2016 (freight), December 2016 (passengers)
Slab track length:	114 km
Slab track solution:	LVT standard system with Vossloh W14 fastening system LVT HA system with Vossloh W14 fastening system



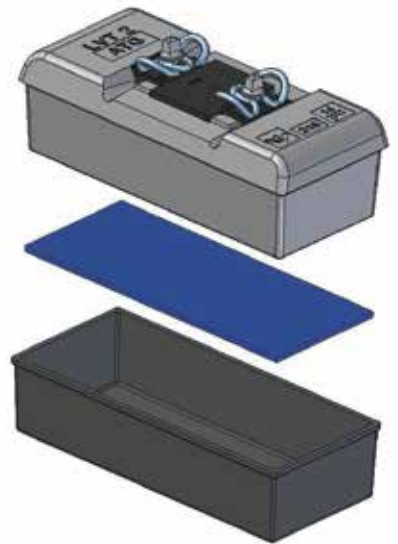
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Exceptional technique for an extraordinary project

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 AlpTransit 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 (SFR) for concrete sleepers in ballasted tracks, had been selected, which made it possible to use a well-known and established fastening system in the SFR 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 (LVT HA) 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 decoupling the LVT concrete block from the embedment concrete by the rubber boot, the transmission of vibrations is attenuated. Additionally, only compression forces are transferred to the filling concrete, which embeds the LVT supports, enabling the elimination of reinforcement in the same. This provides significant advantages in terms of logistics and eases track installation, resulting in high installation rates.

Invention of a new production line for LVT blocks

The concrete blocks of the LVT-System for Gotthard Base Tunnel project were manufactured by Vigier Rail 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 of the blocks is achieved.

Each material and component used for the production of the LVT supports is traceable back to its origin and with that, the highest quality standard is achieved.

Vigier Rail has also 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 5400 LVT supports left Vigier Rail's factory every two 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 Rail and Heitkamp Construction Swiss, the last of more than 375'000 LVT supports was 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 June 2016, with passenger service starting in December 2016.

During track construction, every 20 days 2160 m of LVT slab track were 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 automation 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 even better than a «Swiss clockwork». With a median deviation in the track geometry of 0.3 mm, a new dimension in track accuracy has been reached.



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