

Enabling inter-Europe mobility through 3D digital realities

3.5 million passengers and 90,000 freight trains pass through the Gotthard Base Tunnel each year

Leica Pegasus:Two mobile mapping technology enabled Grunder Ingenieure AG to efficiently capture the as-built environment of the Gotthard Base Tunnel in only a few weeks, without disrupting the ongoing construction, benefiting all working stakeholders.

Enabling understanding

PROJECT: Capturing all the infrastructure of the Gotthard Base Tunnel for as built documentation

CUSTOMER: Grunder Ingenieure AG

SOLUTION: Leica Pegasus:Two

OBJECTIVE: Grunder Ingenieure AG was contracted to deliver a complete inventory and as built documentation of the Gotthard Base Tunnel.

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- when it has to be **right**

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■ Company

Grunder Ingenieure AG in Curitiba, Brazil. www.grupotoniolo.com.br

■ Instruments & Software

- Leica Pegasus:Two
- Leica SiRail Suite

■ Challenge

- Deliver complete inventory and as-built documentation of the Gotthard Base Tunnel
- Avoid disruption of ongoing construction
- Keep staff safe during data capture
- High-definition scans necessary for most accurate representation of the rail geometry and environment
- Delivery of 3D imagery and point clouds database of the rails, signage, posts, electrical lines, and further installations and structural elements

■ Benefits

- Vehicle-independent solution offers flexibility in the carrier platform
- Seven cameras provide full 360-degree dome imagery combined with the scans of the onboard LiDAR profiler ensure that no detail is missed

Grunder Ingenieure AG was contracted to deliver a complete inventory and as built documentation of the Gotthard Base Tunnel. Using Leica Pegasus:Two they were able to efficiently capture the entire project in only a few weeks, without disrupting the ongoing construction, benefiting all working stakeholders.

The company selected the Leica Pegasus:Two to capture infrastructure of the new built open tracks safely and efficiently enabling engineers to work with the most accurate representation available.

When the Gotthard Base Tunnel officially opened in June 2016 as part of the New Rail Link through the Alps (NRLA), a construction project 20 plus years in the making at 9.8 billion Swiss francs yielded the world's longest and deepest traffic tunnel. At 57 kilometers long and with a rock overburden of 2,300 meters, the tunnel increases the total transport capacity across the Swiss Alps while reducing passenger travel time between northern and southern Europe by one hour. With minimal gradient and wide curves, the route is also a flatter, lower-level journey at only 550 m above sea level. The whole tunnel system measures a total of 152 kilometers, plus almost 50 km of new built outdoor tracks.

When Grunder Ingenieure AG, a leading Swiss engineering firm specialising in rail surveys and long-time user of Leica Geosystems solutions, was sub-contracted by the Alptransit Gotthard AG, the firm knew it would be a challenging task but one for the history books. One of the main tasks, before the tracks opened for the test operation, was to capture all the infrastructure of the tunnel for as-built documentation.

"There are several stakeholders working on the overall project, and we were tasked with registering the entire infrastructure to collect for the infrastructure database of the Swiss Federal Railways. All these users can now access this information," said Gilbert Roulier, Grunder's director of imagining, laser scanning and mobile mapping. "Entering the under-construction tunnel and outdoor tracks also presented organising challenges that we needed to account for with our engineers and surveying instruments."

The firm selected the Leica Pegasus:Two to capture the entire infrastructure of the new built open tracks safely and efficiently. In combination with Leica Geosystems total stations, Grunder was able to provide a complete database of 3D imagery and point clouds covering the rails, signage, posts, electrical lines, and further installations and structural elements.

On the fast track

Facing a very short and divided up timeframe of only a few weeks, Roulrier and his team knew they needed a fast and efficient method to capture all the available data. They found this in the Leica Pegasus:Two's seven cameras providing full 360-degree dome imagery combined with the scans of the onboard LiDAR profiler.

Easily attaching the capture platform to the prototype of the firm's specially-designed rail trolley, the engineers were able to quickly and effectively maneuver over the outdoor tracks to collect a few billion points. By constantly capturing data on the move without disrupting ongoing construction, safety increased for Grunder and other employees. No longer were the surveying engineers required to trapeze through a risk-filled construction site, and construction workers no longer needed to worry about avoiding surveyors or instruments set up in the midst of their site.

"This non-contact and kinematic measurement ability allows us to record everything without interruption, significantly decreasing risks" said Roulrier. "This mobile method also reduces the effort, saving the entire project on costs and time, with benefit for all working stakeholders."

With the complete 3D surround capture of the Leica Pegasus:Two's images and point clouds, no critical information is forgotten, either. With only one pass, all important documentation is made. The need to return to site on multiple occasions for data collection is eliminated, saving vital resources.



Sensor merging for digital reality

With the combination of imaging and scanning data, all visual information is brought to reality. The Leica Pegasus:Two and reality capture solutions marry traditional surveying technology, such as:

- Positioning systems
- Laser scanning and
- Radar imaging

into one convenient and easy-to-use platform. A complete and fluid workflow follows reality capture of calibration, post-processing, object extraction and GIS storage.

Enabling the engineers to work with the most accurate and current representation available, the open tracks where presented in 2D and 3D display for maximum manipulation capability. In the rail industry, working with highly realistic models translates into safer design, faster production and reduced costs.

"Being able to provide such a detailed dataset to the stakeholders enabled all interested parties to conduct their work swiftly and successfully," said Martin Baumeler, Grunder's managing director. "The Leica Pegasus:Two increases our business and ensures we provide quality deliverables to our customers."

Visit [leica-geosystems.com/mobile-mapping-solutions](https://www.leica-geosystems.com/mobile-mapping-solutions) to request a demo.

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