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Andrew Solutions™

The Gotthard Base tunnel project

CommScope® provides reliable DAS coverage 3,000 meters underground at 250 km/h

At times we can't even get a strong enough cell phone signal in our own home. Imagine being asked to provide reliable, consistent signal strength for passengers speeding through the Swiss Alps at 250 kilometers per hour. That's right, through the Alps, not over or around them.

In 1998, the Swiss government envisioned a high-speed rail line connecting the international trading hubs of Zurich, Switzerland and Milan, Italy. Only one thing stood in the way: The Swiss Alps. The solution was a 57-kilometer subterranean rail line blasted and bored through solid rock. When it opens in 2016, the Gotthard Base Tunnel will be the world's longest railway tunnel.





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Alcatel-Lucent Switzerland selects CommScope

AlpTransit Gotthard, a wholly owned subsidiary of the Swiss Federal Railways, is currently constructing the Gotthard Base Tunnel as part of a new flat rail link through the famous mountain range. Transtec Gotthard, a consortium of four industry leaders, has been contracted for the provisioning of the railway technology. Alcatel-Lucent Switzerland is the partner responsible for furnishing telecommunications and tunnel control technology.

The sheer scope and complexity of the project are literally unprecedented. No less daunting is the job of ensuring that railway employees, train operators and dispatchers can communicate with each other deep underneath 3,000 meters of Alpine granite. To make that happen, Alcatel-Lucent Switzerland trusted one of the premier global RF solutions providers, CommScope®.

Project parameters and objectives

As the in-tunnel DAS provider, CommScope engineers were asked to design, commission and provide system integration support for the DAS solution. The technical requirements were significant. Trains must be able to connect reliably and seamlessly to the railway's GSM-Railway (GSM-R) network—the system that allows train operators, dispatchers and in-train personnel to communicate. The DAS must also support traffic from public GSM-900MHz and GSM-1800MHz networks, one UMTS 2100MHz network and the railway's PMR-400MHz public safety network. The objective was to ensure accurate, precise voice and data signal handoffs while trains speed through the tunnel at up to 250 kilometers per hour.

The sheer length of the Gotthard Base Tunnel was also a challenge, since it actually consists of two main parallel bores running in opposite directions—each 57 kilometers in length. An additional 43 kilometers of access and service tunnels require reliable signal strength for critical maintenance and emergency response communication. In total, the project required 153 kilometers of spotless wireless coverage.

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ION-M™—the high-speed railway coverage solution

ION-M™ is the heart of CommScope's DAS solution. It is a highly customizable, advanced multi-band, multi-operator, fiber-based DAS that uses master control units connected to multiple remote repeaters via fiber optic cables. It features:

- A radio-over-fibre (RoF) platform that adapts to all existing optical distribution scenarios, while providing exceptional coverage and low interference. This platform ensures that the solution can be upgraded and extended as requirements change.
- Built-in redundancy scenarios that are easily and remotely configured to maintain 99.999% system reliability that is critical to GSM-R and PMR network performance. The system also has on-board AGC (automatic gain control) that enables it to dynamically compensate for optical link loss. This will ensure constant gain regardless of how the link budget changes.
- Remote monitoring and configuration via A.I.M.O.S. (Andrew integrated management and operation system), a proprietary solution that simplifies everything from system supervision and performance oversight to detailed, real-time fault tracking.

A simple, elegant solution to a massive, complex challenge

CommScope engineers began designing the solution by separating the needs of the higher reliability GSM-R and PMR networks from the commercial networks. The GSM-R and PMR networks were assigned to a main system. A parallel system would be responsible for supporting GSM and UMTS commercial networks, including a redundant GSM-R signal.

The completed ION-M DAS solution consists of seventeen master control units and approximately 600 remote repeaters. Andrew Solutions™ RADIAX® radiating cable uniformly distributes the signals from the remote repeaters throughout the main tubes and access tunnels. CommScope used an estimated 150 kilometers of RADIAX cable to ensure complete coverage.

CommScope provides proven expertise and demonstrated success

Through its Andrew Solutions railway connectivity portfolio, CommScope has built an impressive resume of successful high-speed rail projects. The first Andrew Solutions distributed antenna systems (DAS) for railway tunnels were developed in the 1980s for use in the construction of the Channel Tunnel—the world's longest underwater passage, connecting England to France. Since then, CommScope has provided critical communication networks for rail projects in Italy, Taiwan, Spain, Switzerland, Canada, Russia, China and Norway.

"Railway systems rely on clear, constant communication among train engineers and control centers for smooth and safe operation," said Markus Kalt, Vice President Business Operations, EMEA, Distributed Coverage and Capacity Solutions, CommScope. "We were honored to be selected by Alcatel-Lucent to supply coverage solutions that help ensure vital data exchanges."

The Gotthard Base tunnel is scheduled to open to rail traffic in December 2016, but long before Zurich and Milan are actually connected, Swiss Federal Railways can be confident that passengers will experience dependable in-train wireless coverage—even at 250 km/h nearly two miles beneath the Alps.

Your success is our story

As a trusted resource and partner around the world, we're invested in you: your people, your networks, your success. It inspires us to build relationships and infrastructure...connect people and technologies across protocols, oceans, and time zones...and share what we learn along the way. We'll never stop connecting and evolving networks for the business of life at home, at work, and on the go. This is our promise to you.

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