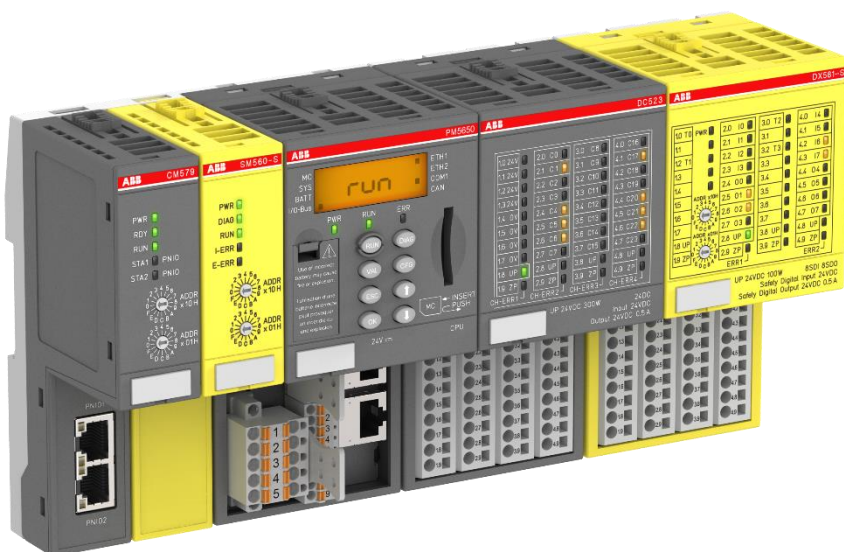


## SUCCESS STORY

# Retrofit of tunnel shaft elevators Automation with AC500-S safety PLC



ABB's AC500-S safety PLC is used in a wide range of automation applications where functional safety standards must be met. This also includes industrial elevators. In this success story from Austria, read how the Structured Text programming language was used to implement the safety functions in a tunnel shaft elevator.

01 AC500-S safety PLC is used in industrial elevators

### The customer

STRABAG Infrastructure & Safety Solutions, short SISS, is a 100% subsidiary of STRABAG AG and provides communication as well as safety solutions for public institutions, public and private transportation, the industry and companies of the most diverse branches. As a general contractor in the areas of operating, communication and safety technology as well as a system supplier in the field of mobile video systems, SISS goes through every step of a project hand in hand with its clients, from the requirement analysis to the planning and systems development all the way to the installation and operation of complete solutions, their service and maintenance. Great importance is attached to perfect implementation of the individual solution in every business area, from the analysis of the infrastructure to the development, design and system planning on site all the way to the definition of the software. Top quality, on-time delivery, effectiveness and teamwork are values which have top priority not only at SISS but also within the entire STRABAG Group. For this reason, SISS is one of Europe's leading companies in the field of communication and safety technology.

In this project, STRABAG was commissioned by the end customer, the Austrian infrastructure company ASFiNAG, to modernize the elevators in two maintenance shafts in the Gleinalm tunnel.

### The application and technology

The Gleinalm tunnel is a highway tunnel in Austria located on the A9 Pyhrn Highway between Leoben and Graz. The tunnel is 8.3 km long and has two exhaust air shafts extending more than 300 m into the mountain. In order to be able to maintain these shafts and inspect their condition, elevators had to be built into the shafts during tunnel construction in 1980. These elevators are simple grating cages suspended from a steel cable drum that moves the elevator up and down. Now, it was time to modernize the shaft elevators and bring them up to the latest technical standard – also in terms of functional safety.

Thanks to previous good cooperation on other tunnel projects, STRABAG opted for an ABB solution and thus for an upgrade with the [AC500-S safety PLC](#). This safety PLC can be used for safety functions up to Performance Level (PL) e according to ISO 13849-1.

As a result of a risk analysis, PL c was defined as a requirement for some functions. Here, the controller reads an encoder, which sends signals for the "safely limited speed" and "safe brake control/safe stop" functions: If the encoder indicates that the elevator speed is above a certain limit, the AC500-S safety PLC activates a hydraulic brake which reduces the speed to a safe level or even performs a safe stop.

Since the PLC is mounted on the steel cable drum level, but the elevator movement has to be controlled from inside the cage, decentralized safety I/Os are located in the cage. The particular challenge here was that a connection had to be established between the PLC and the decentralized I/Os that would work reliably and continue to process safety-related data even if the cage went 360 m down into the mountain. With the AC500-S and the integrated PROFINET/PROFIsafe fieldbus, this is achieved via a redundant Wi-Fi connection and directional radio.

"Before the retrofit, maintenance workers would often get stuck with the elevator – in a dark, cold place with no cell phone reception. Now, everything works smoothly. We are glad that the AC500-S reassures our maintenance workers and guarantees that they will not be cut off from the outside world."

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Bernhard Heinzel, team leader within Technical Support at STRABAG Infrastructure & Safety Solutions GmbH

Due to the extreme climatic conditions especially in winter, up to 3-meter-long icicles can form in the shaft, which can be very dangerous for both staff and equipment. A bespoke sheet-metal construction on the elevator helps to safely break them. For this purpose, ABB's contactless safety sensors Eden (IP69K models) were used, which indicate when the elevator is in a predefined position from which the icicles can be safely shattered using a predefined movement. For just such extreme temperatures or even environments with high humidity, vibrations or hazardous gases, the AC500-S offers an [XC variant](#) for use in harsh conditions.

The main argument for purchasing the AC500-S was also that it is possible to program the safety functionalities using the Structured Text (ST) programming language with which the project engineers were already very familiar due to their experience with non-safety PLCs. ST allows for very flexible and fast programming, and programming errors can be detected with the ABB Safety Code Analysis (SCA) tool. This code analysis tool from ABB can be used to verify safety-related programming rules according to IEC 61508-3 for the ST, FBD (Function Block Diagram) and LD (Ladder Logic) languages. The ABB SCA tool is the first of its kind and has been certified for applications up to SIL 3 (IEC 61508) and PL e (ISO 13849-1) after rigorous testing by TÜV SÜD. The resulting code with a clear structure not only speeds up commissioning, but also significantly reduces certification and maintenance efforts after implementation. ABB's SCA tool was also used here to obtain project approval by the technical expert. The possibility of trigonometrically controlled safety applications offered by the AC500-S controller is also a big plus. Our safety PLC supports complex safety arithmetic functions (SIN, COS, TAN, LOG, LN, SQRT, etc.) with floating point calculations, allowing the safely limited speed of elevators to be monitored dynamically and very precisely for the application.

**"Although this was the first project for STRABAG Infrastructure & Safety Solutions GmbH in Graz with the AC500-S safety PLC, everything went smoothly. We received excellent support from ABB – both at the training center in Heidelberg (Germany) and from the sales department here on site."**

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Bernhard Heinzel, team leader within Technical Support at STRABAG Infrastructure & Safety Solutions GmbH

In addition to installing the AC500-S safety PLC in the shaft elevator, the motors received an upgrade, new emergency stop buttons, switches and contactors were installed, as well as an ABB DCS drive and CP600 touch panels.

ABB offers a complete portfolio of products and solutions for functional safety: safety PLCs, safety sensors, switches and contactors, drives and robots, operator panels and suitable software. Thanks to many years of cooperation with authorities and customers, we have extensive experience in the implementation of safety requirements and standards. We supply everything from safety products to complete safety systems. For more information, visit [ABB Safety Information and Solutions](#).

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ABB AG  
Eppelheimer Str. 82  
69123 Heidelberg, Germany  
[PLC Automation | ABB](#)

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02 Shaft elevator controlled by AC500-S in the Gleinalm tunnel exhaust air shaft

