DOPPELMAYR

AURO – Autonomous Ropeway Operation

Ropeway mobility with a vision

Contents

AURO

The future is autonomous

The Doppelmayr Group has set course for the future of ropeway mobility with the launch of AURO.

Autonomous mobility on ropeways


SOS
SORTIE
EXIT
du Soleil
Ski & Bike

Get on board – in the city or on the mountain

Knowing what will move us tomorrow.

With AURO (Autonomous Ropeway Operation) for gondolas, chairlifts, tramways and funicular railways, Doppelmayr is setting new standards. AURO ropeways carry passengers to their destination safely and reliably - without attendants, interconnected, and equipped with state-of-the-art technology.

To ensure a smooth operation, cameras and sensors monitor the installation, particularly in the loading and unloading areas, both inside and outside the cabin. The AURO system autonomously identifies irregular operating situations and either shuts down or slows the installation automatically.

It is restarted by a ropeway operative who has an overview of operations from the Ropeway Operation Center (ROC). The ROC can be located independently of the installation. The result is an extraordinary interplay of man and technology.

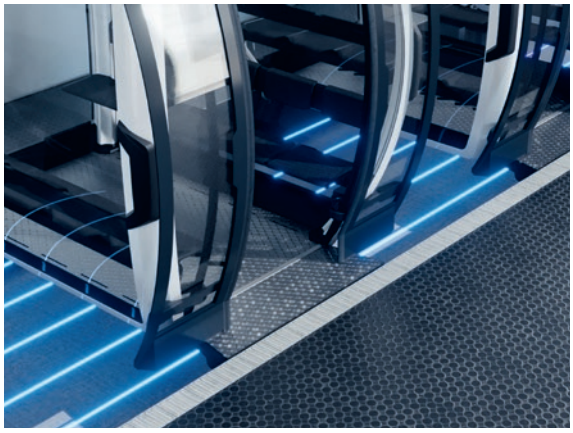
Benefits of AURO ropeways

- Reliable and safe
- Highly responsive and vigilant
- Enhanced comfort and optimization of staff resources
- Temporary video documentation and storage of incidents

AURO in the city and on the mountain

AURO ropeways with their numerous benefits have proven extremely useful in tourist areas, and they seamlessly fit into the transport infrastructure of cities or points of interest, too. Ever higher demands on availability and efficiency both with regard to operation and maintenance along with the rising challenges faced by public transport in urban areas are the fertile ground on which leading-edge transport solutions like AURO grow.

Decades of experience within the Doppelmayr Group in the fields of automated funicular railways and people movers have significantly driven and shaped the development of autonomous ropeway systems.



The adapted cabin step geometry and the cabin stabilization enable barrier-free boarding and disembarking.

AURO for gondolas

The correct answer to today's and tomorrow's questions of mobility

The construction of the first AURO gondola in 2020 marks the starting point for an incredible success story. Numerous autonomous installations have since been built, and new ones are added each year. This development is clear proof: AURO meets our customers' needs for modern cable-propelled mobility solutions for all areas of application.

AURO frees up valuable staff resources which can then be otherwise deployed by the operators. In ski and hiking resorts, for example, where several AURO systems operate, the potential for synergies is even greater as one ROC can be used for several ropeway installations.

Benefits of AURO-gondolas

- Cost savings - no ropeway operatives required in the stations
- Optimized overview thanks to CCTV in the ROC
- High availability through swift reaction to shutdowns
- Comfortable boarding through enhanced cabin stabilization and gap-free step geometry
- AURO concept suitable for operating several installations via one ROC

Accessibility
AURO installations are particularly suited for passengers with impaired mobility. For example, marked areas are designated for wheelchair users. Cabin stabilizing rails and gap-free cabin step geometry make boarding and disembarking very straightforward. In addition, passengers can contact the ropeway operative in the ROC via intercom, for example, to request a slower transit speed; the intercom is situated at a height suitable for wheelchair users.

MGD

AURO MGD elements

1.
Ropeway Operation Center
AURO ropeways are operated from the ROC. Operational disruptions can be remote-analyzed and acknowledged and the installation restarted, for example, if cabin door monitoring triggers a shutdown because a ski boot has become trapped in the door.

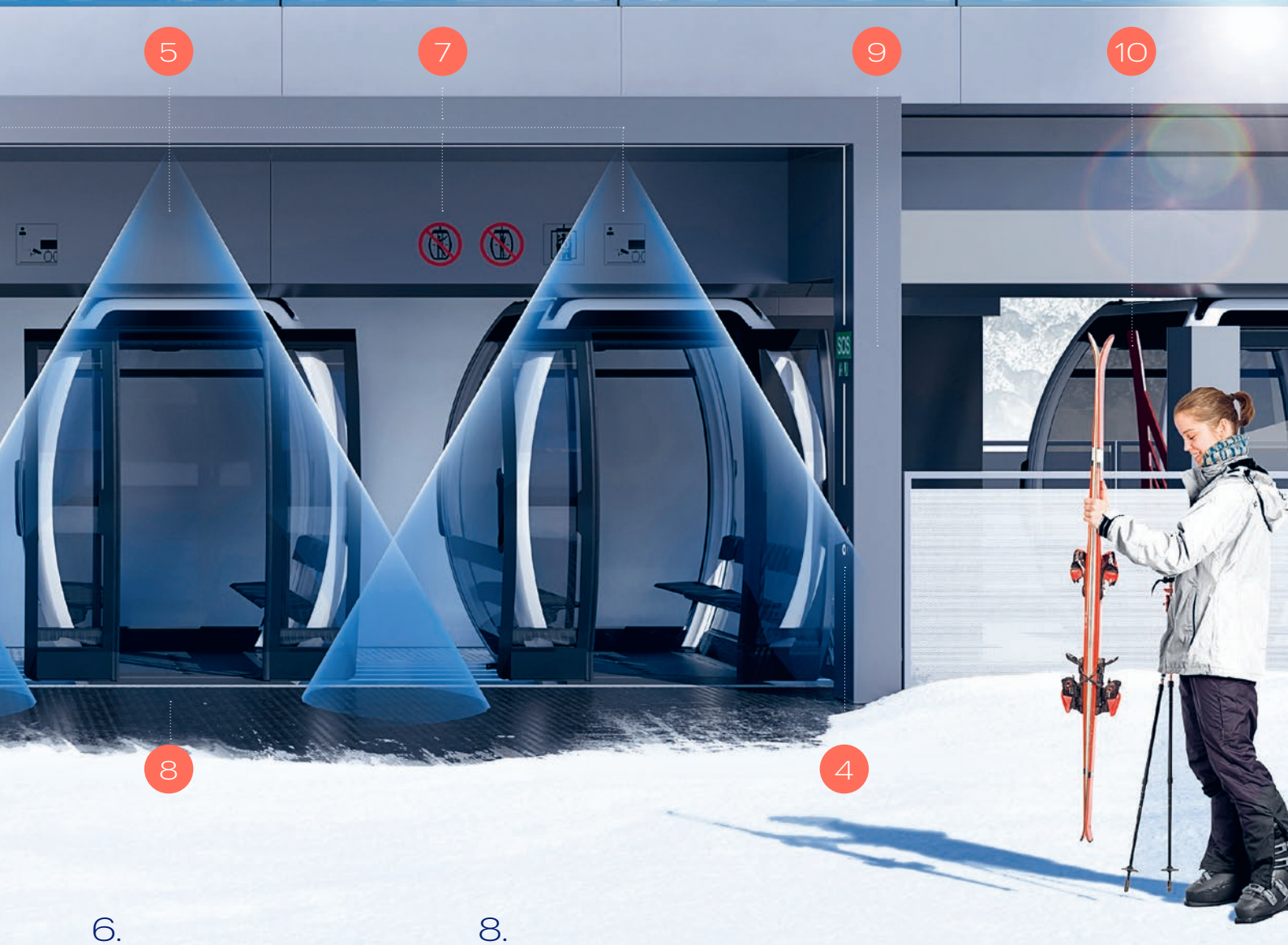
2.
Cabin stabilization
Stabilizing rails ensure an absolutely stable position of the cabins as they transit through the station. This minimizes longitudinal swing and vertical movements of the cabins and enables safe boarding and disembarkation.

3.
Platform gate with shutdown function
The platform gate with shutdown function is located at the beginning of the loading and/or unloading area and prevents people from entering unauthorized zones. Activation triggers an automatic shutdown of the installation.

4.
Emergency stop button and intercom system for passengers
All platform gates are equipped with an emergency stop button and an intercom system on the passenger-facing side. This enables an immediate shutdown of the ropeway by a passenger as well as communication with the ROC, should this be necessary.

5.
CCTV system in the stations
The loading and unloading area, the door closing area, the pit, and the zone for incoming cabins are monitored with cameras. The images are transmitted to the ROC.

AURO continuous ropeways incorporate a series of technical components and digital features that enable unmanned operation. As D-Lines, they also represent Doppelmayr's most advanced ropeway generation.



6.
Pit monitoring with shutdown function
A presence recognition system with shutdown function monitors the carrier pit in the loading and unloading area. If the system detects the presence of a person or an object in this area, the ropeway is automatically shut down.

7.
Information banner
Relevant information is displayed in the loading and unloading areas with pictograms.

8.
Gap-free step geometry
The geometry of the cabin step is designed to match the contour of the platform to ensure a safe transfer from the platform into the cabin and vice versa.

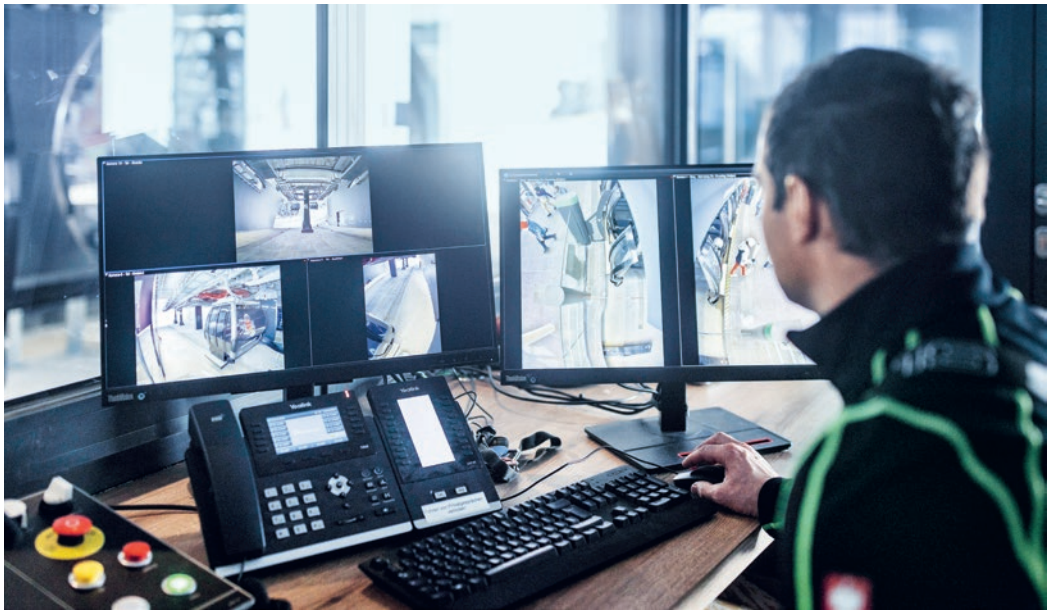
9.
Platform gate with warning function
The platform gate with warning function is located at the end of the loading and/or unloading area and prevents people from entering the cabin door closing area. If the swing gate is activated, an acoustic and optical warning is triggered. A ropeway operative can then try a second time to close the door before restarting the installation from the ROC.

10.
Outline detection with shutdown function
The outline detection system recognizes an object protruding out of a carrier after the door closing operation. The ropeway shuts down automatically if the outline detection system is activated.

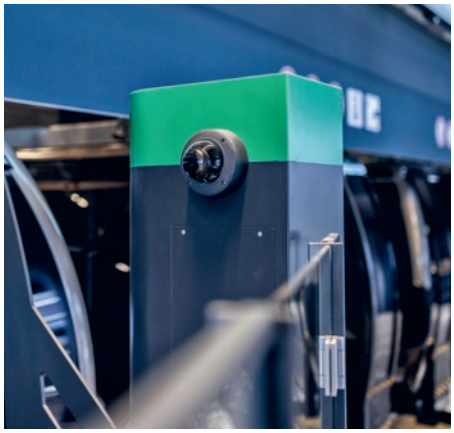
The video management system

A perfect overview and a safe working method for ropeway operators

The video management system (VMS) gives the operative an overview of the installation at all times.



More about AURO MGD



Relevant critical positions in the passenger loading and unloading area are monitored by cameras and sensors. If one of the sensors is activated, for example, the outline detection system, the platform gate, or the light curtain in the pit, the relevant image appears prominently on the VMS screen.

Taking into consideration both the image and the alarm signal on the ropeway controls, the operative in the ROC is able to swiftly assess and remedy the situation. Convenient: Noticeable occurrences are temporarily stored as individual sequences in a GDPR compliant manner and can be exported as required.

Investing in the future

The Silvretta Montafon ski area is home to the Valisera Bahn, Austria's first AURO gondola

The Valisera gondola in Vorarlberg's Silvretta Montafon ski area is a showcase installation: The ropeway represents a world first in terms of its cutting-edge overall concept – as reflected in the cabins, the drive, and the control system through to the station buildings. The bottom and top stations are unmanned, while an operative in the ROC in the intermediate station maintains an overview of the system at all times.

Powerful and comfortable
Smart digital network technology ensures top safety and enhanced efficiency of the Valisera gondola. The installation features two powerful direct drives. Needs-based operation is another smart feature: When there is less demand, the gondola can be run at half capacity, i.e., with fewer cabins. The OMEGA V XL cabins offer generous space and feature TWISTIN ski racks for convenient ski transport. Heated seats provide additional comfort.

Watch video

10-MGD Valisera Gondola
St. Gallenkirch, Austria
Silvretta Montafon Bergbahnen GmbH

The gondola's bottom station serves as a gateway to the resort, featuring EV charging stations, cashiers, a sports shop with ski depot, a food court, restaurant, bar and hotel.

1,286 m
Vertical rise

6.5 m/s
Speed

4,032 m
Inclined length

3,600 p/h
Capacity

AURO for chairlifts

Success story AURO CLD: More and more customers trust in the pioneering technology and benefit from its suitability for retrofitting.

Benefits of AURO chairlifts

- Improved overview thanks to different camera angles
- Enhanced safety through quick reaction to hazardous situations
- Forever vigilant: The system never tires
- Unmanned top station allows for up to 35 percent reduction in personnel costs
- The system learns from different situations and is continually developed further
- AURO is suitable for retrofitting into existing installations

CLD

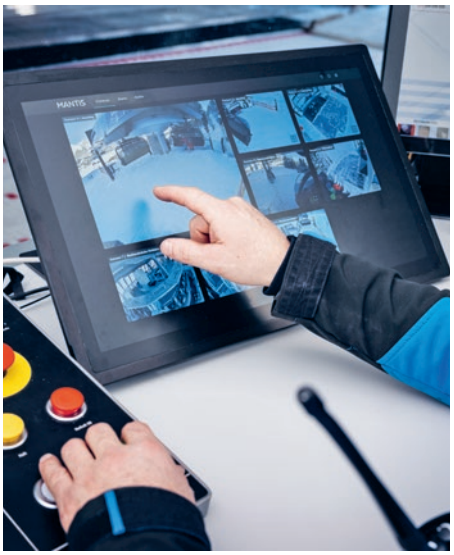
AURO CLD enables passenger service on chairlifts with the top station unmanned. The system uses AI assisted image processing to analyze and evaluate image and video data in real time and trigger automated responses. With AURO, operators are able to operate the top station of their lifts autonomously. As in the case of gondola lifts, AURO for chairlifts is integrated into the control system so that several different ropeway systems can be run from one shared ROC.

For ski resorts in particular, this creates synergies which enable operators to deploy personnel resources in a targeted fashion without compromising safety and transport capacity. For intelligent image recognition Doppelmayr relies on the expertise of its development partner Mantis Ropeway Technologies.

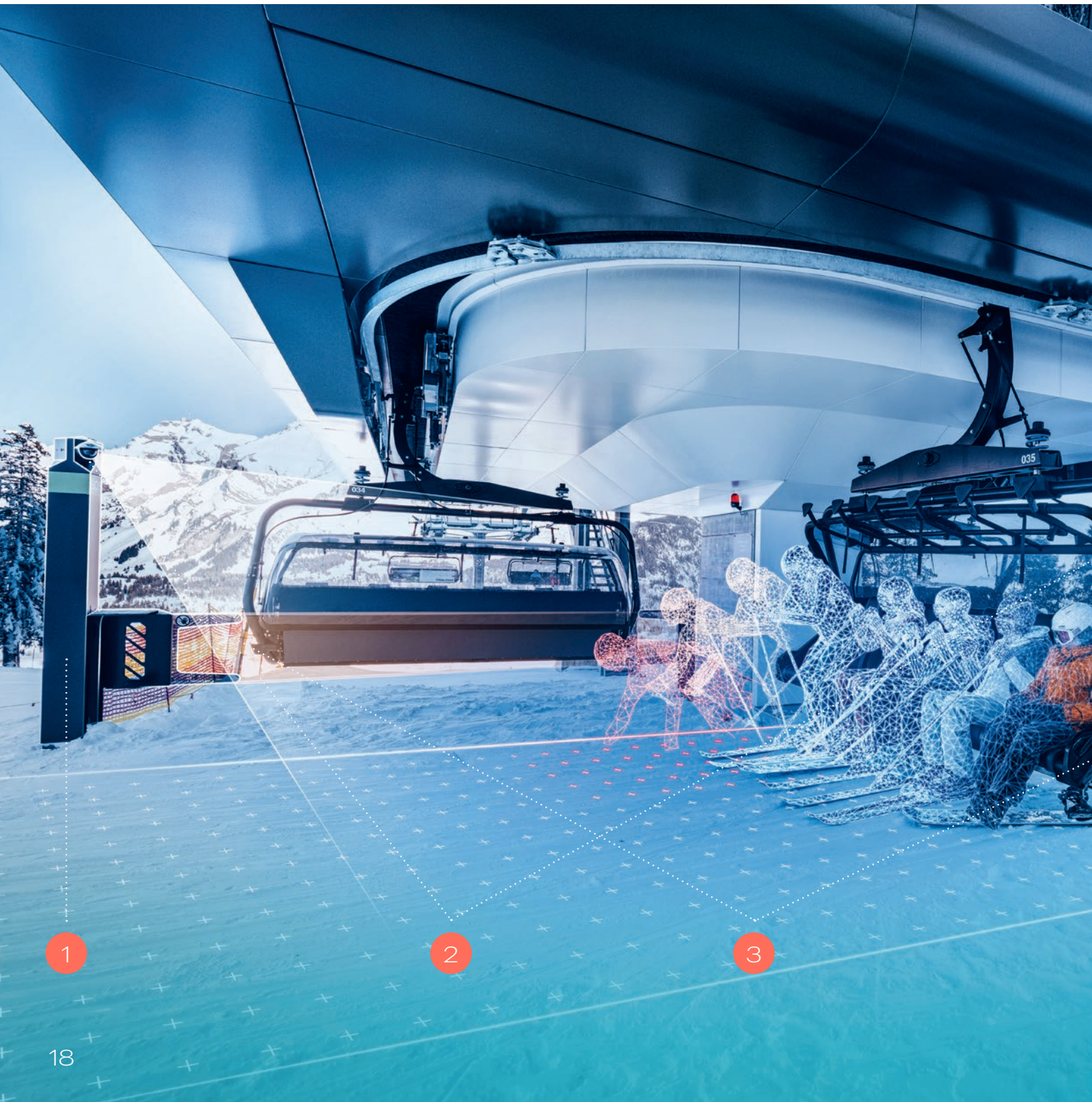
Bottom station assistant
Operatives sometimes get a restricted view of the bottom station chair exit area. But a swift and reliable assessment of the passengers' seating position upon and after loading is key to improving safety. With the introduction of the AI-assisted Mantis Assistance we are solving this issue for our customers' benefit in the next development step.

Slide ramps and pressure mats provide additional safety on AURO chairlifts.

More about AURO CLD



AURO CLD elements



1.
Emergency stop button and intercom system
If necessary, passengers can shut down the installation of their own accord, using the emergency stop button, or they can contact the operative in the ROC. Acoustic warnings or announcements requesting passengers to leave the unloading area can be played automatically via the loud-speakers in the posts.

2.
MANTIS Autonomy Computer Vision System
Weatherproof cameras mounted on the station ceiling, the emergency posts, or the control room façade ensure seamless monitoring of the unloading area.

3.
Ramp boundaries with overrun and light barrier
Ramp boundaries and a light barrier are used to ensure that no person is outside the unloading area.

4.
Marked unloading point
Additional marking highlights the edge to the slide ramp.

5.
Slide ramp
If a passenger disembarks prematurely, the slide ramp will take them onto the pressure mat.

6.
Pressure mat in front of unloading area
The pressure-sensitive sensor mats detect the presence of any foreign object in the defined area. If a passenger were to disembark prematurely, they would slide down the ramp and onto the pressure mat. In that case the installation shuts down immediately.

4-CLD-B Marguns-Plateau Nair
St. Moritz, Switzerland
Engadin St. Moritz Mountains AG

The Marguns-Plateau Nair 4 passenger chairlift in St. Moritz (year of construction 2001) has been operating autonomously with the top station unmanned since the 2024/25 winter season.

Leaders in innovation

Renowned mountain resorts in Switzerland and Austria rely on AURO CLD.

The Engadin St. Moritz Mountains AG is one of the pioneers who has been quick to recognize, and make use of, the potential of AURO CLD. Greater flexibility in terms of workforce planning, easy retrofitting into existing installations, and enhanced passenger safety through continuous monitoring of the unloading area were the factors that guided them in their decision.

»The retrofit solution has helped us optimize chairlift operations considerably. Marguns-Plateau Nair was the first project within our resort-wide strategy for autonomous or semi-autonomous installations.«

Thomas Brunner
Technical Director
Engadin St. Moritz
Mountains AG

5 m/s
Speed

2,000 p/h
Capacity

386 m
Vertical rise

1,555 m
Inclined length

AURO for tramways

AURO technology brings autonomous operation to aerial tramways, too, without requiring the presence of staff.

ATW

The key characteristics of aerial tramways are large-capacity cabins and flexible, intermittent, i.e. non-continuous, operation.

Operating modes

Aerial tramways with AURO technology can operate without requiring the continuous presence of staff, either following a fixed timetable or in flexible lift operation. The ROC is the central hub for automated monitoring of the installation.

In the event of a fault signal, the operative on duty in the ROC is alerted immediately and can then intervene and solve the problem as required. The ROC does not have to be located immediately next to the ropeway and can even be conceived for several installations.

Technology

Depending on the characteristics of an installation and on the customer's requirements, different systems like cameras, sensors, or artificial intelligence are used to ensure a safe operation, without requiring staff to be on site at all times. If necessary, passengers can request assistance any time using the emergency buttons or the intercom system.

Benefits of AURO aerial tramways

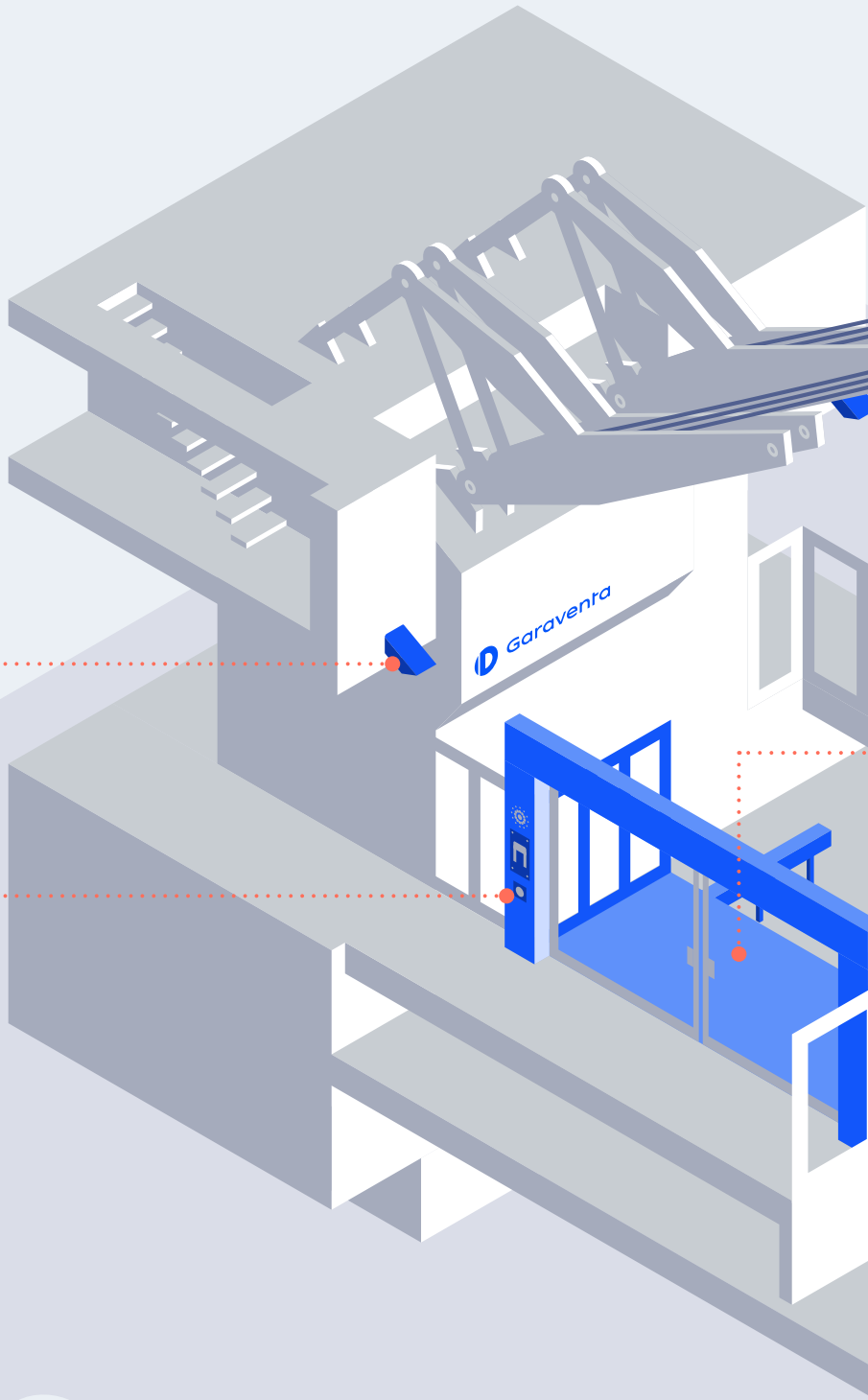
- Cost savings - no ropeway operatives required on the installation
- Optimized overview through CCTV in the ROC
- AURO concept suitable for operating several installations via one ROC
- AURO is suitable for retrofitting into older installations

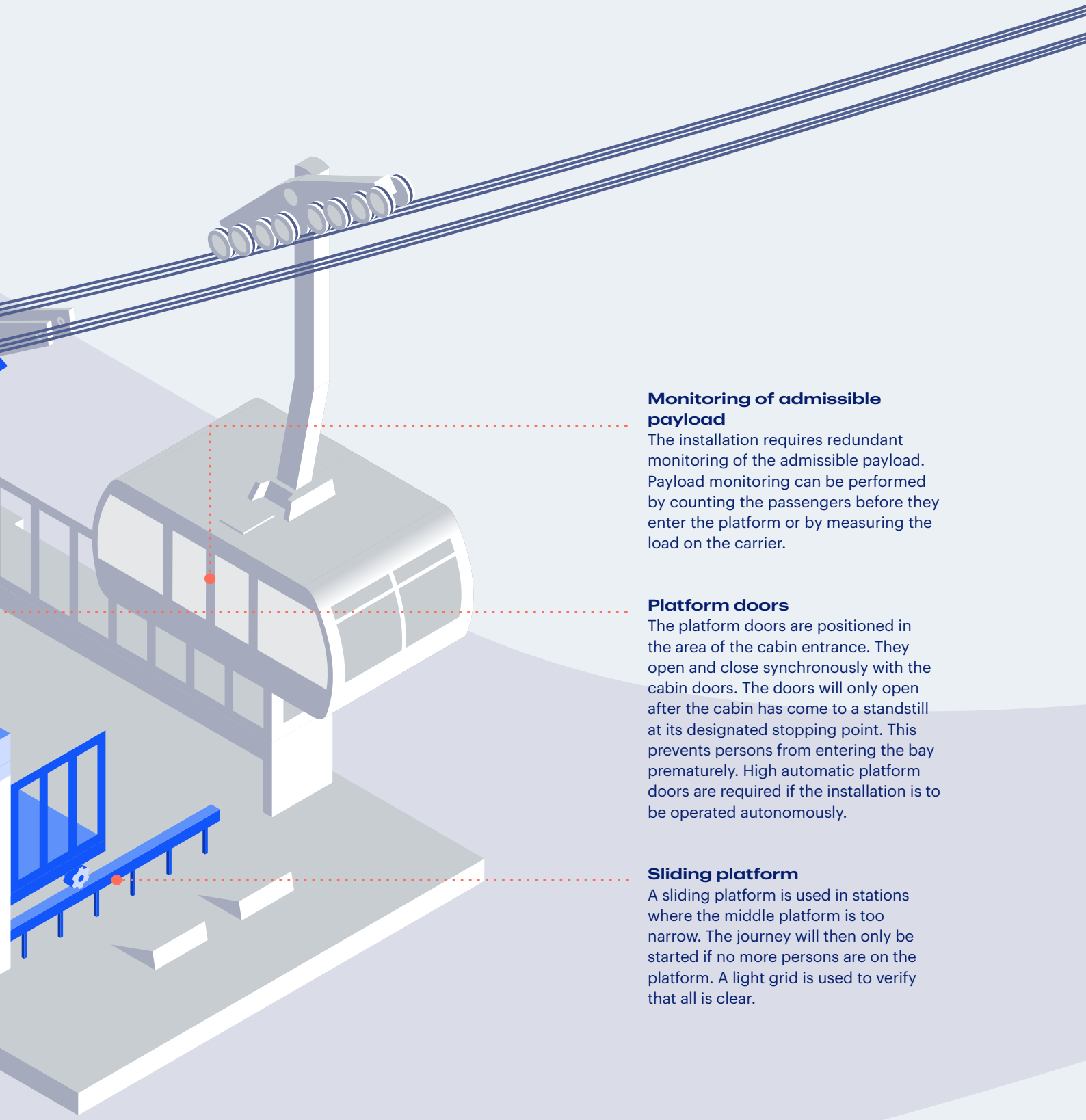
AURO ATW elements

As an example here: 100ATW Zermatt–Furi

Video system
The boarding and disembarking area as well as the cabin door closing area and the cabin interior are monitored with cameras. Images are transmitted to the ROC.

Emergency stop button and intercom system for passengers
The platforms are equipped with emergency stop buttons and an intercom system. These allow customers to shut down the installation immediately and communicate with the control room (ROC.) Passengers with impaired mobility can request assistance via the intercom.





Monitoring of admissible payload
The installation requires redundant monitoring of the admissible payload. Payload monitoring can be performed by counting the passengers before they enter the platform or by measuring the load on the carrier.

Platform doors
The platform doors are positioned in the area of the cabin entrance. They open and close synchronously with the cabin doors. The doors will only open after the cabin has come to a standstill at its designated stopping point. This prevents persons from entering the bay prematurely. High automatic platform doors are required if the installation is to be operated autonomously.

Sliding platform
A sliding platform is used in stations where the middle platform is too narrow. The journey will then only be started if no more persons are on the platform. A light grid is used to verify that all is clear.

AURO ATW

234 m
Vertical rise

10 m/s
Speed

1,680 m
Inclined length

1,030 p/h
Capacity

Special focus on the Matterhorn

The Zermatt–Furi tramway is the first autonomous large reversible aerial tramway. Inaugurated in November 2023, it surprises visitors with a uniquely shaped tower.

The tramway brings a significant increase in transport capacity and is part of the "Matterhorn Alpine Crossing", the highest ropeway route linking two countries in the Alps. The immediate eye-catcher on this installation is its first tower which is shaped like a magnifying glass. The unique tower structure matches perfectly with the surroundings and allows passengers to view the Matterhorn as if through a magnifying glass.

This is the first time AURO is used on a large reversible aerial tramway. Fitted with cameras, 3D sensors, and artificial intelligence for passenger counting, the system continuously collects and evaluates data, for example, the movement of passengers.

More information

AURO for funicular railways

For decades, Garaventa has been relying on automated operation for its funicular railways.

Benefits of AURO funicular railways

- Cost savings – no ropeway operatives required on the installation
- Optimized overview through CCTV in the ROC
- AURO concept suitable for operating several installations via one ROC
- ROC is suitable for integration into the traffic control center of public transport operators

Garaventa can look back on many years' experience in the construction of funicular railways. The first autonomous funicular railway was built in Zurich in 1979: the Rigiblick ropeway. Since then, more than 20 other funicular railways have been successfully approved for autonomous operation. The technology applied is very similar to that used in reversible aerial tramways.

While a timetable is stored for autonomous operation, trip cycles can also be planned manually.

The cabin is dimensioned to admit as many passengers as can safely be accommodated. However, additional sensors can be deployed to determine the number of passengers. Passenger information screens, automated audio announcements, and LED displays ensure frictionless boarding and disembarking. If necessary, the system can also take care of ending operations for the day: It will then automatically switch off the lights and close the gates. Passengers can establish communication with an operative in charge any time via the intercom system.

FUL

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