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The world's highest 3S cableway

After around two-and-a-half years' construction work, the "Matterhorn glacier ride" – the world's highest 3S cableway – has finally opened as planned, and Zermatt has gained a new attraction. From the beginning of the 2018/19 winter season, passengers have been able to use the new cableway to reach the Klein Matterhorn.

An opening ceremony befitting a joint project laden with superlatives saw the official inauguration on Saturday of the new 3S cableway connecting the Trockener Steg mountain station and the "Matterhorn glacier paradise" on the Klein Matterhorn (at 3,883 metres above sea level). The event was attended by members of the construction workforce, media representatives and celebrities from all over Switzerland. Further underscoring the significance of the project for Switzerland and the tourism industry, Federal Councillor Doris Leuthard was there to cut the red ribbon: she congratulated everyone involved on their superb achievement, which she said showed that Switzerland was capable of setting new standards both in tourism and cableway construction.

A pioneering achievement in every way Zermatt Bergbahnen AG and cableway manufacturers LEITNER ropeways were responsible for the construction of the Matterhorn glacier ride, which is 3940 metres in length. Once the new cableway officially starts operations for the forthcoming winter season, passengers in Zermatt will be able to board 25 gondolas, each with 28 seats conceived by the Pininfarina design studio, for the journey to Europe's highest mountain station, situated at 3821 metres above sea level. Four of the gondolas are the special "Crystal ride" cabins, encrusted with thousands of Swarovski crystals and featuring an integrated glass floor through which passengers will be able to observe the 200 m drop below their feet – not a view they will forget in a hurry and perhaps one that will set a few nerves jangling. With a carrying capacity of 2000 passengers an hour, waiting

times at Trockener Steg will be a thing of the past. The nine-minute ride offers first-class comfort and a fantastic all-round view of Zermatt's majestic high-alpine panorama.

The "Matterhorn glacier ride" represents the creation of a high-capacity link between the Zermatt ski area and the Italian ski resort of Cervinia Valtournenche. It represents a successful addition to a series of visionary projects in Zermatt and has further reinforced the already outstanding positioning of the resort. The cableway is extremely important for the tourist industry and gives many people the chance to enjoy a fantastic experience amid the world's most beautiful mountain scenery. A big thank-you to everyone involved."

The construction of the highest 3S cableway in the world to the Klein Matterhorn is just the beginning of an even bigger vision: a first step towards the realization of a continuous lift connection between Zermatt and Italy. An "Alpine Crossing". This will be possible with the addition of another 3S cableway already planned to link Testa Grigia and 'Matterhorn glacier paradise' (on the Klein Matterhorn). In a second stage, the Italian partners envisage two cableways to connect the Zermatt – Cervinia – Valtournenche ski area with that of Val d'Ayas – Alagna – Gressoney (the Monterosa Ski resort). With the addition of 180 kilometres of slopes to create a total of 540 km of pistes, we would have one of the biggest ski areas in the world.

World first in the cable car sector

With this state-of-the-art lift facility, the luxury gondolas and "Crystal ride" cabins, Zermatt has once again come up with something quite unique. To date, there is no comparable project anywhere in the world. In time, the "Matterhorn glacier ride" is set to become a must-see attraction for visitors from Switzerland and around the world. With the new lift we are offering our customers greater comfort, eliminating the waiting time to

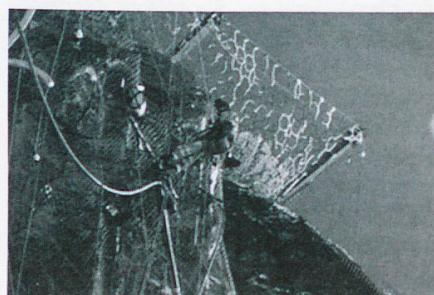
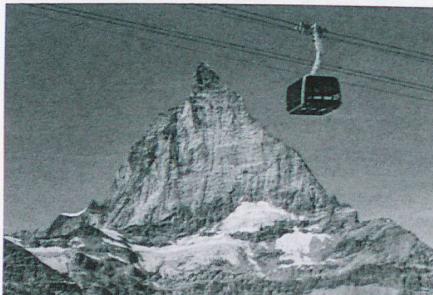
get to the Klein Matterhorn, and giving them the chance to take a spectacular cableway ride across our glacier. We can hardly wait to see how guests will react to the lift and the "Crystal ride" glass-floor cabins. Naturally, we hope they enjoy it as much as we enjoyed the development process and the cableway's construction. Three things are guaranteed when people board the new gondola lift in Zermatt: breathtaking views, a touch of glamour and a gripping experience.

www.zermatt.ch

The Construction Story

On 1st April 2016 the official go-ahead was given for the construction of the new Matterhorn glacier ride. 145 people from 38 different companies had been involved in the biggest construction project in the history of Zermatt Bergbahnen AG. Since November 2018, the 3S (three-cable system) cableway transports up to 2000 passengers an hour to Matterhorn glacier paradise (Klein Matterhorn) – 365 days a year. The cost of building the cableway between Trockener Steg and Matterhorn glacier paradise amounts to some 60 million Swiss francs. The project presented huge challenges to both man and machine, as at altitudes of 3821 metres progress on the building site is heavily dependent on the wind and cold.

Daytime temperatures as low as minus 30 degrees, wind speeds reaching 240 km/h, heavy snow and dense fog are all par for the course on Klein Matterhorn. Since 2016, construction workers in expedition gear had been working on the new Matterhorn glacier ride at almost 4000 metres above sea level and on precariously steep terrain. Because of the lack of oxygen at high altitude the individuals toiling on Europe's highest building site can only perform at around 60 to 80 percent of their normal physical capacity. The altitude is not only tough on the workers – the materials too are pushed to the limit. Concreting work can only take place at temperatures of 5°C or more, so the concrete is mixed using



warm water at the intermediary depot at Lake Cime Bianche on the Italian side of the border and must not be allowed to cool below 8°C during its journey on the transport lift. The construction machinery also had to undergo technical modifications to cope with the extremes of pressure and temperature. At an altitude of almost 4000 metres the air pressure, as well as the amount of oxygen contained, falls to 60% of that at sea level.

Rock Stabilization – protection from falling scree

Before a start could be made on the building work, the site on Klein Matterhorn first had to be made safe from rockfalls. Highly specialized workers from Gasser Felstechnik AG manually put protective netting in place. While abseiling over the rock face from the ridge above, they first used picks and crowbars to clear loose surface rocks from an area of 3000 m². The high-alpine specialists then pinned hexagonal-weave protective netting over the rock surface, requiring the use of ten tonnes of steel. Four protective nets over the building site and future mountain station protected four more areas of 200 m² from falling rocks and avalanches.

Excavation – room for the new mountain station

Having ensured the site was safe and once several tonnes of snow had been removed, a crane was erected for use during the rest of the construction work. It was secured to a 3.5-metre-square base with 16 eight-metre anchors. The main challenge now was how to deploy the drilling machines effectively where there was no level ground.

To overcome the problem, we detonated some small charges and used an excavator with a pick hammer attachment to create two temporary access routes from the opening tunnel to the highest point of the construction pit. That way we could get the drill rigs into place and start excavating from above, explains Thomas Aschwanden, project manager and deputy managing director of Gasser Felstechnik AG. Because of the challenging topography, around one-third of the excavation work was completed not by the two drilling machines but by workers suspended from ropes and using hand drills. The holes, two to three metres in length, were then filled with explosives. Thirty holes were drilled into the rock face each day in this way and an average of 100 m³ of rock removed. Five tonnes of

explosives were needed to excavate a total of 10,000 m³ of rock over a period of 90 days. After the excavation work, concrete was poured in an area of 31 by 8.5 metres to form the foundations for the building.

High-alpine material transport

Initially, the construction site on Klein Matterhorn could only be supplied by helicopter, but in the summer of 2016 a materials cableway was built specially for the Matterhorn glacier ride project between the bases at Lake Cime Bianche in Italy and Matterhorn glacier paradise. The 4015-metre materials cableway built by Moosmair GmbH is capable of transporting loads of up to 8 tonnes. From summer 2016 onwards, most of the construction materials were transported to the high-alpine mountain station on the materials cableway, via a 650 m² intermediate depot at Lake Cime Bianche in Italy.

Three towers and two station-based supports

There are three towers along the route of the Matterhorn glacier ride and two supporting structures, one at the entrance to each station. These are the five structures that carry the support cables. The supports at the stations also ensure that the cabins enter at the correct angle, as well as supporting the station itself. For both stations together, a total of 1550 m³ of concrete was used, such is the scale of the 3S cableway project – these are vast quantities, which would normally be enough for several cableway installations. 440 m³ of concrete went into the foundations of tower 1 alone (altitude: 2941 metres). All the materials for the towers were transported to the site via Testa Grigia (I/CH) using a snow mobile hitched to trailers. A caterpillar crane was deployed for the assembly work. At tower 2 (3059 metres) the loose ground meant that extensive excavation work was required with massive amounts of earth-moving and a total of 141.5 tonnes of steel reinforcing mesh to

anchor the tower securely. The feet of the tower plunge as far as 35 metres into the ground, with only three metres being visible at the top. Work at tower 3 (3771 metres) also posed serious challenges, this time because of the exposed nature of

the site. A walking excavator brought in across the glacier had to take away ice before the excavation work on the rock could begin. Once the four foundations had been built, a second crane, 52 metres high, was erected to assemble the tower itself.

High-wire act for cable transportation

The total of five cables for the new 3S cableway set off from the FATZER plant in Romanshorn to cross Switzerland as an abnormal load en route to Cervinia in Italy, where the really challenging stage of the proceedings was to begin. At 80 tonnes each, the five cable reels were too heavy to be transported by a single truck from Cervinia to Lake Cime Bianche (at 2812 metres), so the individual cables first had to be transferred to two smaller reels and loaded onto two connected trucks before being re-spoiled onto the original reel at their destination. They arrived in convoy at their destination and were then spooled back onto their original bobbins.

From Lake Cime Bianche the cables were attached to a preliminary cable and winched by means of a temporary cable bridge across Furggsattel (altitude: 3365 metres) and on to Trockener Steg (2939 metres). The much lighter preliminary cable was transported by helicopter to Furggsattel from the Italian side of the border and from there it was possible to span it to Lake Cime Bianche via the cable bridge with the aid of an auxiliary winch mechanism. On the Swiss side, it was possible to install the preliminary cable over the Furggsattel chairlift pylons, partly using the helicopter and partly with the help of a snow mobile. Once the preliminary cable had been spanned, the next step was to attach first the hauling cable and then each of the support cables and send them on their way. All in all the cables covered a distance of over 13,000 metres from their arrival in Cervinia and an elevation change of almost 1300 metres.

www.matterhornparadise.ch

