

## GNSS Säntis Schwebebahn

### Continuous support monitoring measurements during renovation work



At 2,502 meters above sea level, the Säntis is the highest mountain in the Alpstein (a mountain range in eastern Switzerland). In mid-January 2019, heavy snowfall on the north side of the Säntis caused a massive avalanche. The 54-meter-high support 1 of the **Säntis Schwebebahn**, which runs from Schwägalp at 1,350 meters above sea level to the Säntis excursion summit, was severely damaged. Following this incident, passenger transport had to be suspended.

In order to immediately detect any movements of the cable car support during the renovation work, the cable car manufacturer Garaventa, together with the Säntis Schwebebahn, decided to monitor the support **permanently** using **GNSS measurements**.

On February 5, 2019, a **TEDAMOS GNSS sensor** was installed on the yoke of support 1 by the cable car employees. Since then, the movements of the support have been continuously measured at 30-second intervals in relation to a second GNSS station on the Säntis summit and automatically checked against specified limit values. If these are exceeded, an alarm is immediately sent to the railway operators via SMS and email.

Railway operations were suspended until the end of May 2019 for repair work. However, we continued the measurements even after the railway was put back into operation until the end of 2020.

This monitoring project was carried out in collaboration with the surveying service provider for the Säntis Schwebebahn, Schällibaum AG.

- 📍 Schwägalp-Säntis, Switzerland
- 👤 Säntis Schwebebahnen AG / Schällibaum AG
- 🕒 2019 - 2020

#### Services

- ◆ Delivery and commissioning of a single-frequency GNSS sensor for the support and a second GNSS sensor as a reference on the Säntis summit.
- ◆ Automatic monitoring of the 3D position and inclination of the support with precise minute, hour, and day solutions.
- ◆ Online access to current measured values via a web-based, password-protected customer portal.

#### Technologies

- ◆ 2 single-frequency GNSS sensors with integrated tilt sensor (data communication via GSM mobile radio)
- ◆ Web-based, password-protected customer portal with 24/7 access