SWITZERLAND, BERNE Access tunnel Railway Station

RBS access tunnel Berne railway station, struts force measurement in excavation pit

THE PROJECT

Bern is the second largest railway station in Switzerland and plays a central role in domestic and international rail traffic. Today it is reaching its operational and spatial limits. As part of the project "Future Railway Station Bern", the SBB (Swiss Federal Railways) and the RBS (Regional Transport Bern-Solothurn) are carrying out extensive construction work to expand the railway junction in Bern.

East of Bern railway station, the new RBS access tunnel will in future be divided into four individual tunnel tubes leading to the two caverns of the new RBS station. The cut and cover tunnel to be built for this purpose will be constructed in a pile wall supported excavation pit (West shaft and central cut and cover tunnel). The excavation will be built directly adjacent to the existing

RBS railway line on the one side and to the existing important Neubrückstrasse on the side. In the shaft, the excavation extends to a depth of approx. 22 m and has 4 layers of struts in the final stage of construction.

THE SYSTEM

During the course of the construction work, the forces acting on the 13 struts, which consist of steel pipes with a diameter of 500 mm, are to be monitored. This can be achieved either by instrumentation with load cells or with strain gauges. On the one hand, load cells for large diameter beams are quite large and require adaptations to the beam supports. Therefore, this method often has comparatively higher costs than the instrumentation with strain gauges. The instrumentation proposed here by Huggenberger

AG to Frutiger Spezialtiefbau AG, using vibrating wire strain gauges, has proved very successful in many similar projects. For the instrumentation of each strut, 3 strain transducers are welded onto the circumference of the strut at a distance of approx. 1.5 m from the strut support, which corresponds to about 3 times the diameter of the strut.

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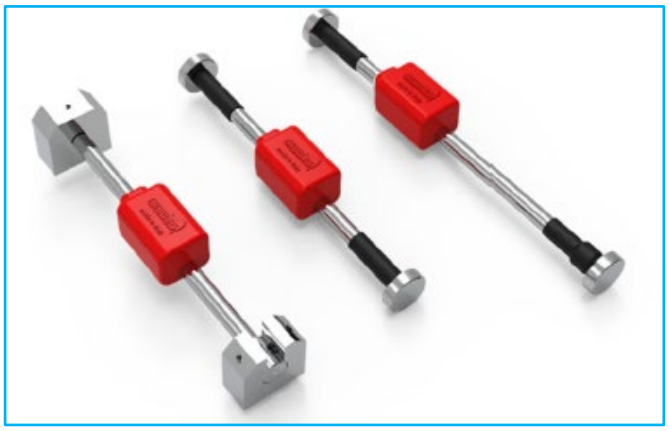
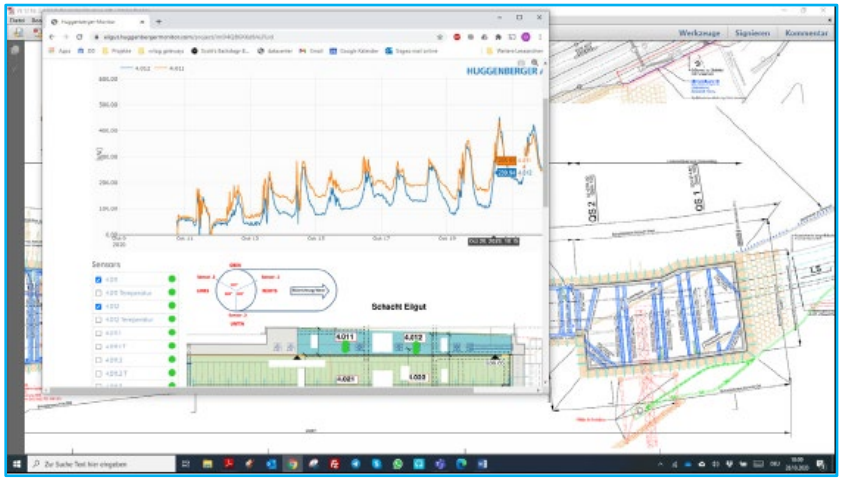
THE OUTCOME



After welding the sensor end blocks, using a welding gauge, the sensor is installed, adjusted and the are cables connected to the wireless data logger located at the edge of the excavation pit. From the strain differences (reference to subsequent measurements) of the 3 strain measuring points, the forces are determined, based on the stiffness of the respective strut.

Currently measurements are carried out every 15 minutes and are then displayed on the Huggenberger-Monitor project website.

The Sisgeo wireless data acquisition system used here, the WRLog system, is based on LORA radio data transmission and can transmit the readings very reliably and robustly over long distances, up to 5 to 10 km range, and with long battery autonomy, from 5 to 10 years. The gateway is located a the site container, from which the measurement results are continuously queried via the Internet using API (Applied Programming Interface).



The companies involved in the project, the contractor Frutiger AG, Basler & Hofmann engineering and Huggenberger AG as technology provider, as well as support for installation, training and commissioning, can easily view the measured values and also the measurement results (strut forces in kN) graphically and numerically on the project website, the Huggenberger Monitor, and can also access images and plans. We would like to thank Frutiger AG for the awarded contract contract and the good cooperation.

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