

FinMeas



Case Rantatunneli

FinMeas' automatic extensometers are the tool of choice for the Rantatunneli Alliance project in Tampere



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Measurement technology developed by FinMeas Ltd. is being used in highway tunnel construction work in the city. FinMeas automatic extensometers are being used to monitor rock-bed movements throughout the tunnel construction project, which will take several years.

FinMeas' client is Tampere Rantatunneli Alliance, whose partner responsible for rock engineering is consulting engineering firm, Saanio & Riekkola Oy. Excavation work on the 2.3 km highway tunnel began in spring 2014 and the finished tunnel is scheduled to open for traffic in 2017.

"In many locations, the excavation and blast sites for the Rantatunneli are located directly below buildings, which makes careful rock engineering vitally important," says Project Manager **Kari Äikäs** from Saanio & Riekkola Oy.

Construction work that involves rock engineering usually includes the monitoring of vibrations caused by blasting and drilling, of groundwater surface levels, of possible subsidence affecting buildings and structures, and of rock movements. Inside the Rantatunneli, FinMeas extensometers are being used to monitor vertical movements in the rock at five measurement points. Rock is usually subject to an area-specific level of stress, to which excavation work causes changes around the excavated cavity. During excavation work, such stress causes the walls of the tunnel to move inwards and the roof to rise. Movement of this kind is measured in millimetres.

"This type of movement is normal. We have used modelling to anticipate rock behaviour and conducted measurements to verify the reliability of our modelling. If there is more than a few millimetres of such movement, this means that our calculations are incorrect and the rock may be affected by unforeseen risk factors."

"If the movements are minor, all is well. However, if the measurements indicate movement that is more substantial than anticipated, people at the construction site can react quickly and, if necessary, add more reinforcement structures, for example."

"Automatic monitoring systems represent a major technological advance, far superior to manual measuring."



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Extensometers continuously measure movement

At the eastern end of the Rantatunneli, an apartment building stands on top of a tunnel roof section which comprises around six metres of rock. Accurate and sufficiently frequent measurements play an important role in ensuring the safety of the tunnel construction project. Such measurements are conducted using five automatic extensometers developed by FinMeas. Each device has three anchors installed at different depths. The nearest measuring points are located a couple of metres from the roof of the tunnel excavation.


The extensometers are installed in boreholes and, when the rock moves, the anchors move with it in relation to the reference head. Such movement is measured automatically and sent wirelessly to FinMeas Ltd's Internet service. The anchor and reference head temperatures are also measured and reported. Alarm limits can be set via the Internet service, so that the system automatically sends information to key personnel via email or SMS, if the movements exceed the alarm limits.

Remote reading is replacing manual monitoring

Consulting engineering firm Saanio & Riekkola Oy has experience of manual monitoring of rock movement: the person in charge of measurements visits the site every two weeks to read and analyse measurement data.

"Substantial movement can occur in rock over a two week period. Of course, we always have personnel on site, but it can be very difficult to detect even major changes through visual inspection alone – in the worst case scenario, the situation can escalate into a collapse. Now that we are using FinMeas automatic measuring devices, we can opt to receive new measurement data as often as once an hour. The devices also enable us to compare possible rock movement more efficiently with the effects of actual excavation work or single blasting events," says Äikäs.

Äikäs recalls an occasion in his career when an extensometer that required manual checking had been installed in a parking area in Tampere. The man who came all the way from Helsinki to check the measurements could not do his job because a car was parked on top of the device. This could not happen in the case of remote reading.

A large-scale construction site for a tunnel. The image shows a deep, rectangular excavation pit with high, reinforced concrete walls. The floor of the pit is a mix of dirt, sand, and construction materials. Several pieces of heavy machinery, including excavators and trucks, are visible within the site. In the background, a multi-story apartment building is visible, partially obscured by the construction site. The overall scene is one of active, large-scale engineering work.

"Our co-operation with FinMeas' experts has run smoothly. They continuously develop their systems, as well as the service packages built around them."

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"Automatic monitoring systems represent a major technological advance, far superior to manual measuring. In addition, FinMeas was able to provide the system at a competitive price. We got more for our money than we expected," says Äikäs.

Measuring is ever more important

During the Rantatunneli Alliance project, rock movement is being monitored throughout the construction process. FinMeas is responsible for maintaining the measuring devices until the project is completed. Äikäs has been highly satisfied with the automatic monitoring systems, as well as the service packages built around them.

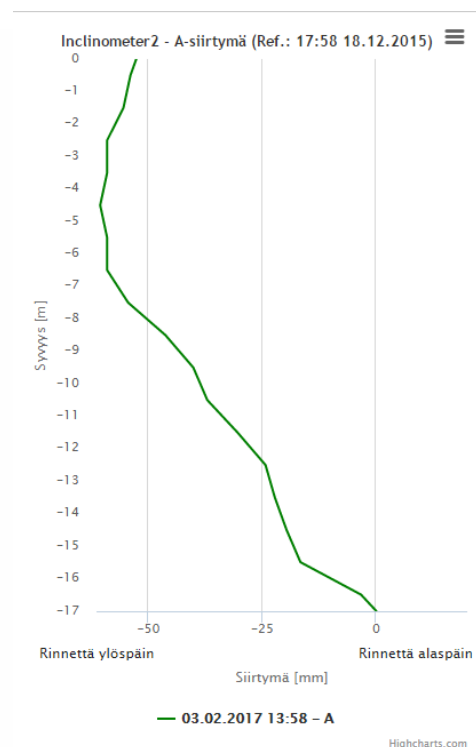
"Our co-operation with FinMeas Ltd's experts has run smoothly. They continuously develop their systems and take strong account of customer needs.

In addition to monitoring rock movement, Äikäs is interested in the possibility of using automatic systems to monitor groundwater surface levels and subsidence.

In the future, even more underground spaces will be built into rock, since most land areas in urban environments are fully built over. Accordingly, Äikäs believes that measuring will also increase in importance, because most high-quality rock resources have already been used within major cities. The main difference between monitoring systems lies in the number of measuring devices installed on each site. This depends on the planner. Accurate, real-time measurements are especially important in large underground spaces, such as subway platforms, used by masses of people.

"Determining the ideal number of measuring devices is always dependent on the information need and financial aspects. FinMeas has been an excellent partner for us, because it always provides us with well-designed and cost-effective solutions that cover all of our needs."

Movement since 30.09.14



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