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Tunnelling Crews Excavate Underwater Roadways with Rugged Technology

Contractors working on road and railway tunnel projects are using Handheld's Algiz rugged tablets to ensure a reliable, safe and efficient excavation process that minimises downtime and reduces personnel costs.

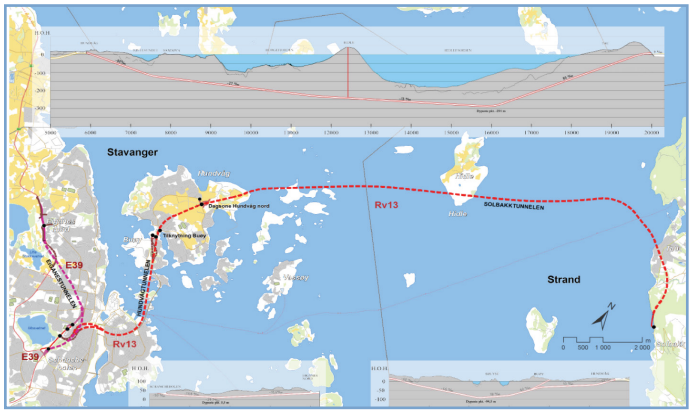
In this example – the Norwegian Ryfast-Solbakk tunnel megaproject – crews were using Algiz tablets as part of the Amberg Navigator solution from Swiss company Amberg Technologies AG, which packages Amberg Tunnel surveying software with Handheld's rugged tablets.

The surveying tablet solution allows tunnel workers to take precise measurements, generate tunnel profile graphics in real-time, and compile detailed reports, eliminating the need for separate surveying crews. Best of all, workers can perform these tasks on the surveying tablet with no prior surveying experience and very little computer training time.

A Tunnel beneath the Sea

Norway's west coast is made up of hundreds of small islands and fjords – areas where seawater reaches into narrow, deep valleys with high cliffs formed by glacial erosion. People travelling to and from the coastal city of Stavanger used to rely on bridges and ferries to access areas separated by water.

The Ryfast tunnel connects Stavanger to Norway's Ryfylke region, replacing a ferry between the two areas and cutting travel time by two-thirds. It is now the world's longest, deepest and safest subsea roadway



tunnel, spanning 14.3 kilometres and reaching 291 metres below sea level at its deepest point.

A Rugged Technology Breakthrough

To extend the tunnel through hard rock beneath the sea's surface, workers drilled holes through the material in precise locations using enormous semi-automatic drill rigs. Explosives placed in those holes blasted the rock away and conveyor belts removed this material from the site.

Traditionally, hole placement for the 'drill and blast' method of tunnel construction has been determined by surveying crews, who measure tunnel profiles and use this data to mark hole patterns or geo-reference drill rigs. But using the Amberg Navigator surveying tablet with automated surveying software eliminated the need for these extra surveyors; the tunnelling crews themselves could quickly and easily perform surveying tasks with detailed real-time analysis on the Algiz rugged tablets.

Of course, such highly precise work requires reliable

technology. For tunnel workers, reliability means two things: adequate speed and memory to process profile data, and exceptional durability in tough environments.

The engineering challenges workers were facing in the tunnel were amplified by the frigid, wet environment where they performed their work. The tunnel's surfaces ranged from muddy and slippery to rough and jagged; temperatures would drop below freezing; and humidity, dust and potential drops all posed threats to ordinary technology. Every piece of equipment at the construction site had to be able to withstand very harsh conditions.

With this in mind, Amberg Technologies chose **Handheld's Algiz ultra-rugged tablets** as the ideal complement to its Amberg Tunnel software. The Algiz tablets met the requirements for storage capacity and processor speed and were tested to stringent MIL-STD-810 U.S. military standards for withstanding humidity, vibration, drops and extreme temperatures. Plus, the IP65-rating meant that they were sealed against dust and water.

A One-Tablet Control Centre

With the Amberg Navigator surveying tablet, crews could measure tunnel profile data quickly and easily, display visualisations of that data in real time, and save detailed data logs. The software automates all measuring tasks, which workers can select and manage with one touch by tapping large, easy-to-interpret icons with illustrations – staying in control of the entire tunnel project.

To take measurements, workers use a total station – an electro-optical scanning tool that measures angles, distances and co-ordinates. They position the total station on a tripod or console aimed toward the area to be measured. Then the Amberg Navigator communicates with the total station using BT, automatically adjusts the total station's viewing area, and initiates profile data collection.

The surveying tablet can automatically profile a tunnel at pre-defined stations; it highlights areas where a blast has taken away too much or too little material; and it evaluates surface-layer thickness and displays the data graphically on the screen. With this information, workers can use the rugged tablet to set precise blast patterns and control drilling machinery.

The Amberg Navigator surveying tablet also made it possible for personnel to carry out simple, routine surveying tasks reliably, efficiently and independently. This meant cutting unnecessary waiting times as the measurements required could be integrated directly in the work procedures.

For more information on Handheld's rugged computers please contact:

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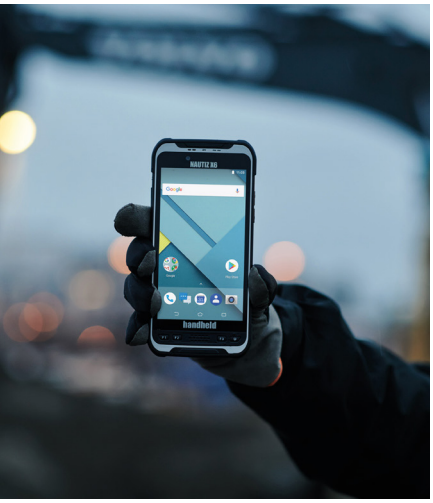

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