Job Report on Hydropower Station in Stanzertal, Austria

By Sascha Schreiner

It is remarkable that three different tunnel-building methods are being used on this hydropower station construction site: excavator, drill and blast, and tunnel boring machine (TBM) advancement. In addition to the normal horizontal tunnel, a vertical shaft is also being built.

In all tunnel-building methods, Aliva machines and Sika concrete products—such as the rotary machine Aliva 257 Top, the telescopic spraying arm Aliva 302, the Aliva 400 Spraying robot, and the Sika PM 407 concrete pump—are being put to the test. The new Aliva spraying device for robotic concrete spraying—the Aliva® Converto RoboSpray—is also in operation for shotcrete application.

The following Sika chemicals are being used: Sigunit® 49 AF (25 kg [55 lb] bags) and Sigunit L-93 AF liquid accelerator. Shotcrete for dry concrete spraying has been produced directly on the construction site in a separate concrete batching plant.

The project aims to combine the use of water from the local mountain river along with treated waste water that was collected and combined in a buffer tunnel and then fed into the new hydropower station.

Location and Preparatory Work

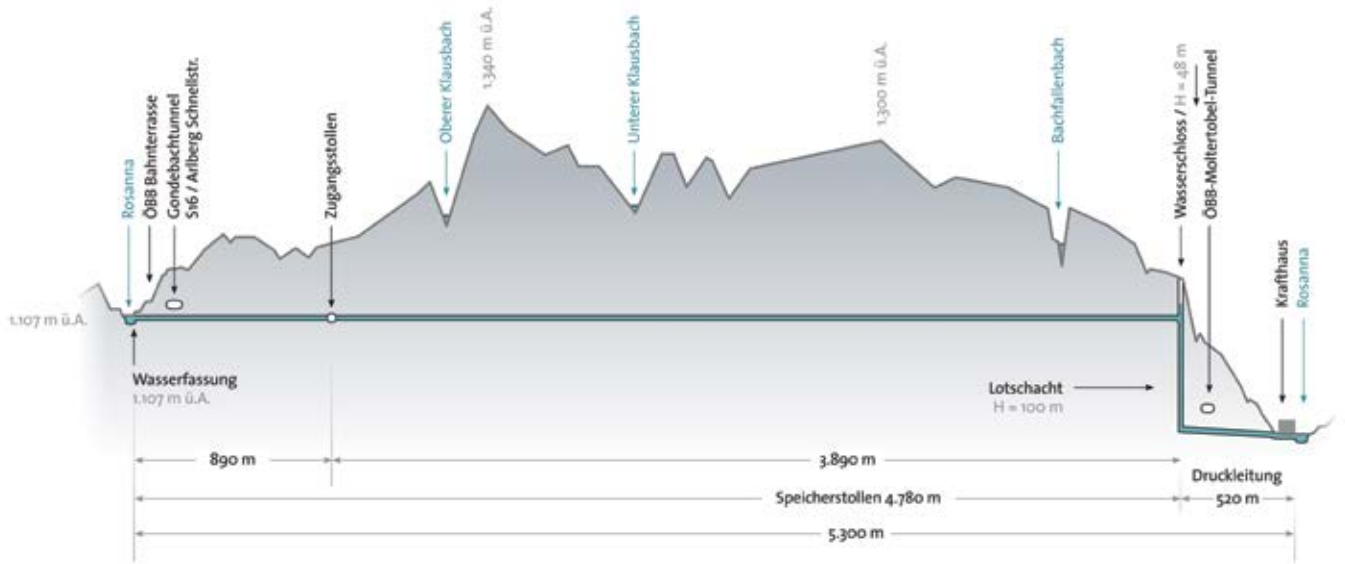
The construction site of this new hydropower station is located in the western part of Austria in the Tirol area. Due to its alpine location as well as its close proximity to the nearby water basin and power station—not to mention the crossing of two existing tunnels—construction work has been very complex and, to a certain extent, only done under extremely difficult conditions. Consequently, flexibility and reliability of the operating team's skills, as well as those of various suppliers/subcontractors, have continually been in demand. The building site facilities, which include the construction infrastructure and the logistics area, are found on the west portal of the site. That is also where the entrance of the tunnel and the disposal area for approximately 100,000 m^3 (130,000 yd^3) of excavated material can be found.

Project Data

- Construction time: March 2013 to September 2014
- ca. 1700 m (5600 ft) conventional drill and blast, excavator
- ca. 3800 m (12,500 ft) machine advancement
- ca. 130 m (430 ft) ALIMAK—advancement
- 3.81 m (12.5 ft) TBM—diameter

Project Execution

The project consists of a main and a secondary tunnel, and a vertical shaft which, upon completion, will all be connected. In addition, there are other buildings on site for energy production



Cross-sectional diagram of project

Telescopic spraying arm, Aliva 302. An automatic measurement system was installed into the road tunnel to detect any potential settlements at an early stage

and administrative work. All operations, such as the construction of the main and secondary tunnels, as well as the vertical shaft and the exit tunnel, were planned and adjusted to a fixed project time schedule. The length of the secondary tunnel is around 1000 m (3300 ft), with the main tunnel measuring approximately 4000 m (13,000 ft). The vertical shaft is 123 m (400 ft) and the exit tunnel 416 m (1360 ft) long. Because the crossing of the road tunnel has just a 4 m (13 ft) overlay, the last 100 m (330 ft) had to be built on a smaller scale. Additionally, three caverns were planned for tunnel crossings and machinery disassembly.

Excavating and Driving the Tunnel

Approximately the first 100 m (330 ft) of each portal were driven using a normal excavator because of the loose stones and sand on the mountain's slopes. Using the same procedure, the secondary tunnel was also constructed.

The entire secondary and exit tunnels were driven by drill and blast due to the geological configuration and other marginal conditions, such as the nearby road and train tunnels.

Spraying machine (rotary) Aliva 257

For both tasks, a Sika PM 407, with an Aliva 302 telescopic arm, in combination with the new Aliva Converto RoboSpray, were used for the application of the shotcrete. Aliva Converto RoboSpray's spraying device was ideal for this application and has exhibited outstanding spraying results.

Thanks to the easy and quick handling of the Aliva spraying arm, the critical part of the tunnel could be completed without a hitch.

Mechanical TBM Drive

During a driving break in the tunnel, an open TBM from Robbins was assembled. The Robbins TBM bored the main tunnel without any considerable breakdowns. An Aliva 257 top was mounted on the TBM. The machine was charged with a train and a shotcrete carrier. The shotcrete carrier was offloaded from a discharging belt on to a steep belt, which loaded the Aliva 257.

Spraying device for dry-mix shotcrete spraying (behind the drill head)

Spraying machine Aliva 257 with on-site conveyer belt

Vertical Shaft

The main tunnel ends in a cavern, which was ideal for the assembly of the ALIMAK machine that dug the 123 m (404 ft) deep shaft. It was comprised of three segments: the 91 m (300 ft) main shaft, a 33 m (110 ft) high water lock, and the transfer into the ventilation tunnel. The disassembly cavern for the TBM was built at the crossing of the main to the vertical shaft.

The vertical shaft was also built using an Aliva 257. This was done together with a conveyer belt and its powder dosing machine right at the bottom of the vertical shaft.

The material was conveyed on a mobile batcher to the portal, and from there it was further transported to the spraying machine by a dumper. The air supply provided was ideal, such that the complete shaft up to 123 m (400 ft) could be sprayed without any problems.

On this construction site, the Aliva machine's Aliva 257 provided the best solution thanks to their easy handling, low maintenance, and high reliability, as well as the availability of the machines. The smooth execution, however, was essentially the work of the highly skilled operating team on site.

Finishing Up and Project Conclusion

After completion of the tunnel advancement, a fiber-reinforced shotcrete lining will be applied in the entire main tunnel. The Sika PM 407 and the Aliva spraying arm Aliva 302 will once again be on hand to get the job done. The finishing touches to the inner lining are made of a steel pipe, which runs throughout the entire tunnel.

This project has proceeded without problems and on schedule thanks to vast experience and extensive know-how in tunnel and shaft construction as well as the reliable performance provided by Aliva machinery.

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