Dam building in the eternal ice
Glaciers are normally associated with "eternal ice", but global warming is threatening the glaciers in the Ötztal Alps: The Tiefenbachferner glacier has been melting continuously over the past 40 years, each year it lost one metre of thickness. In the aim of halting this process, the glacier will be covered with artificial snow in future. The water will come from the new reservoir which will be used to create an important part of the artificial snow in the entire Sölden ski area. The artificial snow will provide a protective layer and snow reserve for the glacier, and most especially on its fragile edge. Skiers in Sölden will also benefit since artificial snow provides a perfect base for winter sports.

Austria's largest artificial lake has a granite bed

The new artificial reservoir “Panorama” has impressive dimensions: With a volume of 405,000 m³, water depth of 17 m and water surface area of 35,000 m², it is the largest artificial lake in Austria. The water basin was created below the Tiefenbachferner glacier at an elevation of 2,900 m. A hollow in the mountain was prepared on one side and an artificial dam was built on the other side. Hamm technology was used for this job. The work involved a series 3000 compactor equipped with Hammtronic and the "HCQ GPS navigator" measurement and documentation system. The machine was used to compact the crushed granite in layers to form the dam structure on the valley side of the lake.
Hammtronic kept the compactors running dependably, economically and efficiently even at this high altitude up in the eternal ice.
Moving mountains: The granite is blasted on the mountain, requiring a total of about 100 t of explosives. Once crushed, thematerial was used to construct the dam on the other side. The asphalt surface installed in the final stage seals the reservoir.

A solid team: Kleemann crushers and Hamm rollers

On the opposite side, the basin for the artificial lake was created by blasting into the side of the mountain. Crushers were deployed to reduce the stone obtained in this process to a grain size of 0/200. The lion’s share of the crushing work was handled using a mobile Kleemann MC 110 R crusher set up right on the bottom of the new reservoir. Immediately after the stone was crushed, it was transported a few metres using dumpers to the opposite side where the Hamm compactor then created the new dam with up to 45 layers of a thickness of 50 cm each.

Superior depth effect

For the compaction work, the construction contractor Hilti & Jehle from Vorarlberg used a 3520 HT compactor. This machine has an operating weight of 20 t to handle the required compaction work with ease. Construction supervisor Alexander Hauser deliberately selected Hamm rollers for this project. His reasoning was as follows: “We enjoy working with Hamm machines. Another requirement at the reservoir was to provide ‘comprehensive compaction control’. In this area, Hamm is the only manufacturer that offers an easy-to-use solution with the company’s HCQ GPS navigator.”

HCQ GPS navigator: Easy documentation of compaction

“HCQ” stands for “Hamm Compaction Quality” and comprises a wide array of different measurement and documentation tools. The GPS navigator was used in the Tyrol. This system basically consists of three modules: A receiver picks up signals from multiple GPS satellites and a differential satellite and determines the exact position of the roller independently of fixed reference stations.

The second module – the compaction measurement system – is also very important. Using an acceleration sensor on the drum, the actual compaction is measured and transmitted to a rugged panel PC installed in the roller. This computer represents the heart of the system. It links the compaction measurement results with the position data at the time of the measurement and saves all of the relevant information. A “compaction map” is then displayed on the panel PC in the operator’s cabin. This map presents the measurement results to the operator using different coloured markings so the degree of compaction and number of completed passes are clearly visible.

Evaluation of the GPS navigator: Simple, fast and clear

Each time compaction of a layer was completed, engineer Hauser would read out the data using a USB stick and save it. The results are in the form of clear, unambiguous measured values and the interpretation process does not require any conversion or external software. “The HCQ GPS navigator delivers clear, traceable data that we can immediately interpret along with our customer. This simplifies the documentation process considerably”, said the construction supervisor in praise of the system. Moreover, operation on the actual roller is just as simple and convenient as the evaluation process. Using a user-friendly touchscreen, the operator or construction supervisor can enter the basic data. All the rest of the process is then handled automatically with no further operating steps required.
The construction season is short up in the high Alps. In good years, it is possible to work for five months at an altitude of about 3,000 m. During the rest of the year, snow and ice prevent further activities. Transportation represents another challenge: All of the machines and equipment including supplies and spare parts must be laboriously transported up into the mountains. It takes very reliable and economical “endurance runners” to complete this type of construction project on time and in an affordable manner.

The Panorama reservoir was built over two summers of construction. Work began late in the spring of 2009. Shortly thereafter, Hilti & Jehle began construction of the dam during the high summer. The Hamm roller was able to work for only two months before the arrival of winter. In 2010, the compactor with the GPS system was used for about five months. Of course, this was not continuous due to repeated weather interruptions, e.g. 60 cm of new snow in early September.
The GPS receiver right over the drum continuously determines the machine’s position. Comprehensive compaction control was specified for the embankment. Construction supervisor Hauser documented the compaction layer by layer and is thrilled with the result: “The system worked fabulously well during the entire time.”

Construction supervisor Ing. Alexander Hauser (left) is happy with his team: Walter Schmied transported the crushed stone using a dumper to the dam site. Bernhard Zangerle used an excavator to arrange the stone into 50 cm layers. Benjamin Zangerle then compacted the material using the compactor.
The compactor used to build the dam was equipped with the Hammtronic engine and machine management system.

Top performance in granite: The Kleemann MC 110 crusher

Granite is extremely hard and can push crushers to the limit. Since Hilti & Jehle was not satisfied with the performance of its existing machine, the company leased a Kleemann crusher of type Mobicat 110 R for this job up in the eternal ice. This mobile system was very impressive overall, including its ease of transport. What was truly fabulous, however, was its top performance during operation. Each day, the crusher processed over 900 m³ of the blasted material. This diverse company was so happy with the performance and dependability of the crusher that it took over the leased machine in the summer of 2010 for its own use.
Hammtronic ensures efficiency and dependability even under extreme environmental conditions

The compactor used to build the dam was equipped with the Hammtronic engine and machine management system. This ensures efficient usage of all of the machine’s capabilities while monitoring the engine and vehicle functions, and especially the drive, vibration, oscillation and engine speed. The electronic engine management system ensures adaptation of the vibration system and driving speed to the current usage conditions. Of course, this contributes to ensuring a long lifespan for the machine itself.

At an altitude of 2,900 m, another benefit of Hammtronic became clear: Due to the lower air pressure, many of the construction machines suffered during sustained operation and could not deliver the necessary performance. On the other hand, Hammtronic responded to the environmental factors and adjusted the machine parameters accordingly. This ensured trouble-free operation even under these unusual operating conditions. Construction supervisor Ing. Alexander Hauser confirmed this: “During the construction period, some of the machines kept us busy with engine failures. But the equipment from the Wirtgen Group ran continuously despite the high altitude.”

Dam construction completed after two years

After only two seasons of construction, the operators were able to begin filling the reservoir in mid-September 2010. Subtracting the delays due to sometimes capricious weather, a net construction time of just less than five months was obtained for the dam. During this time, the Hamm 3520 HT compactor processed about 120,000 m³ of granite. This enormous achievement made a sizeable contribution to the fact that the reservoir could go into operation a whole season earlier than planned. Now, the people in Sölden only have to wait one year until the reservoir is completely filled so the water can be used for snowmaking.