Sika Tunneling & Mining
Tunnel Projects Worldwide
Sika Tunnel Projects Worldwide

Gotthard Rail Tunnel, Switzerland

**Project**
On the axis from north to south, the owners AlpTransit Gotthard are building, with a length of 57 km, the longest tunnel in the world through the Gotthard Mountain. Travelling times for passengers and goods by rail between the economic areas Milan (North Italy) and German–speaking Switzerland/South Germany will be hours shorter.

**Challenge**
The construction of the longest railway tunnel, running 2000 m deep under the mountain top having a specified service life of 100 years without requiring major repair work, represents an extreme challenge also for concrete and shotcrete systems.

**Sika Solution**
The concrete systems based on Sigunit® / SikaTard® / Sika® ViscoCrete® tested for years in extensive prequalification procedures, are proving to be successful now since about 2 years on different sites of the project.

SikaPlan® waterproofing membranes assure the durable waterproofing of the tunnel.

Shotcreting systems Sika*-PM500 as well as the Aliva*-303 tunnel robots, mounted on the TBM, are up to their tough tasks.

**Current Situation 2004**
On four of the five contracts, excavation work is fully progressing. Rock TBM are in action on four excavation sites. There are countless excavation sites going on by drill—and–blast for main tunnel sections, connection tunnels, emergency stations, some under most difficult logistic conditions (site access Sedrun via a 1 km long adit and a 800 m deep vertical shaft)

Hai Van Pass Tunnel, Vietnam

**Project**
Approval by government for US$ 163 million, 5 km–long tunnel on proposed 1'880 km highway along Truong Son mountain range linking north with south of country in August 1997.

The project will cost a total of US$ 251 million. A joint venture of Hazama Construction (Japan) and Vietnam’s Cienco 6 won the tender for package–1A north tunnel section, while Package—18 south tunnel section went to a joint venture of Dong Ah and Song Na Construction. A consortium of Nippon Koei of Japan, Louis Berger of the US and the local Transport Engineering Design Inc. will serve as project designer and construction supervisor.

Main tunnel 6.3 km–long, 7.5 m–high x 11.3 m–wide underway with parallel emergency tunnel 3.8 m–high x 4.7 m–wide with 11 x 22.3 m–long connections for pedestrians and for vehicles. Ventilation tunnel 1.8 km–long x 8.2 m–wide.

**Challenge**
Shotcrete as door opener for selling all possible Sika products during tunnel construction.

**Sika Solution**
Concrete production with admixtures Sikament®, Sigunit®, joint sealing work with Sikaflex®, cementitious pouring work with SikaGrout®. Further products: SikaRock® anchor mortar, Sika® MonoTop® repair mortar, Sika® AnchorFix®, SikaShot® ready for use accelerator mortar, Sika® Waterbars®, Sika®-4a quick setting agent.
Metro Caracas, Venezuela

**Project**

**Metro Line 4:**
Contract award to consorcio de Brazil, led by Odebrecht, which bid US$ 101 million for the first phase of Line 4 consisting of 5 km of track with four stations, November 1999.

First phase with four stations will link Capuchinos on Line 2 with Plaza Venezuela III on Line 3, relieving the central section of Line 1. Civil engineering work will be undertaken by Norberto Odebrecht of Brazil, which bid US$ 101.2 million. The second phase of Line 4 will run southeast from Plaza Venezuela to El Cafetal, bringing the length to 12.4 km. Caracas Metro hopes to complete this extension by 2010.

**Metro Line 3:**
Construction of the El–Valle–La Rinconada section on Line 3 started first quarter of 2002. Four TBMs to be used, two of which coming from Line 4 once the twin tunnels between Capuchinos and Plaza Venezuela are completed. Odebrecht signed a contract to extend southwards Line 3 from El Valle to La Rinconada where the line will intersect with the Valles del Tuy railway. Completion scheduled for 2006.

**Challenge**
Durability under aggressive soil conditions. Alternative proposal to specified concrete mix design. Lower final cost of concrete segments.

**Sika Solution**
Elaborate optimum concrete segment mix design in Sika lab. Segment concrete with Sika® ViscoCrete® Technology and segment coating with Sikagard®-65W (curing, water impermeability and gasket glue).

Uetliberg Motorway Tunnel, Switzerland

**Project**

The core piece of the 11 km long western bypass road of Zurich is the two times 4.4 km long Uetliberg tunnel, running through the 3.3 km long molasse zone and 860 m of non-cohesive soil under the Uetliberg and the Ettenberg. The cross section of each of the tubes of the twin tunnel accommodates 2 traffic lanes and 1 emergency lane totalling 10.50 m of width. The opening for traffic is planned for 2008.

**Challenge**

The cross-section 14.40 m wide and 14.20 m high is excavated in the non-cohesive soil zones by headings with steel arches.

In the molasse section, a widening tunnel boring machine, using undercutting technology for the first time in the world, is used.

**Sika Solution**

SikaRock® anchor mortars are used for the highly demanding support work. Immediate support on driving is executed with SikaShot® dry mix shotcreting, followed by a temporary shotcrete lining with Sigunit® / SikaTard®.

The concrete for the inner lining is mixed with Sikament®. SikaPlan® waterproofing membranes assure durable waterproofing of the tunnel. In the section excavated by headings, the proven mini shotcrete systems Aliva®-503 are up to their hard task.

**Current Situation 2004**

The non-cohesive soil sections are almost completely excavated. The first pilot gallery is bored, and the widening TBM is fully at work in the first tunnel tube.

The first ventilation station is already completed.
Kárahnjúkar Hydroelectric Project, Iceland

Project
The development of the Kárahnjúkar Power Station entails the harnessing of the glacial rivers Jökulsá á Dal and Jökulsá i Fljótstal. These rivers originate in the north–eastern region of the Vatnajökull ice cap and run in a north–east direction through the Jökuldalur and Fljótsdalur valleys to their common estuary in the Héradsflói bay.

Hálslón Reservoir and Dams: The Kárahnjúkar dam (concrete–faced rock fill dam) with a length of 730 m and a maximum dam height of 190 m, together with two saddle dams – the Desjarár dam with a length of 900 m and a maximum dam height of 60 m, and the Saudárdalur dam with a length of 1'100 m and a maximum dam height of 25 m, forms the storage reservoir Hálslón. The square measure of a full reservoir will be 57 km².

Ufsarlón Reservoir and Dams: The Ufsarlón reservoir will cover a surface area of 1 km². It will be formed through the damming of the glacial river Jökulsá i Fljótstal by the Ufsa dam with a length of 675 m and a height of 32 m.

Headrace Tunnel and Penstocks: Water is carried from the Hálslón reservoir through and underground headrace tunnel (length 39.8 km and diameter of approx. 7.2 m) eastward to a juncture with a division tunnel (length 13.3 km and diameter of approx. 5.5 m) from the Ufsarlón reservoir. From there, a single tunnel continues north–east to the Teigsbjarg escarpment.

Powerhouse, Tail Water and Access: The Powerhouse will be located underground and will be approximately 115 m long, 14 m wide and with a maximum height of 34 m.

The project start was in 2002 and the project end is planned for August 2008.

Challenge
The fill materials of the 5 dams, approx. 13'600'000 m³, has to be prepared on site, placed and compacted to receive a watertight construction. The Headrace tunnels are mostly carried out in “full–face boring” system (TBM) with diameters of 6.8 – 7.2 m and 5.5 m. Parts of them are carried out in “drill and blasting” system with cross sections of 5.8 x 5.8 m resp. 7.2 – 7.6 x 8 m.

Sika Solution
A minimum 250 mm thick layer of shotcrete with Sigunit® over the crown is applied throughout the drives with rockbolts, steel sets and thicker layers of shotcrete around more of the exposed tunnel walls required in poorer rock conditions. Among 8 Sika Putzmeister spraying systems on site 3 pumps Aliva®-278 / Aliva®-403 will be installed on the 3 TBMs from Robbins. For the mass concrete of the dams Sika® Plasticiser Plastiment® LA-100 will be used.