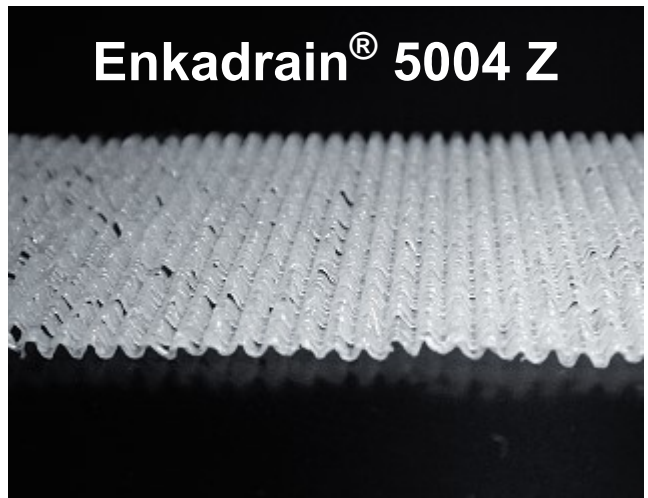




DRAINED TUNNEL SEALING with



SCHOELLKOPF AG 

COLBOND

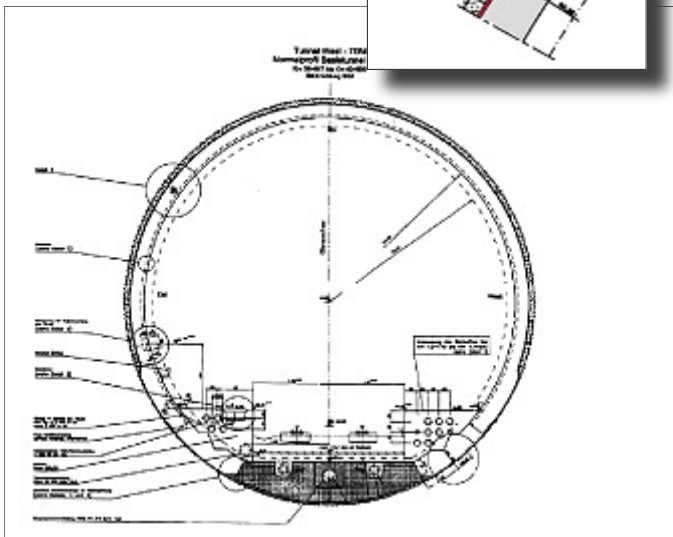
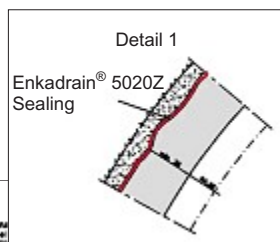
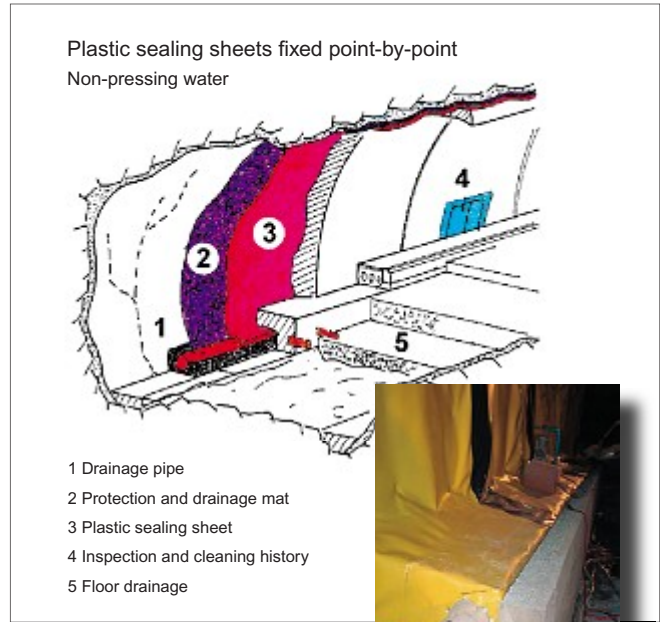
In the Steg Raron sections, some 1000 m² of the sealing system, or 50 meters of tunnel, were laid per day.

The sealing system No. 212, consisting of the liner (KDB) Sikaplan 14.6 and of the Enkadrain[®] 5020Z/2-1s/T200PF protection and drainage mat, is built into various sections of the Lötschberg base tunnel as well as the Gotthard base tunnel.

In both conventional tunnel driving and driving with the tunnel drilling machine (TBM) the tunnel excavation is secured with rock anchors, nets and shotcrete. Before the inner shell is concreted, the liner is built in, using the Enkadrain[®] 5020Z/2-1s/T200PF drainage mat. In the NEAT tunnel a so-called umbrella sealing is being installed, i.e. a sealing of the roof and tunnel walls. It is not seen as necessary to seal the floor.

Enkadrain[®] 5020Z/2-1s/T200PF is stretched tight when laid and protects the 2 mm thick liner from damage and provides a positive drainage system.

The overlapping sheets of the liner are welded together with a double welded seam. Between the 15 mm-wide seams is a 10 mm wide channel which is tested with an overpressure of 2 bar to inspect the weld seam consistency.

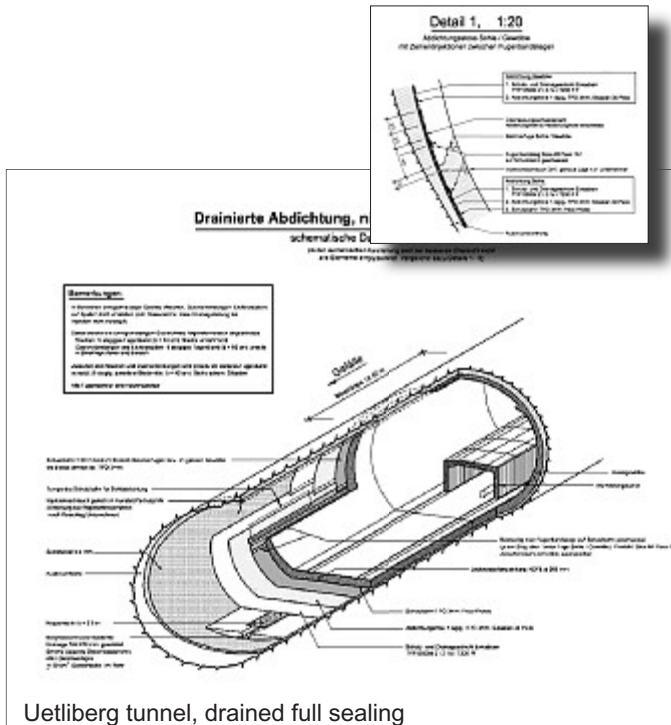
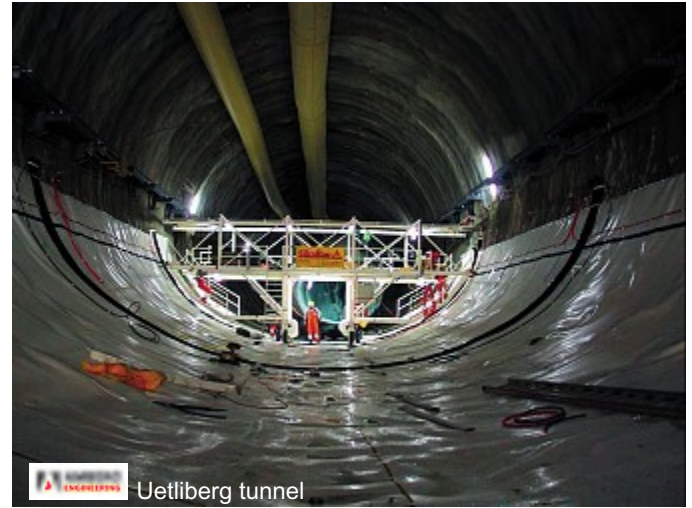


The problems encountered with swelling rock mass led to the development of Enkadrain® 5004Z

Enkadrain® 5004Z was developed during the pre-qualification of the NEAT systems specifically for use as a protection, drainage and injection mat for the highest pressures, such as swelling rock mass.

The third tunnel of the Baregg tunnel near Baden as well as the Uetliberg tunnel of the west bypass of Zurich were constructed with Enkadrain® 5004Z.

The excavation of the Uetliberg tunnel is done with a tunnel boring machine TBM (diameter 5 m) and a tunnel boring extension machine, TBE with undercutting technology which follows it. With the TBE, the previously sunk pilot tunnels are driven to the full cross section of 14.10 to 14.40 m in diameter. The consolidation, consisting of cable bolts, friction tube stabilizers, nets and shotcrete, are fitted directly behind the bore head. Under the trailer, the Enkadrain® 5004Z drainage protection mats and the liner are laid, and the floor, service duct and side backfill are built.



Enkadrain® 5020Z			
Tunnel	Length	Section	Area
Lötschberg	34.6 km	Mitholz	> 400'000 m ²
		Ferden	> 250'000 m ²
		Steg / Raron	> 500'000 m ²
Gotthard	57.0 km	Bodio / Faido	> 1'800'000 m ²
		Sedrun	> 400'000 m ²
Glion	1.3 km		> 50'000 m ²
Enkadrain® 5004Z			
Tunnel	Length	Section	Area
Uetliberg	3.4 km		> 200'000 m ²
Baregg	1.1 km		> 30'000 m ²