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INSIDE THIS ISSUE

[Penetron® Feature:
Penetron Admix
Enhanced Shotcrete
\(PAES\)](#)

[PAES Worldwide:](#)

[SWEDEN –
KROKSBERG TUNNEL](#)

[SWEDEN –
BOTNIABANAN Railway](#)

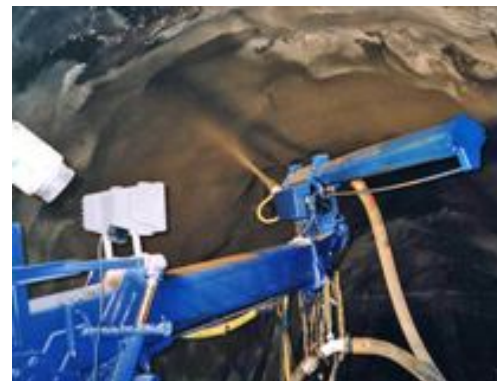
[ITALY MEZZASELVA
TUNNEL, BOLZANO](#)

Internal Waterproofing for Concrete

Penetron® Industry Newsletter

June 2009

Since our first newsletter on the PAES System in November 2005, we have had numerous inquiries into its use as a repair system and for new applications. The overwhelming responses and our continued successes in the Shotcrete industry have prompted us to share more recent projects, applications and testing to underscore the efficacy of PAES.



Penetron® Feature: Penetron Admix Enhanced Shotcrete (PAES)

Tunnel waterproofing is often done by using shotcrete structures that lead the water from the rock into a subsurface draining system. The main problem with this solution is making the shotcrete waterproof. Water leakage is normally caused by cracks in the shotcrete, bad workmanship and porous shotcrete. We traditionally recommended to spray Penetron onto the shotcrete surface. While this is very efficient, it is also labor intensive and hence expensive... In recent years, a better solution was found; using Penetron Admix enhanced shotcrete!

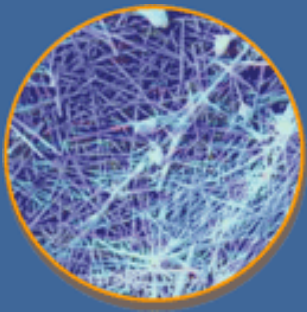
Penetron Admix enhanced shotcrete (PAES) has been extensively tested by accredited concrete laboratories. The test results show that PAES reached the maximum result in the freeze/thaw test SS(EN)-137244 and reduced the depth of penetration of water under pressure Norm SS



SWEDEN – TWIN
HIGHWAY TUNNELS,
STOCKHOLM

FAST FACTS

The Penetron System
allows concrete to
breathe, avoiding build
up of vapor pressure



An intricate web of
insoluble crystals forms
in the presence of
Penetron® and H₂O
creating a permanent
protective seal



Witness Penetron's crack
sealing ability

EN-12390-8 from 21mm for the control concrete
to 7mm for PAES. The adhesion values of this
shotcrete increases as well.

**PAES was tested in 2008 at CONCREMAT in
Brazil in accordance with the following
standards;**

- Concrete aggregates – NBR 7211/05
- Water penetration test according to NBR 10787/94
- Electrical resistance – NBR 9204/85
- Capillary Test– SAI 162/1
- Water absorption, voids and specific gravity – NBR 9778/05

Two steel drums, with numerous drill holes to
allow the water pressure to build up, were primed
with a cement mortar for increased adhesion.
PAES was applied to one drum and a control
shotcrete without Penetron Admix to the other one.



The two drums were then cured for 5 days, sealed and filled with water, after which a water
pressure of 2 bar was applied.

PAES



10/31/2008

Control



10/31/2008



Send to a friend or
colleague.



11/07/2008



11/07/2008



11/12/2008



11/12/2008



11/13/2008



11/13/2008

A visual evaluation showed that the PAES coated drum was around 70% dry, whereas the control shotcrete was completely soaked with water.



PAES Worldwide:



SWEDEN – KROKSBERG TUNNEL

The 110 years old ÅDALSBANAN, a 180km long railway connecting the county town of Sundsvall in middle-east Sweden with the BOTNIABANAN railway (presented in the next project below) is presently being upgraded to an express railway standard. In this very beautiful landscape the project includes 8 new railway tunnels with a total length of about 20 km. 5000m³ PAES™ has already been delivered to the KROKSBERG tunnel which is the first tunnel to be PAES-lined in this project. The railway will open for traffic 2011.



SWEDEN – BOTNIABANAN Railway



[\(Click above to enlarge map\)](#)

The BOTNIABANAN Railway project, a 250km long new railway with around 25km of tunnels is under construction and located 550 - 800km north of Stockholm along the Baltic Sea coast.

The specifications of all products to be used on this project are extremely demanding and stringently controlled, with environmental considerations, zero pollution and ground water contamination all high on the list of priorities. With Penetron's 10 year long experience in Sweden on waterproofing traffic tunnels and after several years of testing for compliance with environmental standards, Penetron was allowed to demonstrate its waterproofing abilities on this project.

Since then, the tunnels treated with the traditional Penetron spray-on method on this project up to November 2005 include Askottberget 3.3km, Varvsberget 2km, Stranneberget 1.4km, Kalldalsberget 1.1km, Hjalta 1.2km and Oberget 0.5km. The railway started its operation in 2008.



A special Penetron Admix enhanced shotcrete (PAES) was developed in 2003 and has been tested for 2 years on special sections of this project. The results were carefully observed and evaluated, resulting in the use of PAES on a full scale section of the Askottberget tunnel.



ITALY MEZZASELVA TUNNEL, BOLZANO

The engineers on this project could not use a PVC membrane due to a lack of space, which opened the door for PAES on this project. In 2004, Penetron Admix was mixed with the shotcrete at the batching plant, after which PAES was applied with an average thickness of 10cm.

The application was a complete success, with even a previously severely leaking construction joint treated with the enhanced shotcrete ending up completely dry.



SWEDEN – TWIN HIGHWAY TUNNELS, STOCKHOLM

Construction of the E18 FRÖSVI TWIN TUNNEL and E 18 ULLBRO TWIN TUNNEL is currently in progress. The PAES application started in February 2009 and so far over 6000m³ of PAES has been applied.

PAES is applied in a one spray wet shotcrete lining process, with a layer thickness of 150mm.



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