Water and Frost Protection

Polyethylene Foam (PE) Sheets

Details provided by Skumtech AS
Following pictures from Norwegian W. Coast road tunnel (Veitastronda). Same system also used for railway tunnels.

- Foam sheet overlap = 30 cm
- Typical bolt spacing 1.2 x 1.2 m
- Bolts Ø16 mm in road tunnels and Ø25 mm in railway tunnels
- Thickness of PE sheets 50-100 mm
Fixation bolts for PE-foam sheets
Foam sheets mounted
Final steps illustration
**Finished Protection**

*First*, permanent **rock support** by rock bolts and fibre reinforced sprayed concrete.

*Then*, PE foam sheet umbrella to divert water to invert drainage **and** prevent drips and build-up of ice. Foam sheets are mounted on rock bolts. Available: 45, 50, 60 and 70 mm thickness & 2x 40 mm.

Mesh reinforcement is mounted on tunnel side of PE-foam sheets at 25 to 30 mm clearance before placing sprayed concrete.

Sprayed concrete applied for **fire protection** and for stiffness against air-pulses created by traffic. 2 kg/m3 added PP-fibres to prevent spalling during fire.
PE-sheets alternatively mounted **without overlap**

Bolt pattern 1.38 X 1.38 m

(Note that when **frost is not an issue**, PE-sheets will be replaced by PVC or HDPE membrane)