BarChip® Synthetic Reinforcing Fibre

Vadheim Tunnel Norway

Product used: Barchip 'Kyodo' 48mm

The Project

Veidekke ASA won the contract to construct the 3.5km long Bogstunnelen in Western Norway in August 2002.

The NOK113 million (Euro14 million) contract from the National Roads Administration was to secure a new stretch of road against avalanches and landslides which the previous road was prone to on a regular basis. The tunnel was constructed on the E39 between Teigen and Bogen at Vadheim in the municipality of Høyanger.

Tunnel portal.

The tunnel's geology consisted of gneiss and solid rock with no major faults. High ground stresses were expected in some areas. Geological studies were carried out by the Norwegian Geological Institute (NGI).

Removal of tights prior to spraying of shotcrete.

Excavation was by drill and blast. Ground support was using rockbolts and fibre reinforced shotcrete (FRS) as a one pass finished lining.

Performance

The shotcrete performance specification for the tunnel nominated two criteria – 700 Joules for the majority of the tunnel and 1000 Joules for areas of higher stress and emergency parking bays where larger roof spans were incorporated. To achieve this Veidekke proposed the use of a hooked end steel fibre dosed at 25kg/m^3 (700 Joules) and 35kg/m^3 (1000 Joules).

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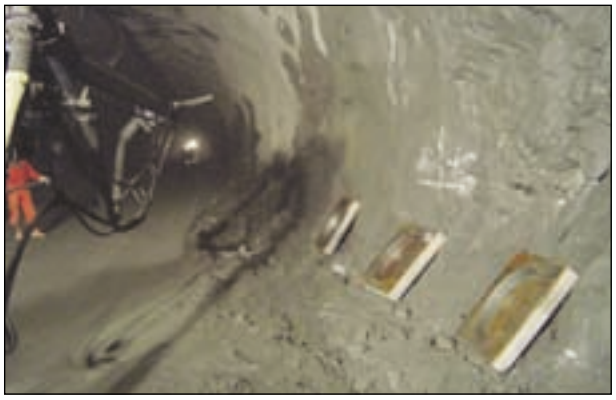
Barchip Trials

In February 2003 Veidekke trialled EPCE's Barchip Kyodo in order to compare it with the hooked end steel fibre. Test panels were sprayed using dose rates of 5kg/m^3 and 7kg/m^3 of Barchip Kyodo which achieved the required performance criteria of 700 Joules and 1000 Joules respectively. Not only did it achieve the required specification but it was easier to handle at batching, did not rust and was cost competitive.



Test panels ready for spraying.

Once the performance of the Barchip had been confirmed as equal to steel fibre a full insitu trial was instigated.

This insitu test involved the spraying of a 100m section of tunnel with the Barchip fibre. To fit in with the excavation cycle and to enable a like for like comparison with the steel fibre it was decided to spray each "cut" (approximately 4 linear metres) alternately with Barchip fibre and then steel fibre reinforced shotcrete.

Preparation for spraying Barchip fibre shotcrete insitu.

Conclusion

Three to four months after the shotcrete's application, both steel and Barchip reinforced shotcrete were inspected to ascertain their insitu performance. The conclusion was that no discernable difference could be seen in the performance of the two types of reinforcement except for the steel fibre which showed signs of rusting in all areas where it was exposed.

References:
Norwegian Building Research Institute
Report 1-Seighetsproving av fiberarmert sproytebetong – Plateproving 04 March 2003
Report 2-Testing of Fiber Reinforced Shotcrete – 18 July 2003
European Specification for Sprayed Concrete EFNARC 1996

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