

UGC - Online

One- and two-component polyurethane MEYCO[®] MP355 for stabilizing ground over TBM drive The Ghomrud Water Tunnel Project, Iran

The Project

The 36 km long Dez-Ghomrud water diversion tunnel in western central Iran is divided into four main contracts. The last 8 km of the tunnel heading downstream is located in a mica-schist with generally good stability. This part is being excavated with a double shielded, 4.6 m diameter hardrock TBM. The trapezoidal segment lining with peagravel annulus fill is being installed concurrently with the excavation.



The Ghomrud water tunnel, downstream portal.

After approximately 3.2 km of excavation the TBM encountered a weak graphite schist with poor stability. When attempting to excavate through this ground, several collapses occurred over the TBM cutterhead and shield. The collapses propagated up to 8-10 m height over the TBM.

The Task

The voids which formed above the cutterhead represented an imminent danger for a continued deterioration of the stability of the rock mass above the TBM. A temporary measure to fill and stabilize the voids was therefore needed.

Contractor JV:

Fater Co, Iran (tunnel contractor)
SELI, Italy (TBM specialist contractor)

This task could be broken down in the following elements:

- Filling of the voids over the TBM by means of injection
- Possibility for step-wise application enabling complete filling of the void from different working positions on the TBM
- Immediate application for resolving of this urgent and difficult situation.
- Avoiding of large volumes of un-reacted or un-hardened grout.

Successful improvement of instable rock and cave-in debris over the shield and cutterhead of a TBM by the injection of one- and two-component polyurethane MEYCO[®] MP355



Ghomrud water tunnel during excavation. Final lining with trapezoidal pre-cast concrete segments.

The UGC Solution

BASF UGC suggested solving the problem by injecting polyurethane foam into the voids. In this way the expanding polyurethane would create a rapid and thorough filling of the voids, as well as consolidation of the rock debris which was resting on top of the shield and cutterhead. The rapid reaction of the foam would cause it to remain in place where intended, and not flow into the TBM.

For the sake of availability both one-component polyurethane MEYCO® MP355 1K and two-component polyurethane MEYCO® MP355/A3 were used. A two component high pressure pump was used for both products.

In order to obtain the highest possible expansion factor of the polyurethane, water had to be added since the ground was completely dry. For the two-component polyurethane MEYCO® MP355/A3 water was added to component A (1% by volume), hence creating an instant foam when the two components were mixed. For the one-component polyurethane MEYCO® MP355 1K, water was sprayed into the void through perforated plastic pipes. Hence, wet conditions were created and the polyurethane foamed instantly.

Speed and supply were essential - Equipment and product were both on stock in Tehran and were delivered at site 7 hours after the site management made their decision to inject.

Application was performed with the specialist contractor Paya Beton with support from personnel from Iranian Degussa Construction Chemicals.

Results

Approximately 2 tonnes of polyurethane was injected over the TBM. This gave a total foam volume of approx 30-35 m³. Hence, a significant void filling was achieved. The TBM was moved forwards and the segments could be placed without the debris caving into the tunnel.



Injection of two-component polyurethane MEYCO® MP355 A3 through pipes into the void over the TBM cutterhead.

The information given here is true, represents our best knowledge and is based not only on laboratory work but also on field experience. However, because of numerous factors affecting results, we offer this information without guarantee and no patent liability is assumed. For additional information or questions, please contact your local UGC representative.

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