

# Synthetic Macro Fibre Reinforced Shotcrete

## Durus® EasyShot

### Synthetic fibre reinforcement in shotcrete

Macro-synthetic fibre reinforced shotcrete (MSFRS) has been used successfully in ground support for more than 30 years.

The main challenge in designing support to underground openings is in determining the strength and deformation properties of the surrounding geological formation.

In New Austrian Tunneling Method (NATM) construction, it is accepted that large deformations are needed to enable the ground to stabilise and accommodate loads.

Designers rely on the residual flexural strength and post crack ductility of a primary concrete lining which can be provided by Durus EasyShot macro-synthetic fibre reinforcement.

### The ductility of fibre reinforced shotcrete

It is important that during the stabilisation and movement of the surrounding ground or rock, the concrete is able to follow without collapsing and absorbs the energy by taking advantage of its post-crack behaviour. The post-crack capacity of FRS can be determined through mainly two internationally recognized methods:

- European *EFNARC panel test (EN 14488-5)*
- American *RDP test (ASTM C 1550)*.

Both tests are used to determine the ductility or toughness of concrete by measuring the centre point load vs deflection. These measurements are used to calculate the energy absorption in Joules.



Shotcreting walls after drill and blast



EFNARC plate test - EN 14488-5



Round Panel test - ASTM C1550

### Advantages of Durus EasyShot in sprayed concrete

#### Performance

Durus EasyShot has a low cost per Joule. With a dosage of 4kg/m<sup>3</sup>, average values of more than 800 Joules in EN 14488-5 plate tests are achieved. Durus EasyShot is a flexible fibre, allowing no limitations to the length of the fibre as they will not block the nozzle during application. This allows Durus EasyShot to outperform steel fibre reinforced shotcrete (25-30kg/m<sup>3</sup>).

#### Durability

Durus EasyShot is manufactured with a working life in excess of 100 years. As the fibres are made out of virgin PP the product is chemically inert and does not corrode in the same way as steel.

#### Other advantages

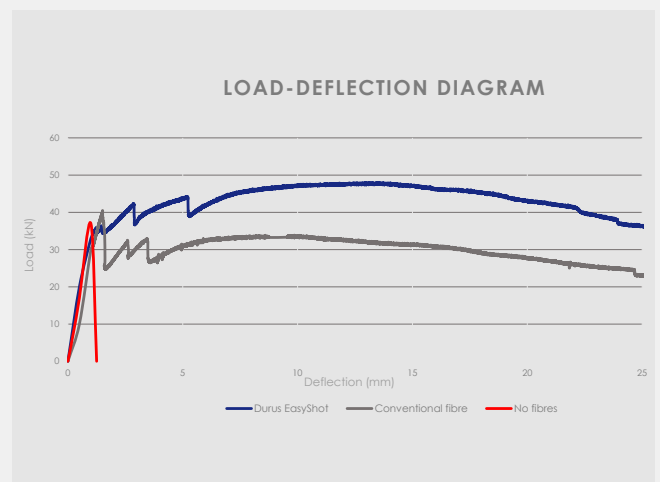
- Easy to pump
- Reduced rebound during application
- Reduced wear and tear on pumps and slick lines
- Improved construction site safety
- No stringent crack width limitation needed for durability
- Significant reduction in embedded carbon (sustainability)



Preparing shotcrete panels for EFNARC Tests



Durus EasyShot - 55 mm long, high performance synthetic macro-synthetic fibre for use in shotcrete



EFNARC panel test of Durus EasyShot vs. conventional fibre