

NORDIC GEO SUPPORT

TBM solutions

&

Soft Eye Technology

FOR
TUNNELLING



TBM Solutions Page



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NORDIC GEO SUPPORT works with the technology leader Dextra to offer customers globally Soft Eye solutions for TBM Tunnelling applications. Nordic Geo Support also offers a comprehensive range of geotechnical solutions from injection technologies, meshes, anchors, spray and shocreting solutions, as well as cement and resin delivery systems. Working with leading certified suppliers in combination with experienced manufacturers that are employing leading edge product design and innovative production facilities, we offer high quality, high performance solutions to your project challenges.

Nordic Geo Support Product Offer

Drilling Consumables

High Performance rock drilling tools and consumables:

- DTH Hammers
- Bits
- Shanks
- Rods
- Drill Pipes
- Adapters
- Augers, Accessories

Injection Grouts

Leading edge resin injection technology for demanding cases:

- Water Stopping
- Sealing
- Ground Consolidation
- Ground Stabilisation
- Construction and structural repairs

Anchoring & Bolting Grouts

Grouting technologies offering ease of use, clean and fast setting:

- Capsules
- Cartridges
- Pumpable grouts
- Additives

Anchoring & Bolting

A broad range of rock bolting and anchoring technologies:

- Double and single coated protected steel
- Steel Self Drilling Anchors
- GFRP bolrs of all types
- Standard bolts and meshes

Cement-Based Additives

Cement based admixtures and additives:

- Concrete Repair
- Admixtures
- Modifiers
- Waterproofing
- Joint Sealants

Pumps & Accessories

Cement and resin mixing and pumping technologies:

- Cement Pumps
- Resin Pumps
- Transfer systems
- Dataloggers
- Hoses, lances, packers

Water control

Waterproofing, drainage and pumping:

- TunnelDrain innovative strip drainage system
- Drainage pipes
- Waterproofing grouts, additives and sealants
- A broad range of dewatering pumps

Ventilation

Air quality, ventilation and safety solutions:

- Ventilation bags and systems, including Mecanicad's rigid ducts
- Fans & inline coolers
- Water atomisers

Re-usable Hangers

Developed in the Nordics, fast, easy to use & reuse:

- Services Hooks for ventilation systems, water and pneumatic lines, electrical cables and distribution boards
- Blasting hooks

Other products

A range of other products:

- Coatings & sealants
- Personal protective products
- Mining accessories

Glossary

Active Anchor: An anchor which is post-tensioned from the external face of the ground immediately after installation and is usually designed to help prevent deformation of the ground or retained structure. It has a free length and a bonded length.

Ground Anchor: A ground or earth anchor is an installation in the ground which is capable of transmitting an applied load to a local bearing stratum. The tensile element of a ground anchor is typically a steel bar, FRP bar or strands.

Passive Anchor: An anchor which is not pre-tensioned. Applied loads are transmitted from the ground or ground structure directly. A passive anchor does not usually have a free (unbonded) length of tendon.

Permanent Anchor: An anchor with a design life greater than two years. The design life of “semi-permanent” anchors, should be defined by the consultant, but is usually in the range of five to ten years.

Soil Anchor: A ground anchor installed in “SOIL” (soft ground).

Soil Nail: A temporary or permanent, passive anchor, installed into the ground. A typical application is slope stabilization.

TBM: Tunnel Boring Machines

Temporary Anchor: An anchor with a design life less than two years

Tie-Back: An anchor, usually horizontal or nearly horizontal, used to reinforce retaining walls for stability. One end of the tieback is secured to the retaining wall, while the other end is anchored to a stable structure, such as a back-wall or anchored into earth with sufficient resistance (grouted bond length). A tie-down is the same kind of anchor but installed vertically or nearly vertically

Soft-Eye: Use Cut-able glass fibre reinforcement instead of conventional steel rebars in the D-Wall / Pile area where the TBM will break-through.

Rock Anchor: A ground anchor installed in “ROCK” (hard ground).

Rock-Bolt: A long anchor bolt, for stabilizing rock, which has usually been excavated. Rock bolts are often used in tunnels or rock cuts. They transfer loads from the unstable rock exterior, to the confined and much more stable interior of the rock mass.

Rock Dowel: Passive reinforcing elements inserted into predrilled holes in rock and bonded in place with grout. Can be temporary or permanent

Single-Corrosion Protection (SCP): Anchor A single layer of corrosion protection preventing the onset of corrosion during the designed life

Double-Corrosion Protection (DCP): Anchor Two protective barriers preventing the onset of corrosion during the designed life. Typical barriers include grout, a corrugated plastic duct, grease or epoxy coating.

Soft-Eye: Use Cut-able glass fiber reinforcement instead of conventional steel rebars in the D-Wall / Pile area where the TBM will break-through.

Hollow Rock: Bolt A rock-bolt using a hollow bar which acts both as an anchor and a grouting pipe.

Self-Drilling Anchor: A hollow anchor bar with end drill bit, allowing drilling, flushing, grouting and anchoring in one operation. Can be temporary or permanent.

Expandable Friction Bolt: A bolt made of a deformed steel tube that is expanded by injecting high-pressure water.

Mechanical Bolt: A non-grouted active anchor using an expansion shell to create a point-anchor at the bottom of the hole, while tensioning is performed at the top of the hole, usually using a plate and nut.

Micropile: Also known as minipiles, micropiles are deep foundation elements constructed using highstrength, small-diameter steel casing and/or threaded bars.

Crosshole Sonic Logging (CSL): This is an accurate method to determine the structural integrity and homogeneity of concrete within diaphragm walls, bored piles, drilled shafts, barrettes, concrete piles or augercast piles.

TBM and Advancement Technologies

Injection resin technology

Nordic Geo Support offers an extensive range of injection materials in silicate, polyurethane, acrylate and epoxy bases. Supported by the complete delivery solutions including pumps, hose, lances, packers and systems for:

- TBM stabilisation,
- TBM Rescue,
- Ground consolidation and
- Water sealing.



Face and Advancement stabilisation technologies

Nordic Geo Support offers a range of solutions in steel and GFRP technologies for:

- Pipe Roofing Systems,
- Spiling Systems,
- Cutable face stabilisation technologies



TBM Cable and Service Hooks

Fast installation, re-usable service and cable hooks
Various designs, with features and benefits including:

- Mounting within seconds no need for added cements/grouts
- Re-usable where required
- Expandable mounting based on shell technology
- Corrosion protection through shell design
- Approved up to 420kg weight capacity
- Designed for immediate support of services



Perforator Cutter Discs

Specialised German manufactured cutter discs using high quality materials, large roller bearings, complete mechanical seals (unsplit). Standard Sizes:

- ø 250 mm 2-ring
- ø 280 mm 2-ring
- ø 305 mm 2-ring
- ø 395 mm 1-ring / 15,5"



Soft Eye



Nordic Geo Support's ASTEC Soft Eye from Dextra is the turnkey solution for efficient boring of reinforced concrete structures. Soft Eye facilitates the penetration of the Tunnel Boring Machines (TBM) through diaphragm walls and secant piles.

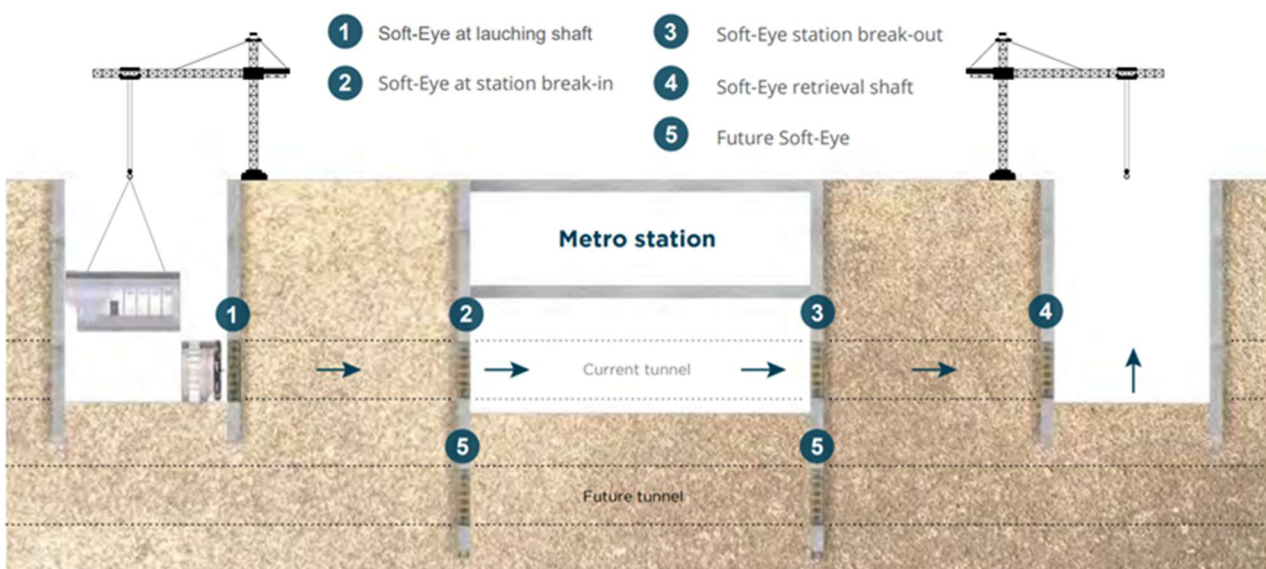
- Speed up the construction schedules. TBM passes through the Diaphragm Wall
- Secure breakthrough. Reduce risk of collapse at the breakthrough point.
- Save equipment. No demolition equipment needed. No metal to metal contact during breakthrough
- Commit on Safety No workers required to access the shaft.

Guidelines

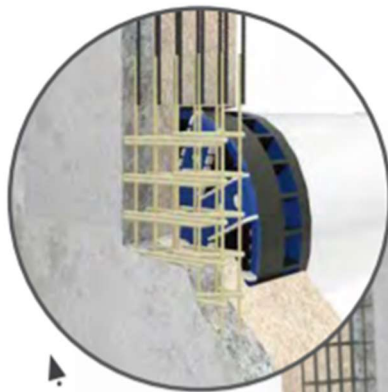
ACI 440.1R-15, 2015:
 "Guide for the Design and Construction of Concrete Reinforced with FRP Bars,"
 Published by the American Concrete Institute, Farmington Hills, MI.

ACI 440.3R-12, 2012:
 "Guide Test Methods for FRP Composites for Reinforcing or Strengthening Concrete & Masonry Structures."

This unique technology uses cut-able Glass Fiber Reinforced Polymer (GFRP) reinforcement as an advantageous replacement for conventional steel rebars. Since 1996, DEXTRA has established new standards becoming the worldwide reference. Dextra is the leaders of this technology, they have successfully supplied over 500 Soft Eyes all around the world.

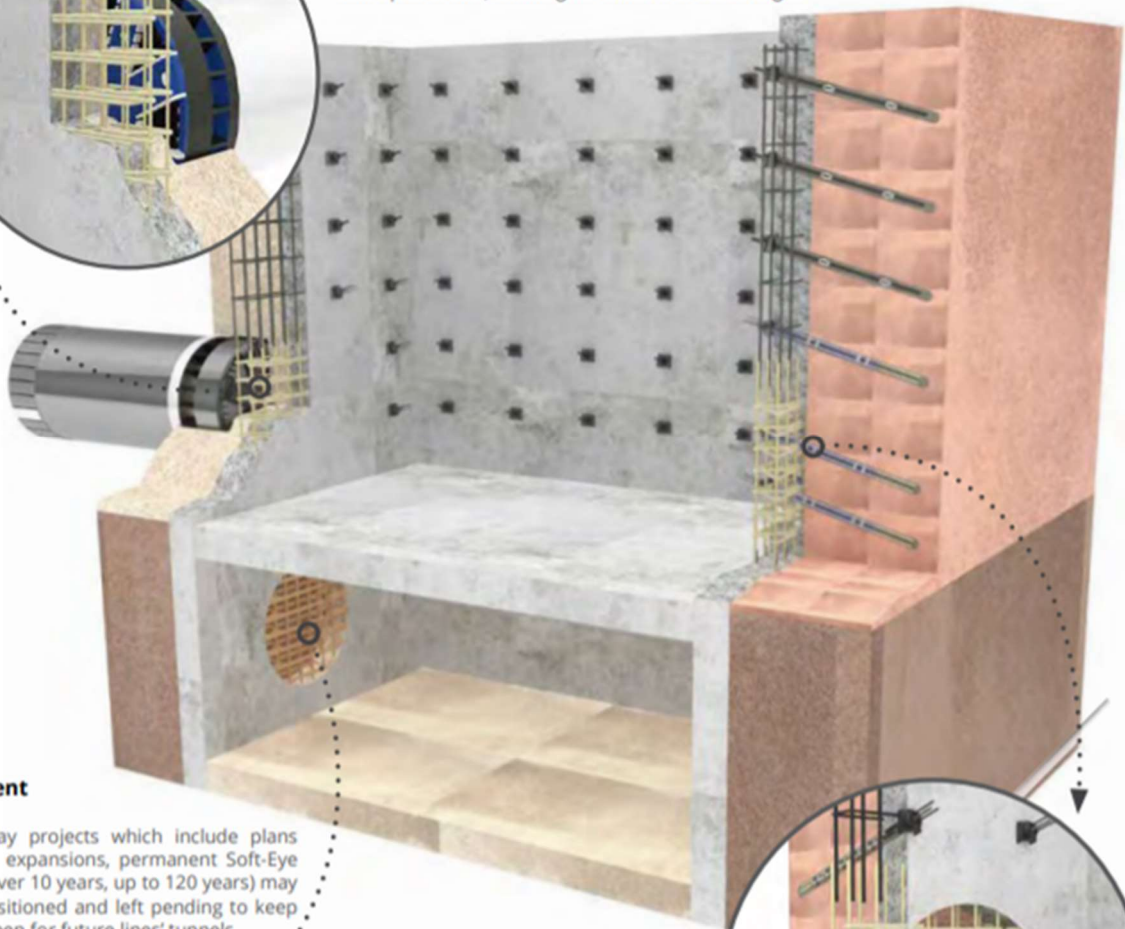


Temporary or Permanent Solutions



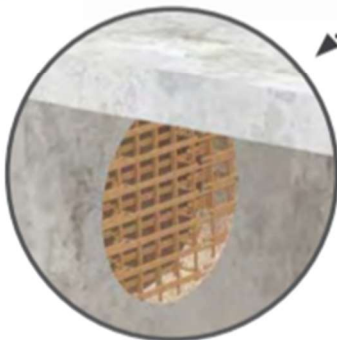
Temporary

The typical Soft-Eye application. Cage is made of GFRP bars which will be cut by the TBM upon arrival, allowing for smooth breakthrough.



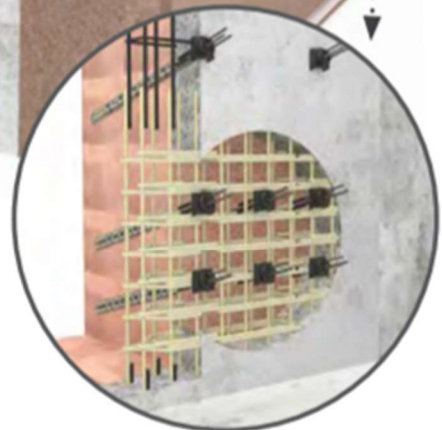
Permanent

For subway projects which include plans of station expansions, permanent Soft-Eye (lifetime over 10 years, up to 120 years) may be pre-positioned and left pending to keep options open for future lines' tunnels.



Temporary + AAA

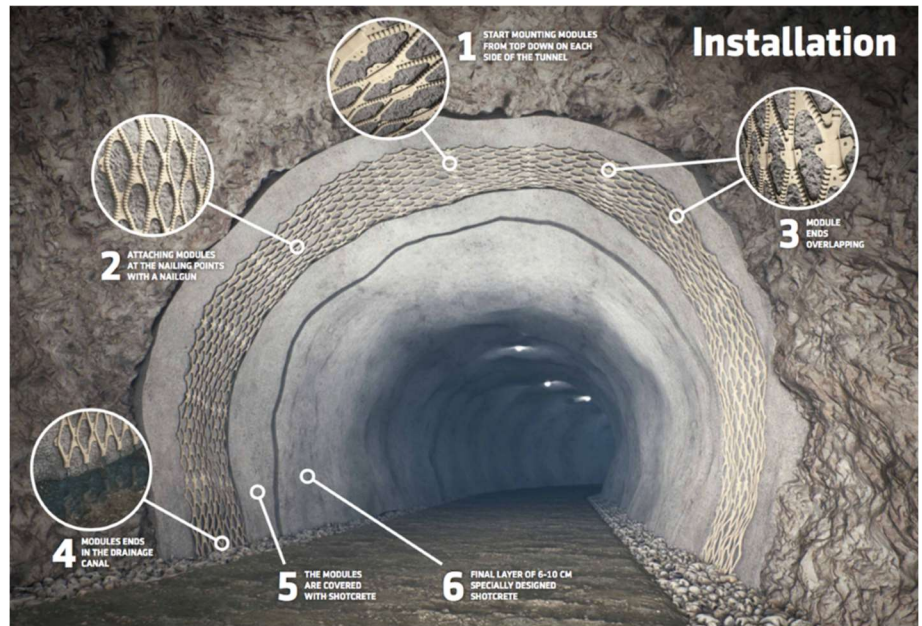
When strong soil forces require retaining wall to be anchored with post-tensioned anchors, Dextra recommends the use of Fully Cut-able ASTEC Active Anchors. Those will also be cut upon TBM arrival.



Drainage systems

Description

The smart Scandinavian design and philosophy of environmentally friendly recycling of materials features in the DTDS Tunnel Strip Drain Panel System. The drainage system is developed for the use of managing ground water in construction pits, basements, underground spaces and for draining tunnels. It operates by preventing built up pressure in the structure and to avoid accumulation of water behind the structure that can cause fractures and leaks.



Fast Installation, less shotcrete required

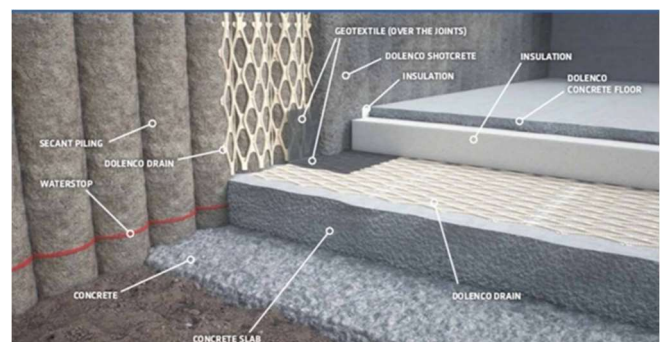
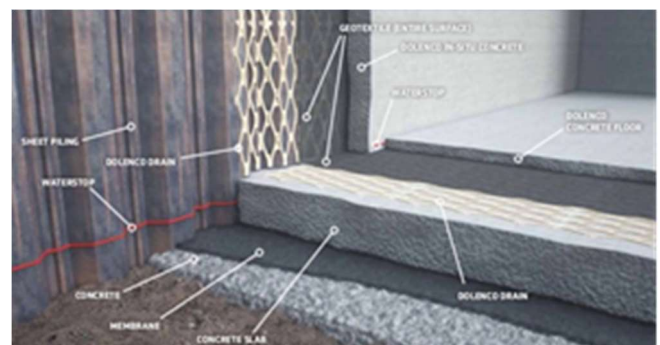
The strip drain modules are nailed to the minimum 3 cm shotcrete surface with a nail gun, one module at a time typically from a forklift. The modules are connected by nailing the top end over the bottom end, starting with the top module and working downwards to the drainage channel. After installation of the system, a layer of porous shotcrete is applied, completely covering. Finally, a ca 6-10cm layer of specially designed shotcrete is applied.

Flexible in Applications

The strip drain modules are suitable for various applications including drainage of secant pile walls, sheet pile walls, basements and underground spaces as well as drainage for slopes and other drainage applications.

Summary of advantages

- Secure permanent drainage
- Made from recycled material
- Makes concrete easy to recycle, no separation of materials
- No-pressure build-up security
- Easy click modular mounting system, no bolting
- Slim, monolithic solution
- Lower system cost
- Lower LCC cost
- No environmental impact
- Flexible, lightweight
- No fire hazard





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