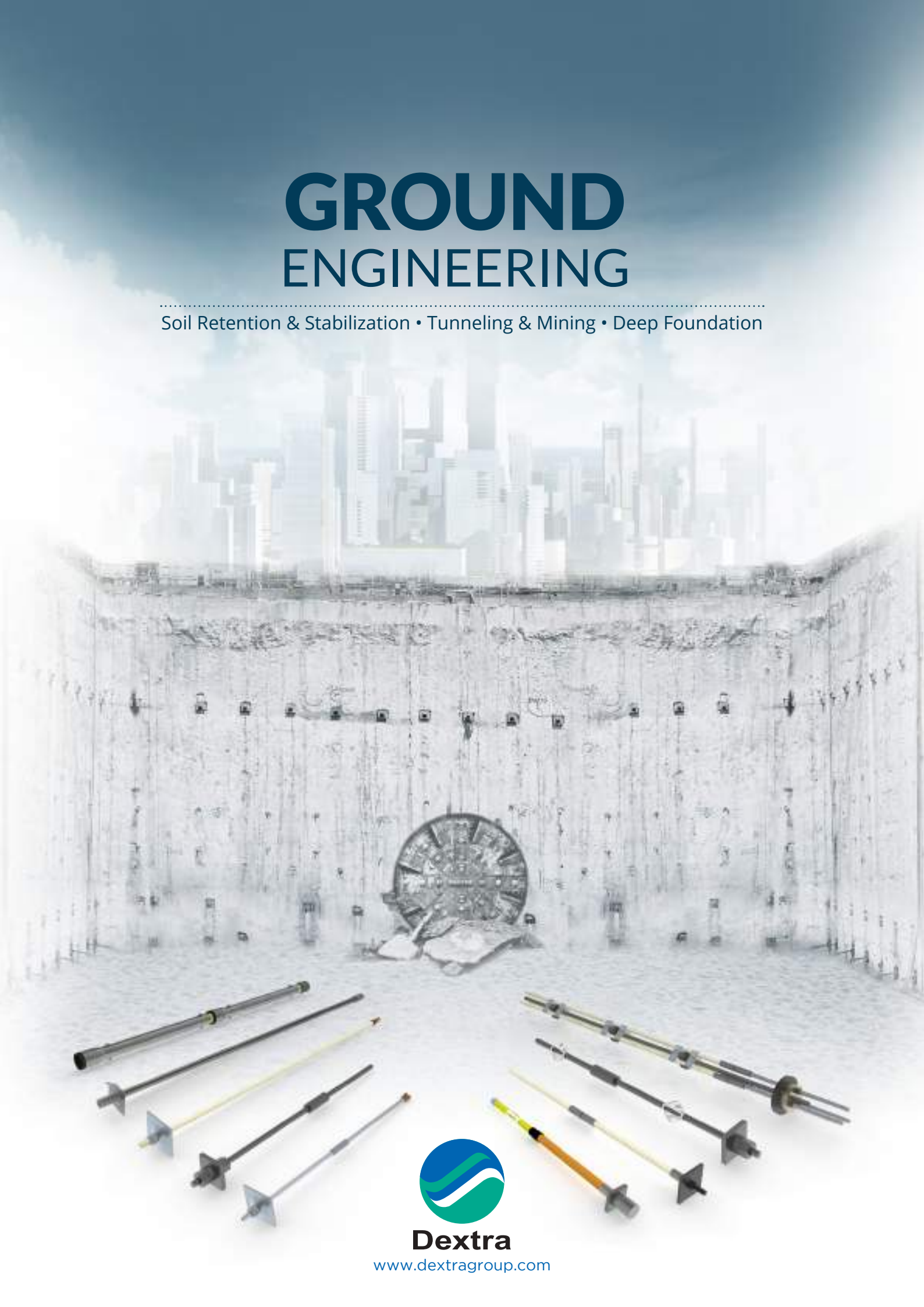
GROUND
ENGINEERING

Soil Retention & Stabilization • Tunneling & Mining • Deep Foundation



Dextra

www.dextragroup.com

Vision

To be a **global leader** in engineering, manufacturing and delivery of high value added **quality products** and services for the construction industry.

Mission

To achieve customer recognition and stakeholder satisfaction by committing to the highest level of performance with integrity, creativity and a passion for results.

Value

Customer Recognition, Integrity & Transparency, Passion for results, Creativity & Agility, Commitment & Accountability.

Provision for change

The information provided in this document is for guidance only. Dextra reserves the right to modify its content including products technical specifications.

About Us

Established since 1983, Dextra is a leading manufacturer and distributor of engineered construction products for the building and civil industries.

Dextra has developed for the past fifteen years a unique range of high-performance bar systems composed of both steel and composite materials (FRP), suitable for a variety of applications in ground anchoring, concrete tensioning, roof and facade support.

The combination of our in-house engineering expertise and design capability with modern manufacturing facilities has allowed us to participate in the supply of very large construction projects in ground engineering such as Doha Metro Musheireb station, the largest subway station in the world, and Al Sadd Metro Station, as well as building excavation such as Sheraton Hotel Car park in Qatar.

Thanks to modern production facilities, our in-house laboratories and our ISO-certified quality systems, Dextra teams are able to control and maintain a high level of quality in all system components, guaranteeing full compliance with the project specifications and customer satisfaction from design stage to delivery and installation.

Content

Soil retention & stabilization

Tunneling & Mining

Deep foundation









Dextra

Our Expertise

DETERMINATION OF THE RIGHT SOLUTION

Dextra can guide you step-by-step in selecting the most appropriate and cost effective solution for your project. Our guidance is based on 30 years experience in managing large-scale & complex projects. We offer a wide ranging and unique portfolio of solutions based on both Steel & FRP technologies.

SYSTEM OPTIMIZATION AND CUSTOMIZATION

Dextra has developed over the years a comprehensive standard range of components that allows a quick adjustment and customization of our products for a truly optimized project solution. Should the time frame allow it, Dextra teams can also engineer, develop and produce taylor-made solutions.

TOTAL CONTROL OVER MANUFACTURING

Dextra has significant experience in developping and manufacturing its own products over many years. Beyond our own facilities and ISO-certified quality assurance processes, all of our suppliers are also regularly audited by our team of engineers in order to ensure quality compliance and drive continuous improvement. Inspections prior to delivery are arranged in our own factory, or in partner laboratories when required.

SUPPLY CHAIN MANAGEMENT

We understand like no one else the importance of having the right product, at the right place and at the right time. Thanks to our network, Dextra is able to organize local storage to serve you with shorter lead-times when needed.
When time is an issue, we are also able to offer acceleration schemes to expedite our solutions in order to prevent site delays.

ON-SITE SERVICE & SUPPORT

We believe that the product delivery is only the beginning of the journey for our customers. Dextra international experts are also able to accompany you during each step of onsite installation until you are truly satistifed with our solutions.

Glossary

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.

By Ground Condition

Soil Anchor
A ground anchor installed in "SOIL" (soft ground).

Rock Anchor
A ground anchor installed in "ROCK" (hard ground).

by Application Method

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.

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.

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.

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

by Protection Grade

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

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.

Black Steel 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 Cuttable glass fiber reinforcement instead of conventional steel rebars in the D-Wall / Pile area where the TBM will break-through.

TBM

Tunnel Boring Machines

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.

by Application Method

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

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.

Combination Bolt
A mechanical bolt combined with a corrugated pipe and a double grout layer all along tendon to provide both high bonding and protection against corrosion.

Lattice Girder

A lightweight, three-dimensional curved steel frames which can provide immediate support for tunneling environments.

Umbrella Pipe

A pre-support forepoling system in soft and weak ground conditions. The system can distribute the load in longitudinal direction, and decrease deformation during excavations.

Micropile

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

Crosshole Sonic Logging (CSL)

Thin black steel tubes available in different diameters with an enlarged end in a bell mouth shape. This makes the connection between two tubes an easy process and minimises labour cost.

GEOTEC

Dextra's trademark promoting versatile Steel & FRP ground engineering solutions. Fully threaded bars are the core components of our systems.

ASTEC

Dextra's trademark promoting unique FRP solutions developed by Dextra. Our hybrid steel / FRP systems guarantee high performances for the most stringent of requirements.

Applications

Soil Retention & Stabilization

Excavation

Retaining walls for excavations are vertical structures that only allow limited deflection.
Typically, pre-stressed active anchors are preferred. High strength tendons anchored to the retaining wall on one end and to the ground on the other end through a bulb of pressure injected grout named 'bond length'.

Pages 14 - 15

Slope Stabilization

On soil-covered slopes, soil is constantly moving downslope due to gravity, therefore larger displacement have to be considered. Typically passive anchors are preferred High strength tendons are fully grouted from the face of the slope into the stable ground.

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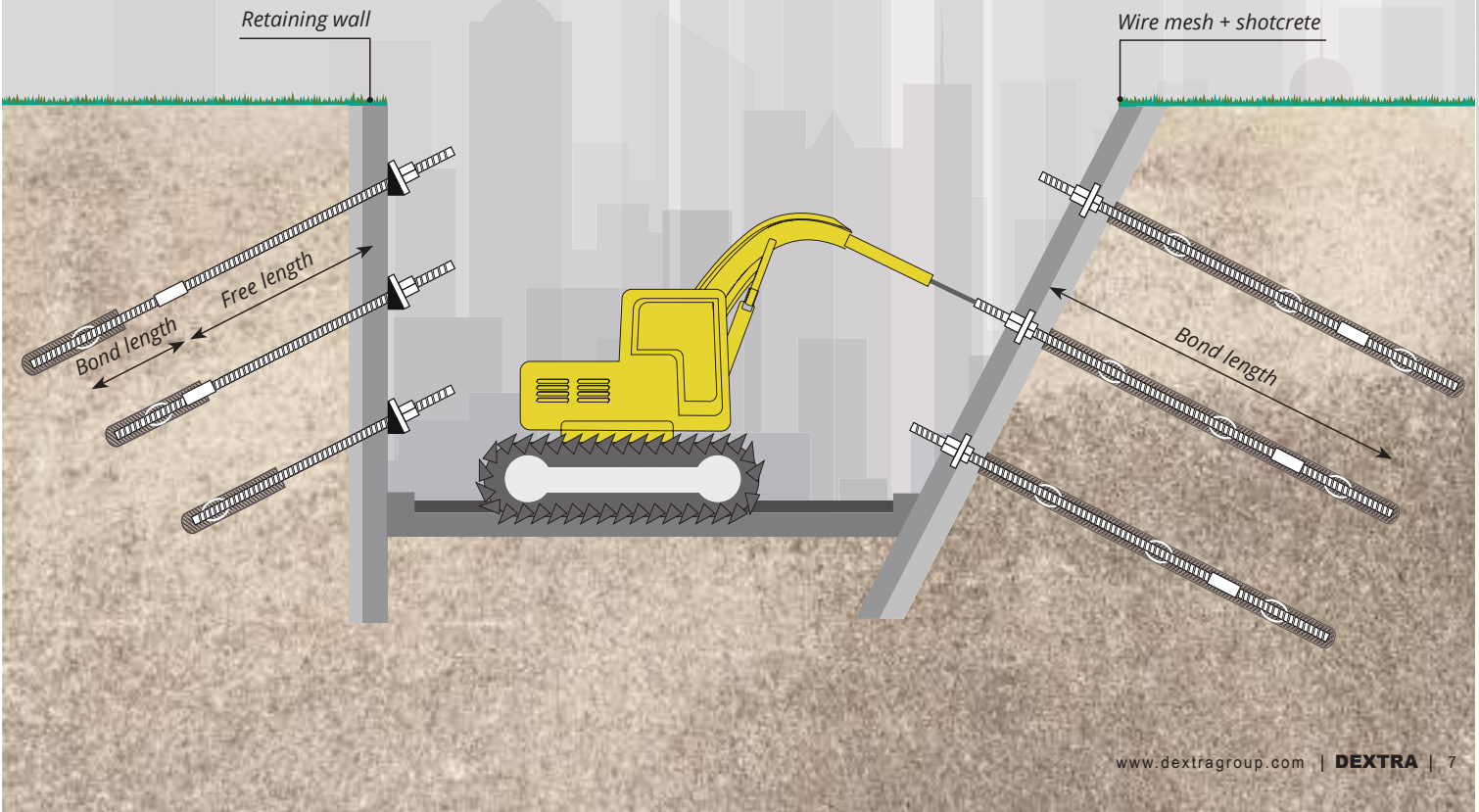

Tunneling & Mining

Cuttable solutions

Cuttable support is mostly used in the longitudinal direction of the tunnel (portal, face) when temporary stabilization is required before moving to the next phase.Also, Mechanized Tunneling is becoming standard in urban areas, especially for underground metro projects. This modern technique is calling for new kind of systems, in particular cuttable reinforcement bars for concrete structures and table ground anchors.

Pages 20 - 23

Radial & lateral support (Roof & Wall)

When building a tunnel by drill & blast or conventional mining, the roof and walls need to be supported.

Rock-bolts are the first type of support installed, before any other kind of mesh or lining is applied. Depending on the construction sequence and technology, both temporary and permanent bolts can be offered.

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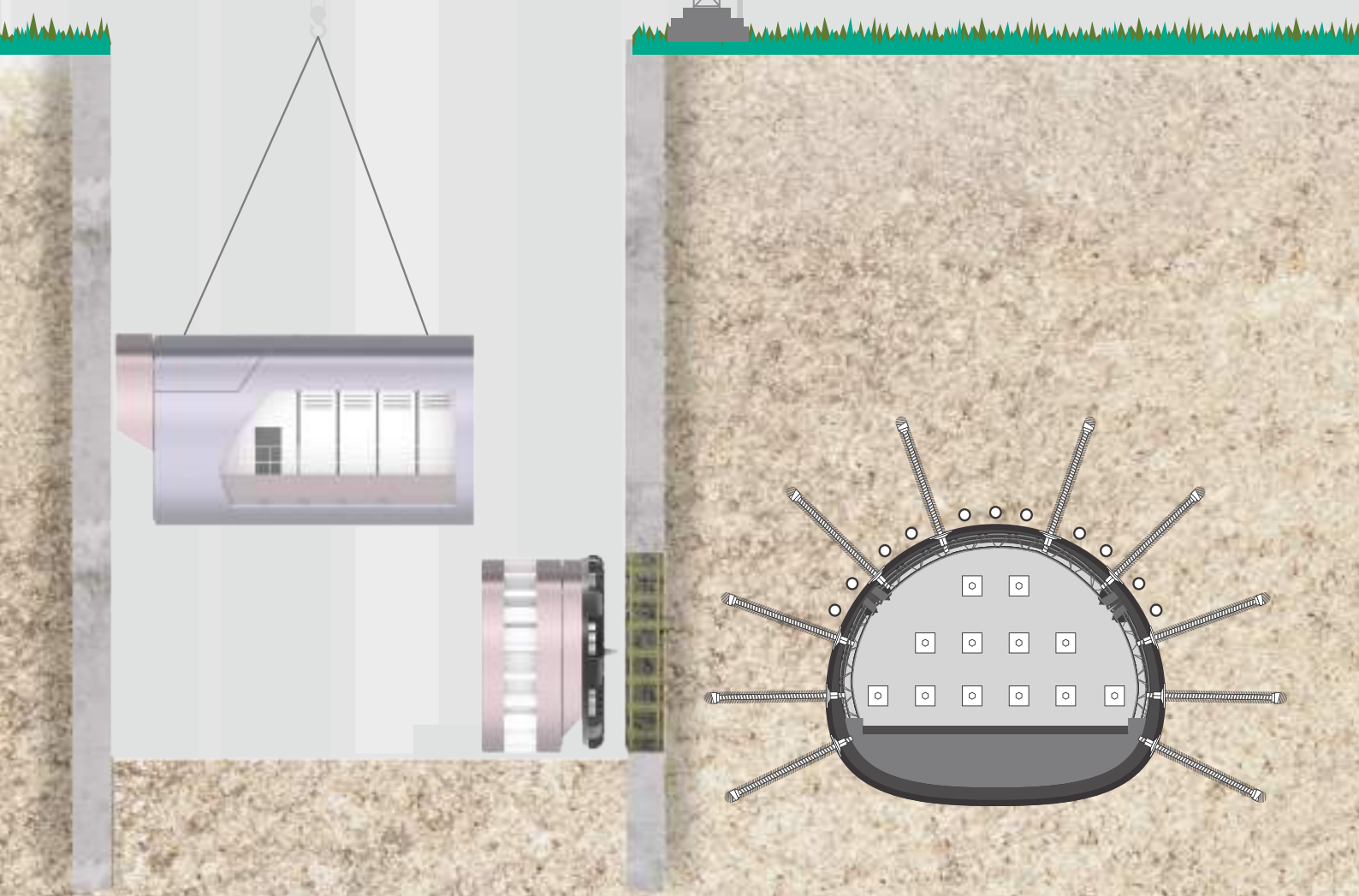
Lattice Girders and Umbrella Pipes are for pre-support in soft and weak ground conditions. They can decrease deformation during excavation by distributing the load in transverse and longitudinal directions.

Pages 32 - 35



Deep Foundation

Micro- and mini-piles

By definition, micro and mini piles are respectively less than 300mm and 1,000mm of diameter. These narrow-profile foundations require high steel grade reinforcement bars to develop the strength with minimum space. Fully-threaded bars are the best answer to this need, and come even in “Double Corrosion Protection” (a.k.a DCP) for permanent structures or aggressive grounds.

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Macro-piles and retaining walls

The fastest and safest way to splice steel cages for deep foundations is by using rebar couplers. In this aspect, Dextra is worldwide leader and offer a wide range of solutions. Upon completion of the deep foundation, concrete integrity testing is usually required. The most common way is by “Cross-Hole Sonic Logging” using SONITEC, a thin-wall steel pipe combined with a push-fit assembly.

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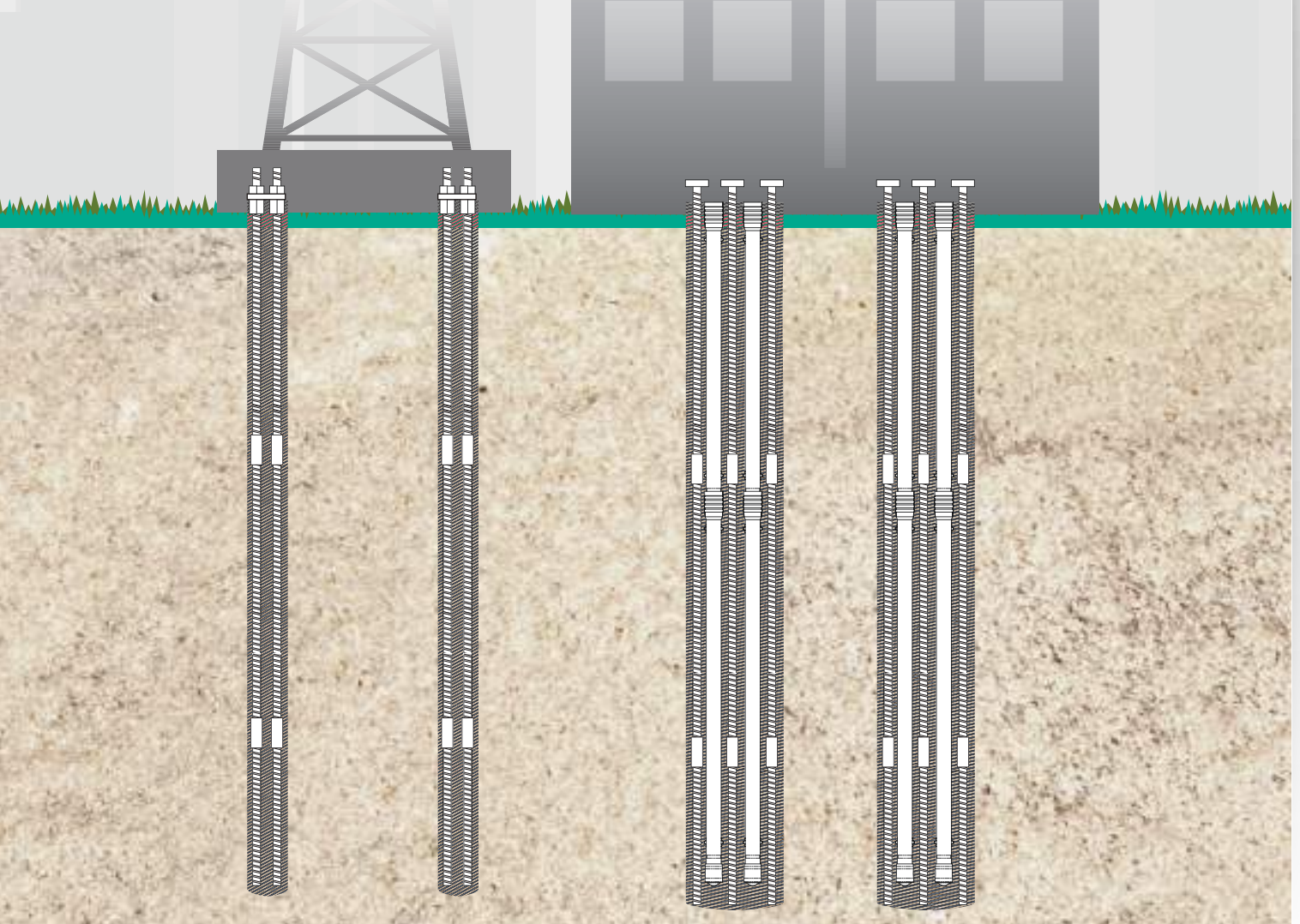


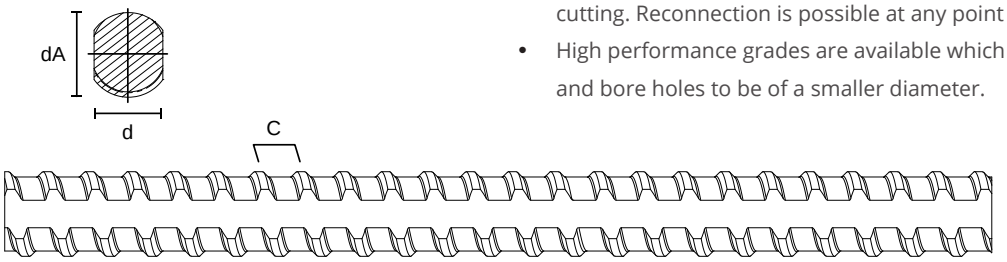
Material Specifications

Material

- Continuous high-tensile hot-rolled threaded bars.
- Modulus of Elasticity: 205 GPa (205 kN/mm²).
- Available with either left-hand or right-hand threads.
- Epoxy coating for corrosion protection available upon request.

Benefits of fully threaded bars

- Continuous thread increases the bonding with surrounding environment.
- Coarse thread and hard bar surface making it robust and less susceptible to damages.
- Length adjustment of fully threaded steel anchors is possible by cutting. Reconnection is possible at any point with couplers.
- High performance grades are available which allow the tendons and bore holes to be of a smaller diameter.



GEOTEC

Nominal diameter d	Max diameter dA	Cross-section area	Linear Weight	Grade 500/550*		Grade 670/800		Grade 830/1030		Grade 930/1080	
				Yield load	Ultimate load	Yield load	Ultimate load	Yield load	Ultimate load	Yield load	Ultimate load
(mm)	(mm)	(mm²)	(kg/m)	(kN)	(kN)	(kN)	(kN)	(kN)	(kN)	(kN)	(kN)
20	23	314	2.47	157	173			261	323	292	339
25	28	491	4.1	246	270	329	393	408	506	457	530
32	36	804	6.65	402	442			667	828	748	868
36	41	1,018	8.41					845	1,049	947	1,099
40	45	1,257	10.34	629	691			1,043	1,295	1,169	1,358
50	56	1,963	16.28	982	1,080	1,315	1,570	1,629	2,022	1,826	2,120
57.5	63	2,597	20.38	1,299	1,428	1,740	2,078				
63.5	70	3,167	24.86	1,584	1,742	2,122	2,534				
75	83	4,418	34.68	2,209	2,430	2,960	3,534				

* Providing MOQ requirements are fulfilled, we can provide the following alternative grades:
- Grade 500/630 and 550/620, available up to diameter 50mm
- Grade 555/700 available for diameters 57.5mm and 63.5mm

Benefits of Fiber Reinforced Polymers (FRP)

The anisotropic characteristic of FRP ensures that it can easily be cut by common excavation and piling equipment, as well as Tunnel Boring Machines (TBM). FRP solutions are the best alternative to removable anchors as they can be left in place.

Suitable for permanent and temporary applications. In both cases it alleviates all concerns about corrosion: FRP profiles are available in formulations resistant to acidic and alkali environments.

A clear advantage of FRP bars is the strength-to-weight ratio: eight times higher than steel. Indeed FRP profiles are twice stronger than steel in tensile for only 25% of its weight

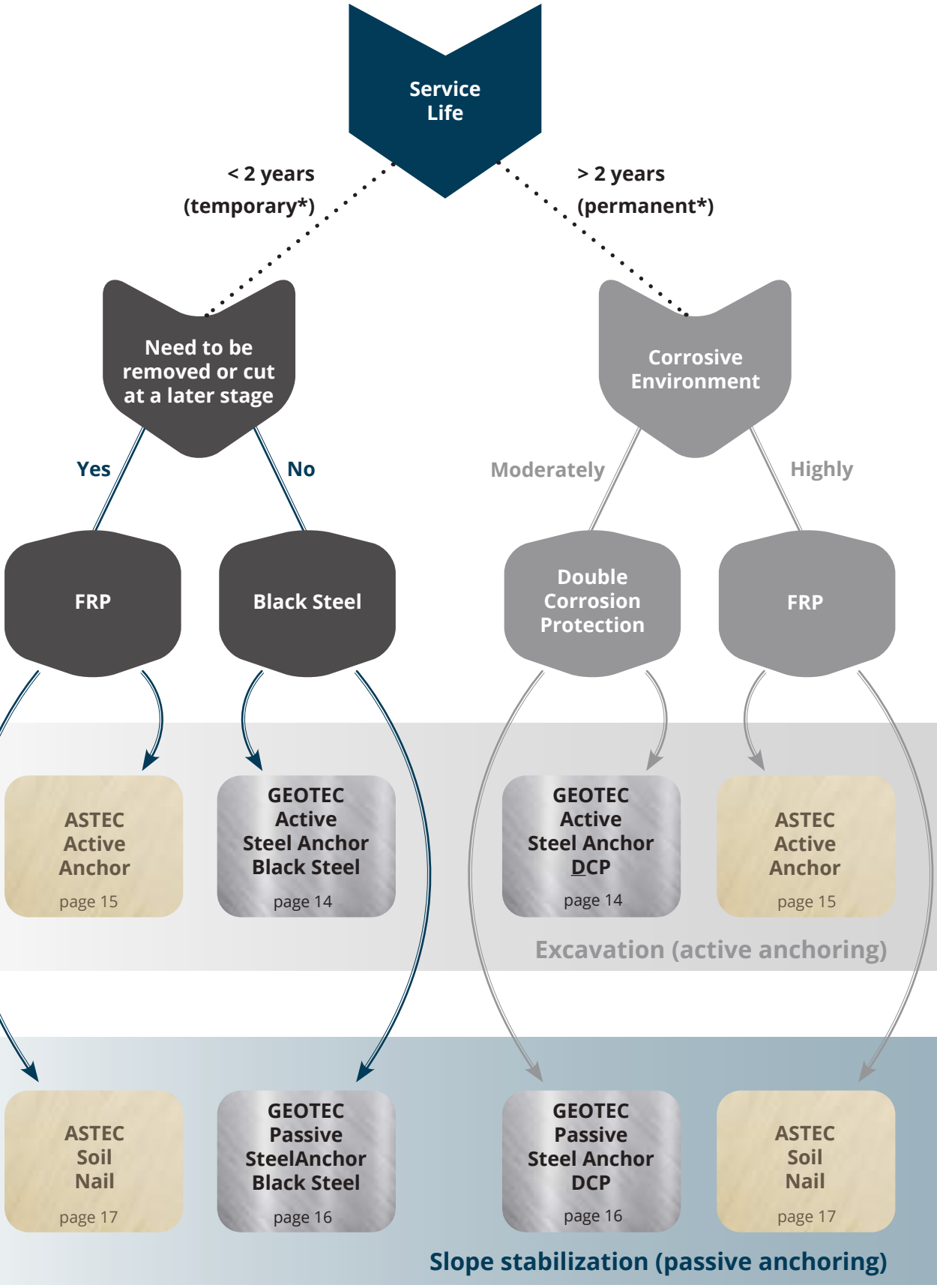
FRP Specifications	GEOTEC	ASTEC
Diameters Range	20 mm to 38 mm	19 mm to 51 mm
Ultimate Tensile Strength	Up to 1,000 MPa	Up to 1,000 MPa
Modulus of Elasticity (MoE)	Up to 50 GPa	Up to 60 GPa
System Performance	Standard accessories: 50% of the bar tensile strength	High performance accessories: 80% to 100% of the bar tensile strength
Bar Profile	Fully threaded (rope thread)	Deformation by helical wrap + sand coating
		

Doha Metro, Qatar

Soil Retention & Stabilization

Selection tree

Identify the right anchor for your excavation & slope stabilization



System based on FRP bars

System based on fully-threaded steel bars

* Temporary and permanent applications are defined as per BS EN 1537:2013

Active Anchor


Duba ISCC Green Power Plant, Saudi Arabia

GEOTEC Active Anchor (Steel)

- **Steel Active Anchors** are the prefered solution for excavation works where post-tensioning is required.
- **Suitable** for any temporary or permanent work as long as tendons do not encroach onto neighboring plots and do not need to be cut or extracted at a later stage.
- **Wide range** based on high-tensile fully threaded bars available in 7 steel grades and 9 diameters up to 75mm (*see page 8*). High steel grades may be preferred to ease handling and reduce the bored hole diameter.
- **Corrosion protection accessories** (SCP / DCP) are part of the system and can be supplied by Dextra.

Codes & Standards

- BS EN 1997 (Eurocode 7)
- BS EN 1537
- BS 8081

Black Steel Anchor

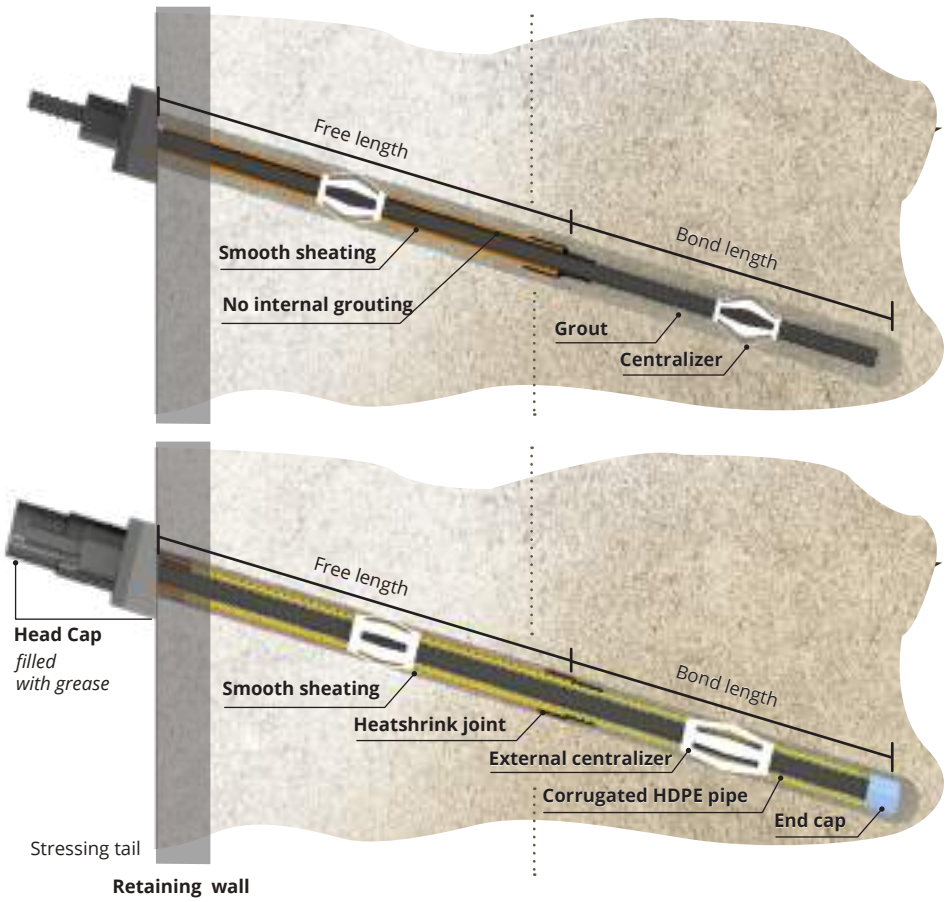
Black Steel Anchor is achieved by 1 layer of grout all along the whole length of the system

- **Bonded length** protection is achieved thanks to the fully threaded bar ribs together with a single layer of grout between the bar and the bored hole.
- **Unbonded length** protection is achieved by covering the fully threaded bar with a smooth HDPE sheating.

Double Corrosion Protection (DCP)

DCP is achieved by 2 layers of grout all along the whole length of the system.

- **Bonded length** protection is achieved thanks to the dual grout layers separated by a corrugated HDPE sheating.
- **Unbonded length** protection is guaranteed by the use of smooth HDPE pipe above the corrugated HDPE sheating.
- **Protective head cap** and **end cap** complement the corrosion protection system.




Doha metro, Qatar

Active Anchor (FRP)

ASTEC Active Anchors (AAA) is an unmatched hybrid GFRP/Steel system, designed as a post-tension anchoring solution for the geotechnical field. For tensioning, a patented connector system makes the interface between a high performance FRP bars and a standard PT strand.

For temporary applications, the cuttable nature of ASTEC Active Anchors removes all needs for the systems to be removed from ground. No removal cost, no additional planning needed.

ASTEC Active Anchor is composed of multiple tendons which are assembled to provide high mechanical performance system which:

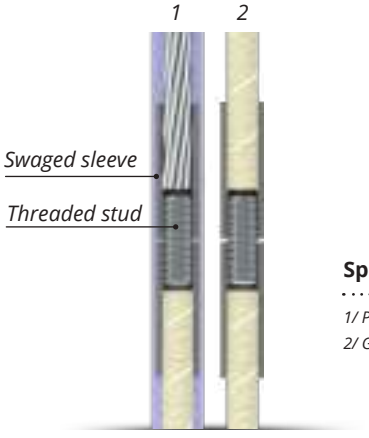
- Constitutes a geotechnical anchor for temporary and permanent usage that are then left in the ground and that won't present an obstacle to any future construction projects as they can be easily cut through.
- Allows easy and fast future extirpation by common TBM and Pile Boring machines due to its anisotropic fiber characteristics.
- Does not require any additional periodic monitoring and maintenance.
- Nullifies need for extra corrosion protection requirements.
- Minimizes weight to ease handling & installation.

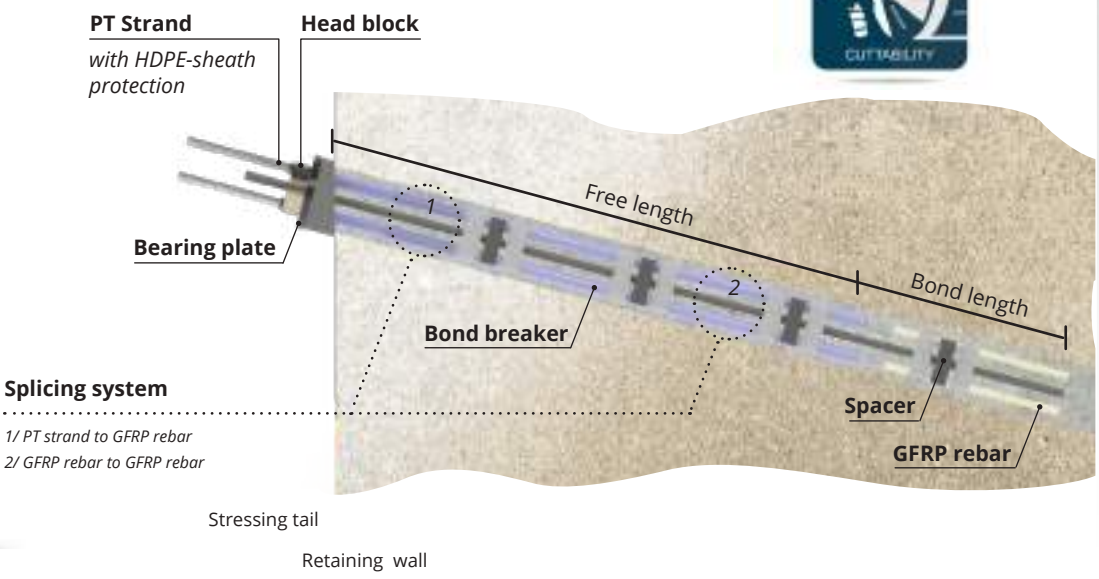
Codes & Standards

- ACI 440-4R-04
- BS EN 1997 (Eurocode 7)
- BS EN 1537
- BS 8081
- ISO 6934-4

Key Numbers

Numbers of tendons	From 1 to 14
Ultimate loads	250 to 3,500 kN
MoE	50 GPa





Passive Anchor

Soil Nail (Steel)

- **Steel Soil-Nails**, also called Passive Anchors, are the prefered solution for slope stabilization. The system is bonded all along the whole tendon length. The head of the system will usually be covered by a wire mesh and shotcrete layer after installation.
- **Suitable** for any temporary or permanent work as long as tendons do not encroach onto neighboring plots and do not need to be cut or extracted at a later stage.
- **Wide range** based on fully threaded bars available in 4 different grades and 7 diameters up to 63.5mm (*see page 8*). High steel grades may be prefered to ease handling and reduce bored hole diameter.
- **Corrosion protection accessories** (SCP / DCP) are fully part of the system and can be supplied by Dextra.

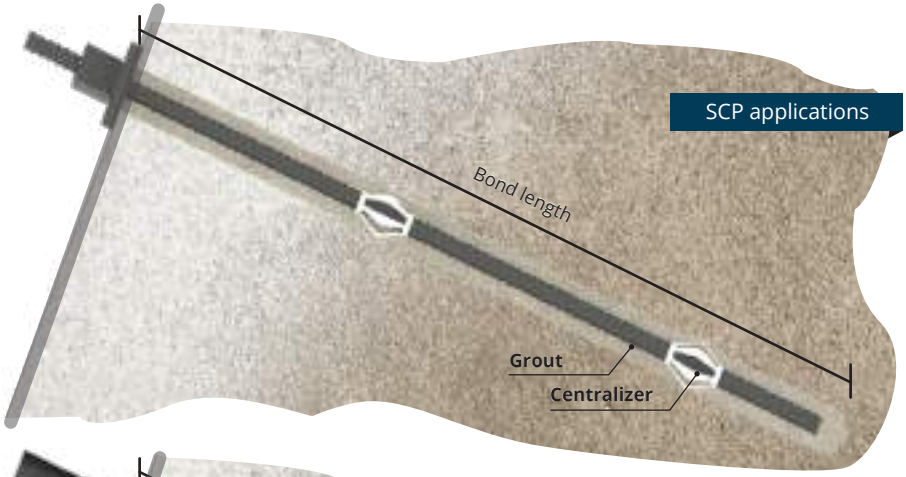
Codes & Standards

- FHWA-IF-03-017
- FHWA-SA-96-069
- HK GEOGUIDE 7

Black Steel Anchor

Black Steel Anchor is achieved by 1 layer of grout all along the whole length of the system

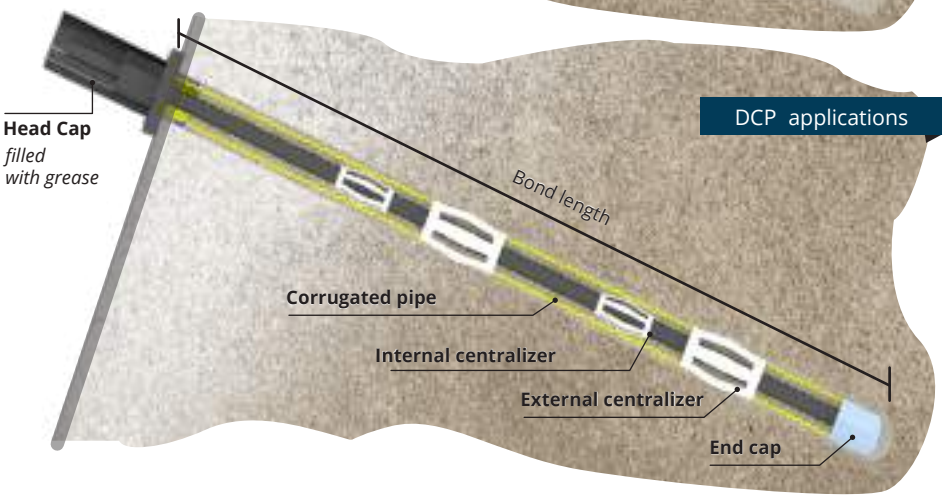
- **Bonded length** achieved with a single layer of grout between the bar and the bored hole



Double Corrosion Protection (DCP)

DCP is achieved by 2 layers of grout all along the whole length of the system.

- **Bonded length** protection is achieved with dual grout layers separated by a corrugated HDPE pipe
- **Protective head cap** and **end cap** complement the corrosion protection system.



MTR Shatin Central Link, Hong Kong

Soil Nail (FRP)

ASTEC Soil-Nail is a non-corrosive passive anchoring system used for rock and soil stabilization. It is suitable for both temporary and permanent ground consolidation.

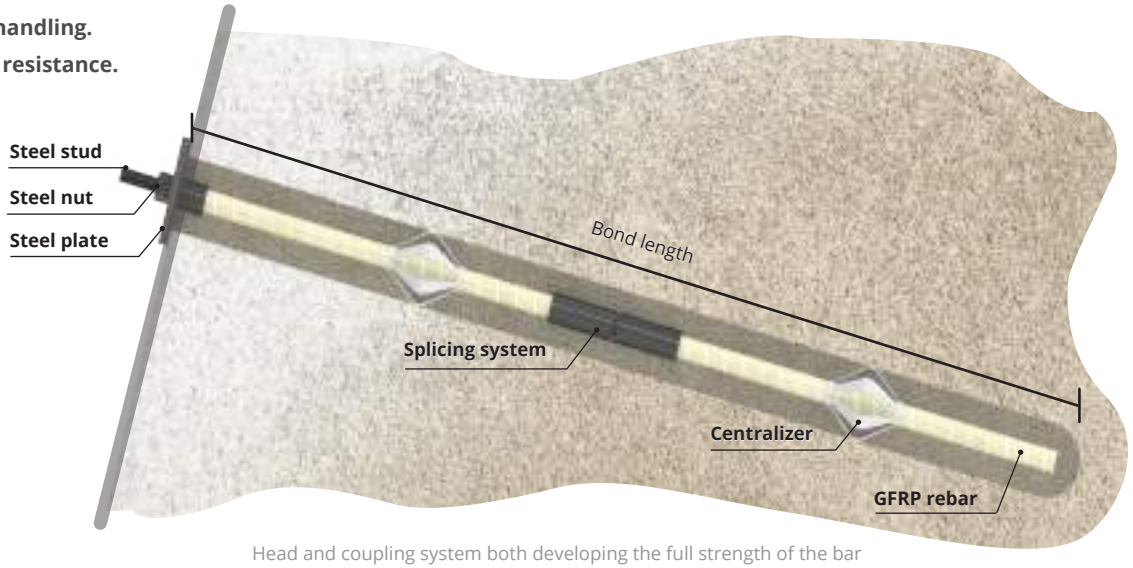
The anisotropic characteristic of the FRP ensures that ASTEC Soil-Nail can easily be cut by common tunnel and pile boring machines. The unmatched connector allows installation of any length while allowing the system to develop the full strength of the rebar.

Codes & Standards

- ACI 440-4R-04
- FHWA-IF-03-017
- FHWA-SA-96-069
- HK GEOGUIDE 7
- ISO 6934-4

GFRP Bar		System
Product Reference	Diameter (mm)	Ultimate Tensile load (kN)
ASTEC SN50T-19	19	250
ASTEC SN50T-25	25	310
ASTEC SN50T-32	32	430
ASTEC SN50T-41	41	770

- **Full Mechanical performace continuity .**
- **Cuttable = Faster excavation + No removal cost.**
- **Light- weight = Easy handling.**
- **Integrated corrosion resistance.**

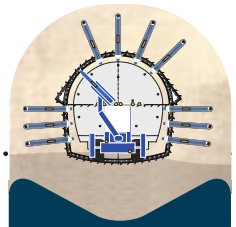


Head and coupling system both developing the full strength of the bar

Tunneling & Mining

Selection tree

Identify the right solution for your tunnel project



Radial & lateral support (Roof & Wall)

- **Permanent**
  - **Highly Corrosive Environment**
    - GEOTEC Soil Nail DCP — page 16
    - ASTEC FRP Combination Bolt — page 28
  - **Immediate Support**
    - GEOTEC Steel Combination Bolt — page 29
- **Temporary**
  - **One Step Installation**
    - GEOTEC Steel Self-Drilling Rock-bolt — page 27
    - GEOTEC FRP Self-Drilling Rock-bolt — page 26
  - **Immediate Support**
    - GEOTEC Steel Mechanical Bolt — page 30
    - GEOTEC Steel Expandable Friction Bolt — page 31
  - **Pre-Support**
    - GEOTEC Lattice Girder — page 32
    - GEOTEC Umbrella Pipe — page 34

Cuttable Solutions

- **Longitudinal Support (Face, Portal, Intersections)**
  - **Resin Bolt**
    - GEOTEC FRP Solid Rockbolt — page 22
  - **Grouted Bolt**
    - GEOTEC FRP Hollow Rockbolt — page 23
  - **One Step Installation**
    - GEOTEC FRP Self-Drilling Rockbolt — page 26
  - **Immediate Support**
    - GEOTEC FRP Combination Bolt — page 28
- **Mechanized Tunneling (TBM)**
  - **Ground Anchor (Tie-Back)**
    - ASTEC Active Anchor — page 15
  - **Reinforcement for Retaining Wall**
    - ASTEC Soft-Eye — page 20

Steel products FRP products

Soft-Eye

Doha Metro, Qatar

ASTEC Soft-Eye

ASTEC Soft-Eye is the turnkey solution for efficient boring of reinforced concrete structures. Softeye facilitates the penetration of the Tunnel Boring Machines (TBM) through diaphragm walls and secant piles.

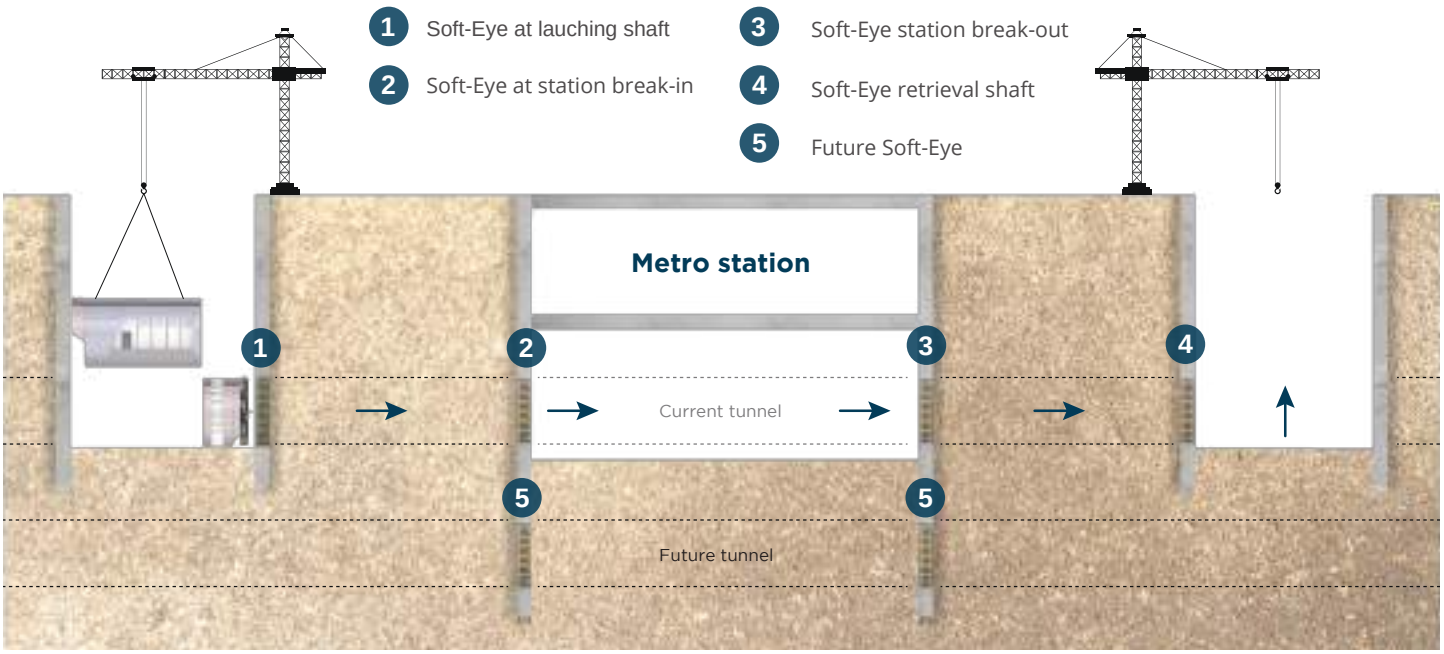
- **Speed up the construction schedules. TBM passes through the Diaphragm Wall**
- **Save equipment. No demolition equipment needed.**
- **Commit on Safety. No workers required to access the shaft.**

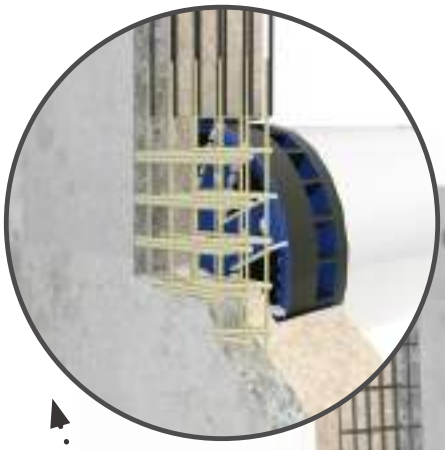
This unique technology uses cuttable Glass Fiber Reinforced Polymer (GFRP) reinforcement as an advantageous replacement for conventional steel rebars. Since 1996, DEXTRA has established new standards becoming the worldwide reference. Precursor of this technology, we have successfully supplied over 500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

Guidelines

ACI 440.1R-15, 2015:
"Guide for the Design and Constructiono 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 & Mansonry Structures."



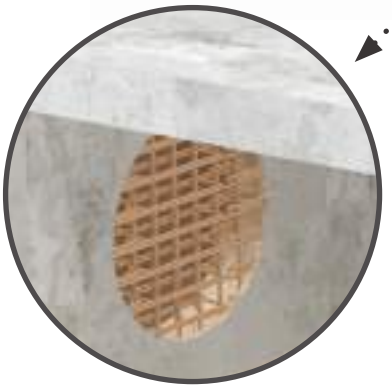


Temporary

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

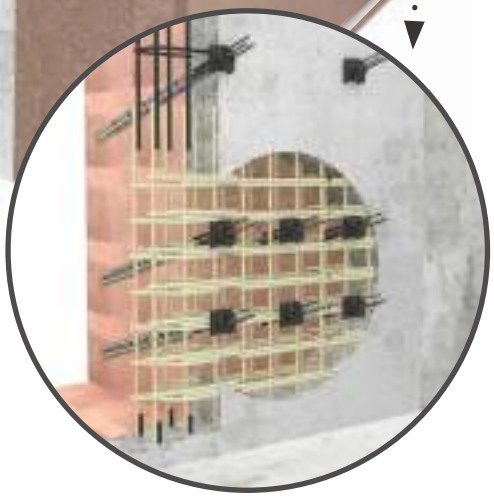
Permanent

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.

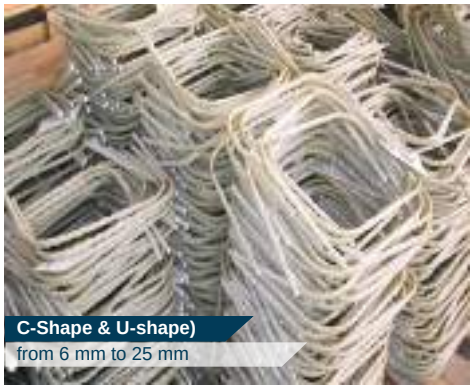


Temporary + AAA

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



Straight: Cut-to-length
from 5 mm to 51 mm



C-Shape & U-shape)
from 6 mm to 25 mm

Loops / Spiral
from 6 mm to 25 mm

FRP Rock-Bolt: Solid & Hollow

GEOTEC FRP Solid Rock-Bolt

GEOTEC FRP Solid Rock-Bolt can be installed with resin cartridges or forced into pre-grouted holes. The cuttability of FRP makes it the ideal solutions for face bolting or any other tunneling/mining application where further excavation is required.

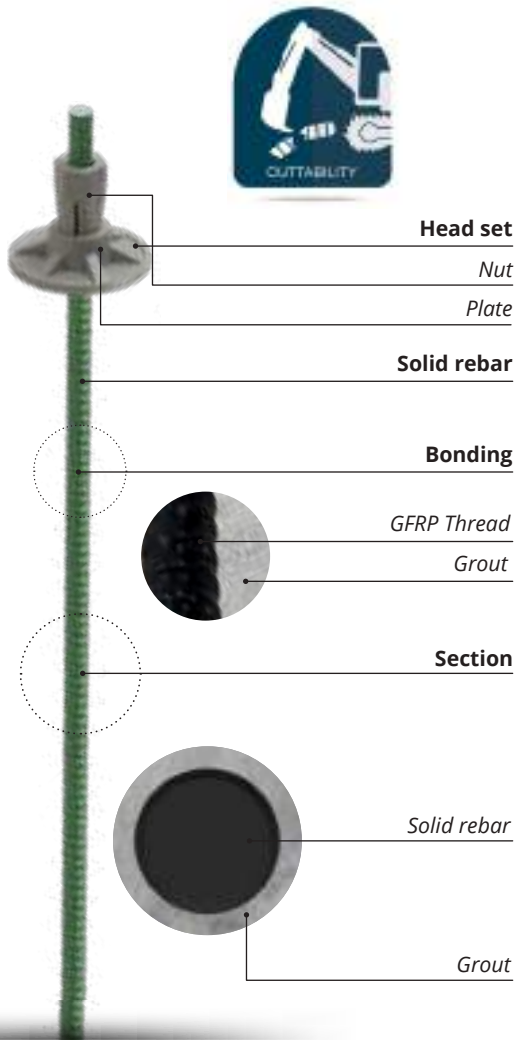
Codes & Standards

- BS EN 1997-1
- BS EN 1537
- BS 7861-1

- **Fully threaded profile for optimum mixing and bonding properties**
- **Available with chamfer to facilitate resin mixing and prevent gloving**
- **Light-weight = Easy handling and installation in the tunnel**
- **Cuttability = Faster excavation process**
- **Corrosion resistance = No premature bolt failure due to corrosion**

Diameter (mm)	Ultimate Tensile Load (kN)	Ultimate Tensile Strength (MPa)
20	200	1000
22	250	1000
25	350	1000
32	560	960

Solid Bar System Performance				
Diameter (mm)	Head Breaking Load (kN)			Loading (kN)
	Steel Flat Plate & Nut	FRP Domed Plate & Nut	FRP Swivel Plate & Nut	Steel Connection Coupler
20	70	70	80	70
22	80	80	90	80
25	120	90	100	120
32	150	100	150	150



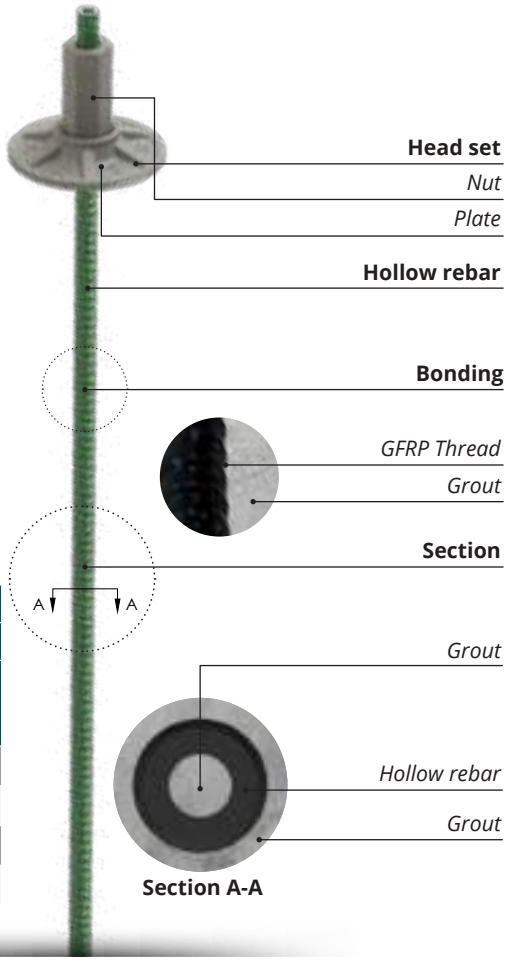
GEOTEC FRP Hollow Rock-Bolt

GEOTEC FRP Hollow Rock-Bolt are inserted into the hole and directly grouted through its hollow core. The cuttability of FRP makes it the ideal solutions for face bolting or any other tunneling/mining application where further excavation is required.

- **2 in 1 = Act as both, anchor rod and grouting pipe**
- **Light-weight = Easy handling and installation in the tunnel**
- **Cuttability = Faster excavation process**
- **Corrosion resistance = No premature bolt failure due to corrosion**

Diameter (mm)	Grade T		Grade P	
	Ultimate Tensile Load (kN)	Ultimate Tensile Strength (MPa)	Ultimate Tensile Load (kN)	Ultimate Tensile Strength (MPa)
25	180	720	220	880
28	260	740	320	900
32	280	765	350	1000
38	400	800	500	1000

Hollow Bar System Performance				
Diameter (mm)	Head Breaking Load (kN)			Loading (kN)
	Steel Flat Plate & Nut	FRP Domed Plate & Nut	FRP Swivel Plate & Nut	Steel Connection Coupler
25	90	90	100	90
28	110	100	120	110
32	120	100	150	120
38	150	100	180	150



FRP Rock-Bolt: Solid & Hollow

GFRP Injected Thread Rock-Bolt

Codes & Standards

- BS EN 7861-1:2007

Cement Grouted Rock-bolt

Top View

Hollow

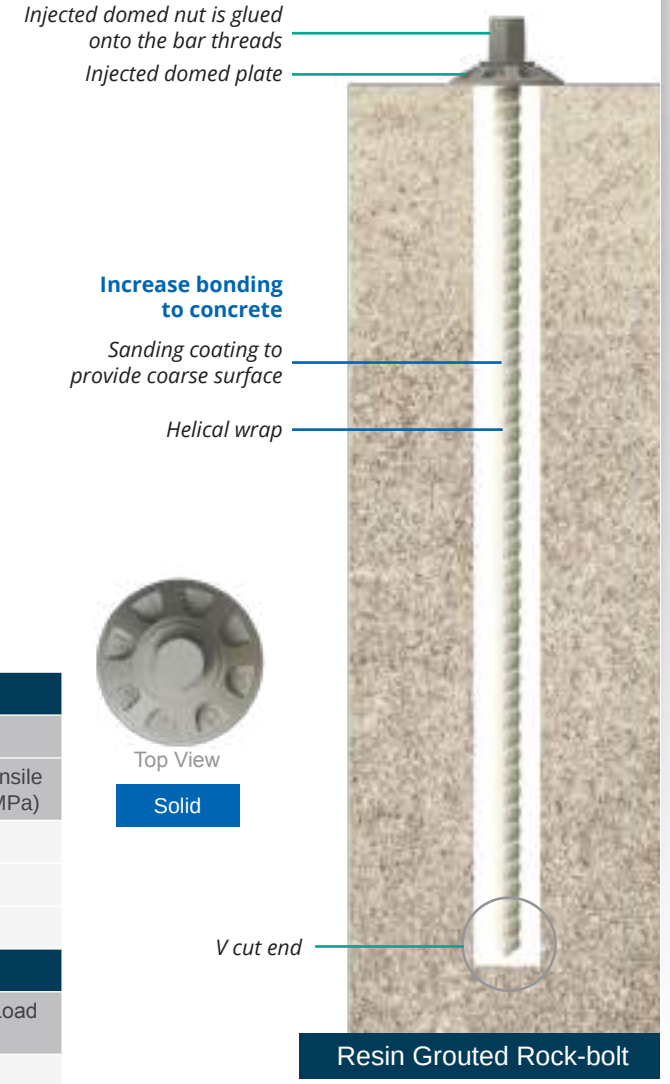
ASTEC GFRP Injected Thread Rock-Bolt is made for permanent and temporary applications. Installed as conventional cement grout anchor bolt, its hollow body allow the cement grout to fill the hole.Its unique glass features make it easy to cut and consume by extraction machines increasing the productivity and reducing the costs. Mainly used in mines, it is also suitable for tunnels and civil project.

Hollow Bar				
OD x ID (mm)	Nominal Dia. (mm)	Nominal CSA (mm^2)	Machanical Properties	
			Ultimate Tensile Load (kN)	Ultimate Tensile Strength (MPa)
32 x 13	32.3	675	350	526

Injected Threads		
Major Diameter x Pitch (mm)	Thread Length (mm)	Breaking Load (kN)
39.5 x 7.0	384	≥ 150

GFRP Thrust Bolt

ASTEC GFRP Thrust bolt is made for permanent applications. The domed nut is injected onto the bar which provides the high tensile load capacity. This is particularly adapted to installation with resin cartridges, its v cut end is desigened to penetrate cartridges, the helical pattern also allows an efficient cartridge mixing.

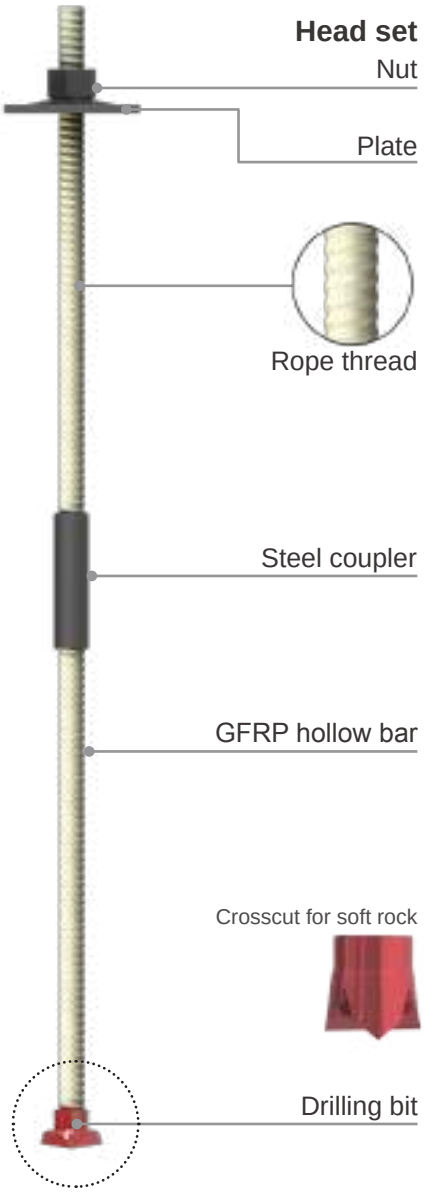


Solid Bar				
Dia (mm)	Nominal Dia. (mm)	Nominal CSA (mm^2)	Machanical Properties	
			Ultimate Tensile Load (kN)	Ultimate Tensile Strength (MPa)
25	25.4	510	350	690
32	32.3	819	450	550
35	35.0	962	550	550

System Capacity		
Transverse Shear (MPa)	Torque (N•m)	System Breaking Load (kN)
124	200	≥ 100
124	300	≥ 130
124	350	≥ 150

Self-Drilling Rock-Bolt (SDRB)

GEOTEC FRP SDRB



Codes & Standards

- BS EN 1997-1
- BS EN 1537
- BS 7861-1

GEOTEC GFRP Self Drilling Rock-Bolt is a rock-bolting system based on a fully coarse thread GFRP hollow bar.

It is especially recommended for the following applications:

- Face bolting
- Soft and loose ground conditions. It does not require to pre-drill a hole, and it is perfectly usable in soft conditions
- Installation with grout. The hollow GFRP bar acts as a grouting pipe to ease set up
- Temporary or permanent applications

Product features

- **3 in 1 concept**: acts as a drilling rod, anchor bar and grouting pipe
- Optimum bonding and load transfer
- Splicing system adjustable to custom lengths
- Sacrificial cross-cut drill bits for soft/loose ground conditions

Benefits

- Fast installation for high productivity
- Dual anchorage: punctual + fully encapsulation
- Cuttable material, will not damage excavation machine
- Suitable for corrosive environments

Technical Information

Fully threaded GFRP hollow bar

Product Type	Thread Direction	ID (mm)	Ultimate Load (KN)	Torsion (N·m)
R32	Left	15	365	300
R38	Left	20	500	420

Steel SDRB

GEOTEC Steel Self-Drilling Rock-Bolt is a rock-bolting system based on a fully coarse threaded steel hollow bar.

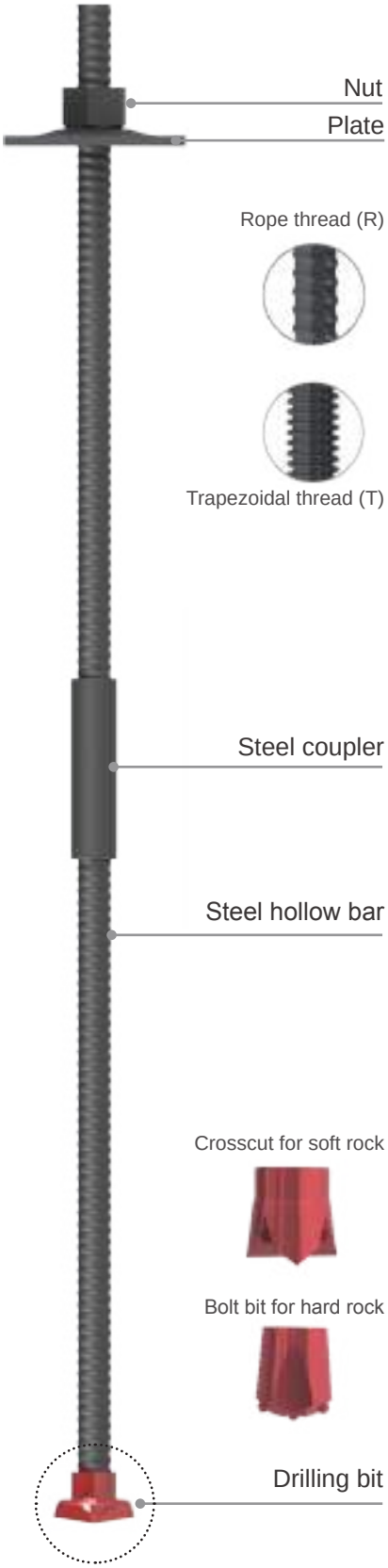
- Especially recommended for roof and wall bolting applications
- Suitable for most ground conditions. It does not require to pre-drill a hole, therefore making it usable even in soft rock conditions
- Installation with grout. The hollow steel anchor rod also acts as a grouting pipe to ease set up. For non-grouting applications, please refer to Mechanical Anchor or Expandable Friction Bolts
- Suitable for temporary applications

Product features

- **3 in 1 concept**: acts as a drilling rod, anchor bar and grouting pipe
- Optimum bonding and load transfer
- Splicing system to adjust to custom lengths
- Standard sacrificial drill bits for every ground conditions

Benefits

- Fast installation for high productivity
- Dual anchorage: punctual + full encapsulation



Technical Information

Fully threaded steel hollow bar

Product Type	Thread Direction	ID (mm)	Yield Load (kN)	Ultimate Load (kN)
R25	Left	16	150	200
R32N	Left	21.5	230	280
R32S	Left	20	280	360
R32SS	Left	18.5	330	400
R38N	Left	24.5	400	500
R51L	Left	33.3	450	550
R51N	Left	36	630	800
T30N	Left	15	220	260
T40N	Left	21	525	660
T40L	Left	22	430	540
T76N	Left	52	1200	1600

Combination Bolt

FRP Combination Bolt

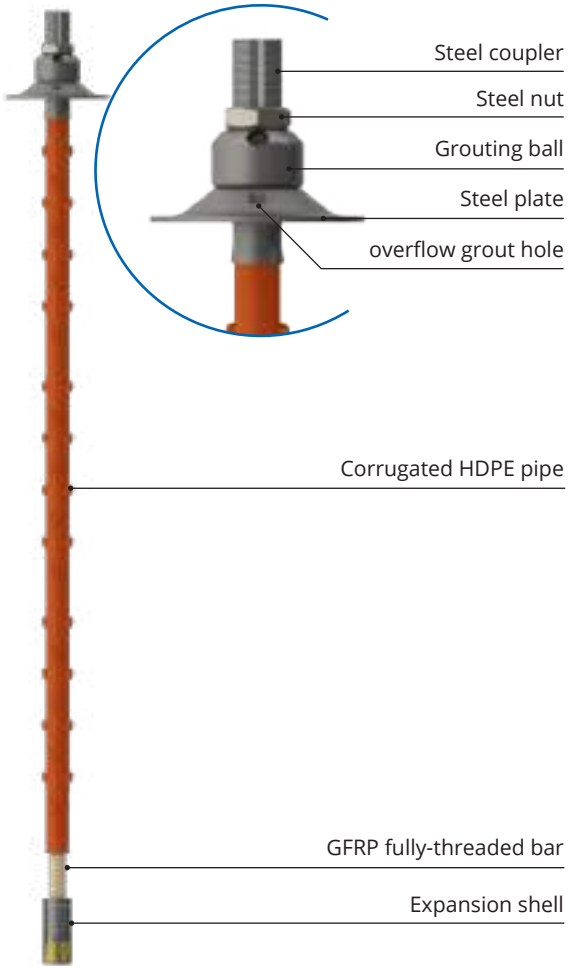
Combination Bolt is a unique and innovative GFRP solution precisely designed by Dextra.

In unconsolidated excavation areas, like steel bolts, GFRP Combination Bolt can be automatically installed by jumbo machine or manually installed.

Thanks to the characteristic of the FRP material, Combination Bolt can easily be cut by common excavation equipment, which makes the product an ideal solution for temporary application for tunnel excavation projects.

Benefits

- Provide immediate support.
- Ideal for Jumbo carrousel equipment.
- No special setup needed on the Jumbo machine to install the product.
- Thanks to its metric metal nut, the number of rotations is similar as steel bolts. During the installation, the operator will not notice any difference when pre-tensioning the bolt.
- Clearance inside the tunnel is maximized due to its short tail length. This also limits the concrete lining thickness if the head have to be embedded.
- Just like conventional steel bolts, Combination Bolt is compatible with automatic grouting process.
- The steel coupler permits an easy connection for the pull out test.



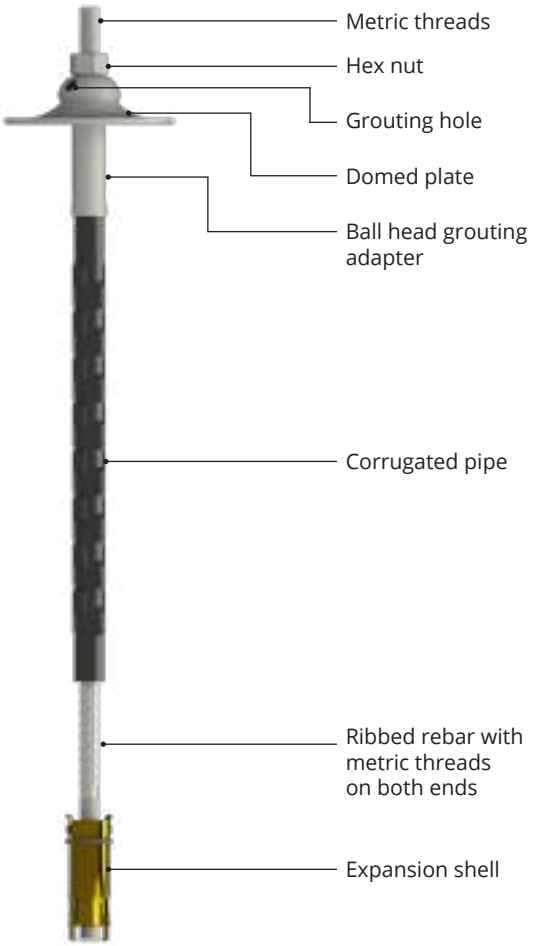
GEOTEC Steel Combination Bolt

GEOTEC Mechanical Combination Bolt is suitable for the most stringent requirements. A mechanical bolt combined with a corrugated pipe and a double grout layer all along tendon to provide both high bonding and protection against corrosion (similar to Double Corrosion Protection / DCP).

It is initially installed for **immediate support** by the use of an expansion shell, to be fully grouted at a later stage allowing it to be classified as **permanent application**.

Benefits

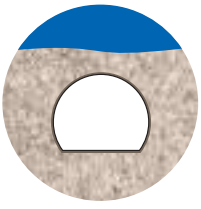
- Fast and immediate installation for a high productivity
- Dual anchorage: punctual + full encapsulation
- Suitable for corrosive environment
- Permanent application
- Provide difference types of coating to against corrosive environment



Applications

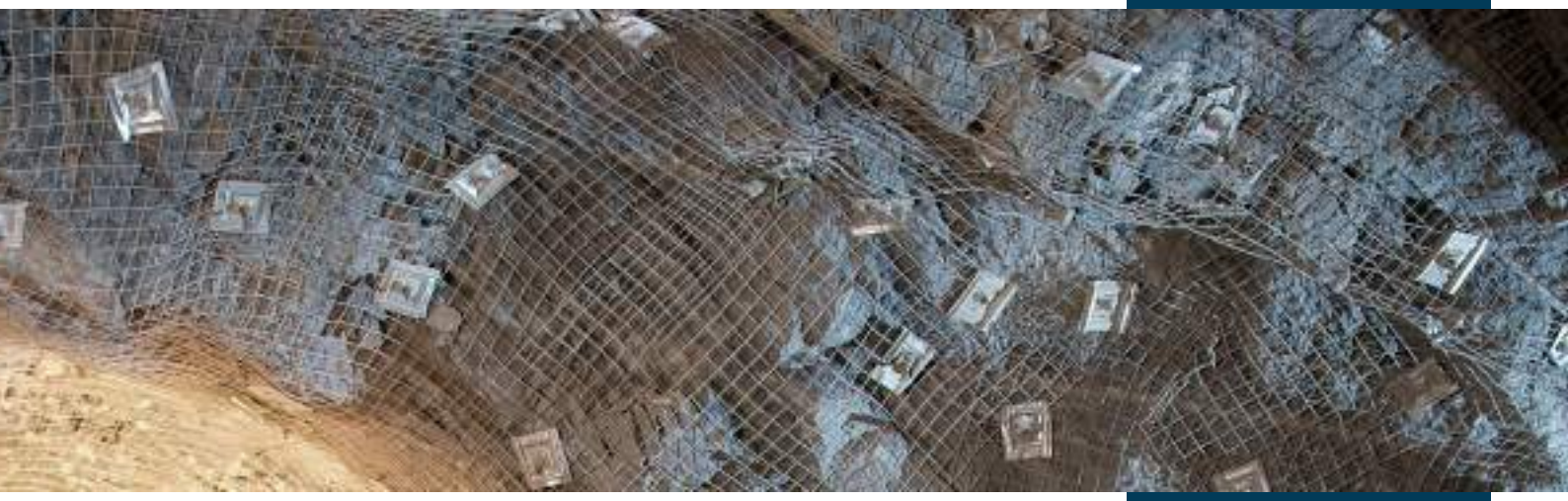
Permanent roadways

Hydropower and underground oil or gas storage caverns



Sub-sea and sewer tunnels

Mechanical Bolt



Mechanical Bolt

GEOTEC Mechanical Bolt is inserted into the hole and anchored to the rock with the help of its expansion shell. The mechanical bonding is immediate and doesn't require any grouting or resin.

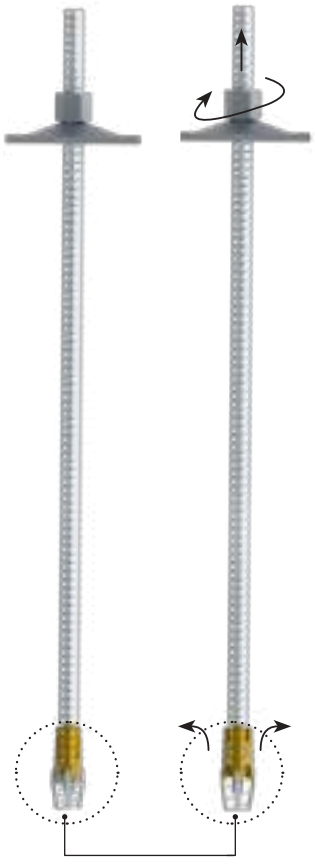
Codes & Standards

- BS EN 1997-1
- BS EN 1537
- BS 7861-1

- **Immediate anchor joint support for faster excavation**
- **No grouting or chemical needed**
- **Different type of shell to adapt any kind of boring holes**

Close

Open



Expansion Shell

Expandable Friction Bolt

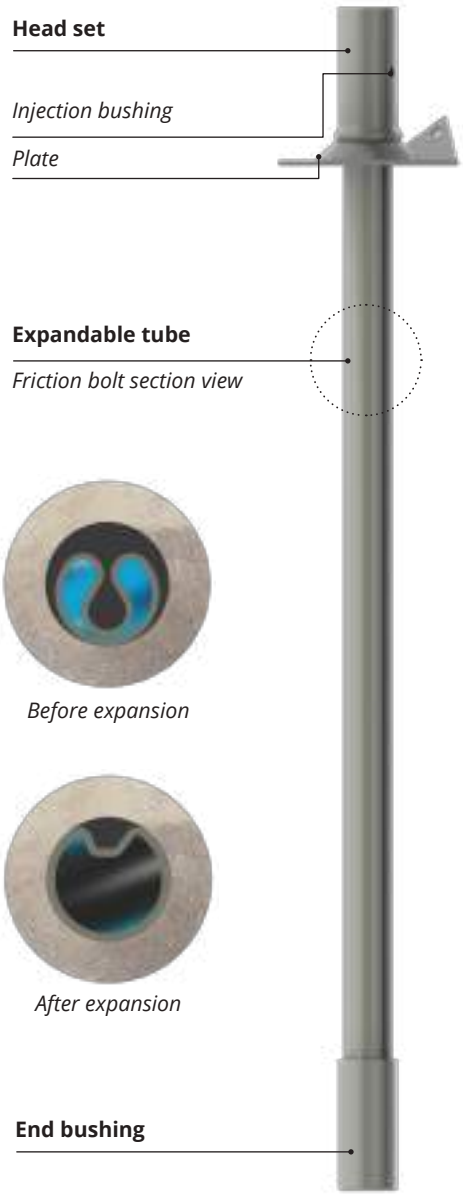
Expandable Friction Bolt

Product features

- Length up to 8 meters.
- 2 diameters available: 27.5mm and 36mm.
- Adapts boreholes between 32 to 52mm.
- 4 high-load capacities up to 24 metric tons.
- Excellent ductility elongation properties,allowing
- substantial rock movement without the boltshearing.

Benefits

- High load-bearing capacity combined with excellent elongation properties.
- The elongation properties allow substantial rock movement without shearing bolt.
- Immediate full length support for faster excavation.
- Simple and clean installation.
- Adjusts to borehole irregularities.
- Reliable installation quality.
- Flexible to variations in drill hole diameter.
- Versatile bolting solution for variable ground conditions.
- No grouting or chemical needed.
- Manual or mechanical installation at choice.



Description	Product type				
	DM120L	DM120	DM160	DM200	DM240
Mechanical properties					
Min. Tensile Load (kN)	100	100	140	170	200
Ultimate Load (kN)	120	120	160	200	240
Min. Elongation (%)	22%	22%	22%	22%	22%
Ultimate Elongation (%)	25% - 30%	25% - 30%	25% - 30%	25% - 30%	25% - 30%
Inflation Pressure (Mpa)	30	24	24	24 - 26	30
Physical properties					
Tube Thickness (mm)	2	1.5	2.3	2.5	3
Bolt diameter (mm)	27.5	36	36	36	36
Original Tube dia. (mm)	44	54	54	54	54
Optimal borehole dia.(mm)	35 - 38	45 - 51	45 - 51	45 - 51	45 - 51
System Weight (2 - 6 m) (kg)	5.4 - 13.7	5.7 - 13.5	7.7 - 19.4	8.48-21.18	9.7 - 24.8

Lattice Girder

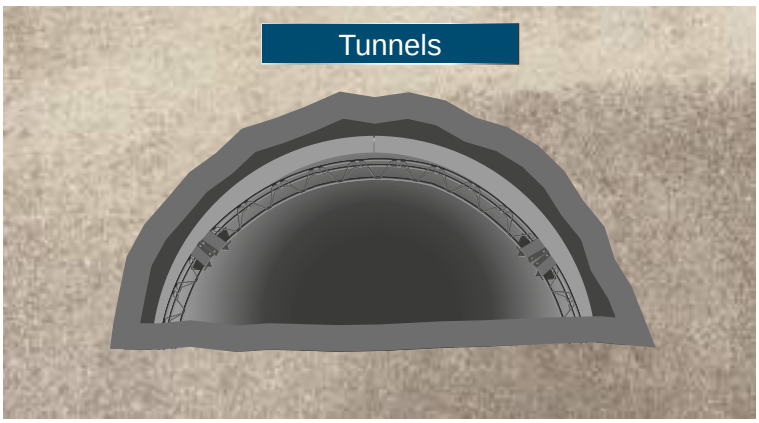
Lattice Girder

GEOTEC lattice girder systems are lightweight, three-dimensional curved steel frames which are composed of main bars, secondary bars, connection plates, foot plates and stiffeners. The lattice girder can provide immediate support for tunneling environments. The radius of the bending is tailor-made to meet each project's demands.

Benefits

- Simple and fast installation
- Solid support for spiling bolts
- Temporary support for shotcrete until it gains sufficient strength to support itself
- Immediate support in the area of the tunnel face
- High moment capacity
- No requirement for major equipment

Applications



Product features

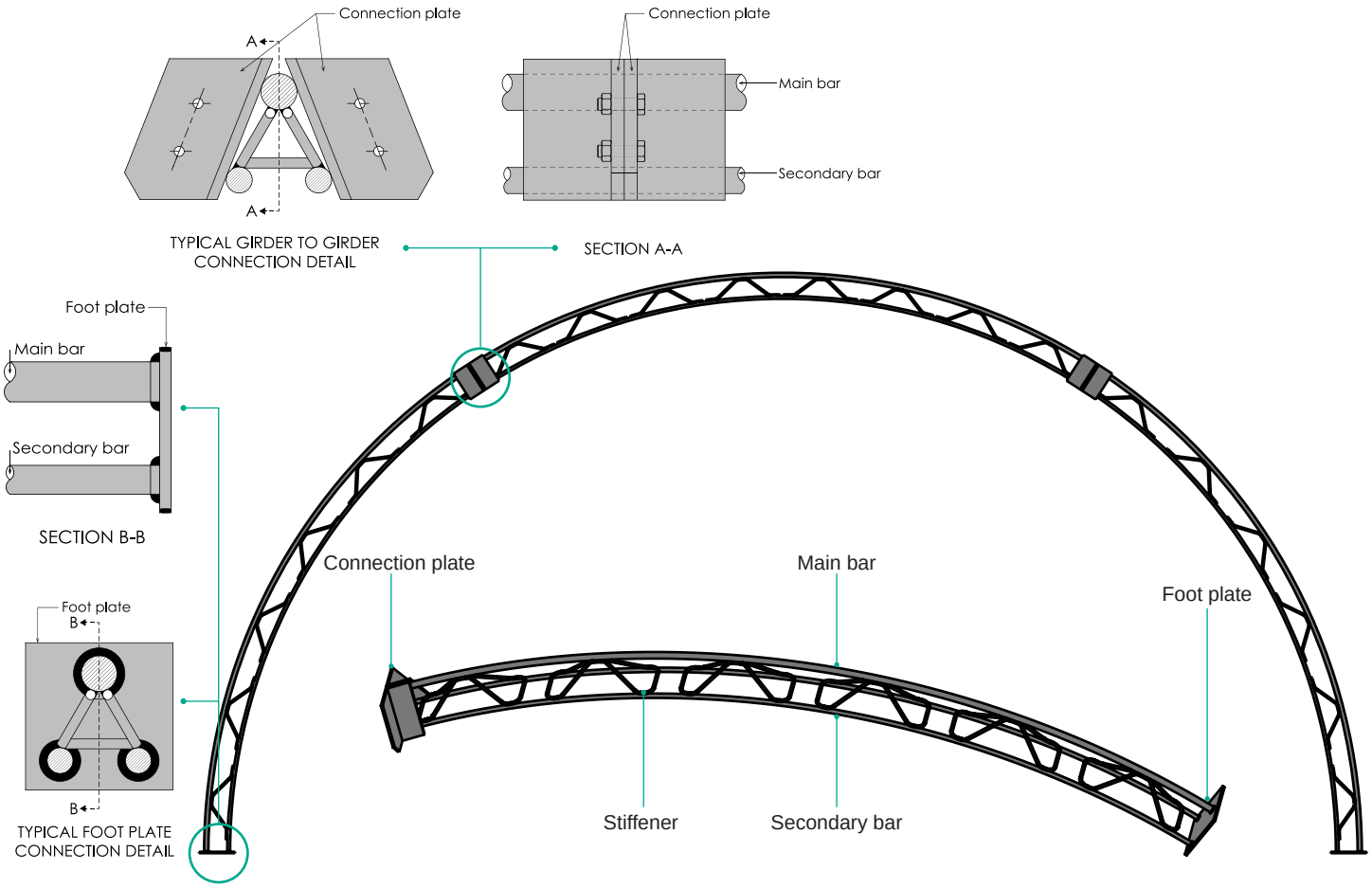
- Two types of design: 3-bar or 4-bar, for different force requirements
- Flexible design with different dimensions available
- Immediate support for tunnels
- Entirely integrated in the shotcrete lining
- Avoid porous zones and shotcrete spray shadows

Dimensions

Three-bar

Four-bar

System components				
Components	**Steel types**	**Standard/Grade**	**Yield Strength (MPa)**	**Tensile Strength (MPa)**
Main bar	Smooth reinforced steel bar	ASTM A615/A615M Gr.75	520	690
Secondary bar	Smooth reinforced steel bar	ASTM A615/A615M Gr.75	520	690
Stiffener	Smooth reinforced steel bar	ASTM A615/A615M Gr.60	420	620
Connection plate	Steel plate	EN 10025-2 S235	235	350 - 510
Foot plate	Steel plate	EN 10025-2 S235	235	350 - 510



Umbrella Pipe

GEOTEC Umbrella Pipe

GEOTEC umbrella pipe system is a pre-support in soft and weak ground conditions. The system comprises steel pipes installed from the tunnel face to form a roof to stabilize the tunnel headings. By distributing the load in longitudinal direction, it can decrease deformation during excavations.

Codes & Standards

EN10219 S 235/275/355
JIS G3444 STK400 / 500
ASTM A 500
BS 1387

Benefits

- Immediate support for the excavation tunnels
- Installed by jumbo machine
- Fast self-drilling installation
- Strong and robust support system
- Length of system and components can be adapted to space
- Maximized safety and extended possibilities

Product features

- The umbrella pipe system contains 2 parts: external pipe casing and rods.
- The external pipe casings are composed by: drill bits, casing pipes, front pipe, extension pipes and end pipe.
- The rods are connected by: pilot device, drill rods, sleeves, drill rods, adapters etc.

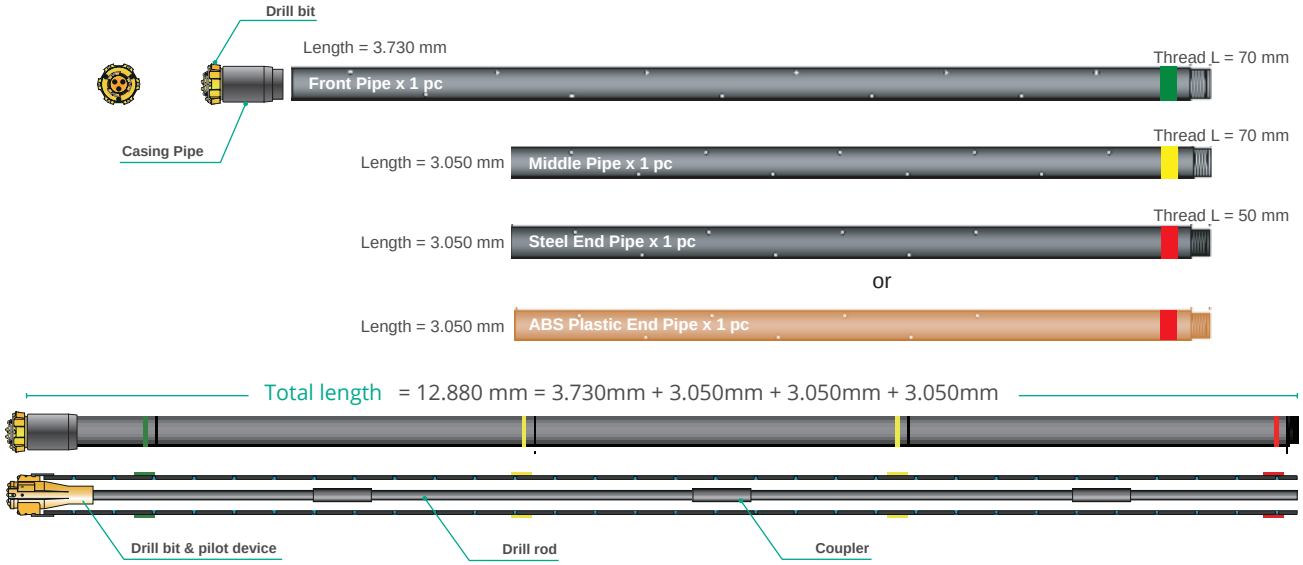
Applications

- Tunnel excavation
- Nearby structure reinforcement
- Ground settlement
- Drainage

Color Marking for Installation Sequence

The drilling and extension pipes are marked in different colors

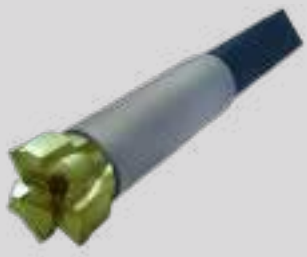
System Diagram



Technical data sheeet

Steel Pipes						
Nominal OD	Steel Grade	Diameter (mm)	Wall Thickness (mm)	Yield Strength (N/mm²)	Ultimate Strength (N/mm²)	Linear Weight (kg/m)
2.0"	JIS G3444 STK 400 or ASTM A500	60.5	5.0	>235	>400	6.76
2.5"		76.3	5.2	>235	>400	9.00
3.0"		89.1	5.2	>235	>400	10.63
3.5"		101.6	5.7	>235	>400	13.31
4.0"		114.3	6.0	>235	>400	15.83
5.0"		139.8	7.0	>235	>400	22.92

Drill system



2.0” & 2.5” Pipes Drill System

3.0” & 3.5” Pipes Drill System

4.0” & 5.0” Pipes Drill System

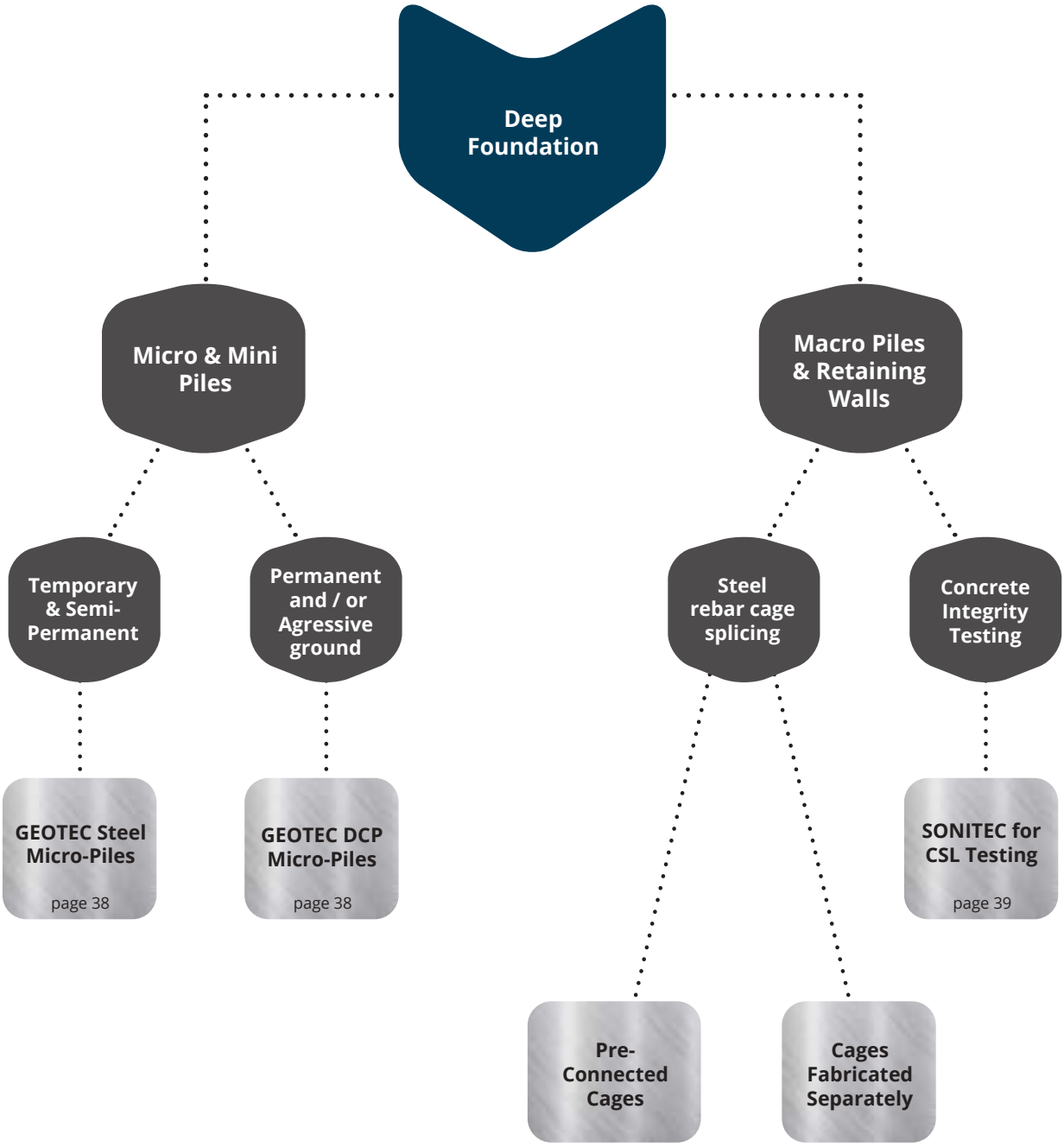
Single Pass Bit Drill System	Bit Diameter	Drill Rods	Ring Lost Bit Drill System	Bit Diameter	Drill Rods	Ring Lost Bit Drill System	Bit Diameter	Drill Rods
2.0" drill	103 mm	T 32	3.0" drill	103 mm	T 32	4.0" drill	125 mm	T 38
2.5" drill	112 mm	T 38	3.5" drill	112 mm	T 38	5.0" drill	150 mm	T 38

Causeway Bridge, Kuwait

Deep Foundation

Selection tree

Identify the right solution for your deep foundations

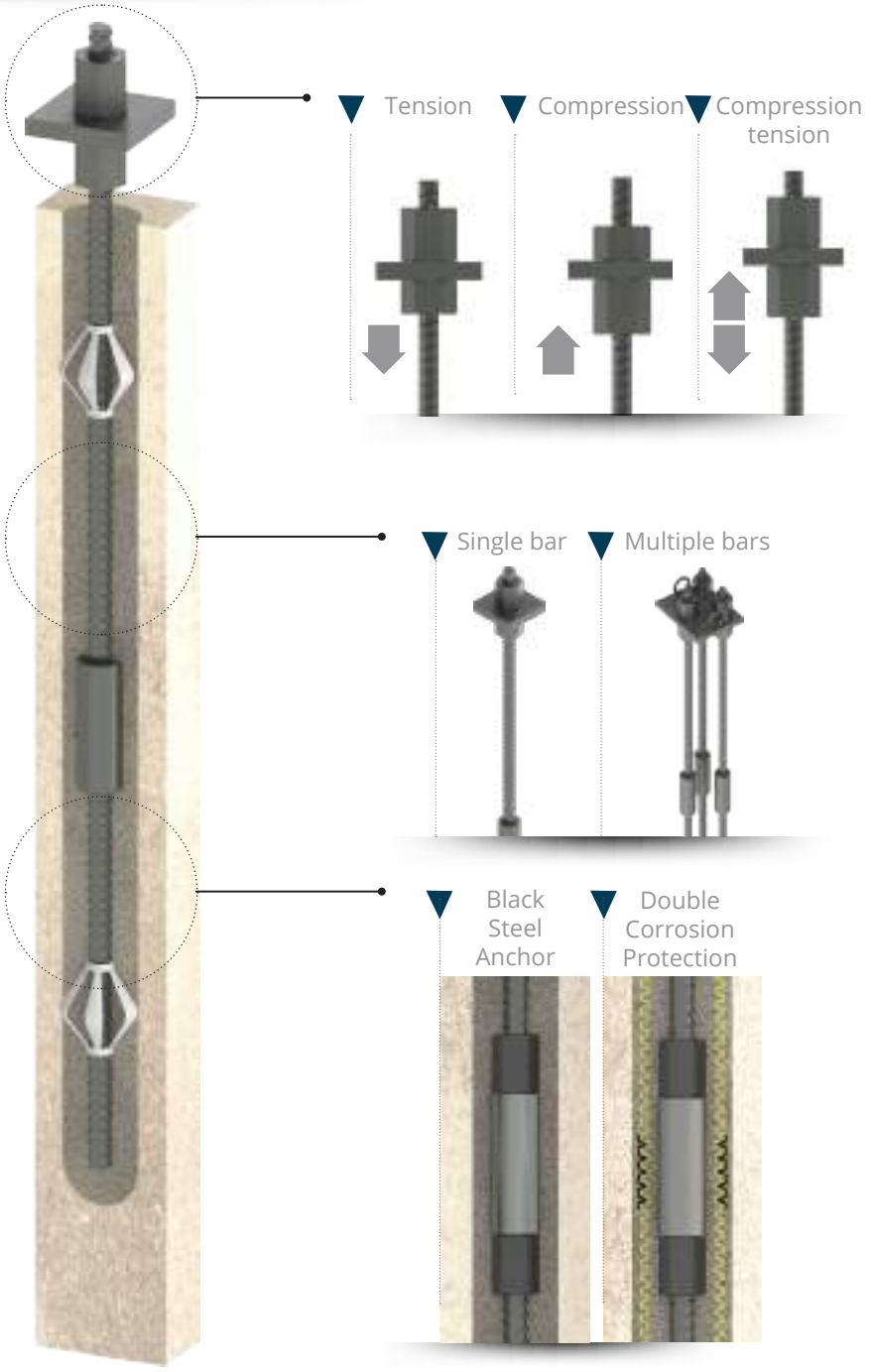


More details on
www.dextragroup.com

Steel products

Micropiles

Tai Po DSD sewage station, Hong Kong



Codes & Standards

- BS EN 1997-1
- BS EN 14199
- BS 8081

GEOTEL

Micropile

Micropiles are structural elements used to transmit an applied tension or compression load into soil or rock. As passive anchors, they do not require post-tensioning.

Suitable for both compression and tension applications thanks to customizable head accessories. For long tendons, couplers may be used to splice threaded bar segments together.

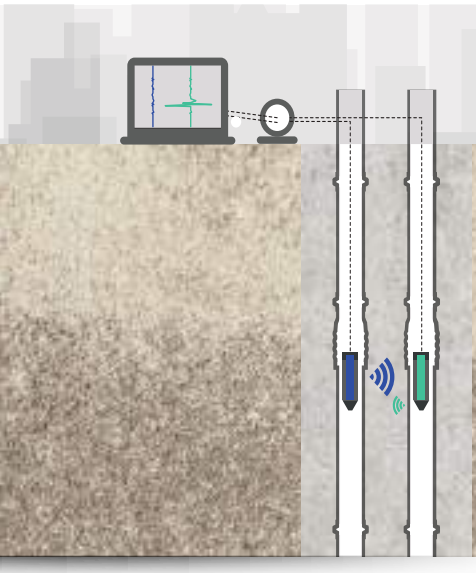
Wide range based on fully threaded bars available in 3 different grades and 6 diameters up to 63.5mm (*see page 8*). Higher grades may be prefered to ease handling and reduce bored hole diameter.

Corrosion protection accessories (SCP / DCP) are fully part of the system and supplied by Dextra. Alternatively, Dextra can also deliver the DCP assemblies pre-grouted.

Multi-bar systems available on request.

SONITEC V2

The most effective solution for drilled shafts integrity check



Definition

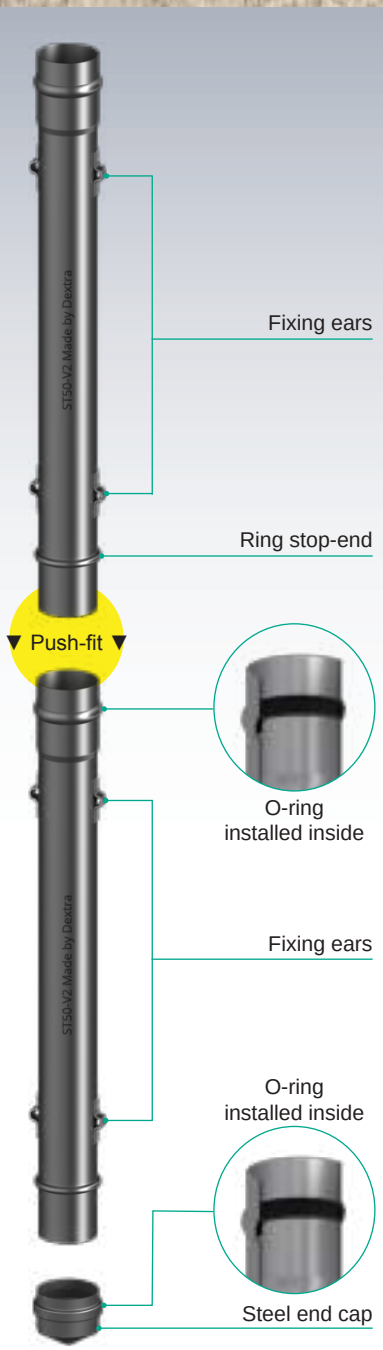
Crosshole Sonic Logging (CSL)

is an accurate method to determine the structural integrity and homogeneity of concrete within diaphragm walls, bored piles, drilled shafts, barretes, concrete piles or augercast piles.

- Widely used for more than 30 years.
- Practical and economical for deep foundation integrity testing.

Product Features

Sonitec V2 are thin black steel tubes available in different diameters with an enlarged end in a bell mouth shape. This makes the connection between two tubes an easy process and minimises labour cost.



Product Benefits

Smart cold-forged manufacturing process:

- Rigid and robust tube connections, high resistance to shocks.
- Fully automated deformation with more precision and consistency.

Better sealing methods:

- The rubber gasket is replaced by an O-ring.
- The O-ring is installed inside the pipe and fully protected from UV & mishandling.
- Standard O-ring, easy to replace (not glued).

Clear engagement for tube to tube connection:

- A physical and visual stopper.
- No sharp edges and much safer for the job operations.

Better end cap solution:

- **Metallic cap with a compact design, high resistance to extreme**
- **temperature & UV.**
- **The cap performance is equivalent to tube to tube connections with the use of the provided O-ring.**
- Rubber cap (without steel) still available as a top cap.

01

Worldwide References

01 | **Major Stations - Musheireb**
Doha, Qatar, 2014
Client: Samsung OHL QBC - JV

02 | **Al-Shahad Tower - West Bay**
Doha, Qatar, 2015
Client: Navayuga

03 | **Nagpur Metro Zero Mile Station**
Maharashtra, India, 2017
Client: ITD Cementation

04 **Grand Paris Express – Bagneux M4-15**
Paris, France, 2016
Client: Franki Foundations

05 **Duba ISCC Green Power Plant**
Saudi Arabia, 2017
Client: Al Saad General Contractor

06 **MRTC - Contract KTE 1001**
Hong Kong, 2015
Client: Nishimatsu Construction

07 | **Causeway Bridge, Kuwait**
Kuwait, 2014
Client: Samsung OHL QBC - JV

08 | **Bangkok MRT – Green Line**
Bangkok, Thailand, 2015
Client: Ch Karn Chang

09 | **Tai Po DSD sewage station**
Hong Kong, 2004
Client: Drainage Service Department, China Harbour

10 | **Doha Metro**
Doha, Qatar, 2014
Client: Samsung OHL QBC - JV

11 | **Chennai Metro**
Chennai, India, 2015
Client: Soma, Lanco Infratech, Afcons, L&T, CCCL,Transtonnelstroy

12 | **Brisbane Air Port Link**
Brisbane, Australia, 2011
Client: Thiess

Commercial presence
in more than
55 countries

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Dextra

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