

# GROUND ENGINEERING

Soil Retention & Stabilization  
Tunneling & Mining  
Deep Foundation



**Dextra**

[www.dextragroup.com](http://www.dextragroup.com)

# About us

Established since 1983, Dextra is an ISO-certified 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 Grand Paris Express, as well as building excavation such as Sheraton Hotel Car park in Qatar.

## Content

[Our Expertise](#)

[Glossary](#)

[Material Specifications](#)

[Soil Retention & Stabilization](#)

[Selection Tree](#)

[Active Anchor](#)

[Passive Anchor](#)

[Tunneling & Mining](#)

[Selection Tree](#)

[Soft-Eyes](#)

[FRP Rock-Bolt: Solid & Hollow](#)

[Self-Drilling Rock-Bolt \(SDRB\)](#)

[Combination Bolt](#)

[Mechanical Bolt](#)

[Expandable Friction Bolt](#)

[Lattice Girder](#)

[Umbrella Pipe](#)

[Deep Foundation](#)

[Selection Tree](#)

[Micropiles](#)

[Sonitec V2](#)

# Our Expertise

## Identification of need

### DETERMINATION OF THE RIGHT SOLUTION

Dextra can guide you step-by-step in selecting the most appropriate and cost effective solution for your project.

## Design & Engineering

### SYSTEM OPTIMIZATION AND CUSTOMIZATION

Dextra has developed a comprehensive standard range of components that allows a quick adjustment and customization of our products for a truly optimized project solution.

## Logistic

### SUPPLY CHAIN MANAGEMENT

Thanks to our network, Dextra is able to organize local storage to serve you with shorter lead-times when needed.

## Manufacturing & Quality

### TOTAL CONTROL OVER MANUFACTURING

Beyond our own facilities and ISO-certified quality assurance processes, all of our suppliers are also regularly audited by our team of engineers.

## Installation & Testing

### ON-SITE SERVICE & SUPPORT

Dextra international experts are able to accompany you during each step of onsite installation until you are truly satisfied 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.

### 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. Typical examples are soil nails used for slope stabilization.

### 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 re-tained structure. It has a free length and a bonded length. Typical examples are tie-backs, that are horizontally installed to reduce the deformation of retaining walls.

### Permanent Anchor

An anchor with a design life greater than two years. The design life of "semi-permanent" anchors, should be de-fined by the consultant, but is usually in the range of five to ten years. Typical examples are FRP anchors and DCP anchors.

### 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.

### 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.

## 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)

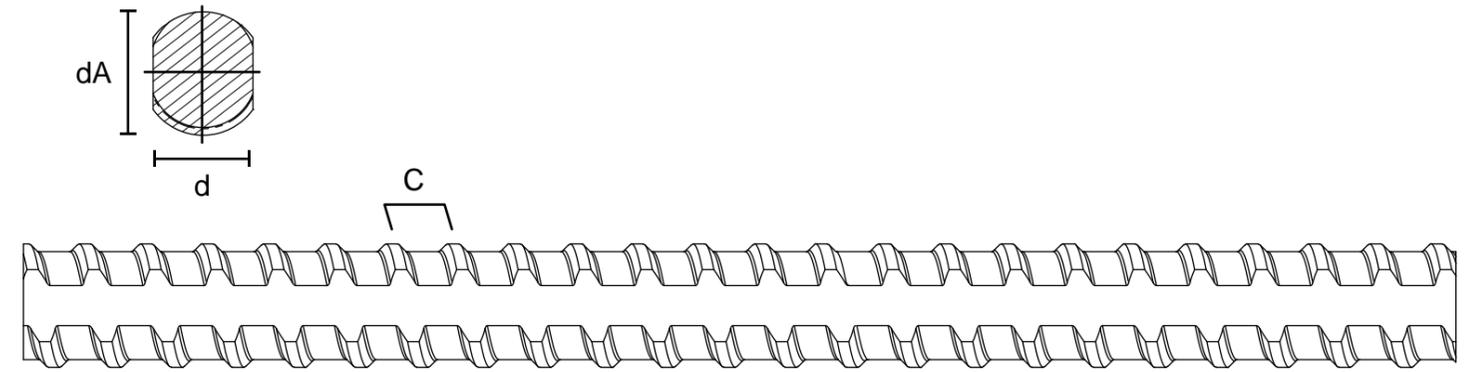
Thin black steel tubes available in different diameters with an enlarged end in a bell mouth shape. This makes the connection between two tubes an easy process and minimises labour cost.



Versatile Steel & FRP ground engineering solutions. Fully threaded bars are the core components of our systems.

Unique FRP solutions. Our hybrid steel / FRP systems guarantee high performances for the most stringent of requirements.

# Material Specifications



## Material

- Continuous high-tensile hot-rolled threaded bars.
- Modulus of Elasticity: 205 GPa (205 kN/mm<sup>2</sup>).
- 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.

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)	(mm <sup>2</sup> )	(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	51	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

# Material Specifications



## Benefits of Fiber Reinforced Polymers (FRP)



Easily be cut by common excavation and piling equipment.



FRP profiles are available in formulations resistant to acidic and alkali environments.



FRP profiles are twice stronger than steel in tensile for only 25% of its weight.

FRP Specifications		
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 

# Soil Retention & Stabilization

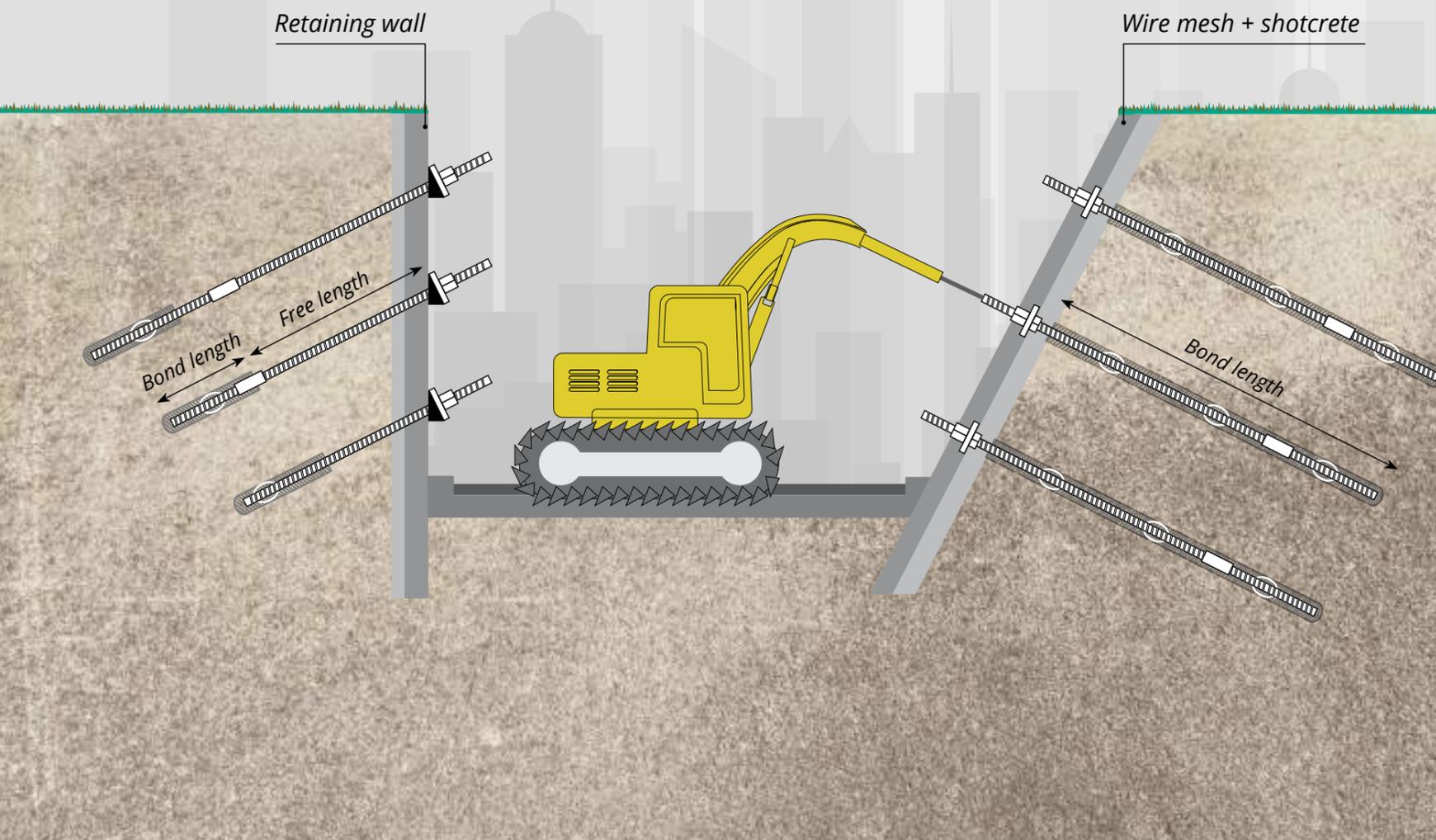
## Applications

### Excavation

- Pre-stressed active anchors are ideal for vertical retaining walls that only allow limited deflection.
- To create bond strength, anchoring high strength tendons to the retaining wall on one end and to the ground on the other end through a bulb of pressure injected grout.

### Slope Stabilization

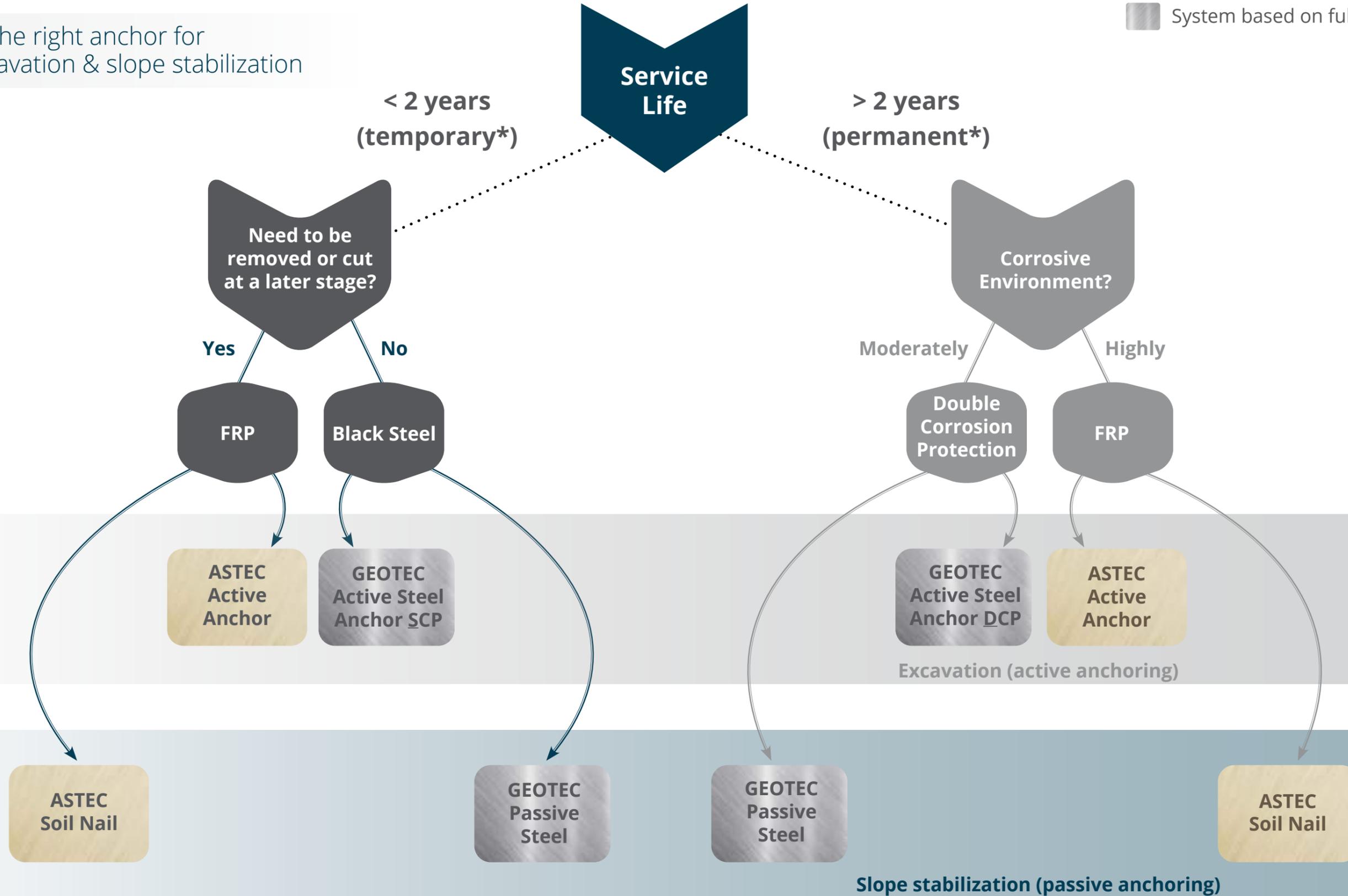
- Passive anchors are a preferred solution for soil-covered slope stabilization.
- With larger displacement, the high strength tendons are fully grouted from the face of the slope into the stable ground to prevent downslope.



# 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

Selection tree



## Codes & Standards

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

## Features

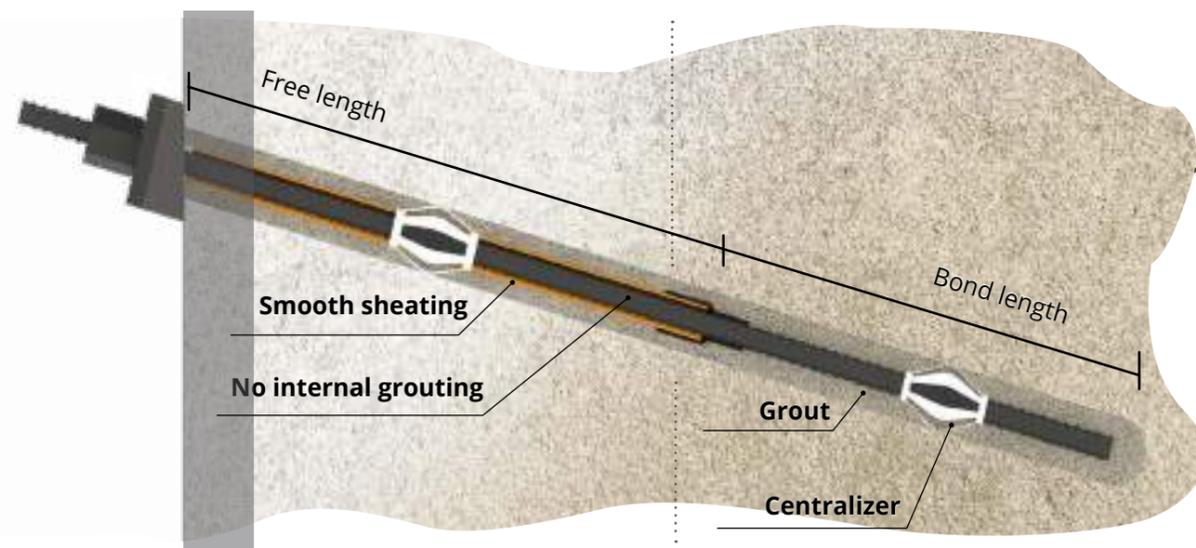
- **Suitable** for any temporary or permanent work as long as tendons do not encroach onto neighboring plots and do not need to be cut or extracted at a later stage.
- **Wide range** based on high-tensile fully threaded bars available in 7 diameters grades and 6 diameters up to 63.5mm.
- **Corrosion protection accessories** available.

## **GEOTEL** Active Anchor (Steel)

### Black Steel Anchor

**1 layer of grout** all along the whole length of the system.

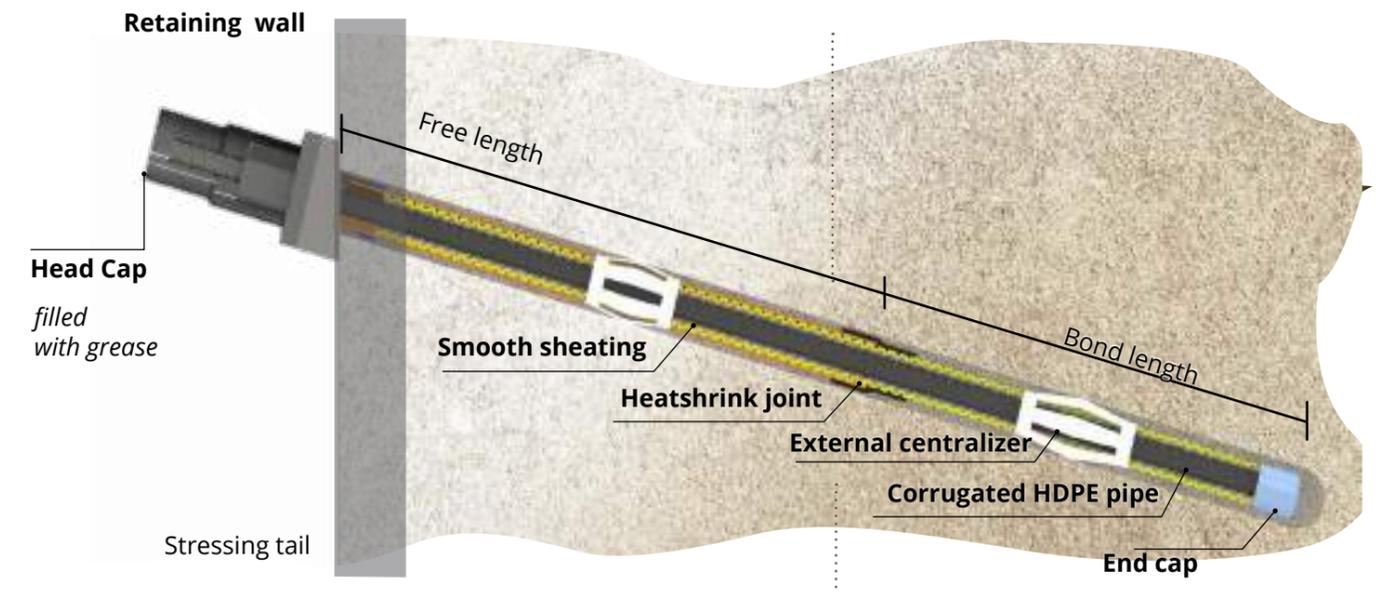
- **Bonded length** protection thanks to the fully threaded bar ribs and one layer of grout between bar and bored hole.
- **Unbonded length** protection is achieved by covering the fully threaded bar with a smooth HDPE sheathing.



### Double Corrosion Protection (DCP)

**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 sheathing.
- **Unbonded length** protection is guaranteed by the use of smooth HDPE pipe above the corrugated HDPE sheathing.
- **Protective head cap** and **end cap** complement the corrosion protection system.



# Active Anchor

Selection tree



## Codes & Standards

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

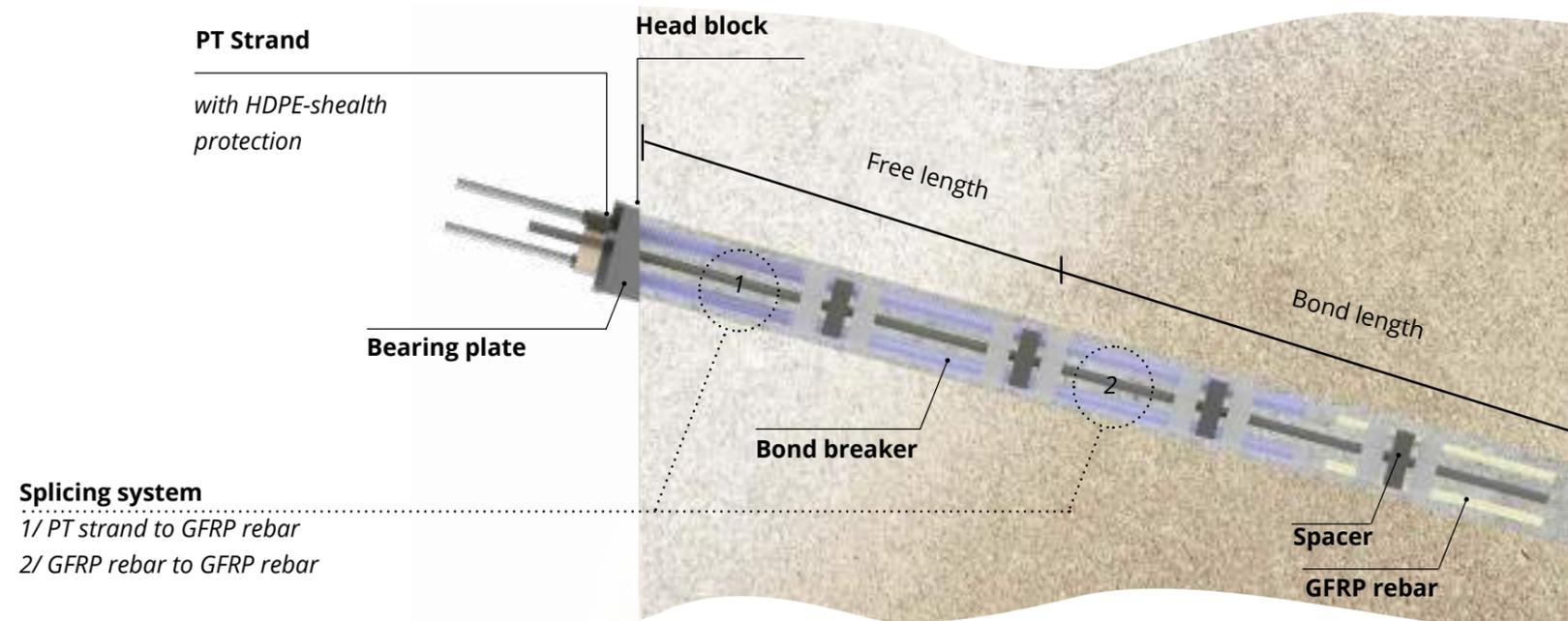
## Features

- No need to remove the anchor from the ground.
- Easy and fast future extirpation by common TBM and Pile Boring machines.
- No additional periodic monitoring and maintenance.
- No need for extra corrosion protection.
- Minimizes weight to ease handling & installation.

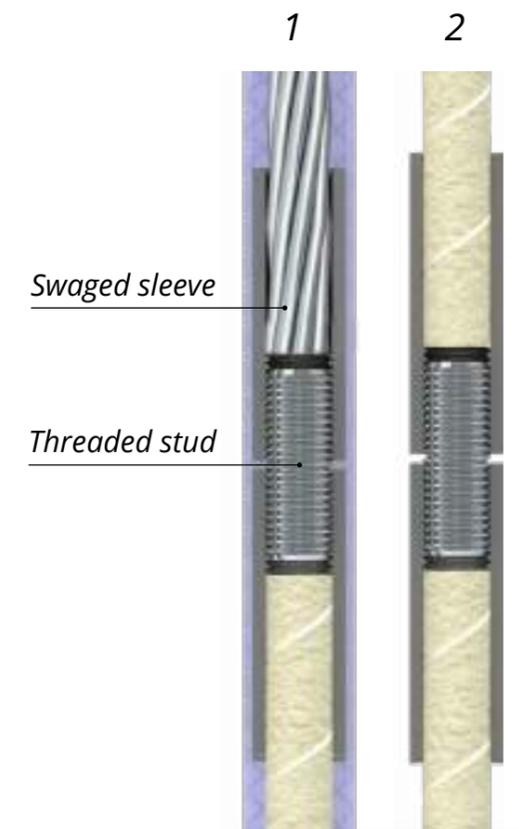


## Active Anchor (FRP)

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.



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



# Active Anchor



Selection tree

## Project References



Green Duba Power Plant, Saudi Arabia



Doha Metro Rail – Phase 1, Qatar



Doha Metro, Gold Line – Al Sadd C-Ring Station, India



Grand Paris Express, France



Nagpur Metro, Zero Mile Metro Station, India



Riyadh Metro, Saudi Arabia

## Resources



Brochure



## Connect with us



[www.dextragroup.com](http://www.dextragroup.com)



# Passive Anchor

[Selection tree](#)



## Codes & Standards

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

## Features

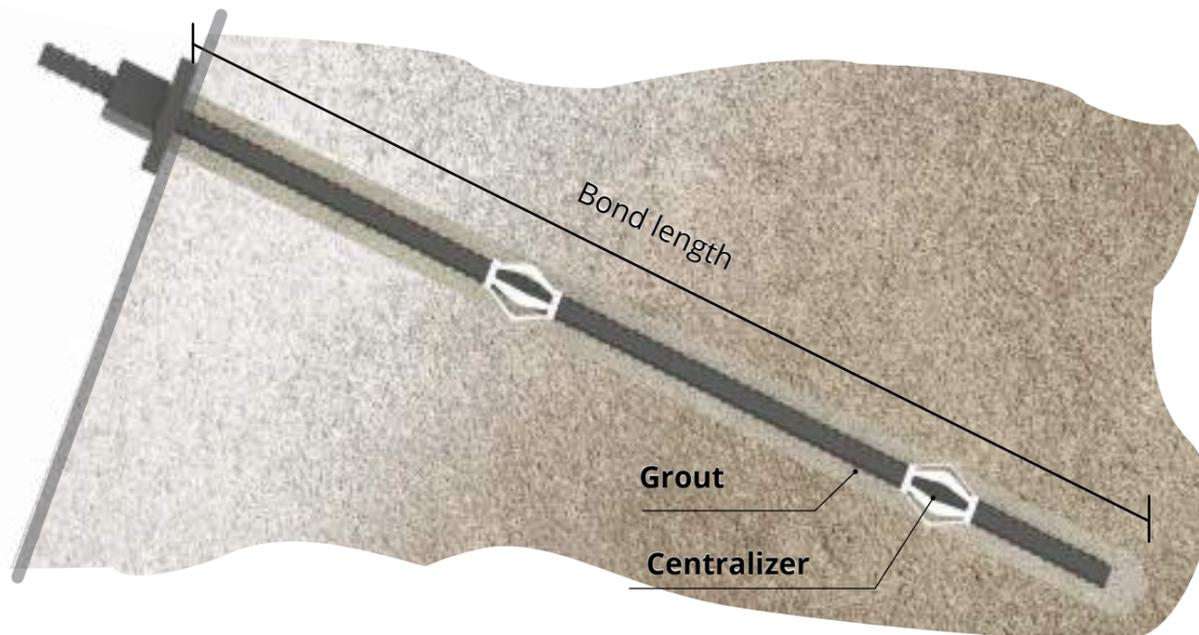
- **The preferred solution for slope stabilization. The system is bonded all along the whole tendon length.**
- Suitable for any temporary or permanent work as long as tendons do not encroach onto neighboring plots and do not need to be cut or extracted at a later stage.
- Wide range based on fully threaded bars available in 4 different grades and 7 diameters up to 63.5mm.

## Soil Nail (Steel)

### Black Steel Anchor

**1 layer of grout** all along the whole length of the system.

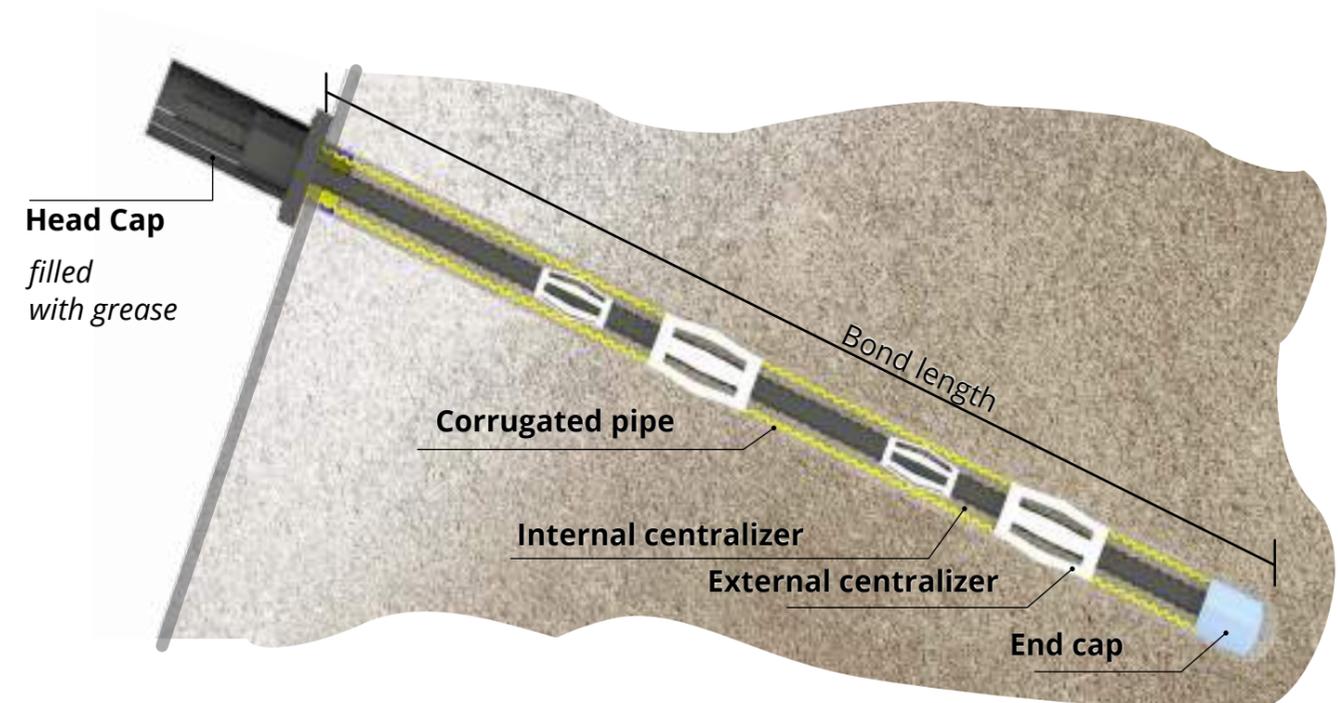
- **Bonded length** achieved with a single layer of grout between the bar and the bored hole.



### Double Corrosion Protection (DCP)

**2 layers of grout** all along the whole length of the system.

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



# Passive Anchor

Selection tree



## Codes & Standards

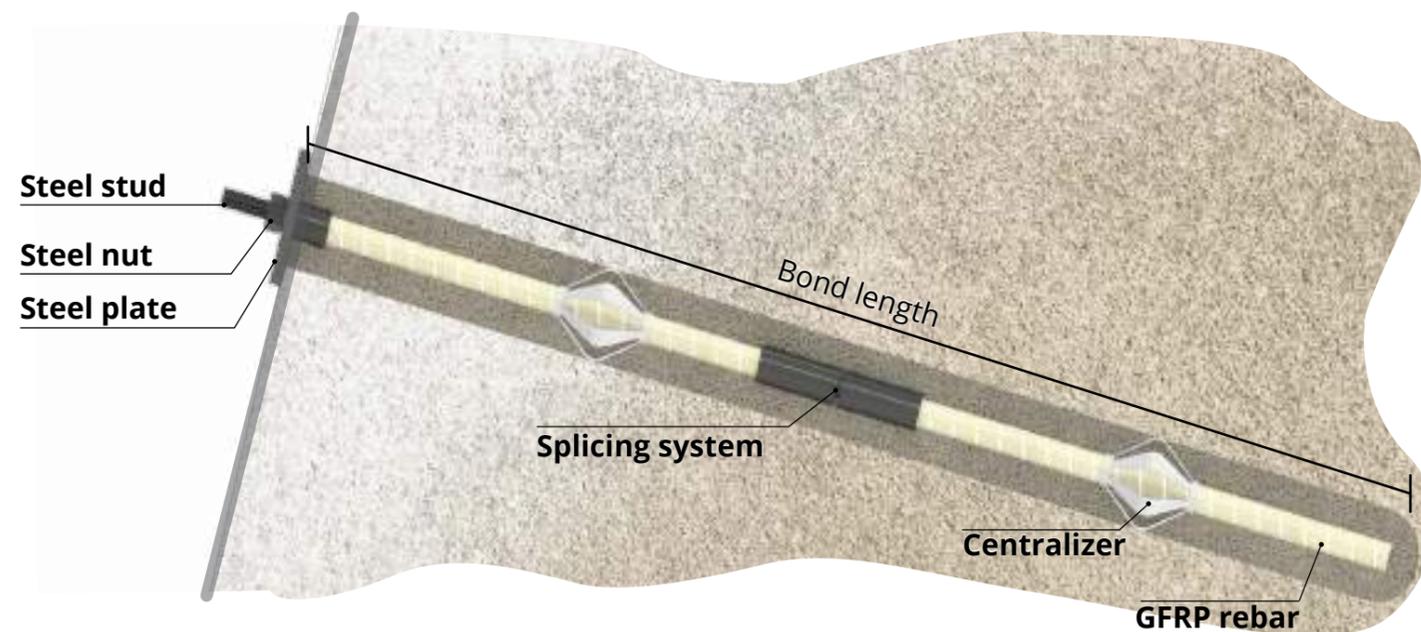
- ACI 440-4R-04
- FHWA-IF-03-017
- FHWA-SA-96-069
- HK GEOGUIDE 7
- ISO 6934-4

## Features

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

## **ASTEC** Soil Nail (FRP)

A passive anchoring system used for rock and soil stabilization. It is suitable for both temporary and permanent ground consolidation.



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

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

# Passive Anchor



Selection tree

## Project References



Belarus Ostrovets Reactors 1&2, Belarus



Anderson Road Quarry, Hong Kong



Melbourne Metro, Australia

## Resources



Brochure



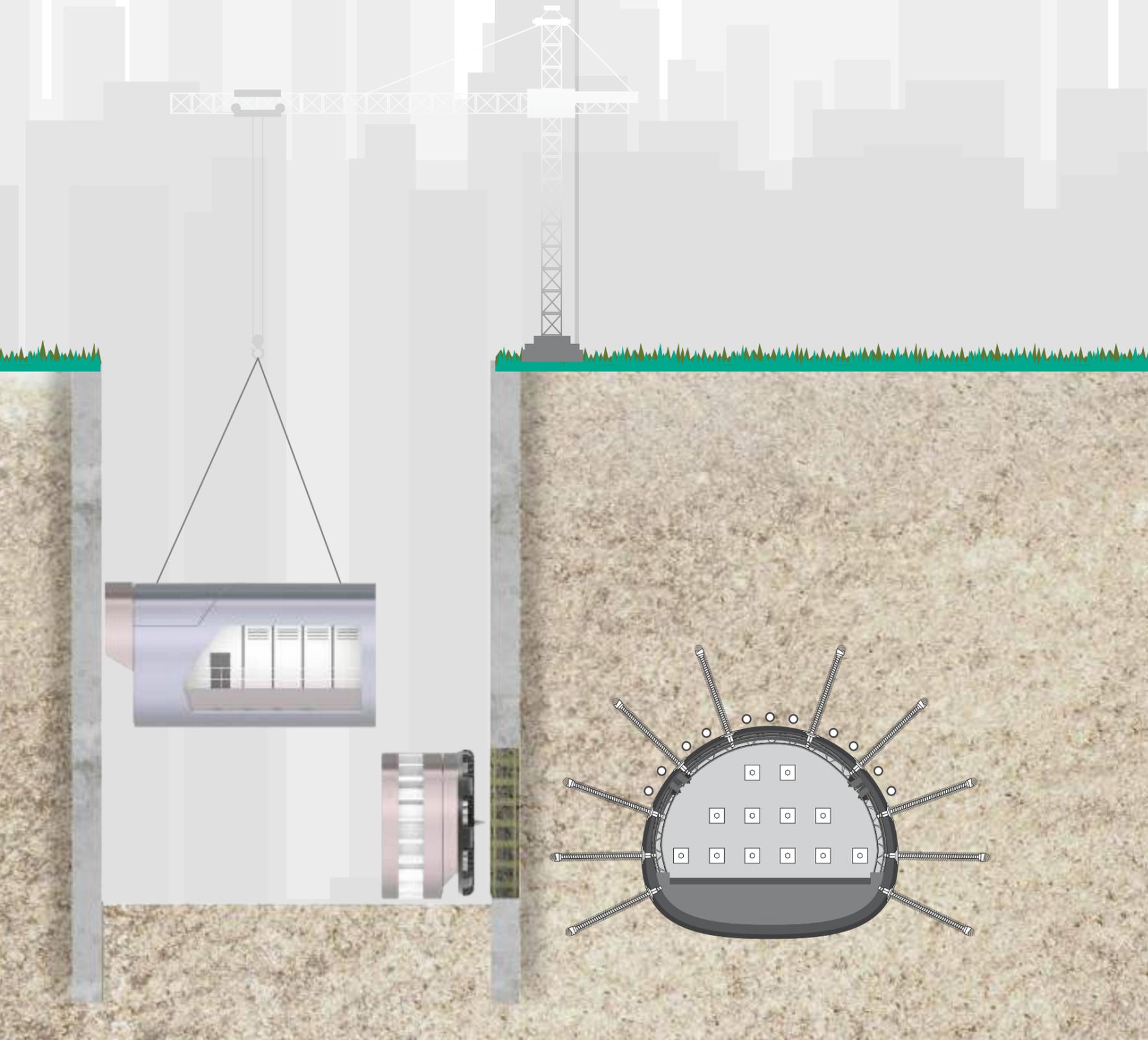
## Connect with us



[www.dextragroup.com](http://www.dextragroup.com)



# Tunneling & Mining



## Applications

### Cuttable solutions

- Cuttable support is mostly used in the longitudinal direction of the tunnel when temporary stabilization is required, especially for underground metro projects.
- Cuttable reinforcement bars and cuttable ground anchors are available.

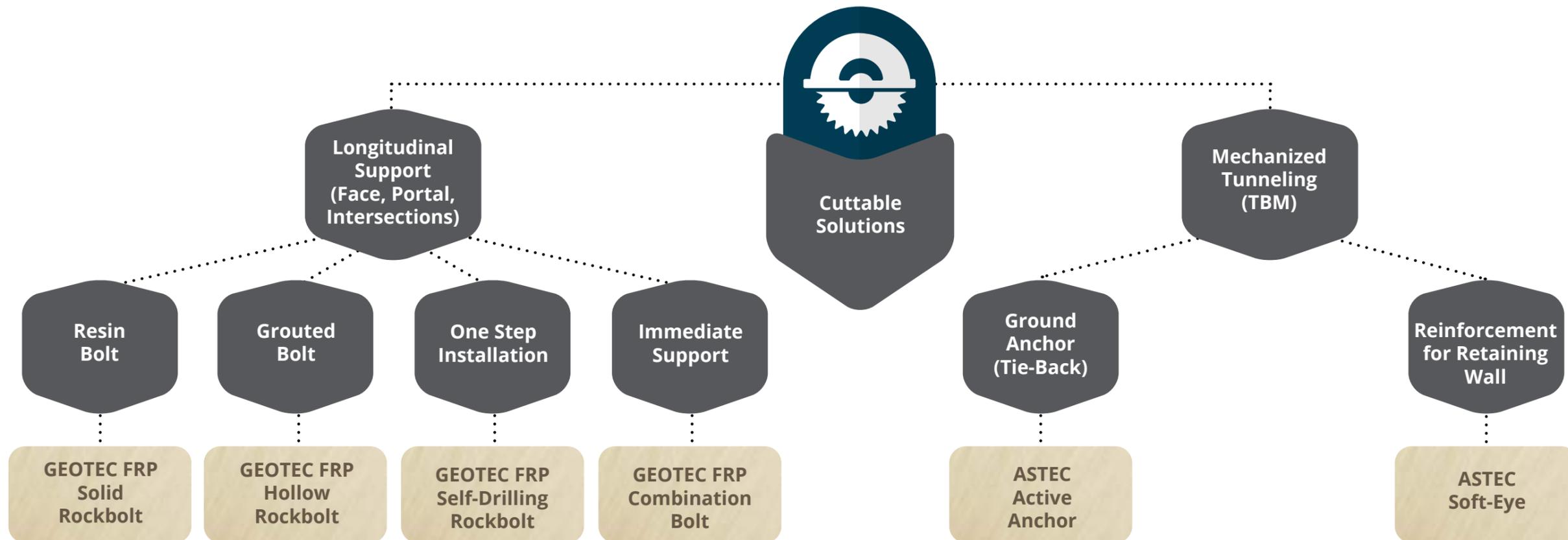
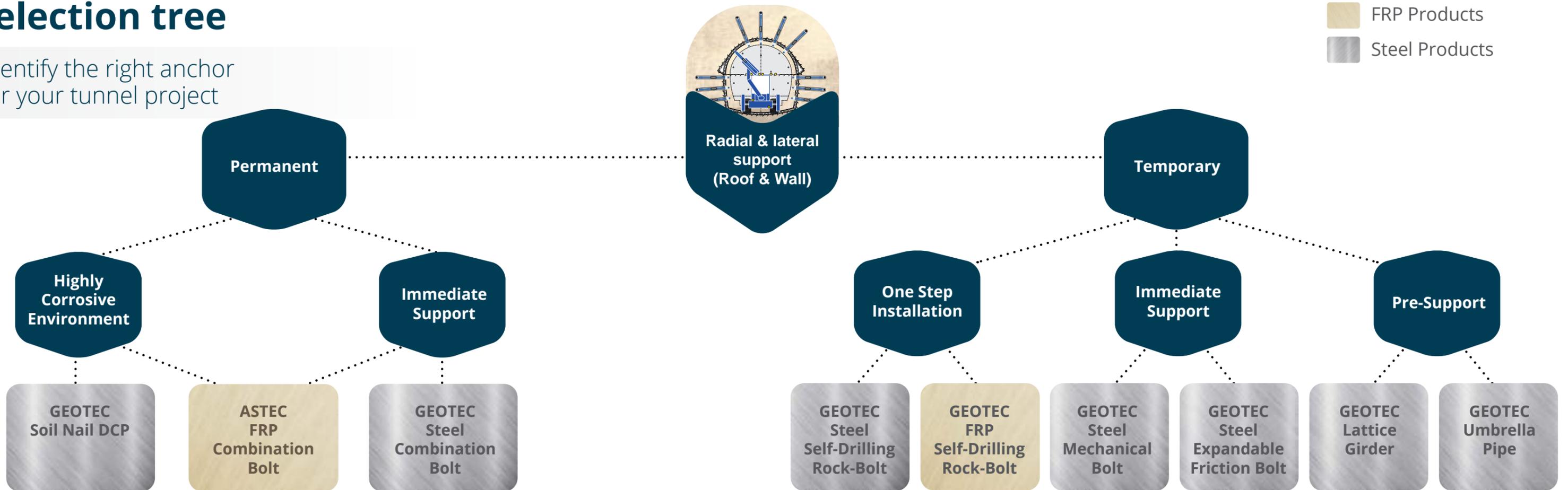
### Radial & lateral support (Roof & Wall)

- Rock-bolts help support roofs and walls during tunnel drilling and blasting.
- Depending on the construction sequence and technology, both temporary and permanent bolts can be offered.
- Provide immediate support for tunneling environments.

# Selection tree

Identify the right anchor for your tunnel project

FRP Products  
Steel Products



# Soft-Eye



## 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."

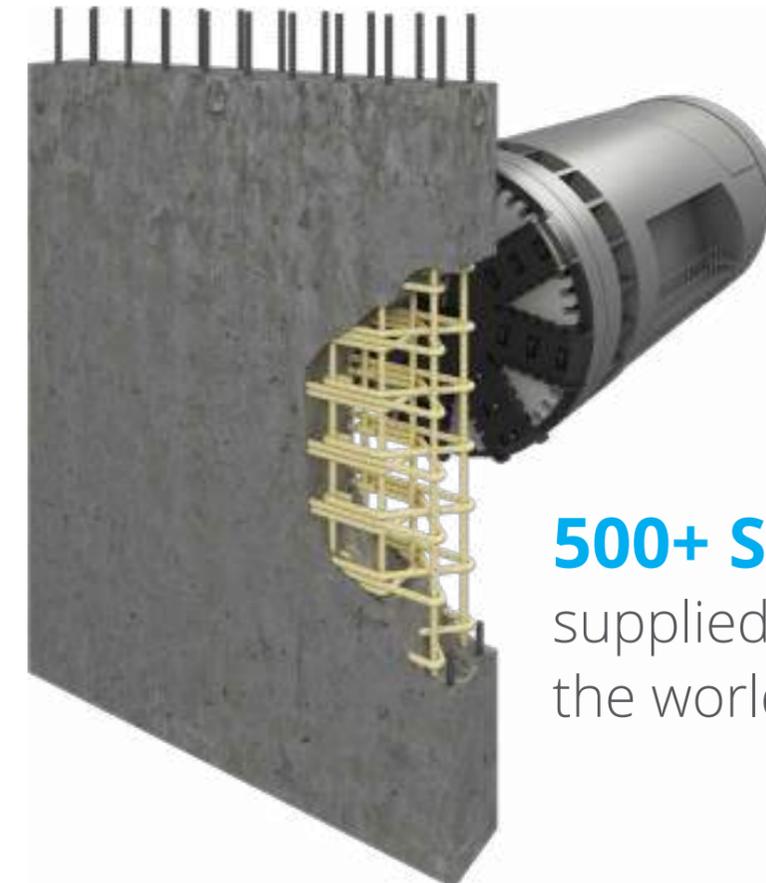
Selection tree

## Features

- Cuttable Glass Fiber Reinforced Polymer (GFRP) reinforcement instead of conventional steel rebars.
- Speed up the construction schedules: TBM passes through the diaphragm wall.
- No demolition equipment needed.
- Commit on Safety: no workers required to access the shaft.



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.



**500+ Soft-Eyes**  
supplied all around  
the world.

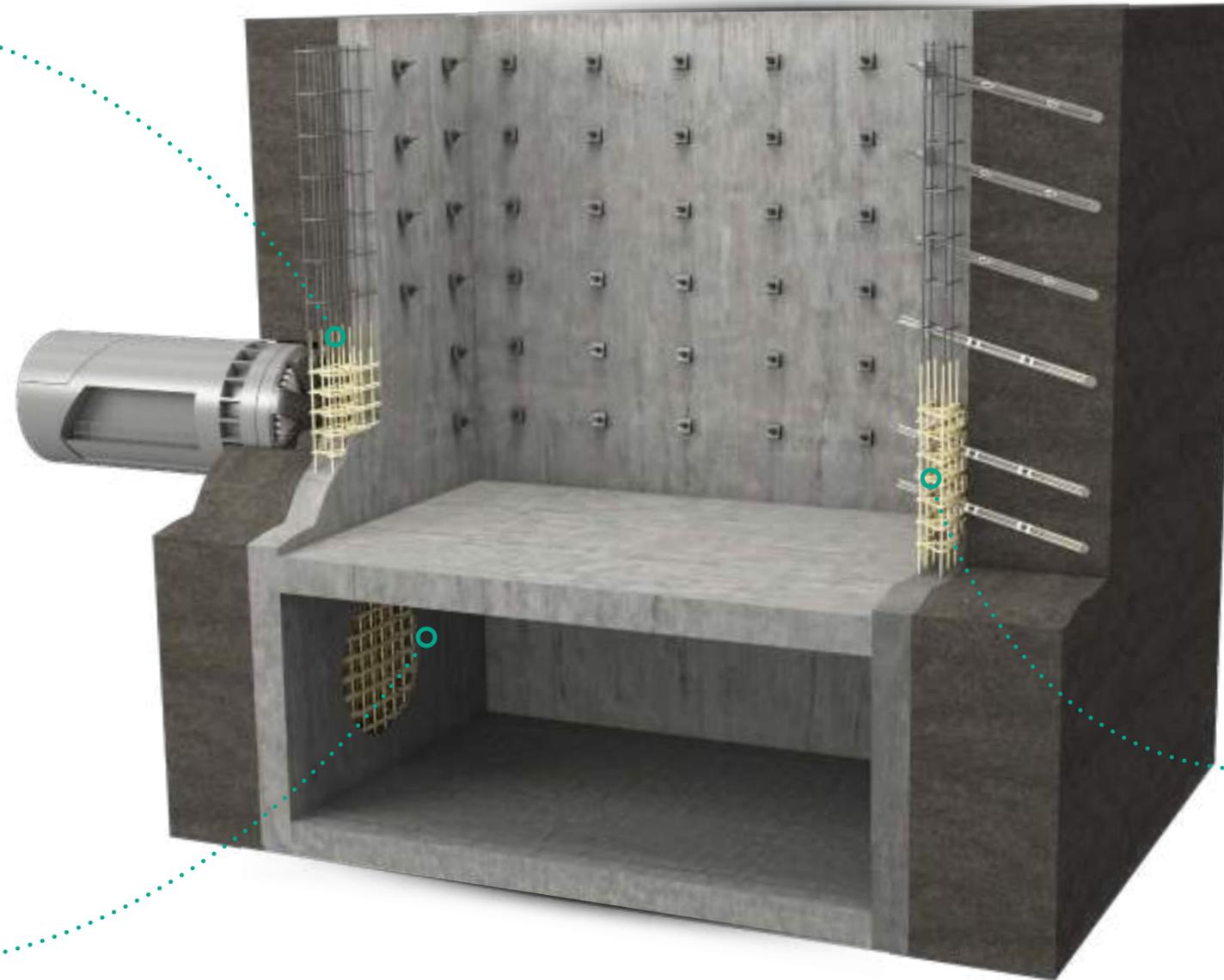
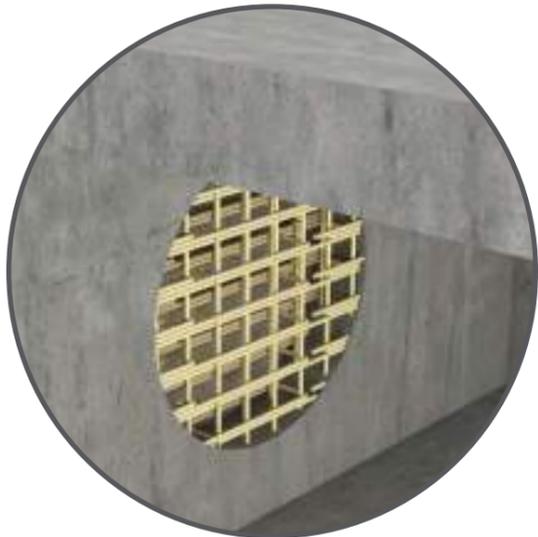
## Temporary

The typical Soft-Eye application. The cage is made of GFRP bars, which will be cut by the TBM during breakthrough.



## Permanent

For subway projects with planned expansions, permanent Soft-Eyes (lifetime up to 100 years) may be pre-positioned for future tunnels and stations.



## Temporary + Astec Active Anchor

When strong soil forces require retaining walls to be anchored with post-tensioned anchors, Dextra recommends the use of Fully Cuttable ASTEC Active Anchors (AAA). Those will also be cut during TBM breakthrough.

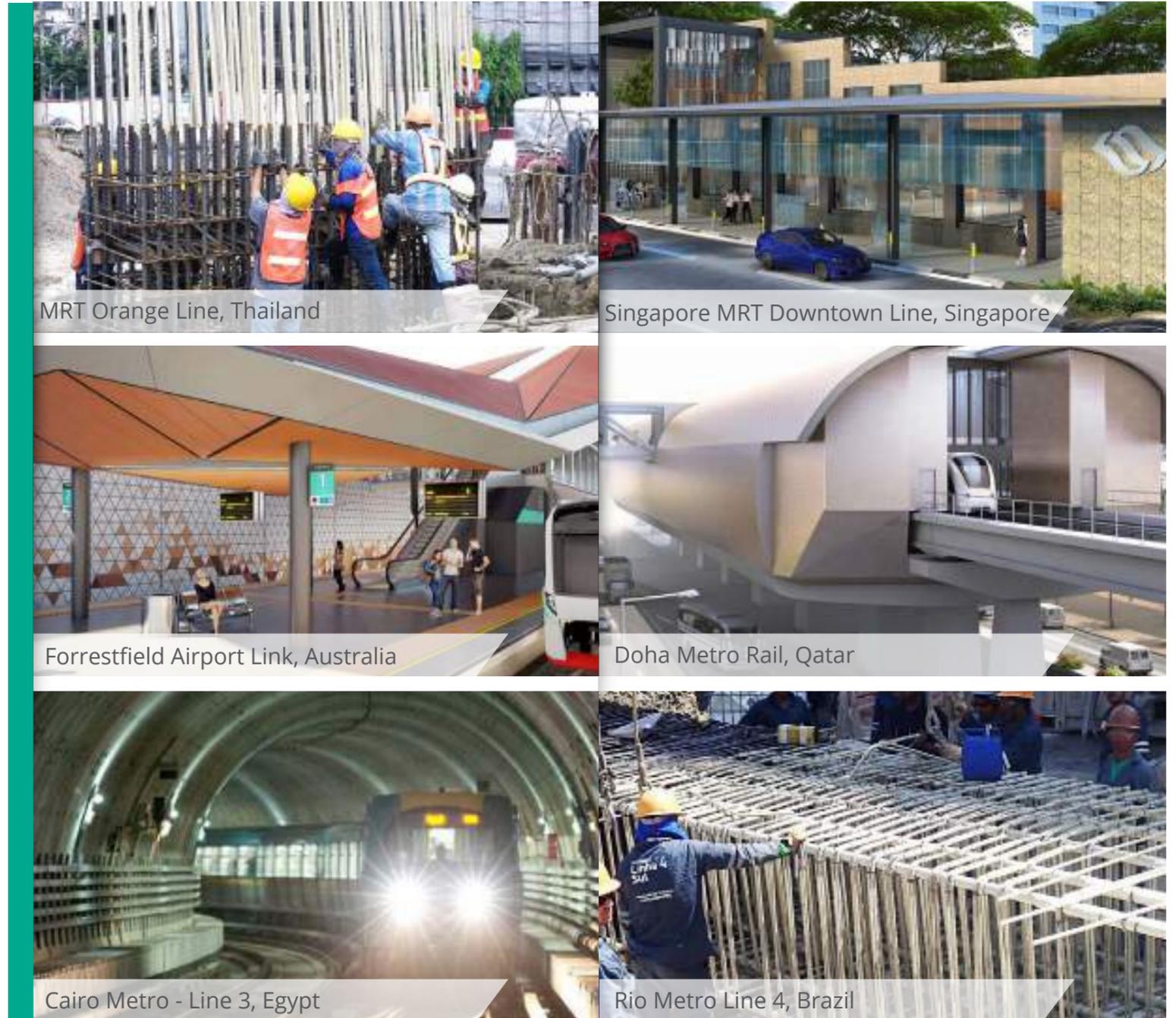


# Soft-Eye



Selection tree

## Project References



MRT Orange Line, Thailand

Singapore MRT Downtown Line, Singapore

Forrestfield Airport Link, Australia

Doha Metro Rail, Qatar

Cairo Metro - Line 3, Egypt

Rio Metro Line 4, Brazil

## Resources



Brochure



## Connect with us



[www.dextragroup.com](http://www.dextragroup.com)



# FRP Rock-Bolt: Solid

[Selection tree](#)



## Codes & Standards

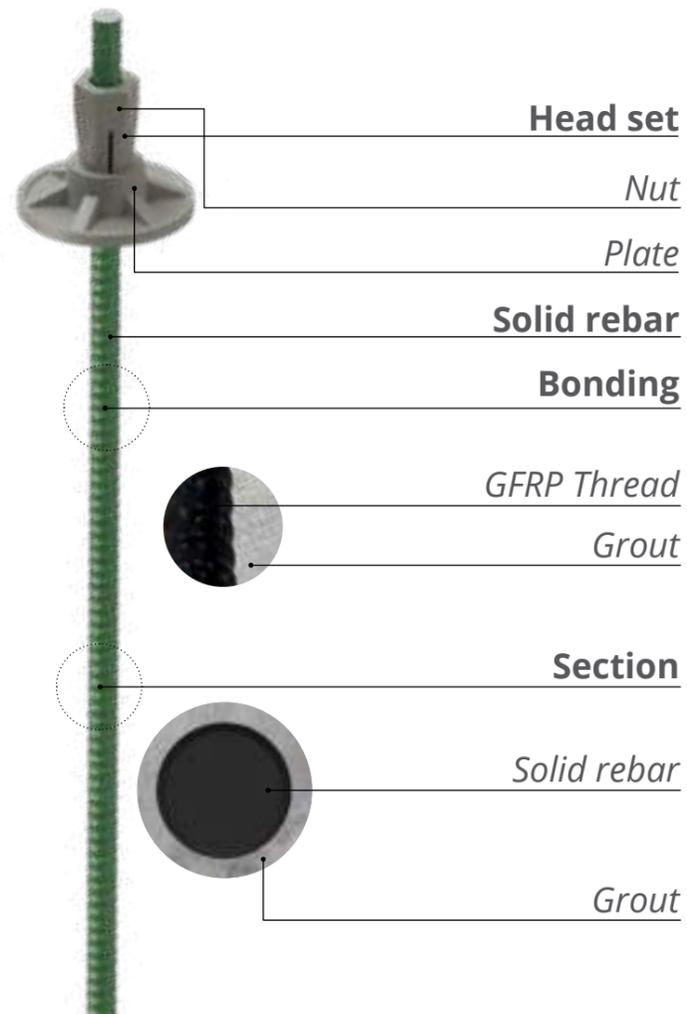
- BS EN 1997-1
- BS EN 1537
- BS 7861-1

For face bolting or any other tunneling/mining application where further excavation is required.

## Features

- Can be installed with resin cartridges or forced into pre-grouted holes.
- 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.

## **GEOTEL** FRP Solid Rock-Bolt



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

Diameter (mm)	Solid Bar System Performance			Loading (kN)
	Head Breaking Load (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

# FRP Rock-Bolt: Hollow

[Selection tree](#)



## Codes & Standards

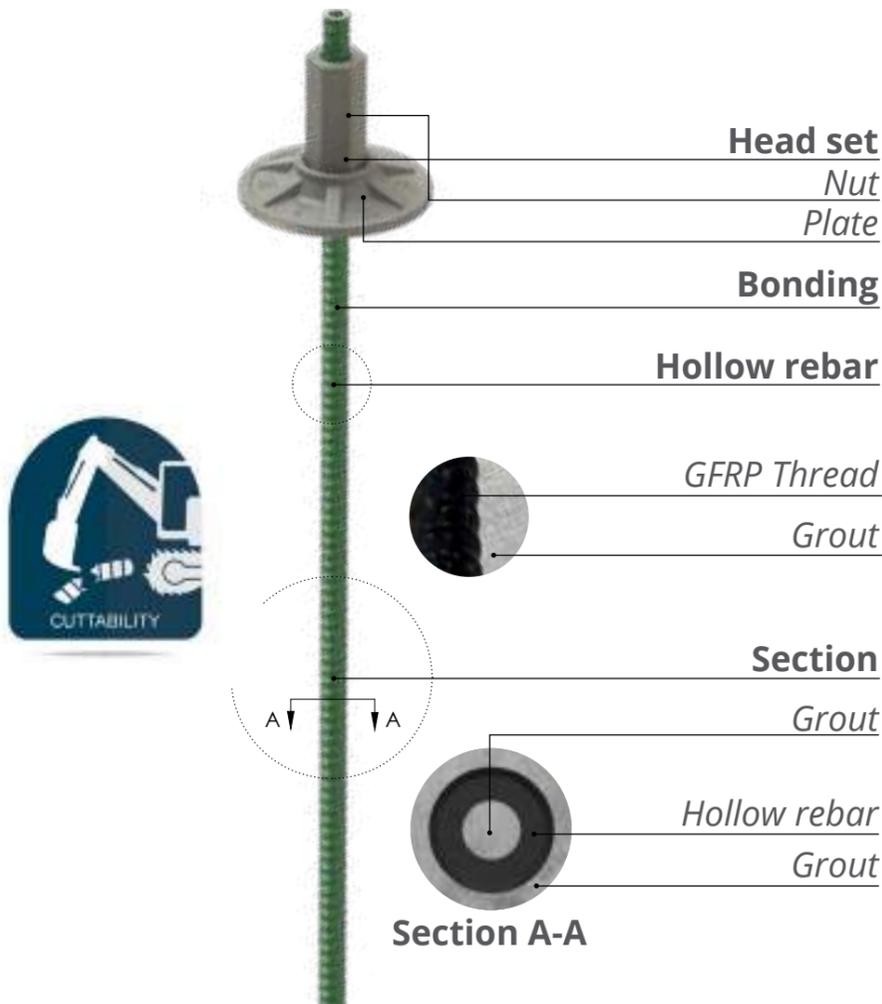
- BS EN 1997-1
- BS EN 1537
- BS 7861-1

For face bolting or any other tunneling/mining application where further excavation is required.

## Features

- **Inserted into the hole and directly grouted through its hollow core.**
- 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.

## FRP Hollow Rock-Bolt



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



Design

BS EN 7861-1:2007



GFRP Thrust Bolt

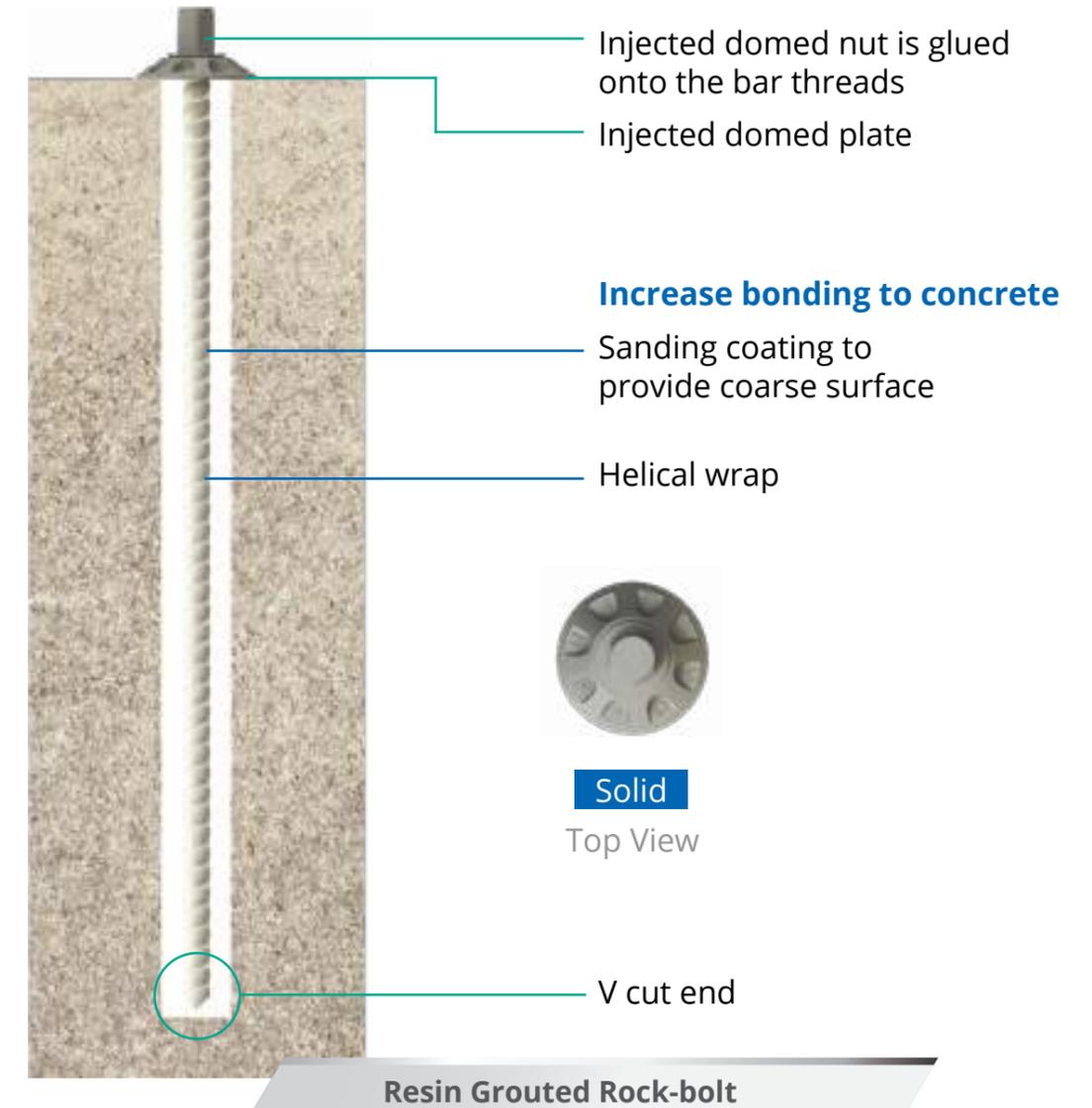
**For permanent applications.** The domed nut is injected onto the bar which provides the **high tensile load capacity**. Ideal for installation with resin cartridges, its v cut end is designed to penetrate cartridges, the helical pattern also allows an efficient cartridge mixing.

Solid Bar						
Dia (mm)	Nominal Dia. (mm)	Nominal CSA (mm <sup>2</sup> )	Grade 45P (MoE: 45 GPa)			
			Material		Mechanical Properties	
			Fiber	Resin	Ultimate Tensile Load (kN)	Ultimate Tensile Strength (MPa)
25	25.4	510	ECR	Epoxy	324	635
32	32.3	819	ECR	Epoxy	450	550
35	35.0	962	ECR	Epoxy	550	550

System Capacity					
Dia (mm)	Nut Length (mm)	Nut OD (mm)	Transverse Shear (MPa)	Torque (N•m)	System Breaking Load (kN)
25	85	74	124	200	≥ 100
32	85	74	124	300	≥ 130
35	85	74	124	350	≥ 150

Selection tree



Accessories			
Dia (mm)	Injected Domed Plate		
	Diameter (mm)	Thickness (mm)	Breaking Load (kN)
25/32/35	150	10	≥ 220

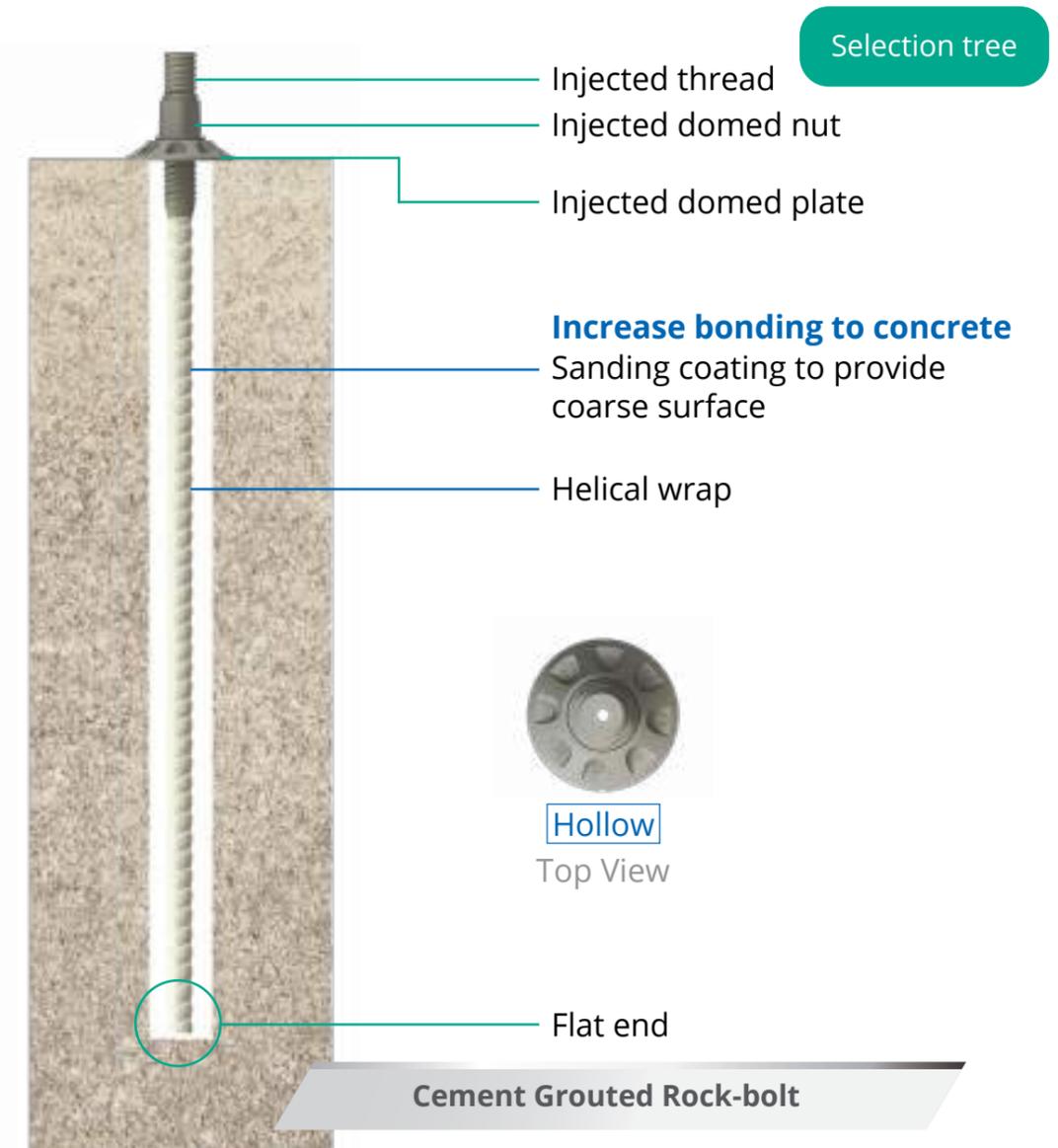
# FRP Rock-Bolt: Hollow



Design  
BS EN 7861-1:2007

## **ASTEC** GFRP Injected Thread Rock-Bolt

**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 <sup>2</sup> )	MoE: 45 GPa			
			Grade 45T	Grade 45P	Mechanical Properties	
			Fiber/Resin	Fiber/Resin	Ultimate Tensile Load (kN)	Ultimate Tensile Strength (MPa)
32 x 13	32.3	675	ECR/PE	ECR/VE	355	526

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

Accessories			
Dia (mm)	Injected Domed Nut		
	Major Diameter x Pitch (mm)	Length (mm)	Breaking Load (kN)
32	40 x 7.0	85	≥ 150
Dia (mm)	Injected Domed Plate		
	Diameter (mm)	Thickness (mm)	Breaking Load (kN)
32	150	10	≥ 220

# FRP Rock-Bolt



Selection tree

## Project References



Hyosung LPG Cavern, Vietnam



Shimla bypass project, India



Udhampur-Srinagar-Baramulla Rail Link (USBRL), India



Anderson Road Quarry, Hong Kong



Melbourne Metro, Australia

## Resources



**GEOTEC**  
FRP Rock-bolt  
Brochure



**ASTEC**  
FRP Rock-bolt  
Brochure



## Connect with us



[www.dextragroup.com](http://www.dextragroup.com)



# Self-Drilling Rock-Bolt (SDRB)



## Codes & Standards

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

## **GEOTEL** Steel SDRB

A rock-bolting system based on a fully coarse threaded steel hollow bar.

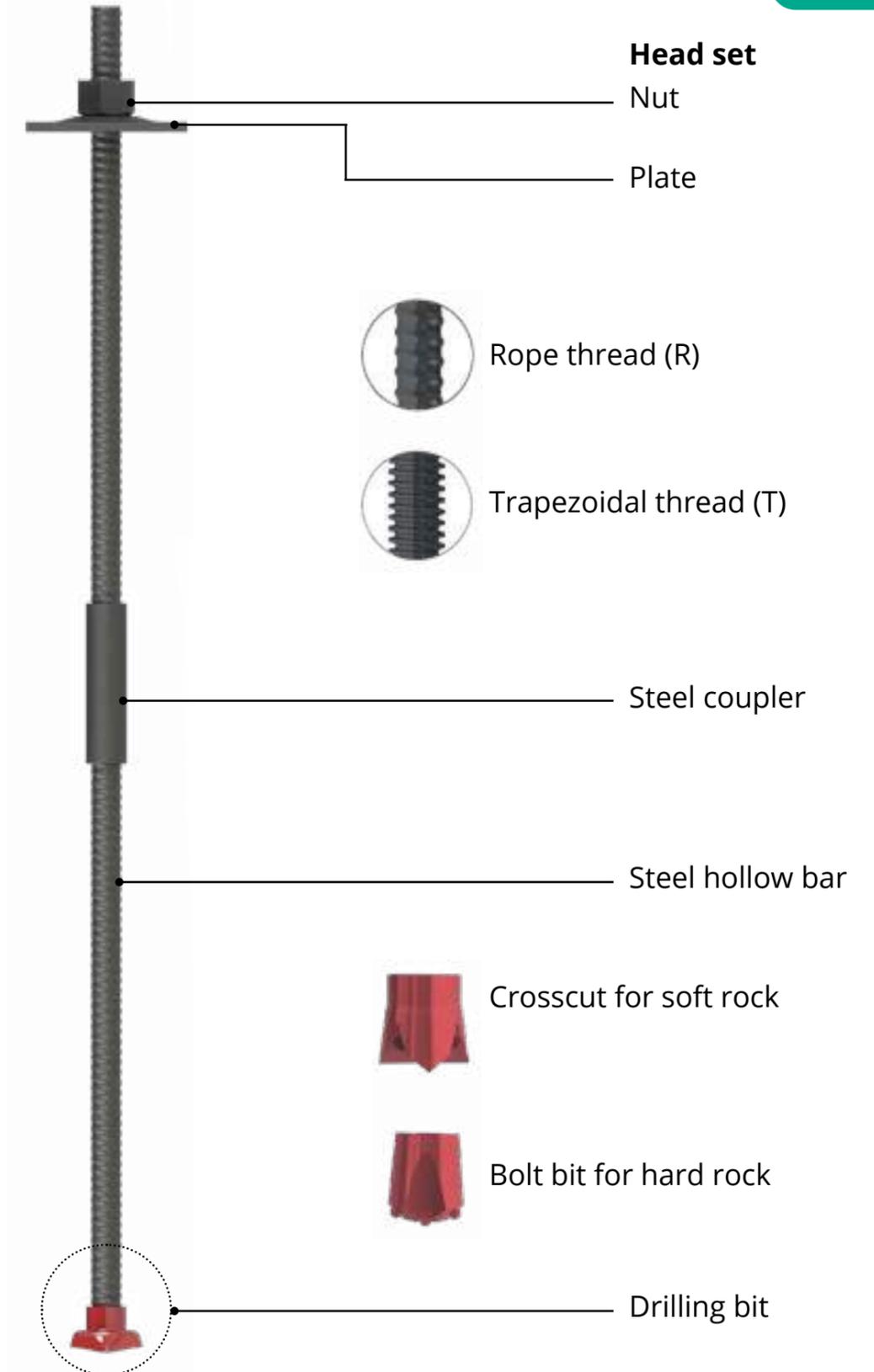
### Applications

- Installation with grout. The hollow steel anchor rod acts as a grouting pipe to ease set up. For non-grouting applications, please refer to Mechanical Anchor or Expandable Friction Bolts.
- 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.
- Suitable for permanent and temporary applications.

### Corrosion Protection

- For temporary applications, the corrosion protection is achieved through encapsulation with grout.
- For permanent applications, epoxy coating is also available upon request.

Selection tree



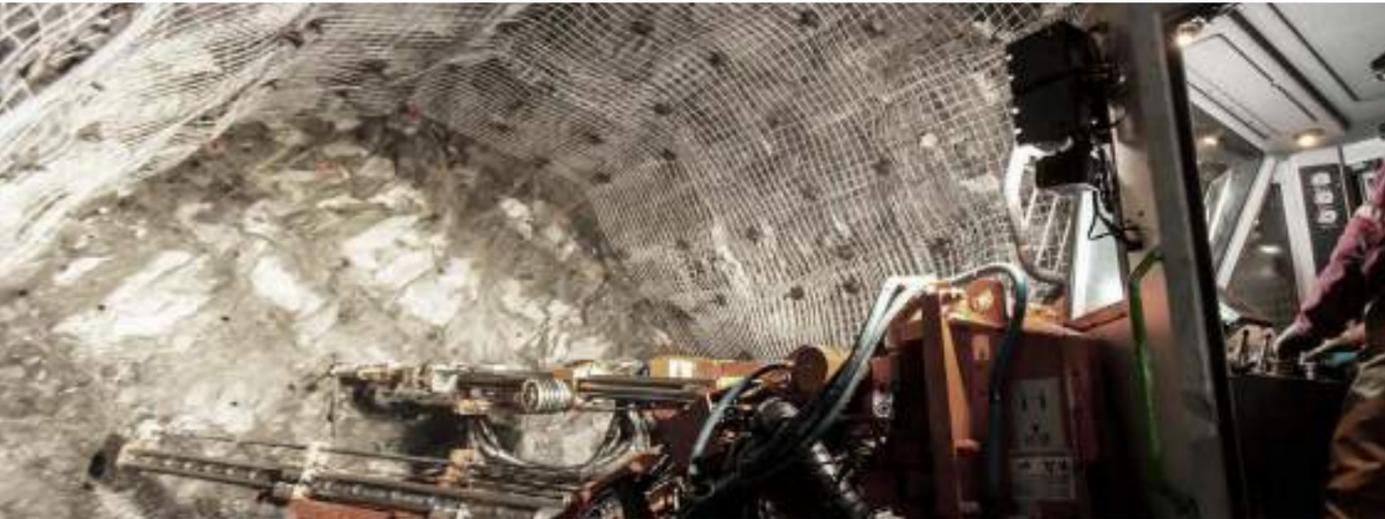
# Self-Drilling Rock-Bolt (SDRB)

[Selection tree](#)

## Fully Threaded Steel Hollow Bar

Product Type	Thread Direction	Linear Weight (kg/m)	Pitch (mm)	ID (mm)	OD (mm)	Yield Load (kN)	Ultimate Load (kN)
R25	Left	2.00	12.7	15	25	150	200
R32N	Left	2.60	12.7	21.5	32	230	280
R32S	Left	2.90	12.7	18.5	32	280	360
R32SS	Left	3.20	12.7	17	32	330	400
R38N	Left	4.20	12.7	23	38	400	500
R51L	Left	5.00	12.7	34	51	450	550
R51N	Left	7.00	12.7	31	51	630	800
T30N	Left	3.00	13	14	30	260	320
T40N	Left	5.90	13	26	40	430	540
T40L	Left	5.00	13	22	40	525	660
T76N	Left	15.60	13	52	76	1200	1600

# Self-Drilling Rock-Bolt (SDRB)



## Codes & Standards

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



A rock-bolting system based on a fully coarse thread GFRP hollow bar.

## Applications

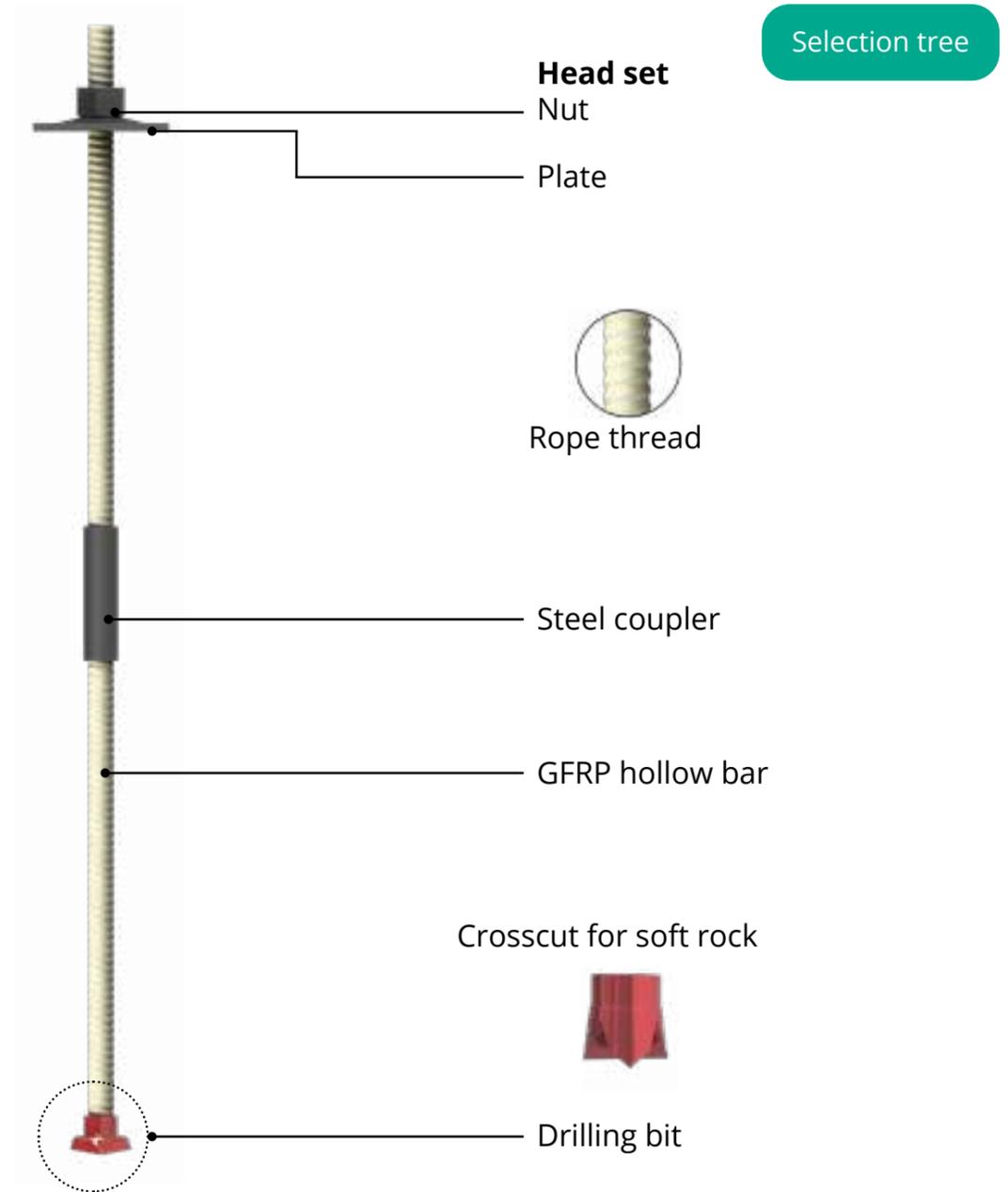
- Face bolting.
- Soft and loose ground conditions. It does not require to pre-drill a hole, and it is perfectly usable in soft conditions.
- Installation with grout. The hollow GFRP bar acts as a grouting pipe to ease set up.
- Temporary or permanent applications.

## Fully Threaded GFRP Hollow Bar

Product Type	Thread Direction	Linear Weight (kg/m)	Pitch (mm)	ID (mm)	OD (mm)	Ultimate Load (KN)	Torsion (N·m)
R32	Left	1.20	12.7	15	25	365	300
R38	Left	1.52	12.7	20	38	500	420

## GFRP Self-Drilling Rock-Bolt accessories

Product type	Plate			Nut		Coupler		
	L x W x H (mm)	Hole Dia. (mm)	Head Breaking Load (kN)	SW (mm)	Length (mm)	OD (mm)	Length (mm)	Load (kN)
R32	150 x 150 x 10	1.40	180	46	100	42	200	180
R38	150 x 150 x 10	3.00	250	55	100	48	200	250



# Self-Drilling Rock-Bolt (SDRB)



Selection tree

## Project References



Anderson Road Quarry, Hong Kong



Udhampur-Srinagar-Baramulla Rail Link (USBRL), India

## Resources



Brochure



## Connect with us



[www.dextragroup.com](http://www.dextragroup.com)



# Combination Bolt



## Codes & Standards

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

## **GEO**TEC 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 (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.

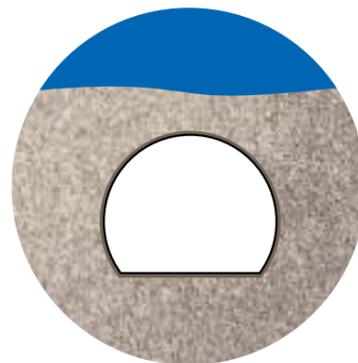
Permanent roadways



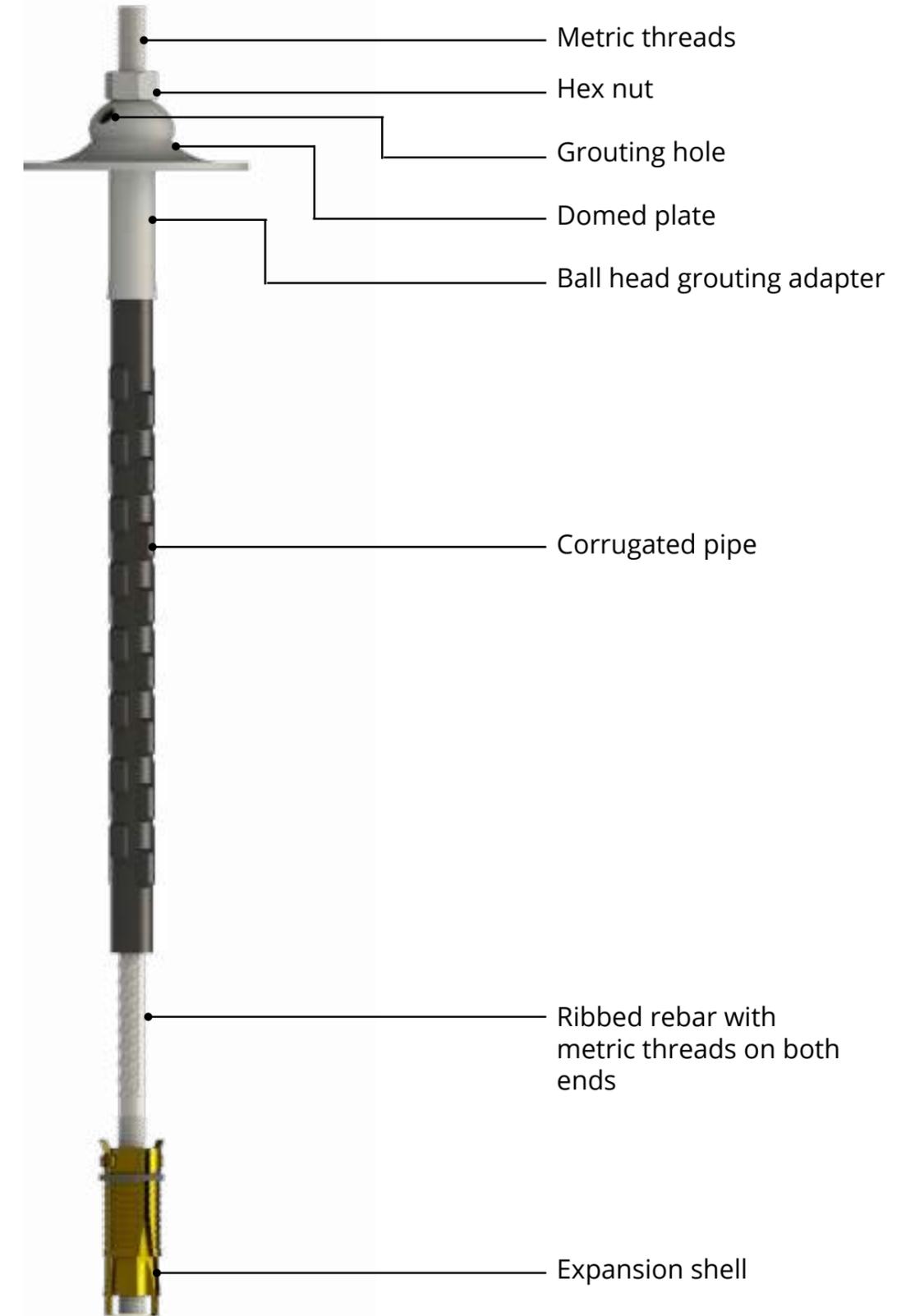
Hydropower and underground oil or gas storage caverns



Sub-sea and sewer tunnels



Selection tree



# Combination Bolt



## Codes & Standards

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



## FRP Combination Bolt

In unconsolidated excavation areas, its can be automatically installed by jumbo machine or manually installed, exactly like steel bolts.

This unique and innovative GFRP solution can be easily cut by common excavation equipment, which makes it the **ideal solution for temporary applications in tunnel excavation projects.**

Temporary reinforcement of underground excavations



Immediate support system



Permanent reinforcement for Metros/Roadways



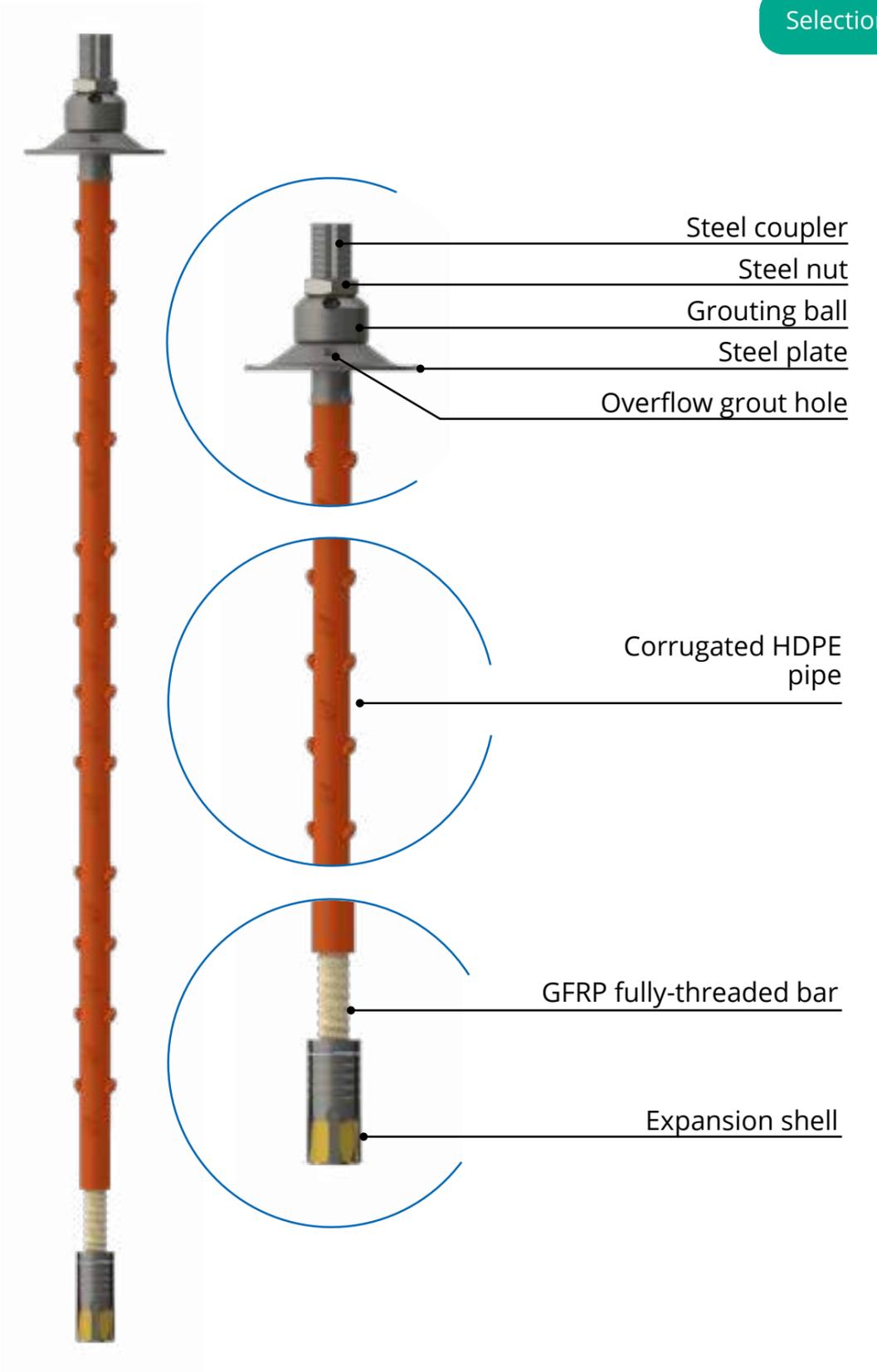
Permanent support for Gas/Oil storage cavern with high corrosive environment



Permanent support for sub-sea tunnels



Selection tree



# Mechanical Bolt



## Codes & Standards

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

## **GEO**TEC Mechanical Bolt

Inserted into the hole and anchored to the rock with the help of its expansion shell.

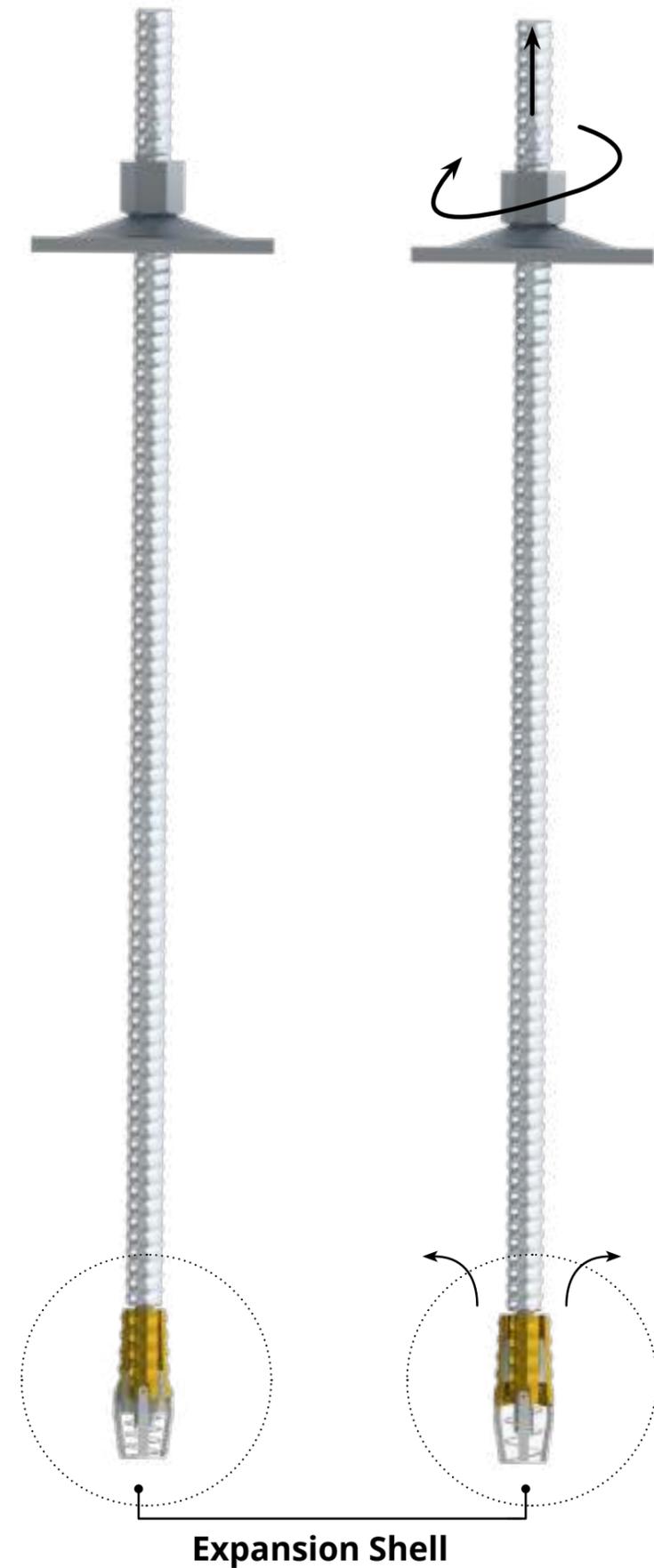
- Immediate anchor joint support for faster excavation
- No grouting or chemical needed
- Different types of shell to adapt to any kind of boring holes



Close

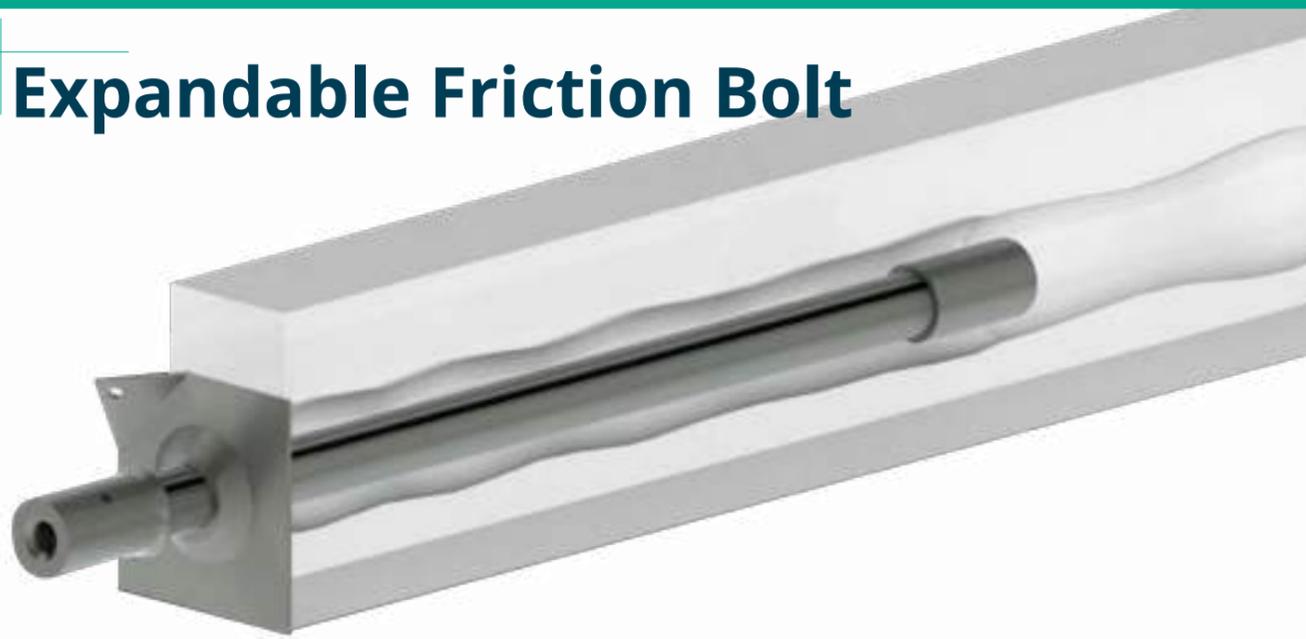


Open



Selection tree

# Expandable Friction Bolt



## Codes & Standards

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



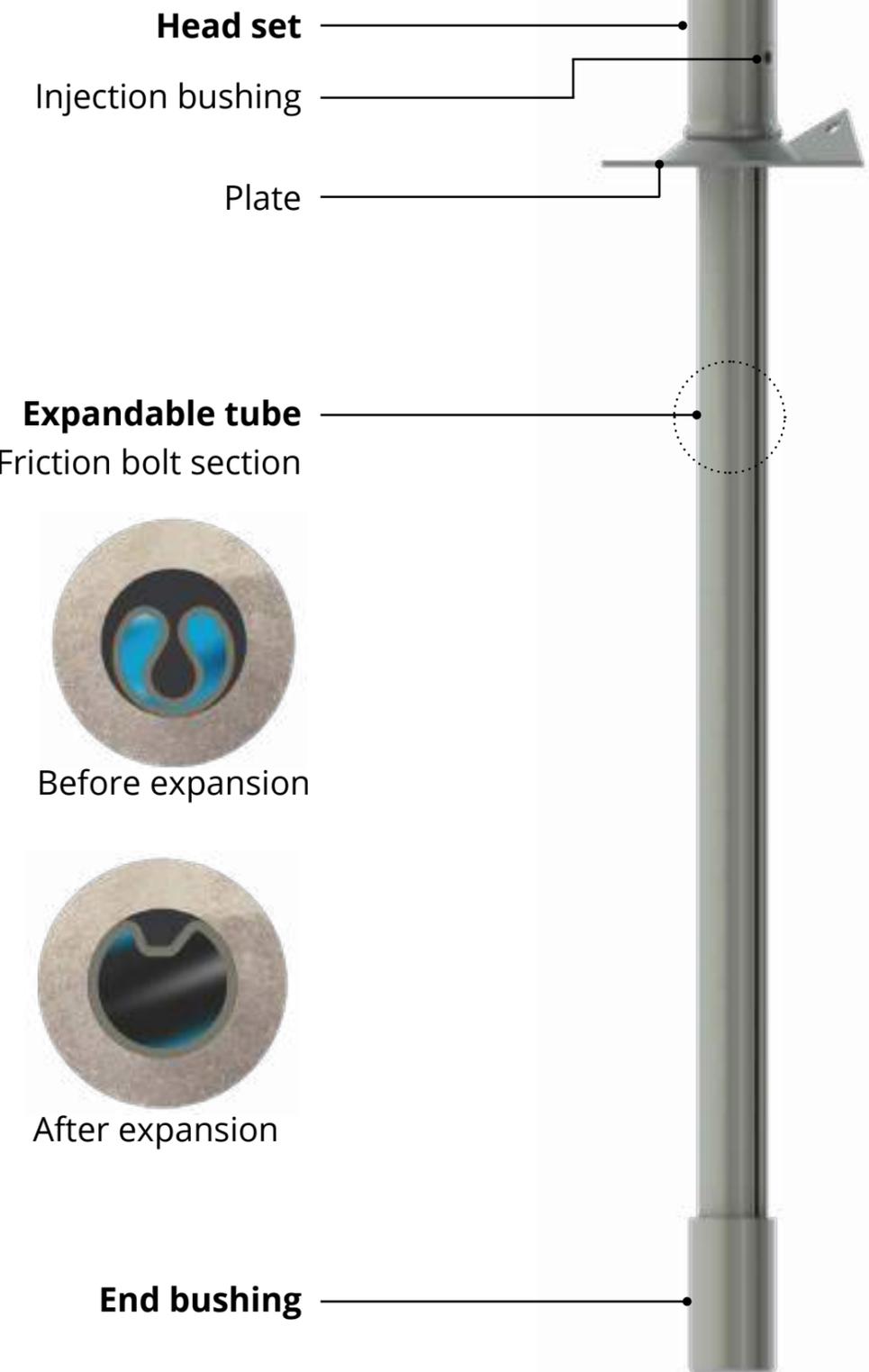
A bolt made of a deformed steel tube which is expanded after installation by injecting high-pressure water.

## Features

- **Roof and wall bolting with irregular bore holes.** The expanded tube will adjust the cavity's shape.
- **No grouting or chemical required.** Only high pressure water is required to expand the tube. Especially recommended in case the ventilation in tunnel is limited.
- **Install and carry on!** Instant anchor support is provided right after the tube is expanded.

Description	Product type				
	DM120L	DM120	DM160	DM200	DM240
<b>Mechanical properties</b>					
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

Selection tree



# Lattice Girder



## Codes & Standards

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

[Selection tree](#)

## Dimensions

### Three-bar



### Four-bar

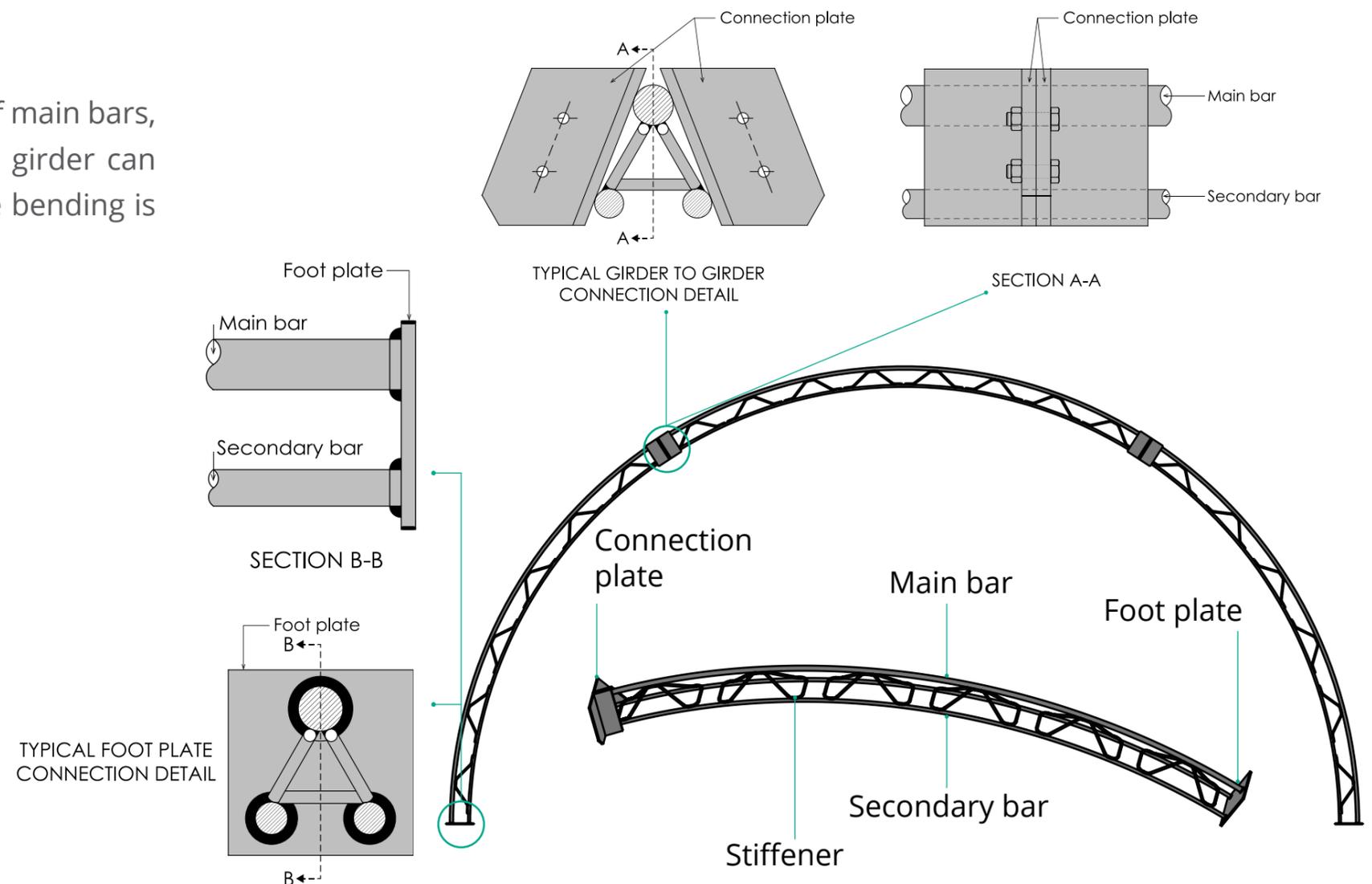


## **GEOTEL** Lattice Girder

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



# Umbrella Pipe

Selection tree



## Codes & Standards

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

## **GEOTEL** Umbrella Pipe

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.

### 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

Steel Pipes						
Nominal OD	Steel Grade	Diameter (mm)	Wall Thickness (mm)	Yield Strength (N/mm <sup>2</sup> )	Ultimate Strength (N/mm <sup>2</sup> )	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	

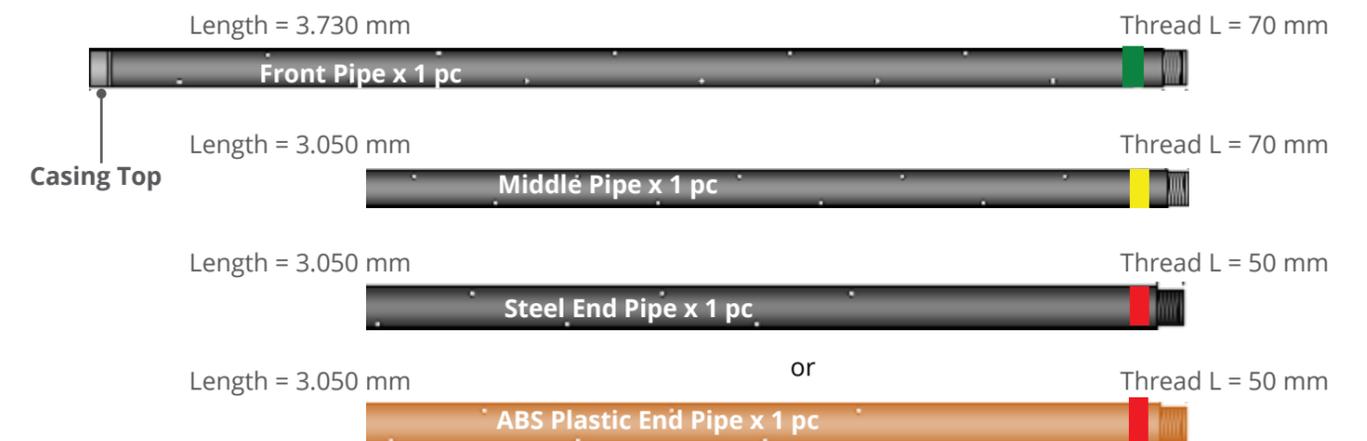
## Color Marking for Installation Sequence

The drilling and extension pipes are marked in different colors

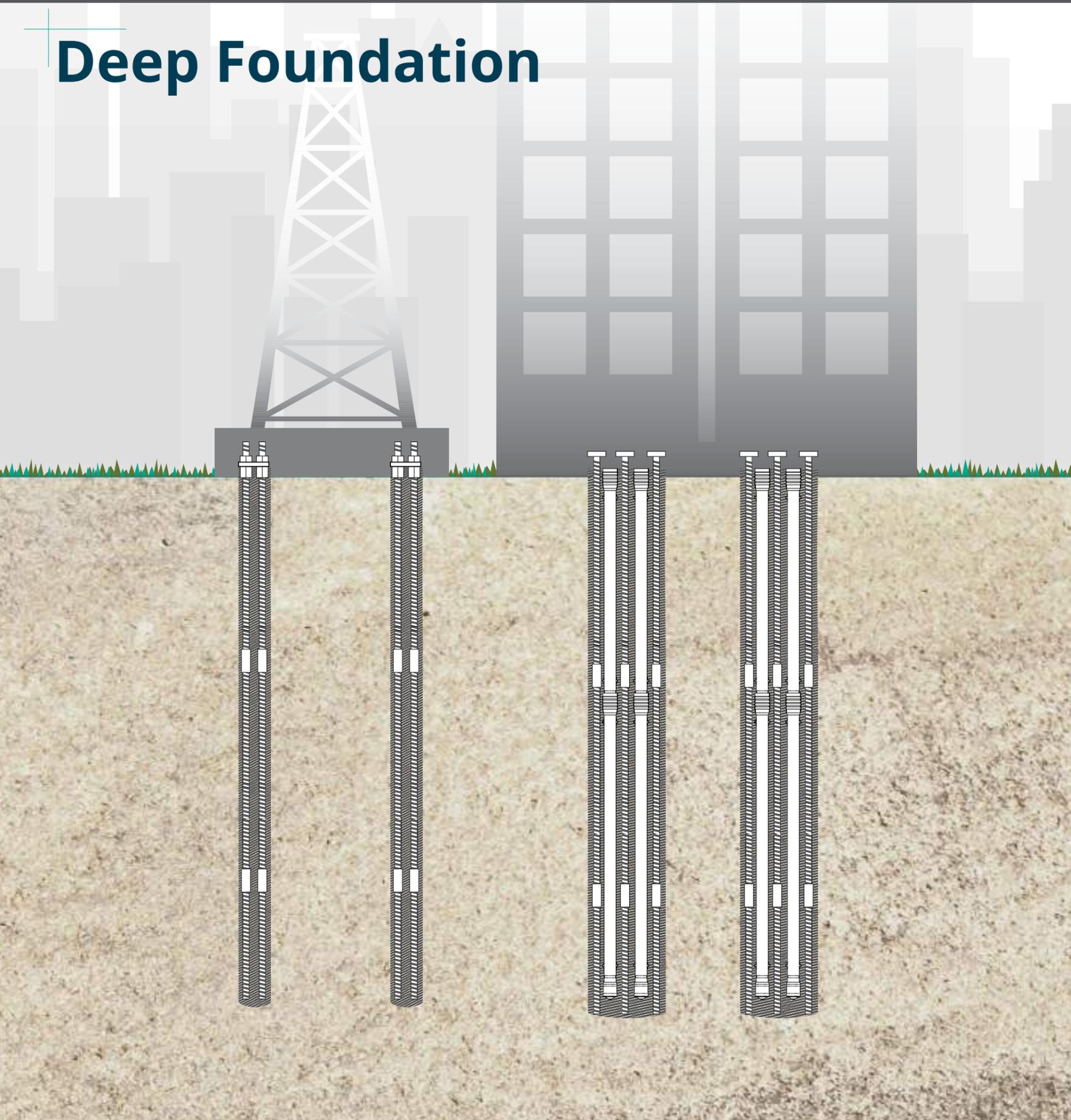


■ End Pipes      ■ Middle Pipes      ■ Front Pipes

## System Diagram



# Deep Foundation



## Applications

### Micro- and mini-piles

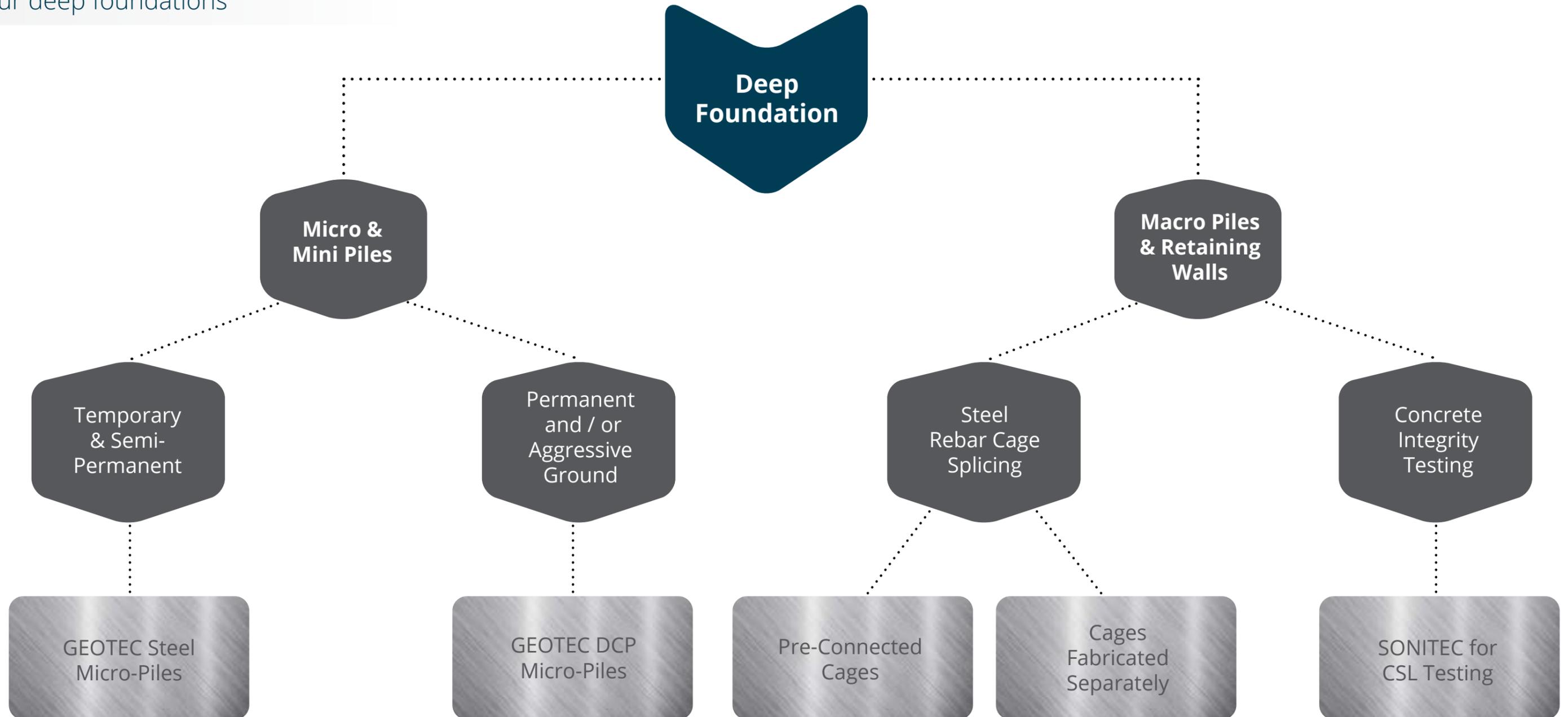
- Micro and mini piles are made of high-grade steel, with respectively less than 300mm and 1,000mm of diameter.
- For permanent structures or aggressive grounds, Double Corrosion Protection (DCP) accessories are available.

### Macro-piles and retaining walls

- The fastest and safest way to splice steel cages for deep foundations is by using rebar couplers.
- Concrete integrity testing is usually required for deep foundations. The most common way is by “Cross-Hole Sonic Logging” testing using Sonitec, a steel tube with a unique push-fit assembly.

# Selection tree

Identify the right anchor for your deep foundations



More details on  
[www.dextragroup.com/rebarcoupler](http://www.dextragroup.com/rebarcoupler)

# Micropiles



## Codes & Standards

- BS EN 14199
- BS 8081:1989
- EN 1537
- ACI 440-3R-12

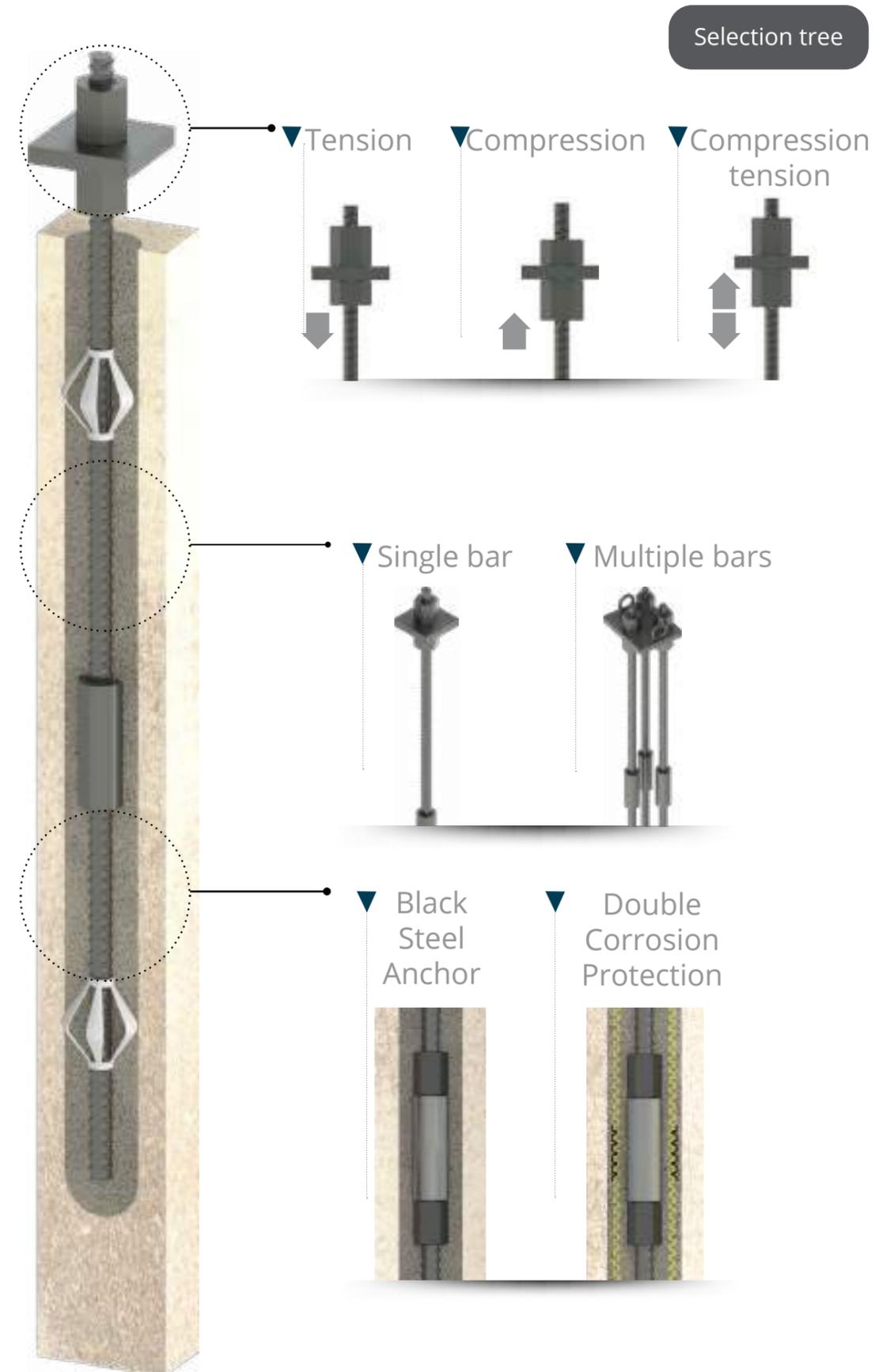
## **GEOTEL** Micropiles

These structural elements are used to transmit an applied tension or compression load into soil or rock.

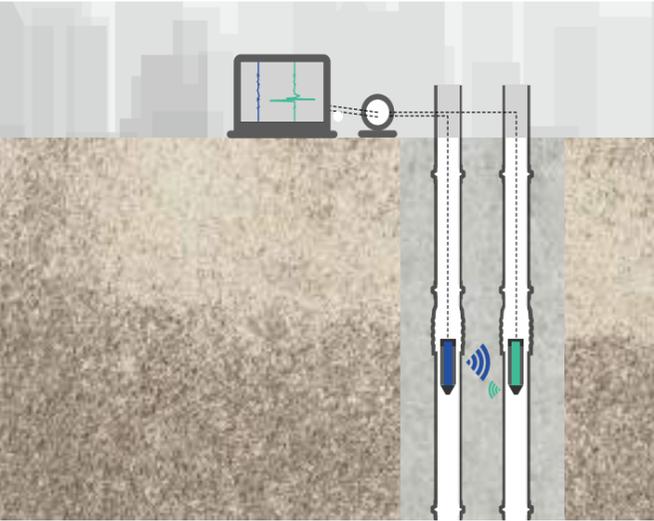
Dextra supplies its micropile systems in two main alternative solutions, depending on corrosion protection requirements.

## Features

- High-grade steel effectively reduces the diameter of the bar allowing for easier handling and a smaller bore hole.
- Continuous thread makes connections possible at any point and increases bonding.
- Fully threaded design allows the bar to be cut and spliced at intermediate points.



# Sonitec V2



## Crosshole Sonic Logging (CSL)

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.

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

# SONITEC V2

The most effective solution for drilled shafts integrity check

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 minimizes labour cost.

### Smart cold-forged manufacturing process:

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

### Effective sealing methods:

- 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.

### End cap solution:

- Metallic cap with a compact design, high resistance to extreme temperature & UV.

## Foundation Type



Bored piles (Ø < 1,000 mm)

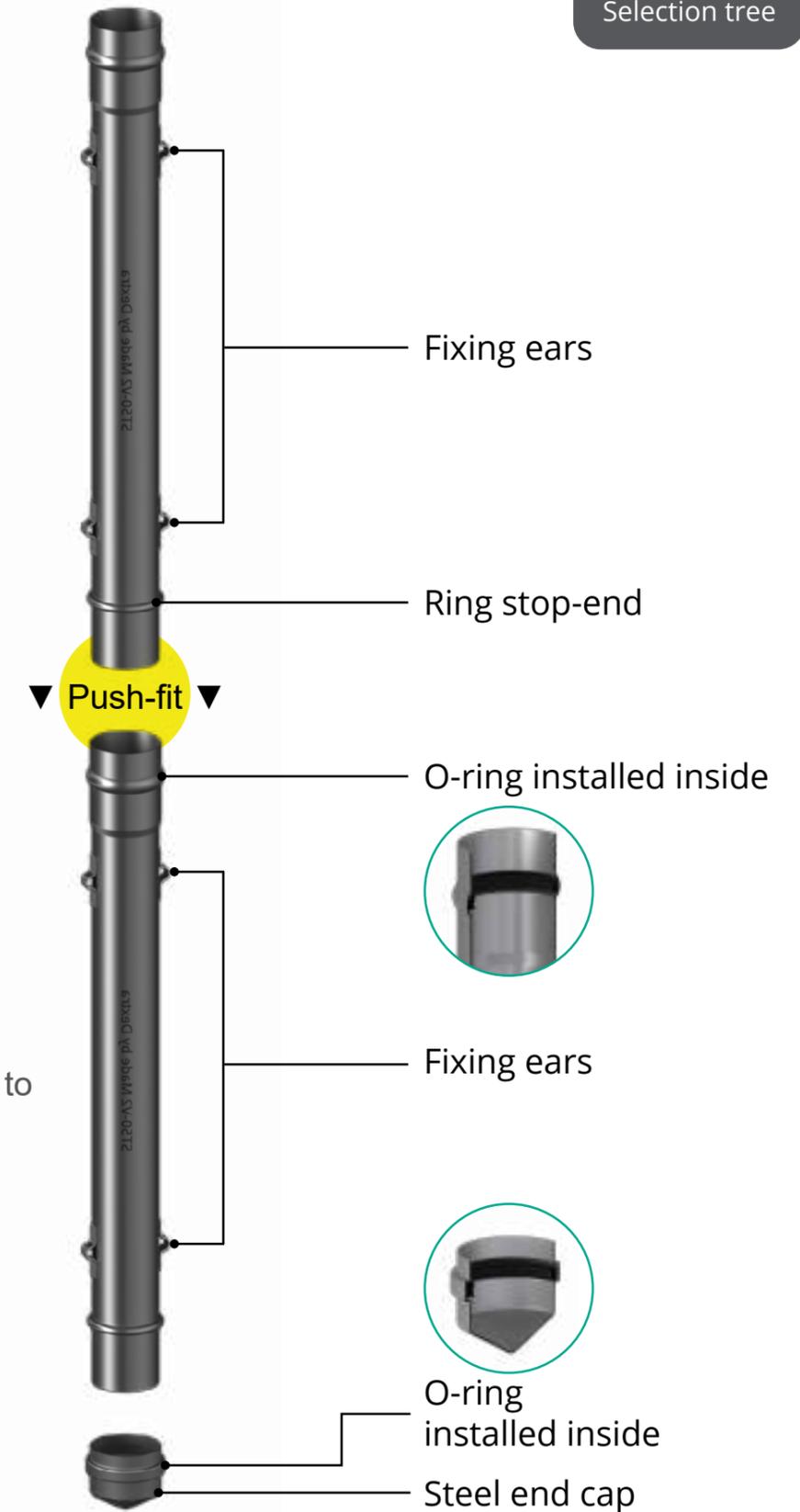


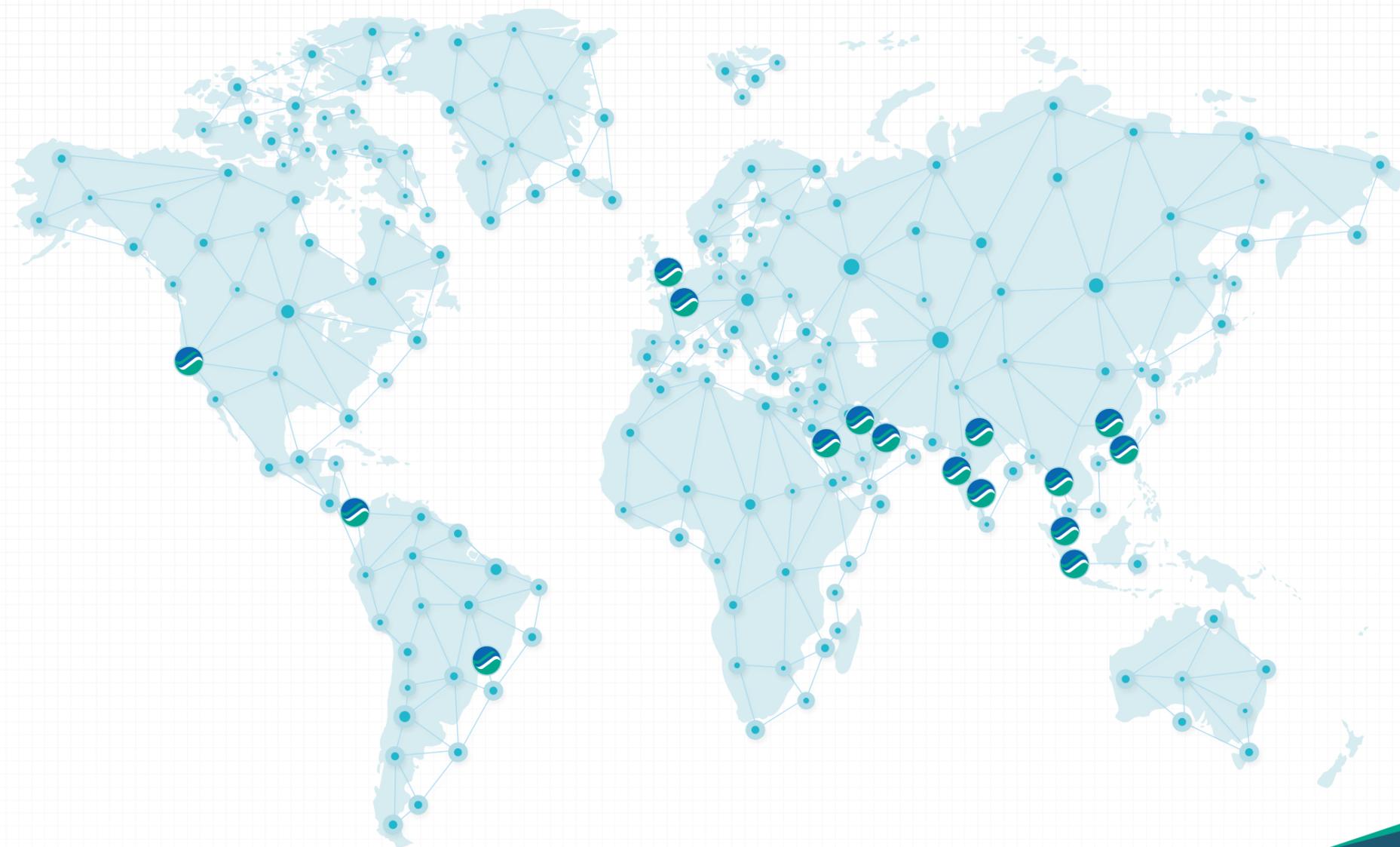
Bored piles (Ø > 1,000 mm)



Diaphragm wall & barrettes

Selection tree





Commercial presence  
in more than  
**55** countries

**Main offices** (click on the address to see more information)

**HEADQUARTERS THAILAND**  
Dextra Manufacturing Co., Ltd.  
Tel: (66) 2 021 3800

**EUROPE**  
Dextra Europe SARL.  
Tel: (33) 1 45 53 70 82

**NORTH AMERICA**  
Dextra America Inc.  
Tel: (1) 206 742 6020

**CHINA**  
Dextra Building Products (Guangdong) Co., Ltd.  
Tel: (86) 20 2261 9901

**MIDDLE EAST**  
Dextra Middle-East FZE  
Tel: (971) 4886 5620

**LATIN AMERICA**  
Dextra Latam  
Tel: (507) 831 1442

**HONG KONG**  
Dextra Pacific Ltd.  
Tel: (852) 2511 8236

**INDIA**  
Dextra India Pvt. Ltd.  
Tel: (91) 22 2839 2694



**Dextra**

[www.dextragroup.com/contact](http://www.dextragroup.com/contact)

[About Us](#)

[Our Expertise](#)

[Glossary](#)

[Material Specifications](#)

[Soil Retention & Stabilization](#)

[Tunneling & Mining](#)

[Deep Foundation](#)