

DYWI[®] DRILL HOLLOW BAR SYSTEM





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Introduction

DYWI® Drill Hollow Bar is a fully threaded self-drilling system installed into loose or collapsing soils without the need for casing. The bar features a hollow bore which enables it to be simultaneously drilled and grouted. The hollow bar incorporates a left-hand thread for standard rotary percussive drilling.

Manufactured from high grade steel tubing to EN 10083-1, DYWI® Drill Hollow Bar is cold rolled to form standard rope thread or "T" thread profiles. The DYWI® Drill rolling process refines the grain structure of the steel, increasing the yield strength and producing a robust drill steel suitable for a range of drilling and grouting applications.

The DYWI® Drill Hollow Bar System includes a full range of drill bits, adaptor sleeves, couplers, nuts and bearing plates. In addition, the range of DYWI® Drill injection adaptors and drill tooling enables the hollow bar to be used with a wide range of drilling equipment.

Key Features

- **European Technical Approval**
 - The DYWI® Drill Hollow Bar System has a full European Technical Approval covering all bars and accessories ETA-12/0603
- **Manufactured in Europe**
 - DYWI® Hollow Bars are produced in a specialist facility in Pasching, Austria
- **No Casing Required**
 - Bars can be drilled into loose or collapsing soils without the need for a casing to support the borehole.
- **Fully Threaded Rod Sections**
 - Continuous thread ensures that rods can be cut and coupled at any point, or extended.
- **Simultaneous Drill and Grout Installation**
 - Grout is injected at all points of the borehole as drilling is advanced, permeating the local strata for increased bond performance and producing bulbing in softer sections of the soil.
- **Rotary Percussive Drilling**
 - This drilling technique is highly efficient, ensures good directional stability of the drill string and helps to consolidate the grout within the borehole.
- **High Strength Threads**
 - Both the Rope threads and "T" threads provide a strong and robust thread ensuring a high level of bond with the borehole grout.
- **Self-Drilling System**
 - The self-drilling function enables bars to be drilled into most ground conditions for both tension or compression applications, and is also used as an injection conduit.
- **Left-Hand Thread**



Bar/Grout bond



Research & Development - DYWI® Drill Hollow Bar drilled into sand and exhumed to measure the diameter and consistency of grout cover

Technical Data

Typically used for Soil Nails

Bar Type	Nominal Thread Diameter	Effective External Diameter	Internal Diameter	Cross Section Area	Ultimate Strength	Yield Strength	Steel Grade Yld / Ult	Weight
	[mm]	[mm]	[mm]	[mm ²]	[kN]	[kN]	[N/mm ²]	[kg/m]
R25-200	25	23.8	14	290	200	150	520/690	2.30
R32-210	32	29.5	21.5	340	210	170	530/660	2.80
R32-250	32	29.5	19.7	370	250	190	510/670	3.00
R32-280	32	29.5	18	410	280	220	520/670	3.40
R32-320	32	29.5	16.5	470	320	280	590/680	3.90
R32-360	32	29.5	15	510	360	300	590/710	4.10
R32-400	32	29.5	12.5	560	400	330	590/710	4.40
R38-420	38	36.4	21	660	420	350	510/610	5.30
R38-500	38	36.4	19	750	500	400	530/660	6.00
R38-550	38	36.40	18.2	780	550	430	550/710	6.2

Typically used for Micropiles

Bar Type	Nominal Thread Diameter	Effective External Diameter	Internal Diameter	Cross Section Area	Ultimate Strength	Yield Strength	Steel Grade Yld / Ult	Weight
	[mm]	[mm]	[mm]	[mm ²]	[kN]	[kN]	[N/mm ²]	[kg/m]
R51-550	51	48.4	35	810	550	450	510/630	7.10
R51-660	51	48.4	33	970	660	530	540/670	7.80
R51-800	51	48.4	30.5	1,150	800	630	570/720	9.00
R51-925	51	48.4	27.5	1,275	925	730	595/775	9.60
T76-1300	76	73.5	57.5	1,590	1,300	1,000	630/820	12.5
T76-1650	76	73.5	54.1	1,975	1,650	1,200	610/835	15.5
T76-1900	76	73.5	49.4	2,360	1,900	1,500	640/810	18.5
T103-2300	103	94	78	3,200	2,300	1,800	560/710	25
T103-3700	103	94	51	5,200	3,700	2,700	560/710	40

DYWI® Drill Rope Thread (R)

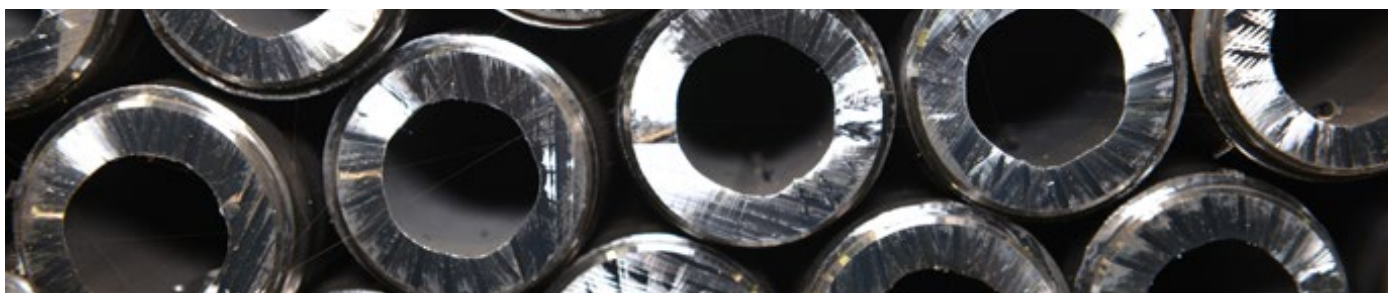


DYWI® Drill "T" Thread



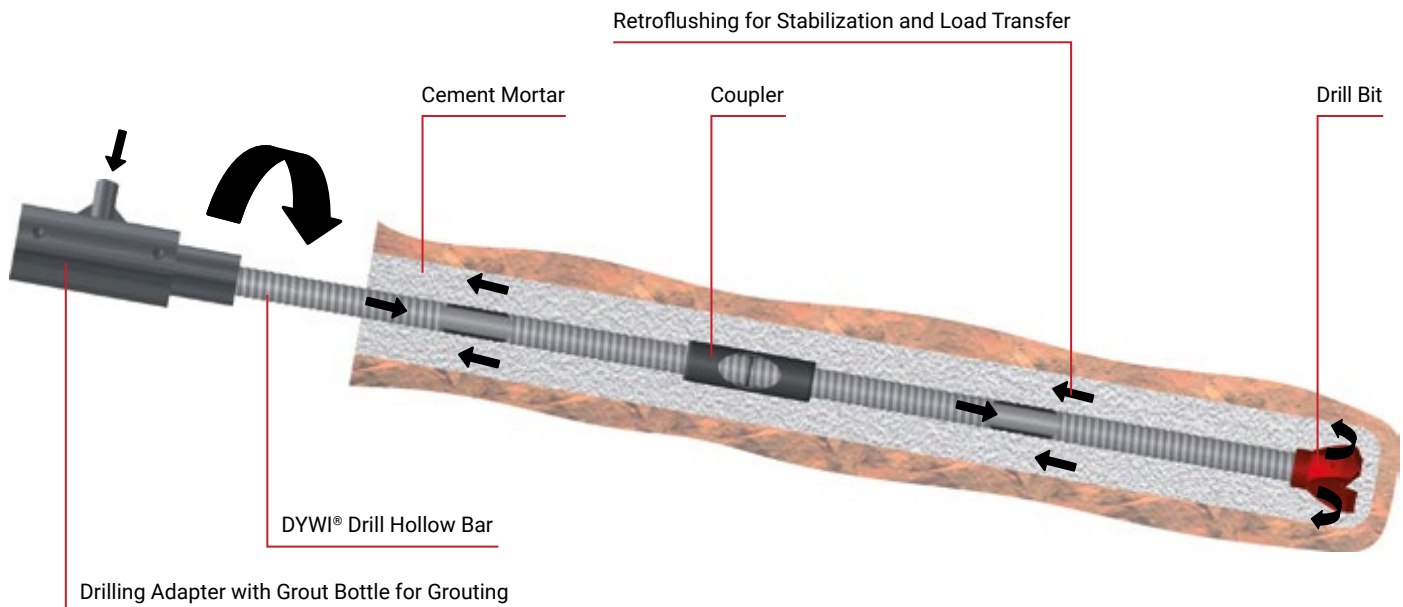
Technical Notes

- Bar lengths
 - 3m or 4m.
- Bar finishes
 - Plain or galvanized to EN 1461
- E Value
 - 205,000 N/mm².
 - Strain at ultimate load (Agt.) ≥ 2.50%.
 - Fractile value of strain $UTS R_m / R_{p0.2} \geq 1.5$.



DYWI® Drill Hollow Bar Installation

The DYWI® Drill Hollow Bar offers high rates of installation, as drilling and grouting can be combined as a single cycle. To achieve these benefits, it is important that the correct equipment is selected to ensure efficient drilling.



Drilling Technique

The three main drilling functions are:

- **Rotation:** 120-150 RPM. This is the key drilling function to ensure the full diameter of the borehole is cut as drilling advances
- **Percussion:** 300-600 BPM, for directional stability and drilling efficiency
- **Fine Feed:** Feed pressures should be regulated to match the achievable drilling rate
 - See DYWIDAG-Systems International Technical Note, TN 104

Rotary Percussive Top Hammer

This is the essential piece of equipment for hollow bar drilling. Rotary percussive drilling ensures efficiency in most ground conditions, provides good directional stability for the drilled bar and helps consolidate the placed grout. The hammer should have sufficient torque and rotation speed.

Although it may be desirable to maximise the size of the drill bit, it should always be compatible to the bar used to drill.

Simultaneous Drilling and Grouting

This method ensures grout is placed at all points of the borehole as drilling is advanced, permeating the local soil strata and producing bulbing in the softer sections of the borehole.

Reaming (extracting and re-inserting whilst under rotation) of the bottom rod section at full depth will further enhance bond performance, as the ground strength is typically highest at this point due to overburden pressure.



A Frame drilling at Watford Cutting



Excavator mounted rig at HoTV A465



Anti-Corrosion Protection

Durability

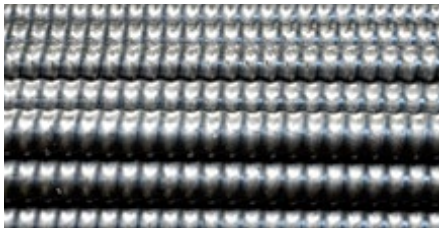
Borehole grout, whilst beneficial, is not the primary basis for ensuring durability of the soil nail over its design life.

Corrosion protection for hollow bar soil nails is achieved through:

- 1. Sacrificial Corrosion Allowance;** This technique calculates the loss of steel over the proposed design life of the soil nail or micro pile based on the total surface area of the bar. The residual strength of the bar is then calculated based on the remaining cross sectional area of steel, this can then be assessed against the required working load of the bar. The quantity of steel loss is based on research in accordance with TRL 380, EN14199, CIRIA C637. Corrosion rates are determined by the aggressive levels of the soil in accordance with the values outlined in the standards. In most cases, highly aggressive ground conditions don't occur naturally and are only present in locations formerly used for industrial processes which have contaminated the soil
- 2. Supplementary Galvanizing;** in accordance with EN1461 hot dipped galvanizing will provide an additional 5-15 years lifespan, depending on aggressive of the soil, for buried installations. This method when applied to the top bar, located at the soil / air interface, the most corrosive area, provides a practical basis for increasing lifespans but minimises additional cost. Corrosion in the deeper parts of the borehole is less prevalent due to the lack of oxygen. A fully galvanized system can be adopted if the project specification requires it.
- 3. Duplex Coatings;** comprises an additional Epoxy Powder coating (80-90 μm) over the hot dipped galvanizing. Although the coating can be damage during rotary percussive installation the remaining Epoxy Coating will provide an additional protective benefit especially in the valleys between the threads, where the Epoxy coating generally remains intact. Loss of Epoxy at the crest of the thread is common, but this part of the bar tends to have a greater wall thickness forming the thread ridge and has greater resistance to corrosion. Any visible damage to the Epoxy coating can be repaired with a two-pack Epoxy paint "touch-up" kit.

Increasing Durability

Sacrificial Corrosion Protection



Plain Steel

Galvanizing / Sheradizing



Hot-Dip Galvanizing

Duplex Coating



Duplex Coating

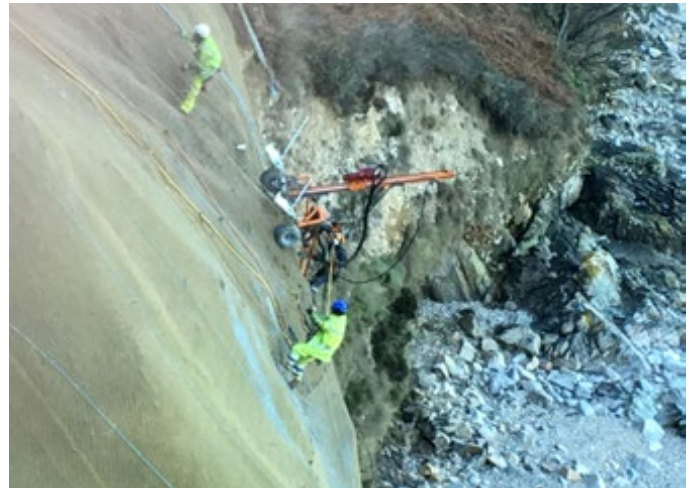


Soil Nailing using DYWI® Drill Hollow Bar at Filton Banks, Bristol

Project Profile – Cheval Rock Hotel Jersey



Initial Slip early 2017



Installation of DYWI® Drill Hollow Bar Soil Nails through GREENAX®



Spoil at toe left in place as erosion control and slope buttressing, DYWI® Mat Green used to prevent erosion.



GREENAX® enables vegetation to establish on steep slopes, providing further reinforcement to the cliff face.

Sacrificial Corrosion – Technical Data

Bar Size	Soil aggressivty	Sacrificial Corrosion – 60 Years				Sacrificial Corrosion – 120 Years			
		Sacrificial Thickness	Cross Sectional Area	Ultimate Strength	0.2 % Yield Strength	Sacrificial Thickness	Cross Sectional Area	Ultimate Strength	0.2 % Yield Strength
		$\Delta_{s,60}$	$A_{s,60}$	$F_{t,k,60}$	$F_{0.2,k,60}$	$\Delta_{s,120}$	$A_{s,120}$	$F_{t,k,120}$	$F_{0.2,k,120}$
		[mm]	[mm ²]	[kN]	[kN]	[mm]	[mm ²]	[kN]	[kN]
R32-210	low	0.8	301	187	143	1.4	274	171	130
	middle	1.5	269	168	128	2.5	226	141	107
	high	2.8	214	133	101	4.9	129	80	61
R32-250	low	0.8	333	225	171	1.4	306	207	157
	middle	1.5	302	204	155	2.5	258	175	133
	high	2.8	246	166	126	4.9	161	109	83
R32-280	low	0.8	378	255	201	1.4	351	237	186
	middle	1.5	347	234	184	2.5	304	205	161
	high	2.8	291	197	154	4.9	206	139	110
R32-320	low	0.8	433	295	231	1.4	406	277	216
	middle	1.5	402	274	214	2.5	359	244	191
	high	2.8	346	236	184	4.9	261	178	139
R32-360	low	0.8	470	334	260	1.4	443	315	245
	middle	1.5	439	312	243	2.5	396	281	219
	high	2.8	383	272	212	4.9	299	212	165
R32-400	low	0.8	524	374	308	1.4	497	355	293
	middle	1.5	493	352	290	2.5	450	321	265
	high	2.8	437	312	257	4.9	353	251	207
R38-420	low	0.8	621	392	326	1.4	588	371	309
	middle	1.5	583	367	306	2.5	529	333	278
	high	2.8	513	324	270	4.9	406	256	214
R38-500	low	0.8	701	470	376	1.4	668	448	358
	middle	1.5	662	444	355	2.5	608	408	326
	high	2.8	593	397	318	4.9	486	326	261
R38-550	low	0.8	757	519	425	1.4	724	496	406
	middle	1.5	719	493	403	2.5	665	456	373
	high	2.8	649	445	364	4.9	542	372	304
R51-550	low	0.8	830	513	420	1.4	785	485	397
	middle	1.5	778	481	393	2.5	705	436	357
	high	2.8	684	423	346	4.9	538	332	272
R51-660	low	0.8	909	619	507	1.4	865	589	482
	middle	1.5	858	584	478	2.5	785	534	437
	high	2.8	764	520	425	4.9	617	420	344
R51-800	low	0.8	1,104	759	607	1.4	1,060	728	583
	middle	1.5	1,052	723	579	2.5	980	673	539
	high	2.8	958	659	527	4.9	812	558	446
R51-950	low	0.8	1,171	904	694	1.4	1,126	869	668
	middle	1.5	1,119	864	664	2.5	1,046	808	621
	high	2.8	1,025	791	608	4.9	879	678	521
T76-1300	low	0.8	1,530	1,228	944	1.4	1,463	1,174	903
	middle	1.5	1,452	1,165	896	2.5	1,342	1,077	828
	high	2.8	1,309	1,050	808	4.9	1,084	870	669
T76-1650	low	0.8	1,891	1,575	1,145	1.4	1,824	1,519	1,105
	middle	1.5	1,813	1,510	1,098	2.5	1,703	1,418	1,031
	high	2.8	1,670	1,390	1,011	4.9	1,444	1,202	874
T76-1900	low	0.8	2,280	1,828	1,443	1.4	2,213	1,774	1,400
	middle	1.5	2,202	1,765	1,393	2.5	2,092	1,676	1,323
	high	2.8	2,059	1,650	1,303	4.9	1,833	1,469	1,160
T103-2300	low	0.8	2,935	2,206	1,777	1.4	1,824	1,519	1,105
	middle	1.5	2,826	2,124	1,711	2.5	1,703	1,418	1,031
	high	2.8	2,627	2,187	1,590	4.9	1,444	1,202	874
T103-3700	low	0.8	5,670	4,545	3,588	1.4	2,213	1,774	1,400
	middle	1.5	5,562	4,458	3,519	2.5	2,092	1,676	1,323
	high	2.8	5,362	4,298	3,393	4.9	1,833	1,469	1,160

Grouting

The grout injection technique used for the installation of DYWI® Drill Hollow Bars is dependent on the type of drilling and the respective application. The most popular method is simultaneous drill and grout. This method ensures that all points of the borehole are homogeneously grouted as drilling is advanced.

For simultaneous drilling and grouting, pressure requirements are not high (up to 7 bar), but constant supply is necessary to ensure that grout circulates within the borehole during drilling. For granular soils, a small return of grout at the mouth of the borehole is all that is required; for cohesive soils, greater flush is necessary.

Typical Grouting Volumes

DYWI® Drill Hollow Bar	Drill Bit Ø	Grout	Drill Bit Ø	Grout
	[mm]	[kg/m]	[mm]	[kg/m]
R32	75	30-40	100	32-42
R38	110	32-42	130	35-45
R51	115	35-45	150	38-48
T76	130	38-48	200	40-50

Grout consumption is dependent on:

- Amount of flush used - simultaneous drill and grout is a part flush/part injection technique
- Ground being drilled – granular soils or fractured ground with voids will result in increased grout take
- Rate of drilling advance

Grout Mixes

- 0.40 w/c ratio (water: cement ratio) = 40 liters water: 100kg cement
- 0.45 w/c ratio (water: cement ratio) = 45 liters water: 100kg cement

Grout Yields

- One 25kg bag of cement, mixed at 0.40 w/c cement ratio, will give 17.5 liters of grout
- Four 25kg bags of cement, mixed at 0.40 w/c cement ratio, will give 70 liters of grout

Grout Pumps

These units typically comprise of a mixer and a pump. The choice of grout pump is dependent upon the application; Concrete Colloidal mixing pumps, Hani, Putzmeister or Turbosol are all suitable. The key requirement is full mixing of the grout and a steady pumping pressure.



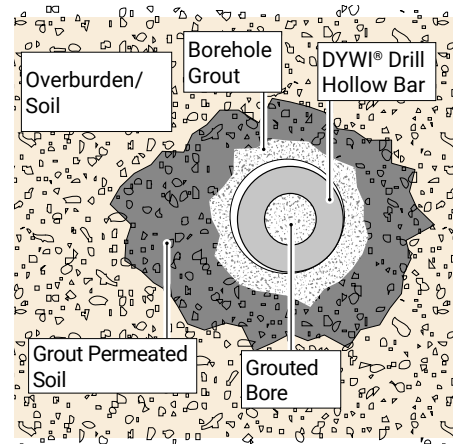
Typical grout plant set-up



DYWI® Drill Hollow Bar grout column crack width analysis



DYWI® Drill Hollow Bar installed with simultaneous drill & grout HoTV A465 South Wales



Typical section of grouted DYWI® Drill Hollow Bar



Grouted soil nails on shotcrete face

Accessories

Drill Bits

Bar Type	Available Drill Types and Diameters								
	CRC Two-Stage RS-Flush (Retro & Side Flush), Hardened	EY Arc- Shaped Button, Hardened	EYY Arc- Shaped Button, Carbide Inserts	EC Arc- Shaped, Hardened	ECC Arc- Shaped, Carbide Inserts	EX Cross, Hardened	EXX Cross, Carbide Inserts	ES Button, Hardened	ESS Button, Carbide Inserts
R25						42	42	42	42
R32	75,100	51, 76	51, 76	76, 90	76, 90	51, 76	51, 76	51, 76	51, 76
R38	110,130	76		76, 90, 115	76, 90, 115	76, 90, 115	76, 90, 100, 115	76, 90, 100, 115	76, 90, 100, 115
R51	150, 175			76, 90, 115, 130	76, 90, 115	100, 115	100, 115	76, 100, 115	76, 100, 115
T76				130, 150	130, 150	130, 150	130	130, 150	130, 150
T103	220						175	175	175

Use R25 / R32 adapter sleeve to fit R32 drill bit to R25 hollow bar.

Use R32 / R38 adapter sleeve to fit R38 drill bit to R32 hollow bar.

Other diameters available. Drill bit is a welded fabrication, therefore, cutting \varnothing can be enlarged to suit borehole requirements.

Drill Bit Adaptor Sleeves

Drill Bit Adaptors can be supplied to allow larger bits to be used with smaller bar.



Couplers and Nuts



N.B Lifting eye as standard do not necessarily provide the full load capacity of the DYWI® Drill Hollow Bar. Full capacity eye pieces can be manufactured upon request



DYWI® Drill Hollow Bar production plant, Austria

Soil Nails

DYWI® Drill Hollow Bar System

DYWI® Drill Hollow Bar soil nails are ideal for loose or collapsing soils, as they can be installed without the need for a casing. The system is used for mixed fills, granular material and loose overburden. The DYWI® Drill hollow bar system allows drilling and grouting to be combined as a single operation and complies fully with EN 14490 (European standard for soil nails).

Soil nails are typically classified as lightly loaded (30-150 kN), passive installations. The fully bonded feature enables the loose wedge at the surface to be tied into the deeper stable zone. Soil nails are normally regarded as low risk installations, with an element of redundancy existing in the stabilized face. The design of soil nailed faces should incorporate a diamond grid

layout to ensure efficient distribution of the reinforcement. Suitable drainage must be incorporated within the nailed face to prevent build up of water within the slope. Water ingress can negate the effects of the soil nails by increasing the bulk weight of the soil, decrease the internal angle of friction and may cause a slope failure.



Soil Nailing using DYWI® Drill Hollow Bar, DYWI® Mat Green & TECCO® G45/2 Cockermouth



Slope stabilisation at Phoenix Park, Dublin



A465 HoTV DYWI® Drill Hollow Bar & DYWI® Mat Green



Drilling in the snow at Kinghorn, Fife



DYWI® Drill Hollow Bar & TECCO® G45/2 stabilising a new cut in Halifax

Soil Nails

Bearing Plates and Facings

Soil nail facings are split into three categories:

- Soft – Erosion Control Matting
- Flexible – Hi Tensile Steel Meshes
- Rigid – Shotcrete

Facing systems provide a combination of structural facing and erosion control. The factors considered when determining the type of facing are slope geometry, geotechnical characteristics and environmental effects such as surcharge at crest and desired design life.

The use of different facings can have a significant effect on the soil nail design influencing spacing & shape of the nail pattern as well as the strength and size of the bar selected.

Bearing plates are used primarily to secure facings. Plates also provide an element of confinement, in conjunction with the retention effect of the fully bonded nail in the wedge zone. Centres for and lengths of soil nails should be defined by assessing the global stability of the slope first and then the internal checks including the superficial failures on the slope surface can be considered.

Angle compensation between the bearing plate and the soil nail must be addressed to ensure full seating of the plate against the face. For flatter slopes (25° to 30°), the amount of angle compensation is significant and can be up to 50°. See below for angle compensation options.

Erosion control matting offers a practical solution for most slopes up to 45°; above this angle facings with structural stiffness to resist bulging are required such as High Tensile Steel Mesh systems or for some vertical faces sprayed concrete may be required.

Flat Plate	Formed Plate	Slotted Plate
up to 15°	up to 20°	up to 55°
		



DYWI® Drill Hollow Bar & TECCO® overlaid with Geocell to retain topsoil on the face



DYWI® Drill Hollow Bar shotcrete used to create a ridged face to a stabilised slope.

Meshes

DYWIDAG-Systems International through partnership with specialist Swiss Geohazards solution provider GEOBRUGG offer a range of high-tensile steel, flexible facing meshes.

GEOBRUGG have vast experience in reducing the impact of rock fall and developed their first Avalanche Protection Structure made of wire rope net in 1951. These avalanche prevention structures were exposed to rockfalls during snow-free periods, and they succeeded in holding these rocks.

Following the success of the Avalanche Barriers, GEOBRUGG developed the TECCO® SYSTEM³. The first mesh was made from High Tensile Strength Steel wire. This then evolved into more discrete, lighter meshes such as DELTAX® and more robust cable nets designed to resist large angular blocks known as SPIDER®.

The synergy between DWYDAG-Systems International & GEOBRUGG allows the supply of an entire Rock Fall Protection System from one source.



	Roll Size	Roll Area	Tensile Strength	Punching Strength	Wire Diameter	Corrosion Protection	Weight per Roll
	[m]	[m ²]	[kN/m]	[kN]*	[mm]		[kg]
DELTAX®	3.9 x 30	117	53	25.7 / 39 ***	2	ULTRACOATING®	76
TECCO® G45/2	3.5 x 30	105	85	80 / 110	2	ULTRACOATING®	121
TECCO® G65/3	3.9 x 30	117	150	180 / 240	3	SUPERCOATING®	193
TECCO® G65/4	3.5 x 20	70	250	280 / 370	4	SUPERCOATING®	231
SPIDER® S-130	3.5 x 20	70	220	230 / 300 **	3 x 3 mm	SUPERCOATING®	182

* using spike plate P25/P33

** using spike plate P33/P66

*** using 150 x 150 / 200 x 200 square plate

	Roll Size	Roll Area	Tensile Strength	Punching Strength	Wire Diameter	Corrosion Protection	Weight per Roll
	[m]	[m ²]	[kN/m]	[kN]	[mm]		[kg]
Stainless Steel DELTAX®	3.9 x 55	214.5	45	60	2	INOX	76
TECCO® G65/3 STAINLESS	3.5 x 30	105	140	170	3	INOX	175

* using spike plate P33

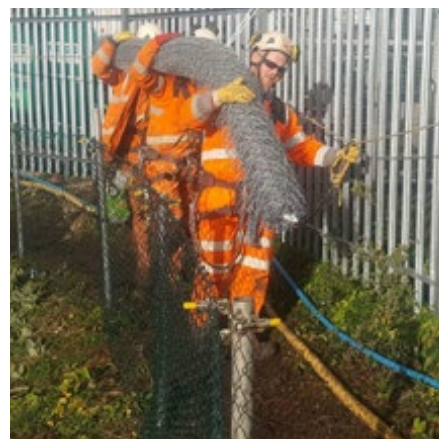
	Roll Size	Roll Area	Tensile Strength	Punching Strength	Wire Diameter	Corrosion Protection	Weight per Roll
	[m]	[m ²]	[kN/m]	[kN]*	[mm]		[kg]
GREENAX®	3.9 x 30	117	53	25.7 / 39 *	2	ULTRACOATING®	123
TECCO® GREEN	3.9 x 25	97.5	150	180 / 240**	3	SUPERCOATING®	200

* using square plate 150 x 150 / 200 x 200

** using spike plate P33/P66



DELTAX® mesh being laid over tree stumps in Hove



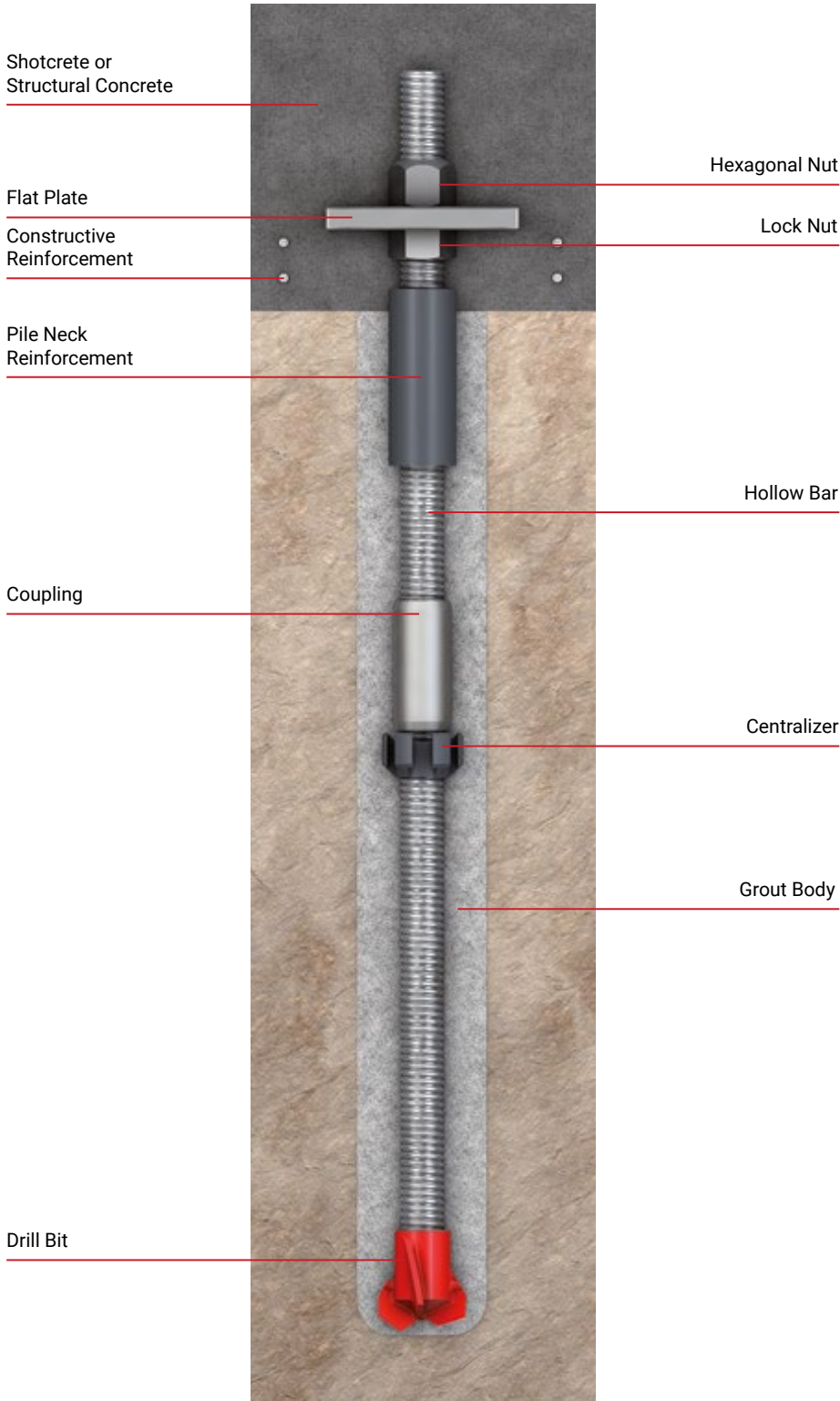
DELTAX® can be manually handled and moved into position

Micropiles

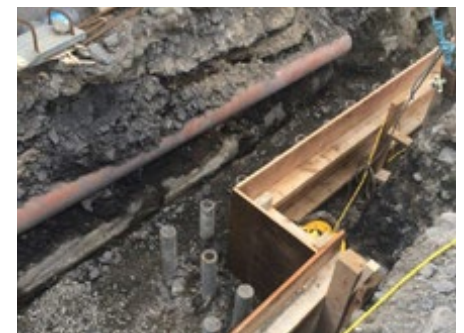
DYWI® Drill Hollow Bar Micropiles can be installed in restricted access areas or within the close proximity of buildings. Due to the fully threaded system, the micropile can be extended and grouted in areas where the founding level is deeper than expected.

The rotary percussive drilling method ensures minimal disturbance is caused during installation compared to driven piling systems, enabling the foundations of old structures or buildings to be upgraded without damage. Pile stiffness can be increased by placing a steel tube over the top 2m of bar and grouting the annulus.

Applications for DYWI® Drill injection piles, in accordance with EN 14199, include: retained facade bases, foundation upgrades, pylon bases, wind turbines, refurbishment of old structures and gantry bases for rail electrification. Larger diameter DYWI® Drill bars can be used to form contiguous piled retaining walls.



Raking T76 Micro Piles



T76 Micro Piles forming a contiguous wall



Ground Anchors

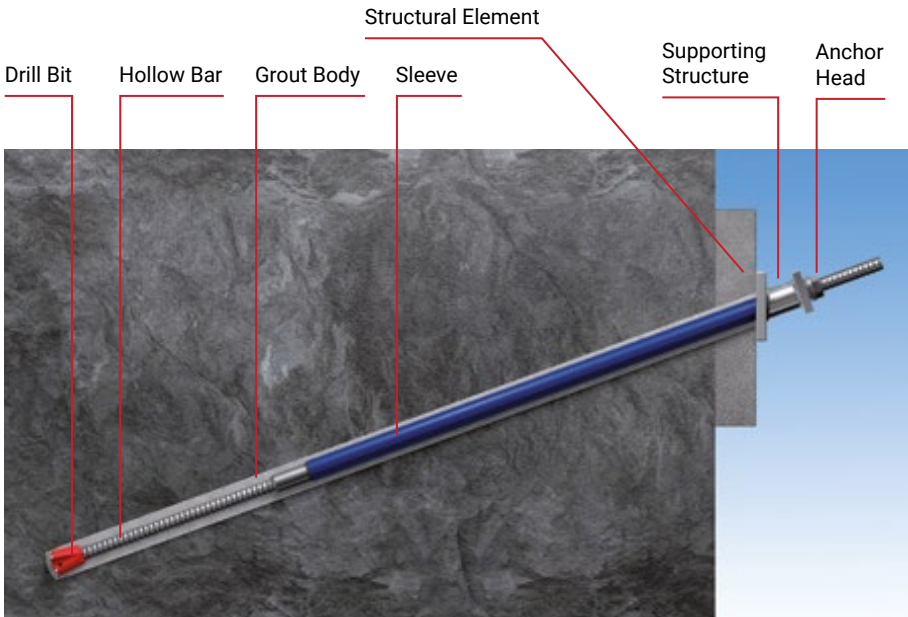
DYWI® Drill Injection Anchors are used extensively in temporary works, as the anchor can be drilled into a range of difficult ground conditions or collapsing soils without the need for a casing. The bond stress of both rope thread and "T" thread bars is high and compares favourably with reinforcing bars of similar diameter (this has been proved by tests carried out by the Technical University of Munich).

The DYWI® Drill free length system incorporates a special de-bond sleeve and compression collar so that the self-drilled anchors remain de-bonded in the free length for stressing.

The stressing operation and acceptance tests ensure that each anchor is fully tested and that additional extension will not occur during its service life.

Irrespective of threadform, hollow bar systems are only suitable as temporary anchors. The high impact energy during rotary percussive drilling prevents the use of an adequate corrosion protection system approved by the building authorities.

However, corrosion protection is mandatory for stressed (active) permanent anchors, in accordance with the design standards for permanent anchors (EN 1537).



DYWI® Drill R51 Duplex coated Hollow Bar is installed on the River Dargal Flood Aleviation Scheme, Ireland

Testing and Monitoring

On-site testing ensures the performance of the DYWI® Drill Hollow Bar System. This demonstrates both the quality and adequacy of the proposed design. Depending on the application, the appropriate test method should be chosen. Some tests may be more rigorous and are therefore conducted on sacrificial trial elements, installed as replicas of the working tendons.

The testing of ground anchors generally involves three categories of tests:

- Investigation Tests
 - Conducted on trial anchors and tested to failure to ascertain the expected performance of the design.
- Suitability Tests
 - Conducted on either sacrificial or working anchors to provide a data reference against which the working anchors can be measured.
- Acceptability Tests
 - Conducted on working anchors to ensure construction methods and safety.

For micropiles and soil nails, investigation and suitability tests are generally utilised.

Investigation tests are used to assess design parameters, verify the pile design, prove the ultimate load resistance and creep characteristics of the grout ground interface and the system within its working range.

Suitability tests prove the construction methods and that the micropile or nail complies with the Specification.

Pull-out tests are the default on-site testing procedure for all tensile elements such as ground anchors and soil nails.

Depending on the loading mechanism (tensile, compression or alternating), micropiles can be tested by either pull out tests or static load tests. Spiles and injection lances are generally not tested.

Testing and monitoring features economic advantages during the service life of the tendon. With information gained from in-situ tests and trials, an optimised assessment of the construction design may be possible. Monitoring and regular inspection increase the service life of both the tendon and therefore the entire retaining structure, as defects or damage can be detected at an early stage.

More information is given in the relevant codes and standards associated with these applications.



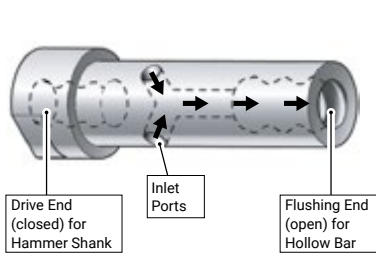
Drilling Accessories

DYWI® Drill Injection Adaptors

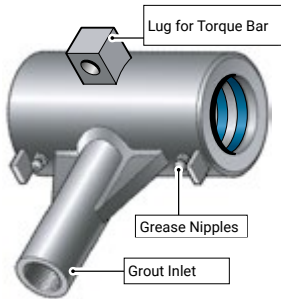
DYWI® Drill Injection Adaptors enable grout to be pumped into the bore of a rotating bar during drilling, ensuring the hollow bar is simultaneously grouted as drilling advances. The injection adaptor is a three component unit consisting of a flushing shaft, grout bottle and a seal kit.

For the connection between the hammer shank and the hollow bar, the selection of the correct injection adaptor unit is important. This will ensure the connection is sufficiently strong to endure the demands of rotary percussive drilling and withstand any temporary misalignment if obstructions are encountered during drilling.

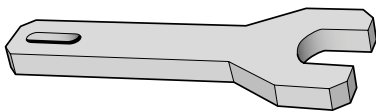
Tightening of the flushing shaft onto the hammer shank is essential to ensure that this joint remains tight during drilling and does not release during rod changes. The seals within the grout bottle should be greased approx. every 20 minutes.



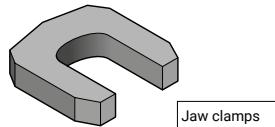
Flushing Shaft



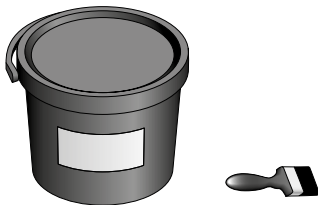
Grout Bottle



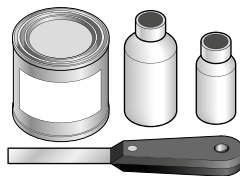
Drill Spanner (drill boom)



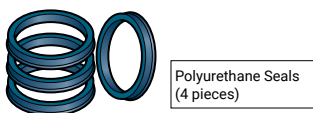
C Spanner



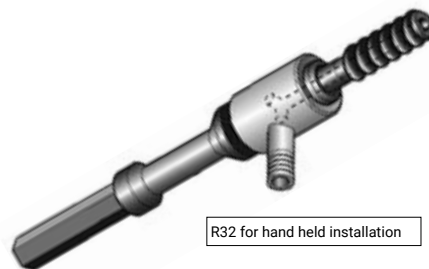
Thread Sealant – TF15, Teflon grease



Thread Lock Kit – Jet Lok



Seal Kit



Rotary Injection Adaptor

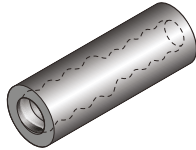


Drill head with simultaneous drill & grout feed

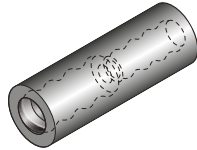
Drill Tooling

Drilling equipment often has to be adapted at short notice to accommodate unforeseen conditions. The DYWI® Drill tool range offers the driller the flexibility to make changes, ensuring limited down time and efficient drilling.

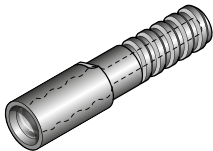
In addition to the tool range, drill spanners are supplied for lock-up of the flushing shaft on the shank adaptor and torque wrenches for the seating of bearing plates on the slope face, by torquing up the nut.



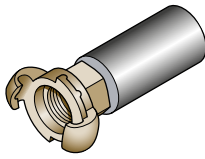
Reducing Coupler



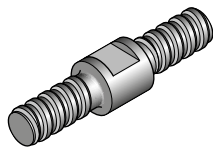
Reducing Coupler, complete with centre bridge



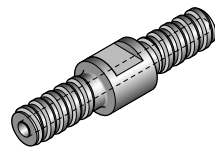
Box/Pin Adaptor (hollow)



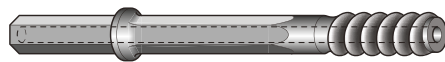
Grout Injection Coupler (for subsequent grouting)



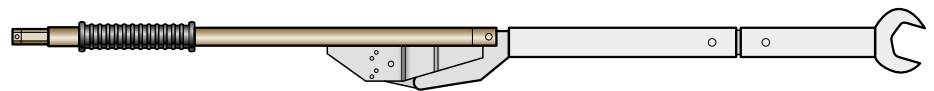
Pin/Pin Adaptor (solid)



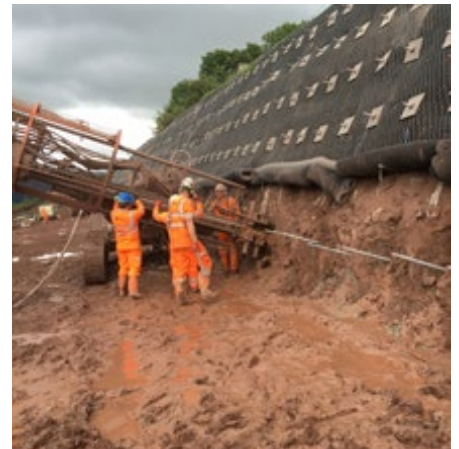
Pin/Pin Adaptor (hollow)



Air Flush Shank



Torque Wrench



Hand drilling through DELTAX® at Hove

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Warwickshire
United Kingdom
Phone +44-1926-81 39 80
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