

# DYWIDAG Soil Nail Anchors



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## Soil Nail Anchors

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# DYWIDAG Soil Nail Anchor System

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## General Notes

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DSI has been a pioneer in the use of soil nails to reinforce existing ground. Today, DSI is widely recognised as the principal worldwide source for soil nails meeting the most demanding performance requirements.

DYWIDAG soil nails allow the economic stabilisation of sliding slopes, excavations and tieback walls. They are well suited in granular soils with sufficient internal friction, so that an effective load transfer along the soil nail is possible, and only slight creep movements occur in the supported soil mass. The soil nails are installed as the excavation progresses from top to bottom. The surface of the cut is usually stabilised by shotcrete and mesh mats.

Soil nails are loaded only by ground movement. The anchoring length of the soil nails must extend into stable ground beyond the failure surface.

## Advantages of Soil Nail walls

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- Top-down construction
- Light construction equipment.

## Advantages of DYWIDAG Soil Nails

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- Can be used for temporary and permanent applications
- Simple components and component assembly
- Easy to install and test
- Durable continuous threads. Allow splicing at any point along the length
- Low corrodibility through robust reinforcing steel quality
- Angle compensation up to 15° through domed nuts and plates.

## Requirements for the site

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- Stable, self-supporting soils at the excavation face
- Benches strong enough to support drilling equipment.

## Requirements for the Soil Nail System

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- High tensile and shear strength
- High ductility
- High bond strength
- Ability to accommodate structural and non-structural face attachments.

## Design Considerations

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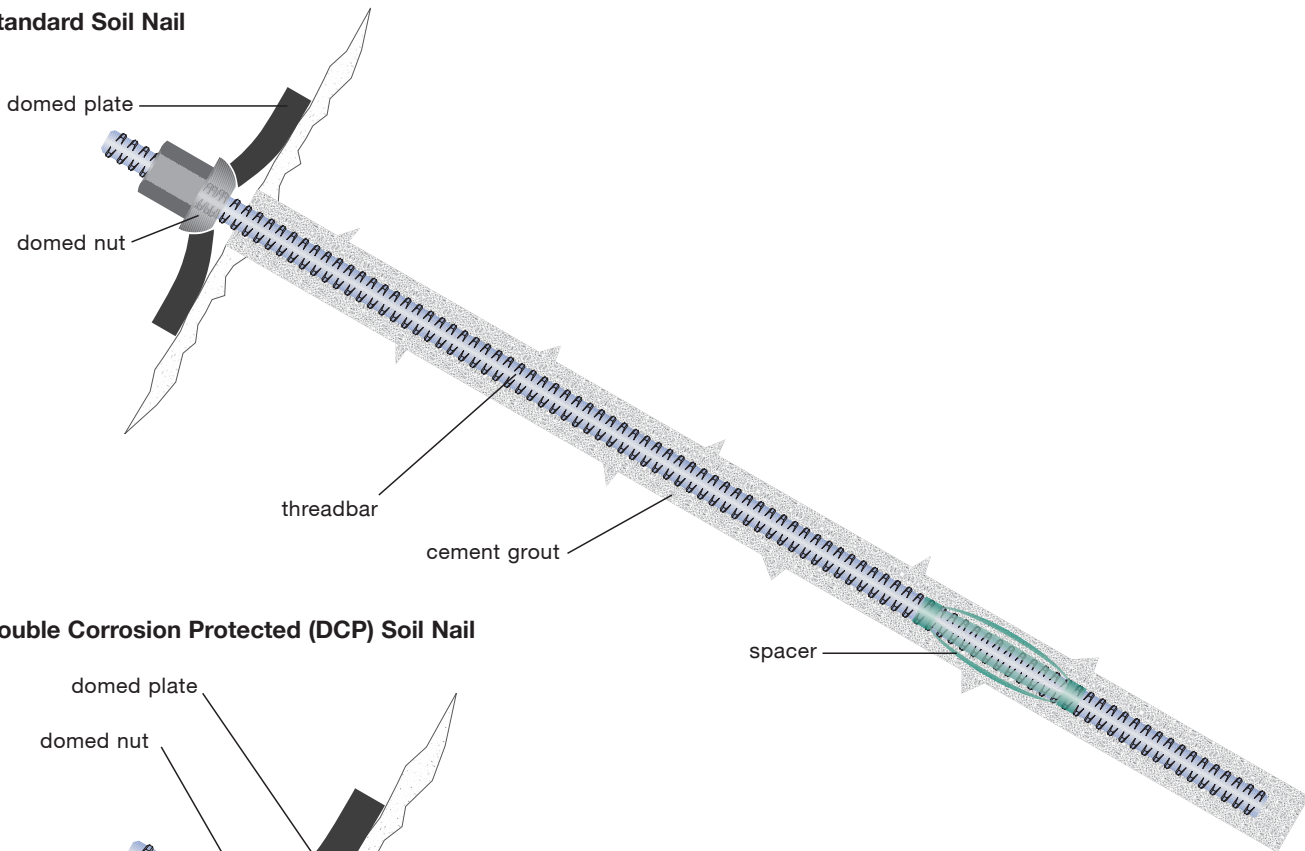
- Design life (permanent or temporary wall)
- Corrosion protection
- Pullout resistance between nail and the ground
- Individual nail capacity
- Length of nail to reach beyond the failure surface
- Nail spacing (typically 1-1.5m)
- Nail inclination (typically 5°-15°)
- Wall inclination
- Stability analysis for each stage of construction
- Allowable horizontal and vertical displacement limits
- Dewatering, if below the ground water table
- Drainage system.

## GEWI® Threadbar System for Soil Nails

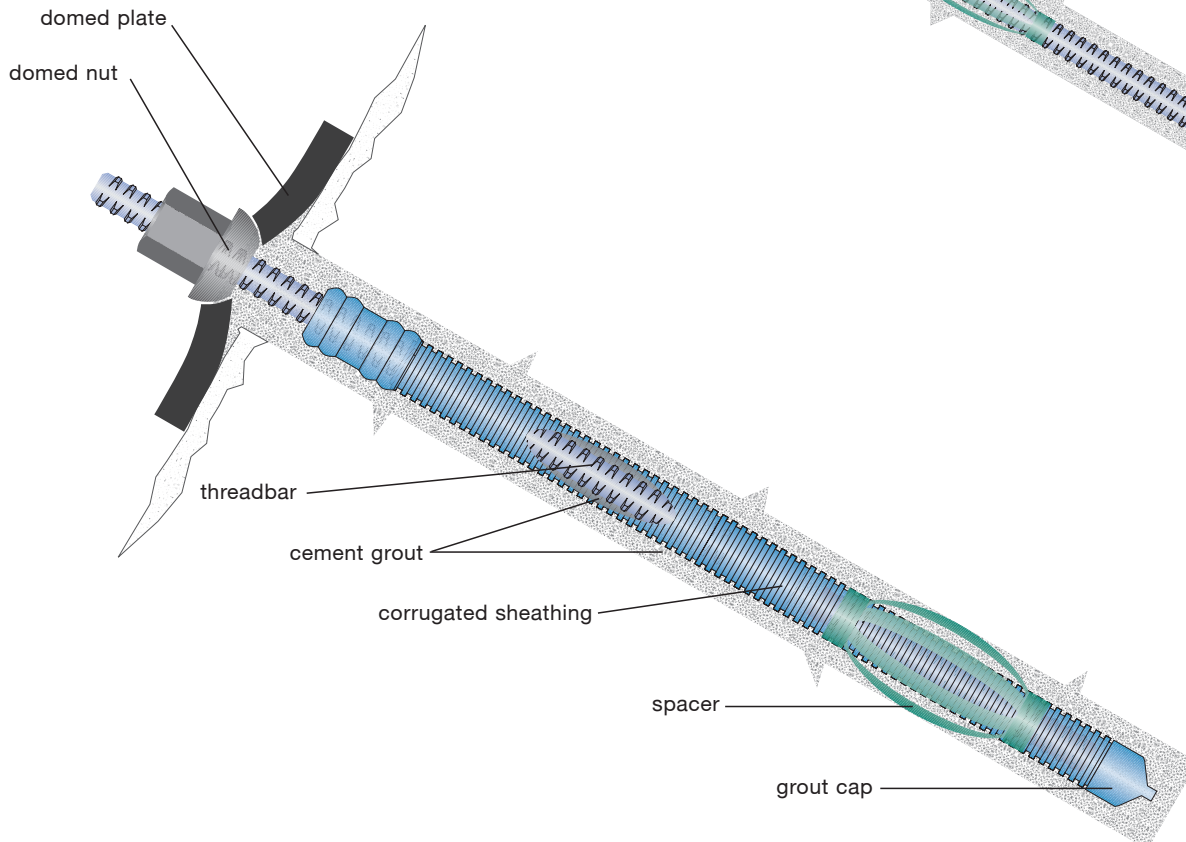
The DSI GEWI® Threadbar is a steel bar with continuous left-hand coarse threads hot rolled on two opposite sides. The continuous robust threads allow for anchorage and coupler installation anywhere along the bar. The coarse threads provide excellent bond to grout and are insensitive to

dirt and damage. In addition, there is no loss of strength due to thread cutting. The different levels of corrosion protection are: bare, hot-dipped galvanised, epoxy powder coated and Double Corrosion Protected (DCP).

### Standard Soil Nail



### Double Corrosion Protected (DCP) Soil Nail

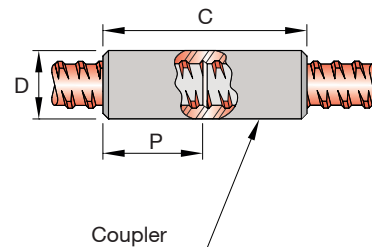
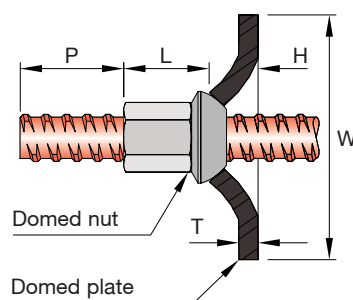
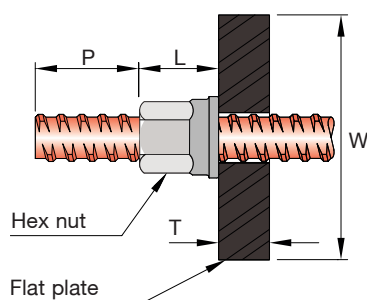


## GEWI® Threadbar Properties: T Grade

Nominal Diameter (mm)	20	25	28	32	40	50	63.5
Minimum Ultimate Steel Grade (MPa)	600	550	550	550	550	550	555
Minimum Yield Steel Grade (MPa)	500	500	500	500	500	500	700
Minimum Breaking Load (kN)	188	270	339	442	691	1,080	2,217
Minimum Yield Load (kN)	157	245	308	402	628	982	1,758
Cross-Section Area (mm <sup>2</sup> )	314	491	616	804	1,257	1,964	3,167
Minimum Thread Diameter (mm)	22.8	27.9	31.6	35.7	44.2	55.6	69.0
Unit Weight (kg/m)	2.47	3.85	4.83	6.31	9.86	15.41	24.86
Minimum Bar Protrusion P* (mm)	55	58	63	70	80	100	130

## GEWI® Threadbar Hardware Dimensions

Nominal Diameter (mm)	20	25	28	32	40	50	63.5
Domed Nut L (mm)	35	40	46	51			
A/F** (mm)	36	38	43	46			
Hex Nut L (mm)	35	50	55	60	70	85	115
A/F** (mm)	36	40	46	55	65	80	100
Coupler C (mm)	110	115	125	140	160	200	260
D (mm)	37	42	48	55	68	84	106
Domed Plates W (mm)	150	150/200	200				
T (mm)	8/10	10/12	16				
Flat Plates W (mm)			200	200/250	250	250	200
T (mm)			16/20	20/25	20/25	20/25	25
Corrugated Sheathing Diameter (mm)	50	50	56	56	65	80	100



Note:

\*Minimum Threadbar protrusion to accommodate tensioning or coupling:  $P = \frac{1}{2}C$  (mm).

\*\*Width measured across flat of nut.

# DYWI® Drill Hollow Bar System for Soil Nails

## The main advantages of the Self-Drilling Hollow Bars are:

- Fast installation and grouting are completed in a single operation
- Removal of casing and drill rods is not required
- Similar installation methods for all ground conditions
- Choice of drill bits for different ground conditions
- The hollow core serves for flushing with air or water during drilling, and also for grouting the soil nail
- Soil nail length increased by using couplers
- Ability to work with small drill rigs without casing in narrow spaces
- Consistent high quality control is provided from production to delivery stage.

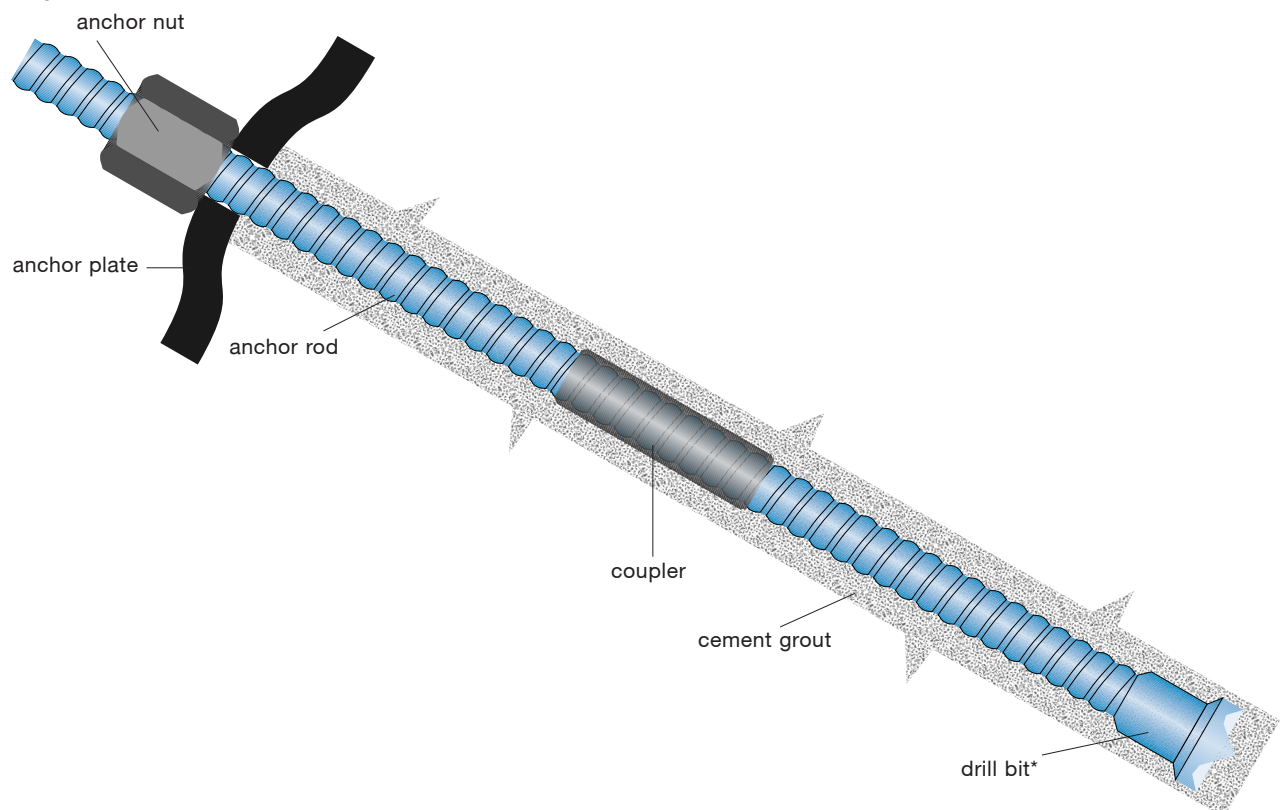
## DYWI® Drill Hollow Bar Properties

Bar Designation	R32N	R32S	R38N	R51N	T76N
Nominal Outer Diameter (mm)	32	32	38	51	76
Ultimate Load (kN)	280	360	500	800	1,600
Yield Load (kN)	230	280	400	630	1,200
Average Cross-Section Area (mm <sup>2</sup> )	430	520	770	1,070	2,120

## DYWI® Drill Hollow Bar Hardware Dimensions

Bar Designation	R32N	R32S	R38N	R51N	T76N
Hex Nut Length (mm)	45	45	50	70	80
Coupler Length (mm)	120	120	150	200	220
Coupler Outer Diameter (mm)	43	43	51	63	95
Domed Plates W (mm)	150	150	200		
T (mm)	10/12	10/12	12/16		
Flat Plates W (mm)				200	200
T (mm)				20/25	25/32

## DYWI® Drill Hollow Bar



\* various drill bits for different ground conditions available

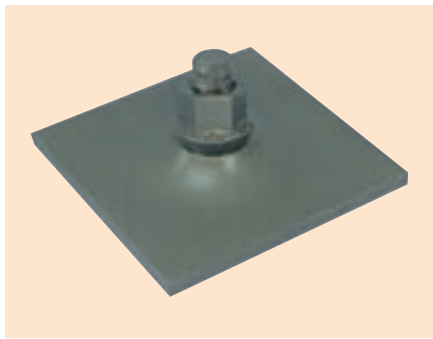
## Soil Nail Accessories

### Plates

Plate designs vary depending on loading and ground conditions. The standard plates previously listed are the most compatible with the DSI domed nuts.

### Domed Plates

- Domed plates are complimentary to the domed nuts and overcome surface angularity up to 15°
- Without the use of the domed nut, the plate must be perpendicular to the bar otherwise bending of the nail at the collar can occur, causing local abnormal loading of the nail and potential early failure
- Corrosion protection can be provided by hot dip galvanising.

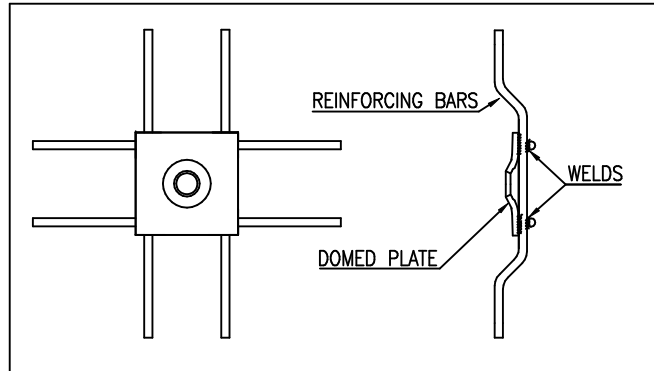


### Flat Plates

- Normally used for larger nail diameter
- Provides little angle compensation (4-5°) for installation of the bolts
- Can be used where rock surfaces are relatively flat
- Provides “stiff” reaction
- Corrosion protection can be provided by hot dip galvanising.

### Spider (Mesh) Plates

- Also called Mesh Plates, these are manufactured by welding reinforcing bars or mesh to plates to enhance bond to shotcrete
- Can be secured to pre-installed bolts to secure steel mesh
- Eliminates the need to use extra bolts to pin mesh.



### Grout Tube

- Grout tube is used to inject cement grout
- DYWIDAG grout tube is manufactured from polyethylene material.

Grout Tube Type	Outer Diameter (mm)	Inner Diameter (mm)	Coil Length (mm)
GTM 20	20	16	200
GTM 16	16	12	300

### Slip-on or Segment Spacers

- Installed on the nail to ensure a grout cover around the nail inside the drilled hole.

## Soil Nail Testing

Soil nail testing is performed to establish the bond capacity within the stable zone of a slope.

### Tests performed, can include:

- Ultimate tests (sacrificial) where nails are tested until failure occurs
- Proof tests can be performed on sacrificial or production nails
- Creep tests are generally conducted during a proof or sacrificial testing to determine long term nail movement and/or load loss. Acceptance criteria should be based on allowable movements of the wall over its life span
- Test load is measured with a pressure gauge calibrated with the hydraulic jacking system. Nail movement is recorded by a dial gauge mounted on an independent stand.





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