



Micropiles



**We make
infrastructure safer,
stronger and smarter.**

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Leading geotechnical solutions

At DYWIDAG, we stand as one of Australia's largest manufacturers and suppliers of specialist ground support.

DYWIDAG is a specialist engineering supply and installation company with its head office in Germany. Built on over 150 years of civil engineering experience, DYWIDAG is globally recognised for technical competence, quality assurance, and proven product reliability. DYWIDAG has firmly established its presence in the geotechnical ground and civil engineering sector across the globe.

With decades of experience in developing, producing, and supporting geotechnical projects, we assure our customers of consistently high-quality products and systems. Our specialised technical services are tailored to meet the unique requirements of each project, whether it's enhancing technical efficiency, reliability or achieving cost-effectiveness. Our team is dedicated to helping you reach your project goals.

The use of micropiles (mini pile, reticulated pile etc) started in the early 1950's in Italy for underpinning applications of historic buildings damaged during World War II. Micropile technology is a reliable pile system that can withstand large capacity axial or lateral loads with minimal disturbance to the existing structures. Micropiles are a popular solution due their ability to transfer loads efficiently through skin friction and their installation advantages. over conventional pile systems.

A GEWI® Micropile is a drilled and grouted micropile, less than 300mm in diameter that is centrally reinforced with either one or a group of two or three high tensile strength DYWIDAG threadbars. GEWI® Micropile can carry loads up to 300 T in compression or tension in relatively small boreholes. A GEWI® Micropile is also a friction pile. The load is transferred by bond from the threadbar to a cement grout body and from there by friction to the surrounding ground. The friction value between grout-ground can be increased by use of post grouting techniques.

Alongside our product range, we provide technical support, inspection, testing, tensioning, monitoring and equipment hire.



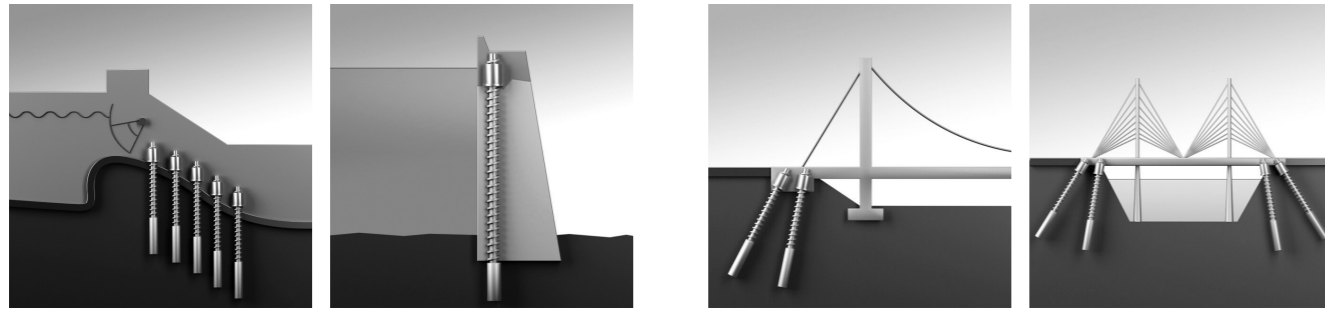
Deutsches
Institut
für
Bautechnik

DIBt

German design approval

DYWIDAG holds DIBt – Deutsches Unstitut für Bautechnik design approval in accordance with DIN EN 14199 DYWIDAG Micropiles comprising of load bearing elements made of reinforcing bar yield 500, 670, 950 mpa with thread ribs and a nominal diameter of 20mm - 75mm range. Couplers and anchoring elements made of steel may be used for permanent installation for composite micropiles as tension or compression piles and are designed for loading by axial loads.

Fields of application



Dams

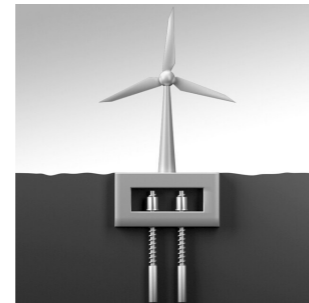
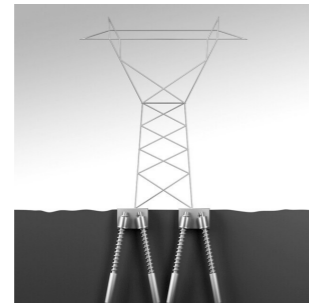
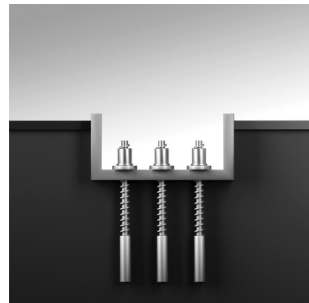
Anchoring techniques strengthen dam structures, providing stability in the face of changing water levels and load conditions.

- GEWI® Soil nails and rock bolts
- Bar and strand anchors
- GEWI® and GEWI® Plus piles
- Tie bars
- High tensile bar

Anchoring of tensile loads

Ground anchors and tensile piles offer economical solutions for tying back tensile loads in various ground conditions. Large visible counterbalances or retaining structures may be eliminated as tensile loads are transferred into the ground.

- GEWI® and GEWI® Plus piles
- DYWI® Drill tension piles
- High tensile bar
- Bar and strand anchors



Uplift control

Tensile piles and tensioned anchors secure foundations against uplift, offering a time-efficient alternative to mass concrete.

- GEWI® and GEWI® Plus piles
- Bar and strand ground anchors
- DYWI® Drill tension piles
- High tensile bar

Stability against overturning

Micropiles and ground anchors permanently stabilise structures at risk of tipping, providing flexibility and resilience in the face of external forces.

- Bar and strand anchors
- GEWI® and GEWI® Plus piles
- DYWI® Drill tension piles
- High tensile bar

Foundations and underpinning

Micropiles provide stability and load transfer to individual and strip foundations, especially in challenging access areas. They enable quick and easy foundation reinforcement and load redistribution.

- GEWI® and GEWI® Plus piles
- DYWI® Drill Hollow bar
- High tensile bar

Manufacturing facilities

Australian manufacturing

DYWIDAG's manufacturing facilities in Newcastle, NSW, are supported by manufacturing facilities strategically located around the world and global supply chain. The local factory has recently increased local capacity, optimising efficiencies and safety.

As one of Australia's largest manufacturers and suppliers of specialist ground support, DYWIDAG's focus is on supplying cost competitive solutions. In Australia, DYWIDAG has recently worked on Snowy Hydro 2.0, North East Link Micropiles, ground anchors and monitoring, Melbourne Metro Micropiles and ground anchors, Sydney Metro West and Sydney Fish Markets 61 strand anchors.

DYWIDAG is experienced in design detailing, anchor fabrication, grouting and testing procedures with dedicated team of specialists, supervisors and QA managers. DYWIDAG Permanent Anchors and Micropiles are trusted around the world as a premium and versatile solution for structure stability and longevity. DYWIDAG Micropiles have been used on key projects around the world and are considered the benchmark for major infrastructure projects with complex stability and access requirements.



Sustainability

As the world is shifting gears and focusing on Environmental, Social and Governance (ESG) principles, DYWIDAG is focused on making a difference. Part of this is looking at harnessing renewable energy, electrifying our equipment, recycling, waste reduction and sustainable product development. We have received Environmental Product Declarations (EPD's) for several of our products and continue make improvements with our products and sourcing options. One of our key suppliers uses steel billets from 100% recycled scrap from the German car manufacturing industry. We are able to provide 'Green' steel as part of our product offering.



Micropiles

DYWIDAG Micropiles are compliant with Australian standards and hold DIBt German approval. They serve as essential components of foundation systems, providing structural support in various construction projects. Unlike traditional piles, DYWIDAG Micropiles operate as passive foundation elements, relying on their inherent strength and stability to bear vertical loads.

A drilled and grouted micropile, is centrally reinforced with either one or a group of two or three high tensile strength DYWIDAG Threadbars. Micropiles are able to transfer loads through skin friction into deeper, stable soil layers. Due to the high strength thread bars micropiles have a high load transferring capacity up to 300T at a small drill hole diameter. Micropiles are able to transfer tension, compression or alternating loads. The load is transferred by bond from the Threadbar to a cement grout body and from there by friction to the surrounding ground. The friction value between grout-ground can be increased by use of post grouting techniques.

Soil types

The Micropile is a foundation element for any ground condition.

Cohesive soils

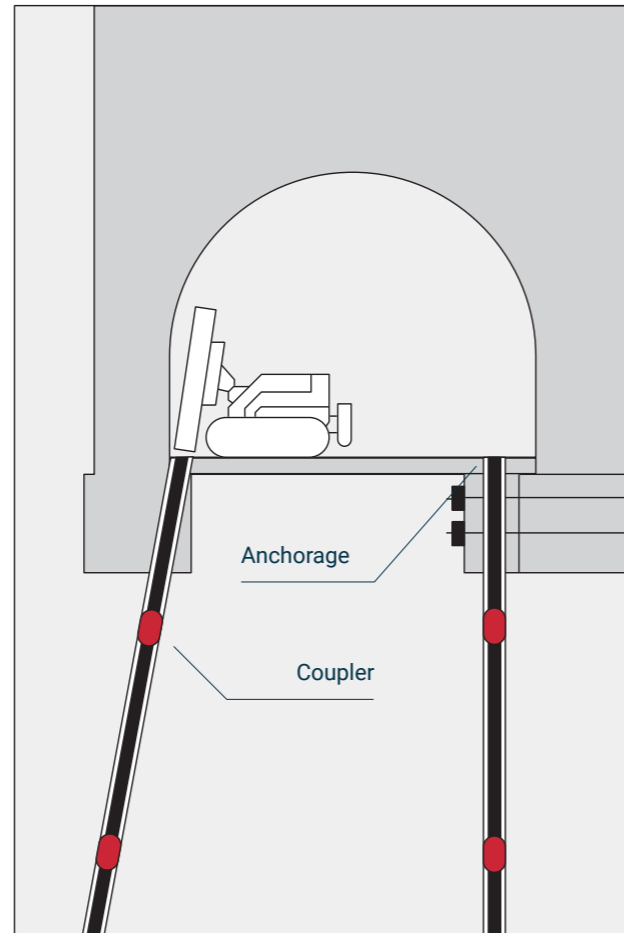
Clays, silts (up to an untrained shear strength of $C_u \geq 1.45\text{psi}$) do not require additional lateral support.

Noncohesive soils

Sand and gravel.

Rock

Ranging from hard clays to granite, with open or closed joints and fissures.



Design methodology

The minimum recommended Micropile design steps are:

- Review project information in regards to micropile layout, loading requirements, access and overhead clearance.
- Review geotechnical data for soil properties, design parameters, corrosion protection requirements, grout-to-ground parameter, bond length, pile spacing for group effects.
- Consider and address additional structural details such as case and uncased length, strain/ductility of the steel, transition between case and uncased section, reinforcement splice connections, pile to footing connection and corrosion protection.



Installation of Micropile

In granular soils, the Micropile is installed in cased bore holes. Due to the small diameter, these bore holes may be advanced quickly without vibrations and relatively quiet. Drilling obstacles such as hard strata, blocks or foundations may be penetrated without problems. The bore holes may be inclined to any degree. The rigid casing permits straight holes in which the Micropiles may be installed without bending while also allowing for pressure grouting of the shaft of the pile. During installation, DYWIDAG Threadbar is carefully inserted into a borehole with a maximum diameter of 300mm. A spacer is employed to centre the Threadbar within the borehole, maintaining uniformity and stability throughout the Micropile's length.

Post grouting

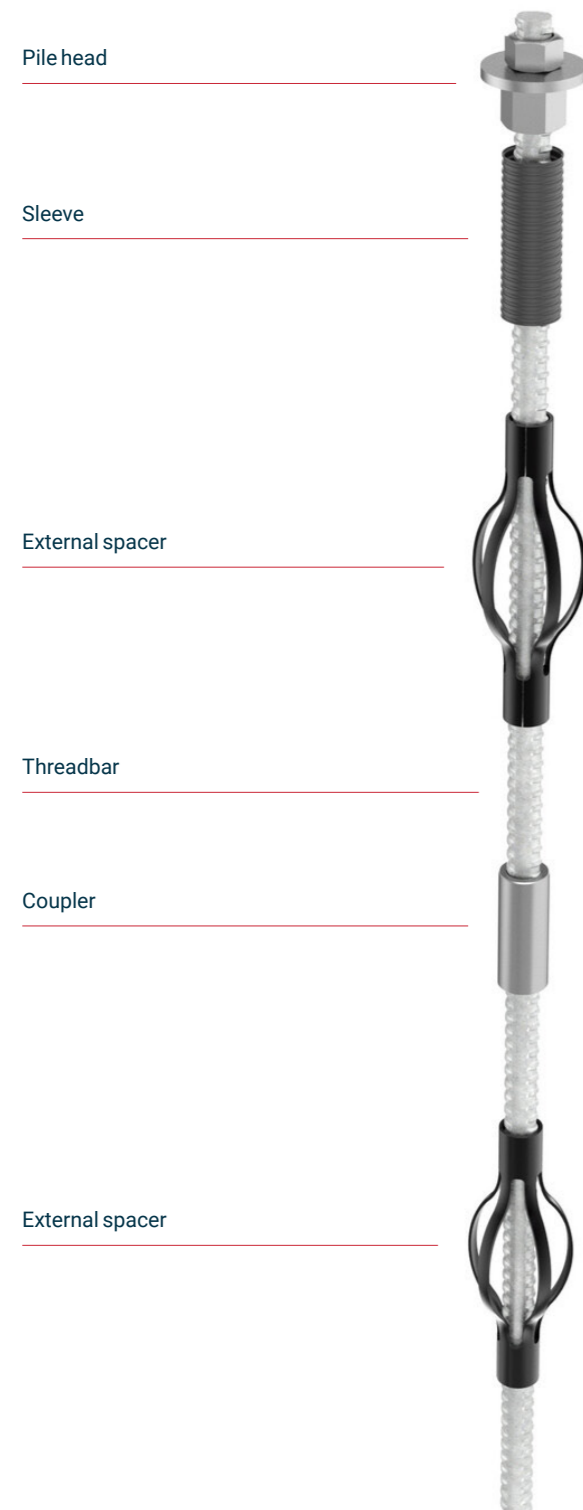
Post-grouting improves the load carrying capacity in cohesive soils by increasing the skin friction. The post grouting system uses a ring line with grout valves. Post grouting may be carried out once or repeatedly. The limits for the load transfer capacity is not only determined by the maximum obtainable skin friction, but also by the ability of the soil itself to carry the load. Failed piles may often be recovered to safe design load by additional post grouting.



WILHELMSHAVEN POWERPLANT, GERMANY
GEWI® PLUS PILES

Temporary Micropiles and Micropiles with extended design life

DYWIDAG temporary micropiles are an ideal solution for structures which only require a design life up to 2 years.



A temporary micropile consists of a black GEWI®, GEWI® Plus or WR Threadbar being installed directly into the borehole. A design life of 2-50 years may be specified in the design. There are many intermediate solutions that may be considered to increase corrosion protection and design life.

Corrosion protection

Corrosion protection design solutions may be used to provide ease of handling, flexibility on site, and optimized pricing for specific requirements without the need for double corrosion protection.

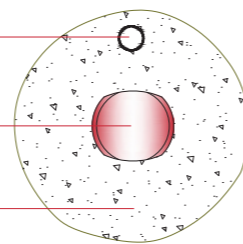
These include:

- Hot dip galvanizing
- Epoxy coating
- Combo coating (galvanized and epoxy coating)
- Sacrificial corrosion (upsizing material specifications to allow for corrosion)
- Increasing grout coverage
- Thermal diffusion galvanizing
- Thermal metal spray
- Applying anticorrosion compound or protective wrapping (denso)
- Partly protect using "double corrosion protection" or using a combination of the above options at critical exposure points

Grout tube

DYWIDAG Threadbar

Borehole grout



Advantages and key features

Easy installation

Compact, lightweight drilling and installation equipment make Micropiles ideal for remote or confined areas such as steep slopes, wetlands, river pier foundations, basements or remote locations. They may also be installed very close to adjacent structures using small drill holes and drilling equipment.

Passive foundation system

Typically installed as passive foundation elements, these micropiles do not require tensioning and rely on their inherent strength to support vertical loads.

Continuous thread

DYWIDAG Threadbar has a continuous rolled on pattern of thread like deformations that allow full load couplers and anchorages to be easily positioned along the pile. The pile length can be segmentally increased allowing access inside low head room areas. Coarse thread remains threadable even if dirty or damaged.

Versatile load transfer

These Micropiles primarily rely on skin friction for load transfer along the grout body, allowing them to accommodate compression, tension, and alternating loads with flexibility and reliability.

Cost effective solution to bored piles

Micropiles offer a practical and cost-effective solution to the costly alternative of bored piles and are also well suited to sites with challenging access and low head room.

Preloading capacity

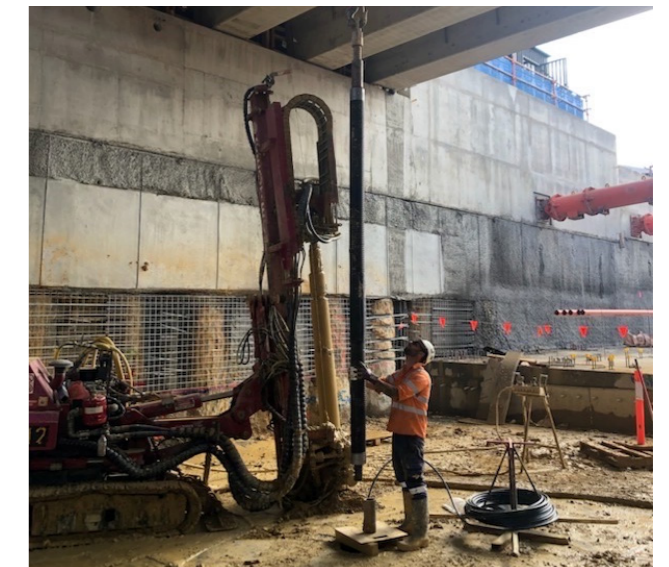
Piles can be easily pre-loaded virtually eliminating long-term settlement of structures.

Environmentally friendly

Micropiles do not require large access road or drilling platforms like bored piles.

Durable and long-lasting

Manufactured from high-quality materials and engineered for durability, micropiles offer long-term stability and performance in challenging soil and environmental conditions.

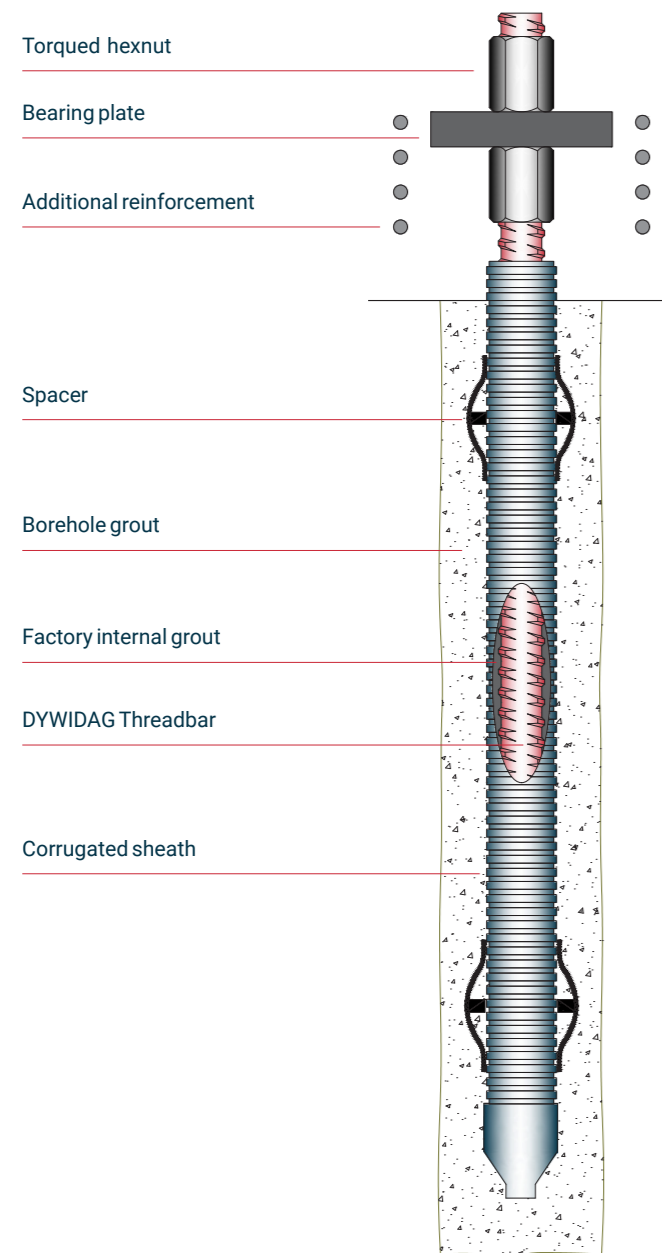


UNION ROAD, AUSTRALIA
INSTALLATION OF MICROPILES

Permanent Micropiles

Double Corrosion Protection (DCP)

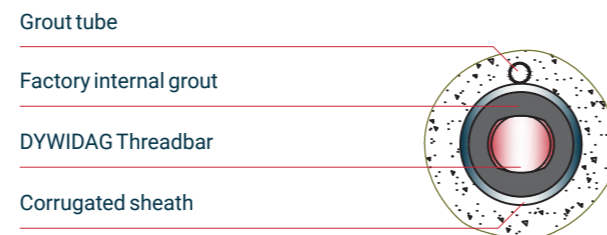
In environments with highly aggressive ground conditions such as those prone to corrosion or chemical exposure DYWIDAG offers a specialised solution. DYWIDAG's Permanent Anchors and Micropiles are trusted as a premium and versatile solution for structure, stability and longevity.



DYWIDAG Permanent Micropiles have been used on many key projects around the world and within Australia, becoming the benchmark for major infrastructure projects in challenging ground conditions or limited space.

DYWIDAG Permanent Micropiles are manufactured to meet a minimum design life of 120 years by utilising our proprietary, factory grouted double-corrosion protection system. A double corrosion protection system (DCP) places a corrugated sheathing over the entire element which has been factory grouted. This dual-layer system safeguards the steel Micropile, extending its lifespan in aggressive ground conditions where conventional piles may corrode prematurely. The resulting product is supplied to site ready to be installed, either as a singular or a multi-bar arrangement to suit the loading requirements of the Micropile.

A single bar Micropile can carry safe working loads of up to 300 tonnes in relatively small boreholes (<175mm) while a multi-bar arrangement can be installed within larger boreholes to accommodate higher loading capacities. Typical lengths for Micropiles are between 10-20m however the Micropile sections can be spliced together continuously using a DYWIDAG coupling system to accommodate longer embedment lengths whilst still maintaining a 120 year design life.



Product benefits

- Designed to withstand harsh environmental conditions, including exposure to moisture, chemicals, and saltwater, thanks to their advanced corrosion-resistant encapsulation.
- The combination of multiple corrosion protection layers ensures the long-term durability and extended service life of GEWI® and GEWI® Plus Threadbar, making them ideal for use in aggressive environments such as marine structures, coastal areas, or chemical plants.
- Easy to install.
- Offer a practical, cost-effective and versatile solution compared to bored or CFA pile systems.
- Allow for high-capacity loads in tight access scenarios.
- Prefabricated and delivered ready for installation means minimal invasion into other work areas and operations on site.
- Proprietary system allows for smaller bored holes than others on the market to increase site efficiencies.



DOUBLE CORROSION MICROPILES

Multibar assembly

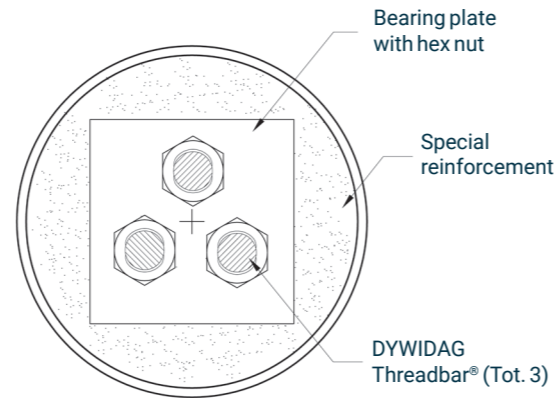


Due to their reliance on skin friction for load transfer, DYWIDAG Threadbar Micropiles are versatile foundation elements capable of accommodating various types of loads, including compression, tension, and alternating loads. For transferring extremely high loads that are greater than a single bar is capable of, several individual Micropiles (usually three) can be combined in a borehole, providing that the borehole diameter is sufficiently wide.

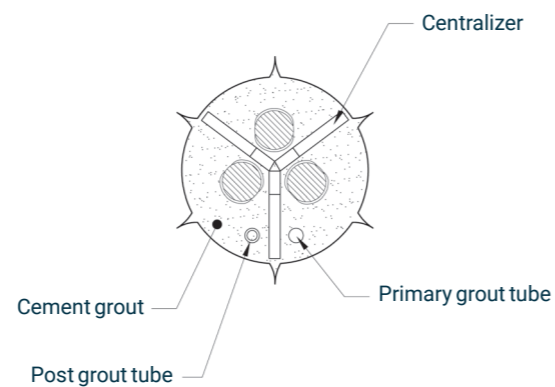
The DYWIDAG Threadbar at the core of the pile is surrounded by a cement grout layer of various thickness. In addition to sealing the bar from moisture, the high pH value of the cement grout passivates the steel surface of the bar, providing further corrosion protection.



At the anchorage



In the borehole



DYWI® Drill Hollow Bar Micropiles

The DYWIDAG DYWI® Drill hollow bar Micropiles are ideal for installation in restricted access areas or close to buildings.

Nut

Flat plate

Pile neck reinforcement (where required)

Coupler

Centraliser

Hollow bar

Drill bit



Where the integrity of the ground is inconsistent and there is a chance of collapse in the borehole of sand or loose soil, hollow bar micropiles are an ideal solution as they may be simultaneously drilled and grouted in a single pass.

With a fully threaded design, these Micropiles can be extended and grouted even if the founding level is higher than anticipated, meeting the standards set by EN 14199. By employing rotary percussive drilling, installation disruptions are minimised, providing an alternative to driven piling systems. This approach facilitates foundation improvement in existing structures or buildings with minimal disturbance.



Key features

Versatility

Suitable for various ground conditions, including soil, rock, and congested or contaminated sites.

Limited access capability

Can be installed in tight spaces like urban areas, slopes, or inside structures due to small equipment footprint and flexible angles.

Minimal environmental impact

Causes minimal soil disturbance, ideal for sensitive or urban areas.

Fast installation

Quick and efficient, reducing construction time and costs compared to traditional methods.

GEWI®, GEWI® +, WR Threadbar, DYWI® Drill Hollow Bar Properties

Reinforcing Threadbar GEWI® Grade - left hand thread T Grade AS 4671 Ductility >10%													
Nominal Diameter (mm)	12	16	20	25	28	32	36	40	43	50	57.5	63.5	75.0
Minimum Yield Grade (MPa)	500	500	500	500	500	500	500	500	500	500	555	555	500
Minimum Ultimate Grade (MPa)	550	550	600	550	550	550	550	550	550	550	700	700	550
Minimum Breaking Load (kN)	62	111	188	270	339	442	560	691	799	1080	1818	2217	2430
Minimum Yield Load (kN)	57	101	157	245	308	402	509	628	726	982	1441	1758	2209
Cross-section Area (mm²)	113	201	314	491	616	804	1018	1257	1459	1964	2597	3167	4418
Unit Weight (kg/m)	0.89	1.58	2.47	3.85	4.83	6.31	7.99	9.86	11.4	15.41	20.83	24.86	34.68
Diameter stocked in Australia	yes	yes	yes	yes	yes	yes	U/R	yes	U/R	yes	U/R	yes	U/R

Reinforcing Threadbar GEWI® + Grade - right hand thread TR Grade AS 4671 Ductility >7%													
Nominal Diameter (mm)	18	22	25	28	30	35	43	50	57.5	63.5	75.0		
Minimum Yield Grade (MPa)	670	670	670	670	670	670	670	670	670	670	670	670	670
Minimum Ultimate Grade (MPa)	800	800	800	800	800	800	800	800	800	800	800	800	800
Minimum Breaking Load (kN)	204	304	393	496	565	770	1162	1570	2077	2534	3535		
Minimum Yield Load (kN)	170	255	329	413	474	645	973	1315	1740	2122	2960		
Cross-section Area (mm²)	254	380	491	616	707	962	1452	1963	2591	3167	4418		
Unit Weight (kg/m)	2.00	2.98	3.85	4.83	5.55	7.55	11.40	15.40	20.38	24.86	34.68		
Diameter stocked in Australia	U/R	yes	U/R	U/R	U/R	yes	yes	U/R	U/R	U/R	U/R		

Post-Tensioning Threadbar WR - right hand thread (and Z bar 15 and 20 mm) AS 4672 Ductility 4-6% High Tensile										
Nominal Diameter (mm)	15	20	26.5	32	36	40	47	57	65	75
Minimum Yield Grade (MPa)	890	900	950	950	950	950	950	835	835	835
Minimum Ultimate Grade (MPa)	1080	1100	1050	1050	1050	1050	1050	1035	1035	1035
Minimum Breaking Load (kN)	191	346	579	844	1069	1319	1822	2671	3434	4573
Minimum Yield Load (kN)	157	283	524	764	967	1194	1648	2155	2771	3689
Cross-section Area (mm²)	177	314	552	804	1018	1257	1735	2581	3318	4418
Unit Weight (kg/m)	1.44	2.55	4.48	6.53	8.27	10.21	14.10	20.97	26.96	35.89
Diameter stocked in Australia	yes	U/R	yes	yes	yes	yes	yes	yes	yes	yes

DYWI Drill Hollow Bar							
Designation	R32S	R38N	R51N	T40L	T40N	T76N	T103N
Nominal Diameter (mm)	32	38	51	40	40	76	103
Minimum Breaking Load (kN)	360	500	800	540	660	1600	2270
Minimum Yield Load (kN)	280	400	630	425	525	1200	1800
Average Cross-Sectional Area (mm²)	430	590	940	730	900	2080	3220
Average Outer Diameter (mm)	32	38	51	40	40	76	103
Average Inner Diameter (mm)	16	19	33	20	16	51	78
Unit Weight (kg/m)	3.6	5.5	8.4	6.1	7.0	16.3	25.3
Minimum Bar Protrusion: P1 (mm)	80	90	100	70	70	110	130

Project experience

Melbourne Metro connecting the west of the city to the south-east



Location: Melbourne, Australia

Owner: Rail Projects Victoria

Contractor: Cross Yarra Partnership
CYP JV

Products: DYWIDAG supplied over 1500 Micropiles in high tensile grade steel in diameters ranging from 57-75mm to five station boxes.

Wind towers reinforced with DYWIDAG Threadbar Micropile System



Location: Navarra, Spain

Owner: Iberdrola, biggest energy supplier in Spain/Portugal

Contractor: Solum Drilling

Products: DYWIDAG DCP Threadbar Micropile System for Wind Tower foundation. Micropiles were used due to the presence of a water table not anticipated in the design phase.

North East Link - Linking Melbourne's freeway network



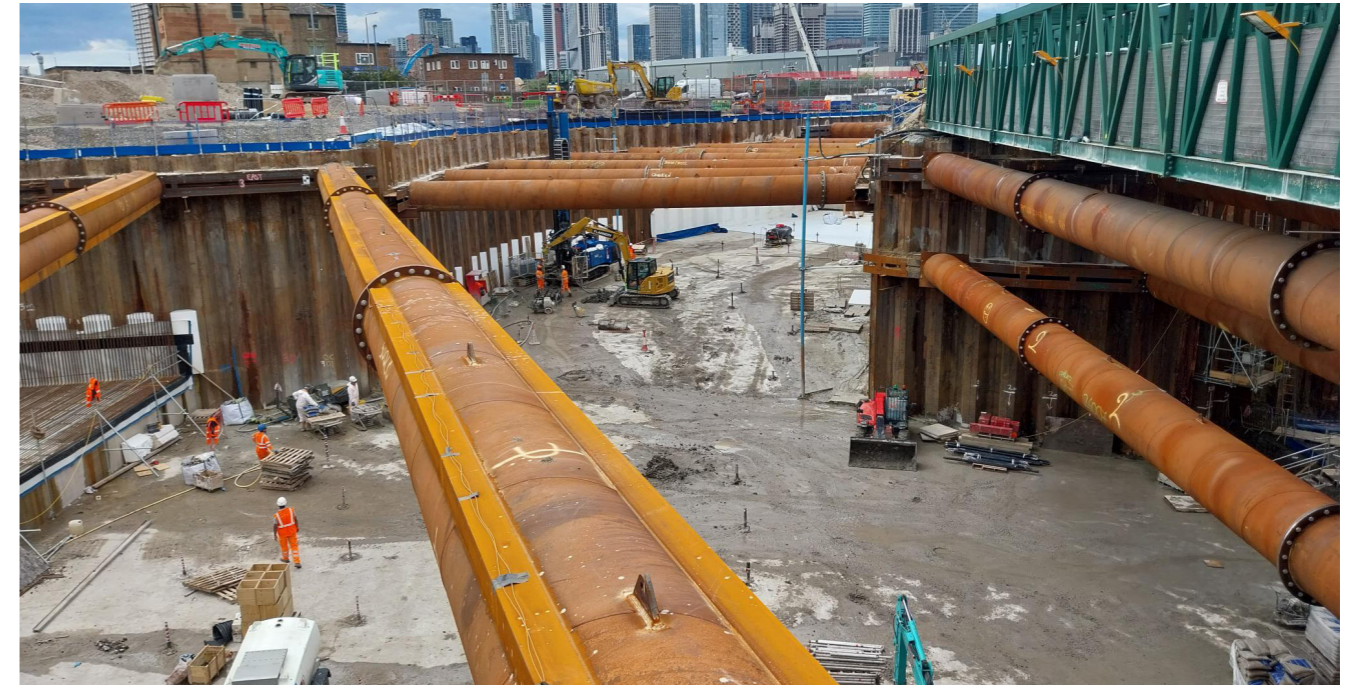
Location: Melbourne, Australia

Products: 75 WR DCP Micropiles, qty 4500.

Owner: Major Transport Infrastructure Authority

Contractor: Spark JV

Connecting communities with Silvertown Tunnel: Easing London's congestions



Location: United Kingdom

Products: Tension Piles, 50mm GEWI® double corrosion bar.

Owner: Riverlinx Consortium

Contractor: Riverlinx CJV

Oroville dam remediation



Location: USA

Unit: DYWIDAG-Systems International USA Inc., BU Geotechnics, USA

Scope: Supply

Products: Supplied 7096 epoxy coated DYWIDAG Threadbar 36mm anchors in varying lengths 4.6m - 7.6m long to anchor the concrete slab.

DYWIDAG played an integral part in the remediation of Oroville Dam in the US. In 2017, the wettest winter in 100 years resulted in extremely high water flow resulting in erosion to the bottom of the weir and the possible collapse of the spillway gate. Issues with the spillway required an emergency response causing the evacuation of 180,000 residents.

Self-drilling system builds bridge foundation in record time



Location: Columbia

Owner: Municipio de Ruonegro

Supply: DYWI® Drill T76 Hollow bar micropile and technical support.

The Roionegro region in Columbia has been rapidly expanding and is expected to continue to grow. Two cantilever bridges were needed to support road transport near the city of Medellin. DYWIDAG worked with the designers at OFB Consulting and determined micropiles would be the best solution due to the project's tight timeline and geotechnical investigations showed stratigraphy (layers of rock). This showed traditional drilling systems wouldn't be efficient enough leading to the selection of the DYWI Drill hollow bar T76 self-drilling system was selected due to its fast installation.

Reinforcement and upgrade of Transmission Networks UK



Location: Port Ann to Crossaig OHL

Owner: SSEN

Contractor: Balfour Beatty

Products: 6141m GEWI® Threadbar & 2219m Permanent casing.

The Port Ann to Crossaig OHL project involved the construction of 44 transmission tower foundations in challenging hillside terrain. DYWIDAG supplied GEWI® micropiles, with pile depths ranging from 6 to 28 meters through peat soil down to bedrock, and rock socket depths between 3 and 5.5 meters.

Construction of electrical transmission tower foundations



Location: Columbia

Owner: Empresas Públicas de Medellín
- EPM, Colombia

Contractor: Nueva Esperanza Joint Venture, consisting of FCC Servicios Industriales y Energéticos S.A. and Ingeomega S.A., both Colombia

Products: DYWIDAG Threadbar Microplie System.

In order not to impair the work of the farms and to avoid possible damage to the agricultural areas, the foundations for the 9 transmission towers were built using the 50mm DYWIDAG GEWI® Pile System. DYWIDAG supplied a total of 6,573m of DYWIDAG GEWI® Bars and accessories for this project.

Our services and capabilities

- Technical planning and support
- Produce JIT in our factory in Newcastle Australia
- Provide installation supervision if required
- ETA European approvals for our systems
- Global and local approvals
- TfNSW Approval – B114 and B113
- ACRS Approval against AS-NZ 4671, 4672.1 and 4672.2
- German Milled steel bar
- Designed for 120-year life
- Global footprint with five technical knowledge centres
- Stressing jacks from 30 ton to 2200 ton
- Grouting equipment from small single bowl to high pressure grouting equipment



ALFRED STREET PEDESTRIAN BRIDGE, SYDNEY
DCP MICROPILES



AUSTRALIAN CATHOLIC UNIVERSITY, ST TERESA OF KOLKATA BUILDING
DYWIDAG DCP THREADBAR MICROPILES

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