



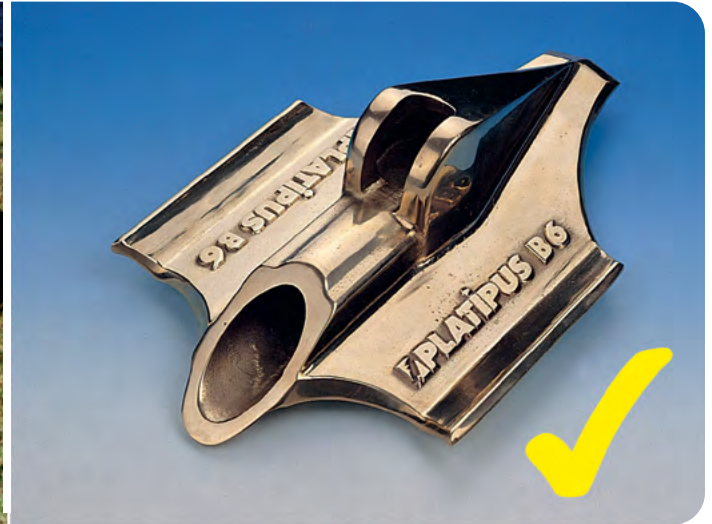
PLATIPUS
EARTH ANCHORING SYSTEMS

**Underwater, Marine &
Shoreline Applications**
Brochure

INTRODUCTION

Platipus® Anchors are market leaders in the design, manufacture and supply of mechanical earth anchoring products. We are renowned for providing some of the most innovative and cost effective anchoring solutions for the Civil Engineering, Construction and Marine industry.

The first 9 pages of the brochure relate to a general overview of the product particularly focused at the "Underwater" element of our three main applications being Underwater, Marine and Shoreline Solutions. Additionally related anchoring solutions for Palm Trees, Stabilised Earth, Drainage and Pipelines are also included.

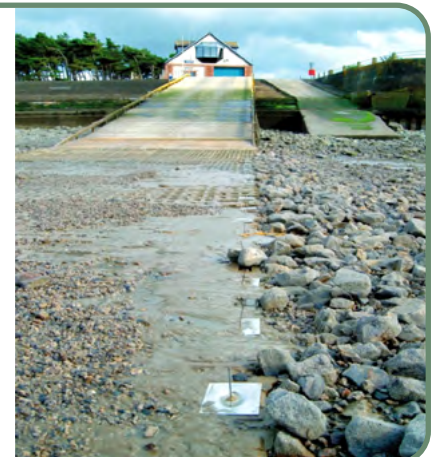


The percussion driven earth anchor (PDEA®) is a unique, modern and versatile device that can be quickly installed in most displaceable ground conditions. It offers a lightweight corrosion resistant anchor that can be driven from ground level using conventional portable equipment. It creates minimal disturbance of the soil during installation, can be stressed to an exact holding capacity and made fully operational immediately. As a completely dry system it also has minimal environmental impact.



Applications

- Piers
- Floating Docks
- Mooring Anchors
- Channel Marker Buoys
- Seawalls
- Sheet Piling
 - (PVC / Composite)
- pontoons
- Flood Protection
- Hurricane Protection
- Overtopping
- Boat Ramps
- Revetment Mats
- Turbidity Barriers
- Pipeline Outfalls
- Underwater Habitats
- Palm Tree Anchoring
- Plus many more...



FEATURES & BENEFITS

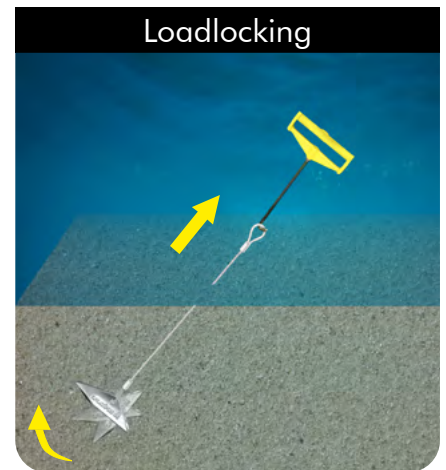
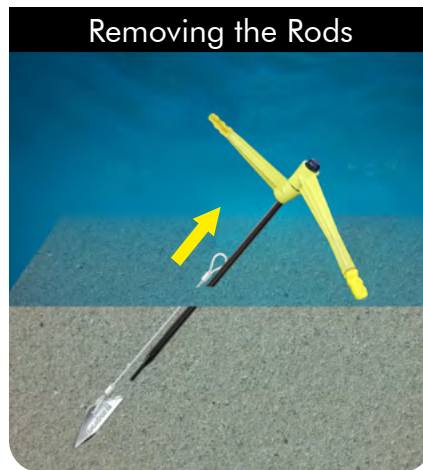
KEY BENEFITS OF THE PLATIPUS® EARTH ANCHORING SYSTEM

- Over 40 years of experience
- Fast and easy installation
- Immediately quantifiable loads
- Low environmental impact - no concrete blocks / reef damage
- Design assistance & anchor testing
- On-site training and support - both wet & dry
- Bespoke installation equipment & tools
- Online anchor specification software



'SIMPLY' HOW A MECHANICAL ANCHOR WORKS

There are three steps to the installation of an anchor system:



STRESS DISTRIBUTION & BEARING CAPACITY



Granular Soil

(Based on Terzaghi's calculation)

The stress distribution in front of a loaded anchor can be modelled using foundation theory. The ultimate performance of an anchor within the soil is defined by the load at which the stress concentration immediately in front of the anchor exceeds the bearing capacity of the soil.

Factors that will affect the ultimate performance of the anchor include:

- Shear angle of the soil
- Size of the anchor



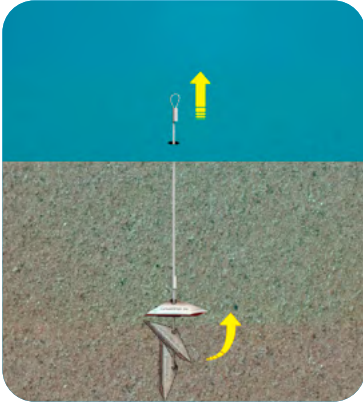
Soft Cohesive Soil

(Based on Skempton's calculation)

Platipus® anchors perform exceptionally well in a granular soil, displaying short loadlock and extension characteristics, a broad frustum of soil immediately in front of the anchor and extremely high loads.

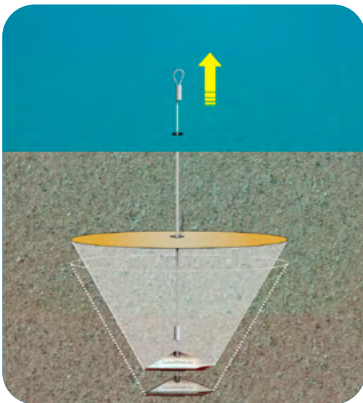
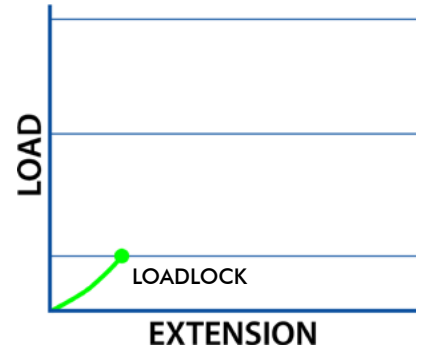
Stiff cohesive soils, such as boulder clays, can also give outstanding results. However, weaker cohesive soils, like soft alluvial clays, can result in long loadlock and extension distances and a small frustum of soil in front of the anchor. Consequently these conditions require a larger size of anchor and if possible a deeper driven depth to achieve design loads.

TYPICAL ANCHOR BEHAVIOUR - UNDERWATER



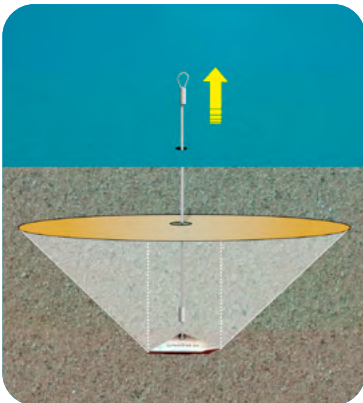
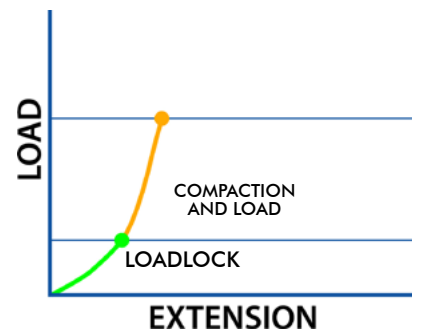
LOADLOCK

The first stage is where a load is applied to rotate the anchor into its loadlocked position. Elements of both load and extension are present.



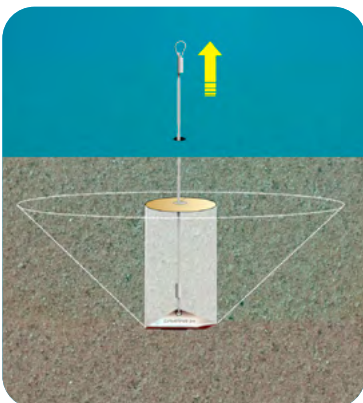
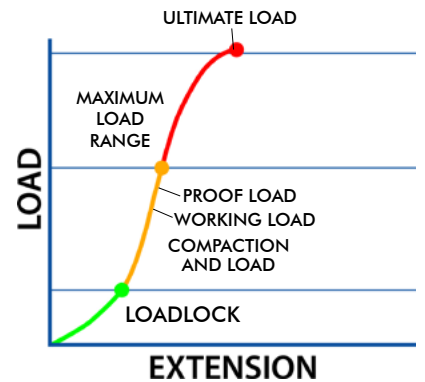
COMPACTION AND LOAD

The second stage is where the anchor system is generating a frustum of soil immediately in front of the anchor. At this point load normally increases with minimum extension. The soil type will affect the overall extension.



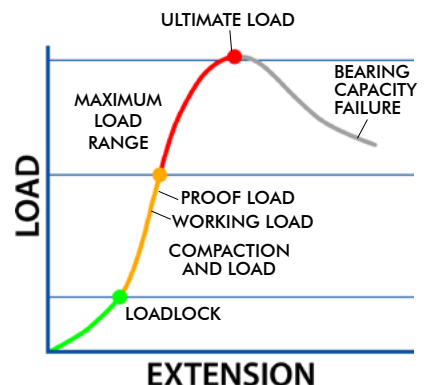
MAXIMUM LOAD RANGE

The third stage is where the anchor produces its ultimate load. As the anchor load approaches the bearing capacity of the soil, the rate of increase in load will reduce until bearing capacity failure of the soil takes place.



BEARING CAPACITY FAILURE

Caution: If the mechanical shear strength of the soil is exceeded, the residual load will decrease with continued extension as the anchor shears through the ground.



STEALTH ANCHOR - UNDERWATER

The Stealth anchor is designed to cover a wide range of lightweight anchoring solutions. Its chisel point and streamline shape makes installation easy using simple hand tools. Each anchor can be supplied with either a wire, rod or chain of a length to match the minimum installed depth.



The table below should be read taking into consideration the following points:

- In underwater applications the soil density will be reduced by the density of the water and therefore holding capacities are reduced by approximately half of their normal value, as depicted in the 'table below'
- The anchor capacity is reliant on the ground conditions in which it is placed
- Our 'Typical Load Range' is based on conservative assumptions / calculations, data and 30 years of experience

ANCHOR TYPE	EYE VERSION	DIMENSIONS L x W x H (mm) (L x W x H inches)	PROJECTED SURFACE AREA Square mm (Square inch)	MATERIALS	TYPICAL LOAD RANGE	MINIMUM DRIVEN DEPTH			
							Wire	Rod	Chain
S2		80 x 28 x 25 (3.1 x 1.1 x 0.9)	1,500 (2.32)	Aluminium Alloy; Hard Anodised	0 - 1.5 + kN (0 - 300lbs)	0.4 - 0.6m	✓	✗	✗
S4		121 x 41 x 34 (4.8 x 1.6 x 1.3)	4,127 (6.39)	Aluminium Alloy; Hard Anodised	1 - 5 + kN (200 - 1000lbs)	0.6 - 0.75m	✓	✗	✗
S6		171 x 58 x 50 (6.7 x 2.2 x 1.9)	8,200 (12.71)	Aluminium Alloy; Hard Anodised	2 - 15+ kN (400 - 3300lbs)	0.8 - 1.2m	✓	✓	✓
				SG Cast Iron; Aluminium Bronze	2 - 30+ kN (400 - 6700lbs)	1.2 - 1.5m			
S8		263 x 90 x 76 (10.3 x 3.5 x 3)	19,555 (30.31)	Aluminium Alloy; Hard Anodised	5 - 20+ kN (1000 - 4500lbs)	1.1 - 1.5m	✓	✓	✓
				SG Cast Iron; Aluminium Bronze	5 - 40+ kN (1000 - 8900lbs)	1.5 - 2.0m			

- The range of 'Typical Loads' gives an indication of each of the anchors performance in a selection of materials from alluvial CLAY to dense SAND
- In many situations the soil material may be mixed and therefore the holding capacity may vary
- All the indicated loads are based on the anchors being driven to the full 'Minimum Driven Depth'

BAT ANCHOR - UNDERWATER

The Bat anchor is designed to achieve higher loads and also enhance anchoring in soft cohesive soils. Its ability to accept the T-Loc lower termination allows flexibility with regard to on-site anchor system assembly. It also means it can accept a wide range of connections from tendon, polyester strap, rod and chain.

Installation requires more powerful hand held breakers and the appropriate hydraulic stressing equipment.



- All anchors need to be fully installed to the recommended depth, loadlocked and individually proof tested
- Care should be taken in selecting anchor materials to meet the service life requirements
- The indicated range of holding capacities do not include any factors of safety (all ultimate loads)
- We strongly advise suitability trials in all conditions to best determine the correct anchor solution for your application
- Bespoke anchor solutions can be provided by us given full soil information (eg. Borehole / Dynamic probe) if this is available and also the details of the proposed solution
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The table below should be read in conjunction with both the notes on the previous page and those above:

ANCHOR TYPE	T-LOC VERSION	DIMENSIONS L x W x H (mm) (L x W x H inches)	PROJECTED SURFACE AREA Square mm (Square inch)	MATERIALS	TYPICAL LOAD RANGE	MINIMUM DRIVEN DEPTH	Wire	Rod	Chain
B4		310 x 110 x 93 (12.2 x 4.3 x 3.6)	28,600 (44.33)	SG Cast Iron; Aluminium Bronze	10 - 50+ kN (2000 - 11000lbs)	2m	✓	✓	✓
B6		336 x 206 x 91 (13.2 x 8.1 x 3.6)	45,500 (70.52)	SG Cast Iron; Aluminium Bronze	15 - 60+ kN (3500 - 13400lbs)	2m	✓	✓	✓
B8		423 x 259 x 105 (16.6 x 10.2 x 4.1)	71,500 (110.82)	SG Cast Iron; Aluminium Bronze	25 - 75+ kN (5500 - 16500lbs)	3m	✓	✓	✓
B10		541 x 335 x 110 (21.3 x 13.2 x 4.3)	115,800 (179.49)	SG Cast Iron; Aluminium Bronze	40 - 100+ kN (9000 - 22000lbs)	4m	✓	✓	✓

INSTALLATION EQUIPMENT - UNDERWATER



Light - Our range of stealth anchors up to the S8 can be installed underwater using simple hand tools.

The S2, S4 and S6 variants need only Drive Rod, Platihook (PH1) and as an option our (RR1) Rod Removers. A Sledge Hammer or Post Rammer can be provided or sourced locally. The S8 requires Drive Rods, Manual Stressing Jack (SJ1), Rod Removers (RR1) or perhaps RR2 should be considered.

The Manual Stressing Jack will provide up to 10kN uplift to load lock and proof test the anchors. For multiple installations the use of hydraulic underwater tools is advised due to fatigue issues at depth.

Medium - The installation of the larger S8 stealth anchor and B4, B6, B8 Bat anchors require the use of hydraulic equipment and multi-piece drive rods.

Over many years we have developed a range of bespoke equipment to provide installation contractors well engineered, high quality, practical tools designed for sustained use in a commercial marine/underwater environment.

Heavy - The B8, B10 Bat anchors should be considered as options for poor ground conditions (soft clays) as the installation of these using a hand held breaker in sandy soils may prove difficult and trials may be necessary.

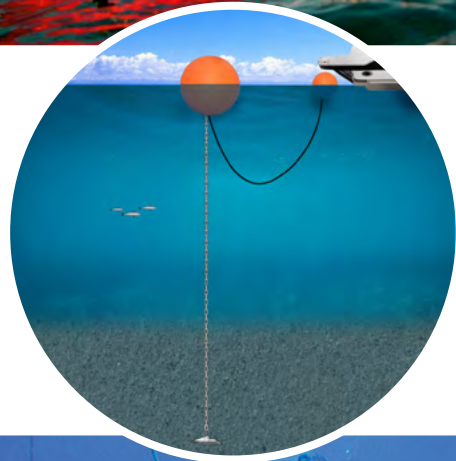
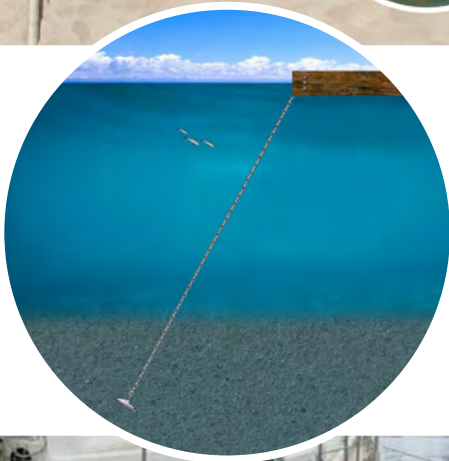
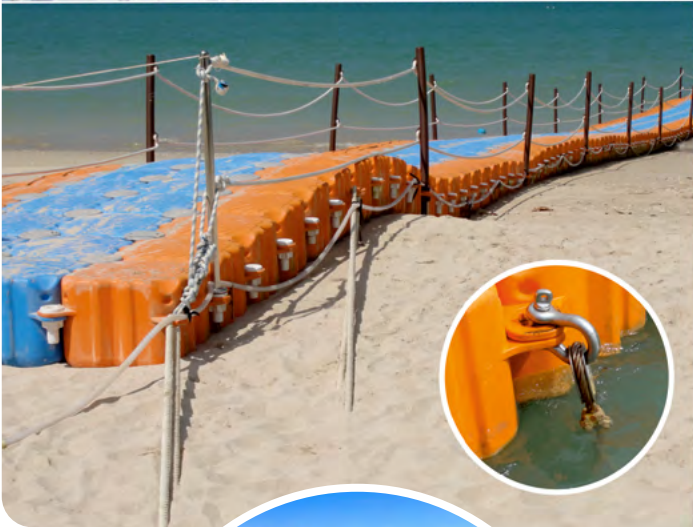
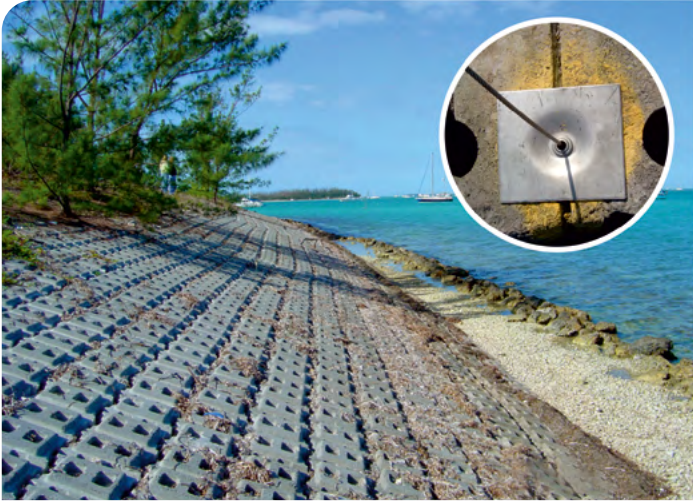
Dependent on the depth of the installation it may be possible to install the anchors from work boat platforms with dry side hammers mounted on suitable excavator arms. The anchors can then be loaded using the work boat crane or if the surface below is suitable one of our hydraulic jacks with a hydraulic source topside.

All the equipment has double seals (where necessary) to stop the ingress of saltwater for installation depths up to 15m. Hydraulic rams and couplers are all in stainless steel to avoid corrosion issues and serviceability. All the tools are designed for biodegradable oils.

IMPORTANT NOTES - *The anchors are only as good as the soil and depth they are placed. Additionally if the anchors are not loadlocked into their working position it is highly likely they will fail. Dependent on the size of anchor and its intended application the liability of the risk increases. It is highly recommended that only qualified installation teams use our installation equipment and all anchors should be individually loadlocked and proof tested.*

Furthermore the dive teams should label each anchor point and provide a log to the client detailing the loads achieved / set and warrant / guarantee the installation. This will raise the standard of the solution, provide confidence and ensure the quality of every installation.

APPLICATIONS - UNDERWATER - SHALLOW



APPLICATIONS - UNDERWATER - DEEP SEA (Case Study)

Anchoring of an offshore pipeline protection structure (150m)

A total of 32 Platipus anchors were used to anchor down the pipeline tie-in protection structures at separate localities within the North Sea. (see Figure 1)

An ultimate load of 35kN was required for each anchor point and due to the differing nature of the geology at both sites, two anchor specifications were designed. At the first site in the southern sector, cohesive material was experienced and a B6 anchor complete with 4m of 8mm stainless steel compacted strand wire tendon, 300mm x 300mm stainless steel load plate and wedge grip was installed. The non-cohesive material found at the northern sector resulted in a S8 anchor configuration being used.

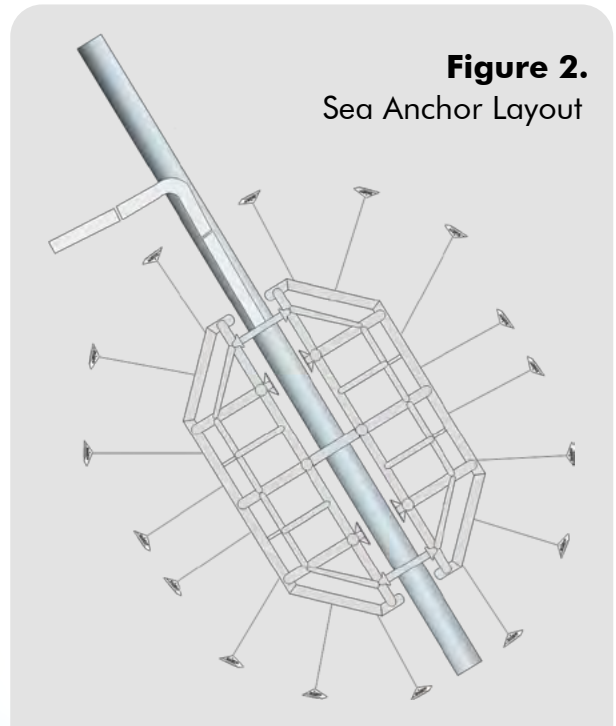
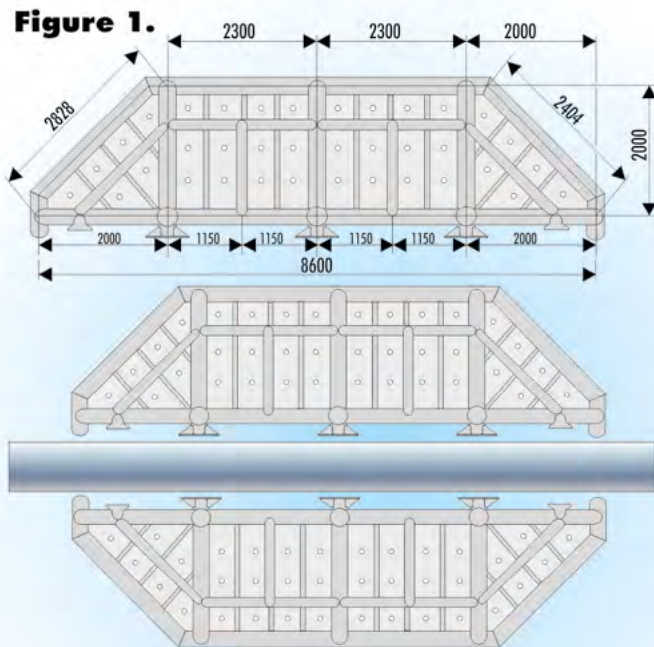


Figure 2.

Sea Anchor Layout

Soil Conditions:	Stiff grey clay Medium sand
Location:	North sea
Water Depth:	150m
Installation Method:	Divers
Design Life:	100 years
Required Load:	35kN/anchor

Both types of anchor were installed at an angle of 25° to a depth of 3m. Each anchor was proof loaded to 35kN and locked on to the structure. (see Figure 2)

The anchors were installed 150m below sea-level using saturation divers. The installation equipment used included a multi-piece drive rod set driven by a heavy duty hydraulic breaker with quick release coupling hoses. Power to the equipment was supplied by a surface deepwater construction support vessel. The anchors were loadlocked using a Platipus hydraulic stressing kit specifically adapted for subsea use. The anchor specification had a design life of 100 years.

We have provided many solutions like this for the gas and oil industry in the North Sea and worked closely with Stena Seaway and Stolt Comex amongst other specialists.



APPLICATIONS - MARINE & SHORELINE

Please refer to our *Platipus Civil Engineering & Construction* brochure for more information or alternatively download this brochure from our website at www.platipus-anchors.com



EROSION CONTROL



COASTAL EROSION



APPLICATIONS - MARINE & SHORELINE

SCOUR PROTECTION



SEAWALLS



APPLICATIONS - MARINE & SHORELINE

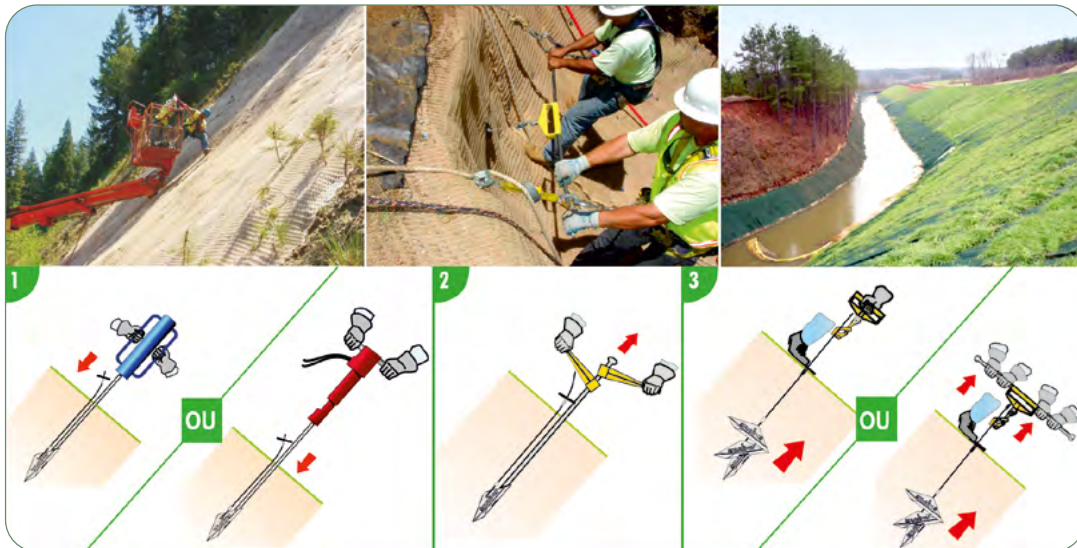
Please refer to our **Platipus ARGs® (Anchored Reinforced Grid Solutions)** brochure for more information or alternatively download this brochure from our website at www.platipus-anchors.com



PLATIPUS ANCHORED REINFORCED GRID SOLUTIONS

The Platipus® Anchored Reinforced Grid Solution (ARGS) is a perfect low impact anchoring solution for surface erosion problems and shallow seated slide failures. These lightweight systems can be used with most geosynthetic products including erosion control matting, membranes, geogrids, reinforced mesh, high density polyethylene coverings and cellular confinement systems.

Our S2, S4 and S6 Percussive Driven Earth Anchors (PDEAs) are particularly effective in situations where access is difficult, where scour protection is required for example flood prone areas, riverbanks and storm water channels. Benefits of the system include its speed and simplicity, in most cases, requiring only hand held equipment for installation. The system provides immediate load bearing capability and when combined with geosynthetic products and an appropriate range of plant types it can retain the slopes surface integrity. Our solutions can incorporate products from all major manufacturers to provide the best complete solution.



PLATI-DRAIN®

Water saturation, due to heavy rainfall and insufficient drainage, leads to the softening of clay soils within slopes and increases hydraulic forces behind earth retaining structures. Plati-Drain® is a unique solution that reduces pore water pressure within clay slopes and behind retaining walls. Unlike conventional weep holes Plati-Drain® provides deep penetration. It can also help prevent shallow or deep seated slope failures.

Available as a 'Passive' or 'Active' solution. The 'Passive' system uses a sacrificial anchor head to drive the Plati-Drain® into its optimum position providing an immediate channel for water to drain. The 'Active' system has an additional wire tendon attached to the anchor which allows it to be loadlocked, providing simultaneous draining and restraining capability.



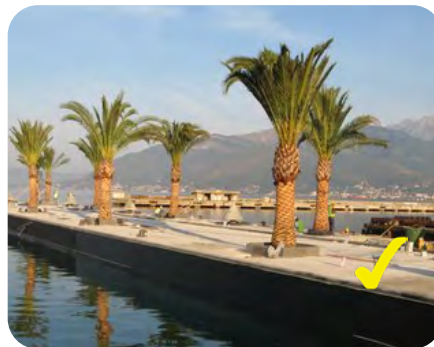
TREE ANCHORING SYSTEMS - PALM TREES

Please refer to our *Platipus Tree Anchoring Systems brochure* for more information or alternatively download this brochure from our website at www.platipus-anchors.com



There is a general trend across the world to plant much taller trees of all species, including Palm Trees. Traditionally these have been planted without support or are supported using unsightly wooden props; sometimes with disastrous results. Platipus®, in conjunction with Landscape Architects and Palm Tree Nurseries, have refined our underground tree anchoring system to meet the demand of anchoring these large rootballed or container grown Palm Trees. Available as a 3 leg or 4 leg system these solutions offer an instantly attractive finish to any landscape.

3 Leg System



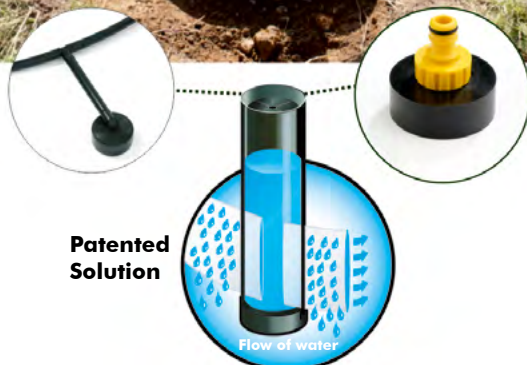
4 Leg System



The use of a 'targeted' irrigation system that delivers water and air directly to the rootzone provides a huge benefit to the development of the tree.

The New Piddler tree irrigation system offers the following improvements over traditional watering systems:

- **Effective supply of water evenly around the rootball**
- **Minimal waste - no run off or evaporation**
- **Easy watering with hose pipe through debris cap or pressurised adapter**
- **Quick to assemble and tailor to size**
- **Compact system offers significant freight cost savings over traditional pipe solutions**



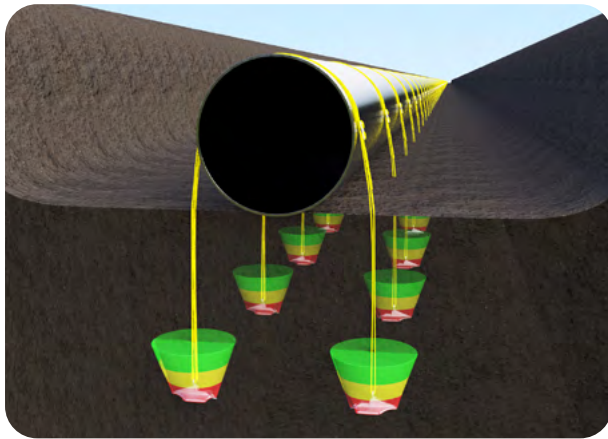
APPLICATIONS - MARINE & SHORELINE

Please refer to our *Platipus Pipeline Buoyancy* brochure for more information or alternatively download this brochure from our website at www.platipus-anchors.com



Over the last decade, we have made a considerable investment into the Research and Development of a range of anchor systems specifically suited to the Pipeline Industry. This has led to the successful completion of a number of major pipeline buoyancy control projects both on and off-shore.

Working together with leading manufacturers of technical ropes, braids and webbing we can now offer systems with the following advantages:



- **Proven design solutions for buoyancy control**
- **Significant cost savings over traditional mass concrete and pipe coating**
- **Minimal environmental damage**
- **Proof testing of each anchor upon installation**
- **Application designed webbing for fast installation without damage to pipes or their coating**
- **Installation before or after the pipe is laid**
- **No specialist installation equipment required**
- **Flexible anchor selection for varying soil conditions**



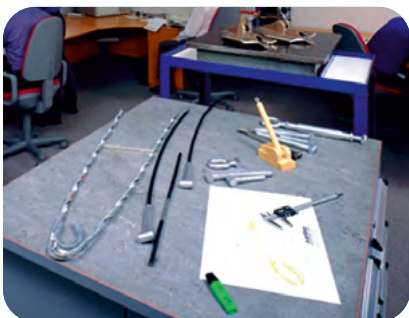
ABOUT DESIGN ASSISTANCE



As part of our commitment to offer a complete package for clients, a full Indemnified Design service is available through our Geotechnical Engineer. These comprehensive designs are covered by Professional Indemnity Insurance.

A typical Indemnified Design will provide a calculation of earth pressures, prevailing and proposed factors of safety and specific earth anchoring system proposals.

RESEARCH & DEVELOPMENT



Platipus® works at the leading edge of ground anchoring and to remain market leaders involves continuous development in product innovation and design.

New and unique applications for our products are constantly being identified. Working closely with customers, distributors and our Regional Managers new system designs are continually being launched into the market.

TECHNICAL PRESENTATIONS



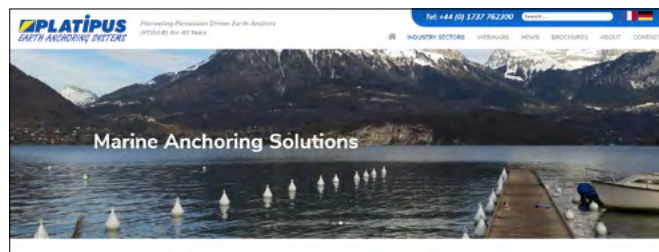
We understand the importance of Continued Professional Development. Our philosophy is to offer busy professionals the opportunity to discover the advantages of the Platipus® Earth Anchoring System through comprehensive technical presentations, at a time and location convenient to you. This may take the form of a focused 1 to 1 introduction to our products or more formal presentation to a larger group.

If you would like a technical presentation please contact us to arrange a suitable date and time.

PLATIPUS ONLINE

The Platipus® website is a quick and easy way to access the latest information. It contains over one hundred pages of product information, brochures, case studies, installation instructions and other technical documents. All are available to print or download.

Visit: www.platipus-anchors.com



We are pleased to operate the necessary standards to maintain ISO 9001 for both our QUALITY MANAGEMENT AND DESIGN SYSTEMS

ISO 9001

PATENTS & TRADEMARKS



Worldwide patents are applicable on a variety of products. Additional patents pending. The trademark 'PLATIPUS' is registered worldwide. All patents and trademarks are the sole property of the company.



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