PLATIPUS
EARTH ANCHORING SYSTEMS

ASP
Enterprises

ARGS®

Anchored Reinforced Grid Solutions

Brochure

INTRODUCTION TO ARGS®
Anchored Reinforced Grid Solutions

Stabilizing slopes offers many significant challenges. Platipus® combine Percussion Driven Earth Anchors (PDEA®) with a suitable surface or facing material to make an Anchored Reinforced Grid Solution (ARGS®). The ARGS® System is ideal for stabilizing slopes where over steepening, excess water, poor drainage or lack of deep rooted vegetation have caused erosion or instability.

The ARGS® System offers many advantages over traditional solutions:

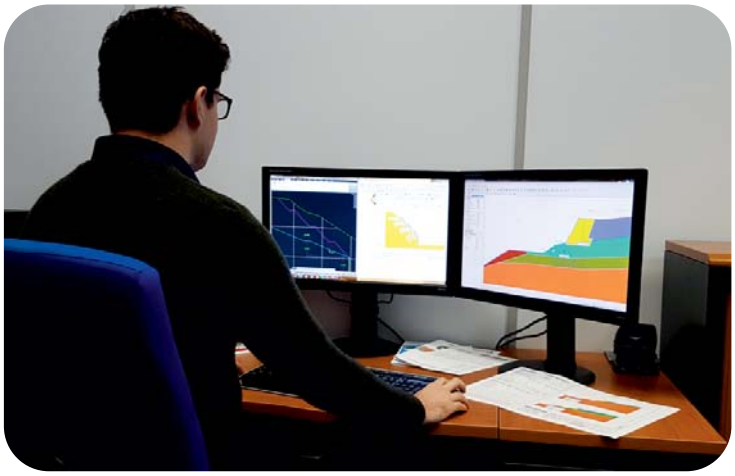
- Simple and cost effective
- Fast and easy installation
- Immediately quantifiable anchor loads
- Low environmental impact
- Encourages re-vegetation
- Can be used with most surface or facing materials
- Incorporating Plati-Drain® can reduce pore water pressure

DESIGN LIFE

Platipus ARGS® Systems are designed to meet the engineers requirements for the project.

TECHNICAL GUIDANCE & SUPPORT

With over 35 years' experience and thousands of successful projects worldwide we offer pre-contract site evaluation and anchor testing together with on-site training and support. In addition, we are able to provide real time technical guidance at all stages of the design and installation process allowing for greater engineering confidence. As part of our commitment to offer a complete package, a System Proposal outlining possible anchoring solutions/specifications, suitable for your project, can be provided at no charge. We understand that each project is unique and suggest that the design of every slope is approved by a qualified engineer.

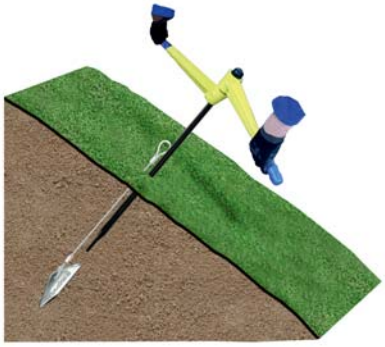


'SIMPLY' HOW A MECHANICAL ANCHOR WORKS

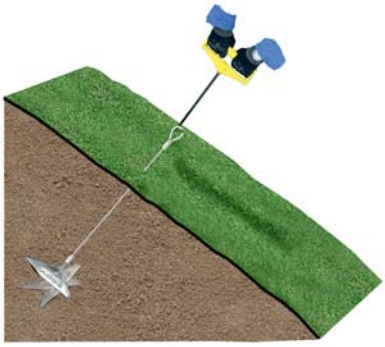
There are three steps to the installation of an anchor system:

1. DRIVE THE ANCHOR

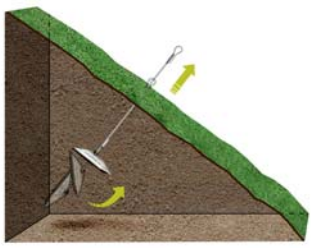
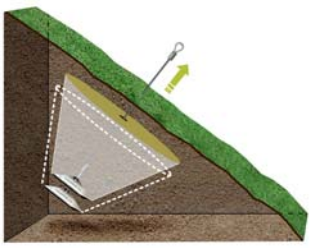
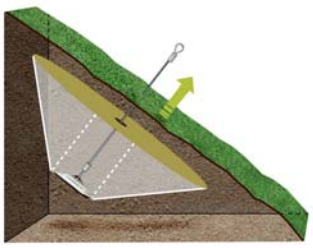
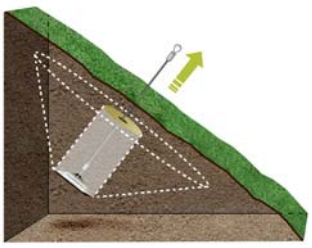
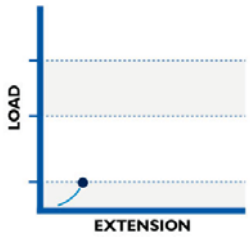
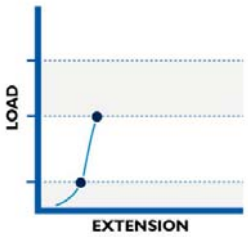
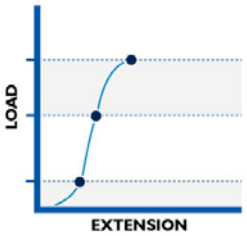
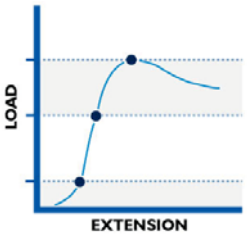
2. REMOVE THE DRIVE ROD



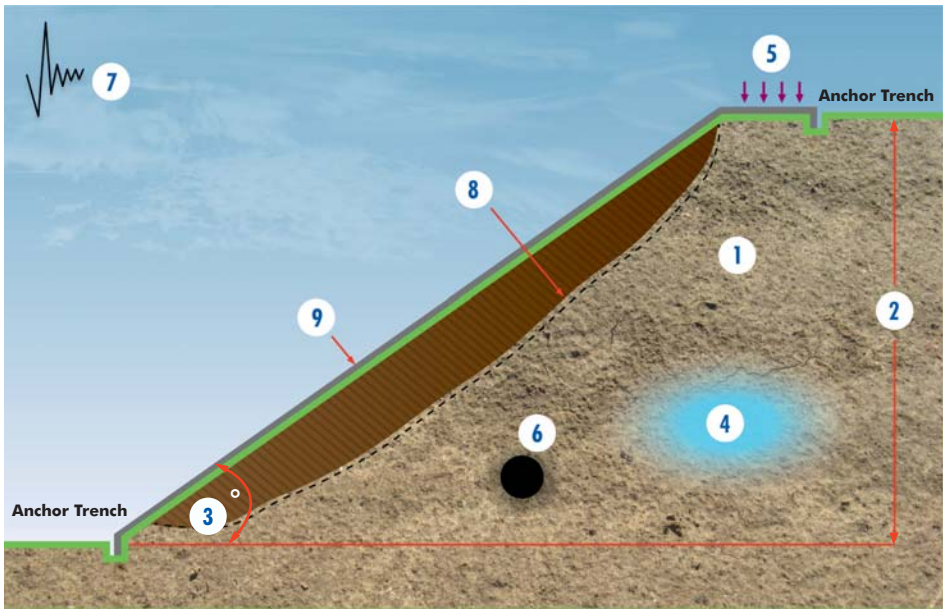
3. LOADLOCK THE ANCHOR



TYPICAL ANCHOR BEHAVIOR

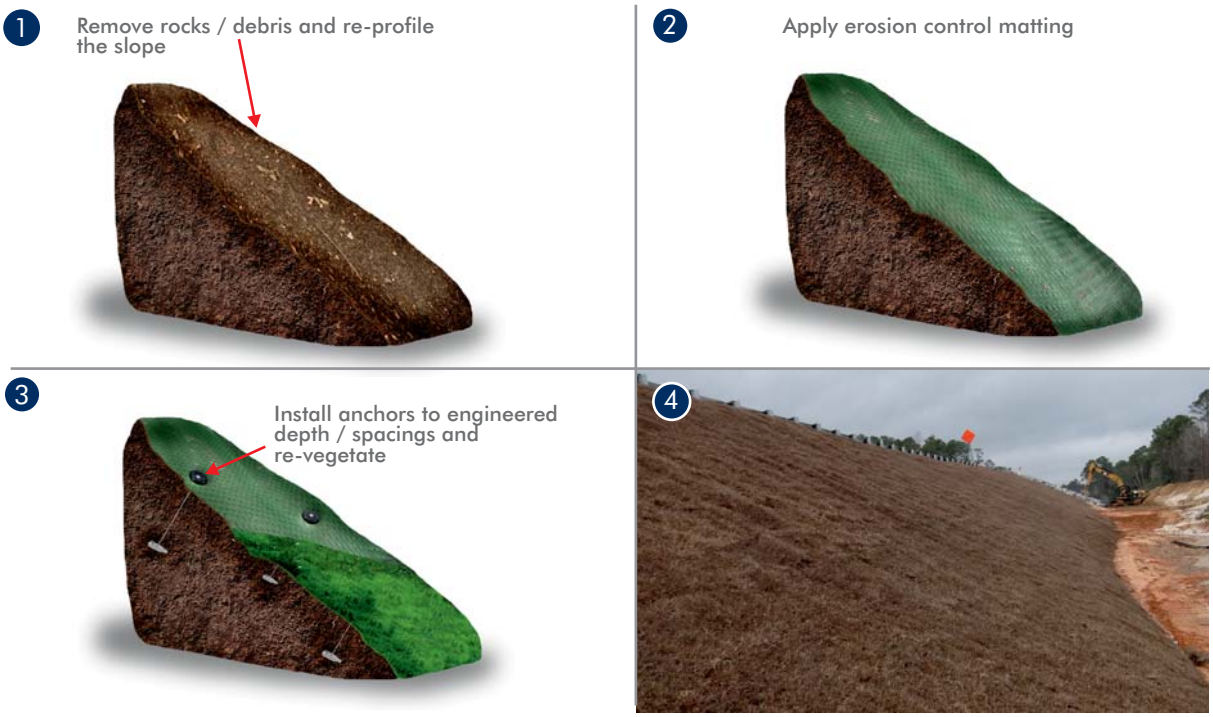
LOADLOCK	COMPACTION AND LOAD	MAXIMUM LOAD RANGE	BEARING CAPACITY FAILURE
			
The first stage is where a load is applied to rotate the anchor into its loadlocked position. Elements of both load and extension are present.	The second stage is where the anchor system is generating a frustum of soil immediately in front of the anchor. At this point load normally increases with minimum extension. The soil type will affect the overall extension.	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.	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 soil.
			

DESIGN CONSIDERATIONS



1. What is the soil type / conditions where the anchor will reside?
2. What is the vertical height of the slope?
3. What is the slope angle?
4. Is the slope affected by pore water pressures or does it have an elevated water table?
5. Is there a surcharge affecting the slope?
6. Are there any buried services which may obstruct the anchor?
7. Is the site within a seismically sensitive area?
8. How deep is the critical failure plane and has movement already occured within the slope?
9. What facing material is locally available?
10. What is the desired factor of safety for the slope (usually between 1.2 to 1.5)?
11. What is the design life?

ARGS® - EROSION CONTROL



PLATIPUS® S2 GEO / S2 ARGS®

The Platipus® S2 GEO / S2 ARGS® System comes in a variety of configurations. The S2 GEO has a field swaged top component, while the S2 ARGS® anchor includes a self-setting wedge grip. See individual project details for specifications.

PLATIPUS® S2 ZIP ANCHOR

The S2 Zip Anchor is a reliable low cost solution. It can be installed, in a wide range of soils, using simple hand tools. The system's unique design incorporates Platipus T-Loc technology with a simple 'cable tie style' strap to receive an adjustable self-locking load plate. It's quick to use and offers a much more reliable alternative to traditional pins which can easily pull out.

Surface Materials

S2 ZIP

- Landfill Rain Covers
- Waste Containment
- Erosion Control Blankets

S2 GEO / S2 ARGS®

- Turf Reinforcement Matting
- Geotextiles / Geogrids
- HDPE Coverings
- Turf Pavers
- Lightweight Concrete Flexacrete

PROJECT EXAMPLES
Erosion Control

SURFACE EROSION



FLOOD PREVENTION



OVERFLOW RETENTION POND

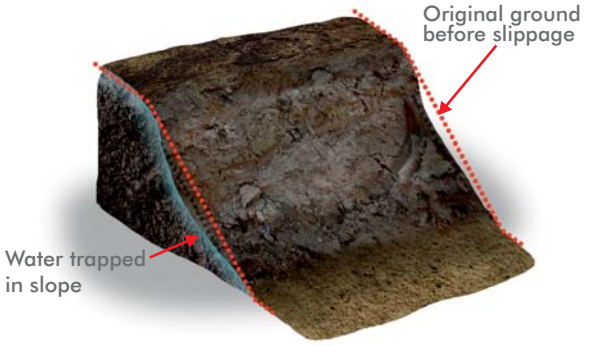


STORM WATER PROTECTION

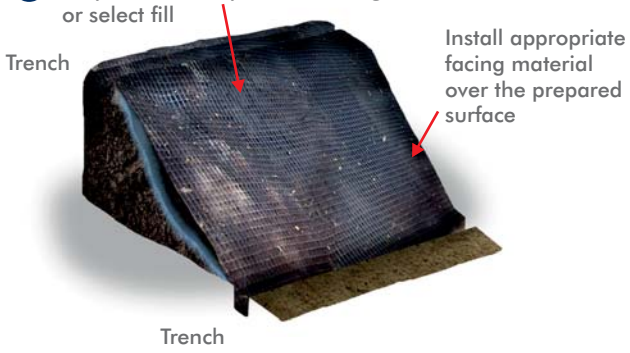


ARGS® - SHALLOW SLIDE PROTECTION

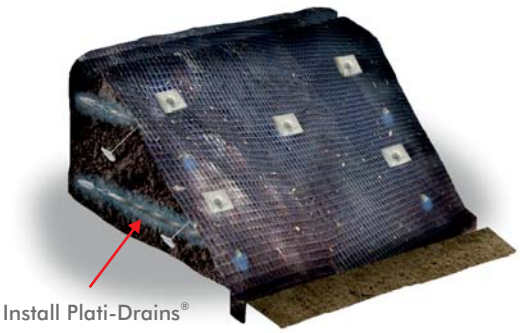
1



2 Re-profile the slope with existing material or select fill



3 Install anchors and re-vegetate



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PLATIPUS® S4 & S6 ARGS®

The Platipus® S4 & S6 ARGS® System assembly comes in a variety of configurations and can vary on a project by project basis. See individual project details for specifications.

Surface Materials

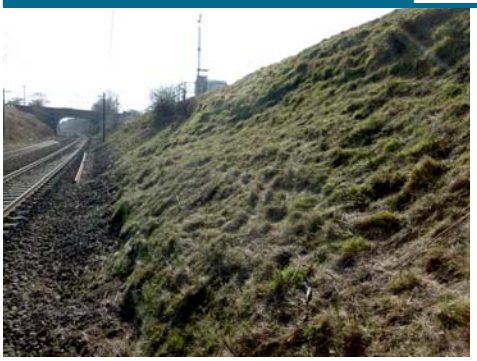
- High Performance Turf Reinforcement Matting (HPTRM)
- High Strength Geotextiles & Geogrids
- Wire Mesh
- Articulated Concrete Blocks (ACBs)
- Landfill Liners

PROJECT EXAMPLES
Shallow Slide Protection

SLIDES



SLOPE REMEDIATION



LANDFILL CAPPING

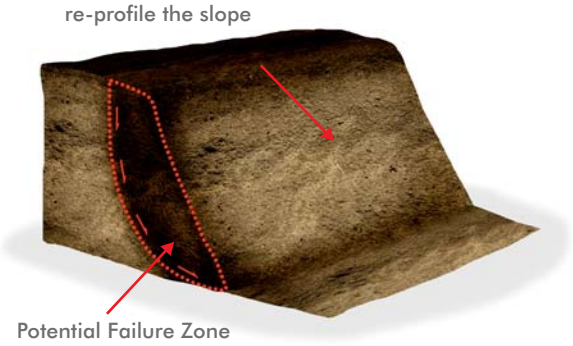


LEVEE PROTECTION & OVERTOPPING



ARGS® - DEEP SEATED FAILURES

1



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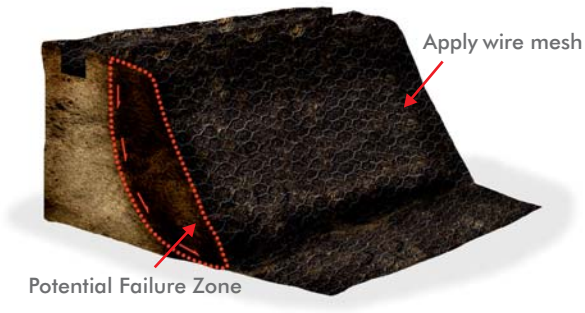

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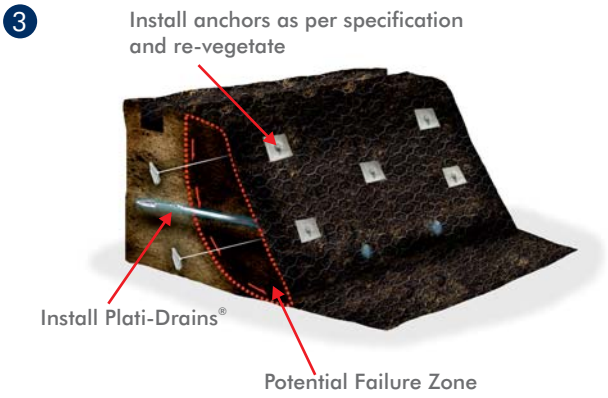

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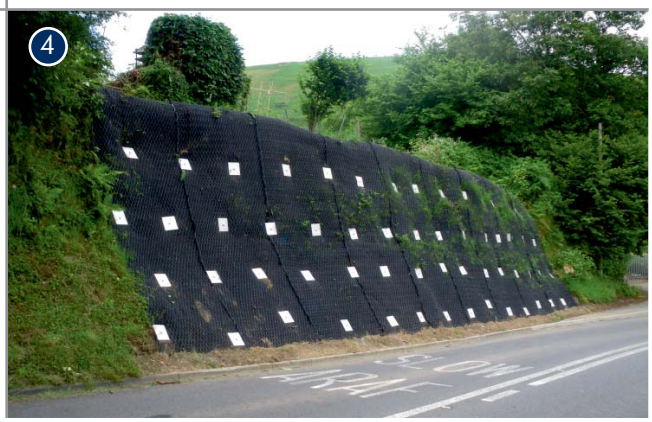


PLATIPUS® STEALTH & BAT ANCHOR SOLUTIONS

Deep seated failures can be supported using larger Stealth and Bat anchors along with a solid geotechnical engineered design. In conjunction with our online Anchor Load Indicator guideline software an Engineer can design a low impact economical solution. Typically this begins with a review of the soils report and installation of a test anchor to prove the holding requirements are met.

Surface Materials

- High Strength Geotextiles
- Shot Crete
- Wire Mesh
- Rockfall protection netting

PROJECT EXAMPLES
Deep Seated Failures

TEMPORARY STABILIZATION



PERMANENT SLOPE REINFORCEMENT



PERMANENT SLOPE REMEDIATION

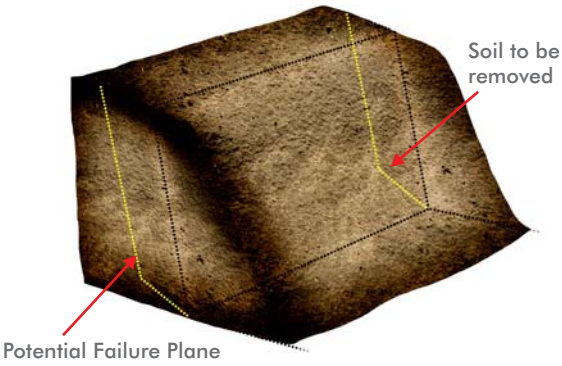


DIFFICULT ACCESS



ARGS® - CUT FACE SLOPES

1



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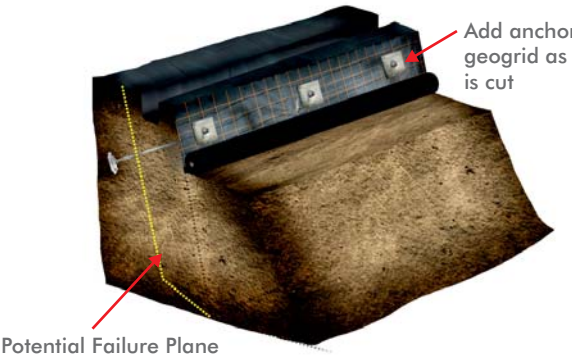

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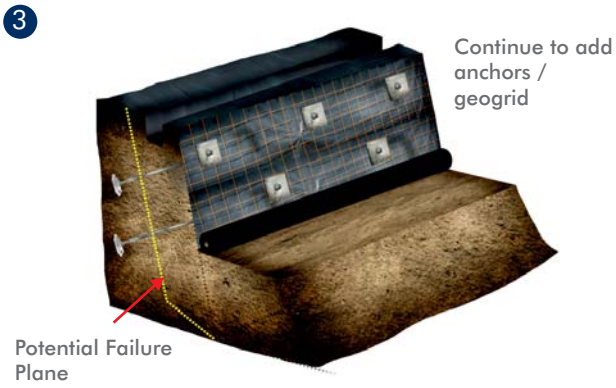


4

PLATIPUS® STEALTH AND BAT ANCHOR SOLUTIONS

Cut face slopes can be supported using larger Stealth and Bat anchors along with a solid geotechnical engineered design. In conjunction with our online Anchor Load Indicator guideline software an Engineer can design a low impact economical solution. Typically this begins with a review of the soils report and installation of a test anchor to prove the holding requirements are met.

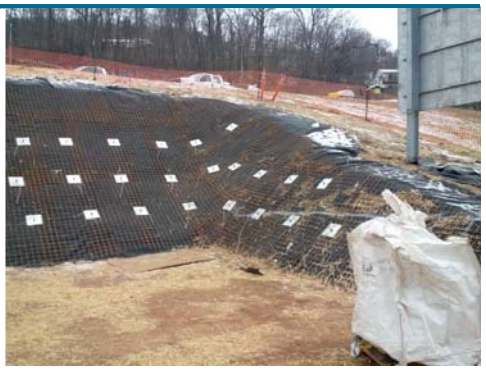
Facing Materials

- Segmental Concrete Blocks
- Poured in Place Concrete Wall
- Vegetated Wire Baskets
- Rock Filled Gabion Baskets
- Sheet Piling
- Timbers
- Shot Crete

PROJECT EXAMPLES
Cut Face Slopes

HYBRID WALLS


TEMPORARY WORKS

DEEP EXCAVATION

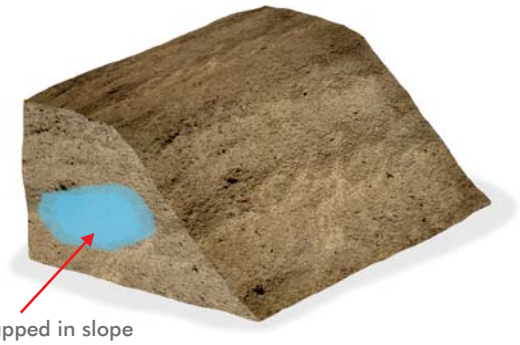


GABION SUPPORT



DRAINAGE SOLUTIONS

1

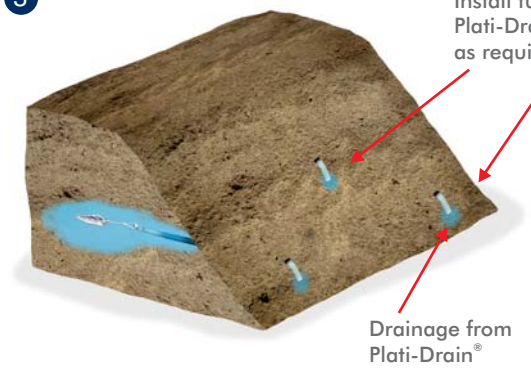


Water trapped in slope

2

Drive Plati-Drain® into optimum position

3



Install further Plati-Drains® as required

Drainage from Plati-Drain®

4

PLATI-DRAIN®

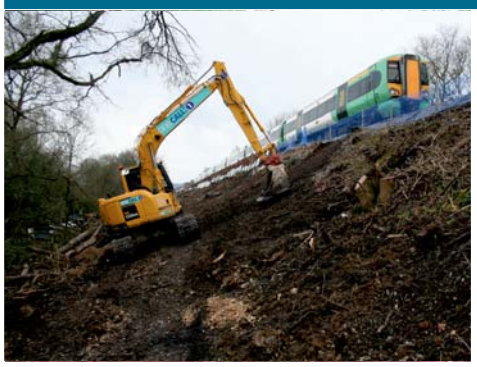
Water saturation, due to heavy rainfall and insufficient drainage, leads to the softening of clay soils within slopes and increases hydraulic forces behind earth retaining structures.

Plati-Drain® is a unique patented solution that reduces pore water pressure within clay slopes. It can provide deep penetration in excess of 10m / 33' and can also 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.

PROJECT EXAMPLES
Drainage Solutions

DEEP SLOPE PENETRATION



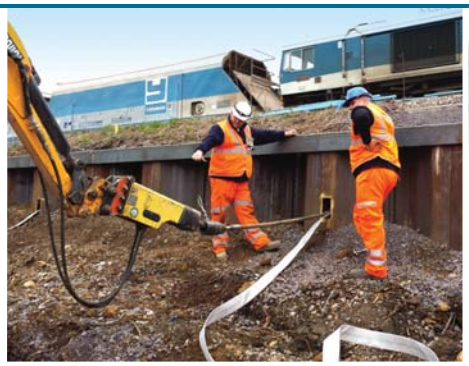
EMERGENCY DRAINAGE



INCREASE SLOPE STABILITY



PASSIVE PLATI-DRAINS


CASE STUDY

Mariscal Sucre International Airport Access, Quito - Ecuador

Project Specification

Steep cuts along the newly constructed access road to the airport required surface protection against deep erosion and shallow surface sliding. Traditional shotcrete methods were used on much of the easy access areas. The extremely high slopes posed difficulties for traditional methods so Platipus introduced the Anchor Reinforced Grid Solution (ARGS®) to protect the surface. The solution was employed and recently withstood a 5.1 earthquake on August 12th 2014 while other unprotected areas experienced some failures.

Solution

The cut slopes were first protected with 2 layers of erosion control materials. The first provided the erosion protection and kept the surface soil from sliding down the slope. The top layer provided the strength to handle the load generated by the Percussion Driven Earth Anchor (PDEA®) as well as UV protection.

CASE STUDY
M4 Motorway Widening, Sydney - Australia

Project Specification

An 11m high steep slope supporting the M4 Motorway required stabilizing as part of the WestConnex infrastructure project which aims to reduce the journey time between Sydney Airport and Parramatta. 7.5km (4.6 miles) of the M4 Motorway is being expanded to 4 lanes and a temporary works embankment was used to enable the construction of a permanent concrete panelled wall.

Solution

The Platipus Percussive Driven Earth Anchor (PDEA®) stabilized the temporary embankment using B6 and B8 anchors driven to 8m (26.2ft). Cirtex Australia provided both design and installation support. The Platipus anchors were installed using locally available equipment and were loadlocked and set with immediately quantifiable loads offering significant cost savings to the contractor and client over alternative methods.

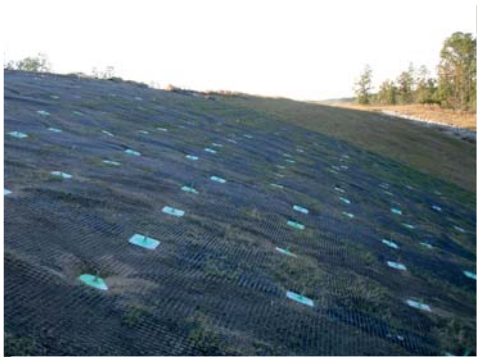
CASE STUDY
US Highway 98, Mobile Alabama - USA

Project Specification

The Alabama Dept. of Transportation's Geotechnical Engineering units tasked TTL Inc to perform a temporary shallow plane failure repair while engineering a permanent embankment stability solution. This site was suffering from shallow plane failures, rill erosion, regressive failures and tension cracks. Through solid engineering practices and on site preliminary anchor testing provided by Platipus it was determined that TTL could provide a solution that would solve the immediate concerns as well as providing the long term 50 year design with the use of Platipus anchors and a permanent surface protection material.

Solution

The slope was re-graded and Platipus Anchors / Plati-Drains® were installed by Bridge Creek Construction, a certified Platipus installer, to a depth of 20' (6m) with a working load of 4,000 lbs (18kN) and a proof load of 6,000 lbs (27kN). The surface of the slope was then covered with a permanent UV stabilized geogrid and re-vegetated. The Anchored Reinforced Grid Solution (ARGS®) provided the opportunity for the Engineer to model the failure and determine the necessary anchor capacity and spacing. In process load testing verified the design through the entire process. The site was then able to be vegetated and put back to an aesthetically pleasing environmentally sound state.



CASE STUDY
Savièse Slope Stabilisation - Switzerland

Project Specification

Soon after this 14m (46ft) high slope had been excavated for a new building, a section of the slope failed due to unforeseen ground conditions leading to the immediate closure of the site. Before construction could continue an urgent solution was required to permanently secure the entire slope. Platipus Percussion Driven Earth Anchors (PDEA®) were proposed through their partner, Anteq SA, and were selected due to a number of key factors: suitable granular material, easy installation in extremely limited space & immediate availability of products.

Solution

This 500m² (5381sq ft) slope was safely secured in two main anchoring stages: Firstly the lower half, which consisted of 4 rows of B4 anchors driven to a depth of 9m (29.5ft), installed using a 'spider' excavator and proof tested to 90kN (20233lbs) each. Secondly the top half, where 5 rows of the smaller S6 anchor were installed using a handheld pneumatic hammer from a mobile platform to a depth of 4m, each proof tested to 30kN (6745lbs). The 55° re-profiled slope was completed using a Maccaferri geomat providing a secure and smart finish to the project.

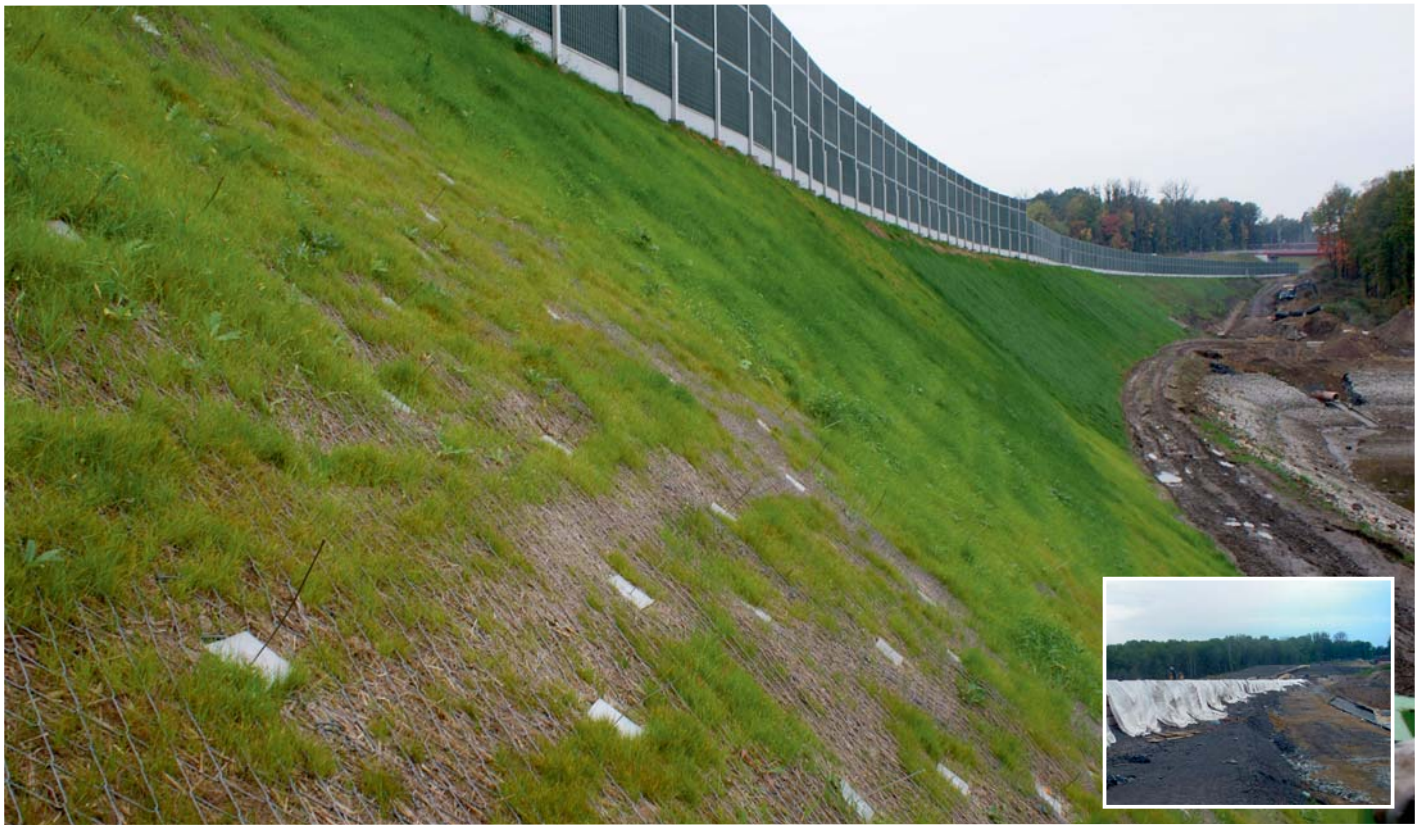
CASE STUDY
A1 Autostrada, Majiejow, Piekary - Poland

Project Specification

The A1 Autostrada is a north-south motorway that runs 568km (353 miles) through central Poland from Gdansk, on the Baltic Sea, through Lódz, to the Polish border in Gorzyczki where it connects to the Czech D1 motorway. As part of an upgrade a new section of motorway was constructed between Piekary and Maciejów which required an anchoring solution to secure all of the facing materials to three large new slopes.

Solution

Early site testing revealed that the compacted granular fill was ideal for the Platipus mechanical anchor confirming that the small S6 anchor would easily achieve the 10kN (2249lbs) ultimate load required by the Designer. Once construction of the motorway section was complete, soil was imported to create a new slope profile.
A hydroseed mix was then sprayed over the freshly imported soil and a combination of coir mat and Geobrugg Tecco Mesh was secured tightly in place, by the Platipus S6 ARGS® anchor system, to encourage immediate vegetation of the slope. Due to the height and gradient of the slope a hydraulic work platform was used to allow quick installation of the anchor system; using simple hand held equipment. On average a total of 130 anchor systems were installed each day which was much more than initially expected.



CASE STUDY
A57 Land Slip - Slope Reinforcement - UK

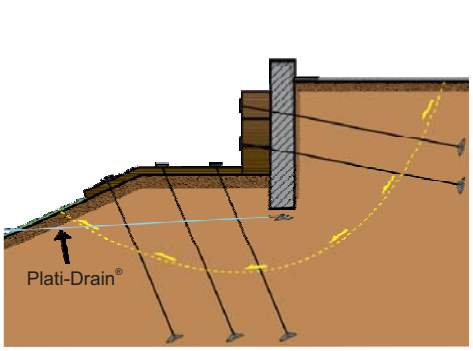
Project Specification

A landslip along a 100m (328ft) stretch of the A57 Manchester Road just outside Sheffield resulted in a partial road closure whilst remedial solutions were considered.

Solution

Platipus Anchors were approached by Amey Consulting to work with them developing an anchored solution for remediation of what the Engineer deemed to be a deep seated failure. Starting with a simple conceptual cross-sectional sketch and a Ground Investigation report, Platipus carried out extensive site testing to prove the performance and 'drivability' of a range of anchor systems.

Amey were responsible for the global design while Platipus Geotechnical Engineers designed and indemnified the Anchor specification to meet the Engineer's requirements. A row of Plati-Drains® were introduced towards the toe of the slope to reduce pore water pressure.



CASE STUDY

Winston Salem State University, North Entry Parking - NC, USA

Project Specification

To provide much needed access to two remote parking lots at Winston Salem State University, a bridge was built that will cross over an existing rail line and connect the lots to the main campus. The owner of the railroad, Norfolk Southern, would not allow the newly built bridge to be accessed until an adjacent abutment that had begun to slough was reinforced. The railroad felt there was a risk that the vibrations caused by passing trains could lead to a shallow plane failure.

Solution

The Platipus ARGS® (Anchor Reinforced Grid Solutions) system was specified by a local Geotechnical Engineer who was very experienced in the local geology of the Piedmont region. Summit Design and Engineering performed a global stability analysis and concluded that the depth of failure was approximately between 5 –10 feet deep. The design included a grid patterned of 2 TN anchors being driven to a minimum depth of 15' and pre-tensioned to 2,000 lbs. After all the anchors were tensioned, the slope was covered in a 4" thick reinforced concrete face including a 4"x4" welded wire mesh. The load plates and wedge grips were post tensioned to the concrete face once the concrete facing had cured.

CASE STUDY
Midshore I Landfill - Easton, MD - USA

Project Specification

Maryland Environmental Service (MES) owns and maintains the Midshore Regional Solid Waste System in a region that serves 140,000 residents on the eastern shore of Maryland's Chesapeake Bay. The 175 acre (708,200m^2) Midshore I closed in 2010 after operating successfully for 20 years. MES chose to cover the landfill with an Exposed Geomembrane Cover (EGC.) Designed to protect the environment and minimize the need for ongoing maintenance, the EGC also allows for future use of the landfill.

Solution

The EGC design specified an HDPE 60mil (1.5mm) geomembrane liner secured with Platipus Percussive Driven Earth Anchors (PDEA®) as a cost effective and easily installed alternative to traditional vertical trenching. The Platipus anchor assembly was manufactured with components to meet the holding capacity and 20-year design life required by Geosyntec Consultants/MES in this highly corrosive environment. The anchor was driven through the liner and into 4-5 feet (1.2 – 1.5m) of compacted waste. The pull out resistance was then field tested to meet the engineered wind and LFG uplift requirements of 1,800 lbs (8kN). Once the anchor assembly was fully installed and tested, a HDPE patch was placed over to create an impermeable system.

CASE STUDY
Orford Levee Improvement - UK

Project Specification

The Orford Estuary Defence Levee protects the town of Orford and surrounding farmland. It also carries a public footpath along its crest. The defences, which have dried and cracked, have also, during the last sixty years, settled into the soft silts below by more than 0.5m (1.6ft). Following on from its application in Louisiana, for the US Army Corps of Engineers during the post Hurricane Katrina flood defence improvement, the Orford levee provided another opportunity to trial this innovative method to increase flood resistance. The landward slope is particularly important for the resilience of levees. Experience has shown that prolonged over-topping of the crest will initiate a breach in the defence.

Solution

The solution was to apply double twist rockfall netting to the back and crest of the defence, which was folded back on itself and infilled with engineered clay taken from the adjacent farmland to heighten the defence. The landward side of the defence was protected by continuing the double twist rockfall netting towards the toe of the slope and securing it with two horizontally offset rows of Platipus S6 ARGS anchor assemblies. These were installed on 2m (6.6ft) horizontal centres and driven to a depth of 1.2m (3.9ft). Combining Platipus anchors with double twist rockfall netting in this way significantly increases the duration of overtopping that can be withstood without damage to the turf. In addition to turf reinforcement, a substantial improvement to the factor of safety against rotational slips has been achieved by the use of the anchors. The whole of the defence was seeded using a native grass mix, which grows through the anchored rock fall netting. Since its successful installation, the system has been used as a model for costing defence strengthening for the remainder of the estuary.

INSTALLATION TOOLS

Over many years we have developed a wide range of bespoke equipment to provide customers with well engineered, high quality, durable and practical installation tools designed for sustained use.

LIGHT INSTALLATION

Our range of stealth anchors up to and including the S6 can be installed using simple hand tools. The S2, S4 and S6 variants need only a Drive Rod, RR1 Rod Removers (optional), Plati-Hook (PH1), Plati-Klein (PHK), SJ5 or Setting Plate / Bobbin.

The anchors can be installed using a sledgehammer or postrammer which can be sourced locally. In multiple anchor installations electric, light air or hydraulic hammers make higher production rates fast and easily achievable.

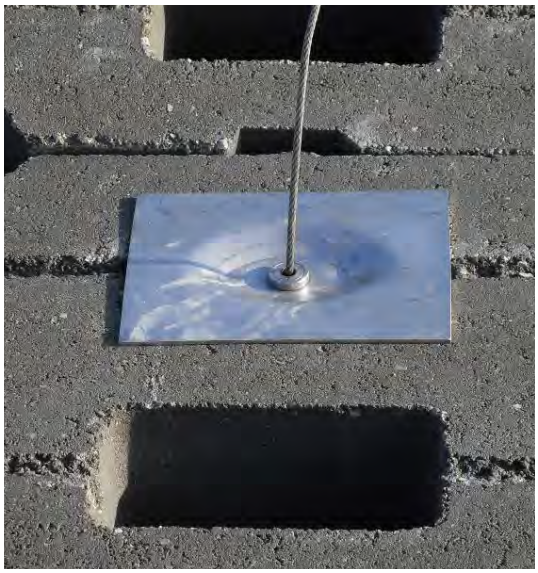
The Manual Stressing Jack (SJ1) will provide up to 10kN of uplift to loadlock and proof test the anchors.

The Stressing Jack (SJ3) is an extremely compact solution for loadlocking / stressing multiple anchor installations particularly on steep slopes up to 10kN.

MEDIUM / HEAVY INSTALLATION

The installation of the S8 and B4 anchors typically require larger installation tools. Manual or Hydraulic Stressing equipment and Rod Removers are useful accessories. For multiple installations the use of hand or powered Hydraulic Stressing equipment is advised.

The B6, B8 and B10 Bat anchors will normally be used in either Deep Seated Failures or Cut Face Slopes. Installation equipment will vary from portable Hydraulic to Machine Mounted Hammers, Drive Rods, Rod Removers and Hydraulic Stressing equipment. In all cases let us advise you of our recommendations for equipment choice based upon your project's criteria.



ASP Enterprises

ASP serves the Midwest including Missouri, Illinois, Nebraska, Kansas & Oklahoma.

P: 636.343.4357 | E: salesasp@aspent.com | W: www.aspent.com

PLATIPUS EARTH ANCHORING SYSTEMS
www.platipus.us

Platipus Anchors Inc,
1902 Garner Station Boulevard,
Raleigh, NC 27603, USA.
T: (919) 662-0991
E: civils@platipus.us

Platipus Anchors Limited,
Kingsfield Business Centre, Philanthropic Road,
REDHILL, Surrey, RH1 4DP, England.
T: +44 (0) 1737 762300
E: info@platipus-anchors.com

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