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ENVIRONMENTAL SOLUTIONS FOR WALLS | SLOPES | WATER APPLICATIONS

綠化護土系統

Slope Greening and Protection System

ABOUT DELTALOK

Deltalok is a versatile civil engineering system designed for erosion control and earth structures.

Deltalok is also a patented system consisting of modular ecology bags and interlocking plates that create a structure to support the earth forces.

In addition, Deltalok is capable of accepting various forms of planting to create an aesthetically pleasing and eco-friendly vegetated system.



Deltalok Interlocking Plate



Deltalok is a permanent, ecological solution.

Structural strength exists even without vegetation.

The modular ecology bag system is constructed with small vertical heights making it easy to build a fairly uniform face.

Deltalok provides mini 'eco-pockets' between each row and each bag where rain water can accumulate and seeds can germinate and thrive on a horizontal surface.

Deltalok allows the root system to penetrate through both the front and back layer of the ecology bag.



Deltalok Near Vertical Retaining Wall

BENEFITS

Environmental

- Friendly to Fish & Wildlife
- Low Environmental Impact (low carbon footprint)
- Anti-Graffiti
- Heat Island Effect Reduction
- Noise Reduction
- Sedimentation & Filtration Capabilities

Functional

- Versatility to use for Walls and Slopes
- Economical Transportation
- Efficient Installation
- No Leveling, Cutting or Waste
- Flexibility Allows to Install Where Others cannot
- Accepts Many Types of Vegetation
- Low Impact Construction



Vegetated Reinforced Soil Slopes



Stream Bank Protection



Infrastructure Solutions

APPLICATIONS

Deltalok is an engineered system designed specifically to provide an environmentally friendly solution for earth structures.

Deltalok creates a reinforced facing option for slopes and walls. The system protects the surface from erosion and provides a natural bed for vegetation which beautifies the structure.

In areas of limited space or access the Deltalok system can accommodate reinforcement using a 'Tie-Back' method of design which does not require geogrid reinforcement. This solution also minimizes excavation requirements.

Applications for Deltalok have included:

- Vegetated Slopes & Walls
- Stream / Waterway Improvements
- Solutions to Infrastructure Projects

VEGETATED SLOPES

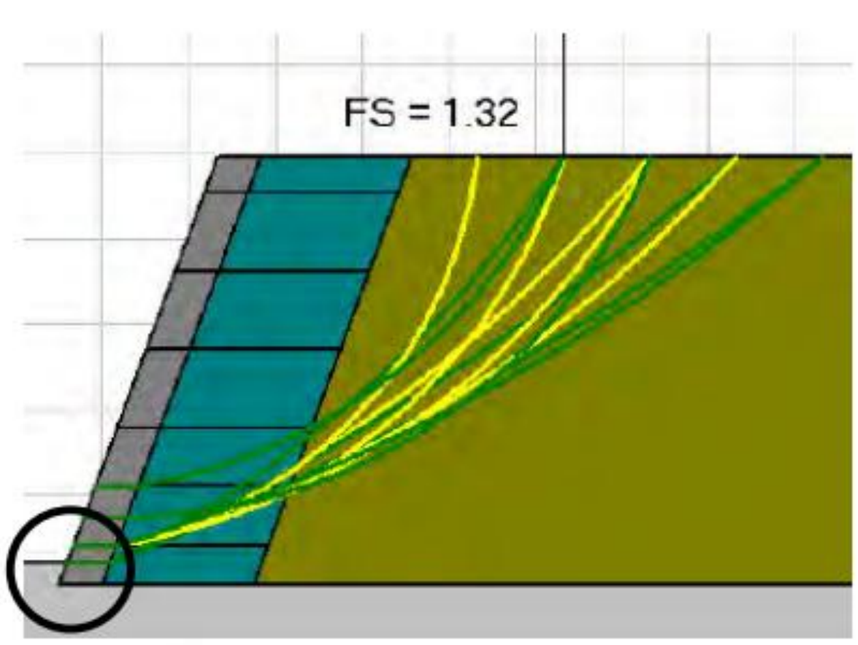
Vegetated reinforced soil slopes provide a significant benefit to highway and commercial construction where there is not enough room for a natural slope.

Deltalok provides speed and efficiency of installation comparable to other modular systems.

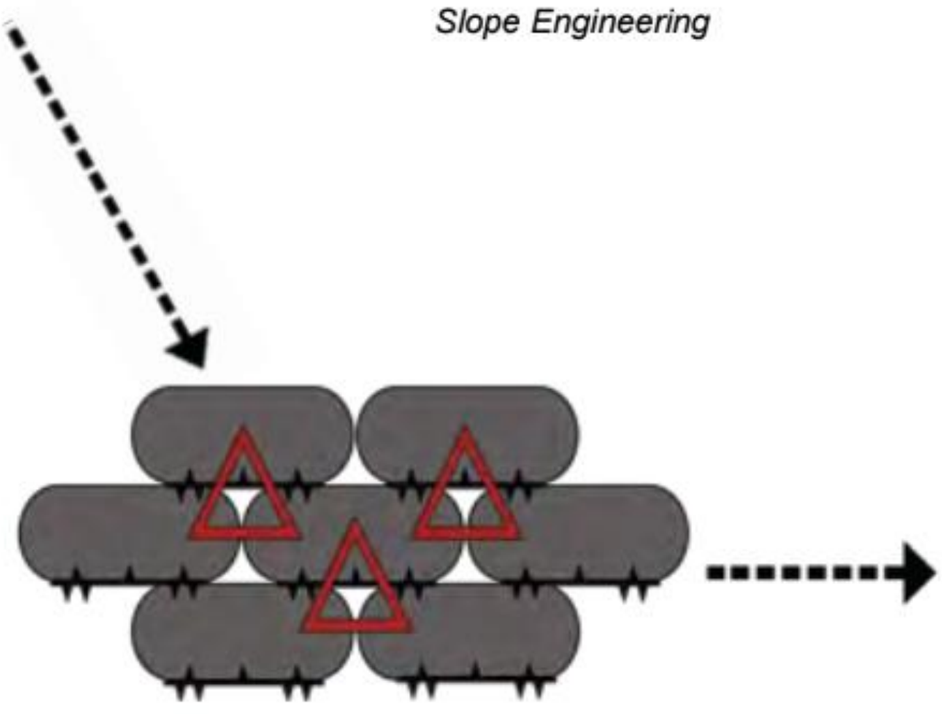
Deltalok provides a consistent and high quality growing medium that allows for healthy, uniform vegetated face.



Vegetated Reinforced Soil Slopes



Slope Engineering



Deltalok Interlocking plate locks units together and units to Geogrid connections.

The superior vegetated outcome is due to eco-pockets located between each row and each bag where rainwater accumulates and vegetation germinates on a horizontal surface.



Deltalok during construction

Deltalok Reinforced Soil Slope (RSS) Benefits:

- Structural Interlocking of the Deltalok Modular Ecology Bags
- A Mechanical Connection with Reinforcing Geogrid
- Instant Protection Against Surface Erosion
- A Vegetated Facing for a Natural, Bioengineered Solution

Deltalok provides instant erosion protection prior to vegetation. The flexible system mimics the pre-existing ground layout.

Deltalok creates an environment for vegetation to thrive. The bag depth offers a thick layer of non-erodable surface for vegetation to mature.



This solution also minimizes excavation requirements.





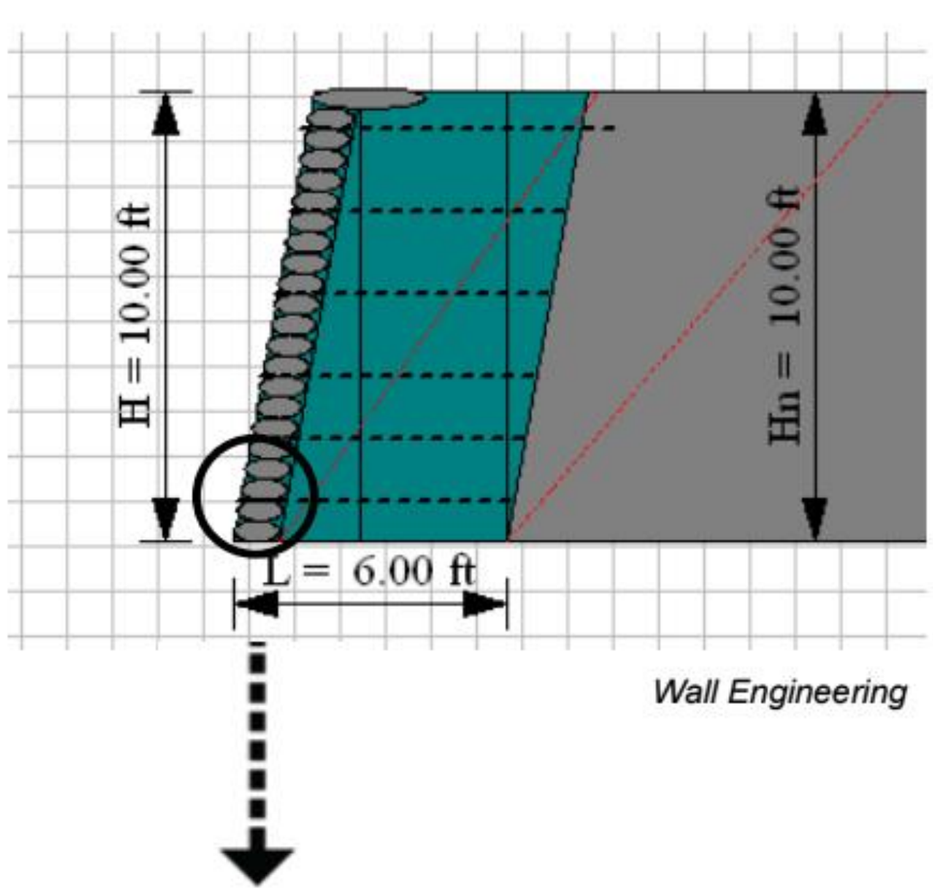
VEGETATED WALLS

Deltalok provides optimal efficiency when designing and constructing vegetated walls.

The modular ecology bags and interlocking plates provide the engineered structural strength for highway and commercial surcharge loadings.



Interlocking Plate



Wall Engineering

The patented Deltalok System locks the modular ecology bags and provides a mechanical connection between the facing and the soil reinforcing materials.

Deltalok allows near vertical walls to be constructed from a few feet tall to structures over 20 feet in height.



Deltalok's design and construction follows guidelines set for other mechanically stabilized earth systems.



Deltalok provided an aesthetically pleasing and environmentally friendly solution for this beach front development.



Deltalok Mechanically Stabilized Earth (MSE) Wall Benefits:

- Conforms to Highway (AASHTO) & Commercial (NCMA) Guidelines.
- Sound Absorption
- LEED Points up to 13 credits
- Reduced Green House Gas Emissions (GHGE)
- Graffiti Resistant
- More Efficient than Modular Block Walls
- No Leveling Footing, No Drainage Zone
- Enhanced Beauty

WATER APPLICATIONS







Millions of feet of shoreline are lost to water erosion. Deltalok is used to form permanent erosion resistant shorelines.



Deltalok Stream Banks and Shorelines Benefits:

- Easy to Build Over Soft Ground or Wet Environments
- Mimics Existing Contour
- Permanent Erosion Protection
- Provides Vegetation for Enhanced Fish and Wildlife Habitat
- Accepted by Environmental Consultants

WATER APPLICATIONS



Rain gardens, ponds, drainage channels, rivers and waterfronts require flat slopes to remain stable with the moving water.

Deltalok allows for steeper slope angles to be built by providing protection from erosion and sedimentation.

This permanent solution minimizes future loss of private and public land.

Infrastructure Projects

Deltalok's infrastructure projects include culvert head walls, trails, road repair, ditch lining, dikes, sound walls & garden walls.

The system's ability to mimic existing contour, adapt to seismic activity and differential settlement as well as perform on soft or low bearing soil positions Deltalok in it's own category.

This soft flexible system can adapt to a wide range of applications.





Undermining of highways by erosion leads to traffic delays and expensive repairs.

Drainage ditches along roads and property lines are susceptible to erosion.

Deltalok provides protection and prevents loss of property without the use of hard materials.





Culverts require head walls and erosion protection between the soils and the pipe.

The modular bags conform easily to the pipe geometry, not requiring special cutting, forming or fitting.



Culverts are located in environmentally sensitive areas which prefer an eco-friendly solution.

Deltalok's green, vegetated outcome is ideal for these types of applications.



Deltalok provides for steeper slopes which reduces the length of the pipes and minimizes land use.

Deltalok Benefits to Infrastructure Projects:

- Allows Simple Construction Around Pipes & Culverts
- Ideal for Wet & Soft Areas
- Environmental Solution that Blends with the Natural Landscape
- Effective Solution for Retention & Detention Areas

DELTALOK Vegetation

Engineered vegetated walls and slopes have been desired for ages. The challenge has always been the stability of soils placed steeper than the natural angle of repose.



Deltalok root penetration exposed in a cut ecology bag

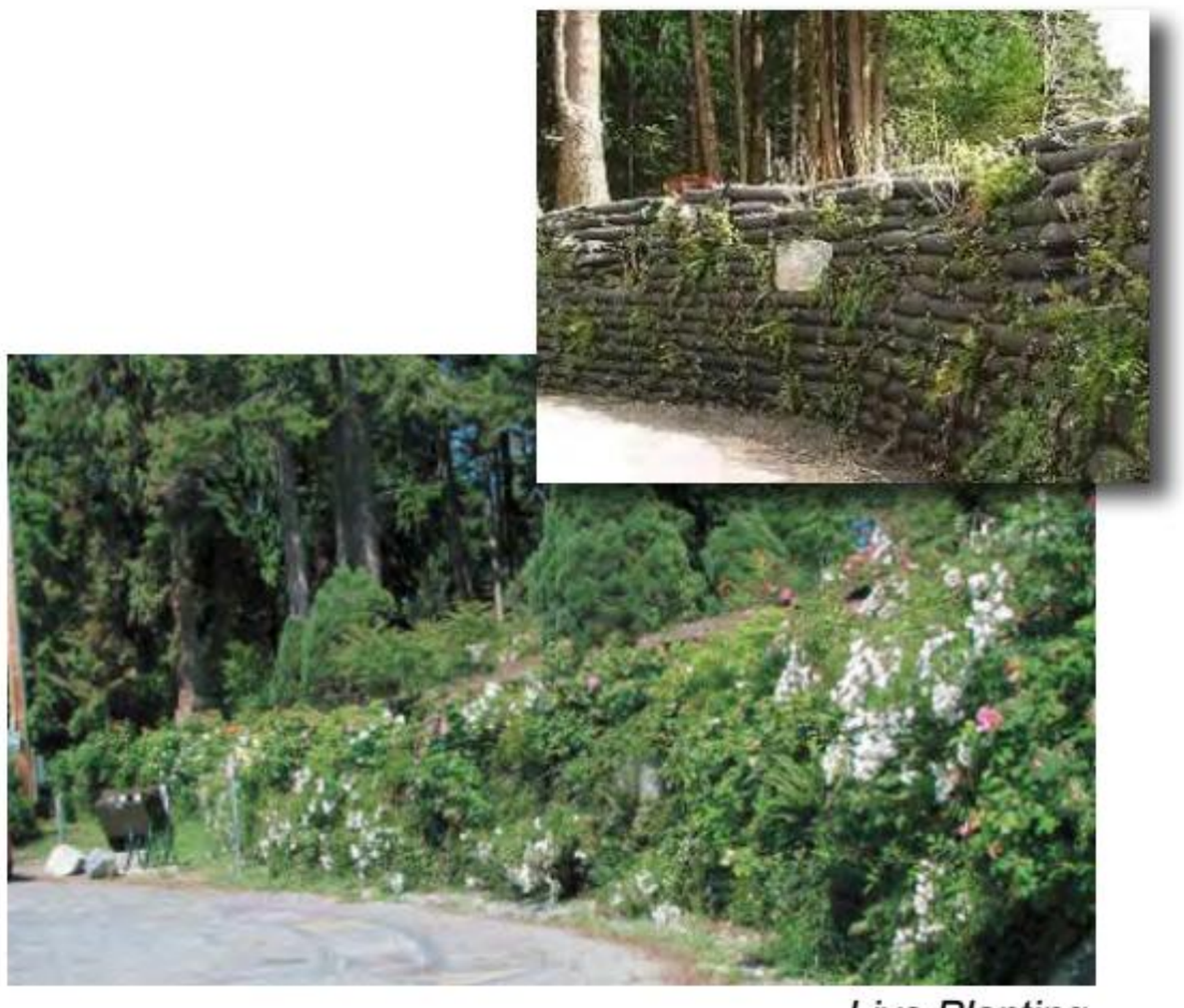


Brush Layering

Placed as modular bags, vegetation grows through the geosynthetic fabric to reinforce the soil within and beyond the face.

Deltalok prevents the erosion of surface soils, and avoids the cost and inconsistency of wrap slopes.

Deltalok creates and maintains a successful vegetated near vertical surface.



Live Planting

The system allows the root system to penetrate through both front and back layer of geotextile as well as grow into the backfill.

In addition, vegetation options such as pre-seeding for near or in water applications, hydro seeding, live planting, live stacking as well as brush layering can be utilized with Deltalok.

Native vegetation and woody plants can penetrate several feet of embedment and backfill.



Hydro-seeded

The modular ecology bags are constructed with small vertical heights making it easy to build without any bulging or sagging of the face.

Mini 'eco-pockets' exist between each row and each bag where rain water can accumulate and seeds can germinate.

Deltalok's patented system addresses these challenges and more.



Live Staking

Deltalok Installation Guide

Deltalok®

Reduce Your Carbon Footprint



1 FILLING & CLOSING DELTALOK BAGS

Fill the Deltalok bags with a clean granular soil and material mix. Properties should include approximately 70% - 80% course sand and 20% - 30% organic soils. Clay and silt are not recommended for filling the bag. Fill the bags consistently, close bag with a UV resistant zip tie. Sewing, stapling, hog-rings, etc. are also acceptable.

2 PREPARATION

Dig a shallow trench 15 inches wide for the length of your desired Deltalok structure and 3 inches deep. The purpose of the trench is to embed the base of the structure to protect from it being undermined by erosion. Tall structures or water applications will require deeper embedment. Ten percent of the design height is a good rule of thumb. With water applications, a minimum of one foot deep or below the scour line is a good rule of thumb.





3 PLACE DELTALOK BAGS & INTERLOCKING PLATE AT BASE

Place the Deltalok interlocking plate on the ground below the first row of bags. Place the interlocking plate face up, so that you are reading the "This Side Up" label. Space the interlocking plate so that it will lie directly below the middle of each bag, approximately 30 inches to 33 inches apart. Place the first row of bags spacing them with 1 inch to 2 inches between the ends of the bags. Compaction will fill the bag into the open space. Do not overlap the bags.

Place the bag with the seam towards the backfill.



PLACING ADDITIONAL ROWS

Place a Deltalok interlocking plate over the space between the two base Deltalok bags. Place another row of bags in a running bond layout over the previous row so that the interlocking plates lie below the middle of each Deltalok bag. After placement, walk on top of the bags to lock them onto the interlocking plate. The bag may flatten forward with compaction, so a backward setback should be considered. We recommend using a simple right angle triangle jig with a small level attached to check that the slopes angle consistent with design drawings or specification.

4





5 FILLING & COMPACTING THE STRUCTURE

Fill and compact the backfill soils every two layers of bags. Compaction should be done on no more than 8 to 10 inch thick lifts of fill. Vibratory compaction equipment is preferred. [A clean gravel fill zone behind the bags is not recommended to help keep alignment or for filtration as required by concrete units]. Vegetation will penetrate the Deltalok bag and grow into the backfill zone, further stabilizing the structure.

Where required

6 GEOGRID PLACEMENT



For structure heights where soil reinforcement is needed, place the geogrid reinforcement from the front of the face of the bags toward the back of the fill area. Place the interlocking plate over the geogrid at the joints between the lower Deltalok bags. Pull the geogrid snug, removing folds and wrinkles. Place the next layer of bags into place over the interlocking plate and geogrid. Then walk on top of the row. Place the fill soil from the front of the structure toward the back, this technique keeps the geogrid flat and tightly connected to the face.



7 TOP ROW

Place the top row of Deltalok bags at a 90-degree angle to the structure alignment. The deeper embedment will anchor the top of the structure and provide for a more stable structure. Embed the rear portion of the bag so that 50% of the bag will be covered with backfill soil. This may require less fill in the top row of bags.

8 PLANTING

Once wall construction is complete it is time to vegetate the wall. You may choose seed mixes of grasses or wild flowers suitable for the local climate and exposure. If live planting the wall, make a small cut in the bag, remove soil as needed to place the live planting material. If combining seeding and live planting, apply seed first, and then add live plant materials.

Vegetation choices are the owner's preference and should be discussed with local experts.



Hydro-seeding

Live Planting

Live Staking

Dimensions: 400mm x 880mm

THE DELTALOK SYSTEM

Mechanically Stabilized Earth, Reinforced Green

How interlocking Geo-Modular Bags and Anchor Plates replace concrete and steel in modern earth-retention design.

THE CHALLENGE

Conventional MSE walls trade ecology for strength

1

Hard, gray facing

Precast concrete panels dominate the streetscape and never soften with age.

2

Heavy carbon footprint

Steel reinforcement and cured concrete carry high embodied emissions and transport cost.

3

Rigid under movement

Brittle materials crack under differential settlement and seismic loading.

4

Slow, equipment-heavy build

Cranes, formwork, and curing time extend schedules on remote or difficult sites.

Deltalok was engineered to deliver the same structural performance — without the tradeoffs.

THE SOLUTION

A patented, vegetated MSE system

Deltalok combines soil-filled **Geo-Modular Bags** with **interlocking Anchor Plates** to build reinforced soil structures without concrete, steel, or formwork — delivering the strength of a gravity wall with a living, vegetated face.

- Modular geotextile bags interlock course over course
- Anchor plates provide a mechanical, high-friction connection between courses
- System ties directly into geogrid for extended backfill reinforcement
- Proven in the field since 2002 across erosion control, retaining walls, and streambank projects

2002

First wall built, South Korea

25+ yrs

Field-tested material durability

0

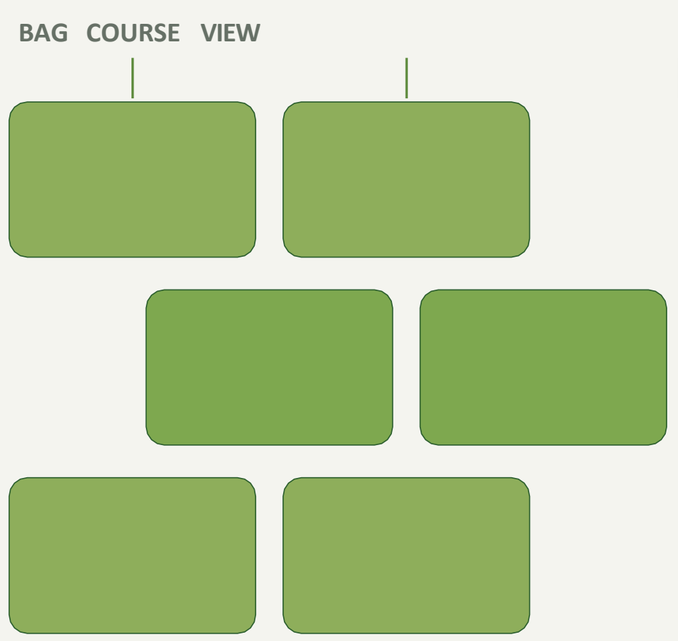
Concrete or steel required

COMPONENT 01

Geo-Modular Bags

The soil-filled reinforcing unit

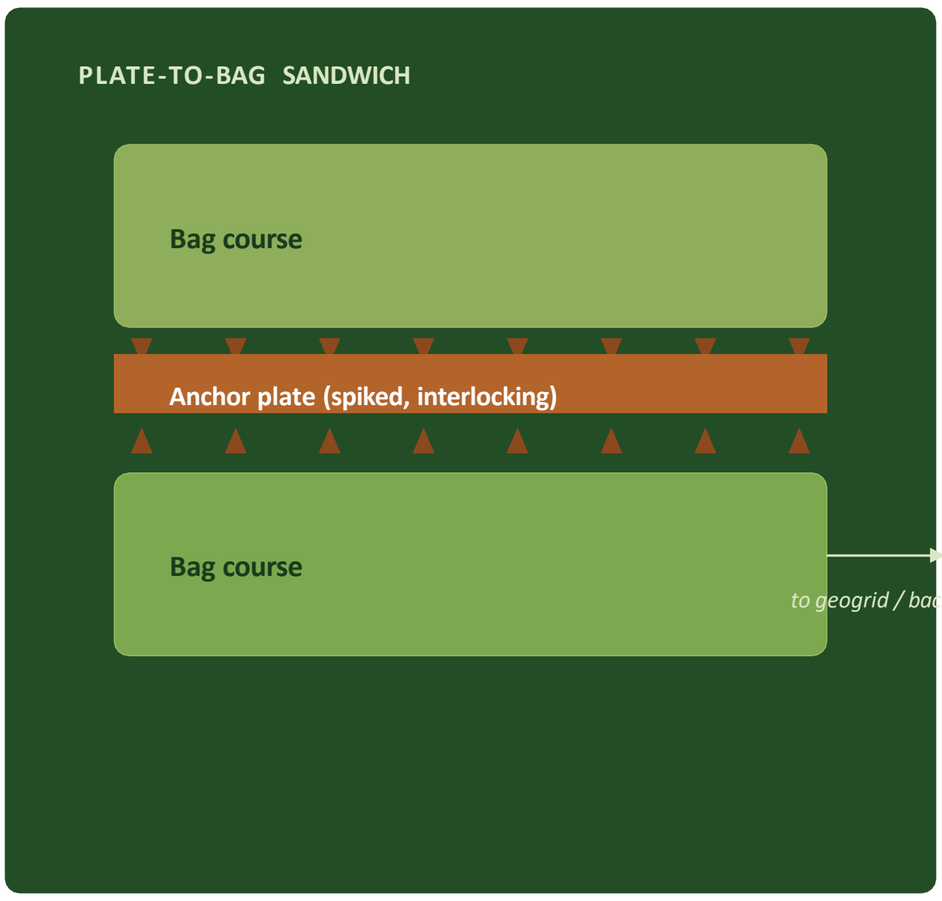
- Woven geotextile shell filled on-site with soil or sand — no specialized tools or plant required
- Porous front and back layers let roots penetrate through the bag, anchoring vegetation into the structure
- Small eco-pockets between bags collect rainwater and germinate seed for a self-sustaining vegetated face
- Root growth performs the same reinforcing role steel performs inside concrete



Vegetated face grows directly through the bag fabric

COMPONENT 02

The mechanical connection that turns bags into a structure



THE MECHANISM

From loose fill to a unified reinforced mass

01

Place & compact

A course of Geo-Modular Bags is filled with soil and compacted in place.

02

Sandwich the plate

Anchor plates are laid across the course; spikes bite into the bag fabric on both sides.

03

Interlock & tie in

The next course locks onto the plate above; geogrid connects at plate points to extend reinforcement into the backfill.

The result: a single, friction-locked soil mass that behaves as one flexible structural unit — self-standing wall and reinforced backfill combined.

BUILD SEQUENCE

Installation: five steps, no heavy plant

1 **Prepare the base**

Level and compact a foundation pad along the wall or slope alignment.

2 **Place first course**

Set and fill the first row of Geo-Modular Bags; compact in place.

3 **Set anchor plates**

Lay interlocking plates across the course at each defined elevation.

4 **Connect geogrid**

Tie geogrid into the plates where design calls for extended backfill reinforcement.

5 **Backfill & repeat**

Fill and compact every 20-30 cm; repeat courses, then seed the face for vegetation.

THE COMPARISON

Deltalok vs. conventional concrete / steel MSE

Criteria	Deltalok System	Conventional MSE
Core materials	Geotextile bags + HDPE anchor plates	Precast concrete panels + steel reinforcement
Wall face	Vegetated, natural, softens over time	Hard, gray, static appearance
Installation	Hand-placed, no cranes or formwork	Cranes, formwork, curing time required
Structural behavior	Flexible, tolerates settlement & seismic loads	Rigid, prone to cracking under movement
Carbon / transport	Lightweight materials, low embodied carbon	Heavy precast units, higher transport cost

WHERE IT'S USED

1

Retaining walls

Near-vertical vegetated walls for grade separation

2

Slope stabilization

Steepened, reinforced slopes on embankments

3

Streambank protection

Erosion control along rivers and waterways

4

Shoreline & flood defense

Wave and flood resilience with a living face

5

Highway embankments

Roadside barriers and approach structures

6

Noise & visual buffers

Vegetated barriers for sound and sightline control

FIELD PROVEN

Two decades of performance in the ground

CASE STUDY

Sea-to-Sky Highway, British Columbia

On the Sea-to-Sky Highway Improvement Project, MSE retaining walls extended the roadway along steep terrain. Culvert walls in the Squamish area used Deltalok's interlocking sandbag system, with bags placed over spiked anchor plates in a sandwich configuration.

Walls up to 300 m long were constructed on the project's DB1 and DB4 sections.

2002

First Deltalok wall constructed, South Korea — still standing today

25+ yrs

Materials tested for durability and bio-neutrality

300 m

Longest continuous wall sections built to date

BEYOND STRUCTURE

Engineering performance with ecological upside

- Establishes wildlife habitat as vegetation matures across the face
- Filters sediment and supports natural water filtration at the structure face
- Living, vegetated face naturally resists graffiti
- Reduces localized heat-island effect versus hard concrete facing
- Vegetated mass helps attenuate roadside and site noise
- Lightweight materials cut transport cost — ideal for remote project sites

Build stronger. Build green.

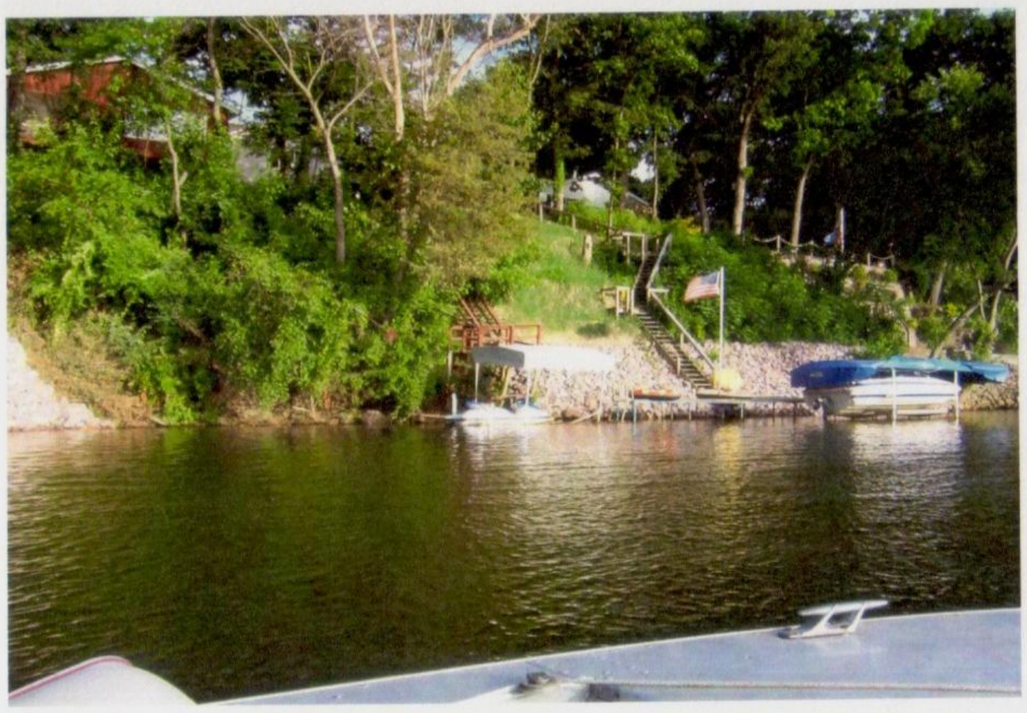
Deltalok's interlocking bags and anchor plates deliver proven MSE performance with a face that grows stronger over time — not one that cracks.

Let's talk about your next retaining wall, slope, or streambank project.









Lakeside Slope Stabilization 1 – Wisconsin, USA

Deltalok®









Boardwalk Along Pond - Langley

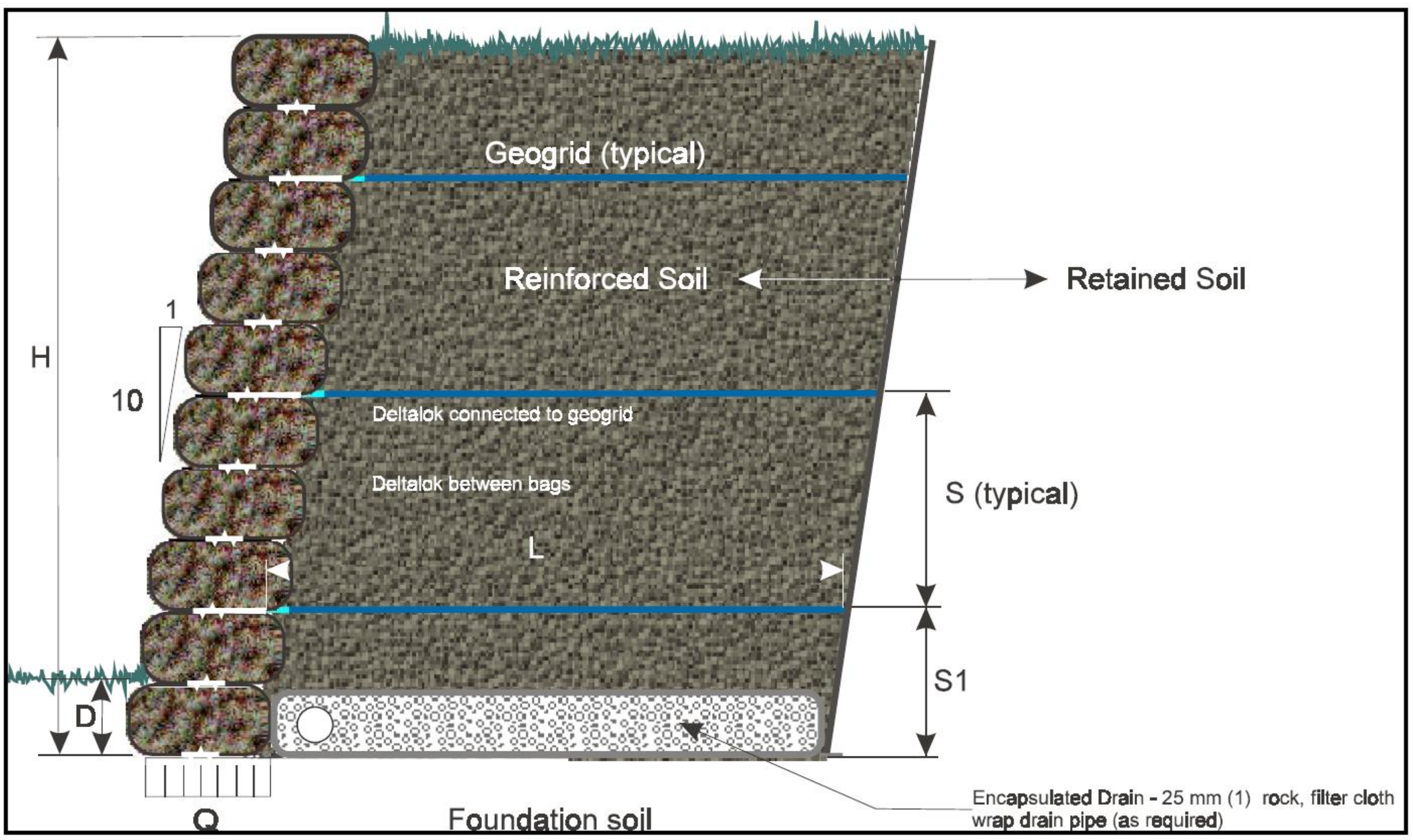
Deltalok®

Geogrid Reinforced Retaining Wall

Gravel and Sand Backfill
Level Slope
No Surcharge

DESIGN ASSUMPTIONS

A. Reinforced backfill, retained and foundation soil are gravel & sand =36, γ_d=19.5-20.5 kN/m^3 (124-130 pcf)
B. Slope of reinforced and retained soil slope level. $FS_{(pullout)}$ 1.5, $FS_{(tension)}$ 1.5, $FS_{(global)}$ 1.3, $FS_{(wedge)}$ 1.3
C. No surcharge from roads, buildings nor parking.
D. Uniform length and spacing of geogrid.
E. Fully functional drainage system with no water pressure in reinforced nor retained soil.
F. Long term design strength in accordance with GRI-GG4 of at least 18.0 kN/m (1235 lb/ft). Geogrid that may meet or exceed this design criteria include: Tensar UX1400SB, Stratagrid 200, Miragrid 3XT, Fortrac 35, Terram 4/2. Consult your local manufacturer for current design assistance.
G. Deltalok GTX Bags, 0.5 m wide, 0.3 m long, 0.2 m high (20"x12"x8") filled dimension may be less, bags filled with reinforced soil.
H. Deltalok Standard Unit for bag connection and Deltalok Geogrid for geogrid connection.



Wall Height - H m (ft)	Depth - D m (ft)	Number of Geogrid Layers	Geogrid Length - L m (ft)	Geogrid Spacing - S m (ft)	First Geogrid -S1 m (ft)	Required Bearing Pressure (Q) kPa (psf)
1.2 m (4 ft)	0.15 (0.5)	1	1.2 (4.0)	-	0.6 (2.0)	25 (500)
1.8 m (6 ft)	0.2 (0.7)	1	1.5 (5.0)	-	0.8 (2.6)	35 (750)
2.4 m (7.9 ft)	0.25 (0.8)	2	1.8 (6.0)	0.8 (2.6)	0.8 (2.6)	48 (1010)
3.0 m (9.8 ft)	0.3 (1)	3	2.0 (6.5)	0.8 (2.6)	0.6 (2.0)	63 (1300)
3.5 m (11.5 ft)	0.35 (1.2)	4	2.3 (7.5)	0.8 (2.6)	0.3 (1.0)	73 (1525)
4.0 m (13.1 ft)	0.4 (1.3)	5	2.6 (8.5)	0.75 (2.5)	0.3 (1.0)	85 (1775)
4.5 (14.75 ft)	0.45 (1.5)	6	2.9 (9.5)	0.7 (2.3)	0.3 (1.0)	95 (2000)
5.0 m (16.4 ft)	0.5 (1.7)	8	3.25 (10.7)	0.6 (2.0)	0.15 (0.5)	105 (2200)

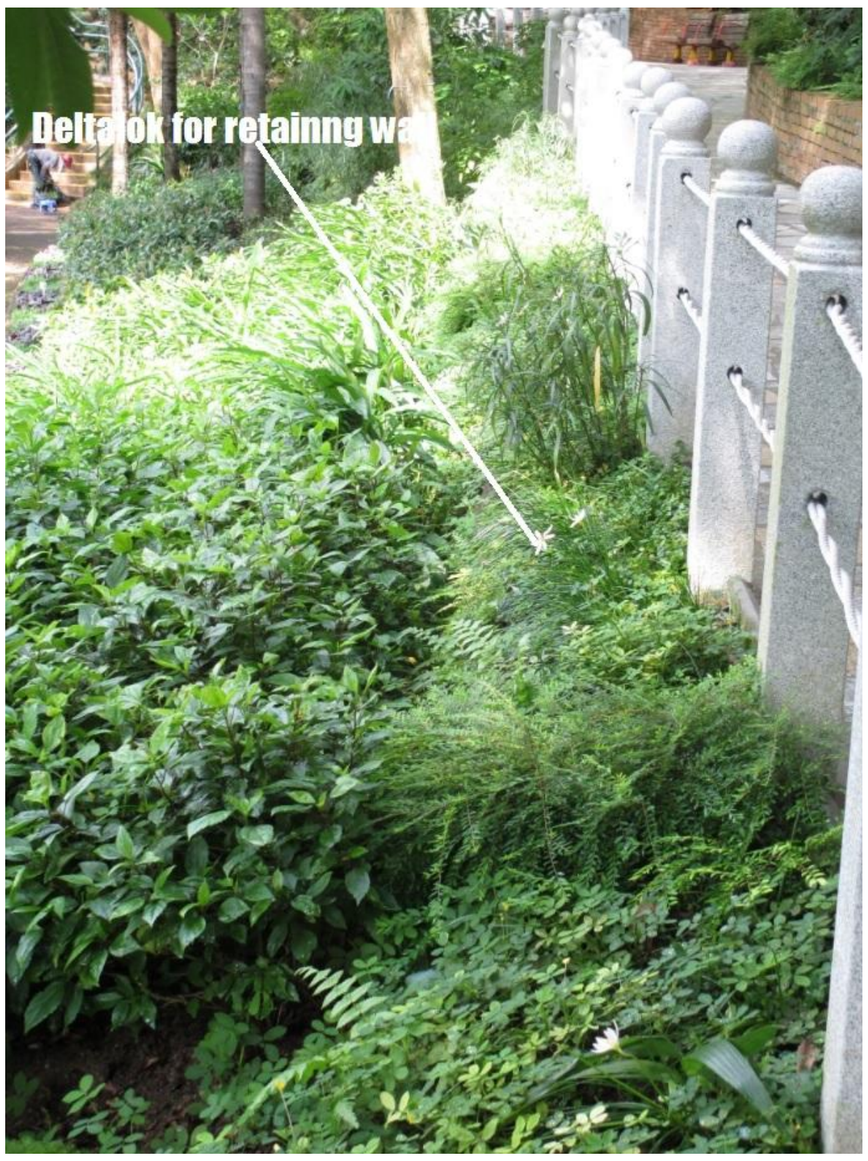
Hong Kong Job Reference

Shing Mun Valley Park城門谷公園








Deltalok for retainng wa


Geotextile Bag
Deltalok Interlocking Plate


Shing Mun Valley Park
城門谷公園


Deltalok for soil erosion in
Shing Mun Valley - LCSD


Deltalok for Seed Plant

Anderson Road Quarry Lake











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