KRT® HDS
CELLULAR CONFINEMENT SYSTEM

EROSION CONTROL

SOIL STABILIZATION

RETAINING WALLS

HYDRAULIC STRUCTURES

International Geosynthetics Society

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KRT® HDS
CELLULAR CONFINEMENT SYSTEM
[G E O C E L L]
Made in Türkiye

MOVEA
GEOSENTETİKLERLE MÜHENDİSLİK
www.movea.com.tr

+90 216 336 66 22
info@movea.com.tr

Zühtüpaşa Mah. Şefik Bey
Sk. No: 3 34724
Kadıköy / İSTANBUL

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[G E O C E L L]

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EROSION CONTROL

- Cut or Fill Embankment Slopes
- Shoreline Revetments
- Containment Dikes and Levees
- Landscape Applications
- Landfill Linings and Covers
- Abutment Protection
- Highway and Railway Side Slopes
- Dams and Spillways
- Vegetated Channel Structures

SOIL STABILIZATION

- Stabilized Drainage Layer
- Permanent and Temporary Access Roads
- Permeable Load-Support
- Roadway Shoulders
- Stabilized Base For Asphalt Pavements
- Track Ballast and Subballast Structures
- Trails and Walkways
- Foundation Mattresses and Pipeline Protection
- Sports Fields and Playgrounds
- Parking Areas

RETAINING WALLS

- Green MSE Walls
- Steepened Embankments
- Shoreline Revetments
- Dike and Levee Protection
- Culvert Headwalls
- Landscape Development Walls
- Vegetated Channel Structures
- Sound Barriers
- Dams and Flood Defence Bunds
- Road Widening

HYDRAULIC STRUCTURES

- Stormwater Diversion or Containment
- Flow Channels
- Shore Protection
- Culvert Outfalls
- Dam Faces and Spillways
- Down Chutes
- Drop Structures
- Swales and Drainage Ditches
- Process Water Channels
- Storm Water/Waste Water Lagoons
- Geomembrane Protection

KRT® GEOCELL [CELLULAR CONFINEMENT SYSTEM]

KRT® HDS
CELLULAR CONFINEMENT SYSTEM

KRT® Geocell (Cellular Confinement System) is a high quality erosion control and soil stabilization material with a three-dimensional honeycomb structure. The system provides fast, economical and long lasting solutions for soil stabilization applications and hydraulic structures, while preventing earth loss due to water and wind in general purpose sloping surfaces.

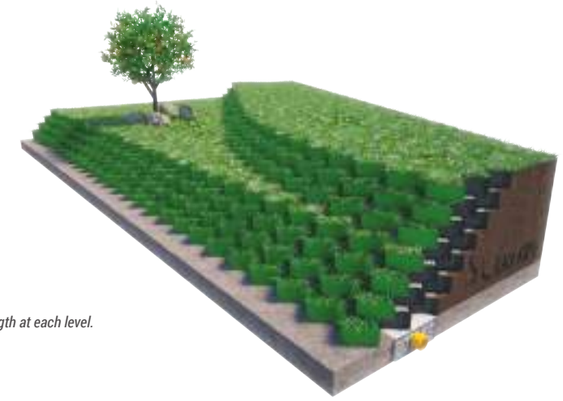
KRT® Geocell, produced by first quality polymer strips with special additives with innovative ultrasonic welding technology, provides excellent protection and reinforcement on the applied surface.

While the perforated structure of the material allows fast drainage of water, the textured surface of the cells allow the filling material to be reliably held even at high slopes. Cells can be filled with different materials (sand, gravel, soil, concrete) according to the purpose of use. Cell heights vary between 50-200 mm depending on project requirements.

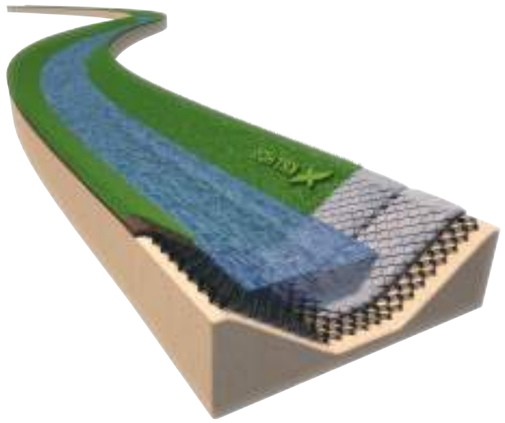
> Thanks to high quality raw materials, KRT® Geocell can function safely for decades without being damaged in the nature.

RETAINING WALLS

KRT® Geocell can be filled with vegetative soil and stabilizing material to build green walls. Flexi retaining walls, which can be constructed using geogrid reinforcement, perform well against earthquake as opposed to conventional reinforced concrete walls.



1. *Depending on the height of the wall, geogrid reinforcement can be used at the determined type and length at each level.*
2. *A springer irrigation system can be formed on the front of the wall.*
3. *The material to be used inside the cells must be high quality engineering fill.*
4. *At each stage, the infill material should be compacted with a vibrating cylinder / compactor.*



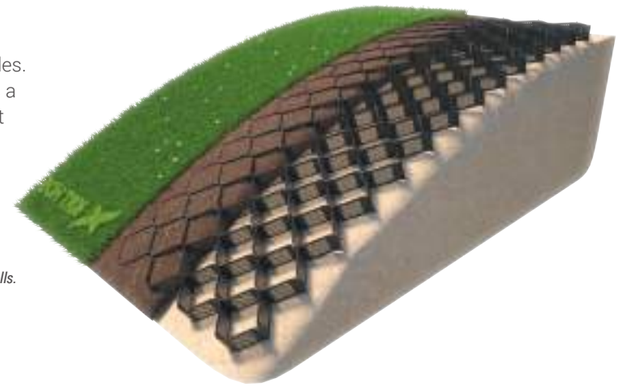
HYDRAULIC STRUCTURES

KRT® Geocell provides economical and safe solutions for hydraulic structures such as open channels, dam structures, shoreline protection structures and lagoons. Cellular confinement system that can be filled with soil, crushed stone and concrete protects the structures against destructive effects of water.

1. *In the crushed stone fill applications, a separation geotextile should be used under the geocells.*
2. *If there is a membrane on the slope surface, it is recommended to use tendons for fixing.*
3. *Slope stability should be checked before the application.*
4. *In the pond/lagoon applications, the cells are filled with concrete.*
5. *In channel applications and steep slopes an anchorage ditch should be build for safety.*

EROSION CONTROL

KRT® Geocell protects steep slopes against erosion and landslides. The system, which protects the material inside the cell, provides a natural and safe protection against erosion by allowing safe root development and vegetation.



1. *In the crushed stone fill applications, a separation geotextile should be used under the geocells.*
2. *In steep slope applications, it is recommended to use tendons for fixing.*
3. *Slope stability should be checked before the application.*
4. *In steep applications an anchorage ditch should be build for safety.*

SOIL STABILIZATION

KRT® Geocell provides superior ground reinforcement under roads, railways, airfields, access roads, sidewalks and parking areas. The system reduces the base thickness to be used and provides a significant economical cost of filling.

1. *The material to be used inside the cells must be high quality engineering fill.*
2. *The infill material should be compacted with a vibrating cylinder / compactor.*
3. *A separation geotextile should be used under the geocells.*

Hand Tools

- Hammer
- Driller
- Shovel
- Vibrating Plate Compactor

Supplies

- Anchorage Bar
- Plastic Clips/Stapling
- Geotextile
- Tendon
- Geogrid

Geocell Cellular Confinement System

- KRT® Geocell for Soil Stabilization and Erosion Control
- KRT® Geocell for Retaining Wall

S M L

H: 50-100-150 200 mm

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Infill Materials

Erosion Control

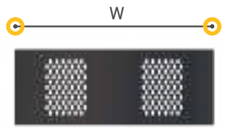
- » *Vegetative Soil*
- » *Vegetative Soil & Crushed Stone*
- » *Crushed Stone*

Soil Stabilization & Retaining Walls

- » *Mechanical Fill*
- » *Crushed Stone*

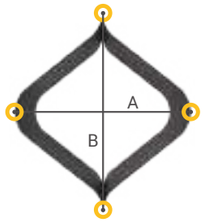
Hydraulic Structures

- » *Vegetative Soil*
- » *Vegetative Soil & Crushed Stone*
- » *Crushed Stone*
- » *Concrete*



W WELDING DISTANCE

The distance between two welding points of the cell. The cell size increases as the welding distance increases.

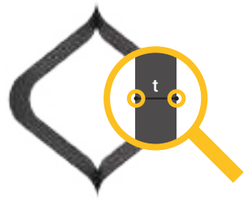


AxB CELL SIZE

It is the transverse (A) and longitudinal (B) inner distances of the opened cell. If the slope or load on the cell increases, the cell size is reduced.

H CELL HEIGHT

It is determined by the height of the material to be filled into the cell. As the slope increases, the height of the cell also needs to be increased.



t STRIP THICKNESS

It is the strip thickness of the cell walls. Increasing the thickness of the strips increases the tensile strength of the strips.

Welding Distance (W)	Cell Width (A)	Cell Length (B)	Cell Height (H)	Strip Thickness (t)
330 mm	210 mm	250 mm	50/75/100/150/200 mm	1,3 - 2,0 mm
400 mm	260 mm	290 mm	50/75/100/150/200 mm	1,3 - 2,0 mm
450 mm	280 mm	340 mm	50/75/100/150/200 mm	1,3 - 2,0 mm
500 mm	340 mm	365 mm	50/75/100/150/200 mm	1,3 - 2,0 mm
600 mm	390 mm	420 mm	50/75/100/150/200 mm	1,3 - 2,0 mm
660 mm	420 mm	490 mm	50/75/100/150/200 mm	1,3 - 2,0 mm
700 mm	448 mm	520 mm	50/75/100/150/200 mm	1,3 - 2,0 mm

**The dimensions given above have a tolerance of ± 10%.*

WHICH KRT® GEOCELL?

Choosing the right parameters and cell size in Geocell cellular confinement system applications is very important in terms of both safety and reducing project costs.

As Movea® engineering team please contact us so that we can offer you the safest and most economical Geocell for your project.

Welding distances (W) and cell dimensions (AxB) given above belong to our standard products. According to project specifications KRT® Geocell can be manufactured to desired welding distance from 300 mm to 800 mm and to strip thickness of up to 2.0 mm.

> KRT® Geocell provides high erosion protection even in the most steep slopes with its high weld and tensile strength.

WHY KRT® GEOCELL?

KRT® HDS
CELLULAR CONFINEMENT SYSTEM

High Quality Materials

KRT® Geocell is manufactured from the highest quality materials. Cells reinforced with specially added polymers serve safely even in the most difficult natural conditions.

Increased Strip Thickness

KRT® Geocell has superior strength against tensile loads with strip thickness of 1.30 millimeters and over.

Excellent Welding Strength

KRT® Geocell has a special ultrasonic welding system with superior strength that does not break even under extreme loads.

Textured Cell Wall

The specially designed textured frictional surface prevents the loss of material in the cell by increasing the adhesion between the cell wall and the infill material.

Perforated Cell Wall

The increased perforated structure permits rapid drainage of water between cells and propagation of the plant root system.

EROSION CONTROL

KRT® cellular confinement system protects a number of engineering structures, such as highway and railway side slopes, containment dikes and levees, abutments against erosion and landslides. Even on extremely sloped surfaces, the system prevents the valuable material on the slope surface from being lost due to environmental factors (rain, water, wind etc.)

The cell size and cell height are determined according to the slope height and slope to be applied. The type of infill material to be used has also an important influence on cell size selection.

- *Allows aesthetic landscape applications.*
- *Prevents the loss of material on the slope surface.*
- *Increases slope stability by regulating water intake from the surface.*
- *Protects the root system of plants and provides safe vegetation.*

EROSION CONTROL

- » Cut or Fill Embankment Slopes
- » Shoreline Revetments
- » Containment Dikes and Levees
- » Landscape Applications
- » Landfill Linings and Covers
- » Abutment Protection
- » Highway and Railway Side Slopes
- » Dams and Spillways
- » Vegetated Channel Structures

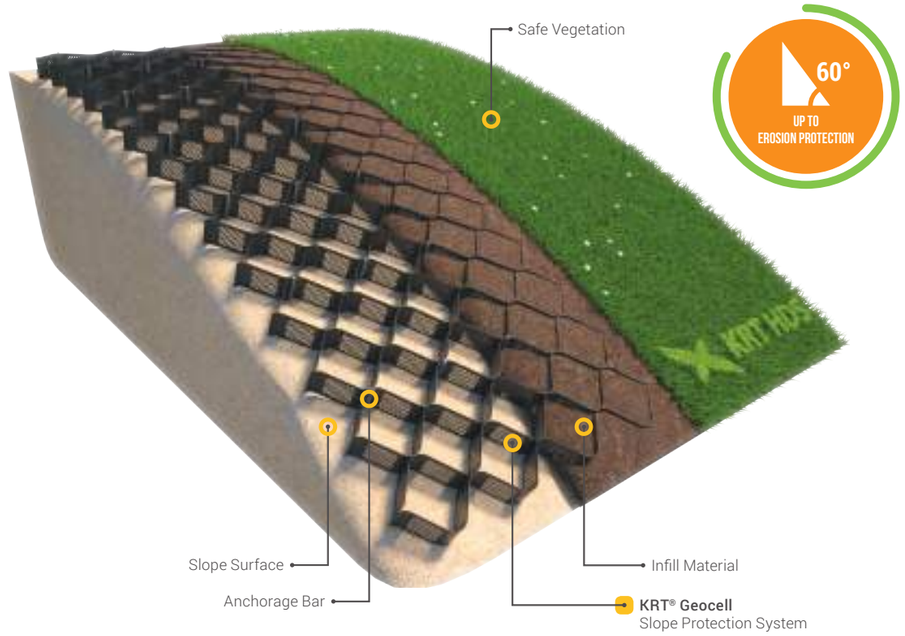
KRT® HDS
CELLULAR CONFINEMENT SYSTEM

INFILL MATERIALS

Vegetative Soil

Crushed Stone

Vegetative Soil & Crushed Stone



> In slopes that are not suitable for planting, the cells are filled with colored stones to provide a permeable and aesthetic appearance.

EROSION CONTROL

KRT® HDS
CELLULAR CONFINEMENT SYSTEM

WEATHERING EROSION

Weathering erosion is the removal of valuable vegetative soil by water and the transport of soil particles through small cracks. As abrasion and decomposition increase, or as the flow rate of water increases, the gutters deepen and expand.

KRT® Geocell significantly increases the performance of slopes against erosion by controlling the flow of water and the migration of fill material inside the cells.

ROOT PROTECTION [VEGETATIVE SOIL]

Reinforces root systems and directs hydraulic flows over the top of cells, with the cells acting as a series of check dams.

GRANULAR PROTECTION [CRUSHED STONE]

Improves the performance of granular filled slopes by controlling the migration of fills that would otherwise be initiated by hydraulic and gravitational forces.

SOIL STABILIZATION

- » Stabilized Drainage Layer
- » Permanent and Temporary Access Roads
- » Permeable Load-Support
- » Roadway Shoulders
- » Stabilized Base For Asphalt Pavements
- » Track Ballast and Subballast Structures
- » Trails and Walkways
- » Foundation Mattresses and Pipeline Protection
- » Sports Fields and Playgrounds
- » Parking Areas

SOIL STABILIZATION

KRT® HDS
CELLULAR CONFINEMENT SYSTEM

CELLULAR CONFINEMENT

Horizontal movements of the infill material are prevented by the confinement effect of the interconnected three-dimensional cells. The system works with a flexible base principle and spreads the loads that affect the system to a wider area.

KRT® Geocell forms a three dimensional load support system that significantly increases the load bearing capacity of the underlying subgrade soil.

Each cell confines the soil, preventing lateral spreading and increasing base stiffness. Both soil interaction with the cell walls and passive resistance developed between adjoining cells increases vertical shear resistance of the infill material. When filled with granular infill, KRT® Geocell can reduce base course thickness by as much as 50%.

- *Significantly minimizes surface rutting.*
- *Increases load bearing capacity of the soil.*
- *Allows fast and controlled soil compaction.*
- *Controls shearing and lateral movement of the coarse infill material.*
- *Distributes loads laterally and reduces vertical deflection.*

SOIL STABILIZATION

STABILIZED SUPPORT SYSTEM

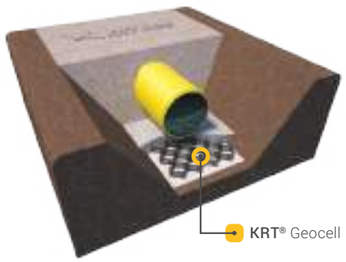
With the use of KRT® Geocell, vehicle and pedestrian loads are distributed over a larger area instead of a direct contact point.

Stabilized 3D support system.

Thanks to the superior confinement effect of the system, the load concentration on the base decreases significantly. Due to the high drainage capacity of the material, settlements are reduced dramatically.

KRT® HDS
CELLULAR CONFINEMENT SYSTEM

BURIED STRUCTURES FOUNDATIONS



KRT® Geocell system performs well in protecting the underground utilities and buried pipelines. The geocell layer can reduce the spread and intensity of shear strain under the footing, tending to reduce both soil surface settlement and pipe deflection.

SPORTS FIELDS
PLAYGROUNDS

BICYCLE/MOTORCYCLE
TRAILS AND WALKWAYS

SAND STABILIZED
ACCESS ROADS

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RETAINING WALLS

GEOGRID REINFORCEMENT APPLICATION

Geogrid reinforcements are used in Flexi Geocell retaining walls when the wall height is too high or there is a relatively high surcharge load on the wall. Geogrids are used in different lengths and types in each filling stage of the MSE wall to reinforce the compacted fill material with friction and interlocking mechanism.

RETAINING WALLS

- » Green MSE Walls
- » Steepened Embankments
- » Shoreline Revetments
- » Dike and Levee Protection
- » Culvert Headwalls
- » Landscape Development Walls
- » Vegetated Channel Structures
- » Sound Barriers
- » Dams and Flood Defence Bunds
- » Road Widening

RETAINING WALLS

KRT® HDS
CELLULAR CONFINEMENT SYSTEM

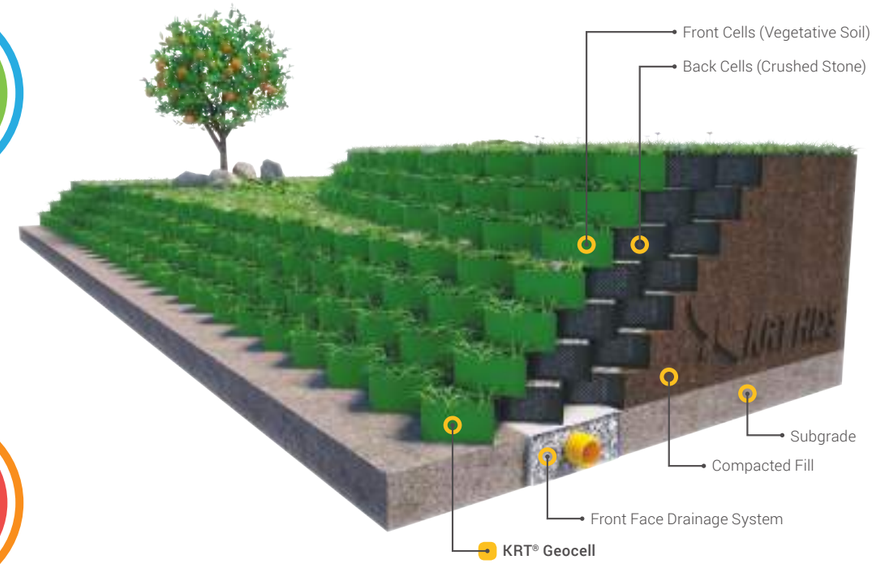
Flexi KRT® Geocell retaining walls manufactured using the KRT® Cellular Confinement System are green retaining structures that do not require concrete and mold, are perfectly compatible with nature and are extremely resistant to earthquake.

Flexi KRT® Geocell walls can easily reach the height that conventional retaining walls (stone, reinforced concrete) can not reach. The system allows for construction flexibility and provides aesthetics through a completely vegetated face.

- *It has an aesthetic vegetated front face integrated with nature.*
- *Fits with horizontal and vertical geometry perfectly.*
- *Retaining walls with unlimited height can be manufactured.*
- *Its flexible structure provides excellent performance against earthquake.*
- *The system does not require concrete and mold.*

PERFECT PERFORMANCE AGAINST EARTHQUAKE

UNLIMITED WALL HEIGHT



> With Flexi retaining wall system it is possible to produce safe, aesthetic walls that are compatible with nature.

RETAINING WALLS

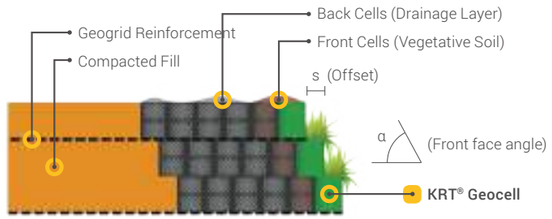
KRT® HDS
CELLULAR CONFINEMENT SYSTEM

FLEXI WALL FRONT FACE DRAINAGE SYSTEM

In Flexi KRT® Geocell retaining wall applications, the cells behind the cells filled with vegetable soil on the front of the wall are filled with a crushed stone so that the water can be transferred to the continuous drainage system at the base of the wall.

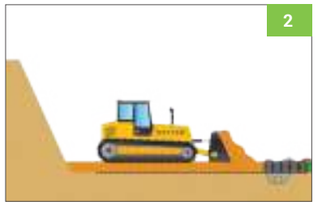
Flexi KRT® Geocell retaining walls constructed to ensure the stability of the steep slopes against the landslide can be manufactured with the method of laying geogrid reinforcements and compacting high quality filling material at every stage. Desired front face angle (α) of the wall can be achieved by setting offsets(s) at every stage with a prescribed distance.

The main components of the wall system are KRT® Geocell wall element, high quality fill material and geogrid reinforcements (if necessary).

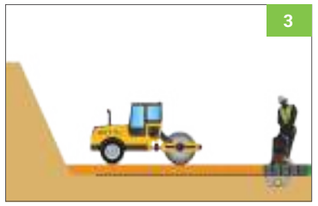


Flexi KRT® Geocell Retaining Wall
Cross Section Detail

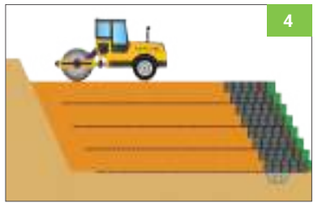
Levelling and drainage excavation are done according to the project. KRT® Geocell and other materials are installed on the wall line.



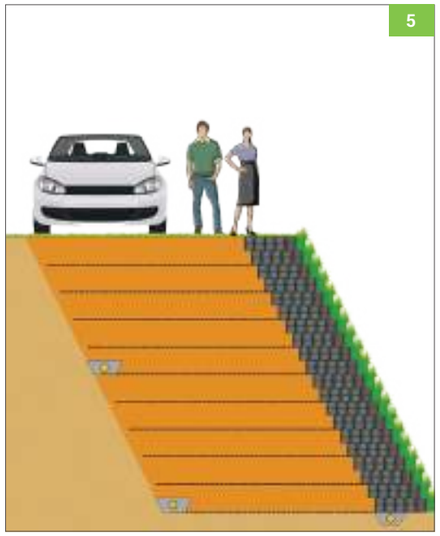
At each level of the compaction laying of geogrid and geocell is done with extensive care so that the geogrids are not damaged.



The front face cells are filled with crushed stone and vegetative soil in each step and compacted with vibrating plate compactor.



In order to achieve desired front face angle of the wall, offsets are set with KRT® Geocell at each level of laying/compaction.



The application of the wall is completed when the laying and compacting process reaches the specified height. KRT® Geocell front cells are planted to create aesthetic natural look.

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> In areas with limited easements, Flexi KRT® Geocell retaining wall can be constructed by filling the cells with concrete or crushed stone.

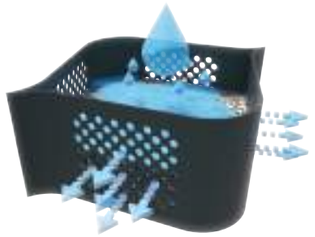
HYDRAULIC STRUCTURES

- » Stormwater Diversion or Containment
- » Flow Channels
- » Shore Protection
- » Culvert Outfalls
- » Dam Faces and Spillways
- » Down Chutes
- » Drop Structures
- » Swales and Drainage Ditches
- » Process Water Channels
- » Storm Water/Waste Water Lagoons
- » Geomembrane Protection

HYDRAULIC STRUCTURES

KRT® HDS
CELLULAR CONFINEMENT SYSTEM

GRANULAR DRAINAGE SYSTEM



Thanks to high drainage capacity of KRT® Geocell system with perforated cell walls, the flow of water is directed to the cell surface, preventing from erosion on the slope surface and on the channel bed.

KRT® Geocell offers a wide variety of flexible protection applications for hydraulic structures. The cellular confinement system provides stability and protection of channels exposed to erosive conditions ranging from low-to-high flows either intermittent or continuous.

The system greatly improves the hydraulic performance of conventional protection materials such as aggregate, rip-rap and vegetation by confining them within the cellular structure. KRT® Geocell system can be designed for specific site conditions based upon compatibility with local environmental, ecological and aesthetic requirements.

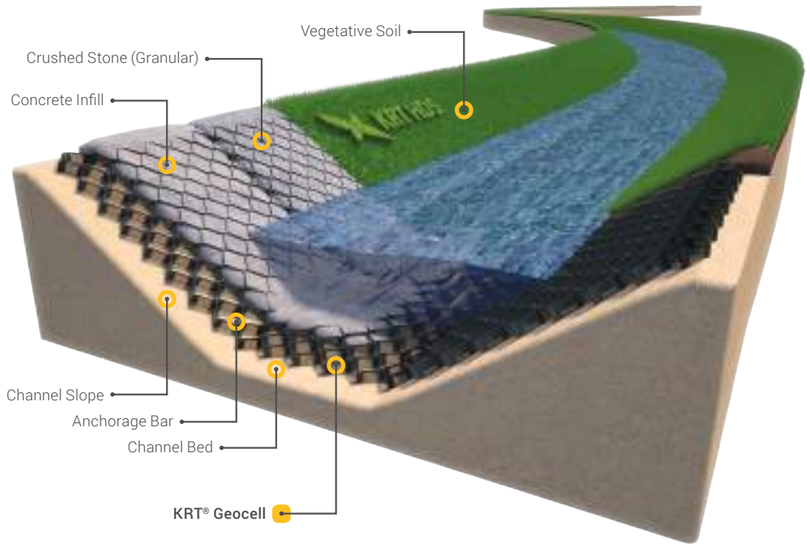
- *Can be used in Intermittent or continuous/low to high flow channels.*
- *Offers different infill alternatives depending on the flow conditions.*
- *Increases the performance of conventional protection materials.*
- *Reduced installation costs.*

INFILL MATERIALS

Vegetative Soil

Crushed Stone

Concrete



PERFORATED - TEXTURED GEOCELL WALL
ADVANTAGES

- Perforations facilitate parallel slope drainage of the infilled cell. In saturated conditions, the removal of excess water increases infill friction, reducing down slope sliding forces, resulting in a more stable system.
- In vegetated systems, perforations allow roots to grow from cell-to-cell creating greater vegetative stability against short-term hydraulic events. Perforations also allow nutrients and microorganisms to pass through neighboring cells.
- Textured surfaced cells significantly increase the frictional resistance of the cell wall with the infill material. Frictional surface limits the movements and the loss of the infill materials due to freeze-thaw cycles, water and other eroding factors.

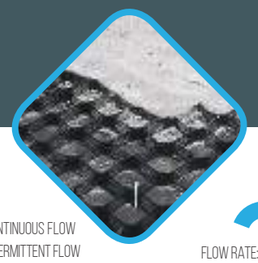
HYDRAULIC STRUCTURES

3 DIMENSIONAL CONFINEMENT

KRT® Geocell system greatly improves the hydraulic performance of conventional protection materials such as aggregate, rip-rap and vegetation by confining them within the three dimensional flexible cellular structure.

KRT® Geocell offers a great protection system n pond applications. Geocell filled with concrete creates a protective layer on the geomembrane against uplifting of water and erosion.

KRT® Geocell Geomembrane Protection Layer



CONTINUOUS FLOW
INTERMITTENT FLOW
FLOW RATE: 3,5-13,0 M/S

CONCRETE INFILL
RIGID PROTECTION

A cost effective alternative to traditional installed concrete lined channels.

- Installation costs are dramatically reduced through elimination of costly forms and other construction techniques.
- Increases the stability significantly in steep slopes where the flow rate is relatively high.
- Can produce a flexible concrete slab for a low-friction, armored channel lining.
- Permits conformance with subgrade movement without the potential cracking and undermining associated with poured-in-place concrete slabs.

CONTINUOUS FLOW
INTERMITTENT FLOW
FLOW RATE: 2,0-3,5 M/S

CRUSHED STONE INFILL
PERMEABLE PROTECTION

Performs well, allowing the use of different sizes for variances in flow velocities encountered from site to site.

- Allow to use smaller diameter, less costly aggregate by confining and improving the performance of infill material.
- Cost effective alternative to large rip rap or hard armoring protection.
- Directs flow over the top cells; there by increasing the shear resistance of the fill.
- Limits the movement of the aggregates due to the eroding effect of flow.

INTERMITTENT FLOW
FLOW RATE: 0,0-6,0 M/S

VEGETATIVE SOIL
PLANT ROOT PROTECTION

Provides an aesthetically pleasing look and performs exceptionally well in applications with low to moderate flows.

- Reinforces root zones and directs flow over the top cells; there by increasing the shear resistance of the fill.
- Confined vegetative soil performs well where the flow is intermittent.
- Prevents formation of cracks.
- Compared to conventional methods, it offers a more aesthetically superior solution.

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