TERRAFORCE®

The original, reversible, hollow core retaining block

Terrafix is an interlocking element made of high strength concrete. It was designed to provide a flexible lining where protection against wind and water erosion is required. They can be laid in a variety of configurations to suit most site conditions.

This makes it the ideal product to help combat the rapid degradation of our rivers and streams, caused by urbanisation and poor farming practices all over South Africa and the world. Terrafix can help prevent our soil being eroded away, while still being permeable enough to help preserve our precious ground water reserves and biodiversity.

The system offers one of the most cost-effective and speedy erosion control methods and provides a perfect regime for establishing vegetation. Stability improves as vegetation takes root.

Block	Terrafix 100
Blocks/m² (Measured on the face)	4-10
Block mass/kg	13
Block infill volume/ m³	0.004
Ave. constructed mass 10/m² kg per m² of area	190
Block wall thickness mm	40

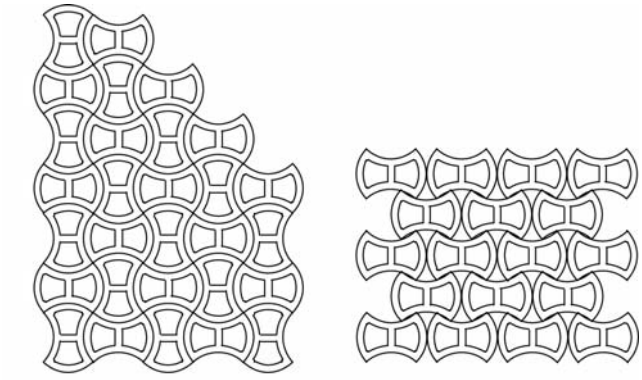
Block	Terrafix 120
Blocks/m² (Measured on the face)	4-10
Block mass/kg	16
Block infill volume/ m³	0.005
Ave. constructed mass 10/m² kg per m² of area	235
Block wall thickness mm	40

Block	Terrafix 150
Blocks/m² (Measured on the face)	4-10
Block mass/kg	21
Block infill volume/ m³	0.006
Ave. constructed mass10/m² kg per m² of area	300
Block wall thickness mm	40

TERRAFIX

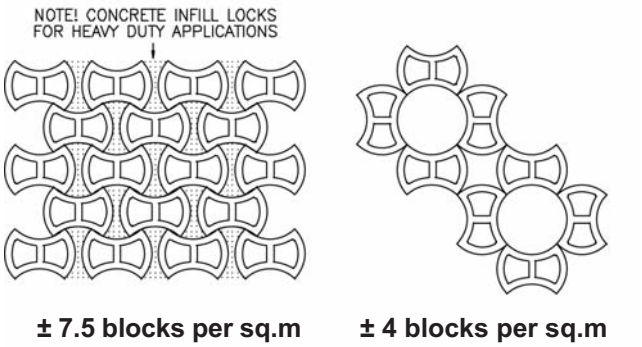
For variations check with your local supplier.

TERRAFIX™



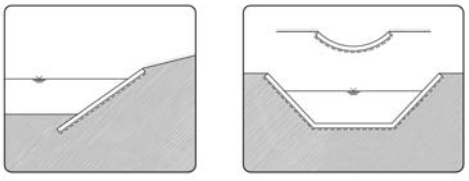
± 10 blocks per sq.m

± 9 blocks per sq.m



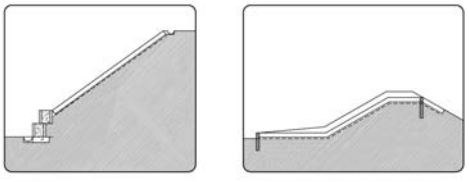
± 7.5 blocks per sq.m

± 4 blocks per sq.m



RIVERBANKS AND SHORES

STORM WATER CONTROL



SLOPE PROTECTION

DAMS AND SPILLWAYS

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EROSION CONTROL – SUBSTAINABLE CONCRETE SOLUTIONS

Rampant urbanization in many parts of the world leads to rapid degradation of rivers and streams. Apart from our precious soil disappearing down to the beach, so are our undernourished ground water reserves, our biodiversity doing likewise.

Urban areas

The “Effects of urbanization on catchment water balance” have been thoroughly researched and documented to the Water Research Commission by Professor D. Stephenson and others of the Water Systems Research Group at Wits University. In a nutshell their findings are summarized below:

“In nature a semi-equilibrium exists between precipitation, runoff and infiltration into the ground. Over years the water table fluctuates about a mean. The construction of impermeable barriers on the surface, such as roads and buildings, reduce the rate of ground water replenishment.

The water runs off easier and the limited permeable areas restrict infiltration. The groundwater level will therefore drop and the zone above the water table will gradually dry out. Vegetation and the soil characteristics will change. If we are not to affect our environment adversely we should attempt to return some of the storm-water we channel off urban areas back to the ground.”

Permeable surfaces

“This can be accomplished by ensuring adequate permeable surfaces and by directing storm-water into specially selected or constructed seepage areas. We will then not only maintain the regime but also minimize design flow rates downstream”

“Surface water runoff in urban areas has been found to be ± 4 times higher than in rural areas of similar geographical composition. Impermeable buildings, roadways, parking areas and even storm-water drains may cover ± 20% of the total area. Reduced infiltration, increased runoff velocity and erosion are the direct result.”

Awareness

According to a survey conducted for the Water Research Commission by consultants Economics Project Evaluation, most South Africans undervalue their water supply and a large percentage don’t even know the origin of their Municipal water. Public/private partnerships in the form of maintenance contracts, awarded to local communities should help in correcting this deficit.

Nature Conservation

It is all well documented fact that surface water runoff is aggravated by alien vegetation. A lack of understanding by large portions of citizens, coupled presently by substantially reduced state funding for nature conservation, do not contribute much toward solving these problems. Again the co-operation with local communities is the route to follow for developing nations.

Rural areas

The effects of overgrazing, deforestation and veld burning resulting in increased water runoff and soil erosion, are enormous. Ways and means to counter them involve strictly applied and enforced environmentally compatible farming methods that have been well documented elsewhere.

“The essence of sustainable farming is the attempt to reconcile a short-term survival strategy with a long-term conservation one. The dramatic population growth in Sub Saharan Africa , easily tempts us to revert back to survival strategies at the cost of natural resources. Meanwhile, in the developed North, protectionist government policies contribute to agricultural unsustainability.” Dr. Izak Groenewald, Centre for Sustainable Agriculture, University of the Free State.

Solutions

Most design professionals are presently discarding some of yesterday's solutions such as impervious concrete lined storm water canals. Instead permeable catchment storage in the form of shallow channels, roadways or flood plains are recommend at the head of a system, whereas detention pond storage was found to be most economical at the outlet of the catchment. It has also been found that increasing the permeability in most urban situations is more beneficial than reducing roughness in storm-water canals. Research has shown that a well designed hard-lawn with 25% openings can infiltrate 500L/sec/ha.

Water Research Commission

The Water Research Commission has suggested various measures including changes to Town Planning regulations and practices to achieve the desired effects. Increased state funding for nature conservation projects, would also help in raising the level of understanding amongst citizens. Rain water harvesting in large format drums, encouraged with public subsidies, could have an enormous regulating effect. These measures will ultimately lead to a regeneration of dried-up springs. A heavy responsibility also rests on the shoulders of engineers, architect and environmental designs to ensure that their projects impact positively on the environment of future generations.

Materials

Of the various materials available to fight erosion, dense vegetation cover with deep rooted proven plant species should be considered. Many non-invasive types are known and catalogued, adapted to various climatic and soil condition. In combination with plastic or natural fibre mats, effectiveness for light erosion control measures can be improved considerably.

Rock rip-rap is often specified to good effect but has its limitations. Stability is often a problem and drive-over maintenance is impossible.

Wood and metal-based materials are still popular and can be very effective. Durability is their main stumbling block, meaning that they have to be impregnated or coated. These processes involve highly toxic substances.

Segmented concrete products are rapidly gaining in popularity over other methods and in combination with vegetation cover are more durable, versatile and cost effective. From the environmental point of view this combination stands out head and shoulders above the other methods.

Design Considerations (Articulated Concrete Blocks)

Arguably design of erosion control measures should be based on a multi-disciplinary approach, involving engineers, landscape architects, horticulturist and environmental experts. The U.S. based N.C.M.A. (Reference Tec 11- 9A Articulated Concrete Blocks for Erosion Control) published a few guidelines.

TERRAFIX IN ENVIRONMENTALLY FRIENDLY AGRICULTURE - PERMEABLE STORM WATER CHANNELS

DESIGN CONSIDERATIONS (ARTICULATED BLOCKS)

- Blocks are placed together to form an erosion-resistant overlay with specific hydraulic performance characteristics.
- Includes a geotextile underlay to allow infiltration and exfiltration and to provide particle retention of the soil subgrade.
- Systems are simple to produce, easy to install and environmentally friendly.
- ACBs have excellent resistance to hydraulic shear and overtopping conditions.
- The ability to support the ecosystem''s habitat is a major advantage. Easy and fast to install, easy to inspect.
- Cabled systems can facilitate machine placement. Cables don't increase hydraulic or structural values however.
- Can be constructed in virtually seamless fields.
- Are not designed to add structural strength to steep slopes.
- A feasibility study conducted for Terraforce by The Council for Scientific and Industrial Research provides further design guidelines. **See www.terraforce.com/downloads**

BASIC GUIDLINES FOR THE USE OF EROSION CONTROL BLOCKS

Minimum Requirements (Hewlett et al. 1987)

Block mass --- 15 kg Mass/m² --- 135 kg/m²

Thickness --- 85mm Ave block width --- 255 mm

A roughness coefficient of 0,04 (CERC 1984) has to be assumed.

Where flow velocities of over 6m/s are expected to occur, these should be reduced with weirs of concrete retaining blocks or gabions. Should this not be possible and where flow depths are greater than 1.5m, sidewalls of concrete retaining blocks or gabions, as well as ground anchors for the bed lining should be considered.

Erosion control blocks are ideally suited for flow velocities between 6m/s and 3m/s, provided that oscillation is effectively prevented. This is best achieved by providing sufficient lateral restraint between adjacent blocks (more than 75% face contact between blocks) and with mechanical anchors into the subsoil.

Generally no special considerations should be necessary for flow velocities below 3m/s expect standard requirements such as • drainage • reinforcing for overtopping • backfill details • protecting from scour • providing for lateral inflow • alignment • position of weirs • vegetation • maintenance.

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TERRAFIX BLOCKS CAN BE USED FOR THE FOLLOWING APPLICATIONS

1. Storm water channels, stream lining

2. River bank protection

3. Lake shore and dam spillway lining

4. Embankment and sand-dune stabilisation

It is probably safe to say, that concrete erosion control blocks can successfully integrate with the environment. It is also true that rehabilitating and maintaining a healthy ecosystem should be the responsibility of every citizen. Individual efforts, when added up, amount to much more than bombastic corporate or government statements that lack the will to follow though.

If we don't look after Mother Nature, she is going to look after us in a way that is difficult to imagine at this stage. Catastrophic floods experienced at present in Europe and Asia may be an early indication what could be in store for us. The challenges facing us are more complex than meets the eye and the following quote sums it up perfectly.

"And that's just a part of the task that lies before us. There's a growing Third World at home. There are systems of illegitimate authority in every corner of the social, political, economic and cultural worlds.

For the first time in human history, we have to face the problem of protecting an environment that can sustain a decent human existence. We don't know that honest and dedicated effort will be enough to solve or even mitigate such problems as these. We can be quite confident, however, that the lack of such efforts will spell disaster." Noam Chomsky 1986.

FAIRLAND STREAM - TERRAFIX AND GABIONS FOR HEAVY EROSION CONTROL

"To provide protection to the river bed and embankment we made use of a combination of gabion and Terrafix blocks, which have proven highly successful in stream bed armouring in the Johannesburg Botanical Gardens"

The advantage of Terrafix blocks, Mr Holland said, is that if correctly installed they are able to withstand turbulence and water velocities which can wash our most other erosion protection systems.

"The system is also highly plantable and, importantly, provides nesting areas for creatures such as frogs and crabs. In this way Terrafix assists in bringing back essential life to dead streams"

"Furthermore, the combination of vegetated Terrafix blocks and the pools, which we have created, should attract a lot of fish and bird life."

Bruce Holland of Johannesburg Metropolitan Council. Urban Management, January 1997

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REHAB OF BADLY ERODED AND UNSTABLE CUT SLOPE

THE SAME INSTALLATION NEXT TO A BUSY ROAD

CAUSEWAY OVER LAGOON

SLOPE STABILISATION AROUND A NEW BUILDING

HEAVY EROSION CONTROL FOR A STREAM

EROSION CONTROL FOR A SMALL STREAM

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STORM WATER INLET AND WETLAND REHABILITATION

DAM SPILLWAY

EMBANKMENT EROSION CONTROL

EROSION CONTROL FOR INDUSTRIAL APPLICATION

BRIDGE ABUTMENT STABILISATION

STORM WATER CHANNEL WITH GOOD GRASS GROWTH

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