ARMORFLEX

ARTICULATING CONCRETE BLOCK REVETMENT SYSTEM

CHANNEL LINING
RIVERBANK PROTECTION
DRAINAGE DITCH LINING
PIPELINE PROTECTION
BOAT RAMPS
RESERVOIR SLOPE PROTECTION

LAKE SHORELINE PROTECTION
BRIDGE ABUTMENT PROTECTION
DYKES PROTECTION
DAM CRESTS AND SPILLWAYS
WEIRS AND OVERFLOW CHANNELS

BY
ARMORTEC™

EROSION CONTROL SOLUTIONS
Armorflex – strength with flexibility

The best designs are simple. Armorflex is no exception. In fact, the perfection of its design has led to its current position as one of the most popular systems used today to control erosion caused by wave action.

A machine-compressed cellular concrete block, Armorflex has a unique interlocking shape – which provides great strength when laid, yet makes it remarkably flexible during installation.

Armorflex mats are manufactured and assembled in our UK factory, where the blocks are linked longitudinally by means of galvanised wire cables or polyester ropes. The horizontal linkage is made by means of an interlocking stretcher bond. The made-up mats are then delivered to the site where suitable lifting equipment is provided.
But what about the environment? “Concrete can’t be considered when a ‘green’ solution is desired.” Nothing could be further from the truth. One of the great benefits of Armorflex is the way its open structure can actively encourage plant growth when used on canal and river banks. This not only acts as a secure binding agent but can also hide the original structure below a lush cover of vegetation. Armorflex can therefore provide a truly green solution.

With an array of important features, Armorflex is the right solution for a wide range of erosion control problems.

**Quality**

The blocks are produced using sophisticated, purpose-built machinery to ensure the consistent high quality commensurate with its specification: sulphate-resistant to Grade 2, for excellent durability in service.

**Design features**

Up to 35% of the surface area can be open by making two rectangular cells within the blocks. This permits free drainage of ground water, thus preventing a destabilising build-up of back-pressure behind the revetment and permits the establishment of indigenous vegetation.

*The unique double taper on the sides of the block also greatly enhances the ‘friction interlock’ when the revetment is blinded with the specified granular mixture.*

(Refer to H.R. Wallingford Revetment systems against wave attack - a design manual)
The mats are fully interlocked transversely, so adjacent mats can be butted against each other without discontinuity. Furthermore, mats may be linked both longitudinally and transversely for more aggressive situations. A range of mat weights, from 140 – 435 kg/m², enables the optimum weight to be chosen for each design requirement. Solid blocks are also available.

**Easy installation**
Laying is comparatively quick, 150 m² per hour for a 4-man team plus crane can easily be achieved.

Armortec does more than provide you with the product. Our Field Engineers will help you select the right product for your particular situation and will assist with on-site advice during the installation.

Moreover, Armortec supplies a wide range of geosynthetic fabrics enabling the best possible solution to be chosen by the designer every time.

**Plenty of help**
Extensive research has been carried out in the Netherlands, the USA and the UK and design recommendations can thus be made on the basis of extensive trial data and experience.
Armorflex – a quality pedigree

Armortec has carried out extensive research into wave and open channel flow conditions on Armorflex in the United States and the Netherlands. Design manuals and computer programs are available to assist in the proper Armorflex block selection for your hydraulic conditions. Design recommendations can thus be made on the basis of specific research data and sound engineering principles.

Since the early 1980’s, Armortec has initiated and participated in a wide range of research projects to evaluate the performance of Armorflex, including the following:

1. Tetratech model tests – California, USA.

**Design assistance**

A computer program produced by the Armortec Corporation can be utilised to give valuable assistance at the design stage as well as providing ‘in-use’ statistics which demonstrate the product’s merits.
Installation couldn’t be faster or easier

Prior to laying Armorflex, the subgrade must be profiled to line and level and compacted where necessary. As the mats are articulated and will adapt to any profile, great care is necessary at this stage. A geosynthetic fabric is then laid on the profiled surface.

The mats are delivered to the nearest hard road on 40’ trailers containing 60 to 180m² per load, with the geosynthetic and the lifting beam delivered on the first vehicle. On suitable sites the delivery can be phased so that mats can be offloaded directly from the road vehicles onto the prepared subgrade.

If the revetment has a gradient of 1:2 or steeper, the mats may slide on the geosynthetic fabric until the system settles and vegetation begins to grow. Temporary anchorage can be achieved by means of wooden pegs driven at 0.6m centres along the top of the mats. Permanent anchorage for special installations can be achieved using ground anchors and non-corroding cables.

Mats subject to wave attack should be blinded with a 5mm to 30mm sand/gravel mixture with a D₁₀ of 5mm. Above the normal waterline, mats may be topsoiled and seeded to give a ‘green’ effect.

Filling volumes are as follows:
- Armorflex 140  – 0.02 m³ per m²
- Armorflex 180  – 0.03 m³ per m²
- Armorflex 220  – 0.04 m³ per m²
- Armorflex 165  – 0.01 m³ per m²
- Armorflex 215  – 0.012 m³ per m²
- Armorflex 305  – 0.015 m³ per m²
- Armorflex 435  – 0.023 m³ per m²

Product Advice

Our Field Engineers will help you select the right product for your particular installations and will assist with on-site advice during the installation.
Summary of benefits

**Armorflex** is a flexible, interlocking matrix of concrete blocks of uniform size, shape and weight connected by a series of cables which pass longitudinally through preformed ducts in each unit. **Armorflex** is installed over site-specific filter fabric on a prepared surface. **Armorflex** revetment systems combine the favourable aspects of lightweight blankets and meshes, such as porosity, flexibility, vegetation encouragement and habitat enhancement with the nonerodable, self-weight and high tractive force resistance of a rigid lining.

**Armorflex** has proven to be an aesthetic and functional alternative to dumped stone riprap, gabions, structural concrete and other heavy-duty, durable erosion protection systems. **Armorflex** is easy to install, therefore, can dramatically reduce overall project costs. More specifically, when compared to other revetment systems, life-cycle costs have been reduced because **Armorflex** is a permanent system and saves on subsequent maintenance expenses.

**Resistant to wave attack**

**Prefabication at works for fast site installation**

**Underwater installation possible**

**Economical and easy to handle**

**Advanced design – interlocking blocks and double-taper for greater strength**

**Different weights and sizes available for optimum design**

**Encourages plant growth – environmentally acceptable**

**Mats can be lifted and re-used**

**Resistant to frost**

**Flexible: will accommodate variations in profile**
Specifications
Concrete cube strength: 50 N/mm² at 28 days
 Sulphate resistant to Class D5.2.
Cables: galvanised or polyester.
Mat sizes 6 x 2.4m, 6 x 1.2m, other lengths available.
(see also detailed specification sheet)

Cellular block mats

**Armorflex 140**
L x B x H: 340 x 400 x 85mm
Block weight: 17.3kg each
Unit weight: 140kg/m²
Open area (max.): 35%

**Armorflex 140S**
L x B x H: 340 x 400 x 90mm
Block weight: 19kg each
Unit weight: 150kg/m²
Open area (max.): 35%

**Armorflex 180**
L x B x H: 340 x 300 x 120mm
Block weight: 17.3kg each
Unit weight: 180kg/m²
Open area (max.): 35%

**Armorflex 220**
L x B x H: 340 x 300 x 150mm
Block weight: 21.9kg each
Unit weight: 225kg/m²
Open area (max.): 35%

Solid block mats

**Armorflex 165**
L x B x H: 340 x 400 x 85mm
Block weight: 20kg each
Unit weight: 160kg/m²
Open area (min.): 6%

**Armorflex 215**
L x B x H: 340 x 300 x 120mm
Block weight: 21kg each
Unit weight: 220kg/m²
Open area (min.): 6%

**Armorflex 205**
L x B x H: 340 x 300 x 150mm
Block weight: 26.7kg each
Unit weight: 285kg/m²
Open area (min.): 6%

**Armorflex 435**
L x B x H: 340 x 300 x 225mm
Block weight: 41kg each
Unit weight: 435kg/m²
Open area (min.): 6%

Also refer to: Revetment Systems against wave attack – a design manual: Hydraulics Research, Wallingford.

Wave attack data

The following table is based on Delft Hydraulics Laboratory Report M 1910 and is intended to offer a guide to designers. Designs for specific projects can be prepared using the report itself.
The table assumes the following data:
a) Revetment slope 1 in 3.
b) No reinforcement effect from cables (assumed corroded).
c) Revetment blinded with sand/gravel mixture after installation.
d) Irregular wave pattern Tp = 3.75 secs (most damaging period found in tests).

<table>
<thead>
<tr>
<th>Armorflex type</th>
<th>Significant Wave Height Hs</th>
<th>Maximum Wave Height H max</th>
</tr>
</thead>
<tbody>
<tr>
<td>140 Cellular</td>
<td>1.0m</td>
<td>1.2m</td>
</tr>
<tr>
<td>180 Cellular</td>
<td>1.3m</td>
<td>1.5m</td>
</tr>
<tr>
<td>220 Cellular</td>
<td>1.6m</td>
<td>1.8m</td>
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</tbody>
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NB. Run-up Cellular blocks mats can reduce wave run-up by 30% as compared with smooth revetment. This may enable a reduction in the height required for the protected area.

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