Eco-concrete

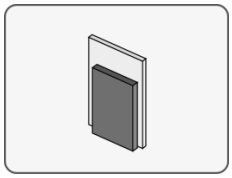
- *Type: uses natural forces*
- *Application: in fresh and salt waters as a replacement for standard concrete breakwater structures and extensive dike revetments;*
- *Contributes to:*
  - Natura 2000 species [4]: among others, fish, seaweed, molluscs, birds.

Modern concrete is getting much smoother, and so it is much less amenable as a habitat for many marine animals that like hard sub-surfaces. Eco-concrete can be a solution. It has a special texture and geometries that allow organisms such as algae, seaweed, periwinkles and mussels to colonise it much easier. Different varieties of eco-concrete are available, examples being eco-concrete slabs and 'Eco-Xblocks', concrete blocks with unusual shapes and a rough surface that resemble natural rocks [1].

Eco-concrete slabs are installed on hard structures that are already in place and the Eco-Xblocks are found in places where other 'traditional' Xblocks or other breakwater structures structural would be used. There are no restrictions on form.

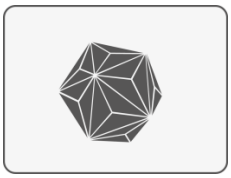
Specimen projects:
- *Zuiderhavenpier IJmuiden [2];*
- *'Sea wall' for Kansai Airport in Japan [3].*

Spatial aspects



Replacing old structures

Growing time 3-5 years



Free form

Services

Ecosystem services generate benefits if people can exploit the services and capitalise them.

Cleaning

The arrival of mussels and aquatic flora can have a positive effect on water quality. Both mussels and aquatic flora remove nutrients from the water column, reducing availability for free-floating algae. In addition, the capture of suspended matter improves the light climate, in turn furthering the germination and growth of submerged aquatic flora. The largest impact on water quality is seen when there is a high ratio of bank length to surface area and when water replenishment is moderate (as in docks).

Biodiversity

Using Eco-concrete furthers the establishment of algae, aquatic flora and seaweed, which are sources of food for species such as periwinkles, mussels and birds. This food web contributes to the stability, and therefore the robustness, of the ecosystem, helping to achieve the objectives of Natura 2000 and the European Water Framework Directive.

Benefits and cost savings

The ecosystem services referred to above generate benefits if people can exploit the services and capitalise them.

The principal benefits result from the changes to existing structures.

Leisure value

Improvements to water quality help to prevent the growth of duckweed and algae (including cyanobacteria).

Aquaculture

The structures serve as breeding and feeding grounds for fish and crustaceans.

Natura 2000 and WFD measures

Eco-concrete can be used for mitigation or compensation.

Costs

Construction

It is expected that production will cost two to three per cent more than the production of traditional 'smooth' concrete.

Maintenance (1 km)

Inspection and monitoring in the first two years: EUR 10,000 (three field days + reporting over a period of two years).

Management and maintenance

No extra maintenance is required in highly dynamic environments. Regular inspection and maintenance suffice.

Physical boundary conditions

These will be the boundary conditions for the establishment of nature on the Eco-concrete.

Wave impact and currents

The application is intended for use in both highly dynamic and not very dynamic environments. The less dynamic the locality, the more opportunities there will be for colonisation by flora and fauna. There is no specific research available about currents and waves that can serve as a basis for boundary conditions. The trial with the Zuiderhavenpier did show that developments in highly dynamic environments is possible.

Embankment

Application is possible on all embankment inclines. Generally speaking, the shallower the better. Shallower inclines result in a larger surface area for vegetation and therefore in larger feeding grounds for a range of animals, such as birds. Heat stress as a result of exposure to the sun can be a problem for some species

such as barnacles. These varieties thrive better on steeper inclines.

Salinity

Salinity determines the types of flora and fauna. In salt and brackish waters, there will be more species because there are more species here that bond to hard substrates in dynamic conditions. Application in freshwater conditions results in only limited added value and there are better alternatives.

Flood dynamic

This ranges from permanent inundation to temporary dry periods (for example in the tidal area). Long dry periods should be prevented.

Potential sites

The application focuses on making large smooth surfaces rougher (such as concrete in structures like breakwaters and groynes).

1. *Xbloc. Ecological Tests IJmuiden, The Netherlands. www.xbloc.com/projects/ecological-xbloc-tests-ijmuiden/item586.*
2. *Ecoconsult (2011) Pilotstudie Ecobeton Zuiderhavenhoofd IJmuiden 2008 - 2010 een Rijke Dijkproject.*
3. *Furodoi et al. (2002) Kansai International Airport Environmental Management Project.*
4. *Compendium voor de leefomgeving (2013) Beschermde soorten Vogel- en Habitatrichtlijn, 2013. http://www.compendiumvoorde-leefomgeving.nl/indicatoren/nl1328-Beschermde-soorten-volgens-Vogel--en-Habitatrichtlijn.html?i=19-48.*