CCELL

Hyperboloid Reefs

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CCELL

Hyperboloid Designs

LONG-TERM, NATURE INSPIRED COASTAL PROTECTION

CCell hyperboloid reefs combine the highest known strength-to-weight ratio, with an intricate internal complexity that supports both coastal protection and habitat creation. Their adaptable height, profile, and use of materials ensures their compatibility with local conditions.

Inspired by nature and bolstered by the growth of bivalves and corals, these reefs are a regenerative alternative to traditional coastal protection methods.

Key Features

- STRUCTURAL INTEGRITY

  The hyperboloid profile ensures structural integrity due to the double-curvature of surfaces formed from its straight structural members. This provides optimal load distribution and reduces stress concentration points, enhancing longevity.

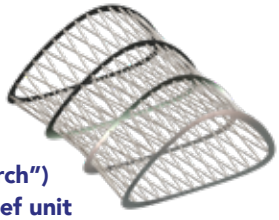
- ECO-FRIENDLY DESIGN

  CCell uses sustainable construction practices that combine the use of eco-concrete, reused steel, and bio-based materials. Hyperboloid units provide efficient material usage, aligned with circular economy principles. Mineral accretion technology (MAT) is incorporated to provide additional structural bulk from seawater minerals.

- EASY INSTALLATION

  Modular units come in a flat-pack design for efficient transport. Units can be assembled quickly with interlocking bars and frame rings; with multiple units aligning together to form the length of the reef. The process is non-disruptive and employs a rapid installation method.

Vertical hyperboloid reef unit



Horizontal ("Arch") hyperboloid reef unit

Applications

- COASTAL PROTECTION

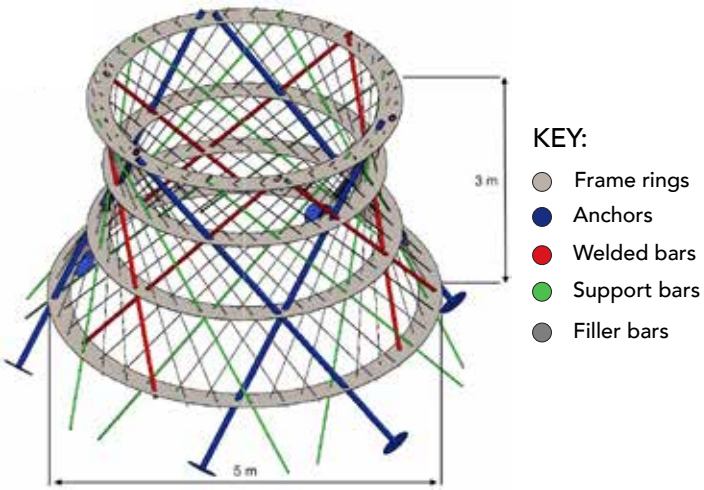
  CCell reefs attenuate waves through both wave breaking and internal turbulence. This calms the nearshore waters, causing sand to accumulate on shore. Erosion is reduced during severe storms and hurricanes as the reefs temper extreme waves.

- HABITAT RESTORATION

  The units are the skeleton for a reef that fosters biodiversity, boasting sheltered spaces for aquatic organisms and textured rock surfaces ideal for the attachment of marine species. They are well-suited for rewilding projects, outdoor aquariums, and snorkelling attractions.

- PIERS AND JETTIES

  The vertical hyperboloid reefs can form the bases of wooden decks and walkways. The reef profile can also be adapted to provide suitable deep edges for small boat moorings.



Arrangement of frame, anchors and bars in a typical unit

[1] CCell follow the following DNV guidelines:

- DNVGL-OS-C101- Design of offshore steel structures - LRFD method
- DNV-RP-C204 - Design Against Accidental Loads
- DNV-RP-C205 - Environmental Conditions and Environmental Loads
- DNVGL-RP-C203 - Fatigue design of offshore steel structures

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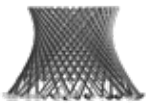
Technical Properties

Property	Units	HBC	HBS6	HBS4	HBA4	HBA2	HBB
Water Depth*	m	8	6	4	4	2	2
Unit Height**	m	7.5	5.5	3.5	3.5	1.5	1.5
Unit Width	m	12.5	9.1	5.8	8.3	5.3	2.2
Initial Unit Weight	t	67.6	36	14	1.6	0.3	0.1
Main Material	-	Eco-concrete	Steel	Steel	Steel	Steel	Bamboo
Optional Mineral Accretion	-	Yes - for steel components	Yes	Yes	Yes	Yes	Yes
Sketch	-						
Ideal in / for***	-	Intense wave and hurricane climates	Intense wave and storm climates	Mild wave and weather climates	Mild wave and weather climates	Mild wave and weather climates	Mild climates Bio-based design focus

* Recommended freeboard ranges from -0.5m (below the surface) to 1m (protrusion above water line) according to environmental suitability.
** Height, width and weight values are theoretical and may need to change to adapt to local material stock and quality.
** Ask a CCell representative for detailed information regarding ideal conditions and uses.