A new type of breakwaters

Breakwaters are used to limit coastal erosion. Coastal erosion is the process by which local sea level rises, strong wave action, and coastal flooding wear down or carry away rocks, soils, and/or sands along the coast.

All coastlines are affected by waves and currents that cause erosion; the combination of storm surge at high tide with additional effects from waves creates the most damaging conditions. The extent and severity of the problem is global, but it differs in different parts of the world, so there is no one-size-fits-all solution.

Breakwaters have been successful in reducing the impact of waves and current all around the world. Breakwaters that are made of piles of natural stones, concrete blocks of different shapes and forms, i.e. tetrapods etc. are used worldwide.

Figure 1 Breakwater with concrete shaped blocks

Figure 2 Breakwater with concrete shaped blocks

At LITTORAL we have, following the principles of conventional breakwaters, designed a new type of submerged breakwaters.

The breakwaters are placed at a certain distance from the beach, shoreline which make the incoming waves break and lose a lot of their wave energy. This in turn reduces the wave impact on the beach and reduces the natural erosion.

Similar systems have proven their functionality and suitability however, our systems are more ecological and are designed to increase in strength over time. In the following paragraphs we explore the LITTORAL breakwater system. First, let’s review the conventional breakwaters.

1. Conventional submerged breakwater

Submerged breakwaters exist around the world coast lines and are predominantly of the types given in Figure 3,4,5 below

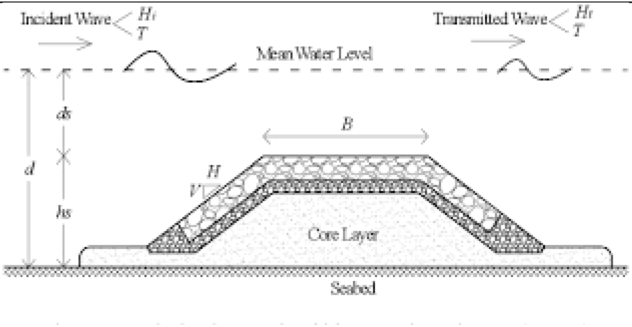

Figure 3 Submerged breakwater with concrete shaped blocks

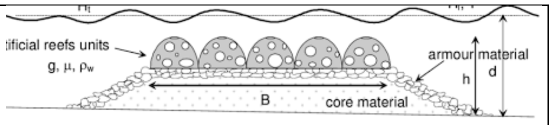

Figure 4 Breakwater with concrete shaped blocks and coral growth friendly

Figure 5 Picture of submerged breakwaters

As can be seen the breakwaters in Figures 3,4, and 5 are suitable for breaking incoming waves, reducing current speed and reducing wave energy impact on the shoreline, beach in turn reducing the sand erosion on the beach.

Due to the fact that the breakwater is submerged it will become a substrate for marine life (the surface on which an organism such as a plant, fungus, or animal lives).

For a breakwater 10 m long, 5 metres wide on top and 5 m inclined walls (as in Figure 3), the total surface area is 150 m^2, thus providing 150 m^2 of surface upon which coral growth, kelp etc. can grow. Also, the surfaces are exposed to the waves and the current and as such might make it difficult for the plankton and small fauna and flora to hang onto to later become a larger coral or kelp system.

The systems also require huge number of rocks and concrete that is made off materials that are being displaced from one location to another, which impacts the global environment, mining for stones etc.

2. LITTORAL submerged breakwater

The littoral system has the same advantages as the conventional system, i.e., reducing wave energy, current speeds to reduce the beach erosion, while.

a. Promoting the growth of Coral Reefs and kelps and in general all marine fauna and flora by increasing the substrate area.
b. Using a fraction of the natural materials (rocks, sand etc.) required for a conventional breakwater.
c. Using much less concrete
d. Providing protection against waves and current flows for small marine life.

In numbers this translates as follows.

a. Substrate area for a 10 m long system is calculated to be in excess of 600 M^2 compared to 150 m^2 for a conventional breakwater.
b. Use of rocks and other displaced material = 0
c. Use of concrete, calculated at 15% than for conventional breakwater.
d. The tubular members give a protected substrate inside and even outside as they are in the lee of other members.

It can be seen that this type of breakwater works as conventional ones however it is also a perfect substrate, available surface for coral reef and kelp to grow, which conventional ones are not really. See Pictures below from a previous project.

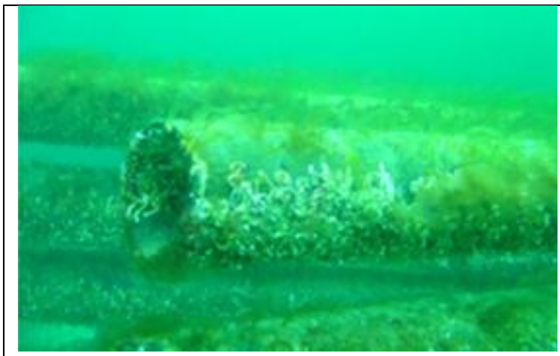

Figure 6 marine growth after 3 months

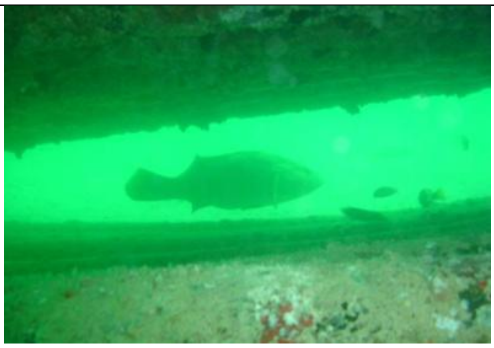

Figure 7 Marine growth after 6 months

Figure 8 Flora and Fauna after 6 months

Figure 9 Flora and Fauna after 6 months

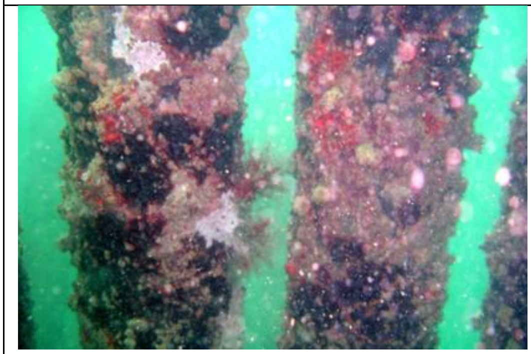

Figure 10 Flora and Fauna after 1 year

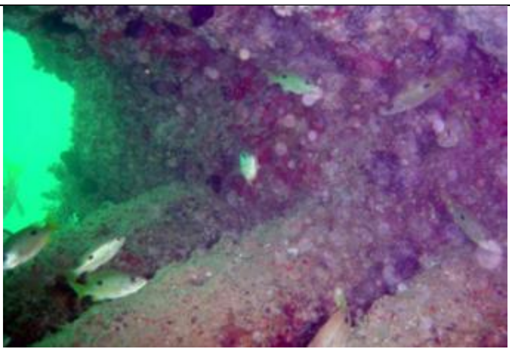

Figure 11 Flora and Fauna after 1 year

3. Technical aspects of the new breakwater

In order to design the correct breakwater, the following is reviewed,

1. Metocean data
2. Geotech data
3. Stability of the breakwater
4. Location offshore
5. Wave, current attenuation and soil deposition and erosion impact
6. Shape and final design of the breakwater
7. Reef creation

4. Conclusion

Based on our design and the experience with existing projects we have concluded that the new type of breakwater proposed gives the following advantages.

1. No large boulders or rocks etc. have to be mined to form the breakwater.
2. Concrete used is about 15% of conventional breakwaters made from concrete blocks.
3. The environmental impact is positive as it creates a perfect substrate, basis for marine life to start and grow. Substrate area is 4 x that of a conventional breakwater and it also provides protection areas for plankton and fishes.
4. The corals become a carbon sink as it will extract carbon dioxide from the atmosphere at an approximate rate of 0.15 Tonnes per m2 / per year. [Ref.1]
5. With time the breakwater is covered in Coral or kelp and becomes an actual reef solid garden and disappears under the fauna and flora, creating a natural barrier against waves.

Our type of BREAKWATER brings large environmental advantages with it.

Note;

[Ref.1] The significance of coral reefs as global carbon sinks— response to Greenhouse, D.W.Kinsey D.Hopley

Contact:

YVES DE LEENEER, LITTORAL Pte Ltd
CORPORATE: 1 Wallich Street #14-01 Guoco Tower, Singapore 078881
Mobile: +65 9615 0549 yves@littoral.sg
www.littoral.sg