Philippa McAlister
for Kaytech Engineered Fabrics
philippa2@polka.co.za
082 441 5779

Leading the way in innovative coastline defense systems

As the damage inflicted on Durban's coastline in 2007 is repaired, are we ready for the next devastating storm predicted to hit our shores in 2025?

IN ITS QUEST TO PROVIDE the most innovative solutions to coastal erosion, Kaytech Engineered Fabrics has looked to science to predict the environment its defense systems will encounter in the future.

The world's coastlines are under threat and the eastern coast of Africa is no exception. While the increase in sea levels has been attributed to global warming and climate change, coastal developments are standing in the way of beach retreats that would otherwise naturally move inland.

Further coastline erosion is an indisputable fact, but with valuable real estate needing to be protected, Kaytech investigated what the future holds to ensure the company offers the most innovative solutions to its clients.

The facts should grab most engineers' attention. The South African Data Centre for Oceanography, which compiles seasonal swell records from voluntary observation ships, indicates Durban's average deep-sea wave height to be 1,57 m, with an average breaking wave height of 2,6 m. Indian Ocean cyclones are getting stronger but less frequent, while southern hemisphere westerlies are increasing in strengths of up to 10%, which in turn threaten to increase wave heights in the Durban area by as much as 25%. Sea levels are increasing by about 2,7 mm a year, but alarming as these facts may be, Durban's coastline is eroding at rates in line with world averages.

In 2006 and 2007 accelerated erosion laid claim to Durban's coastline. This has largely been attributed to the lunar tidal cycle coupled with strong equinoctial erosion. This erosion ended in October 2007 and by January 2008 the eastern coastline had returned to almost 60% of its former position. In areas where significant buffers between beaches and infrastructure were not in effect, artificial stabilisation had to be introduced, as the natural buffers no longer existed.

One of these areas requiring artificial stabilisation was the Durban Promenade, which suffered severe damage in the 2007 storms. In partnership with the eThekwini Municipality, Kaytech helped to create a second line of defense, a sea wall that will hold back the tide once the beach has been depleted.

Proactively, the Durban Port Authority regularly dredges the harbour mouth and, in conjunction with the Municipality, uses the sand to replenish the beaches. Natural tidal activity eventually depletes this sand from the beach, as currents shift the aggregate up the coast and back offshore. This is when the second line of defense becomes necessary.

The Municipality's solution was to create a soft defense – designed to complement the natural tidal process. To this effect Marco Pauselli of GAP Consulting was appointed to design the Promenade's sea wall. His design followed a two-fold approach, namely ongoing beach nourishment, and protection by large sand bags.

Pauselli's design called for the use of 3,5 to 4 tonne geocontainers, an aesthetically pleasing solution, which were used in a double layer, with one bag positioned behind the other to the full height of protection at a slope of 1:1. In addition, provision was made for a flexible front toe that protrudes out from the main structure, commonly referred to as a "Dutch toe" or "self-healing toe" for scour mitigation.

Constructed from Kaytech's EnviroRock™ Geocontainers®, these bags will provide a temporary holding measure, acting as an erosion guardian, until dredged sand can be pumped back onto the beach and the natural beach profile re-established. EnviroRock® geocontainers are specifically designed for the projects for which they are used. Kaytech manufactures them from a robust, durable nonwoven staple-fibre polypropylene material, which is UV stabilised and abrasion-resistant, making it well suited to coastal erosion control applications.

This is not the first time Kaytech's innovative geocontainers have proved integral as an erosion buffer. They have also been employed effectively in two major groynes constructed to help restore Langebaan's beaches after severe storm

damage. Globally this technology has also been hailed for its effectiveness in Australia and other international markets.

While ensuring that the financial constraints of the Municipality were considered, Kaytech protected the area immediately in front and some distance either side of buildings with a double layer of geocontainers, whilst the remainder of the Promenade was protected with a two meter high Bidim® A6 geotextile wrap-around wall.

Bidim A6 is a thick needle-punched nonwoven polyester geotextile that provides reinforcing characteristics for steep slopes less than 70 degrees and ensures minimum deformation in the structure. The thickness of the geotextile provides sufficient drainage capacity within its plane, enabling it to reduce pore pressure build-up in the reinforced soil, thereby improving the internal shear resistance and overall stability of the structure.

The Promenade sea wall is one of the soft defenses that municipal authorities have included in their policy to address coastal erosion in urban areas. Soft defenses are implemented to mimic coastlines in terms of their acceptance of 'wave loading' during storms. While these structures are considered temporary, they play a part in promoting the regeneration of natural erosion barriers.

Kaytech and its technology partners can now offer an excellent suite of geocontainer solutions, which have proved effective in beach erosion protection. These solutions could play a crucial role in the years ahead as scientists predict that climate change will increase the occurrence of large storms, while a rise in sea levels due to global warming will increase coastal erosion. And most certain of all is the evidence that suggests that erosion events are cyclical, making them predictable and easier to plan for. In 1988 cyclone Demoina wrecked havoc on the coastline and 18 years later Durban's coast was left weakened by these latest events. Kaytech's solution can help many coastal developments and property owners to prepare for 2025, while maintaining the integrity and beauty of Durban's coastline and protecting our fragile ecosystem. □

1 Single layer of EnviroRock™
2 Single layer of EnviroRock™ with RockGrid® PC wrap around wall
3 Double-layer EnviroRock™ wall
4 Installed section of the EnviroRock™ wall

Source:
http://www.saice.org.za/downloads/monthly_publications/2010/2010-Civil-Engineering-oct/#/0