

Effects of Cross Shore Profiles on the Sustainable Design of Coastal Structures

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Figure 1: Reinforcement of beach profile by concrete revetment at Loran, Alexandria, Egypt.

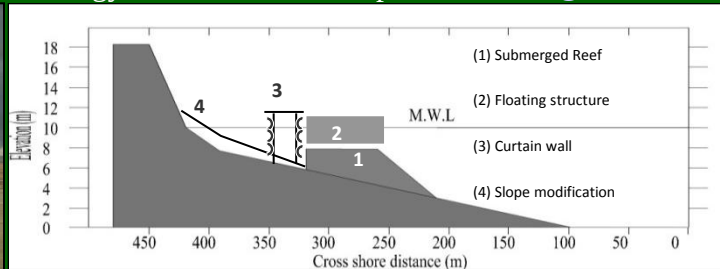


Figure 3: Cross section of the sloped beach with the proposed structures at Sporting.

Introduction:

- The performance of the existing coastal structures at three different locations along Alexandria coastline, Egypt was re-examined.
- The first area "Shatby" has a narrow sandy beach that is protected by a vertical seawall of 3-5 m above sea water level.
- The 2nd area "Sporting" was protected by a revetment of 25 width with 10t concrete blocks.
- The 3rd area "Loran", revetment protected the shoreline against further erosion with beach profile completely covered by blocks, (Figure1).
- The benefits of complementing the existing structures by adding limited modification are Investigated.
- Submerged Breakwater was applied in Mandara beach in 2009. Figure 2 shows its good effect.



Figure 2: Effect of submerged breakwater in beach width at Mandra beach, Alexandria.

Methods:

- Profiles' surveying were carried out from a constructed land baseline to a water depth of 10.0 m below the M.W.L.
- Two dimensional Reynolds-Averaged Navier-Stokes (RANS) numerical model has been used (Reeve et al., 2008, Lin and Xu, 2006).

References:

- El-Sharnouby and Soliman (2011): *Behavior of Shore Protection Structures at Alexandria, Egypt, during the Storm of December 2010*, Proceedings of the 2011 Conference on Coastal Engineering Practice, San Diego, California, ASCE, USA, pp. 780-792.
- Lin and Xu (2006): NEWFLUME: a numerical water flume for two dimensional turbulent free surface flows, *Journal of Hydraulic Research*, vol. 44 (1), pp. 79-93.
- Reeve, Soliman, and Lin (2008): Numerical study of combined overflow and wave overtopping over a smooth impermeable seawall, *Coastal Engineering*, ELSEVIER, vol. 55(2), pp. 155-166.

Results:

- Four coastal protection schemes were investigated; submerged Reef, Floating structure, Curtain wall and slope modification (Figure 3).
- Wave characteristics used at the surveyed profiles are: $H_s = 1.00$ m, $T_m = 6.0$ s.
- Their effects on the reduction of wave breaking heights, wave run-up as well as maintaining nourished sandy beaches is evaluated (Figure 4).

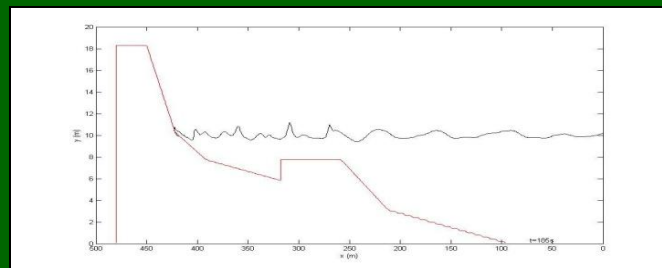


Figure 4: Snapshot of the free surface at Sporting with the proposed submerged artificial reef.

Analysis:

- Table 1 shows a comparison between the values of wave run-up for the nature beach profile and after the construction of the submerged artificial reef. The numerical model results showed the reduction of wave run-up (20%) .

Location	Wave run-up (m)	Wave run-up with AR (m)
Shatby	0.14	0.11
Sporting	0.13	0.10
Loran	0.13	0.12