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Coastal Sediment Transport, Engineering Practice,A case study in The Sea of Oman, Iran

A.R.Zarifsanayei[1], N. H. Zaker[2]

1,2- Faculty of Environment, University of Tehran, Tehran,Iran

a.r.zarif@ut.ac.ir
nhzaker@ut.ac.ir

Abstract

There are many fishery ports in Iran. Sedimentation rate around these ports is one of the most significant parameters to design these small ports. It is usually difficult to estimate the longshore sediment transport (LST) with sufficient accuracy. Periodical bathymetric and beach profile measurements near the new harbours are a valuable tool for evaluating or calibrating the existent LST relationships and The final decision on the construction of the groin is made after monitoring the sedimentation rate around the port during the first few years after its construction. This paper discusses Coastal sediment transport in Zarabad Fishery Port Coastal area located in the Sea of Oman in Iran. sediment transport rates, derived from bulk sediment transport rate formulas (CERC and Kamphuis and Van Rijn) and measurements, were compared. Finally, Coastline changes due to construction of the port was simulated numerically by LITPACK. The model was calibrated using the periodically collected hydrographic data. The results showed that using bulk sediment transport formulas in the study area had errors of up to several times more than the real values and Coastline never reaches the tip of groin 20 years after construction of the port.

Keywords: Coastal Sediment Transport, LITPACK, Bulk transpot formula, Coastline change

1. INTRODUCTION

It is usually difficult to estimate the longshore sediment transport (LST) with sufficient accuracy. Based on both experimental and practical applications and calibrations worldwide, the CERC, Kamphuis, and Van Rijn formulae were considered the best for evaluating littoral drift on fine sandy and sand fraction beaches ([1]; [2]; [3]).

The CERC formula was originally developed by the U.S. Army Corps of Engineers based on the proportionality principle of the volume of transported fine sediments[4]. The Kamphuis formula was developed (and so applied) based on dimensional analysis and calibration carried out on both laboratory and field data with median grain sizes in the range of d_{50} = 200 to 600 μm and surf zone slopes in the range of $\tan\beta$ = 0.015 to 0.15. The Van Rijn formula developed based on the parameterization of computed transport rates of modeled works (CROSMOR2000 model) and measured transport rates in the surf zone of various beaches. It is valid for coastline with very fine particles, especially for sand with a median diameter of d_{50} =150 to 500 μm and bed slopes in the range of $\tan\beta$ = 0.02 to 0.1. In Kamphuis and Van Rijn formulae, d_{50} was defined as the median particle size in the surf zone, and $\tan\beta$ was defined as the beach slope (the ratio of the water depth, at the breaker line, and the distance from the still water beach line to the breaker line). Since there are some empirical coefficients in aforementioned LST formulas, using the formulas without calibrating maybe yield several times error in estimation of sediment transport rate. Periodical bathymetric and beach profile measurements near the new harbours are a valuable tools for evaluating or calibrating the existent LST Formulas. The blockage of longshore sediment transport by jetties and breakwaters and the resulting growth and erosion patterns of the adjacent beaches have yielded reasonable evaluations of the net (and sometimes gross) transport rates at many coastal sites[5].

In the present paper, measured and estimated sediment transport rates, derived from bulk sediment transport rate formulas, were compared using the periodical hydrographic surveys around the Zarabad Fishery Port in Iran. In addition, the solution for controlling the sedimentation of the port was investigated numerically using the LITPACK model.