



## REMR TECHNICAL NOTE CO-RR-1.1

### DOLOS REPAIR AND REHABILITATION

PURPOSE: To urge caution when stability coefficients, as determined using the Shore Protection Manual (SPM) (Ref a) and Engineer Manual 1110-2-2904 (Ref b), are being used for sizing dolos for use in rehabilitation of rubble-mound breakwaters and jetties.

BACKGROUND: Stability coefficients presented in the SPM are derived from extensive laboratory tests in which model structures simulate new construction with no (or very minor) overtopping. In conducting these tests, it was assumed that underlayer materials would be sized and placed in accordance with requirements of the armor to be used.

PROBLEM: A deteriorated structure may consist of a conglomerate of mixed material sizes, and the old armor may be completely or partially gone, making it difficult to level slopes. In sizing an overlay or new armor, it must be determined whether or not stability coefficients developed for new construction should be used. Intuition would suggest that the coefficients probably need to be reduced. Results of tests conducted for breakwater rehabilitation at Nawiliwili, Cleveland, Crescent City, and Humboldt are summarized below.

<u>Project Characteristic</u>	<u>Nawiliwili</u>	<u>Cleveland Harbor</u>	<u>Crescent City</u>	<u>Humboldt</u>
Portion of structure	Trunk	Trunk	Elbow & head	Head
Wave form	Breaking	Nonbreaking	Breaking	Breaking
Overtopping condition	Moderate	Moderate	Major	Major
w tons	11	4	42	45
a pcf	146	140	156	155
H ft	19.4	12	33	40
Armor slope	1V:1.5H	IV:2H	IV:4H	IV:5H
Stability coefficient:				
from model tests	15.4	7.9	5.6	7.7
from SPM	15.0	31.0*	7.0	7.0

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\* Nonbreaking wave with no overtopping.

Use of the SPM stability coefficients would have predicted accurately the dolos weight required for Nawiliwili and Humboldt; however, the weight required at Crescent City would have been underestimated significantly, and the Cleveland Harbor weight would have been underestimated drastically. Reduced stability coefficients for Crescent City and Cleveland Harbor probably result primarily from underlayer material characteristics, boundary conditions at the dolos structure interface, and complex bathymetry unique to these particular structures.

CONCLUSIONS: Selection of armor weights for rehabilitation presents the designer with unique problems. Major rehabilitation plans should be optimized based on results of a hydraulic model investigation. Guidance for selection of armor that is of dissimilar type or size or both will be developed as part of the work under the Coastal problem area of the RF14R Research Program.

- REFERENCES:
- a. Shore protection manual. Coastal Engineering Research Center, US Army Engineer Waterways Experiment Station, Vicksburg, MS, 4th ed., 1984, 3 vols., US Government Printing Office, Washington, DC.
  - b. Design of breakwaters and jetties. US Army Corps of Engineers, Washington, DC, Apr 1963. Engineer Manual 1110-2-2904.