

Evaluation of Alternative Methods for Dam Freeboard Design

Carmen E. Bernedo, P.E.¹
Senior Engineer

Lori L. Hadley²
Coastal Engineer

John C. Haapala, P.E.³
Senior Hydrologist/Hydraulic Engineer

Abstract. Recent activities in the design of reservoirs in coastal regions have pointed out the challenges of applying coastal engineering to inland reservoirs. Analysis on one project showed a cost impact on the order of \$20 million using the same basic wind and rainfall design criteria, but alternative methodologies. How can that be? It is easier to understand when the design is for shallow reservoirs with large surface areas and long impoundment perimeters. One reservoir covered a surface area of 17,000 acres with a fully encircling embankment dam 20+ miles in length. In south Florida, subject to powerful hurricanes, embankment freeboard is a major cost component of any dam.

The complex nature of coastal hydraulics has historically been evaluated using such tools as the Shore Protection Manual (SPM), Coastal Engineering Manual (CEM), and numerical wave models such as STWAVE. Due to the importance of freeboard design, a detailed effort was made to compare the alternative methodologies. Wave heights were determined using equations (CEM/SPM) and modeling (STWAVE). Wave run-up and overwash were evaluated using numerical methods from the SPM, CEM, Technical Advisory Committee on Flood Defense (Netherlands) guidance, documentation from the Portland Cement Association, and the computer program ACES. Wave heights, runup, and overwash can be determined using different sources in series, but not always with the consistency necessary for accurate results.

This paper will emphasize understanding the basis of the formula or methodology for correct application. Numerical results are presented in comparative tables as well as recommendations.

¹ MWH, Denver, Colorado
1801 California St. Suite 2900
Denver, CO 80202
Tel: (303) 291-2222
e-mail: carmen.e.bernedo@mwhglobal.com

² USACE - Jacksonville District
Tel: (904) 232 - 1386
e-mail: lori.l.hadley@saj02.usace.army.mil

³ MWH, Bellevue, Washington
2353 130th Avenue N.E., Suite 200
Bellevue, Washington 98005
Tel: (425)-602-4000
e-mail: john.c.haapala@mwhglobal.com