The Design, Feasibility and Cost Analysis of Sea Barrier Systems in Norfolk, Virginia and the Comparative Cost of Shoreline Barriers

by

Charles H. Hasenbank

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Abstract

Protecting a coastline from the damage of a storm surge, or tidal flooding associated with sea level rise, is a challenging and costly engineering endeavor. Low lying properties located directly on an ocean coastline are limited in protective solutions to include constructing shoreline barriers, increasing building elevations, or relocation. However, shoreline properties on an estuary are afforded the additional protective option of a dynamic sea barrier spanning the mouth of the bay or river.

The Delta Works projects in the Netherlands pioneered the design and construction of large scale dynamic sea barriers. Although similar projects have been built or proposed, the high costs have minimized wide spread implementation. Even with positive benefit-cost ratios of prevented property damage to sea barrier cost, the willingness to fund these multi-billion dollar projects is reduced when the probability of extreme coastal flooding is associated with 100 to 1000 year storms. However, if sea level rise shifts the flooding probability to include king tides and annual storms, the perspective regarding the relative cost of a sea barrier system may soon change.

This study serves as a design, feasibility and cost analysis of potential sea barrier systems in the Chesapeake Bay near Norfolk, Virginia. Several sea barrier concept designs were proposed, and analyzed against intermediate sea level rise scenarios for the year 2100, to determine feasibility based on topography and projected tide levels. The cost and performance of the design concepts were then examined to determine an optimal design. Finally, the cost of the optimal sea barrier system was compared to the notional cost of installing shoreline barriers along the extent of the estuary, to determine the most cost effective method of coastal flooding protection.

Thesis Supervisor: Daniel Frey
Title: Professor of Mechanical Engineering