DESIGN STORM SURGE HYDROGRAPHS FOR THE FLORIDA COAST

PROBLEM STATEMENT

Design water flow conditions for Florida's coastal roadways and bridges are, in general, created by hurricane storm surges. In order to estimate the magnitude of design flow velocities and peak water elevations, two-dimensional hydraulics (computer) models are configured and run for the region containing the points of interest. The most important boundary condition for these models is the open coast storm surge hydrograph for the frequency storm of interest (e.g. 50, 100, 500 year return interval). Several governmental agencies have published storm surge elevations for locations along the coast of Florida. Some of these agencies have also published a limited number of storm surge hydrographs (time history of the open coast water elevation for a specific frequency of return interval storm). The problem is that there are (sometimes significant) differences between the predicted storm surge elevations and the hydrograph shapes. The problem, thus, is in deciding which values FDOT should recommend for use by the FDOT Districts and their consultants?

OBJECTIVES

The objectives of this study included the following:

- collect, compile and reduce published information and data on open coast storm surge along Florida's coast
- analyze and compare the methods of analysis and data by the various agencies
- make recommendations regarding 50, 100, and 500 year return interval design storm surge elevations and hydrographs for the entire coastline of Florida.

FINDINGS AND CONCLUSIONS

Four government agencies have published storm surge information for the Florida coastline, National Oceanic and Atmospheric Administration (NOAA), Federal Emergency Management Administration (FEMA), US Army Corps of Engineers (USACE), and Florida Department of Environmental Protection (FDEP) (formerly Florida Department of Natural Resources, Bureau of Beaches and Shores). In addition, Ayres Corporation, with funding from the Departments of Transportation of several coastal states (Pooled Fund Study), analyzed USACE (ADCIRC model) data and produced recommended design storm surge hydrographs and elevations for the US East Coast and the US Gulf of Mexico.

Information and data from all of these studies were compiled and analyzed in this investigation. Even though all of these studies started with the same governing differential equations (the continuity and momentum equations), different mechanisms were included/excluded in the

analyses. The numerical schemes used in solving the equations were also different, as were the techniques used to arrive at the different return frequencies. The FDEP analysis was the only one that consistently included all of the major storm surge generation mechanisms, including wave setup. However, FDEP only covered 26 of the 34 coastal counties in their analysis. The recommended storm surge elevations and hydrographs are based primarily on the FDEP results with some guidance from FEMA in the areas not covered by FDEP. Thus, the objectives of the study were achieved.

BENEFITS

The benefits of this research are that (1) FDOT and its consultants will now have easy access to information on design, open coast storm surge hydrographs for their analyses, (2) FDOT will save both time and money on projects requiring this type of analysis by not having to review the literature for each project, and (3) the likelihood of someone using incorrect published storm surge information is reduced. The use of incorrect storm surge elevations will result in under- or over-designed structures. Improved design flow predictions will mean improved predictions for hydrodynamic loads, sediment scour depths, establishing bridge elevations, and so forth. This translates into safer (and, in many cases, less expensive) roadway and bridge designs.

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