



Florida Department of Transportation Research

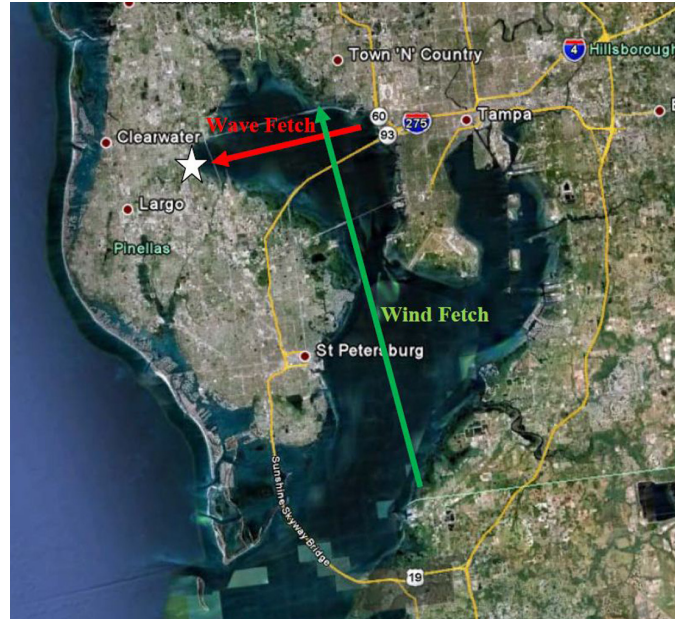
Development of Methods for Improving Levels I and II MET/Ocean Parameter Predictions

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Coastal bridges in Florida are designed to withstand wave effects up to the intensity of a 100-year event. The prediction of storm surge, wave effects, and moments on bridges requires design parameters based on the 100-year meteorological and oceanographic (met/ocean) conditions, such as water levels, wave heights, and wave periods. A complete design must also include bridge parameters, such as dimensions, elevation, and orientation. The standard design protocol is established by the *Guide Specification for Bridges Vulnerable to Coastal Storms* from the American Association of State Highway and Transportation Officials (AASHTO). The *Guide* describes three levels of analysis of increasing complexity and accuracy. Levels I and II are frequently used, but they tend to severely overestimate the met/ocean parameters, leading to costly, excessive bridge designs. Level III analysis is much more accurate, but it is also very costly, prohibitively so considering the number of coastal bridges in Florida.

Researchers from Ocean Engineering Associates, Inc., (OEA) used a recent hurricane hindcasting and wave forces study of Tampa Bay as the basis for a study of Level I and Level III analyses. Their goals were to compare the met/ocean parameters produced by both analyses, to examine correlations between the sets of parameters, and determine whether simple adjustments could be found that bring the Level I analysis results closer to the Level III results and still produce conservative results that preserve a margin of safety for the bridge design.

The study built on previous work for the Florida Department of Transportation by OEA. The researchers chose the Tampa-St. Petersburg area because the shape of the bay provides bridges in a variety of settings, resulting in a broad-based test of Level I and Level III analyses. One critical difference between the analyses is that Level I assumes that all major met/ocean conditions align



This view of Tampa Bay is marked to show how wave fetch and wind fetch differ for one of the bridges examined in this study. This difference is critical to the difference between Level I and Level III analyses.

to produce a maximum effect. In many cases, the geographical setting of a bridge prevents this kind of maximal alignment.

The approach taken in this study was to determine the ratio of Level I and Level III design water elevations at several bridge sites. Ratios were correlated with a number of quantities associated with overall and local water body geometry. The same approach was taken using Level I and Level III wave height predictions. The researchers found better correlations based on water elevation than on wave height, but both approaches successfully lowered Level I parameters while retaining an appropriate, safe degree of overestimation.

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For more information, visit <http://www.dot.state.fl.us/research-center>