

# Design 500-, 700-, and 1700-year coastal flood elevations beyond code requirements: A case study of Gulf Coast, United States

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This research aims to address the limitations of current building codes and regulations for coastal flood hazards in the United States. The current codes only consider the 100-year flood hazard, which is not adequate for areas that are prone to more severe floods. The research presents a new methodology that considers longer return period floods by using data from flood insurance studies (FIS), statistical models and best practices to provide guidance for architects and engineers when designing buildings in coastal high hazard areas.

The National Flood Insurance Program (NFIP) insurance policies and building codes require structures in coastal high hazard areas to be elevated above the design flood elevation (DFE) without using fill. However, the current elevation procedures only take into account the 100-year base flood elevation with minimal guidance for longer return period floods, which is of particular concern for critical facilities and buildings with a longer design life such as institutional buildings.

The methodology proposed in this research uses stillwater elevations (SWEL) from FIS and statistical models to extrapolate flood elevations associated with longer return periods. The FIS data is fitted using the Gumbel extreme value distribution, which results in an equation that can be used for extrapolating flood elevations beyond code requirements and current best practices. The results are evaluated using  $R^2$  values, differences in projected elevations and known elevations for the same return period, and normalized data for the 100-year SWELs.

It's important to note that the results of this research are not intended to be integrated into the current codes or policy regulations in the United States. Instead, it's intended to provide generalized guidance to aid practitioners in decision making by consolidating current codes, best practices, and characteristics of the changing coastal environment. This research aims to provide architects and engineers with a better understanding of the potential flood hazards in coastal areas and help them design buildings that are more resilient to these hazards.

Keywords: stillwater elevations (SWEL), design flood elevation (DFE), National Flood Insurance Program (NFIP), base flood elevation (BFE), Gumbel extreme value distribution, flood insurance studies (FIS)