This was an exploratory study on structural demands due to the hurricane hazard environment with consideration of how the demand models fit in the larger picture of performance-based engineering. For the hurricane context, this study focused on the feasibility of applying a performance-based methodology to hurricane hazards. The purpose of this study was to enumerate structural hazards associated with hurricanes events, exhibiting a variety of intensities, speed and surge heights at a location. The outcome of the study could be used to understand the response and performance of structures under the hurricane loads. Since this was the exploration study, more emphasis was given to the usage of available resources, research, and models. In the course of this study, various available wind field, storm surge and wave height models generated by researchers were studied and evaluated. After reviewing several models, the wind field model by Batts et al. (1980) was selected for generation of wind speed data. For calculation of storm surge, the SLOSH (Jelesnianski et al., 1992) program was used. Wave data was generated from NOAA database. The output generated by the wind field model, NOAA database and SLOSH program were fitted by suitable probability distributions. Thereafter, the distribution properties were calculated and correlations between the data were established and a joint probability distribution function (PDF) of the correlated parameters (wind speed, wave height and storm surge) was estimated.

Once the correlation between the parameters was established, the next step was to measure the response of the structural system to these hazards. To measure the structural response, Finite Element Model of three story concrete frame and time histories of hazards was constructed. To create time histories of Wind, wind tunnel test results was adopted. While, wave height time histories were generated using Laboratory basin test data surge was treated as static load in this analysis. Thereafter, these time histories are applied to finite element model and response was measured. Response of the structural system was measured in terms of the drift recorded at nodes of model. Subsequently, measured response was mapped to the damage caused to structure using Damage model. The final step in the process was to map the damage estimated from damage model to repair cost, repair time and loss of operability using loss model. The outcome of this whole analysis was to be used by engineers and local authorities for planning and regulation of design and mitigation activities. The data can also be used to update local building codes and possibly for use in the insurance industry. The target location chosen for conducting this study is Miami-Dade county of Florida.

Major: Structural & Geotechnical Track

Educational Career:
Bachelor's of Civil Engineering, BS, 2006, Shri GS Institute of Technology and Science

Committee in Charge:
Dr. Kevin Mackie, Chair, Civil Engineering
Dr. Manoj Chopra, Civil Engineering
Dr. Necati Catbas, Civil Engineering

Approved for distribution by Dr. Kevin Mackie, Committee Chair, on March 17, 2010.

The public is welcome to attend.