**Developing Performance-Based Standards for Wind-Driven Rain Intrusion through the Tracks of Sliding Glass Doors: Reliability-Based Experimentally Informed Approach**

## INTRODUCTION AND MOTIVATION

Hurricanes have historically driven multiple direct and indirect hazards that significantly impact the building envelope and structural systems. One of the most critical hurricane-induced hazards is wind-driven rain (WDR) intrusion, which has adversely affected buildings, particularly in Florida. Past hurricanes have shown that water intrusion can cause minor to severe interior content damage and property loss. Wind-driven rain (WDR) is a significant concern for buildings in hurricane-prone regions, especially regarding the performance of sliding glass doors (SGDs). WDR occurs when rain is propelled by wind at high velocities leading to water infiltration through pathways (e.g., defects and/or breaches in the building envelope). Our recently funded project by the Florida Building Commission (FBC) showed that the current standards pertaining to the prevention of water intrusion through the tracks of SGDs need to be revised to develop a robust testing protocol of WDR intrusion through the tracks of sliding glass doors. The recent experimental testing on sliding glass doors at FIU and UF indicated that if wind and rain parameters including turbulence are realistically and holistically simulated in the experiments, WDR intrusion is possible through the tracks of sliding glass doors. The wind turbulence can also cause window/door components and connections to vibrate and/or deflect/deform causing WDR intrusion. The mixed-phase flow dynamics (i.e., fluctuating winds with entrained rain precipitation) through these operable systems are also not properly simulated in the existing testing standards, which may influence how effectively water infiltrates and drains. These effects, not currently considered in traditional static-type WDR tests in labs but can be incorporated to improve the current standards. Wind directionality is also important to simulate in the current testing protocols.

### Research Idea

In this research, we plan to build on previous testing research at FIU and UF to develop a holistic WDR intrusion testing protocol for SGDs. We will redevelop the testing pressure chamber developed at UF from previously funded FBC projects and calibrated with FIU WOW testing parameters from previously tested SGDs. The experimental testing calibration will account for mixed-phase flow dynamics (i.e., fluctuating winds with entrained rain precipitation) through the tracks of sliding glass doors. The calibration will also include turbulence modeling, and wind directionality. The main objective of this project is to come up with testing parameters (e.g., wind pressure, rainfall intensity) and the application method that can mimic the actual loading induced by hurricanes on sliding glass doors. The output from this testing will inform calibration parameters for industrial testing facilities to generate testing environment that is equivalent/close to the testing environment at WOW. The collected experimental data for the hazards' intensities (wind pressure, rainfall intensity) and the resistance of sliding glass doors samples will be used as input for a reliability analysis to develop fragility functions that can capture the performance of sliding glass doors in terms of water infiltration. This will shift the current standards from the pass/fail criteria for water infiltration through SGDs to performance-based assessment based on prescribed performance states that will be developed as a part of this project.