BUILDING ENCLOSURES AND HURRICANES

Hurricanes bring wind, rain, and flooding that can damage buildings, causing municipalities, asset managers, property owners, and insurance companies to seek information about their buildings’ condition. A post-hurricane assessment can help determine the extent and causes of damage to the building and its enclosure, including roofs, exterior wall cladding/siding, insulation, windows, and curtain walls.

COMMON BUILDING ENCLOSURE PROBLEMS CAUSED BY HURRICANES

Following a hurricane, it is important to understand the enclosure’s condition. It may also be necessary to determine the timing of wind, rain, and flooding with respect to their impact on the building, and develop strategies for repairs. Common building enclosure considerations, system susceptibilities, and causes of failures related to wind and water include the following:

- **Roof Damage.** Wind damage to the roof covering system (e.g., shingles, clay tiles, and roofing membranes) during a hurricane is often caused by uplift forces or impact damage, leading to water leaking into the building. Many roofing warranties exclude damage caused by winds above 55 mph, which is well below the sustained wind speed of a Category 1 hurricane. The roof’s age, quality of original installation, and preexisting deterioration can also affect the roof’s performance during a hurricane.

  Wind creates suction, or uplift loads, on roofs. If these forces exceed the strength of the covering or its attachment, it can pull off. The highest uplift pressures typically occur at roof corners and edges, so these zones can be more vulnerable to uplift failures.

  Roofs are also susceptible to damage from impact, due to flying debris or roof-mounted equipment displaced by wind. Even small punctures in the roof covering can lead to significant water leakage.

  Roof systems that seem intact after a hurricane should be carefully inspected and checked for evidence of water leakage. Trapped moisture can degrade materials over time, which may negatively affect the roof’s performance during future events and reduce its thermal performance. Identifying wet materials during a post-hurricane assessment helps owners and property managers plan for repairs that can prolong the roof’s service life.

- **Facade and Fenestration Damage.** Leakage through the facade, windows, or curtain wall systems can occur at wind pressures significantly lower than those needed to cause structural damage to the building or these systems. This leakage can occur even without visible signs of system damage. If the leakage paths are concealed within the systems or surrounding construction, it can be difficult to find and repair the leakage sources without a detailed investigation.
Exterior walls and windows can also be damaged by flying debris or wind pressure, resulting in cladding loss, glass breakage, or weakening of system attachments. These issues can also lead to water leakage into concealed wall spaces or the interior. If the building loses window or curtain wall glass, it can experience increased internal building air pressure due to wind and contribute to structural, roofing, or interior wall damage.

- **Flooding.** Exterior walls, foundations, and slabs-on-grade can be affected by flood waters and potential contaminants carried by the water. Even relatively minor flooding can cause significant damage by submerging materials and components that are not designed to be wet.

  During floods, rapidly rising water levels, strong currents, and waves in the water may create extreme pressures against exterior walls, cladding systems, and floor systems. Depending on water depth and flow velocity, flood loads may be many times greater than wind loads.

**CONCLUSION**

Hurricanes can cause extensive wind and water damage to building enclosure systems and they can also cause extensive water damage inside the building without obvious damage to the enclosure system itself. Post-hurricane assessments of the building enclosures can help identify apparent and concealed damage caused by the storm, and determine causes of water entry into the building. When these events occur, detailed investigations and analyses of building enclosure systems may also be necessary to determine the underlying causes of enclosure failures and support a comprehensive scope of work to repair the building.

Simpson Gumpertz & Heger (SGH) is a national engineering firm that designs, investigates, and rehabilitates structures, building enclosures, and materials. Our award-winning work encompasses building, energy, civil/infrastructure, and science/defense projects in the United States, Canada, and more than thirty additional countries.

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