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SUBROGATING WIND DAMAGE

by
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Introduction

In order to identify potential subrogation of wind damage, any Claims Professional assessing windstorm damage must have an understanding of how wind acts upon a building or structure, the governing Building Code requirements and the ramifications of the actual vs. design wind speeds. Having a grasp of these issues will tell the Professional whether or not subrogation of a wind damage claim should be investigated further.

Understanding Wind and Wind Speeds

The two basic types of wind are circular winds and straight line winds. Circular wind events include hurricanes, tropical storms and tornadoes. Straight line wind events are Macro Bursts, Squall Lines and Gust Fronts. Hurricanes and tropical storms behave similarly and can create a wide swath of damage. Wind speeds for hurricanes vary from 74 mph to over 200 mph (Camille in 1969). The maximum wind speeds in these circular wind events occur in the eye wall and decrease outward. The ground speed affects of wind speed are enhanced on the east side of the storm and reduced on the west side. Tornadoes create the highest wind speeds (112 mph to over 300 mph) and create damage in a narrower, but more catastrophic path. Whereas there is usually some warning of impending circular wind events, there is little warning of an impending tornado. Straight line wind events create the lowest wind speeds, but may be sustained in length and can also spawn tornadoes. Squalls average up to 30 mph, Macro Bursts can be up to 100 mph and Gusts up to 80 mph.

Damage from wind loads is not just a factor of the wind speed that may have been recorded for a specific area by a weather agency. It also depends upon whether the building was designed and constructed in accordance with the local building code.
Recorded wind speed measurements are usually quoted at a height of 33 feet in elevation but the same storm will have different speed measurements at different locations and heights due to the type of terrain in the specific location.

When investigating questionable damage from a windstorm, it is important to gather recorded wind speed data from the area. While it may be impossible to ascertain the exact speed at the location of the damaged building, the best estimate for the location should be obtained and compared to the Code defined design wind speed for the area. Various sources of recorded wind speed data are available, such as: National Weather Service, local news media, NOAA website, FEMA website, and private weather services (CompuWeather, etc.).

Wind Behavior: How Wind Attacks Buildings and other Structures

Buildings may be thought of as obstacles to the wind. Since wind behaves similarly to fluids with regard to obstacles, it can be visualized that in the horizontal plane, eddies and wakes are created by interrupting a flow of wind by a building. So, on the leeward side of a building there is actually a suction created, rather than a pressure pushing on the building like on the windward side. In the vertical plane, the wind is forced up and over a building. This creates a lift, as in an airplane wing, on the roof of a building. This is why roof truss or rafter connections are designed for what we call "uplift". If a structure does not have proper uplift connectors on the roof framing members, extreme or catastrophic damage may result, whereas if the members are properly connected, there may be no damage at all to the roof structure.

There are other possible "obstacles" to the flow of wind. A hill or escarpment acts as an extremely wide obstacle. A hill is defined as the topography of the land sloping up to a crest and then down again. An escarpment is where the topography slopes up to a crest and continues on at that new elevation. The land does not slope down to the original elevation, but remains at the new higher elevation. With hills and escarpments, instead of the wind splitting or going around or over the obstacle, the wind stream compresses and the pressure rises.

Building surfaces (walls and roofs) are subjected to localized pressures based upon the following factors: wind direction, surface location and surface configuration. Localized surface areas on a building are categorized into "zones".

On roofs and walls, the typical area is known as an "interior zone". This is the basic pressure for the building surface. "End zones" occur at a discontinuity of the surface (near the edge). This would include wall areas near a corner and roof areas near the edge of the roof or the overhang. These "end zones" can be subject to 50% higher wind pressures than the "interior zone" of the wall or roof. A "corner zone" is an area at the intersection of two discontinuities. This means it is adjacent to two edges, such as a roof corner. This area can be subject to 100% higher pressures than the "interior zone".

Flying debris become "missiles" attacking the building. These projectiles can create significant openings in the building "envelope" by breaking windows or glazed doors. Projectile damage most often occurs in the coastal regions, rather than inland regions. The region most affected by projectile damage is known as the "Wind-Borne Debris Region". For example, in Florida, all coastal areas with a basic design wind speed of 120 mph or greater are included in the Wind-Borne Debris region. By Code, this area has more stringent requirements than other areas. Typically, this means that all glazed doors and windows must be made of impact-resistant glass or be protected by pre-manufactured protective coverings or shutters.

The reason that openings created by projectiles are so critical is that once a significant opening is created in the building envelope, the interior of the structure becomes pressurized. An opening on the windward side of a building will create a "positive" pressure, causing the building to inflate like a balloon. This can over-stress the roof connections and blow off the roof or push the walls out. An opening on the leeward side of a building causes a "negative" pressure, creating a vacuum inside the building. This internal pressurization add to the external pressures on the building.

In the design of a structure, the engineer must classify the building as "open", "partially enclosed" or "enclosed". There are criteria based upon size and number of openings in the building that the design engineer uses to assign the proper label. Where these labels become important is in this fact: In an "open" or "partially-enclosed" building, the structure is designed to withstand hurricane-force winds with all windows and glazed doors assumed to be broken out. This saves the structure, but contents can become a total loss due to water and wind intrusion. In a building designed as "enclosed", it is imperative that all windows and glazed doors remain intact and do not allow wind to enter the building. This is because the design pressures used in the building's design are lower than the pressures used to design an "open" or "partially-enclosed" building. So, if an "enclosed" building has its building envelope compromised, then the structure itself is compromised and could fail. Design pressures for an "open" or "partially enclosed" building are three to seven times higher than design pressures used in designing an "enclosed" building.

Significance of Building Code Requirements with Regard to Wind Damage

Whether a State abides by the International Building Code, or a state-specific Code, like the Florida Building Code, these Codes refer the design engineer to the ASCE 7 Code for wind design. Previously, each State or region had its own Building Code. In those older Codes, wind speeds were discussed using the "fastest mile wind". Now, Codes refer to the "three-second gust" wind speed. While the wind speed numbers are significantly different using the two ways of measuring wind speed, they still describe the same storm and a building will experience the same forces.

The minimum design speed for a typical locale is specified in the governing Building Code. However, the Code-specified minimum wind speed may be increased by the local authority having jurisdiction in issuing building permits.

Once the design wind speed and the estimated actual wind speed have been determined, then the damage may be evaluated with regard to the potential for subrogation on the basis of defective design or construction. There are three possibilities. Either the actual wind speed is less than the design wind speed, the actual equals the design speed, or the actual is greater than the design speed.

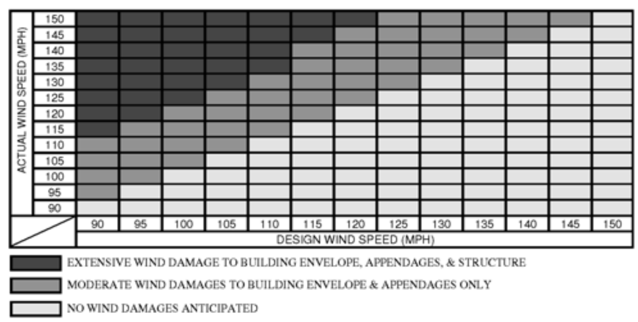
If the actual wind speed is less than the design wind speed, then there should be no significant damage to structures. If significant damage is sustained, then one must conclude that either the design or construction is deficient.

If the actual wind speed is equal to the design wind speed, then there should still be no significant damage. Based upon the factors of safety embedded in the Codes, structures designed and constructed properly should be able to withstand winds equal to or even slightly higher than the design wind speeds.

If the actual wind speed is greater than the design wind speed, then there could be significant to catastrophic damage to a building or structure.

Expected and Unexpected Damages

Below is a chart showing "Wind Speed Comparisons". It is a guide for the type of damage to expect using a comparison of actual vs. design wind speeds for the location. It categorizes the expected damages into "No Damage", "Minimal to Moderate Damage" and "Significant Damage".



For example, a building located in an area that has a code required design wind speed of 110 MPH should have no damage when subjected to actual wind speeds of up to 110 MPH and minimal damage for actual wind speeds of up to 130 MPH based on the factors of safety built into the codes. If it sustains extensive damage for winds speeds of 130 MPH or below, subrogation should be evaluated further.

Conclusions:

Before the Claims Professional goes out to survey the damage to an insured building that has been reported to have sustained substantial wind damage, he/she should try to find out the magnitude of the storm and the wind speeds that the loss location was subjected to. If the reported winds were less than 120 mph for an inland loss site, or 130 mph for a coastal loss site and substantial wind damage is found, it's time to call in an expert to determine why and whether there is potential subrogation.

ABOUT THE AUTHOR

Dara M. Zolkower, PE has over 28 years of experience in design and analysis of new and remodeled structures as well as forensic review of failed, damaged or distressed structures. She is a registered Professional Engineer in seven states, is a Florida Special Inspector of Threshold Buildings and is a LEED Accredited Professional.

She can be contacted through Forcon’s Brandon, Florida office or at dzolkower@forcon.com

Forcon Moves to New Engineering/Evidence Storage Facility in Richmond.

FORCON News!

FORCON International is pleased to announce our Richmond Virginia engineering office is moving to a new and larger facility on April 10th!

Please note: 804-230-4820 will be the new phone number.

The new facility is 10,000 square feet of warehouse and office space allowing multiple vehicle storage and enhanced evidence inspection capability.

The address for the new engineering office is 5424 Distributor Drive, Richmond VA 23225.

Come pay us a visit and check it out!

Mechanical engineer John Leffler, PE of FORCON's Atlanta office was elected Vice Chairman by the members of the ASTM E58 Forensic Engineering Technical Committee. Mr. Leffler is the primary author of an in-process new E58 standard to be titled "Standard Guide to Forensic Engineering". Mr. Leffler also recently presented "Forensic Engineering Use of Walkway Traction Testing" at the January conference of the National Academy of Forensic Engineers (NAFE), and a corresponding peer-reviewed technical paper will soon be published in the NAFE Journal.

Scott Conrad PE, mechanical engineer in Forcon's Richmond office, and Gordon Stobbelaar PE, electrical engineering consultant with Forcon's Richmond office both recently obtained their Certified Fire & Explosion Investigator (CFEI) designations.

EDUCATION SEMINARS AVAILABLE

In-house educational and C.E. approved seminars are available to insurance / self-insured / TPA claims, defense law firms and conference / meetings as part of their agenda. For additional information, please contact Bob Dwyre radwyre@forcon.com.

The list of approved C.E. seminars includes a one hour course on Subrogating Wind Damage based on the article in this newsletter.

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