TORNADO OUTBREAK of 2011

IN ALABAMA, GEORGIA, MISSISSIPPI, TENNESSEE, AND MISSOURI

D Glossary

Accessory structures: Accessory structures are also called appurtenant structures. An accessory structure is a structure on the same parcel of property as a principal structure and the use of which is incidental to the use of the principal structure. For example, a residential structure may have a detached garage or storage shed for garden tools as an accessory structure. Other examples of accessory structures include gazebos, picnic pavilions, boathouses, small pole barns, storage sheds, and similar buildings.

Advection: The transfer of a property of the atmosphere, such as heat, cold, or humidity, by the horizontal movement of an air mass.

Base reflectivity: One of the three fundamental quantities (along with base [radial] velocity and spectrum width) that a Doppler radar measures. Reflectivity is related to the power, or intensity, of the reflected radiation that is sensed by the radar antenna. Base reflectivity is expressed on a logarithmic scale in units called dBZ (decibels of Z, where Z represents the energy reflected back to the radar). The term "base" refers to the product being "basic," with little advanced processing performed on the data. Base reflectivity is related to rainfall intensity (e.g., drop size and rainfall rate) and hail size (for large values of reflectivity).

Basic wind speed: Three-second gust wind speed at 33 feet above the ground in Exposure C. (Exposure C is flat open terrain with scattered obstructions having heights generally less than 30 feet. See "Exposure category.") Note: Since 1995, American Society of Civil Engineers (ASCE) standard ASCE 7 has used a 3-second peak gust measuring time. A 3-second peak gust is the maximum instantaneous speed with a duration of approximately 3 seconds. A 3-second peak gust wind speed could be associated with either a given windstorm (e.g., a particular storm could have a 40-mph peak gust speed), or a design level event (e.g., the basic wind speed prescribed in ASCE 7).

Best available refuge area: Per Federal Emergency Management Agency (FEMA) 431, *Tornado Protection: Selecting Refuge Areas in Buildings* (2009), a "best available refuge area is" an area in an existing building that have been deemed by a qualified architect or engineer to likely offer the greatest safety for building occupants during a tornado. It is important to note that, because these areas were not specifically designed as tornado safe rooms, their occupants may be injured or killed during a tornado. However, people in the best available refuge areas are less likely to be injured or killed than people in other areas of a building.

Bond beam: A structural member along the top of a bearing wall used to support and distribute roof loads. Bond beams are either reinforced concrete or reinforced masonry units.

Bow echo: A bow-shaped line of convective storm cells that is often associated with swaths of damaging straight-line winds and small tornadoes.

Building: A walled and roofed structure. A building includes not only the structure, but also the non-structural elements that complete a building, including walls, roof, glazing, interior finishes, and exterior finishes.

Building envelope: The entire exterior surface of a building, including roof and wall covering, exterior glazing and doors, skylights, and other components enclosing the building.

Building footprint: Land area occupied by the building.

Communications tower: A structure that supports antennae for cellular phones, Emergency Management Services, fire, police, and other critical functions.

Components and cladding (C&C): ASCE 7-10 describes C&C as elements of the building envelope that do not qualify as part of the Main Wind Force Resisting System (MWFRS). These elements include roof sheathing, roof coverings, exterior siding, windows, doors, soffits, fascia, and chimneys and include components of some MWFRS elements such as the chords of roof trusses.

Continuous load path: The condition required to resist loads acting on a building. The continuous load path starts at the point or surface where loads are applied (i.e., the building envelope), moves through the building, continues through the foundation, and terminates where the loads are transferred to the soils that support the building.

Convective Available Potential Energy (CAPE): One of two important parameters necessary to predict long-track violent tornadoes (LTVTs). High CAPE values represent an unstable atmosphere and are associated with warm weather and sunny skies. Locations in the mid-south experience their highest CAPE values during the summer months.

Corbel: A structural feature resembling a bracket that projects from a wall and supports a beam or ceiling.

Critical facility: A facility that is essential for the delivery of vital services or protection of a community. Critical facilities include, but are not limited to, hospitals, emergency operation centers, fire and police stations, schools, and primary utility facilities. Critical facilities are Category III and IV buildings as defined in ASCE 7.

Cyclogenesis: The development or strengthening of a circulating area of low pressure in the atmosphere which results in the development of a cyclone.

Damage indicator (DI): A category for buildings, structures, and trees used to estimate wind speeds on the Enhanced Fujita (EF) scale. The EF scale currently has 28 DIs, each of which have several degrees of damage (DODs).

Debris rowing: A phenomenon that occurs when wind-borne debris is spread in straight lines as a result of a tornado.

Degree of damage (DOD): Numbered level of damage for each DI used in estimating wind speeds on the EF scale. For each DI, several DODs are identified, increasing sequentially from slight visible damage to complete destruction of the particular DI.

Design wind speed: see "Basic wind speed."

Diffluent zone: An area where wind spreads laterally in a fan-like pattern from a central axis parallel to the flow along the axis.

Emergency Operations Center (EOC): The physical location at which the coordination of information and resources to support incident management (on-scene operations) activities normally takes place. An EOC may be a temporary facility or may be located in a more central or permanently established facility, perhaps at a higher level of organization within a jurisdiction. EOCs may be organized by major functional disciplines (e.g., fire, law enforcement, and medical services), by jurisdiction (e.g., Federal, State, regional, tribal, city, county), or some combination thereof.

Energy Helicity Index (EHI): An index that incorporates CAPE and Storm Relative Helicity (SRH), two important parameters in the prediction of LTVTs.

Enhanced code construction: Construction that exceeds minimum building code requirements. Also commonly referred to as "Code-Plus" and "Fortified." The exact meaning varies geographically because different States and communities have adopted and amended different building codes, or different editions of those codes, and thus have different minimum design and construction requirements.

Enhanced Fujita (EF) scale: A tornado strength rating model implemented by the National Weather Service (NWS) in 2007 that has six categories, from zero to five, representing damage from increasing wind speeds. The EF scale is an improvement of the previous Fujita scale that better relates wind speeds to levels of damage observed after a tornado. The EF scale contains 28 DIs for the type of building, structure or tree; each DI includes DODs, which are damage descriptors associated with an expected estimated wind speed.

Exposure Category: Wind exposure categories defined in ASCE 7 based on the terrain and obstructions surrounding a building. There are three exposure categories: Exposure Category B is for buildings in urban/suburban areas surrounded by low- to mid-rise buildings and/or wooded areas; Exposure Category C is for buildings in open terrain with scattered obstructions having heights generally less than 30 feet (includes the shoreline in hurricane-prone regions); and Exposure Category D is for buildings at the shoreline (except in hurricane-prone areas) with wind flowing over open water for at least 1 mile.

Federal Emergency Management Agency (FEMA): Independent agency created in 1979 to provide a single point of accountability for all Federal activities related to disaster mitigation and emergency preparedness, response, and recovery.

Federal Insurance and Mitigation Administration (FIMA): A component of FEMA which manages the National Flood Insurance Program (NFIP) and other programs designed to reduce future losses from natural disasters to homes, businesses, schools, public buildings, and critical facilities.

Funnel cloud: As defined by the National Oceanic and Atmospheric Administration (NOAA), a condensation funnel extending from the base of a cloud, associated with a rotating column of air that is not in contact with the ground. This is different from a tornado because it is not in contact with the ground and does not have a debris cloud.

Gable end wall: The vertical triangular end of an exterior wall above the eave line formed under a gable roof.

Glazing: Glass or transparent or translucent plastic sheet used in windows, doors, and skylights.

Guy wire: A tensioned cable used to add stability to a structure, such as a tower.

Hardened area: Areas that are designed and constructed to provide some level of protection, but do NOT necessarily meet International Code Council (ICC) / National Storm Shelter Association (NSSA) Standard for the Design and Construction of Storm Shelters (ICC 500) criteria or FEMA guidelines. These areas are commonly referred to by builders and homeowners as "shelters."

Hip roof: A roof type composed of four sloping sides. A hip roof does not have any gable ends.

Hook echo: A radar reflectivity pattern characterized by a hook-shaped extension of a thunderstorm echo, usually in the right-rear part of the storm (relative to its direction of motion). A hook is often associated with a mesocyclone and indicates favorable conditions for tornado development.

Importance Factor: A multiplier that accounts for the degree of hazard to human life and damage to property. Importance Factors are given in ASCE 7-05 and earlier versions of the standard. Note: In ASCE 7-10, the Importance Factor was eliminated for wind loads because the degree of hazard to human life and property damage is accounted for by selecting the proper wind speed map.

Jet streak: The region in the jet stream where the wind speeds are highest.

Linear bow echo: A large convective system shaped like an archery bow on the radar; systems with this shape can produce severe straight-line winds and occasionally tornadoes.

Long-track violent tornado (LTVT): A strong tornado that stays on the ground for a relatively long time, creating a long track.

Low-sloped roofs: A category of roofs generally made of weatherproof membrane installed on slopes of 3:12 or less.

Main Wind Force Resisting System (MWFRS): ASCE 7-10 defines the MWFRS as an assemblage of structural elements designed to provide support and stability for the overall structure. The MWFRS consists of the foundation; floor supports (e.g., joists, beams); columns; roof rafters or trusses; and bracing, walls, and diaphragms that help transfer loads.

Masonry infill wall: A wall consisting of either steel or concrete frames with masonry inset between the openings.

Mean recurrence interval (MRI): An estimate of time between events with a common level of intensity; an estimate of the amount of time that would elapse between two wind events of the same strength.

Mesoscale: A meteorological phenomenon larger than microscale and storm-scale cumulus systems, but smaller than synoptic weather-scale systems; 10 to 1,000 kilometers in horizontal extent.

Mitigation: Any sustained action taken to reduce or eliminate long-term risk to people and property from hazards and their effects.

Multiple vortex structure: A type of tornado in which two or more columns of spinning air have a common center of rotation.

National Oceanic and Atmospheric Administration (NOAA): An agency within the United States Department of Commerce that specializes in the conditions of the oceans and atmosphere. NOAA reports daily weather forecasts, severe storm warnings, and climate monitoring to fisheries management, coastal restoration, and supporting marine commerce entities.

National Weather Service (NWS): One of six agencies in NOAA that produce weather, hydrologic, and climate forecasts and warnings for the United States, its territories, adjacent waters, and ocean areas for the protection of life and property and the enhancement of the national economy.

Near-absolute protection: The level of protection for which, based on our current knowledge of tornadoes and hurricanes, the occupants of a safe room will have a very high probability of being protected from injury or death.

Occupancy Category: For the purpose of applying the environmental loads of flood, wind, snow, earthquake, and ice, buildings and other structures are classified in ASCE 7-05 into one of four Occupancy Categories based on how they are used. Category I buildings are those that pose low hazard to human life if failure occurs; essential facilities are classified as Category IV. In ASCE 7-10, these are now called "Risk Categories."

Particularly dangerous situation (PDS): A type of watch issued that implies an increased risk of severe and life-threatening weather, such as a major tornado outbreak.

Prescriptive measures: Guidance that has been predetermined and calculated for specific circumstances.

Primary structural system: A structural system that supports the building against all lateral and vertical loads.

Quasi-linear convective system (QLCS): A group of thunderstorms in a linear arrangement; also known as a "squall line." Development of a QLCS depends on the cold pool produced by the storm and the environmental shear. The movement of the two components creates horizontal velocity that can create tornadoes.

Redundancy: The practice of using system components that, when another critical component fails, can resist the loads of the first component as well as its own; redundancies increase the reliability of structural performance.

Retrofit: Any change or combination of adjustments made to an existing building that is intended to reduce or eliminate damage to that building from natural hazards.

Right mover: A thunderstorm that moves appreciably to the right relative to the main steering winds and to other nearby thunderstorms. Right movers are typically associated with a high potential for severe weather. (Supercells are often right movers.)

Risk Category: A term defined in ASCE 7-10 based on the risk to human life, health, and welfare associated with potential damage or failure of the building. These Risk Categories dictate which design event MRI is used when calculating the building's resistance to these events. In ASCE 7-05, these are called "Occupancy Categories."

Roof assembly: An assembly of interacting roof components including roof deck, vapor retarder (if present), insulation, and membrane or primary weatherproof roof covering.

Roof deck: The structural component of a roof assembly that supports the roof system.

Roof system: A system of interacting roof components generally consisting of a membrane or primary roof covering and roof insulation (not including the roof deck) designed to weatherproof and sometimes improve the building's thermal resistance.

Safe room: A specially designed hardened structure that meets FEMA criteria and provides "near-absolute protection" from extreme wind events. The level of protection provided by a safe room is a function of the design wind speed and resulting wind pressure used in designing it, and of the wind-borne debris load criteria. To be considered a safe room, the structure must be constructed as detailed in the prescriptive plans in FEMA 320, *Taking Shelter From the Storm: Building a Safe Room For Your Home or Small Business* (2008), (for homes and small businesses) or designed and constructed to FEMA 361, *Design and Construction Guidance for Community Safe Rooms* (2008), (for communities) guidelines. FEMA 361 also contains guidance for homes and small businesses.

Shortwave trough: Also called "shortwave." A disturbance in the middle or upper part of the atmosphere that induces upward motion ahead of it. If other conditions are favorable, the upward motion can contribute to thunderstorm development ahead of a shortwave trough.

Sill plate: The bottom of the wall that provides the connection point between the wall and the foundation below.

Squall line event: According to NOAA, a squall line event is a line of active thunderstorms, either continuous or with breaks, including contiguous precipitation areas resulting from thunderstorms.

Steep-slope roof: A category of roofing that generally includes water-shedding types of roof coverings installed on slopes exceeding 3:12.

Storm Relative Helicity (SRH): One of two important parameters necessary to predict LTVTs. High SRH values promote rotating updrafts and are associated with wind shear (changing wind speed and wind direction with height in the atmosphere).

Storm relative radial velocity: Base velocity with the average motion of all storm centroids subtracted out. Storm relative radial velocity can be useful in finding mesocyclones or other circulation patterns. It is characterized on the Doppler radar by a tight couplet of green and blue colors moving toward the radar and red and orange colors moving away.

Storm shelter: Structures, buildings, or portions thereof designed and constructed to meet International Code Council (ICC) standard ICC-500 guidelines and provide life-safety protection from extreme weather events, such as tornadoes and hurricanes. Unlike safe rooms, storm shelters do not meet all FEMA criteria and are not considered to offer "near-absolute protection" in these weather events. Storm shelters can be for homes, small businesses, or communities.

Structure: A part of a building or a freestanding constructed element, such as a roof system, tower, or platform.

Supercell: According to NOAA, potentially the most dangerous of the convective storm types. Storms possessing this structure have been observed to generate the vast majority of long-lived strong and violent (F2 to F5) tornadoes, as well as downburst damage and large hail. It is defined as a thunderstorm consisting of one quasi-steady to rotating updraft that may exist for several hours.

Synoptic weather observation: A surface weather observation of sky cover properties, such as, the state of the sky, cloud height, atmospheric pressure (reduced to sea level), temperature, dew point, wind speed and direction, amount of precipitation, and other special phenomena made periodically for the same area.

Tilt-up wall construction: A type of construction during which pre-cast panels, usually concrete, are lifted (tilted) into place on a concrete foundation. These walls may be self-supporting or part of a steel load-bearing framework.

Tornado: A violently rotating column of air, often visible as a funnel cloud, suspended from a cumuliform cloud or underneath a cumuliform cloud.

Tornado outbreak: An event that occurs when 6 or more tornadoes occur within approximately 24 hours in the same region from the same synoptic-scale weather system.

Tornado track: The path that the tornado follows or is predicted to follow.

Tornado refuge area: Any location where people go to seek cover during a tornado. Tornado refuge areas may have been constructed to comply with basic building code requirements (that do not consider tornado hazards). These areas may also have continuous load paths, bracing, or other features that increase resistance to wind loads. It is important for people to know that such an area may not be a safe place to be when a tornado strikes and they still may be injured or killed during a tornado event.

Tributary area: The area of the floor, wall, roof, or other surface that is supported by the element. The tributary area is formed by one-half the distance to the adjacent element in each applicable direction.

Trough: An elongated region of relatively low atmospheric pressure often associated with fronts, but not usually associated with a closed circulation.

Uplift: An upward force caused by winds perpendicular to the uplift direction caused by a sudden change in wind direction caused by an object blocking the airstream (i.e., a building). Uplift can occur on structural and non-structural components from wind forces.

Velocity couplet: A tornado vortex signature that appears on the Doppler radar as side-by-side velocities—one inbound and one outbound. It is also known as "gate-to-gate shear."

Vortex: The core of the tornado. In this region of the tornado, the winds are complicated and include the peak at-ground wind speeds, but are dominated by the tornado's strong rotation. It is in this region that strong upward motions occur that carry debris upward, as well as around the tornado.

Vulnerability assessment: An assessment that is focused on building and operational weaknesses when impacted by a particular hazard event. Results of the assessment would be used to determine what mitigation activities would most likely reduce the vulnerability.

Wedge structure: A profile formed by a large single-vortex tornado that resembles a wedge stuck in the ground. Sometimes a wedge can be so wide that it appears to be a large block of low-hanging clouds.

Wind-borne debris (missiles): Debris that becomes airborne during a wind event.

Wind field: The spatial three-dimensional pattern of winds in a region.