# Elements of Hurricane Resistant Construction



***This article is Chapter I of the Hurricane Resistant Construction Manual recently published by SBCCI. It is available for $35 (members) or $45 (non-members) from the SBCCI order department.***

**Introduction**

The most important step in the design and construction of a building is the determination of the types and magnitudes of natural hazards that will impact a building during its lifetime. On much of the Gulf of Mexico and Atlantic coastlines, hurricanes, with their associated high winds greater than 74 mph, storm surges, and large waves are the hazard of greatest concern. Earthquake hazards must be accounted for in a limited number of coastal areas, such as in South Carolina. North of South Carolina, winter storms, or nor'easters, can be equally or more damaging than hurricanes because of their greater frequency, longer duration, and their high erosive impacts on the coast. Although earthquakes and nor'easters are important to consider, this manual is limited to and specifically addresses the problems of hurricane-resistant design and construction for residences and small commercial structures.

Once the hazard is identified, it is then necessary to establish design criteria for the building. To establish these criteria some statistical analyses are necessary. In the case of hurricanes, many of the analyses have been made, including recurrence interval, wind velocities, storm surge, and wave heights.

**Recurrence Interval**

Building codes require a minimum design condition using a wind speed based on either a 50 year or 100 year mean recurrence interval (MRI). The recurrence interval is based on records maintained over a long period of time. For example, if records were kept between 1885 and 1985 and a wind velocity of 100 mph occurred in the years 1934 and 1936, the recurrence interval would be 50 years for a 100 mph wind. A 50 year MRI means that each year there is one chance in 50 that the mapped wind speed will occur. While one chance in 50 seems small at first glance, the probability of such a storm over the lifetime of a residence or other building is cumulative. Statistically, the probability of a 50 year storm hitting in any 50 year time period is about two chances in three. Table 1-1 indicates the probability or percent chance that events of different sizes and rarity will occur at least once in a 10- to 70-year period. Note that even for the extremely rare, catastrophic event such as a 200-year storm, the probabilities are nearly 3 in 10 (30%) that the event would occur in a 70-year building lifetime.

**TABLE 1-1**
***OCCURRENCE PROBABILITY***

| Event | Probability of Events Occurring in a 10 - 70 Year Period — Percent Chance of Occurring at Least Once In | | | | |
|---|---|---|---|---|---|
| **Annual Probability** | **10 yrs** | **20 yrs** | **30 yrs** | **50 yrs** | **70 yrs** |
| 10-year | 65% | 88% | 96% | 99% | 99.9% |
| 25-year | 34% | 56% | 71% | 87% | 94% |
| 50-year | 18% | 33% | 45% | 64% | 76% |
| 100-year | 10% | 18% | 26% | 39% | 51% |
| 150-year | 06% | 13% | 18% | 29% | 37% |
| 200-year | 05% | 10% | 14% | 22% | 30% |

Generally a residence lifetime is expected to be approximately 70 years. If a residence is to be designed for a 100 year recurrence interval, the chance of the residence experiencing the storm during its expected lifetime is 51 percent, and the same residence for a 50 year recurrence is 76 percent.

A 100 year or 50 year recurrence may sound like a severe design condition for a building. However, when one considers that a building has a 50 per cent or 75 per cent chance of being required to resist these loads, it is a very reasonable minimum standard. In fact, a building design for loads in excess of these minimum values may be a wise investment.

**Winds**

Wind velocities have been recorded for more than a century at weather stations throughout the United States. Most of these stations are located several miles inland from the coast. Ground surface friction is much higher than water surface friction, and as a result, the wind velocities at the inland stations may be considerably less than those at shoreline sites. This difference can be as much as 30 percent for sites 5 to 7 miles inland. Most wind velocities shown in codes have accounted for this difference. Maps indicating the wind velocities for 100 and 50 year recurrences are shown in Figures 1-1 and 1-2, respectively. Comparing two maps for Key West, Florida, the 100 year interval map (Figure 1-1) shows a design wind velocity of 130 mph, while the 50 year map (Figure 1-2) shows a design wind velocity of 110 mph. It should be noted that mathematical comparisons between the two maps cannot be made as the maps are based on different data.

Generally, local governments adopt one of the model codes for regulating construction. Each of the model codes specify one or both of the Basic Wind Speed Maps shown in this section. When both maps are specified, the 50 year recurrence interval map is specified for building heights of 60 feet or less. In areas where local data indicates the design wind velocities are different from those indicated on the two maps, the local government normally adopts one or two specific design wind velocities for the area.

The fastest mile wind speed is defined as the highest speed at which a mile of wind passes a measuring point 30 feet above the ground. This wind speed differs from the wind speed reported by the National Hurricane Center and the news media. The wind speed reported by the center and news media is peak gust associated with a one or two second averaging time. This means that a peak gust of 100 mph would pass a given point in one or two seconds, while a fastest mile wind of 100 mph will take 60 seconds to pass the same point. Obviously considerably more total force must be resisted by the building impacted by 100 mph fastest mile wind, than a building impacted by 100 mph peak gust. This results in reported wind velocities being considerably higher than equivalent