

## BLU PRINT

# Wooden Wind Anchors for Hurricane-Resistant Construction Near the Ocean

The connections between the major components of a building are a critical concern when designing for hurricane-force winds. For more than a decade, tie-down straps made of galvanized sheet metal have been used as connections in wooden buildings. Specialists in hurricane-resistant construction strongly recommended these tie-down straps to resist uplift forces which occur in extreme wind. These connectors have proven very effective during hurricanes and other high-wind storms throughout the country.

However, metal tie-down straps are not suitable in exposed positions on buildings near the ocean or near other saltwater shorelines with large, breaking waves. Coastal winds blow salt spray from the breaking waves inland, dramatically increasing the corrosion rate of exposed metal tie-down straps.

### Enclosing tie-down straps

Totally enclosing the straps with siding or sheathing appears to provide adequate protection that lasts as long as the rest of the materials in the building. For example, straps connecting ceiling joists to side walls usually are protected by exterior siding. But some straps can't be enclosed, as in elevated, piling-supported buildings with open areas underneath. It is usually impossible to completely cover the straps connecting the floor joists to the floor beams. Exposure tests of similar galvanized sheet metal roofing indicate a useful life of less than 10 years in such conditions.

Since the straps are only needed during infrequent high winds, their failure is rarely noticed until it's too late. Few owners even realize the straps have corroded. And, even if they do notice the corrosion, repair or replacement is difficult. Major structural failure during

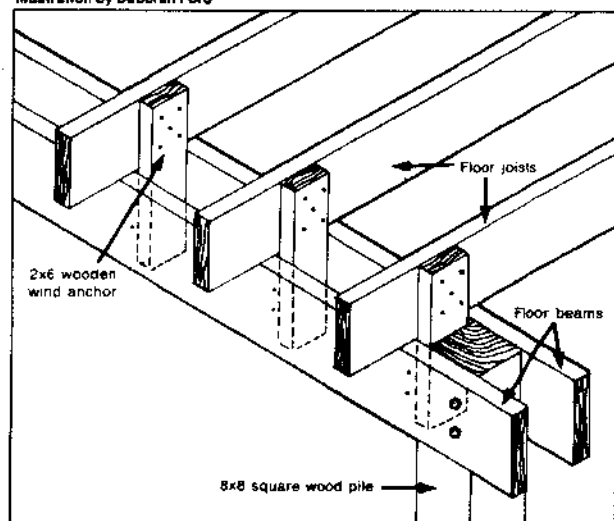
high winds can occur needlessly because of the failure of this connection.

### Wooden Wind Anchors

An alternative corrosion-resistant method can be even stronger than most commercially available sheet-metal straps. Wooden wind anchors have been used along parts of the Texas coast for several years. In 1983, Hurricane Alicia hit the shoreline near Galveston with around 100 mph sustained winds. Many buildings received major damage, often from obvious failures of poor connections in the building.

But, where they were used, the wooden wind anchors effectively connected the floor joists to the floor beams without any failures in those buildings that were inspected. In a number of cases, the connections even held when the rest of the building was destroyed, leaving only the piles and the floor platform.

Illustration by Deborah Ford



Wooden wind anchors connect joists to beams

Wooden wind anchors are formed by nailing a short length of 2 x 6 board as a spacer between a double floor beam and every or every other floor joist. The number and size of the nails used to fasten the 2 x 6 determines the allowable design strength of the connection. The table lists approximate design uplift values for different nailing schedules in Southern pine. With appropriate nailing, wooden tie-downs can be stronger than most commercially available galvanized sheet-metal straps.

Nailing Schedule for 2 x 6 wooden wind anchors<sup>1</sup>

Number-Size of Nail <sup>2</sup>		Allowable Design Uplift Values <sup>3</sup> (lbs)
Floor joist	Floor beam	
6 - 8d	6 - 8d	430
4 - 10d	4 - 10d	450
5 - 10d	5 - 10d	570
	(or) 4 - 16d	
6 - 10d	6 - 10d	680
	(or) 5 - 16d	

- 1 From "National Design Specifications for Wood Construction"
- 2 common nails
- 3 in Southern pine with 1.33 load duration factor for wind

In areas exposed to salt spray, the wooden wind anchors are expected to last the lifetime of the building; metal straps are likely to be effective for less than 10 years. The double beam allows a strong, bolted connection to each

foundation pile without excessively notching the top of the pile. Care should be taken to ensure that the pile is accurately notched to the width of the 2 x 6's. Otherwise, full penetration of the nails may be reduced. Additional care should be taken to avoid letting the nails split any of the wood. In both cases, the strength of the connection will be reduced.

### A Stainless Steel Strap

Another alternative to the galvanized tie-down straps is a stainless steel strap which must be special-ordered from the manufacturer. Both 304 and 316 stainless steel have been shown to last at least as long as the rest of the building in heavy salt air. While the cost of stainless steel is about three times higher than standard straps, the total increase in cost for stainless steel in a typical residence is only about \$50. The regular galvanized straps may require replacement every five years on the oceanfront, but 304 stainless steel should last for over 50 years.

You can make the regular galvanized straps more corrosion-resistant by hot-dip galvanizing the straps a second time after they are fabricated. This thicker layer of galvanizing provides greater protection of the sheet metal, but it is still not sufficient for exposed straps on buildings near the ocean. This type of strap should be adequately protected for buildings with moderate exposures to salt spray.

For more details on this and other hurricane- or erosion-resistant construction methods, contact Spencer Rogers, UNC Sea Grant's coastal engineer, at the N. C. Marine Resources Center/Ft. Fisher, P.O. Box 130, Kure Beach, N.C. 28449 or call 919/458-5780.

— Spencer Rogers

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