Early Lessons Learned: Floating Docks With Tall Pilings

Sandy was a "hybrid storm" that combined the punch of a hurricane with the reach and longevity of a nor'easter. Sandy's arrival also coincided with an unusually high lunar tide, which resulted in a massive — and destructive — eight- to 12-foot surge.

As with every other major storm, BoatU.S. Technical Services has been meeting with claims personnel and CAT team staff and surveyors to learn what could have been done to protect boats. In past storms, boats on shore were less likely to be seriously damaged, since boats don't sink on land. But Sandy's unusually high surge picked up boats — thousands of boats — that were being stored ashore for the winter and then bounced them against each other as well as buildings, telephone poles, electric wires, and automobiles.

It's difficult to see how this sort of damage could have been reduced. Storage on high ground typically wasn't an option and there wasn't enough time or resources available to haul boats inland. Boats left in the water at marinas, as in past storms, proved to be equally as vulnerable to damage as boats on shore and many were bashed against pilings or sunk. The one exception that we saw — the *only* place that boats consistently resisted damage — was at floating docks with pilings that were taller than the surge. The boats shown above, at a heavily battered area on Staten Island, simply floated up and down with the surge. Boats at floating docks with shorter pilings, however, were among the most damaged boats — the surge lifted the docks off the piling and carried them ashore. The key was the height of the pilings.

In the coming months, we will be debriefing our CAT team personnel and talking to marina owners in an effort to learn more. And we will share what we learn in the pages of *Seaworthy* and in webinars for the industry and for owners in hopes of reducing the damage should another hybrid storm like Sandy come calling.

The Making Of A Superstorm

Let's be clear — when Sandy came ashore on October 29, it was not a hurricane. Technically, it was an extratropical cyclone. Factually, it was all but unique in the annals of weather history in this country. The meteorological ingredients that created Superstorm Sandy may never have come together in just this way before. So what went into making Hurricane Sandy into a "superstorm"?

To answer that, we need to start with some meteorological basics. Tropical cyclones, which include hurricanes, develop around a core of warm air and are not associated with frontal systems. They are fueled by oceanic heat and moisture and grow strongest when the surrounding air is uniformly warm and humid and upper-level winds are relatively weak. In these conditions, sustained wind speeds can reach 120 to 150 knots, but the storm center is usually very compact, often less than 100 miles in diameter. When separated from their warm-water energy source, whether by moving over land or over colder water, tropical cyclones quickly become disorganized and wind speeds drop to gale force. Damage at landfall is usually limited to the tight band around the storm center where the strongest winds and largest surges occur; once inland, most damage results from flooding as the tropical air cools and loses its moisture in the form of heavy rainfall.

In contrast, extratropical cyclones, known as lows or nor'easters in the United States, develop around a core of cold air and are typically positioned at or near the intersection of a cold front and a warm front. They draw their energy from the temperature and pressure differentials across these front lines and can be strengthened by the strong winds of the polar jet stream. They average three to four times larger than tropical cyclones, but their wind speeds rarely reach half of the highest wind speeds of a fully developed hurricane. They can last for days and cover thousands of miles before the front lines dissipate and the low center "fills."


Photo: NOAA

Superstorm Sandy on October 29, a few hours before landfall.

For Hurricane Sandy to become Superstorm Sandy, it had to undergo a process called extratropical transition — to switch from a warm-core, tropical cyclone fueled by the Gulf Stream to a cold-core, extratropical cyclone fueled by a complex frontal system and the jet stream. Meteorologists are aware of three ways this can occur, as described by Bob Henson in a blog post on the website for the National Center for Astomspheric Research: