Harvey, Irma, and RICOWI: AN UPDATE

By Phil S. Mayfield

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In the aftermath of two Category 4 storms (*Figure 1*) affecting millions of people and causing hundreds of billions of dollars in damage, many in the roofing industry want to know: What did the Roofing Industry Committee on Weather Issues (RICOWI) do in response to hurricanes Harvey and Irma?

The primary focus of RICOWI is to perform timely investigations of high-impact storms. The key word is "timely." Quick response to a major weather event is needed to learn firsthand how buildings are damaged by violent weather. By inspecting structures soon after storms, investigators can more easily differentiate between old and new damage. A wind "event" is described below in the RICOWI Wind Investigation Program policy.

> The Wind Investigation Program identifies an event as a major hurricane making landfall in a heavily populated area in Florida, or in an area previously investigated by RICOWI, with wind speeds at or above ASCE 7-2005 design levels based on early projections by NOAA/NHC and/or other credible sources. Alternatively, a hurricane similarly projected by NOAA/NHC to include one-minute sustained wind speeds equal or greater than 95 mph (Category 2) making landfall along the northeast corridor.

Because of the limitations of both budget and volunteers, an additional requirement for deployment is significant and widespread damage accompanying the storm. Because members volunteer their time and pay their own expenses, only the most severe events qualify for event mobilization. Likewise, RICOWI's budget is derived primarily from sponsors who generously support the organization's goals. That budget does not allow for unlimited investigations, even if qualified investigators are plentiful.

RICOWI inspection teams often have access to affected areas not open to others, allowing inspectors to see defects before they are covered with tarps or repaired. Teams are composed of experts from various roofing disciplines (e.g., metal, tile, shingle, single-ply, built-up, and modified-bituminous roofing). They often include roofing consultants, insurance adjusters, and testing lab personnel.

Information gathered during RICOWI site visits has been used to improve roofing design, construction methods, and materials. Thanks in part to data collected from other major hurricanes, codes and designs have focused more on enhancing perimeter and corner fastening, among other things. The latest IBC version—IBC 2018—calls for even greater attention to roof fastening requirements to prevent peel-back and blow-off damage to roofs.

Following is a look at the two Category 4 storms in Texas and Florida.

Figure 1 – Saffir Simpson hurricane wind scale, courtesy National Hurricane Center.

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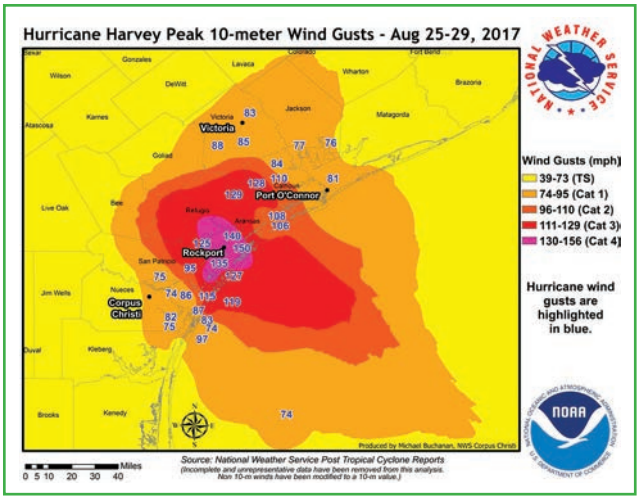

Figure 2 – Hurricane Harvey wind gust map, courtesy of the National Weather Service and the National Oceanic and Atmospheric Administration (NOAA).

HARVEY

As Harvey was slowly working its way up into the Gulf of Mexico, there were dire projections of massive damage from this monster storm's punishing winds. Severe damage did occur on August 25, when it first reached landfall in Texas, but most of it was in relatively low-population areas (e.g., Rockport and southeastern Aransas County, outside of Corpus Christi). See *Figure 2*.

According to weather.gov:

> Although there was a significant number of trees, fences, and power poles down or damaged in the Corpus Christi metropolitan area, structural damage was much more isolated.
>
> Besides wind and storm surge, hurricanes and tropical storms are notorious for producing torrential rainfall and flash flooding. Unfortunately, Harvey was unique. Instead of moving inland and farther away from the coast, Harvey stalled over South and Southeast Texas for days, producing catastrophic devastating and deadly flash and river flooding. Southeast Texas beared [sic] the brunt of the heavy rainfall, with some areas receiving more than 40 inches of rain in less than 48 hours! Cedar Bayou in Houston received a storm total of 51.88 inches of rainfall, which is a new North American record.

After traveling a few miles inland, the hurricane withdrew to the Gulf, only to make a second landfall farther up the coast in Cameron, Louisiana, on August 30. Again, wind damage was limited, compared to Wind Investigation Program criteria for a RICOWI event.

Remaining a named storm 117 hours after landfall, Harvey set the record for the longest a Texas hurricane remained a named storm after landfall, according to Colorado State University tropical scientist Phil Klotzbach.

It was the slow storm movement between the two prolonged landfalls that caused the catastrophic flooding experienced in southeastern Texas. It was historic rainfall, storm surge, and flooding that will be Harvey's legacy, not wind damage.

IRMA

As with Harvey, forecasters described Irma as a storm of historic proportions. It was estimated to be several times larger and more potentially destructive than Hurricane Andrew, which blasted southern Florida in 1992. Andrew's catastrophic wind damage was the primary catalyst for major code changes that turned some of the country's weakest construction requirements into some of the strongest.

As Irma blew into Cuba on Saturday, September 9, the alarming forecasts appeared to be accurate. Hurricane Irma was the first landfall of a Category 5 storm in Cuba since 1924, based on NOAA's historical database. Ciego de Avila recorded gusts of 159 mph as Irma made landfall.

A day after arriving in Cuba, Irma made landfall twice in the U.S.: first in the Keys (*Figure 3*), and later, near Marco Island in southwestern Florida. When Irma's eye crossed Cudjoe Key, just east of Key West, the sustained winds were estimated at 130 mph.

Even though some of Irma's winds were at or above the level where roofs can be heavily damaged, the worst winds appear to have stayed on the eastern side of the eye, over water. Without question, there was severe roof damage in the Keys. Surprisingly, most of it was isolated, not widespread. According to a RICOWI on-the-ground source, "Irma's landfall was near Marco Island, and within blocks of the shore it is difficult to find any wind damage."

In reviewing NOAA post-storm aerial images, it was common to see one heavily damaged home or business, surrounded by several with little or no damage.

Later in the day, when Irma made landfall on Marco Island and continued on to the Florida mainland, the worst of her winds had diminished considerably. RICOWI members and contacts in that area reported sporadic, not widespread wind damage. With few exceptions, reported surface winds were well below code level for most places in Florida.

As with Harvey, the primary consequences of Irma were storm surge, rain, and flooding.

SUMMARY

With the arrival of Harvey, then Irma, this was the first time two Category 4 storms made landfall twice in the same hurricane season—let alone twice in 16 days. And this was with over two months left in hurricane season!

Why was there so little roof damage? Possibly because of the Hurricane Andrew-inspired improvements in building codes and construction practices in Florida, which have made buildings more wind-resistant. Lack of widespread roof damage does not mean that Irma was not a deadly, destructive hurricane. The storm surge that occurred on the coasts was devastating. Older structures and mobile home parks experienced significant damage. The Caribbean Islands that were in the path have been largely

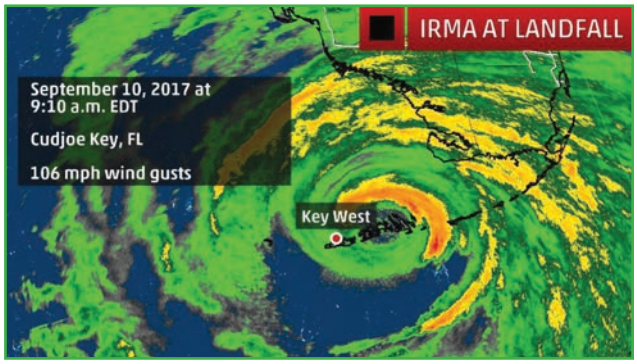

Figure 3 – Hurricane Irma U.S. landfall, courtesy of www.weather.com.

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destroyed. Power outages in Florida caused great disruption, but power was restored in most areas in less than a week. Those outages were due, primarily, to vegetation damage and power poles that were not securely installed for wind resistance.

While RICOWI is devoted to leading the industry, when it comes to learning how to improve roofing design and construction, it cannot mobilize teams to all destructive storms. In addition to limitations of budget and trained volunteers, there is also the issue of practicability. Both areas near the landfall of Harvey and Irma experienced historical flooding, power outages, and damage to infrastructure.

At a time when first-responders are having prolonged difficulty with road access, potable water, toxic standing water, phone service, and rescue, it was not the right scenario for teams of volunteers to add to the confusion. Because of that, a large RICOWI mobilization was not scheduled. Instead, a smaller group of volunteers was organized and scheduled a few weeks after Irma, giving cities time to do much of the cleanup and restore services. At the time of this article, the results of that "mini-investigation" have not been completed. As usual, once RICOWI's data have been organized and analyzed, a report will be posted to its site, free of charge to members and non-members.

RICOWI MINI-INVESTIGATION OF IRMA DAMAGE

On October 30 and 31 and November 1, three RICOWI teams performed a "mini" investigation, after receiving reports from Florida contacts that some roof damage was worth examining. Each team was composed of four members and assigned a geographic portion of the hardest hit areas in and around Fort Myers, Naples, and the Keys.

RICOWI investigators wasted no time getting up on roofs where they were able, and using drones to inspect hard-to-reach damage. In some cases, roof access was prearranged. In others, team members made "cold calls" to building owners, many of whom were willing to allow RICOWI experts to inspect their buildings. In addition to team members, local roofing contractors helped by providing ladders and leads.

While a comprehensive study may not be completed by the spring RCI/RICOWI meetings in Houston, there will be a presentation on the results of its mini-investigation. Foremost on the agenda is a discussion of why two "monster" storms caused relatively little roof damage in Texas and Florida.

Hurricane IRMA WIT participants in Florida. Front row, left to right: James Bush, Ron Keogh, Joel May, and Phil Mayfield. Back row, same order: Allen Kidd, David Roodvoets, David Balistreri, Christian Lussier, Marc Kubena, Tom Kelly, and Eric Velliquette.

Following are representative photos of some of the damage from hurricanes Harvey and Irma. Courtesy, NOAA.

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DAMAGE FROM HURRICANES HARVEY AND IRMA

None of these high-rise buildings exhibits conspicuous roof damage.

A hotel's single-ply roof appears undamaged, but light damage is visible on mansard panels.

This commercial building is covered with built-up roofing, tile mansards, and no visible damage.

This waterfront commercial building experienced conspicuous blow-off damage of its white roof membrane.

None of these high-rise buildings in Key West exhibits conspicuous roof damage.

Key Colony multifamily and commercial roofs exhibited some of the worst damage: peel-off of white single-ply and gray mod-bit roofing.

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Three identical buildings and roofs: two of three mod-bit membranes show partial peel-off.

A K-Mart occupies the left end of this shopping center. Its modified-bitumen roof appears undamaged. The two mod-bit roofs at the right end (CVS and Winn Dixie) have been partially blown off.

Visible damage to less than 10% of these hotel roofs.

At the Key West Naval Air Station, a low-slope modified-bitumen membrane has been peeled back from half of this commercial roof. The metal canopy roofs, however, appear unscathed.

Both ends of the roof at right show visible damage to the modified-bitumen roof. The mirror image building, at left, shows no such damage. These are the "Key West at the Sea" condos on A1A, less than one mile from the end of Key West.

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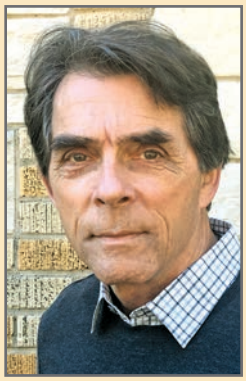
No conspicuous roof damage to the various roofs covering these Key West residential structures.

Only the center unit of these of these beachfront condos exhibited damage to its mod-bit roof.

Just east of the Key West Naval Air Station, none of these buildings appear to have noticeable roof damage.



Phil Mayfield

Phil Mayfield has been a member of RICOWI since 2004. During that time, he has participated in multiple investigations of wind and hail events as a member of the Wind Investigation Team (WIT) and Hail Investigation Team (HIT). Since 2010, he has chaired RICOWI's Wind Investigation Program. Phil is founder of PSM Consultants, an independent firm in Texas, specializing in roofing and waterproofing consulting. Phil began his roofing career in 1986 and worked for three different roofing/waterproofing manufacturers prior to starting PSMC in 1995.

Recent Changes to FM Data Sheets

Changes to some Factory Mutual (FM) Data Sheets have recently been released. Related to the building envelope is DS1-33, *Safeguarding Torch-Applied Roof Installations*, which has been completely revised. The major changes are:

- Expanded information related to fire watch and fire monitoring
- Added guidance on training torch applicators
- Editorial changes throughout the document, including moving some information from Section 2.0 to Section 3.0.
- Several definitions added to Appendix A

AIA Releases Updated Facility Support Standard

The American Institute of Architects (AIA) released an updated version of its AIA Documents B210 for architectural services such as commissioning services, building certification assistance, facility management, and maintenance management services.

AIA Document B210-2017, Standard Form of Architect's Services: Facility Report replaces the earlier B210-2007.

"An owner can use B210 to hire an architect to assess the condition, performance, and operation of an existing facility or group of facilities," according to the AIA. It may be used in conjunction with other standards for service documents.

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