Hurricane Irma

Willis Re’s post-event field damage survey report

Representatives from Willis Re spent four days in the field assessing the damage caused by Hurricane Irma to property in Florida. This report summarizes our observations from this damage survey.

Executive Summary

Hurricane Irma — the ninth named storm and first Category 5 hurricane of the 2017 Atlantic hurricane season, with peak winds of 185mph — is now the strongest historical Atlantic hurricane outside of the Caribbean and Gulf of Mexico. Irma made first US landfall on Cudjoe Key, Florida as a Category 4 storm and then made a second landfall on Marco Island, Florida as a Category 3 storm - ending a 12 year wait for a major hurricane (Category 3 and above intensity) to make landfall in Florida.

Willis Re’s damage reconnaissance team spent four days in the field assessing Irma’s damage. We reviewed many examples of property damage due to wind and identified how well various property elements performed in resisting hurricane wind forces. Our team travelled nearly 900 miles covering various properties exposed to the storm in Florida cities; these include Winter Haven and Lakeland in Polk County; Plant City and Brandon in Hillsborough County; Fort Myers, Cape Coral and Bonita Springs in Lee County; Naples in Collier County; Everglades City, Key Largo, Key West, Marathon Key and Big Pine Key in Monroe County.

Hurricane Irma’s estimated wind speeds on the ground for all of the surveyed areas were significantly below the minimum design level wind speeds (roughly 100 year mean recurrence interval wind speed) for residential buildings. In fact, in many areas, Irma’s estimated wind speeds were below the American Society of Civil Engineers’ ASCE 7-10 standards, 50 year mean recurrence wind speed intensity levels.

ASCE 7-10 Mean Recurrence Interval wind speed vs estimated Irma wind speed for select surveyed locations

<table>
<thead>
<tr>
<th>Location</th>
<th>10-Year</th>
<th>25-Year</th>
<th>50-Year</th>
<th>100-Year</th>
<th>Estimated Irma wind speed</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bonita Springs, FL</td>
<td>85 mph</td>
<td>103 mph</td>
<td>117 mph</td>
<td>129 mph</td>
<td>90 - 100 mph</td>
</tr>
<tr>
<td>Fort Myers, FL</td>
<td>84 mph</td>
<td>100 mph</td>
<td>114 mph</td>
<td>125 mph</td>
<td>85 - 95 mph</td>
</tr>
<tr>
<td>Marco Island, FL</td>
<td>86 mph</td>
<td>107 mph</td>
<td>124 mph</td>
<td>136 mph</td>
<td>115 - 125 mph</td>
</tr>
<tr>
<td>Naples, FL</td>
<td>86 mph</td>
<td>106 mph</td>
<td>122 mph</td>
<td>133 mph</td>
<td>95 - 105 mph</td>
</tr>
<tr>
<td>Key West, FL</td>
<td>90 mph</td>
<td>115 mph</td>
<td>130 mph</td>
<td>150 mph</td>
<td>125 - 135 mph</td>
</tr>
</tbody>
</table>

In general, we observed direct wind damage to insured properties ranging from minor to significant. Observed damage to surveyed buildings includes damage to: roof cover, roof deck, wall siding, attached structures such as carports, pool enclosures, and utility sheds.
Key Conclusions
1) Of all the surveyed areas, highest damage was observed in Marco Island, Cudjoe Key and Marathon Key
2) Newer buildings and newer roofs performed better than older buildings
3) Metal roofs performed much better than shingles and tiles
4) Major damage to gas station canopies supported by single row of columns was observed
5) Across the surveyed areas, mitigation measures such as strong storm shutters were effective
6) Although many buildings exhibited minor direct wind damage, insurance claim payouts for these could still be significant since entire roof cover will likely be replaced to avoid the cosmetic effects of mismatched tiles seen when only the damaged parts of roofing are replaced

Damage from Wind
Overall, we observed minor-to-significant damage to buildings from Hurricane Irma’s direct winds. We also observed instances of property damage due to tree fall in limited cases. However, based on the observed damage patterns and tree coverage in the surveyed region, it appears that tree coverage shielded surrounding homes from severe wind gusts.

Single family dwellings and low rise buildings
Our team observed minor-to-significant damage to single-family dwellings and low-rise commercial buildings. Damages varied with the age-of-construction where newer buildings showed less damage than older buildings.

Direct wind damage to single family dwellings and low-rise commercial buildings was limited to partial roof cover damage in newer buildings. Significant loss of roof shingles and minor siding damage was observed with older buildings (more than 15 years old). The better performance of newer roofs is likely due to relatively less degradation of physical properties of shingles — due to limited weathering time and also as improvements to newer products, such as greater bond-strength of self-seal adhesives and adhesive surface areas. Of the surveyed single family dwellings, about 15% have metal roofs, 35% concrete/clay tiles and 45% asphalt shingles.

In addition to roof cover damage, minor-to-moderate roof deck damage was observed in relatively high intense wind exposed areas along the coast of Naples, Marco Island and Florida Keys.

We observed much damage to tiled roofs. In some cases, the damaged tiles acted as flying debris, falling on neighboring tiles and causing additional damage. In addition, we noted that relatively older tiled roofs suffered more damage compared to newer roofs. Three main attachment methods were observed for tile roofs: mortar-set, mechanically attached and foam-set (adhesive-set). However, we found no clear damage differentiation among various tile attachment methods used in the surveyed regions.
A large portion of surveyed metal roofs are located in Key West. We saw that metal roofs performed relatively better than tiled and shingle roofs in the surveyed areas. However, a three story motel with a metal roof, surveyed in Key West, exhibited major roof damage. According to publically available building permit records, this building had undergone a minor metal roofing job in 1998-99 and a major job in 2005. The roofing design details, though, were not available for detailed investigation. But, from the failure mode of the roof, it appears to us that internal pressurization may have led to this major roof damage.
Manufactured homes
Our team visited four mobile home parks in the study region. All surveyed homes are located in manufactured home parks and are double-wide. Damage to manufactured homes is largely limited to loss of shingles, siding damage and major damage to add-on structures such as carports, screen enclosures and utility sheds.

In most observed cases, the add-on structures did not inflict additional damage to the main structure. In cases where there was additional damage, add-on structures caused very minor additional damage to the main structure. We did not observe damage to mobile home tie-downs or foundations.

Of all surveyed damaged mobile homes, 90% experienced none-to-moderate damage (0% to 10% damage) and the rest experienced moderate-to-significant damage (10% to 20% damage).

Mid- to High-rise buildings
We observed damage to mid- to high-rise condominiums and commercial buildings, including: damaged window panes, architectural awnings and overhangs and loss of roof tiles and wall stucco/plaster. We didn’t see any major structural damage. In fact, most of the mid-high rise buildings performed very well to Irma’s winds.
All of the surveyed buildings are in the 2010 Florida Building Code (FBC 2010) windborne debris region. Unsurprisingly, almost all of surveyed buildings’ glass openings (windows and balcony sliding doors) were protected by storm shutters which appeared to be effective in limiting wind damage.

Though the physical damage to most structures was minor, the cost of repairing some buildings will likely be very expensive. This is because of required workmanship and its associated challenges.

Gas stations
We saw extensive damage to gas station canopies, which included damage to soffit, fascia, framing, foundation and complete collapse. In studying a wide variety of canopies in the study region, we noted that some were supported by one row of columns and others had two rows of columns.

In general, canopies supported by two rows of columns are more stable. They exhibit a higher stiffness and redundancy than canopies supported by a single row. We concluded that canopies supported by two rows of columns performed far better. We also noted, in many cases, the main building and or convenience store of the gas station experienced none to minor wind damage.
Boats and Marina
We observed that the damage to boats and warehouses, in marinas along the coast, was primarily due to storm surge and related flooding. Boats were pushed on to streets and docks by the storm surge. We did see some roof damage to warehouse structures storing boats in marina. However, no significant damage to boats stored inside warehouses was observed.

Boat pushed off from its mooring position due to winds (left), boat pushed on to street by storm surge in Marathon Key (right)
Conclusions

Hurricane Irma’s direct wind damage to insured properties ranged from minor to significant in the surveyed areas. Observed damage to surveyed buildings includes: loss of roof cover, partial roof deck, wall siding, damage to attached structures such as carports, pool enclosures and utility sheds.

In many areas, Irma’s estimated wind speeds are below the Florida Building Code 2010 (ASCE 7-10) 50 year mean recurrence level wind speeds. We also saw that in many of the surveyed areas, homeowner-installed hurricane shutters minimized the impact. The same held true for strong hurricane shutters installed on small commercial and large condominiums.

Irma’s wind-exposed areas in Florida intersect with areas impacted by Hurricane Charley of 2004. Learning from history impacts future damage. That is, the minor damage observed in some of the areas highlighted the effectiveness of mitigation measures, code compliance and historical experience of homeowners dealing with hurricanes.

At the Marco Island, FL landfall point, Irma’s estimated tropical storm windspeeds (50kts) extend up to 110 miles away from center. Given the relatively large size of Irma, if Irma wind speeds had been 5 to 10mph more intense on the ground, we might have experienced significantly more wide-spread damage to building stock in Florida.

Willis Re will be evaluating all the scientific data, observations from our field surveys and other information available for this event. And just as homeowners learned from Charley, we are confident that we can aid clients as they make business decisions moving forward — as we take the results of this detailed study, in conjunction with clients’ claims data and work together before the next big one hits.