

DAMAGE ASSESSMENT FROM HURRICANES HARVEY & IRMA – SUMMARY REPORT

Introduction

In 2017, regions of Texas and Florida experienced unprecedented damage due to Hurricanes Harvey and Irma, respectively. A recent Texas A&M study, commissioned by NAHB, sought to determine how building code year impacted the amount of damage homes sustained during these weather events. The study found that, in Texas, homes built to the International Residential Code (IRC) after 2003 performed much better during the severe weather events than older homes. The study also found that Florida homes built after 1994 and to the Florida-specific building code based on the IRC were more resilient to wind damage.

The study, conducted by the Zachry Department of Civil Engineering at Texas A&M University, found that building to the IRC was very effective in preventing the destruction of homes due to wind during Hurricanes Harvey and Irma and resulted in significantly less damage to wall and roof coverings and loss of those components while also minimizing window breakage.

Prior to this study, anecdotal reports, including statements in the Federal Emergency Management Agency's damage assessments and media coverage, suggested that homes built to the IRC performed well in both states. However, there was little empirical evidence to support those claims.

To better understand building performance, NAHB contracted with Texas A&M University to conduct a statistical analysis of wind damage to residential buildings affected by Hurricanes Harvey and Irma using publicly-available damage assessments collected by teams funded by National Science Foundation rapid-response grants. Almost 2,000 assessments collected in Texas and 1,100 assessments collected in Florida¹ formed the basis of the study.

Method

For each assessment, the project team classified the observed damage for the overall home and for individual components of the walls and roof of the home. The level of wind damage to each component was rated on a scale of one to five, ranging from no damage to total/complete loss:

- Level 1 – No/minimal damage
- Level 2 – Minor damage
- Level 3 – Moderate damage
- Level 4 – Severe damage
- Level 5 – Total loss

After determining which wall and roof components suffered the most wind damage, the team charted the levels of damage to those components based on the year of construction.

Results

TEXAS

Building Codes

Most cities in Texas near Harvey's landfall (Corpus Christi, Port Aransas, Ingleside, Rockport, Portland) build to the 2012 or 2015 IRC. Although several small- to mid-size cities and many counties in Texas do

¹ Available at <https://web.fulcrumapp.com/communities/nsf-rapid/>

not enforce a building code, the Texas Windstorm Insurance Association requires construction to the 2006 IRC for buildings within the first tier of coastal counties.² It also requires compliance inspections.

Damage Assessment Results

Of the 1,983 homes evaluated in Texas, a relatively small number suffered complete loss of roof framing, wall framing, wall sheathing or windows due to hurricane winds. The statistical analysis identified damage to roof coverings, wall coverings, and windows as the most important contributors to the overall wind damage level.

Based on that analysis, damage levels for each of those three components were charted by the year of construction; Houses constructed after 2003 showed significantly lower levels of damage to wall and roof coverings and windows.

On average, homes constructed before 2003 suffered minor to moderate damage to roof coverings. The average home constructed after 2003 typically had no damage or minor roof damage.

Homes included in the study generally had either no wall damage or minor wall damage; however, homes constructed before 2003 performed the worst. Homes built between 2003 and 2009 were more likely to have no damage. (See Figures 1-2)

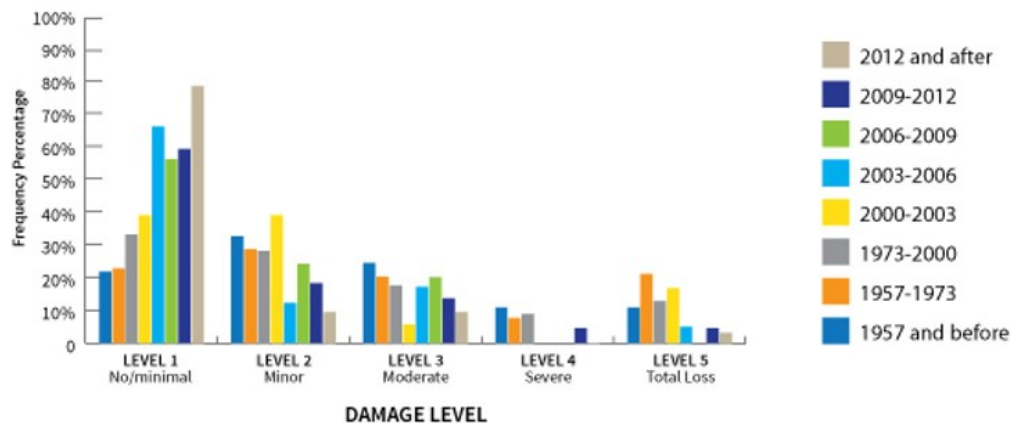


Figure 1. Histogram of damage to roof cover for Year-of-Construction subsets in Texas.

² Cameron, Willacy, Kenedy, Kleberg, Nueces, San Patricio, Refugio, Aransas, Calhoun, Matagorda, Brazoria, Galveston, Chambers and Jefferson counties.

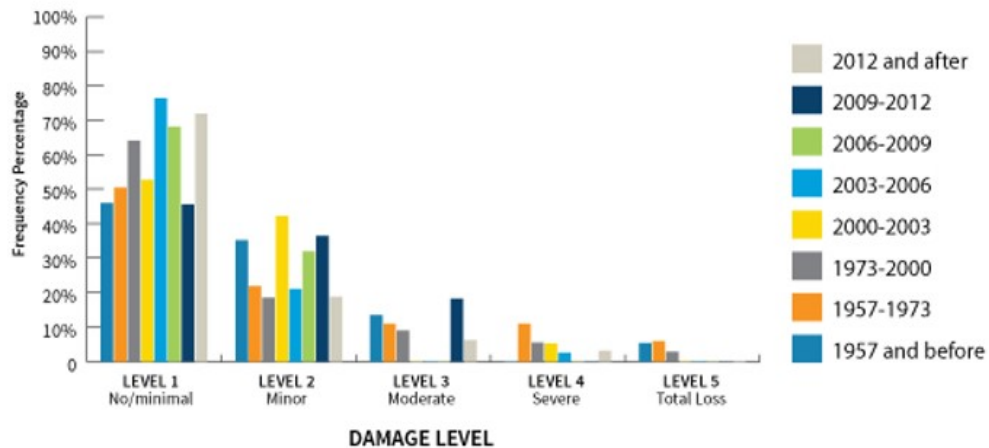


Figure 2. Histogram of damage to wall cover for Year-of-Construction subsets in Texas.

FLORIDA

Building Codes

Following Hurricane Andrew in 1992, building codes in Florida were updated and made more stringent. The first post-Andrew code, the South Florida Building Code, was enacted in 1994. In 2002, the Florida Building Code or FBC, which is based on the 2000 IBC and IRC, was adopted statewide. The FBC includes special provisions for a High-Velocity Hurricane Zone that apply to Broward County, Miami-Dade County, and the Florida Keys. The current edition of the FBC was adopted in 2017 and is based on the 2015 IBC and IRC.

Damage Assessment Results

A relatively small percentage of the 1,100 Florida homes included in the analysis suffered a complete loss of roof framing, wall framing, wall sheathing or windows. Roof and wall coverings sustained the most damage; the level of damage to those components was charted based on the year the homes were built.

The analysis found that homes in Florida constructed after 1994 had significantly lower levels of damage to roof and wall coverings than homes built earlier.

On average, the roof covering damage in the Florida homes ranged from no/minimal damage to minor damage. The average degree of damage generally decreased for homes constructed after 1994. (See Figure 3)

On average, the wall covering damage in the Florida homes ranged from no damage to minor damage. Homes built before 1994 performed worst, yet more than 80 percent of these homes had no/minimal damage. No homes constructed after 1994 had wall damage classified as total or complete and no homes constructed after 1999 had wall damage classified as either severe or total. Almost 95 percent of the homes constructed after 2008 sustained little or no damage, and a few percent had minor damage. (See Figure 4)

Window damage was not a significant component of overall damage to homes in Florida. This may be a result of the greater use of windows rated for design wind pressures that are consistent with hurricanes or the installation of impact-resistant windows or hurricane shutters.

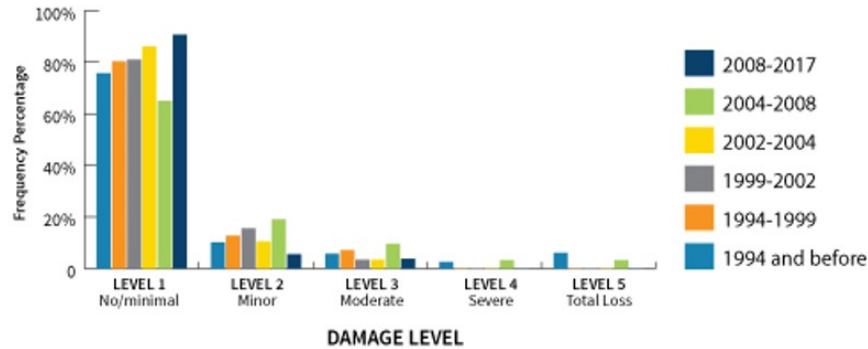


Figure 3. Histogram of damage to roof cover for Year-of-Construction subsets in Florida.

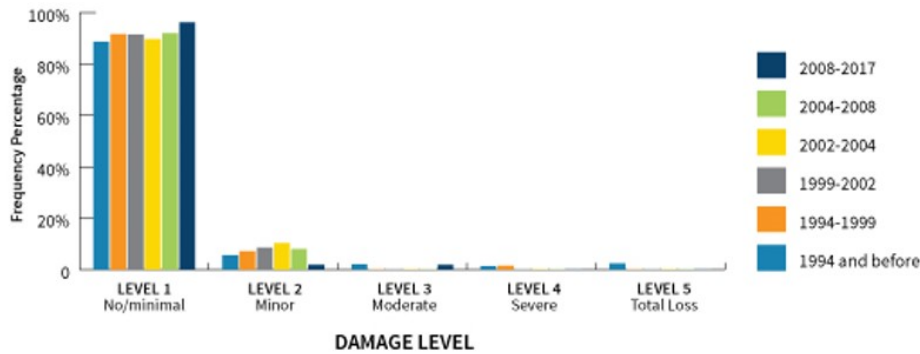


Figure 4. Histogram of damage to wall cover for Year-of-Construction subsets in Florida.

NAHB Summary and Conclusionsⁱ

In general, the analysis shows that few homes in Texas and Florida experienced more than moderate damage to structural roof or wall components, but the majority of the wind damage from Hurricanes Harvey and Irma was to the roof and wall coverings. In Texas, there was significantly lower levels of damage to wall and roof coverings among houses constructed after 2003. Based on these findings, it can be inferred that very few homes constructed in Texas after 2003 suffered severe damage to roof sheathing, wall sheathing and framing or total loss and collapse of those components.

Similar damage levels were observed among the houses in Florida. Only small percentages of homes constructed after 1994 were classified as having severe damage to/total loss of wall and roof coverings or total loss of them. No homes constructed after 2008 were classified as having severe damage to wall and roof coverings or total loss of those components. Consequently, it can be inferred that very few homes constructed in Florida after 2008 suffered severe damage to roof sheathing, wall sheathing and framing or total loss and collapse of those components.

These observations demonstrate that the IRC, since its inception, has been very effective in preventing the destruction of homes due to hurricane winds. The structural provisions ensure that the integrity of the roof framing and sheathing is maintained, and that wall structure and sheathing damage is minimized. Other required building practices have also resulted in less damage to wall and roof coverings and the loss of those components while also minimizing window breakage.

ⁱ The findings and conclusions in this section were reached by NAHB staff, and are not included in the formal report.