Using What We Learned in Hurricane Harvey to Strengthen Homes

National Tornado Summit 2019
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Hurricane Harvey Weather Conditions
- Initial landfall near Rockport, TX on August 26, 2017 with maximum sustained winds of 130 mph (Cat 4)
- Small size (12 miles radius of max winds) & short duration limited storm surge
- Slow movement
  - Hurricane-force winds near Rockport for 6–7 hours
  - Significant flooding in Houston

Hurricane Harvey Effects
- First major (Category 3 or higher) U.S. landfall since Hurricane Wilma in 2005
- Second most costly hurricane in U.S. history behind Katrina
- At least 68 fatalities
- Estimated $125 billion in damages
- 15,000 homes destroyed
  
- 25,000 damaged in Aransas, Nueces, Refugio, and San Patricio Counties
- 220,000 customers lost power
- 391,000 claims

IBHS Post-Disaster Investigation Program
Why?
To determine performance of materials and systems on residential buildings when subjected to a Category 3+ hurricane

IBHS Post-Disaster Investigation Tool
- Georeferenced data
- Terrain exposure
- Elevation and roof structure materials and systems
- Openings and opening protection
- Attached structures

Deployment Strategy: Site Selections
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Location | Construction Era | Wind Speed Estimate (mph) | General Damage
---|---|---|---
Portland | 1960s–1970s | 80–90 | Minor
Ingleside | 1960s–1990s | 80–90 | Minor
Mustang Island | 1990s–2010s | 90–100 | Minor (newer homes), Major (older homes)
Aransas Pass | 1990s–2000s | 110–120 | Minor
Port Aransas North | 1990s–2010s | 110–120 | Minor (newer homes), Major (older homes)
Rockport Southwest | 2000s | 120–130 | Minor
Holiday Beach | 1960s–1990s | 120–130 | Major
Port Aransas South | 2000s–2010s | 120–130 | Minor
Rockport Northwest | 1960s–2010s | 130–140 | Major

Preliminary Findings: IBHS Survey Zone Observations

- Wind damage: total destruction to no visible damage
- Exposure affected wind performance
- Roof covering loss was common & water intrusion was problematic
- Widespread use of shutters and plywood reduced structural damage
  Worked best when all openings were protected
- Widespread power loss
- Newer buildings generally performed better

Post-Harvey

- Built in 1987
- Built in 2006

- >85% had shingle roofs
- >50% of shingle roofs were damaged
- 3-tab roofs had higher damage frequency
Building System Performance: Roof Slope

- Most homes had moderate roof slope
- Roof cover damage was generally consistent
- Roof underlayment and decking damage more frequent for lower slopes

Building System Performance: Roof Shape

- Most roof shapes were gable, hip, or gable/hip combo
- Roof cover damage was generally consistent
- Roof underlayment and decking damage was more frequent for gable roofs

Building System Performance: Doors

- Unprotected doors had damage frequencies up to 6x higher
- Highest damage frequencies for slider doors (protected & unprotected)

Building System Performance: Attached Structures

- Often have weak connections
- Can cause additional damage to main building
- 23% evaluated were damaged

Effects of Exposure

- Relatively open exposures had highest damage frequency
- Open exposures were typically located along the bay

Breaking the Cycle

Findings match engineering models
But now we have **Quantitative Data** to assess **Vulnerabilities** instead of just pictures and anecdotes
Wind Speed Effects: Roof Component Damage Severity Vulnerability

Asphalt Shingle Roof Underlayment Damage Severity by Wind Speed

Asphalt Shingle Roof Deck Damage Severity by Wind Speed

Wind Speed Effects: Underlayment & Decking Damage in 110+ mph Zones

- Underlayment damage <10% on most (75%) homes
- Roof deck damage <10% on most (85%) homes

Wind Speed Effects: Garage Door Damage Frequency

- Failure rates low for wind speeds <110 mph
- Single-car garage doors had higher damage frequency (This is consistent with another ongoing post-event IBHS study)
- Only 1 of 62 double-car doors failed
  - Located in all neighborhoods except Holiday Beach & Mustang Island
  - Majority located in Rockport SE
- More research needed to understand vulnerability by door size

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Lessons Learned: Insurers

- Shingles dominate—claims and lab data needed to assess other materials
  - Over 50% of shingle roofs had cover damage
  - 3-tab shingle damage occurred on every home assessed in three neighborhoods
  - Damage severity for architectural shingles was less than 20%
  - Roof slope and shape did not affect roof cover loss

- Terrain exposure affected damage rates
- 23% of attached structures assessed were damaged
- Vulnerability curves produced:
  - Damage frequency and severity of roof cover damage
  - Damage severity of underlayment and decking damage
  - Damage frequency and severity of garage door damage

Lessons Learned: Insurers, Contractors, Homeowners

- Lower damage frequencies for roof decking and underlayment for
  - Steep-slope roofs
  - Hip or hip/gable combo roofs
- Unprotected doors damaged up to 6x more often
- Slider doors had highest damage frequency
- Single-car garage doors failed more than double-car doors

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Questions?

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