“Where building safety research leads to real-world solutions.”
Objective science can – and does – significantly reduce property losses, injuries and deaths.
IBHS Research Center

- Wind
- Hail
- Wildfire
- Water
IBHS RESEARCH CENTER FOUNDERS

AAA – The Auto Club Group
AAA Insurance - Auto Club Insurance. Co. of FL
AAA Mid-Atlantic Insurance Group
AAA Northern California, Nevada & Utah
ACE Tempest Re
Alfa Insurance Companies
Allstate Insurance Company
American Agricultural Insurance Company
American Family Insurance
American Insurance Association
American Modern Insurance Group
Amica Mutual Insurance Company
The Andover Companies
Aon Benfield
Aspen Re
Auto-Owners Insurance Group
Bankers Insurance Group
California FAIR Plan Association
COUNTRY Financial
Enumclaw Insurance Group
Erie Insurance
Farm Bureau Property & Casualty Insurance Co.
Farmers Insurance
Florida Farm Bureau Casualty Insurance Co.
FM Global
Gen Re
Guy Carpenter
The Hartford Steam Boiler Inspection & Ins. Co.
Holborn Corporation
HomeWise

Insurance Information Institute
Interinsurance Exchange of the Automobile Club
IPCRE Limited
Liberty Mutual Insurance Group
The Main Street America Group
MetLife Auto & Home
Mississippi Farm Bureau Casualty Insurance Company
Munich Re
Mut. Assurance Soc. of VA Fund (Community Foundation)
National Association of Mutual Ins. Cos.
Nationwide Insurance
The Norfolk & Dedham Group
OneBeacon Insurance
Property Casualty Insurers Association of America
Quincy Mutual Group
Reinsurance Association of America
RenaissanceRe Risk Sciences Foundation, Inc.
Rhode Island Joint Reinsurance Association
South Carolina Farm Bureau Mutual Ins. Co.
South Carolina Wind & Hail Underwriting Association
State Farm Insurance Companies
Swiss Re
Travelers Companies, Inc.
USAA
Verisk Insurance Solutions
Virginia Farm Bureau Mutual Insurance Cos.
W. R. Berkley Corporation
Willis Research Network
XL Group
Large Test Chamber

- 145 ft W x 145 ft L x 70 ft H test chamber
- 60 ft W x 30 ft H wind inlet
- 105 fans, each with 350 hp motors
- Enough power for 9,000 homes
- Flow volume = 20 X Niagara Falls
- High-speed cameras & TV lighting

Insurance Institute for Business & Home Safety
Where building safety research leads to real-world solutions.
Recreating Mother Nature in the Lab

Wind Data Gathered in Field During Disasters

Engineers Use Data to Recreate Actual Wind Scenarios in Lab

105 Fans Bring Scenarios to Life
TTU Wind Engineering Research Field Laboratory

- Located in flat, open terrain in Lubbock, Texas
- Simple building design
- 9.14 m (30 ft) wide x 13.72 m (45 ft) long x 3.96 m (13 ft) tall
- Nearly flat roof (¼:12 pitch)
- 204 pressure taps
- Used to validate wind tunnel and CFD results
Tap Locations
[from Lombardo 2009]
Mean Pressures

TTU Field Data 6-deg

UWO Wind Tunnel

Open Country, with vane action

Open Country, Davenport coherence
Standard Deviation of Pressures

TTU Field Data 6-deg

UWO Wind Tunnel

Open Country, with vane action

Open Country, Davenport coherence
Initial Major Research Focus

• Roofs = 1st line of defense against many natural hazards
  – Wind
  – Wind driven rain
  – Wind driven ember (firebrand) attacks
  – Hail
• Wind Loads and Wind Effects
• Current Test Standards and Ratings
Winds and Rains in the Real World
Wind-Driven Rain ~ 8 in. per hour
Drainage system in the attic to collect water that entered though vents and, after roof shingles were blown off / removed, through the roof deck.
Water collection system in living space;
50 – 2’ x 10’ collection zones in the duplex
Water Intrusion through Soffits

Open vs. Covered
At a wind speed of 30 mph+

Water Entry Rate for Open Vent = Wind-driven Water Deposition Rate
Water Intrusion: Exposed Roof Sheathing

- Water entry through sealed roof deck ~ 1/3 that through unsealed roof deck.
- Water entry through un-taped roof deck >> water entry through openings at eave and gable end.
## Water Entry Through Openings: Roof On

<table>
<thead>
<tr>
<th>Opening</th>
<th>Open Soffit</th>
<th>Vinyl Vented</th>
<th>Gable End</th>
</tr>
</thead>
<tbody>
<tr>
<td>Direction &amp; Wind Speed</td>
<td>Head On</td>
<td>Head On</td>
<td>Head On</td>
</tr>
<tr>
<td>miles/hour</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>50</td>
<td>1.3 (15)</td>
<td>1.6 (20)</td>
<td>6%</td>
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<td></td>
<td></td>
<td>3%</td>
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<td></td>
<td></td>
<td></td>
<td>~8 (100%)</td>
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<tr>
<td>70</td>
<td>2.9 (33)</td>
<td>-----</td>
<td>25%</td>
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</tbody>
</table>

**Accumulation / hr** (% wall deposition)

**Relative to Open Soffit**
Examples of water entry into living space
Consequences of Water Entry
Loss Estimates

Unsealed Roof Deck = 3 X Greater
Furniture Cleaning versus Replacement
($16,935 vs. $5,408)
VIDEO FROM SEALED ROOF DECK TESTING GOES HERE
Next Up: Making Hail Inside the Lab
Wind loads on:

1. Shingles
2. Commercial rooftop equipment
3. Residential and commercial photovoltaic systems (solar arrays)
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