BEFORE ALL HAIL BREAKS LOOSE!
2018 MHEC MPP LOSS CONTROL WORKSHOP
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Objectives

• Hail Hazard for MHEC MPP
• Types of Hail Damage to Facilities
• Hail Mitigation
  – New Projects
  – Existing Buildings
• 3 Key Takeaways to follow up on at your Campus
Hail Hazard Map

Swiss Re CatNet ®

United States

Legends

<table>
<thead>
<tr>
<th>Hail Days (&gt;2cm) per 2500 km² and year</th>
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<tbody>
<tr>
<td><strong>Hail Risk</strong></td>
</tr>
<tr>
<td>Extreme (&gt;1.0)</td>
</tr>
<tr>
<td>Very High (0.8 - 1.0)</td>
</tr>
<tr>
<td>High (0.6 - 0.8)</td>
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<tr>
<td>Significant (0.4 - 0.6)</td>
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<tr>
<td>Moderate (0.2 - 0.6)</td>
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<tr>
<td>Low (0.1 - 0.2)</td>
</tr>
<tr>
<td>Very Low (&lt;0.1)</td>
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</tbody>
</table>
Hail Hazard Map

FM Global FMDS 1-34

Exposure to Damaging Hail Storms
- Moderate
- Severe
- Very Severe
- No Data
**Hail day:** A day where minimum \( \frac{3}{4} \) in. (19 mm) diameter hail occurred within 25 mi (40 km) of a location.

**Very Severe Hail Hazards**
Areas in the United States shown as Very Severe in Figure 8, *Hail Storm hazard map for the United States.*

**Severe Hail Hazard**
Areas that have experienced on average at least three hail days per year.

**Moderate Hail Hazard**
Areas that have not experienced on average at least three hail days per year.
MHEC MPP Campus Location Map

Source: Global Risk Consultants
Hail Ratings by Location (FMDS 1-34)

- Severe: 55%
- Moderate: 22%
- Very Severe: 23%

MHEC MPP Campus Locations
MHEC MPP Losses 2013-2017

- 14 reported hail losses
- Total $20,714,281
- Average $1,479,592
- Median $605,969
Common Hail Damage to Facilities

• Damage to Roofing Components
  – Roof Covers & Substrates
  – Skylights
  – Vents
  – Flashing

• Damage to Walls/Wall Panels

• Damage to equipment
  – Rooftop Units
  – HVAC
  – Solar
  – and other equipment

• Water damage to interior of building
  – Restoration cost
  – Replacement of furnishings or equipment
Damage to Roofing Components

• Many types of roof covers for both flat and sloped roofs

• Factors that influence susceptibility to hail damage to all types of roofs is
  – Age
  – Weathering
  – Degradation
  – Temperature
  – Listed/Approved Components

• According to FM Global, the most damageable roofs are asbestos-cement, cementitious fiber and any roof in poor condition.
Damage to Roofing Components
Damage to Roofing Components
Damage to Roofing Wall Panels
Damage to Roofing Components

Source: http://rci-online.org/
Damage to Roofing Components

Source: http://rci-online.org/
Damage to Roofing Components

Hole in TPO Wall Flashing
(temporary repair applied)
Damage to Equipment

Fig. 3. Hail damaged HVAC unit

Source: FMDS 1-34
Damage to Equipment

Hail Pits in Condenser Fins
Hail Mitigation

New Installations:

- Specify proper Hail Approval/Listing
  - Roofing Systems
  - Wall Panels
  - Skylights
- Hail Guards
  - Condensor Fins
  - Equipment

Existing Installations:

- Roof Inspection Program
- Qualified Contractors
- Hail Guards for Equipment
- Age matters
New Roof Installations

- Stone or paver ballasted roofs are acceptable for all hail ratings (some limitations)

<table>
<thead>
<tr>
<th>Hail Hazard Area (FMDS 1-34)</th>
<th>Roof Hail Rating</th>
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</thead>
<tbody>
<tr>
<td></td>
<td>single-ply, multi-ply or panel roofs</td>
</tr>
<tr>
<td>Very severe (VSH)</td>
<td>VSH</td>
</tr>
<tr>
<td>Severe (SH)</td>
<td>VSH, SH</td>
</tr>
<tr>
<td>Moderate (MH)</td>
<td>VSH, SH, MH</td>
</tr>
</tbody>
</table>
• Ice balls are used in this test method to simulate hailstones.

• The test specimen shall show no evidence of visible cracking or breakage or any damage such as punctures, fractures, disengagement of lap elements or exposure of materials not so intended.
Other Standards

• UL 2218 Standard for Impact Resistance of Prepared Roof Covering Materials
• ASTM D3746 Standard Test Method for Impact Resistance of Bituminous Roofing Systems
Roof Inspection Program

Why?

- Age and condition matter!
- ANSI FM 4473: “Exposure of roof coverings to the elements over an extended period of time has a potential to significantly lower the hail resistance of the roof materials….. “

How Often?

- Scheduled roof inspections at least 2 times per year (spring and fall)
- Additional inspections after major storms
- Document the age and condition of all roofs for important buildings
- GRC property surveys for all MHEC MPP members will include audits of the roof inspection programs
Roof Inspection Program

Conditions that make certain roofs prone to hail damage.

**Built-up and modified bitumen:**
- Original surface coating, such as granules or gravel missing
- Blisters, deteriorating felts (scrim is showing) and alligator surfaces

**Single-ply membranes:**
- Crazing (very fine cracks in the membrane surface)
- Stretching at the edges and seams, indicating probable embrittlement.

**Liquid applied roof covers:**
- Crazing, cracking, peeling, flaking or erosion.
Fig. 5. Hail damage to severely "alligatored" roof (built-up roof)

Source: FMDS 1-34
Roof Inspection Program

Figure 1 – Severe deterioration of TPO membrane with embrittled/loss of top coating and exposed scrim.

Figure 2 – Close-up view of deteriorated TPO membrane with embrittled/loss of top coating and exposed scrim.

Source: http://rci-online.org/
Roof Inspection Program

Figure 14 – Cracking in top surface of TPO membrane at fastener head protruding up on membrane.

Figure 16 – View of underside of membrane at crack revealing corrosion on fastener head.

Source: http://rci-online.org/
Roof Inspection Program

Shrinking EPDM Pulling Away From Flue Pipe

Roofing Membrane Pulling Away From West Roof Flashing
Roof Inspection Program

• Routine inspections can be done by a competent person

• When issues or concerns are found contact your roofing consultant

• Registered roof consultant (RRC) is a designation made by RCI, Incorporated; which is an international association of professional consultants, architects, and engineer who specialize in the specification and design of roofing, waterproofing, and exterior wall systems.

http://rci-online.org/

• Reference MHEC Property Risk Control Standards section 8: Roof Maintenance
Walls, Panels & Skylights

**Walls:**
- Select wall systems that are inherently fire and hail resistant such as brick or concrete block.
- Select wall panels with Approved/Listed hail rating

**Skylights:**
- Select Approved/Listed hail rating
- Skylights can also be protected with minimum No. 11 gauge diameter steel wire mesh with maximum mesh opening size of 1.0 in.
Equipment

Cooling Fins for HVAC Units:

• Provide hail guards or steel wire mesh
• Min No. 11 gauge diameter steel wire mesh with maximum mesh opening size of 1.0 in. and supported on a steel framework

Roof Vents:

• Steel Wire Mesh

Fig. 4. HVAC unit with hail guard over cooling fins at same location as hail damaged unit in Figure 3
3 Takeaways

1. Specifications for New Projects
   ✓ Do specifications for new construction and renovations include proper hail ratings for roofs, skylights, wall panels?

2. Inspection Program
   ✓ Is there a formalized/documented roof inspection program?
   ✓ At least 2 scheduled inspections per year and after major storms?
   ✓ Repairs being performed by qualified personnel (RRC)?
   ✓ Do we have hail guards on condenser fins or other rooftop equipment?

3. Age and Condition
   ✓ Do we document the age and condition of all our roofs on campus?
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