Wind Loss Mitigation Implementation
Issues and Recommendations

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Outline

I. Loss Relativities Recap
II. Problems and Implementation Issues
III. Recommendations

Notes: WMRD = Wind Mitigation Rate Differentials
FBC = Florida Building Code
FBCo = Florida Building Commission
I. Loss Relativities Recap
Recap: 2002 & 2008 Loss Relativities

1. 2002 loss relativities were well “validated” by 2004-5 Florida hurricane damage and insurance data.

37 Insurance Data Sets

[Graph showing peak gust wind speed in open terrain (mph) and percent loss reduction with mitigation features like Pre-2002 to Post-FBC, 2-Story, 1-Story, Terrain A to Terrain B, etc.]
Recap: (Continued)

2. 2008 study incorporated significant amounts of new data and funded research.
   - New features include: number of stories, roof cover type, roof slope, soffits, window leakage, roof cover age effects,…
   - A 2007 FBC Era was introduced to capture new building code enhancements
   - WMRD apply only to dwelling and not to attached/detached structures. This will have a significant impact on magnitude of WMRD. See 2007 OIR study.
## 2002 and 2008 Features

### Single family and Group I Multi-family

<table>
<thead>
<tr>
<th>2002 Features</th>
<th>Features Added in 2008</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Terrain</td>
<td>1. Number of Stories</td>
</tr>
<tr>
<td>2. Roof Shape</td>
<td>2. Roof Cover Material</td>
</tr>
<tr>
<td>3. FBC, Non-FBC Roof Cover</td>
<td>3. Roof Slope</td>
</tr>
<tr>
<td>5. Roof-to-Wall Connection</td>
<td>5. Vinyl Siding</td>
</tr>
<tr>
<td>7. Opening Protection</td>
<td>7. FBC Roof Cover Age</td>
</tr>
<tr>
<td>10. Wall-to-Foundation Restraint</td>
<td></td>
</tr>
</tbody>
</table>

### Groups II and III Multi-family

<table>
<thead>
<tr>
<th>2002 Features</th>
<th>Features Added in 2008</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Terrain</td>
<td>1. Parapets</td>
</tr>
<tr>
<td>2. Design Building Code</td>
<td>2. Rooftop Equipment</td>
</tr>
<tr>
<td>4. FBC, Non-FBC Roof Cover</td>
<td>4. FBC Roof Cover Age</td>
</tr>
<tr>
<td>5. Opening Protection</td>
<td>5. Minimal Condition Requirements</td>
</tr>
<tr>
<td>6. Roof Deck Material</td>
<td></td>
</tr>
<tr>
<td>7. Secondary Water Resistance</td>
<td></td>
</tr>
</tbody>
</table>

### 2008 Minimal Condition Requirements:

- Roof Cover, Roof Deck, and Windows

### Roof Cover Age Transition

"Typical" House in Terrain B

![Chart showing Roof Cover Age Transition](chart.png)
3. Mitigation of a typical pre-FBC strength home to a well-mitigated or new code home produces about a 40-60% loss reduction. The weakest homes generally have loss increases of 100 to 200% over the typical home.
4. How do these WMRD magnitudes translate into a difference in homeowner premium.

Example:
- Fixed Costs = 15% TP
- Wind Loss Cost = 50% of Total Loss Costs
- 80% Wind Premium for Dwelling Structure
- For WMRD = 50%, Reduction in HO Total Premium = 17%
II. Problems/Implementation Issues
Problems and Implementation Issues

The State has not developed a coherent vision and coordinated long term plan for wind loss mitigation.

Problems and Implementation Issues:

1. Credit mentality
2. Potential double counting of credits with BCEGS
3. Potential for fraudulent data
4. Reinsurance rates do not adequately reflect mitigation
5. Little coordination among state agencies responsible for various system components and decision making
6. Mandating credits for all winds (including hail) vs hurricane winds
Some Questions Going Forward

1. How to transition from a credit approach implementation to a wind mitigation rate differential implementation?
2. How to get the Cat Fund Reinsurance program to better recognize mitigation?
3. How to integrate rate offset or rebalance and reflect portfolio changes with time (year over year)?
   - Avoid “my rates go up because my neighbor put up shutters.”?
4. How to get the insurance industry to promote mitigation?
5. How to transition from 2002 Relativities to 2008 Relativities, reflect building code changes, and update mitigation inspection forms/data?
6. How to collect accurate mitigation inspection data and maintain updated mitigation conditions/features known for a home?
7. How to have a statewide uniform grading scale and allow for different mitigation filings based upon different modelers?
III. Recommendations
Recommendation Topics

1. **Coordinated Long Term Goal/Vision.** A must for moving mitigation forward and cleaning up existing problems/ disconnects.

2. **Rate Differentials.** Credits should transition to WMRD (Wind Mitigation Rate Differentials) and be applied accurately.

3. **Accurate /Periodic Data Collected by Insurers.** WM data collection should be done by insurance companies periodically (every 5 years) on each home. The data collection cost/ maintenance should become an allowable annual fee.

4. **Baseline Rates/Rebalance.** Baseline dist. of bus. for each insurer must be established to rebalance system for WMRD.

5. **HO Premium Transition.** Changes in homeowner premium averaged over 5 years during Baseline and Transition

6. **Reinsurance Based on Mitigation.** Cat Fund reinsurance rates should change to reflect mitigation and uncertainty

1. Coordinated Long Term Plan

1. There should be a long term goal/ vision. We need to get back to basics and emphasize cost – effective mitigation.
   - WMRD provide the economic incentive for cost effective wind mitigation in the high hurricane hazard regions in the state.
   - See attached presentation: “Recommendations for Long-Term Solutions to Florida’s “Insurance Crisis”, presented to Florida’s 2007 Wind Study Mitigation Committee.”

2. Process must be treated as an integrated system that supports the long term goals:
   1. Accurate determination of presence/absence of wind mitigation features
   2. Encourages building owners to invest in cost-effective mitigation
   3. Encourages insurance companies to collect wind mitigation data and promote WMRD
   4. Provides adequate rates and encourages competition
1. Coordinated Plan (cont’d)

5. Encourages reinsurance companies and requires Cat Fund to reflect distribution of wind mitigation features
6. Promotes continued improvements to FBC
7. Promotes validation, updates, and refinements to loss mitigation modeling, building ratings, and rate differentials.

Multiyear Transition Depends on Decisions (D) and Probabilities (P)
(Using AAL for P to Produce Mean Estimates)
Loss Reduction Scenario

Cumulative Statewide Loss Reduction: Case B vs Base

- Insured Loss
- Insured + Public Costs

~240 Billion w/Public Costs
120 Billion Insured

Cumulative Loss Reduction in $Billions

Year
2000 2010 2020 2030 2040 2050
2. Credits to Rate Differentials

3. Accurate Data Collected by Insurers

4. Baseline Rates/Rebalance

5. HO Premium Transition

1. Insurers are encouraged to inspect their book with the inspection cost included in the HO Premium as a mitigation data collection/maintenance fee (say $25 per year).
   - The fee would be permanent to allow re-inspection of each property every 5 years at a minimum.
   - Insurers provide a mitigation report to HO
   - Periodic re-inspections allow for new mitigation features to be treated, based on WMRD updates, condition assessment, and encouragement of homeowner to perform cost-effective mitigation
   - Quality control would be managed by insurer and this approach significantly reduces potential for fraud and errors.
2-5 Recommendations (Continued)

2. Insurers establish a Baseline Distribution of Business through inspections over a 1-5 year period
   - 100% inspected book achieved no later than 5 years
   - New business inspected within first year
   - Independent clearing house? allows data to flow over, if homeowner requests, but not within first 5 years following previous insurer’s inspection

3. Homeowner credits transition over a 5 year period to Baseline
   - In general, homeowner WMRD must transition over time with updated loss relativities, building re-inspections, and improved modeling/data/FBC changes occur.

4. Once Baseline/Offset is achieved, their would be no major offsets and hence a homeowners WMRD are “not dependent on whether or not his neighbor puts up shutters.”
   - This is critical to measurement of long term improvement in Florida Building Stock, Mitigation, and the slow reduction in loss costs.
   - Notable Offsets/Rebalances do not occur after the Baseline Period! This is a key feature of this approach.
   - Note: Reduction in loss costs is the proper measure of mitigation effectiveness. Do not confuse reduction in loss costs with the countering effects of inflation and insured value increases over time.

6. Approach produces high confidence of a book’s wind mitigation distribution and results in best possible Cat Fund rates, based on average relativity of the inspected buildings.
   - Books with very little information about mitigation (few inspections) – pay highest Cat Fund rates (unknown)
   - Uncertainty is expensive.
## Example Book Transition

<table>
<thead>
<tr>
<th>Year</th>
<th>Total Houses</th>
<th>Inspect'ed Houses</th>
<th>Unk. Houses</th>
<th>Weak</th>
<th>Strong</th>
<th>Weak Rav</th>
<th>Strong Rav</th>
<th>Baseline Offset</th>
<th>Weak R/Rav</th>
<th>Strong R/Rav</th>
<th>Base Rate</th>
<th>Total Revenue</th>
<th>Relativities</th>
<th>Comments</th>
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<tr>
<td>1</td>
<td>1,000</td>
<td>0</td>
<td>1,000</td>
<td>0</td>
<td>0</td>
<td>None</td>
<td></td>
<td>$100</td>
<td></td>
<td>0</td>
<td>None</td>
<td>$100,000</td>
<td>W=0.8, S=0.3</td>
<td>Starting Point</td>
</tr>
<tr>
<td>2</td>
<td>1,000</td>
<td>1,000</td>
<td>0</td>
<td>600</td>
<td>400</td>
<td>0.6</td>
<td>1.67</td>
<td>1.33</td>
<td>0.50</td>
<td>$167</td>
<td>$100,000</td>
<td>100</td>
<td>W=0.8, S=0.3</td>
<td>Baseline Inspections/ Offset Complete</td>
</tr>
<tr>
<td>3</td>
<td>1,000</td>
<td>1,000</td>
<td>0</td>
<td>550</td>
<td>450</td>
<td>0.63</td>
<td>1.33</td>
<td>0.50</td>
<td>$167</td>
<td>$95,833</td>
<td></td>
<td></td>
<td>W=0.8, S=0.3</td>
<td>50 Houses Mitigate, Book is stronger</td>
</tr>
<tr>
<td>4</td>
<td>1,100</td>
<td>1,100</td>
<td>0</td>
<td>550</td>
<td>550</td>
<td>0.6</td>
<td>1.33</td>
<td>0.50</td>
<td>$167</td>
<td>$100,833</td>
<td></td>
<td></td>
<td>W=0.8, S=0.3</td>
<td>100 Strong Houses Added</td>
</tr>
<tr>
<td>5</td>
<td>1,200</td>
<td>1,200</td>
<td>0</td>
<td>650</td>
<td>550</td>
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<td>$167</td>
<td>$114,167</td>
<td></td>
<td></td>
<td>W=0.8, S=0.3</td>
<td>100 Weak Houses Added</td>
</tr>
</tbody>
</table>
6. Reinsurance Based On Mitigation

1. There should be a long term goal/ vision. We need to get back to basics and emphasize cost – effective mitigation.
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2. Process must be treated as an integrated system that supports the long term goals:
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   3. Encourages insurance companies to collect wind mitigation data and promote WMRD
   4. Provides adequate rates and encourages competition
### Florida Hurricane Catastrophe Fund
2009 Ratemaking Formula Report
Windstorm Mitigation Construction Rating Classification Factor Relativities

To Calculate the Final FHCF Rate for a risk:

- Preliminary relativity = (year built relativity) x (roof deck attachment relativity) x (roof shape relativity) x (opening protection relativity)
- Capped relativity =
  - 1.1 if the preliminary relativity exceeds 1.1;
  - 0.9 if the preliminary relativity is less than 0.9;
  - the preliminary relativity in all other cases.
- Actual relativity =
  - the smaller of the capped relativity and (1 – BCEG credit) if the BCEG credit exceeds 0%; or
  - the capped relativity if the BCEG credit equals 0%.
- Final rate = (Base rate) x (actual relativity) x (on balance relativity)

<table>
<thead>
<tr>
<th>Relativity</th>
<th>Construction Feature Description</th>
<th>Type of Business</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Commercial</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Residential</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Mobile Home</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Tenants</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Condos</td>
</tr>
<tr>
<td>Year Built Relativity</td>
<td>Meets 2002 FBC or 2002 or later</td>
<td>0.6685</td>
</tr>
<tr>
<td></td>
<td>Does not Meet 2002 FBC and Unknown or Mobile Home Pre 1995</td>
<td>1.0361</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1.1594</td>
</tr>
<tr>
<td></td>
<td></td>
<td>0.7173</td>
</tr>
<tr>
<td>Roof Deck Relativity</td>
<td>Roof Deck Attachment Reinforced Concrete Roof Deck Other or Unknown</td>
<td>0.6729</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1.3533</td>
</tr>
<tr>
<td>Roof Shape Relativity</td>
<td>Roof Shape Hip, Masard, or Pyramid Gable, Other or Unknown</td>
<td>0.6366</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1.0207</td>
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<tr>
<td>Opening Protection Relativity</td>
<td>Opening None or Unknown Basic Shutters Hurricane Shutters</td>
<td>1.0470</td>
</tr>
<tr>
<td></td>
<td></td>
<td>0.9515</td>
</tr>
<tr>
<td></td>
<td></td>
<td>0.8561</td>
</tr>
<tr>
<td>On Balance Relativity</td>
<td></td>
<td>1.0377</td>
</tr>
<tr>
<td></td>
<td></td>
<td>0.9995</td>
</tr>
</tbody>
</table>

This page revised 4-1-2009.
Cat Fund Rates Disconnected

1. Cat Fund has surcharges and discounts
2. Cat Fund credit for mitigation seems to be severely capped at Relativity of 0.9
3. Approach puts Primary Insurers in a untenable squeeze
4. Factors are multiplied together independent of one another—does not follow the relativity matrix nor recognize the building is a system
5. Table treats unknown same as none or weakest.
6. Methods not consistent and do not promote mitigation or well defined book
7. Systematic Updating/Validation of WMRD

1. Tracks evolution/improvements in FBC
2. Validated with physical damage data
3. Consistent with insurance loss data
4. Recognizes the building is a system (weak link) and damage is progressive
5. Allows modeler competition through public standards and approved filings
WMRD- Modeling Standards

1. Must recognize that mitigation reduces physical damage
   1. Losses are reduced when physical damage is reduced.
   2. Mitigation reduces damage and reduced damage reduces economic loss.

2. Example Standards for Consistent Modeling of Structures, Building Code Changes, and Retrofits:
   1. Loads
      1. Estimation of wind-induced loads and variation by direction
         - Component loads: windows, doors, shingles, roof sheathing, …
         - System loads: roof uplift, walls, sliding, ….
      2. Explicit modeling of missile impact energy and momenta
      3. Computation of internal pressure
      4. Treatment of progressive, cumulative effects, storm duration
      5. Water intrusion (pressure difference, opening size, rain intensity…)
WMRD- Modeling Standards

2. Resistances
   1. Resistance of components to wind loads (pressures, forces>>)
   2. Resistance to debris impact
   3. Reflect Code requirements, improvements, lab and full scale data

3. Field Data allows for validation of Physical Damage Model

4. Loss Models determine financial losses given physical damage
   - Insurance loss data and claims provide for validation of economic loss
5. Damage is cumulative and the effects of mitigation (increasing resistance, improved geometry, ...) varies significantly with structure type and mitigation strategy.
   - The complexity of the physical interactions cannot be treated with judgment based vulnerability models.
   - Failure of the building envelope must be explicitly modeled and treated with loads and resistances.
   - Use of insurance data alone cannot be used to build an engineering model of the structure nor capture building code changes.

6. The number of mitigation combinations is too large to use empirical data/expert judgment to develop WMRD.
   - 2 roof shapes x 3 roof deck strengths x 3 roof to wall connections x 2 SWR x 2 opening protections x 2 building heights x 2 roof cover types x 2 roof cover strengths x 2 roof slopes x 2 soffit types x 2 terrains = 4,608 combinations
## Example Bldg Outputs - 2008 LR Study

### Building Description

<table>
<thead>
<tr>
<th>Year:</th>
<th>2008</th>
</tr>
</thead>
<tbody>
<tr>
<td>Stories:</td>
<td>1</td>
</tr>
<tr>
<td>Primary Roof Shape:</td>
<td>Gable</td>
</tr>
<tr>
<td>SWR:</td>
<td>No</td>
</tr>
<tr>
<td>Roof Cover: (ft-lbs)</td>
<td>Curved Tiles</td>
</tr>
<tr>
<td>Roof Deck:</td>
<td>Plywood</td>
</tr>
<tr>
<td>Roof Deck (psf) Attachment:</td>
<td>6d/6.00/12.00/6.00</td>
</tr>
<tr>
<td>Wall (psf) Construction:</td>
<td></td>
</tr>
</tbody>
</table>

### Wind Climate

- **Num of Year Sim:** 500,000
- **Weighted:** Yes
- **Sim File:** WindClimateData\SIMW0013.dat

<table>
<thead>
<tr>
<th>Type</th>
<th>Min</th>
<th>Max</th>
<th>Azmth</th>
<th>Sim</th>
<th>v^2</th>
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</thead>
<tbody>
<tr>
<td>Missile: R</td>
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<td>1.00</td>
<td>1.00</td>
<td>1.00</td>
<td>1.00</td>
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<tr>
<td>Missile: C</td>
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<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
</tr>
<tr>
<td>Terrain:</td>
<td>0.35</td>
<td>0.35</td>
<td>0.35</td>
<td>0.35</td>
<td>0.35</td>
</tr>
</tbody>
</table>

- **Num Sim Per Storm:** 30
- **100 Yr Wind Speed:** 121 mph
- **250 Yr Wind Speed:** 131 mph
- **1000 Yr Wind Speed:** 147 mph

### Economic Description

<table>
<thead>
<tr>
<th>Protection Level</th>
<th>Area (sf)</th>
<th>Percent *</th>
</tr>
</thead>
<tbody>
<tr>
<td>050 ft-lb @5%</td>
<td>188</td>
<td>8%</td>
</tr>
<tr>
<td>243 ft-lb @5%</td>
<td>56</td>
<td>3%</td>
</tr>
</tbody>
</table>

- **Value: $165,206.00**
- **Cap: 1.25**
- **Contents: $82,603.00**
- **ALE: $33,041.20**
- **Deductible: 0/3304/8260**
- **Cap Cont Cov: 0.5**
- **Cap ALE Cov: 0.2**
- **OHP: 1.2**
- **R&R: 1.25**

### Global Results: Base Case

- **Average Damage State:**
- **Ground Up AAL:**
- **Ground Up Loss Cost:**
- **PML 100 yr:**
- **PML 250 yr:**
- **PML 1000 yr:**

---

### Program Parameters

- **Hurdam Directories:**
  - Base: \runs
  - Program: \Programs\*

- **Loss Directories:**
  - Program: \Programs\*

- **Version:**
  - HURSIM:
  - HURDAM: MitCost: 2.6
  - RESCOMLOSS: 19
  - HurReport: 1.2

---

### Loss Percentages

- **Fen:** Windows: 9, Doors: 1, Sliders: 1, Garage: 1, Skylights: 0
- **Gnt:** NA NA NA 18% 11%

---

### Type Plan Roof Wall Fen Glazing

<table>
<thead>
<tr>
<th>Type</th>
<th>Plan</th>
<th>Roof</th>
<th>Wall</th>
<th>Fen</th>
<th>Glazing</th>
</tr>
</thead>
<tbody>
<tr>
<td>Area (sf)</td>
<td>2406</td>
<td>2600</td>
<td>2218</td>
<td>304</td>
<td>244</td>
</tr>
<tr>
<td>Percent</td>
<td>NA</td>
<td>NA</td>
<td>NA</td>
<td>18%</td>
<td>11%</td>
</tr>
</tbody>
</table>

- **Protection Level:**
  - Area (sf) 188
  - Percent 8%

---

### Example Bldg Outputs - 2008 LR Study

- **HurReport - Single Family Residential**
- **WindClimateData\SIMW0013.dat**
- **Base Case**

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**EXPANDING THE REALM OF POSSIBILITY**
Window, Door Failures

Frequency of Failure of At Least One Glazed Opening
(Windows and Sliders)

Percentage of Storms

Gust Speed (mph)

Frequency of Fenestration Failure

Average Number of Failed Windows & Sliders, Max = 3.63 of 10

Average Number of Fenestration Failures

Any Mode
Frame
Glass
Missile

ARA
EXPANDING THE REALM OF POSSIBILITY
Ave. Percentage of Roof Cover Damage, Max = 91.92%

Ave. Percentage of Roof Deck Damage, Max = 84.96%

Percentage of Homes w/ Whole Roof Damage, Max = 90%

Percentage of Homes with Roof Deck Damage, Max = 99.52%

Roof Damage
Ave Qty of Water Entering Bldg Through Damaged Fens (in), Max = 0.07 in

Ave. Number of Missile Hits on Building, Max = 79.36

Miscellaneous Damage Measures
Movie Using ARA Model
Time Step Outputs