Peer Review of the Proposed Methodology

TDI Expert Panel

Austin, Texas
April 14, 2016

Agenda

- Introductions
- Background
- Peer Review
  - Summary
  - Key Findings
  - Response to Key Findings
  - Refinements to Proposed Methodology
- Next Steps
- Open Discussion and Comments

Introductions

- Sam Amoroso, Ph.D. P.E., S.E. — Forte & Tablada, Inc.
- Bob Bailey, Ph.D., P.E. — Exponent, Inc.
- Bill Coulbourne, P.E. — Coulbourne Consulting
- Andrew Kennedy, Ph.D. — University of Notre Dame
- Doug Smith, Ph.D., P.E. — Texas Tech University

Background

- The Panel held eight Public Meetings prior to today. The first meeting was on August 22, 2013.
- The TWIA Expert Panel was appointed under Insurance Code §2210.578 and 28 Texas Administrative Code §§5.4260-5.4268.
- The purpose of the Panel is to develop ways of determining whether a loss to TWIA-insured property was caused by wind, waves, tidal surges, or rising waters not caused by waves or surges.

Background

- After the Panel completes its work, the commissioner will consider the Panel's findings and publish guidelines that TWIA must use to settle claims.

- The commissioner may accept all, part, or none of the recommendations presented by the Expert Panel.

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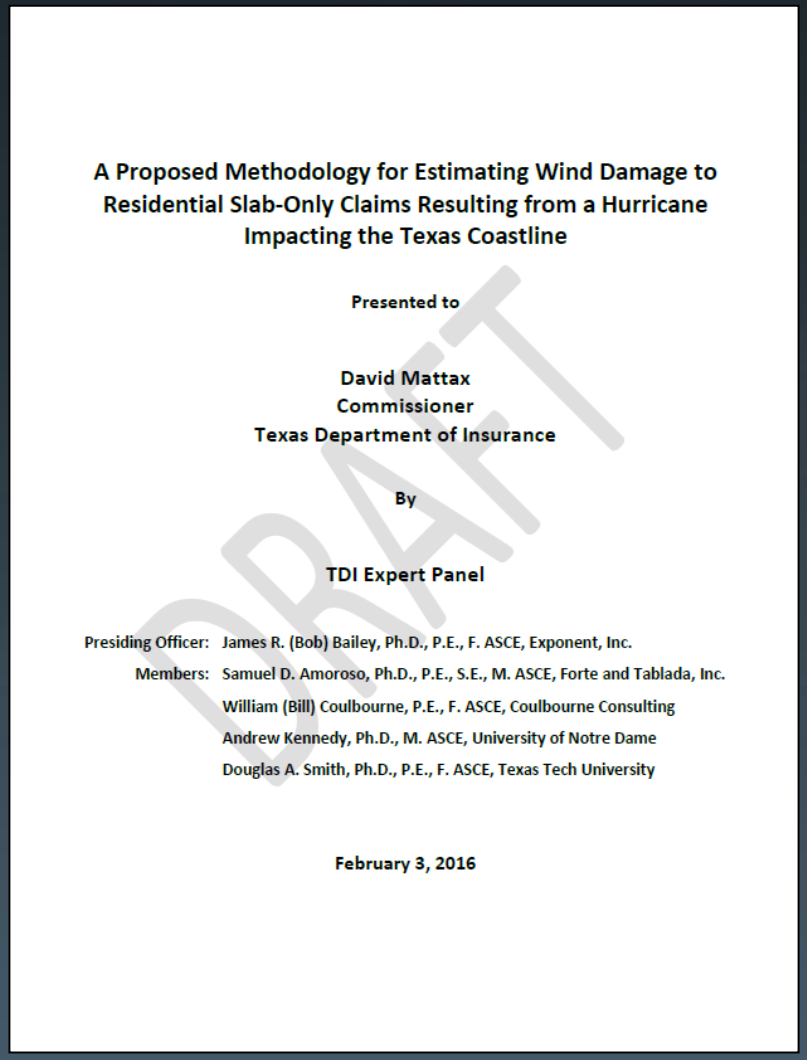
Proposed Methodology



A Proposed Methodology for Estimating Wind Damage to Residential Slab-Only Claims Resulting from a Hurricane Impacting the Texas Coastline

Presented to

David Mattax
Commissioner
Texas Department of Insurance

By

TDI Expert Panel

Presiding Officer: James R. (Bob) Bailey, Ph.D., P.E., F. ASCE, Exponent, Inc.
Members: Samuel D. Amoroso, Ph.D., P.E., S.E., M. ASCE, Forte and Tablada, Inc.
William (Bill) Coulbourne, P.E., F. ASCE, Coulbourne Consulting
Andrew Kennedy, Ph.D., M. ASCE, University of Notre Dame
Douglas A. Smith, Ph.D., P.E., F. ASCE, Texas Tech University

February 3, 2016

Peer Review (2016)

- TDI posted Peer Review invitation on January 7th.
- The application deadline was January 25th.
- TDI subsequently selected five firms/individuals to serve as Peer Reviewers.
- The Expert Panel did not participate in the selection of the Peer Reviewers.
- Expert Panel presented a Draft Report of the proposed methodology to TDI on February 3rd.

Peer Review (2016)

- Peer Review period was from February 5th to March 2nd.
- Reviews were completed and comments forwarded by TDI to the Expert Panel on March 3rd.
- Expert Panel presented TDI their responses to the Peer Reviewer comments on March 29th.
- Expert Panel presented the proposed methodology with modifications to TDI on April 8th.

Summary

- The five Peer Reviewers submitted a total of 159 comments:
  - Observation (87) – No action required.
  - Editorial (46) – Agree to the change as proposed by the reviewer(s) with no comment.
  - Substantive (26) – Agree to clarify statements based on a consensus response by the Panel members.
- The Damage Estimation Module also underwent an independent Quality Assurance review by an ISO 9001 certified firm.

Key Finding

- Concerns were expressed among the Peer Reviewers about the sensitivity of the calculation of a FOSM-MV reliability index to the specific formulation of the performance function; and some of the random variables used in the analysis have non-normal probability distributions that are approximated as Gaussian by the FOSM-MV method.

Response

- A Sensitivity Analysis was performed for various failure probability calculation techniques.
- Three techniques:
  - First Order Second Moment-Mean Value (FOSM-MV) Reliability Index
  - Rackwitz-Fiessler Procedure
  - Monte Carlo Simulation (MCS)

Response

- The analysis was conducted to determine whether limitations associated with the FOSM-MV technique will have appreciable practical impacts on the results of the failure probability calculations.
- Roof cover damage results using the FOSM-MV technique were compared to results using MCS for a variety of wind speeds and structure characteristics

Response

Wind 85 Scenario	FOSM-MV	MCS All Gaussian	MCS GCp - EV I
1	0.0572	0.0580	0.0515
2	0.0830	0.0842	0.0798
3	0.1180	0.1232	0.1125
4	0.0984	0.1006	0.0916

Wind 100 Scenario	FOSM-MV	MCS All Gaussian	MCS GCp - EV I
1	0.1082	0.1111	0.1006
2	0.1589	0.1700	0.1526
3	0.2219	0.2310	0.2151
4	0.1907	0.1955	0.1840

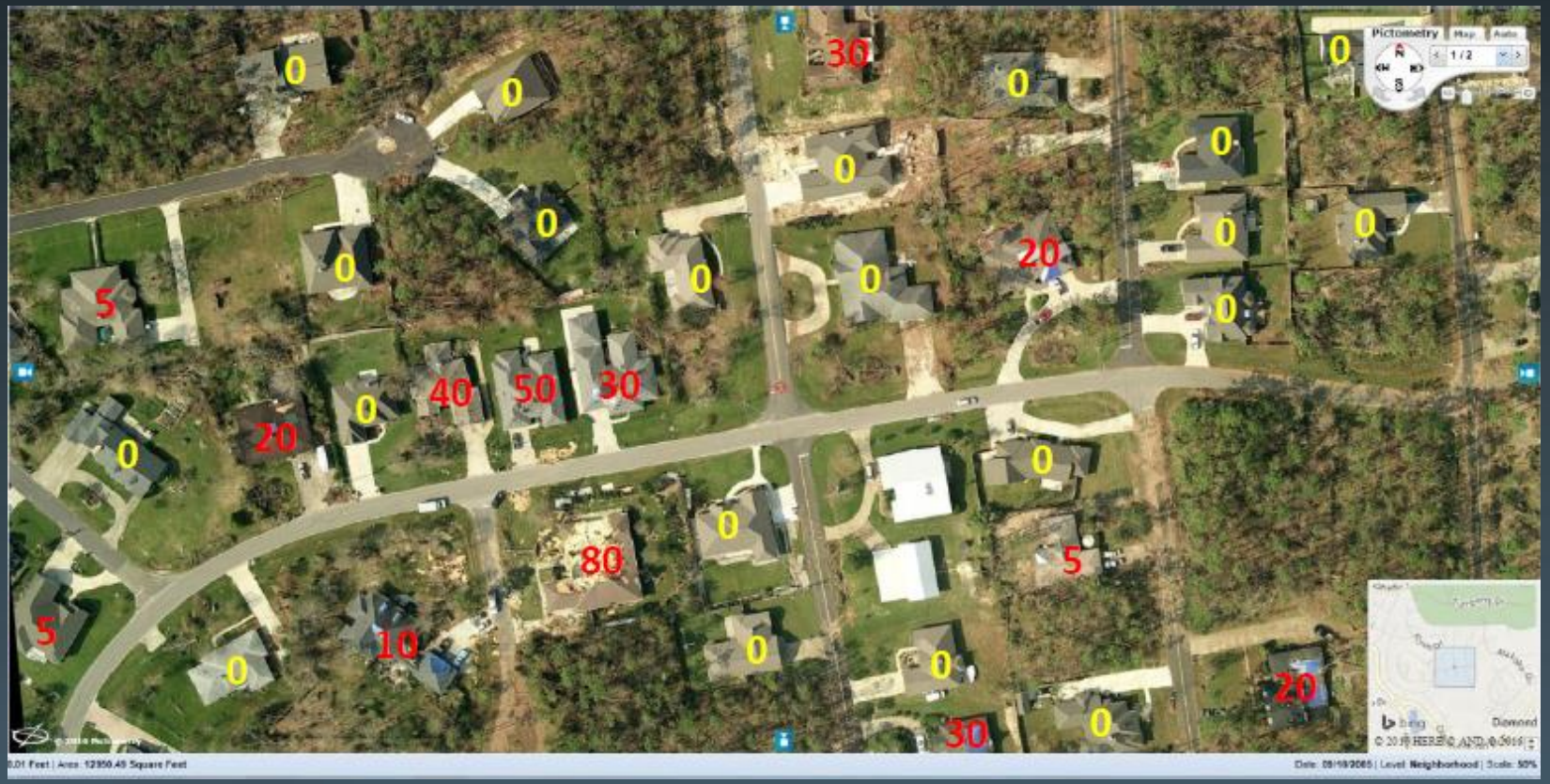
Wind 115 Scenario	FOSM-MV	MCS All Gaussian	MCS GCp - EV I
1	0.1875	0.1905	0.1816
2	0.2664	0.2720	0.2598
3	0.3543	0.3652	0.3466
4	0.3191	0.3267	0.3085

Key Finding

- Concern was expressed about the significance of the limitation associated with using average damage ratios to estimate damage to a single property. The Panel noted that there is large variation in the relative performances of individual structures that cannot be captured by the recommended methodology.

Response

- Consider the following scenario…



34 Houses located in a southern Mississippi neighborhood impacted by Hurricane Katrina in 2005.

Response

Estimated Roof Damage (%)	Number of Houses	Percent of All Houses
0	21	62
< 5	3	9
10	1	3
20	3	9
30	3	9
40	1	3
50	1	3
60	0	0
70	0	0
80	1	3
90	0	0
100	0	0

Total:	**34**	**100**

Average:	**10%**
Median:	**0%**

Houses less than or equal to Avg.	**74%**
Houses greater than Avg.	**26%**

Response

- Although the average roof damage sustained by the 34 houses is 10 percent, most of the houses sustained no roof damage (0%).
- Typically roof cover damage is not normally distributed.
- The average value is also often influenced by a few higher losses or even a single high loss.

Response

- Excluding the house with 80 percent roof damage causes the average to decrease from 10 percent for 34 houses to eight percent for 33 houses.
- Excluding the top three houses with the most roof damage (40%, 50%, and 80%) causes the average to decrease by half from 10 percent for 34 houses to five percent for 31 houses.
- As illustrated in this example, the most likely damage level and the average damage level are not the same.

Response

- An important consequence of this limitation of the proposed methodology is that, all other factors being equal, *for a majority of slab-only cases the estimated wind damage for a given house will be greater than the damage likely to have occurred to that house*.

Response

- To illustrate this point imagine that all 34 of the houses shown in the preceding figure were completely washed away by storm surge after the photograph was taken
- Assume the damage estimation module correctly predicted that the homes experienced an average roof cover damage rate of 10 percent.
- In reality as shown in the figure the majority of structures (24 out of 34, or 70%) actually experienced less roof cover damage than what was predicted by the Damage Estimation Module.

Refinements

- Recommend a Two-step Approach to arrive at a more equitable result for wind damage.

- Include results from Additional Quantitative Analysis of the model using data from Hurricane Ike.

Two-step Approach

The time at which surge slabbing reaches its maximum probability is given by t_{surge}. The next step calculates the wind damage at time t_{surge} as D_{t_surge} using the Damage Estimation Module. The recommended physical damage levels to be used for wind damage, D_{total} , are then recommended to be given as a probability weighted blend of the computed damage at time t_{surge} , D_{t_surge} , and a total damage.

$$D_{total} = \frac{P_{surge} D_{t\_surge} + P_{wind} D_{100\%}}{P_{surge} + P_{wind}}$$

where $D_{100\%}$ = 1.0 represents the damage for total damage. This relation changes smoothly as probabilities and damage levels also change. It also implicitly accounts for timing.

Two-step Approach – Examples

Example 1: Strong Surge, Weak Wind

Assume the probability of surge slabbing is P_{surge} = 0.9 and the computed wind damage at t_{surge} is D_{t_surge} = 0.1. The low probability of wind slabbing is taken as P_{wind} = 0.05. The probability-weighted wind damage is D_{total} = 0.1474.

Example 2: Weak Surge, Strong Wind

Assume the probability of surge slabbing is P_{surge} = 0.1 and the computed wind damage at t_{surge} is D_{t_surge} = 0.8. The high probability of wind slabbing is taken as P_{wind} = 0.75. The probability-weighted wind damage is D_{total} = 0.9765, reflecting the high likelihood of wind slabbing.

Two-step Approach – Examples

Example 3: Weak Surge, Weak Wind

The most difficult case is when slabbing occurs with low probabilities of wind and surge slabbing. However, an answer must still be obtained. So, assume the probability of surge slabbing is $P_{surge} = 0.1$ and the computed wind damage at t_{surge} is $D_{t\_surge} = 0.1$. The low probability of wind slabbing is also taken as $P_{wind} = 0.1$. The probability-weighted wind damage is $D_{total} = 0.55$, reflecting the high uncertainty in this estimate.

Two-step Approach – Examples

Example 4a: Strong Early Surge, Strong Wind

When wind and surge slabbing probabilities are both large, timing becomes important. Assuming a strong early surge occurs before the wind peak, so $P_{surge} = 0.9$ and the computed wind damage at t_{surge} is $D_{t\_surge} = 0.1$. The high probability of wind slabbing is taken as $P_{wind} = 0.75$. The probability-weighted wind damage is $D_{total} = 0.5091$.

Two-step Approach – Examples

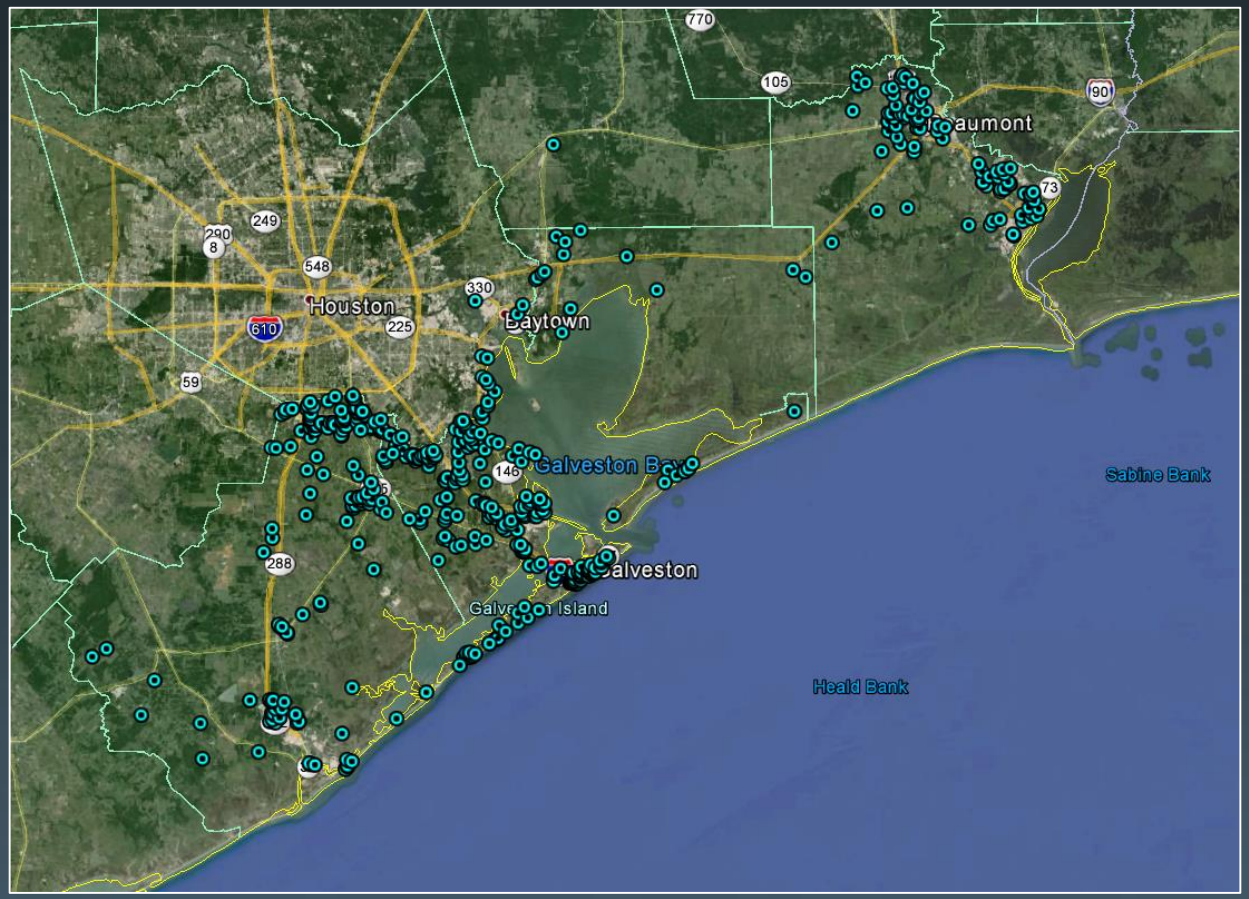
Example 4b: Strong Late Surge, Strong Wind

Assuming a strong late surge occurs after the wind peak, so $P_{surge} = 0.9$ and the computed wind damage at t_{surge} is $D_{t\_surge} = 0.7$. The high probability of wind slabbing is taken as $P_{wind} = 0.75$. The probability-weighted wind damage is $D_{total} = 0.8364$.

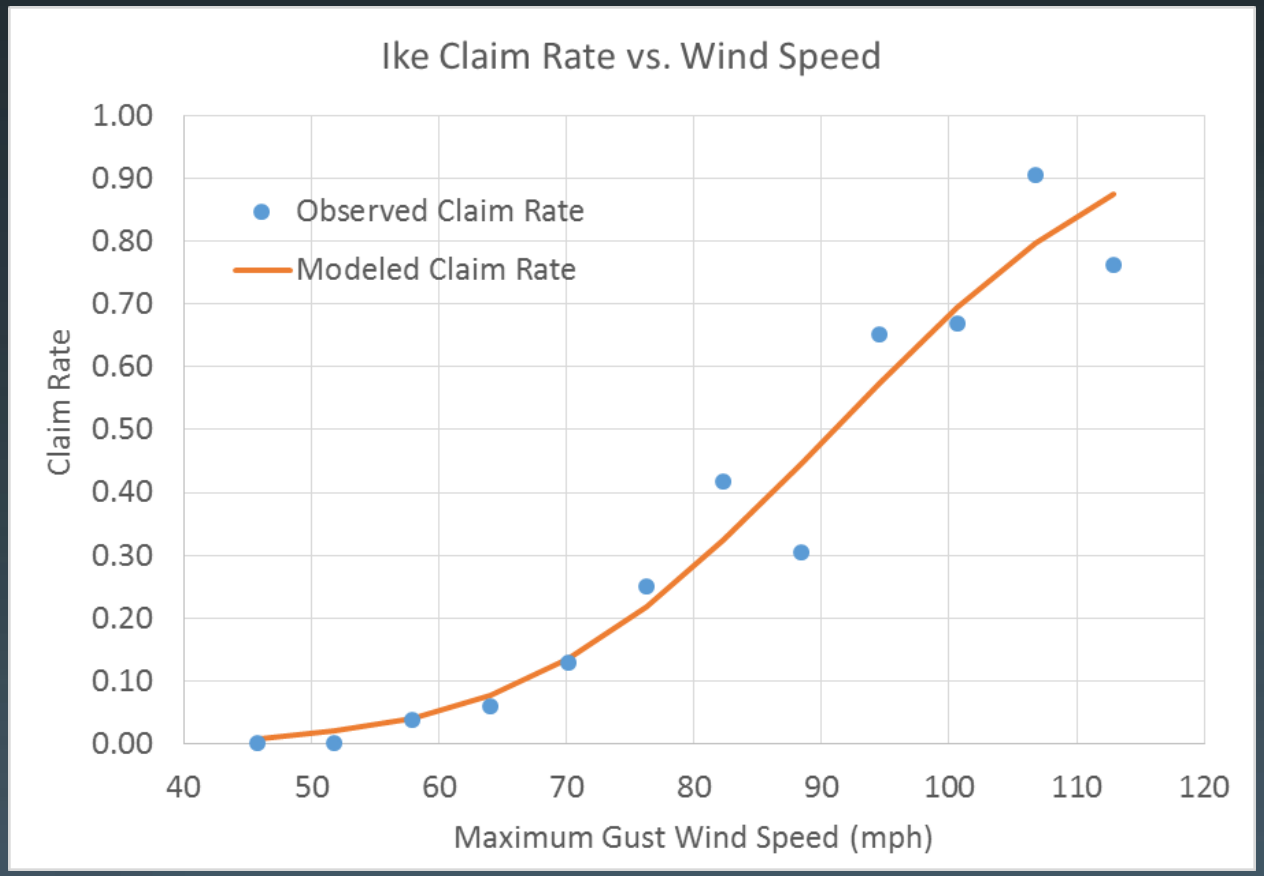
Additional Quantitative Analysis

- Panel members requested to review TWIA claim files for Hurricane Ike which struck Texas in 2008.
- TWIA subsequently delivered to the Panel a random sampling of 500 claims, of which 471 contained useful data.
- The Panel assigned maximum gust wind speeds to each property location using the gridded H*Wind swaths that were produced after the storm by the Hurricane Research Division of NOAA.

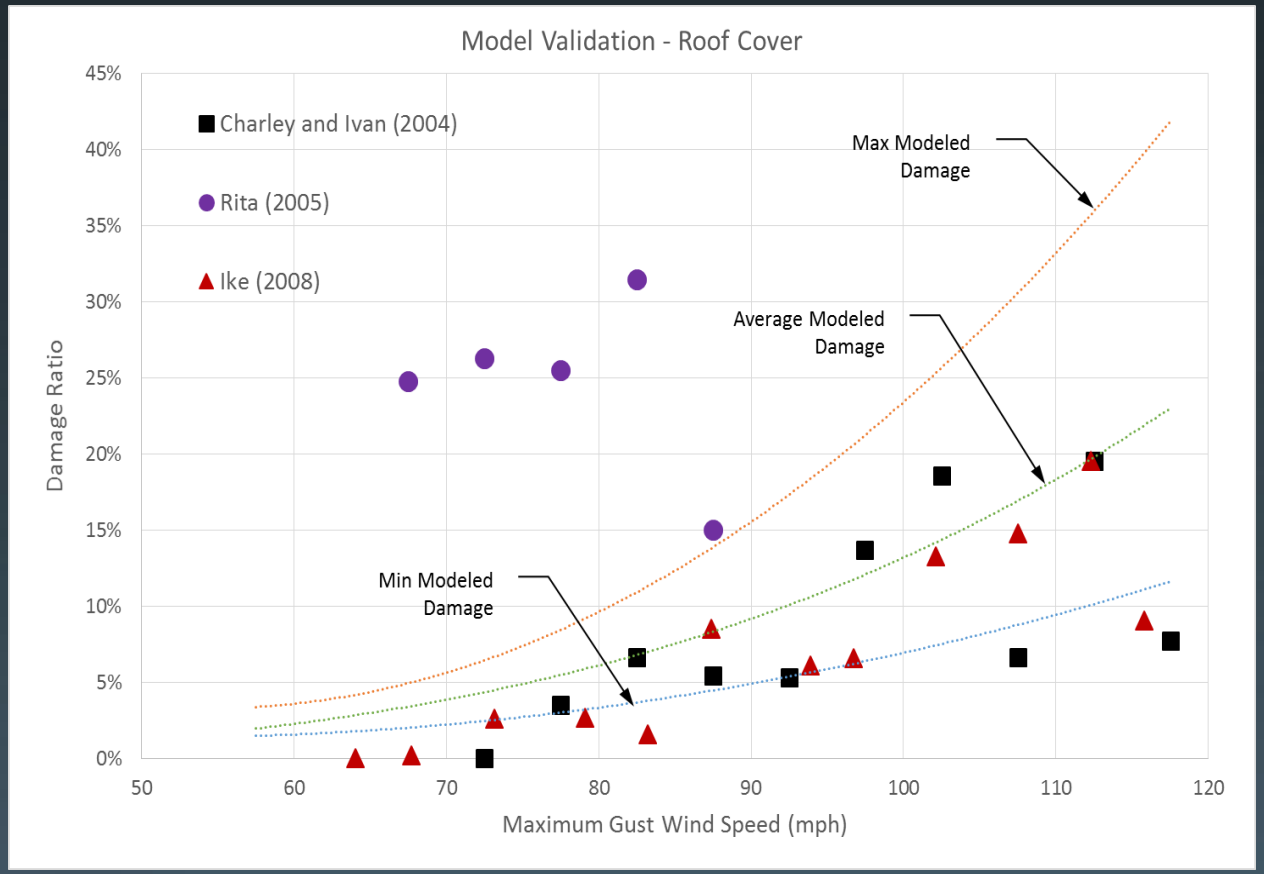
Additional Quantitative Analysis



Additional Quantitative Analysis



Additional Quantitative Analysis



Additional Quantitative Analysis

Observed Damage Ratios from TWIA Hurricane Ike Claims

WS Group	Roof Cover	Roof Panel	Roof Framing	Wall Cover	Wall Panel	Windows	Doors	Garage Doors	Interior Finish	Number of Claims
60-65	0.0%	0.0%	0.0%	1.6%	0.0%	0.0%	0.0%	0.0%	0.0%	1
65-70	0.2%	0.0%	0.0%	0.2%	0.0%	0.0%	0.0%	0.0%	1.8%	3
70-75	2.6%	0.0%	0.0%	0.0%	0.0%	1.7%	0.0%	0.0%	2.2%	2
75-80	2.7%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	1
80-85	1.6%	0.1%	0.1%	0.3%	0.0%	0.2%	0.0%	1.1%	1.7%	15
85-90	8.5%	1.3%	1.1%	0.8%	0.0%	0.8%	0.0%	0.0%	3.2%	10
90-95	6.1%	0.4%	0.3%	1.2%	0.0%	0.9%	0.5%	0.9%	9.0%	93
95-100	6.6%	0.4%	0.2%	1.5%	0.2%	0.8%	1.1%	2.1%	8.3%	239
100-105	13.3%	0.7%	0.2%	2.7%	0.2%	2.6%	3.0%	8.3%	5.0%	90
105-110	14.8%	0.0%	0.0%	4.0%	0.0%	0.0%	6.7%	26.9%	1.7%	12
110-115	19.5%	3.3%	2.2%	6.5%	0.0%	0.0%	0.0%	0.0%	10.9%	4
115-120	9.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	1

Additional Quantitative Analysis

- In general, the Damage Estimation Module provides reasonable estimates of the magnitudes and trends of damage when compared to observations of damage from actual storms, with the following exceptions:
  - The damage observed for Hurricane Rita from the TWIA claim files deviates significantly from both the predictions of the Damage Estimation Module and the damage observed for the other three storms (Charley, Ivan, and Ike).

Additional Quantitative Analysis

- It systematically overestimates damage for relatively low wind speeds.
- It systematically overestimates damage to roof panels at all of the wind speeds considered so far in the validation effort.
- It underestimates the rate at which wall panel damage increases with wind speed.

Next Steps

- Present Final Report describing proposed methodology and recommendations to the commissioner by April 18th.
- Commissioner will consider the Panel's findings.
- The commissioner may accept all, part, or none of the recommendations presented by the Expert Panel.
- Under the Administrative Procedure Act, the commissioner will adopt rules for TWIA to use when adjusting residential slab claims.

Open Discussion and Comments