Addressing Catastrophe Modeling Challenges @ CAGNY 2020 Annual Meeting

Model Completeness

David Keeton, CCRMP – Avoca Underwriting & ISCM President

Shari Zola, CCRMP – Munich Re & ISCM Vice President

1

iscm
International Society of Catastrophe Managers

Perspective Overview

Discussion Backdrop

- Why CAT models?
- Evolution of CAT models
- Where do we stand today?

Discussion Focus – Model Completeness

- Hazard – Earthquake Example
- Vulnerability – Industry Assumptions vs individual risk characteristics
- Risk Normalization - Exposure values & policy coinsurance clause
- Pricing – Much more than just Average Annual Loss
- Claims – Physical damage vs. final claims payment
- Post Event Loss Estimation

2

Why CAT Models?

What Constitutes an "Insurable Risk or Hazard"?

Loss from an insurable Risk / Hazard must:

1. Be unexpected or accidental
2. Be measurable and definitive
3. Have sufficiently large number of similar, independent occurrences so that losses are reasonably predictable

- ✓ CATS can't be predicted
- ✓ Losses from CATS are Measurable
- ✖ CAT events & losses are too infrequent!

Why CAT Models?

- Because traditional experience rating isn't sufficient
- To generate enough probabilistic events to adequately reflect the risk of CAT losses, i.e. reflecting the uncertainty around loss estimates

3

Evolution (or "How we got here")

Pre-Cat Model

- Experience Rating
  - Walking backwards into the future
- Exposure Rating
  - Simple distributions (e.g., Pareto)

How to Insure the "Un-Insurable"

- 'Handshake' Reinsurance or
- 'Promise to pay back over time'

Then along comes Andrew & Northridge…

- Stretches definition of "insurable risks"
- New Tools for approximating impact of Catastrophes

"New" Profession – CAT Risk Management

- Mix of Actuarial, Underwriting, Engineering & Scientific Expertise
- Evolved to 'new' levels of sophistication

4

Where do we stand today?

Premise – CAT models are portfolio loss estimation tools

- Hazard – Best Science available
  - General industry assumptions
  - Distilling dynamic perils into generalized / practical key loss drivers / granularity
- Vulnerability - Industry Assumptions
  - Finite handful of general vulnerability classes vs. infinite number of combinations
- What are CAT Models designed to achieve?
  - Provide insight into range of possible outcomes for use in a priori decisions
    - Underwriting & Risk Management
- What are they NOT designed to do?
  - Not designed to predict losses
  - Not designed to include all possible event scenarios
  - Not individual location modeling

5

Hazard Completeness

Premise – CAT models evolve & change year on year

- Every new event, exposes a 'missing' component.
  - With enough 'consensus', those components get added in next model versions
- Science and engineering improve every year
  - Models in turn get 'upgraded' with the latest knowledge from time to time

6

Hazard Completeness

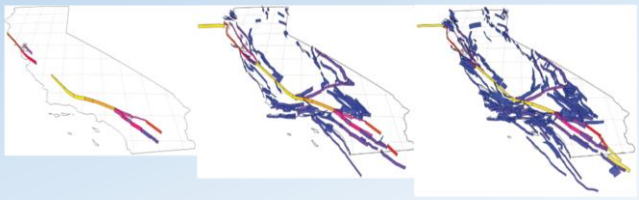
Premise – CAT models evolve & change year on year

- Every new event, exposes a 'missing' component.
  - With enough 'consensus', those components get added in next model versions
- Science and engineering improve every year
  - Models in turn get 'upgraded' with the latest knowledge from time to time

1998
16 faults

2007
200 faults

2014
300 faults



Hazard Completeness

Premise – CAT models evolve & change year on year

- Every new event, exposes a 'missing' component.
  - With enough 'consensus', those components get added in next model versions
- Science and engineering improve every year
  - Models in turn get 'upgraded' with the latest knowledge from time to time
- When should we incorporate missing components?
  - Only when vendors roll them out or…?
- Will the models ever have everything we want in them?
  - What are some adjustments you currently add and
  - What is 'Best Practice" for incorporating them?

Hazard Limitations - Earthquake

One master source for all models

- USGS frequencies & attenuation are still the best
- Still material uncertainties relative to larger quakes
  - Magnitude and location

Refining complex hazard into simpler model components

- Event definitions
- Granularity of intensity (attenuation / soils amplification)
- Complex loss drivers

Exposure information

- Mismatch between granularity of exposure & that reflected in Hazard module
- Portfolio level models – NOT individual risk models!

9

Vulnerability Completeness - General

Industry Average Vulnerability Classes / Curves

Based on 'Primary' Building Characteristics

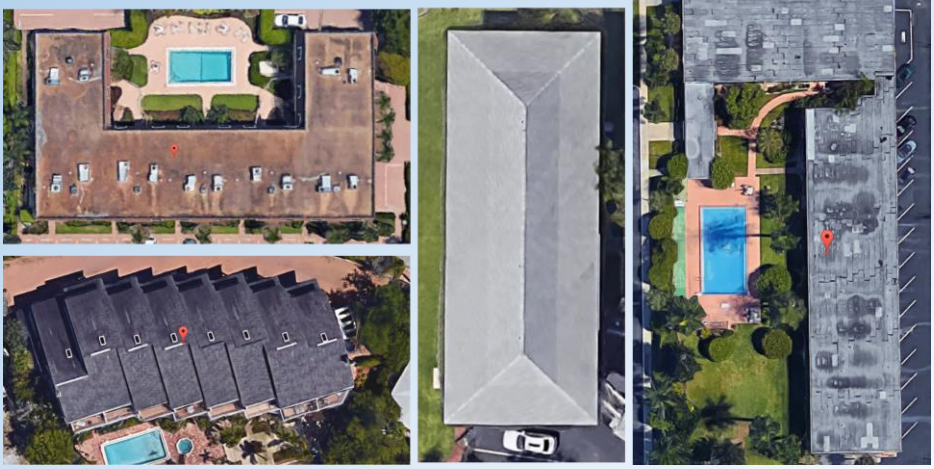
- Construction - One group for combo of bldg. characteristics
  - Masonry – 3 actual types – unreinforced, partially reinforced & reinforced
    - Models – typically 2 general types offered
    - Exposure capture – typically only one
  - 'Hidden' vulnerability groups…. More options offered than actual curves
- Occupancy – Attempt to differentiate claims paid trends
  - Early model versions were driven by these group classifications
  - Targeted portfolios & market demand exposed need for additional classes
  - More descriptions offered than actual curves
- Year Built
  - Intent – to reflect bldg. code changes
  - Actually - Bldg. Codes and compliance can vary by local government –
    - State and multi state assumptions may not reflect local conditions

10

Vulnerability Completeness - Wind

Same Primary Vulnerability Curve = 1 Average Loss Ratio

- Occupancy
  - Condo
- Construction
  - Joisted Masonry
- Year Built
  - Pre 1994
- Floor Area
  - > 10,000 sf

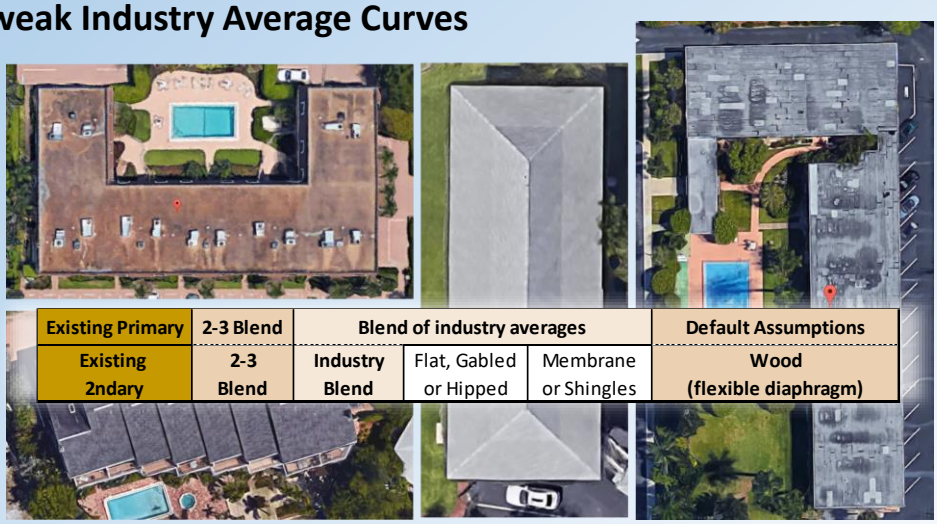


11

Vulnerability Completeness - Wind

Existing Models Tweak Industry Average Curves

- Occupancy
  - Condo
- Construction
  - Joisted Masonry
- Year Built
- Existing Industry Average Model
  - > 10,000 sf



Existing Primary	2-3 Blend	Blend of industry averages			Default Assumptions
Existing 2ndary	2-3 Blend	Industry Blend	Flat, Gabled or Hipped	Membrane or Shingles	Wood (flexible diaphragm)

12

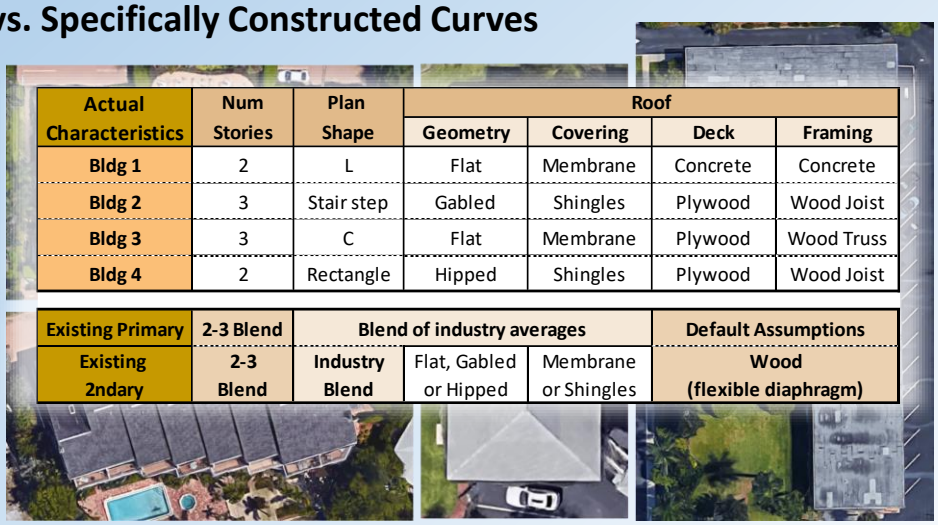
Vulnerability Completeness - Wind

Industry Average vs. Specifically Constructed Curves

- High Def. Eng. Model
- Construction
  - Joisted Masonry
- Year Built
- Existing Industry Average Model
  - > 10,000 sf

Actual Characteristics	Num Stories	Plan Shape	Roof			
			Geometry	Covering	Deck	Framing
Bldg 1	2	L	Flat	Membrane	Concrete	Concrete
Bldg 2	3	Stair step	Gabled	Shingles	Plywood	Wood Joist
Bldg 3	3	C	Flat	Membrane	Plywood	Wood Truss
Bldg 4	2	Rectangle	Hipped	Shingles	Plywood	Wood Joist

Existing Primary	2-3 Blend	Blend of industry averages			Default Assumptions
Existing 2ndary	2-3 Blend	Industry Blend	Flat, Gabled or Hipped	Membrane or Shingles	Wood (flexible diaphragm)



iscm International Society of Catastrophe Managers

Financial / Risk Transfer Completeness

Normalizing Valuations

- Models assume Value = Replacement Cost
  - Allow for limits to differ from assumed replacement cost
- Agents Role / Impact
  - Law requires Agent to advise policyholder to insure for full value
  - Commissions based on volume & % of sales –
  - Differences between Agencies & Agents
- Actual – Variations & Inconsistencies
  - Option – Include benchmark, 3rd party valuation
  - Challenges – single source, industry assumptions, unintended bias
- How does and when should, UW judgment play a role?

Financial / Risk Transfer Completeness

Valuation & Policyholder Co-Insurance Clause

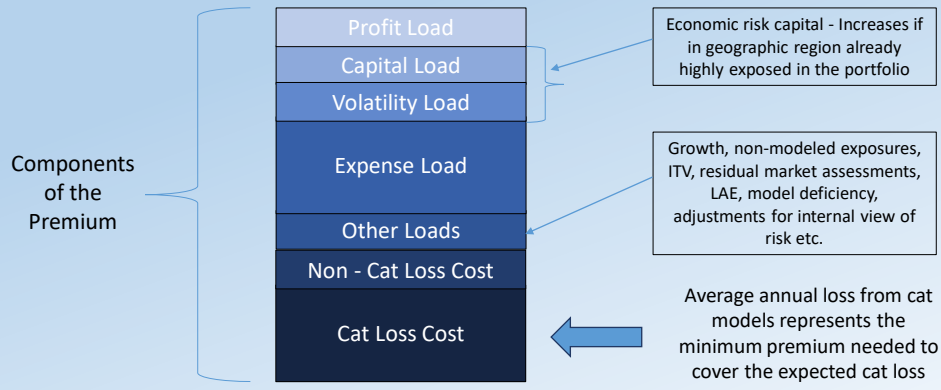
- Managing the Risk of Undervalue Reporting
  - Standard industry forms only request limits to quote (NOT values)
  - Only comes into play when paying claims
  - Impact – reduces claims if actual replacement costs > limits provided*
- Flavors of Actual Policy Forms / Coverage
  - Replacement Cost vs. Actual Cash Value (latter uses deprecation as in roofs)
  - Agreed Value – Limit is agreed replacement cost regardless of actual value
  - % Coinsurance* – options include 80, 90 & 100%
    - if replacement cost exceeds agreed Limit / % agreed, then payments reduced

How do we differentiate between individual risks and portfolios with different approaches to Replacement Cost?

15

Pricing

What needs to be considered in pricing business that is not included in the modeled loss?



16

Pricing - Understand the Risk

- Assessment of exposure and quality of data are key factors in understanding validity of the modeling results.
- For underwriters differentiating books of business not always possible. Deep-dive review of use of models and the process helps underwriters evaluate the credibility of the model results.

17

Claims

- **Similar buildings with similar physical damage can have very different claims paid due to:**
  - Speed to settle
  - Coverage issues
  - Investigative practices
  - Evaluation methods
  - Social inflation costs
  - COVID inflation (cost to repair impacted by new regulations)

18

Physical Damage vs. Settled Claim

Photo: Munich Re / Mark Bove

Charley

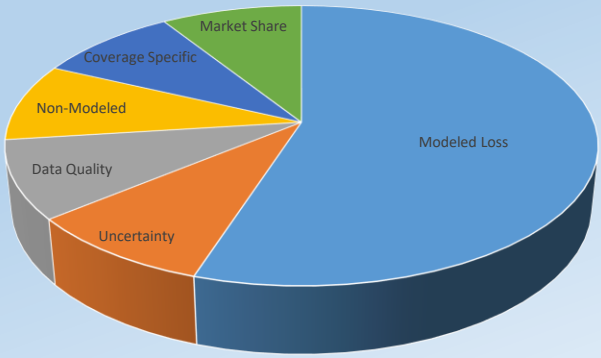
19

Claims

- **Similar buildings with similar physical damage can have very different claims paid due to:**
  - Speed to settle
  - Coverage issues
  - Investigative practices
  - Evaluation methods
  - Social inflation costs
  - COVID inflation (cost to repair impacted by new regulations
- **Payout difference - Agreed value vs 90% clause**
- **Individual claims aggregate to portfolio level and highly impact Post Event Loss Estimation analysis**

20

Post Event Loss Estimation



Completeness and transparency in building out loss estimates is key

21

Post Event Loss Estimation

Insurance companies receive immediate feedback from policyholders after an event. For reinsurers there is a delay, models play an important role in estimating losses.

Model estimates will never represent the full insured loss, so what are the items to consider to "complete" the picture.

Model Uncertainty

- Vulnerability
- Severity
- Demand Surge
- Application and calculation of policy terms
- Storm track and wind field
- Large Loss Uncertainty
- Storm Surge Level
- Fire losses following the earthquake
- Possible Casualty related losses
- **Pre-existing damage**

Non-Modeled Perils /Coverages

- Contingent BI
- Loss adjustment expenses
- **Claims inflation and local claim settlement practices (i.e. AOB)**
- Water related losses (i.e. sewer backup, flood leakage)
- Government mandates
- **Wind pool assessments**
- Extra contractual liability
- Mold damage, foundation collapse, etc.
- Tree damage

Data Quality

- Address match
- Missing exposures
- ITV
- Incorrect or missing data
- **Dated information**

22

Post Event Loss Estimation - Issues

- HU Harvey / HU Irma – limited adjusters and supplies
- Superstorm Sandy – non-hurricane deductibles applied
- CA Wildfires – prohibiting insurer deducting cost of land from replacement cost coverage if insured relocated (or built) elsewhere rather than rebuild, time element extensions (partly due to environmental cleanup)
- Cosmetic damage / aesthetic impairment language – Colorado hail
- Retroactive legislative changes
- Damage from repetitive events – Hurricane Laura / Hurricane Delta
- Clash between pandemic – remote work, unreliable adjusters
- Multiple deductibles vs. seasonal deductible understates model result – FL & LA annual deductible

Concluding Comments

- **Models are simplified representations** of catastrophic events impacting man made exposures
- **Analogy** – lottery tickets
  - Cost $1 – expected return = $.01
  - Most likely value = $0
  - Least likely =$10.0m
  - Is there Right or a Wrong outcome?
  - Why should our view of Stochastic CAT models be any different?
- **Therefore:**
  - **Cat models are neither wrong nor right**, they are just useful tools if we use them responsibly, with appropriate adjustments to answer questions that they are designed to answer!