



# Input to Catastrophe Models

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Bringing Science to the Art of Underwriting™



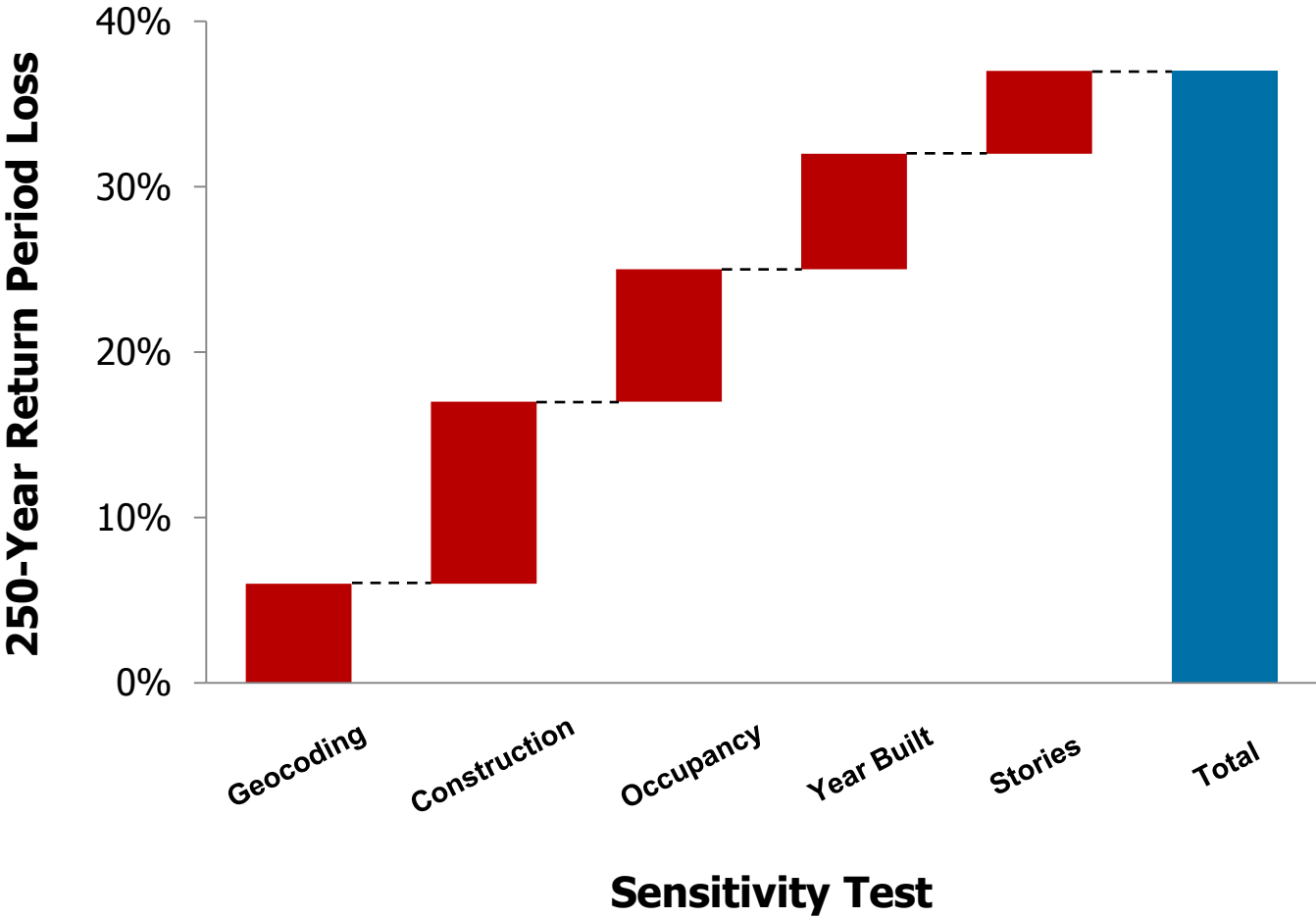
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# Topics

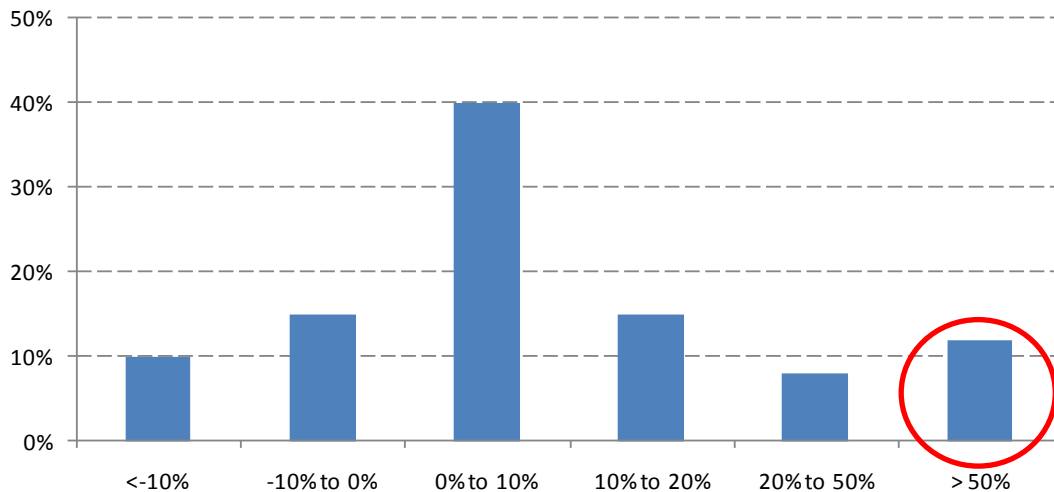
- Why it matters
- Location
- Construction, occupancy
- Valuation
- Financial structures
- Diagnostics

# Incomplete Increases Uncertainty



# Inaccurate Data Can Bias Model Results or Lead to a Brittle Portfolio

- Portfolios are biased if inaccuracies lead to an overall increase (or decrease) in losses
- In some cases, location level inaccuracies appear to cancel out at portfolio level
- Changes in loss from specific events can still be significant



# Also a Pronounced Impact at Account Level

Account	Original Average Annual Loss	Enhanced Average Annual Loss	% Change	
Account A	\$81,939	\$148,980	82%	} Underpricing risk
Account B	\$65,895	\$85,950	30%	
...	...	...	...	
...	...	...	...	
Account Y	\$206,280	\$123,195	-40%	} Overpricing risk
Account Z	\$6,303	\$3,438	-45%	

# Potential Bias

- Might be caused by assumptions used to develop the input data
  - For example, contents value = 50% of building value
- Bulk coding can cause a bias
  - Non-linearity of the model
- Some might attempt to “game” the model
  - Enter “unknown” for unfavorable characteristics
  - Enter real values for favorable characteristics

# A.M. Best SRQ Data Quality Questions

- Percentage of data containing known attributes
  - Geocoding resolution, occupancy and construction characteristics
- Bulk coded data
  - “Bulk coding of data includes methods, programs, or procedures that assign a pre-determined value or default value to a required data field when the actual value is unknown or missing and the assigned value is not verified for accuracy.”
- Percentage of data containing the most frequently observed value
  - Occupancy and construction characteristics
- Methods used to verify the accuracy of data



# Value proposition of data quality

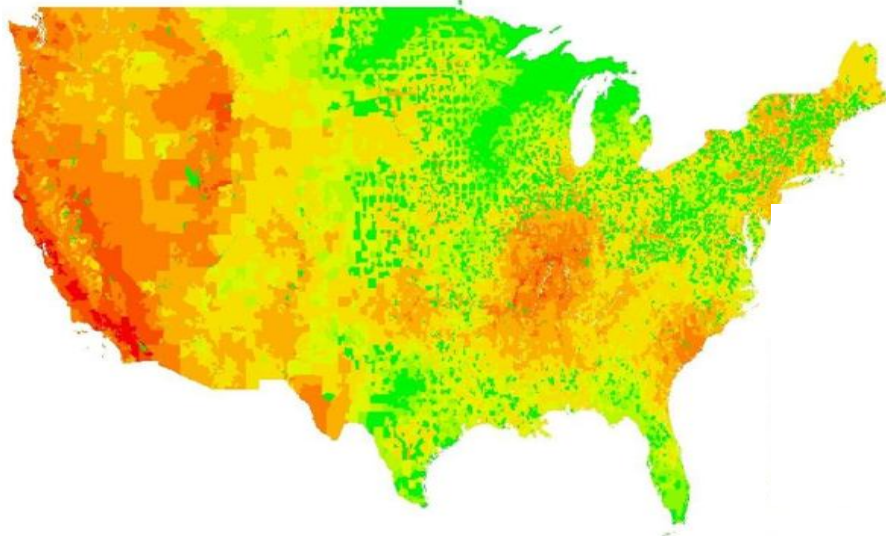
1. Underwriting – pricing, discipline, capital allocation
2. Reinsurance placement – pricing and capacity
  - *'Reinsurers are charging a surcharge of up to 25% for poor data quality'\**
3. Regulators / Rating agencies – demonstrating effective capital adequacy
4. Good data quality is seen as an indicator of robust catastrophe risk management processes

Source: Ernst & Young 2008 Exposure Data Quality Survey of Major Reinsurers

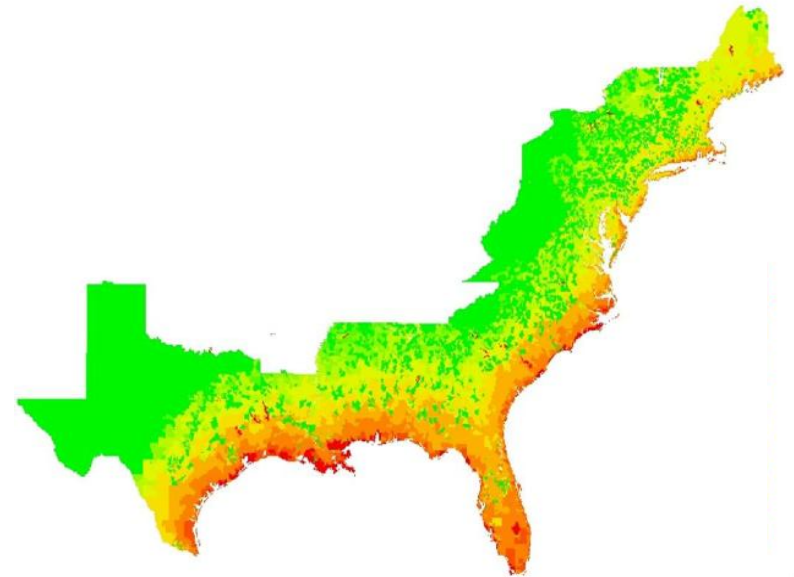
# Location

# Location

- Importance of geographic resolution depends on hazard gradient

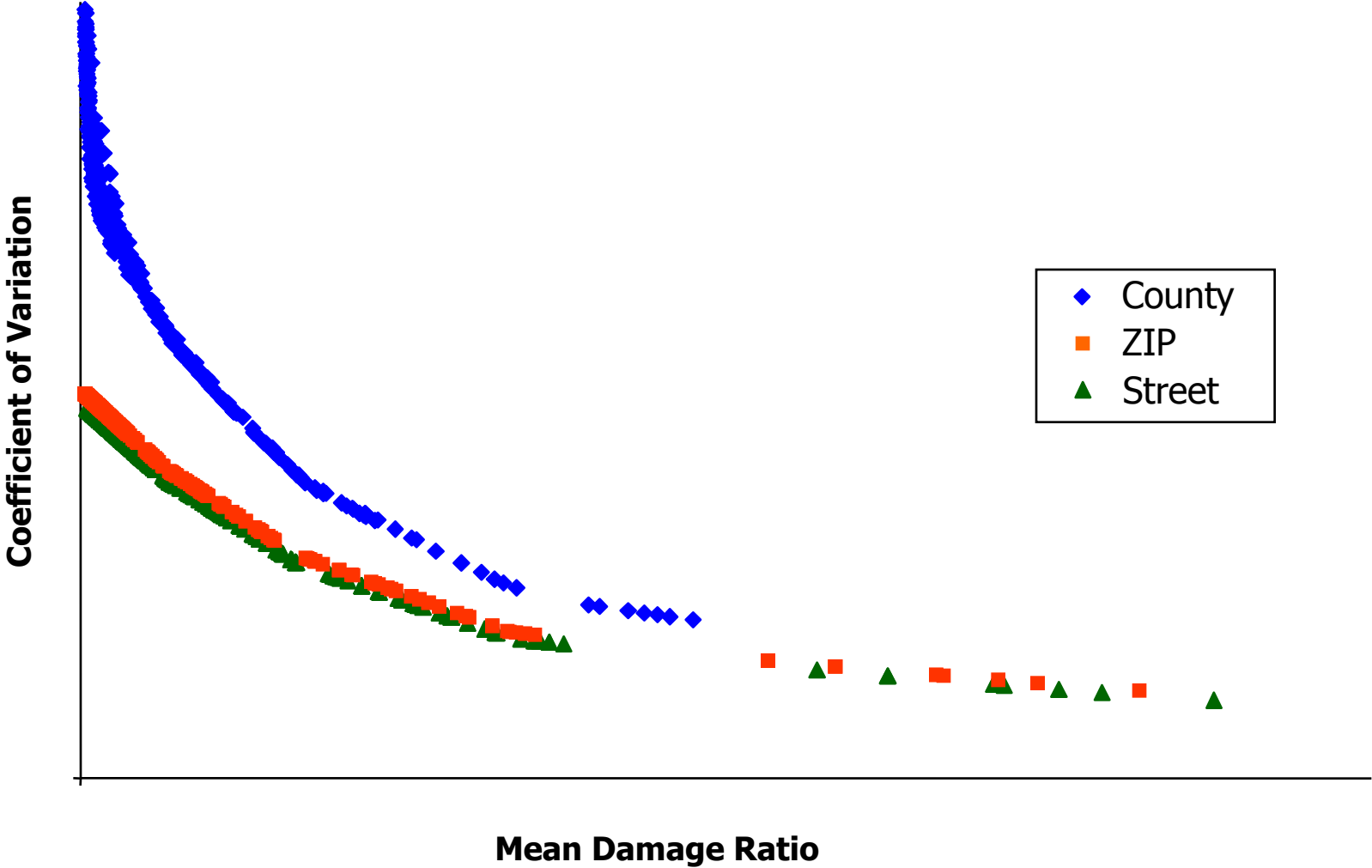


Earthquake hazard gradient



Hurricane hazard gradient

# Geographic Resolution



# Construction and Occupancy

# Primary Building Characteristics

■ Construction class

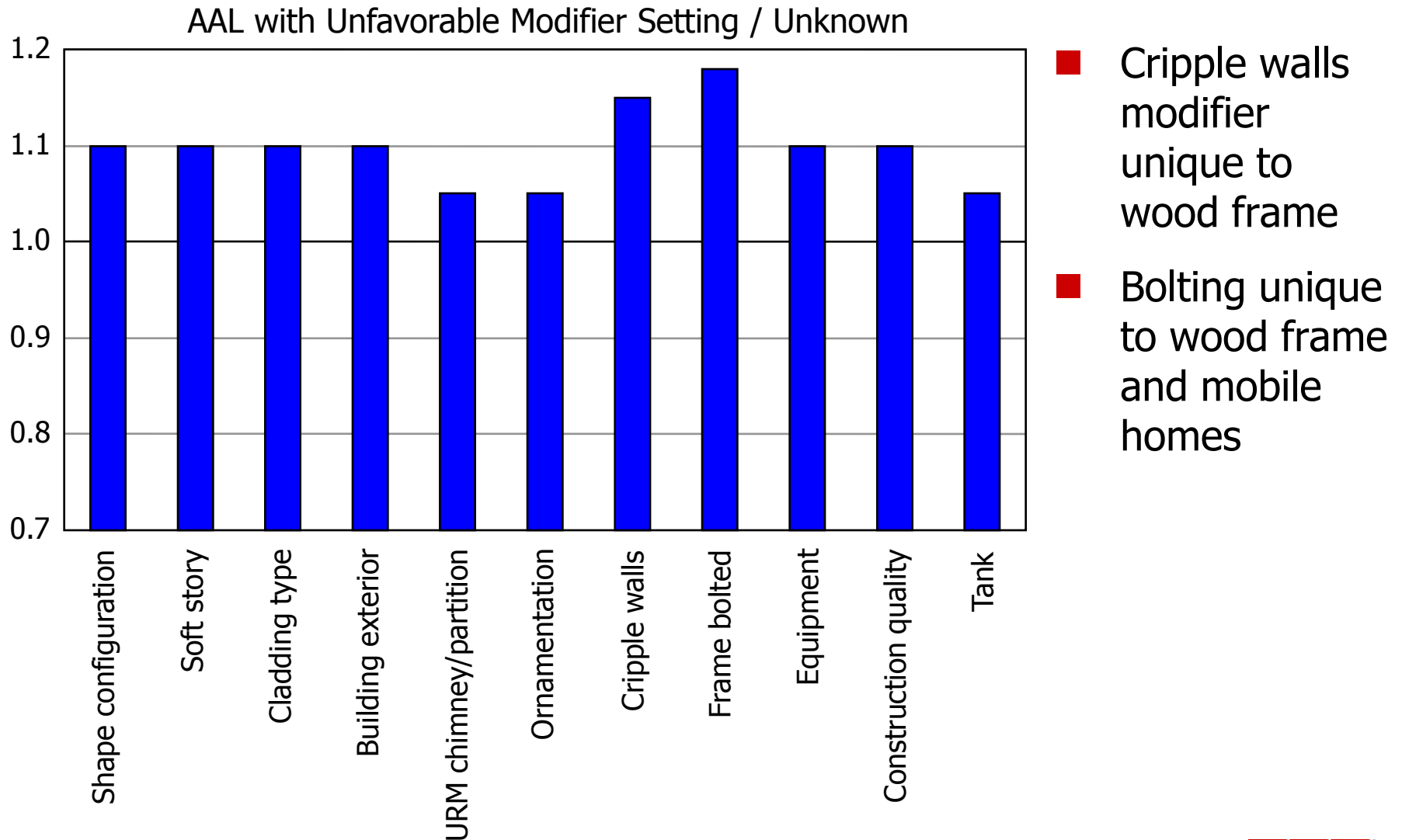
■ Occupancy type

■ Year built

■ Number of stories

**Relative importance depends  
on peril, region, line of business**

# Effect of Various Modifiers on EQ AAL – Wood Frame



# Valuation



# Valuation

- Building
  - Valuation software is available, eg. Marshal Swift / Boeckh
- Contents
  - Value vs. limit
- Time element (additional living expense, business interruption, etc.)

# Effect of Valuation Errors

- Proportional for ground-up losses
  - X% error in valuation yields X% error in modeled ground-up loss results
- Leverage effect for deductibles
  - X% error in valuation yields greater than X% error in modeled loss results net of deductibles
- Policy limits reduce the effect of valuation errors
  - Usually deductibles have a greater effect than limits

# Financial Structures

# Coding Policy Financial Structures

- There are various ways to code policy information into the model
- The information in the policy slip is not sufficient.
  - Policy contract, schedule of locations
  - Interview underwriter, claims manager

# Policy A

<b>LIMIT OF LIABILITY:</b>	<p>The following Limit of Liability is for 100% unless otherwise stated.</p> <p>USD 150,000,000 combined single limit any one occurrence / accident and in the annual aggregate separately in respect of Flood and Earthquake.</p>
<b>EXCESS:</b>	<p>The following Excess is for 100% unless otherwise stated.</p> <p>USD 15,000,000 any one occurrence / accident, except</p> <p>USD 5,000,000 in respect of Property Damage and 30 days waiting period in respect of Extra Expenses subject to a combined minimum of USD 20,000,000 any one occurrence / accident in respect of C, N, L and R;</p> <p>USD 5,000,000 any one occurrence / accident in respect of any non-generating assets (excluding dams, reservoirs and waterways at hydroelectric plants); and</p> <p>2% of values at location affected subject to a maximum of USD 25,000,000 any one occurrence / accident in respect of Earthquake.</p>

Deductible or policy attachment point?

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“Except” = deductible  
“Excess of = attachment point

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Code deductible at location or policy level?

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Magnitude looks more like policy than location



# Diagnostics

# Geocoding diagnostics

- Use of county or ZIP centroids coded as latitude & longitude
  - Bulk coding
  
- Conflicting address information
  - Zip, city, county, state mismatch

# Construction & Occupancy Diagnostics

## ■ Unrealistic Attributes

- Number of stories > 100

## ■ Conflicting Attributes

- Basic engineering rules (eg. high-rise wood frame)
- Conflict with building regulations

## ■ Check for potential bias

- # of favorable modifiers / (# of favorable + unfavorable)
- Results as coded / results if all “unknown”

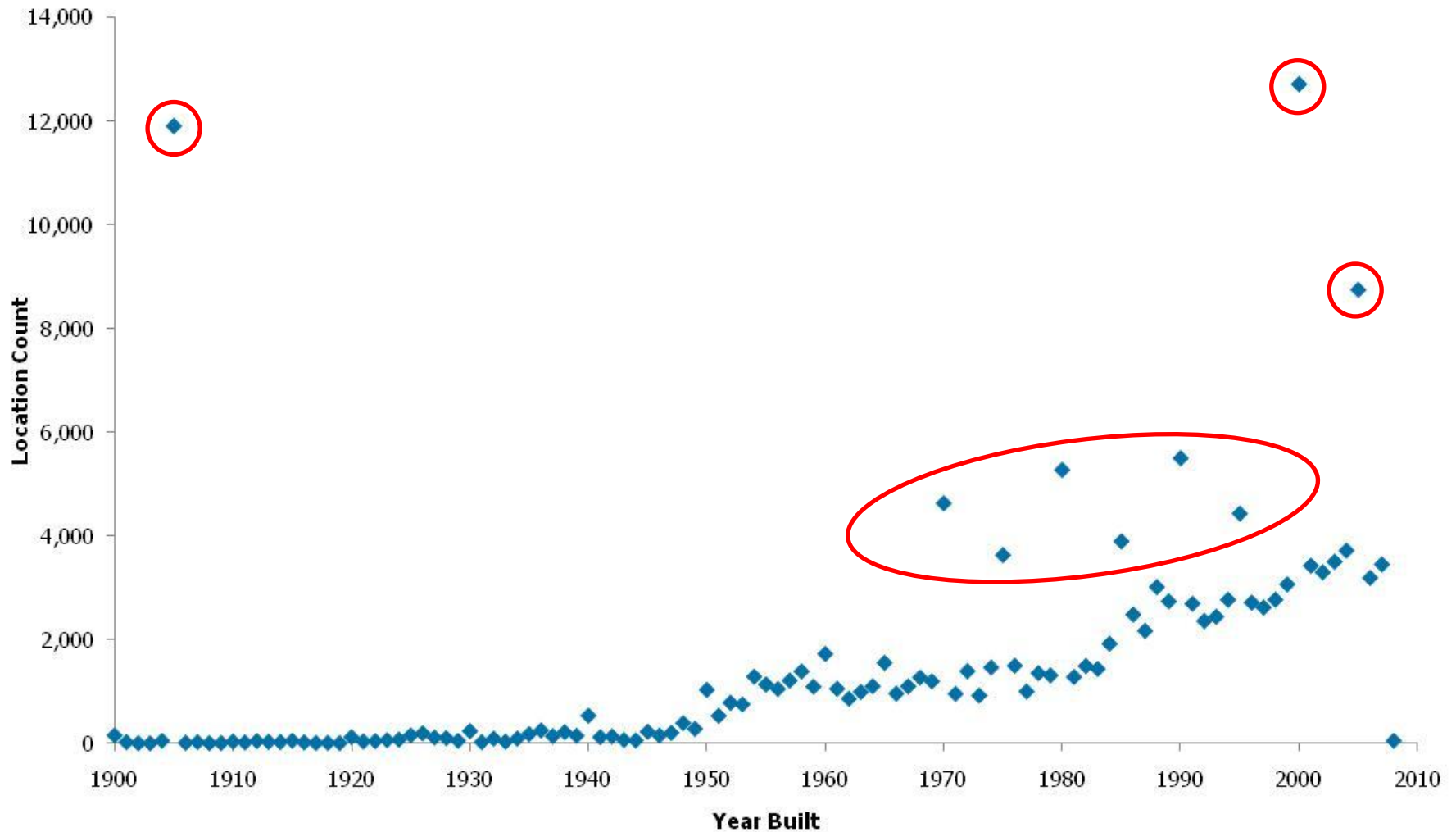
## ■ Bulk coding

# Diagnostics check for inconsistent construction class and occupancy

- ~ 5000 locations coded as bridges
- State capital
- Construction = **Bridge**
- Occupancy = **Communication**
- Apartment building
- Construction = **Bridge**
- Occupancy = **Multi-family**



# Potential Bulk Coding - Year Built



*RMS Sample Data*

# Valuation Diagnostics

- Limit > value
- Unrealistically high or low values
- Bulk coding

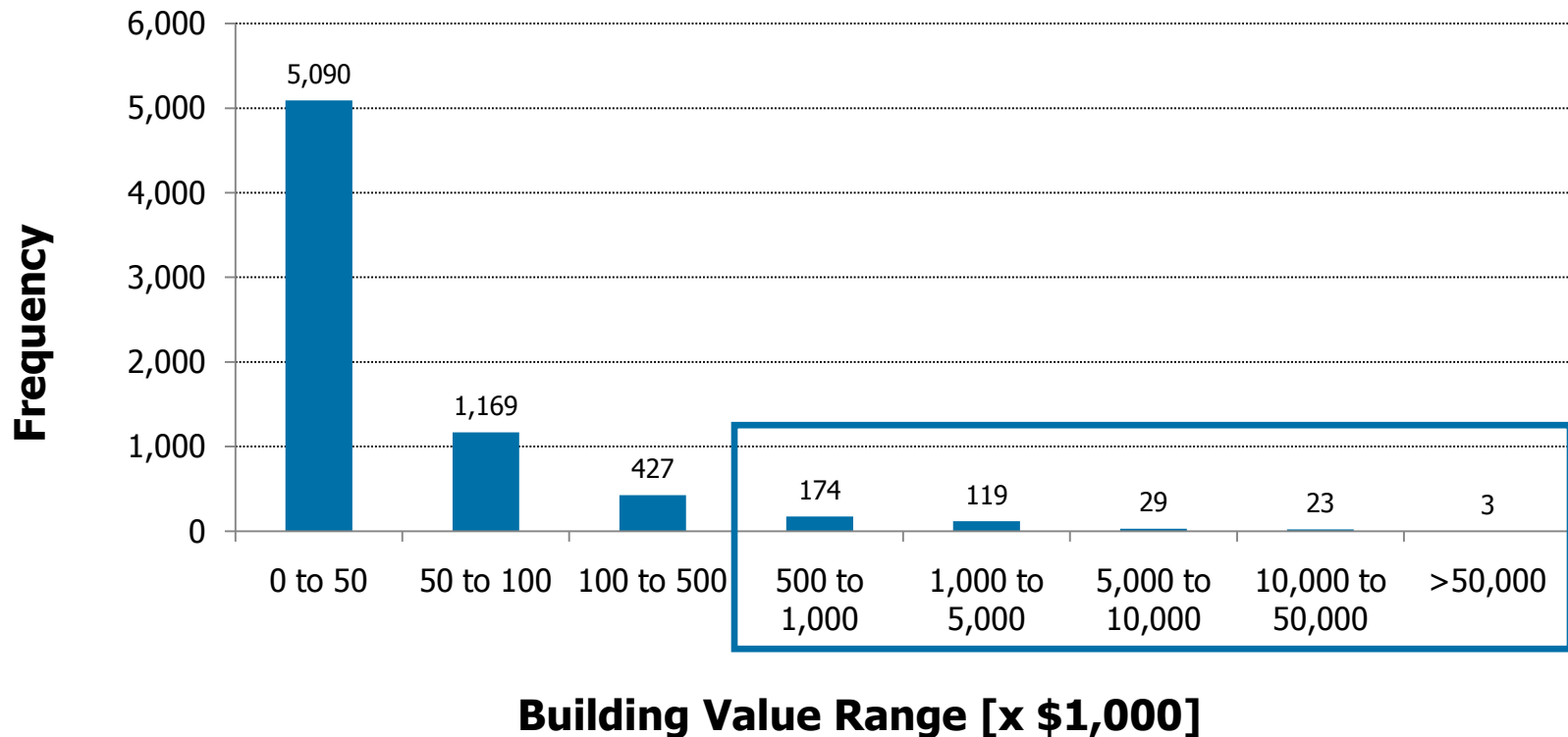
# Process Issues During Data Import

## Diagnostic Check for Policy Limits > Building Value

Account	Limit	Building Value	Limit/Value
Rein Bakery	984,000,000	984,000	1,000
Yellow Brick Books	959,000,000	959,000	1,000
A.L. Industries	805,800,000	948,000	850
A.L. Industries	780,300,000	918,000	850
Western Lumber Co.	698,000,000	698,000	1,000
Brown Box Storage	553,790,000	701,000	790
A.L. Industries	549,480,000	723,000	760
Valley Manufacturing	469,500,000	626,000	750
Dougie's Barber Shop	401,000,000	401,000	1,000
Peterson, and Jones, LLC	238,740,000	346,000	690
Eastern Florida Utilities	227,800,000	335,000	680
Absolute Acoustics	190,000,000	190,000	1,000
Hick, May, and Ritter	81,270,000	129,000	630
Petersburg Distributors	28,000,000	28,000	1,000
Shop-Mart	24,190,000	41,000	590

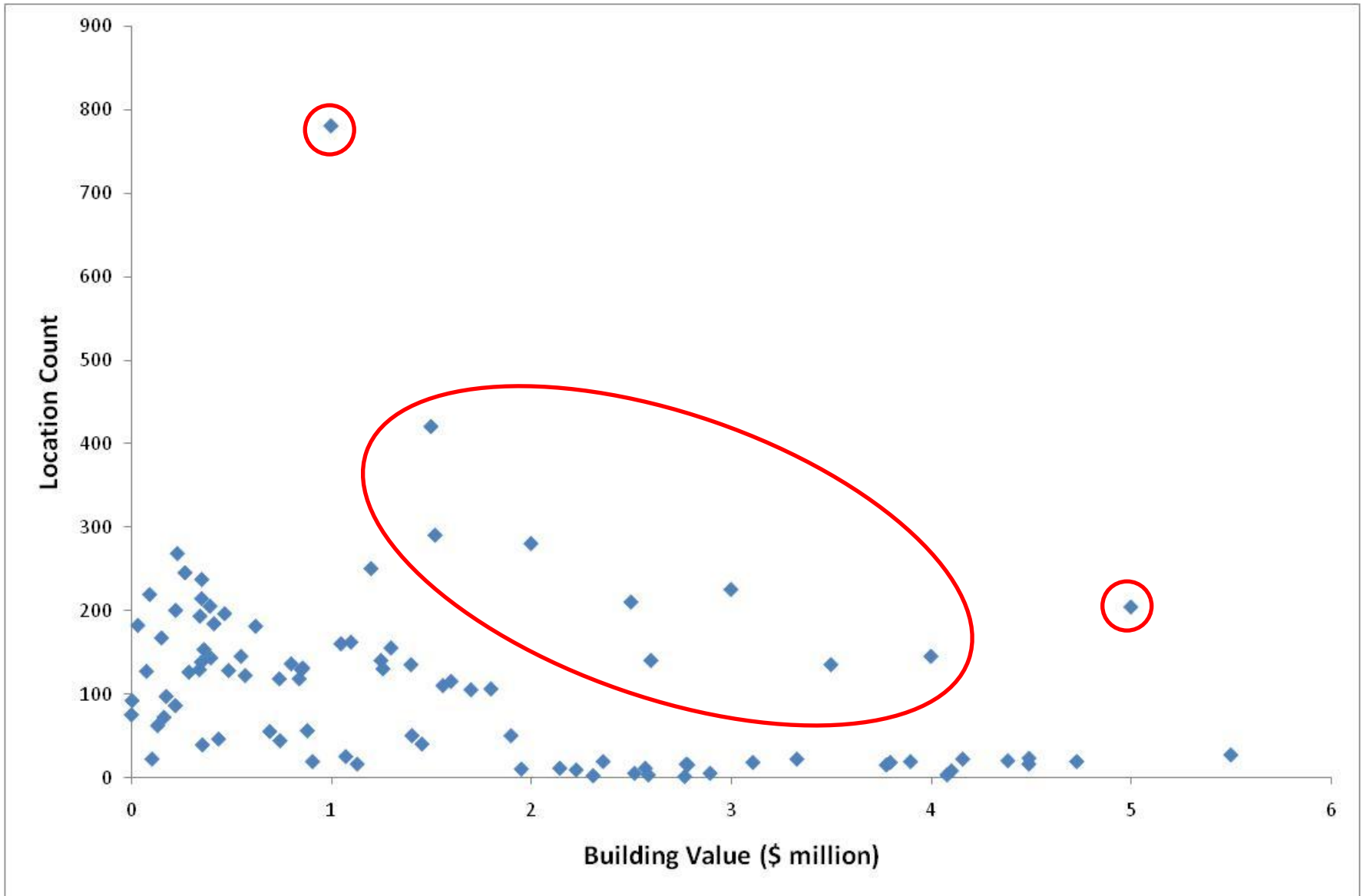
# Inconsistent Attributes

## Diagnostics check for inconsistent construction class and building value





# Potential Bulk Coding – Building Values



# Financial Structure Diagnostics

- Invalid or unexpected currency
- Flag when there are no deductibles on an account
- Policy limits  $> \$100,000,000$  or  $< \$10,000$
- Deductibles between \$1 and \$100 (maybe the user forgot to check the % box)

# **GIGO**

**Garbage In – Garbage Out**

**Gold In – Gold Out**

# ASK

# ?