

# Catastrophe Risk: Modeling and Opportunity

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**Evolving Frontiers, Exciting Prospects**

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# Agenda



- **Catastrophes in India and Impact on Insurance Industry**
- **Understanding Catastrophe Risk**
- **Catastrophe Modelling**
- **Applications of Catastrophe models – Risk Management**
  - Reinsurance Optimization
  - CAT Bonds
  - Portfolio Risk Management
  - Demonstrating Financial Strength

# Catastrophes in India – Why Cat Modelling is Essential?



Gujarat Earthquake -2001

Economic Losses – INR 30bn  
Insurance Loss – INR 0.5bn  
% of Insurance Loss – 1.67%



Orissa Cyclone - 2013

Economic Losses – INR 9 bn  
Insurance Loss – INR 0.7bn  
% of Insurance Loss – 8%



Worldwide CATs in 2013

Economic Losses – \$ 130 bn  
Insurance Loss – \$ 42 bn  
% of Insurance Loss – 32%

With increased penetration of Insurance, more frequent natural CAT events, coupled with growth in Indian economy, cat exposure of Indian insurance industry is increasing.

**It is becoming increasingly important to understand , monitor and manage cat risk.**

# Impact of CATs on Developing Countries

Due to low insurance coverage in developing countries, the cost of CAT events is borne by local government and aid agencies.

Lack of proper catastrophe risk management strategies in developing countries or low purchasing power resulting lower insurance penetration.



Governments responsible for financing reconstruction and rehabilitation and the impact on (re)insurance industry is minimal.



Funds diverted from development projects **OR** Help requested from international donors such as UN.



Governments are increasingly using the insurance solutions or creating pools to transfer the risk to capital markets. This resulting in direct or indirect cost to insurers (ex. Levies for Flood Pool)

# Catastrophe Risk in Insurance Industry

The deviation in actual claims from its total expected claims, resulting from a large single event, or a series of events, occurring usually over a short period of time.

CAT risk is one of the key risks that a typical P&C insurance company faces today and could potentially destroy the company. This not only impacts the policyholders but creates systematic risk in the market. It is not easily diversifiable because many policyholders are affected at the same time.

Insurers have to hold additional risk capital to ensure that they can pay large indemnity payouts at any time.

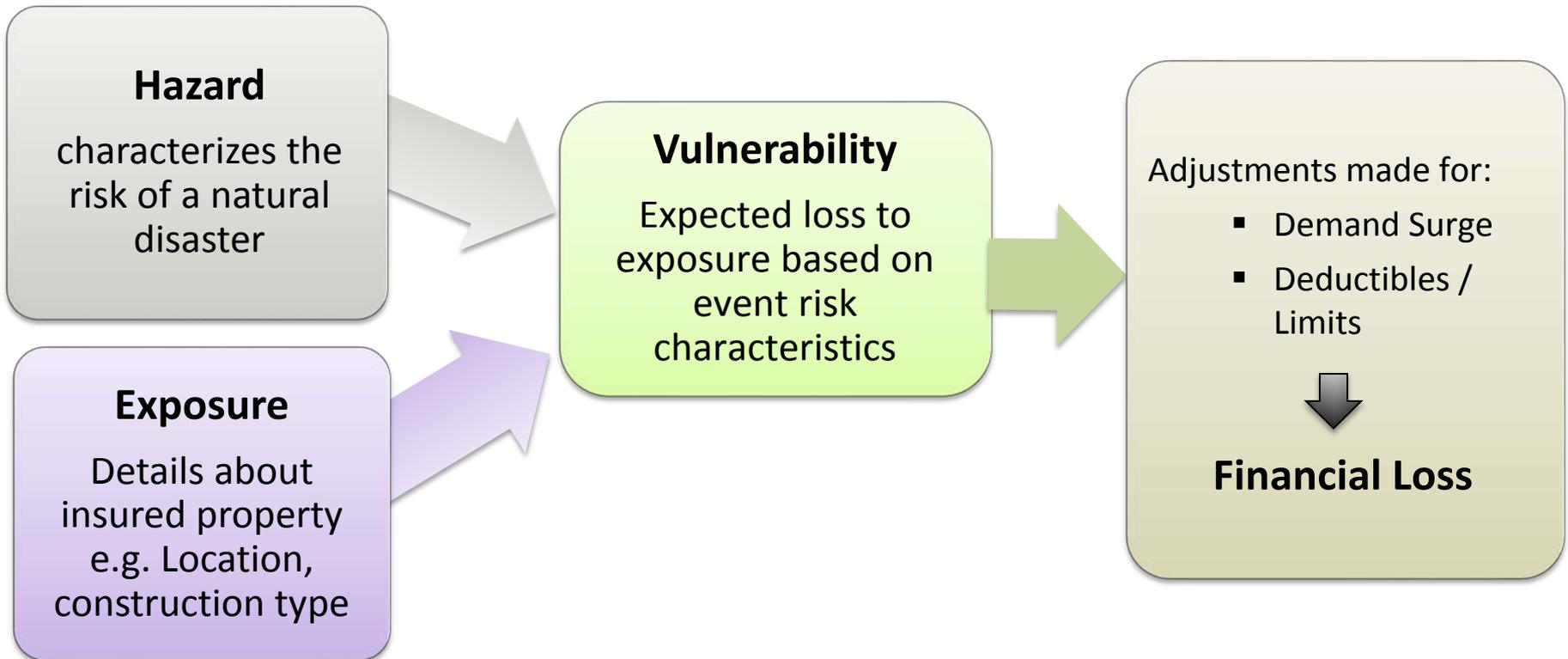
Holding additional risk capital generates additional costs which are ultimately passed to policyholders.

Emphasis on risk assessment and management of natural disasters, which can be done via catastrophe modeling

# What is Catastrophe modeling?

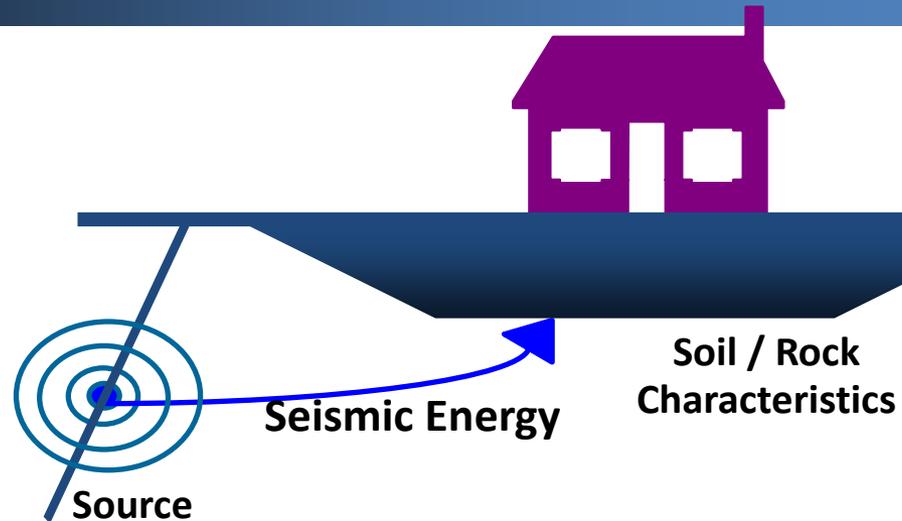
Simulation based method to project losses from a catastrophic event by using proprietary cat models such as RMS, EQECAT etc .

Simply put, it's a hazard and exposure based model used to calculate the probability of occurrence of a CAT event and the expected cost of the event if it occurs. A simple structure of all CAT models available presently is given below:



# Understanding the components of CAT modeling

**Hazard module:** An earthquake hazard is characterized by its epicenter location and magnitude. A hurricane is characterized by its projected path and wind speed.



**Exposure details:** The most important parameter for a property at risk is its location. A process called *geocoding* is normally used to assign geographic coordinates to a property based on its street address.

For a building, these parameters include its construction type, the number of stories in the structure, and its age. If the property is insured, information on the nature of the policy, such as the deductible and coverage limit, is also required.

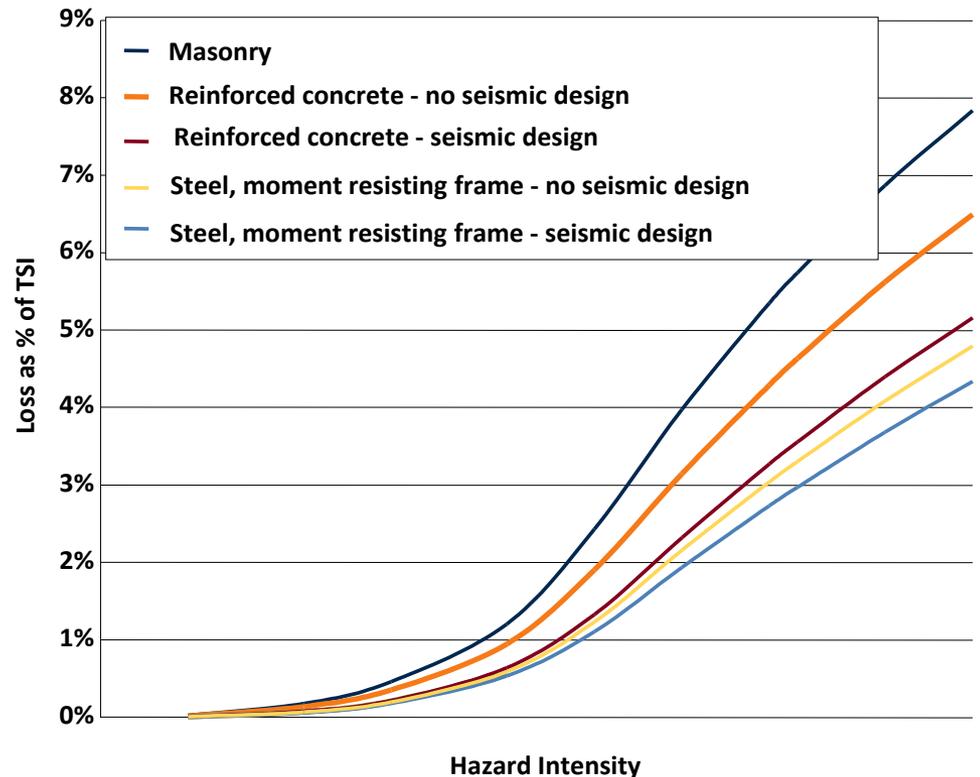


# Understanding the components of CAT modeling

## Vulnerability:

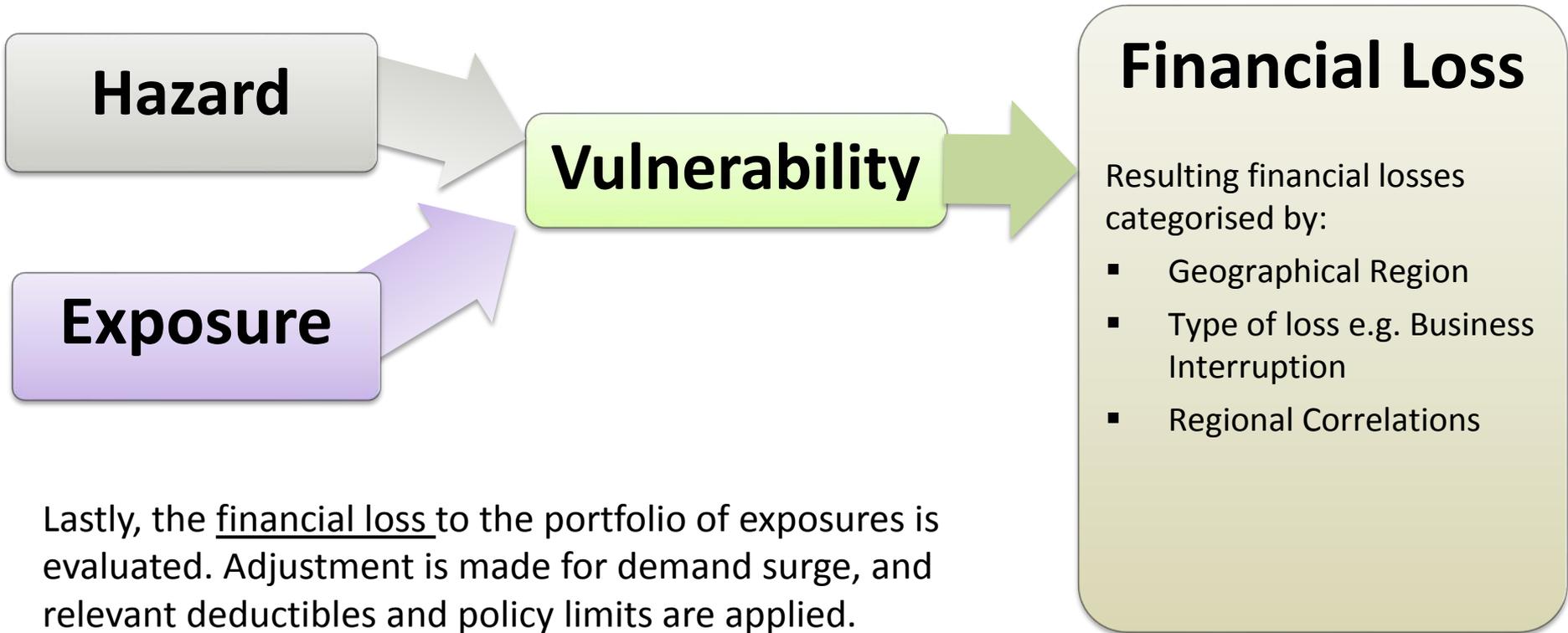
The hazard and exposure modules enable the calculation of the vulnerability to damage of the structures at risk.

This step in the model quantifies the physical impact of the natural hazard phenomenon on the property at risk. The model constructs damage curves and relates structural damage to an event severity parameter, such as peak wind speed or peak ground acceleration.



**Example of Vulnerability curve:** The amount of damage to a building depends on its structural characteristics

# Understanding the components of CAT modeling



# CAT Risk Management

Stop writing policies that are exposed to high CAT risk

Reduce The Exposure  
OR Diversify

Manage / transfer to Reinsurer or Capital Markets

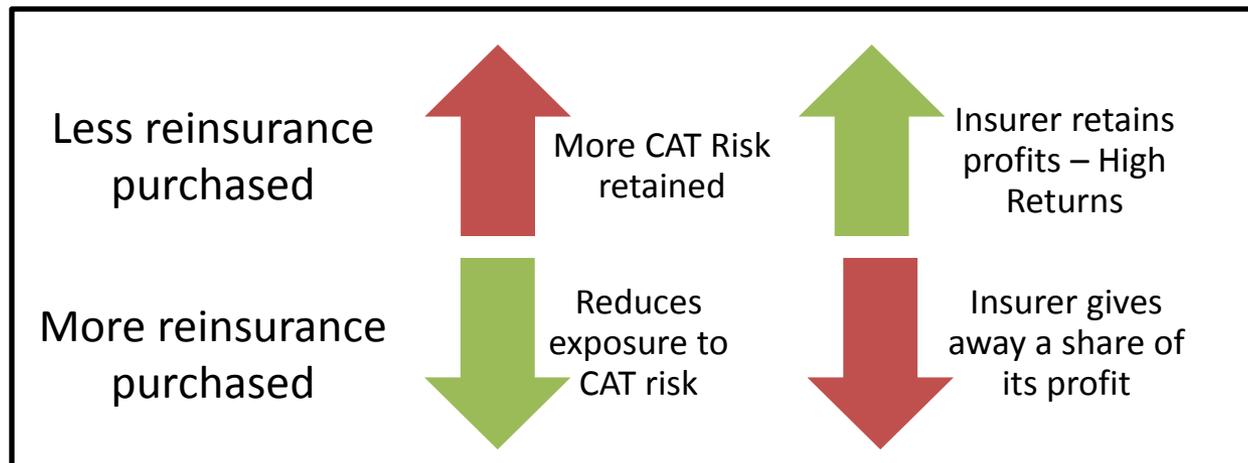
Charge Higher Price for CAT exposed policies – Cat Loading

# Manage Risk – Transfer to Reinsurer

## Reinsurance Optimization

How much risk an insurer wants to transfer depends on the following factors:

- Level of Risk transfer appropriate to Insurer's risk appetite
- RI arrangement suitable to insurance portfolio characteristics
- Capital requirement – to demonstrate Solvency to regulators, Rating Agencies
- Business strategy – to increase capacity, protect profitability or get better diversification
- Availability and cost of optimal reinsurance cover



# Reinsurance Optimization - Example

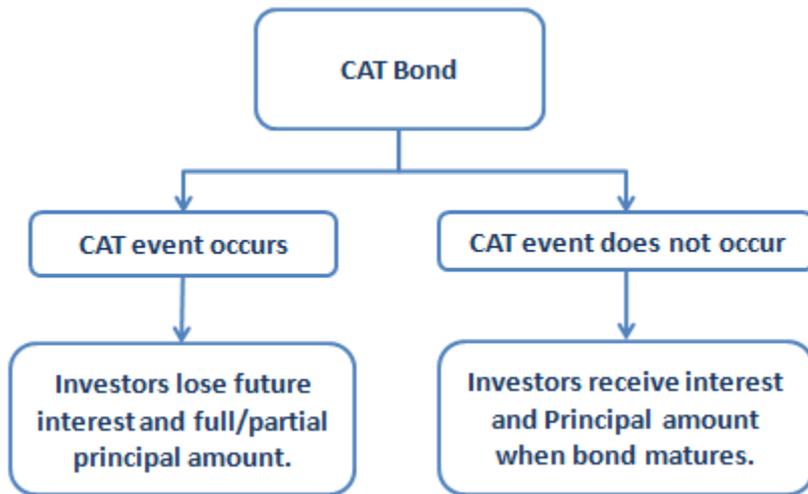
If an insurer's objective is to reduce Expected Losses, then it can use CAT modelling to project CAT losses, and hence evaluate the benefit from different reinsurance covers available in the market.

It can then purchase the most cost effective RI cover.

	<u>No Cover</u>	<u>Cover A</u>	<u>Cover B</u>
Limit:		Rs. 25M	Rs. 75M
Excess:		Rs. 75M	Rs. 25M
Cost:		<b>Rs. 0.6M</b>	<b>Rs. 0.8M</b>
Avg Net CAT Loss (Estimated using CAT models):	<b>Rs. 2M</b>	<b>Rs. 1.5M</b>	<b>Rs. 1M</b>
Expected CAT Outgo:	<b>Rs. 2M</b>	<b>Rs. 2.1M</b>	<b>Rs. 1.8M</b>

# Manage Risk – Transfer to Capital Market

## Cat Bonds – RISK LINKED SECURITIES



Four basic trigger types:

- ❑ **Indemnity:** triggered by the issuer's actual losses
- ❑ **Modeled loss:** if the modeled losses are above a specified threshold, the bond is triggered.
- ❑ **Indexed to industry loss:** triggered when the insurance industry loss from a certain peril reaches a specified threshold.
- ❑ **Parametric:** The parameter would be the wind speed (for a hurricane bond), the ground acceleration (for an earthquake bond).

	<b>Cat Bonds</b>	<b>Traditional Reinsurance</b>
Similarities	Transfer of Risk to investors	Transfer of risk to Reinsurer.
Differences	Insurer gets the principal amount in the beginning.	Insurer gets the claim amount in the end.
	Insurer has to pay out interest to the investors.	Insurer pays the premium to the Reinsurer.

# Manage Risk – Portfolio Risk Management

Understand high risk zones, exposure in these areas and manage in line with company strategy

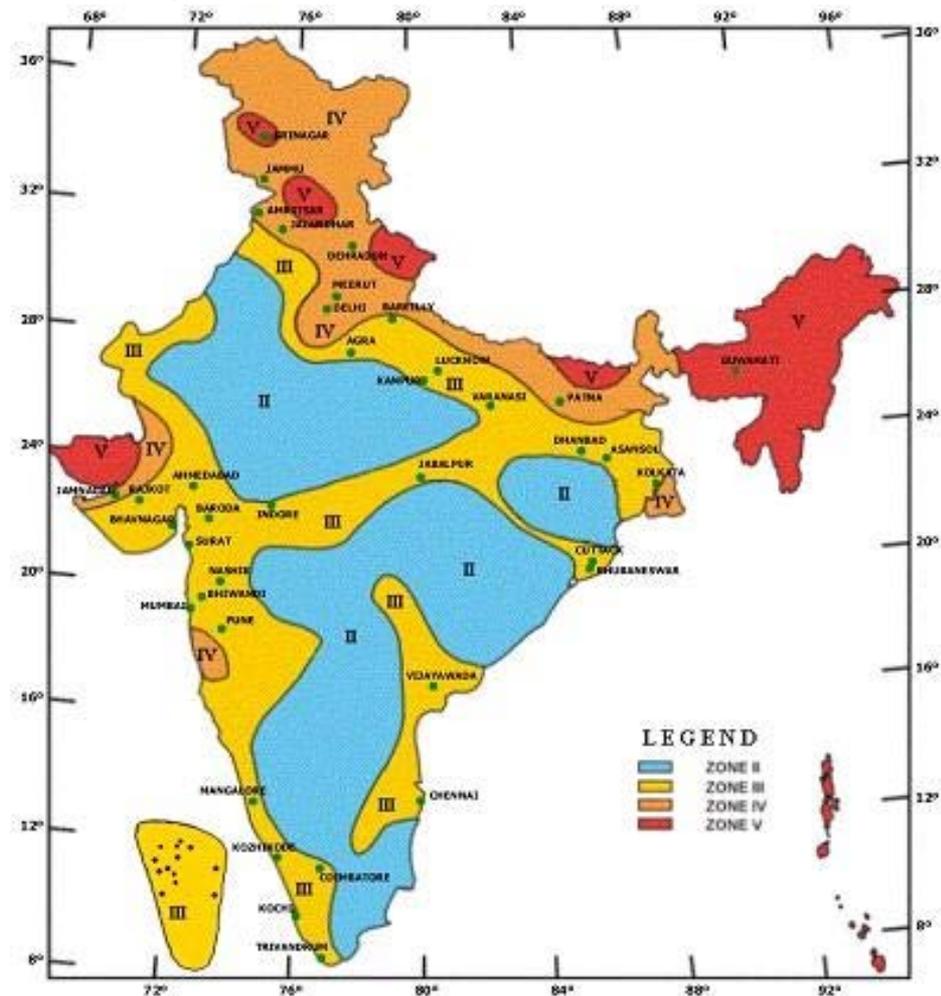
In the following graph, we can see EQ hazard zones in India (red being the most risky and blue is least risky).

By combining the hazard zones and its exposure in these zones, an insurance company can understand its susceptibility to cat loss in the event that an earthquake occurs.

Actions that can be taken:

- Stop writing business in risky zones
- Diversify the exposure by writing in both high and low risk areas
- Price accordingly eg. Higher Cat loading for a property in Delhi and no loading for Jaipur.
- Transfer risk to re-insurer

Earthquake Hazard Zones in India



Source: Indian Met Dept

# Demonstrate Financial Strength

An integrated catastrophe model is only practical way to provide information requested by regulators and rating agencies such as S&P, Fitch and AM Best

Standard & Poor's considers extreme-event (cat risk) management one of three pillars in an insurer's ERM framework and is using cat risk management practices as one of five criteria for classifying an insurer's ERM capabilities as excellent, strong, adequate, or weak.

Fitch's Prism model directly incorporates cat modeling results— both in isolation and through correlation assumptions with the other risks modeled — into its quantitative relationships that determine estimates of economic capital. This formalizes the connection between ERM and cat risk management practices.

Finally, A.M. Best robustly addresses CAT Risk through its Supplemental Rating Questionnaire. Quantification is expected of the Tail Value at Risk, in addition to the historical statistics of Probable Maximum Loss and Average Annual Loss

