Catastrophe Life and Personal Accident

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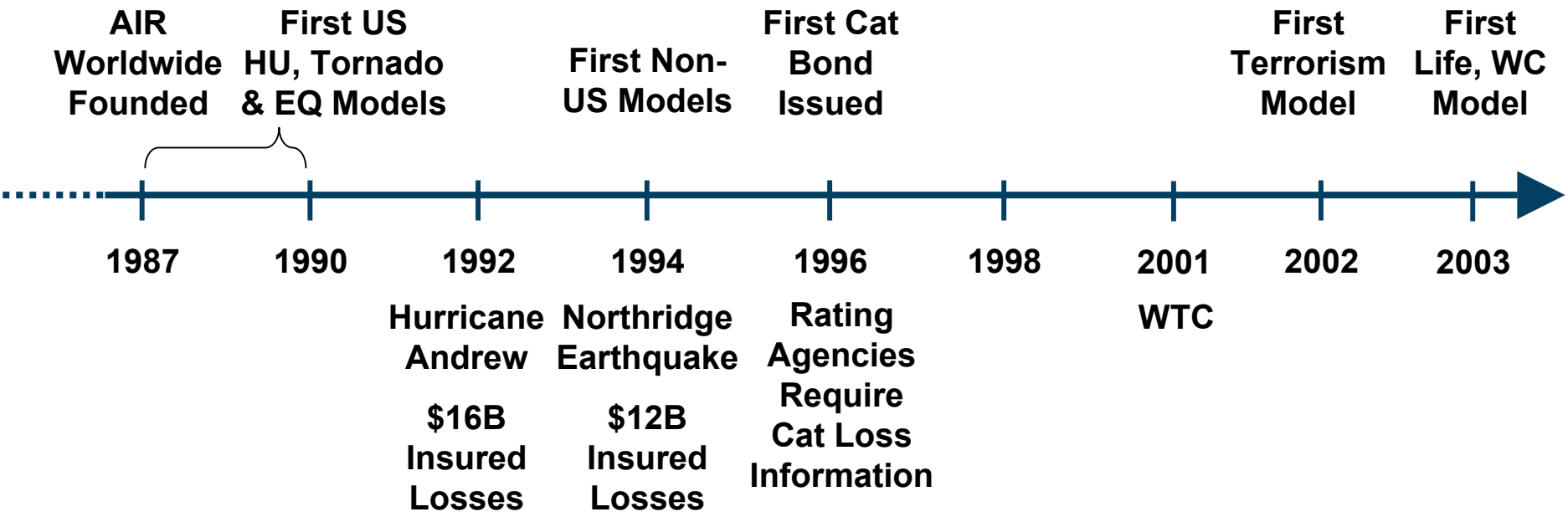
BETTER TECHNOLOGY
BETTER DATA
BETTER DECISIONS

AIR

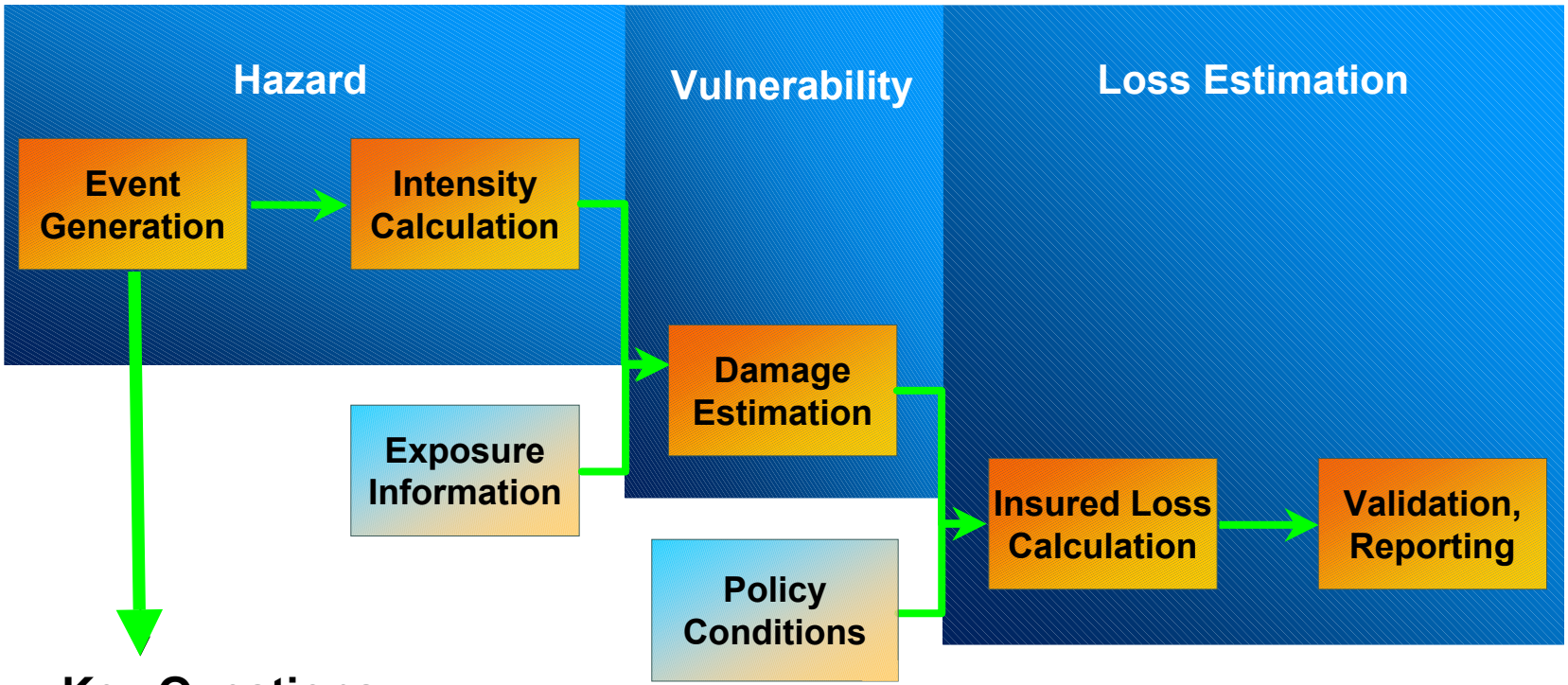
Modeling Extreme Events

- Extreme event losses are highly variable and are a key driver of enterprise risk profile
- The high severity and low frequency of extreme events are not amenable to estimation via traditional actuarial methods
- Technology, science and engineering allow us to improve dramatically upon traditional approaches
  - Historical loss data is scarce
  - Property values change
  - Repair and replacement costs change
  - New properties continue to be built in areas of high hazard
- Modeling of detailed exposure allows incorporation of actual policy conditions
- Modeling of extreme event risk provides more complete picture of your company's current risk profile and the potential impact on financial results

History of Catastrophe Modeling



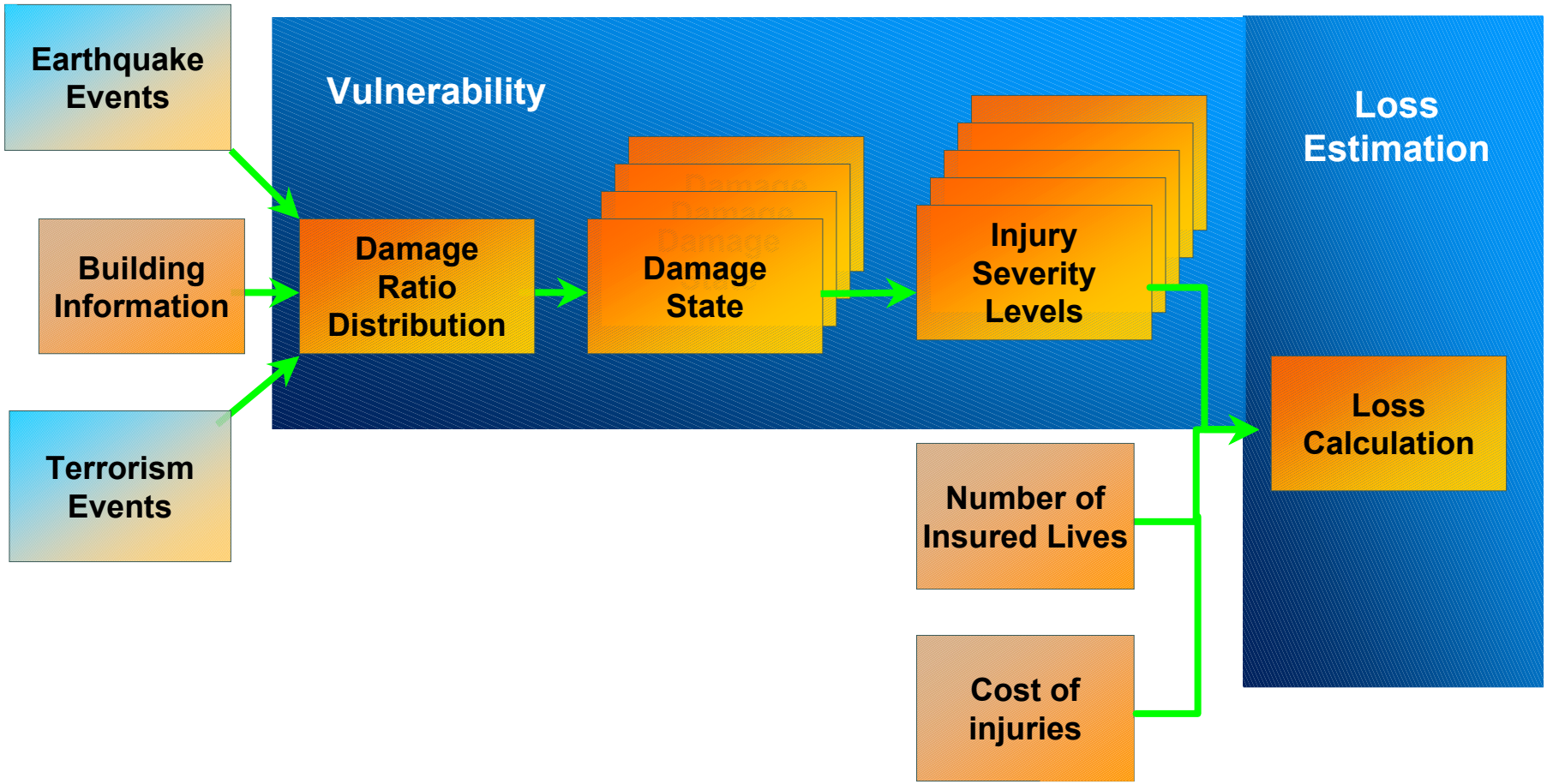
Catastrophe Model Components



Key Questions:

- What?
- Where?
- How big?
- How often?
- How much?

Components of Injury Related Models



Assessment of Data Elements for Modeling

- Location details
  - Address information sufficient for geocoding (street address preferable)
  - Number age and sex of insureds at each location
  - For life and accident, both work and home location of insureds
  - For workers' compensation, employee shift (day, evening, night)
- Property physical characteristics
  - Construction type
  - Occupancy type
  - Individual risk characteristics i.e. building height
- Insurance value and terms
  - Expected claim costs
    - Workers' compensation benefits by state and injury type
    - Life and Accident policy face value
    - Disability average payments and duration
  - Deductibles, waiting periods
  - Reinsurance terms

Example of Augmenting Data

Determine the Location Details

- Utilize public industry databases
  - Identifies individual locations and total insureds per location
  - SIC code for each location

Determine the Structural Characteristics for Modeling

- Utilize detailed property industry database
  - Used for over 15 years by property insurance / reinsurance
  - SIC codes provide defaults for construction, age and height by ZIP Code

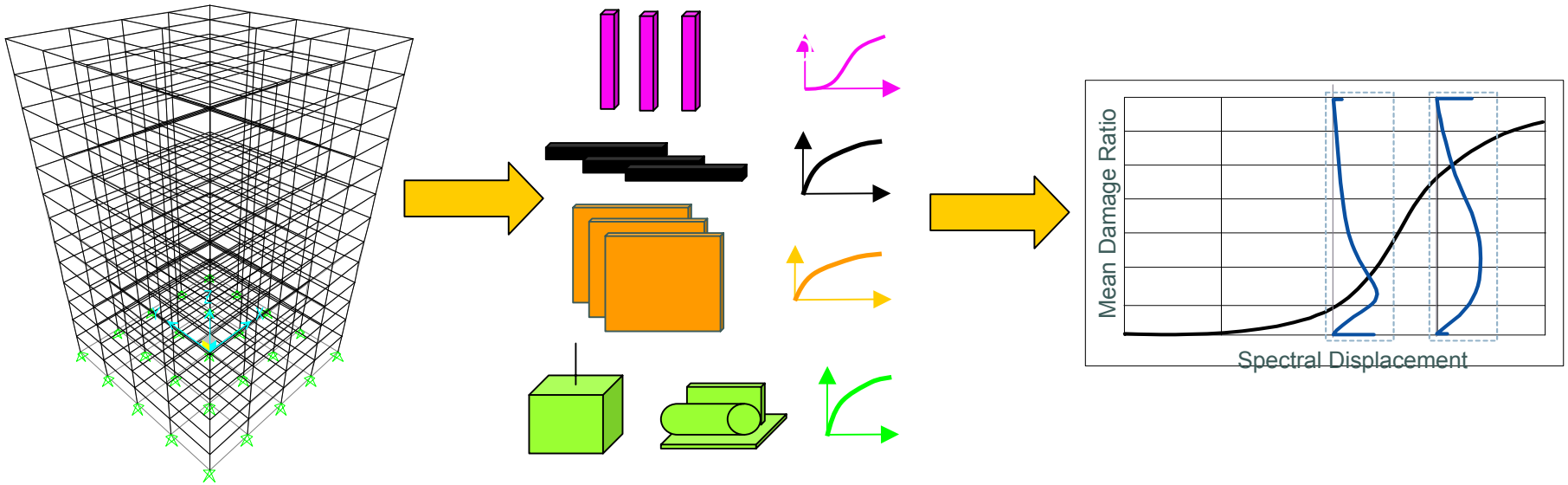
Determine Location by Time of Day

- Industrial occupancy rates vary by time of day
  - 2:00 p.m.: 80%
  - 5:00 p.m.: 50%
  - 2:00 a.m.: 10%

Determine Claims Benefit Structure

  - Utilize client provided policy values
  - Utilize medical cost data

Estimating Earthquake Damage

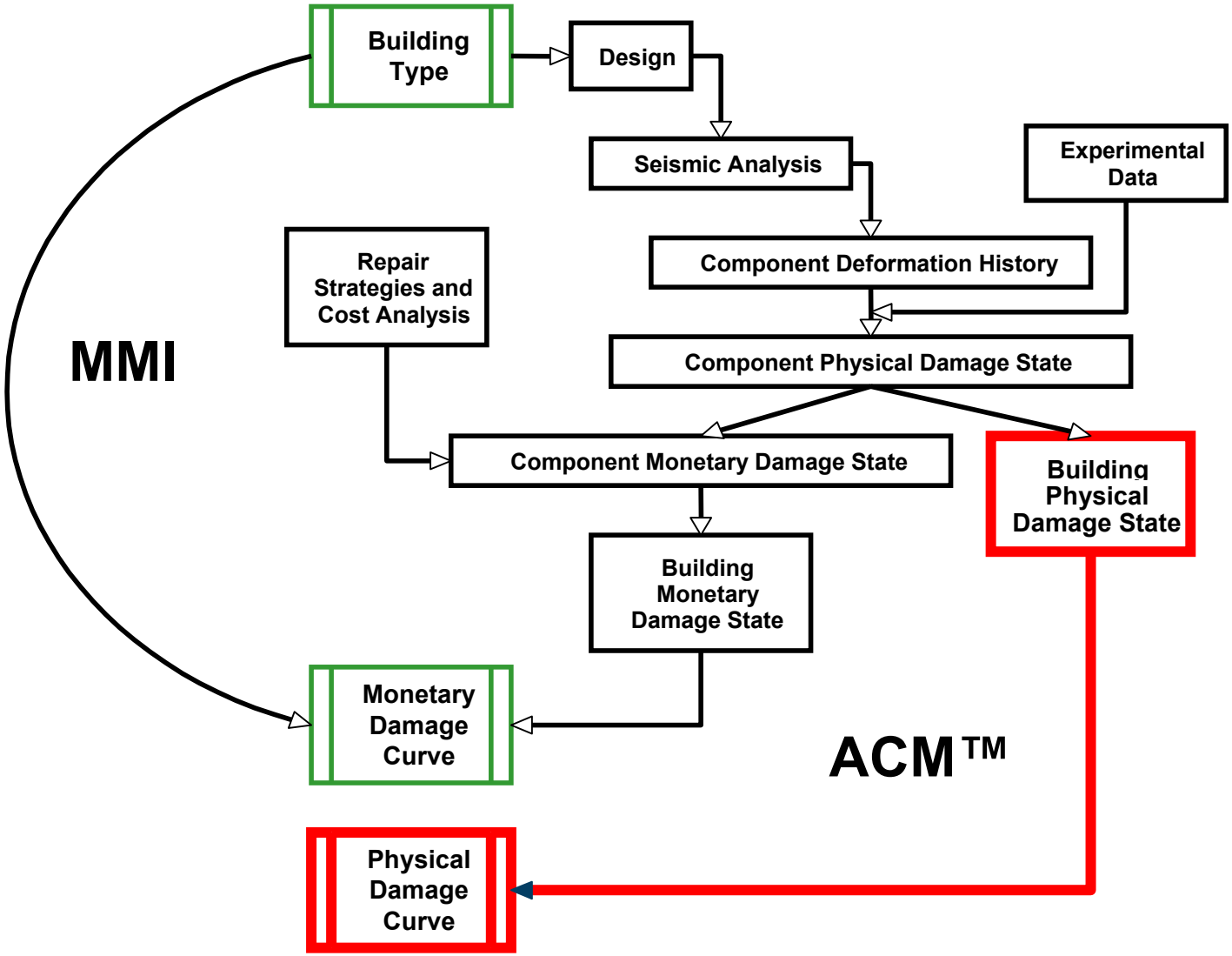


Create engineering models.

Assess vulnerability at the component level.

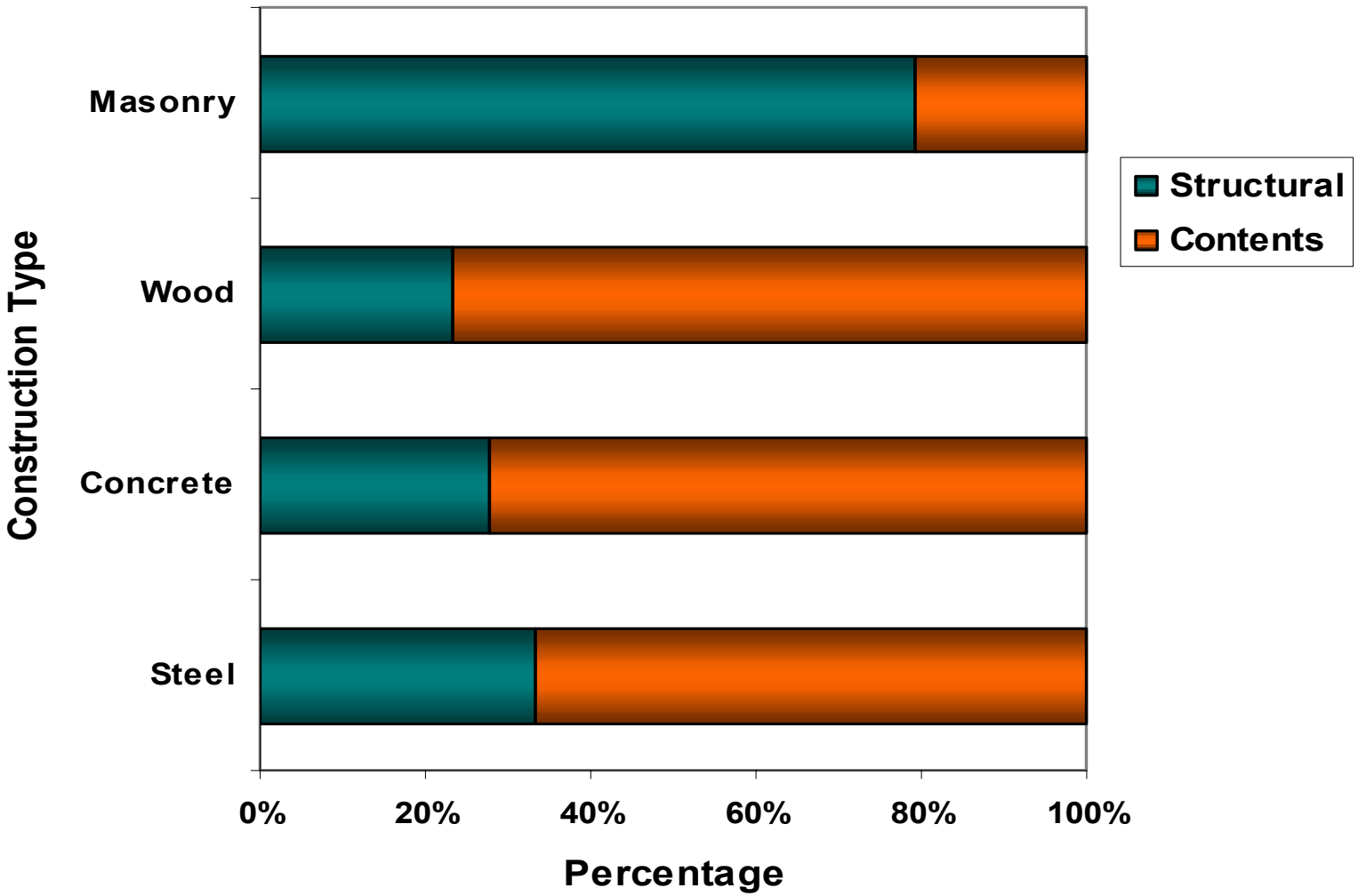
Assemble composite damage function for the building.

Calculating Physical Damage from Earthquake Events



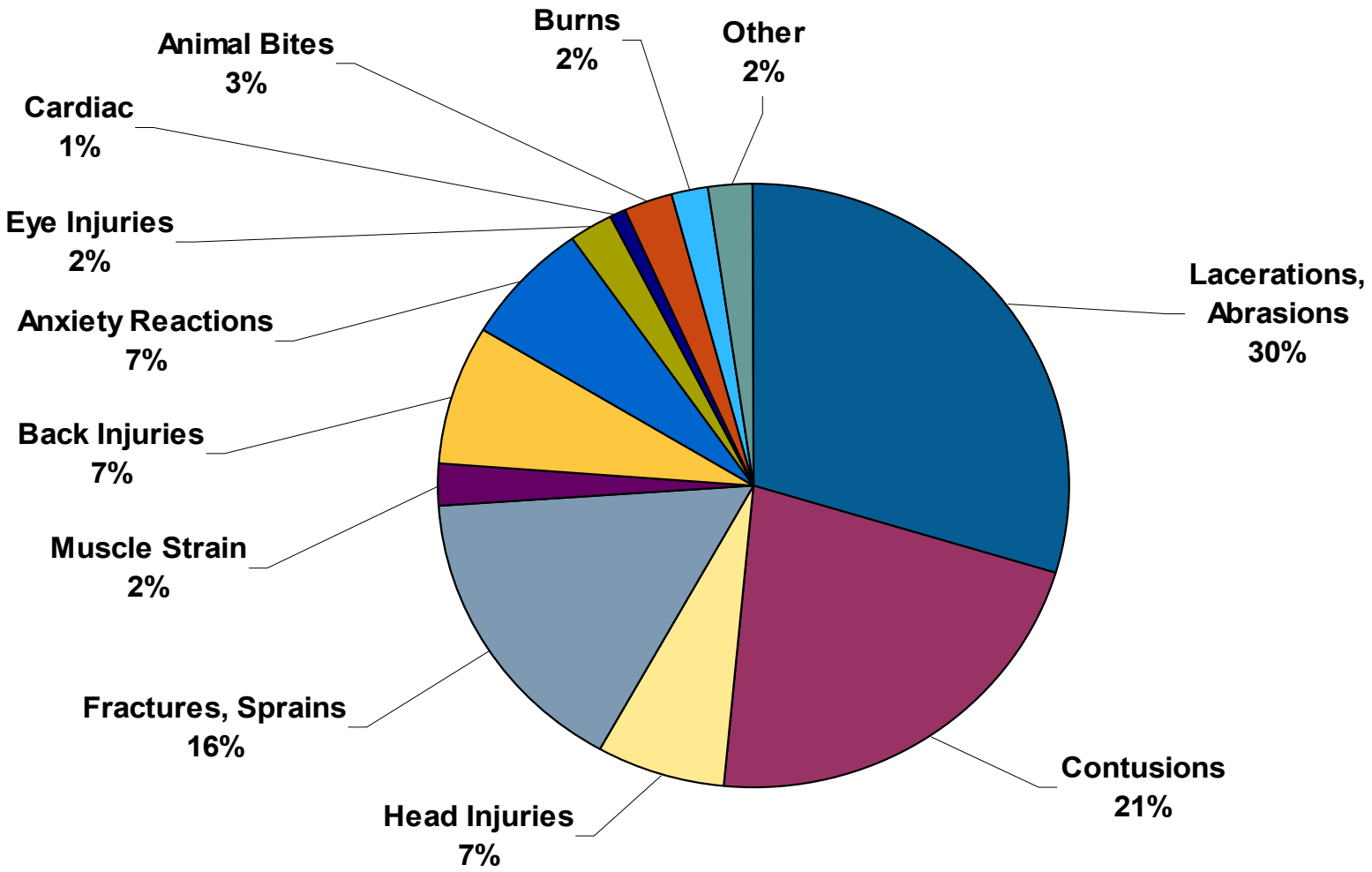
Physical Damage versus Monetary Damage

Cause of Injury by Construction Type

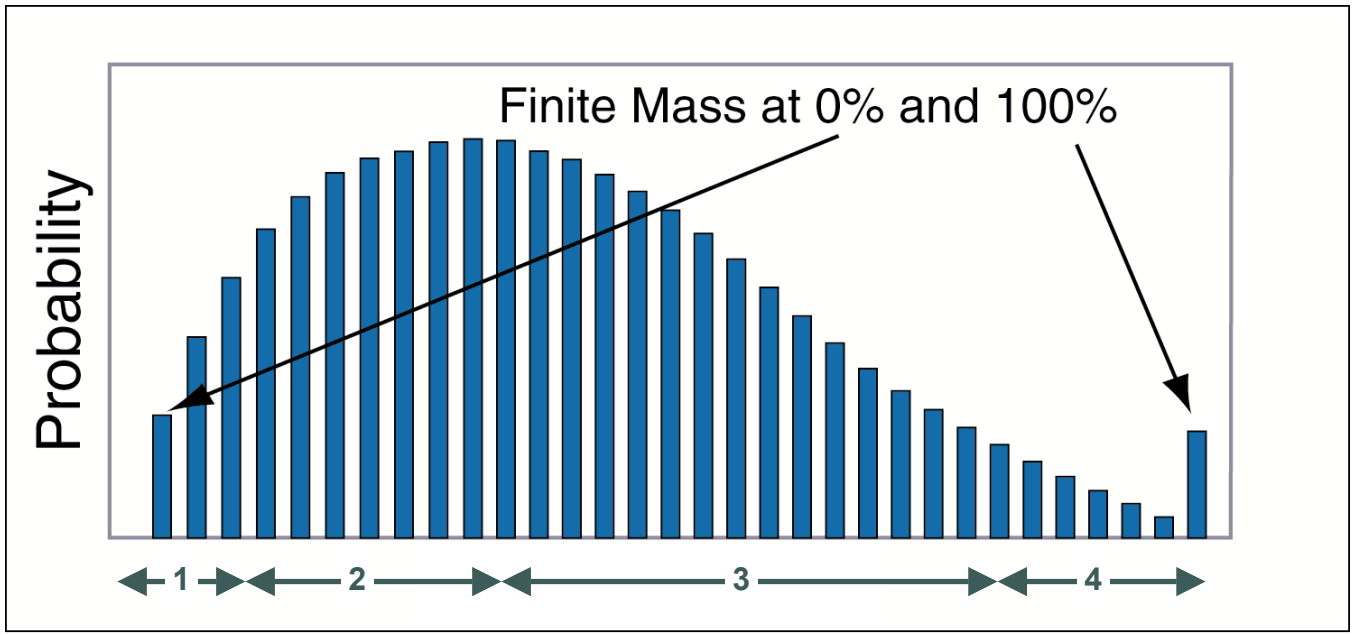


Note: Data from County of Santa Cruz hospitals

Typical Injury Types from Earthquakes

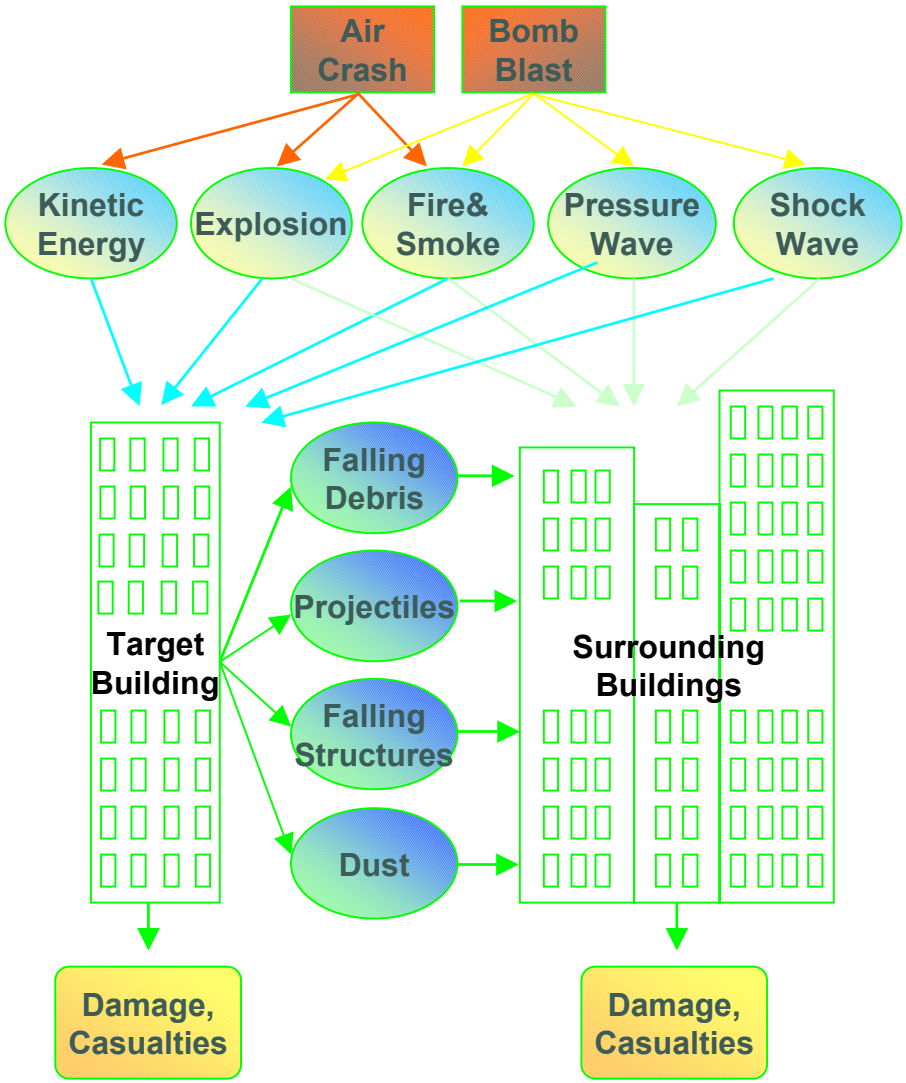


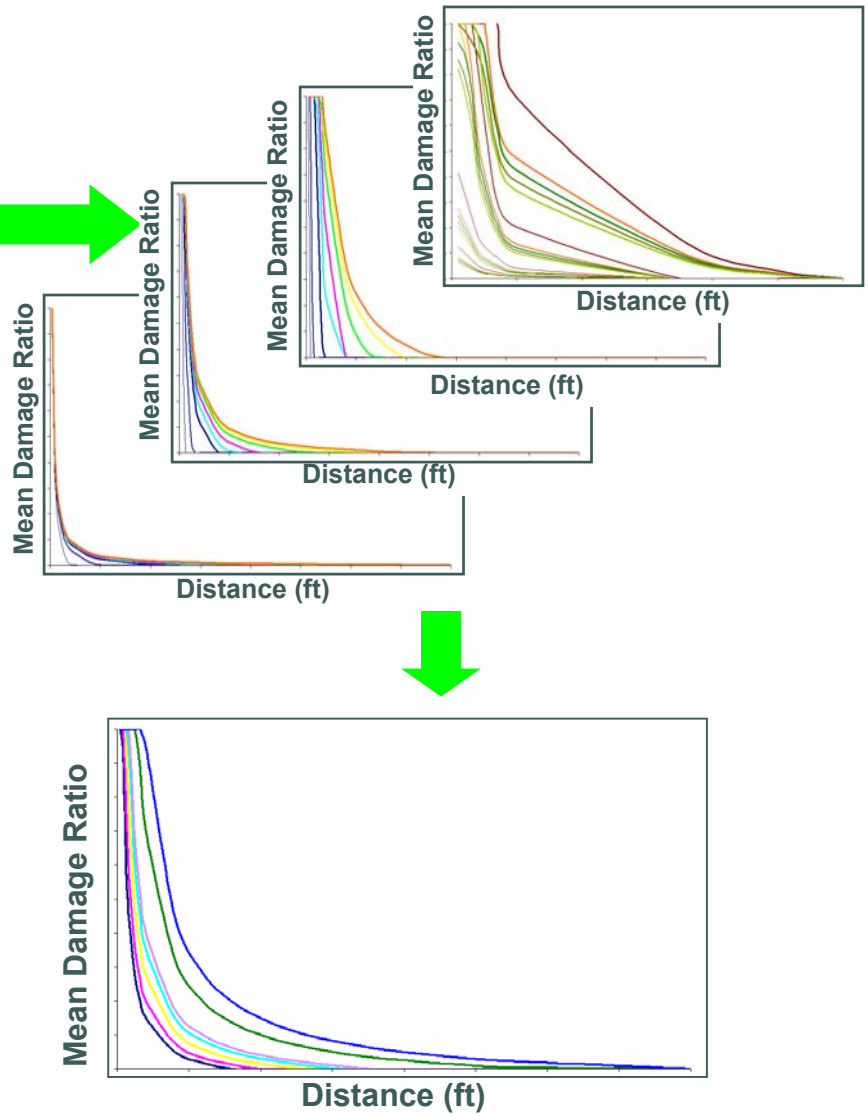
Building Physical Damage Distribution Mapped to Damage States



1 - Slight Damage
2 - Moderate Damage
3 - Extensive Damage
4 - Complete Damage
- collapse
- no collapse

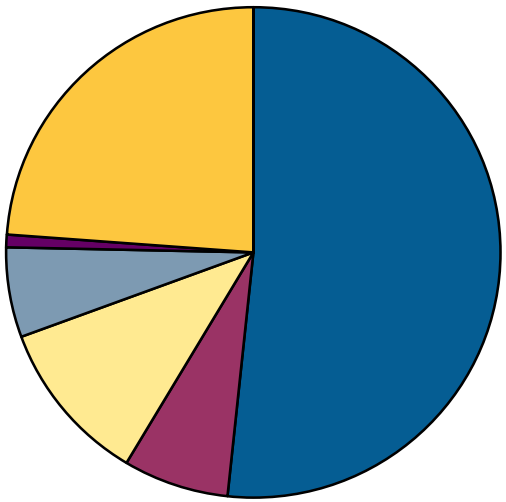
Damage and Casualty Estimates Consider Multiple Effects on the Target and Surrounding Buildings



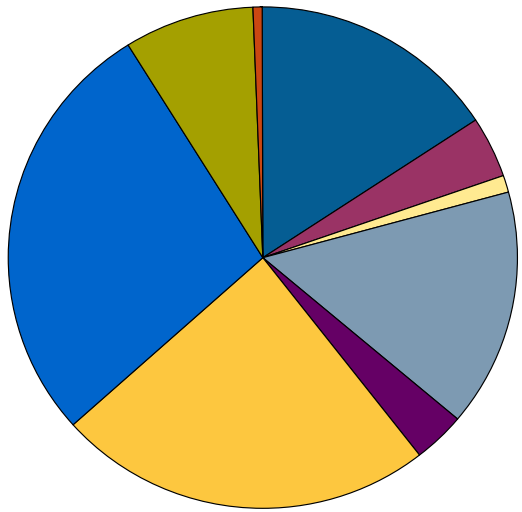


Typical Injury and Fatalities from Conventional Attacks

Oklahoma City Bombing



World Trade Center



- Lacerations, abrasions and contusions
- Fractures and dislocations
- Head injuries
- Eye injuries
- Burns
- Fatalities
- Inhalation
- Sprain or strain
- Crush

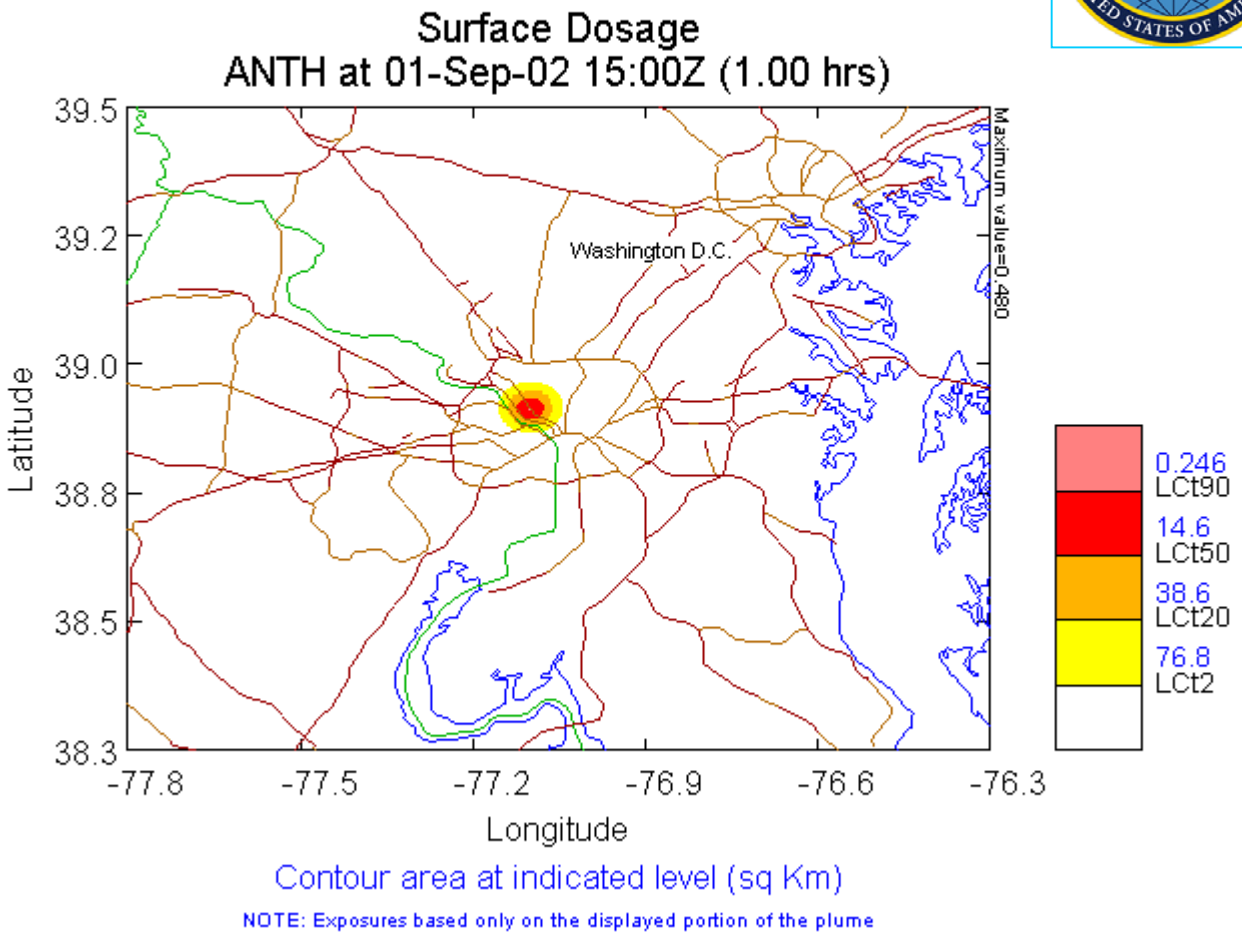
Calculating Damage and Injuries from CBRN Attacks

- Physical damage state not relevant for CBRN attacks
- DOD's Hazard Prediction and Assessment Capability (HPAC) Model for CBRN Events
- Event simulation
  - Full spectrum of CBRN
  - Accurately predicts the effects of hazardous material releases
  - Embedded climatology and historical weather data
  - Terrain data and supporting wind-flow models calculate the local windfield
- Model output
  - Fatality rate contours
  - Contaminant concentration levels over time and distance

Simulated Losses from a CBRN Attack

Anthrax Aerosol Dispersion

- 3,144 fatalities
- 250,811 injuries

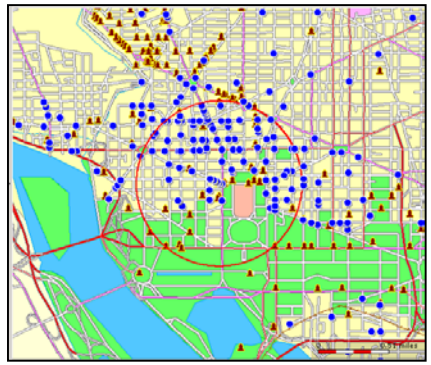


Sample Severity Calculation

- The expected duration of injuries simulated by the model is used to determine if disability payments will result
- Disability payments begin after a number of days away from work
  - Short term disability provides benefits for 13 to 26 weeks
  - Long term disability picks up when short term benefits expire, and continues for an extended period of time
- Average ultimate disability claim cost = expected claim duration x average monthly payment
- Expected claim duration is developed from a claim continuance table

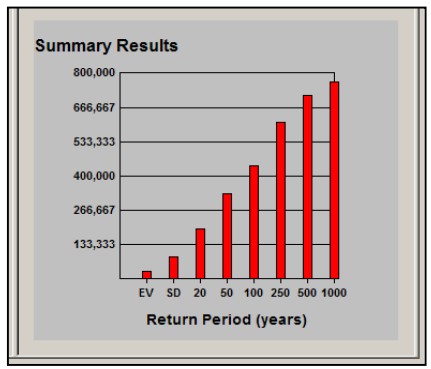
Managing Life and Personal Accident Risk

- Where are our exposure concentrations the greatest?
- How close are we to any potential terrorist targets?



- What are our losses if a terrorist attack occurs in a certain location?
- What are our losses from a repeat of the 1906 San Francisco earthquake?

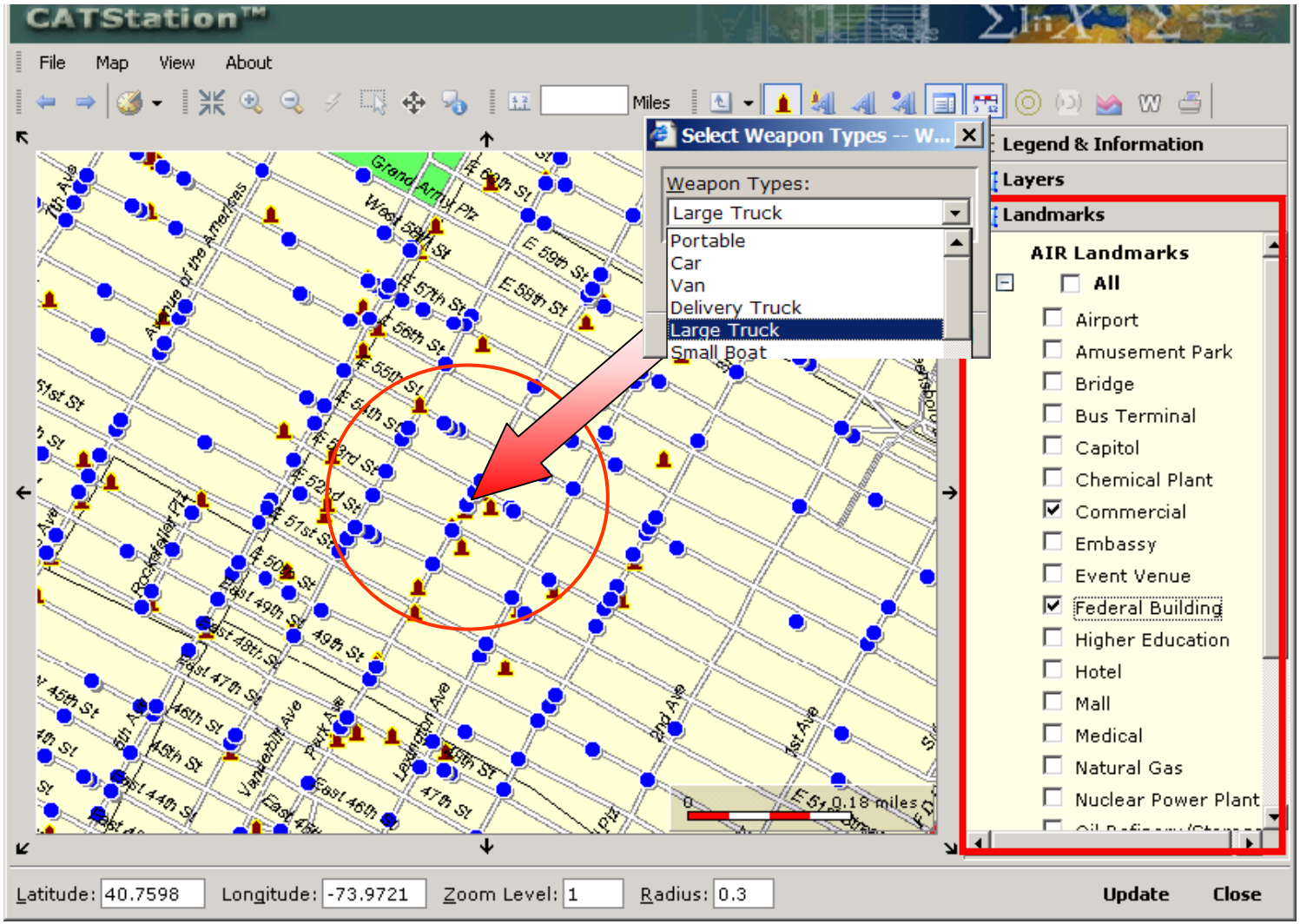
- How do we price or evaluate earthquake insurance?
- How do we quantify our total risk to terrorism?



Measuring Exposure Concentrations

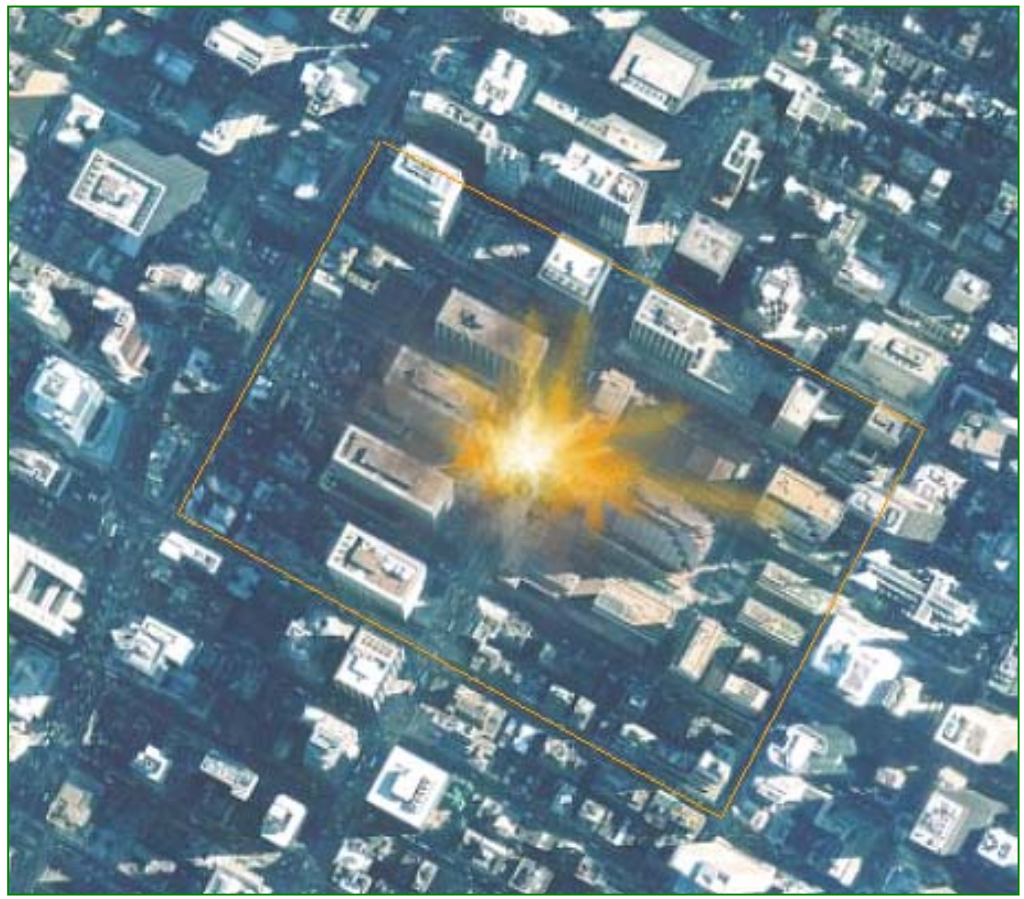
- Defining exposure
  - Number of Locations
  - Number of Employees
  - Total Replacement Value
  - Total Insured Value
  - Number of Landmarks
  - Net Insured Value
- Select Boundary
  - State
  - County
  - Postal Code
  - Landmark Ring
  - Location Ring

Identifying Exposure Concentrations and Proximity to Potential Targets



Simulated Losses from Midtown Manhattan Delivery Truck Bomb

- Delivery truck bomb
- 80,000 workers in surrounding area
- Expected 25,000 casualties (workers)
  - 2,500 fatalities
- $4-5 billion workers' compensation loss
- $187M in group life losses
- $3-4 billion total property loss
  - 29 buildings affected



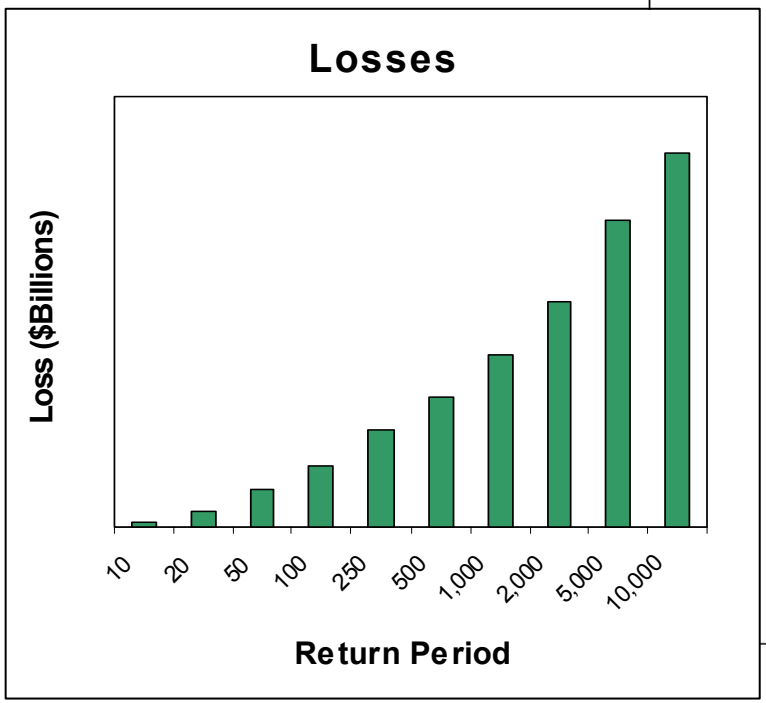
Typical Injury Types from CBRN Weapons
Sarin Attack - Tokyo Subway, March 20, 1995

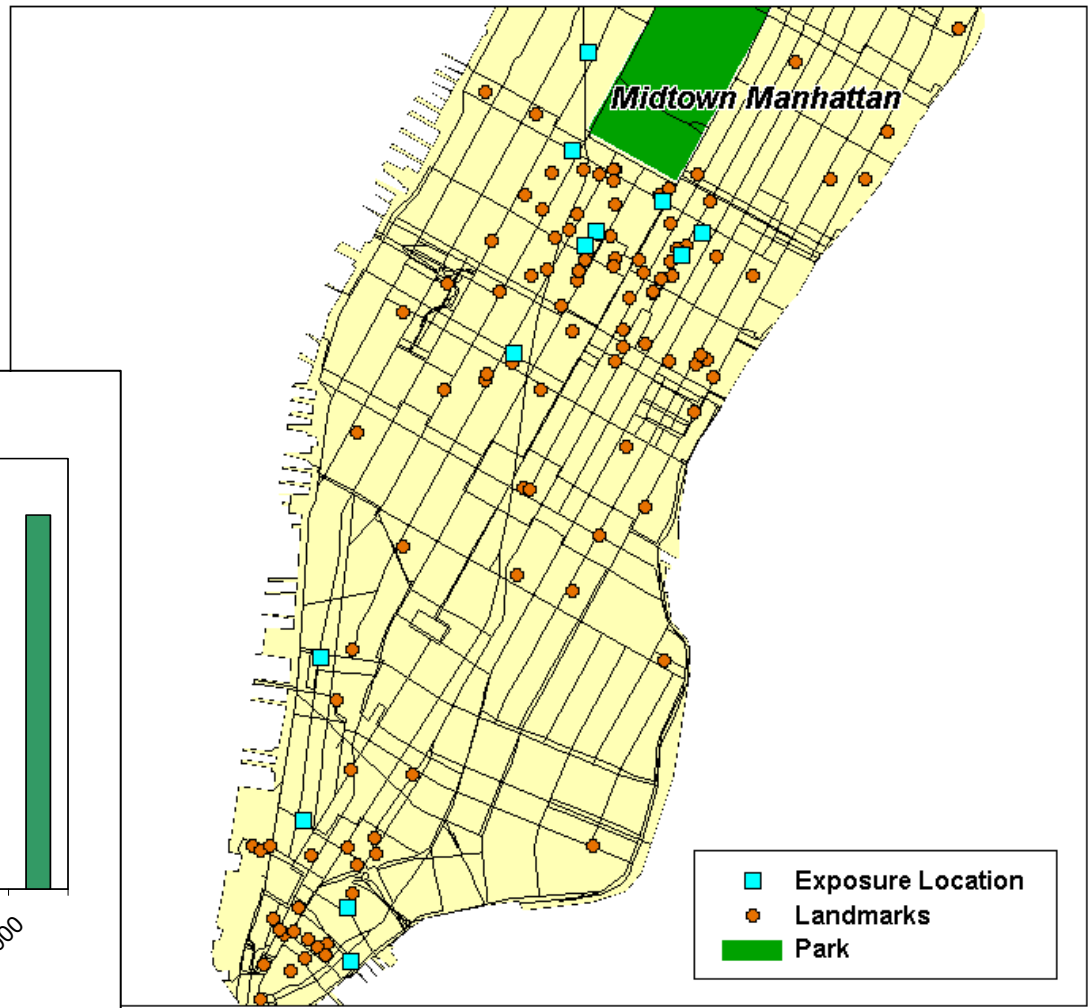
- 12 killed
- 5,122 injured
- 984 severe to moderate poisoning

- Types of injuries
  - Miosis
  - Headache
  - Dyspnea
  - Nausea
  - Ocular pain
  - Blurred vision
  - Vomiting
  - Coughing
  - Muscle weakness
  - Cardiac arrest
  - Respiratory arrest
  - Post-traumatic stress disorder

Source: Intensive Care Medicine. 1995: 21:1032-1035.

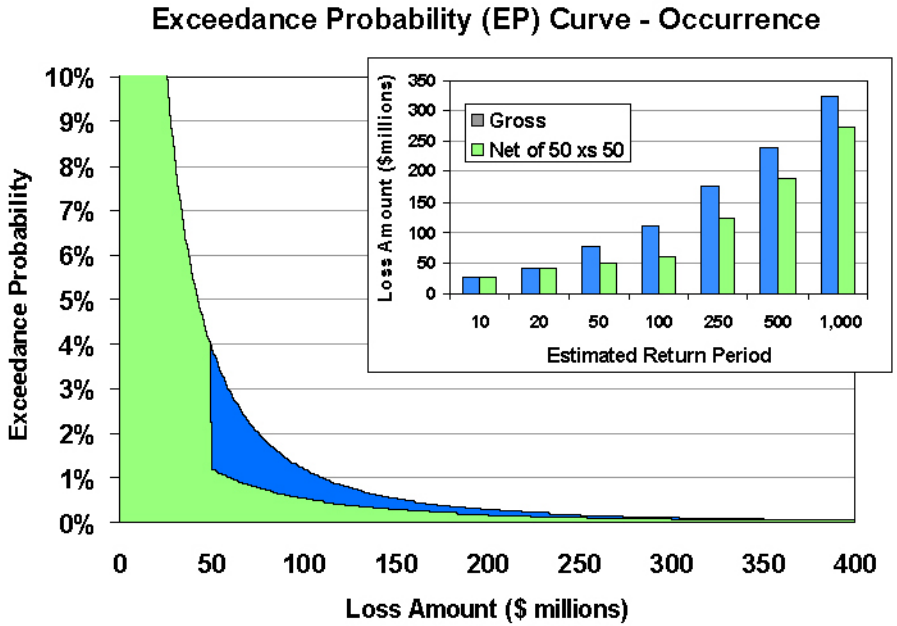
Probabilistic Portfolio Analysis





Results of the Catastrophe Models

- Event by event loss information
- Probability distribution of losses (EP curves)
- Annual aggregate losses
- Annual occurrence losses
- Industry and company specific
- Direct, ceded and net retained
- Loss costs
- Large losses, historic losses
- Number of injuries by severity level
- Structural flexibility
  - Location, policy, zone, territory, portfolio levels
  - Foreign vs. domestic sources, conventional vs. CBRN attacks



Evolution of Catastrophe Modeling

- Originally, models were used to help insurers and reinsurers assess the price and structure of reinsurance contracts
- Today, models are integrated into companies operations and form the basis of sound risk management practices
  - Assess companies' risk profile
  - Ensure companies collect adequate premium
  - Manage exposures
  - Evaluate underwriting guidelines
  - Assess the feasibility and credits of mitigation strategies
  - Price various risk transfer strategies
  - Analyze the risk in securitizations of insurance risk
  - Assess aggregate exposure in mergers and acquisitions
  - Manage the correlation within portfolios of reinsurance contracts
  - Relied on by rating agencies and investors
  - Input to underwriting and enterprise risk management models

Summary

- Catastrophe models have been successfully extended to life and personal accident insurance
- Ongoing improvement in the level of detailed data being collected to deal with accumulation exposures throughout the insurance industry
- Data augmentation methods are available to supplement incomplete data
- Companies are managing their catastrophe risk by monitoring concentrations of exposure and performing deterministic and fully probabilistic analyses