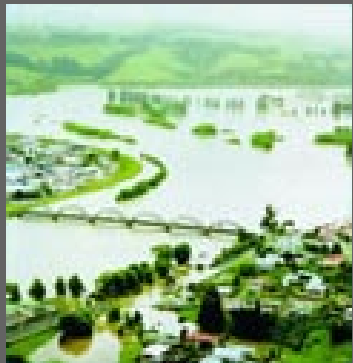


# The Regional Risk-Scape Model



Andrew King **GNS Science**

Rob Bell **NIWA** & 25+ collaborating colleagues





**Napier 1931 During**



**Tarawera 1886**

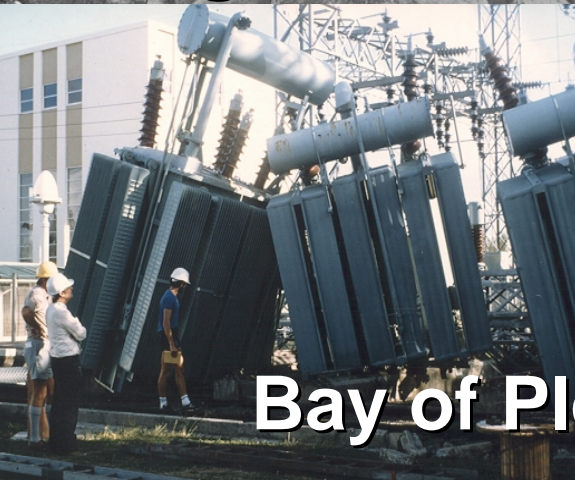


**Tangiwai 1953**

**We don't have earthquakes, do we....?**



**Napier 1931 Before**



**Bay of Plenty 1987**



**Napier 1931 After**

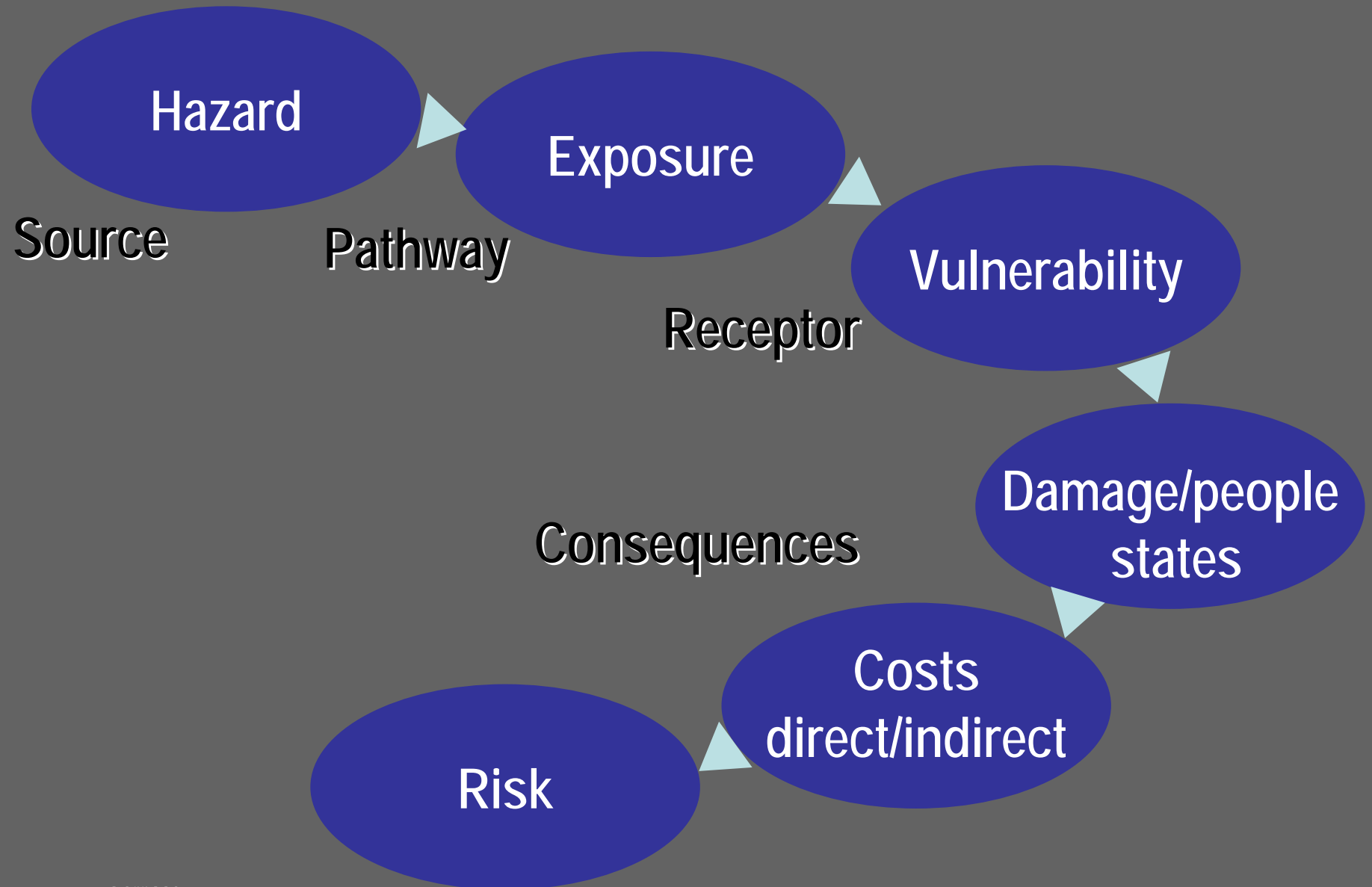
## Aim & Uses: RiskScape Model

- Aim— To develop a toolbox that **quantifies** regional risks from **different** natural hazards in a single package
- Primary users— Civil Defence Emergency Management (CDEM) groups, insurance sector, Engineering Lifelines (power, water, roads, sewerage etc), planners
- Benefits— will enable groups to **analyse** and **compare** natural-hazard risks to underpin decision-making on **risk treatment** e.g. 1) prioritise investment on hazard mitigation; 2) emergency-management response & recovery; . . .

# Consultation & Concepts

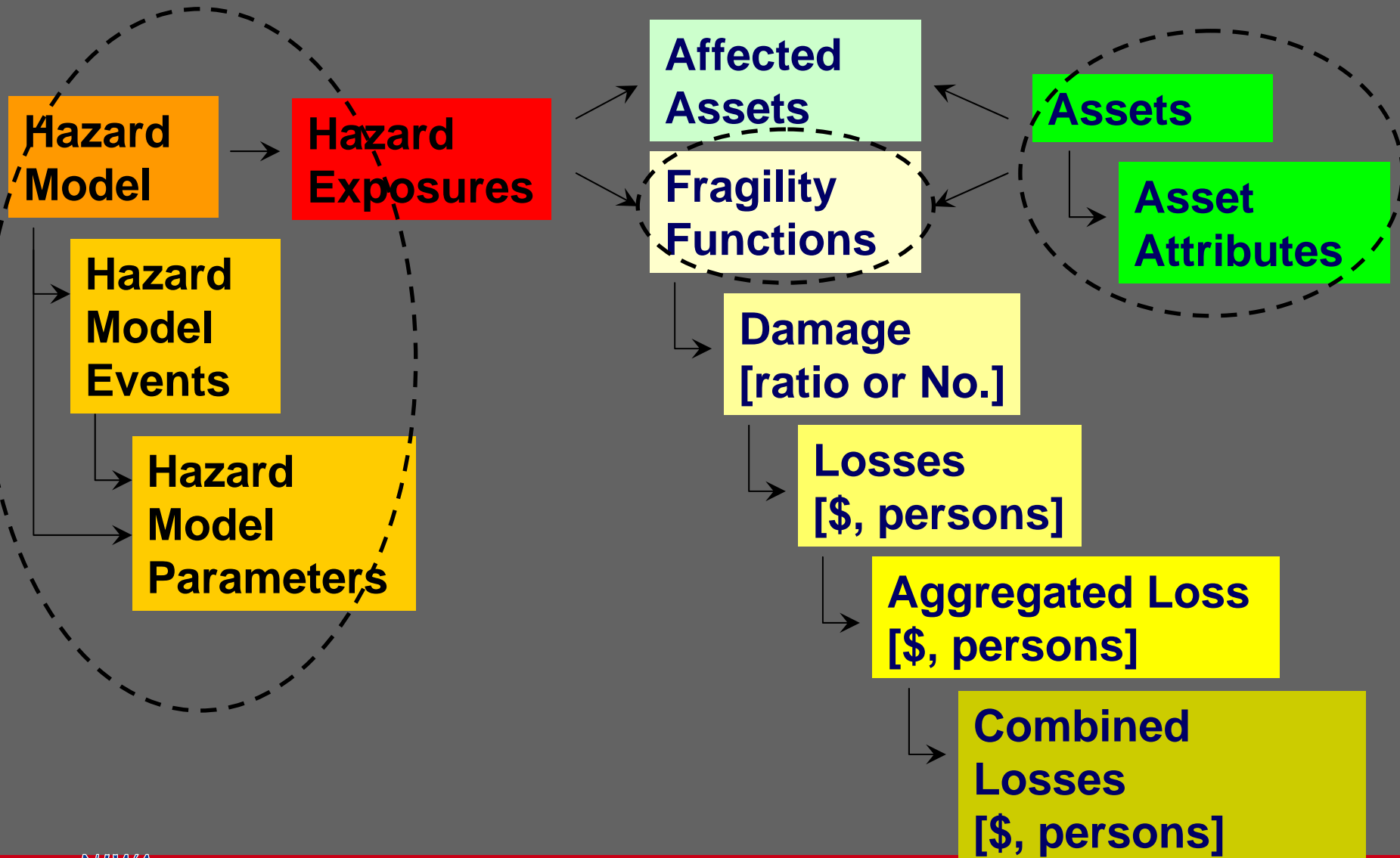
- **Consultation & implementation**
  - Meet end-user groups to establish needs/expectations
  - Collaborative partnerships with local councils for prototype project with 3 scales of population:
    - 3,000
    - 30,000
    - 300,000
  - Wider consultation now prototype is developed
- **Design of system & platform**
  - GIS?, Java/relational database executable

# Hazard → Risk





# RiskScape Tool – Fundamental Concepts



# Hazard exposure modules

- Hazard exposures for the pilot project
  - Earthquake (ground shaking, liquefaction, landslides)
  - River floods (not urban stormwater floods)
  - Storms (wind only)
  - Volcano (ash fall only)
  - Tsunami
- Hazard exposures computed by hazard models for region or locality
- Probabilistic AND scenario-based for a given recurrence intervals (synthetic or historic events)

# RiskScape common user interface

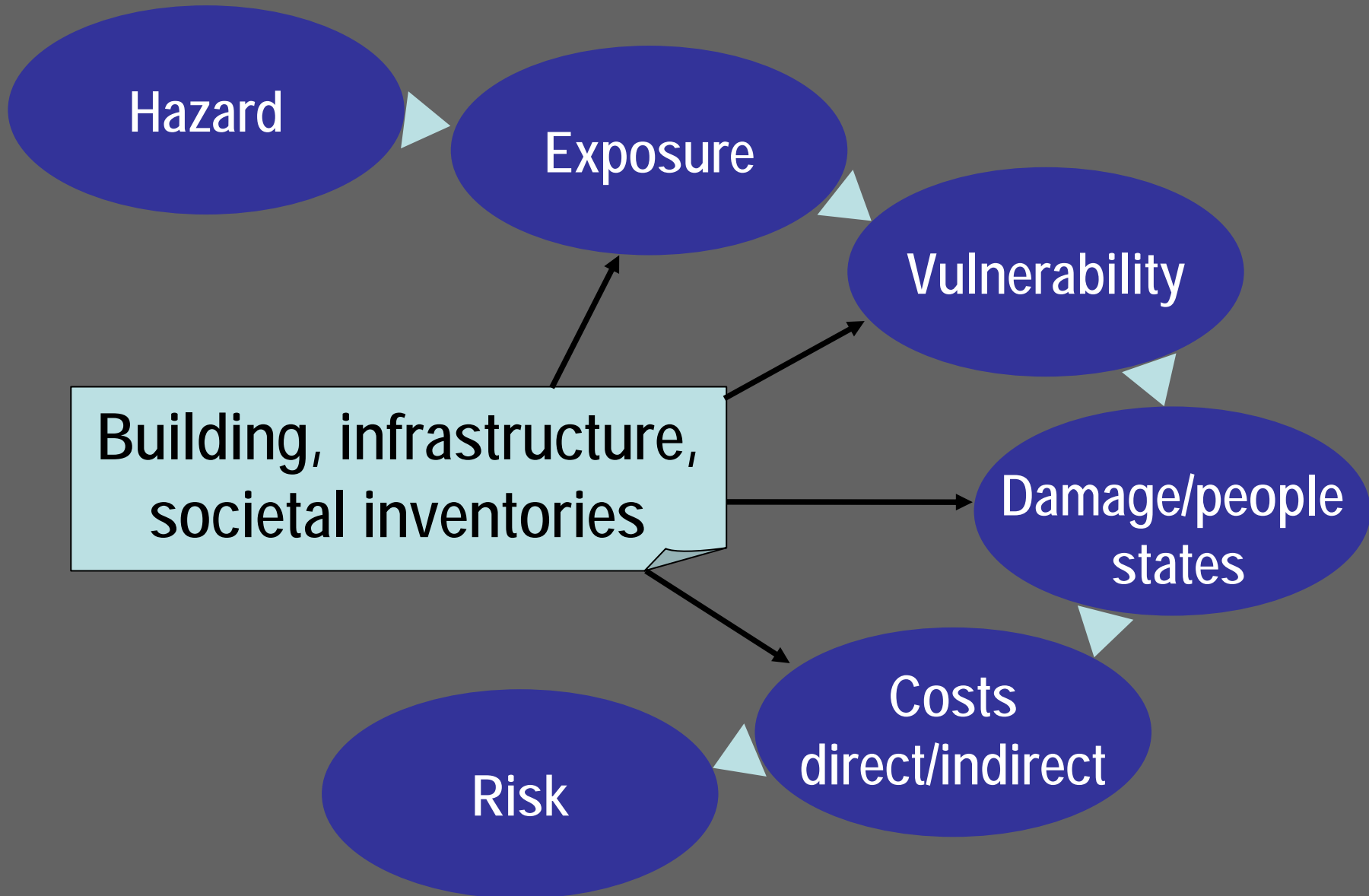
The screenshot displays the RiskScape software interface. At the top, there is a menu bar with 'File', 'View', and 'Help'. The main window is divided into several sections:

- Map View:** A central map of New Zealand showing the North Island, South Island, and Chatham Islands. The map is overlaid with a grid.
- Hazard Selection:** On the left side of the map, there is a list of hazard types with radio buttons:
  - Earthquake (1)
  - Inundation-River Flood (3)
  - Inundation-Tsunami (2)
  - Storm (3)
  - Volcano (1)
- Navigation Tools:** On the right side of the map, there are two sets of navigation icons. The top set includes zoom in, zoom out, home, pan, and refresh. The bottom set includes zoom in, zoom out, pan, and a selection tool.
- Task List:** At the bottom left, there is a vertical list of tasks with dropdown arrows:
  1. Choose hazard
  2. Choose hazard model
  3. Define model parameters
  4. Select assets
  5. Select fragility function
  6. Select fragility parameters
  7. Select aggregation type
- Data Tables:** At the bottom right, there are three empty tables with headers: 'Hazard exposures', 'Asset attributes & exposures', and 'Damages'.
- Status Bar:** At the bottom center, it displays 'Grid coordinates: 3301000,5915950'.

The Windows taskbar at the bottom shows the Start button, several application icons, and the system tray with the time '8:02 p.m.' and the date 'Andrew King - I...'. The RiskScape application is running in multiple windows.



# Hazard > Receptors > Fragility



# Regional inventories & databases

- **Physiographic**
  - Topography
  - Bathymetry
  - Geology
- **Human Environment**
  - Residents
  - Age profile
  - Seasonal/diurnal variations
  - Socio-economic
  - Cultural
- **Business sectors**
  - Farming & Horticulture
  - Forestry
  - Tourism
  - Transport etc
- **Built Environment**
  - Essential facilities: Medical/Fire/Police/TA/CDEM
  - Buildings: Residential/Commercial/ Industrial
  - Utilities: gas/power/tel-com/water/sewerage)
  - Transport: road/rail/air/sea
  - Natural hazard defences
- **Natural environment**
  - Land-use inventory
  - Soils

## Asset surveys & sub-sampling



**New Zealand has NO consistently collated database on building & infrastructure attributes, so developed field sampling techniques**

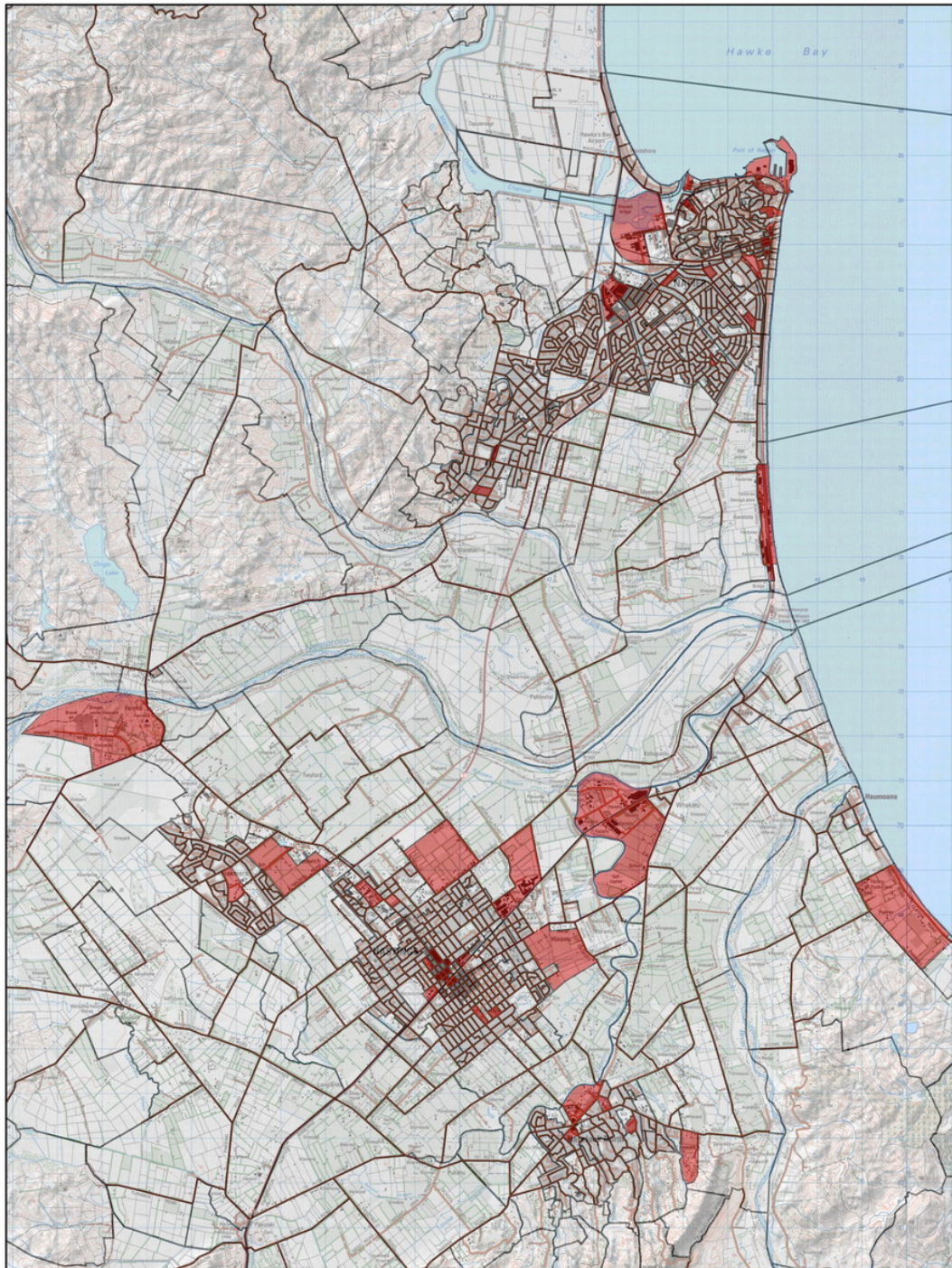




**Westport example:  
our friendly staff  
out surveying  
building attributes**

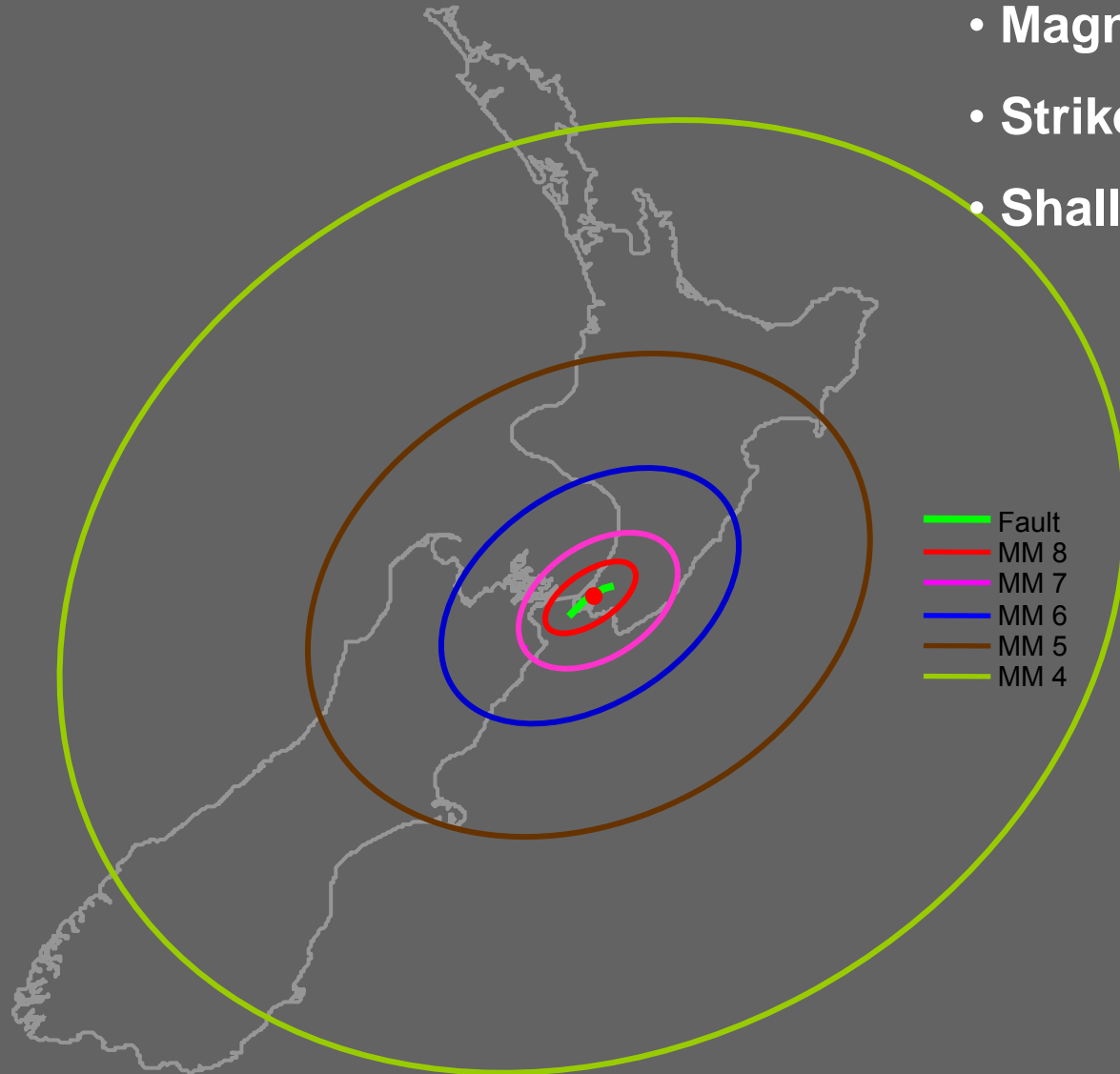


# Inventory Sampling

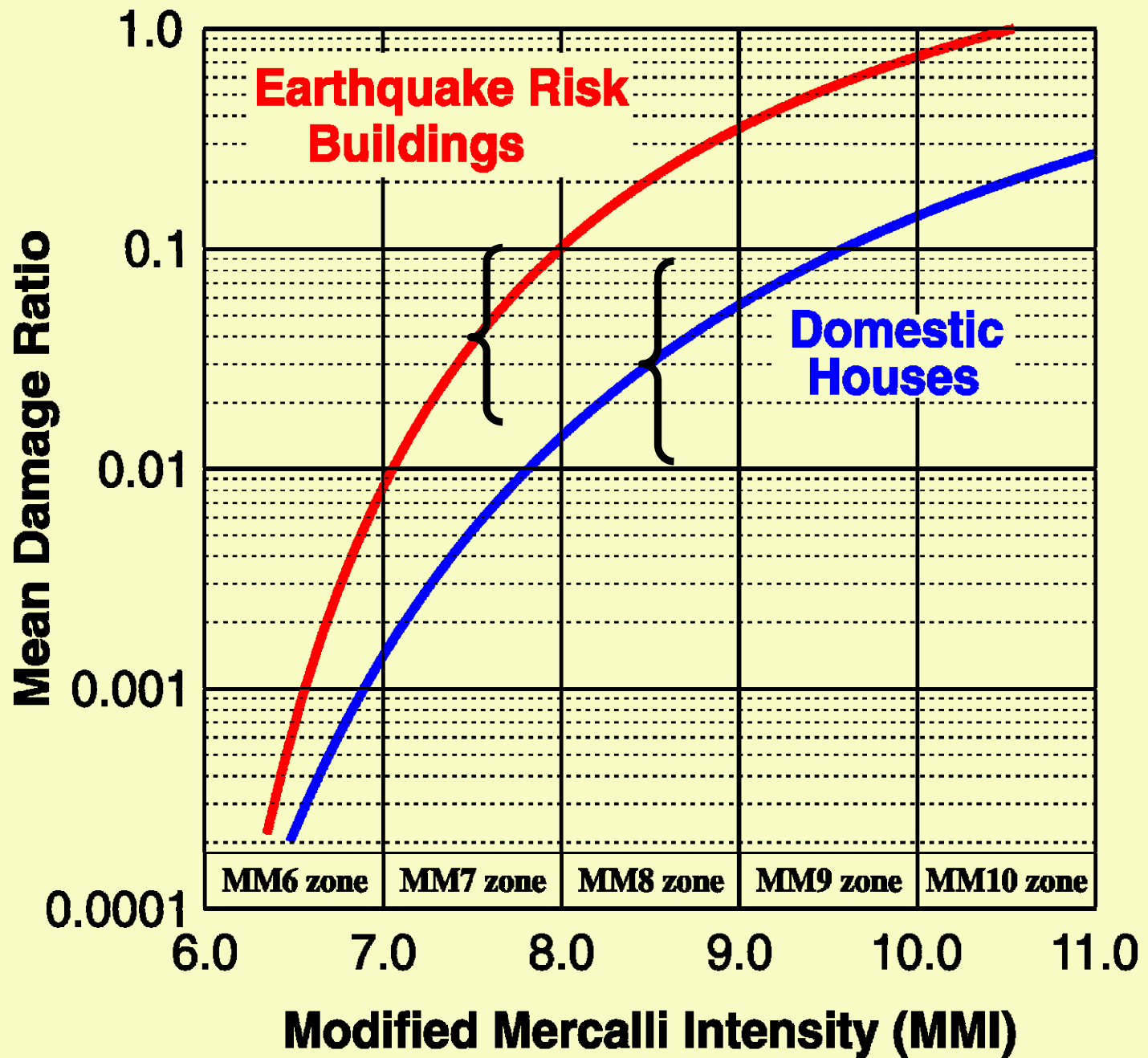


# Earthquake scenario example

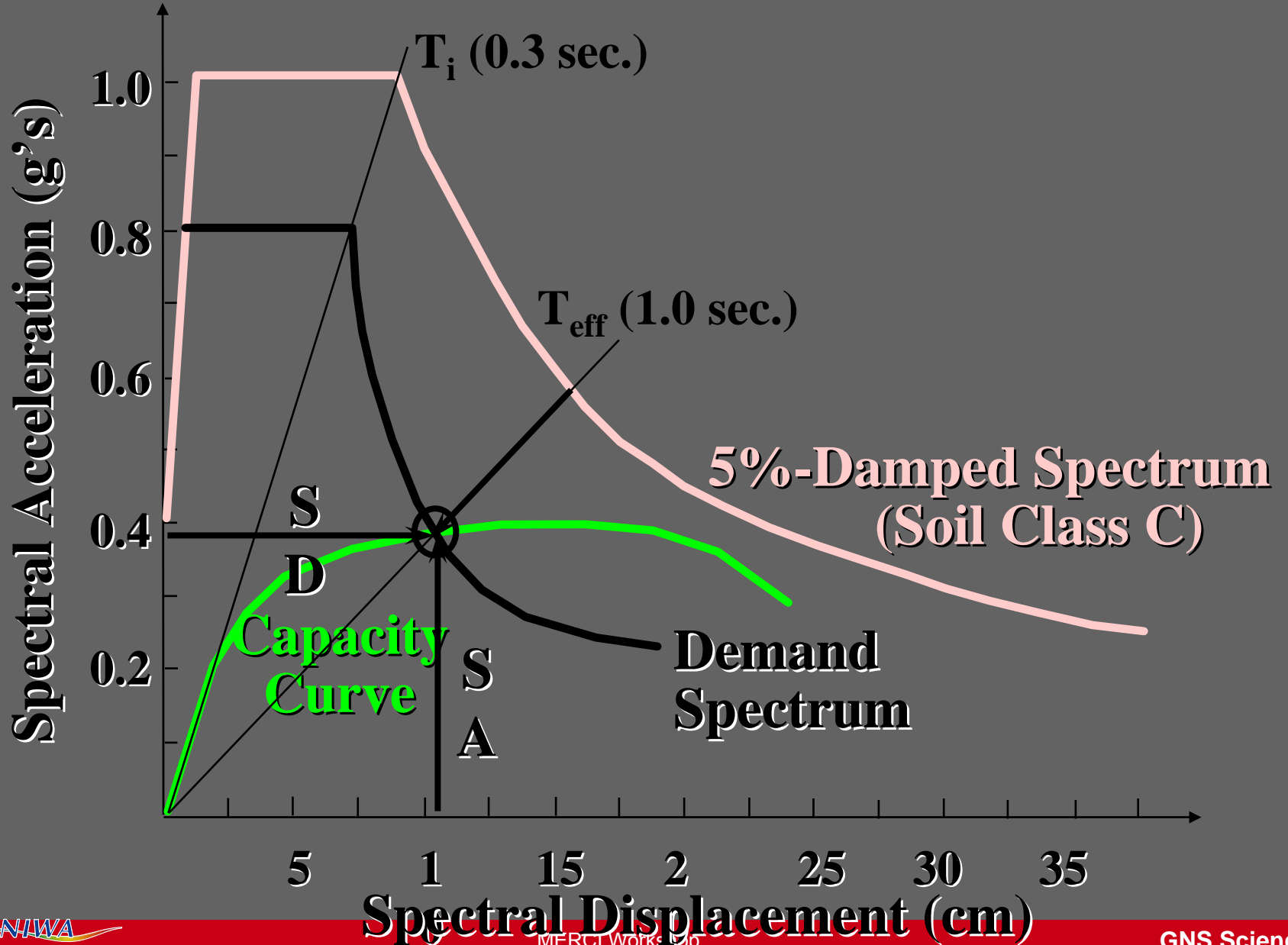
- Magnitude 7.5
- Strike-slip
- Shallow depth



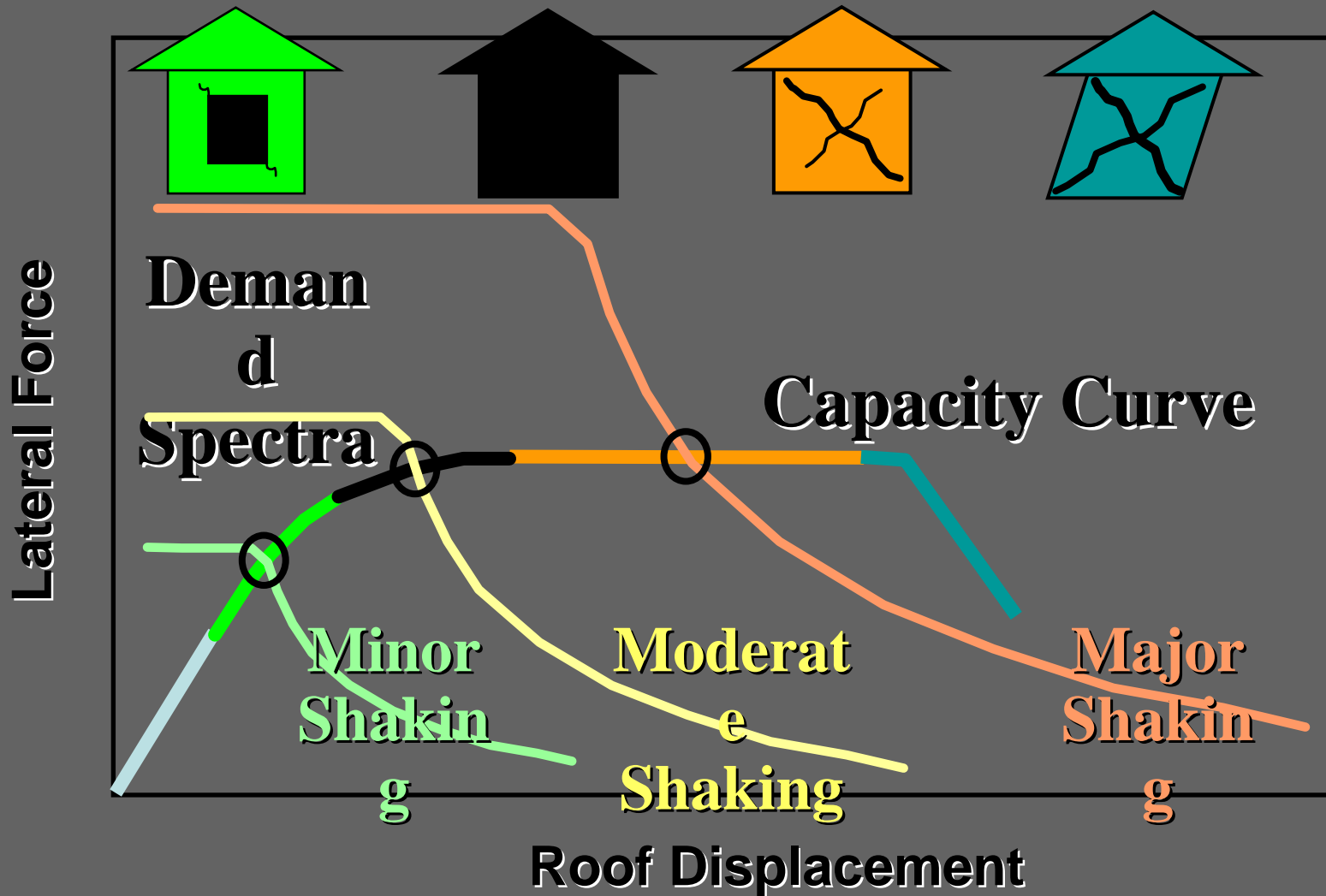




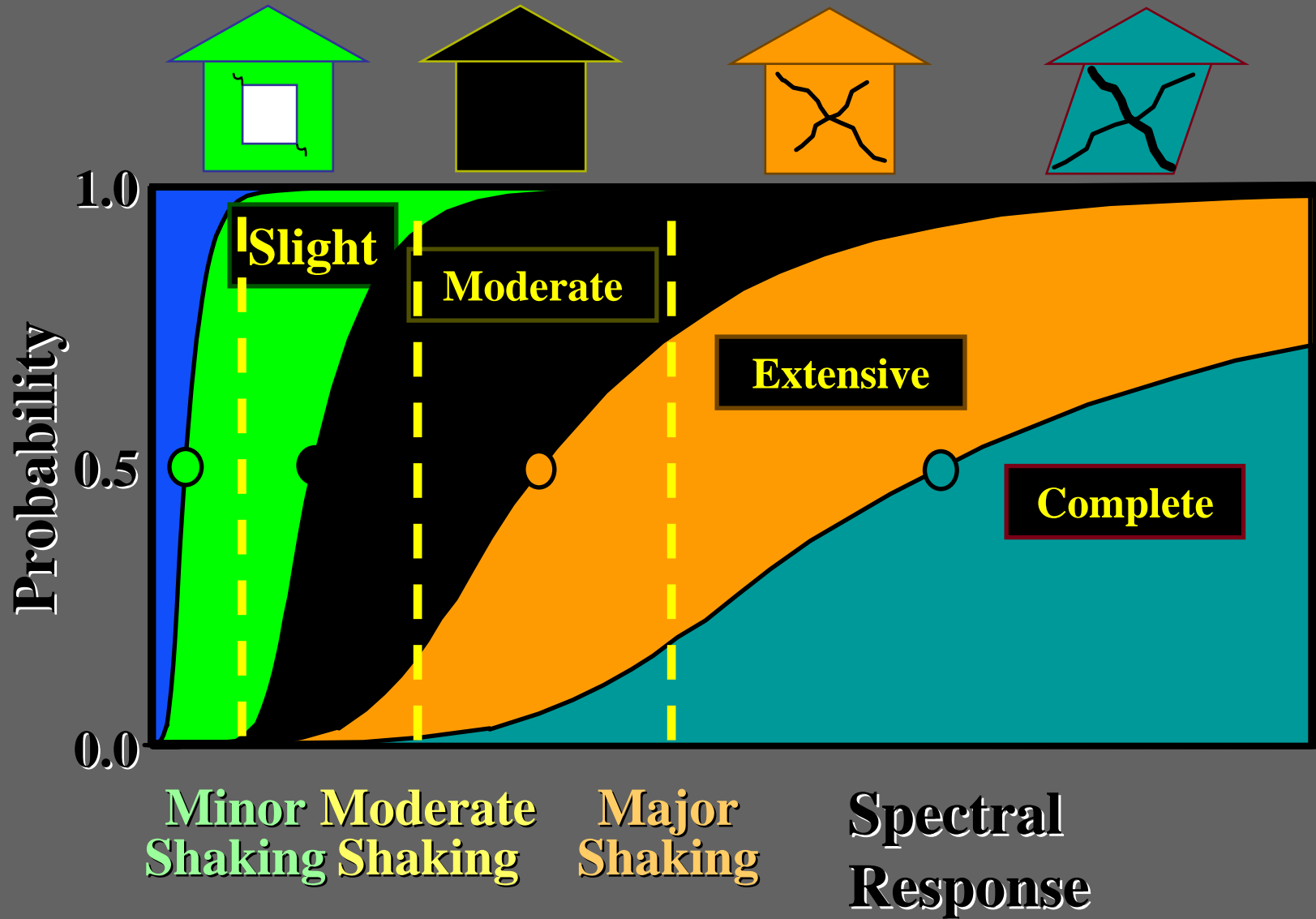
# Example Calculation of Building Response Soil Class C



# Schematic Building Response



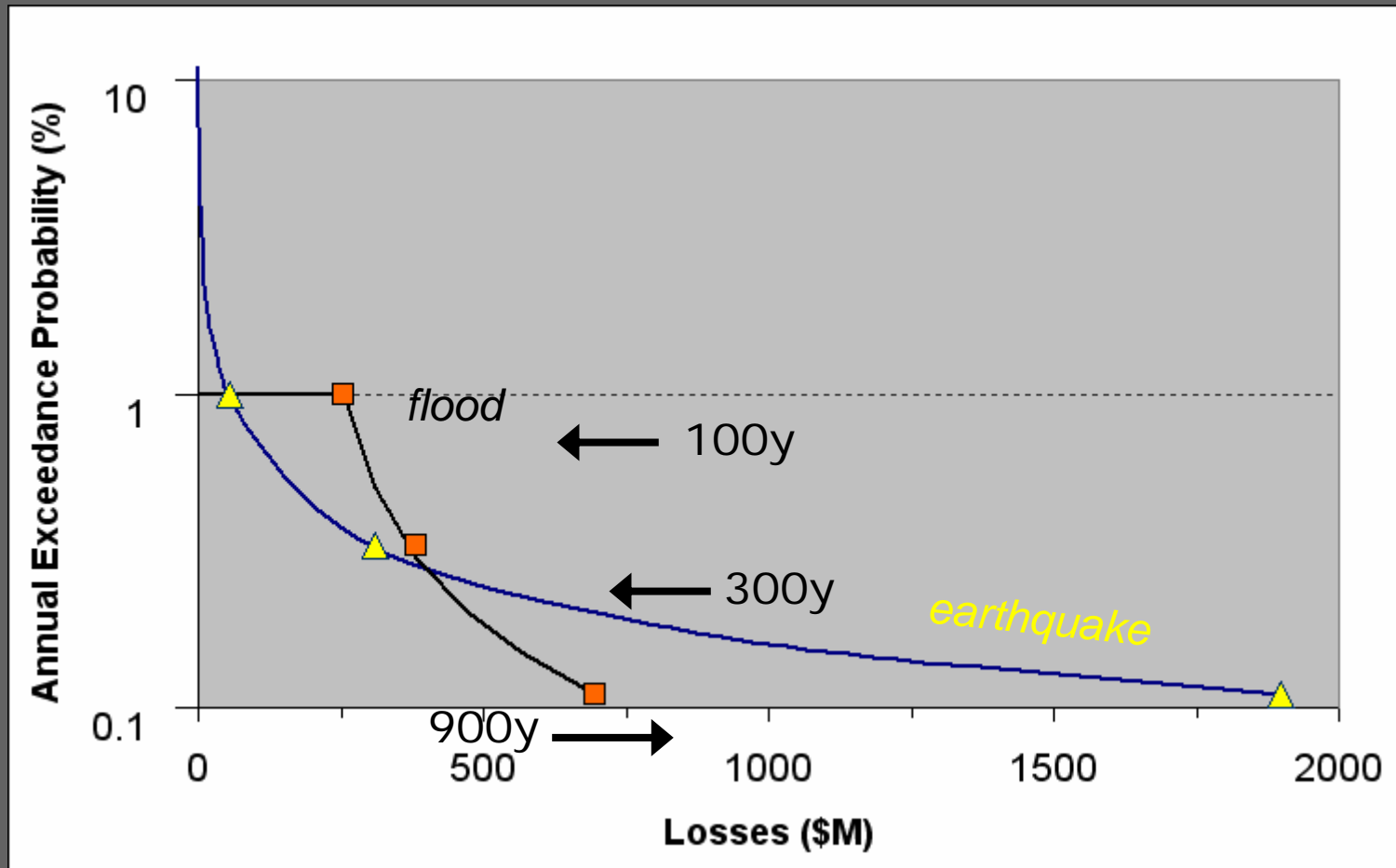
# Fragility Curves



## Presenting comparable direct losses

### Flood vs Earthquakes (example only)

e.g. could report 1%, 0.33%, 0.11% AEP



# Issues: RiskScape approach

- Variable accuracy of modelling hazard exposure, esp. topographic-driven (flood, tsunami, wind, landslide)
- Adequacy of assets & demographics datasets for vulnerability assessments + maintenance
- Consequences for life, injuries and other intangibles (direct or indirect) esp. with mobile population & warning times
- Relevant geographical focus e.g. spatial scales
- Development & emergency-aid sectors have different requirements for communicating risk & uncertainty e.g. timeliness



# Future Development Possibilities (1)

- Induced Damage Module
  - Fire following
  - Hazardous Substance release
  - Debris generation (e.g. logs in rivers, flying materials during storms, tsunami debris)
- Indirect Losses Module
  - Supply shortages
  - Sales decline
  - Regional/National economic losses
  - Employment
  - Tourism

## Future Development Possibilities (2)

- Other hazard exposure modules e.g.
  - Landslides
  - Drought
  - Wild fire
  - Coastal erosion
  - Coastal storm inundation & climate-change
  - Hail & Snow
  - Maritime hazards (e.g. ports)
  - Terrorism

# Potential End-user Groups & Sectors

- Central Govt
- Regional Councils & TAs
- CDEM Groups
- Insurance & EQC sector
- Real estate sector (individuals, real estate companies)
- Māori communities & economy
- Emergency management operations (MCDEM, Police, Fire, Ambulance)
- Lifelines & Utilities
- Building sector (BIA, planning, codes, BRANZ)
- Engineering consultancies
- Agricultural/Horticultural sector (e.g., Fed. Farmers, Producer groups)
- Transport sector (e.g. maritime, aviation, road, rail)
- Science/research sector