

Structural & Non Structural Mitigation



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Risk Reduction Strategies

- **Disaster risk reduction requires a combination of structural and non-structural measures**
- **Structural measures (examples):**
 - Improve construction practice
 - Retrofit critical structures and lifelines
- **Non-structural measures (examples):**
 - Improve response capacity
 - Improve post-disaster assessment and communication capacity
 - Communicate risk and mitigation measures to various stakeholders

Construction Practice

Engineered Constructions

- ✱ Designed and constructed with the assistance of qualified engineers
- ✱ Design to comply with relevant BIS codes

Non-Engineered Constructions

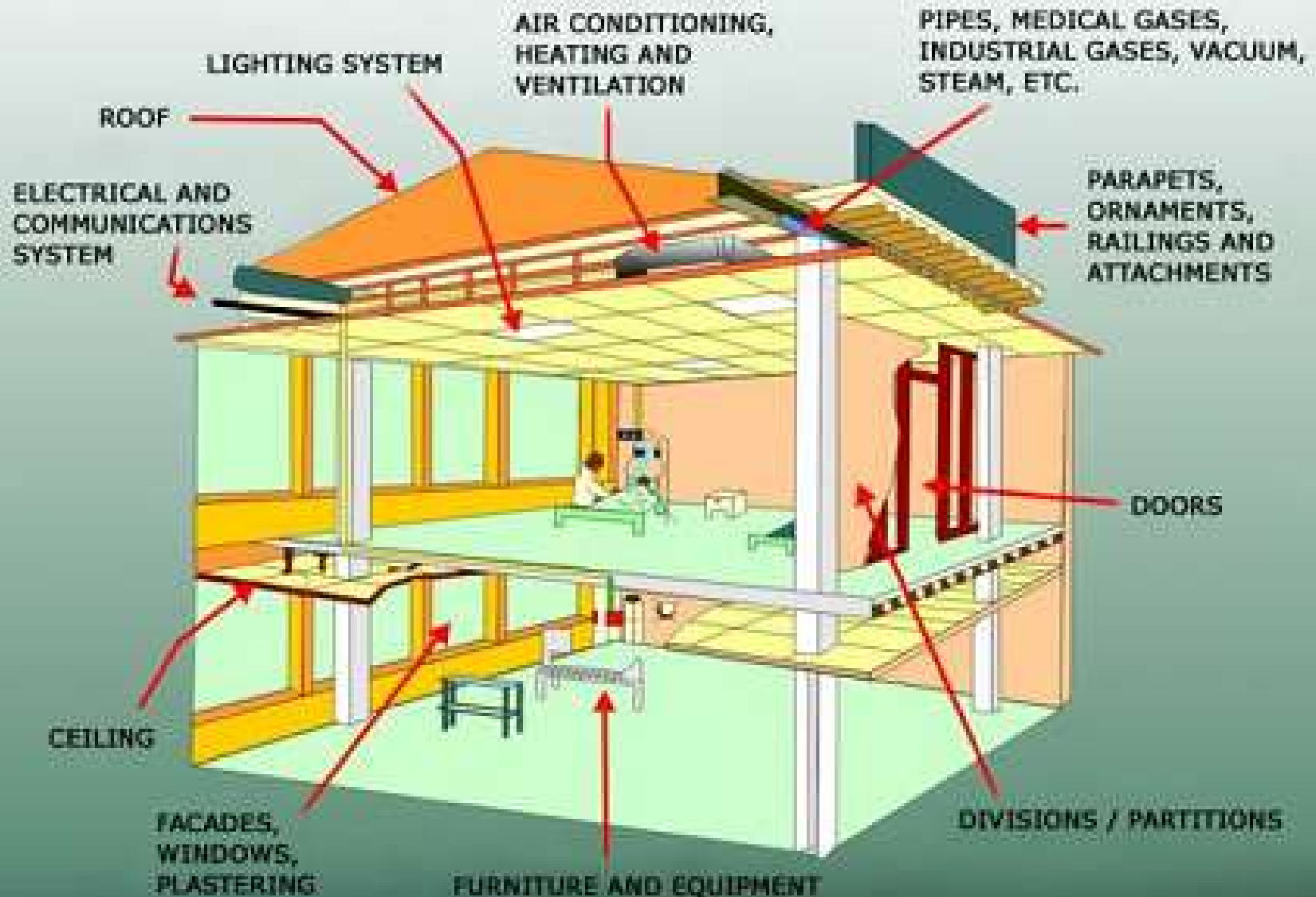
- ✱ Constructed without the assistance of qualified engineers
- ✱ Most constructions use light-weight roofs
- ✱ Poor seismic resistance expected

What is non - structure

**The parts of a building that carry its weight are the structure.
Everything else is non- structural.**



Non-structural Elements



- NSM is a new subject regarding earthquake preparedness and we learn new things every day.
- In order for NSM to be successful, everyone must be educated and part of the process.
- NSM needs to become part of our lives.

- Non- Structural Hazards are serious !
- 50% of the injuries and 3% of the deaths in the 1999
- Turkey earthquake damages were caused solely by non-structural hazards !

Non Structural Elements

Architectural Elements

- **False Ceiling**
- **Windows and partition walls**
- **Parapets and cornices**
- **Stairways**
- **Water tanks**

Electrical Systems

- **Transformers**
- **Lighting**
- **Emergency power**

Non Structural Elements

Furnishing and Equipment

- **Computers**
- **File cabinets**
- **Shelving**
- **Display cabinets**
- **Shop equipment**
- **Lab equipment**
- **Kitchen appliances**

Hazardous Materials

- **Natural gas**
- **Chemicals**
- **Asbestos, lead**

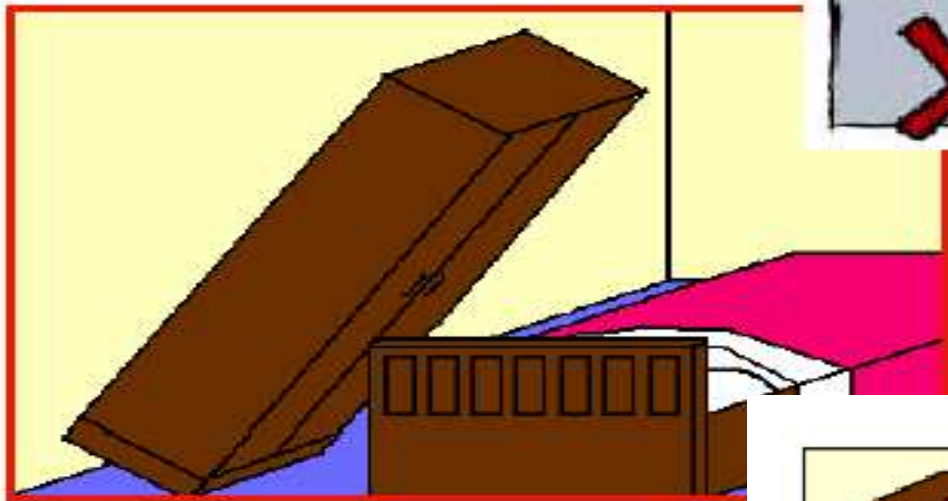
- After an earthquake, people may need to quickly, but calmly exit buildings.



Osmaniye, Turkey









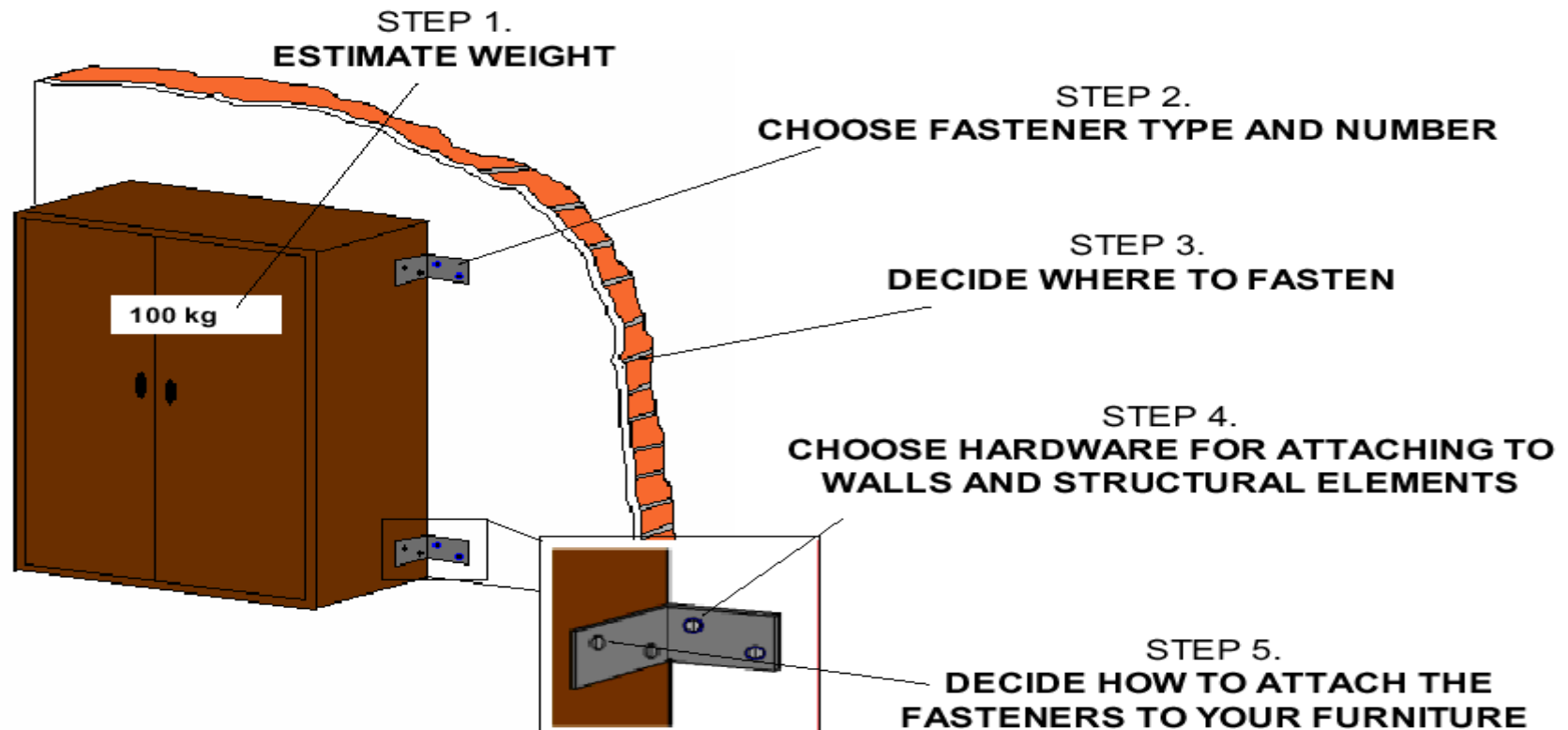


Would you stand a chance if you run out while these are raining down?!



Example of NSM

5 Important Steps



Delhi Context

Retrofitting of Life line buildings

- **School (other agencies as well)**
- **Hospital**
- **Delhi Police**
- **Secretariat**
- **Divisional Commissioners Office**

Structural and Non-Structural Measures School at Ludlow Castle

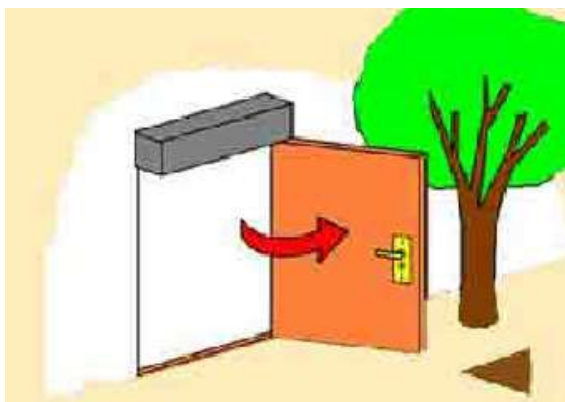
- **Non Structural Mitigation Measures**
- **Small measures to reduce damage like**
 - **Fixing of furniture – almirah etc.**
 - **Replacing wall clock**





- **Opening of doors outside**
- **Arranging additional exit in rooms**
- **Plastering glass windows**
- **Proper care for chemistry lab**
- **Drills**

Total cost in thousands



Structural Mitigation Measures

- **Rebuilding the structure and retrofitting**
- **Retrofitting cost is Rs. 62 lakhs for Ludlow Castle School while rebuilding cost would be Rs. 7 Crore for**

VULNERABILITY REDUCTION

- Engineering intervention in buildings and structures
- Restrictions on land-use to minimise exposure of the society to disaster
- *Land use restrictions*, in the town and country planning laws or master plan rules.
- *Earthquake resistance provisions in Municipal bye-laws :*
Standards are not mandatory and do not form part of the bye-laws of the Local Bodies.
- Past earthquakes in Uttarkashi (1991), Latur-Osmanabad (1993), Jabalpur (1997) Chamoli (1999), Kachchh (2001) and Kashmir (2005) have clearly shown lack of implementation of these Codes and Guidelines.

Summing up

- Carry out the engineering, architecture and planning measures
 - Land use zoning.
 - Planning of habitat,
 - Implementation of building codes in all new constructions
 - seismic retrofitting of existing buildings & infrastructure.
- Create the supportive structure of
 - public awareness,
 - education and training
 - research and development
- Appropriate policy, financial and institutional support at national and state levels need to be provided for putting this strategy into a workable action plan.

Thank you

The text 'Thank you' is rendered in a bold, sans-serif font. Each letter is filled with a different color from a rainbow spectrum, starting with magenta for 'T', followed by red, orange, yellow, green, blue, and purple for 'you'. The text has a slight 3D effect, with a soft, grey shadow cast to the left and slightly forward, giving it a sense of depth against the plain white background.