STRUCTURAL & NON STRUCTURAL MEASURES
DISASTER RISK REDUCTION (DRR)

▪ Conceptual framework of elements considered with the possibilities to minimize vulnerabilities and disaster risks throughout society, to avoid (prevention) or to limit (mitigation and preparedness) the adverse impacts of hazards, within the broad context of sustainable development

▪ A systematic process of using administrative decisions, organization, operational skills and capacities to implement policies, strategies and coping capacities of the society and communities to lessen the impact disasters

▪ This comprises all forms of activities, including structural and non-structural of natural hazards and related environmental and technological structural measures to avoid (prevention) or to limit (mitigation) adverse effects of hazards
MITIGATION

- Disaster mitigation measures are those that eliminate or reduce the impacts and risks of hazards through proactive measures taken before an emergency or disaster occurs.

- The theory behind disaster mitigation is a simple one: by making an investment of time, money and planning prior to the occurrence of natural disasters, there can be tremendous savings that result from reducing the impact of natural disasters when they inevitably occur.
WHY MITIGATION IS NEEDED?

- Habitation of threatened areas has increased.
- Even smaller storms can cause large damage.
- Engineering studies have consistently shown that inexpensive measures can have a large effect on damage reduction (Cost Benefit Analysis)
TYPES OF MITIGATION

- Disaster mitigation measures may be structural (e.g. flood dikes) or non-structural (e.g. land use zoning)
- Mitigation activities should incorporate the measurement and assessment of the evolving risk environment. Activities may include the creation of comprehensive, pro-active tools that help decide where to focus funding and efforts in risk reduction.
- Hazard mapping
- Adoption and enforcement of land use and zoning practices
- Implementing and enforcing building codes
- Flood plain mapping
- Reinforced tornado safe rooms
- Raising of homes in flood-prone areas
- Disaster mitigation public awareness programs
- Insurance programs
STRUCTURAL MEASURES FOR CYCLONE
STRUCTURAL MEASURES FOR CYCLONE

- Engineering measures such as cyclone shelter is one of the key cyclone mitigation measure adapted.

- For effective employment and management of cyclone shelters, multipurpose versions have been built in carefully selected locations, identifying uses for both normal and disaster periods.

- Cyclone shelters demonstrate an excellent dual purpose use during non-disaster periods and cyclones.
DROUGHT RISK REDUCTION MEASURES (STRUCTURAL)
DROUGHT RISK REDUCTION MEASURES

▪ Deep tube wells in the region to increase agricultural productivity.

▪ Irrigation is necessary for many types of crops, especially for boro rice cultivation.

▪ There is a significant development of irrigation systems nowadays in compared to 1980s.
EARTHQUAKE RISK REDUCTION MEASURES (NON-STRUCTURAL)
EARTHQUAKE RISK REDUCTION MEASURES

- Adequate sustainable land use planning with seismic microzoning mapping.

- The link between land use master planning for earthquake protection and other urban planning protection measures and the control of building quality are so interrelated.

- Very high resolution satellites are being used for the detection of tectonic movement of the earth and earth’s fault zones.

- Further to that, seismic vulnerability maps of the buildings and earthquake prevention plan for urban areas are some other useful measures for earthquake prevention.
FLOOD RISK REDUCTION MEASURES (STRUCTURAL)
FLOOD RISK REDUCTION MEASURES (STRUCTURAL)

- Structural measure refers to those disasters management or mitigation tools which have physical entity such as embankment, flood or cyclone shelter, dam etc.

- Structural measures aim at protecting an area up to certain level of flooding. It can be divided into five categories:
  - Storage reservoir or basins to restrict overflow.
  - Retarding basins to lower the flow of flooding
  - Levees and floodwalls to confine floodwaters
  - Improvement of channel capacity
  - Some structural measures such as Flood Embankment, Channel Improvement, River Training, Coastal Embankment etc. to combat the flood sufferings.
FLOOD RISK REDUCTION MEASURES (STRUCTURAL)

- There are some options of structural measures-
  - Dams and Reservoirs for impounding excess runoff.
  - Detention basin, Retention Pond to lower the level of flooding downstream. (Not feasible due to topographical limitation.)
  - Embankment, Dyke, Polder, Levee, Bund, or Flood wall to block the movement of water from rivers to floodplain. (most preferred option)
  - Improvement of Conveyance Capacity (planned but not done due to cost element)
  - Flood bypass, flood diversion (not feasible)
  - Watershed Management and afforestation (not practiced.)
FLOOD RISK REDUCTION MEASURES (STRUCTURAL)

- In India
  - Flood Embankment,
  - Channel Improvement,
  - River Training,
  - Coastal Embankment etc. to combat the flood sufferings.

- Among these structural measures, construction of embankment is most popular and very old practice. This is also a very cheap method compared to other structural measures.
FLOOD RISK REDUCTION MEASURES (STRUCTURAL)

- Since 1960s, India government is involved in large scale flood control projects and by 1993 over 8,000km of embankments and other structures had been built at a cost of over US$5bilion.

- Loop embankments have been built to protect major urban centres and coastal agricultural land while submersible embankments have been constructed for crop production and protection against flash floods in certain areas.
FLOOD RISK REDUCTION MEASURES (STRUCTURAL)

▪ Impacts of Structural measures
  ▪ With the experience over the last few decades, it was observed that the structural measures do not usually bring only blessings. They also have adverse effect.
  ▪ The adverse effects always do not appear shortly after their construction but become apparent with the elapse of time.
FLOOD RISK REDUCTION MEASURES (NON-STRUCTURAL)
FLOOD RISK REDUCTION MEASURES (NON-STRUCTURAL)

- **Non-Structural Measure** to reduce loss or damage by administrative measures. It does not control or affect the process of inundation.
  - Flood Plain Zoning & Management;
  - Policies for infrastructure Planning and Development in the flood plains;
  - Flood Proofing;
  - Disaster Preparedness & Response Planning and
  - Flood Forecasting and Warning.
  - Flood fighting,
  - Evacuation and shelter management,
  - Flood insurance
FLOOD RISK REDUCTION MEASURES (NON-STRUCTURAL)

- **Non-Structural Measure**
  - Raised community areas with basic human needs.
  - Home placed at higher elevations and built with flood resistant materials.
  - Flood resistant infrastructure to continue critical services during floods.
  - Floodplain zoning
  - Changes in cropping pattern
  - Training and Public Awareness
  - Institutional Arrangements
  - Flood Warning System
  - Local Disaster Action Plans

- Flood forecasting and warning were later incorporated as it was felt that structural measures alone could not mitigate flood problems.
FLOOD RISK REDUCTION MEASURES (NON-STRUCTURAL)

▪ Non-structural mitigation measures undertaken focus on preparedness and possibilities for action to reduce risks and losses and better coordination mechanisms between all actors involved (GO, NGO and community people at grass-root level) during all phases of any disaster.

▪ Due to increased population pressure it is a typical scenario in India that the human habitat is extending more and more towards flood plains, which are vulnerable to recurrent flood.

▪ Moreover, more lands of the flood plains are being occupied and converted to habitat and agricultural lands, which were mostly, back swamp. Flood plains are generally regarded as the extended portion of the main river channel.
FLOOD RISK REDUCTION MEASURES (NON-STRUCTURAL)

- **Flood plain zoning and management** is the effective means of regulating habitat construction and agricultural use with minimum interference to the natural condition prevailing in the flood plains.

- Due to a swell in population in the flood plains, the governments are bound to undertake more and more development projects in the flood plains.

- Policy formulation should be on the basis of scientific study and research
FLOOD RISK REDUCTION MEASURES (NON-STRUCTURAL)

- **Flood proofing** is a measure, which has been found to have less adverse effects. In most of the flood prone areas in India, the people used to flood proofing technique in such a way that people build their houses on the built-up earthen mounds. This is being in practice for centuries. **Community participation and awareness** are very important in the flood proofing measures.

- Many of the damages of the floods can be reduced to a great extent through a proper **Disaster Preparedness and Response Planning**. For the Disaster Preparedness regarding the flood, the most important tool is the **Flood Forecasting and Warning System**. With the current advancement in the information technology and hydrological and hydraulic sciences, it is possible to provide most accurate advance warning.

- In this regard assessment of response of the people to the **flood warning** is very important element in **response planning**. Disaster Preparedness program cannot be made successful without proper response planning.