Disaster Communication System (Early Warning and Its Dissemination) & Land use planning and development regulations

What is Disaster Communication System ?

A Disaster Communication System (DCS) is a set of technical solutions that provides responders and the public the ability to communicate in extreme situations.

A Disaster Communication system(DCS) should provide primary and back-up communications alternatives.

A DCS strategy assumes a communications system must be operable before it can be interoperable.

A DCS can include multiple technical solutions for both responders and public including:

- Traditional public safety systems(e.g.- tactical radio)
- Emergency notification systems and text messaging.
- Satellite television services.
- Quickly deployable commercial and private equipment's/systems(e.g.- satellite, transportable radio systems.)

During a Disaster

Communication plays an integral role in Disaster Management.

Response and recovery phase needs more information and communication means.

All conventional methods of communication including telephone ,Radio and Television could be down during a disaster.

CASE STUDY

NEW YORK CITY WORLD TRADE CENTER ATTACK

During the September 11 attack in 2001, traditional communications were stretched and overloaded .Phone networks along the entire East coast were congested into uselessness.

Communications between emergency services personnel were limited by a lack of interoperability between departments.

Many fire fighters died when the towers collapsed because they couldn’t receive the warning that police officers received from the New York city police Department (NYPD) helicopters.

Land use Planning

WHAT IS LAND USE PLANNING ?

Land-use planning is the process of regulating the use of land in an effort to promote more desirable social and environmental outcomes as well as a more efficient use of resource. Goals of land use planning may include environmental conservation, restraint of urban sprawl, minimization of transportation costs, prevention of land use conflicts, and a reduction in exposure to pollutants. The uses of land determine the diverse economic activities that occur in a specific area, the patterns of human behaviour they produce, and their impact on the environment.

Land use planning phases

- **Before the Disaster**
- Prevention, Mitigation, Preparedness
- Planning: Knowledge, Risk Assessment, Decision
  - **During the Disaster**
- Emergency
- Individual Behaviours
  - **After the Disaster**
- Reconstruction, Relocation, Recovery

Before the disaster

- Characterisation and location of vulnerable sites.
- Documentation, risks, opportunities.
- Local Risk Reduction.
- Elimination of possible damages.
- Loss of human life, material destruction
- Example of Hurricane Sandy in(October 2012)

During the Disaster

- **Planning for Emergency Situat**
- Safe Sites Identification
- Natural Disaster Refugees
- Temporary Relocation
  - Services: water, food, medication
- Rubble Removal & Disposal
- Public Information Strategy and Diffusion
  - Every individual should know what to do, and where to go, in case of a disaster.
- Role of Social Networks (WiFi Networks) (example of Hurricane Sandy in October 2012)

After the Disaster

Reconstruction

- Compensation for harm or loss.(monetary) / Replacement (material)
- Same sites / New sites
- **Relocation**
- New Physical Environment

CONCLUSION

These land-planning decisions require accurate and spatially explicit information on the land suitability for proposed uses. With accurate and comprehensive knowledge of the area’s opportunities and constraints, land planners can mitigate, and often prevent, environmental impacts associated with population growth and redistribution.

Development Regulations

Development Regulations are a set of rules that are planned to ensure the proper and effective development of a city, as well as the general welfare of the public. Regulation is necessary to ensure planned development. It depends on a “plan-led system” whereas development plans are made and the public is consulted.

What are the motives of the Development Regulations?

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The motive of Development Control Regulations (DCR) is that any approved plan is implemented by individuals and by corporate or by public-sector developers and thus all new developments should adhere to the terms of the plan

How many types of Development Regulations are there?

- Town and Country Planning Act
- Building Bye-laws
- Land Acquisition Act
- Zoning Regulations
- Slum Clearance Act
- Periphery Control Act

Objectives of the Development Regulations?

To stop the unfavourable demand and misuse of land.

To assist private interest along with public interest in all phases of development.

Development control is legal in nature and the planning authority has the power to punish the defaulters.

To control and limit overcrowding on land.

To control the private development as per the required rules in connection to public safety, health, and convenience.

REFRENCE

https://en.wikipedia.org/wiki/Land-use_planning#:~:text=In%20urban%20planning%2C%20land%20use,of%20land%20within%20their%20jurisdictions.

https://www.sciencedirect.com/topics/earth-and-planetary-sciences/land-use-planning

https://www.commonfloor.com/guide/what-are-the-development-control-regulations-building-bye-laws-2019-55954

Disaster Safe Design and Development Regulations

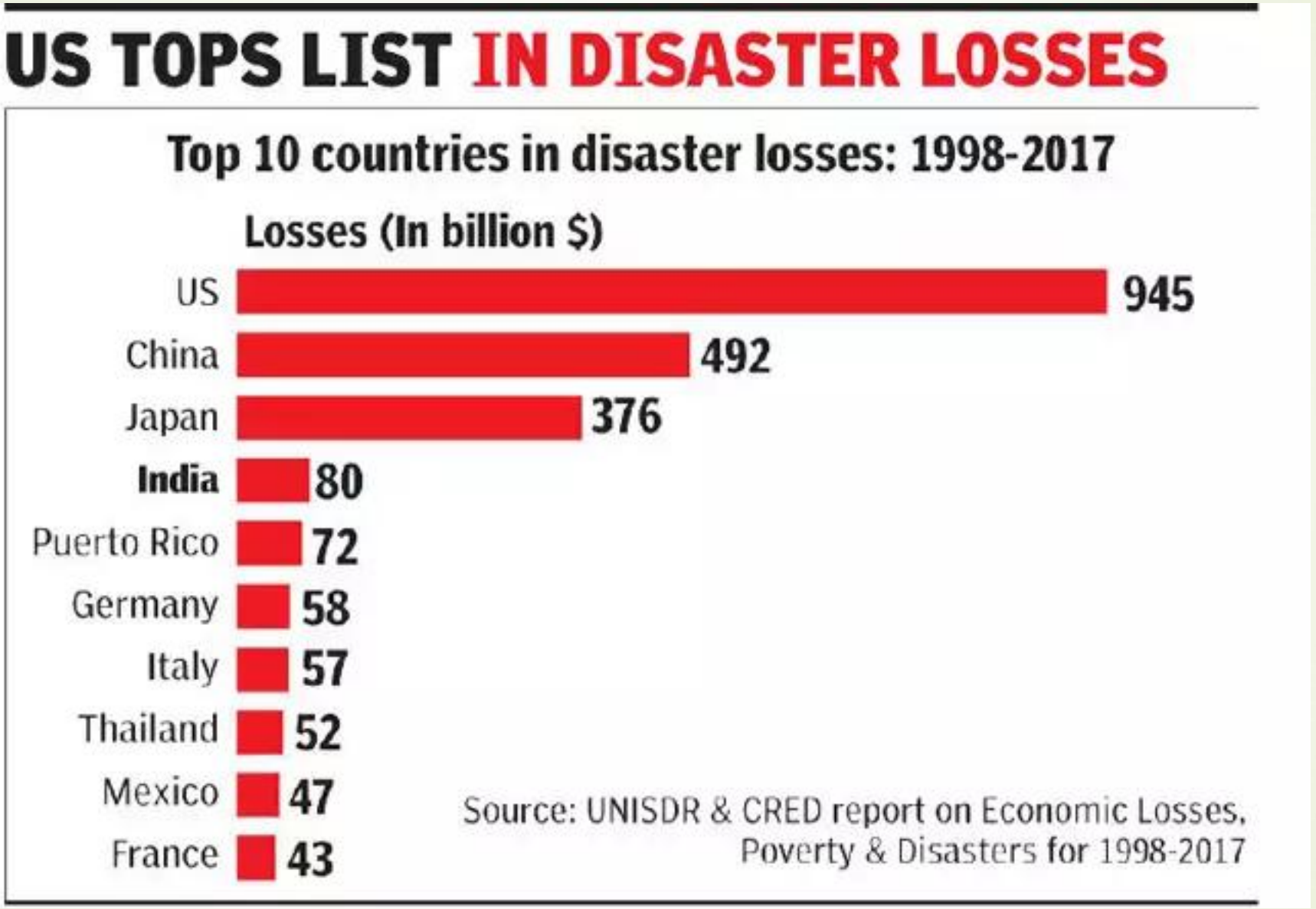
According to the statistics,

68% prone to drought,
60% prone to earthquakes,
12% prone to floods and,
8% prone to cyclones

85% of Indian land

50 million people

US TOPS LIST IN DISASTER LOSSES



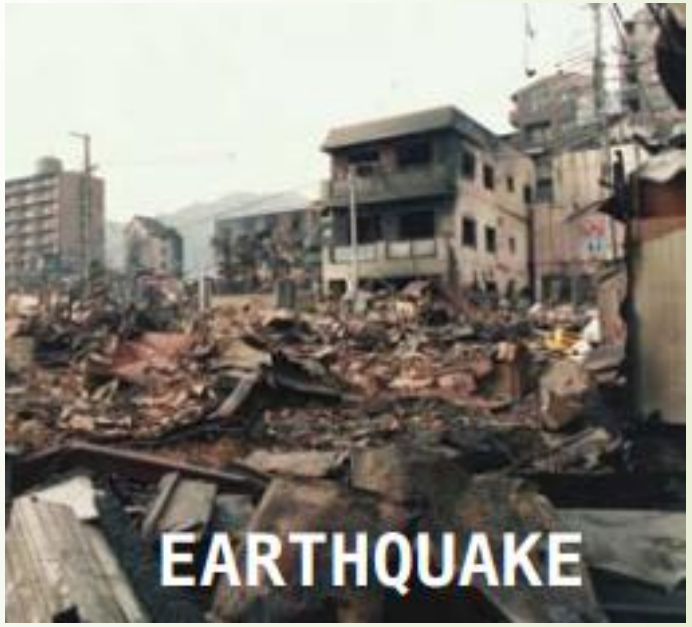
How can it be controlled and/or minimized?

Disaster Safe Designs and Development Regulations

Disaster Safe Design

Disaster Aftermath

- Loss of Human and animal lives
- Economic loss in terms of damages to crops and infrastructure
- Loss of livelihood
- Damage to housing and habitat
- Improper location
- Faulty design, use of poor quality materials
- Sub-standard construction practices
- Non-compliance to building codes
- Lack of awareness of:
  1. Safe Construction practices
  2. Disaster resistant practices

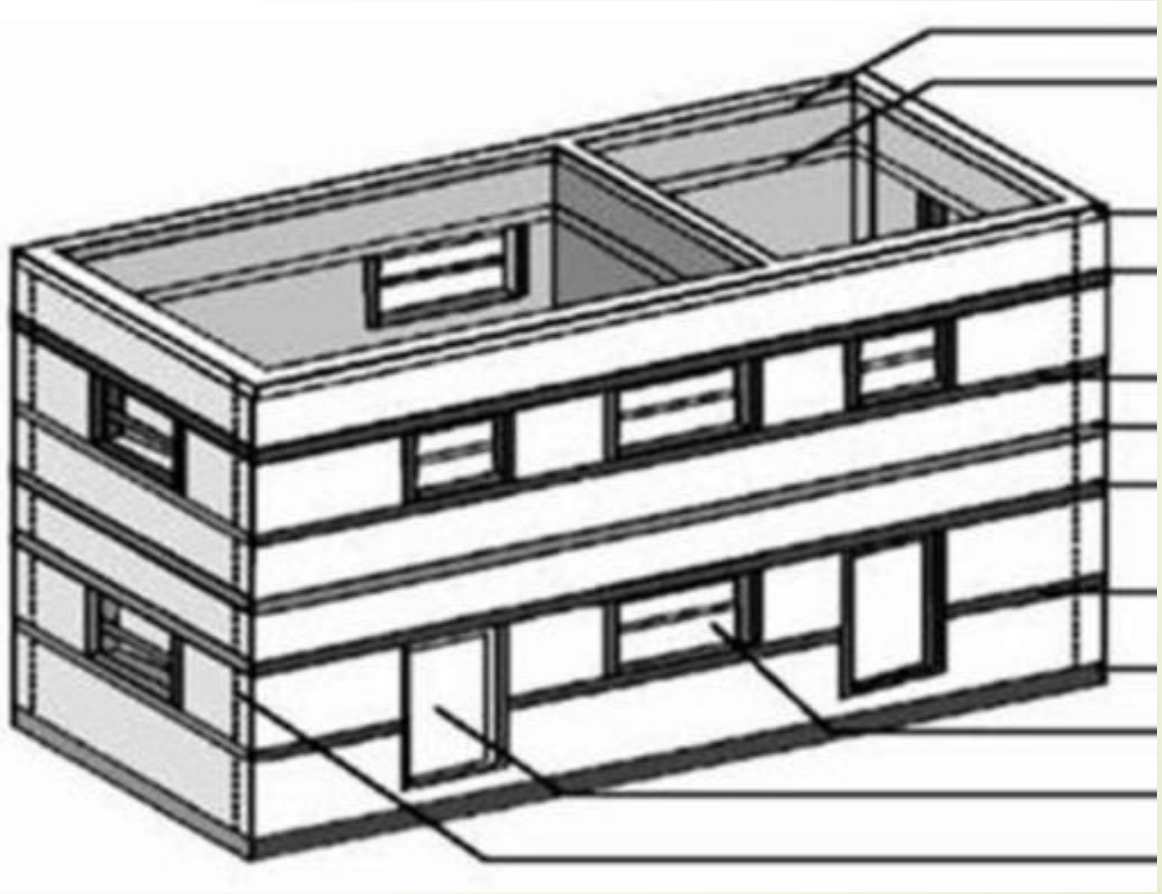


Disaster Resistant Construction

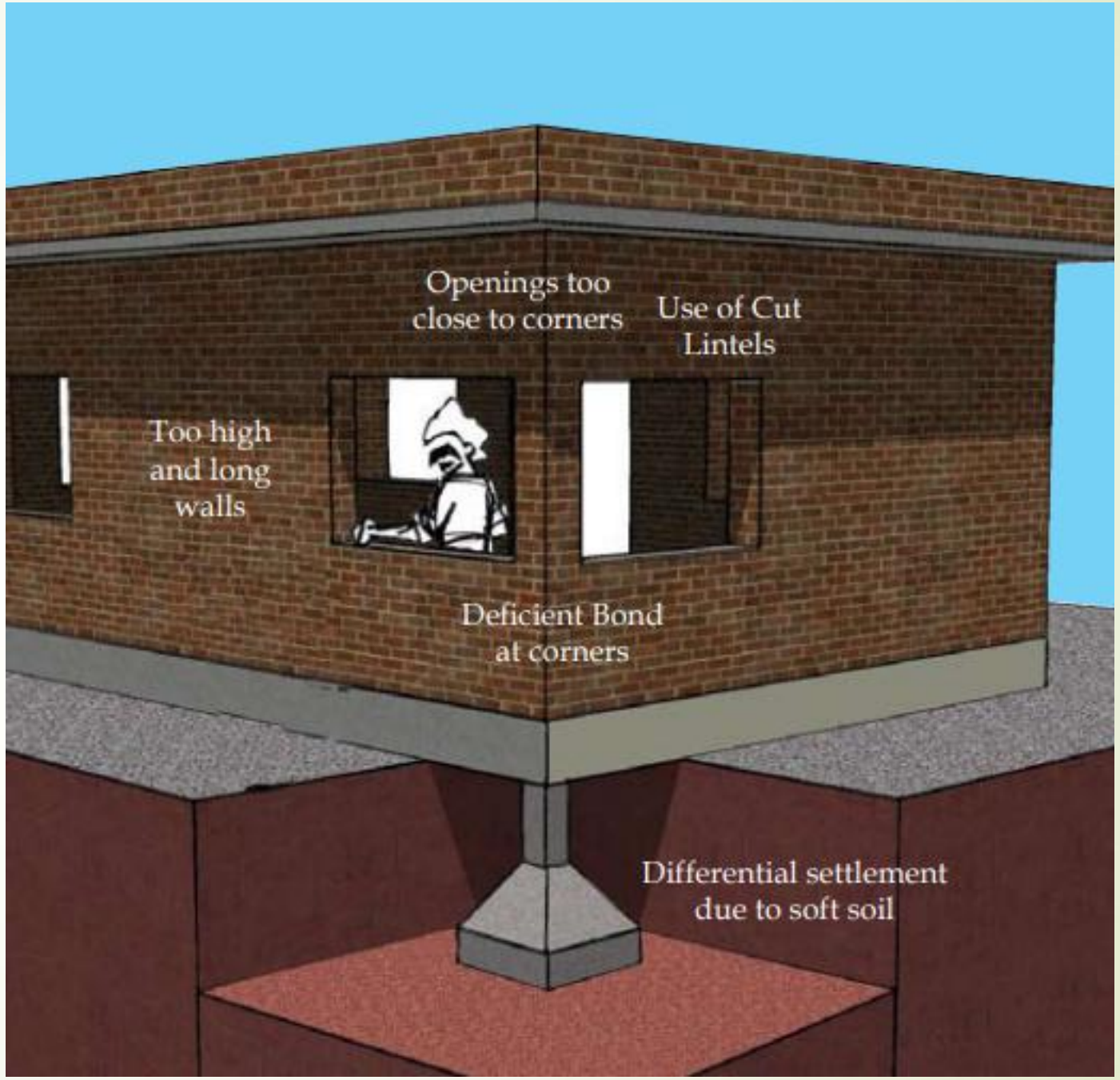
- Disaster Resistant construction practices are as important as disaster resistant structrual designs. Infact the methodology for construction also should be designed for disaster resistance.
- We should have proper implemenation of the structural details so as to let the structure behave as envisiged.
- The quality and methodology of construction is equally important.
- For example we use cover blocks. If the cover blocks are not cast properly in good quality concrete then they facilitate concrete deterioration. Ultimately this affects durability and serviceablity of the structure.

What a building comprises of ?

1. Walls
2. Openings
3. Foundation
4. Plinth
5. Beams/Columns
6. Roof/Slabs



Vulnerable Parts of a Building



Disaster Resistant Construction Practices

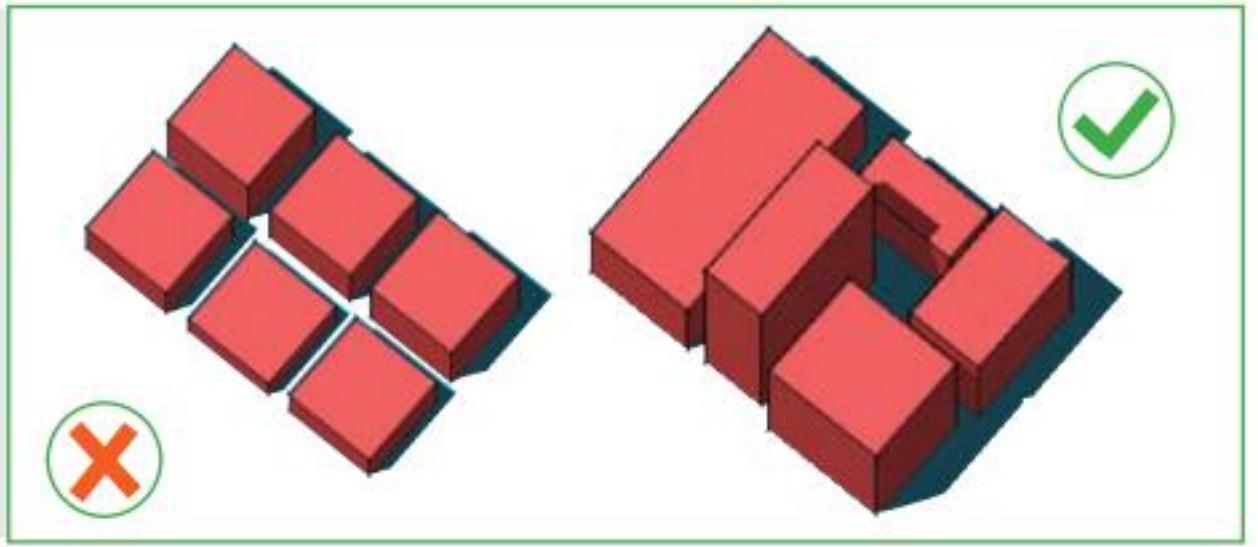
1. Settlement pattern and Design Considerations

PROVIDE

- Clustered (zigzag) planning avoids tunneling effect and reduces susceptibility to disaster

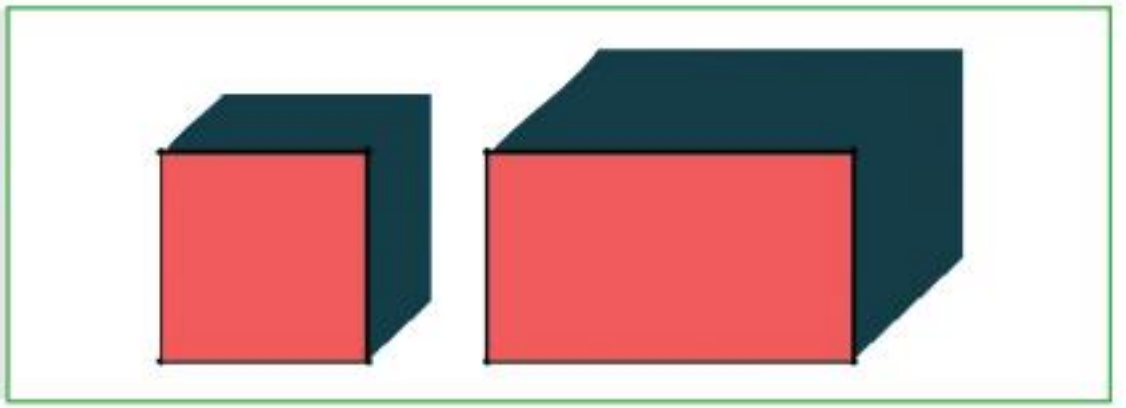
AVOID

- Row house settlement with roads leading to Sea



PROVIDE

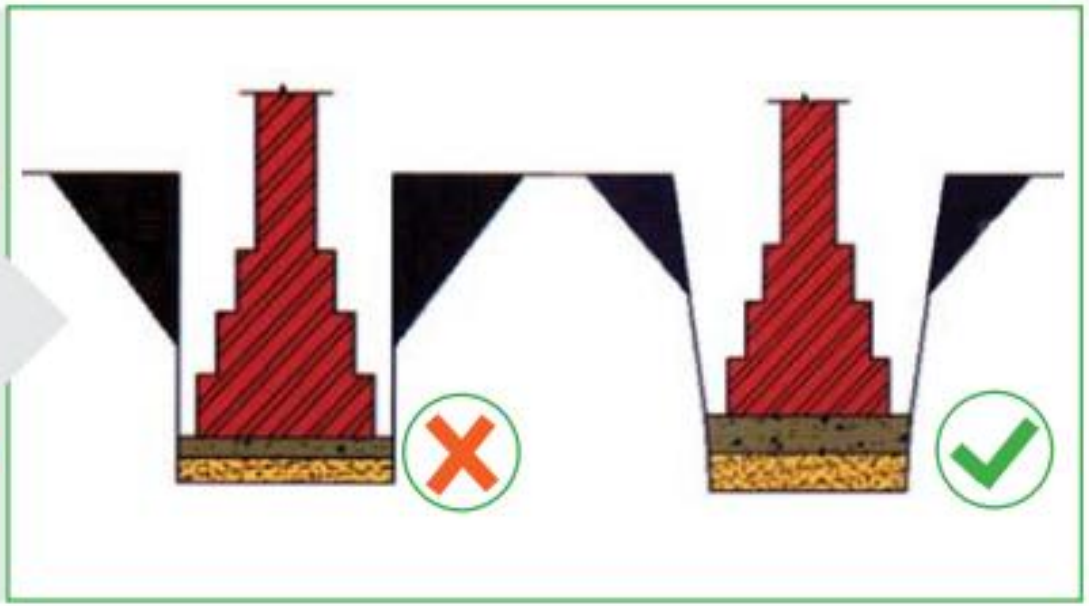
- Simple Square/Rectangular and Symmetrical plan is Suitable
- Length of Building ≤ 2xWidth



2. Foundation

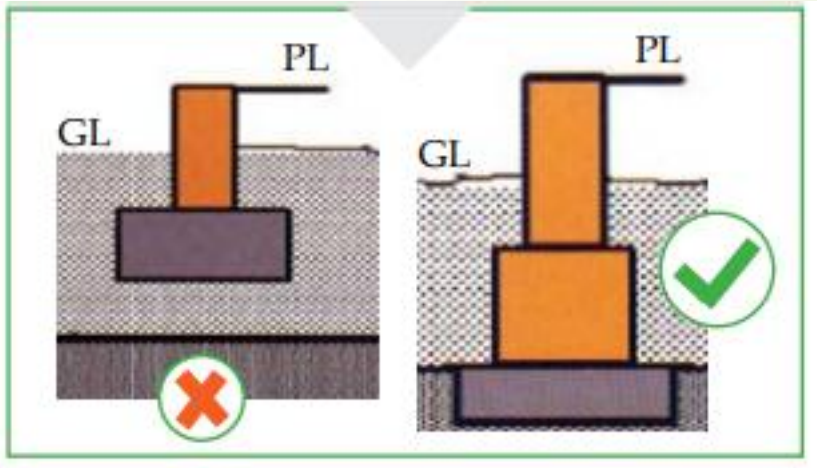
PROVIDE
- Slightly Slanting cut
- Sand Compaction thickness more than 150mm
- PCC thickness more than 75mm

AVOID
- Straight Cut
- Sand compaction less than 150mm
- PCC less than 75mm



PROVIDE
- Foundation on Hard Soil

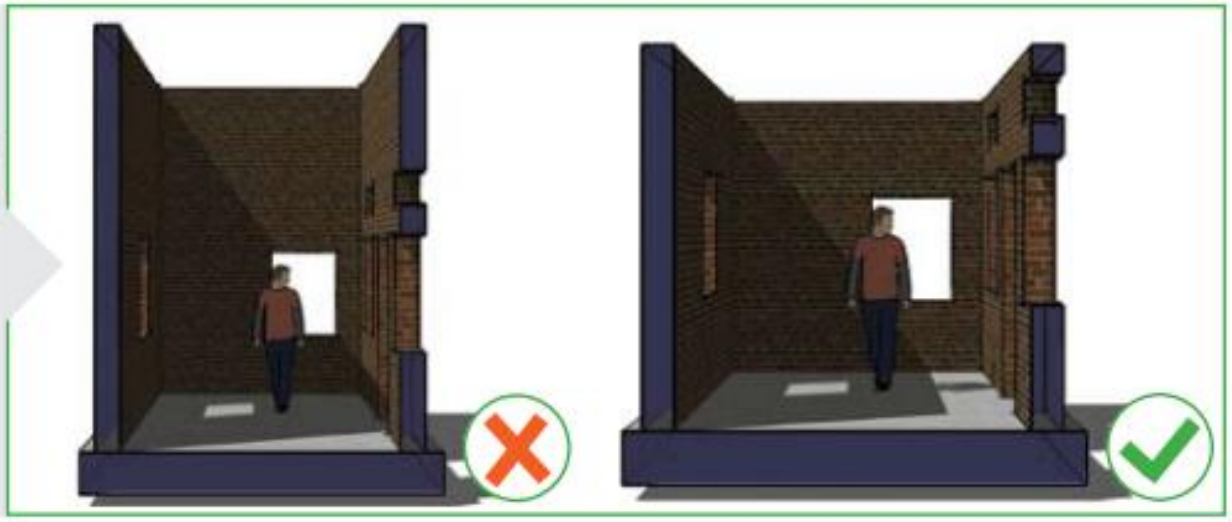
AVOID
- Foundation on Loose or Soft Soil

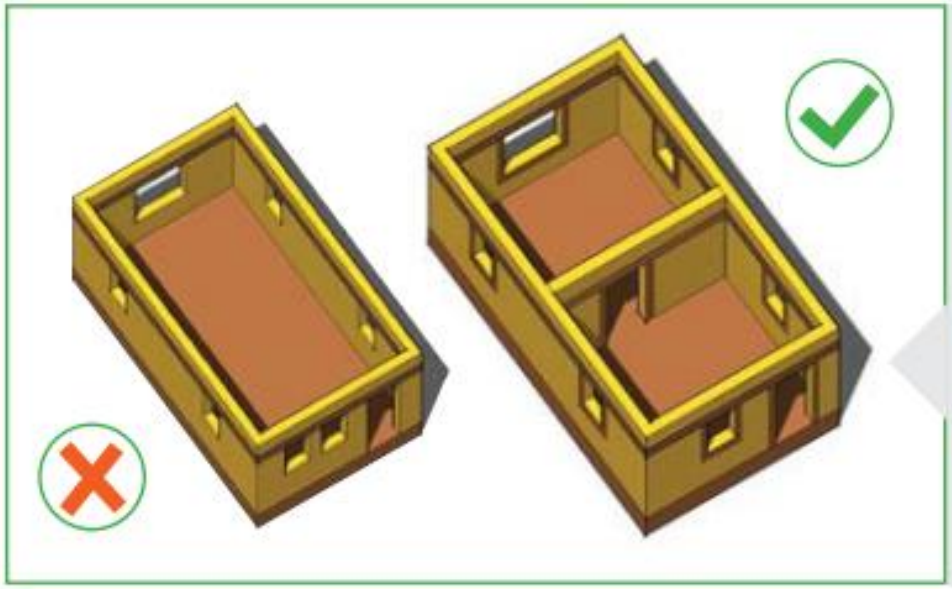


3. Walls

PROVIDE
- Average wall height should be 2700 to 3000mm

AVOID
- Too High Walls

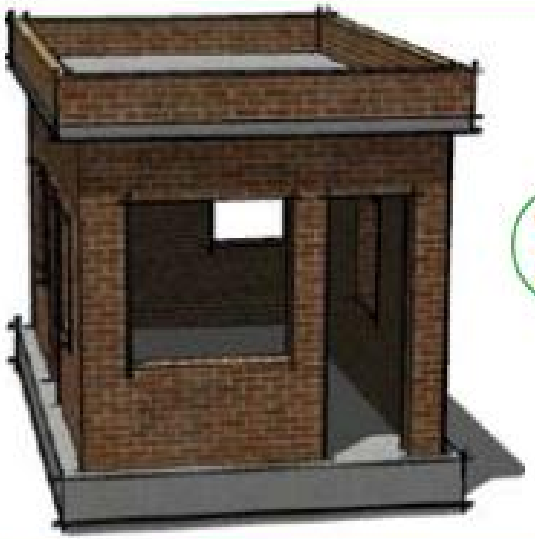




PROVIDE
- The length of the wall should not exceed 8 times the thickness
- Addition of a buttress wall reduces L/H Ratio

AVOID
- Walls that are too high or too long

4. Openings



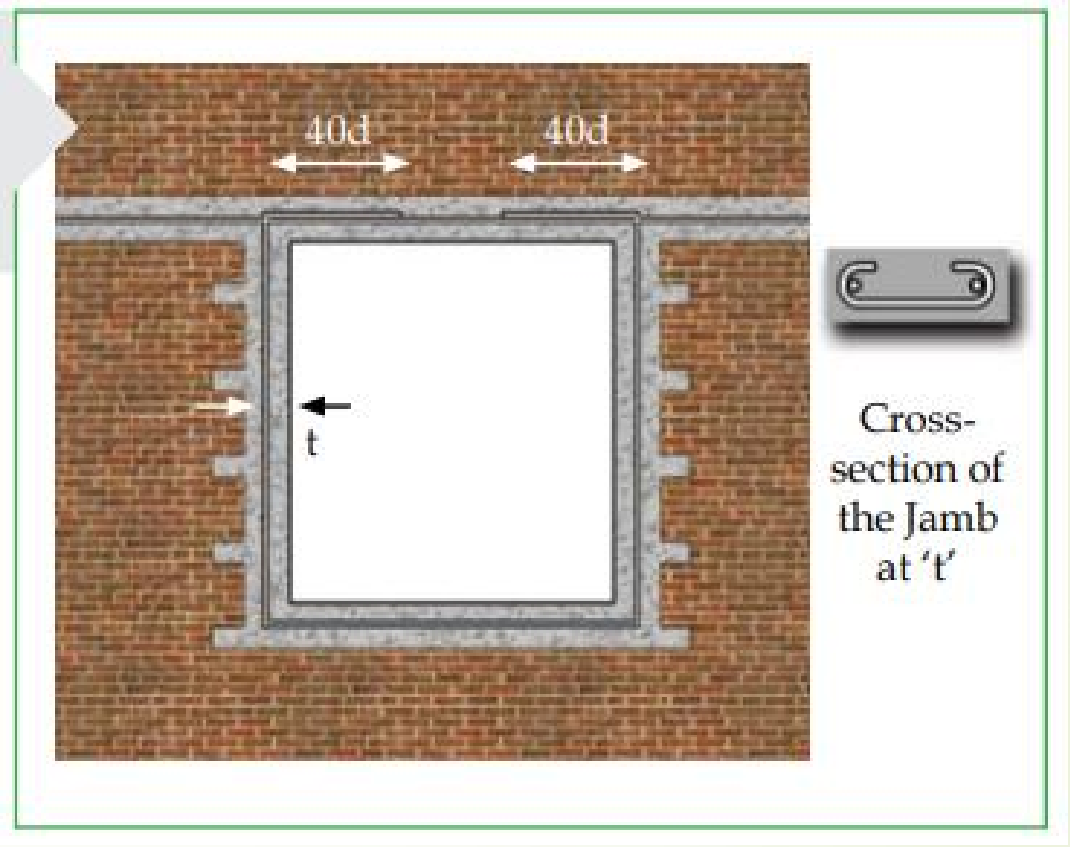
Openings are the most Vulnerable part in a building. Large shear forces get accumulated around openings and therefore, edges of the openings should be specifically strengthened.

Design Considerations

-Avoid too many openings in the wall
-The minimum distance between unreinforced openings should be 600mm

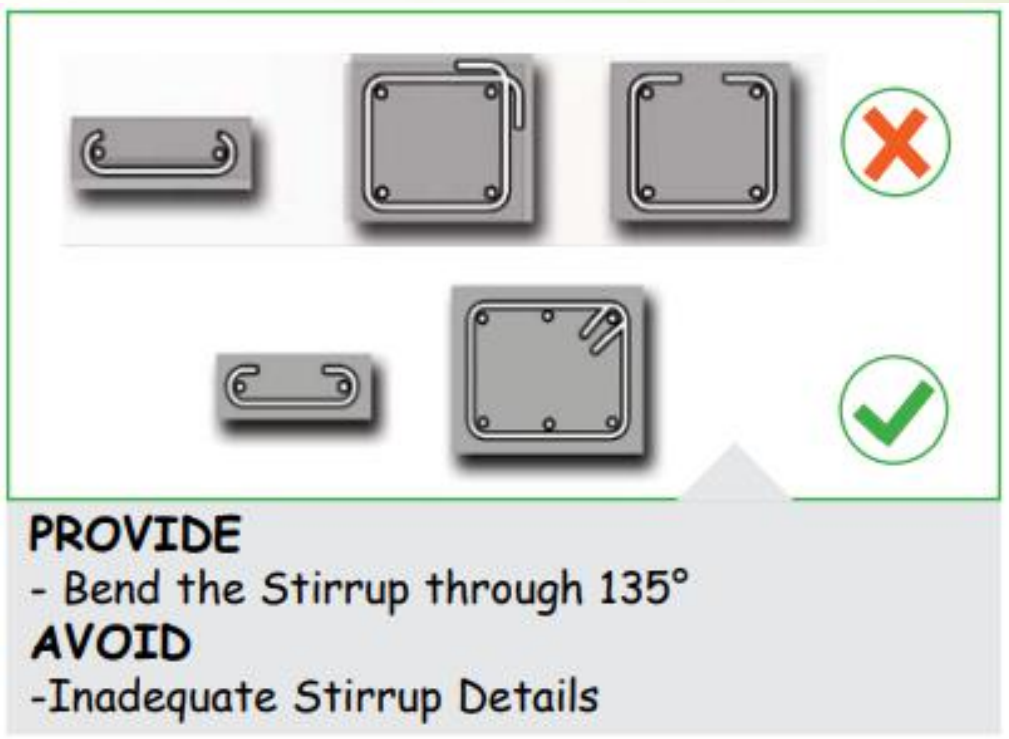
4. Openings

Protect Openings with Reinforced Band all around as shown.

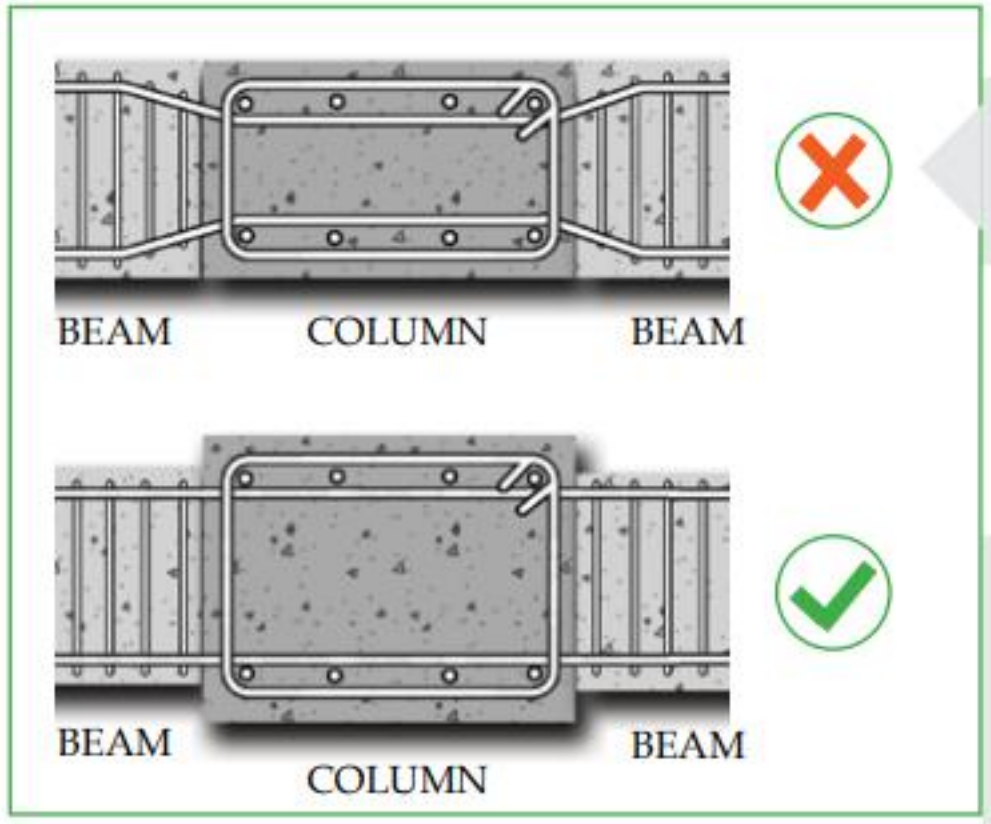


5. Columns & Beams

Columns and Beams are main elements of the RCC frame construction. They should be designed for Earthquake resistance and detailed as per the ductile detailing norms. If the ductile detailing is not followed, the structure will be damaged in the event of a dynamic loading during disasters.

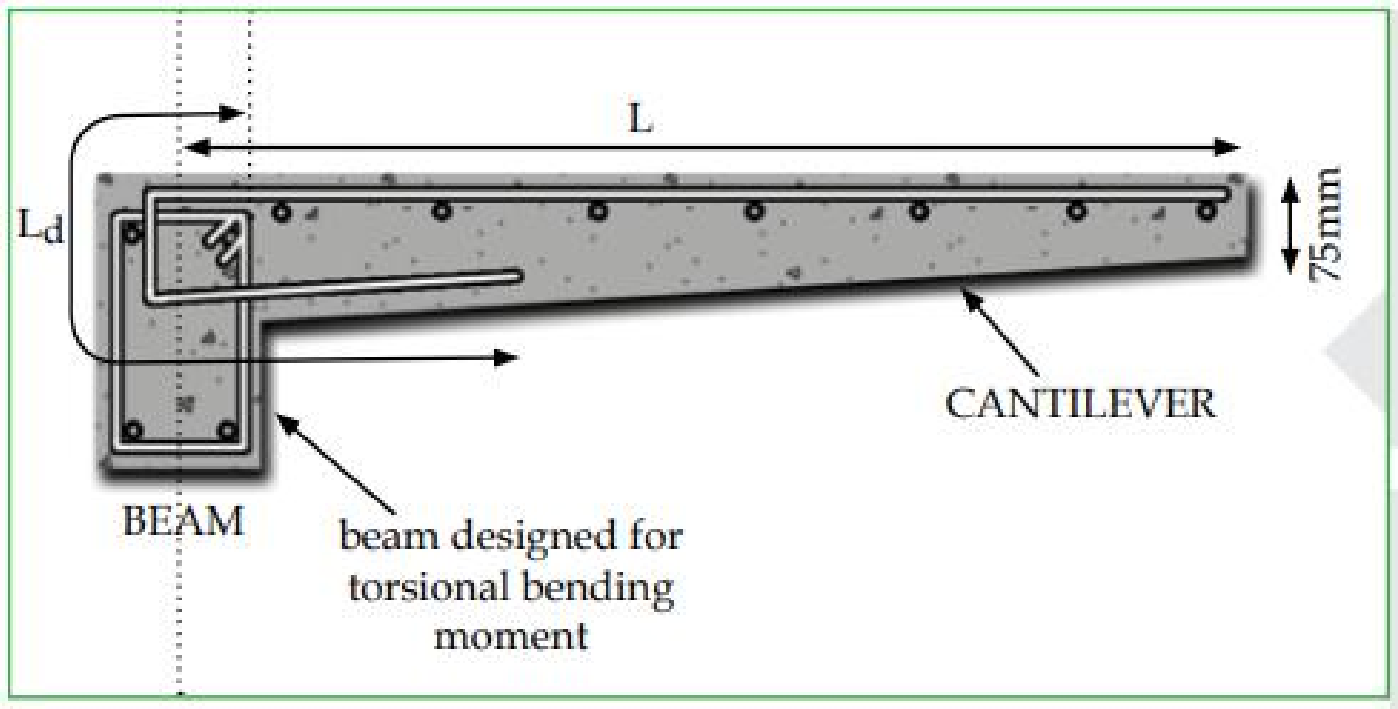


5. Columns & Beams



Beam bars bent in joint region overstress the core concrete adjoining the bends

6. Overhangs and Slabs



Detail for Sun-shade or any cantilever starting from top-edge of the support of the Beam

Development Regulations

Development Control Regulations (DCR) in India

Development Control Regulations are a set of rules that are planned to ensure the proper and effective development of a city, as well as the general welfare of the public. Regulation is necessary to ensure planned development. It depends on a “plan-led system” whereas development plans are made and the public is consulted.

Under the DCR, the Metropolitan Commissioner is the supreme authority for review of its provisions and his decision would be final.

Why is Development Control Regulations necessary?

1. Development Control Regulations are a must for every growing city because the area immediately beyond the city limits is often a source of health risk to the city and generally under no strict control of the effective local authority.

2. Factors like density of area and its exposure level are other important factors which has their relation with development control regulation and their proper implementation.

3. Change in development control regulation can reduce or increase damage to the structure

How many types of Development Controls Regulations are there?

- Town and Country Planning Act
- Building Bye-laws
- Land Acquisition Act
- Zoning Regulations
- Slum Clearance Act
- Periphery Control Act

What are the objectives of the Development Control Regulations?

- To stop the unfavorable demand and misuse of land.
- To assist private interest along with public interest in all phases of development.
- Development control is legal in nature and the planning authority has the power to punish the defaulters.
- To control and limit overcrowding on land.
- To control the private development as per the required rules in connection to public safety, health, and convenience.

Disaster Safe Designs, Construction Structural And Non Structural Mitigation Of Disasters

&

Science And Technology Institutions For Disaster Management

Disaster Safe Designs

Earthquake safe design

Landslide safe design

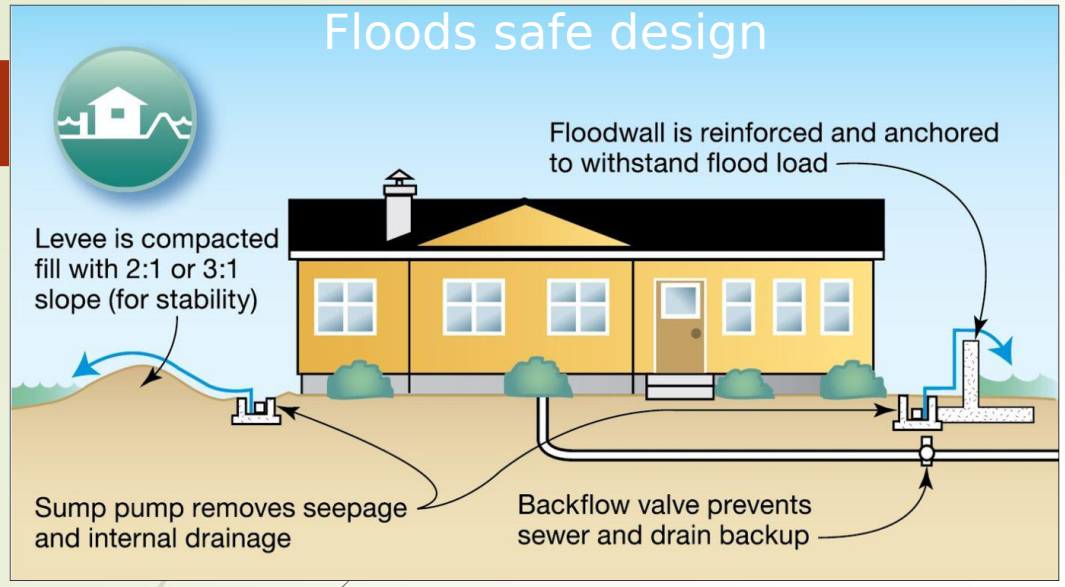
Floods safe design

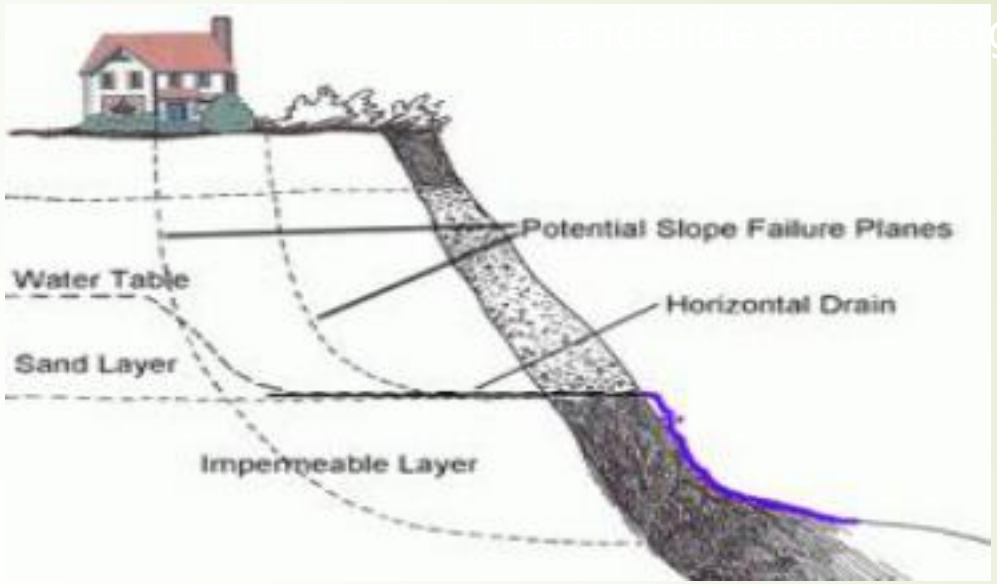
Cyclones safe design

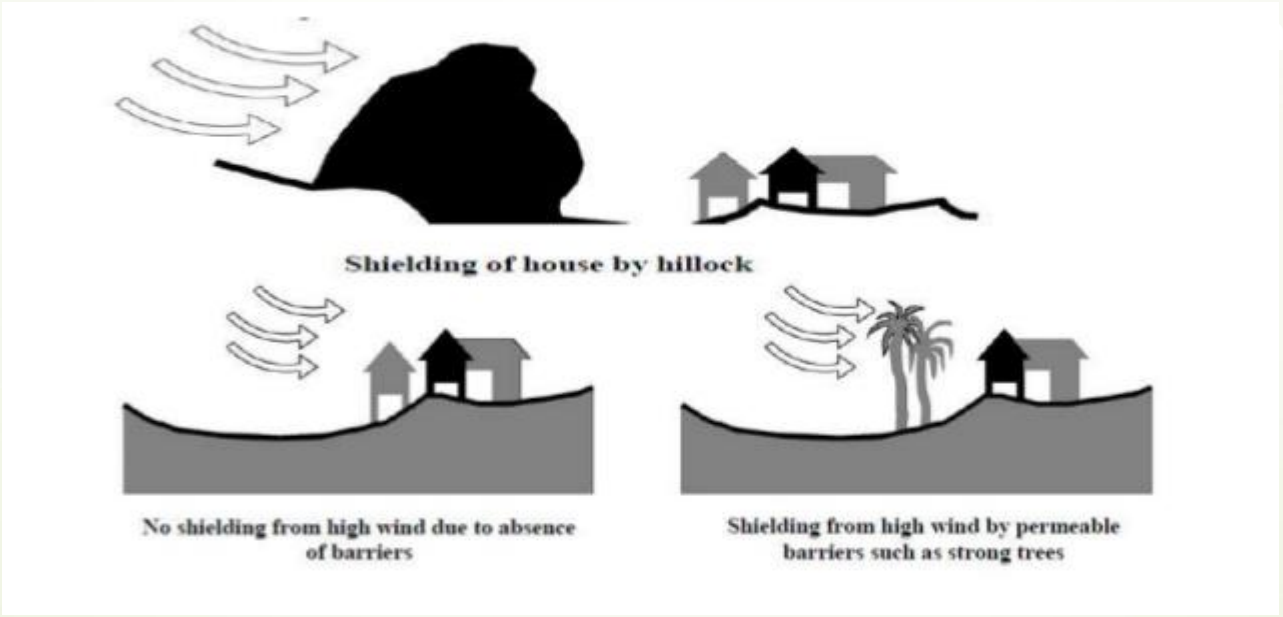
Earthquake Safe Design

- The building should have a simple rectangular plan.
- Long walls should be supported by reinforced concrete columns.
- Door and window openings in walls should preferably be small and more centrally located.
- The location of the openings should not be too close to the edge of the wall.
- Vertical reinforcements should be provided at corners and junctions of walls.
- It shall be passing through

Floods safe design







Construction Structural And Non Structural Mitigation Of Disasters

WHAT IS MITIGATION?

Mitigation is defined as any sustained effort undertaken to reduce a hazard risk through the reduction of the likelihood and/or the consequence component of that hazard's risk.

In other words, mitigation either seeks to reduce the likelihood of hazard occurrence or to reduce the negative effects if it were to occur.

Each hazard is unique in its impact on humans and the natural and built environments.

Likewise each hazard type has a unique set of mitigation options from which disaster managers may choose that have been developed or conceived but remain to be developed.

TYPES OF MITIGATION: STRUTURAL AND NON–STRUCTURAL

Structural Mitigation:–

Structural mitigation measures are those that involve or dictate a necessity for some kind of construction, engineering, or other mechanical changes or improvements aimed at reducing hazard risk likelihood or consequence.

They often are considered at “man controlling nature” when applied to natural disasters.

Structural measures are generally expensive and include a full range of regulation, compliance, enforcement, inspection, maintenance, and renewal issues.

The structural mitigation groups are:

Resistance construction
Building codes and regulatory measures
Relocation
Structural modification
Construction of community shelters
Construction of barrier, deflection, or retention systems
Detection systems
Physical modification
Treatment systems
Redundancy in life safety infrastructure

Non–structural Mitigation:–

Non–structural Mitigation, as defined previously, generally involves a reduction in the likelihood or consequence of risk through modifications in human behavior or natural processes, without requiring the use of engineered structures.

Non–structural mitigation techniques are often considered mechanisms where man adapts to nature.

They tend to be less costly and fairly easy for communities with few financial or technological resources to implement.

The non–structural mitigation groups are:

Regulatory measures

Community awareness and education programs

Nonstructural physical modification

Environmental control

Behavioral modification

Science And Technology Institutions For Disaster Management

A disaster is an event or series of events that leads to sudden disruption of normal life, causing severe damage to life and property to an extent, that available social and economic protection mechanism are inadequate to cope.

Disasters could be, natural (geological, hydro-meteorological and biological) or induced by human processes (environmental degradation and technological hazards).

While we cannot prevent an earthquake or a hurricane from occurring, or a volcano from erupting, we can apply the scientific knowledge and technical know-how to issue early warnings on volcanoes and cyclones and organize proper community response to such warnings.

Science and technology help us to understand the mechanism of natural hazards of atmospherically, geological, hydrological, and biological origins which are made up of an orderly system of facts that have been learned from study, experiments, and observations of floods, severe storms, earthquakes, landslides, volcanic eruptions and tsunamis, and their impacts on humankind and his works.

The scientific and technological disciplines which are involved include basic and engineering sciences, natural, social and human sciences.

They relate to the hazard environment (i.e., hydrology, geology, geophysics, seismology, volcanology, meteorology, and biology), to the built environment (i.e., engineering, architecture, and materials), and to the policy environment (i.e., sociology, humanities, political sciences, and management science).

Application of technology in disaster management:–

GIS and remote sensing

Internet

Warning and forecasting system

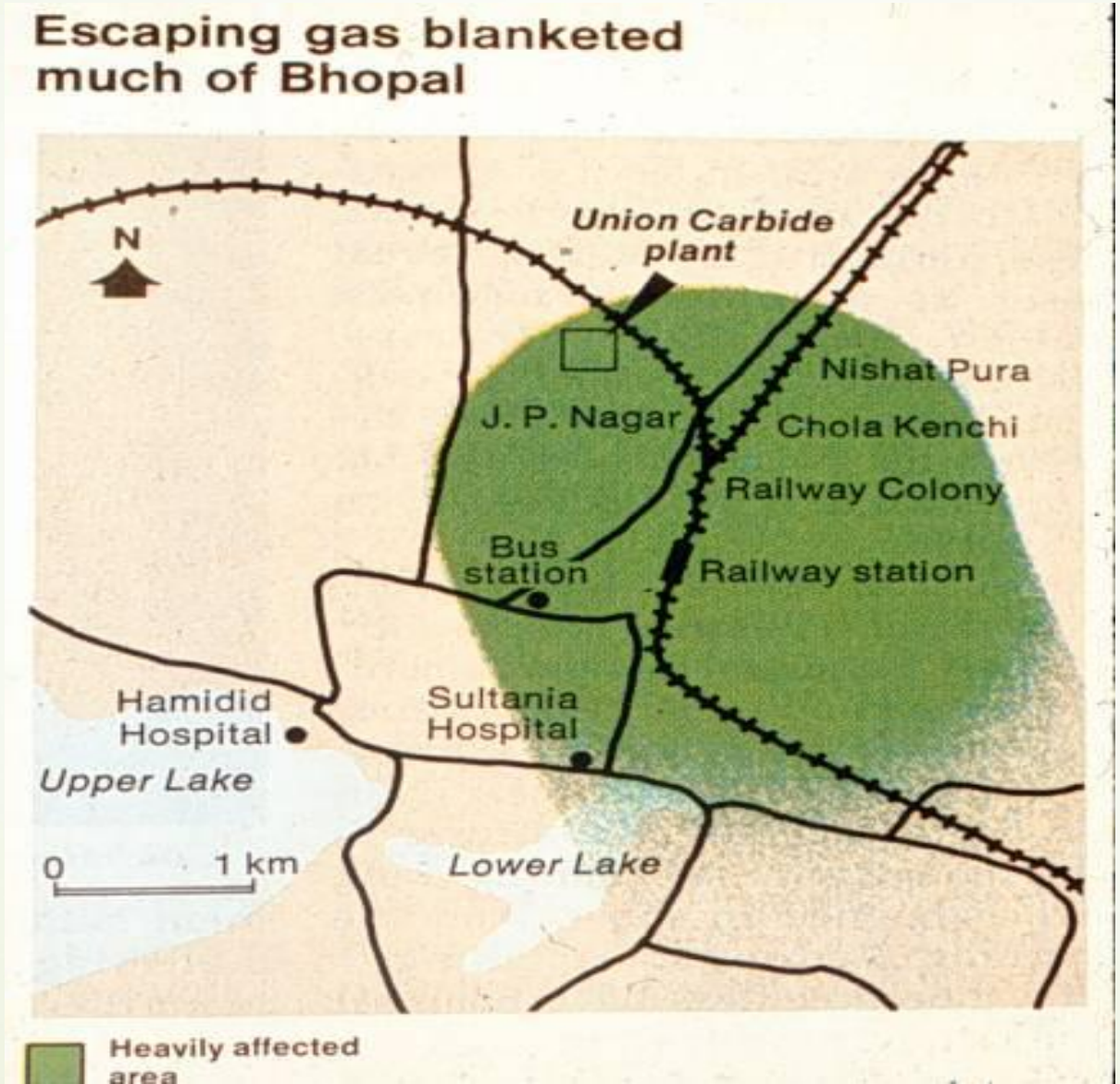
DISASTER MANAGEMENT

BHOPAL GAS TRAGEDY

THE BHOPAL DISASTER

- Around 1 a.m. on Monday, the 3rd of December, 1984, In the city of Bhopal, Central India, a poisonous vapour burst from the tall stacks of the Union Carbide pesticide plant.
- This vapour was a highly toxic cloud of methyl isocyanate.
- 2,000 died immediately
- 300,000 were injured
- 7,000 animals were injured, of which about one thousand were killed.

THE AFFECTED AREA



THE POSSIBLE CAUSES

- A tank containing methyl isocyanate (MIC) leaked.
- MIC is an extremely reactive chemical and is used in production of the insecticide carbaryl.
- The scientific reason for the accident was that wa ter entered the tank where about 40 cubic meters of MIC was stored.
- When water and MIC mixed, an exothermic chemi cal reaction started, producing a lot of heat.
- As a result, the safety valve of the tank burst bec ause of the increase in pressure.
- It is presumed that between 20 to 30 tonnes of MI C was released during the hour that the leak took place.
- **The gas leaked from a 30 m high chimney a nd this height was not enough to reduce the effects of the discharge**.

THE WEATHER EGGED ON THE PROCESS…

- The high moisture content (aerosol) in the discharge when evaporating, gave rise to a heavy gas which rapidly sank to the ground.
- A weak wind which frequently changed direction, which in turn helped the gas to cover more area in a shorter period of time (about one hour).
- The weak wind and the weak vertical turbulence caused a slow dilution of gas and thus allowed the poisonous gas to spread over considerable distances.

THE POSSIBLE REASONS...

- One of the main reasons for the trage dy was found to be a result of a comb ination of human factors and an incor rectly designed safety system.
- A portion of the safety equipment at the plant had been non-operational f or four months and the rest failed.

LAPSES ON THE PART OF THE GOV ERNMENT

- The Madhya Pradesh State governme nt had not mandated **any** safety stan dards.
- Union Carbide failed to implement its own safety rules.
- The Bhopal plant experienced six acc idents between 1981 and 1984, at le ast three of which involved MIC or ph osgene.

WHY DID THE PEOPLE STAY QUITE??

- The country needed pesticides to protect her agricultural production
- MIC is used to produce pesticides that control insects which would in turn, help increase production of food as a part of India’s GREEN REVOLUTION.
- Initially, India imported the MIC from the United States.
- In an attempt to achieve industrial self-sufficiency, India invited Union Carbide to set up a plant in the state of Madhya Pradesh to produce methyl isocyanate.
- To the people of the city of Bhopal, Union Carbide was a highly respected , technically advanced Western company.
- This coupled with political power and scientific expertise worked together to changed the people’s perception of what was dangerous and more importantly what was safe.

UNION CARBIDES AMERICAN PLANT

- Dr. Paul Shrivastava, an Associate Professor of Business in New York University conducted studies that revealed that Bhopal was neither an isolated incident nor the first of its kind in the corporation.
- There had been many accidents of similar nature in UCC's American plants prior to the Bhopal accident.
- He found that 28 major MIC leaks had occurred in UCC’s West Virginia plant during the five years preceding the Bhopal incident, the last one occurring only a month before.

PROCESS CHEMISTRY

- The reaction involved two reactants, methyl isocy anate (MIC) and alpha naphthol.
- The process begins with a mixture of carbon – mo noxide and chlorine to form phosgene. Phosgene i s then combined with monomethylamine to form MIC. MIC is further mixed with naphthol to produc e the end product carbaryl.

$$CO + Cl_2 \rightarrow COCl_2 \text{ (Phosgene)}$$

$$COCl_2 + CH_3NH_2 \rightarrow CH_3NHCOCl + HCl$$

$$CH_3NHCOCl \rightarrow HCl + CH_3NCO \text{ (Methyl Isoacyanate)}$$

LAPSES ON PART OF UNION CARBIDE

- Improper design of chimneys (without consideration of weather conditions in all seasons)
- Improper design and maintenance of safety equipment.
- Not following safety regulations as that followed by UCC plants in USA.
- Decision to neglect a flare system in need of repair.
- Inadequate emergency planning and community awareness.
- Lack of awareness of the potential impact of MIC on the community by the people operating the plant.
- Inadequate community planning, allowing a large population to live near a hazardous manufacturing plant.

Basic Green Chemistry Principles

- These principles would have averted the disaster.
- Eliminate or reduce the production of Hazardous chemicals.
- Hazardous chemicals produced should not be stored and should be consumed in the course of the reaction.
- The inventory of Hazardous chemicals if inevitable should be of many small containers and not of one large container.

Alternate Chemistry (suggested so lution)

- Alpha Napthol on carbonyl group add ition followed by reaction with methyl amine would eventually gives carbar yl.
- This process does not generate or re quire handling the of Phosgene.
- This process does not require storage of MIC.
- Inherently safe process.

Conclusion

- The Bhopal gas tragedy could have been a verted.
- There were lapses on part of the governm ent and UCC.
- The actual reason for the tragedy is contra ry to popular belief.
- An alternate way to produce carbaryl was suggested.
- Design of Inherently safer process was req uired.