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Building Constructi on



Building Failure

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- ❑ Introduction
- ❑ Mechanism of deterioration
- ❑ Investigation of failure and damages

INTRODUCTION

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- ❑ All the materials deteriorate with age either due to:
 - ✓ Weathering action,
 - ✓ Poor selection of materials,
 - ✓ The human ignorance,
 - ✓ Vandalism, and
 - ✓ Biological agencies.
- ❑ **Deterioration** means that the condition of a structure or a building or its components has degenerated or has become unusable.

INTRODUCTION

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- ❑ Deterioration of building or its components, if allowed to occur may result in complete decomposition where replacement becomes the only solution.
- ❑ Deterioration is nothing but gradual disintegration on account of any destructive action from:
 - ✓ Aggressive waters and soils,
 - ✓ Exposure conditions to weathering agents , and
 - ✓ Relative movements of components.
- ❑ The rate of deterioration of building varies with resistance of the materials used.

MECHANISM OF DETERIORATION

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- ❑ There are several ways in which mechanism of deterioration sets up. One is the **external environment** to which structure is exposed and second is **internal causes** within the material.
- ❑ The process of deterioration can also be classified as under:
 - A. **Mechanical**: Wear and tear ,Fatigue, impact, or over loading.
 - B. **Physical**: thermal change, Volume change , Cracking, deformation of shape ,freezing and thawing.
 - C. **Chemical**: reaction of aggressive substances in contact, Reaction of harmful chemicals present within material. Electro-chemical

MECHANISM OF DETERIORATION

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❑ The primary source and causes of deterioration and decay in structures and building can be listed as follow

* Human aspects *

Chemical factors

* Environmental aspects *

Structural

* Moisture hazards * Fire

* Faulty design * Faulty
construction

MECHANISM OF DETERIORATION

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HUMAN ASPECTS

Lack of maintenance culture: Deterioration occurs due to lack of appropriate maintenance culture on the part of the maintenance staff.

Occupants Misuse Buildings: Using a building for a function which is different from the designed one

CHEMICAL FACTORS

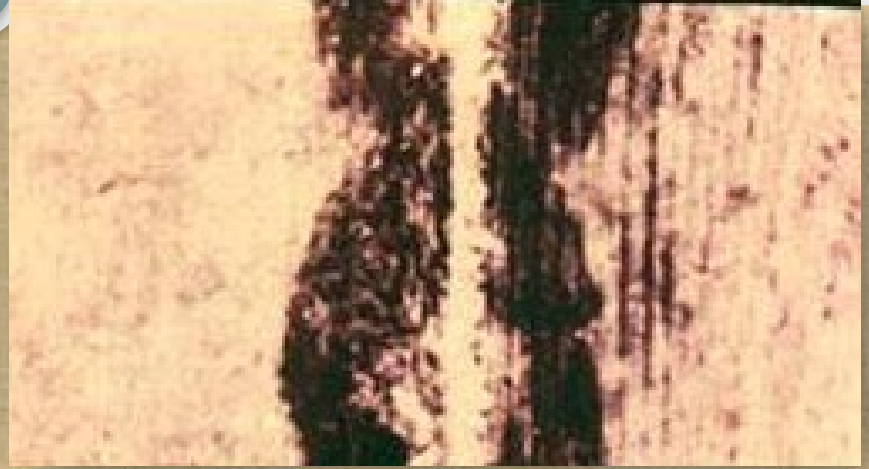
- Interaction of certain **cleaning agents** with materials and/or components causing disintegration, softening or discoloration.
- Chemical reactions involving aggregate can lead to serious deterioration problems in concrete.

MECHANISM OF DETERIORATION

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Corrosion of



Discoloration as concrete



Alkali aggregate
reaction

MECHANISM OF DETERIORATION

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ENVIRONMENTAL ASPECTS

❑ Environmental factors refer to exposure of building components with atmospheric agencies, such as, air, rain, moisture, gases, radiation and surrounding soil. The various environmental factors causing deterioration are:

✓ **Solar Radiation:** most building materials absorb the radiation, depending upon the nature and color of the surface.

✓ **Temperature Effects:** Temperature changes cause dimensional changes in the materials, particularly when the coefficient of expansion is high.

✓ **Moisture:** moisture in solid, liquid or vapor form can be regarded as principal agent causing deterioration.

✓ **Ground Salts and Water:** Salts present in the

MECHANISM OF DETERIORATION

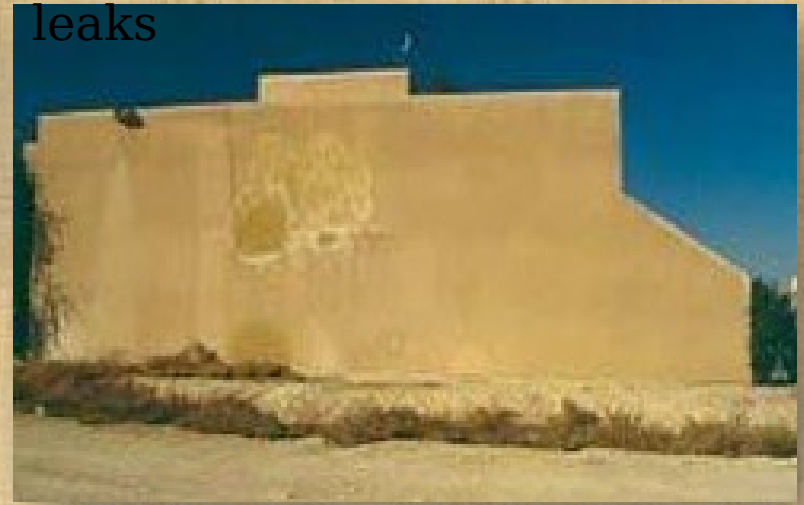
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External finishing- presence of moisture in between



Dampness on ceiling-roofs leaks



External finishing- leaks of plumbing in bath rooms

MECHANISM OF DETERIORATION

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FAULTY DESIGN

- ❑ Faulty design leads to faster deterioration of structures.
- ❑ Unsuitable materials due to lack of knowledge of their characteristics and use of **inadequate size** of structural members will result in failure of structures.
- ❑ Inadequate provisions for access to carry out maintenance activities.

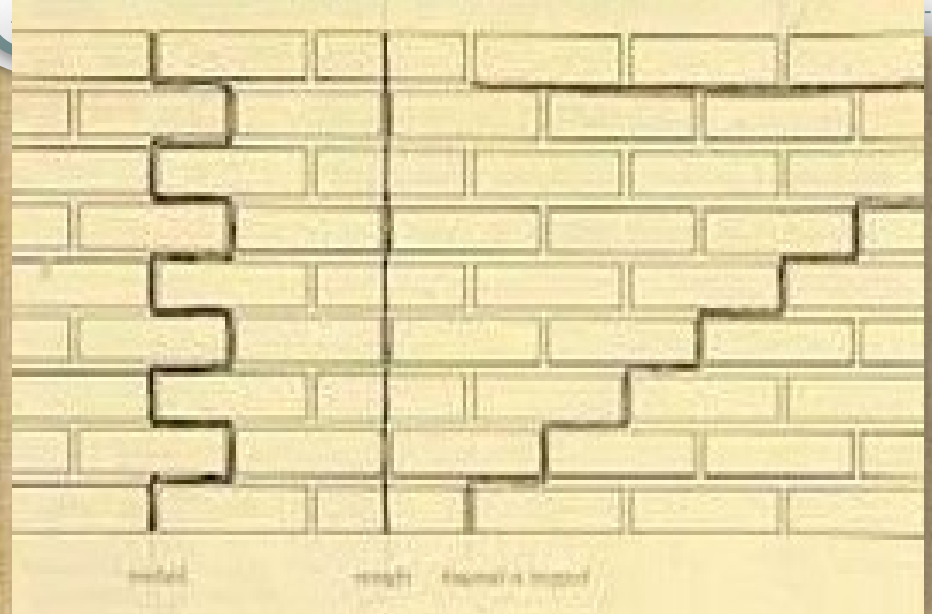
STRUCTURAL

- ❑ Reaction of the structural elements to settlement, moisture, shrinkage and thermal movements.
- ❑ Reaction of the structural elements to the change of loading patterns
- ❑ Reaction to the corrosive elements in the

MECHANISM OF DETERIORATION



RC building collapsed in a side sway mechanism.(India)



Crack types in brick and block work
(Structural)



Flat slab without proper design for drainage

MECHANISM OF DETERIORATION

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FIRE HAZARDS

- ❑ All materials and components can be adversely affected by fire.
- ❑ These can be directly burnt wholly or partially, or by losing some of its properties, particularly structural strength and its aesthetic appeal.

FAULTY CONSTRUCTION

- ❑ Lack of supervision during construction period,
- ❑ Failure to understand and follow exactly the specifications and drawings,
- ❑ Lack of skilled labor,

MECHANISM OF DETERIORATION

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Fire
hazard



Sticking to forms damage caused during stripping of formwork from concrete.

MECHANISM OF DETERIORATION

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FAULTY MATERIALS

- ❑ Wrong selection of material and specifications;
- ❑ Use of substandard material;
- ❑ Provision of inadequate facilities for storage at site;
- ❑ Use of state/expired materials;

FAULTY SYSTEM

- ❑ Inability of the builder to follow specifications/drawings,
- ❑ Failure to follow maintenance instructions and
- ❑ Inability of the owner to operate the system as instructed

MECHANISM OF DETERIORATION

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INAPPROPRIATE CLEANING

- ❑ Use of incorrect cleaning materials/ techniques;
- ❑ Inadequate supervision to carry out effective cleaning;
- ❑ Failure to employ specialists for cleaning special fittings and equipment.

MISUSE OF BUILDINGS

- ❑ Lack of security,
- ❑ Blatant abuse and misuse of building, its fittings, furnishing and finishes may result in deterioration.

INVESTIGATION OF FAILURE AND DAMAGES

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Primary task in investigation is to determine whether the damage is **structural** or **non-structural**.

Structural repairs are undertaken to restore the structural stability to sustain the actual stresses under the service conditions.

Non-structural repairs are undertaken for the long term durability and aesthetic appearance, but these do not increase the load bearing capacity of the structure in question.

The primary aim of investigation is to:

- ✓ Determine the extent of damage or distress,
- ✓ Classify the damage as structural or non-structural and

