CAUSES AND AGENTS OF DETERIORATION

Design errors

1. Not fully understanding the requirements of the owner
2. Design too complex for site conditions
3. Bad choice of materials (Materials that are not suitable for environment or usage of building)
4. Not taking into consideration all load combinations
5. Not taking into consideration effects of environment and other factors like vibrations

Construction errors

1. Use of inadequate materials (defected materials or materials that are not according to the specifications)
2. Use of inadequate workmanship

Change of use

May cause an increase in loads leading to faster deterioration of the building.

Lack of maintenance

Small defects grow and cause larger defects and may lead to other problems.

Environmental effects

1. Solar radiation
    a. Photochemical effects
        i. Fading of colors
        ii. Break down of polymer chains causing them to be brittle
    b. Thermal effects
    Materials absorb radiation causing them to heat and expand then cool and contract. Successive cycles of expansion and contraction causes cracks specially when inner layers of the material does not undergo the same expansion contraction cycles.
2. Wind
    a. Wind loads causes stresses on a building
    b. Action-suction effect which may cause fatigue damage to some components of the building
    c. Driving rain cause moisture to penetrate or enter parts of the building
    d. Wind loaded with sand and dust particles causes erosion of facades and removal of paints and protective layers of exposed steel structures
3. Atmospheric gases
    a. CO_2 causes carbonation in concrete which leads to reduced PH and corrosion of steel. CO_2 also reacts with rain forming carbonic acids which attack and dissolve lime stones.

   b. O_2 causes corrosion of metals
   c. SO_2 and SO_3 react with rain forming acids which attack facades and accelerate corrosion.
4. Moisture
   a. Change in relative humidity causes dimensional changes which may lead to cracks
   b. Rain can erode and dissolve materials
   c. Presence of moisture causes corrosion of metals and other chemical reactions
   d. Moisture help fungal growth and helps insects attack of organic materials
   e. Moisture dissolves salts present in some materials and when water evaporates the salts change to crystals which expand causing internal stresses and the presence of pockets in paint

Chemical effects

1. Corrosion
2. Sulphate attack
   Sulphates reacts with some of the components of cement producing a gel which expands causing internal stresses that lead to cracks and disintegration of the cover exposing another layer to attack and so on.
3. Alkali aggregate reaction
   Some aggregates react with the free lime in cement producing a gel which expands causing internal stresses that lead to cracks in concrete

Biological effects

1. Insects and some types of fungi attack organic material like wood
2. Fungi and algae growth causes deterioration to paints and finishes, and some types may be hazardous to health

Mechanical effects

1. Mechanical wear e.g. on floors
2. Vibrations
   Vibrations causes stresses in some parts of the building which may lead to cracks.
   Vibrations may also lead to the compaction of soil in some parts of the structure causing uneven settlement.