SNS COLLEGE OF TECHNOLOGY

AN AUTONOMOUS INSTITUTION

Approved by AICTE New Delhi & Affiliated to Anna University Chennai
Accredited by NBA & Accredited by NAAC with "A+" Grade, Recognized by UGC

COIMBATORE

DEPARTMENT OF CIVIL ENGINEERING

19CEB201 – CONSTRUCTION MATERIALS

II YEAR / III SEMESTER

Unit 1 : Stones – Bricks – Building Blocks

Topic 5 : Deterioration of Stone Work

Causes of Stone Deterioration

The various natural agents such as rain, heat, etc. and chemicals deteriorate the stones with time.

RAIN:

- Rain water acts both physically and chemically on stones.
- The physical action is due to the erosive and transportation powers and the latter due to the decomposition, oxidation and hydration of the minerals present in the stones.

PHYSICAL ACTION:

- Alternate wetting by rain and drying by sun causes internal stresses in the stones and consequent disintegration.

CHEMICAL ACTION:

- In industrial areas the acidic rain water reacts with the constituents of stones leading to its deterioration.

Causes of Stone Deterioration

DECOMPOSITION:

- The disintegration of alkaline silicate of alumina in stones is mainly because of the action of chemically active water.
- The hydrated silicate and the carbonate forms of the alkaline materials are very soluble in water and are removed in solution leaving behind a hydrated silicate of alumina (Kaolinite).
- The decomposition of felspar is represented as

$$K_2Al_2O_3.6H_2O + CO_2 + nH_2O = K_2CO_3 + Al_2O_3.2SiO_2.2H_2O + 4SiO_2.nH_2O$$

Causes of Stone Deterioration

OXIDATION AND HYDRATION:

- Rock containing iron compounds in the forms of peroxide, sulphide and carbonate are oxidised and hydrated when acted upon by aciduated rain water.
- As an example the peroxide—FeO is converted into ferric oxide—Fe2O3 which combines with water to form FeO.nH2O.
- This chemical change is accompanied by an increase in volume and results in a physical change manifested by the liberation of the neighbouring minerals composing the rocks.
- As another example iron sulphide and siderite readily oxidize to limonite and liberates sulphur, which combines with water and oxygen to form sulphuric acid and finally to sulphates.

Causes of Stone Deterioration

FROST:

- In cold places frost pierces the pores of the stones where it freezes, expands and creates cracks.

WIND:

- Since wind carries dust particles, the abrasion caused by these deteriorates the stones.

TEMPERATURE CHANGES:

- Expansion and contraction due to frequent temperature changes cause stone to deteriorate especially if a rock is composed of several minerals with different coefficients of linear expansion.

Causes of Stone Deterioration

VEGETABLE GROWTH:

- Roots of trees and weeds that grow in the masonry joints keep the stones damp and also secrete organic and acidic matters which cause the stones to deteriorate.
- Dust particles of organic or nonorganic origin may also settle on the surface and penetrate into the pores of stones.
- When these come in contact with moisture or rain water, bacteriological process starts and the resultant micro-organism producing acids attack stones which cause decay.

MUTUAL DECAY:

- When different types of stones are used together mutual decay takes place.
- For example, when sandstone is used under limestone, the chemicals brought down from limestone by rain water to the sandstone will deteriorate it.

Causes of Stone Deterioration

CHEMICAL AGENTS:

- Smokes, fumes, acids and acid fumes present in the atmosphere deteriorate the stones. Stones containing $CaCO_3$, $MgCO_3$ are affected badly.

LICHENS:

- These destroy limestone but act as protective coats for other stones.
- Molluses gradually weaken and ultimately destroy the stone by making a series of parallel vertical holes in limestones and sandstones.

Thank You!!