Lecture 5,6: Lime and Mortar

LIME:

- Lime is produced by heating limestone which is calcium carbonate
- Lime or quicklime is essentially calcium oxide, CaO
- Lime has been used as materials of construction from ancient times

Sources of Lime:

Lime is obtained by burning limestone from

- Limestone hills
- Beds of old rivers
- Kankar found below ground
- Shells of sea animals

** White chalk is pure limestone and kankar is an impure limestone

Properties of Lime:

1. Easily workable
2. Provides strength to masonry
3. Possesses good plasticity
4. Offers good resistance to moisture
5. Stiffens early
6. Excellently cementing property
7. Shrinkage on drying is small

Uses of Lime:

1. as matrix of concrete
2. as a binding materials in mortars
3. for plastering walls and ceilings
4. for white washing and as a base coat for distempers
5. for knotting timber work before painting
6. for production of artificial stone, lime –sand bricks, foam-silicate products etc
7. for producing lime cement motar mixing with cement
8. as a flux in the manufacture of steel
9. as hydraulic lime for masonry work under ground level
10. in the manufacture of paints
11. as stabilizer in soil stabilization
12. for creating good sanitary conditions in foul, damp and filthy places

Types of Lime:

Quicklime: lime obtained by calcining (heating limestone to redness) pure lime stone.

$$CaCO_3 \text{ === } CaO + CaO_{2;}$$

CaO is quicklime or pure lime is unstable and to make it stable slaking or sprinkling water over it

Lump lime: lime obtained in lumps after burning in kilns

Fat lime: lime with high calcium oxide content

Hydraulic lime: lime contains small quantities of silica, alumina and iron oxide and can set even in the absence of CO2 and under water

Slaked lime/hydrate of lime: Slaking means sprinkling water on quick lime. When quicklime absorbs water (i.e by slaking) hydrated lime, which is a dry powder of calcium hydroxide, and heat is produced.

$$CaO + H_2O \text{ ===== } Ca(OH)_2 + \text{heat}$$

and slaking produces,

- Hydrated lime as dry powder
- Plastic mass of lime called putty when water is much [eaten with betel leaves]
- Milk of lime - used in white washing with other materials

Constituents of Limestone:

- Clay
- Soluble silica
- Magnesium carbonate
- Alkalies and metallic oxides
- Sulphates
- Iron compounds
- Carbonaceous matter

Manufacture of Lime:

- Collection of raw materials
- Burning of limestone --- called calcining
- Slaking of burnt lime --- to get Ca(OH)2 in the form of powder, putty or liquid

Classification of Limes: after calcining, limes obtained may be,

- **Fat lime –** also known as rich, common, high calcium or pure lime, slakes vigorously wih 2 to 2.5 times volume increase
- **Hydraulic lime -** also known as water lime, depending on percentage of clay, may be feebly, moderately and eminently hydraulic limes
- **Poor lime -** also known as lean or meager lime containing more than 30% clay, slakes slowly, hardens very slowly with poor binding property

Precautions in handling of lime: during storage, goggles for eyes, respirators for nose and throat, skin protection cread may be used

Storage of Lime: safely stored in the form of lime putty for two wks, hydrated limes in bags to be stored in closed store house free from moisture

Testing of Limestones:

- Physical; on ***texture, appearance, colour and odour of limestone***
- Chemical as ***Heat test, Hydraulic test-slaking and Acid test***

Questions:

What are the types and uses of limes?
What are the sources of limestone? How is lime produced?
What is slaking of lime? What happens during slaking?
What is the classification of lime after calcining?

How are limestone tested?

MORTAR:

What is it?:

Mortar is a paste generally made by mixing cementing and binding material [lime or cement] and an inert material with water

Why is required?

Mortars are usually required to join bricks, stones blocks etc.

What are the types and uses?

Types of Mortar: on the basis of binding material,

i) Cement mortar
ii) Lime mortar
iii) Gypsum mortar
iv) Mud mortar

: on the basis of application

- Brick laying mortar
- Finishing mortar
- Special mortar – for acoustics, X-ray shielding, plugging concrete at oil fields etc

What are the **uses of mortar**?

- Fill up the spaces between bricks or stones for making wall weather tight
- Bind together bricks or stones
- Provides a soft even bed between layers of brick or stone
- Used as matrix in concrete
- Used in pointing and plastering
- Used to improve general appearance of structure
- Used to hide open joints in a brick or stone work

What are **characteristics of good mortar**?

- Strength – cement mortars are recommended
- Resistance to penetration of rain – strong borders may be used, but not too strong
- Mobility and placeability
- Water retention
- Good bond
- Low drying shrinkage

What are the **functions of ingredients**?

- Cement, lime and clay used as binder impart adhesive power and strength
- Sand as inert material, carries and subdivides binder and reduces shrinkage
- Water lubricates surfaces of sand and causes hydration of cement

What are the **properties**?

Type of Work	Cement:Sand Proportion	Strength (N/mm2)	Strength Type
Pointing, RC brick, Foundation	1 : 3	10.0	High
Masonry, Plaster-interior	1 : 4	7.5	High
Plaster -exterior	1 : 5	5.0	Medium

What are the **tests**?

Mortars are tested for their quality by the crushing strength, soundness, setting time as cement tests. Besides, permeability test is also done

Mortar Grout: cement mortars of fluid consistency used to fill the voids and joints in masonry and to repair the cracks

Guniting: application of mortar or concrete under pneumatic pressure through a cement gun is known as guniting – the gunite may be defined as sand cement mortar conveyed through a pneumatically forced gun

Plaster:

Plaster is a thin coat of mortar of different composition which is applied on both external and internal faces of walls, ceilings, columns, staircases etc. – the process is known as plastering

Uses/Objectives of Plaster:

- To give a smooth and finished surface to the works
- To cover joints and defective workmanship
- To preserve surface from action of weathering
- To provide a ground for decoration

Specification of Good Plaster:

- Should adhere firmly to the surface on which it is applied
- Should not shrink or contract in volume on drying and setting
- Should not have unslaked particles of lime for lime mortar

Classification/Types of Plasters:

- Lime plaster – lime and sand at 1:2-3, mixed with water, kept for 24 hrs and then laid 3.8-1/2 thick on soaked surface, the plastered surface to be kept moist for two wks
- Surki plaster – 1 part lime plus 1.5 to 2.0 part surki plus water
- Lime-surki plaster – sand is added to prevent shrinkage, sand, suliki, lime in 1:1:1
- Neeru or lime putty – from quick lime puty
- Mud plaster – selected mud plus cow dung or saw dust
- Stucco plaster – decorative plaster made of lime, white stone, gypsum and oxides of coloring , applied in two or three coats
- Gypsum plaster – natural ground gypsum when heated to temp. of 140oF is called plaster of paris, mixed with sand at 1:3 plus water
- Mosaic plaster – mixture of ½ inch down stone chips plus cement in the ratio 2:1 plus water, polished and then waxed

- Cement plaster – Portland cement plus sand in the ratio 1:2 plus water, applied to scrapped, cleaned and soaked wall in single coat – this is used in most buildings

Pointing:

What is it?
Pointing is the finishing off (with trowel) of the mortar in the rough brick joints of walls

Why is done?

It is done -- to protect the joints from atmospheric agencies, and
to improve the appearance of the structure

How is done?

- Prior to pointing all mortar joints are raked out
- Loose mortar and dust are brushed out
- Joints are filled with lime or cement mortar by well pressing
- Finished pointing is kept wet for 4 days
