Materials and Methods of Construction

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Section: A

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Q#1: Ans

(a)

A brick is a block of ceramic material used in masonry construction, usually laid using various kinds of mortar. Bricks were often used for reasons of speed and economy, even in areas where stone was available. Bricks may be made from clay, shale, soft slate, calcium silicate, concrete, or shaped from quarried stone. Clay is the most common material, with modern clay bricks formed in one of three processes - soft mud, dry press, or extruded. Clay is highly needed for it's merely properties of plasticity which contributes in resisting against cracking during the process of firing the bricks. Normally, brick contains the following ingredients,

Characteristics:

1. Silica (sand) - 50% to 60% by weight

2. Alumina (clay) - 20% to 30% by weight

3. Lime - 2 to 5% by weight

4. Iron oxide - 5 to 6% (not greater than 7%) by weight

5. Magnesia - less than 1% by weight

The clay brick has been used as a construction and architectural materials for several millennia. And as the time went on, various improvements have been made on clay bricks, whereby some additives such as shale and broken brick fragments have been used to improve both strength and durability, additives of chopped straw to the wet clay to improve structural strength of the product.

(b)

Technical reasons of good Building Stone:

Reason Number One:

Good building stone can be found most anywhere, usually free for the gathering. We built our 1,100-square-foot home with 18 pickup loads of free boulders, most of which were gathered from a single field about a mile from our construction site. The rancher who owned the land was delighted to have his field cleared of "all them blankety-blank, machinery-bustin' rocks." Similar rancher/farmer/ landowner situations exist all over the country.

Reason Number Two:

As to the common complaint that stone is unbearably heavy to work with, we can only answer by noting that all the rocks used in our 10-inch-thick walls were about football size and weighed no more than the timbers commonly employed in wood-frame construction. (If necessary or preferred you could build much thicker walls using denser and heavier stones.)

Finally, a stone house doesn't take long to build. Our walls went up in just eight weeks, and we moved in a short five months after beginning construction with 100% of the work is having been done by Sharon and me, and our two girls (who were then 9 and 11 years old).

Reason Number Three:

Stone is durable, fireproof, bug- and vermin-proof, and rot-free. While some log or wood-frame buildings tend to crumble into ruin and decay after 50 years or so, well-built stone structures will often stand for *centuries.* (Of course, you won't live in your stone house that long, but your great-grandchildren might still be there ... which would certainly help save precious building materials for others.)

You're not likely to lose a stone house to fire either, but even if the structure's wood frame interior were somehow gutted by flames, you could probably rebuild from the original stone shell.

Reason Number Four:

Stone is attractive and maintenance-free. Natural stone comes in so many shapes, sizes, colors, and textures that the final appearance of a rock house is limited only by the builder's imagination, daring, and methodical effort. While our house was constructed rather simply to save time, money, and labor, we've seen veritable castles of colorful stonework all over the country.

Another great advantage of "rock living" is that—once your stone house is complete—you can totally forget further maintenance: There'll be no need to repaint, no expensive siding to install, no weather-warped boards to repair, no woodpecker holes.

Q#2: Ans

(a)

Use of Copper:

Copper is the red-hued metal with atomic number 29. Like most metals copper is a very good conductor of heat and electricity. It is also malleable and ductile. Its most distinct feature is its excellent ability to make alloys with other metals.

These above characteristics make copper a very useful metal to humankind. Actually copper has been in regular use since almost 8000 BC, where coins and ornaments were made from copper. In the modern day, the most important use of copper is in wiring for electronic devices such as computers and mobile phones. Also, conductors, transformers and other systems of distribution of power depend on copper due to its excellent conductivity.

Use of Lead:

In construction, lead is used frequently for roofs, cornices, tank linings, and electrical conduits. In plumbing, soft solder, used chiefly for soldering tinplate and copper pipe joints, is an alloy of lead and tin. ... Construction projects vary in their scope and potential for exposing workers to lead and other hazards.

Use of Tin:

Tin (Sn), a chemical element belonging to the carbon family, Group 14 (IVa) of the periodic table. It is a soft, silvery white metal with a bluish tinge, known to the ancients in bronze, an alloy with copper. Tin is widely used for plating steel cans used as food containers, in metals used for bearings, and in solder.

It is use in road construction.

Uses of Zinc:

Zinc is a bluish metal. It is actually a hard and brittle metal. It can be malleable between 100° to 150° C but is hard at other temperatures. In comparison to other metals, it has a relatively low melting as well as the boiling point. Zinc is also fairly non-corrosive

One of the most important uses of zinc is its suitability to be used in Galvanization. A thin layer of zinc coats other metals such as iron. It protects the iron from corrosion. Also since Zinc is a more reactive metal it acts as a sacrificial metal. The oxygen in the air reacts with Zinc to form Zinc Oxide, thereby protecting the iron.

Uses of Aluminum:

Aluminum in the Building and Construction Industries. Aluminum is widely used in building because of its intrinsic properties of lightness and corrosion resistance. Aluminum is used in external facades, roofs and walls, in windows and doors, in staircases, railings, shelves, and other several applications.

(b)

Blasting is essential to the mining industry.

Explosives provide the energy to break and loosen the rock necessary for processing. To effectively blast rock, a tremendous amount of energy must be released in a very short period of time. If not done correctly, this energy release can cause damage, injury or death.

The challenge in blasting is to control the energy to break and move the rock without causing flyrock, high vibration or air blast.

Proper planning

When blasting, there are at least two major safety concerns. One is premature detonation. The other is flyrock and quarrying.

Premature detonation involves an unplanned detonation during the loading or tying-in procedures, or while waiting scheduled firing. Explosives require heat or shock energy to begin the detonation process. Therefore, preventing contacts with these sources of energy is of utmost importance.

Q#3: Ans

(a)

Comparison of Brick Masonry and Stone Masonry:

Comparison of Brick Masonry and Stone Masonry, Brick masonry, Stone masonry,

Masonry is the art of the construction in brick or stone. Except in dry masonry some mortar is used to bind the bricks or blocks of stones, with each other. There are in general two types of masonry, *viz.,* Brick Masonry and Stone masonry. Brick masonry is that in which bricks are used while in stone masonry, stone blocks are used.

Comparison of Brick Masonry and Stone Masonry

1: Generally brick masonry is cheaper than stone masonry and can be easily constructed.

2: The minimum, thickness of wall in stone masonry can be 35 cm whereas, in brick masonry, walls of 10 cm thickness can be constructed.

3: The brick masonry construction proceeds very quickly whereas the stone masonry construction proceeds vary slowly, as the bricks are handy whereas stones are not.

4: Skilled masons are required for stone masonry construction, whereas unskilled laymen can do the brick masonry work.

5: Brick masonry requires less mortar whereas stone masonry requires more mortar which cannot be easily estimated.

6: Stone masonry is stronger and more durable brick masonry.

7: It is not essential to plaster the stone masonry walls whereas brick walls have to be plastered or painted, when exposed to the open atmosphere.

8: Bricks are of an absorbent nature and no absorbing moisture make the buildings damp, but stones are less adsorbent, and hence stone masonry walls or buildings are more damp proof.

9: Brick masonry work cannot be allowed to come in contact with urine, sewage etc., without protecting them, whereas this is not the case with stone masonry.

10: Brick masonry is more fire-resistant than stone masonry.

11: Good ornamental work can be cheaply and easily done in plaster in case of brick masonry, but it is not possible in stone masonry.

12: Being uniform and regular in shape, proper bond can be easily obtained in case of bricks as compared with stones. Similarly, obtuse and acute angle joints can be easily provided with brick in masonry than stone masonry.

13: Brick absorbs less quantity of heat than stone, therefore in not climates, during nights, stone walls emit mere quantity of heat and make sitting in the room uncomfortable

Q#3: Ans

(b)

Plastering is used to protect the exposed surface of masonry. However, in pointing only joints are properly filled with mortar.

Cement, sand and lime are used in plastering. In pointing, we use just cement mortar. The plastering is done at both sides of surface (both inside and outside). However, pointing is done only at the outer side of the wall.

In plastering work, we use the large amount of materials. However in pointing, we use less amount of mortar.

After the plastering, the defects of the masonry are not visible. However, after the pointing, the surface does not become smooth and plain.
When we plaster the wall, after the plastering work, the surface becomes smooth and plain. However, after pointing, the defects of masonry can be seen.

Q#4: Ans

(a)

Seasoning is the process of drying timber to remove the bound moisture contained in walls of the wood cells to produce seasoned timber. Seasoning can be achieved in a number of ways, but the aim is to remove water at a uniform rate through the piece to prevent damage to the wood during drying (seasoning degrade).
Seasoned timber tends to have superior dimensional stability than unseasoned timber and is much less prone to warping and splitting in service. In higher grades of timber, particularly

hardwoods, the process of seasoning can enhance the basic characteristic properties of timber, increasing stiffness, bending strength and compression strength.

Method of seasoning

There are two main ways of seasoning timber, Natural (Air) and Artificial (Kiln) drying. Both methods require the timber be stacked and separated to allow the full circulation flow of air, etc. around the stack.

Air Seasoning

Air seasoning is the method used with the timber stacked in the open air. It requires the following:

- Stacked stable and safely with horizontal spacing of at least 25 mm.
- Vertical spacing achieved by using timber battens (piling sticks) of the same or neutral species. Today some timber yards are using plastics. The piling sticks should be vertically aligned and spaced close enough to prevent bowing say 600 to 1200 mm max centers.
- Ends of boards sealed by using a suitable sealer or cover to prevent too rapid drying out via the end grain.
- The stack raised well clear of the ground, vegetation, etc to provide good air circulation and free from rising damp, frost, etc.
- Over head cover from effects of direct sunlight and driving weather.

Kiln Seasoning

There are two main methods used in artificial seasoning, compartmental, and progressive. Both methods rely on the controlled environment to dry out the timber and require the following factors:

- Forced air circulation by using large fans, blowers, etc.
- Heat of some form provided by piped steam.
- Humidity control provided by steam jets.

The amount and duration of air, heat and humidity again depends on species, size, quantity, etc. Schedules are published for the various species to enable operators to select an appropriate drying environment. In the UK they are usually provided by the Kiln Manufacturers and also published in the Handbook of Hardwoods and Handbook of Softwoods (BRE).

Compartmental

A compartment kiln is a single enclosed container or building, etc. The timber is stacked as described above and the whole stack is seasoned using a programmed of settings until the whole stack is reduced to the MC required.

Progressive

A progressive kiln has the stack on trolleys that 'progressively' travel through chambers that change the conditions as it travels through the varying atmospheres.

The advantage of this system, although much larger, has a continuous flow of seasoned timber coming off line.

(b)

1. Foundation failure due to Soil Movement

When water present between soil particles is removed, the soil tends to move closer together. When water is absorbed by soil, the soil starts to swell. This movement of soil is based on the type of soil. Large movement is seen with clayey soils than sandy soils. These kind of movement of soil due to change in water content affects the foundation settlement. Foundation tends to settle to and excessive settlement of foundation may lead to differential settlement and damage to the structure.

Soil movement can occur due to following:

1. Presence of vegetation or remains of old cut tree
2. Presence of mining areas
3. Shrinkable soils

Remedies for foundation failure due to soil movement:

1. Use of pile foundations where the soil is shrinkable, so that forces are transferred to the hard strata or rock.

2. Taking the foundation levels down to avoid foundation on shrinkable soils.
3. The vegetation is removed from the construction site and its roots are removed. Any cavity due to roots of vegetation shall be compacted and filled with concrete.
4. Presence of any mining areas needs to be inspected and professional help shall be taken while construction new buildings in such areas.

2. Foundation failure due Settlement of Soil Fill

If the building is constructed on a newly developed land by soil filling, the foundation on such soils tend to settle more with time as long time is needed for such soil to settle and become compact to resist the loads from the building foundation.

Remedies:

It shall be ensured that such soils are adequately compacted before construction begins on them. The foundation depth shall be increased to the hard strata or rock below the filled soil or pile foundations shall be used to prevent subsidence of foundation.

Q#5: Ans

(A)

Causes dampness in a building

The absorption of moisture by building materials is one of the main causes of dampness. This can be caused by faulty structure design, bad workmanship or the use of defective structures or materials.

Sources of dampness in buildings include the rising of moisture through the foundation walling; splashing rainwater which rebounds after hitting the wall surface; penetration of rainwater through unprotected tops of walls, parapets or compound walls; gutters which allow rainwater to descend through the top supporting wall. In the case of buildings with flat roofs, inadequate roof slopes, improper rainwater pipe connections and defective junctions between roof slabs and parapet walls can also cause dampness.

How to prevent dampness in a building

1. Membrane Damp Proofing

This involves placing layers of water-repellant materials between the source of dampness and the structure. This type of material is commonly known as damp proof course (DPC). It could be made from materials like plastic or polythene sheets, cement-based concrete, bituminous felts or asphalt. Applying DPC in a basement is usually referred to as tanking and can prevent ground moisture from seeping into the concrete walls.

2. Integral Damp Proofing

This form of damp proofing involves adding certain waterproofing compounds to the concrete mix to increase its impermeability (resistance to absorbing moisture). The compounds made from sand, clay or lime help to fill the voids in concrete and make it waterproof. Compounds such as aluminum sulfate, calcium chlorides and alkaline silicates chemically react when mixed with concrete, producing waterproof concrete.

3. Surface Treatment

This type of treatment involves filling up the pores of the surfaces subjected to dampness. Water repellent metallic soaps such as calcium and aluminum oblates and steerages are often used for this purpose. Cement coating, transparent coatings, paints, varnishes and bituminous solutions also fall under this category. Another economical option for damp surface treatment is lime cement plaster. This effectively prevents dampness in walls as a result of rain.

4. Guniting

For this type of damp-proofing, a cement gun machine is used to deposit a layer of rich cement mortar over the surface. The surface must be completely cleaned of dirt, dust, grease or loose particles by wetting it properly. Cement and sand (or fine aggregates) are then fed into the machine. This mixture is finally shot onto the prepared surface under a pressure of 2 to 3 kg per square centimeter by holding the nozzle of the cement gun at a distance of 75 to 90 cm from the working surface.

5. Cavity Wall Construction

This form of damp-proofing consists of protecting the main wall of a building by an outer wall, leaving a cavity between the two walls. The cavity prevents moisture from spreading from the outer to the inner wall.

(b)

Rope in building-related operations

One whole category of rope fastenings associated with building that has prevailed throughout history is the practice of lashed connections.[12] The great majority of vernacular buildings erected during past centuries by non-European indigenous peoples of many cultures have used—and continue to use—lashing to secure the component members of the structural frame, whether of walls or roof. In the Western world, moreover, the practice of lashing wooden members together still survives in many areas in scaffolding assemblages. Hence both permanent and temporary installations have customarily employed lashing, whether of native lianas, rattans, and vines or of locally handicrafted rope. The predominant reasons for the universality of lashing among indigenous peoples are clearly economic (the saving of skilled carpentry work), practical (the use of readily available natural materials), and structural (no notching or mechanical injury to the continuity of the grain in the wooden members, which would impair their strength).

Among peoples of nonmechanized societies where human labor is cheap, many mechanical operations have been conducted by coordinated teams of men using ropes. Two examples from the Far East, photographed for *National Geographic*, are explained by these brief descriptions:

A Three-Man Shovel (Fusan, Korea): A tool peculiar to this country, being a long-handled scoop from which two ropes extended. While the one holding the handle guides the implement, the two others furnish the power by pulling the ropes from a distance of about twelve feet. . . .[13]

Annamese Farmers Have Devised a Novel Means of Irrigation. Manipulating woven bamboo baskets with ropes attached at top and bottom, they dip water from the stream and by deft, rhythmic movements empty it into irrigation channels. There is no loitering, for to make this method successful the workers must move in unison.[14]

Most devices for raising and lowering men or materials or both require ropes: gins, shear-legs, cranes, great wheels, and windlasses. An example of the makeup and use of handicrafted rope in such circumstances in China and of its life expectancy under constant use is given in an account that begins: