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GURU NANAK INSTITUTE OF TECHNOLOGY

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Date: 19-10-2014

DEPARMENT OF CIVIL ENGINEERING

CIRCULAR

The Department of civil engineering is organizing a one day Workshop on “construction materials” on 23th oct, 2014.

In this connection I request you to circulate this among Teaching Staff and students about the seminar date and venue.

A handwritten signature in blue ink, appearing to read 'D. S. S.', is written over a light blue rectangular background.

PRINCIPAL

A handwritten signature in black ink, appearing to read 'M. R. S.', is written over a light beige rectangular background.

HOD-CIVIL

Report of Workshop

On

CONSTRUCTION MATERIALS

Date of seminar: 23-oct-2014

Name of the Expert: Mr. A.Srinivas

CONSTRUCTION MATERIALS is any material which is used for construction purposes. Many naturally occurring substances, such as clay, rocks, sand, and wood, even twigs and leaves, have been used to construct buildings. Apart from naturally occurring materials, many man-made products are in use, some more and some less synthetic. The manufacturing of building materials is an established industry in many countries and the use of these materials is typically segmented into specific specialty trades, such as carpentry, insulation, plumbing, and roofing work. They provide the make-up of habitats and structures including homes.

Fired bricks and clay blocks



A pile of fired bricks.



Clay blocks (sometimes called clay block brick) being laid with an adhesive rather than mortar



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Bricks are made in a similar way to mud-bricks except without the fibrous binder such as straw and are *fired* ("burned" in a brick clamp or kiln) after they have air-dried to permanently harden them. Kiln fired clay bricks are a ceramic material. Fired bricks can be solid or have hollow cavities to aid in drying and make them lighter and easier to transport. The individual bricks are placed upon each other in courses using mortar. Successive courses being used to build up walls, arches, and other architectural elements. Fired brick walls are usually substantially thinner than cob/adobe while keeping the same vertical strength. They require more energy to create but are easier to transport and store, and are lighter than stone blocks. Romans extensively used fired brick of a shape and type now called Roman bricks.^[11] Building with brick gained much popularity in the mid-18th century and 19th centuries. This was due to lower costs with increases in brick ^[12] manufacturing and fire-safety in the ever crowding cities.

The cinder block supplemented or replaced fired bricks in the late 20th century often being used for the inner parts of masonry walls and by themselves.

Structural clay tiles (clay blocks) are clay or terracotta and typically are perforated with holes.

Cement composites

Cement bonded composites are made of hydrated cement paste that binds wood, particles, or fibers to make pre-cast building components. Various fibrous materials, including paper, fiberglass, and carbon-fiber have been used as binders.

Wood and natural fibers are composed of various soluble organic compounds like carbohydrates, glycosides and phenolics. These compounds are known to retard cement setting. Therefore, before using a wood in making cement bonded composites, its compatibility with cement is assessed.

Wood-cement compatibility is the ratio of a parameter related to the property of a wood-cement composite to that of a neat cement paste. The compatibility is often expressed as a percentage value. To determine wood-cement compatibility, methods based on different properties are used, such as, hydration characteristics, strength, interfacial bond and morphology. Various methods are used by researchers such as the measurement of hydration characteristics of a cement-aggregate mix,^{[13][14][15]} the comparison of the mechanical properties of cement-aggregate mixes^{[16][17]} and the visual assessment of microstructural properties of the wood-cement mixes.^[18] It has been found that the hydration test by measuring the change in hydration temperature with time is the most convenient method. Recently, Karade et al.^[19] have reviewed these methods of compatibility assessment and suggested a method based on the 'maturity concept' i.e. taking in consideration both time and temperature of cement hydration reaction.

Bricks were laid in lime mortar from the time of the Romans until supplanted by Portland cement mortar in the early 20th century. Cement blocks also sometimes are filled with grout or covered with a parge coat.



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Concrete



Falkirk Wheel

Concrete is a composite building material made from the combination of aggregate and a binder such as cement. The most common form of concrete is Portland cement concrete, which consists of mineral aggregate (generally gravel and sand), portland cement and water.

After mixing, the cement hydrates and eventually hardens into a stone-like material. When used in the generic sense, this is the material referred to by the term "concrete".

For a concrete construction of any size, as concrete has a rather low tensile strength, it is generally strengthened using steel rods or bars (known as rebars). This strengthened concrete is then referred to as reinforced concrete. In order to minimise any air bubbles, that would weaken the structure, a vibrator is used to eliminate any air that has been entrained when the liquid concrete mix is poured around the ironwork. Concrete has been the predominant building material in the modern age due to its longevity, formability, and ease of transport. Recent advancements, such as insulating concrete forms, combine the concrete forming and other construction steps (installation of insulation). All materials must be taken in required proportions as described in standards.

Fabric

The tent is the home of choice among nomadic groups all over the world. Two well-known types include the conical teepee and the circular yurt. The tent has been revived as a major construction technique with the development of tensile architecture and synthetic fabrics. Modern buildings can be made of flexible material such as fabric membranes, and supported by a system of steel cables, rigid or internal, or by air pressure.



Foam



Foamed plastic sheet to be used as backing for firestop mortar at CIBC bank in Toronto.

Recently, synthetic polystyrene or polyurethane foam has been used in combination with structural materials, such as concrete. It is lightweight, easily shaped, and an excellent insulator. Foam is usually used as part of a structural insulated panel, wherein the foam is sandwiched between wood or cement or insulating concrete forms.

Glass

Glassmaking is considered an art form as well as an industrial process or material.

Clear windows have been used since the invention of glass to cover small openings in a building. Glass panes provided humans with the ability to both let light into rooms while at the same time keeping inclement weather outside.

Glass is generally made from mixtures of sand and silicates, in a very hot fire stove called a kiln, and is very brittle. Additives are often included the mixture used to produce glass with shades of colors or various characteristics (such as bulletproof glass or lightbulbs).





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The use of glass in architectural buildings has become very popular in the modern culture. Glass "curtain walls" can be used to cover the entire facade of a building, or it can be used to span over a wide roof structure in a "space frame". These uses though require some sort of frame to hold sections of glass together, as glass by itself is too brittle and would require an overly large kiln to be used to span such large areas by itself.

Glass bricks were invented in the early 20th century.

Gypcrete

Gypcrete is a mixture of gypsum plaster and fibreglass rovings. Although plaster and fibres fiborous plaster have been used for many years, especially for ceilings, it was not until the early 1990s that serious studies of the strength and qualities of a walling system Rapidwall, using a mixture of gypsum plaster and 300mm plus fibreglass rovings, were investigated. It was discovered, through testing at the University of Adelaide, that these walls had significant, load bearing, shear and lateral resistance together with earthquake-resistance, fire-resistance, and thermal properties. With an abundance of gypsum (naturally occurring and by-product chemical FGD and phospho gypsums) available worldwide, gypcrete-based building products, which are fully recyclable, offer significant environmental benefits.

Metal

Metal is used as structural framework for larger buildings such as skyscrapers, or as an external surface covering. There are many types of metals used for building. Metal figures quite prominently in prefabricated structures such as the Quonset hut, and can be seen used in most cosmopolitan cities. It requires a great deal of human labor to produce metal, especially in the large amounts needed for the building industries. Corrosion is metal's prime enemy when it comes to longevity.

- Steel is a metal alloy whose major component is iron, and is the usual choice for metal structural building materials. It is strong, flexible, and if refined well and/or treated lasts a long time.
- The lower density and better corrosion resistance of aluminium alloys and tin sometimes overcome their greater cost.



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Copper belfry of St. Laurentius church, Bad Neuenahr-Ahrweiler

- Copper is a valued building material because of its advantageous properties (see: Copper in architecture). These include corrosion resistance, durability, low thermal movement, light weight, radio frequency shielding, lightning protection, sustainability, recyclability, and a wide range of finishes. Copper is incorporated into roofing, flashing, gutters, downspouts, domes, spires, vaults, wall cladding, building expansion joints, and indoor design elements.
- Other metals used include chrome, gold, silver, and titanium. Titanium can be used for structural purposes, but it is much more expensive than steel. Chrome, gold, and silver are used as decoration, because these materials are expensive and lack structural qualities such as tensile strength or hardness.

Plastics



Plastic pipes penetrating a concrete floor in a Canadian highrise apartment building

The term "plastics" covers a range of synthetic or semi-synthetic organic condensation or polymerization products that can be molded or extruded into objects, films, or fibers. Their name is derived from the fact that in their semi-liquid state they are malleable, or have the property of plasticity. Plastics vary immensely in heat tolerance, hardness, and resiliency. Combined with this adaptability, the general uniformity of composition and lightness of plastics ensures their use in almost all industrial applications today. High performance plastics such as ETFE have

become an ideal building material due to its high abrasion resistance and chemical inertness. Notable buildings that feature it include: the Beijing National Aquatics Center and the Eden Project biomes.^[20]

Papers and membranes

Building papers and membranes are used for many reasons in construction. One of the oldest building papers is red rosin paper which was known to be in use before 1850 and was used as an underlayment in exterior walls, roofs, and floors and for protecting a jobsite during construction. Tar paper was invented late in the 19th century and was used for similar purposes as rosin paper and for gravel roofs. Tar paper has largely fallen out of use supplanted by asphalt felt paper. Felt paper has been supplanted in some uses by synthetic underlayments, particularly in roofing by synthetic underlayments and siding by housewraps.

There are a wide variety of damp proofing and waterproofing membranes used for roofing, basement waterproofing, and geomembranes.

