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Engineering Materials (CE 2103)

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24-04-19 | 1(B)-Day

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Professor

Course content:

* Definition and properties of Eng. materials
* Bricks
* Mortar
* Timber
* Paints and Varnishes
* Rubber and Plastics
* Ferrocement

Reference Books

i) Civil Eng. material – by N. Sivakugan, C.T. Gnanendran, R. Taylandhar, M.B. Kannan

ii) Eng. Materials – by S.C. Rangwala

iii) " " = by M.A. Aziz

Properties of Engineering Materials

* What is an Eng. material?

Any material which is used or applied in engineering purposes is known as eng material.

* Examples of Eng. Materials

i) Metals
ii) Ceramics
iii) Polymers
iv) Composites
v) Semiconductors
vi) Biomaterial
vii) Concrete, etc.

* Civil Engineering Materials:

Any material which is used or applied in civil engineering purposes is known as civil eng. materials.

* Examples of Civil Eng. Materials

i) Bricks

ii) Timber

iii) Aggregate

iv) Cement

v) Reinforcement (M.S Bar) — Mild steal Rod

vi) Concrete (sand + cement + khoa + water)

vii) Paint

viii) Glass

ix) Tiles → Tiles → roustic tiles

x) Fittings (water supply, electric wire, sewage line)

2015

* Basic Properties of Eng. Materials :

* Classification of properties

i) Physical properties : size, shape, density, porosity, structure
are those properties of a material which can be observed and measured.
Key point

ii) Mechanical properties :
are those properties of a material which can be measured and compute by mechanical means.
strength, elasticity, plasticity, stiffness, ductility, malleability, hardness, brittleness, ~~resistance~~ resilience, creep

iii) Chemical properties :
are those properties of a material which can be observed and measured ~~and compute~~ by chemical means

Corrosion resistance, acidity, alkalinity, chemical composition.

iii) Magnetic properties: Permeability, cohesive force, hysteresis.

iv) Electrical properties:
are those properties which can be measured and compute by electrical properties. means Conductivity, dielectric permitivity, dielectric strength.

v) Thermal properties:
are those properties of a material which can be observed and measured by thermal means. specific heat, thermal expansion, conductivity.

Physical properties

i) colors
ii) size
iii) texture
iv) melting point
v) boiling point
vi) solubility
vii) luster
viii) density
ix) magnetism
x) odors
xi) viscosity
xii) crystalline structure

diff betn phy prop and mechaprop
2018

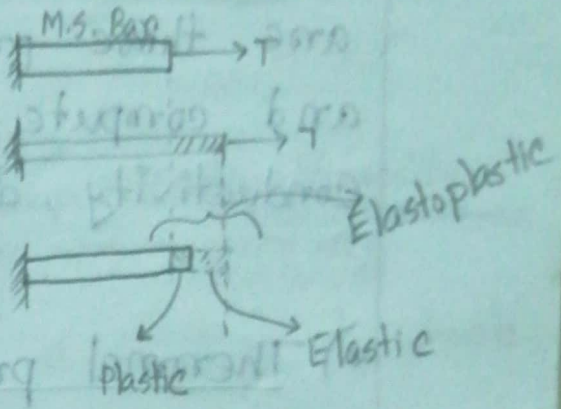
29-4-19

1(E) - Day

2011 2012 Elasticity → Ability of an object or material to resume its normal shape after being stretched or compressed.

Mechanical Prooperotie's:

i) Elasticity
ii) Plasticity
iii) Strength (Tensile or compressive)
iv) Stiffness
v) Toughness
vi) Hardness
vii) Ductility
viii) Malleability
ix) Brittleness

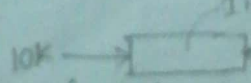


2011 2012 Plasticity: Materials cannot regain its original shape and size after removal of applied load.

Elastoplastic material has both elastic and plastic prooperoty
Ex: Soil

Stress:

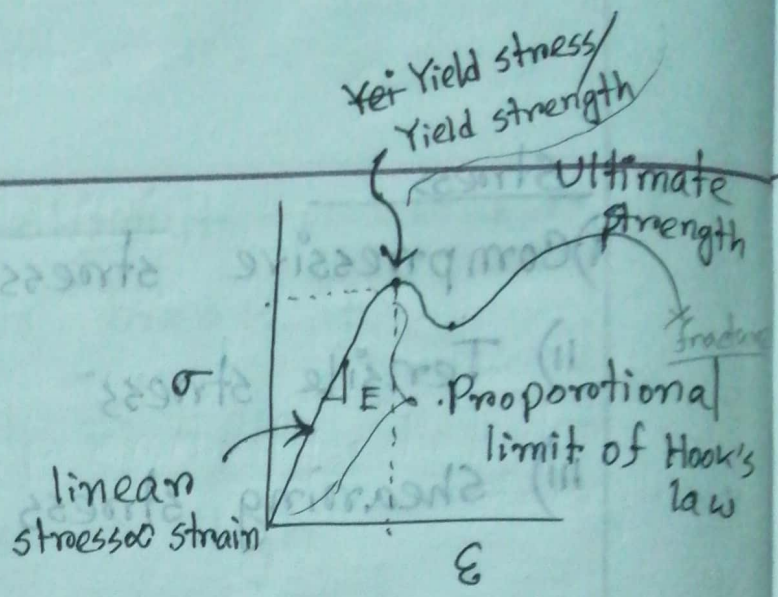
Stress is defined as internal resisting force per unit area due to applied load.



The body will move for (12-10) = 2kip . 10kip acts

So, stress, $\sigma = \frac{10}{1} = 10$ ksi

Strength:



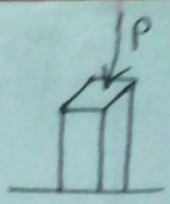
যখন failure হবে
তখনের stress টুকু হল
strength.

~~linear~~ অন্যান্য সব জায়গারটা stress. কিন্তু failure
হওয়ার Point পর্যন্ত strength.

- The strength of a material is its capacity to withstand (প্রতিরোধ করা) destruction (ধ্বংস) under the action of external loads.

* It determines the ability of a material to withstand stress without failure.

* The maximum stress that any material will withstand before destruction is called ultimate strength.



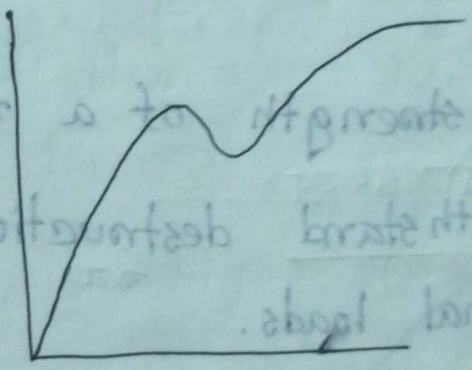
Stress

i) Compressive stress $\sigma_{com} = \frac{P_{com}}{A} = \frac{P_{internal}}{A}$

ii) Tensile stress $\sigma_{ten} = \frac{P_{ten}}{A} = \frac{P_{internal}}{A}$

iii) Shearing stress

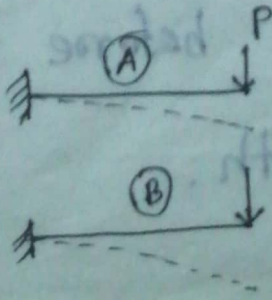
Stress - strain diagram of mild steal



2018

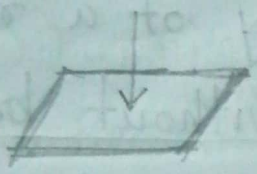
Stiffness: is the property of material by virtue of which it resists deformation.

Which one is stiffer



A is more stiffer than B.

Glass ⟶ It is difficult to bend it, but easy to break it.



strength ⇒ Low

stiffness ⇒ High

strength ⟶ hard to be broken

stiffness ⟶ hard to be deformed.

Hardness: কঠিনতা

Hardness is usually defined in terms of the ability of a material to resist to scratching, abrasion (ঘর্ষণ), cutting, identation (mark) or penetration.

Methods used for determining hardness:

Brinel, rockwell, vickers

18-06-19

2(E)-Day

Properties of Engineering Materials

Ductility: It is a the property of a material which enables it to deform without breaking

Ex: Mild steel, Bitumen etc. are ductile materials.

2018

Malleability: Malleability of a material is its ability to be flattened into thin sheets without cracking by hot or cold working.

Ex: ~~E.g~~ Lead can be readily rolled and hammered into thin sheets but can be drawn into wire. Mild steel, gold etc. (most malleable)

2018

Brittleness: Tendency of a material to fracture or fail upon the application of a relatively small amount of force, impact or shock.

Ex - Bricks, glass, ceramics etc.

Chemical Properties :

Ex :

i) burning

ii) Reaction with acid

iii) reaction with water

**iv) corrosion / rusting / oxidation
অক্সিডেশন

v) others

Electrical Properties :

i) Resistivity and conductivity

ii) Dielectric constant

**iii) Galvanism

**iv) Electrochemical corrosion

Thermal properties :

i) Service temperature

ii) Thermal expansion coefficient

iii) Thermal conductivity

iv) Thermal diffusivity

2015

Basic facts to consider when selecting EM

i) Mechanical properties

ii) Availability

iii) Transport

iv) cost

Chapter-2

Brick

kind of stone — মূল উপাদান 1) বালু 2). sand

What is brick?

A brick is an artificial kind of stone made of clay.

Factors Affecting the Quality of Bricks:

i) Chemical properties of the clay used

ii) Preparation of clay (সঠিকভাবে করলে ভাল হয়)

iii) Blending of clay (ingredience মিশানো)

iv) Moulding (ছাঁচে ফেলে আকার দেওয়া / মেশিনে করলেও)

v) Drying

vi) Burning

Constitute of Brick Clay:

i) Silica —— 55%

ii) Alumina —— 30%

iii) Iron Oxide —— 8%

iv) Magnesia —— 5%

v) Lime —— 1%

vi) Organic Matters — 1%

2018 2010 2006

Functions of the Constituents of Brick Clay:

2018 2010 2006

Functions of Silica 55%

i) It prevents cracking, shrinking & warping of raw bricks

Positive side

ii) It imparts (প্রদান করা) uniform shape of the bricks

iii) It makes the bricks durable.

Negative Side

i) Excess silica destroys the cohesion between particles

ii) Bricks becomes ~~bittle~~ brittle

22-06-19

3(B)-Day

☑ CT

Function of Alumina : 30%

Positive sides

i) It gives plasticity to brick earth

ii) It imparts density

iii) It makes the brick harden and stronger.

2014

Negative sides

i) Excess alumina causes shrinkage and warping of raw bricks

ii) The bricks become too hard

2013 A small quantity of oxide of iron to the extent of about 5 to 6 percent is desirable in good brick earth.

2018 ☑ Function of Iron Oxides: 8%

Positive sides

i) It helps to fuse (গলানো) silica

ii) It makes the red colour of bricks

iii) It enhances the impermeability (ভেদ্যতা) and durability (স্থায়িত্ব).

2014 Negative sides

i) Excess iron oxide makes the brick blue or ~~reddish~~ blackish in colour. (picked bricks = ঝামা bricks)

ii) The colour of bricks becomes yellow if the content of iron oxide is less.

☑ Function of Magnesia: 5%

Positive sides

i) It imparts yellow (yellow shade) tint to the bricks

ii) It decreases shrinkage

Negative sides

i) Excess magnesia leads to the decay of bricks

☑ Function of Lime: 1%

2010
R006

Positive sides

i) It prevents shrinkage of raw bricks.

ii) It also helps to fuse sand slightly.

2018
2014

Negative sides

i) Excess lime causes the bricks to melt and the shape of bricks is lost.

ii) Excess lime forms a lump on the surface of bricks.

☑ Function of Organic matter: 1%

Positive sides

i) It assists burning of bricks

Negative sides

i) Excess organic matter makes the brick porous.

2008

Harmful Ingredients of brick clay :

2017 i) Iron pyrites : It causes crystalization and disintegration because of the oxidation of iron pyrites.

2014 2017 2018 ii) Alkalies : It causes fuse, twist and warp their shape of bricks. As a result, bricks are melted and they looses. It also causes efflorescences

iii) Pebbles (stone chips) : It hampers the uniform and through mix of clay. It hampers the clay to be mixed uniformly and thoroughly.

iv) Vegetation : It makes the bricks porous.

v) Lime → xm point

2018 ***

Efflorescences: Efflorescences is a phenomenon in which the salt inside a brick clay is brought out on the surface of brick clay with the help of water and forms a white deposite/ white colour on removal of moisture.

Causes → Na_2SO_4, K_2SO_4

i) Presence of alkalies in brick (sodium sulfate, potassium sulfate, etc)

ii) Presence of moisture or water

iii) Evaporation of moisture

Damages →

i) The colour of plaster surface is destroyed.

ii) ~~The Dising~~ Disintigration of plaster surface occurs

iii) The disintigration of bricks occurs.

iv) The plaster surface becomes damp

Removal →

i) It is removed using brush or sprinkling of water.

Control ⟶

i) Make a mixture of 15–20 droops bathroom cleaner, & 500 ml vinegar and 100 ml water.

ii) Apply the mixture on the surface of brick or plaster.

Manufacturing of Bricks:

1) Preperation of clay
2) Moulding
3) Drying
4) Burning

23-06-19

3(c)-Day

describe

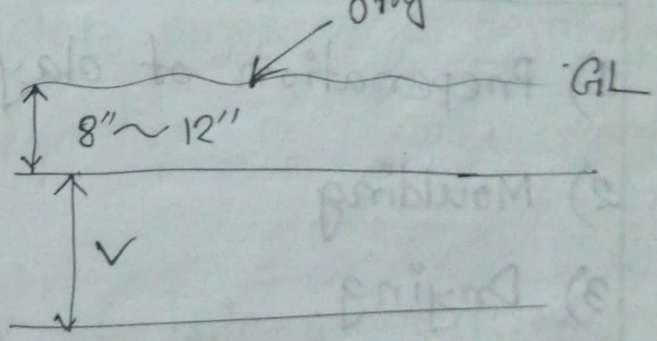
1) Preparation of Clay:

2018

i) Unsoiling
ii) Digging
iii) Cleaning
iv) Weathering
v) Blending
vi) Tempering

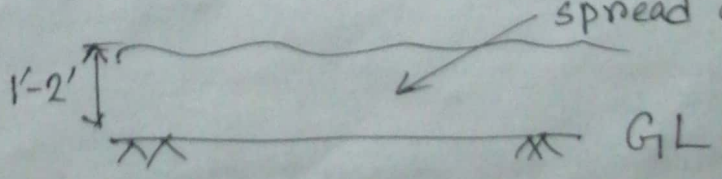
diff 2014, 2012

Unsoiling:



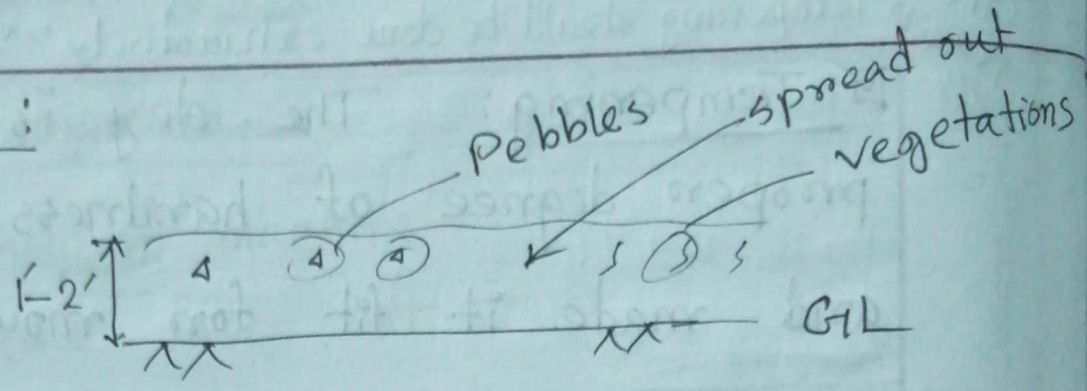
The process of removing soil from the top layer of earth is known as unsoiling.

Digging:



The clay is dug out and spread on the ground. The process is known as digging.

☑ Cleaning:



Stones, pebbles, vegetations are cleaned from the clay spread out. and this process is known as cleaning

☑ Weathering: Clay is exposed to weather for softening or mellowing for few weeks to attain maturity and this process is known as weathering.

☑ Blending: Hermonious mixing of clay with/without addition of any ingredient is known as blending

2011 Give reason

2014 diff betn blending and tempering

"Tempering should be done exhaustively" Rangawala page 73

☑ **Tempering:** The clay is brought to a proper degree of hardness by kneading and made it fit for moulding.

2019 Pugmill is used to temper the clay. The process of making clay fit for moulding using pugmill is known as pugging.

2) **Moulding:** Giving a specific shape of brick using raw clay is known as moulding.

Types of moulding:

i) Hand moulding
ii) Machine moulding

- Ground moulding — not time consuming
- Table moulding — Time consuming

diff 2015 2017

advantage, difference

shape, size, table

Ground surface

☑ Machine Moulding:

With the help of machine

i) brick অনেক fast তৈরী হবে।

ii) Suitable for large scale brick production

iii) Uniform shape and size

অসুবিধা for

i) costly is small scale

Difference bet^{n} hand moulding and machine moulding

→ at least 3টা point 3 marks এর qstn এ

→ বই থেকে

Machine moulding can be divided under the following

i) Plastic clay machine / wire cut bricks

ii) Dry clay machine / pressed bricks

Details

বই থেকে advantage / disadvantage / difference

Rangawala বই

5-06-19 3(E)-Day

Relative Advantage - disadvange

Hand moulding	Machine moulding
Advantage	
i) Moulding is done by hand	i) Moulding is done by machine
ii) Suitable for small scale brick production	ii) Suitable for large scale
iii) Time consuming	iii) Takes a very short time
iv) not economical	iv) economical
v) Not give uniform shape, size	v) Give uniform shape, size
vi) Manpower is cheap and readily available	vi) Sometimes expensive when machine is not available
vii) Time consuming	

2017 2003

Tests for bricks (mechanical)

i) **Absorption** → Bricks should not absorb water not more than 1/5 (20%) of its own weight

ii) **Crushing strength** → The minimum crushing or compressive strength of bricks is 3.5 N/mm²

iii) **Hardness** → If a scratch is not made on the surface of brick by using nail, then it is sufficiently hard brick.

iv) **Presence of soluble salts** → Percentage of soluble salts should not exceed 2.5%

v) **Shape and size** → Bricks should be of standard size and shape should be truly rectangular with sharp edge.

vi) Soundness: The two bricks are taken and struck with each other. Bricks should not break and a clear ringing or metalic sound ~~be~~ should be produced

vii) Structure: ~~A brick is bro~~ It should be homogeneous, compact and free from any defects such as holes, lumps etc.

2017 2008

*Write down the factors affecting strength of bricks

Ans: Following factors affect the strength of bricks

i) Composition of brick earth

ii) Preparation of clay and blending of ingredients.

iii) nature of moulding adopted

iv) Care taken in drying and stacking of raw or green bricks.

v) Type of kiln including type of fuel and its feeding

vi) Burning and cooling process

vii) Care taken in unloading.

* 2017 Discuss briefly the mechanical tests of bricks
* difference between Jhama bricks and Jhama 2011 bats

* 2010 2006 Write short notes on i) Brick works ii) Brick Drying iii) Pugmil

Blending	Tempering
i) Harmonious mixing of clay with/without addition of any ingredient is known as blending	i) The clay is brought to a proper degree of hardness and made fit for moulding is known as tempering
ii) Harmonius mixing	ii) Homogeneous mixing
iii) To loose the brick clay	iii) To hard the brick clay
iv) No machine is used to make this job	iv) Pugmill is used ~~for~~ to tempero the clay
v) Makes clay fit for tempering	vi) Makes clay fit for moulding.

Ground moulding	Table moulding
i) Moulding is done ~~bgin~~ on ground	i) Moulding is done on table
ii) Bricks are not uniform shape and size	ii) uniform shape, size
iii) Time is not consumed	iii) Time consuming
iv) Easy to transfer	iv) Hard to transfer
v) Cheap	v) Costly
vi) Not easy to work	vi) Easy to work

2005 2007 A frog mark is placed on raw bricks during moulding — give reasons

Frog: A frog is a mark on the surface of brick (10-20 mm in depth).

2014 Why called so?

*The indent required a wooden former in the bottom of the mould box.

*This looks like a crouching frog and the name stuck despite its reference to the indent.

2014 **Purposes**

i) It indicates the trade name of the manufacturer.

ii) It enhances the shearing resistance.

iii) It affords a key for mortar in between any two adjacent courses of bricks.

Brick work → short note

2010 short note

3) **Drying:** Drying is a process of removing moistures from the brick clay.

☑ Purposes

i) To remove water content to accelerate burning

ii) To minimize the cracking and distortion of bricks.

iii) To increase the handling facility.

☑ Types

i) Natural drying

ii) Antificial drying

Natural drying process:

Arranged in such a way that proper air circulation is ensured.

↕ diff 2017 2018

Antificial drying process:

i) Hot floor dryer

ii) Tunnel dryer

Moulded bricks are allowed to pass through the hot tunnel dryer.

2017 2018

4. Relative advantage – disadvantage

Natural drying	Artificial drying
cost free	time consuming
– বর্ষাকালে করা যায় না	weather
time বেশি লাগে	fuel burn হয়
i) Drying is done under sunlight and air	i) Drying is done in dryers.
ii) Season dependent	ii) Season ~~un~~ independent
iii) Economical	iii) Not economical
iv) Time consumed (ব্যয় করা)	iv) Not time consumed
v) Used for small scale	v) Used for large scale
vi) Uneven drying (অসমান)	vi) Evenly drying (সমান)

Burning	Drying
i) To make the bricks dense	i) To remove water content from the brick clay
ii) To impart hardness and strength to the bricks	ii) To minimize cracking and distortion of bricks
iii) To attain durability	iii) To increase handling facility.

Scanned with CamScanner

29-06-19

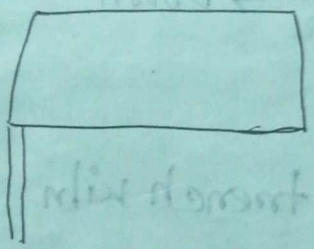
4(B)-Day

2017 diff betn burning and drying of bricks

4) Burning:

i) Usually 1100°C temperature is required to burn bricks

ii) At this temperature, alumina and sand bind themselves together.



Objectives of Brick Burning:

i) To impart hardness

ii) To impart strength to the bricks

iii) To make the bricks dense

iv) To attain durability.

Types of Burning:

i) Clamp burning or Pazawah burning → বিভিন্ন প্রকার

ii) Kiln burning → বেশি ব্যবহৃত

Types of Kiln Burning:

i) Intermittent kilns → Up-draught kiln
                      → Down-draught kiln

ii) Continuous kilns
- Hoffman's kiln
- Bull's trench kiln

2014

Calmp Burning:

Rangwala র বই থেকে figure আঁকতে হবে।

* slope is kept 15°
* 15° angle এ রাখা হয়।

Fuel * dark color গুলা Fuel (saw dust, dried grass, rice-husk, etc)

Lines * Alternative Layers of dried brick (4-5 course, confirm air circulation)

* Brick wall in mud (3-5 m)
* Earth cover

2013 Discuss the advantages of kiln burning over clamp burning.

* Initial and fuel cost is low. Capacity is low. Brick quality is low. Obsolete. (60%) বিলুপ্তপ্রায়

Kiln Burning:

Rangawala র বইতে figure

2010 → Bull's Trench Kiln → is popular in Bd. cause → বাংলাদেশে জনপ্রিয় কারণ

2006 i) economy in construction

ii) Not affected by wind or moderate rain. মাঝারি

iii) Short period of burning

iv) Better quality of bricks

2018 Hoffman's Kiln → fig. সহ short note

Comparison Between Bull's Trench and Hoffman's Kiln

* Semi-continuous	* Perfectly continuous
* Shape is rectangular, circular, oval	* Shape is circular
Bull's Trench Kiln	**Hoffman's Kiln**
i) Less initial cost	~~ii) Consumption of fuel is less~~ i) High initial cost
ii) Consumption (খরচ) of fuel is more	ii) Consumption of fuel is less
iii) Stop ~~functioning during monsoon~~ working in rainy season	iii) Works all the year round
iv) About 18 lac bricks per year	iv) About 60 lac bricks per year
v) Percentage of good bricks is moderate (মাঝারি)	v) Percentage of good bricks is high
vi) More space for drying	vi) Less space for drying

Hoffman's সবদিক দিয়ে ভাল। কিন্তু initial cost অনেক বেশি বলে বাংলাদেশে Bull's trench টাই use হয়।

2010
2007
2006
2005

Quality / Characteristics of Good Bricks:

i) The bricks should be uniform in color, size and shape.

ii) They should be neither overburnt nor underburnt

iv) They should be sound and compact.

v) They should not absorb water more than 1/5 of their own weight.

vi) The compressive strength of brick should be 5000 to 8000 psi.
but 3000 এর উপর হলেও কাজ চলবে। তবে 5000 to 8000 or better.

vii) The weight of one brick should be 6 pound

viii) Percentage of soluble salts should ~~be~~ not exceed 2.5%

ix) They should have low thermal conductivity.

2005

2014
2007

Fild test of Brick:

i) Scratch test

ii) Impact test

iii) Fall test.

Scratch test:

i) Take a brick

ii) Try to make mark on its surface by nail

iii) If mark is possible, it's not a good brick.

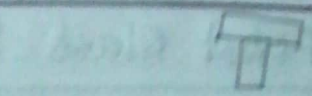
Impact test:

i) Take a brick

ii) Strike it with a hammer. hammer দ্বারা আঘাত করাকে strike বলে।

iii) If it gives clear ringing / metallic sound, it's a good brick. If not, it's a bad brick

Fall test:



i) Take two bricks and form a T

ii) Drop them from a height of 6 ft on a more or less solid surface.

iii) If any one of them breaks, it's not a good brick. Otherwise, the bricks are good.

Types of Bricks:

i) First class bricks

ii) Second class bricks

iii) Third class bricks

Besides —

i) First class bats

ii) Second class bats

iii) Picked jharna bricks

iv) Jharna bricks

v) Jharna bats

02-07-19

4(E)-Day

First Class bricks:

2017

i) They are table-moulded

ii) They have standard shape and size.

iii) The surface and edges are sharp, square, smooth and straight.

iv) They comply with the qualities of good bricks.

Second Class bricks:

2012

i) They are ground-moulded

ii) Their surface is somewhat rough.

iii) The shape is slightly irregular

iv) The bricks may have hair cracks (सूक्ष्म)

v) Edges may not be sharp and uniform.

vi) The strength is same as first class bricks

Third Class bricks:

i) They are ground-moulded

ii) The surface is rough.

iii) Edges are irregular and distorted.

iv) The bricks are not hard.

First class Bats:

They are broken bricks of first and second class.

Second class Bats:

They are broken bricks of third class.

→ Used where strength is not a factor.

Picked Jhama Bricks:

i) They are uniformly vitrified (to be glass) throughout.

ii) They must be of good shape and heavy.

iii) They must not be spongy.

iii) Preferable for khoa but not wall.

2011 diff betn Jhama bricks and Jhama bats

Jhama Bricks:

i) They are well burnt bricks but not well shaped as picked jhama bricks.

ii) They must not be spongy.

iii) They must be free from cinders and projecting lumps.

Jhama Bats:

They are broken bricks of picked jhama and jhama bricks.

Special Bricks: Characteristics and uses

i) Paving bricks / Checkered brick — used in garden walks, brick masonry, street pavements

ii) Jamb bricks — bricks chamfered and

iii) Bull nose brick

iv) Plinth brick

v) Coping brick.

2014 diff betn bullrose and perforated

vi) Cornice brick

vii) Gutter brick

viii) Hollow brick

ix) Perforated brick ⟶ short note 2017

2014 **Size of bricks:**

** imp for viva

According to PWD (Public Works Department), the standard size of brick:

$9\frac{1}{2}'' \times 4\frac{1}{2}'' \times 2\frac{3}{4}''$

2011 2007 2005 **Uses of bricks:**

Write down the uses of various types of bricks

i) Construction of wall

ii) Construction of roads

iii) Construction of bridge piers

iv) Construction of tunnel

v) Preparation of khoa and suroki.

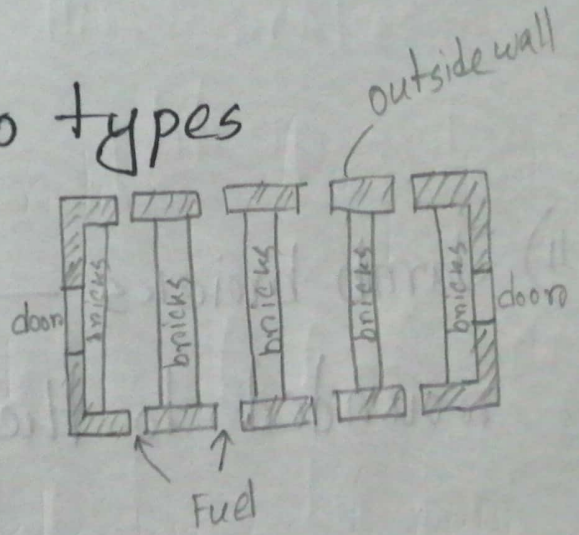
* Intermittent kilns

These kilns are intermittent in operation. They are loaded with dry bricks then fired, cooled and unloaded.

They are classified into two types

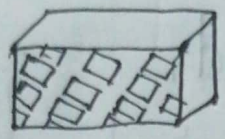
i) Up-draught kilns:

ii) Down-draught kilns.

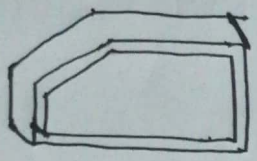


Special bricks

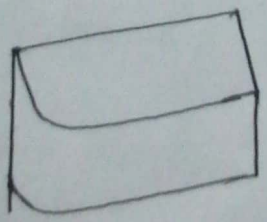
i) Paving bricks (checkered bricks) ⟶ used in brick masonry, garden walks, street pavements.



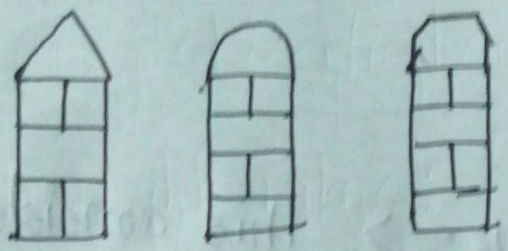
ii) Jamb bricks ⟶ Bricks chamfered (কোনা কাটা) and rounded to the desired shape at one corner



iii) Bull nose brick ⟶ It is used for rounded quoin. It is used to increas the ornament (such as corners of a building)



iv) Coping bricks → These bricks are made to suit the thickness of walls on which coping is to be provided. They are used to ornamental purposes



vii) Channel bricks

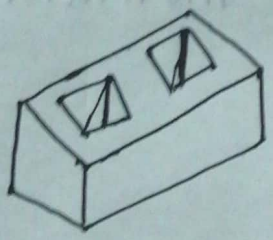
i) looks like channel

ii) used to function of drain

v) Hollow bricks →

i) known as cellular or cavity bricks

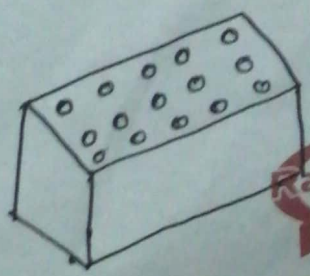
ii) Used in hollow walls in building, ~~use~~ in making partition wall



vi) Perforated bricks →

i) Contain cylindrical holes throughout their thickness

ii) Used in building walls



2010 2006
Brick works

i) First class brick-work → This consists of first class bricks laid in lime or cement mortar. All the materials should be of first class quality

ii) Second class brick-work → This consists of 2nd class bricks laid in lime or cement mortar.

iii) Third class brick work → This consists of 3rd class bricks in mud mortar.

4. Volume of Brick:

Calculate the no. of bricks required to complete 1 cft of brick works.

Soln: For brick Stone

1. Vol of 1 brick $= \frac{9.5 \times 4.5 \times 2.75}{(12)^3} = 0.068$ cft

0.068 cft of volume = 1 no. of brick

$\therefore$ 1 cft " " $= \frac{1}{0.068}$ no $= 14.69$

$\simeq 15$

2. Brick work/masonry work এর জন্য

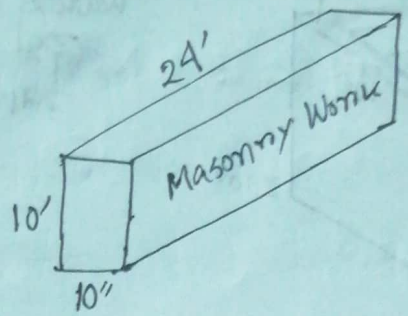
vol of 1 brick $= \frac{10 \times 5 \times 3}{(12)^3} = 0.087$ cft

0.087 cft of volume = 1 no. of brick

$\therefore$ 1 cft " " $= \frac{1}{0.087}$ no

$= 11.5 \simeq 12$

Prob -03



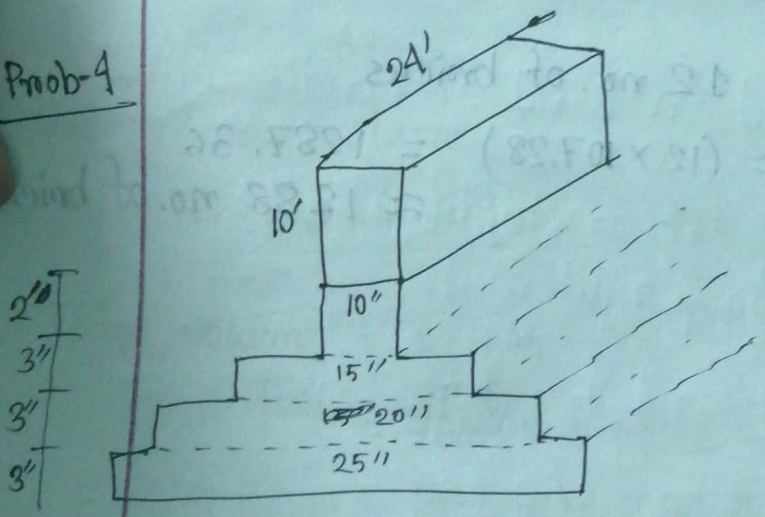
Calculate the No. of brick required.

Vol = $\frac{10}{12} \times 10 \times 24 = 200$ cft

1 cft এর জন্য 12 টি brick লাগবে → required brick for 1 cft = 12

No. of brick = $12 \times 200 = 2400$

Prob-4



$V_1 = 24 \times 10 \times \frac{10}{12} = 200$ cft

$V_2 = 24 \times \frac{10}{12} \times 2 = 60$ cft

$V_3 = 24 \times \frac{20}{12} \times \frac{3}{12} = 10$ cft

$V_4 = 24 \times \frac{25}{12} \times$

$V_1 = 24 \times 10 \times \frac{10}{12} = 200$ cft

$V_2 = 24 \times 2 \times \frac{10}{12} = 40$ cft

$V_3 = 24 \times \frac{3}{12} \times \frac{15}{12} = 7.5$ cft

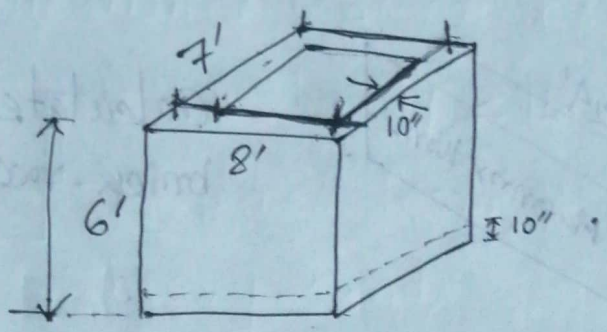
$V_4 = 24 \times \frac{3}{12} \times \frac{20}{12} = 10$ cft

$V_5 = 24 \times \frac{3}{12} \times \frac{25}{12} = 12.5$ cft

∴ Total volume = 270 cft

no of bricks required = $12 \times 270 = 3240$

Prob 5



Water tank তৈরী করতে কতইট লাগবে?

Water tank

outer volume = $7' \times 8' \times 6' = 336$ cft

inner volume = $(7 - \frac{10}{12})' \times (8 - \frac{10}{12})' \times (6 - \frac{10}{12})' = 228.72$ cft

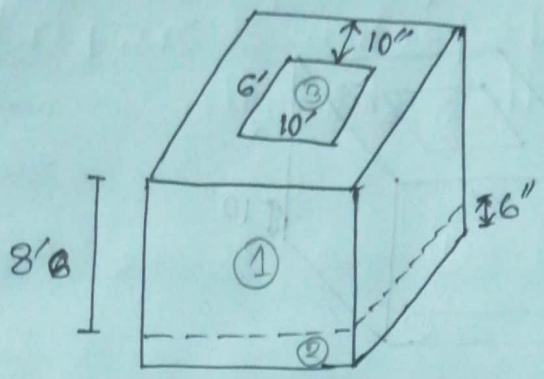
Total volume = $336 - 228.72 = 107.28$ cft

1 cft of volume = 12 no. of bricks

$\therefore$ 107.28 cft " " = $(12 \times 107.28) = 1287.36$

≈ 1288 no. of bricks

CT 1



Outer ~~Inner~~ volume, $V_1 = \left(10 + \frac{2\times10}{12}\right) \times \left(6 + \frac{2\times10}{12}\right) \times (8$ ~~+ 6/12~~$)$

$= $ ~~760.28 cft~~ 715.56 cft

Base volume, $V_2 = \left(10 + \frac{2\times10}{12}\right) \times \left(6 + \frac{2\times10}{12}\right) \times \frac{6}{12}$

$= 44.72$ cft

~~Outer~~ Inner volume, $V_3 = 10 \times 6 \times 8$

$= 480$ cft

Total volume $= V_1 + V_2 - V_3$

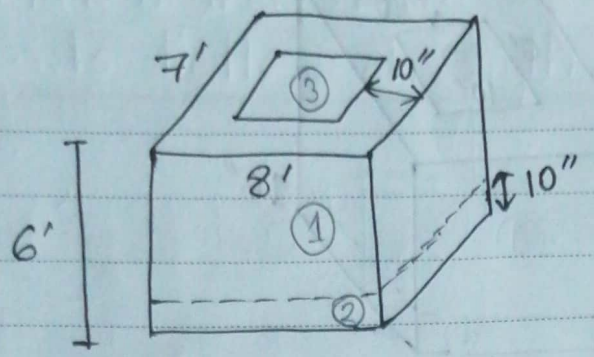
$= $ ~~760.28~~ 715.56 $+ 44.72 - 480$

$= $ ~~325 cft~~ 280.28 cft

1 cft volume = 12 no. of bricks

$\therefore$ 325 cft $=$ ~~325~~ 280.28 $\times 12) =$ ~~3900~~ 3363.36 ≈ 3364 no. of bricks

Problem 5



Outer volume, $V_1 = 8 \times 7 \times \left(6 - \frac{10}{12}\right) = 289.33$ cft

Base volume, $V_2 = 8 \times 7 \times \frac{10}{12} = 46.67$ cft

Inner volume, $V_3 = \left(8 - \frac{2\times10}{12}\right) \times \left(7 - \frac{2\times10}{12}\right) \times \left(6 - \frac{10}{12}\right)$

$= 174.52$ cft

Total volume $= V_1 + V_2 - V_3$

$= 289.33 + 46.67 - 174.52$

$= 161.48$ cft

No. of bricks required $= (161.48 \times 12)$

$= 1937.76$

≈ 1938

6-07-19

5(B)-Day

Ch- Mortar

2015 What is mortar?

Mortar = Binding material + Inert material + water

Mortar is a paste prepared by mixing binding material and an inert material with water.

2015 2010 Function of sand in mortar;

i) Sand acts as adulterant → Volume for economy

ii) More surface area

iii) Prevent shrinkage and cracking

iv) Adjustment of strength

*** imp

Classification of mortar

Mortars are classified based on the following.

i) Bulk density

ii) Kind of Binding Material

iii) Nature of application

iv) Special mortars

Pumice Mortar: Fine ground pumices are added to the lime mortar in the portion of one part to one part. It imparts better strength.

Classification based on Bulk density:

- Heavy Mortar
  - i) Bulk density $\geq 15\ kN/m^3$
  - Prepared from quartzs or other heavy sand
- 2013 Light Mortar
  - Bulk density $< 15\ kN/m^3$
  - Prepared from light porous sand.

Classification based on kind of binding material:

- 2014 Lime Mortar
  - Lime (fat or hydraulic lime) is used as binding material
  - Lime + sand + water = lime mortar
  - It has high plasticity and good cohesiveness
  - It is sufficiently durable
  - It is generally used for lightly loaded above ground parts of building.

cement এর সাথে Lime এর compare CT'16

*

Surki Mortar

- Lime + surki + water = surki mortar
- It is used for ordinary masonry work.

Cement Mortar (Popular — সবচেয়ে বেশি ব্যবহৃত)

1. Cement is used as binding material
2. Cement + sand + water = cement mortar
3. Proportion may be 1:2 to 1:6 depending on the strength required
4. It is used for important work like masonry work, plastering etc.

2017

* Cement is sometimes added to the lime mortar — give reasons

Gauged Mortar (2014, 2013)

- Lime + cement + sand + water = Gauged mortar
- cement makes lime mortar economical, strong and dense
- Cement is used to improve the quality of lime mortar and to achieve early strength. This process is known as gauging.

→ Used for bedding and thick brick wall

Gypsum Mortar

- Gypsum is used for binding material

2015

Classification based on the nature of application:

Bricklaying Mortar
- Mortars are used for brickwork and walls.

Finishing Mortar
- Mortars are used for plastering work
- It is also used for decorative finishing.

Special Mortar

Grout Mortar (2018, 2019)
- Very thin or liquid mortar is termed as grout
- It is used to fill in the cracks, faults or narrow joints
- The process of application is known as grouting.

thick & liquid mortar

Nisha

2013 * Short note on Pumic mortar

2. Fire Resistance Mortar
- Aluminous cement is added to the finely crushed powder of fire bricks.
- Aluminous cement : powder of fire brick = 1 : 2
- This mortar is fire-resistant
- It is used with fire-bricks for (i) lining furnance, (ii) fire places, (iii) Ovens.

3. Packing Mortar

Properties of packing mortar are:
i) High homogeneity and water resistance
ii) Predetermined setting time
iii) Ability to form solid water proof plugs in cracks and voids on rocks.
iv) Resistance to subsoil water pressure.
v) Types : a) Cement-sand, b) Cement-loam and c) cement-sand-loam
vi) It is used in packing oil well

09-07-19 5(E)-Day

4. Saond Absorbing Mortar
   - To reduce the noise level, saond-absorbing mortar plaster is used
   - It is used in auditorium.

5. X-ray shielding mortar
   - It is a heavy mortar with bulk density over 22kN/m³.
   - The aggregates are obtained from heavy rock
   - It is used for providing the plastering coat to walls and ceiling of X-ray cabinates.

6. Air Entrained Mortar
   - To improve the workability of lean cement-mortar, air is entrained
   - It acts as a plasticizer

2018

Air Entraing Admixture:

1) Air entraining admixture is a read-to-use aqueous solution of special organic materials.

ii) Air entrainment is the intentional creation of tiny air bubbles in mortar.

iii) Air entraining admixtures are: Natural wood resin, Animal and vegetable fat and oil, alkali salt, aluminum powder, water soluble soap, vinsol resin, etc.

7. Special Mortar

- Decorative Mortar
  - This mortar is used to impart a pleasant outer appearance to the surface of structure.
  - This is attained by adding coloring agent of pigments to the mortar.

Preparation of Lime Mortar:

Two methods

i) Pounding and

ii) Grinding

2015
State the procedure to carry out the tensile strength test of cement mortar

2015
2014
2013

Preparation of Cement Mortar:

i) At first sand is poured
ii) Then cement is poured
iii) Mix thoroughly
iv) Make a pond and add water

} hand mixing

Machine mixing:

i) Machine mixing is used when large quantity of mortar is required continuously.
ii) Sand, cement and water are added to the ~~mixture~~ mixer.
iii) They are mixed for some time till the mixer has a uniform consistency.

2017
2008

Properties of a good mortar mix:

i) It should have good adhesion with the building units.

ii) It should attain the desine design strength

iii) It should resist penetration of rain ভেদ্যতা

iv) It should be cheap and durable.

v) It should be workable.

vi) It should set quickly for speedy construction

2017
2010

Precautions in using Mortar:

V.V. imp topic point

Mortar consumption সময়

i) It should be consumed within 30 minutes for cement mortar.

ii) It should be consumed with 36 hours after its preparation for lime mortar.

Mortar consumption during frost তুষারপাত

i) It is advisable to stop using mortar in the presence of frost.

Mixing of sea water

2018 1) ~~Seaa~~ water should not be used in making mortar because salt is present in sea water which causes efflorescence. And sea water prevents quicly drying of mortar.

Application of Mortar in building

1) Building unit should be soaked in water before mortar is used

Sprinkling of water in plaster:

1) The masonry or plaster surface should be kept damp by sprinkling water for at least 7 days.

Building unit should be soaked in water before used in mortar so that the walls ~~do n~~ can not absorb water from mortar. If this precaution is not taken, ~~the~~ building units will absorb water from mortar and the mortar will become weak. This will reduce the strength. The presence of water in mortar is essential to cause its setting action.

13-07-19

6(B)-Day

Selection of ~~water~~ Mortar

Nature of work	Type of Mortar
Waterlog area	Cement mortar (1:2); lime mortar (1:3)
Dam-proof course DPC	Cement mortar (1:2)
Cement concrete roads	Cement mortar (1:2)
Partition wall and parapet wall	Cement mortar (1:3)
Plaster work	Cement mortar (1:5)
Plaster work ceiling	Cement mortar (1:4)
Reinforced brickwork	Cement mortar (1:3)

Test of Mortar

i) Normal consistency test
ii) Setting time test
iii) Cube test
iv) Tensile strength test.

Uses of mortar:

i) To bind the building units into a solid mass.

ii) To carry out plastering works

iii) To improve the general appearance of the structure.

iv) To prepare hollow blocks / hollow bricks.

v) As a filler material in ferro-cement works

vi) To give neat finishing to concrete works.

Ch – Plaster

What is plaster?

~~A th~~ Plaster is a thin coat of mortar.

The process of applying plaster is known as plastering.

Classification of plaster:

20th

Lime plaster

- *Lime mortar is used in lime plastering (Lime : sand) (1:2)
- Thickness of plaster is 3/8 to 1/2 inch in one coat

Surki ~~Mortar~~ Plaster

- Surki mortar is used in surki plastering (Lime : surki) (1:2)
- Thickness → 3/8 to 1/2 inch in one coat
- Mainly used in plinths and walls.

Lime - Surki plaster

- Surki mortar is used (Lime : Sand : surki = 1 : 1 : 1)
- Thickness = 3/8 to 1/2 inch in one coat.

Neeru or Lime putty

- Neeru is prepared from quick lime
- It is then used in plastering
- Mainly used in walls.

Cement plaster

- Cement mortar is used (1:2 to 1:5) (cement : sand)
  Portland cement : standard sand = 1:2
- Thickness of plaster is 1/2 inch to 1 inch in one coat.
- Mainly used in walls, ceiling, colum, beam, staircase, etc.

2013 * Composition and application of cement ~~mortar~~ plaster

Stucco plaster

- Stucco means ornamental coat of plaster
- This is made of either clean white shell lime and powdered marble (1:2) or cement mortar (1:3)

Mosaic plaster

- cement : sand : marble = 1:2:2 or 1:1:2
- Crashed marbles are used

Methods of plastering:

i) Plastering by hand

ii) Plastering by machine

Specification / Requirement of a Good Plaster:

A good plaster should —

i) Adhere (লেগে থাকা) firmly on the applied surface

ii) not shrink

iii) be hard and durable

iv) ~~be~~ cheap and economical

v) resist penetration (অনুপ্রবেশ) of water.

2014

Pointing:

*Pointing is the finishing off the mortar in the rough brick joints of walls to give the surface beautiful appearances.

* Cement mortar is usually used.

* Cement : sand = 1:2

Uses of pointing

i) Pointing gives ~~beau~~ attractive appearance of walls. The Curzon Hall in Dhaka city is a typical good example of pointing

ii) Pointing ~~po~~ projects joints from dampness and makes them water proof (Protect)

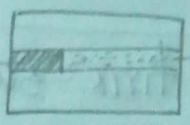
iii) Pointing is also applied on old walls when the joints become loose and defective.

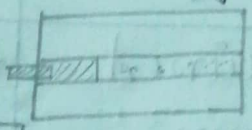
Mortar	Plaster
i) Mortar is a paste	i) Plaster ~~its~~ is its application
ii) Used ~~in for~~ in masonry for joining bricks, stones blocks etc	ii) Used for rendering on outside and inside of walls
iii) It is formed from binding material, inert material and water	iii) It is formed from mixture of cement, lime/clay, fine aggregate and water

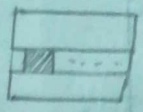
2013 * uses of pointing

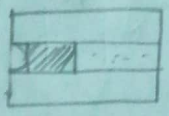
2013

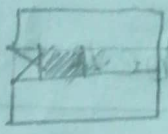
Types of pointing:

i) Tuck pointing / Flush pointing 

ii) Bastard pointing 

iii) Cut pointing 

iv) Rule pointing 

v) V- pointing 

2018

Plastering Vs Pointing

Plastering	Pointing
i) It is applied to entire surface.	i) It is provided only at exposed joints
ii) It provides smooth surface	ii) It does not provide smooth surface
iii) It conceals defective workmanship in the masonry construction	iii) It is used to expose beauty of well built masonry work
iv) It provides a base for applying white / colour washing	iv) White washing or colour washing are ruled out.

Plaster	Pointing
v) economical	v) costly
vi) time saving	vi) time consuming
vii) not required skilled labour	vii) Required skilled labour

16-07-18

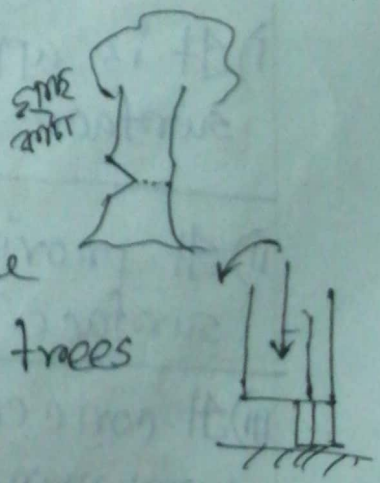
6(E)-Day

Ch - Timber

What is timber?

2010

The timber denotes wood which is suitable for building or carpentry or various other engineering purposes



Preperation of timber:

1. Felling of Trees: Felling is the process of downing individual trees

2. Seasoning of timber: Raw tree contains at least 50% of its own weight as water.

2015 * diff betn wood and timber

2010 * The process of drying of timber is known as seasoning

Types of seasoning

i) Air seasoning / Natural seasoning

ii) Kiln seasoning / Artificial seasoning.

Advantage disadvantage

definition, process, Advantage disadvantage

2015 diff Arti and natural

Types of Artificial seasoning of timber:

2003

i) Kiln seasoning
ii) Chemical Seasoning
iii) Electric seasoning
iv) Water seasoning

Chemical seasoning:

i) Also known as salt seasoning
ii) Timber is immersed in solution of salt.

iii) Then it is removed and seasoned
iv) Less change of shrink and crack.

Electric seasoning:

i) High frequency AC current is passed through timber.
ii) Timber gets heated and dries out.
iii) Uniform seasoning is possible but costly.
iv) Rapid method and used to manufacture plywood.

Water seasoning:

i) Timber log is immersed wholly in water
ii) Running water is better
iii) After few days, it is taken out from water and dried in air

2013 * How does seasoning improve the Quality of timber

2014
2011

Purpose of Seasoning:

i) Reduce moisture
ii) Impart hardness, stiffness and strength.
iii) Make the timber light in weight.
iv) Easy to paint and polish
v) Easy to add preservative and paint
vi) Reduce seasonal changes (crack, shrink and warp)
vii) Increase life
viii) Safe timber from insect attract
Insect attacks when — (i) there is moisture
(ii) It is raw

2011 * Explain the various methods of sawing timber

2011

Sawing method

Sun Mon Tue Wed Thu Fri Sat

Date :

i) Ordinary sawing or cross sawing

ii) Radial or rift sawing

iii) Tangential or slash sawing

iv) Quarter sawing.

v) Combination sawing

i) Ordinary sawing or cross sawing : Sawing is done approximately perpendicular to the tree.

ii) Radial or rift sawing : Sawing is done parallel to medullary rays and perpendicular to the annual rings.

iii) Tangential or slash sawing : Sawing is done perpendicular to medullary rays and ~~parallel to the annu~~ more or less tangential to annual rings.

iv) Quarter sawing : Sawing is done in quardants of circle.

v) Combination sawing : The central portion ~~is sawn at~~ Axicet right angles by ordinary method while the outer quardants are sawn by radial or rift method.

23-07-19 7(E)-Day

Natural Vs Artificial Seasoning:

2012

Natural	Artificial
i) Slow process	i) Quick process
ii) Simple and economical	ii) Technical and expensive
iii) More space is required	iii) Less space is required
iv) More porn to fungi and insect attack	iv) Less porn to fungi and insect attack.

Preperation of Timber:

Adding Preservatives

i) To increase the life of timber and

ii) To protect the timber from attack of fungi, insects, preservatives are added.

2011 Various method of sawing timber

Sawing of Timber

i) Timbers have sawn to the desired shape to meet up different engineering requirements.

2012 2010 2008

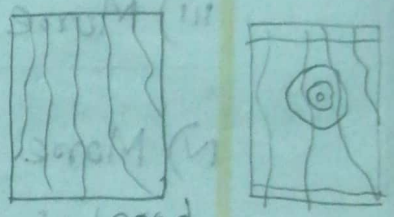
Quality / Properties / Characteristics of good Timber:

1) The color of good timber should preferable be dark.

2) A good timber should be free from defects.

3) It should be durable.

4) It should have straight fibers.



5) It should be hard

6) It should not deteriorate easily under mechanical wear or abrasion.

7) It should be uniform in size and shape.

8) It should have sufficient strength

9) It should be tough

10) It should stand reasonably the weathering effects.

1 inch = 2.34cm
= 23.4mm

Market Form of Timber:

1) Batten: The thin piece of timber (breadth and thickness ≤ 50 mm)

2) Board: It is plank (thickness < 50mm ; width > 150mm)

2018 3) Log: It is the trunk of tree obtained after removal of branches.

2018 4) Plank: It is a timber piece with parallel sides (thickness < 50 mm, width > 50 mm)

2013 2012 5) Veneers: Thin sheets or slices of wood of superior quality (thickness varies from 0.4 mm to 6mm).

Veneers are used to produce plywood, laminboards, batten boards etc.

2010/2007 diff → veneers plywood

Veneers	Plywood
iii) No adhesive is added	i) Adhesive is added
iv) Have effect of moisture content	iv) Have no effect of moisture content

thickness may vary from 6mm to 25mm

2012 * Application of pentex

2012
6) Ply wood: Plywoods are boards prepared from three or more thin layers of wood or veneers in odd numbers.

2013 diff betn ply and Fiber

* plywoods are used in ceiling, doors, furniture, partitions, railway coaches etc.
* thickness varies from 6mm to 25 mm

7) Fiberboards: They are rigid boards

⇒ They are also known as pressed board

⇒ Thickness varies from 3-12 mm.

⇒ They are used in wall paneling, partition wall, flush door, top of table, formwork for cement concrete, etc.

Pentex (or timber use করা)

Plywood

i) Prepared from veneers
ii) Thickness varies from 6-25 mm
iii) Commercial sizes have width upto 1.5m and lengths upto 3m

Fiberboards

i) Prepared from plywood, veneers
ii) 3-12 mm
iii) Available in widths varying from 1.2 m to 1.8m and in lengths varying from 3m to 4.5m

Impreg
2018
8) Impreg timber: Fully or partially covered by resin

⇒ Phenol formaldehyde is used as resin

⇒ Veneer is immersed in resin and consolidated mass is developed.
সংকুচিত, চাপ

⇒ Formica, sunmica, sunglass etc. are commercial name.

⇒ Used for mould, furniture, decorative articles.

* Compare impreg and compreg
2011

9) Compreg timber: ১) আরো point add করতে হবে।

⇒ Process of compreg timber is same as impreg timber.

⇒ Curing is done by pressure rather than by temperature

⇒ Strength of compreg timber is more than impreg timber.

Ply wood	Fiberboards
i) Boards which are prepared from 3 or more thin layers of wood or veneers in odd number	i) Rigid boards and also known as pressed boards
ii) Commercial form — Battenboard, laminboard, veneered plywood etc	ii) Trade name — Eurnaka, Indianite, Insulite etc.
iii) Thickness varies from 6mm to 25 mm	iii) Thickness varies from 3mm to 12mm
iv) Commercial sizes have widths upto 1.5m and lengths upto 3m	iv) Available in width of varying from 1.2m to 1.8m and length varying from 3m to 4.5m
v) Used in ceiling, doors, furniture, partition, railway coaches etc	v) Used in wall paneling, partition wall, Flush door, top of the table, formwork for cement concrete etc

Axiom

Impreg timber	Compreg timber
i) It is not cured under pressure.	i) It is ~~not~~ cured under pressure
~~ii) It is not cured at temperature~~	ii)
ii) It is cured at a temperature about 150-160° C	ii) It is not cured at temperature.
iii) Strength and durability is ~~not~~ less than compreg timber	iii) Strength and durability is more than impreg timber.

2013 * Name the uses of timber

Uses of timber:

1) In making doors and windows
2) As a formwork of cement concrete.
3) In making furniture
4) In making agricultural instruments.
5) In railway coach wagons.
6) In making toys.
7) ~~In m~~ As a railway sleepers
8) In making boats.

27-07-19 8(B)-Day

Rubber

What is rubber?

An elastic material obtained from a milky liquid (for natural rubber) or

derived from petroleum and natural gas (for synthetic rubber)

Natural Rubber:

i) Extracted from rubber trees in the form of milky juice. নিষ্কাষিত

ii) Filtered, purified and coagulation.

iii) Water and rubber are separated.

iv) Rubber sheets are dried out.

v) It melts when hot and gets hard and brittle when cold.

Vulcanization

The chemical process for converting natural rubber or related polymers into more durable materials via the addition of sulphur or other equivalent additives or the accelerators.

Properties of natural rubber:

i) Low melting point

ii) Low tensile strength

iii) Too rigid when cooled

iv) Too soft and sticky when hot

v) Insoluble in water.

Vulcanization of Rubber:

1) 1-3% by weight of sulphur is added to raw rubber.

2) It is mixed and heated carefully.

3) Sulphur atoms form cross-links between adjacent chains of rubber polymer at the carbon-carbon double bonds.

4) It makes the rubber stiffer and stronger.

2012 2013 2014

Effect of Vulcanization of Rubber:

i) Increas tensile modulus (E এর মান বৃদ্ধি)

ii) Increase slightly the dynamic modulus.

iii) Rubber becomes insoluble in any solvent.

iv) Rubber becomes less susceptible to temperature change.
ধারণে অসমর্থ

2012 2013 2014 * Enumerate the effect of vulcanization on the properties of rubber.

2015 uses

Application of Vulcanized Rubber: (uses)

i) Belts → ও চালের মিলের wheel এর connecting Belt

ii) Tire

iii) Shoe soles

iv) Bowling balls

v) Bouncing balls

vi) Toys

vii) Erasers

viii) Instrument mouthpieces, etc.

2010

Synthetic Rubber:

i) Artificial elastomer

ii) Obtained mainly from petroleum

iii) Elastic materials

iv) Good qualities and cheap.

v) Recyclable.

2010

Properties of synthetic rubber:

i) Solid, flexible, durable.

ii) It hardens when it is cooled

iii) It can be moulded when heated

iv) Resistant to heat, light and chemicals.

v) Heat and electrical insulator.

2007
2003
* properties and uses of rubber

Uses of synthetic rubber:

i) Car tires
ii) Flexible rubber toys
iii) Paints
iv) Rubber gloves
v) Tubes
vi) Hoses

2018
2011

Application of Rubber in Civil Engineering

i) Rubber water dam → A recent technology
ii) Base Isolation system → building
iii) Base Isolation bearing
iv) Rubber pad in bridge → earthquake
vibration control
absorb

Plastic

2007
2003

What is plastic?

Plastic is an organic substance consisting of natural or synthetic binders or resins.

*In general, plastics are compounds of carbon with other elements such as ~~strength~~ hydrogen, nitrogen and oxygen.

~~C_2H_4N~~ (पालिइथिलिन) Polyethylene

$(C_2H_4)_n$

The process of combining or synthesizing to form polymers (using monomers) is known as polymerization. Thus a polymer consists of thousands of monomers joints togethers.

Classification of Plastic:

1) Thermo - Plastic

2) Thermo - setting

2018 diff betⁿ thermo-setting and thermoplastic

Thermo-Plastic: → Heat non-convertible group

1) It becomes soft when heated and hard when cooled

2) Hardening and softening may be repeated infinite time, provided that temperature during heat is ∧

not so high.

iii) It is thus possible to shape and reshape with heat and pressure.

Analogy of thermo-plastics:

i) Ice

ii) Chocolate

iii) Metal

Application of thermo-plastics:

i) Polycarbonate lenses

ii) Plastic bottles

iii) Chairs

2015 * Short note on plastic as an eng. material

Thermo - Setting plastics :→ Heat convertible group

i) It can be heated and moulded once.

ii) It is not normally recyclable

iii) A plastic becomes thermo-setting plastics when temperature is above 127°C

Analogy of thermo-setting plastics:

i) Cement

Application of thermo-setting plastics:

i) Formica

ii) Bakelite

iii) Gears

iv) Cables

v) Telephone

vi) Car

vii) Bullet train

8 (E) - Day

Properties of plastic:

i) Plastic offers great resistance to moisture, chemicals and solvent. (দ্রাবক)

ii) The plastic is quite durable. (টেকসই) (পুরোপুরি)

iii) The plastic lacks ductility - নমনীয়

iv) It possesses excellent electric insulation property.

v) It is combustible. (দাহ্য)

vi) It has low melting point (about 50°C)

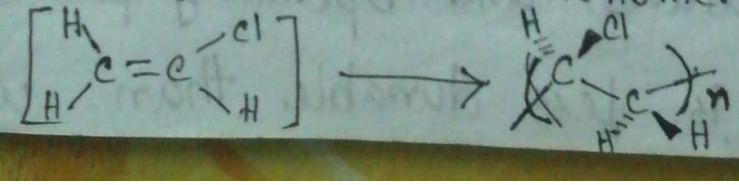
vii) The thermal conductivity of plastics is low. (পরিবাহীতা)
It has low thermal conductivity

PVC

2014

2013 i) PVC (polyvinyl chloride) is a common, strong but lightweight plastic used in construction.

ii) Polyvinyl chloride is produced by polymerization of the vinyl chloride monomer as follows.



iii) PVC is a polymer with good insulation properties

iv) It is used for ~~sw~~ sewerage pipes, electric cables, furniture, flooring materials etc.

2014 2017 diffⁿ betⁿ uPVC and PVC

uPVC :

2014 2013 Advantages of uPVC over PVC

i) uPVC actually stands for unplasticised polyvinyl chloride.

ii) uPVC is also commonly known as rigid PVC.

iii) It is called this because it is hard and does not flex.

iv) It is incredibly resistant to chemical erosion.

অবিশ্বাস্যভাবে

ক্ষয়

v) It also functions well in a wide range of temperatures and operating pressures.

vi) PVC is less durable than uPVC.

2011

FRP

2014 * How does fiber reinforcement improve the quality of FRP

i) FRP means Fibre-reinforced plastic (FRP)

2014 2013 2011 [also fibre-reinforced polymer and glass fibre reinforced plastic (GRP)

ii) A composite material made of a polymer matrix reinforced with fibres.

iii) It is one of the strongest and most durable materials in the world.

iv) Light weight with high strength.

v) Corrosion free and impact resistant.

vi) Dimensional stability

vii) Electrically non-conductive

viii) Non-magnetic and non-sparking.

ix) Low thermal conductivity.

2019 * Write a short note on plasticizer

How to prepare FRP:

~~Fiber~~ Fibres used are:

i) glass
ii) carbon
iii) Aramid
iv) basalt

Uses of FRP: (net থেকে পড়ে নিতে হবে)

2014
2013 building এর ক্ষেত্রে FRP যেভাবে দেওয়া হয় যাতে strength বাড়ে

Strainer তৈরীতে
Dome "
Root "
Large well / water tank "

i) Used in deep tubewell
ii) Used in finishing work
iii) Used in shades
iv) Used in large containers
v) Used in weak structure to make it strong.

Supporting wall → wall কে support দিতে

2012 2014 ## Uses of Plastic:

i) electric goods তৈরীতে → switch, socket, bulb,
2) overhead water tank তৈরীতে
3) ~~bath~~ and sink units
4) Corrugated sheet (ঢেউটিন)

11) Paints and varnishes
10) Electric insulators
5) doors, windows
6) PVC pipes
7) Concrete shuttering.
8) Internal partitions and wall paneling
9) Lighting fixtures
12) pipes to carry cold water
13) bottles

2007
2003
Application and uses of plastic

FRP

vi) Used on walls and ceilings
vii) Used in buildings, bridge, pipelines
viii) Used in the rehabitation of concrete structures
ix) Used in aerospace, automotive, marine and construction.

Thermo Plastic

i) It is heat non-convertible group

ii) Become soft when heated and hard when cooled

iii) Temperature should not exceed 127°C

iv) ~~Can be~~ It is recyclable

v) Application :
Polycarbonated lenses
Plastic bottles
Chains

Thermo setting

i) It is heat convertible group

ii) Become rigid when moulded with suitable pressure and temperature

iii) Temperature can be over 127°C

iv) It is not normally recyclable.

v) Application :
Formica
Bakelite
Gear
Cables
Telephone
Car
Bullet train

PVC	uPVC
i) PVC means Polyvinyl chloride	i) uPVC means unplasticised; polyvinyl chloride.
ii) Less durable	ii) More durable
iii) Can not be recycled	iii) Can be recycled
iv) Can't be used in high temperature	iv) Used in wide range of temperature and operating pressure.
v) soft and flexible	v) Hard and doesn't flex
vi) ~~Use~~ Not used in window frame	vi) Used in window frame
vii) Plasticizers is added	vii) Plasticizer is not added
viii) Uses → Sewerage pipes, electric cables, furniture, flooring materials etc.	viii) Uses → Window frame, plumbing, draining

19-08-19

9 (B) - Day Paints and Varnishes

What is Paint?

Paints are coatings of fluid materials applied over the surfaces of timber and metals.

* It is usually defined as a dispersion of pigments in a ~~dy~~ drying oil, with addition of driers and thinners.

Objectives of paintings:

i) To protect the surfaces from weathering actions.

ii) To prevent decay of wood or metals.

iii) To give good appearance and smooth surface of wood or metal.

iv)

Characteristics of Ideal / good paints:

i) It should have good spreading power

ii) It should be cheap and economical.

iii) It should dry out in a reasonable time.

iv) It should be long lasting

v) It should not affect the health of painters.

vi) It should stand the weathering effect.

vii) It should possess attractive and pleasing appearance.

Ingredients of oil Bonne paint:

diff 2015

i) A base
ii) A vehicle or carrier
iii) A drier
iv) A coloring pigment
v) A solvent

} প্রত্যেকটা paint এর জন্যই থাকতে হবে

vi) Inert filler
vii) Plasticizer.

] optional

2012

Base:

i) A base is a solid substance in a fine state of division.

ii) It forms the bulks of a paints.

iii) It determines the character of a paint.

iv) It imparts durability of paints

v) It reduces shrinkage cracks on paints on drying

vii) Example : White lead, Red lead, oxide of iron, Aluminum powder, Titanium ~~powder~~ white.

A Vehicle or carrier :

i) A vehicle is a liquid substance which hold the ingredients of paints in liquid suspension.

ii) It helps spread the paint evenly and uniformly.

iii) It works as a binder for the ingredients of paints.

iv) Example : Linseed oil, Tung oil, poppy oil, Nut oil.

A Drier:

i) It accelerates the process of drying.

ii) It may be in the form of soluble driers or paste driers.

iii) It increases the durability of paints and brings down the cost of paints.

iv) It also prevents shrinkage and cracking.

v) More than one drier is used in a mixture.

vi) It should not be used unnecessarily. Excess injures the color of paints and destroy the elasticity of paints.

vii) Example :- Cobalt, lead, manganese,

A coloring pigments:

i) It is used to have a different color other than the base of paint.

ii) It is available in the form of powder.

iii) It provides required shade and color to the paints

iv) It reduces the intensity of development of cracks due to droying of the vehicles.

v) Example: Graphite (black color), Indigo (blue color), Copper sulphate (green color), Carmine (red color), Zinc chrome (yellow color).

2012

A solvent / Thinner / Dilutes:

i) It is a liquid and volatite substance added to paints to make its applicability ease and smooth.

ii) It is used to make a paint thin to spread easily.

iii) It also helps in penetrating the paint through the porous surface.

iv) However, it reduces durability, lessens the gloss, flatten (crush) color.

v) Example: Turpentine, mineral spirits, xylol, dipentine.

Inert fillers:

i) It is an adulterant usually mixed in an oil paint to modify its weight

ii) It is used to improve its durability and economy in the cost of base used

iii) Example: Silica, charcoal, gypsum, etc.

2019

Plasticizer:

i) Plasticizers are used to give elasticity to the film.

ii) They minimize or prevent cracking.

iii) Some oils are used as plasticizers.

Types of Paints:

i) Aluminium paint

ii) Anticorrosive paint

iii) Bituminous paint

iv) Cellulose paint

v) Cement paint

vi) Emulsion paint

vii) Enamel paint

viii) Plastic paint

ix) Synthetic rubber paint.

Aluminium paint:

i) The very finely grounded aluminium is suspended in either quick-drying spirit varnish or slow drying oil varnish as required.

ii) It is visible in darkness

iii) It resists heat to a certain degree.

iv) It gives good appearance and possesses high electrical resistance.

Anticorrosive paints:

i) It consists of oil and a strong drier.

ii) A pigment such as chromium oxide or lead orange lead or zinc chrome after mixing with some quantity of sand is added to the paint

iii) It has a black appearance.

iv) It is cheap and durable.

2017 ✠ **Bituminous paint:** — short note

i) It is prepared by dissolving asphalt or mineral pitches or vegetable bitumen in any type of oil or petroleum.

ii) It has a black color

iii) It is used for painting ironwork under water.

2015 **Cellulose paint:**

i) It is prepared from nitro-cotton, celluloid sheets, photographic films etc.

ii) A cellulos paints hardens quickly by evaporation of thinning agent

iii) It is costly but presents a flexible, hard and smooth surface.

iv) It can be washed easily

v) It is not affected by hot water and extreme degree

of cold and heat.

2012 Application [4] Cement paints:

i) A cement paint consists of cement and hydrated lime mixed along with a colouring pigment.

ii) Composition of cement paint: White cement = 60 to 75%, hydrated lime = 10 - 20%; hygroscopic salts (calcium or sodium chloride) = 4 to 5%; calcium or aluminium streamate = 1%; white pigment = 2 to 5%; coloring pigments = upto 8%

iii) Inert filler (sand) is often used to make the paint economical.

iv) Cement paint is available in powder form and require mixing only in water before use.

v) It can be applied with a brush. It imparts pleasing appearance.

vi) It can be applied over new and damp walls

which cannot be painted with oil paints.

vii) It can be washed. It is water proof and durable.

viii) It does not take on peel off by climate conditions.
It proves to be very economical.

ix) It is commonly used as a lasting finish on outer surfaces of walls and ceiling in residential and public buildings.

disadvantage
Mixing % ঠিক না থাকলে, cement বেশি হলে ফাটল cracks তৈরী হবে।

26-08-19 10(B)-Day

Emulsion Paint:

i) It consists of polyvinyl acetate and synthetic resin as binding material.

ii) It is easy to apply and dries quickly

iii) The paint possesses excellent alkali resistance

iv) The colon of paint is retailed for a long time.

v) The surface of paint is tough and it can be cleaned by washing with water.

vi) It is mostly employed for painting steel and woodwork which is to be built in masonry.

2012 Application

Enamel paint:

i) Enamel paint consists of white lead or zinc white grounded in a small quantity of oil and mixed with petroleum spirit and resinous matter.

ii) It dries slowly and forms a hard and durable surface.

iii) It is not affected by cold and hot water.

iv) It is little costly but economical in the long run.

v) It resistant to stream, fumes, acids and alkalis.

It is durable and form a tough, elastic and glossy film.

ব্যবহার

i) Door ii) windows iii) wood based work iv) timber

2012 Application

Oil Paints:

i) This is the ordinary paint

ii) They are also termed as primes, undercoats, and finishing coats.

iii) It is cheap, easy to apply, possesses good opacity but have low gloss.

iii) It is affected by the presence of dampness.

iv) It serves as a foundations for the fresh paint.

2012 Application

Plastic Paints:

i) The paint contains necessary variety of plastics

ii) It is available in the market under trade names.

iii) The plastic paint can be applied either by brush painting or spray painting.

iv) The paint possesses pleasing appearance and is attractive.

v) These paints are finest types of paints.

vi) They provide durable film on drying.

vii) As they are attacked by salts, dust gases, they should be used for interior jobs.

viii) They should not be used in metalic surfaces

ix) ব্যবহার

i) Showroom

ii) Auditorium

iii) Interior wall

iv) Theater.

2017

2017

Synthetic Rubber Paints: — advantages

i) This paint is prepared from resins.

ii) It dries quickly, offer good resistance to water

iii) It is easy to apply

iv) It is moderate in cost

v) It possesses excellent chemical resisting properties

vi) It is little affected by sunlight and weather.

ব্যবহার → Easily used in outer walls of buildings

2015 Short note → Turpentine

Varnish

What is varnish?

Varnish is the solution of resins or resinous substances prepared either in ~~alcho~~ alcohol, oil or turpentine.

Paint এবং varnish এর পার্থক্য important

Objectives of Varnishing:

i) To brighten the appearance of wood

ii) To render brilliancy to the painted surface.

iii) To protect the painted surfaces from atmosphere.

Characteristics of an Ideal Varnish:

i) It should render surface glossy

ii) It should dry quickly

iii) It should not fade away due to atmosphere

iv) It should be tough, hard and durable.

v) It should not shrink or crack after drying.

Ingredients of varnish:

i) Resins or resinous substance — must

ii) Dryers → optional

iii) Solvent — must

Resins:

i) Commonly used resins are copal, lac, shellac and iron

ii) Other resins are amber, mastic, etc.

Dryiers:

i) It accelerates the drying process

ii) Common drier is litharge, white copper, lead acetate

Solvent:

i) It is used depending on the type of resin.

ii) Boiled linseed oil is used for amber, copal

2011
2010 * diff betn paint and varnish

iii) Methylated spirits of wine is used for lac or shellac.

iv) Turpentine is used for Mastic, resin.

v) Wood naphtha is used for cheap varities of resins.

Types of varnishes:

i) Oil varnish
ii) Spirit varnish
iii) Turpentine varnish
iv) Water varnish

2015 compare
2015

i) Application,
ii) properties,
iii) ingredients কিকি দিয়ে তৈরী
পড়তে হবে

* diff betn paints and verish

Application of paints and Varnishes:

নিজে পড়তে হবে

31-08-19

10(E)-Day

Ferrocement

cement এর new construction technique

2017
2012
2010

What is Ferrocement?

Ferrocement is relatively new construction material consists of wire meshes (তারের জালি) and cement mortar.

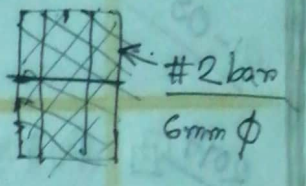
Ferrocement is also referred to as ferroconcrete.

2012

Constituent materials / ingredients:

i) Cement
ii) Fine aggregate (ক্ষুদ্রাংশ material specification)
iii) water
iv) Admixture
v) Reinforceing mesh
vi) skeletal steel
vii) Coating

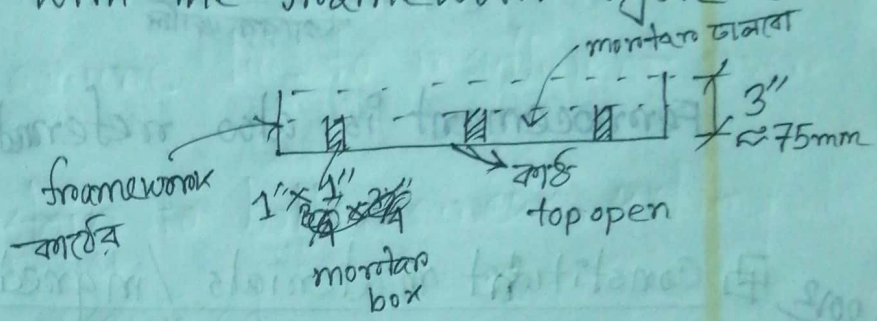
Explain composition and specification for ferrocement



Process of ferrocement construction:

i) Fabricating the skeletal framing system
নির্মাণ কাঠামো

ii) Tie the meshes with the framework system



iii) Prepare a framework, place the mortar block and ~~Sit~~ Place the framework on the mortar ~~on the mortar~~ block.

iv) Fill ~~the~~ up to the thickness of the framework with mortar and smooth the top surface.

v) Curve the system for 28 days

over conventional building materials

2018
2011
2010
2005

Advantages of ferrocement:

i) Basic raw materials are readily available in most of the countries in the world.

ii) Can be fabricated in any desire shaped.

iii) Easy to construct

iv) Low self weight

v) Long lifetime.

vi) Low construction cost.

vii) Better resistance against earthquake.

viii) Relatively good strength.

ix) Resistant to impact

x) Not brittle
ভঙ্গুর

Disadvantages of ferrocement:

i) Can be punched by ~~pollution~~ collision with pointed object.

ii) Corrosion may occure due to insufficient cover.

iii) Difficult to sustain (বজায় রাখা) to bolts (বল্টু), screws, welding etc.

iv) Skilled labourer is required.

~~v) Time mesh~~

v) Tieing mesh is a tedious (বিরক্তিকর) job

2016

Advantages of ferrocement over R.C.C.:

i) A high ratio of strength to weight compare to RCC.

ii) Cost effectiveness compare to R.C.C.

iii) Speedy process of construction.

iv) High acceptibility in terms of shape and form.

v) Flexibility with regards to cutting, drilling and joining.

vi) More energy efficient compare to R.C.C.

2015 Discuss the scope of ferrocement in civil Engineering

2015 Uses of the applications of ferrocement:

2005 / 2006

i) Roof channel

ii) Boats

iii) Water tank

iv) Wall ~~panel~~ parmel

v) Door

vi) Small houses

vii) canel lining

viii) Retaining walls

ix) Monuments

2013 * How do we use ferrocement to repair damaged concrete?

Ans: Following steps are taken:

i) Damaged concrete is taken into a mould

ii) Then the composition of cement mortar with the steel mixture is given to the mould.

iii) It is kept some times like 1 hour.

iv) Then the mould will be raised carefully

v) Finally without any vibration we can get the repaired concrete.

08-09-19

11(E)-Day

Brick — 1+

Mortar · Plaster — 1/2

Basic — 1/4

Timber — 1/2

Paint & varnish — 1/2

Ferrocement — 1/4

Rubber — 1/4

Plastic — 1/4

Semester final 25th set

* Glass brick.

Class Test **CE 2103** **II/CE(17s)** **FM=20**

Q.1	Write down the function of Alumina in producing good brick.	5.00
Q.2	Note down the causes and damages of Efflorescence.	5.00
Q.3	Write short note of Bull's Trench Kiln.	5.00
Q.4	A water tank of internal size 10ft×6ft×8ft is to be constructed. If the wall size of tank is 10 inch all around, base of tank is 6 inch and the top of tank is open, calculate the number of bricks required to construct it.	5.00

Class Test **CE 2103** **II/CE(17s)** **FM=20**

Q.1	State the function of sand in mortar.	5.00
Q.2	Enumerate the properties of packing mortar.	5.00
2005, 2007 — Q.3	"Building unit should be soaked in water before mortar is used"-give reasons.	5.00
Q.4	Differentiate between Surki Mortar and Gauged Mortar	5.00

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