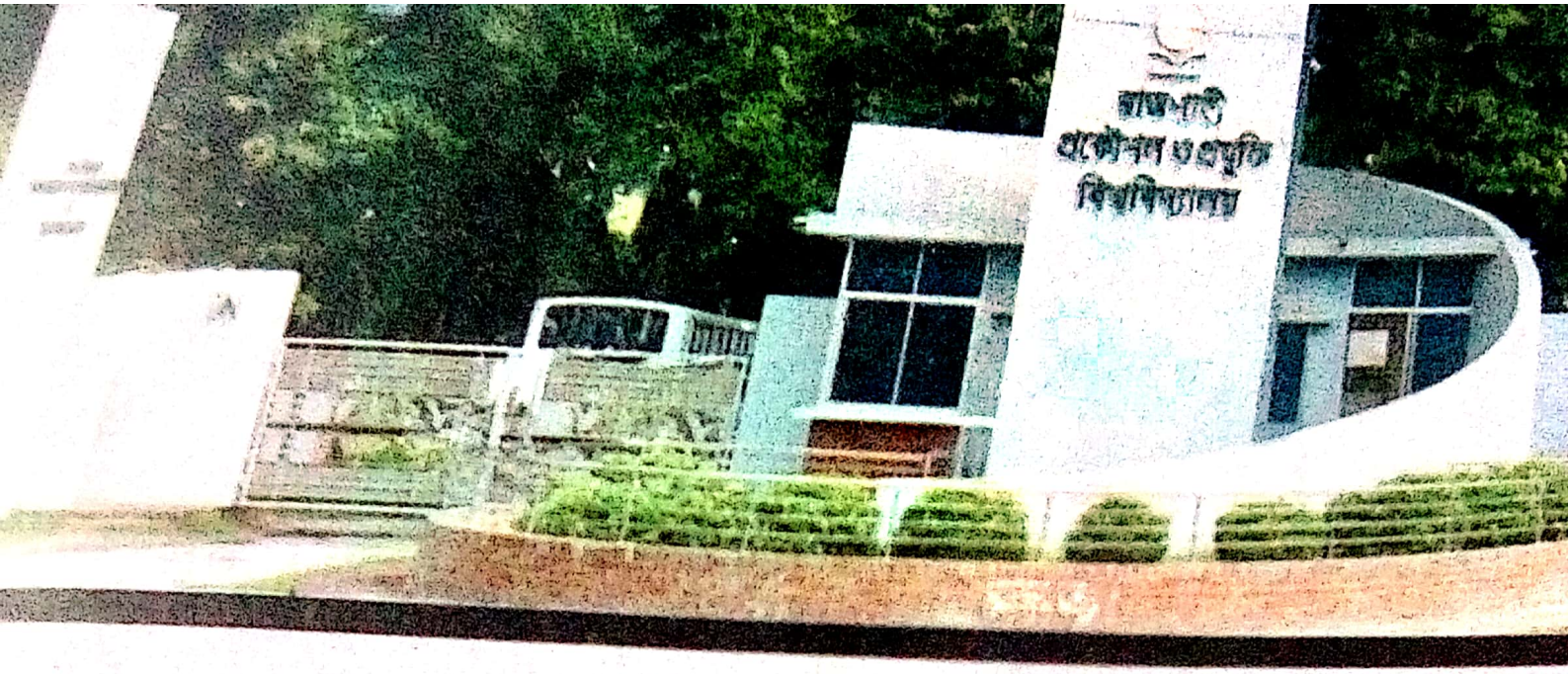


Name:....Noushin...Tabassum...Tasnim.....

Roll:.....1800130.....

Engineering Materials

Syllabus:

(i) Properties of Engineering Materials
(ii) Bricks
(iii) Mortar (सीमेंट मोर्टार)
(iv) Timber (लकड़ी)
(v) Paints and varnish
(vi) Rubber and plastic
(vii) Ferro cement

Chapter - I

Properties of Engineering Materials

What is Engineering Materials ?

→ Materials that are used as raw materials for any sort of construction or manufacturing in an organised way of engineering application are known as engineering materials.

What is civil Engineering Materials ? ⊛ civil engineering

Examples of Engineering Materials:

1. Melals
2. Ceramics
3. Polymars
4. Composiles
5. Semi- conducloir
6. Bio - melals materials
7. Concrele etc

Examples of Civil Engineering Materials:

1. Brick
2. Sand
3. Timber
4. Stone
5. Cement
6. Steel
7. Paint
8. Glass
9. Plastics.

Basic properties of Engineering Materials:

1. Physical Properties
2. Mechanical "
3. Chemical "
4. Electrical "
5. Thermal "

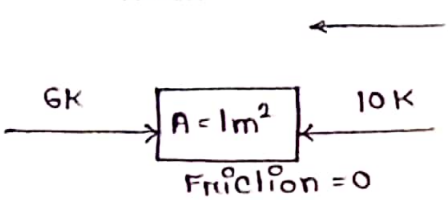
① Physical property: Properties that can be observed or can be felt.

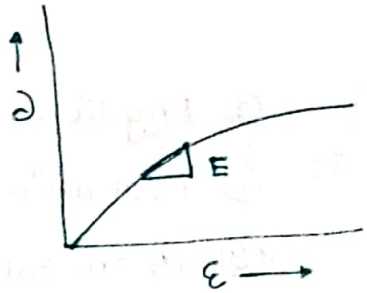
Ex: Colour, size, shape, texture, density, odor.

② Mechanical property: Properties that are obtained through mechanical means.

Ex: Elasticity, plasticity, strength, stiffness, toughness, hardness, ductility, malleability, brittleness, stress, string.

Stress = $\frac{\text{load}}{\text{Area}}$



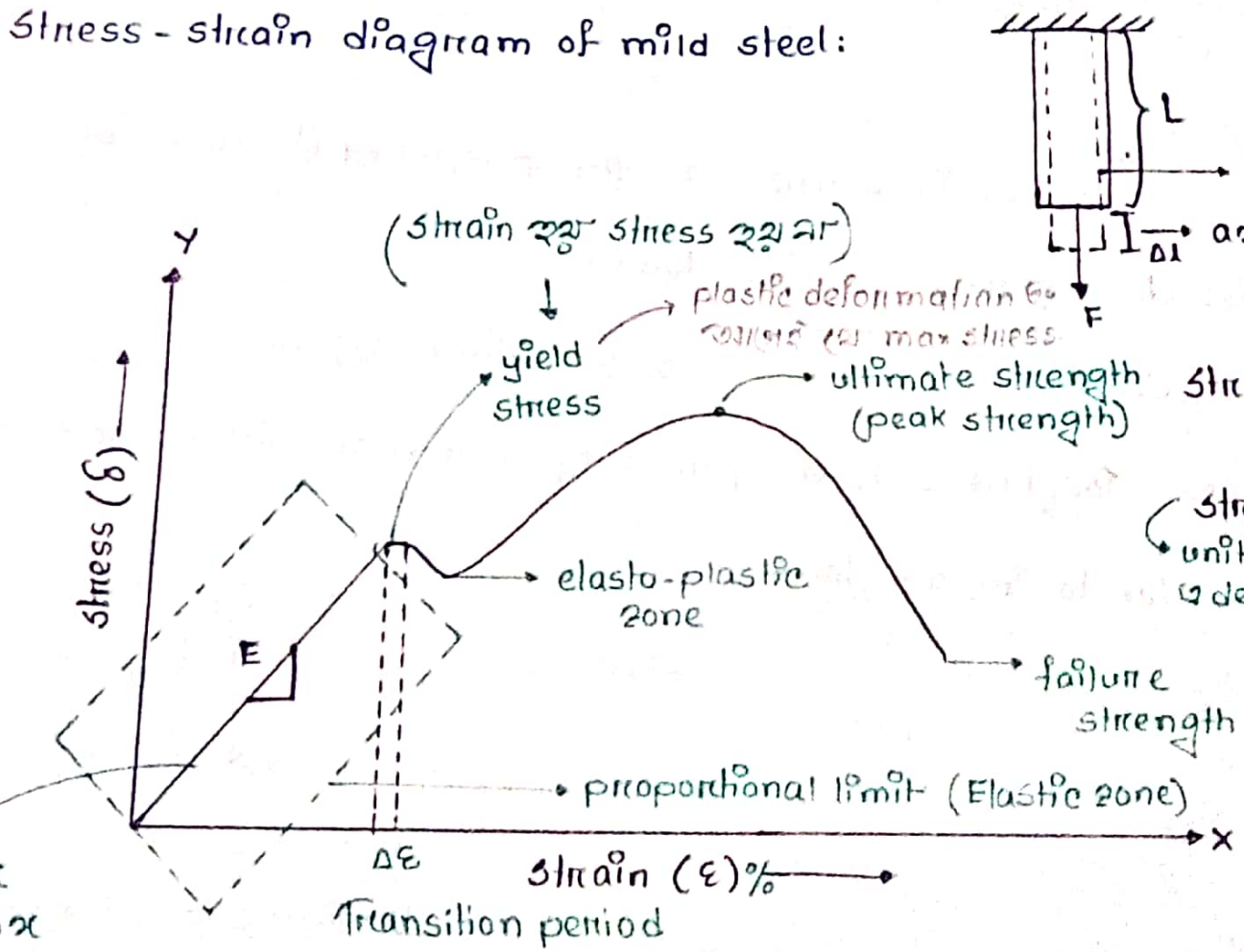


a = ?

↳ $a = \frac{6}{1} = 6$ [10 K applied, 4K resultant force, 6K resisting force]

Ex: rod (mild steel)

Stress - strain diagram of mild steel:



$\text{Stress} = \frac{\text{load}}{\text{Area}}$

$\text{Strain} = \frac{\Delta l}{L} = \varepsilon$

unit length
deformation
unitless

$= E\varepsilon$

$\Rightarrow E = \frac{\delta}{\varepsilon}$

modulas of elasticity

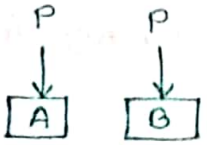
linear part ⟶ Elasticity

Curve " ⟶ Elasto-plasticity

Strength: সর্বোচ্চ stress বহনের capacity.
max stress ই হলো strength.

Strength is the ability of a material to with stand load at the moment of failure / destruction.

It indicates the capacity of a material to with stand max stress.



[same size, shape and load]

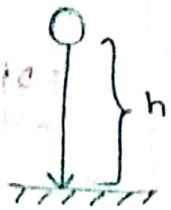
deformation → A → 10 mm
B → 30 mm
} A stiffer than B. (দৃঢ়)

Stiffness: Stiffness is defined as the property of material to resist deformation against loading.

Ex: glass, stainless steel (যেগুলো সহজে deform হয় না)

Toughness: Toughness is the property of a material to absorbe energy due to impact load.

Iron, concrete, high carbon steel, ceramic



Static load: mg

Dynamic load: mgh

Hardness: Scratch প্রতিরোধ ক্ষমতা

Hardness is defined as the resistance of material to scratching or abrasion or indentation or penetration.

Ex: diamond, glass (যেগুলোতে অহজে scratch পড়ে না)

Ductility: deform হওয়ার ক্ষমতা

It is the property of material to deform without breaking.

Bitumen.

Malleability: Ability to be flattened into thin sheet without cracking.

Ex: Gold, Pb, Cu

Malleability is the ability of a material to be flattened into thin sheet without cracking.

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

(আগে থেকে ধারণা করা যায় না) → strain energy কম্মা থাকে

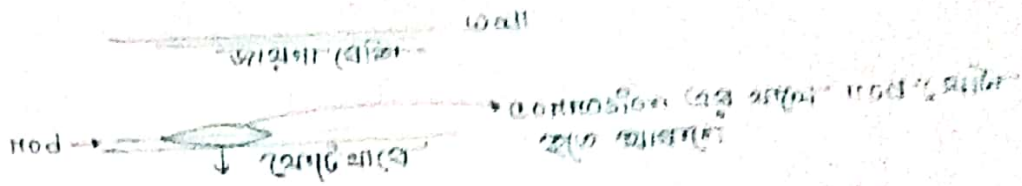
Ex: Glass, brick, ceramics.

* Force → static
Impact → dynamic
Shock →

Chemical Properties: Properties related to chemical activities or reactions.

① Corrosion
② Reactions with acid
③ Burning

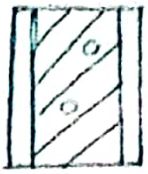
Corrosion:



* Concrete চাপ নিতে পারে, tension নিতে পারে না।

Electrical Properties: Properties related to electro-chemical or electro-magnetic activities.

① Conductivity (Thermal conductivity)



Basic facts to consider when selecting engineering materials:

① Transportation
② Availablity
③ Cheaply
④ Match of properties

→ ① Material properties
② Availablity
③ Transport
④ Cost

Paper is a engineering material - justify.

Chapter-2

Brick

* What is brick ?

⟹ Artificial stone (stiffness stone এর মতো)

Brick is an artificial kind of stone, made of clay.

→ manmade
→ stiffness কিছুটা stone এর মতো

Factors affecting the quality of bricks:

① Chemical composition of brick's clay.

② Preparation of clay.

③ Methods of molding.

④ Methods of drying → Natural
→ artificial

⑤ Methods of burning. → কাঠ দিয়ে পোড়ানো
→ কয়লা " "

Constituents / Ingredients of brick's clay:

Name of Ingredients	percentage (%)
① Silica (বালি)	55%
② Alumina (clay-র অংশ)	30%
③ Iron oxide	8%
④ Magnesia	5%
⑤ lime	1%
⑥ Organic Matter	1%

Function of the constituent of brick's clay:

① Function of Silica:

(+ve) sides → ① It prevents cracking, shrinking and warping of raw bricks. (ফাটা/ভাঙা) (বেঁকে যাওয়া)

② It imparts / gives uniform shape of bricks.

③ It makes the brick durable.

(-ve) sides → ① excess silica destroyes the cohesion betn particles.

② Bricks become brittle.

Sand → 4.75 mm

(ii) Function of alumina: (plastic material)

(+ve) side → (i) It imparts plasticity to the brick earth / clay.

(ii) It imparts density.

↳ silica- এ space / gap গুলো fillup করে alumina. যাতে vol. বাড়ে না, ওজন বাড়ে, density বাড়ে।

(iii) It makes the bricks harder and stronger.

(-ve) side → (i) Excess alumina causes shrinkage and warping of raw bricks.

(ii) Bricks become too hard.

↳ বেশি hard হলে brittle হবে, দুটুকরাগুলোও smooth হবে, খোয়াগুলো smooth হলে সেগুলো use করা যাবে না, ruff হতে

(iii) Function of Iron oxide:

1100°C তাপমাত্রায় brick কে পোড়ানো হয় sand গুলো গলে গিয়ে একটা আরেকটার সাথে লেগে যায় → hard হয়।

(+ve) → (i) It helps to fuse sand. (গলে যাওয়া)

(ii) It gives red colour to the brick.

(iii) It enhenses the impermeability and durability. (অভেদ্য)

(-ve) → (i) excess Iron oxide makes the bricks dark blue or blackish or black (over burn)

(iv) Function of magnesia:

(+ve) side ⟶ (i) It imparts yellow shade to the brick.

(ii) It decreases shrinkage.

(-ve) side ⟶ (i) excess magnesia leads to the decay of bricks.

(v) Function of lime:

(+ve) side ⟶ (i) It prevents shrinkage of raw bricks.

(ii) It also helps to fuse sand slightly.

→ বালু particle গুলো fuse হয়ে bond তৈরি করে।

(-ve) side ⟶ (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.

পোড়া/কাঁচা অবস্থায় তৈরি করে

(vi) Organic Matter:

(+ve) side ⟶ (i) It assists burning of bricks.

(-ve) side ⟶ (i) Excess organic matter makes the brick porous.

Harmful constituents in brick earth:

① Iron pyrites : ① form crystalization. (দানা-তৈরি)
② disintegration. (ভেঙে যায়)

② Alkalies : ① causes fuse, twist and warp.
* ② creates efflorescence

③ Pebbles : ① hampers uniform and thorough mixing of clay.
(Stone-এর ছোট টুকরা)

④ Vegetation: ① creats pours speces.

▣ Efflorescence: A crystaline deposites on the surface of bricks usually of white colours.

* Efflorescence আসা রুধের (ক্ষতি)

causes: ① Alkalis. (Na_2S, K_2S)
② Moisture / water
③ evaporation of moisture or water.

Removal: (i) clean the affected surface with pure water.

(ii) Use brush if necessary.

(iii) If not removed properly, use efflorescent removal.

Control: (i) clean the wall surface with water and detergent.

(ii) Prepare a solution of 1000 ml water with addition of bathroom cleaner and vinegar.

(iii) Apply the solution on the affected area.

(iv) we can use paint.

Manufacturing of bricks:

It includes 4 operation ——→

(i) Preparation of clay.

(ii) Holding

(iii) drying

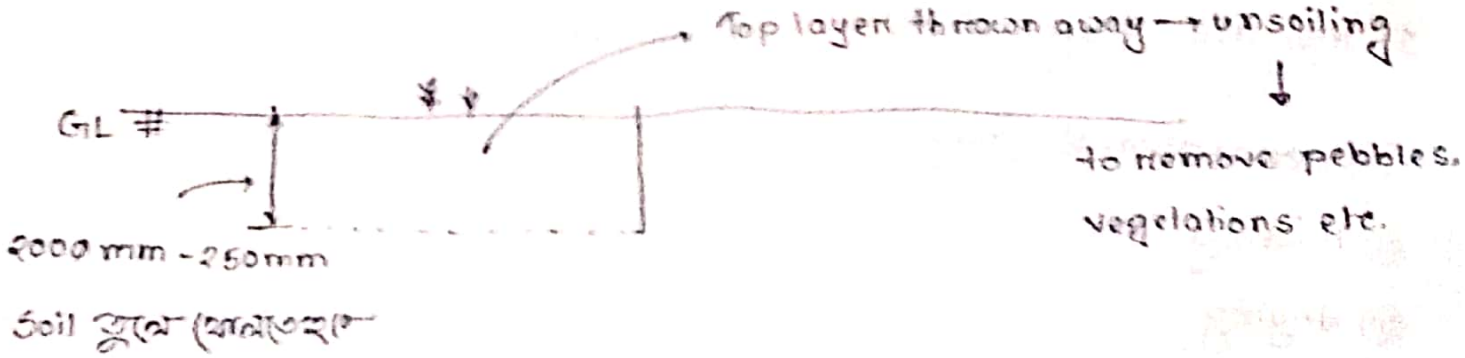
(iv) burning

① Preparation of clay:

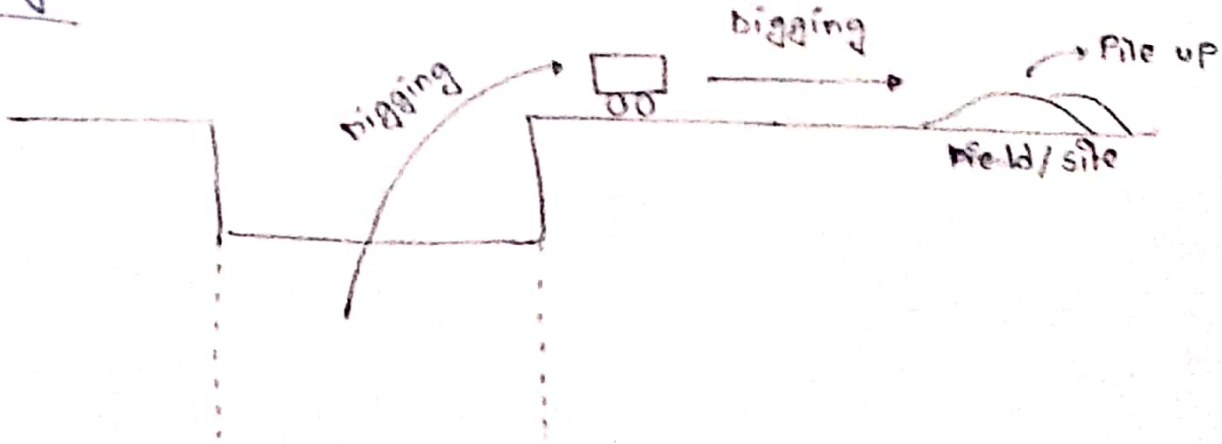
1. Unsoiling
2. Digging
3. Clearing
4. Weathering
5. Blending
6. Tempering

① Unsoiling: Sand : clay = 55 : 30

removing top surface



② Digging:



(iii) Cleaning: Soil ও pebbles সরানো হয়।

* spread out on the ground
* remove extra pebbles, if any

field

(iv) Weathering: Soil exposed to air and sun light for few weeks (at least 2-
(কারণ এই অবস্থায় element mix করা

* (v) Blending: যে ingredient করা, সেগুলো mix করা

mixing of soil with the addition of any element which is not sufficient

(water না থেকা better)

** (vi) Tempering: homogeneous mixing of clay with addition of water.

Method → manual
→ using machine (Pug Mill)

the paste of clay should neither be hard nor be soft.

(দুরকমগুলো খুব shape নষ্ট হয়ে)
হওয়া

Difference betn blending and tempering:

Blending	Tempering
(i) water is added	(i) extra element is added.
(ii) dry mixing	(ii) wet mixing

② Moulding:

↳ shape দেওয়া

Giving specific shape of brick using clay is known as moulding.

Types of moulding

① Hand moulding

② Machine moulding

① Hand Moulding: ~ with the help of hand.

process: (৪২)

Mould + বালি (clay যেমন লেগে থাকে) → excess গুলো কেটে দিয়ে কাটব

Advantage and disadvantage:

(+ve) → ① low cost

② No skill labour is required

③ Suitable for small scale brick production.

(-ve) → ① Slow method.

② Accurate shape is not gained.

③ Not suitable for large scale.

Types of hand moulding →

① Ground Moulding → (মেঝেতে করা surface smooth হয় না) বই

② Table Moulding.

→ advantage:

① Perfect shape can be attained.

② Foreign material is not mixed to the clay.

③ Covenient for the labourres to work with. (speedy ও হয়)

disadvantage:

① costly making tables.

② Machine Moulding:

(+ve) sides →

① perfect shape can be atteined.

② Fastem. method.

③ Few labourrs required.

④ large soake production.

(-ve) side →

① Costly

② skilled labourrs required.

Which method will you suggest and why?

Which method is popular in Bd?

09/02/2020

③ Drying:

Removing moistures from the raw bricks.

Objectives:

① To remove moisture
② To facilitate easy transport
③ To reduce volumetric shrinkage

{ এখনি brick কে তাপমাত্রা শুষ্ক করা হয়।

Types:

① Natural drying : Removing moisture from raw bricks naturally.
② Artificial drying

① Natural drying:

Process: brick গুলো ফাঁকা ফাঁকা রেখে শুকানো হবে। উপরের অংশ সূর্যের আলোতে, পাশের একটা অংশ বাতাসে শুকাবে।
(1 month)

Advantages: ① Cheap
② No skilled labour required.

Disadvantages: ① Time consuming
② Uneven drying.
③ Season depended.
④ Quality of brick is hampered.

② Artificial drying:

Process: Hot chamber এর মধ্যে বাতাসের brick গুলো শুকানো হয়।

Advantage: (Natural drying এর disadvantage)

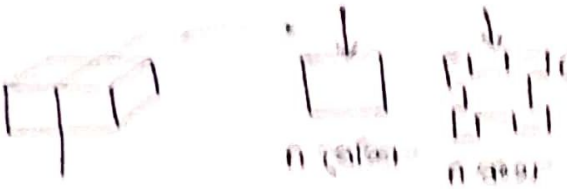
① Time saving
② Even drying.
③ Independent
④ Best qualities.

Disadvantage: (Natural drying এর advantage)

- Natural ~ artificial drying এর difference.
- Bangladesh এর প্রেক্ষিতে কোনটা উপযুক্ত ?
  - ① যেটা cheap
  - ② যেখানে skilled labour কম লাগবে।

Frog mark:

Shearing force



$\sigma = \frac{y}{R}$

Strength of brick ——— called as brick

Share ——— frog mark of brick

Defination:

Frog mark is a mark on the surface of brick

(i) Why it is called frog mark ?

Objectives:

(i) It indicates the trade name of the manufacturer of bricks.

(ii) It enhances the shearing resistance

(iii) It affords a key for mortar in between courses of bricks. (layers)

Burning of Bricks:

Oven এর temp ⟶ 1100°C

Alumina, silica আগে fuse হয়ে fluid আকারে থাকে, solid mass তৈরি করে।

(i) 1100°C temperature is required to burn bricks.

(ii) At this temperature, silica and alumina bind themselves together to form a solid mass.

Objectives of burning:

(i) To give hardness

(ii) To impart strength.

(iii) To densify the brick.

(iv) To attain durability.

Types of burning:

(i) clamp burning, (পাকা/আজা)/Pazawah burning.

(ii) kiln burning.

① Clamp burning:

(i) Old method of burning.

(ii) Obsolute method of burning.

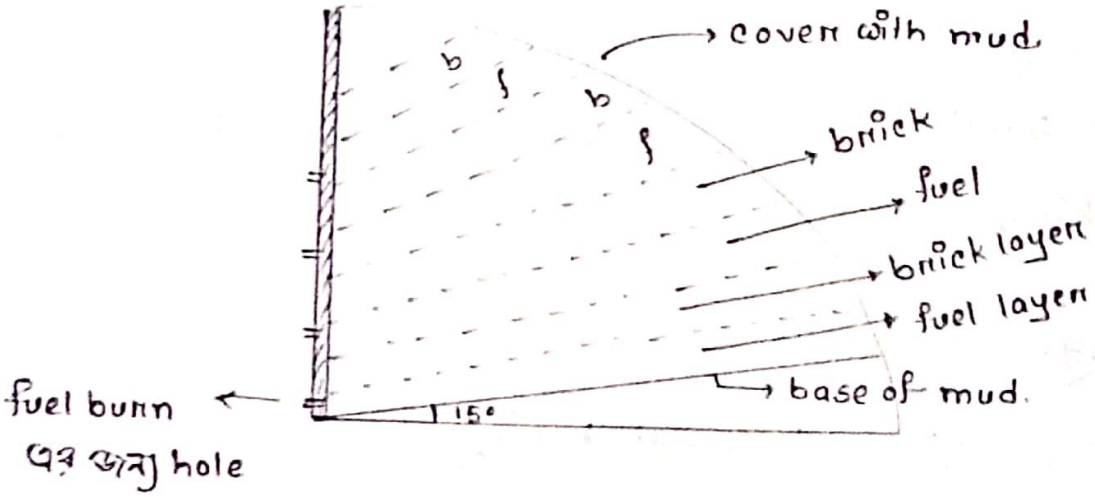
(iii) Poor quality of bricks.

(iv) Suitable for small scale brick production. (Few amounts of bricks is produce

(v) low fuel cost.

(vi) Initial investment is low.

process of clamp burning:



এর জন্য hole

০২ যাতায়াত করতে পারে,

(Rangwala - র বই—)

② Kiln burning: আধুনিক যুগে ব্যবহৃত হয়।

① Huge amount of brick is produced.

② Quality of bricks is higher.

③ Inital investment is more.

④ Higher fuel cost.

Types:

① Intermittent kiln. (বিরতি) ——→ ① Steps are not continuous.

② Continuous kiln. ——→ Steps are continuous.

Steps:

loading ——→ burning ——→ cooling ——→ unloading ——→ gap ——→ ...
(Intermittent)

Types of Intermittent kiln:

① Up-draught kiln.

② down-draught.

Types of continuous kiln:

① Bull nose kiln /Bull's kiln/Bull's trench kiln

② Hoff-man's kiln.

Whichone is most famous —— compare to Intermittent ~ Continuous in Bd

12/02/2020

Intermittent:

(+ve) → ① Inilal investment is low.

② Suilable for small scale.

Continuous:

Which one is more popular for bd — bull's nose or hoffman's.

Bull's kiln:

① Low inilial investment

② Suilable for small scale brick production.

③ Can work in monsoon and moderate wind.

Comparision beln bull's kiln and Hoffman's kiln.

Bull's kiln	Hoffman's kiln.
① less initial cost	② High initial cost
② Consumption of fuel is high.	② Conjumption of fuel is less.
③ Stop functioning during heavy rain.	③ Can works all the year round.
④ About 18 lac bricks can be produced/year.	④ About 60 lac bricks can be produced per year.

(iii) % of good brick is moderate.	(iv) % of good brick is high.

Quality of a good or ideal brick. / Property / Characteristics of good br

⇒ (i) A good brick should have uniform colour, size and shape.

(ii) It should neither be over burnt nor be under burnt.

over burnt
- (i) brittle
- (ii) Jhama / spongy (sponge এর মতো)
- (iii) More permeable
- (iv) Absorb more water
- (v) Shape can be destorted (বিকৃত)
- (vi) blakish colour.

under burnt
- (i) less strenght
- (ii) low density
- (iii) more permeable.
- (iv) Can absorb more water
- (v) less hardness.
- (vi) less stiffness.
- (vii) Yellowish colour.

(iii) It should be sound and compact.

- density বেশি
- more impermeable
- High strength
- High stiffness
- High hardness.

(iv) The weight of a good brick is 6 lb. $\left(\frac{6}{2.204} \approx 3 \text{ kg}\right)$

(vi) It should not absorb water more than $\frac{1}{5}$ of its own weight.

(vii) % of soluble salt should not exceed 2·5 %

(viii) The compressive strength of a good brick should be more than 3000 psi.

(ix) It should have low thermal conductivity. (তাপ পরিবহন ক্ষমতা)

↳ room temp ও outer temp balance থাকবে।

* প্রতিটিবৈশিষ্ট্যের জন্য explanation.

(x) Field test of brick.

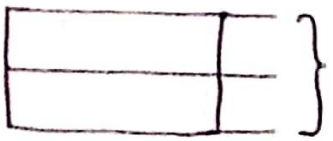
(i) Dimension test.

(ii) Scratch test

(iii) Impact test

(iv) Fall test.

(i) Dimension test :



3 জায়গায় dimension করতে হবে।

(ii) Scratch test:

(i) Take a brick.

(ii) Try to make a mark on the surface of brick by nail.

(iii) If it is possible to make mark on the surface of brick, it is not a good brick.

18/02/2020

(iii) Impact test:

(i) Take a brick.

(ii) Strike the brick with a hammer/another brick.

(iii) If metalic/ringing sound is noticed, it is a good brick.

(iv) Fall test: (2টা brick লাগবে)

(i) Take two brick.

(ii) Form a 'T' (T)

(iii) Fall the 'T' from a height of around 6 ft on more or less hard ground.

(iv) If anyone of the two bricks is broken, it is not a good brick.

Classification or the types of bricks:

(i) 1st Class bricks
(ii) 2nd " "
(iii) 3rd " "

besides;

(i) 1st Class bals
(ii) 2nd class bals
(iii) Picked Jhama. bricks
(iv) Jhama bricks
(v) Jhama bals.

(i) First Class bricks:

(i) They should be table moulded.
(ii) They have standaird shape, size and colour.
(iii) Surfaces are smooth.
(iv) Their edges should be sharp and straigth.
(v) They should comply with qualities of a good bricks.
(vi) High Strength.
* uniformly burnt.

(ii) 2nd class bricks: — bd তে প্রস্তুতকৃত bricks কে generally 2nd class. (ordinary bricks বলা)

(i) They are ground moulded.

(ii) Surfaces are some what rough.

(iii) The shape is slightly irregular.

(iv) They may have hair cracks.

(v) Edges may not be sharped and straight.

(vi) Strength of 2nd class brick is same as 1st class brick.

(iii) 3rd class bricks:

(i) Ground moulded.

(ii) Surfaces are rough.

(iii) Edges are irregular and distorted.

(iv) Strength are not same as 1st and 2nd class bricks.

Uses: গুদামঘর (গ্রাউন্ড floor) (Ground floor)

① 1st class bats:

↳ broken bricks. ($\frac{1}{4}$, $\frac{1}{2}$, $\frac{3}{4}$ ... of bricks)

They are broken bricks of 1st and 2nd class bricks.

uses: wall, road তৈরি।

Characteristics: (shape, size ভাল) 1st, 2nd class ভাল points.

② 2nd class bats:

They are broken bricks of 3rd class bricks.

③ Picked Jhama bricks:

① They are well burnt bricks.

② They are slightly over burnt sometimes.

③ Some parts of picked jhama bricks is heavy blue or blueish colour. (not black → spongy থাকবে না)

④ They must not be spongy.

⑤ Their shape and size are uniform.

uses: perfect for making khoa.

(iv) Jhama bricks:

(i) They are well burnt bricks.

(ii) Must not be spongy.

(iii) Shape and size may not be uniform.

(iv) Also used as khoa. (अधिक spongy का अर्थ)

(v) Jhama ~~bricks~~: bals:

They are broken bricks of picked jhama and jhama bricks.

Special Bricks:

(i) Paving bricks / checkered bricks.

(ii) Jamb bricks.

(iii) Bull nose bricks.

(iv) plinth bricks.

(v) Coping brick.

(vi) Cornice brick.

(vii) Gutter brick.

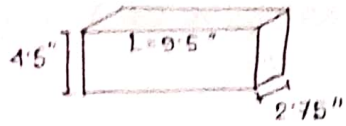
(viii) Hollow brick.

(ix) Perforated bricks.

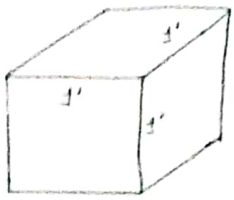
(pics and uses)

Standard size of brick:

According to PWD (Public Work department) the standard size of brick is $\underset{L}{9.5"} \times \underset{w}{4.5"} \times \underset{b}{2.75"}$



① 1 cft (ft^3) of brick = ? No. of brick.



$\Rightarrow \frac{9.5 \times 4.5 \times 2.75}{(12)^3}$ cft = 1 No. of brick

$\Rightarrow$ 1 cft = $\frac{(12)^3}{9.5 \times 4.5 \times 2.75}$ No.

= 14.69 No.

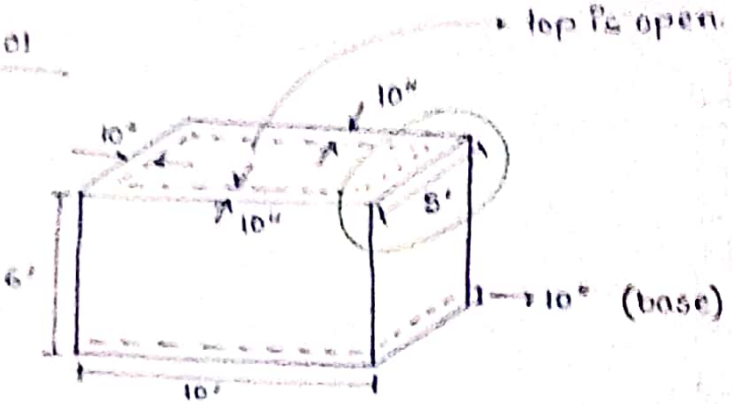
$\approx$ 15 No. (To stone)

For brickwork: (e.g. wall, masonry) $\longrightarrow$ 10" × 5" × 3"

$\therefore$ 1 cft = 11.52 No of bricks $\left(\frac{12^3}{10" \times 5" \times 3"}\right)$

$\approx$ 12 No. of bricks.

* Prob - 01



* Volume এর unit feet হবে
কারণ length feet.

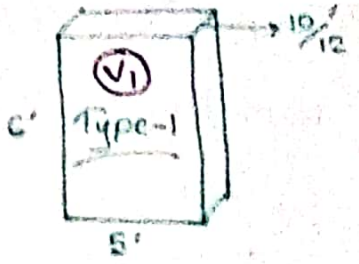
① Compute the numbers of brick required to construct the water tank as shown in fig.

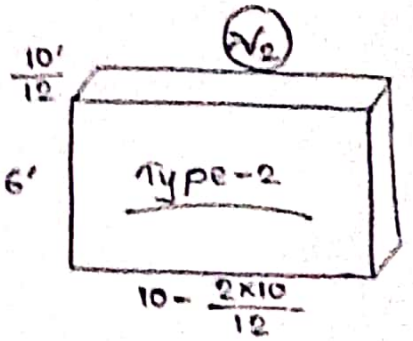
⇒ total tank টাকে solid ধরি,

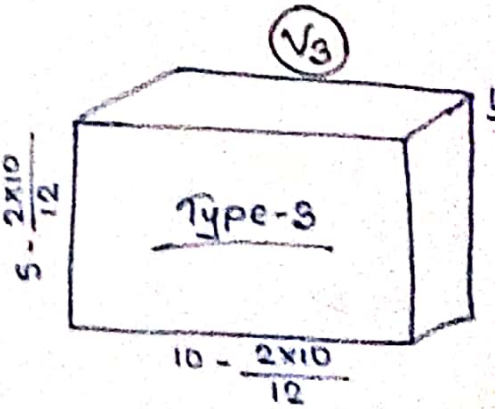
$V_1 = 10 \times 6 \times 5$

$V_2 = \left(10 - \frac{2\times10}{12}\right) \times \left(6 - \frac{10}{12}\right) \times \left(5 - \frac{2\times10}{12}\right)$

$V = V_1 - V_2$







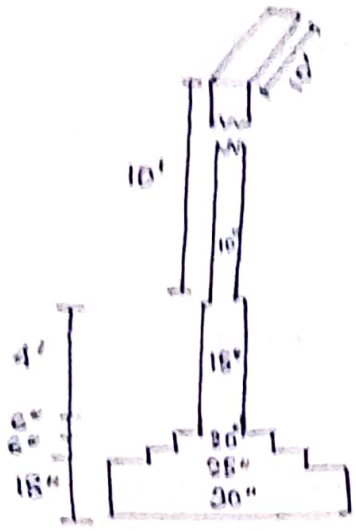
$V_{total} = 2(V_1 + V_2) + V_3$

$= 156.48$ cft

No of bricks $= 156.48 \times 12$

$= 1878.$

Prob - 2



Compute the no of brick required to construct the wall with foundation as shown in figure.

→

Uses of bricks / Applications of bricks:

1. (i) Constructions of wall.
   (ii) Constructions of road.
   (iii) Construction of bridge piers. (abutment brick এর তৈরি করতে পারে, নাও পারে)
   (iv) Construction of bridge abutments.
   (v) " " " tunnels.
   (vi) Making khoa.

26/02/2020

Mortar And Plaster

Mortar: Mortar is a paste prepared by a binding material ~~with~~ and inert material with water.

Mortar = inert material + binding materials + water.

→ Binding Material:

① Cement
② Lime
③ Gypsum.

→ Inert material:

① Sand (salt free)
② Surki

(fly ash powder can be used to be economic.)

→ Water:

It must be free from salt.

Why inernt material is used ?

→ economic
→ volume বাড়াবে

cement : sand = 1:5 → wall
cement : sand = 1:4 → plast

Functions of sand in mortar:

(i) Sand works as an inert material.

(ii) Increases volume.

(iii) It decreases shrinkage (volumetric shrinkage)

(iv) We can control strength of mortar by varying its proportion

hydration curve (সৃষ্টি: cement থাকবে না)
→ heat release
→ volumetric shrinkage
→ crack.

1:3 বেশি strength বেশি
↳ এটা use করা হয়।
cement বেশি → strength

Types of mortar:

Preparation of mortar:

(Depending on the types of binding material)

Cement Mortar : (i) Manually / Hand preparation
(ii) Using machine.

(i) Manually : (i) prepare a solid ground. (usually made of br
(ii) Spread the sand over the solid ground.
(Sand should be dry).
(iii) Pour the cement over the sand.
(iv) Mix cement and sand thoroughly.
(mixing ভালো হলে strength ভালো হবে)

(v) Make a small pond and pour required quantity of water.

(vi) Mix the sample again and apply the mortar to the desired place.

(ii) Using machine: (i) Add sand into the machine.

(ii) Add cement

(iii) Pour required quantity of water after few minutes.

(iv) Unload the paste from the machine and apply it to the required place.

Preparation of lime mortar:

manually: dry lime হলে ——→ same as cement mortar.

wet lime ——→ x

26/02/2020

Classification of mortar: Types based on ——

(i) Bulk density
(ii) Kind of binding material
(iii) Nature of application.
(iv) Special mortar

(i) Bulk Density:

(a) Heavy mortar
(b) Light mortar

(a) Heavy Mortar:

(i) Bulk density $\geq 15\ kN/m^3$
(ii) Source of sand = heavy stone (quartz)

* cement, water cons. sand varies for density
(পাথর ভাঙ্গা যেকে heavy sand collect করা হয়)

(b) light Mortar:

(i) Bulk density $< 15\ kN/m^3$
(ii) Source of sand = porous stone.

(ii) Kind of binding material:

(a) Lime mortar

(b) Surki mortar

(c) Cement-mortar

(d) Gauge mortar

(e) Gypsum mortar

(a) Lime mortar:

(i) Lime is used as binding material.

(ii) Formula: Lime mortar = Lime + sand + water.

(iii) It is durable.

(iv) Strength is relatively less. (কম area রেখে দেয়া যায়)

(v) They are used in lightly loaded structure.

(b) Surki mortar: (রাজবাড়িগুলোতে ব্যবহার করা হতো)

(i) Lime is used as binding material.

(ii) Formula: Lime + surki + water = surki mortar.

(iii) They are used in less important-cases.

(c) Cement mortar:

① Cement is used as binding material.

② Formula: cement + sand + water = cement mortar.

③ Mostly used and popular paste.

④ Proportion of cement and sand → 1:2 to 1:6.

⑤ They are used in important work, like brick work, plastering etc.

(d) Gauge mortar:

① Formula: cement + lime + sand + water = gauge mortar.
(1:1 → cement: lime)

(e) Gypsum mortar:

① Formula: gypsum + sand + water = gypsum mortar.

② Use: garden wall, partition wall.

Classification of mortar based on nature of application.

(i) Bricklaying mortar: used for brickwork and walls.

(ii) Finishing mortar: a) used for plastering work.
b) decorative finishing.

Special mortars:

(i) Grout mortar →

- very thin and liquid mortar.
- It is used to filling cracks, faults and narrow joints.
- It process of application is known as grouting.
- Finishing floor or wall.

(ii) Fire resistance mortar →

- Aluminus cement is added to the finely crushed powder of fire bricks.
- Aluminus cement : powder of brick = 1:2
- This mortar is fire resistant.

(heat প্রয়োগ mortar ভেঙে পড়ে না. → (450-600) (400 -500)°C
100-200°C -এ concrete ভেঙে পড়ে
temp প্রয়োগ concrete এর strength কমে প্রায় ~0.
(100-200°C) → Plaster সহ্য করতে পারে।

- It is used with fire-bricks for (i) lining Furnace
(ii) fire places
(iii) ovens.

(iii) Packing Mortar ——→ (যুক্ত করে থাকা)

Properties:

- High homogeneity and water resistance.
- Predetermined setting time. (setting time নিজে করে নেওয়া যায়)
- Ability to form solid water proof plugs in cracks and voids or rocks.
- Resistance to subsoil water pressure.

Types: (a) cement - sand
(b) cement - loam and ——→ sand, silt and clay এর mixture.
(c) cement - sand - loam.

- It is used in packing oil well.

(iv) Sound Absorbing mortar: ——→

- To reduce the noise level, sound absorbing plaster is used.
- It is used in auditorium.

(v) X-ray shielding mortar ——→

- It is a heavy mortar, with bulk density over 22 kN/m^3.
- The aggregate are obtained from heavy rock.
- It is used for providing the plastering coat to walls and ceiling of x-ray cabinates.

(vi) Air Entrained mortar → (বাতাস বাইরে থেকে ঢুকানো হয়, workability বাড়ে ও frictionless হয়)

- To improve the workability of lean cement mortar, air is entrained.

- It acts as an plasticizer.

Admixtures:

- Air entrained admixture is a ready-to-use aqueous solution of special organic materials.

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

- Air entrain admixtures are:

  a) Natural wood resin.

(viii) Decorative mortar ⟶

- It is a mortar used to impart a pleasent outer appearance to the surface of structure.
- This is attained by adding colouring agents or pigments to the mortar.
- Creating rough surface.

Preparation of lime mortar:

14/03/2020

Properties of a good mortar mix:

- It should have good adhesion with the building units.
- It should attain design strength.
- It should resist penetration of rain.
- It should be cheap and durable.
- It should be workable.

Precutions in using mortar:

- Mortar consumption.
  - a) cement mortar — should be consumed within 30 min.
  - b) Lime " — " " 36 hours after its preparation.
    - (strength gain করতে time লাগে)

- Mortar consumption during frost: → hydration এর prob → crack.

(cement এর hydration এর জন্য best temp. 23~27° C.
এরপর setting time কমে গেলেই again করবে।

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

7 days → 65%
21 days → 35%
years → 5%

- Mixing of sea water.

(Surface water use করতে হবে, নাহলে efflorescence হবে)

Sea water would b not be used in making mortar.

- Application of mortar in building.

brick কে পানি দিয়ে soak করতে হবে। নাহলে brick, mortar থেকে পানি নিবে → strength কমবে।

Building unit should be soaked in water before mortar is used.

- Sprinkling of water in plaster and masonry work.

নাহলে moisture, weather থেকে নিবে।

The masonry of plastered surface should be kept damp by sprinkling water for at least 7 days.

Selection of mortar:

Nature of work	Type of work.
(i) Watering area.	cement-mortar (1:2) sand lime mortar (1:3)
(ii) Damp-proof course	cement-mortar (1:2)
(iii) Cement-concrete roads.	cement-mortar (1:2)
(iv) Partition wall and parapet wall.	cement mortar (1:3)
(v) Plaster work.	cement mortar (1:5)
(vi) Plaster work ceiling.	cement-mortar (1:4)
(vii) Reinforced brick.	cement-mortar (1:5)
(viii) Brick work or masonry work.	cement mortar (1:5)

Test of mortar: (lab details).

- Normal consistency test: → cement mortar কত পানিতে কতটুকু দৃঢ় হয়।
- Setting time test: → initial and final setting time. (প্রায় ৩০ মিনিট)
- Cube test: → compressive strength বের করার।
- Tensile strength test: → tensile strength বের করার।

tensile : comp = 10 : 1.

Uses of mortar:

- To bind the building unit into a solid mass.
- To carry out plastering works.
- To improve the general appearance of the structure.
- To prepare hollow blocks.
- As a filler material in ferro-cement works.
- To give neat finishing to concrete works.