LECTURER NOTES ON BUILDING MATERIAL & CONSTRUCTION TECHNOLOGY

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Building Material

Building material

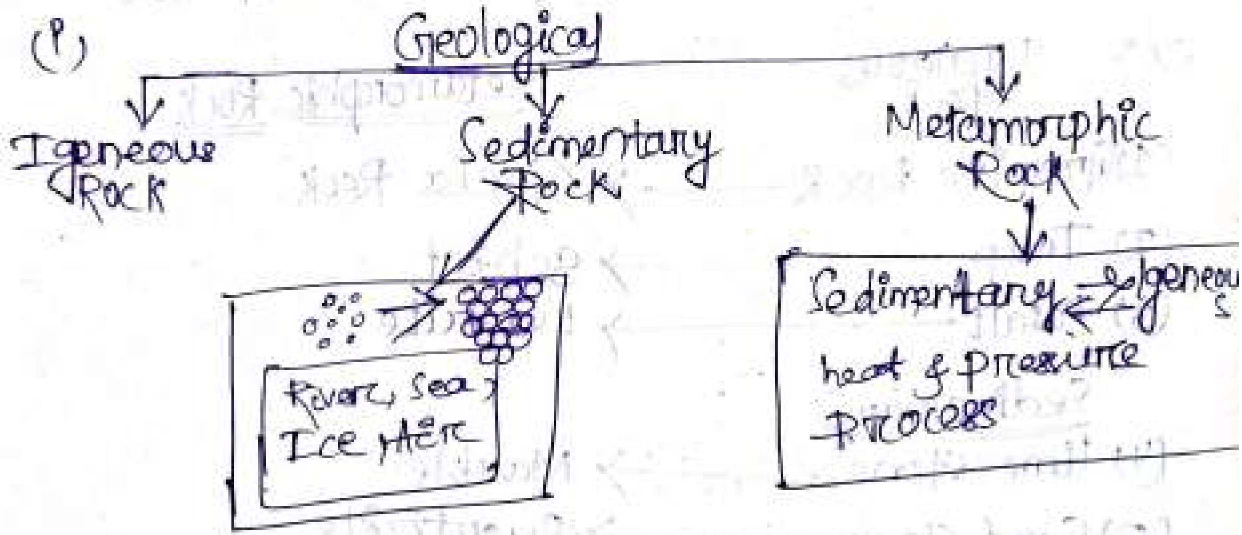
(1) Bricks (3) Water (5) Cement (7) paint
(2) Sand (4) Aggregate (6) Steel (8) Stone

STONE — 1st chapter

classification of Stone

(i) Geological
(ii) physical
(iii) chemical

(i)



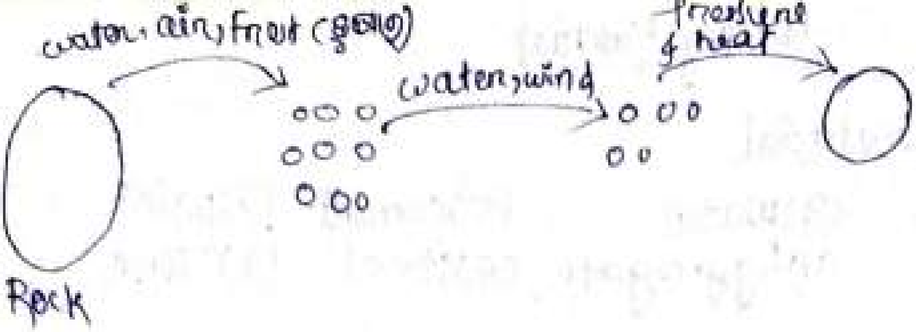
① ↳ Igeneous (strong & Durable Rock) {costly}.
The Rocks are formed by cooling and Solidifying of the rock from the molten magmatic condition of the material of the earth.

গলিত → cool হওয়া

ex: Basalt, Trap, Granite (strong Rock)

② Sedimentary Rock
Due to weathering action of water air and frost existing rock disintegrate. The disintegrate materials is carried by wind & water. These diposited layers of material get consolidated under pressure and heat. (পাললিক)

ex:



(1) Sand stone
(2) Lime stone
(3) Mudstone etc.

③ ↳ Metamorphic Rock

Igeneous and Sedmentary rock undergo changes due to metamorphic action of pressure and heat.

ex:- Igeneous Rock → Metamorphic Rock

(1) Granite Rock → Gneiss Rock
(2) Trap → Schist
(3) Basalt → Laterite

Sedimentary

(4) lime stone → Marble
(5) Sand stone → Quartzite
(6) Mud stone → ~~State~~ slate

physical Classification

(i) stratified Rock
(ii) Unstratified Rock
(iii) Foliated Rock

(i) Stratified Rock (Layer)

These rock are having layer structure. They can easily split along the planes.

ex:- Sand stone, Lime stone, slate stone,

(ii) Unstratified Rock

* These rocks are non stratified. They posee crystaline & compact grains. They

* They cannot be split into ~~things~~ thin slab.

* ex:- Granite, Trap, Marble are the example of unstratified Rock.

(iii) Foliated Rock

* These rocks have tandency to split along a definate direction.

* The direction need not be parallel to each other as in case of stratified rock.

* ex:- All metamorphic Rock. (not parallel to each other)

Chemical Classification

(i) Silicious Rock (Silica:- s, cl) cement 60% silica

(ii) Argillaceous Rock (clay)

(iii) Calcareous Rock ($CaCO_3$)

(i) Silicious Rock

* The main conent of this rock is silica.

* They are ~~had~~ hard & durable.

* ex: Granite, Trap, Sand stone

(ii) Argillaceous Rock

* The main content of this Rock is argil/clay that is clay.

* These stone are hard & durable but they are breittle.
* They can not with stand shock.
* ex: Slate, Laterite

Cast Iron
mild (Ni, Cro, Fe)
steel

(iii) Calcareous Rock

* The main constitutent of this rock is Calcium carbonate ($CaCO_3$).
* Ex: Lime stone, Marble.

Dt: 21.010.22

Qualities of Good Building stone:

1) Strength
2) Durability
3) Hardness
4) Toughness
5) Specific gravity
6) Porosity and Absorption
7) Dressing
8) Appearance
9) Seasoning
10) Workability
11) Cost
12) Fire Resistance
13)

1) Strength

* Generally most of the building stones have high strength to resiste load coming on it

* Compressive strength of building stone generally fall within the range of 60 to 200 $\frac{N}{mm^2}$.

2) Durability

Building stone should be capable to resist the adverse effect of natural forces like wind, rain and heat.

3) Hardness

* When stones are used in floor works, pavements are bridges they become subjected to wearing & abrasive forces caused by movement of men or machine over them. So it is required to test hardness of stone.

* Hardness of stone is determined by mohs scale.

4) Toughness

Toughness of stone means its ability to resist impact forces. Building stone should be tough enough to sustain stress developed due to vibration.

5) Specific Gravity

The more the specific gravity of stone the more heavier & stronger the stone is. Therefore stones having higher specific gravity value should be used for construction of dams, returing ~~work~~ wall docks.

* The specific gravity of good building ston is between 2.4 to 2.8

6) Porosity & ~~Abservation~~ Absorption

* porosity of building stone depend on the mineral constituent & structural formation of the parent rock. If stones used in building construction are porous than rain water can easily ~~entire~~ enter into the pore spaces and cause damage to the stone.

* Water absorption of stone is directly proportional to the porosity of rock.

Dt:28.10.22

7) Dressing

Giving ~~requires~~ required shape to the stone is called dressing.

8) Appearance

Light coloured stone are more preferred than dark coloured stone as colour are lightly to ~~feed~~ fade out with time.

9) Seasoning

Good stone should be free from quarry sap. They are allowed to get read of quarry sap by the action of nature.

* This process of removing quarry sap is called seasoning.

10) Workability

Stone is said to be workable when the work involved in stone working is economical & is easy to conduct.

11) Cost

Distance of the quarry (Stone Blasting) to building side bringe down the cost of transportation.

12) Fire Recistance

Stones should be free from calcium carbonate ($CaCO_3$), oxide of iron & mineral having different coefficcient of thermal expansion.

characterestic of stone

~~(1) Granat~~

(1) Granite

(i) Igneous Rock

(ii) Composed of Quart, Felspar, Mica.

(iii) Hard and durable

(iv) High Recistance to weathering

(v) Specific Gravity is 2.7 and compressive strength is 700 to 1300 Kg/cm^2

(vi) Used for ornamental work, railway ballet for construction of Bridges, piers (Bridge conduct)

(2) Sand stone :- (i) Sedimentary Rock

(ii) It is available in fine grained, Coarse grain.

(iii) Specific gravity ~~2.65~~ is 2.65 to 2.95.

(iv) Compressive strength is 650 Kg/cm^2.

(v) Used for ashlar work.

(3) lime stone :- (i). Sedimentary Rock

(ii) It is available in compact lime stone, granular lime stone, magnesia lime stone, Kanker lime stone.

(iii) Used for road metal.

(4) Marble :- (i) Metamorphic Rock

(ii) High compactness

(iii) suitable for decorative work, pile, table slab, steps of stair case. (সিঁড়ি)

(5) Slate :- (i) Metamorphic Rock

(ii) Non absorbent, compact fine grained, produce metallic ringing sound when ~~strop~~ struck

(iii) Used for providing DPC.

Dt: 29.10.22

2nd chapter

Brick

Constitutent: (1) Silica 50% to 60%
(2) Alumina 20% to 30%
(3) Lime 5% to 10%
(4) Iron oxide 5% to 7%
(5) Magnesia < 1%

(1) Silica
☆ It is responsible for prevent cracking, ~~Shri~~ shrinking & warping of raw brick.
(6&10) (বাঁকা হওয়া)
☆ If it axes it destroyes cohesion between particles.
same particles force of attraction

(2) Alumina
☆ It is responsible for molding of brick.
☆ If a present axes than raw brick shrink & work during drying.

(3) lime
☆ It prevents shrinkage of bricks on drying
☆ ~~Axess~~ Axaces of lime causes the brick to melt & brick losses it shape.

(4) Iron Axide :
* It gives red colour to brick.
* It improves imperability & durability
[illegible]

ex :- Ca sand

* If present in axcess colour of brick becomes dark blue or blakish.

(5) Magnesia :-
* It gives yellow colour to bricks.
* Axacess of magnesia leads to decay of brick.

Harmful Ingradients of brick

(1) lime
(2) Iron pyrites
(3) Alkalies
(4) pebbles
(5) Vegetation and organic matter,

Manufacturing of brick

(1) preparation of clay
(2) Moulding
(3) Drying
(4) Burning

Dt: 31.10.22

(1) Preparation of clay

Steps

(i) Unsoiling
(ii) Digging
(iii) cleaning
(iv) weathering.
(v) Blending
(vi) Tempering.

(i) Unsoiling

* The top layer of the soil about 200 mm in depth is taken out and thrown away.

* The clay in top soil is full of impurities so it is rejected for the purpose of preparing bricks.

(ii) Digging

* The clay is than dug out from the ground.

* It is spread on the levelled ground.

* The height of heaps of clay is about 600 mm to 1200 mm.

(iii) cleaning

* The clay as obtained in the process of digging should be cleaned of stones, vegtable matter.

(iv) Wheathering

* The clay is than exposed to atmosphere for softening. The period varies from few weeks to full season.

v) Blending

The clay is made ~~tose~~ loose and it is spread out at its top. The blending is carried out by taking a small amount of play every time and turning it of ~~and ado~~ ang upon down in vertical direction

vi) Tempering

In the process of tempering clay is brought to a proper degree of hardness. Tempering is done by ~~needed~~ kneaded or pressed under the feet of man or cattle. also tempering is done by pugmill.

Dt: 2.11.22

Moulding (Mixing) → Hand moulding → Machine Moulding.

(2)
Hand Moulding

* In hand moulding the bricks are moulded by hand.
* It is adopted where main power is chefe and ~~a~~ his readly available for (all) manufaturing process of bricks on the small scale.
* The moulds are rectangular boxes which are open at top and bottom.
* It should be sprepane from well season wood.
* The steel moulds are more durable than woulden one.

* The bricks shreink the bricks during drying and burning. Hence moulds are made larger than the breant bricks.

Hand Moulding
- → Ground Moulded
- → Table Moulded

Machine Moulding
* Generally two proces
  - → plastic clay Machine
  - → Dry Clay Machine

Machine Moulding is carried out
This type of moulding by two proces.

plastic clay Machine
* Such machine conict of a reectangular opening having length & width is equal to an ordinary brick.

* These are ~~called~~ cut into streps by the wire fixed at the frem. The arrangement is made in such a way that the streeps thickness is equal to the of the bricks are oftened - so it is also called wire cut brick.

Dry clay Machine

~~H.e~~

In these machine the strong clay is finally converted into powder ~~from~~ form.

A

* A small quantity of water is then added to form a stiff plastic ~~test~~. paste.
* Such paste is placed in mould and pressed by machine to form dry & well ~~saved~~ shaped brick.

(3) Drying

* The damp brick if burnt are likely to be cracked. Hence the moulded brick are dried before they are taken for the next operation of ~~burni burin~~ burning.
* For the drying the bricks are laid longitudinally in the stacks of with equal to two bricks. A stack consist of ~~10~~ ten or eight bricks. All the bricks are placed on edges.
* The bricks are alouded to dry until moisture content is about 2%.

Dt. 04.11.22

(4) Burning

* Bricks are burn at high temperature to gain strength, durability, density and red colour appearences.

* Brick's are brunt at 1100°C because fusing of sand and lime take place at this tempera- -ture.

* Brick's are not brunt above 1100°C temper- -ature because it will result in melting of brick.

* Brick's can be brunt in two methods.

~~(i) calm~~
(i) Clamp burning
(ii) Kiln burning

(i) clamp burning is a temperary structure generally constructed over the ground with a hight of about 4 to 6m.
↳ It is use when demand of bricks is lowere.
↳ It is use when there is no moonsoon season.
↳ ~~This~~ disadvantage of clamp burning.
↳ Brick's at the bottom are over brunt & at the top are under brunt.
↳ Brick's loose there shape.
↳ This method can not use for the manufacturing of large number of brick.
↳ It can not be use in monsoon season.

(ii) Kiln burning
↳ Kiln is a large oven use for the burning of brick. Generally materials like wood, cow dung, is use as fuel.

↳ They are of two types.
(1) Intermittent kiln
(2) Contineous kiln

(1) <u>Intermittent Kiln</u>
↳ These are also periodic kind of kiln because in such kiln only one process can take place at one time.

↳ These process are loading, unloading, cooling and burning of bricks.

↳ Intermitten kiln are two types
(i) Up-draught
(ii) Down-draught kiln

↳ Down-draught intermittent kiln are more efficent than ~~oftenct~~ obdent.

(2) <u>Contineous kiln</u>
↳ This kilns are called continous because all the process, such as loading, unloading, cooling and burning are take place simultaneously.

↳ This kilns are used, when the bricks are demanded in larger scale.

↳ Brick's burning are completed in one day.

↳ They are two continous kilns.
(1) Bull's trench kiln
(2) Hoffmans kiln

(1) Bull's trench kiln.

↳ Bull's trench kiln ~~const~~ consist of a rectangular, circular or oval shape.

↳ They are constructed below the ground level by ~~exca~~ excaviting at ~~range~~ trange of the required with for the given capacity. of brick manufa-cturing.

↳ ~~These~~ This strenge is divided generally in ~~00~~ 12 chamberes. So that two no.s of ~~cycles~~ cycles of brick burning can take place at the same ~~time~~.

↳ The structure is underground so the heat is conserved to a large extend.

↳ It is more efficient than hoppenis kilning.

↳ Once ~~faire~~ fire is ~~stro~~ started it constantly travel's from 1 chamber to the other chamber & operation like loading, unloading, cooling & burning take place simultanously.

↳ This kilns are use for manufacturing capacity of about 2000 bricks per day.

↳ The draw back of this kilns is the ~~they~~ is there is not a permanent roof so it is not easy to manufact-ure of bricks during monsoon season.

classification of brick

Dt: 9.11.22

1) First class Brick

These bricks are table moulded. The surface & edge of brick are sharp, square, smooth & strait. These bricks are used for superior work of permanet nature.

(2) Second class Brick

These bricks are ground moulded. The surfaces of these bricks are rough & shape is slightly irregular these bricks are used ~~and~~ at places where brick work is too be provided be ~~palastar~~ pot of plaster.

(3) Third class Brick

These bricks are ground moulded and they are burnt in clamps. These bricks are not hard & they have rough surfaces with irregular ~~adjust~~ edges. they are used for unimportant and temporary structure & at places where rainfall is not heavy.

(4) Four class Brick

These are over burnt with irregular shape and dark colour. These bricks are used as aggregate for concrete in foundation.

~~1st class~~ : compressive strength

1st class : $> 10\ N/mm^2$

2nd " : 7.0 to $10\ N/mm^2$

3rd " : ~~$< 3.0\ N/mm^2$~~ 3.5 to $7.0\ N/mm^2$

4th " : $< 3.5\ N/mm^2$

~~Cement~~ ~~chapter : 3.~~

Cement chapter: 3

Defination

* Cement is bindere a substance that sets & hardens and can bind other material together.

* Cement is used in construction

chemical

4 compund in cement

1) C_3S carbon tri - solifeed

2) C_2S carbon dio - solifeed

3) C_3A carbon tri - Alum-inate

4) C_4AF carbon tetra Alumino feratie

(1) C_3S (early strength)

(2) C_2S (later strength & lough heat

(3) C_3A (early strength & high heat of hydratin

(4) C_4AF (later strength)

Ans (1)(d) Advantages of seasoning of timber

(i) To decrease the volume and weight of timber and there by to lower the cost of transport & handling.

(ii) To improve strength, hardness and stiffness and better electrical resistance to timber.

(iii) To allow the timber to burn readily ~~in use~~ if used as fuel.

(iv) To increase the ~~resting~~ resisting power of timber so that it is less liable to attack by insect

(v) To maintain the size and shape of the componets of the timber particle

(vi) To make timber easily workable

(vii) To reduce the tendency of timber to crack, shrink & warp.

(e)
(i) Blistering is the formation of small to large, broken or unbroken bubbles which are under or within a coating at the paint surfaces.

(ii) Blistering causes adhesion failure. Therefore blistering causes damage to the structure.

(F) classification of piles based on function.

Based on function

(1) Bearing pile
(2) Friction pile
(3) Screw pile
(4) Compaction pile
(5) Uplift pile
(6) Batter pile
(7) Sheet pile

~~Composition of Cement~~ Dt.- 23/11/22

~~Ingradient~~ ~~chemical form~~

~~(1) Lime~~ ~~CaO 60~~

Composition of cement

Ingradient	chemical form
(1) Lime	(CaO) 62%
(2) Silica	(SiO_2) 27%
(3) Calcium sulphate	($CaSO_4$) 4%
(4) Alumina	(Al_2O_3) 5%
(5) Iron Oxide	(Fe_2O_3) 3%
(6) Magnesia	(MgO) 2%
(7) sulphure	(S) 1%
(8) Alkalies	1%

~~Conson of cement in o~~

Function of cement in Gradient

(1) Lime (Strength

Imparts ~~strange~~ strength and soundness to the cement.

(2) Silica

Imparts strength due to formation of dicalcium and tricalcium Silicate.

(3) Alumina

Imparts ~~which~~ quick setting property.

(4) Calcium sulphate

present in the form of gypsum which increases the initial setting ↓ time of cement.

(Increase the intial setting time)

(Cack ~~to~~ decrease the Initial setting.

Wet process Dt:- 25.11.22

~~SALCAR~~

Calcareas material

lime stone

Crushing

Storage

Agrillaceas material

clay

Whashing

Storage

channel

Grinding mill

Formation of slurry

Correction Basin

storage

pumping

Cold dust

Rotary kiln

Formation of clinker

cooler

Grinding of clinkers in Ball miles and Tube mills

Gypsum

storage in silos

weighing and packing in Bags

Distribution

Quality of good cement

(i) colour should be uniform :
(ii) It is should of uniform fineness & free from lumps.
(iii) cement if thrown in water should ~~stink~~ sink.
(iv) When tested in accordance with IS code the avarage compressive strength at the age of 3 days and 7 days shouldn't be less than 11.5 mpa and 16 mpa.
(v) The avarage tensile strength at the age of 3 and 7 day shouldn't be less than 2 N/mm² and 2.5 N/mm².
(vi) Inteal setting ~~time less than~~ - greater than happen hour.
(vii) Final setting time around 10 hrs.
(vii) In solibul residue should be (less than) < 1.5 %
(viii) Magnesia content < 5 %.
(ix) Expansion (soundness) of cement should not be > 10 mm. during soundness test.
(x) When the cement is sieved in 90 micron sieve the residue should not exceed 10 %.

Dt: 26/11/22

Concrete

Concrete is mixture of cement, sand, brick or stone, ballast and water which when placed in forms and allowed to cure becomes hard like stone the hardening is caused by the chemical reaction between cement water.

Characterestic of Good Concrete

(i) Concrete should have high compressive strength.

(ii) On hardening its should exhabit minimum Shrinkage.

(iii) The density of good concrete should be about 24 KN/mt³.

(iv) It should be economical for desired strength.

(v) It should be Suffsiently hard & provide enough resistance to ebration.

(vi) It must be adicuatly durable to resist the affect of wheathering agencies.

(vii) It should have minimum thermal expansion to provide good resistance to fire.

Composition

(1) Cement

(2) Aggregate

Coarse aggregate

Fine aggregate

(3) Water
(4) Admixture
(5)

(1) Cement

Function
* It ~~feels~~ fills of voids existing in the fine aggregate and ~~mor~~ makes the concrete impermeable.

* It provides strength to concrete on shafting and hardening.

(2) Aggregate
↳ Coarse Aggregate
* particle size is more than 4.75 mm.

Function of sand
* It fells the voids existing in the coarse aggregate.
* It reduces shrinkage and cracking of concrete.
* By varying the portion of sand economical concrete can be prepare for any required strength.
* It helps in hardening of cement by allowing water through its voids.

Function of coarse Aggregate
* Coarse aggregat mass solid and har mass of concrete with cement & sand

★ It increase the crushing strength of concrete.

★ It reduces cost of the concrete.

(3) <u>Water</u>

function

★ water is only the ingreadent that ~~reac~~ reacts chemically with cement & make concrete hard.

★ Water as a lubricant for the aggregate and mix the concrete workable.

<u>Addmixture</u>

<u>Function</u>

★ It improves workabilty.

★ It reduces segregation of concrete.

★ It accelerates setting and hardening of concrete.

ex: ~~Fla flysh~~ flyash, calcium chloride, gpsym, ~~ven~~ vinoxyl resile.

<u>Water Cement Ratio</u>

The water cement ratio is the ratio of the weight of water to the weight of cement.

A lower water cement ratio leads to higher strength and durability but make the mix difficult to work ~~beat~~ with.

Workability can be improve by using plasticizer.

$CaCl_2$ Increase setting time

Reetarda decrease setting time

2marks

Dt: 2/12/22

Properties of fresh Concrete

(1) Workability
(2) Bleeding
(3) Segregation
(4)

(1) Workability

Workability is defined as the ~~ese~~ ease (easily) with which concrete is handled, transported and placed in forms with minimum loss of homogeneity.

(2) Bleeding

Measurement of workability

The ~~folow~~ following test are used to measure workability.

(1) Slump Test
(2) Compacting factor test
(3) Flow test
(4) Kelly bell Test
(5) Veebee consistometer test

(1) Slump Test

Degree of Workability	Slump (mm)	Used For
Very low	—	Roads vibrate by power operated machine.
Low	25-75 mm	Mass concrete foundation without vibration.
Medium	50-100mm	Heavily reinforced section with vibration.
High	100-150mm	Not normally suitable for vibration, for pumping purpose.
Very high	>150mm	~~Used~~ Not suitable

Dt: 5.12.22

Compacting factor Test

* It is one of the most efficient test for measuring workability of concrete. ~~This test~~
* This test works ~~on~~ the principle of determining the degree of compaction achived by a standard amount of work done by allowing the concrete ~~to~~ to fall through a standard height.
* The degree of compaction called the compaction factor is measured by the dencity ratio. That is the ratio of the dencity actually achived in the test to dencity of same concrete fully compacted dencity.

Degree of workability	Compacting factor: small apparatus	large	Used for
Very low	0.78	0.80	Roads vibrated by power operated machine
Low	0.85	0.87	Roads vibrated by hand operated machine
Medium workability	0.~~87~~92	0.935	Flat slab using crushed aggregate
High	0.95	0.96	Not normally suitable for vibration used for pumping
Very high	—	—	Not suitable

Vee-bee Consistometer Test

(i) This test used for measuring in directly the workability of concrete.

(ii) This method is very suitable for very dry concrete. whose slump value can not be measured. by a slump test.

~~Manf.~~

Manufacture of Concrete

The various stages of manufacture of concrete are batching, mixing, transporting, placing, compacting, finishing, curing.

Batching

The measurement of materials for making concrete is known as batching. There are two method of batching.

(i) Volume batching

(ii) Weight batching

(i) Volume batching

Volume batching is not a good method for making of concrete because of the difficulty it offers to measure granular material in terms of volume ~~method~~

↳ The effect of bulking could be considered for ~~agg~~ wate fine aggregate

↳ cement is always measured by weight it is never measured in volume.

↳ Generally for each batch mix one bag of cement is used.

↳ Gauge boxes are used for measuring the fine and coarse aggregate.

↳ The volume of the box is made equal to the volume of one bag i.e 35 litres ~~or~~ ~~multiple~~.

↳ ~~व~~

Batch volume of materials for various mix

	cement Kg	Sand liters	Coarse aggregate liters
1:1:2 (M 200)	50	35	70
1:1 ~~1~~(1.5)/2:3 (M 200)	50	52.5	105
1:2:3	50	70	105
1:2:4 (M 150)	50	70	140
1:2 1/2:5	50	87.5	175
1:3:6 (M 100)	50	105	210

Weight batching

(i) weight batching is the correct method of measuring materials.

(ii) On large work sites, the weight ~~back~~ batching are ~~adp~~ adopted.

Mixing

~~They~~ There are two method adopted for mixing concrete hand mixing, machine mixing.

Hand Mixing

* Hand mixing is done for small scale unimportant concrete work.

* As the mixing can not be efficient there fore it is desirable to add 10% more cement for preparation of concrete.

~~Mcl~~ Dt: 10.12.22

Machine Mixing

Mixing of concrete is almost carried out by machine for reinforced concrete work & for medium or large scale mass concrete work.

A Machine mixture can be classified as batch mixture & continous mixture.

Batch Mixture

Batch mixture produce concrete batch by batch with time intrroval. where as continous mixture produce concrete continously without stopage.

Batch mixture may be pan type or drum type.

↳ Drum type may be ~~for~~ further classified as tilting, nontilting • reversing type.

Continous Mixture

The continous mixture machine gives a stream of mixed concrete based on volumetric proportion.

Transporting

Concrete can be transported by variety of methods & equipments like mortar pan, wheel borrow, crane, bucket, ~~trop~~ transites mixture, truck mixture, dumper, pumps, chute, pipe line.

placing of concrete

↳ placing of concrete is the process of depositing the concrete in its required position.

↳ Concrete should be placed in position in proper manner as early as possible with in the intial ~~st~~ setting time of the cement.

Compaction

↳ Compaction of concrete is the process adpoted for removing entrapped air from the concrete after placing it in position.

↳ In the process of mixing transporting & placing of concrete, air is lightly to get entrapped in the concrete.

Method of Compaction

The following method are addopted for compacting the concrete.

(i) Hand Compaction.

↳ Rodding
↳ Ramming
↳ Tamping

(ii) Compaction by vibration

↳ Internal vibrater
↳ From work vibrater
↳ Table vibrater
↳ platform vibrater
↳ Surface vibrater
↳ Vibratory roller.

Finishing

↳ Finishing operation is the last operation in making concrete.

↳ In concrete road pavement, air field pavement, flowing of a domestic building, carefull finishing is of great importants.

↳ finishing may be achieved by following operation.

(1) Screeding

It is the levelling operation that removes humps and hollows & provide a true & uniform concrete surface.

(2) Floting

It is the process of removing ~~ill~~, the irregularities from the surface of concrete left after screeding

(3) Trawting

It is the ~~fenee~~ final operation of finishing. It is performed where smooth surface is required.

(4) Curing

Concrete derives its strength by the hydration. of cement particle.

Cement requires a water cement ratio about 0.23 for hydration. & a water cement ratio of ~~0.18~~ 0.15 for filling the voids in the concrete.

Therefore water cement ratio of about 0.38 ~~with~~ be would be require to hydrate all the particle of cement.

Curing is the process of controlling the rate & extend of moisture loss of ~~o~~ from concrete during cement hydration.

Curing may be divided into 4 types

(1) Water curing.

(2) Mambrain curing

(3) Application of heat

(4) Miscellaeous

Dt: 15.12.22

Timber

(i) Wood is a natural product available in abundance in nature. It is used for construction of doors, window, roof, beams, cobords ~~selfs~~ shelves.

(ii) The products of wood cut down from trees suitable for construction purpose are called timber.

(iii) The trees from which timber is obtained is classified into two catogories

(1) Exogenous tree (outward growing trees)
(2) ~~E~~ Endogenous tree (growing by addition of tissue in wards like bambo palms)

~~a~~ Exogenous tree are further divided into two main catogories.

↳ Hard wood
↳ ~~sho~~ Soft wood

Hard Wood

These are the trees which have brad ~~leves~~ leaf, dark colour & well defined ~~a~~ enular ~~leane to an~~ rings.
(1 yr of patra jhada)

↳ They are deciduous tree which chade there lives anually.

↳ Hard wood are heavy, hard and strong

Shoft Wood

↳ Shoft wood have long & narrow pointed ~~ler~~ ~~lefes~~ leaf and are ~~ce~~ characteriside by distinct annular rings

↳ It has ~~strait~~ straight grains, light colour, more uniform texture.

↳ soft wood are very strong for direct ~~pool~~ pull but weak in resisting shear.

classification of timber

Exogenous tree

Soft wood : chir, deodar tree, fir, pine, koel

Hard Wood : Babul, Mohogany (costly), oke tree, sal, ~~tek~~ teak

Endogenous tree

Bambo, palm & cane

Dt: 23.4.22

Structure of timber

★ The cross section of a tree has several layers which differ from one tree to other.

★ The layer include pith or medulla, heart wood, sapwood cambium layer, medullary rays and the bark.

pith or Medulla :

★ The inner most central portion that contains entire cellular tissue is called pith or medulla

Heart Wood

i) The ~~annula~~ annual rings that surrounding the pith is called as Heartwood.

ii) This portion is dark in colour and it does not take part in the growing of a tree.

(vii) This part forms the strongest and durable part of a tree.

Sapwood

(i) The few outer annual rings are called sapwood. This part of the tree is active in growth.

(ii) Cambium layer

~~The ti~~

The thin layer between the bark and sapwood is termed as cambium layer. This layer contains sap which is yet to be converted into sapwood.

Medullary Rays

These are vertical layers of cellular tissues and are thin radial lines from pith to the cambium layer (determin age of tree) sport good, wooden floor.

Workability

The timber should be easily work-able and should not clog the teeth of saw.

Toughness and Abrasion

A good timber should be capable of offering resistance to shock due to vibration and should not damage due to mechanical wear.

Surface of Timber.

Dt : 23. 12. 22

Structure Of Timber

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The thin layer between the dark and sapwood is termed as cambium layer, this layer contains sap which is yet to be converted into sapwood.

Medullary Rays

These are vertical layers of cellular tissues and are thin radical lines from pith to the cambium layer. (determine age of tree)

Bark (Cortex)

It is the outer most cover of the tree.

(i) It is further divided into the inner bark and outer bark.

(ii) The layer covering the cambium layer is called inner bark.

(iii) The outer skin (cover) which is the protective layer of the tree is called outer bark.

Characteristics of good timber

(i) **Strength**: It should posses enough strength is direct compression & tension.

(ii) **Durability**: According to durability timber is classified into 3 categories

a) ~~over~~ class (1): Timber having average life of 120 month and over.

b) class (2): Timber having an average life of 60 to 190 month.

c) class (3): Timber having average life of 59 moth or below

iii) Weather Resistance: A good timber should posses adequate resistance against weathering effect such as alternate heating and cooling wind effect.

iv) Fire Resistance:- The timber should offer sufficient resistance against fire so that it should net easily ignite. It helps in fire protection of building.

v) Elasticity:- The timber should be capable of regaining its orginal shape when load removed.

The property is used when the timber is used for bows, sport good, wooden floore.

vi) Workability: The timber should be easily workable and should net clog the teeth of saw.

vii) Toughness and Abrasion: A good timber should be capable of offering resistance to shock due to vibration and should net damage due to mechanical wear.

chapter-5

Surface Protective Materials

Paint

Paint is a liquid that will spread over a solid surface, dry and harden forming a coherent film acting as a surface protective materials

Composition of paint :

The six important constituent of paint are (i) Base.
(ii) filler
(iii) Vehicle
(iv) solvent
(v) pigment

(i) Base

↳ Base is the body of the paint.
↳ It forms the bulk of a plant.
↳ A base is usually opaque and posses covering power.
↳ It gives acuralricity to the surface.
↳ It makes the paint as resistant against abrasion and prevents. crinkage cracks in the film.

(ii) Filler

↳ These is used to dilute the base of a paint.
↳ Filler increase the durability and lower cost of a paint.
↳ Barium sulphate, charcoal, gypsum, magnesia are the used as a filler.

(iii) Vehicle

↳ Vechicle is a liquid substance used in a paint for dissolving and holding the base and pigment is suspension.
↳ Vehicle enables the paint to spread over the surface a thin and uniform layer when applican.

↳ The vehicle helps the base and pigment to enter into pores, cracks on the surface.

↳ Refined linsad oil is the most commonly used vehicle in paints.

(IV) Drier

↳ Driers are used to accelerate the process of drying and hardening.

↳ Driers are required to thickness the vehicle.

↳ It improves durability and prevents shrinkage cracks.

(V) Thinner:

↳ Thinner is required to reduce the consistency of the paint.

↳ It ~~evap~~ evaporates after the paint has been applied to the surface.

↳ It increases the workability of paint.

↳ Turpentine oil is used as thinner.

(vi) Pigments

↳ Pigments is the colouring agent mixed with base to produce desired colour of the paint.

↳ Indigo, cobalt blue, graphite amber, copper sulphate, zinc chromate are the example of colour pigments.

Flow Diagram of paint manufacture

Pigment | Thinner and Drier | Vehicle oil | Plasticizer

↓

Mixer

↓

Grinding Mill

↓ ← Vehicle

Thinning Tank

↓

Quality Control Test

↓

Transfer Tank

↓

Packing

↓

Containers

↓

Finished Packed Paint in Container

Composition of enamels

↳ Examples : is a paint having white lead or zinc white in a small quantity of oil and mixed with petroleum sprit and resinous matter.

↳ They dry quickly and furnish a hard glossy surface

↳ They can be used for internal as well as external work specially for wood work.

↳ These are acid resistant and water proof.

↳ It is not affected by hot and cold water.

Process of Application of Enamel

↳ The surface of the wood work is rubbed with a sand paper and cleaned.

↳ A primer coat consisting of titanium white in linseed oil is applied.

↳ Primer coat is followed by two to three coats of enamel paint.

Composition of Varnish

↳ A transparent or semi-transparent solution of a resinous substance either einsed oil turpentine or alcohol is called varnish.

↳ Varnish provide a protective coating and gloss to the surface.

↳ Ingredients of a varnish are:- (i) Resin
(ii) Solvent
(iii) Drier.

(iii) Drier:- It helps in quick drying of the varnish. ex:- litharage white copper, lead acetage

(iii) Solvent :- It acts vehicle of the varnish and helps in spreading the resin.
ex:- Boiled, Finished oil.

(iv) Resin : A natural or synthetic organic substance which a soluable in some organic solvent
ex:- Amber, copal, gum anime.

* The type of solvent depends upon the resin used

Slno	Resin	Solvent
1	Amber, Copal, gumanime mastic	Boiled linseed oil
2	Common resin, gum dammer	Turpentine
3	Raw Copal, cheap resins	wood naptha
4	lac, shellac	methylated sprints

Characteristics of varnish

↳ It should dry reapically.
↳ It should form a hard film on drying
↳ It should not crack on drying.
↳ It should be durable and weather resistant.

Application of Varnish

↳ The wood work is made smooth by rubbing it with sand paper and cleaned.

↳ A coat of red lead in water mixed with glue is applied.

↳ After it dries another coat of red lead in oil and thinned by boiled turpentine oil is applied.

↳ Two coats of varnish prepared by dissolving shellac in methylated sprit or wine are used.

↳ The surface of the wood work is rubbed again and cleaned.

↳ Varnish is then applied in two coats.

~~Dt. 8.3.19~~

TYPES AND USE OF PAINT

The following are types of paint

(1) Aluminium paints

↳ This paint is manufactured using finely ground aluminium powder suspended in sprit varnish.

↳ This paint is not affected by high temperature, salt water and moist weather.

↳ It offers good protection against, and corrosion.

(2) Bituminous paints

↳ This paint is made of asphalt, bitumen dissolved in anytype Filler petroleum or white sprit.

↳ This paint is used on surface which are immersed in water.

↳ They deteriorate very fast when exposed to sunlight.

(3) Anti-Corrosive paints

↳ These paints essentially consists of the linseed oil as vehicle.

↳ They ~~are~~ have redload, zincoxide, iron oxide, zincdust zinc chromate etc. as their based.

↳ These paints should have quick drying or hardening properties.

(4) Powdercoated paints (painton metal):

↳ The most common way of a applying the powder coating to metal objects is to spray the powder using an electrostatic gun.

↳ This is durable finish very resistant to scratches, cracking, UV rays and rust.

Use of special paints

The following are the special type of paint

(a) Bronze paint
(b) plastic paint
(c) Silicate paint

(a) Bronze paint

↳ These paint are prepared by dissolving aluminium bronze or copper bronze in cellulose locquer as vehicle.

↳ These paints give a very reeblective type of surface and are useful for being applied on rediator.

(b) Plastic paint

↳ plastic emulsion paints is a water based wall paints.

↳ It is extreemely durable but is not suitable on external surfaces, wood and iron surface.

↳ It should confirm to the specification given by IS : 5411

(c) Silicate paint

↳ silicate pain is prepared adding calcium and finely ground silica.

↳ It is possible to apply directly on brick, concrete or plastered surface.

↳ The paint does not require any priming coat.

↳ This paint is not applied on wet surfaces.

↳ It is acid rain resistant.

Uses of enamel paints

↳ An enamel paints is adding white lead or zinc white (base) to varnish (vehicle)

↳ To obtain the required colour, colouring agents may also be added.

↳ Enamel paint can be used both interiour as well as exterior painting.

↳ Enamel is also used on wood to make it resistant against water and ret.

↳ Enaimel paints are classified as
(a) oil-based enamels.
(b) Water-based enamels.
(c) Alkyd-based enamels.

(a) oil-based enamels

(i) It has a strong solvent oder.
(ii) oil-based enamels reaches optinum hardness in 8 to 24 hours depending enarying conditions.

(iii) Paint thinner or mineral sprits are used to cleanup the surface.

(b) Water-based enamels

(i) These are also called latex or acrycic paints.

(ii) Water based enamels dry from outside to inside A skin forms on the surface of the paints, soit feels dry to the touch within an ~~hair~~ hour.

(iii) In humid or cool conditions, It can take several weeks to fully harden

(iv) It has a fairy low odour.

Building Construction

Dt: 6.1.23

What is building ?

Ans: Building is a structure which include foundation, plinth, walls, floors, roofs, chimney, plumbing, verandah, balcony.

Main parts of building

A building has two basic parts one is (1) substructure or foundation (2) superstructure

(1) substructure

It is the lower portion of the building usually located below the ground level which transmit to the supporting soil.

(2) Superstructure

↳ It is the upper portion of the building which is ~~abo~~ above the ground level.

↳ A part of the superstructure located between the ground level & floor level is known as plinth.

↳ The level of the floor is usually known as plinth level.

↳ The built of covered area measure at the floor level is known as plinth area.

Componets of building

A building has the following componets

(i) Foundation
(ii) plinth
(iii) Masonary units (walls & columns)
(iv). Floor structure
(v) Doors, windows
(vi) stair, lift, Ramps.
(vii) Building finishes
(v) Roof structure

(i) Foundation

It is the lowest part of the building below the surfaces of the surrounding ground which is in direct content with the sub soil & transmit all load on to it.

~~(ii) plinth~~ Function

↳ To destribute loads uniformly to the soil.

↳ To increase the stability of the structure against sliding & over turning.

↳ To provide a level & hard surface for superstructure.

(ii) plinth

↳ It is define as the portion of the structure between the surface of the ground level & floor level of the building.

↳ Minimum height of plinth should not be less than 450mm.

Function

↳ To protect the building from dampn-ess or moisture penetration into it.

↳ To transmit the load of superstructure to the foundation.

↳ To improve the elevation of the building

Dt: 9.1.2023

Building Finishes

(i) Finishes are several types such as ~~plastering~~ pointing, plastering, painting distempering decorative colour washing etc.

Function of finishes

(i) To protect the structure, ~~especially~~ from affect of rain, sun, wind.

(ii) To increase the life of the structure.

(iii) To provide a true, event and smooth ~~fai~~ finished surface.

Site Investigation

The ~~filled~~ field and labrotorey investigation required to get essentialy information about soil is known as soil investigation or soil exploration.

Objective

(1) To know the type of soil & thickness of different strata existing below the ground level.

(2) To determine the depth of foundation.

(3) To know the depth of underground water table.

(4) To select safe & most economical type of foundation.

Depth of soil exploration

i) Soil exploration should be carried out to a depth at which increasing pressure due to loading is causes settlement or shear failure of foundation is known as significant depth.

Stages in site Investigation

i) site reconnaissance
ii) preliminary site exploration
iii) Detailed exploration
iv) preparation of soil investigation Report.

Dt 11.1.23

i) Site Reconnaissance

(i) It is the first stage of site investigation. In this stage visual inspection of the site is done and information about topographical and geological picture of the site are collected.

(ii) presence of drainage and dumping yards.

(iii) location of ground water table by observing well in that site

(iv) presences of springs.

(v) High flood level marks on the bridges

(vi) presence of vegation & nature of the soil

ii) preliminary site exploration

(1) The main objective of preliminary exploration is to optain approximate

picture of subsoil condition at low cost

(2) The soil sample is collected from experime-ntal borings & sollow test pits & labrotory test such as moisture content, density are conducted

(3) Soil composition, position of ground water table, engineering proptics of soil are calculated

3) What are the aims of energy mangement of building?

Ans: (i) The simplest way to introduce energy mangement is the effective use of energy to maximize proft by minimizing costs. Energy mangement could save up to 70% of the energy consumption in a typical building or plant.

(ii) Energy Mangement saves cost

Now we already know that using an EMS in a building may bring up to 29% savings on total energy consumption costs.

(iii) Reduces the risk of energy scarcity

Through energy is just converted from one from to another, it is still susceptible to its scarcity

(iv) To reduce greenhouse gas emissions

Through energy is just converted from one from to another, It is still susceptible to its scarcity.

(v) Renewables have overhead costs too

Even the energy obtained from renewables sources has substantial overhead costs and captical costs attached to them. So we need to consider this