Lecture/ E-learning notes

 Course number: 13 CE 4103

 Course name: **Quantity Surveying & Valuation**

 Class: IV B. Tech

 Branch: Civil Engineering

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**UNIT – II**

 **SPECIFICATIONS**

General specifications give the idea and class of work in general terms and are generally attached with the rough cost and detailed estimates.

**1. GENERAL SPECIFICATIONS OF FIRST CLASS BUILDINGS**

**Foundation and Plinth** :- Shall be of first class burnt bricks in lime or cementmortar(1:6)over a bed of cement concrete. (1:6:12 or 1:8:16)

**Superstructure:-** Shall be of first class burnt brick work in lime or cementmortar (1:6)

 **Damp Proof Course**:- Shall be of a cm thick cement concrete (1:2:4) with on-layer ofbitumen laid hot or any other specified water proof material.

**Roofing:-** Shall be of R.C.C. slabs (1:2:4) covered with two coats of bitumenlalid hot and a layer of lime or cement concrete 8 cm. thick over it with a tile flooring with cement flush with cement flush pointed on the top.

**Flooring:-** Shall be of TERRAZO in drawing, dining, bath and W.C., 4 cm thickplain conglomerate polished floors in bed rooms and in other rooms.

**Doors and Windows**:- Doors and windows shall be of teak wood, paneled orpaneled and glazed with gauze shutters to outer doors and fixed wire gauze to windows and ventilators Fittings shall preferably of brass or good quality metal.

**Finishing:**- The inside and outside walls shall have 1.25 cm. thick cementplaster. Drawing, dining and bed rooms inside of walls shall have 2 coats of distemper and other rooms shall have three coats of white washing. The outside of the wall shall have two coats of colour washing over one coat of white washing.

**Painting:**- Doors and windows shall be given three coats of white lead whereexposed and white zinc or cream or grey silicate paint elsewhere.

 **Miscellaneous:-**

First class buildings shall be provided with first class sanitary and water supply fittings and electrical installations. A plinth protection 1.50 m. wide of bricks sloped away from the building shall be provided all round the building.

Plinth Area Rate

Rs. 4500.00 to Rs. 5,500 per sq. meter. (Rates variable)

1. **GENERAL SPECIFICATIONS OF SECOND CLASS BUILDINGS**

**Foundation and Plinth**:- All walls shall be built of first class burnt bricks laid inmud mortar over a bed of lime concrete or cement concrete. Top course of the plinth shall be laid in cement mortar(1:6)

**Superstructure:** - All walls shall be built of first class burnt bricks laid in mudmortar.

The Following portions to be built in cement mortar (1:6.)

* 1. Shills of windows, C. windows and almirahs.
	2. Back of almirahs.
	3. Top course of parapet.
	4. Jambs of doors, windows, C. windows and almirahs.

Drip course, cornice and weather course etc.

1. Two courses below the R.C.C. slab and roof battens.

**Damp proof Course**: - Damp proof course 4 cm thick shall be of Portlandcement concrete (1:2:4) with one coat of bitumen laid hot.

**Roofing:-** All main rooms shall have R.B. roof or R.C. roof and first class orsecond class mud roofs over other rooms.

**Floors:-** the main rooms shall have conglomerate floors and verandahs shall haveflat or brick on edge floors over cement concrete and sand.

**Doors and Windows:-** Interior and exterior surface of wall shall be cementplastered 1.25 cm thick, covered with three coats of white washing.

**Painting:** - Doors and windows shall be painted with three coats of chocolatepaint or any other approved paint.

**Miscellaneous:-** Roof drainage shall be carried by means of Gargolyes andkhassi parnalas. Plinth protection1.50 m. wide of bricks shall be provided all round the building.

Plinth Area Rate: Rs. 2500 to Rs.3000 per sq.m

**3. GENERAL SPECIFICATION SOR THIRD CLASS BUILDINGS**

**Foundations and Plinth**: - All walls shall be built of second class burnt laid inmud mortar over bed on lime concrete.

**Superstructure: -** All walls shall be built of second‟s class burnt bricks laid inmud mortar.

**Roofing:-** All rooms shall have second class mud roof and the verandahs shallhave G.I. sheet roof.

**Floors:**- Floors everywhere shall be of brick over mid concrete and cement

pointed.

**Doors and Windows: -** Doors and windows shall be of kail, Chir, Mango or anyother soft wood, ledged, battened and braced type.

**Finishing: -** Interior surface of walls shall be mud plastered and covered withthree coats of white washing. The outside surface shall be flush lime pointed.

**Painting: -** Doors and windows shall be give two coats of ordinary chocolate

paint.

Plinth Area Rate: - Rs. 1500.00 to Rs. 1800.00 per sq.m.

**4. GENERAL SPECIFICTIONS OF FOURTH CLASS BUILDINGS**

**Foundation and Plinth**:- All walls shall be built of se3cond class brick work laidin mud mortar.

**Superstructure:** - All walls shall be built of sand molded sun dried bricks laid inmud mortar with the exception of the following which shall be built in second class brick work in mud.

1. Two courses underneath the roof battens.
2. Jambs of doors and windows.
3. Pillars under the roof beams.
4. Sills of windows, C. windows and almirahs.

**Roofing:**- Third class mud roof.

**Floors: -** Mud floors(2.5cm) mud plaster over the rammed earth and gobri

leeped.

**Doors and Windows**:- Doors and windows shall be of kail, chir or any other softwood battend doors.

**Finishing:**- mud and mud plaster inside and outside. **Painting:** Two coats of ordinary paint.

**Plint Area Rate**:- Rs. 800.00 to Rs. 1000.00 per sq.m.

**DETAILED SPECIFICATIONS**

Detailed specifications give the method of constructions and specify the nature of work.

***1.* EXCAVATION OF FOUNDATIONS**

Equality of pressure should be aimed at in designing foundations. The foundation Trenches shall be taken down to the exact width of the widest part of the foundation. The trenches where possible shall always be taken down to a few cms into good hard soil. In order to ascertain the nature of the soil, it is essential to dig trial pits at each of the four corners of the proposed site of a building before starting the construction.

The bottoms of all trenches shall be well watered and rammed. The soft and defective place shall be filled with concrete or with any other hard material as directed by the Engineer-in-charge.

If, however, rocky surface is met, it shall be made as leveled as possible and any small in equalities shall be filed with concrete.

Foundation in bad soil

Where great depihs of bad soil are met with, such as black cotton soil, it may be necessary to resort to piles which may be of wood, steel or reinforced concrete. Where the depth of the bad soil is not excessive, the foundations may consist of beams or concrete arches of concrete pillars.

The pillars being taken down into good soil. In some cases the structure may be built on a raft of concrete reinforced with a grillage of R.s Beams.

**2. EARTH FILLING**

Earth used for filling shall be free from saltpeter and white ants and only foamy and clayey soil free from clods shall be used. It shall be laid in 15 cm layers and each layer shall be well watered and rammed with iron rammers. In case of high embankments, the layers shall not exceed 30 cm depth and the settlement allowances shall be made @ 10% of the height of uncomapacted fills.

**3. Concrete in foundations**

Lime concrete or cement concrete shall be used in foundations to be a base for the super structure.

**3.1. LIME CONCRETE**

Ingredients

Lime, Surkhi, Sand, Brick ballast or stone ballast and water.

**3.1.1. Lime**

Lime is always used as putty lime of class „B‟ [semi – hydraulic or quick lime form] and

Class „C‟ [Non- hydraulic in hydrated or quick lime form], shall be used as directed by the Executive Engineer.

The hydrated lime used should be thoroughly mixed with water in suitable container. It shall then be stirred into thick consistency and left undistributed for not less than 36 hours. Extra water should be drained out and putty should be bused. Similarly quick lime should be converted into putty. The volume of lime putty shall be taken as equal to the volume of dry slaked lime.

3.1.**2 surkhi**

Surkhi shall be obtained by pounding fully bricks or bats. It shall be free from admixture of claly, dust or foreign matter. No un burnt bricks or bats shall, be used for grinding in to surkhi.

1. **Aggregate**

The brick aggregate shall be broken from first class or second class bricks or their bats, or from dense over burnt bricks. The gauge of the ballast shall be 2 cm to 4 cm.

The stone aggregate shall consist of good hard tough broken stone, gravel or shingle of the gauge specified. It shall free from dirt, leaves or any other organic, or admixture of soft or decayed stone.

1. **Water**

Water used in construction shall be clean, free earthly, vegetable or organic impurities, like alkalis, salts etc. which cause efflorescence and affect setting time of mortar.

1. **Mixing And Laying**

The aggregate previously well soaked, shall be measured and laid on a clean platform of brickscyut 555 or wood. The platform shall be sufficient size to give ample room for mixing 23 to 28 cub.m. of concrete. Lime and surkhi shall be measured and laid on the aggregate. The whole dry and wet mix is then turned over three or four times so that it shall be thoroughly mixed concrete shall be laid slowly and gently in layer of 15 cm (not thrown from a height) and thoroughly consolidated with 5.5 kg. Rammers shall be used for consolidating the edges.

**5. Tests**

The consolidation of a concrete is said to be complete if (a) a stick end ways from a height of I m rebounds with ringing sound. (b) The second test is by digging a hole in the concrete and pouring water in the hole. If the consolidation in complete, the water shall not be absorbed in the.

**6. Curing**

The concrete shall be kept wet for a period of at least ten days no brick work masonry shall be laid on the concrete for at least seven days after laying.

**PERMISSIBLE SAFE LOADS OF FOUNDATIONS.**

|  |  |  |
| --- | --- | --- |
| SOIL |  | Lonnes per sq.m. |
| Ordinary earth | …… | 5.46 |
| ….. |  | 5.46 |
| Make up ground, well consolidated | …… | 5.46 to 10.93 |
| …… |  | 8.20 to 16.40 |
| Soft clay | …… | 16.40 to 21.86 |
| …… |  | 21.86 |
| Loamy soils and sand mixed clay | …… | 32.80 to 43.70 |

|  |  |  |
| --- | --- | --- |
| …… |  |  |
| Ordinary clay | …… |  |
| …… |  |  |
| Solid clay | …… |  |
| …… |  |  |
| Very hard clay | …… |  |
| …… |  |  |

**7. USE OF COARSE AAGAGREGATE FOR DIFFERENT TYPES OF CONCRETE**

(I) 65mm, Nominal size:

For unreinforced mass concrete word on ordinary work. (ii) 40mm, Nominal size:

For unreinforced mass work of cement concrete on small jobs over 15 cm minimum dimensions. For reinforced works, it shall be used where the dimension of members exceed 45cm.

(iii) 20mm Nominal size:

Unless otherwise mentioned, if will be used as under-

1. Unreinforced cement concrete work between 5cm minimum size.
2. Conglomerate floor.
3. R.C.C. works exceeding 12cm but not exceeding 45cm in minimum dimension.

(iv) 15mm Nominal size.

Unless otherwise mentioned and specified, this aggregate shall be used in cement concrete works of the following description.

* 1. R.C.C. lintels and slabs under12cm and more than 5cm.
	2. R.C.C. posts and battens less than 40cm sectional area.
1. **CEMENT CONCRETE**
2. Ingredients

Cement, sand, brick or stone aggregate, gravel or shingle and water

**8.1.1 Cement**

Cement shall be Portland cement of the Indian standard Specifications as perIS: 269. All cement shall be brought to the site of work in bags with the seals in tack. Fresh and from moisture. All cement shall be gauged by weight and shall be added at the mixture in whole 50kg.bags.

**8.1.2 Fine Aggregate (Sand)**

It shall consist of clean, hard, uncoated grains of natural sand or crushed stone sand rushed gravel sand or combination of any of these free clay, loam, silt, organic or other deleterious substances. The sand shall be washed before using Fig.8.1 shous the trough for washing sand.

**8.1.3. COURSE AGGREGATE**

Coarse aggregate (bajri or grit ) shall consist of good hard tough and clear water worn bajri obtained from natural streams. The girl shall be free from dirt, clay, leaves or other organic matter and soft or decayed

stone and shall be of the gauge specified according to the nature of the work.

**8.1.4 WATER**

Water used in construction shall be clean, free from earthly, vegetable or organic impurities: like alkalis, salts etc. which cause efflorescence and affect setting time of mortar.

**8. MIXING (CEMENT CONCRETE 1:6:12 ETC)**

In all proportions of cement concrete except 1:1 ½:3, 1:2:4 and 1:3:6, the measured quantity of cement is to be placed on top of the measured quantity of the aggregate (fine and coarse) and the whole mass mixed three or four times so that it shall be thoroughly incorporated. The required quantity of water (clean, rather drinking water) shall then be added and the entire wet mass shall be turned over unto the homogeneous mixture of the required consistency is obtained.

**9. LAYING AND CONNSOLIDATION OF CEMENT CONCRETE IN FOUNDATIONS**

Concrete shall be handed from the mixing platform to the place of final deposit as rapidly as possible. It shall be laid slowly and gently in layers of 15cm (not thrown from a height) and thoroughly consolidated with 5.5 kg. Rammers.

**10. FARMA OR BATCH BOX**

The design of the farma (Fig. 8.2) is given below

15” x 15” x 9 x 5”/8 = 1.25 cft.

Or 38cm x 38 cm x 25cm = .036m

**11. REINFORCED CEMENT CONCRETE**

The standard mix for reinforced cement concrete is (1:2:4).

In addition to this, round steel bars are embedded to make the structure strong to take up all the tensile stresses.

**12. MIXING**

The two ingredients i.e. cement and sand shall be hand mixed dry, three or more times until the mix comes to a uniform colour. The measured quantity of coarse aggregate shall then be added to the mixture and whole mixed dry thoroughly. The required quantity of water shall then be added with a

**13. Reinforcement**

Round steel bars as far as possible shall be used in preference to square bars. The bars shall be thoroughly cleaned of rust, scale and of coatings that might destroy or reduce bond. The ends of all bars shall be properly hooked and bends shall be made as per drawing and design supplied. In case of joints in reinforcement an overlay of not less than 40 diameters shall be given for tension member. Figs.8.3,8.4 and 8.5 show the method of bending and overlapping the steel bars.

**14. MIXING CEMENT CONCRETE (1:2:4 OR 1:3:6)**

The two ingredients i.e. cement and sand shall be mixed dry, three or more times until the mix comes to a uniform colour. The measured quantity of coarse aggregate shall than be added to the mixture and whole mixed dry thoroughly. The required quantity of water shall then be added with a rose.

**15. PLACING AND HANDLING THE CONCRETE**

Concrete shall be handled from the mixing platform to the final deposit as rapidly as possible. After depositing, the concrete is to be ridded, vibrated, tamped or worked to ensure that no hollow places are left.

**16. FORMS AND CENTRING**

Forms wherever required shall be sufficiently rigid and strong to withstand the weight placing and putting of concrete and the movement of labor, material and plant. Forms shall be sufficiently water right to prevent leakage of mortar. Forms shall be supported or fixed by wedges of the load being eased and the forms removed without sock to the work and without hammering.

**17. LAYING**

Before depositing the concrete, the reinforcement shall be correctly laid in position and secured against displacement by tying with soft iron wire. The bars shall remain in position 20 mm. above the surface of centering.

**18. CURING**

The concrete when laid shall be carefully protected from the extremes of weather and temperature and from unequal or too repaid drying. It shall be thoroughly kept wet for at least 15 days.

**19. EXPASION JOINTS**

In every long lengths of slab work, expansion joints shall be provided at intervals of about 9 m. to 12m.

**20. BEARING**

The bearing of slabs not be less than the thickness of the slab with a minimum of 12cm.

**21. DAMP PROOF COURSE**

In order to prevent water absorption form the soil and thus causing dampness in the walls, a continuous layer of an impervious material is provided. Such a material is known as a horizontal damp proof course. It consists of cement concrete 1:2:4, I part cement washed sand and 4 parts shingle (gauge 6mm to 20mm,) Unless and otherwise specified, the damp proof course shall consist of 4 cm, thickness of cement concrete with one coat of bitumen laid hot @ 1 kg. per square meter of Damp proof course and be sanded immediately.

The Damp proof course shall extend to the full width of the superstructure walls except in the case of outer walls where it shall not be carried across doorways and verandah openings and similar openings.

Vertical D.P.C. shall consist of 12mm or 18mm thick 1:3 cement plaster with two layer of bitumen laid hot. Bitumen shall be blown bitumen grade 85/25, having application temperature 177 to 204 c.

**BRICK WORK**

Brick work consists of first class bricks laid in the mortar specified. 22. **BRICK WORK IN MUD MORTAR**.

23.**1 Bricks**

Shall be first class made from good brick free from saline deposits and shall be sand molded thoroughly burnt without being vitrified, of good colour, shall be regular

and uniform in shape & size with sharp and square arises and parallel faces. Emits a clear ringing sound when struck, shall be free from flaws, cracks etc. should not absorb more than 20% of water by weight after being soaked in water for 24 hours.

1. **Mud mortar**

Mud mortar shall be prepared from stiff clay, broken up into powder and free grass, stones, kankar, roots and other matter. The clay shall then be worked up with water by mens‟ feet and PHOWRATHS on a clean platform.

1. **Joints**

The thickness of the joints shall be 6mm and in no case exceeds 10mm. All brick

work shall be taken truly plumb, laid in English bond.

1. **BRICK WORK IN LILME MORTAR**
	1. **Bricks**

Same specifications as per para 23.

1. **Lime mortar**

Ingredients-Lime, Surkhi sand or cinder and water. The proportions upon the

ingredients available at site.

General one part of lime and 2 parts of surkhi are suitable. 2.4.2.1 **Lime:** Same specification as perpara 3.1.1.

24.2.2 **Surkhi:** same specification as per para 3.1.2.

24.2.3. **Mixing:** the mortar shall be mixed by measure on a clean platform close to the mill. The measuring wooden boxes may be used. The ingredients shall be mixed twice dry and then ground with sufficiency of water in a mill continuously for three hours.

For big works a bullock mortar mill (see Fig.2.6) is used and shall be constructed of first class bricks in lime mortar. Class shall be taken that fresh mortar shall be made daily and used as fresh as

1. lying:- Bricks should be laid in proper bond.
2. Soaking:- All bricks shall be soaked in clean water before use for at least one

hour.

1. joints:- Joints shall be of uniform thickness, not exceeding 6mm. 10mm and 13mm for 1st class brick work respectively. The vertical joints must be quite symmetrical and truly plump in case of Ist class brick work.

The joints in faces which are to be plastered or pointed shall be raked out while the mortar is green.

The brick work shall be kept moist for a period of ten days.

**24. BRICK WORK IN CEMENT MORTAR**

1. **Bricks:** (same specifications as per in Para 23)
2. **Cement mortar**: cement mortar shall consist of mixture of 1:3, 1:5,or1:6 accordingto the nature of work.
3. **Mixing**: cement and sand shall be thoroughly mixed dry and then water is addedwith a fine rose to make the mortar workable. Mortar to which the water has been added shall be used within 30 minutes of the addition of water.
4. **Joints**: (Same as per in item 24.5)

The thickness of joints shall be regulated so that height of 10 courses when laid with Horizontal joints shall measure one meter in height.

The joints in faces which are to be plastered or pointed should be racked out while the mortar is green i.e not later than 24 hours after the work is done.

**25.5 Watering**:- Walls as they progress shall be kept thoroughly well watered on theirfaces and tops.

**BRICK OR TILE FLOORING**

Consists of first class burnt bricks or tiles laid flat or on edge over a bed of 10cm, thick lime concrete or cement (1:6:18) and 10cm. thick sand.

1. **Laying**: All bricks or tiles or tiles shall be laid in lime or cement mortar with bedand vertical joints full of mortaar1:4 simple “lipping” at the edge shall not be permitted. The laying shall be in plain, diagonal, herring bone or other pattern as desired by the Engineer-in-charge. The work shall be protected from the effect of sun, frost and rain during construction.
2. **Soaking**: Before use, all bricks or tiles shall be soaked in clean water intanks for at least one hour.
3. **Joints**: The joints shall not exceed 6mm in thickness. The mortar in thejoints shall be struck off flush with s trowel. Care shall be taken that no mortar shall spreed over the edge of the bricks or tiles.
4. **Curing**: The floor must be kept wet for seven days after laying. Ifcement pointing is done, it shall be kept moist for at least 15days after the pointing has been done.
5. **TERRAZO FLOORING**

A rough foundation of ordinary cement concrete 1:2:4 to within 29mm below the

required finish grade shall first be provide. The material of the terrazo consisting of 1 x ½ parts of very small marble chips machine crushed and free from marble dust and foreign matter, 6 to 13 mm, to one part cement shall then be laid and floated over the rough surface, so that flat sides of the chips lay evenly at the top if the marble chips do not show up sufficiently, the defective parts may be filled up by hand. After the terrazzo concrete has hardened enough to prevent dislodgement of aggregate, it shall be ground down with an approved type of grinding machine shod with free rapid cutting carborundum stones to expose the coarse aggregate. The floor to be kept wet during grinding process. After this the finish shall be scrubbed with warm water and soft soap and mopped dry.

1. **MARBLE FLOORS**

The marble flooring shall consists of marble tiles laid on 12mm thick mortar bed

over the usual base courses of 10cm base concrete 1:8:16 and 10cm said or stone filling in case of ground floor or over R.C.C slabs. In case of upper floors the mortar bed shall be of 1:3 cement sand mortar.

The marble slabs should be of approved quality and thickness 20mm to 25mm with truly plane surface. The size of marble slab shall be slightly oversize to permit cutting to actual size of tiles at the site of work.

**36.1 Curing**: During the progress of work and for 10days after laying, each section offloor shall be kept flooded. Three clear days shall be allowed for setting before the pavement is walked over and no weight should be rested upon the surface, until 7days after laying is completed, Polishing is done, as in case of Terrzo flooring and no first cutting is usually needed.

1. **ROOFING**

First class mud roofing consists of two layers of tiles 30 x 15 x 4 cms. Resting on

wooden or reinforced cement concrete battens spaced 30 cm centre to centre. The top of tiles shall have 13mm thick cement plaster (1:4) covered with two coats of

bitumen laid hot and 10 cm. thick earth, another 2.5 cm. layer of mud plaster to be given and finished with gobri leeping. (45 tiles are required for one sq.m. of roof area).

**DOORS & WINDOWS**

Doors and windows may range from the humble ledged and braced doors and windows which are usually, fitted to out houses, to the multiple, paneled and paneled and fitted fitted with ornate molding and paneled, and which are usually associated with the entrances to important buildings.

In all cases the construction shall be such as to ensure that the door shall be satisfactory in service.

**46.1 Timber**

All doors, windows, clerestory windows and all almirahs with their chowkats shall be made of well seasoned deodar wood or any other food timber free from sapwood, large knots, shakes cracks and other serious defects.

**46.2 Panels**

In case of paneled doors, the panels shall not be less than 13 mm thick.

**46.3 Sash Bars**

In case of glazed doors, Sash Bars shall be of the full thickness of the leaf and 38 mm. in width and shall be molded and mitered on the outside and rebated from inside. The width of the rebate shall be 13 mm.

**47. WHITE WASHING**

The surface to be white washed must be clean and smooth and perfectly dry before applying white wash.

Each coat be allowed to dry before nest is applied. New plastered surface tone white washed, shall not be trowel led to a glaxed surface otherwise white wash will not adhere.

The white wash shall be made from pure fat lime, brought to the work in an unsa0laked condition and termed as class „C‟ lime. Water shall ne added to this lime in a tub, until the mixture is of a consistency of cream and allowed to rest for 24 to 48 hours. The mixture shall then be strained through coarse cloth, suitable quantity of gum shall be added, dissolved in hot water. This hot water shall be added at the rare of about 5 liters per kg. to produce kilky solution.

**47.1 Colour washing**

The colour wash shall be made from pure slaked fat lime and mixed with the necessary pigment to give the required shade. The pigment shall be such as to be unaffected by lime.

The surface to be colour washed shall be given one coat of white wash and then one or two coats of colour washing. Each coat of site or colour wash is to be allowed to dry and passed by the Engineer- in-Charge before the next is applied.

**48. PAINTING**

**48.1 Wood work (New)**

Before commencing any painting, the surface should be rubbed down with sand paper and make it smooth with grade 2 1/2 paper and then with 1 1/2 grade. The sand papering must be finished with the grain.

Before applying paint, all knouts must be killed or covered with two coats of patents knotting or with a preparation of red lead glued size, laid on hot. When the wood work is thoroughly dry, the priming coat shall be applied.