Lec-1

ESTIMATION & COSTING

— It is a technique of calculating/computing the various quantities and the expected expenditure to be incurred on a particular work/project.

Need for Estimation :

— Estimation is carried out to fulfill the following needs :

(i) It gives the idea of cost of the work hence helps in deciding the feasibility of project.

(ii) It gives the idea of time reqd. for completion of project.

(iii) It gives the idea of material quantity reqd for completion of work.

(iv) It helps in inviting the tenders for the project.

(v) It helps in controlling the expenditure on project.

(vi) It helps to evaluate where there is any benefit to execute the project.

Data Required for Preparing the Estimates :

Lec-1

Drawings

- Plan
- Section
- Elevation
- Location
- Dimensions

Specifications

General

- Nature
- Class
- Quality of work and material

Detailed

- Quantity
- Proportion
- Workmanship
- Method of working

Rate

- Unit rate of all items (Manpower, Material, Machine) → 3 'M'

TYPES OF ESTIMATES :

Approximate/Rough/Abstract/Preliminary

- Plinth Area Method
- Cubical Rate Method
- Unit Rate Method
- Typical Bay Method

Detailed

- Revised Estimate
- Supplementary Estimate
- Revised & Supplementary Estimate
- Annual Repair & Maintenance Method

(1) APPROXIMATE ESTIMATE :

- For calculating approximate estimate of a work, no detailed knowledge is required, and it can be done on the basis of practical knowledge.
- It is done to obtain administrative approval of the project.
- It helps in deciding the financial aspect of the project.
- eg : cost of construction is 1300 ₹/sq. ft
  plot area = 3000 sq. ft
  No. of stories = 3
  Built-up area ⇒ 1st floor = 80 %.
  2nd floor = 85 %.
  3rd floor = 90 %.

→ Total cost = (0.8 + 0.85 + 0.9) × 3000 × 1300
= 99.45 lakhs

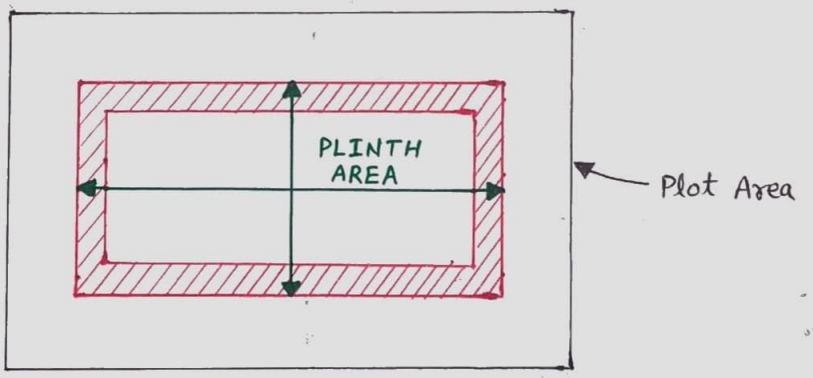
Lec-1 (35:00)

- Approximate estimate can be made by following methods :

(i) Plinth Area Method :

- Approximate cost = Plinth Area × Rate of Plinth Area

- Plinth Area :
  - The built-up covered area of a building measured at floor level of any storey.



As per IS : 3861 – 2002 :– [1966 old code]

– For the purpose of plinth area, following shall be 'INCLUDED' :

(a) Area of wall at the floor level excluding plinth offsets, if any.

(b) Shaft for sanitary, water supply installation, electrical installation, fire fighing, air conditioning & light.

(c) Stair case

(d) In case of open verandah with parapets :
  (i) 100 % area for the portion protected by projections above
  (ii) 50 % area for the portion unprotected by projections above

(e) 100 % of area of balcony protected by projection above,
  50 % of area of balcony unprotected by projection above

(f) In case of 'ALCOVE' made by cantilevering slab :
  (i) 25 % of alcove of height 1 m
  (ii) 50 % of alcove of height 1–2 m
  (iii) 100 % of alcove of height >2 m

Lec-1 (54:20)

Explanations :

(a) Wall का area, floor level पर include करना है, offset means gap, अगर gap दिया हुआ है तो wall का area include नहीं करना है। मतलब, plinth के portion के बाहर अगर wall बनी है तो उसको include नहीं करना है

(b) Shaft मतलब opening given for pipes to be carried from one point to another.

(c) घर के अन्दर बनी stair case included है पर घर के बाहर बनी stair case को include नहीं करना है।

(d) अगर open verandah with parapets ऊपर से covered है तो इसको 100 % include करना है, अगर ऊपर से cover नहीं है तो 50 % include करना है।

(e) अगर balcony ऊपर से covered है तो 100 % include करना है, अगर ऊपर से covered नहीं है तो 50 % include करना है।

(f) Alcove, generally, India में नहीं मिलते। wall में कोई depression बना रखा है तो इसको alcove बोलते हैं। जैसे– Forts में बने रहते हैं। अगर ये alcove 1 m height का है तो 25 % include करेंगे, 1–2 m height का है तो 50 % include करेंगे और >2 m height का है तो 100 % include करेंगे।

Lec-2

'EXCLUDED' in Plinth Area :

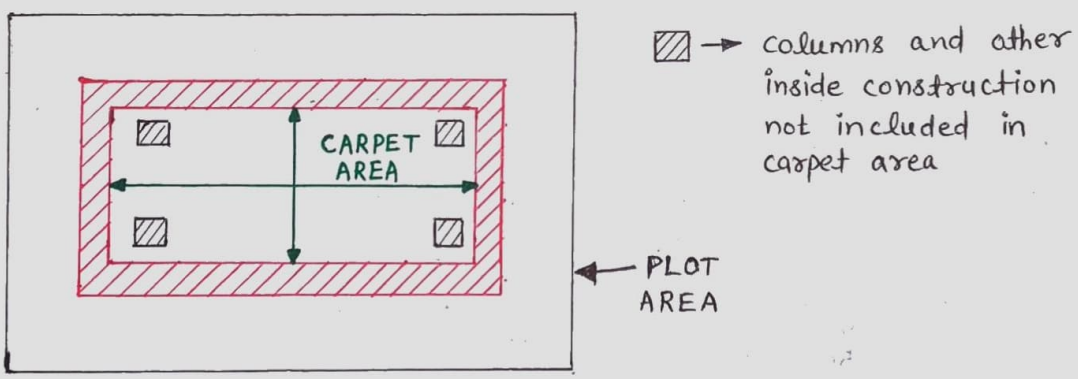
(a) Area of loft
(b) Area of Architectural band, cornice etc.
(c) Area of vertical sun breaker
(d) Open platform
(e) Terrace
(f) Open spiral / service stair cases
(g) Area of mumty, machine rooms, towers, domes above terrace level.

Explanations :
(a) Open cantilever (दाँत) is not included in plinth.

NOTE :

Carpet Area :

- The covered area of the usable spaces of rooms at any floor is termed as carpet area.
- It is measured b/w the walls to walls within the building
- It is the sum of actual area which can be carpet



- Followings are 'NOT INCLUDED' in carpet area :
  - Wall area, veranda, corridors, passages, entrance hall, porch, staircase, stair cover, lift shaft, bathroom, machine room, kitchen & pantry, store room, canteen, AC duct, shaft for sanitary work.

NOTE :

(1) Plinth area is 10 - 20 % more than carpet area.

(2) Carpet Area = Plinth Area − Area not included in carpet area

(3)

Type of Building	Carpet Area
Office	60 - 75 % of Plot Area
Residential	50 - 65 % of Plot Area

Lec-2 (35:15)

NOTE :

Floor Area :

- It is the plinth area excluding area of walls.
- Floor Area = Plinth Area − Wall Area

Set-Back Area :

- Set back is the minimum open space required around any building.
- The purpose of providing setback area is that the construction should be far away from the road, any water body, any nearby construction.

Circulation Area :

- Area that is helpful in movement of people through the building, around the building or between the building is termed as circulation area.
- eg: Lobbies, corridors, stairs, lift, landing etc.
- These are classified into two categories :
  (a) Vertical circulation area : staircase, lift
  (b) Horizontal circulation area : corridor, passage, balcony, verandah, lobby etc.
- Vertical circulation area $\simeq$ 3 % of Plinth Area
  Horizontal circulation area $\simeq$ 7 % of Plinth Area

NOTE :

$$\text{Floor Area Ratio (FAR)} = \frac{\text{Total Floor Area}}{\text{Total Plot Area}}$$

Que : Floor Area (FA) = 1000 sq.m , Plot Area (PA) = 2000 sq.m

Sol :

$$FAR = \frac{FA}{PA} = \frac{1000}{2000} = 0.5$$

Que : If above construction is of four storey, what is FAR.

$$FAR = \frac{4 \times 1000}{2000} = 2$$

Lec-2 (56:15)

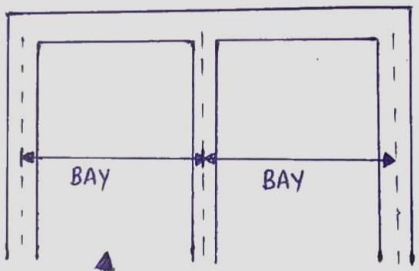
(ii) Cubical Content Method :

- It is more suitable to be applied for multi-storied buildings.
- **Approximate Cost = Volume x cubical rate**
- This method is most accurate in approximate estimation methods.

(iii) Unit Rate Method :

- In this method, estimate is made by considering the unit rate of different items.
- **Approximate Cost = No. of units x unit rate**

Type of Building	Unit
School Building	Classroom / Bench / student
Hospital	Bed
Theater / Stadium	Seat
Water Tank	Litre
Bridge	Span



(iv) Typical Bay Method :

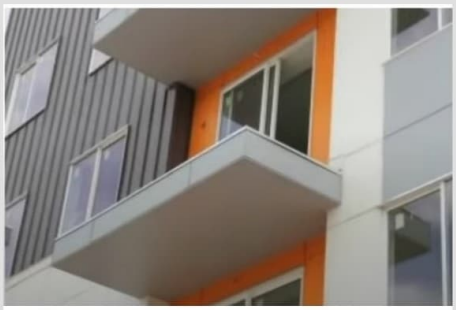
- In this method, estimate is made by considering the cost of bay (span)
- **Approximate Cost = No. of Bays x Bay Rate (Span Rate)**
- This method is generally used for the construction of bridge.

Included in Plinth Area

Shaft for Sanitary etc.

Stair Case

Open Verandah with Parapets



Balcony Protected by Projection Above

Alcove

Excluded in Plinth Area

Area of Loft

Architectural Band

Area of Vertical Sun Breaker

Open Spiral Stair Case

Open Platform

Terrace

Area of Mumty

Lec-3

NOTE :

Lumpsum :

- While preparing an estimate it is not possible to workout the details of 'PETTY ITEMS' (Insignificant wrt civil engg.), Hence, their lumpsum value is considered.

(i) Contingency : (3-5 % of project cost)

- It is unforeseen/ incidental expenses which can not be predicted prior to the execution of project.
- eg : severe accident, specialist visit on site

(ii) Work Charge Establishment : (1.5-2 % of project cost)

- During the execution of the project, certain services are required, expense of which is paid from work charge establishment.
- eg : watchman, security camera, supervisor

(iii) Tools and Plants : (1-1.5 % of Project cost)

- It is the cost of tools and machines purchased/hired for the execution of project.

(iv) Departmental Cost (Engineering Cost) : (10-15 % of project cost)

- It is the cost of engineer for certain work like designing, planning, supervision etc.

(v) Sanitary & Water Supply : (8 % of project cost)

- Laying of pipes, disposing water out of the plant

(vi) Electrification : (8 % of project cost)

- Cost for lighting etc.

These lumpsum values can also be applied in our day-to-day life.

Lec-3 (26:00)

Que: Prepare an approx estimate of building with total plinth area of all building as 5000 sqm, using following data:

(i) Plinth area rate Rs 5000 /m^2

(ii) cost of water supply @ 8 % of cost of building.

(iii) Cost of electrification @ 8 % of cost of building.

(iv) Cost of architectural features @ 1 % of cost of building.

(v) Cost of contingency @ 3 % of cost of building.

(vi) Supervision charge @ 8 % of total cost.

Sol: Cost of building = plinth area x plinth rate

$= 5000 \times 5000 = 25 \times 10^6$ ₹

Cost of water supply $= \frac{8}{100} \times 25 \times 10^6 = 2 \times 10^6$ ₹

Cost of electrification $= \frac{8}{100} \times 25 \times 10^6 = 2 \times 10^6$ ₹

Cost of architectural features $= \frac{1}{100} \times 25 \times 10^6 = 2.5 \times 10^5$ ₹

Cost of contingency $= \frac{3}{100} \times 25 \times 10^6 = 7.5 \times 10^5$ ₹

Total cost $= 3 \times 10^7$ ₹

Supervision charge $= \frac{8}{100} \times 3 \times 10^7 = 2.4 \times 10^6$ ₹

$\therefore$ Total cost of building $= 3 \times 10^7 + 2.4 \times 10^6$

$= 3.24 \times 10^7$ ₹

(2) DETAILED ESTIMATE:

- It consists of preparing the estimate in two stages:
  (a) In the first stage, working of different quantities of items of project is carried out.

(b) In the second stage, cost of each item is worked out.

- Quantity of item is reported in form of 'measurement sheet' and the cost of item is reported in form of 'Abstract Sheet'.

Lec-3 (41:45)

Format of Measurement Sheet :

S.No.	Description of Item	No.	Length	Width	Height	Total Qty.	Remarks

Format of Abstract Sheet :

S.No.	Description of Item	Qty.	Rate	Cost	Remarks

- Total Actual Cost = Quantity x Rate of Item
- This method is more reliable.
- This detailed estimate is required for 'Technical Sanction'.
- Detailed estimate can be made by any of the following method :

(i) Revised Estimate Method :

- It is done when cost of work exceeds by 5 % of original sanctioned cost, or
- When cost of work exceeds 10 % of administrative sanction.

(ii) Supplementary Estimate :

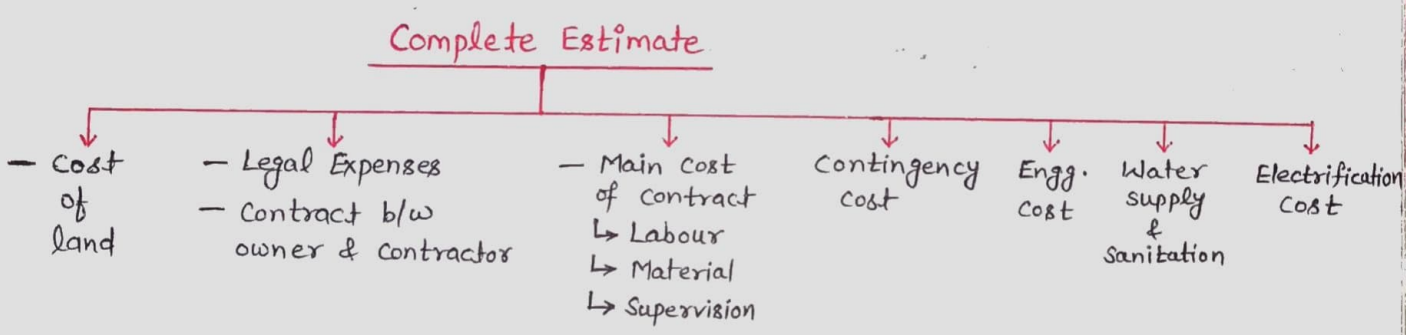
- This is fresh detailed estimate in addition to the original sanctioned estimate, prepared when additional work is also to be carried in the project.
- The abstract of cost shows the amount of original sanctioned estimate and supplementary amount for which the approval is required.

(iii) Revised - Supplementary Estimate :

- It is used when there is deviation in material, design and change in construction/ items of works which require both revised and supplementary estimate.

(iv) Annual Repair & Maintenance Estimate :

- This estimate is used for repair & maintenance of structure like painting, white washing, polishing, filling the leakage, pot holes repair etc.



NOTE :

Administrative Approval :

- For any project to be executed by department, approval from competent authority is required wrt the cost of work on the basis of approximate estimate, and it is termed as 'Administrative Approval'.
- Thus, administrative approval denotes the formal acceptance by the administrative department for proposal of incurring expenditure.

Lec-4 (33:20)

Expenditure Sanction :

- It is done by financial department in which it allocates the required fund for the execution of work.

Technical Sanction :

- After approval of administrative and expenditure sanction, the detailed estimate of project is made for technical sanction.

Schedule of Rates :

- List of rate of all the items like labour, material, transportation etc are mentioned in a book which is known as 'Schedule of Rate Book'.
- It is prepared by PWD, CPWD.
- It is of following types :

  CSR : Common Schedule Rate
  SSR : State Schedule Rate
  DSR : District Schedule Rate

Degree of Accuracy : (As per IS : 1200)

- Dimension shall be measured upto 0.01 m (1 cm).
  ↳ If it is more than 25 m, it is measured upto 0.1 m.
- Area shall be measured upto $0.01\ m^2$.
- Volume is measured upto $0.01\ m^3$.
- Mass shall be measured upto 1 kg.
- Woodwork shall be measured upto $0.002\ m^3$.
- Reinforcement shall be measured upto 0.005 m.
- Thickness of slab projected outside the beam or column shall be measured upto 0.005 m (5 mm)

[जो चीज जितनी costly होगी, उतनी ही ज्यादा precisely measurement होगा]

Types of Works According to Cost :

— Works can be classified into three types, on the basis of cost : (i) Petty work : Cost < 50,000 /-

(ii) Minor work : Cost = 50,000 – 2,00,000 ₹

(iii) Major work : Cost > 2,00,000 ₹

Lec-5

SPECIFICATIONS:

- It is used to provide the description of work required to prepare the estimates.
- These specifications are of following types :
  (i) General Specifications
  (ii) Detailed Specifications

Lec-5 (14:55)

General Specifications	Detailed Specifications
– It provides general description of various items of work.	– It provides detailed description of various items of work.
– It specifies material, quantities, proportion materials.	– It specifies quantities of materials, workmanship to be adopted.
– eg: plinth area = $200m^2$ flooring = $50m^2$	– eg: plinth area = $200m^2$ Concrete flooring = $50m^2$ (PCC/RCC, Lime concrete or cement concrete, M20 etc.)
– It gives general idea of work.	– It gives nature and class of work.
– It is required to prepare general estimate.	– It is required to prepare detailed estimate.

Units of Measurement :

Lec-5 (30:00)

- सारी units याद रख पाना थोड़ा मुश्किल है, तो एक basic concept याद रखना है जिससे सारी units खुद निकाल सकते हैं।
- Mass work / Volume work → m^3
  ↳ means bulk में काम हो रहा है।
- Shallow & thin section → specify one dimension and measurement in 'm^2'
  eg: DPC, plastering
- Long & thin work → specify two dimensions and measurement in 'm' (running meter)
  eg: Railing, fencing, piping
- Piece work / item work → number

S.No.	Particulars or item	Units of measurement	Units of Payment
	Earth Work		
I	(1) Earthwork in excavation	cum	Per % cum
	(2) Earthwork in filling in foundation trenches	cum	per % cum
	(3) Earth work in filling in plinth	cum	per % cum
	Concrete		
II	(1) Lime concrete in foundation	cum	per cum
	(2) Cement concrete in lintels	cum	per cum
	(3) RCC in slab	cum	per cum
	(4) CC or RCC chujja, sun-shade	cum	per cum
	(5) LC in roof terracing (thickness specified)	sqm	per cum
	(6) Cement concrete bed	cum	per cum
	(7) RC sunshade (specified width & height)	cum	per cum

III	Damp Proof Course (D.P.C.) (Thickness should be mentioned)	sqm	Per sqm
	Brick Work		
IV	(1) Brick work in foundation	cum	per cum
	(2) Brick work in plinth	cum	per cum
	(3) Brick work in super-structure	cum	per cum
	(4) Thin partition walls	sqm	per cum
	(5) Brick work in arches	cum	per cum
	(6) Reinforced brick work (R.B. work)	cum	per cum
V	Stone Work : Stone masonary	cum	per cum
	Wood Work		
VI	(1) Doors and windows frames or chowkhats, rafters beams	cum	per cum
	(2) Shutters of doors and windows (thickness specified)	sqm	per cum
	(3) Doors and windows fittings (like hinges, tower bolts, sliding bolts, handles)	Number	per number
	Steel work		
VII	(1) Steel reinforcement bars etc in RCC and RB work	Quintal	per quintal
	(2) Bending binding of steel reinforcement	Quintal	per quintal
	(3) Rivets, bolts and nuts, Anchor bolts, Lewis bolts, holding down bolts.	Quintal	per quintal
	(4) Iron hold fasts	Quintal	per quintal

→ DPC is provided at plinth level, to prevent the entry of moisture from the subsurface into supersurface. DPC is layer of mortar or concrete (2-2.5 cm) certain water repelling agents are also mixed in DPC. (Stearic Acid, Oelic Acid)

	(5) Iron railing (height and types specified)	Quintal	per quintal
	(6) Iron grills	sqm	per sqm
VIII	**Roofing**		
	(1) RCC and RB Slab roof (excluding steel)	cum	per cum
	(2) LC roof over and inclusive of tiles or brick or stone slab etc (thickness specified)	sqm	per sqm
	(3) Centering and shuttering form work	sqm	per sqm
	(4) AC Sheet roofing	sqm	per sqm
IX	**Plastering, Pointing and Finishing**		
	(1) Plastering - cement or Lime Mortar (thickness and proportion specified)	sqm	per sqm
	(2) Pointing	sqm	per sqm
	(3) White washing, colour washing, cement wash (no. of coats specified)	sqm	per sqm
	(4) Distempering (no. of coats specified)	sqm	per sqm
	(5) Painting, varnishing (no. of coats specified)	sqm	per sqm
X	**Flooring**		
	(1) 25 mm cement concrete over 75 mm lime concrete floor (including L.C.)	sqm	per sqm
	(2) 25 mm or 40 mm CC floor	sqm	per sqm
	(3) Doors and window sills (CC or cement mortar plain)	sqm	per sqm

- If the formwork is provided over the mid-span of any horn construction, it is termed as centering. eg: slab
- If the formwork is provided on column construction, it is termed as shuttering.

XI	Rain water pipe / plain pipe	Running Metre (RM)	per RM
XII	Steel wooden trusses	Number (No.)	per No.
XIII	Glass Panels (supply)	sqm	per sqm
XIV	Fixing of glass panels or cleaning	Number (No.)	per No.

- If we know weight of steel, we can calculate its length and vice-versa.

$$\text{weight of steel in 1 m} = (\text{Area} \times \text{Length}) \times \text{density of steel}$$

$$= \left(\frac{\pi}{4} d^2 \times 1 \times 10^{-6}\right) \times 7850 \text{ kg/m}^3$$

$$= 0.00617\, d^2 \text{ kg}$$

$$\therefore \text{Weight of Steel} = 0.00617\, d^2 \text{ kg/m} \qquad d \rightarrow \text{in mm}$$

$$= \frac{d^2}{162} \text{ kg/m}$$

Major Items of Works :

(1) Earthwork :

- Measurement : m^3
- eg : Excavation, cutting, filling, banking
- Depth of excavation < 30 cm, measurement (m^2)
  eg : surface dressing, levelling.
- If trench width > 1.5 m & depth < 30 cm : measurement (m^2)
- In general, Lead and Lift is 30 m and 1.5 m.

Lead : It is the avg. distance b/w source of soil to the deposition of soil.

Lift : Avg. height from source of soil to the point of deposition.

Lec-6

Excavation

Cutting

Filling

Banking

(2) Steel Work :

- Density of steel = 7850 kg/m^3
- Generally, it is 0.6 – 1% of total area (Plan Area).
- Weight of steel in 1m = $0.00617\ d^2$ kg/m [d = mm]
- Measurement : Quintal
- Used in : Rolled steel section (T, L, C).
  - Binding wire
  - Fabrication
  - Fastener (bolt, rivet)
  - Wire netting
  - Reinforcement

NOTE :

- Steel can be used in the form of iron also
  eg : Iron gate, rolling shutter, steel door, windows, iron grill, collapsible gate, GI sheet
- Measurement of above mentioned : m^2

Lec-6 (22:30)

NOTE :

- Cast iron Reinforcement, wire fencing : running meter
- Threading : running meter

Que : What is the weight of 10 mm dia bar in 20m length ?

Sol : Weight of steel in 1 m $= 0.00617\, d^2$

$= 0.00617\, (10)^2$

$= 0.617$ kg/m

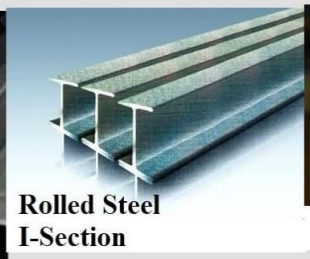
$\therefore$ weight of steel in 20 m $= 20 \times 0.617$

$= 12.34$ kg

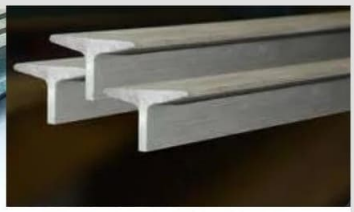
GI Sheet

Rolled Steel Angle Section

Rolled Steel Channel Section



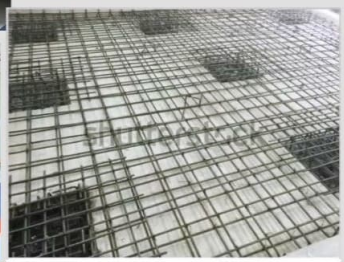
Rolled Steel I-Section



Rolled Steel T-Section

Binding Wire

Fabrication



Wire Netting

Rolling Shutter

Steel Door

Steel Window

Iron Grill

Collapsible Gate

Cast Iron Reinforcement

Wire Fencing

Threading

Iron Roof

Jaspal Sir

Ajay Prakash

Lec-6 (38:20)

(3) Concreting :

- Measurement : m^3
- eg : RCC, PCC, CC, precast concrete, RCC chajja, lime concrete.

NOTE : Exceptions of concreting

- **DPC :**
  - Damp Proof Course
  - Provided on plinth level
  - Repels water from entering into super structure from sub-structure.
  - Depth is in range of 2-2.5 cm
  - Grade : M10 – M20 with water repellant chemicals (Bitumen, stearic acid, oelic acid)
  - Measurement : m^2
- LC in Roof Terracing : m^2
- Concrete jali & Jefferie Concrete : m^2
- Concrete Floor : m^2

(4) Plastering :

- Measurement : m^2
- Inside plaster : 12 mm
  outside plaster : 20 mm
- It is done to provide surface for paint or finishes.
- It protects the masonary work from wear & tear.
- It does not give strength to masonary.
- Lime and cement mortar is used.

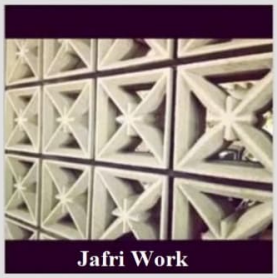
Inside Plaster

Outside Plaster

Precast Concrete

RCC Chajja

Concrete Jali



Jafri Work

Concrete Floor

(5) Brick Work :

- Measurement : m^3
- Thickness > 10 cm : m^3
  ≤ 10 cm : m^2 (Half brick work, partition work, Brick soling, honeycomb work)

Lec-7

Half Brick Work

Partition Work

Brick Soling

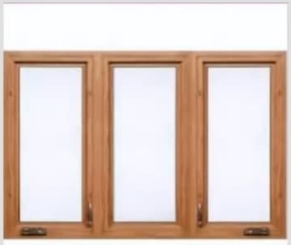
Honey-Comb Work

Lec-7 (9:40)

(6) Wood Work :

- Measurement : m^3
- Thickness > 10 cm : m^3
  ≤ 10 cm : m^2
- [Window frame, door frame, rafter beam, roof truss] → (m^3) [window shutter, timber wall, door shutter, showing of timber] → (m^2)
- Door and window fittings : Number
  (Bolt, hinges, handles)

- जब हम tree को cut करते हैं, तो raw state में tree के ऊपर से bark को remove करते हैं, उसके बाद जो sapwood, heartwood and pith का portion बचता है, उसको showing of timber बोलते हैं।
- In general, rafter is provided with masonary work because they have low load carrying capacity.
  ↳ Brick masonary की load carrying capacity कम होती है तो इसको supplement करने के लिए rafter provide कर दिया जाता है।
- Measurement of chowkhats can be done in m^3.
  ↳ window & door frame.


Window Frame


Door Frame


Rafter


Roof Truss


Beam


Window Shutter


Timber Wall


Door Shutter

(7) Stone Work :

- Measurement : m^3
- For any type of masonary

Lec-7 (25:20)

Rubble Masonary

- In this, rough or undressed stones are used.
- Here, joints are wider and are of irregular size.
- It is cheaper.

Ashlar Masonary

- In this, smooth or dressed stones are used.
- Here, joints are finer and are of regular size (3 mm)
- It is costly.

Properties	Stone Masonary	Brick Masonary
(i) Strength	High	Less
(ii) Durability	High	Less
(iii) Appearance	No External Treatment reqd.	Finishing is required
(iv) Mortar Joint	Thick	Thin
(v) Dampness	No	Yes
(vi) Cost	More	Less
(vii) Uses	Pier, dam, wall work, [stone dressing, chajja, sunshade] m^2	Residential or Public work

Rubble Masonary

Ashlar Masonary

Stone Dressing


Chajja


Sun Shade


Wall Work

(8) Flooring :

- Measurement : m^2
- Thickness of floor > 7.5 cm : m^3
  ≤ 7.5 cm : m^2
- Generally, thickness of floor is 25-50 mm.


Concrete Floor

(9) Miscellaneous Work :

- AC sheet, formwork, pointing, shuttering, white washing, colouring, painting, dado, distemper, centering → m^2
- Electric work : point/Number
- Skirting, cornice, string course, Drip course, edging, bend : m


AC Sheet

NOTE :

- Acc. to measurement rule, width should be measured very accurately than length and height.

AC sheet → Asbestos Cement Sheet

- Formwork is the support being given in order to carry out the casting of concrete (i.e., in order to provide required shape and size)
- Pointing is the re-application of mortar in masonary.

Lec-7 (52:10)

- Wall के lower portion में जो sheeting / skirting provide कर रखी हैं, उसको dado बोलते हैं। कई बार इसके ऊपर एक rail भी बनाई जाती है, उसको dado rail बोला जाता है। कई बार floor और wall के intersection पर भी skirting दी जाती है। यानी skirting और dado rail के बीच में जो vertical member provide किए, वो dado है। In order to prevent wear & tear, dado is provided.
- Cornice is aesthetic work which is done on roof.
- String course is provided to prevent the seepage of rainfall into structure.
- ~~Exterior में किए गए किसी भी construction से बाहर की तरफ अगर~~
- Original structure से outward projected construction जो कि exterior पर कर रखा है, उसको Drip course बोलते हैं। The purpose of drip course is also to divert the rainfall so as to prevent the seepage of water into structure.


Formwork

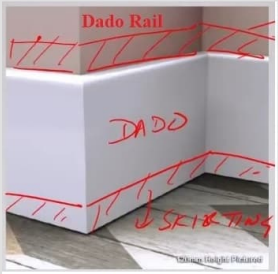

Pointing


Shuttering


White-Washing


Colouring


Painting



Dado


Distemper


Centering


Electric Appliances


Skirting


Cornice


String Course


Drip Course


Edging

Rules of Deduction :

Lec-8

(1) Plastering :

- Area of opening $< 0.5\ m^2$: (No deduction)
  (Jamb, soffit and sill)
- Area of opening $(0.5 - 3\ m^2)$: Deduction is on one side only.
- Area of opening $> 3\ m^2$: Deduction is on both sides.

- Vertical part of opening is termed as jamb.
- Topmost portion of opening is termed as soffit.
- Lower most portion of opening is termed as sill.

Ex: wall = $5\ m \times 5\ m$
opening = $0.75\ m^2$
So, Area of plastering to be reported = $(5 \times 5) \times 2 - 0.75$

↑ wall के दोनों तरफ plastering

↑ एक side पर ही deduction bcoz Area of opening is $0.5 - 3\ m^2$

Jamb, Soffit, Sill


Soffit


Sill

Lec-8 (14:20)

(2) Masonary Work :

- No deduction is made for opening of $0.1\ m^2$ or $1000\ cm^2$
- No deduction for lintel, chajjas & offset
- No deduction for end of beam, soffit, rafter & purlin upto $0.05\ m^2$ or $500\ cm^2$
- No deduction when bed plate, wall plate, bearing of chajja upto 10 cm is available.

Lintel


Chajja


Soffit


Purlin


Wall Plate

(3) White-Washing, Colouring, Distemper :

- During white-washing, colouring, distemper on AC & GI sheet, area of washing, colouring and distemper is increased.

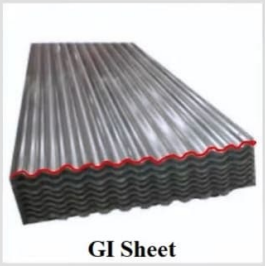
	Area increase	Area coeff (for one side)
(a) GI Sheet	14 %	1.14
(b) AC Sheet	20 %	1.2
(c) Semi-corrugated AC sheet	10 %	1.1

NOTE :

- If these works (white-washing, colouring & distempering) are carried out on both the sides, the area coefficient is doubled.

Lec-8 (28:20)

- AC sheets में area increase ज्यादा हुआ as compared to GI sheets bcoz roughness is more, area में increment ज्यादा निकल कर आएगा।
- इससे पिछले वाले cases में deduction करना पड़ रहा था, पर इसमें addition करना पड़ेगा।



GI Sheet

AC Sheet

Semi Corrugated AC Sheet

(4) Steel Work :

Bar Bending Schedule (BBS) :

- It is a comprehensive list that describes the :
  - (a) Location
  - (b) mark
  - (c) type
  - (d) size
  - (e) length
  - (f) number
  - (g) bending details

  } of each reinforcement bar.

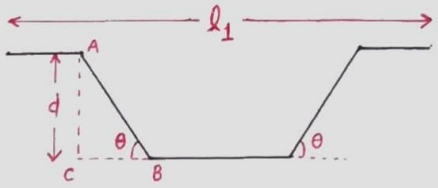
ये सारी चीजें drawing से देखकर easily बता सकते हैं, except length & bending details.

So, we should know, how to calculate length.

Lec-8 (38:55)

(i) Bent-up Bars :

— The total length of bars to be provided is termed as 'crank length'.



d → size of bent
θ → angle of bend

length of bent AB = $\frac{d}{\sin\theta}$

If bent is not provided, then length would be BC = $\frac{d}{\tan\theta}$

So, additional length due to bent = $\frac{d}{\sin\theta} - \frac{d}{\tan\theta}$

θ	Additional Length
30°	0.27 d
45°	0.42 d
60°	0.57 d
90°	0.89 d

Bent Up Bar

eg: If in previous diagram θ = 45°, find crank length.

Crank length = Actual length + Additional length

= $l_1 + 2 \times 0.42d$

= $l_1 + 0.84d$

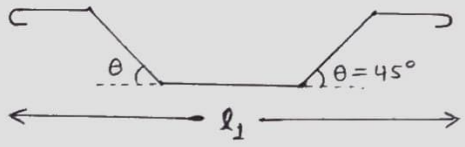
(ii) Hook Length :

RCC में हम calculate करते हैं कि bend देने से कितनी anchorage value मिलती है, पर यहाँ हम बात कर रहे हैं कि reinforcement का size कितना बढ़ जाएगा, जब हमने hook provide किया।

Angle of bend (θ)	Hook length
θ = 90°	6 ϕ
θ = 0°/180°	9 ϕ
θ = 45°/135°	12 ϕ

Lec-8 (55:30)

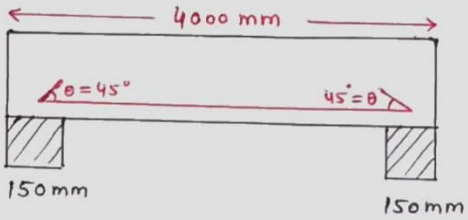
eg:



Crank Length = $l_1 + 2 \times 0.42d + 2 \times 9\phi$

↑ 2 hooks of 180°

Que:



Find crank length.

Sol: Crank length = $4000 - 2 \times \frac{150}{2} + 2 \times 12\phi$

↑ 2 hooks

$= (3850 + 24\phi)$ mm

Lec-9

(5) Brick Soling :

- Process in which base of dry bricks is prepared is termed as soling.

NOTE :

- No. of bricks in $1\,m^3$ of brick masonary (Std. brick) $= 500$ $\left[N = \frac{\text{Vol. of Masonary}}{\text{Vol. of 1 brick}}\right]$
  No. of bricks in edge soling of $1\,m^2 = 54$ $\left[N = \frac{\text{Area of Soling}}{\text{Area of 1 brick}}\right]$
  No. of bricks in flat soling of $1\,m^2 = 34$ (Conventional Brick)
- In the above calculation, wastage of mortar is not considered.
- In general, conventional bricks are used for brick soling but in question, if specifically mentioned standard bricks, then calculate accordingly
- If wastage is also to be included in question, we have to account it too. If we talk about wastage of mortar, तो masonary work में से उतना mortar subtract करना पड़ेगा। If 20% wastage takes place, then out of $1\,m^3/1\,m^2$ masonary work, subtract 20% volume/area of mortar and do the calculation accordingly.
- Mortar wastage varies upto 20% on an average, but it may extend upto 25%.

CONTRACTS & TENDERS

Lec-9 (19:25)

CONTRACTS :

- It is an agreement b/w the owner and contractor which is enforcable by court of law.
- Contract is made so that contractor execute the work as per specifications.
- Requirements of contract :
  - (i) Subject should be simple and understandable.
  - (ii) Contract should be in written.
  - (iii) It should be enforceable by court of law.
  - (iv) There must be free consent by both parties.
  - (v) Both the parties must be competent to sign the contract.

CONTRACT DOCUMENT :

(i) Title Page :
- It has name of work mentioned over it.

(ii) Index Page :
- It has page reference with content.

(iii) Tender Notice :
- It consists of brief description of work, cost of project & completion time and amount of Earnest Money.

(iv) Tender Form :
- It consists of bill of quantities, contract rate and total cost.

(v) Schedule of Rate : Discussed earlier in detail

(vi) General Specifications

(vii) Detailed Specificatios

(viii) Drawing of work

(ix) Conditions of Contract

(ix) Conditions of contract :

(a) Contractor shall deposit 10% of estimated cost as security deposits. (It includes 2% of Earnest Money.)

Earnest money is guarantee amount which shows seriousness of contractor and avoids false bid.

Lec-9 (50:00)

Purpose of security deposit is to compensate, in case contractor does not fulfill the contract.

(b) Work is open for inspection.

(c) For bad work, that work can be dismantled.

(d) The work shall be done with specifications mentioned in contract.

(e) The work shall be completed within project period.

TYPES OF CONTRACT :

- Contracts are of following types :

(i) Item Rate / Unit Rate / Schedule Contract :

- In this contract, contractor undertakes the execution of work on the item rate basis.
- The amount to be received by the contractor depends upon the quantities of various item of work actually executed.
- This type of contracts are used for public or government projects.

Advantages :

- In this contract, there is no need of detail drawing at the time of allotting the contract. (bcoz payment will be on the basis of quantity of items provided)
- The payment to the contractor is done on the basis of actual work. (means contractor कम काम करके, ज्यादा payment नहीं ले सकता)

Disadvantages :

- The total cost of work is not known at the start of work. {bcoz detail drawing is not available}
- To increase the profit, contractor may use poor quality of items. {bcoz payment is on the basis of qty. of items}
- To check how much work has been completed, we have to appoint our own staff. So, cost will increase.

Lec-9 (1:17:25)

(ii) Percentage Rate Contract :

- It is modified form of item rate contract.
- Contractor, here, is asked to quote only percentage of fee to be taken for execution of work.
- This method is used in state department work.

Advantages :

- It is profitable to contractor.

Disadvantage :

- No incentive to finish the job.
- Total cost is not known before the start of project.

(iii) Cost plus Fixed Fee Contract :

- In this system, a fixed fee is given as contractor's profit irrespective of total cost of work.
- This is to control the tendency of the contractor to increase the cost of project unnecessarily.
- Smaller the completion time, more is profit and hence the contractor hurries in this case to complete the project, thus compromising with quality.
- This is generally not used.

Lec-10

(iv) Cost plus Variable Fee or Scale of Fees Contract :

- In this type of contract, the contractor is paid by the owner the actual cost of construction plus an amount of fees inversely variable according to increase or decrease of the estimate cost.

Advantages :

- In this case, the contractor shall not try to increase the cost of project unreasonably.

Disadvantages :

- In this, quality of material can be compromised by contractor to increase profit. (cheap quality → cost of project less → profit of contractor more, as inversely related)

(v) Cost plus Fixed Percentage Contract :

- In this type of contract, the contractor is paid the actual cost by the owner with a certain percentage as fees, as agreed in contract.
- In this type of contract, proper control has to be exercised by the owner in the purchase of material and in managing the manpower.

(vi) Lum-Sum Contract :

- This is single fixed price contract.
- In this contract, contractor agrees to perform specific job for fixed sum.
- The owner provides the contractor exact specification of work.
- In this contract, both parties try to fix the conditions of work as precisely as possible.

Advantages :

- Owner is aware of cost of project before the starting of project.
- It is suitable to be used for small work / project.

Disadvantages :

- It is very difficult to accomodate any change in project during its execution.
- In case of any unforeseen hazard, the entire burden is over contractor.

(vii) Labour Contract :

- In this contract, owner (deptt) pays to the contractor for only the use of labour in project.

(viii) Negotiated Contract :

- When work is allotted to the contractor by mutual understanding b/w two parties and the cost can be negotiated, it is termed as Negotiated Contract.

(ix) Target Contract :

- In this type of contract, additional fee is also given to the contractor on completion of pre-specified target.

(X) Turn key Project :

— Owner is desired to deal with contractor which performs all the aspects of the project i.e; planning, drawing, execution, maintenance.

Lec-10 (37:20)

(XI) Package Contract :

— In this contract, two or more related jobs are given to a particular contractor in form of package.

(XII) Continuing Contract :

— In this type of contract, new or additional work is awarded to the contractor on same agreed terms & conditions.

(XIII) Running Contract :

— Such contracts provide goods and services at specified intervals or as and when required by the owner.

— In this case, price is not fixed and payment is done on the basis of number of units purchased.

(XIV) BOT Contract (Build- Operate- Transfer) :

— It is a contract in which contractor builds the project, operate it & transfer the work after the completion of the project period.

— eg: Highway work.

(XV) Departmental Work/Contract :

— If no contractor is willing to accept the project on given set of conditions, then the project is executed by department itself.

(XVI) Void Contract :

— This contract is done with a minor person (age below 18 years) or without free consent.

- Void → Not valid

TENDERS :

— It is defined as an offer in writing to execute the work as specified by the owner.

NOTE:

Lec-10 (1:02:00)

NIT (Notice Inviting Tenders) :

— It is prepared by administrative department after getting all the necessary approval.

— Sealed tenders are invited by giving advertisement in leading newspaper, on notice board/website & sending the letters to prominent contractors.

— In this, notice, description of work, estimated time, cost, earnest money is mentioned.

Types of Tender :

(i) **Local Tender :**

— In this, tender is invited for any type of work in local area or surrounding area.

(ii) **Global Tender :**

— For a big project, the specified work or design are required, which are available in global market. Hence, for these type of work, global tender is invited.

(iii) **Open Tender :**

— The client advertises this tender offer in the local newspaper & is available for all interested contractors.

(iv) **Sealed Tender :**

— It is invited for important and big projects.

(v) **Limited Tender :**

— It is only available for selected contractors.

(vi) **Single Tender :**

— Invitation is given only to one firm to render the service by quoting their rates.

Procedure of Inviting Tender :

Lec-11

- Tender is invited in following stages :
  (i) Preparation of tender documents
  (ii) Issue of notice inviting tender
  (iii) Submission and opening of tenders and their scrutiny
  (iv) Acceptance of tender & award of contract
- Tender documents consists of the following :
  (i) Tender drawings
  (ii) Specification (a) General (b) Detailed
  (iii) Bill of Quantities
  (iv) Condition of contract
  (v) Form of tender
  (vi) Form of agreement
  (vii) Form of bond
- Form of tender is given by contractor to the owner to execute the work. It consists of :
  (a) Starting date
  (b) Duration
  (c) Tender sum
- Form of agreement consists of names of all the parties (i.e; contractor & client), all the documents of contractor, signature of contractor, taxation reports of contractor, registration no. of contractor and also consists a third party which takes surity that contractor will complete the project.
- Form of bond is a bond which is signed by owner, contractor and third party. If contractor does not complete the project, then the owner recovers losses from third party.

Important Terms Used in Tendering :

Lec-11 (16:00)

(i) Earnest Money / Deposit (1-2 %) :

- It is a guarantee amount deposited by the contractor to show his seriousness for the execution of proposed work and to avoid false bid.

(ii) Security Deposit (5-10 %) :

- It is the deposit made by contractor after acceptance of his tender, purpose of which is to get work done by the contractor as per specification & stipulated time.
- This security deposit includes 2 % of earnest deposit.

- 10 % से 5 % इसकी value बहुत time पहले कर दी थी but books में 10 % ही मिलता है। presently, corona की वजह से इसको 3 % तक reduce कर दिया है। But, exam में 5-10 % ही choose करना है। 10 % is most preferable.
- Technically तो project complete होते ही ये 10 % contractor को return कर देना चाहिए पर 5 % ही return करते हैं, 5 % को hold करके रखते हैं। जब liability period खत्म हो जाता है, तब ये 5 % return करते हैं। इसको retention deposit बोलते हैं। पहले 10 % security deposit return करें और फिर 5 % retention deposit लें, ऐसा करने की बजाय 10 % security deposit में से ही 5 % retention deposit रख लिया जाता है practically. But अगर exam में पूछे तो यही बताना है कि 10 % security deposit, project complete होने पर contractor को return कर देते हैं।

(iii) Tender Time Limit (Tender Validity Period) :

- It is the time upto which quoted bid by the contractor is valid.
- Generally, it is in the range of 30-90 days.

(iv) **Extra Item :**

- Items which are not specified in tender but are used in actual during the execution of project are termed as extra items.

(v) **Arbitration :**

- It is the process of settlement of dispute b/w the contractor & owner (department).
- Person who settles the dispute is termed as Arbitrator.
- The result of Arbitration is termed as AWARD.

(vi) **Maintenance Period (Defect – Liability Period) :**

- In this period, contractor is required to maintain the entire work in case any defect is observed in it.

$$\text{Maintenance Period} = \max \text{ of } \begin{cases} \text{One monsoon} \\ \text{6 months after completion} \end{cases}$$

- Project के हिसाब से इस value को बढ़ा भी सकते हैं पर above given value is standard.
- इस period के खत्म होने के बाद retention deposit, contractor को return करते हैं

(vii) **Liquidity Damage (LD) :**

- It is the amount of compensation paid by the contractor to the owner (dept) in case of delay of work.
  - Security deposit से compensate कर लेते हैं, पर Contractor को इसका notice भेजना पड़ता है।

(viii) **Corrigendum :**

- Process of extension of tender notice is termed as corrigendum.

Conditions of Corrigendum :
(a) Sufficient tender form not received.
(b) Tender prepared is short for the contractor.
(c) Major change in specifications or drawing or material.

Lec-11 (47:10)

(ix) Procedure to Submit the Tender (Envelope System):

- Tender is submitted in 4 envelopes :
  - (a) Envelope - 1 : Earnest money
  - (b) Envelope - 2 : Contractor technical certificate, work experience form, registration form, tax details etc.
  - (c) Envelope - 3 : Tender form
  - (d) Envelope - 4 : Evelope 1, 2, 3 are kept in this.
- Opening of Tender : Envelope 4 → Envelope 1 → Envelope 2 → Envelope 3

Lec-12

(x) Work Order :

- After acceptance of tender, the work order is issued and time limit is given to the contractor to pay the security deposit.

(xi) Act of God :

- All the natural disasters come under the act of god.
- In such case, contractor is not liable for delay in project and owner is not liable for any damages.

(xii) Mobilization Advance :

- Some amount of money given to the contractor for mobilisation of resources to the site is termed as mobilisation advance.

(xiii) Rejection of Particular Tender :

- It is rejected in following conditions :
  - (a) Earnest money is not deposited.
  - (b) Tender is not signed by contractor.
  - (c) Contractor is not experienced.

(XIV) Rejection of all Tenders :

(a) When there is a fight b/w the contractors.
(b) When any fraud is detected in the submission of tenders.
(c) When group formation is suspected b/w the contractors.

Lec-12 (15:20)

(XV) Types of Bill :

(a) First & Final Bill :

— This bill is used for making payments to the contractors for their work as well as supplies in a single go for small projects.

(b) Running Account Bill (RA Bill):

— It is issued by the contractor upon completion of a part of work.

(c) Final Bill :

— Addition of all RA bills is termed as final bill.

Various Account Form to be Used :

(i) Measurement Book : Form No. 23
(ii) Cash Book : Form No. 7
(iii) Ist & Final Bill : Form No. 24
(iv) Running Account Bill : Form No. 25
(v) Final Bill : Form No. 26
(vi) Nominal Muster Roll : Form No. 21

↳ It is used for keeping a complete record of :

(a) Attendance
(b) Payment
(c) Unpaid wages
(d) Work done by daily labours on project

Organization Chart of PWD :

- The organizational structure has six tier hierarchy :
  (i) Engineer in-chief
  (ii) Chief Engineer
  (iii) Superintending Engineer
  (iv) Executive Engineer
  (v) Assistant Engineer
  (vi) Junior Engineer

Lec-12 (36:50)

VALUATION

Lec-12 (41:50)

- Valuation is the process of fixation of cost or return expected of a building/structure at prevalent rates.
- This value of structure depends upon the present utility of a structure.
- Factors considered for valuation are as follows :
  (a) Type of building
  (b) Location
  (c) Building structure and durability
  (d) The quality of materials used.
  (e) Size of building

Necessity of Valuation of a Property :

(a) Mortgage Loan (गिरवी रखने पर loan)
(b) Taxation : 14% in present time
(c) Rent Fixation
(d) Sell and Purchase
(e) For insurance premium
(f) For assessment of stamp duty (Registry करवाना)

Lec-13

Cost :

- It is the original cost of construction.
- It is used to find loss or profit of property value due to various reasons.

Value :

- Present day cost of a engineering structure (sellable value) is termed as value.
- It may be more or less than cost.

Price :

- Total cost including profit is termed as price.

Gross Income :

- It is total amount of income including all receipts from various source.
- The outgoings, the operational cost and collection charges are not deducted from this.

Net Income :

- It is the amount left after deducting all the outgoings, operational cost and collection charges.

Outgoings :

- The expenses that are required to be incurred in order to maintain the revenue of the structure is termed as outgoing.

(i) Taxes :

- These are annual taxes paid by the owner such as wealth tax, property tax and municipal tax etc.
- It varies b/w 10 – 25 % of net income.

(ii) Management :

- Upto 10 % of gross income is used for management purpose which includes security guard, sweeper etc.

(iii) Repairs :

- 1.5 % of the total construction cost is set aside for annual repair of building.
- These repairs are must to maintain the building.
- It is also calculated as 10 % of gross income.

(iv) Sinking Fund :

- A certain amount of the gross rent is set aside annually as sinking fund to accumulate the cost of construction at the end of design life.
  - 5 lac की गाड़ी खरीदी जिसकी life 10 years है और No scrap value. इसको 20,000 per month से rent पर दिया तो इसकी life के end पर हमारे पास फिर से 5 lac available रहें इसलिए इस 20,000 per month में से कुछ amount इस तरह से अलग रखेंगे कि 10 साल के end पर 5 lac available हों, इसको sinking fund बोलते हैं।

(v) Miscellaneous :

- Lighting of common area, expenditure of liftman etc.
- It is applicable for big buildings only.

(vi) Loss of Rent :

- This is also an outgoing in case a building is not fully occupied by the tenants.

(vii) Insurance :

- Premium given against fire or theft is also a form of outgoing.

Perpetual Income :

- Income received for indefinite period is termed as perpetual income.
  eg : pension, royalty

Differed Income :

- Income receiveable after the certain period is termed as differed income.
  eg: return from insurance policy

Lec-14

Scrap Value :

- It is defined as the value of an asset of property after being dismantled.
- It is generally taken to be 10% of cost of structure or asset.
- This value is computed by subtracting the cost of dismantling the structure from the cost of dismantled material.

$$\text{i.e.; Scrap Value} = \begin{pmatrix}\text{Cost of Dismantled}\\ \text{material}\end{pmatrix} - \begin{pmatrix}\text{Cost of (labour)}\\ \text{Dismantling the structure}\end{pmatrix}$$

- This value can be +ve, -ve or zero.
- It is +ve for steel structures
  -ve for concrete
  zero for RCC structures

Salvage Value :

- It is the value of building / asset / structure at the end of its utility period without being dismantled.
- It can also be +ve, -ve or zero.

Distress Value :

- When the property is sold or purchased at a lower value than its market value, is termed as distress value.
- It is observed in following situations :
  eg: war zones, riots, earthquakes, financial problem of seller

Sentimental Value :

- When the property is sold or purchased at higher rate than its market value, it is termed as sentimental value.

Lec-14 (22:05)

Market Value :

- It is defined as the value which a property can fetch when sold out in open market.
- This value is variable, depending upon the will to buy or sell.

Speculative Value :

- When the property is purchased at lower rate but it is sold at higher value, it is known as speculative value.

Potential Value :

- When property is capable of fetching higher value than its actual cost due to its alternative use, it is termed as potential value.

Monopoly Value :

- If the owner demands higher value of the property due to some advanced feature of property like location, size, shape etc, it is termed as monopoly value.

Accomodation Value :

- When agricultural land is converted into developed land then suddenly cost of land increases, it is termed as accomodation value.

Rateable Value :

- It is the net annual letting out value of a property obtained after deducting the amount of yearly repair & maintenance cost from gross income.

$$\text{Rateable value} = \text{Gross Income} - \text{Repair \& Maintenance cost}.$$

Book Value :

- It is the value of the property/assets as being entered in account books after allowing necessary depreciation upto that time.
- It is independant of market value.

$$\text{Book Value} = \text{Original Cost} - \text{Depriciation}$$

- At the end of design life, book value is equal to scrap/salvage value, as the case may be.

Lec-15

Depreciation :

- It is defined as loss in value of an asset/building due to its continuous use over the period of time.
- This decrease in value takes place due to wear and tear, impact, corrosion, change in fashion or design etc.
- A reverse fund must be created in order to realise the total depriciation at the end of design life.

Types of Depriciation :

Physical
- It is due to wear & tear.
- eg: Construction equipments like tractor, crane etc.

Functional (Obsolence)
- It is due to change in function, fashion or design.
- eg: electronics commodity

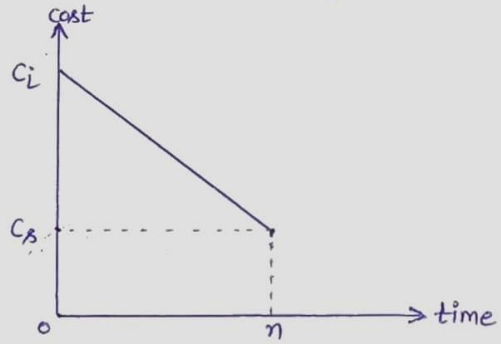
Contingent
- It is due to contingency.
- eg: accident, fire, flood, earthquake etc.

Computation of Depreciation :

- It can be computed by any of following methods :

(A) Straight Line Method :

- In this method, it is assumed that the value of an asset/building decreases by constant amount every year.



$D = C_i - C_s$ → Total Depriciation

$D_m = \frac{C_i - C_s}{n}$ → Depriciation per year

$B_m = C_i - \frac{(C_i - C_s)m}{n}$

C_i → initial cost
B_m → Book value at a particular year (time)
C_s → Scrap/salvage value
n → Design life
m → particular year (time)

- वो assets जिनमें obsolense का खतरा नहीं रहता, या जिनकी demand constant रहती है, उसमें हम ये वाला method use करते हैं, यानी civil engg. में straight line method ही use होता है।

- इस method में asset की value constant amount से decrease होती है पर rate of depreciation constant नहीं होती, rate बढ़ती जाती है। rate of depreciation = $\frac{\text{Depriciation per year}}{\text{Book value on that particular year}}$

1st year rate of depreciation, $r_1\% = \frac{\left(\frac{C_i - C_s}{n}\right)}{C_i} \times 100$

2nd year rate of depreciation, $r_2\% = \frac{\left(\frac{C_i - C_s}{n}\right)}{\left(C_i - \frac{C_i - C_s}{n}\right)} \times 100$

⋮

– This method is recommended for all the assets which have constant demand and does not face obsolescence.
[ऑब्सोलेसन्स]

Que : Original cost of building = 20 lakhs
scrap value = 2 lakhs
life = 80 years

Calculate book value after 20 years.

Sol :

$D = 20 - 2 = 18$ lakhs

$Dm = \frac{18}{80} = 0.225$ lakhs/year

Depreciation after 20 years $= \frac{1.8}{8} \times 20 = 4.5$ lakhs

$\therefore$ Book value, $B_{20} = C_i - D_{20}$
$= 20 - 4.5$
$= 15.5$ lakhs.

(B) Declining Balance Method / Constant Percentage Method :

– In this method, the property is assumed to lose its value by a fixed % of its book value (FDB).
↳ Fixed Declining Balance

$B_0 = C_i$

$D_1 = FDB \cdot B_0 = FDB \cdot C_i$

$B_1 = C_i - D_1 = C_i - FDB \cdot C_i = C_i(1 - FDB)$

$D_2 = FDB \cdot B_1 = C_i(1 - FDB) \cdot FDB$

$B_2 = B_1 - D_2$ or $C_i - D_1 - D_2$

$= C_i(1 - FDB) - C_i(1 - FDB)FDB$

$= C_i(1 - FDB)^2$

Book value at the end of 'n' years, $\boxed{B_n = C_i(1 - FDB)^n = C_s}$

$$\therefore \boxed{FDB = 1-\left(\frac{C_s}{C_i}\right)^{1/n}}$$

So, depreciation after 'x' years $= C_i(1-FDB)^x \cdot FDB$

Lec-15 (48:15)

Ex: $C_i = 20L$, $C_s = 20k$, $n = 16$ years, $D_5 = ?$

$$FDB = 1-\left(\frac{2\times10^4}{2\times10^6}\right)^{1/16} = 0.25$$

$$D_5 = 2\times10^6\,(1-0.25)^5 \times 0.25 = 118652\ ₹$$

Lec-16

(C) Sum of the Year's Digit Method :

- This method also falls in the category of accelerated type of depreciation method like declining balance method.
- In this method, the digits corresponding to the no. of each year of list are listed in reverse order.
- The sum of these digits is then determined.
- A depreciation factor (DF) for any year is calculated as follows:

$$DF = \frac{n-m+1}{\frac{n(n+1)}{2}}$$

- The depreciation of any year by this method is given by:

$$D_m = (C_i - C_s)\,DF$$

Que: $C_i = 250000$ ₹

$n = 5$ years

$C_s = 25000$ ₹

Find depreciation each year by sum of year digit method.

Lec-16 (18:45)

Sol: $D = C_i - C_s = 250000 - 25000$

$= 225000$ ₹

List the years in reverse order:

Year	Remaining Life of Asset (order Number)	DF
1	5	5/15
2	4	4/15
3	3	3/15
4	2	2/15
5	1	1/15

→ written in reverse order

Sum of year's digits = $1+2+3+4+5 = 15$

$$\text{Depreciating Factor (DF)} = \frac{\text{Order Number}}{\text{Sum of year's digits}}$$

OR, we can use expression given previously:

eg: for 4th year, $DF_4 = \frac{5-4+1}{\frac{5(5+1)}{2}} = \frac{2}{15}$

Year	ON	DF	$D_m = DF(C_i - C_s)$
1	5	5/15	$\frac{5}{15} \times 225000 = 75000$
2	4	4/15	$\frac{4}{15} \times 225000 = 60000$
3	3	3/15	$\frac{3}{15} \times 225000 = 45000$
4	2	2/15	$\frac{2}{15} \times 225000 = 30000$
5	1	1/15	$\frac{1}{15} \times 225000 = 15000$

{ Each year depreciating amount is decreasing }

Book Value

$250000 - 75000 = 175000$

$175000 - 60000 = 115000$

$115000 - 45000 = 70000$

$70000 - 30000 = 40000$

$40000 - 15000 = 25000$

(D) Sinking Fund Method :

Lec-16 (31:45)

— In this method, depreciation of property is assumed to be equal to sinking fund plus ~~rate~~ interest over it.

eg:

Year	Dm	Total Depretiation
1	A	A
2	A+a	2A+a
3	A+a+b	3A+2a+b
4	A+a+b+c	4A+3a+2b+c
5	⋮	⋮

5 साल design life लेकर चल रहे हैं। पहले साल की depreciation, sinking fund के बराबर लेकर चलेंगे। Sinking fund वो fund होता है, जो अगर हम एक fixed interval पर separate out कर दें तो ये design life के end पर asset की value के बराबर हो जाता है, ये fixed interval कुछ भी ले सकते हैं तो 1st year depreciation = A → sinking fund। दूसरे साल depreciation, sinking fund के बराबर तो होगी ही होगी और इस पर साथ में interest भी charge कर देंगे। तो 2nd year depreciation = A+a, a is interest on A. 3rd year में depretiation, sinking fund के equal तो होगा ही पर साथ में इस sinking fund (A) पर interest और last year के interest (a) पर भी interest charge कर देंगे। suppose total interest = b तो 3rd year में depreciation A+a+b होगा। And, so on.

— **Sinking Fund :** It is the reqd amount to be invested ~~in~~ ~~crde~~ or separated at fixed interval of time (one month, one year or so →) such that at the end of design life of structure/asset, it is equal to the cost of asset/ structure.

$$\text{Annual Sinking Fund} = \text{Sinking Fund} \times \text{Sinking Fund Factor}$$

$$= S \times \left[\frac{i}{(1+i)^n - 1}\right]$$

, i = rate of interest per year

$S = C_i - C_s$

- Depreciation for any year (m) using sinking fund method is given : D_m = Annual Sinking Fund $\times (1+i)^{m-1}$

Lec-16 (44:00)

(E) Quantity Survey Method :

- In this method, highly qualified experienced surveyor is required to compute the detail studies of property cost and depreciation cost.

eg:

Life of structure	Annual Depreciation	Total Depreciation	Cum^v Depreciation
0 - 5	0 %	0 × 5 = 0 %	0 %
5 - 10	$\frac{1}{2}$ % per year	$\frac{1}{2} \times 5 = 2.5$ %	2.5 %
10 - 20	3/4 % per year	$\frac{3}{4} \times 10 = 7.5$ %	10 %
20 - 40	1 % per year	1 × 20 = 20 %	30 %
40 - 80	1.5 % per year	1.5 × 40 = 60 %	90 %

तो 80 years के बाद asset की value 10 % बची (90% depreciation हो गया)

Que : The initial cost of an equipment is ₹ 1100×10^3, salvage value is ₹ 100×10^3. Life of an structure is 5 years. The rate of interest for sinking fund is 8 %. Calculate the yearly depreciation and book value at the end of each year by all possible methods.

Lec-17

Sol : (i) Straight Line Method :

$$D_m = D_1 = D_2 = D_3 = D_4 = D_5 = \frac{C_i - C_s}{n}$$

$$= \frac{(1100 - 100) \times 10^3}{5}$$

$$= 200 \times 10^3 \text{ ₹}$$

(ii) Declining Balance Method :

$$FDB = 1 - \left(\frac{C_s}{C_i}\right)^{1/n} = 1 - \left(\frac{100 \times 10^3}{1100 \times 10^3}\right)^{1/5} = 0.381$$

$$D_1 = C_i \times FDB = 1100 \times 10^3 \times 0.381 = 419100 \text{ ₹}$$

$$B_1 = C_i - D_1 = 1100 \times 10^3 - 419100 = 680900 \text{ ₹}$$

Lec-17 (20:00)

$D_2 = B_1 \times FDB = 680900 \times 0.381 = 259423$ ₹

$B_2 = B_1 - D_2 = 680900 - 259423 = 421477$ ₹

$D_3 = B_2 \times FDB = 421477 \times 0.381 = 160581$ ₹

$B_3 = B_2 - D_3 = 421477 - 160581 = 260896$ ₹

$D_4 = B_3 \times FDB = 260896 \times 0.381 = 99402$ ₹

$B_4 = B_3 - D_4 = 260896 - 99402 = 161494$ ₹

★ $D_5 = B_4 \times FDB = 161494 \times 0.381 = 61529$ ₹

$B_5 = B_4 - D_5 = 161494 - 61529 = 99965$ ₹ $\neq 100 \times 10^3$ (C_8)

But book value at the end of 5th year = salvage value

i.e., $B_5 = C_8 = 100 \times 10^3$

तो ये इस method का drawback है। Last year की book value, star (★) marked & Depreciation तरीके से नहीं निकालनी है।

$B_5 = C_8 = 100 \times 10^3$ ₹

$\therefore D_5 = B_4 - B_5 = 161494 - 100 \times 10^3 = 61494$

(iii) Sum of year digit method :

$$D_m = (C_i - C_8)\left[\frac{n-m+1}{\frac{n(n+1)}{2}}\right] \Rightarrow D_1 = (1100-100)10^3\left[\frac{5-1+1}{\frac{5(5+1)}{2}}\right] = 333334 \text{ ₹}$$

$B_1 = 1100 \times 10^3 - 333334 = 766666$ ₹

$$D_2 = (1100-100)10^3\left[\frac{5-2+1}{\frac{5(5+1)}{2}}\right] = 266667 \text{ ₹}$$

$B_2 = B_1 - D_2 = 766666 - 266667 = 499999$ ₹

$$D_3 = (1100-100)10^3\left[\frac{5-3+1}{\frac{5(5+1)}{2}}\right] = 200000 \text{ ₹}$$

$B_3 = B_2 - D_3 = 499999 - 200000 = 299999$ ₹

$D_4 = (1100-100)10^3 \left[\frac{5-4+1}{\frac{5(5+1)}{2}}\right] = 133333$ ₹

$B_4 = B_3 - D_4 = 299999 - 133333 = 166666$ ₹

$D_5 = (1100-100)10^3 \left[\frac{5-5+1}{\frac{5(5+1)}{2}}\right] = 66666$ ₹

$B_5 = B_4 - D_5 = 166666 - 66666 = 100000$ ₹

Lec-17 (40:00)

(iv) Sinking Fund Method :

Annual sinking fund = sinking fund x Sinking Fund Factor

$= (C_i - C_s)\left[\frac{i}{(1+i)^n - 1}\right]$

$= (1100-100)\times 10^3 \left[\frac{0.08}{(1+0.08)^5 - 1}\right]$

$= 170456$ ₹

$D_m = D(1+i)^{m-1}$

$D_1 = 170456\,(1+0.08)^{1-1} = 170456$ ₹

$B_1 = 1100\times 10^3 - 170456 = 929544$ ₹

$D_2 = 170456\,(1+0.08)^{2-1} = 184093$ ₹

$B_2 = B_1 - D_2 = 929544 - 184093 = 745451$ ₹

$D_3 = 170456\,(1+0.08)^{3-1} = 198820$ ₹

$B_3 = B_2 - D_3 = 745451 - 198820 = 546631$ ₹

$D_4 = 170456\,(1+0.08)^{4-1} = 214726$ ₹

$B_4 = B_3 - D_4 = 546631 - 214726 = 331905$ ₹

$D_5 = 170456\,(1+0.08)^{5-1} = 231904$ ₹

$B_5 = B_4 - D_5 = 331905 - 231904 = 100\times 10^3$ ₹

Lec-18

Free Hold Property :

- Any property which is in complete possesoin of owner, it is known as free hold property.
- The owner can use this property in a way he likes.

Lease Hold Property :

- Any property which is given to some person on yearly payment basis by the free holder, then the property is termed as lease hold property.
- Lease in India is for 99 to 9 years in case of buildings.

Mortgage Loan :

- Loan which is being raised by the owner against its property is termed as mortgage loan.

Sinking Fund :

- It is the amount which if it is kept aside annually, at the end of design life of building / structure / asset would be equal to an amount by which construction, replacement and repair of building can be carried.
- Annual Sinking Fund = Sinking Fund × Sinking Fund factor

$$= (C_i - C_s) \times SFF$$

$$= S \times \frac{i}{(1+i)^n - 1}$$

Ex: Cost of building = 3 lakhs

i = 5 %

Scrap value = 10 % of cost

Design Life = 20 years

Find annual sinking fund.

Sol: Annual sinking fund $= (3\times10^5 - 3\times10^4) \times \frac{0.05}{(1+0.05)^{20}-1} = 8165.5$ ₹

Lec-18 (36:00)

Que: Cost of equipment = 8 lakhs

Scrap value = 75×10^3 ₹

Rate of Interest = 8 %.

Design Life = 8 years

Compute the annual sinking fund.

Sol: Annual Sinking Fund = S × SFF

$$= (8 \times 10^5 - 75 \times 10^3) \times \frac{0.08}{(1+0.08)^8 - 1}$$

$$= 68160 \text{ ₹}$$

यानी 68160 ₹ को 8 साल तक 8 % rate पर compound interest लगेगा तो 8 साल के end में $8 \times 10^5 - 75 \times 10^3 = 7,25,000$ ₹ collect हो जाएँगे।

Capital Cost :

— Cost of land along with cost of building is termed as capital cost.

Year Purchase :

— Capital sum required to be invested in order to receive the net income of 1 ₹ at the certain rate of interest.

$$(YR) \cdot i \cdot 1 = 1 \text{ Rs.}$$

$$\boxed{YR = \frac{1}{i}}$$

YR → Year Purchase

Capitalized Value :

— It is defined as the amount of money whose annual interest at the highest prevailing rate of interest is equal to net income from that property.

पूरे साल rate of interest change होती रहती है, तो इनमें से max. rate of interest लेनी है।

$CP \times i \times 1 = \text{net income}$

$$CP = \frac{\text{net income}}{i} = \text{net income} \times \text{year purchase}$$

Lec-18 (57:00)

Que: Annual rent = 1 lakhs

Interest rate = 5 %

What is capitalised value.

Sol: $CP \times 5\% \times 1 = 10^5$

$$CP = \frac{10^5}{0.05} = 20 \times 10^5 \text{ lakhs.}$$

Lec-19

Annuity :

- Annual installment of sinking fund.

Repair :

- Amount used for repair of structure is taken as follows :
- Repair amount = 1 - 1.5 % of monthly rent
  = 10 - 15 % of gross income
  = 1 - 1.5 % of total cost of project.

Management & Collection Charge :

- Some staff is required for maintenance of building, eg: sweeper, liftman, guards etc.
- The costing of this staff is considered in this category.
- It is taken to be 5 - 10 % of gross income.

Methods of Valuation :

- Valuation can be done by any of following methods :
  (i) Depreciation method of valuation
  (ii) Valuation based on cost
  (iii) Valuation based on profit

(iv) Valuation by development method

(v) Valuation by rental.

Lec-19 (12:35)

(i) Depreciation Method of Valuation :

- In this method, entire structure is divided into four parts:
  (a) wall
  (b) roof
  (c) floor
  (d) doors and windows
- Then, depreciation in these four components is calculated and on the basis of depreciation, we carry out the valuation of building / structure.

(ii) Valuation based on Cost :

- In this method, valuation is done based on the cost of construction of structure and the depreciation that will occur over the years.

(iii) Valuation based on Profit :

- This method is generally adopted for big commercial projects.
  eg: Valuation of cinema hall, theatres, banks, big supermarkets etc.
- This valuation is done on the basis of the profit earned.
- More is the profit earn, more will be valuation.

(iv) Valuation by Development Method :

- This method is adopted for the structures in which development is going on wrt time. eg: Construction of metro
- As development progresses, valuation increases.

(v) Valuation by Rental :

- This method is generally adopted for commercial office or setups.
- Valuation is done based on rental.
- more is the rental, more is valuation

ANALYSIS OF RATES

Lec-19 (18:40)

- The process of determining the rates of any work in engg. project like earthwork, brickwork, plastering, painting etc is termed as analysis of rates.
- The rates of these work further help in determining the cost of particular work and in turn cost ~~and~~ of project.
- Analysis of rate is being done for :
  (i) To determine the actual cost of an item
  (ii) To determine the project cost
  (iii) To find the feasibility of project
  (iv) To modify existing schedule of rates
  (v) To check the rate offered by the contractor.
- Analysis of rates depends upon following :
  (i) Specifications of work and material
  (ii) Quantity of material & their cost
  (iii) Cost of labour & their wages
  (iv) Location of site
  (v) Profit charged
  (vi) Overhead and establishment
  (vii) Taxes

Task Work (Out Turn) :

- It is the capacity of skilled labour to work for 8 working hours or it may be termed as output of labour per 8 working hours.

$$\text{No. of Labours} = \frac{\text{Total Work}}{\text{Task Work}}$$

S. No.	Item Description	Work done per day per mason
A	Brick Item	
(i)	Brick work in foundation and plinth with mud mortar	1.50 m^3
(ii)	Brick work in super structure with mud mortar	1.25 m^3
(iii)	Brick work in foundation and plinth (sub-structure) with lime or cement mortar	1.25 m^3
(iv)	Brick work in super structure with lime mortar and cement mortar	1 m^3
(v)	Brick work in arch	0.55 m^3
(vi)	R.B. work (Reinforced Brick work)	1 m^3
(vii)	Brick work in partition wall (Half brick wall. 4" wall)	5 m^2
B	Stone Masonary Work	
(i)	Random Rubble Stone Masonary	1 m^3
(ii)	Course rubble stone masonary	0.80 m^3
(iii)	Ashlar stone masonary	0.40 m^3
(iv)	Stone masonary in arch	0.40 m^3
C	Cement Concrete Work (CC Work)	
(i)	Lime concrete or cement concrete (PCC) in foundation and plinth	8.5 m^3
(ii)	Lime concrete in roof terracing	6 m^3
(iii)	1:2:4 CC work	5 m^3
(iv)	RCC work	3 m^3
(v)	$2\frac{1}{2}$ cm thick CC floor	7.5 m^3

D	Earth Work Items	
(i)	Earth work in excavation in rock	1 m^3
(ii)	Earth work in excavation in hard soil	2 m^3
(iii)	Earth work in excavation in ordinary soil	3 m^3
(iv)	Earth filling in plinth or foundation	4
E	Miscellaneous Item	
(i)	12 mm thick plaster work	8 m^2
(ii)	Pointing work	10 m^2
(iii)	White washing or colour washing in single coat	200 m^2
(iv)	White washing or colour washing in double coat	100 m^2
(v)	White washing or colour washing in three coat	70 m^2
(vi)	Painting or distemper for larger surface area	35 m^2
(vii)	Painting or distemper varnish in door, window frame	25 m^2
(viii)	Brick on edge in floor	7 m^2
(ix)	Brick flat floor	8 m^2
(x)	Timber frame work sal or teak wood	0.07 m^3
(xi)	Wood framing in simple wood	0.15 m^3
(xii)	Sawing of hard wood	4 m^3
(xiii)	Sawing of soft wood	6 m^3
(xiv)	Breaking of 40 mm gauge brick ballast	0.75 m^3
(xv)	Breaking of 25 mm gauge brick ballast	0.55 m^3
(xvi)	Breaking of 40 mm gauge stone ballast	0.40 m^3
(xvii)	Breaking of 25 mm gauge stone ballast	0.25 m^3
(xviii)	Ashlar stone dressing	0.70 m^3
(xix)	Mixing of mortar	3 m^3 (100 cft)
(xx)	Delivery of brick distance upto 15 m	4200 bricks
(xxi)	Delivery of brick distance upto 10 m	4200 bricks
(xxii)	Delivery of Mortar	5.5 m^3

Lec-19 (46:25)

Lead :

- Horizontal distance by which transportation is done b/w two points is termed as lead.
- The costing is done on the basis of lead for metal road & if the surface is changed, suitable modification factor is to be applied.

Type of surface	Modification Factor
Metalled	1
Cart	1·1
Sandy	1·4

NOTE :

- Costing is done on the basis of lead but transportation can also be in the vertical plane (i.e; lift). So, lift is converted into eqᵛ lead.
- To convert the lift into horⁿ lead, following modifications are applied:

Lift	Lead	eg: Lift	Lead
≤ 3.6 m	Lift × 10	2 m	2×10 = 20m
3·6 – 6 m	$(\text{Lift})^2 \times 8.3$	5 m	$(5)^2 \times 8.3 = 207.5$ m
>6 m	Lift × 20	15 m	15×20 = 300m

outturn of worker depend on lift and lead, hence the calculation is done only for 30m of the lead and 1·5m of the lift. Standard value of lift and lead which is considered to find is 1·5m and 30m, respectively. Hence, the value of lift and lead is more than this value, we have to apply modification factors.

Quantities of Various Items of Work :

Lec-20

(i) RCC or PCC :

1 m^3 of dry concrete = $\underbrace{(1.52-1.54)\,m^3}_{\text{depends upon w/c ratio}}$ of wet concrete

1.54 @ w/c = 0.38 and 1:2:4 → in BMC

BM + FA + CA + water = concrete (1 m^3)

(BM + FA + CA) = $(1.52-1.54)\,m^3$

Que : Compute the quantity of ingredients reqd to prepare 10 m^3 of design mix of 1 : 2 : 4.

Sol : Vol. of dry concrete = $1.52 \times 10 = 15.2\ m^3$

$\therefore$ Vol. of cement = $\frac{1}{1+2+4} \times 15.2 = 2.17\ m^3$

No. of cement bags = $\frac{2.17}{0.0347} = 63$ bags

→ Vol. of 1 cement bag = 34.7 L

weight of cement = $63 \times 50 = 3150$ kg

↳ weight of 1 cement bag = 50 kg.

Vol. of Sand = $\frac{2}{1+2+4} \times 15.2 = 4.34\ m^3$

Vol. of gravel = $\frac{4}{1+2+4} \times 15.2 = 8.68\ m^3$

(ii) Brick Work :

- No. of bricks in 1 m^3 of masonary = 500 (Assuming no wastage of mortar)
- Vol. of bricks in 1 m^3 of masonary = $0.7695\ m^3 = (500 \times .19 \times .09 \times .09)$
- Vol. of mortar in 1 m^3 of masonary = $0.2305\ m^3 = (1 - 0.7695)$

NOTE :

- If 20 % wastage is considered, then Vol. of mortar in $1\ m^3$ of masonary $= 0.28\ m^3$

$1\ m^3$ of dry mortar $= 1.25\ m^3$ of wet mortar (Assuming w/c = 0.38) → 25 % more than wet mortar

→ For brick work, this value is increased by 5 % bcoz undulations and frog is present in bricks, so amount of mortar will be more. → This point is only for brick work.

i.e., $1\ m^3$ of dry mortar in brick masonary $= 1.30\ m^3$ of wet mortar → 30 % more than wet mortar

- $1\ m^3$ of brick masonary, dry mortar $= (0.28 - 0.35)\ m^3$ → $1.3 \times (0.23 \text{ to } 0.28)$

Que : For 50,0000 bricks in 1 : 3 cement mortar, compute the amount of sand required.

Sol : Vol. of brick masonary using 5×10^5 bricks $= \frac{5 \times 10^5}{500} = 1000\ m^3$

$1\ m^3$ of brick masonary $= 0.23\ m^3$ of wet mortar

$1\ m^3$ of brick masonary $= 0.23 \times 1.3$

$= 0.3\ m^3$ of dry mortar

$1000\ m^3$ of brick masonary $= 0.3 \times 1000$

$= 300\ m^3$ of dry mortar

$\therefore$ Vol. of sand $= 300 \times \frac{3}{1+3} = 225\ m^3$

(iii) Plaster Work : (Std. thickness = 12 mm)

- Qty. of dry mortar = 25 % more Qty of wet mortar
- For plastering work, Qty of dry mortar = (25 % + 25 to 30 %) more Qty of wet mortar

↓ bcoz of unevenness & voids in brick

Lec-20 (47:35)

- Hence, for plaster work :

Qty of dry mortar = (55-60) % more than Qty. of wet mortar

- For $1\ m^2$ of plaster work : ($t = 12mm$)

Vol. of plaster/mortar used = $1\ m^2 \times 12\ mm$

$= 0.012\ m^3$ → wet mortar

Vol. of dry mortar in plaster = $1.6 \times 0.012 = 0.0192\ m^3$

$\simeq 0.02\ m^3$ in $1\ m^2$ of plaster

$(1.55 \times 0.012 = 0.0186 \simeq 0.02\ m^3)$

Que: Calculate the qty of cement reqd in m^3 for plastering a wall of 5x4 m with 12 mm thick plaster of mix 1:6.

Sol: Area to be plastered = $(5 \times 4) \times 2 = 40\ m^2$ (↑ both sides of wall)

Vol. of dry mortar = $0.02 \times 40 = 0.8\ m^3$

Vol. of cement = $\frac{1}{1+6} \times 0.8 = \frac{1}{7} \times 0.8 = 0.114\ m^3$

Lec-21

(iv) Pointing :

- Dry volume of mortar for pointing = $0.6\ m^3$ per $100\ m^2$ of pointing work

(v) Damp Proof Course : (2.5 cm thick)

- Dry vol. of concrete = (1.52-1.54) Vol. of wet concrete
- If DPC is done with the mortar :

Dry vol. of mortar = (1.25) Vol. of wet mortar

Lec-21 (9:55)

Que: Find the quantity of ingredients for pointing work of $1000\ m^2$ using 1:3 cement mortar.

Sol: For $1000\ m^3$ pointing work,

$$\text{dry vol. of mortar} = \frac{0.6}{100} \times 1000 = 6\ m^3$$

$$\text{Vol. of cement} = \frac{1}{4} \times 6 = 1.5\ m^3$$

$$\text{Vol. of sand} = \frac{3}{4} \times 6 = 4.5\ m^3$$

$$\text{No. of cement bags} = \frac{1.5}{0.0347} = 44$$

Que: Find the ingredients for DPC using 1:2:4 mix of 25 mm for $100\ m^2$ plinth area.

Sol:

$$\text{Vol. of concrete} = 100 \times 25 \times 10^{-3} = 2.5\ m^3$$

$$\text{Dry vol. of concrete} = 2.5 \times 1.52 = 3.8\ m^3$$

$$\text{Vol. of cement} = \frac{1}{7} \times 3.8 = 0.54\ m^3$$

$$\text{No. of cement bags} = \frac{0.54}{0.0347} = 16$$

$$\text{Vol. of sand} = \frac{2}{7} \times 3.8 = 1.1\ m^3$$

$$\text{Vol. of gravel} = \frac{4}{7} \times 3.8 = 2.2\ m^3$$

(vi) Stone Masonary Work :

- Stones reqd. for $1\ m^3$ stone masonary $= 1.25\ m^3$ (25% ↑)
- For $1\ m^3$ ↑ rubble masonary stone work, vol. of mortar reqd. $= 0.42\ m^3$
- For $1\ m^3$ of Ashlar masonary stone work, vol. of mortar reqd. $= 0.25\ m^3$
  (Rubble में mortar ज्यादा लगेगी bcoz of rough surface)

Methods of Taking Out Quantities :

Lec-21 (27:30)

— The quantities like earth work, foundation concrete, brickwork in plinth and super-structure etc. can be worked out by following methods :

(i) Long wall - short wall method

(ii) Centre Line method

(iii) Partly centre line & short wall method.

(i) **Long Wall - Short Wall Method, or**
Separate Wall Method, or
Individual Wall Method, or
Out to out & In to In Method, or
PWD Method

→ Since this method is standard, simple and accurate, it is used in PWD.

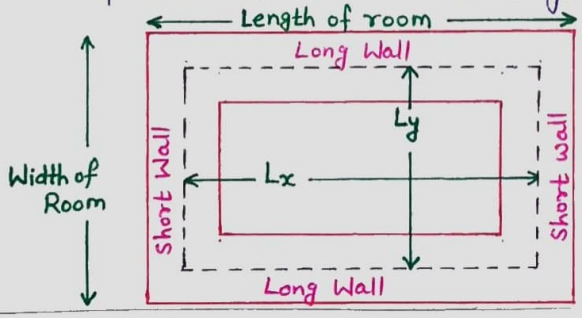
— In this method, wall along the length of room is considered to be the long wall and the wall perpendicular to this is considered short wall.

— To get the length of long and short wall, the centre line length of individual wall is computed.

— Then the length of long wall may be calculated by adding half of width at each of the centre line length. $\left(Lx + \frac{W}{2} + \frac{W}{2} = Lx + W\right)$

— Length of short wall is then computed by subtracting the half width on either side from centre line length of short wall. $\left(Ly - \frac{W}{2} - \frac{W}{2} = Ly - W\right)$

— The length of long wall usually decreases from earth work to brick work in superstructure while the length of short wall increases.



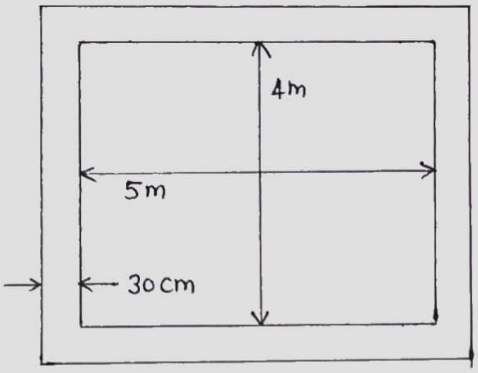
Length of Long wall = $Lx + \frac{W}{2} + \frac{W}{2} = Lx + W$

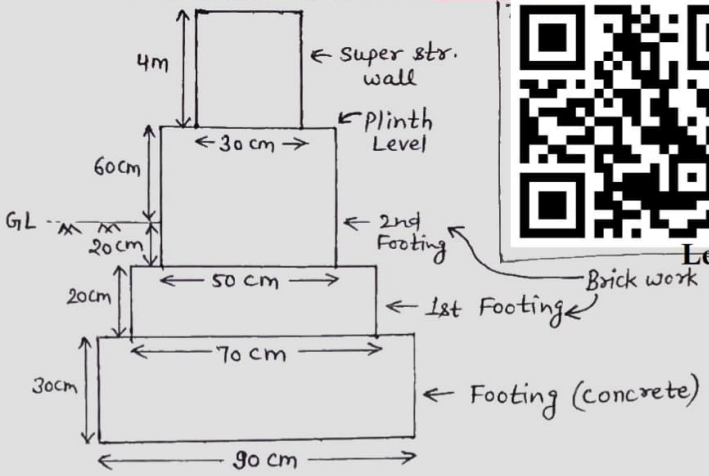
Length of Short wall = $Ly - \frac{W}{2} - \frac{W}{2} = Ly - W$

Total Length of wall = Length of (long wall + short wall)

Qty of wall = L x B x H

Que :





Lec-22

Sol :

Particular Item	No.	L(m)	B(m)	H(m)	Quantity(m^3)	Total qty (m^3)
(i) Earthwork in Excavation						
L_{LW} = 5.3 + 0.45 + 0.45 = 6.2 m	2	6.2	0.9	0.7	7.812	12.096
L_{SW} = 4.3 − 0.45 − 0.45 = 3.4 m	2	3.4	0.9	0.7	4.284	
(ii) Concrete work for footing						
L_{LW} = 6.2 m	2	6.2	0.9	0.3	3.348	5.184
L_{SW} = 3.4 m	2	3.4	0.9	0.3	1.836	
BRICK WORK						
(i) Sub-structure						
(a) Ist Footing						
L_{LW} = 5.3 + 0.35 + 0.35 = 6m	2	6	0.7	0.2	1.68	2.688
L_{SW} = 4.3 − 0.35 − 0.35 = 3.6m	2	3.6	0.7	0.2	1.008	
(b) 2nd Footing						
L_{LW} = 5.3 + 0.25 + 0.25 = 5.8m	2	5.8	0.5	0.8	4.64	7.68
L_{SW} = 4.3 − 0.25 − 0.25 = 3.8m	2	3.8	0.5	0.8	3.04	
(ii) Super-structure						
L_{LW} = 5.3 + 0.15 + 0.15 = 5.6 m	2	5.6	0.3	4	13.44	23.04
L_{SW} = 4.3 − 0.15 − 0.15 = 4 m	2	4	0.3	4	9.6	

L_{LW} : Length of Long Wall

L_{SW} : Length of Short Wall

	Footing	Ist Footing	2nd Footing	Super-structure
L_{LW} :	6.2	6	5.8	5.6
L_{SW} :	3.4	3.6	3.8	4

So, As we go up from sub-structure to super-structure :
Length of long wall decreases, and
Length of short wall increases.

Lec-22 (48:10)

(ii) Center Line Method :

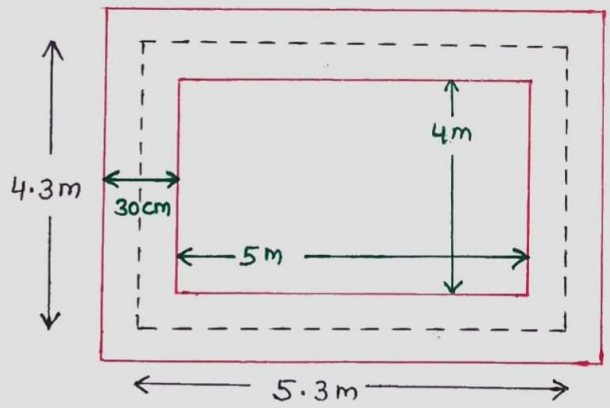
- This method is suitable for walls of similar c/s.
- Here, the total centre line length is multiplied by width & depth of the item respectively to get the total quantity of item.
- This method is most accurate and quick.
- It is also suitable for finding the quantity of wall which is curved in plan.
- Since the wall are found to overlap at the junctions, from centre to centre suitable deductions are to be made as follows :

Lec-23

Case-I : L-Junction (Corner) :

- In case of L-junction, no deduction will be applied over the centre line length.

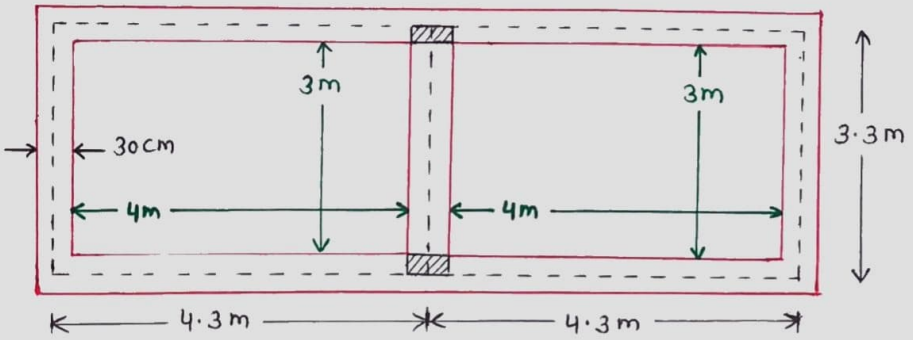
eg :



Total Center Line Length =
$2 \times (5.3 + 4.3)$
$= 19.2\,m$

Case-II : T- Junction :

- In case of T- junction, half width of wall is to be deducted from centre line length.



जब length को width और depth से multiply करेंगे, तब shaded portion 2 बार count हो जाएगा, इसलिए deduction apply करते हैं।

$$\text{Total Centre Line Length} = 8.6 \times 2 + 3.3 \times 3 = 27.1 \text{ m}$$

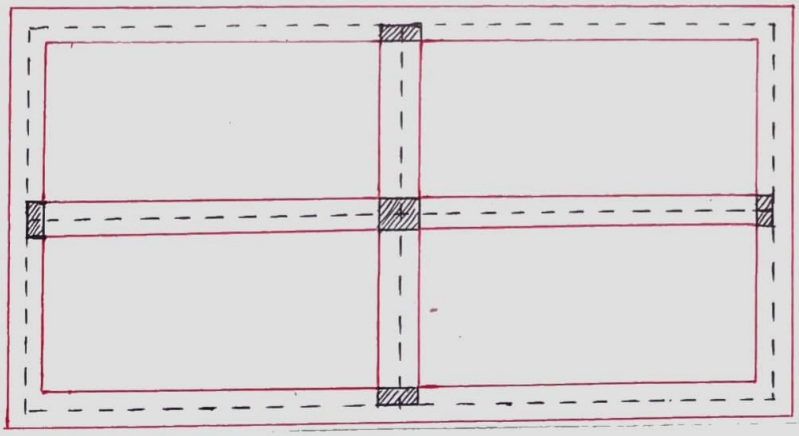
$$\text{Net Centre Line Length} = 27.1 - 2 \times \frac{0.3}{2} = 26.8 \text{ m}$$

2 T-junctions

Half width Deducted

Case-III : Cross Junction (+) :

- In case of cross junction, full width of the wall is to be subtracted from centre line length.



4 L-Junctions

4 T-Junctions

1 Cross Junction

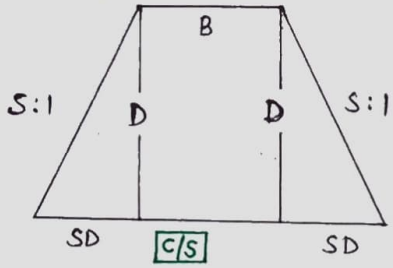
NOTE :

Lec-23 (33:00)

— Other methods for measurement of earthwork :

(i) Mid Section Method :

— In this method, the qty. of earthwork is computed with the help of size of mid-section.

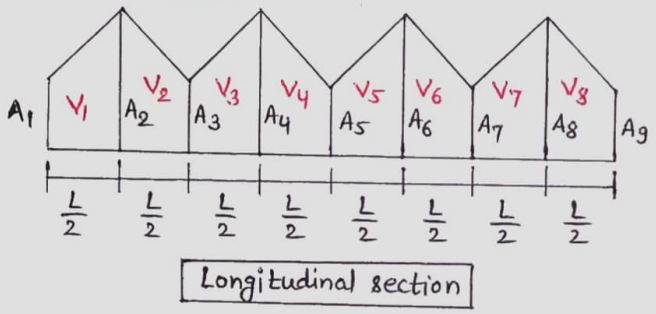


$$A = \frac{1}{2}(B + B + 2SD)D = BD + SD^2$$

$$\text{Volume} = A \cdot L$$
$$= (BD + SD^2)L$$

— Generally used for earthwork calculation of pavement and canal.

(ii) Trapezoidal Method :



Longitudinal section

$A_1, A_2, \ldots$ सारे Area अन्दर की तरफ हैं।

$$V_1 = \frac{1}{2}(A_1 + A_2)\frac{L}{2}$$

$$V_2 = \frac{1}{2}(A_2 + A_3)\frac{L}{2}$$

$$V_3 = \frac{1}{2}(A_3 + A_4)\frac{L}{2}$$

$$\vdots$$

$$V_n = \frac{1}{2}(A_{n-1} + A_n)\frac{L}{2}$$

$$V = V_1 + V_2 + \cdots + V_n$$

$$= \frac{1}{2} \times \frac{L}{2}(A_1 + A_2 + A_2 + A_3 + \cdots + A_{n-1} + A_{n-1} + A_n)$$

$$= \frac{1}{2} \times \frac{L}{2}\left[(A_1 + A_n) + 2(A_2 + A_3 + \cdots + A_{n-1})\right]$$

$$V = \frac{1}{2} \times \frac{L}{2} \left[(A_1 + A_n) + 2(A_2 + A_3 + \cdots + A_{n-1}) \right]$$

$$V = \frac{\text{Common distance}}{2} \left[\text{Area of Ist section} + \text{Area of last section} + 2(\text{Area of other sections}) \right]$$

— There is no limitation of this method and it can be applied for any number of ordinates.

(iii) **Prismoidal Method** : (Simpson's One-Third Rule)

— More accurate than previous two methods.

— $\text{Volume } (V) = \frac{\text{Common distance b/w areas}}{3} \left[\text{Area of 1st section} + \text{Area of last section} + 4(\text{Area of even section}) + 2(\text{Area of odd section}) \right]$

$$= \frac{L/2}{3} \left[A_1 + A_n + 4(A_2 + A_4 + \cdots) + 2(A_3 + A_5 + \cdots) \right]$$

— This can be applied only if number of sections are odd.

(iv) **Simpson's $\frac{3}{8}$th Rule** :

— $V = \frac{3}{8} \times \text{Common distance} \times \left[A_1 + A_n + 2(\text{Area multiple of 3}) + 3(\text{remaining area}) \right]$

$$V = \frac{3}{8} \times \text{Common distance} \times \left[A_1 + A_n + 2(A_3 + A_6 + \cdots) + 3(A_2 + A_4 + A_5 + \cdots) \right]$$