Estimating and costing

Estimate :- Before execution of any project, it is necessary to know the items of work, its specification, quantities and the unit rates and the total project cost which is worked out by estimating. So, estimate is a computation or calculation of quantities required and expenditure likely to be incurred in the construction of work.

→ It is the probable cost of work and is determined theoritically by mathematical calculation based on plans, drawing and current rates.

→ Accurate estimate is prepared by detailed estimate method.

Actual cost :- It is the cost known after completion of the work. All expenditures during the project execution are maintained by account section and at the end of the completion of work when account is completed, the actual cost is known.

→ The variance between actual cost to estimated cost should not vary much.

Detail Estimate :- Process of detail estimate consists of working out the quantities of different items of works and then working out the cost i.e two step process.

(a) Quantity calculation sheet
(b) Abstract of Estimated cost.

④ Quantity calculation sheet or Measurement sheet

Item No	Description or Particulars	No	Length	Breath	Height or depth	Quantity	Unit	Remarks

- The whole work is divided into different items of work as earth work, DPC, Brick masonry, concreting etc. and this items are again classified into subheading. The quantities of each are calculated in prescribed form.

⑤ Abstract of Estimated cost

Item No	Description or Particulars	Quantity	unit	Rate	Amount	Remarks

Quantities are taken from quantity calculation sheet whereas unit rate are based on market or current or government rate and norms of works.

→ Further, (2-3)% in general are added as contingencies (to allow for petty contingent expenditure, unforeseen expenditures, change in design, change in rates etc which may occur during execution of work).

→ 1.5-2% added for work-charge establishment

→ VAT (13%)

→ Finally, grand total is the total estimated amount.

Work-charged Establishment :- It is the establishment which is charged to work directly. During the construction work, a certain numbers of work supervisor, chaukidar (securities) etc are required to be employed and their salaries are paid from the amount under heading of workcharge establishment which is generally 1.5-2% of estimated cost.

Centage charges or departmental charges :- When the engineering department takes the work of other department a percentage amount of (10-15)% of estimated cost is charged to meet the expenses of establishment, designing, planning, supervision etc. and this percentage is known as centage charge.

Purpose of estimation

→ To give reasonable accurate idea of cost of work.
→ To estimate various types and quantities of materials required
→ To estimate various categories and quantities of labours required.
→ To estimate various types and quantities of tools and plants required.
→ To estimate time of completion of work/project
→ To determine the value of property.
→ To justify investment from benefit cost ratio.
→ To invite tenders and prepare bills of payment.

Requirements of estimating / data required for estimating

Following datas are required for good estimate

(a) Drawing :- Drawing are the basis from which quantities of various items of work are calculated so, clear, fully dimensioned drawing showing plans, different sections and other relevant details for the work.

(b) Schedule of rates :- Quantities calculated with drawing are multiplied with rates for the project cost. So, rates are vital parameter. Normally, engineering departments provide government approved rates with current schedule of rates per unit of work, labour wages, transport etc.

(c) Specification :- Specification specifies or describe the nature and the class of the work, material's to be used in the work, workmanship etc and is very important for the execution of the work.

→ Cost of work depends much on specifications.

Specification are two types

(i) General or brief specification

(ii) Detailed specification

General or brief specification :- gives the nature and class of the work and materials in general form. It gives general idea of whole work be useful in preparing the estimate.

* Detailed specification :- specifies the qualities and quantities of material, the proportion of mixes, workmanship, the method of preparation and execution and method of measurement.

Methods of building Estimate

⑤ Separate or individual or Long and short wall method.

In this method, the external length of walls running in longitudal direction generally the long walls out-to-out, and the internal length of walls running in transverse direction in-to-in or short wall are multiplied to breath and height of wall to calculate quantities

Length of long wall = centes to centes length + half the breath of one side + half the breath of other side

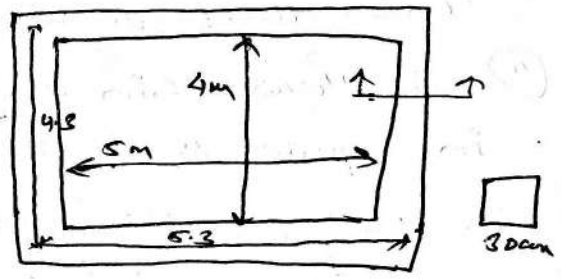
Length of short wall = centes to centes length - half the breath of one side - half the breath of other side.

Long wall length $= \left(5+\frac{0.3}{2}+\frac{0.3}{2}\right)+\frac{0.3}{2}+\frac{0.3}{2}$

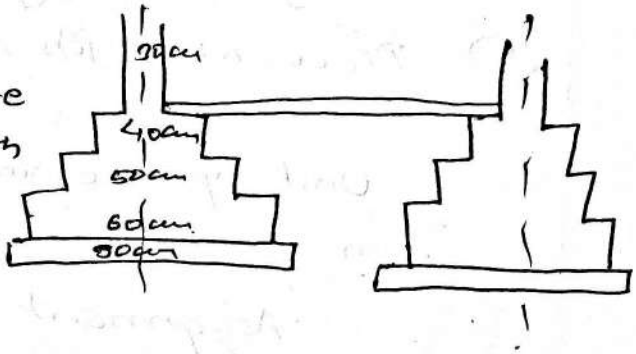
$= 5.6\ m$

Length of short wall $= \left(4+\frac{0.3}{2}+\frac{0.3}{2}\right)-\frac{0.3}{2}-\frac{0.3}{2}$

$= 4\ m$



→ In this method, long walls are gradually decreasing in length from foundation to superstructure, whereas short wall are gradually increasing.



→ This method is simple, accurate and there is less or no chance of mistake.

d. Methods of measurements

Updated mode of measurement for standard. Deductions & additions are also necessary to determine the correct quantities of work.

Examples:

→ Dimensions shall be measured to the nearest 0.01 meter

→ Area shall be measured to nearest $0.01 m^2$

→ cubic content be worked upto the nearest $0.01 m^3$

Principle of units.

The units of different work depends on their nature, size and shape. Generally, they are based as follows.

(i) Mass, voluminous and thick work shall be taken in cubic unit or volume (eg. m^3)

(ii) Shallow, thin and surface work shall be taken in square units or in area (eg. m^2)

(iii) Long and thin work shall be taken in linear or running unit (eg. m)

(iv) Piece work, job work shall be enumerated (eg. number)

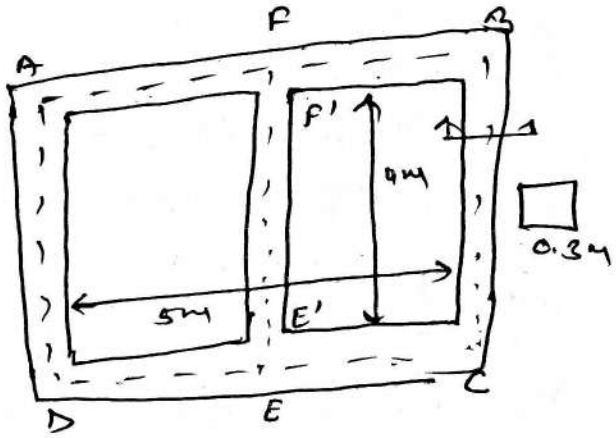
Unit of measurement & payment of various item of work.

· Assignment.

(b) Centre line Method:-

This method is suitable for walls of similar cross sections. Here the total centre line length is multiplied by breadth and depth of respective item to get the total quantity at a time. When cross walls or partitions or verandah wall join with main wall, the centre line length gets reduced by half of breadth for each junction.

→ The estimates prepared by this method are more accurate and quick.



Total centre line length

= AB + BC + CD + DA + E'F'

= 5.3 + 4.3 + 5.3 + 4.3 + 4

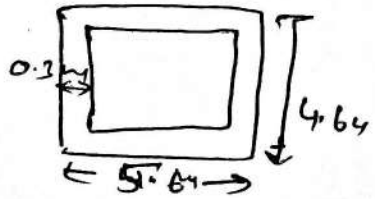
= 19.2 + 4

= 23.2 m

(c) Crossing Method:-

In this method, overall perimeter of building is calculated and to this four times the thickness of wall is subtracted to obtain centre line length.

Total length = 5.6 + 4.6 + 5.6 + 4.6 - 4 × 0.3 = 19.2



Types of estimate

1. Approximate estimate
2. Detailed estimate
3. Revised estimate
4. Supplementary estimate
5. Annual repair and maintenance estimate
6. Extension and improvement estimate
7. Complete estimate

Approximate estimate

→ It is required for preliminary studies of various aspects of project, to decide financial position & policy for administrative sanction

→ It is prepared from the practical knowledge & cost of similar works.

→ The approximate estimate/preliminary estimate may be prepared by various way for different structures and works such as

@ Per unit basis

School, hostels — per students
Schools - per class
hospitals - per bed
Cinemas/theatre halls - per seat
factories - per bays
Roads/highways - per km
Irrigation channels - per km
or
command area
Bridge & culvert - per running meter
Sewarage & water supply - per person
or
area covered

(b) plinth area basis

cost of building = Total plinth area * Prevailing plinth area per m²
in m²

Total plinth area = carpet area + circulation area + wall + column area

carpet area = It is useful area or liveable area or lettable area.

= Total area - circulation area (corridors, passages, verandahs, staircase, lift, entrance hall) & non-useable area as sanitary accomodation (bath rooms & water closets), air conditioning rooms.

carpet area → office building (60-75)%
→ Residential (50-65)%

circulation area :- Area in floor area used for movement of pessons in building which are verandahs, passages corridors, balconies, entrance hall, porches, staircases etc.

→ Horizontal circulation area (10-15)% of plinth area
→ Vertical " " (4-5)% " " "

Plinth area :- It is built up covered area of any building measured at floor level of any storey.

→ Calculation is done taking external dimension of the building at floor level excluding plinth offsets
→ Court-yard, open areas, balconies and cantilevers projections are not included whereas supported porches are included.

Floor area :- It is the total area of floors in between walls and consists of floor of all rooms verandahs, passages, corridors, staircase room, entrance hall, kitchen, stores, bathroom & latrines (W.C) etc.

Generally,

Floor area = Plinth area - area occupied by walls

Q Find the cost for building a school having 10 numbers of classrooms with 48 students on each classes. Assume carpet area = 1.5 m²/student. Assume other datas.

Solution

Let 'x' be plinth area

carpet area = 10 × 48 × 1.5 = 720

circulation area = 20% of x = 0.2x

As we know,

column area → (8-10)% of plinth area (frame structure)
→ (15-20)% " " " (load bearing)

column area = 10% of x = 0.1x

⇒ Plinth area = 720 + 0.2x + 0.1x

⇒ x = 720 + 0.3x

⇒ $x = \frac{720}{0.7} = 1028.5\ m^2 \approx 1030\ m^2$

(a) cost of building = 1030 m² × rate/m²

(b) Then cost of water supply & sanitary work = (8-10)% of (a)

(c) " " " Electrical installation = (6-10) of (a)

(d) Extra cost for special architectural treatment = 1-2% of (a)
(e) " " " internal road, parking, footpath = (2-5)% of (a)
(f) " " " Boundary wall & guard house = (2-10)% of (a)
(g) " " " land scaping = (2-5)% of (a)
(h) " " " W/s & sanitary system = (2-4)% of (a)
(i) " " " Electricity system = (2-5)% of (a)
(j) " " " other services = 5% of (a)
(k) Total of (a) to (j) = Rs
(l) contingency 5% of K
(m) Total K & L
(n) consultancy fee = 5% of (m)
(o) VAT = 13% of total
(p) Grand total

(c) Cube Rate Estimate

This estimate is prepared on the basis of the cubical content of the building and the cube rate which is taken from cost of similar building having similar specification & construction, in the locality.

→ This is more accurate as compared to plinth area estimate as the height of building is also compared

→ Value = (length x breath * height) * prevailing cube rate
= Total plinth area * Ht of building * "

Q. Prepare the rough estimate for a proposed commercial complex for a municipal corporation for the following data.

Plinth area = 500m²/floor cubical content = Rs 10000/m³
Ht. of each storey = 3.5m
No. of storey's = G+2

Provided for a following as a percentage of structural cost

(a) W/s & sanitary arrangement = 8%

(b) Electrification = 6%

(c) Fluctuation of rates = 5%

(d) Contractor's profit = 10%.

(e) Petty supervision & contingencies = 3%.

Sol^n.

cubical content = No. of storey's * Plinth area per storey * height of storey

= 3 * 500 × 3.5 = 5250 m3

structural cost = cubical content * cubical content rate

= 5250 × 1000 = 52.5 lakhs

Other provisions.

(a) W/s & sanitary = 52.5 * 8/100 = Rs 4.2 lakhs

(b) Electrification = 52.5 * 6/100 = Rs. 3.15 lakhs

(c) Fluctuation of rates = 52.5 * 5/100 = Rs 2.625 lakhs

Total structural cost = (52.5 + 4.2 + 3.15 + 2.625) lakhs

= Rs 62.475 lakhs

(d) Petty supervision & contingencies = Rs 62.475 * 3/100

= Rs 1.874 lakhs

(e) Contractor's profit = Rs 62.475 * 10/100 = Rs 6.247 lakhs

Grand total = Rs (62.475 + 1.874 + 6.247) lakhs

= Rs 70.596 lakhs

2. Detailed Estimate

↳ After getting administrative approval on approximate estimate, detailed estimate are prepared.

↳ This is an accurate estimate and consists of working out the quantities of each item of work and working the cost.

↳ Dimensions are taken correctly from drawing & quantities of each item are calculated, and abstracting & billing is done.

Approval of approximate estimate by concerned administrative authority

↓

Detail design

↓

Detail drawing

↓

Detail estimate

↙ ↘

Measurement/quantity sheet

Abstract of estimated cost sheet

Measurement or Quantity sheet

SN	Particulars	NO	L	B	H	Q	Unit	Remarks

Transfer these quantities in abstract of cost sheet

SN	Particulars	Quantity	unit	Unit Rate	Amount	Remarks

(a) Total cost of item = Rs

(b) Contingency = Rs 5% of (a)

(c) Work charge establishm...

(d)

3. Revised Estimate

→ Revised estimate is a detailed estimate and is required to be prepared under any one of following cases:-

(a) When original sanctioned estimate is exceeds or likely to exceed by more than 5%.

(b) When the expenditure on a work exceeds or likely to exceed the amount of administrative sanction by more than 10%.

(c) When there are material deviation from original proposal, even though the cost may not from the sanction amount.

Item No	Original Estimate					Revised estimate				variation			
	particulars	Qty	unit	Rate	Amount	Qty	unit	Rate	Amount	Qty	unit	Amount	Remarks

4. Supplementary Estimate

It is a fresh detail estimate of additional works in addition to the original estimate and is prepared when additional works are required to supplement the original works, or when further development is required during the progress of work.

The Abstract of cost shows the amount of original estimate and total amount including supplementary amount for which sanction is required.

5. Annual Repair and maintenance Estimate

→ It is also a detail estimate prepare to maintain the structure/project in proper order and safe condition

→ 1 - 1.5%. of capital cost per year

→ Example, white washing, coloring, patch repairs etc.

(E) Extension and Improvement Estimate
→ It is also detail estimate is prepared for addition and alteration (i.e extension & improvement) of building / project after project is completed.

(F) Complete estimate :- Estimate incurring all the possible cost of project is complete estimate.
eg. Total cost of land + total cost of building & external services
→ It is prepared in standard form & complete set of estimate consists all parameters, designs, specifications drawing and it must be approved by concerned officers in the office.

2.8 Split up the cost of building work ?
→ cost of material - 65 to 75 % of whole cost
→ cost of labores - 30 to 35 % of whole cost
→ cost of foundation and plinth - 10-15 % of WC
→ cost of superstructure - 85 - 90 % of WC

Break down of cost of various work for load bearing structure
i. cost of E/W in excavation & filling = 1 to 1½ % of WC
ii. " " construction of foundation = 5-6 % " "
iii " " DPC = 1 - 1½ % " "
iv " " Brick work = 30-34 % " "
v. " " Roofing work = 18-20 % " "
vi " " flooring work = 5-6 % " "
vii " " wood work = 16-20 % " "
viii " " plastering & pointing work = 10-12 % " "

ix. Cost of white washing/painting = 2-4 % of WC
x. Miscellaneous work = 5-6 % of WC

For Road work
→ cost of embankment/cutting = 14%.
→ " " soling of stone aggregate including consolidation = 22%.
→ cost of wearing coat of stone aggregate & bitumen = 44%.
→ cost of other item of work = 20%.

* Analysis of Rate *

Introduction

The method of determining the unit rate of an item of work considering the total cost of material, total cost of labours, hire charges of tools and plants, contractors overhead and profit etc. is known as analysis of rate.

Purpose
→ To revise the schedule of rates
→ To workout the economical use of material
→ To workout the actual cost of unit rate of items
→ To work out the unit rate of an extra items of works which are not provided in the contract agreement (bond)

Importance

Gives the clear picture of the various types of materials, various categories of labours, various types of ~~work~~ tools & plants required for completing a particular work

Requirements

→ Correct information of the market rate of material
→ correct " " " " " labours
→ Output of labours (unit turn of works)
→ knowledge, rate and outturn of various types of tools and plants to be used in the construction works.
→ Upto date knowledge of construction works

Factors affecting the rate analysis

→ Quality of materials
eg. Handmade bricks & machine made bricks
→ Proportion of material
mortar 1:3 & 1:6
→ Location of the site of work
→ Construction facilities available with regard to tools and plants to the site of work
→ Transportation facilities available for materials and labours to the site of work
→ Transportation charges and condition of road to the site of work
→ Overhead charges
→ Profit desired
→ Experience of workers and amenities provided to them.
→ Management

Method of preparing rate analysis
OR
Governmental procedure of rate analysis

(a) Total cost of materials : Rs (x)

(b) Total cost of labours : Rs (y)

(c) Hire charges of tools and plants = Rs (z)
(including fuel cost)

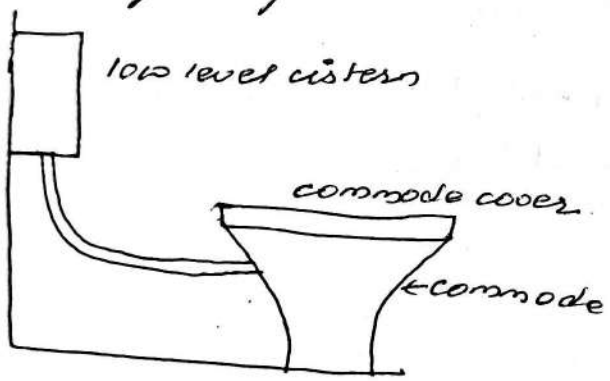
Total = Rs (x+y+z) = Rs (C)

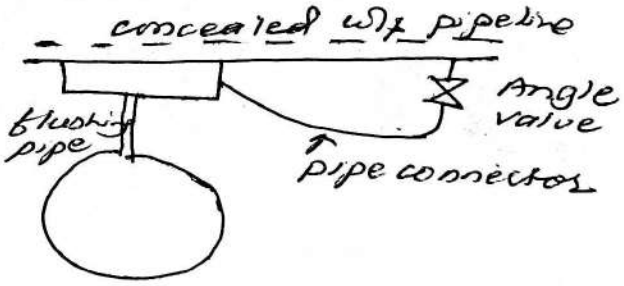
(d) Contractors overhead and Profit = Rs 0.15C
(5%) (10%)

Unit rate of item = Rs 1.15C

Rate Analysis for water supply and Sanitary

** Prepare an analysis of rate for WC commode with cistern per number





(A) Materials

(i) White glazed ceramic clay WC commode = 1 no * 2000
with Por S trap = Rs 2000

(ii) White glazed ceramic clay 10 litres
low level cistern with complete accessories = 1 no * Rs 2500
= Rs 2500.

iii Bakelite heavy duty covers with C.P hinges = 1no * Rs 500

iv. 40mm dia PVC flushing pipe with couplin = 1no * Rs 300 = Rs 300

v. Chromium plated (CP) valve = 1no * Rs 800 = Rs 800

vi. 15 * 450mm PVC pipe connector with couplin = 1no * Rs 200 = Rs 200

viii. Clamp, screw, pipe tape etc lump sum = Rs 200

Total of A = Rs 6500

B. Labours

(i) Skilled = 3 no's * 960 = Rs 2880

(ii) Unskilled = 3 no's * 700 = Rs 2100

Total B = Rs 4980

C Contractor overhead and profit 15% of (A+B)

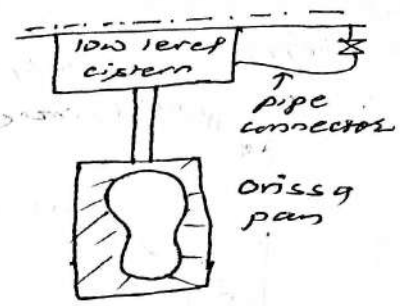
= Rs 0.15 * (6500+4980)

= Rs 1722

Unit rate = Rs (6500+4980+1722)

= Rs. 13202

** Prepare an analysis ~~of~~ rate for 1 no Pan with cistern per numbers.



(A) Material

(i) White glazed ceramic clay WC orissa pan with P or S trap = 1no * Rs 1800 = Rs 1800

(ii) White glazed ceramic clay 10 ltr capacity low level cistern with complete accessories = 1no * Rs 2500 = Rs 2500

(iii) 40mm dia PVC flushing pipe with coupling = 1no * Rs 300 = Rs 300

(iv) chromium plated (CP) valve = 1no * Rs 800 = Rs 800

(vi) 15mm * 450mm PVC pipe connector with coupling = 1no * 200 = Rs 200

(vii) clamp, screw, pipe tape etc lumpsum = Rs 200

Total of A = Rs 5800

(B) Labour

(i) skilled = 3no's * Rs 960 = Rs 2880

(ii) Unskilled = 3no's * Rs 700 = Rs 2100

Total of B = Rs 4980

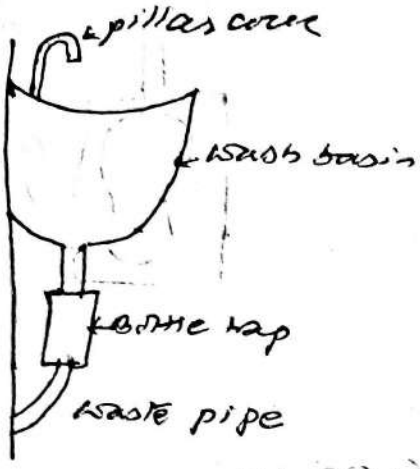
(C) contractors overhead and profit 15% of (A+B)

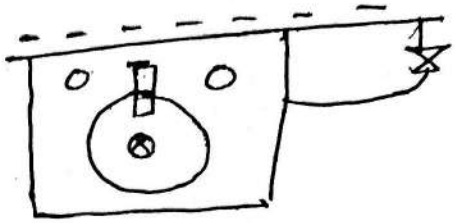
= 0.15 * (5800 + 4980)

= Rs 1617

Unit rate = Rs (5800 + 4980 + 1617) = Rs 12397

* Prepare an analysis of rate for wash basin per no





(A) Material

(i) White glazed ceramic clay 550×400mm = 1no × Rs 1200 = Rs 1200
Wash basin ~~with CP~~

(ii) CP fancy type (Blue star or equivalent) = 1no × Rs 1300 = Rs 1300
pillar cock

(iii) 32mm dia PVC waste pipe = 2 no × Rs 200 = Rs 200

(iv) PVC bottle trap = 1no × Rs 400 = Rs 400

(v) chromium plated (CP) Angle valve = 1no × Rs 800 = Rs 800

(vi a) 15mm * 450mm PVC pipe connector with coupling = 1no × Rs 200 = Rs 200

(vi b) clamp, screw, pipe tape etc lumpsum = Rs 200

Total (A) = Rs 4300

(B) Labour

(i) Skilled = 2 nos * Rs 960 = Rs 1920

(ii) Unskilled = 2 nos * Rs 720 = Rs 1440

Total (B) = Rs 3320

(C) Contractor overhead and profit 15% (A+B) = Rs 1143

Rate per no = Rs 8763

17 Calculate the quantities of materials required for the following items of work.

a) 48.50 m^3 of brickwork in (1:3) cement mortar

Soln Quantity = 48.50 m^3

Size of brick & and thickness of mortar is not given,

Assume, size of brick, 230 * 110 * 55 mm

& thickness of mortar joint = 10 mm (3-12 mm)

Now, size of the brick with mortar = 240 * 120 * 65 mm

$$\therefore \text{No. of brick} = \frac{48.50}{0.24 * 0.12 * 0.065}$$

$$= 25909 \text{ Nos.}$$

Add 5% wastage, then

No. of bricks = 25909 (1.05)

= 27205 Nos.

Volume of mortar = 48.50 − 25909 (0.23 * 0.11 * 0.055)

= 12.45 m^3

Add 30% to get dry volume

dry volume of mortar = 12.45 * 1.3 = 16.19 m^3

Total part of mix proportion = 1+3 = 4 parts

Cement = $\frac{16.19}{4} * 1$ = 4.05 m^3 * 28.80 bag

= 116.57 bags

Sand = $\frac{16.19}{4} * 3$ = 12.14 m^3

Water cement ratio $\left(\frac{w}{c}\right) = 0.5$ ∴ water(w) = 0.5 * 116.57 bags * 50 kg/bag

= 2914.25 Lit.

House

Materials	Quantity
No of brick	27205 Nos.
cement	116.57 bags
Sand	12.14 m^3
Water	2914.25 Lit

b) 15 cm thick foundation pcc (1:3:6), 0.95m wide and 42m long

Sol? → Total quantity = $42 * 0.95 * 0.15 = 5.99 m^3$

Increase 50 to 50% for dry concrete

Volume of dry concrete = $5.99 * 1.50$

$= 8.99 m^3$

Total part of mix proportion = $1+3+6 = 10$

Cement = $\frac{8.99}{10} * 1 = 0.899 m^3 * 28.8$ bags

$= 25.89$ bags

Sand = $\frac{8.99}{10} * 3 = 2.697 m^3$

Aggregate = $\frac{8.99}{10} * 6 = 5.394 m^3$

$w/c = 0.5 \rightarrow w = 0.5 * 25.89 * 50$ kg/bag

$= 647.25$ Lit Ans

c) PCC $(1 : 1\frac{1}{2} : 3)$ for Rcc roof 0.10m thick 20m wide and 25m long (Assume 0.8% vol. of pcc)

Sol? Pcc for Rcc work = $25 * 20 * 0.10$

$= 50 m^3$

Increase 50% for dry concrete

vol. of dry concrete = $50 * 1.5 = 75 m^3$

Total part of mix proportion = $1 + 1\frac{1}{2} + 3$

$= 5.5$

Cement = $\frac{75}{5.5} * 1 = 13.63 m^3 * 28.8$ bags

$= 392.73$ bags

Sand = $\frac{75}{5.5} * 1.5 = 20.45 m^3$

aggregate $= \frac{T5}{5.5} * 8 = 40.91\ m^3$

$\frac{W}{C} = 0.5 \Rightarrow W = 0.5 * 332.73\ bags * 50\ kg/bags$

$= 9818.25\ Lit.$

M.S. bars (steel reinforcement)

$= \frac{0.8}{100} * 50$ (Wet volume)

$= 0.4\ m^3 * 7850\ kg/m^3$

$= 3140\ kg$

d) $415\ m^2$ of 40 mm thick cement concrete (1:2:4) on floor

Sol^n volume of wet concrete $= 415\ m^2 * \frac{40}{1000}\ m$

$= 16.6\ m^3$

Add 10% for unevenness of base concrete

Total vol. of wet concrete $= 16.6 * 1.10$

$= 18.26\ m^3$

Increase by 50% for dry volume

volume of dry concrete $= 18.26 * 1.5$

$= 27.39\ m^3$

Total part of mix proportion $= 1+2+4 = 7$

cement $= \frac{27.39}{7} * 1 = 3.91\ m^3 * 28.8\ bags = 112.69\ bags$

Sand $= \frac{27.39}{7} * 2 = 8.11\ m^3$

aggregate $= \frac{27.39}{7} * 4 = 15.65\ m^3$

$W/C = 0.5 \Rightarrow W = 0.5 * 112.69 * 50\ kg/bag$

$= 2817.25\ Lit.$

e) 713 m^2 of 12.5 mm thick cement plaster (1:4) in wall

Sol^n vol. of wet mortar = 713 * 0.0125
= 8.91 m^3

Add 50% to get dry volume

dry volume of cement mortar = 8.91 * 1.50
= 13.37 m^3

total mix of proportion = 1+4 = 5 parts

cement = $\frac{13.73}{5} * 1$ = 2.746 m^3 * 28.8 bags/m^3
= 79.09 bags

Sand = $\frac{13.73}{5} * 4$ = 10.98 m^3

$\frac{w}{c} = 0.8$, $\Rightarrow w$ = 0.8 * 79.09 bags * 50 kg/bags
= 3163.6 lit.

f) 110 m^2 half brickwall in (1:3) cement mortar

Let the thickness of half brick
We have a known size of the brick, 230 * 110 * 55,
then thickness of half brick wall = $\frac{230}{2}$ = 115 mm

Vol. of brickwork = 110 * 0.115
= 12.65 m^3

then, same as a,

Note :- Density of cement = 1440 kg/m³ ∴ 1 bag = 50kg
1 m³ cement = 1440 kg = 1440/50 bag = 28.8 bag

Government Procedure of Preparing Rate Analysis

(A) Total Cost of materials = Rs x
(B) " " " labourers = Rs y
(C) Hire charge of tools & plants = Rs z

Total = Rs (x+y+z) = Rs C

(D) Contractors overhead cost & profit = 15% of Rs C = Rs 0.15C

Unit rate of an item of work = Rs 1.15C #

[please Don't Refer Other Indian Books for this chapter]

4.6.1 Method of Preparing Rate Analysis for building works.

1) Prepare an analysis of rate for pcc (1:2:4) Per 10m³

Sol^n

(a) volume of Concrete = 10m³

(b) Add 50-55% to get unmixed/dry volume = $10 + \frac{54}{100} \times 10 = 15.40 m^3$

(c) Total part of mix Proportion = 1+2+4 = 7 Parts

(d) Cement = $\frac{15.4}{7} \times 1 = 2.2 m^3 * 28.80 = 63.36$ bags

(e) Sand = $\frac{15.4}{7} \times 2 = 4.4 m^3$

(f) Aggregate = $\frac{15.4}{7} \times 4 = 8.8 m^3$

(g) $\frac{w}{c} = 0.5 \Rightarrow w = 0.5 * 63.36 * 50kg = 1584 kg = 1584$ lit

(A) Materials

(i) Cement = 63.36 bags * Rs 650 per bag = Rs 41184
(ii) Sand = 4.4m³ * Rs 1800 per m³ = Rs 7920
(iii) Aggregate = 8.8m³ * Rs 2000 per m³ = Rs 17600
(iv) Water = 1584 lit * Rs 0.1 per lt = Rs 158.4

Total of A = Rs 66862.4

Note for pcc: $10m^3$ → 10 NOS ..
1 " → 1 NOS "
& $10m^3$ → 40 NOS unskilled
1 " → 4 NOS "

(B) Labourer

(I) Skilled = 10nos * Rs 500 perhead per day = Rs 5000
(II) Unskilled = 40nos * Rs 350 " " " = Rs 14000

Total of B = Rs 19000

Total Cost of A & B = Rs 85862.4

(C) Contractors overhead cost & profit = 15% of (A+B) = Rs 12879.36

Rate per $10m^3$ = A+B+C = Rs 98741.76

Rate per m^3 = $\frac{98741.76}{10}$ = Rs 9874.176

2066 Bhadra / 2067 Ashwin

Q-2 Prepare an analysis of rate for pcc (1:2:4) per $100m^3$

Soln (a) volume of Concrete = $100m^3$
(b) Add 50-50% to get unmixed/dry volume = $100 + \frac{54}{100} * 100 = 154m^3$
(c) Total part of mixed proportion = 1+2+4 = 7 parts
(d) Cement = $\frac{154}{7} * 1 = 22m^3 * 28.80 = 633.6$ bags
(e) Sand = $\frac{154}{7} * 2 = 44m^3$
(f) Aggregate = $\frac{154}{7} * 4 = 88m^3$
(g) $W/C = 0.5 \Rightarrow W = 0.5 * 6336 * 50kg = 15840kg = 15840$ L

(A) Materials
(I) Cement = 6338 bags * Rs 650 per bag = Rs 411840
(II) Sand = $44m^3$ * Rs 1800 per m^3 = Rs 79200
(III) Aggregate = $88m^3$ * Rs 2000 per m^3 = Rs 176000
(IV) Water = 15840 lit * Rs 0.1 per lit = Rs 1584

Total of A = 668624

(B) Labour
(I) Skilled = 100 NOS * Rs 500 perhead per day = Rs 50000
(II) Unskilled = 400 NOS * Rs 350 " " " = Rs 140000

Total of B = Rs 190000

Total cost of A & B = Rs 858624

(c) Contractors' overhead cost & profit = 15% of (A+B) = Rs 128793.6

Rate per $100 m^3$ = Rs (A+B+C) = Rs 987417.6

Rate per m^3 = $\frac{987417.6}{100}$ = Rs 9874.176

Note:- which is same as from Q-1.

Similarly following the same procedure as above. Solve the following problems

(a) $105 m^3$ of PCC (1:4:8) in foundation ⟶ 2068 Baishakh

b) $10 m^3$ PCC (1:3:6) in foundation ⟶ 2067 Ashadh

c) $100 m^3$ PCC (1:3:6) in foundation ⟶ 2065 Shrawan.

3. Prepare an analysis of rate for 50 mm thick PCC (1:3:6) per $10 m^2$

(i) volume of PCC work = $\frac{50}{1000} * 10 = 0.5 m^3$

Add 50 - 55% to get dry/unmixed volume of PCC

(ii) unmixed/dry vol. of PCC = $0.5 + \frac{55}{100} * 0.5 = 0.775 m^3$

(iii) Total part of mixed proportion = 1+3+6 = 10 parts

(iv) Cement = $\frac{0.775}{10} * 1 = 0.0775 m^3 * 28.8$ bags = 2.232 bags

(v) Sand = $0.0775 * 3 = 0.225 m^3$

(vi) Aggregates = $0.0775 * 6 = 0.45 m^3$

(vii) $\frac{w}{c} = 0.5 \Rightarrow w = 0.5 * 2.232 * 50 = 55.8$ kg

(A) Materials

(i) Cement = 2.232 bags × Rs 650 per bag = Rs 1450.8

(ii) Sand = 0.225 m^3 × Rs 1800 per m^3 = Rs 405

(iii) Aggregate = 0.45 m^3 × Rs 2000 per m^3 = Rs 900

(iv) water = 55.8 lit × Rs 0.1 per lit = Rs 5.58

Total of A = Rs 2761.38

(B) Labour

(i) skilled = 1.25 Nos × Rs 500 per head per day = Rs 625

(ii) unskilled = 2.50 nos × Rs 350 " " " = Rs 875

Total Cost of B = Rs 1500

Total of (A+B) = Rs 4261.38

(C) Contractors overhead & Profit = 15% of A+B = Rs 639.207

Rate per 10 m^2 = Rs 4900.587

∴ Rate per m^2 = $\frac{4900.587}{10}$ = Rs 490.0587 ✱✱

Note:-

PCC works	no. of skilled labour	no. of unskilled labour
50 mm	1.25	2.5
40 mm	1	2
75 mm	1.25	3

no. of labours is independent of proportion of ~~mgmt~~ materials

Q-4 Prepare an analysis of rate for PCC M_{20} (1 : 1½ : 3) for RCC work per m^3

Soln (i) Volume of pcc for RCC work = $1\ m^3$

Add 50-55%.

(ii) Dry/unmixed volume = $1 + \frac{50}{100} \times 1 = 1.5\ m^3$

(iii) Total part of mix proportion = $1 + 1\frac{1}{2} + 3 = 5.5$ Parts

(iv) cement = $\frac{1.5}{5.5} * 1 = 0.272\ m^3 * 28.80 = 7.8$ bags

(v) Sand = $\frac{1.5}{5.5} * 1.5 = 0.41\ m^3$

(vi) Aggregates = $\frac{1.5}{5.5} * 3 = 0.81\ m^3$

(vii) $w/c = 0.5 \rightarrow W = 0.5 * 7.8$ bags $* 50$ kg/bags $= 195$ kg
$= 195$ lit

(A) Materials

(i) cement = 7.8 bags * Rs 650 per bag = Rs 5070

(ii) Sand = 0.41 m^3 * Rs 1800 per m^3 = Rs 738

(iii) Aggregate = 0.81 m^3 * Rs 2000 " = Rs 1620

(iv) water = 195 lit * Rs 0.1 per lit = Rs 19.5

Total cost of A = Rs 7447.5

(B) Labourer

(i) skilled = 0.80 nos * Rs 500 per head per day = Rs 400

(ii) unskilled = 7 nos * Rs 350 " " " = Rs 2450

Total cost of B = Rs 2850

Total cost of A+B = Rs 10297.5

(C) Contractor overhead cost & profit = 15% of (A+B) = Rs 1544.625

∴ Rate per m^3 = A+B+C = Rs 11842.125 #

for M_{15} (1:2:4) labours for 1 m^3 → skilled → 0
M_{25} (1:1:2) → unskilled →

Q-5 Prepare an analysis of rate for steel reinforcement for RCC work per metric ton (MT)

Soln

Materials

(i) Steel rods of different sizes = 1 MT
Add 5% wastage = 0.05 MT

Total = 1.05 MT * Rs 80,000 per MT = Rs 84,000

(ii) Binding wire = 10kg * Rs 95 per kg = Rs 950

Total Rs 84950

(B) Labourer

(i) Skilled = 12 Nos * Rs 500 per head per day = Rs 6000
(ii) Unskilled = 12 Nos * Rs 250 " " " = Rs 4200

Total of B = Rs 10200

Total of A & B = Rs ~~85800~~ 95150

(C) Contractor's overhead cost & profit = 15% of A+B = Rs 14272.5

∴ Rate per MT = Rs 109422.5

& Rate per kg = $\frac{109422.5}{1000}$ = Rs 109.4225

Q-6 Prepare an analysis of rate for Brickwork (1:4) cement Mortar in Superstructure per m^3

Soln If Size of brick & thickness of mortar is not given, we assume

So, Assume Size of brick 230 * 110 * 55 mm
& thickness of mortar joint = 10 mm (8–12 mm)

(I) Size of brick with mortar = 240 * 120 * 65 mm

(II) No. of Brick = $\frac{1}{0.24 * 0.12 * 0.065}$ = 534 Nos

(III) Add 5% wastage = 534 * 1.05 = 560 Nos

(IV) volume of mortar = 1 − vol. of brick
= 1 − 534 (0.23 * 0.11 * 0.055) = 0.26 m^3

Add 30% to get dry volume

(V) dry vol. of mortar = 0.26 * 1.3 = 0.338 m^3 Say 0.35 m^3

(VI) Total part of mix proportion = 1 + 4 = 5 parts

(VII) Cement = $\frac{0.35}{5} * 1$ = 0.07 m^3 * 28.80 bags = 2.016 bag

(VIII) Sand = $\frac{0.35}{5} * 4$ = 0.28 m^3

(IX) $w/c = 0.5 \Rightarrow W = 0.5 * 2.016 * 50$ Kg = 50.4 Kg = 50.4 lit

(A) Materials

(i) Bricks = 560 Nos * Rs 8 per no = Rs 4480
(ii) Cement = 2.016 bag * Rs 650 per bag = Rs 1310.4
(iii) Sand = 0.28 m^3 * Rs 1800 per m^3 = Rs 504
(iv) water = 50.4 lit * Rs 0.10 per lit = Rs 5.04

Total cost of A = Rs 6299.44

(B) Labourer

(i) Skilled = 1.5 Nos * 500 = Rs 750
(ii) Unskilled = 2.2 Nos * Rs 350 = Rs 770
(iii) Unskilled = 0.70 Nos * Rs 350 = Rs 245

Rs 1765

(C) Cost of scaffolding = 3% of cost of unskilled (II) = Rs 7.35

Total Cost of A+B+C = Rs 8071.7

(D) Contractor's overhead cost & Profit = 15% of (A+B+C) = Rs 1210.

∴ Rate per m^3 = Rs 9282.56

IOE 2068 Chaitra

Q No. 7. Work out the no. of bricks, cement, & sand required for 115 m^3 of brick masonry in (1:3) cement mortar in superstructure. The size of brick is 240 × 120 × 60 mm and the thickness of mortar joint is 12 mm.

Sol:

i) size of the brick = 240 * 120 * 60 mm
ii) size of the brick with mortar = 252 * 132 * 72 mm.
No. of brick in the given vol. = $\frac{115}{(0.252 * 0.132 * 0.072)}$
= 48017 nos
iii) Add 5% wastage = 48017 + 48017 * 0.05
= 50418 nos
iv) vol. of mortar = 115 − vol. of brick
= 115 − 48017 (0.24 * 0.12 * 0.06)
= 32.03 m^3
Add 30% to get dry volume
v) dry vol. of mortar = $32.03 + 32.03 * \frac{30}{100}$
= 41.64 m^3
vi) Total part of mix proportion = 1+3 = 4 parts
vii) cement = $\frac{1}{4} * 41.64$ = 10.41 m^3 * 28.8 bags = 299.81 bags

iii) Sand = $\frac{4}{5} * 41.64 = 33.31\ m^3$

iv) $\frac{W}{C} = 0.5 \Rightarrow W = 0.5 * 299.81\ bags * 50\ kg = 7495.25\ kg$

(A) **Materials**

i) Bricks = 504 18nos * Rs. 8.00 per no = Rs 403344
ii) cement = 299.81 bags * Rs 650 per bag = Rs 194876.5
iii) Sand = 33.31 m^3 * Rs 1800 per m^3 = Rs 59958
iv) water = 7495.25 lit * Rs 0.1 per lit = Rs 749.53

Total Cost of A = Rs 658928.03

(B) **Labours**

i) Skilled = 1.5 * 115 Nos * Rs 500 per head per day = Rs 86250
ii) Unskilled = 2.20 * 115 Nos * Rs 350 " " " " = Rs 88550
iii) Unskilled = 0.70 Nos * 115 * Rs 350 " " " " = Rs 28175

Total of B = Rs 202975

(C) Cost of Scaffolding = 3% of Cost of unskilled (ii) = Rs 845.25

Total Cost of (A+B+C) = Rs 862748.28

D Contractor's overhead cost & profit = 15% of (A+B+C) = Rs 129412.24

∴ Rate per 115 m^3 = Rs 992160.522

Q.NO.8. Prepare an analysis rate for salwood for doors and windows frame per m³.

Solⁿ

(A) Materials:

i) Salwood = 1.00m³
Add 10% wastage = 0.10m³
1.10 m³ * Rs. 120,000 per m³ = Rs. 132,000.00

ii) M.S. holdfast = 92 nos. * Rs 15 per no. = Rs. 1,380.00

iii) Screws = 184 nos. * Rs. 2 per no. = Rs. 368.00

Total of (A) = Rs. 133748.00

(B) Labour:

i) Skilled = 34 nos. * Rs. 500 per hd/day = Rs. 17000.00

ii) Unskilled = $\frac{1}{10}$ * 34 nos. * Rs. 350 per hd/day = Rs. 1190

Total of (B) = Rs. 18190

Total of (A+B) = Rs. 151938

(C) Contractor's overhead and profit 15% of (A+B) = Rs. 22790.8

Rate per m³ = Rs. 174728

Q.No. 9 Prepare an analysis of rate for 12mm thick cement sand plaster (1:4) in ceiling per 10m².

Solⁿ

~~(A) Materials~~

i) Volume of plaster = $\frac{12}{1000}$ × 10 = 0.12m³

Add 50-55% to get dry/unmixed volume of plaster

ii) dry volume = $0.12 + \frac{50}{100} \times 0.12$ = 0.18 m³

iii) Total part of mixed proportion = 1+4 = 5 parts

iv) Cement = $\frac{0.18}{5} * 1$ = 0.036 m³ * 28.8 bags = 1.037 bags

v) Sand = 0.036 * 4 = 0.144 m³

vi) $\frac{w}{C}$ = 0.8 ⇒ w = 0.8 * 1.037 * 50 = 41.48 kg
= 41.48 Lt

(A) Materials:

i) Cement = 1.037 bags * Rs. 650 per bag = Rs. 674.05

ii) fine sand = 0.144 m³ * Rs. 1800/m³ = Rs. 259.2

iv) Water = 41.48 lit * Rs. 0.10 per lit = Rs. 4.148

Total of (A) = Rs 937.398

(B) Labour :.

i) Skilled = 1.5 nos. * Rs. 500 per hd/day. = Rs. 750

ii) Unskilled = 2 nos * Rs 350 per hd/day = Rs. 700

Total of (B) = Rs. 1450

Total of (A+B) = Rs. 2387.398

(C) Contractor's overhead and profit 15% of (A+B)
= Rs 358.197

Rate per 10 m² = Rs. 2745.588

∴ Rate per m² = 274.55

10 Prepare an analysis of rate for providing & laying 15mm dia (medium) GI pipe perm.

Soln

(A) Materials

(i) 15mm dia GI pipe (m) = 1m * Rs 220 per m = Rs 220

(ii) GI fittings (Elbow, bend, Tee etc) L.S. (20-30%) = Rs 60

(iii) pipe tape, clamp, screws etc L.S. (5-7%) = Rs 10

Total-Rs 90

(B) Labourer

(i) Skilled = 0.18 no * Rs 500 perhead per day = Rs 90

(ii) Unskilled = 0.16 no * Rs 350 " " " = Rs 56

Total = Rs 146

Total of (A+B) = Rs 436

(C) Contractors overhead & profit = 15% of (A+B) = Rs 65.4

∴ Rate per m = Rs 501.4

Q-11 prepare an analysis of rate for providing, laying & Consol of 10 cms thick compacted gravel for subgrade per m^2

Soln

Volume of gravel subgrade = $\frac{10}{100} * 1 = 0.1 m^3$

Add 30-40%, Loose vol. of gravel = $0.035 m^3$

Total = $0.135 m^3$

(A) Materials

(i) well graded gravel = $0.135 m^3$ @ Rs 1500 per m^3 = Rs 202.5

B) labourer

(i) Unskilled = 0.14 Nos * Rs 350 per head per day = Rs 49

(C) Equipment

(i) Roller = 0.028 hr * Rs 1000 per hr = Rs 28

Total = Rs 279.5

(D) Contractor's overhead & profit = 15% of (A+B+C)

= Rs 41.925

∴ Rate per m^2 = Rs 321.425

PROJECT ESTIMATE

1> Mention the various ~~project~~ types of work involved in estimate for a project and list the various papers should be submitted.

Ans A project or Major scheme consists generally the following works.

(1) Preliminary Investigation, Reconnaissance, Preliminary survey, trial boring, soil testing

2> Preparation of preliminary estimate and obtaining administrative approval

3> Selection of site or alignment

4> Detailed surveying → plane table survey, levelling etc.

5> Preparation of survey plan, plotting of levels and counters, Preparation of Longitudinal section, cross section etc.

6> Selection of site or alignment on the drawing

7> Working out requirements - number, type and size of building of diffrent types in the case of building project, Waterway for bridges and culverts, capacity of channels etc.

8> Land acquisition: Calculation for area of land to be acquired for various projects

9> Marking formation line of road or Formation line of bed of channels etc.

10> Designing:-

11> planning; Preparation of drawings:-

12> Preparation of site plan or Index plan, in the case

13> of road or Irrigation project, preparation of key map, Index map, ~~detailed~~ location, survey plan etc.

13) Quantity estimate of diffrent items of work
14) Collecting data required for preparing estimate
15) Preparation of detailed ~~est~~ specification of each item of work.
16) Working out the rate analysis of diffrent items of work
17) Preparation of detailed estimate and abstract of cost
18) Preparation of general Abstract of cost for the whole project
19) Working out the B/C ratio especially for irrigation project
20) Purchase of diffrent materials and equipments
21) Estimate for temporary accommodation for office, staff quarters, workmen etc.
22) Technical report of project

The following papers should submitted for a project

i) Report
ii) Design data and calculation of design
iii) Specification
iv) Detailed statement of measurement, quantities & rates
v) An abstract of total estimated cost of each item
vi) The detailed estimate in specified form
vii) Plan and drawing

Q) Mention the various subheads to be provided while writting reports on estimate of building project.

Ans Following sub-heads should be provided in general

1. History :- reason to proposal, necessity of project
2. Design :- it should contain description of original and final proposal and refrence to specification, basis of design and drawings
3. Scope or provision made :- Accomodation provided and the works that are covered and the works that are not included in the estimates should be distinctly stated.
4. Land : Arrangement of lands and its acquisition if necessary
5. Rates :
6. The manner for execution
7. Total cost :- The total cost of the project and how to be financed, Return or revenue income
8. Establishment :- Provision made for work-charged establishment and its rate
9. Tools and plants :- Provision made in estimate to purchase construction plants etc.
10. Time of completion :

~~3) Mention the various subheads to be provided~~

3) Mention the various factors to be considered whi preparing the a road project estimates.

→ A road project should contain the following papers.

i) Abstract of cost
ii) Project report
iii) General report
iv) Reconnaissance survey work report
v) Roller statement
vi) Analysis of rate
vii) Earthwork estimate
viii) Land acquisition
ix) Turfing estimate
x) Water-way chart
xi) Abstract of activities per K.m.
xii) Abstract of cost
xiii) Bar chart
xiv) Diffrent maps, drawings and road sectio suitable intervals of the existing gro level and proposed formation level
xv) Detailed survey sheets

4) Factors to be considered in a irrigation drain project estimate

i) Project or general report
ii) Technical notes
iii) Benefit
iv) Gouge curve
v) Design calculation
vi) statement of
a) Flood damages
b) Flood damages and relief
c) Benifit cost ratio

vii) Report of estimate

viii) General abstract of cost

ix) Abstract cost of estimate

x) List of bridges to be constructed

xi) Calculation of earthwork

xii) Analysis of rates

xiii) Drawings

=) Factors to be considered for a small sewerage project estimate

i) Project report

ii) Design criteria

iii) Technical specification

iv) Design

v) Abstract of estimate

vi) Detailed design

vii) Detailed estimate of each unit

viii) Analysis of rate

ix) Drawings

6) Facters to be considered in Water supply project

1) Report :- It should contain the following sub
a) Introduction giving information about
b) Existing water supply
c) Past history of water supply project
d) scope of present project
e) zonal data
f) pupulation projection
g) Water demand
h) Source of supply and intake work
i) Treatment of water etc.

2) Estimates :- Estimates consists of following sub heads
a) Summary of estimates of capital cost
b) Summary of estimate of Annual operatio and Maintainance Expenditure

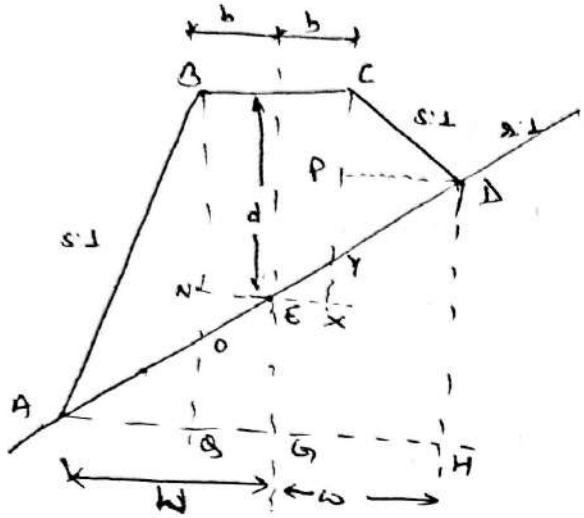
3) List of Important correspondences

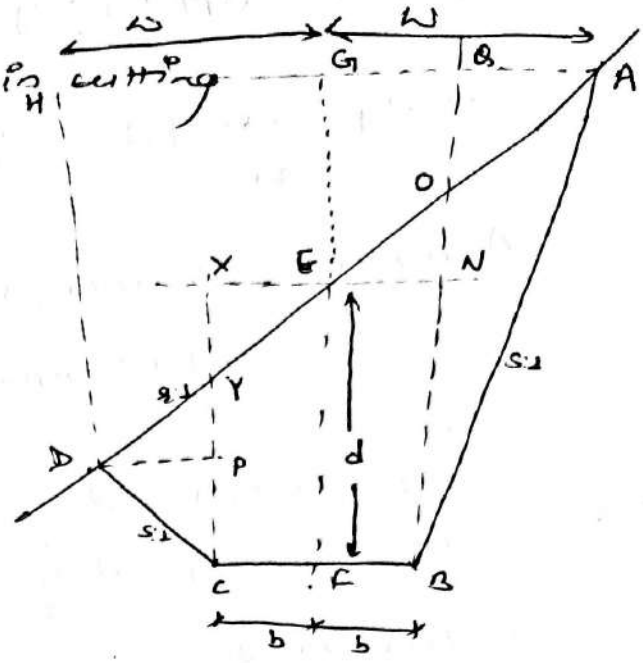
4) Drawings :- includs plan, contours, positio of Intake, storage reservoi

5) Salient features of the scheme ;- Thes contain following informations
a) Designed pabulation b) Area covered
c) Number of wards or villages included
d) Number of industries included
e) Number of distribution zone
f) Per capita water supply

Hill Road

① Fully in Banking or Fully in cutting





Transverse slope or cross slope of ground : r:1

Side slope of bank or of cutting = s:1

Height of bank or depth of cutting at centre = d.

Half formation width = b

$$OQ = \frac{AQ}{s_2}, \quad BQ = \frac{AQ}{s}, \quad ON = \frac{NE}{s} = \frac{b}{s_2}$$

So, $BQ = BN + ND + OQ$

$$\text{or } \frac{AQ}{s} = d + \frac{b}{s_2} + \frac{AQ}{s_2}$$

$$\text{or } AQ\left[\frac{1}{s} - \frac{1}{s_2}\right] = d + b/s_2$$

$$\text{or } AQ = \frac{s_2 s}{s_2 - s}\left(d + b/s_2\right) \quad \text{— ①}$$

Similarly,

$$XY = \frac{Ex}{s_2} = \frac{b}{s_2}; \quad CP = \frac{DP}{s}, \quad PY = \frac{DP}{s_2}$$

So, $CX = CP + PY + XY$

$$\text{or } d = \frac{DP}{s} + \frac{DP}{s_2} + \frac{b}{s_2}$$

$$\text{or } d - \frac{b}{2} = OP\left(\frac{1}{r} + \frac{1}{s}\right)$$

$$\Rightarrow OP = \frac{r*s}{r+s}\left(d - \frac{b}{2}\right) \quad \text{---} \quad (2)$$

Area ABCD = Area OBCY + Δ AOB + Δ CYD

$$= 2bd + \frac{1}{2} \times BO \times AG + \frac{1}{2} \times CY \times OP$$

where,

$$BO = BN + ON = d + \frac{b}{2}$$

$$CY = CX - XY = d - \frac{b}{2}$$

$\therefore$ Area ABCD

$$= 2bd + \left\{\frac{1}{2}\left(d + \frac{b}{2}\right) \times \frac{rs}{r-s}\left(d + \frac{b}{2}\right)\right\} + \left\{\frac{1}{2}\left(d - \frac{b}{2}\right) \times \frac{rs}{r+s}\left(d - \frac{b}{2}\right)\right\}$$

$$= \frac{sb^2 + r^2(2bd + sd^2)}{r^2 - s^2}$$

Side width (w) = AG + OG

$$= b + \frac{rs}{r-s}\left(d + \frac{b}{2}\right)$$

Side width (w) = EX + PD

$$= b + \frac{rs}{r+s}\left(d - \frac{b}{2}\right)$$

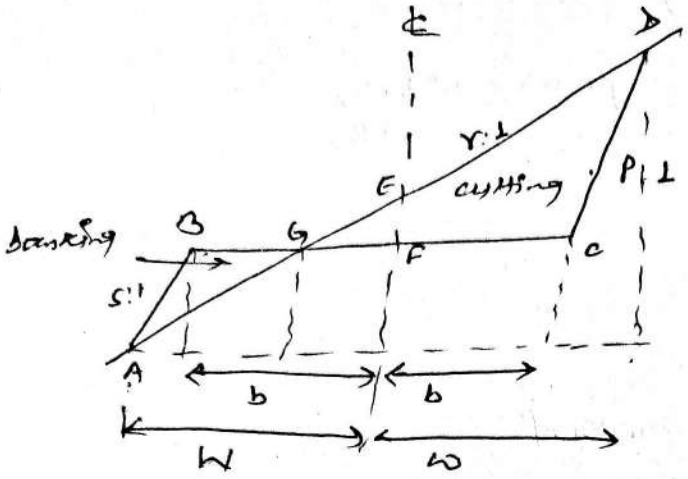
Side slope

$$AB = \frac{w-b}{s}\sqrt{s^2+1}, \quad CD = \frac{w-b}{s}\sqrt{s^2+1}$$

length

$$AE = \frac{w}{2}\sqrt{s^2+1}, \quad DE = \frac{w}{2}\sqrt{s^2+1}$$

case II Partly in Banking & Partly in cutting



Area of banking $ABG = \frac{1}{2} \frac{(b-rd)^2}{r-s}$

Area of cutting $DCG = \frac{1}{2} \frac{(b+rd)^2}{r-p}$

Side width:

$$W = \frac{(b-sd)}{r-s} * 2$$

$$W = \frac{(b+pd)}{r-p} * 2$$

Side slope →

$$AB = \frac{b-rd}{r-s}\sqrt{s^2+1}, \quad CD = \frac{b+rd}{r-p}\sqrt{p^2+1}$$

If G falls on the right side of centre E,

Then,

$$\text{Area } ABG = \frac{1}{2} * \frac{(b+rd)^2}{r-s}$$

$$\text{Area } DCG = \frac{1}{2} * \frac{(b-rd)^2}{r-p}$$

① for mid-sectional area method

final mean depth or height (d) = $\frac{d_1+d_2}{2}$

final mean harmonic slope (r) = $\frac{2 s_1 s_2}{s_1+s_2}$

$Q = A_m * L$

② Mean sectional area

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

③ Prismoidal formula method

$Q = (A_1+A_2+4A_m) * \frac{L}{6}$

Q→ Calculate the quantity of earthwork of a hill road in side long ground, for a length of 200m from 5 to 10 chainage, tangent of the angle of transverse slope of ground (tan θ) is equal to 0.2 although as measured by flat Traces. The length of chain is 20m. The formation width of the road is 7m and slope basic is 2:1. R.L. of ground and formation level at the centre of the road are as follows:-

chainage	Distance	RL of ground at centre	RL of formation at centre.
5	100m	200m	201.2m
6	120m	199.75m	201.8m
7	140m	200.5m	202.4m
8	160m	201.7m	203m
9	180m	202.4m	203.6m
10	200m	201.5m	204.2m

Solution

$B = 7.0m$, $b = \frac{7.35}{2} M$, $\tan\theta = 0.1 \Rightarrow \frac{V}{H} = \frac{1}{10} = \frac{1}{s}$

$s = 10$, $r = 10$, $n = 2$

Chainage	Ht of bank (m)	sectional area $= \frac{sb^2 + n^2(2bd + sd^2)}{s^2 - n^2}$ (m^2)	Mean sectional area (m^2)	Distance (m)	Quantity m^3	Remarks
5	1.2	$\frac{(2\times3.5\times1.2) + 1^2(2\times3.5\times1.2 + 2\times1.22)}{10^2 - 1^2}$ $= 12$	–	–	–	
6	2.05	23.96	17.98	20	359.6	
7	1.9	21.63	22.8	20	456	
8	1.3	13.26	17.45	20	349	
9	1.2	12	12.63	20	252.6	
10	2.7	35.13	23.57	20	471.4	
			Total		$= 1888.6\ m^3$	

Q→ A road is to be constructed in hill areas with formation widths of 10m in banking and 8m in cutting. side slope in banking is 2:1 and side slope in cutting is 1.5:1. The heights of filling or the depths of cutting at the centre of the road and the cross slope of the ground at interval of 30m are as given below. Calculate the quantities for the length of 210m.

chainage	depth of cutting	Height of banking	cross slope of ground
0m	60cm	—	10:1
30m	70cm	—	12:1
60m	50cm	—	15:1
90m	40cm	—	12:1

120m	—	70cm	10:1
150 m	—	60cm	15:1
180 m	—	80cm	12:1
210 m	—	90cm	10:1

Solution

As the road passes from cutting to banking in between chainage 90 m to 120 M and passes through zero.

$$\frac{x-90}{120-90} = \frac{0-(-0.4)}{0.7-(-0.4)}$$

$$x-90 = 10.91$$

$$\Rightarrow x = 100.91 \approx 101\ m$$

Mean harmonic cross slope of ground at zero point

$$r = \frac{2 r_1 \cdot r_2}{r_1 + r_2} = \frac{2*12*10}{12+10} = 11\% \text{ approx.}$$

At zero point one half of road will be in cutting and one half will be in banking, $d=0$, and formation width may be taken as 10m, i.e. $b=5m$

At $d=0$, sectional area of cutting $= \frac{1}{2} \frac{(b+nd)^2}{r-p}$

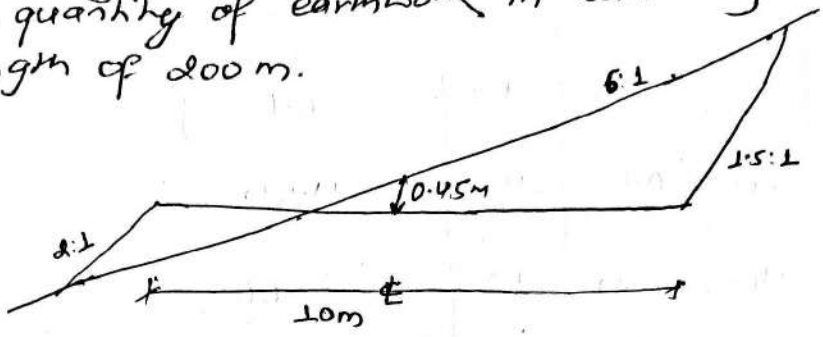
$$= \frac{1}{2} * \frac{b^2}{r-p} = \frac{1}{2} \times \frac{5^2}{(11-1.5)} = 1.3\ m^2$$

At $d=0$, " " " filling $= \frac{1}{2} * \frac{(b-nd)^2}{r-s}$

$$= \frac{1}{2} * \frac{b^2}{(r-s)} = \frac{1}{2} * \frac{5^2}{(11-2)} = 1.4\ m^2$$

CH	depth of filling or cutting m	cross slope of ground	Sec. Area = $\frac{sb^2 + r^2(2bd + sd^2)}{s^2 - s^2}$ m^2	Mean area m^2	Dist. m	Quantity	
						cutting m^3	filling m^3
0	-0.6	10	$\frac{1.5 \times 4^2 + 10^2(2 \times 4 \times 0.6 + 1.5 \times 0.6^2)}{10^2 - 1.5^2}$ = 5.71	-	-	-	-
30	-0.7	12	6.6	6.155	30	184.65	—
60	-0.5	15	4.54	5.57	30	167.1	—
90	-0.4	12	3.66.	4.1	30	123	—
101	0	11	cutting area = 1.3 filling area = 1.4	2.48	11	27.28	—
120	0.7	10	$\frac{2 \times 5^2 + 10^2(2 \times 5 \times 0.7 + 2 \times 0.7^2)}{10^2 - 2^2}$ = 8.83	5.115	19	—	97.19
150	0.6	15	7.07	7.95	30	—	238.5
180	0.8	12	9.9	8.485	30	—	254.55
210	0.9	10	11.58	10.74	30	—	322.2
				Total =		502.03	911.44 m^3

Q. A road is to be constructed in a side long round partly in cutting and partly in banking. The formation width of road is 10m, cross slope of ground is 6:1, side slopes in banking 2:1 & in cutting 1.5:1, depth at centre is 45cm although. Calculate the quantity of earthwork in banking and in cutting for a length of 200 m.



Solution

$b = \frac{10}{2} = 5m$

$d = 0.45m$

cutting slope $p = 1.5$

filling slope $s = 2$

For cutting

$$\text{Sectional area} = \frac{1}{2} * \frac{(b+rd)^2}{r-p} = \frac{1}{2} * \frac{(5+6\times0.45)^2}{6-1.5} = 6.59\ m^2$$

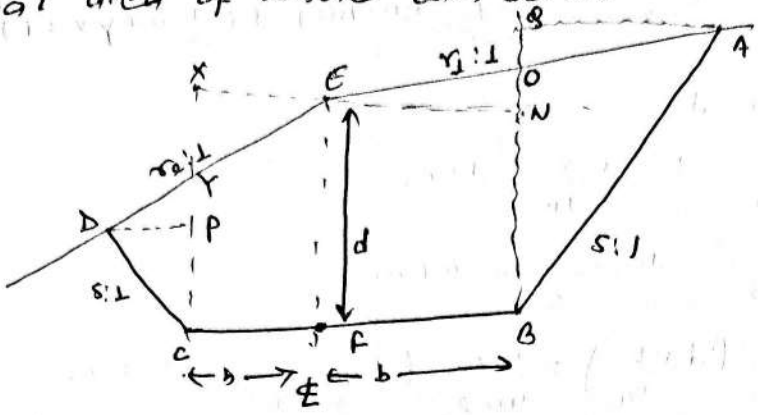
$$\text{Quantity} = 6.59 \times 200 = 1318\ m^3$$

For filling

$$\text{Sectional area} = \frac{1}{2} \times \frac{(b-rd)^2}{r-p} = \frac{1}{2} * \frac{(5-6\times0.45)^2}{6-2} = 0.66\ m^2$$

$$\text{Quantity} = 0.66 \times 200 = 132\ m^3$$

Case III :- The side long ground has different cross-slopes either side of the centre of the formation, r_1:1 on one side and r_2:1 on the other side, as shown in figure below. The sectional area of whole can be as



Sectional area = Area FBDE + Area FCYE + ΔABO + ΔDCY

$$= \left(\frac{FE+BO}{2} * b\right) + \left(\frac{FE+CY}{2} * b\right) + \left(\frac{1}{2} * BO * AQ\right) + \left(\frac{1}{2} * CY * DP\right)$$

$FE = d$

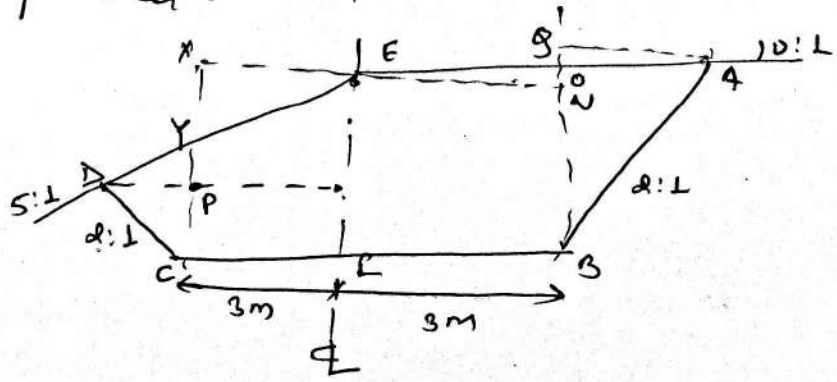
$BO = d + \frac{b}{2_1}$, $CY = d - \frac{b}{2_2}$

$AQ = \frac{r_1 S}{r_1 + S} * \left(d + \frac{b}{2_1}\right)$

$DP = \frac{r_2 \cdot S}{r_2 + S} \left(d - \frac{b}{2_2}\right)$

Q → The formation width of hill road is 6m, the road is passing on hill side having the average cross-section as below. Calculate the quantity of earthwork for 300m length of road.

Soln



Sectional Area

= Area FBDE + Area FEYC + Δ BDA + Δ CYB

$= \left(\frac{FE+OB}{2} \times b\right) + \left(\frac{FE+CY}{2} \times b\right) + \left(\frac{1}{2} \times BD \times AB\right) + \left(\frac{1}{2} \times CY \times DP\right)$

Here,

$EF = 1.2m = d$

$OB = d + \frac{b}{2_1} = 1.2 + \frac{3}{10} = 1.5m$

$CY = d - \frac{b}{2_2} = 1.2 - \frac{3}{5} = 0.6m$

$AB = \frac{r_1 s}{r_1 - s}\left(d + \frac{b}{2_1}\right) = \frac{10 \times 2}{10-2}\left(1.2 + \frac{3}{10}\right) = 3.75m$

$DP = \frac{r_2 s}{r_2 + s}\left(d - \frac{b}{2_2}\right) = \frac{5 \times 2}{5+2} \times 0.6 = 0.86$

Sectional area $= \left\{\frac{1.2+1.5}{2} \times 3\right\} + \left\{\frac{1.2+0.6}{2} \times 3\right\} + \left\{\frac{1}{2} * 1.5 \times 3.75\right\} + \left\{\frac{1}{2} \times 0.6 \times 0.86\right\}$

$= 9.82 m^2$

Quantity $= 9.82 * 300 = 2946 m^3$

Q. Work out the quantities of earth work in embankment and cutting for length of 360 m, from the following data

formation width of road = 12 m

side slope in embankment = 2:1

side slope in cutting = 1.5:1

Chainage(m)	0	30	60	90	120	150	180	210	240	270	300	330	360
RL of Ground	101	101.35	101.6	101.8	103	101.65	101.2	101.5	101.2	100.65	100.35	100.6	100.75
RL of formation			101.8						101.9				
Gradient	Rising gradient 1 in 200						Falling gradient 1 in 120						

Solution

Measurement sheet

sloping breadth of side slope $d\sqrt{s^2+1}$

Sn & Ch (m)	distance	depth	Mean depth	central area (bd)	Area of sides sd^2	Total area $bd+sd^2$	distance bet sn's	Earthwork in cutting	Earthwork in filling	Area of both side slopes $d\times(sd\sqrt{s^2+1})$ $(s^2>1)$
0	0	-0.5	x				~~30~~	—	—	
30	30	-0.7	-0.6	7.2	0.54	7.74	30	232.2		
60	60	-0.8	-0.75	9	0.84	9.84	30	295.2		
90	90	-0.85	-0.825	9.9	1.02	10.92	30	306		
120	120	-0.9	-0.875	10.5	1.15	11.65	30	449.5		
150	150	-0.4	-0.65	7.8	0.63	8.43	30	252.9		
170	170	0	-0.2	2.4	0.08	2.48	20	49		
180	180	0.2	+0.1	1.2	0.02	1.22	10		12.2	
210	210	0.65	0.425	5.1	0.36	5.46	30		163.8	
240	240	0.7	0.675	8.1	0.91	9.01	30		270.3	
270	270	1	0.85	10.2	1.44	11.64	30		34.2	
300	300	1.05	1.03	12.36	2.12	14.48	30		434.4	
330	330	0.55	0.65	7.8	0.85	8.65	30		259.5	
360	360	0.15	0.35	4.2	0.25	4.45	30		133.5	
							Total	1485.4	1622.2 m³	

$$\frac{x-150}{180-150} = \frac{0-(-0.4)}{0.2-(-0.4)} = \frac{0.4}{0.6}$$

$\Rightarrow x = 170$

9) To specify the equipments, tools and plants to be engaged for a work and thus enables to procure them beforehand etc.

13. Valuation

Valuation is the art of assessing the present fair value of the property (land, land and building, factory, Machine, Agricultural land, Jewellary etc). The value of property mainly depends upon its life, structure, supply & demand, location, rent etc.
It is done on basis of facts and figure.

Cost: It means original cost / construction cost / purchase cost of the property.

Value means present salable value of the property, it may be more or less than original cost of the property.

Purpose of Valuation

1. Buying and selling of the property.
2. Security of the loan (Mortgage)
3. Auction bid of the property.
4. Aquisition of the property. (for compensation)

⑤ Insurance of the property.

⑥ Determination of the rent of the property.
(6 to 10% of the value of property per yr)

⑦ Assessment of taxes (property tax, Gift tax etc)

⑧ partition of the property.

⑨ preparation of balance sheet of a firm or company.

Principles of valuation

Valuer must be expert in his profession. He should have the sound knowledge of planning, designing and construction works. He should also be aware of the town planning laws, rent restriction act, rate of interest etc.

following principles should be observed while evaluating fair and reasonable value of property

i) cost depends upon supply and demand of the property.

ii) cost depends upon the design & specifications of material used.

iii) cost depends upon its location.

iv) cost varies with the purpose for which valuation is to be done.

spot value = 0.05 crore / Annual.
Market value = 1.5 crore / A.
Broker value = 1.71 "

weightage	
10%	→ Rs 0.005 crore / Ann.
60%	→ 0.90 "
30%	→ 0.51 "
	Recommended value = Rs 1.451 crore / Annual.

v) Cost is affected by the age of the property & its physical condition. (maintenance)
vi) Vender must be willing to sell & also purchaser willing to purchase.
vii) present and future use of the property should be given due weightage in valuation.
viii) Cost analysis must be based on statistical data

factors affecting the value of property.

1) Climatic condition 2) increase in population.
3) supply and demand 4) purpose of purchase.
5) cost of construction. 6) Rate of interest
7) Security of Capital 8) location.
9) improvement of public scheme
10) Abnormal condition etc.

Value Clarification.

1) Book value 2) scrap value 3) salvage value
4) Distress " 5) Monopoly " 6) Assessed "
7) Speculative " 8) capitalised value etc.

1) Book value = original cost - depreciation till that year
used in balance sheet of a company.
2) Value of dismantled material after deduction of labour cost
→ may be sometime -ve value in case of framed structure building.
→ 5 to 10% of the value of property.

3) Value of property without dismalting. It is taken as 5 to 10% of value of property.

4) Distress value is always lower than market value due to a) financial difficulties b) insufficient knowledge

Capital Value= Net rent/ Income * year of purchase

year of purchase = 1/ interest rate

Capitalized value * interest rate = Net income

70000 = 7000 *YP
YP= 70000/7000= 10 yrs
YP= 1/ interest rate = 1/0.1= 10

Gross= 10000
Net= Gross - outging
=10000-3000
=7000

3) Capitalized value = net rent x year's purchase

net rent = Gross rent - outgoing (expenses)

(taxes, Repair, insurance, loss of rent, sinking fund etc)

interest rate that the capital assest must earn

Amount deduced from your account .

year's purchase = $\frac{100}{i}$ (for indefinite period)

i = highest prevailing rate of Interest.

year's purchase = $\frac{1}{i_p + i_c}$ (fo

i_p = highest prevailing rat

(A/F,i%,N) = coefficent of sinking fund = ic = i / [(1+i)^N -1]

F= [A (1+i)^N -1] / i

A= (F *i) / [(1+i)^N -1]

i_c = coefficient of sinking fund.

$$i_c = \frac{i}{(i+1)^N - 1}$$

i = rate of interest for sinking fund in decimal.

N = life of structure

Sinking fund: accumulation of fund for reconstruction of building or replace.

nnual sinking fund = $s \times i_c$

s = total sinking fund to be deposited (= (i = scrap or salvage value)

Method of calculating depreciation.

1) SL line method.

annual dep (Da) = Original cost − scrap / salvage value / life of structure in yr.

$= \frac{C-S}{n} = \frac{(100-10)C}{60} = 1.5\%$ of C per year

2) Constant percentage rate of dep

$$p = 1 - \left(\frac{S}{C}\right)^{1/n}$$

3) Sinking fund of dep.

Annual sinking fund $= \frac{i * S_o}{(i+1)^x - 1}$ ——— (1)

where x = life of structure in yr.

An amount of Rs 1 per annum in 'n' years

$= \frac{(i+1)^n - 1}{i}$ ——— (2)

The product of two eqn is & 2 gives the rate of dep.

As ={ (I-S) *i} / [(1+i)^N -1]

Dn =As*{(1+i)^n -1 } / i

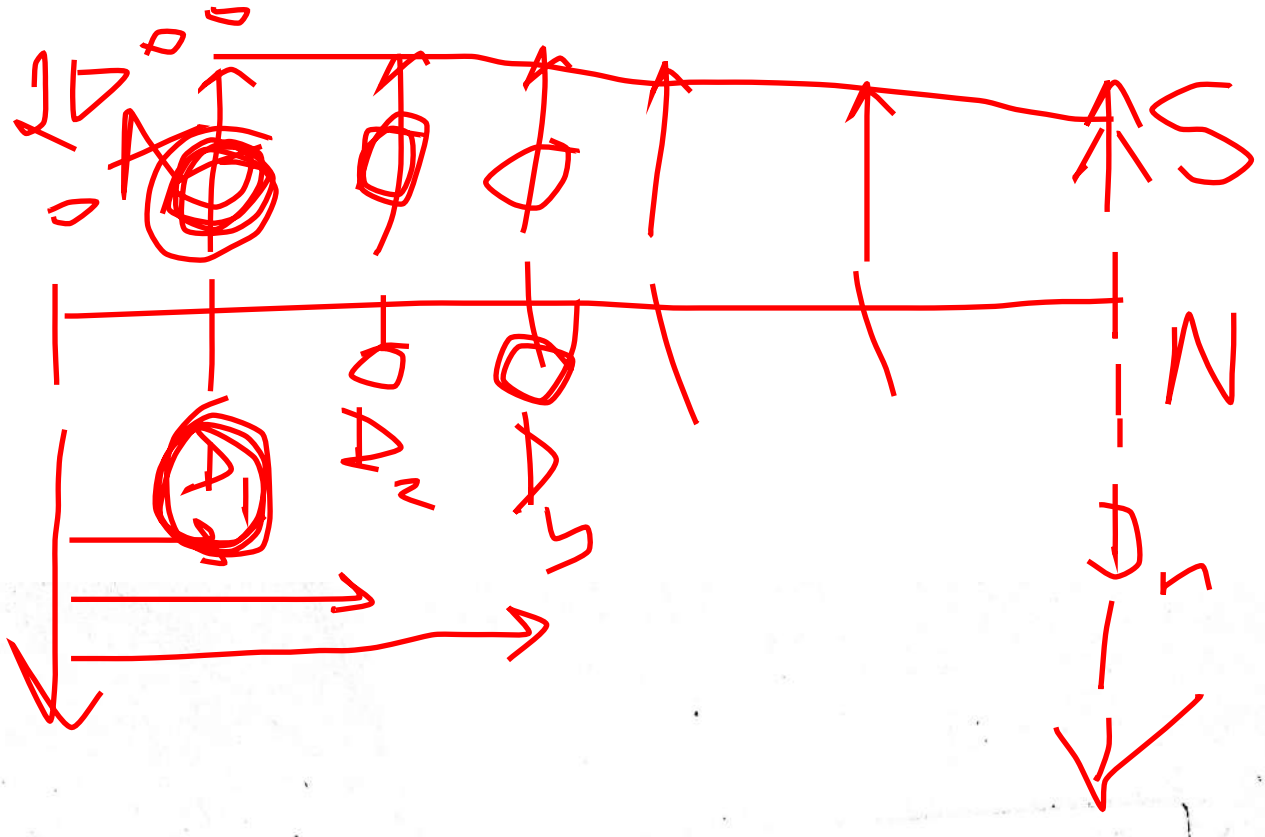
equating this
Dn ={ (I-S) *i} / [(1+i)^N -1]*{(1+i)^n -1 } / i

Dn= (I-S) [{(1+i)^n -1 }/{(1+i)^N -1}]

BVn= I - Dn

As= Sinking fund annuity (here theory is that amount depreciated per annum is equal to that is sinking fund collected i.e. sinking fund annuity)

I= Initial investment
S= Salvage value
i = rate of return
N= Total life of an assets
n= depreciated life
Dn= Total depreciation to year n
BVn= Book value for year n



Qualification of good valuer.

① Planning, designing and construction works.

② Estimating and costing.

③ Surveying and levelling.

④ law of easement

⑤ law of contract.

⑥ Rate of interest.

⑦ market value of land.

⑧ Building by laws of locality

⑨ Vastu.

10) Report writing etc.

Various method of valuation.

① cost based method of valuation → most accurate.

② depreciation " " "

③ plinth area " " "

Rental Method
Income based Method
Land Developmend Method
Direct Comperision Method

TDB1= D1=A
TDB2= D1(1+i)^1+D2= A(1+i)^1+A
TDB3=D1(1+i)^3+D2(1+i)^1+D3

F=TDBn=A * [(1+i)^n -1] / i

Value of property = Depreciated value of building + Value of land.

Depreciated value of bldg (D) = $P\left(\frac{1 - rd}{100}\right)^n$

P = cost of bldg at present market rate

rd = fixed rate of dep.

n = Age of bldg in year.

life of structure (yrs)	value of rd.
100	1.05
75	1.30
50	2.00
25	4.00
20	5.00

Decling Balance Method
Depreciation percentage per year (r) = 1 / N

Where
N = estimated life of building

For double decling balance method
r= (1/N) *2

P = plinth area / built up area * Prevailing plinth area rate / m^2

Value of property = total plinth / built up area in m^2 * prevailing plinth area rate per m^2 - total dep. + value of land.

Value of property = capitalised value.

Capitalised value = net rent * year's purchase

net rent = Gross rent - total outgoing's (expenses)

value of property ∝ rent

$$\text{year's purchase} = \frac{1}{i_p + i_c}$$

i_p = highest prevailing rate of interest in decimal.

i_c = Coefficient of sinking fund $= \frac{i}{(i+1)^n - 1}$

i = rate of interest for sinking fund in decimal

n = life of building.

profit based ⇒ used in hotel, commercial complex, cinema hall etc

free hold ⇒ gift दिले
lease hold ⇒ lease. घेतले.

A freehold property consisting of a house having a total plinth area of 300 m^2 was constructed 20 yrs ago is proposed to be purchased by Mr 'x' for his use. The rate of construction for similar type of bldg is Rs 25000.00 per m^2, the total area of land is 900 m^2 & cost of land in that area is Rs 1000.00 per m^2. Assume life of bldg is 75 yrs & scrap value is 10%. Advise Mr 'A' as to at what cost he should purchased the property?

depreciation method:

value of property = depreciated value of bldg + value of land.

$P = 300\ m^2 \times 25000 = 75,00000$

life of building = 75 yrs rd = 1.3

$n = 20$ yrs.

$D = P\left(1 - \frac{rd}{100}\right)^n = Rs.\ 7500000\left(1 - \frac{1.3}{100}\right)^{20}$

D = amound after depreciation.

value of property = + 900 m^2 @ Rs 1000.00/m^2

= Rs 6673037.00

plinth area ~~of~~ method.

Value of property = total plinth area * prevailing plinth area rate - total dep + value of land

$= 300 m^2 \times 25000/m^2 - \frac{100-10}{75} \times 20 \times 7500000 + 900 \times 1000$

$= 66,00,000.000$

Security of loan → mortgage

Q) A RCC frame structure 8 storied bldg having cubic content $1400 m^3$ was constructed 15 yrs ago on a freehold land measuring $1100 m^2$. The building fetches a rent of Rs 14000/month what amount will you recommend for advancing a loan to the owner against the mortgage, if the rate of land is Rs 500.00 per m^2 in that area Insurance premium Rs 900.00 per annum.

Repair and maintenance 8% of gross rent

Mgmt and collection charges 8% of gross rent.

Taxes (property & municipal taxes) 30% " "

Assume the future life to be 60 yrs, Rate of interest as 8% & for redemption of capital 5%.

(Rebuildings)

Value of property = Capitalised value of bldg + value of land.

capitalized value = net rent * year's purchase

net rent = Gross rent - total outings.

Gross rent = 14000 /month * 12 = Rs 168000.00 per yr

Outgoings

i) Insurance premium = Rs 900.00/ per annum

ii) Mgnt & collection = $\frac{8}{100} \times 168000$ = Rs 13440.00 per yr

iii) Repair & maintenance = $\frac{8}{100} \times 168000$ = Rs 13440.00 per yr

iv) taxes. = $\frac{30}{100} \times 168000$ = Rs 50,400.00 per yr

total outgoings = Rs 78180.00 per yr.

Net Rent = 168000 - 78180 = Rs 89,820.00

year's purchase = $\frac{1}{i_p + i_c} = \frac{1}{0.08 + 0.0028} = 12.07$

$i_c = \frac{i}{(1+i)^N - 1} = \frac{0.05}{1.05^{60} - 1}$

Capitalized value of propery

= 89820 * 12.07 + 1100 m^2 x Rs 500 /m^2

= Rs 1635026.00 → Market value ✓

Value of Cinema hall = Value of land + Value of hall
Value of land =1200000
Value of hall = Capitalized value =(Net Income or Net Revenue Net Profit) * Year of Purchase

Net Income = Gross Income - Outgoing

GR =750000

Outgoing
a= Operation cost= 30% GR= 0.3*750000=225000
b=Repair and maintenance of machinary = 5% of 950000=0.05*950000=47500
c. Sinking fund (As)=(F *i) / { (1+i) ^N -1}

F= 100%*950000- 10%*950000= 90% *950000= 855000

As =(855000*0.04) /{ (1+0.04)^25 -1}
As =20530
d=Insurance =10000
e= Repair of hall = 2% of GR= 0.02*750000= 15000

Total outgoing =318030

Net Income=431969

Year of Purchase= 1/(ip +ic)
ip= 8%=0.08
ic=????????
i= 4%=0.04
ic= i / { (1+i) ^N -1} = 0.04/{ (1+0.04)^25 -1} = 0.0042

YP= 1/(0.08+0.0042) = 11.87 years

Value of hall= Net income * YP
=431969*11.87= 5127483.9

Total value of Cinema hall=1200000+5127483.9 =6327483.9

c) Repair of machinary. $= \frac{5}{100} \times 950,000 = Rs\ 47500.00$

d) Annual sinking fund $= S * i_c$

$= \frac{90}{100} \times 950,000 * \frac{i}{(i+1)^n - 1} = 855000 * \frac{0.04}{1.04^{25} - 1}$

$= Rs\ 20530.00$

d) Insurance premium $= Rs\ 10,000.00$

e) Repair of hall $= \frac{2}{100} \times 750,000 = Rs\ 15000.00$

total expenses $= Rs\ 318030.00$

Net income $= 750,000 - 318030 = Rs\ 431970.00$

year's purchase $= \frac{1}{i_p + i_c} = \frac{1}{0.08 + i_c} = \frac{1}{0.087} = 11.87$

$i_c = \frac{i}{(i+1)^n - 1} = \frac{0.04}{1.04^{60} - 1}$

Value of Cinemahall $= 431970 * 11.87 + 12,00000$

$= Rs.$

A town planning authority has to acquire an area of $350,000 m^2$ for the development of new colony. After developing the area it is proposed to be sold at Rs 45.00 per m^2. Work out the maximum

Gross Income of Colony Developer = Sellable area * Rate per unit area

Total area of acquisition = 350000 m2
area for park, road and public space= 40% of total area
=0.4*350000=140000m2 (this area is loss for the colony developer)

Total sellable area= 350000-140000= 210000 m2
selling rate per m2= Rs. 45 per m2

Gross income of developer = 210000*45= Rs 94,50,000

Outgoing
a. Authority establishment = 15% of 9450000= 0.15*9450000= Rs 14,17,500
b. Colony improvement expenditure = 350000*7 = Rs 24,50,000
c. Engineers Fee = 4% of 94,50,000 = Rs 3,78,000

Total Outgoing = Rs 42,45,500

Net profit to colony developer = 94,50,000 - 42,45,500 = Rs 52,04,500= the maximum money that the colony developer can give to the land owner.

Compensation (<=) Rs 52,04,500 for the area of 3,50,000 m2
Compensation per m2 (<=) Rs 14.87 per m2

iii) Engineer's fee $= \frac{4}{100} \times 9450000 =$ Rs _____

total expenses = Rs 4245500

Maximum price of underdeveloped land =

Rs 9450000 − 4245500

= Rs 5204500

The max^m posible compensation which can be given to land owners $= \frac{\text{Rs } 5204500}{350000\ m^2} = 14.87$ per m^2

Compensation rate for the aquasition less than equal to (<=) Rs 14.87 per m2

SPECIFICATION

Specification: Statement of a particular item can be defined as the written instruction limiting and describing in detail various work to be undertaken.

Specification can be defined as the properties of material for the building construction which will make the building of I, II, III class, category.

Specification describes the construction to be done, the quality of materials and workmanship to be used, method of construction to be adopted, tools and plants, equipment to be used, method of testing, inspection etc.

Specification is statement giving clear and concise description of the materials, labours to be employed in the execution of any project and methods, precaution etc required therefore.

1.2 purpose of Specification.

A contract document between the owner & the contractor limiting and describing their responsibilities.

Contract document consist of ① BOQ ② specification ③ form of securities ④ Bid bond 10.5% of ⑤ performance bond. (5% of contract amount)
(Banker's)

e) mobilization advanced security
(10% tender amount)

tender (form contract bid etc)

① tender notice ⑤ Instruction to tenderer
② form of bid
③ form of agreement
④ form of qualification information
⑥ condition of contract — General
Special.
⑦ drawings

B) Guide to the bidder / tenderers at the time of tendering to quote reasonable rates
c) Guide to site engineer in the execution of the project
D) Guide to the manufacturing agencies for preparing their products
(Quality of material are detail describe)

12.2. Types of specifications

① General specification (Brief specification)
② Detailed specifications.

① gives general idea of the whole work and on so case gives the general description of the quality of materials, workmanship etc. while

electrical provisions.

a. for material following details are given
→ Chemical composition of the material.
→ physical properties " " "
→ precaution during storage, handling, construction
→ method of performing various tests.

b. for control of workmanship
detail regarding
1) The method of construction of each item of work.
2) detail regadding the protection of the finished work as well as adjacent properties
3) details of the desired quality of product in keeping view with the practical limit of tolerance.

B) Specification for / preparation

Specification writing.
1) Specific language (IS, BS etc), code of practices
2) Brevity (Brief) → refer to national & international standards
3) fairness: (Standard practices, fair to all parties)
4) Inclusion of item (non item is missed, all item effectiv
5) standard sizes and pattern.
6) Inapplicable texts → delete inapplicable mate
7) Repitition of informations → should be avoided.
8) Specification should be prescribed the desired quality of materials, strength etc.

designing a structure, the designer gives the general specification of each item of work.
(cost estimate. [illegible] ieep [illegible])

" ⓐ detailed estimat specification: These specification form a part of contract document and gives the detailed information regarding the quality of material, workmanship etc.

Detailed specification.

a) General provision
- general conditions of the project/contract
- whole project
- जो applicable.
- W/S for construction & drinking purpose.
- Electric supply for construction site & office
- signboard.
- site office
- laboratory

b) technical provision (in detail)
- final result of item of work.
- how to test, inspection should be mentioned.

types of technical provision:
- a. specification for material & workmanship.
- b. specification for performance.
- c. specification for proprietory commodities.

About the standarized item plywood. (manufacturers ले specify. जस्तो material use गर्ने)

c) standard specification.
- NS, IS, BS code of practices NBC of Nepal. etc

B) Combination of material. 1 part cement : 4 part sand

i) proportion / measurement: by wt. if less than $1m^3$ then not necessary of volume analysis.

ii) Mixing [Machine → cement / sand be mixed in mechanical mixture Drum is rotated at least 2 min.
hand. ↓

shall be permitted

If volume < $1m^3$.

water tight and sufficient

Atleast three times turn in dry condition & 3 times after adding water

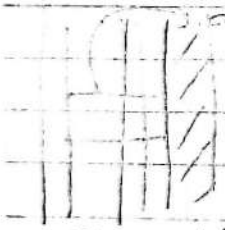
→ by Hose

c) preliminary.

i) Wetting the brick :- soaked at water atleast 24hrs before use

ii) Scaffolding : sufficiently strong, carries all loads, shall be [double ⇒ clear face brickwall / single ⇒ for plaster

wall shall be plastered ⇐



iii) Old work: cleaned, soaked at water and use cement

...@hotmail

(g) specific in paragraph.
i) specific for materials.
ii) combination of materials.
iii) preliminary work prior to laying / construction / installation
iv) Laying / construction / installation
v) Test if any.
vi) Clearing on completion
vii) schedule if any.
viii) Mode of measurement.

for example.

Write down detailed specification for Brickwork in 1:4 cement mortar.

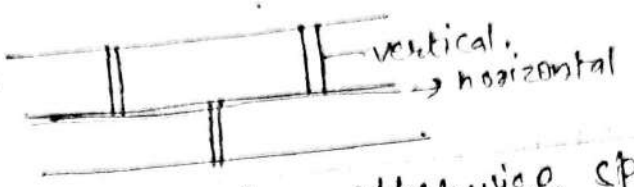
i) brick: shall conform to the standard laid in NS 01-2035
ii) Cement: Unless otherwise specified OPC shall be used. The OPC shall conform to the standard laid in NS 49 - 2041
iii) Sand. Sand shall be river or pit. It shall be well graded, free from mica, clay / silt ≯ 5%
Sand shall be washed before use.

(cting cost of work should be included)

materials)

Sand shall conform to the standard laid in IS 383-1952.

iv) Water: portable water shall be used for mixing and curing.



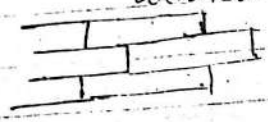
(iii) Laying

i) laying : frog ⇒ upward, unless otherwise specified. English bond shall be used. (strongest bond) Brickwork shall be true to line, level plumb.

ii) Joint [horizontal joint → truely horizontal.
vertical " " vertical.

iii) Uniform raising : Thickness of joint < 12mm.
wall shall be raised uniformly.

toothed joint



A) fair faced brick : Brick shall be of uniform colour scaffolding shall be double.

iv) test : test shall be conformed to standard laid in IS1-2035

Clearing on completion

i) protection : Heat, cold, Rain
↓ ↓
>38°C <4.5°C
specification prefered.

ii) curing ⇒ 14 days.

scheduling: —— x

mode of measurement: measurement shall be taken as NS 989 - 2054

Importance of specification (explain)

1) Tender / contract agreement without specification is incomplete, baseless and invalid.

2) Any changes in the specification changes the tendered rates.

3) In the event of conflict between the specification & the drawings, the specification shall govern.

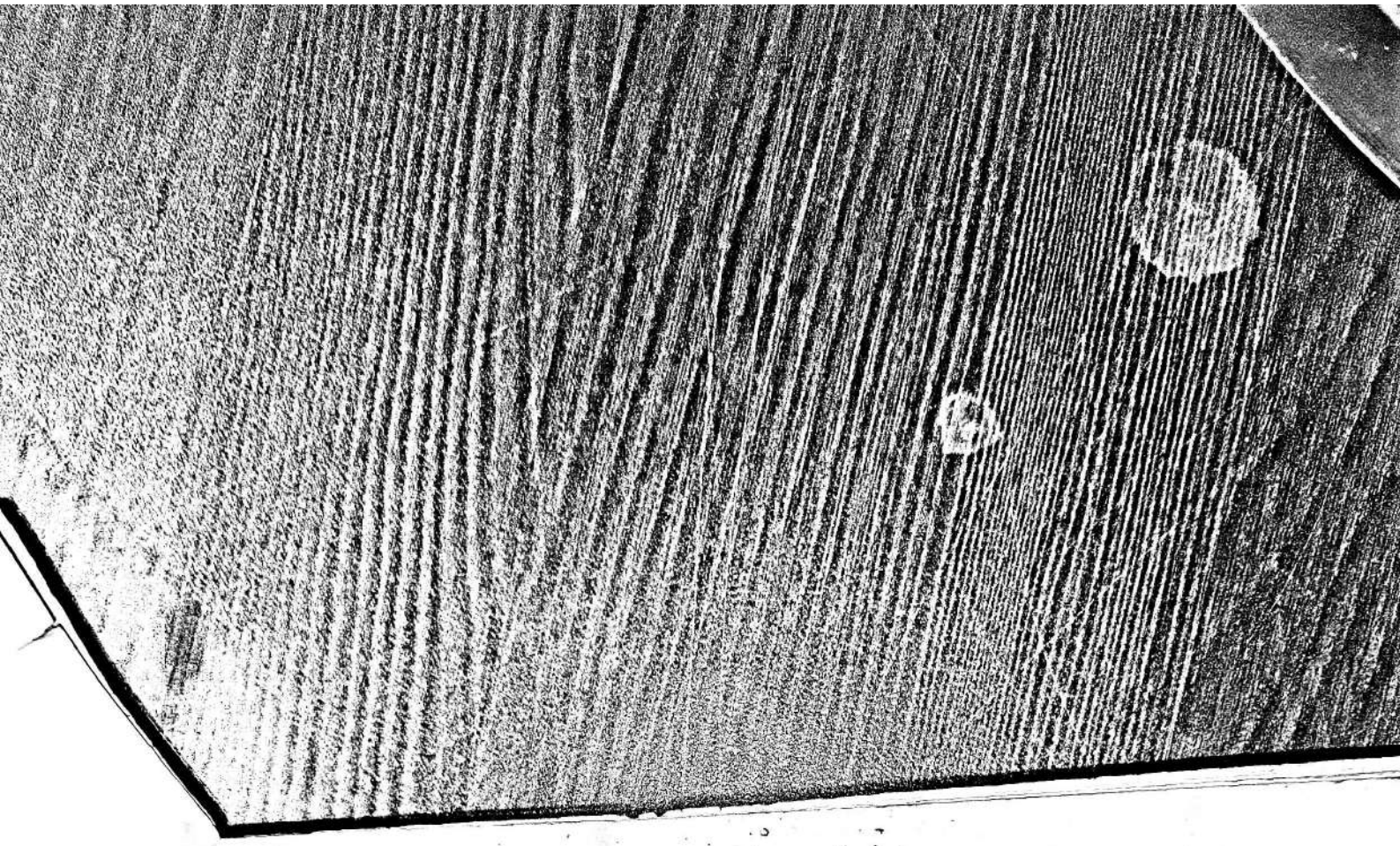
4) Specification is an essential contract document and is required for court cases or Arbitration.

5) Serve as a guide to the supervision.

6) To procure the materials required for a project as well as the owner can check the quality of materials confirming the specification, avoiding dispute with the contractor.

7) The cost of an unit quantity of work is governed by its specification.

8) To verify and check the strength of materials for a work involved in a project.



9) To specify the equipments, tools and plants to be engaged for a work and thus enabled to procure them beforehand etc.

13. Valuation

Valuation is the art of assessing the present fair value of the property (land, land and building, factory, Machine, Agricultural land, Jewellary etc). The value of property mainly depends upon its life, structure,