



Estimating, Costing & Valuation

Detailed notes + compact revision summary

Contents

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The notes are prepared for exam revision. Always check design values against the current IS codes before using them in real work.

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CHAPTER 01

Estimates — Types, Approvals and Areas

Purpose and data of estimates, approximate and detailed estimates, other types, AA/TS procedure and building area definitions.

1.1 Estimate — meaning, purpose and data required

An **estimate** is a computation of the probable cost of a work, made before construction, from drawings and specifications. It is only an approximation; the **actual cost** is known only after the work is finished and all accounts are closed. **Estimating** finds the quantities and cost; **costing** fixes the rates and keeps the cost of the work under control during execution.

- **Purposes:** to know the probable cost and seek sanction/funds; to invite tenders (schedule of quantities); to plan materials, labour and equipment; to judge whether the project is worth building (feasibility); to control expenditure and value the property.
- **Data required:** (i) drawings — plan, elevation, sections and details with dimensions; (ii) specifications — general and detailed, which fix quality and workmanship; (iii) rates — from the Schedule of Rates (SOR/DSR) or by rate analysis, for materials, labour, carriage and plant.
- Quantities are written item-wise in the **measurement form**; costs are worked out in the **abstract of cost** (quantity × rate = amount).
- A detailed estimate is usually accompanied by a **report** (need, site, design basis, sources of materials), **specifications**, **design calculations**, **drawings**, **rate analysis** of non-schedule items and a **site plan**.

1.2 Approximate (preliminary) estimates

A **preliminary**, **approximate** or **rough-cost estimate** is prepared quickly from the cost of similar works, to obtain **administrative approval** and to decide the financial feasibility. No detailed drawings are needed — only the size, type and use of the structure.

Methods of approximate estimate

Method	Basis	Cost formula / use
Plinth area method	Plinth area of building (m ²)	Cost = plinth area × plinth area rate (from recent similar buildings)
Cube rate (cubical content) method	Volume of building (m ³)	Cost = plinth area × height × cube rate; more accurate for tall storeys
Service unit (unit base) method	One unit of service	Per bed (hospital), per student (school/hostel), per seat (cinema), per km (road), per litre (tank)
Typical bay method	Cost of one bay	Cost = cost of one typical bay × number of bays (sheds, godowns, factories)
Approximate quantity method	Running metre of wall	Foundation + superstructure cost per running metre of wall × total wall length
Comparison method	A similar completed work	Cost adjusted for size, specification and cost index

Plinth area estimate

$$\text{Cost} = A_p \times R_p$$

A_p = plinth area (m²); R_p = plinth area rate (Rs./m²)

Add % for water supply, sanitary and electrical installations, then contingencies

Cube rate estimate

$$\text{Cost} = \sum (A_p \times h) \times R_c$$

h = storey height from floor to top of roof (m); R_c = cube rate (Rs./m³)

Foundation, plinth and parapet are usually not counted in the cube

Worked example — Plinth area estimate

A residential building has a plinth area of 120 m². The plinth area rate is Rs. 22,000/m². Add 8 % for water supply & sanitary installations, 12 % for electrical installations and 3 % contingencies. Find the approximate cost.

1. Basic cost = $120 \times 22,000 = \text{Rs. } 26,40,000$
2. WS & SI = $0.08 \times 26,40,000 = \text{Rs. } 2,11,200$; EI = $0.12 \times 26,40,000 = \text{Rs. } 3,16,800$
3. Sub-total = $26,40,000 + 2,11,200 + 3,16,800 = \text{Rs. } 31,68,000$
4. Contingencies = $0.03 \times 31,68,000 = \text{Rs. } 95,040$

Answer: Approximate cost $\approx$ Rs. 32,63,040 (say Rs. 32.63 lakh)

Worked example — Cube rate and service unit

(a) A two-storey building has 120 m² plinth area per floor and storey height 3.2 m; cube rate Rs. 7,500/m³. (b) A hostel for 200 students at Rs. 1.5 lakh per student.

1. (a) Cubical content = $2 \times 120 \times 3.2 = 768 \text{ m}^3$; cost = $768 \times 7,500 = \text{Rs. } 57,60,000$
2. (b) Cost = $200 \times 1,50,000 = \text{Rs. } 3,00,00,000$

Answer: (a) Rs. 57.6 lakh; (b) Rs. 3.0 crore

Exam tip: The plinth area method is the one most used by PWDs for buildings (CPWD publishes **Plinth Area Rates** along with a cost index). Service-unit costs are used for hospitals (per bed), schools (per student) and roads (per km).

1.3 Detailed estimate and its add-ons

A **detailed estimate** is prepared from complete working drawings. Each item of work is measured separately and costed at the sanctioned rate; it is the basis for **technical sanction** and for the tender **schedule of quantities (BOQ)**. It is prepared in two stages: **details of measurement and calculation of quantities** (measurement sheet), and the **abstract of estimated cost**.

Typical measurement sheet (details of measurement)

Item no.	Description	No.	L × B × H (m)	Quantity	Remarks
1	Earthwork in excavation in foundation	1	19.20 × 0.90 × 1.00	17.28 m ³	CL length
2	PCC 1:4:8 in foundation bed	1	19.20 × 0.90 × 0.30	5.18 m ³	—

Items added to the abstract of a detailed estimate

Item	Usual provision	Purpose
Contingencies	3–5 % of estimated cost	Petty unforeseen items and minor price changes not covered by any item
Work-charged establishment (WCE)	1.5–2 %	Wages of temporary staff (work munshi, chowkidar, work assistant) employed for the work and paid from it
Tools & plant (T&P)	Lump sum or small %	Departmental tools and plant hired/used for the work
Water supply & sanitary, electrical installations	% of building cost or detailed separately	Services estimated as separate sub-heads
Centage (departmental charges)	% fixed by Government	Charged on deposit works to recover establishment, T&P and audit costs
Prime cost (PC) and provisional sums	Lump sums	Specialist articles (fittings, lifts) and work not yet detailed

- **Prime cost (PC) item:** a specified article (e.g. sanitary fittings) for which a fixed sum is included; the contractor is paid actual cost plus agreed profit.

- **Provisional sum:** an amount for work that cannot be detailed at the time of estimate (e.g. special flooring yet to be decided).
- **Lump-sum items:** small items not worth measuring (e.g. site clearance, petty works) included as a lump sum.
- **Day work:** work paid on actual labour and materials, used when an item cannot be measured.

Exam trap: Contingencies are for **unforeseen** small items — not for planned items left out. A large omission needs a **supplementary estimate**, not the contingency provision.

1.4 Other types of estimates

Types of estimates

Type	When prepared	Key point
Revised estimate	Sanctioned estimate likely to be exceeded by more than 5 % (rates or quantities changed), or expenditure beyond sanction	Fresh detailed estimate; comparative statement of original vs revised with reasons; needs fresh sanction
Supplementary estimate	Additional work found necessary during execution (not covered by original)	Prepared for the additional work only; original amount + supplementary shown together
Annual repair (maintenance) estimate	Every year to keep a structure in proper condition	Whitewashing, painting, minor repairs; about 1–1.5 % of capital cost for buildings
Special repair estimate	Major repair or renewal not covered by annual repair	E.g. re-roofing, re-plastering, replacing floor
Complete (project) estimate	For the whole project	Includes land, buildings, roads, services, compound wall, establishment, contingencies — the total outlay

Worked example — Need for revised estimate

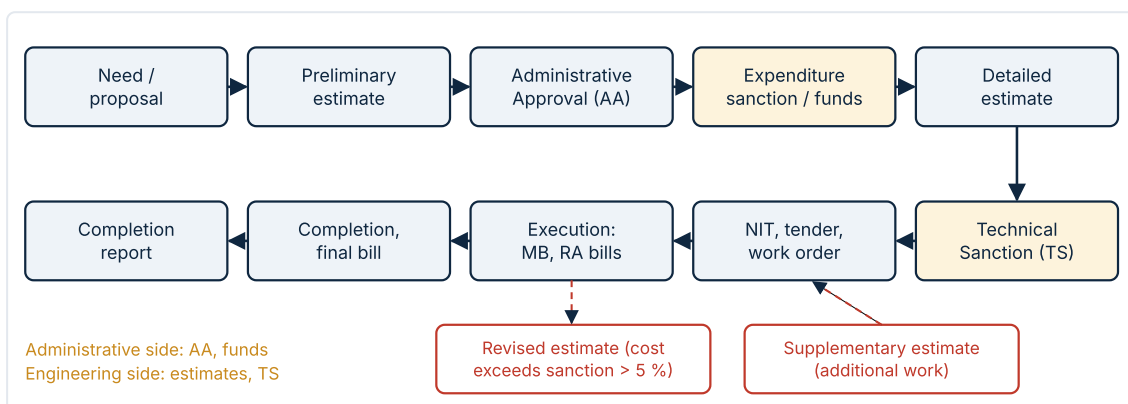
A work was sanctioned for Rs. 50.0 lakh. Due to rise in rates the expenditure is expected to be Rs. 53.5 lakh. Is a revised estimate required?

1. Excess = $53.5 - 50.0 = \text{Rs. } 3.5 \text{ lakh}$
2. Percentage excess = $3.5/50.0 \times 100 = 7 \%$

Answer: $7 \% > 5 \% \rightarrow$ a revised estimate and fresh sanction are required

Remember: The 5 % limit is the conventional rule asked in exams; departmental manuals may fix different limits for AA and TS. Always quote the rule of the department concerned in practice.

1.5 Administrative approval, technical sanction and budget



Sequence of estimate, approvals and execution of a public work

CHAPTER 06

RCC Work and Bar Bending Schedule

How reinforcement is scheduled and weighed: BBS format, cover, hooks, bends, cranks, cutting lengths, laps and development length, with worked BBS for a slab and a beam and the volume of a sloped footing.

6.1 Bar bending schedule — purpose and format

A **bar bending schedule (BBS)** lists every bar of an RCC member with its mark, diameter, shape, number and **cutting length**, and converts the total length of each diameter into weight. It is used for estimating and billing steel (paid in kg), for ordering bars by diameter, and by the bar bender at site for cutting and bending.

- **Columns of a BBS:** member/location, bar mark, diameter, shape sketch with dimensions, number of members × bars per member, cutting length, total length, and weight ($\Sigma \text{length} \times d^2/162$).
- Cutting length is the length of the **centre line** of the bar; drawing dimensions are usually **out-to-out**, so a correction is made at every bend.
- Weights are summed diameter-wise; a small allowance for wastage (rolling margin, cut pieces) is added in purchase but not in measurement for payment.
- Steel is paid on the calculated weight from the BBS or on actual weighed weight as the contract says; laps, chairs and spacer bars are paid only if shown or approved.

Exam tip: BBS questions in exams almost always ask: number of bars ($= \text{length} \div \text{spacing} + 1$), cutting length (with crank/hook/bend corrections) and weight ($\text{length} \times d^2/162$).

6.2 Cover, hooks, bends and cranks

Bars stop short of the concrete faces by the **nominal cover** (IS 456 cl. 26.4). The cover is to the outermost steel (stirrups/ties). Bends and hooks change the length of bar needed, and cranked (bent-up) bars need extra length for the inclined portion.

- **Nominal cover (IS 456 Table 16):** mild 20 mm, moderate 30 mm, severe 45 mm, very severe 50 mm, extreme 75 mm.
- For mild exposure, cover may be reduced by 5 mm for main bars up to 12 mm.
- Columns: longitudinal bars not less than 40 mm cover (or bar diameter); footings minimum 50 mm.
- Anchorage value (IS 456 cl. 26.2.2.1): standard U-hook = **16d**; bend = **4d for each 45°**, maximum 16d. Deformed bars may be used without hooks if the development length is satisfied.

Site convention for bend deduction (out-to-out dimensions) — varies slightly between offices

Bend angle	Deduction per bend	Hook allowance (added)
45°	1d	—
90°	2d	—
135°	3d	10d per 135° hook (stirrups/ties)
180°	4d	9d per standard hook (mild steel)

Extra length for a 45° crank

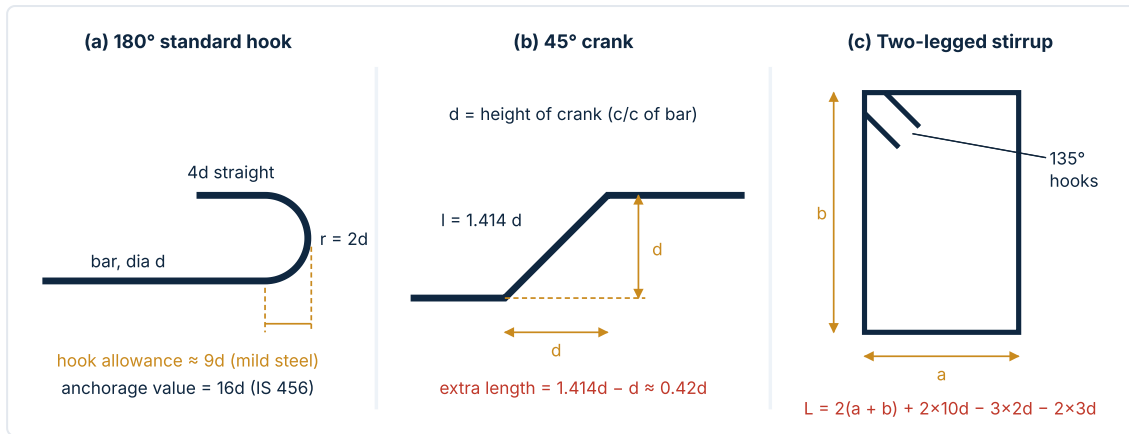
$$\Delta L = \frac{d}{\sin 45^\circ} - \frac{d}{\tan 45^\circ} = 0.414d \approx 0.42d$$

d = height of crank (centre-to-centre of bar at top and bottom)

Crank height in a slab

$$d = D - 2c - \phi$$

D = slab depth, c = clear cover top/bottom, ϕ = bar dia



Hook allowance, crank geometry and a two-legged stirrup with 135° hooks

Code value: IS 13920:2016 (ductile detailing): stirrups and ties end in **135° hooks** with an extension of **6d** but not less than **65 mm**. The 10d hook allowance used in BBS covers the bend plus this extension.

6.3 Cutting length formulas

Straight bar

$$L = \ell - 2c$$

ℓ = overall length of member; c = end cover

Straight bar with two hooks

$$L = \ell - 2c + 2(9d)$$

mild steel standard hooks

Cranked bar (two cranks)

$$L = \ell - 2c + 2(0.42d_c) - 4(1\phi)$$

d_c = crank height; four 45° bends deducted

Rectangular stirrup

$$L = 2(a + b) + 20\phi - 6\phi - 6\phi$$

a, b = centre-line sides; three 90° bends, two 135° hooks

Centre-line sides of a stirrup

$$a = B - 2c - \phi, \quad b = D - 2c - \phi$$

$B \times D$ = beam section; c = clear cover

Number of bars / stirrups

$$n = \frac{\text{length to be covered}}{\text{spacing}} + 1$$

round up to the next whole number

- Square column tie:** $L = 4a + 20\phi - 12\phi$, with a = column side $- 2c - \phi$.
- Circular (helical/ring) tie:** length of one ring = $\pi \times (\text{core diameter} - \phi) + \text{hook allowance}$; helix length per turn = $\sqrt{[(\pi D)^2 + p^2]}$.
- L-bar (one 90° bend):** $L = a + b - 2\phi$. **U-bar (two 90° bends):** $L = a + 2b - 4\phi$.
- Chair** (supports top steel in slabs/footings): $L = 2 \times \text{foot} + 2 \times \text{height} + \text{top} - 4 \times 2\phi$; usually 8–12 mm bars, about one per m^2 (or as specified).

Worked example — Column tie

Column 300×300 mm, clear cover 40 mm, 8 mm ties with 135° hooks. Find the cutting length of one tie.

1. $a = 300 - 2 \times 40 - 8 = 212$ mm

2. $L = 4 \times 212 + 2 \times 10 \times 8 - 3 \times 2 \times 8 - 2 \times 3 \times 8$

3. $= 848 + 160 - 48 - 48 = 912$ mm

Answer: 0.912 m per tie

6.4 Laps and development length (IS 456)

The **development length** L_d is the embedded length needed so that the bar can develop its design stress through bond. Laps are provided where bars have to be joined; their length is derived from L_d .

PART B

Compact Summary Notes

Estimating, Costing & Valuation

Illustrated one-page-per-topic revision sheets — read these in the last days before the exam, after studying the detailed notes in Part A.

Summary notes

page 49

8 pages of summary notes

Estimating & Costing in Civil Engineering

Compact Handwritten Notes

Purpose : This notebook is a compact handwritten revision of important topics in Estimating & Costing used in preparation of estimates, BOQ and tendering in civil engineering works.

CONTENTS (At a Glance)

- ① Procedure of Estimating
- ② Units of Measurement
- ③ Standard Sizes of Bricks, Walls, Doors and Windows
- ④ Types of Estimate
- ⑤ Plinth / Floor / Carpet Area
- ⑥ Worked Preliminary Estimate
- ⑦ Sanctions and BOQ
- ⑧ Analysis of Rates
- ⑨ Specifications and Measurement Rules
- ⑩ Valuation Basics
- ⑪ Contracts and Tenders
- ⑫ Quick Reference Card

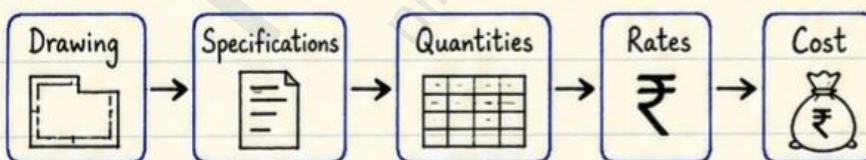
TIP 1

★ Standard sizes and units are **CRITICAL** for accurate quantity calculation and numericals.

TIP 2

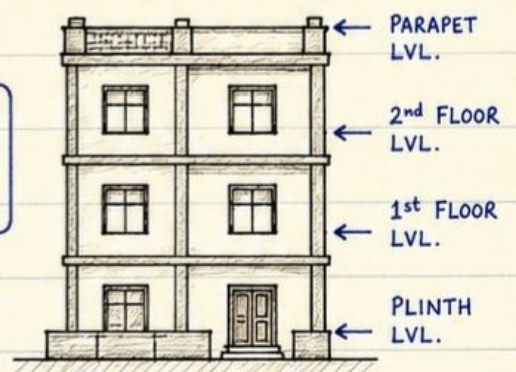
★ Always check whether **MODULAR** or **TRADITIONAL** bricks are intended in the project.

1. Estimating Workflow (Big Picture)



Good drawings + clear specs + correct quantities + realistic rates =
RELIABLE COST

TYPICAL ELEVATION



KEY POINTS TO REMEMBER

- ★ All dimensions are in mm unless mentioned.
- ★ Quantities are generally in m, m², m³, Nos., kg, Cum, Ltr.
- ★ Use standard sizes and units as per IS codes.
- ★ Round off final cost as per instructions.

COMMON ABBREVIATIONS

Nos. - Numbers m - Metre
 m² - Sq. Metre m³ - Cu. Metre
 TMT - Thermo Mech. Treated
 BOQ - Bill of Quantities
 S.O.R. - Schedule of Rates

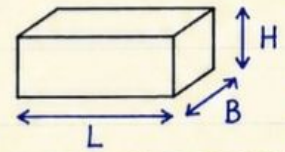
★ Practice numericals regularly - accuracy comes with practice!

Procedure of Estimating

1. Definition of Estimate : Probable anticipated cost of a work prepared before construction by computing quantities and applying rates.
2. Data Needed : Drawings, Specifications, Rates.
3. Rate Includes : The rate of each item covers materials, transport, labour, scaffolding, tools & plant, water, taxes, establishment / supervision and contractor's profit.
4. Method of Estimating Quantities (Mensuration):
Compute quantities from dimensions using $L \times B \times H$, or $L \times B$, or $L \times H$ as applicable.
5. Typical Main Items of Building Work :
Earthwork, Foundation Concrete, Masonry, RCC, Flooring, Roofing, Plastering, Doors / Windows, Finishes, Sanitary-Water Supply, Electrification.
6. Deductions : Openings for doors, windows, niches, etc., are usually deducted from the items of work. Small openings up to about 0.1 m^2 each are often not deducted.
7. Nomenclature : Use standard item names and descriptions as per CPWD / IS / Schedule of Rates.
8. Lump Sum Provision : Provide for contingencies, unforeseen items, contractor's establishment etc., as lumpsum or percentage as per practice.
9. Rounding Convention : Dimensions to 0.01 m ; Volume to 0.01 m^3 ; Area to 0.01 m^2 ; Money to nearest rupee.
10. General Note : Work neatly, show steps clearly and write units at every stage.

FORMULA DOODLE

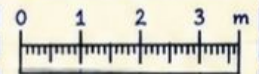
$$\text{Volume} = L \times B \times H$$



TIP 1

★ Know units cold - many numericals silently assume them.

MEASURING SCALE



Always measure accurately!

Units of Measurement - Field Reference

Item of Work	Unit	Item of Work	Unit
1. Plain Cement Concrete (PCC)	m^3	Measured in cubic metres (Volume)	m^3
2. Reinforced Cement Concrete (RCC)	m^3	Measured in cubic metres (Volume)	m^3
3. Damp Proof Course (DPC)	m^2	Measured in square metres (Area)	m^2
4. Brickwork in foundation / superstructure	m^3	Measured in cubic metres (Volume)	m^3
5. Half-brick partition	m^2	Measured in square metres (Area)	m^2
6. Plastering (internal / external)	m^2	Measured in square metres (Area)	m^2
7. Flooring / Tiling	m^2	Measured in square metres (Area)	m^2
8. Painting / Distempering	m^2	Measured in square metres (Area)	m^2
9. Doors / Windows (including frames & shutters)	m^2	Measured in square metres (Area)	m^2
10. Steel / Iron Work (reinforcement, grills, etc.)	kg	Measured in kilograms (Weight)	kg
11. Earthwork in excavation	m^3	Measured in cubic metres (Volume)	m^3

★ Remember : $1 \text{ m}^3 = 1000 \text{ Litre}$; $1 \text{ m}^2 = 10.764 \text{ ft}^2$; 1 running m = length in metres



End of the free preview

Estimating, Costing & Valuation

The full PDF has 56 pages:

Part A — detailed typed notes: 11 chapters, 44 pages

Part B — handwritten compact summary: 8 pages

Chapters in the full notes

- 01 Estimates — Types, Approvals and Areas
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- 09 Specifications
- 10 Contracts, Tenders and PWD Accounts
- 11 Valuation

Formula boxes with every symbol explained · IS / IRC code values in tables · labelled sketches
Worked examples step by step · exam tips & traps · quick revision points after every chapter

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