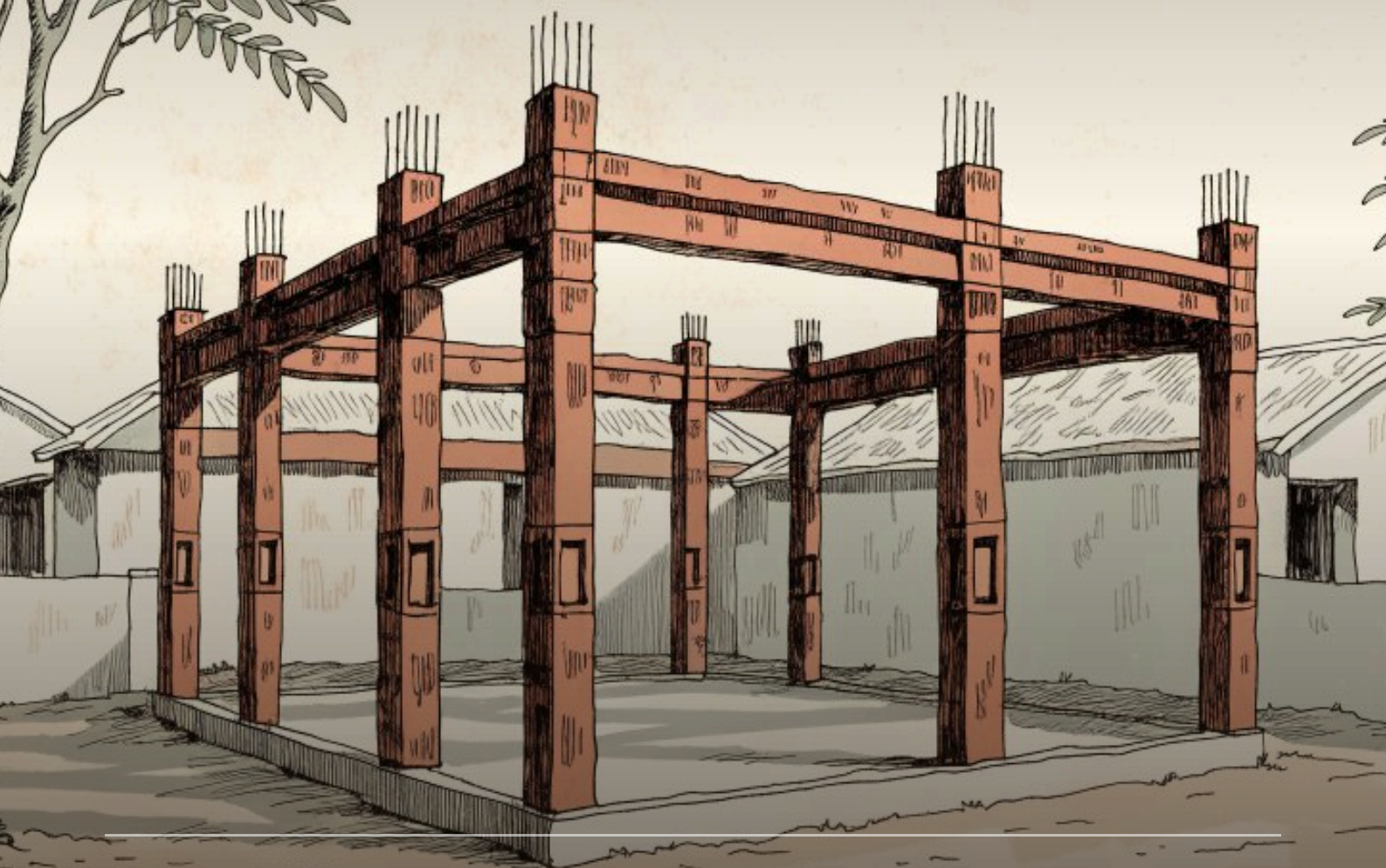


Understand *your structure*

Footings, columns, beams and slabs. Read the design.
Check the work with your engineer.



01

LOADS

Where the weight goes

02

GROUND

Soil and footings

03

FRAME

Concrete, cover and steel

04

DETAILS

Links, joints and checks

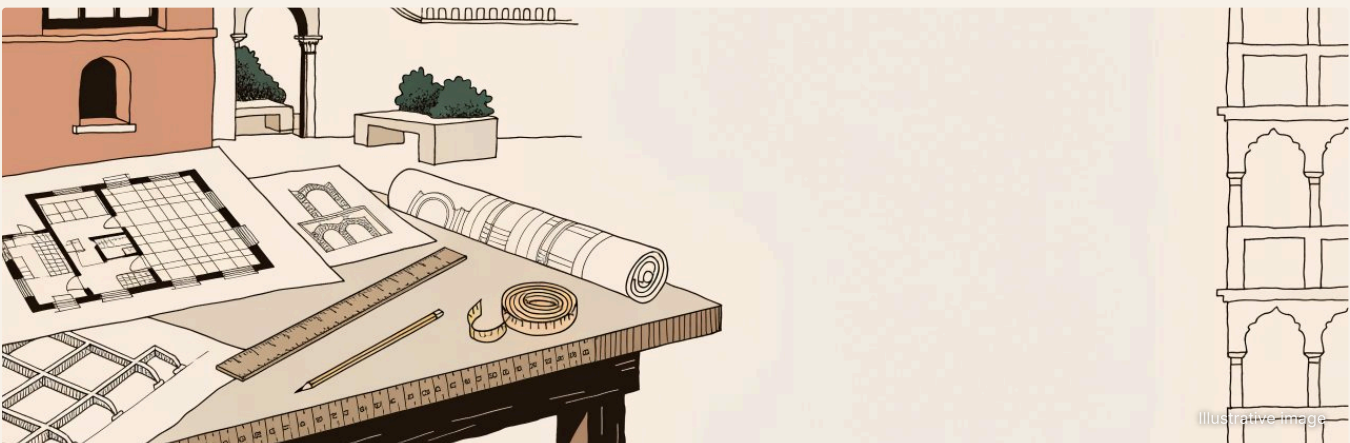
A safe house starts *with a signed design.*

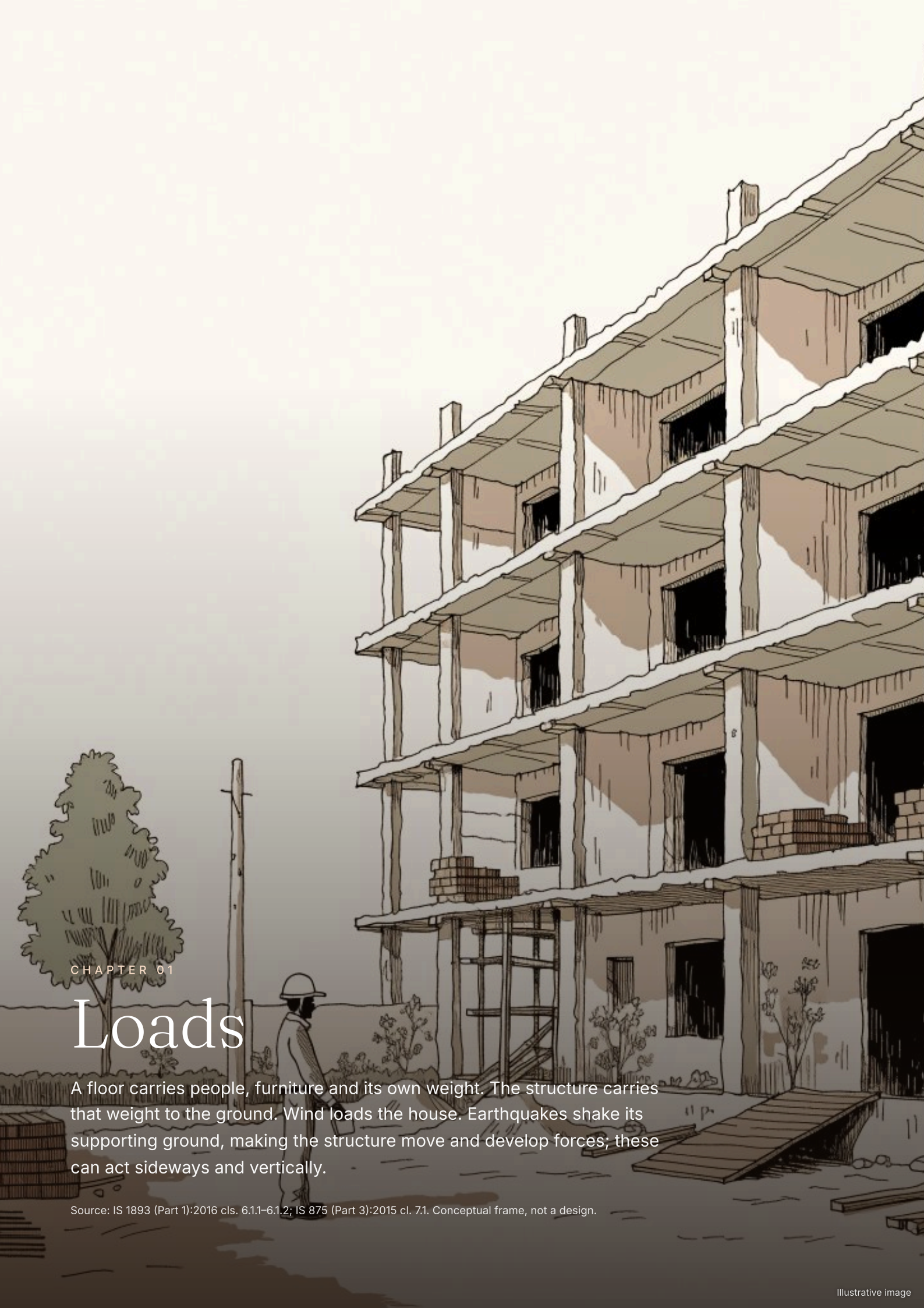
The engineer designs the structure. You can learn how it works, read its drawings and check what gets built. Start with the load path. End with evidence before concrete hides the steel.

01	Loads	03
	The load path, the engineer and the drawing	
02	Ground	07
	Soil, foundation choice and footing cover	
03	Frame	11
	Cover, columns, beams and slabs	
04	Details	16
	Ductile hooks, joints, laps and steel records	
05	Checklist	22
	Before the pour, after it and before a change	

HOW TO READ THIS BOOK

CODE means a selected provision from the cited edition. Inspection prompts help you compare the work with the signed drawing. Images are illustrative. Minimum details alone do not prove safety.





CHAPTER 01

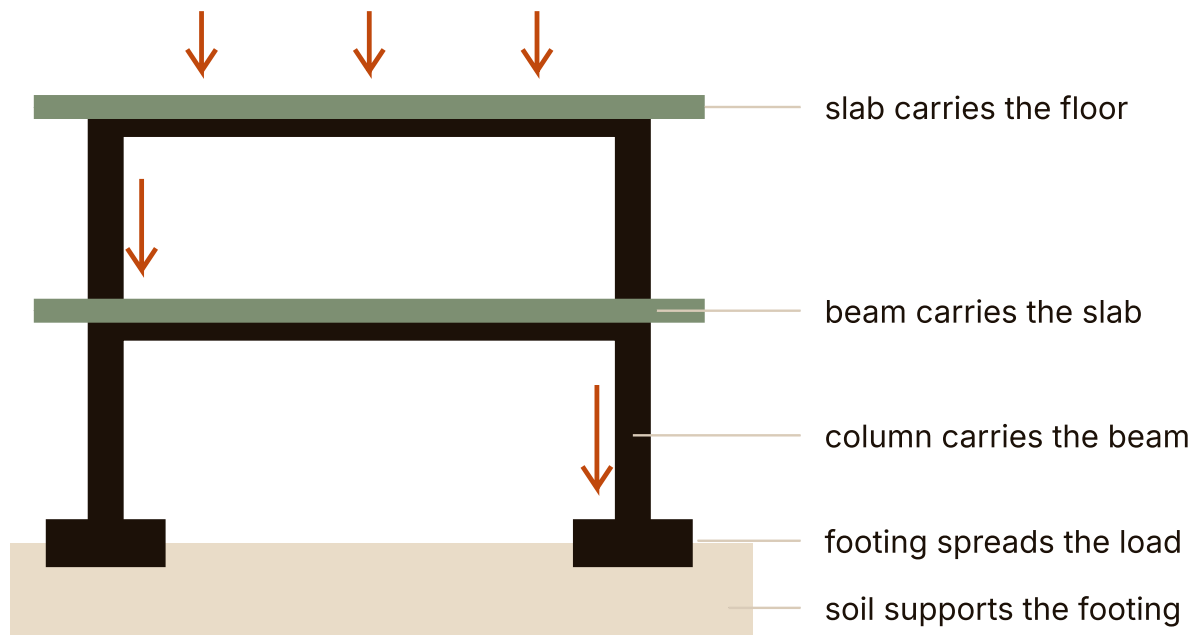
Loads

A floor carries people, furniture and its own weight. The structure carries that weight to the ground. Wind loads the house. Earthquakes shake its supporting ground, making the structure move and develop forces; these can act sideways and vertically.

Source: IS 1893 (Part 1):2016 cls. 6.1.1–6.1.2; IS 875 (Part 3):2015 cl. 7.1. Conceptual frame, not a design.

Follow the weight *all the way down.*

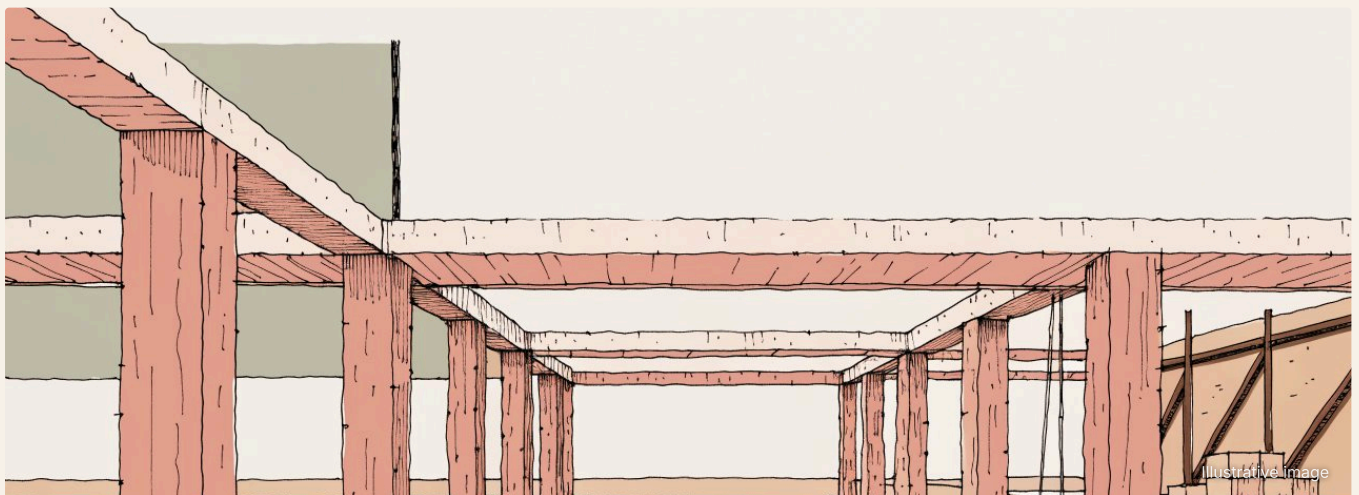
Reinforced cement concrete, or RCC, combines concrete and steel. In this frame, the floor passes its load to beams, then columns, then footings and soil.



A frame example. A load-bearing wall house has a different path.

Downwards. Trace the roof and each floor. A wall may carry loads too. Ask which walls are structural before moving or cutting them.

Sideways. Ask the engineer to show how floors, frames or structural walls pass wind and earthquake forces into the foundations. Connections belong to that path.



Who designs, *who signs?*

Appoint a competent structural engineer registered or licensed as your authority requires. The engineer designs and signs the structural work. Record the local approval and certification duties.

01

Gujarat

Structural Engineer on Record

Structural reports, drawings, assumptions and certification belong to this role.

2A

structural-design
certification form

02

Maharashtra — areas governed by UDCPR

Building category matters

The checked rule requires the certificate above G+2 or above stilt+2. Special buildings have separate provisions.

G+2

Above G+2 or above stilt+2
in the checked 30 January
2024 text; confirm current
local requirements.

03

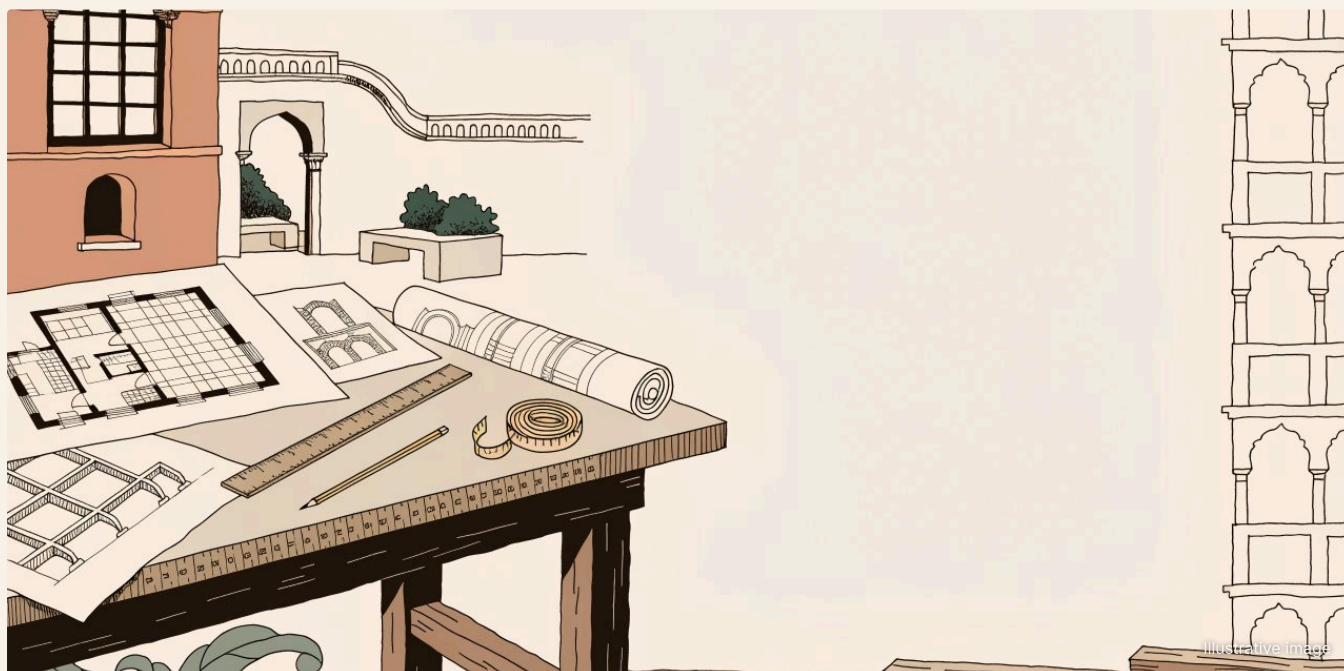
Your house

Write the responsible names

Name the engineer, site supervisor and inspecting person. Ask who releases concealed work.

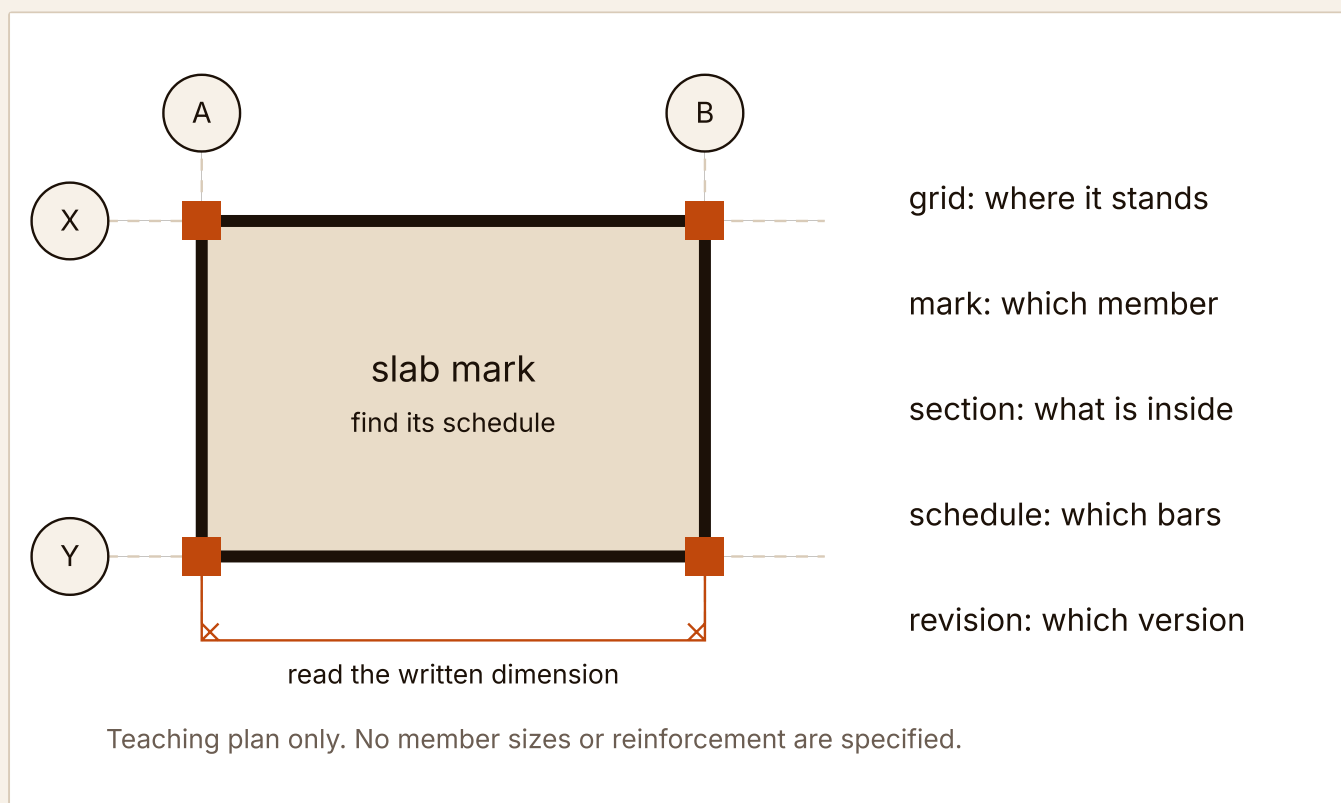
Ask

your own authority



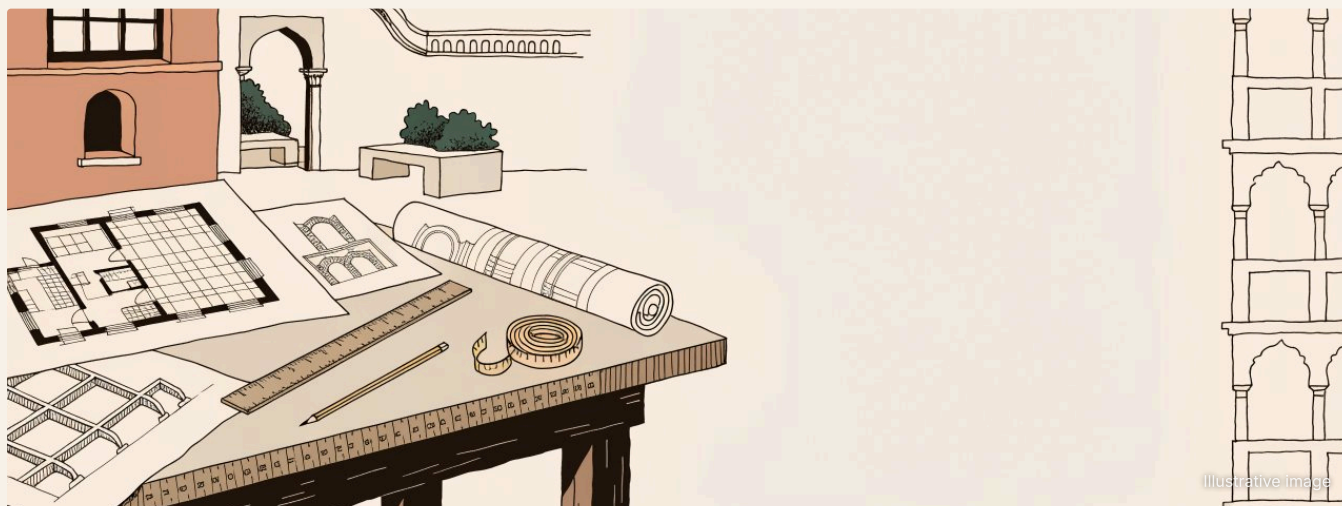
Read the drawing, *then find the member.*

Start with the title block and revision. Find the grid crossing, then the member mark. Read the section and bar schedule together. A floor plan alone cannot tell you the steel.

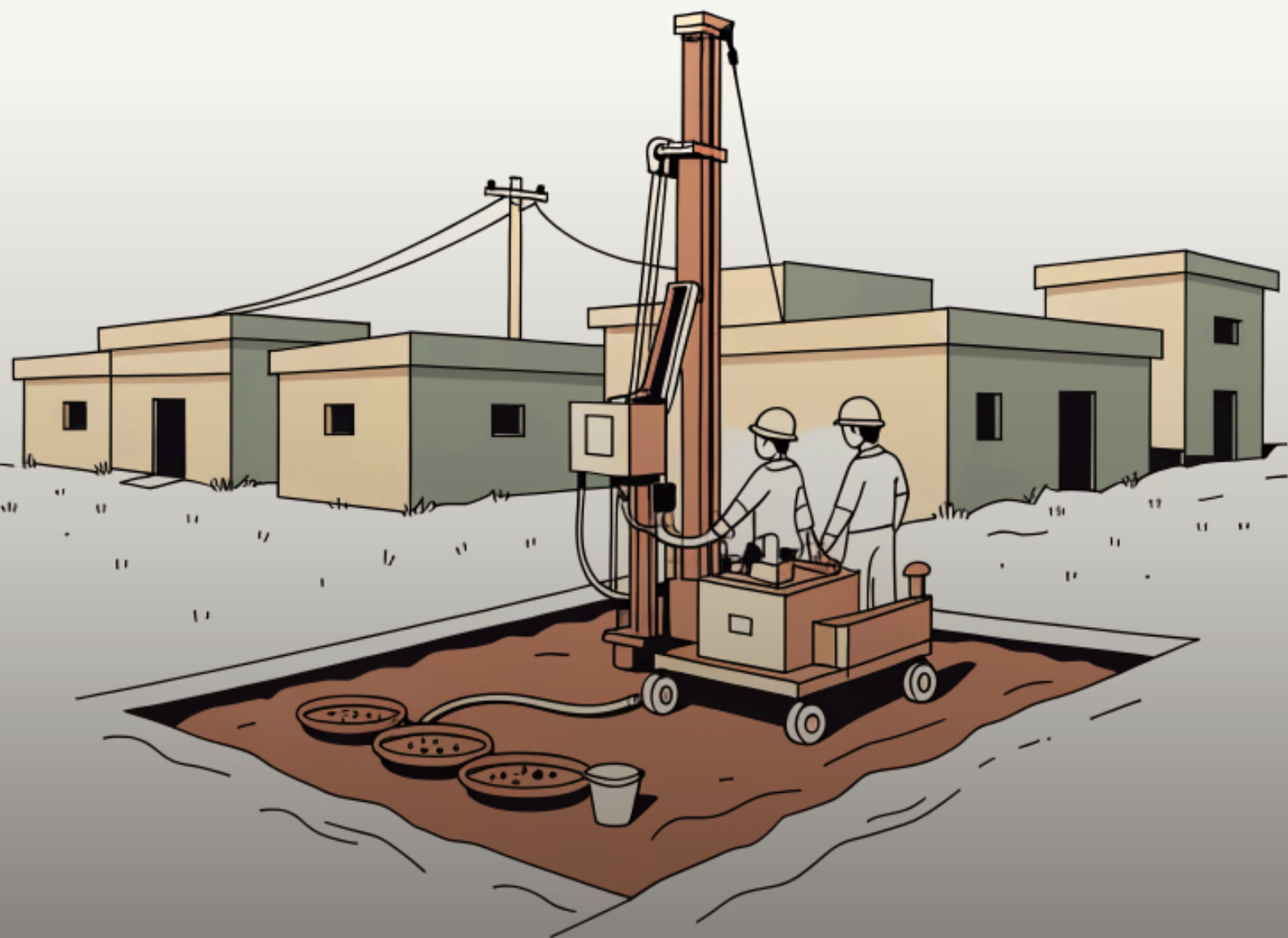


Read the notes. Find concrete grade, steel grade, cover, levels and units. A level is a height from a named reference. A bar schedule lists bar marks, sizes, shapes and quantities.

Match the site. Follow written dimensions, not the apparent size of a print. Compare the installed bars and links with the current drawing. Send any mismatch to the engineer before it is covered.



Inspection prompts: compare the work with the signed design. A detail checklist does not prove structural capacity. IS 2502:1963 cl. 2.1 and Table I (reinforcement schedule); cl. 5.1 (scheduled dimensions); cl. 6.1 (bending procedure). Letter marks are teaching labels; this is not a construction drawing.



CHAPTER 02

Ground

The soil is part of the structure. A footing that suits the next plot may fail here. Groundwater, soil layers and settlement change the decision.

Source: IS 1904:2021 cl. 1 and IS 6403:1981 cl. 6.1. No universal footing depth is established.

A soil report is *a design input.*

Ask the engineer to define the investigation. The report describes the ground and gives recommendations. The engineer checks those recommendations against the house loads.

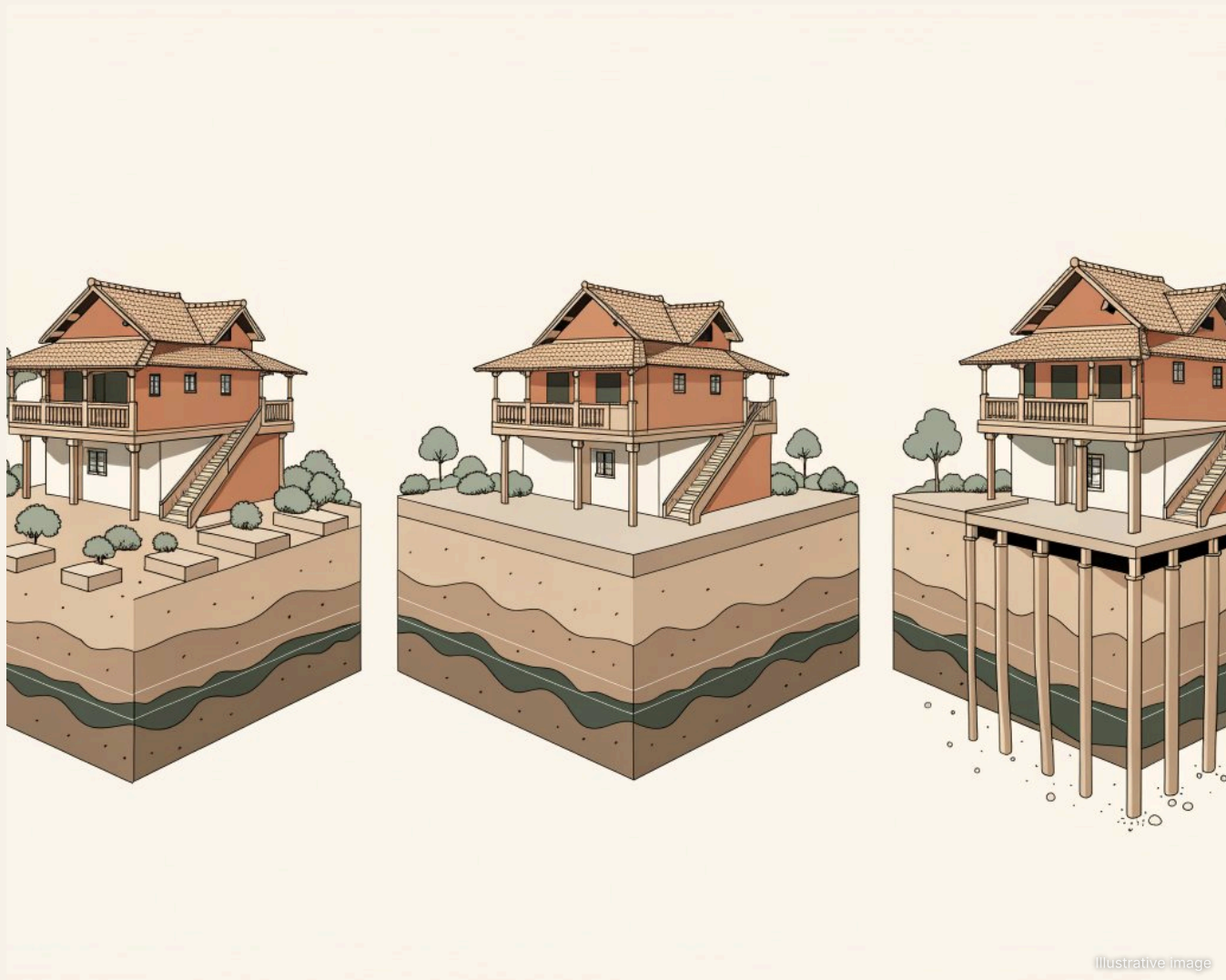


What to retain. Keep the investigation brief, soil logs, groundwater observations, test results and accepted recommendations. Ask which ground condition the foundation design assumes.

What to challenge. "The neighbour used this bearing capacity" is not evidence for your plot. Allowable bearing pressure must address both shear safety and settlement: sudden failure and excessive movement.

Choose the foundation *from the ground* *up.*

Separate footings, a raft and piles are different ways to pass loads into the ground. Their appearance does not tell you which is suitable. The engineer chooses from the soil report and the structural design.

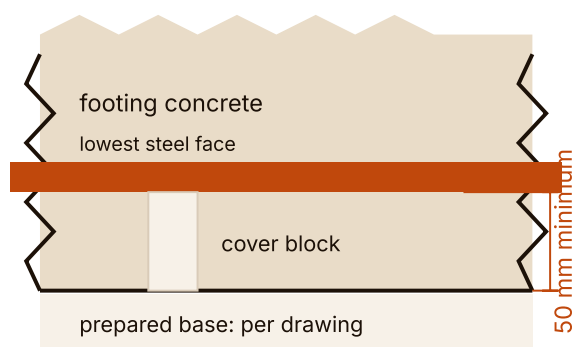


Ask for the reason. Which soil layer supports the house? How are bearing pressure and settlement checked? What happens where foundations approach the boundary or meet each other?

Inspect the actual ground. Before footing work, have the engineer accept the excavated formation. Report water or ground conditions that differ from the report. Keep the inspection record.

Footing cover: *measure the gap.*

Cover is the concrete between a concrete face and the nearest steel face. Read the specified cover before placing the cage. Measure to the outside of the steel, not its centre.



Local section; cover drawn to scale.
Bar size and other dimensions are not assigned.

≥ 50 mm

Nominal footing cover in the checked code.

Before the pour. Match bars, starters, levels and cover blocks to the drawing. Starters are bars that continue into the column.

The drawing shows a local cover detail. Footing width, thickness, depth and steel come from the signed design.



IS 456:2000 cl. 26.4.2.2; CPWD Specifications 2019 Vol. I cl. 5.2 (formwork), cl. 5.3.3 (reinforcement placement and cover), and cl. 5.4 (concreting).
Bottom cover shown: 50 mm minimum. Side faces and bar ends are outside this local detail; use the signed drawing for all covers.

CHAPTER 03

Frame

Concrete surrounds steel. Long bars carry the designed forces. Closed links hold the cage together and help resist shear. Their sizes and positions belong to the design.

Source: IS 456:2000 cl. 26 and IS 13920:2016 cls. 6–7, including Amendments 1:2017 and 2:2020. Selected details, not a capacity check.

Cover depends on exposure.

Rain, damp, salt and other exposure change how much protection steel needs. The engineer classifies the exposure. Use the specified cover and check the member-specific requirements too.

20 mm

Mild exposure
Table 16

30 mm

Moderate exposure
Table 16

45 mm

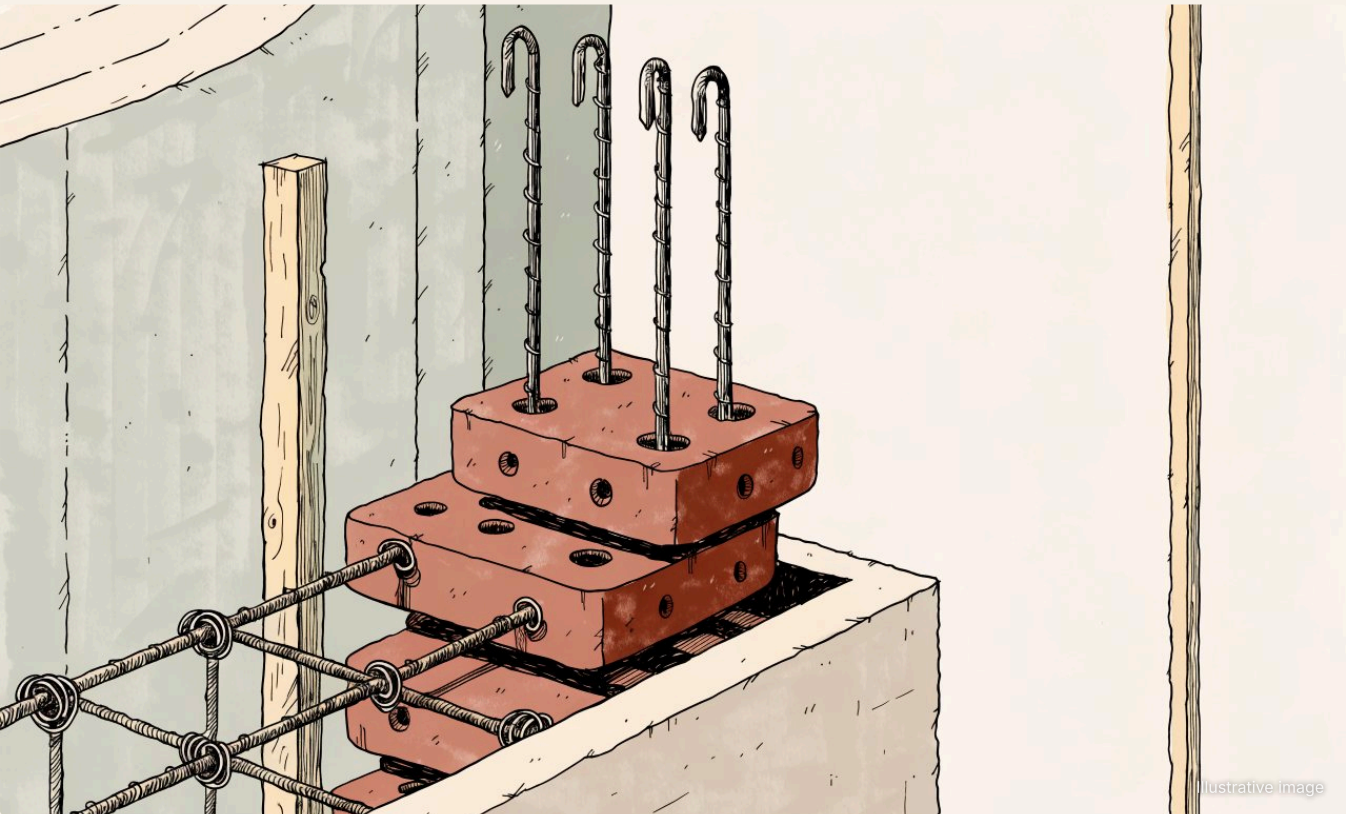
Severe exposure
Table 16

50 mm

Very severe exposure
Table 16

75 mm

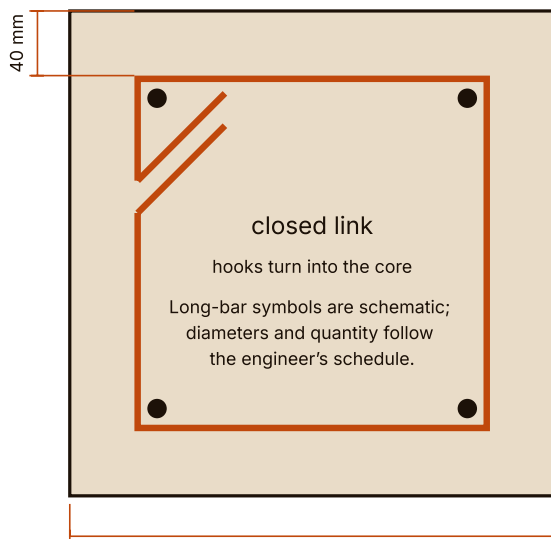
Extreme exposure
Table 16



IS 456:2000 Table 16; column cl. 26.4.2.1 and footing cl. 26.4.2.2 have member-specific requirements. Selected provisions; qualifications remain with the engineer.

A column is *more than its width.*

Long bars and closed links form a cage. A larger-looking column is not proof of safety. Size, steel, loads and detailing must work together.



300 mm branch of the minimum
Column outline and cover to scale;
steel symbols and hook details schematic.

$\max(300, 20db)$

Minimum shortest dimension, in mm, for the ductile provision. db is the largest beam bar through or anchored in the joint.

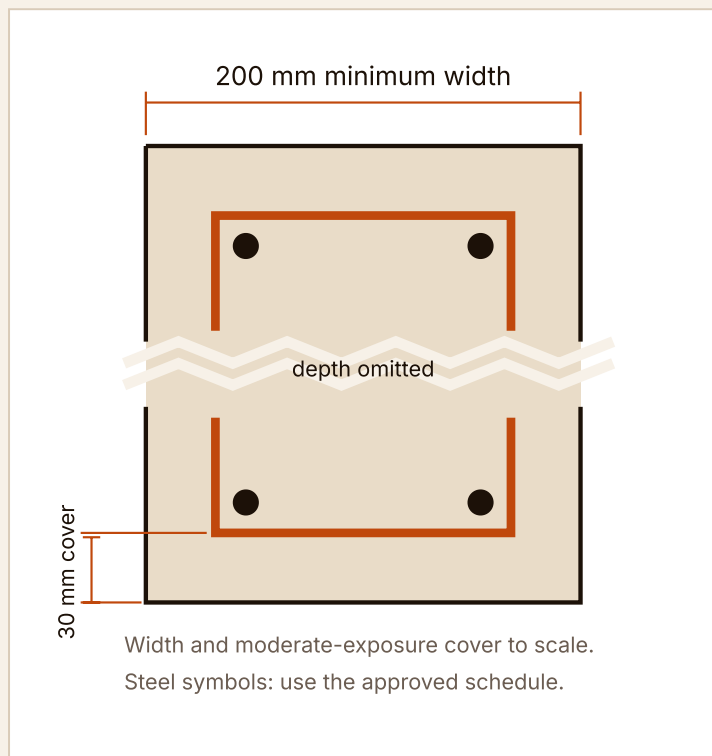
Ordinary cover. At least 40 mm or the bar diameter, whichever is greater; stated exceptions apply.

Minimum long steel. At least 0.8% of the column area; at least four bars in rectangular columns, six in circular ones; bar diameter at least 12 mm. Qualifications apply.



Read a beam *in section.*

A section cuts across the beam. It shows long bars inside closed links, with concrete cover outside. The depth, anchorage and bar schedule still need the full drawing.



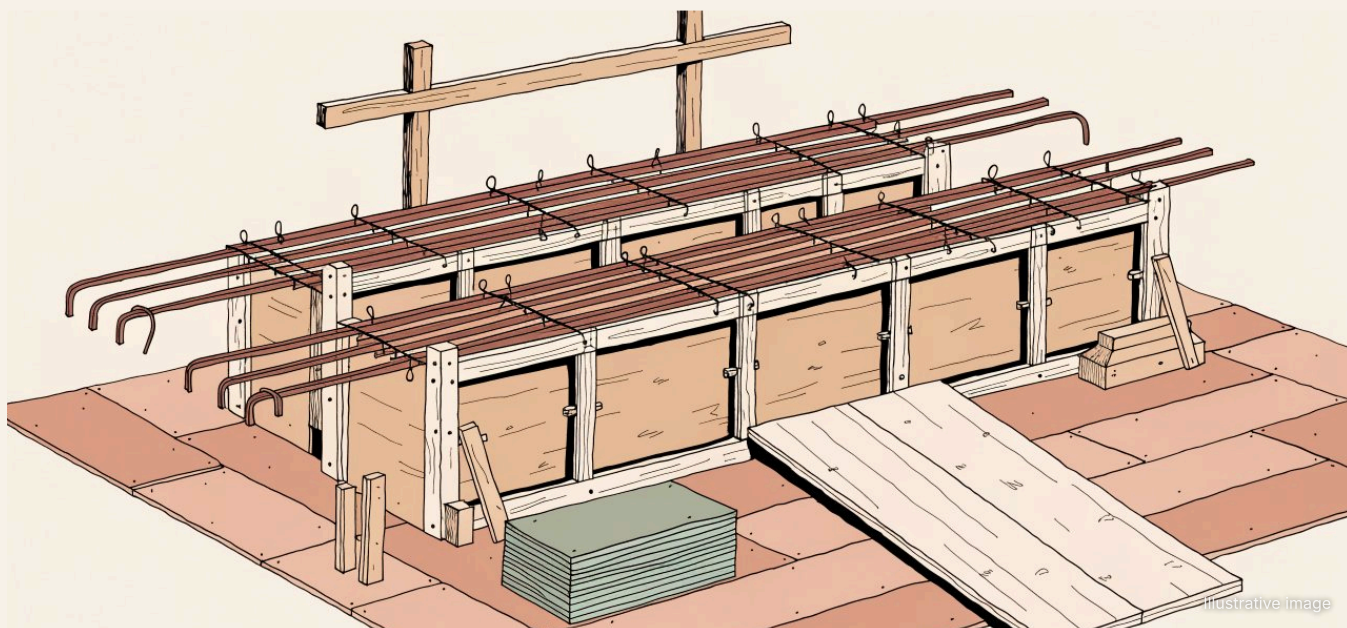
≥ 200 mm

Beam width in the ductile provision; not a universal beam size.

Ductile bars. At least two 12 mm bars at both top and bottom. The design can require more.

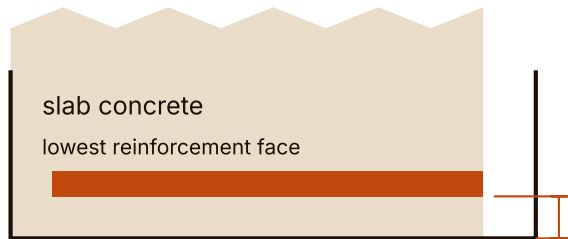
IS 456 minimum tension steel: $A_s \geq 0.85bd/f_y$.

Ductile beams also require the separate minimum in IS 13920 cl. 6.2.1(b). Ask the engineer to check both. A_s is steel area; b is width; d is effective depth, in mm; f_y is steel strength in N/mm². Ask the engineer to show the check.



A slab needs steel *in each direction.*

Read the slab schedule and its sections. Check both directions, the support zones, openings and cover. The lower-face detail here does not specify the slab thickness.



20 mm: mild-exposure cover example

Cover to scale. Thickness and bar size unset.
Top steel and supports follow the full drawing.

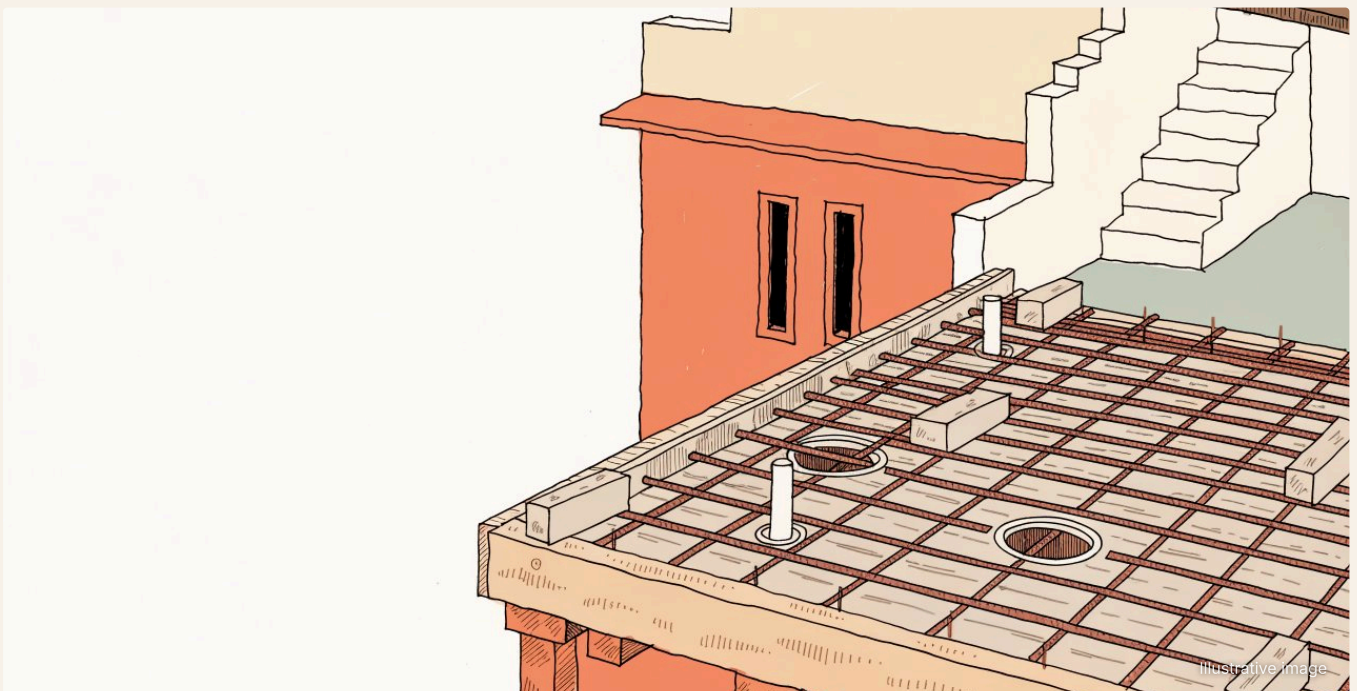
0.12%

Minimum each direction for HYSD bars or welded wire, as a share of the total slab section.

0.15%

Minimum each direction for mild steel.

Effective depth is measured from the compression face to the centre of the tension reinforcement area. It differs from overall concrete thickness and excludes separately applied finishes. The engineer selects both.





CHAPTER 04

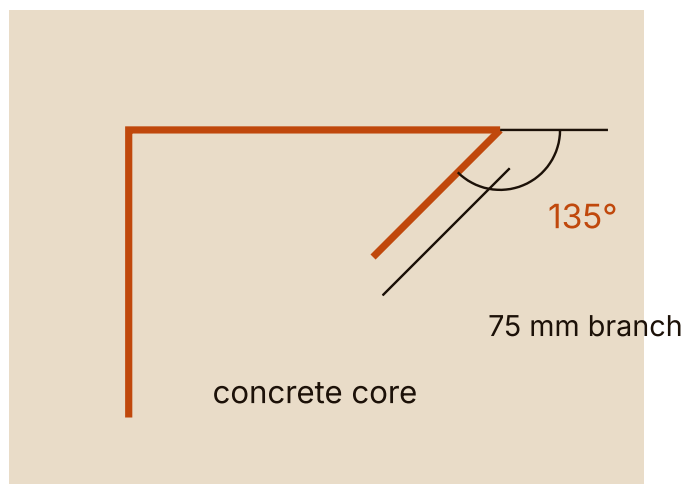
Details

Earthquake detailing helps a frame carry repeated sideways movement. Small details matter: a hook, a close link, a joint and the place where bars overlap.

Source: IS 13920:2016 cl. 1.1.1 and cls. 6-7, including Amendments 1:2017 and 2:2020. Scope: RC lateral systems in zones III-V; optional in II.

The hook turns *into the core.*

A closed link has a specified hook and tail. Compare them with the amended detail and the approved bar bending schedule, or BBS. A familiar-looking bend is not enough.



tail ≥ 8 link diameters

and tail ≥ 75 mm

Use whichever is greater.

Bend radius: approved BBS.

Angle and straight tail to scale; sharp bend is a construction line, not a bending instruction.

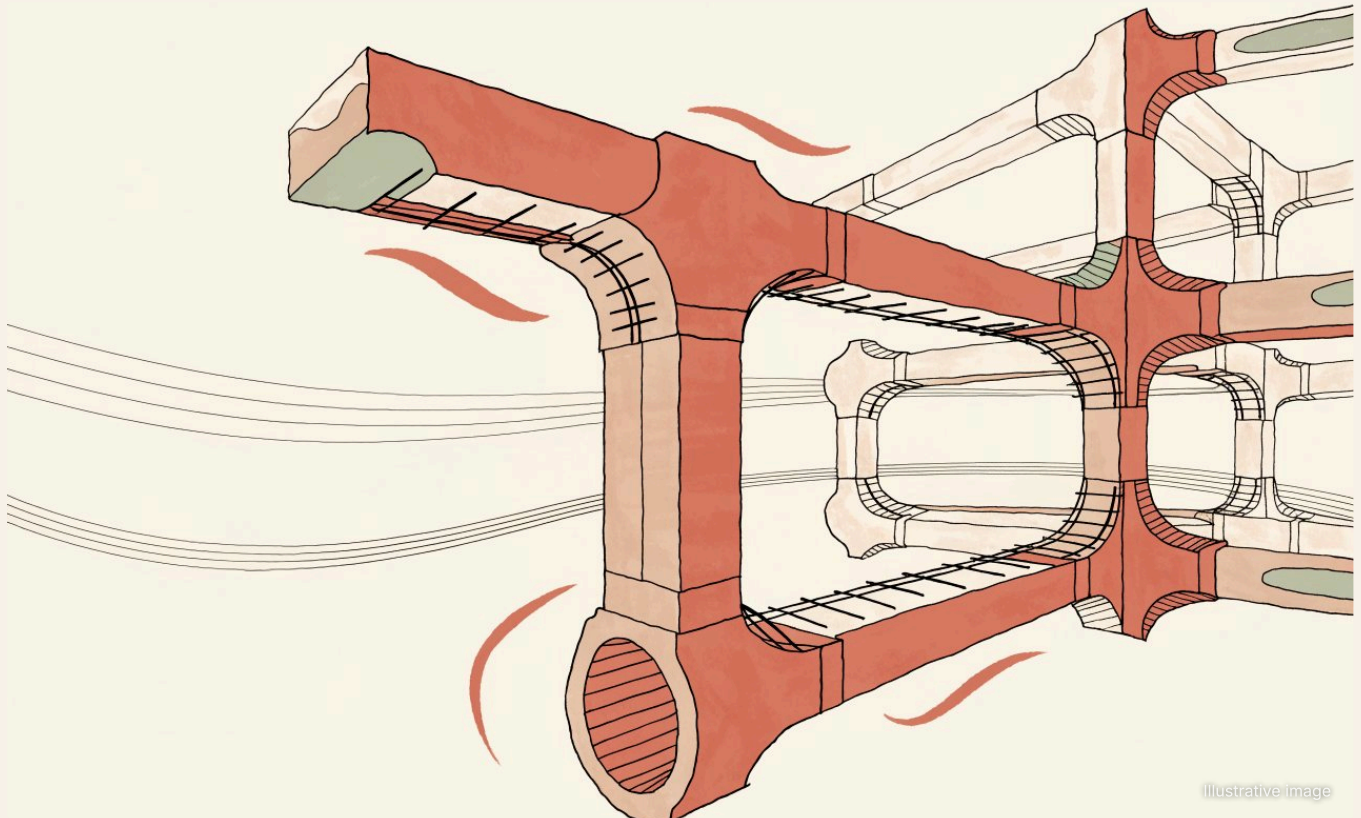
The code check. The hook is 135°. Its straight extension is at least eight link diameters and at least 75 mm. Both limits apply. The drawn tail shows only the 75 mm branch.

The site check. Ask the engineer to verify the bend and extension before the cage is closed. Use the specified bending procedure and BBS. This inset does not give a bend radius or permission to alter a bar.



Near the joint, *links get closer.*

A joint is where beams and columns meet. Read the marked confinement zones on the drawing. Do not spread links evenly when the drawing asks for close spacing at the ends.



$2d$

Beam-end zone length from the joint face. d is the beam's effective depth.

cls. 6.3.5–6.3.5.1

≤ 50 mm

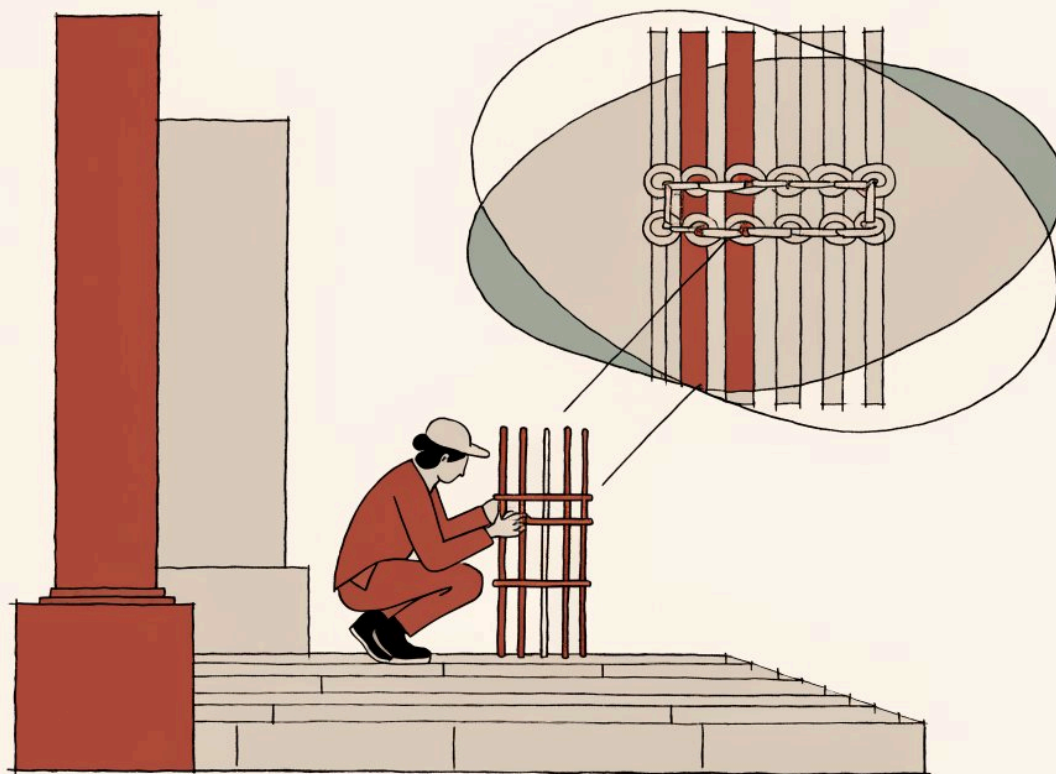
First beam link from the joint face.

cl. 6.3.5.1

Within the beam-end zone, spacing $\leq \min(d/4, 6d_b, 100 \text{ mm})$. Here d_b is the smallest longitudinal beam-bar diameter. The engineer checks the joint and specifies the complete detailing.

An overlap has *a permitted place.*

A lap joins bars by overlapping them. Length alone is not enough. Location, the amount of steel spliced together and the links around the splice matter too.



Illustrative image

Column laps. Column laps belong only in the central half of the clear column height, outside the joint and excluded end regions. At any one cross-section, lap no more than 50% of the longitudinal steel area. Bars larger than 32 mm require mechanical splicing. Link spacing in the lap is at most 100 mm. The engineer gives the actual lap length.

Confinement and beam laps. Column special-confinement spacing is at most six smallest longitudinal-bar diameters; the engineer specifies its extent. Beam laps have their own excluded zones. Never copy a column lap position into a beam.

Steel arrives *with evidence.*

Ribs and a grade name cannot prove that a bar is suitable. Ask for traceable steel, the specified grade and test documents. Connect each delivery to the records kept for the house.



At delivery. Compare bundle identification, delivery papers and test certificates. Have the engineer verify the specified mechanical properties. Retain the records with the reinforcement schedule.

Before installation. Match bar marks, diameter, shape and quantity to the approved BBS. Use the specified bending procedure. Report a proposed substitution or changed bend to the engineer before using it.

Thumb rules *to reject.*

These shortcuts leave out the design. Ask for the missing evidence. A confident answer is useful only when it comes with calculations, drawings and the engineer's review.

01

Same column everywhere

Omits loads, spans, lateral demands, soil and detailing.

Loads

must be designed

02

Bars from plot area

Omits member forces, continuity, anchorage and ductility.

Forces

decide the steel

03

Copy a neighbour's footing

Omits your soil, groundwater, settlement and loads.

Soil

is plot-specific

04

Slab thickness from a ratio

Basic ratios 7, 20 and 26 use effective depth and need modifications and other checks.

Depth

is not thickness

05

Add a floor: it looks sound

Omits capacity, foundations and connections.

Review

before a change

06

A mix ratio is enough

Omits exposure, strength, production control and testing.

Tests

need records



Illustrative shortcuts to challenge; IS 456:2000 cl. 23.2.1: basic span/effective-depth ratios 7 cantilever, 20 simply supported, 26 continuous, modified as specified. These are not slab-sizing instructions.

Before the pour, *keep the evidence.*

Print this page. Compare the work with the signed drawing while the steel is visible. Have the inspecting engineer resolve mismatches and record the release before concrete placement.

DESIGN

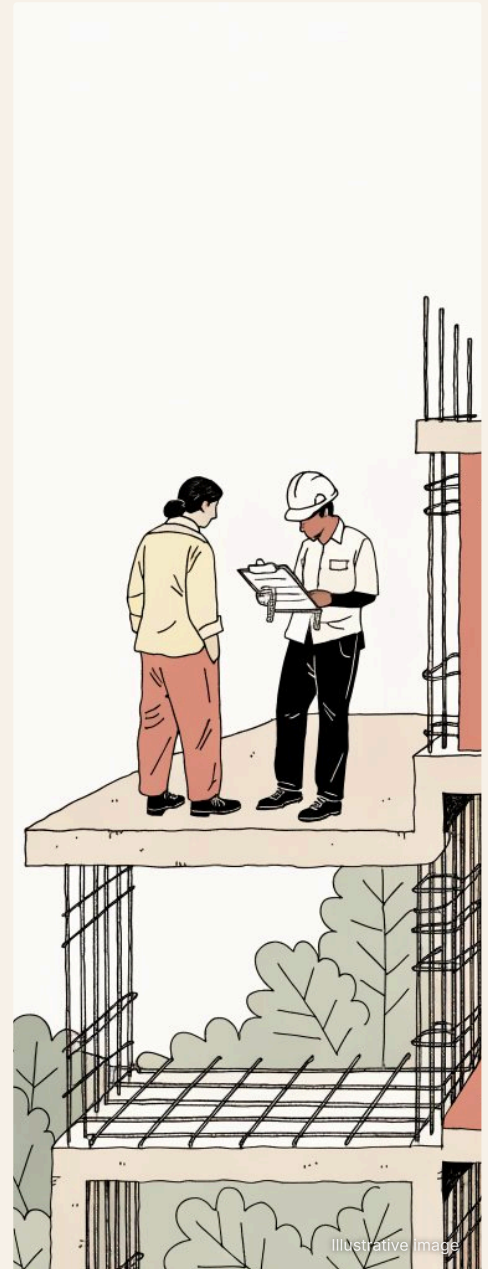
- ☐ **Current signed drawing and revision?**
Member marks, sections and schedules match.
- ☐ **Ground and foundation accepted?**
Keep the investigation and formation records.

STEEL

- ☐ **Bars, links and cover match?**
Check both slab directions and support details.
- ☐ **Hooks and close-link zones checked?**
Use the amended detail and marked extents.
- ☐ **Lap locations and steel records checked?**
Retain the BBS and traceable test documents.

BEFORE CONCEALMENT

- ☐ **Formwork, supports and openings reviewed?**
Coordinate service routes before placement.
- ☐ **Concrete sampling and curing arranged?**
Record who witnesses and retains the results.
- ☐ **Inspection release recorded?**
Name, date, drawing revision and photographs.



Concrete still needs *care and records.*

Retain placement, sampling, test and curing records. Ask the engineer to assess defects and release temporary supports. A good surface does not prove concrete strength.



7 days

Minimum moist curing for OPC, increased to at least 10 days when exposed to hot, dry weather.

cl. 13.5.1

10 days

Minimum for blended cement or mineral admixtures; also at least this long in hot, dry weather.

cl. 13.5.1

14 days

Recommended extension for blended or mineral-admixture concrete.

cl. 13.5.1

For moist curing, keep exposed concrete continuously damp or wet throughout the required period. Calendar days alone do not authorise removal of supports. The concrete-strength criterion and the engineer's release govern.

Keep the drawings. *Ask before changing.*

A checked cage is one part of a safe house. Keep the signed design and the construction evidence together. An extra floor, moved column, tank or major opening goes back to the engineer before work starts.

Your project file

Approved and as-built drawings, revisions, structural certificates, steel records, concrete tests and concealed-work photographs.

Your named engineer

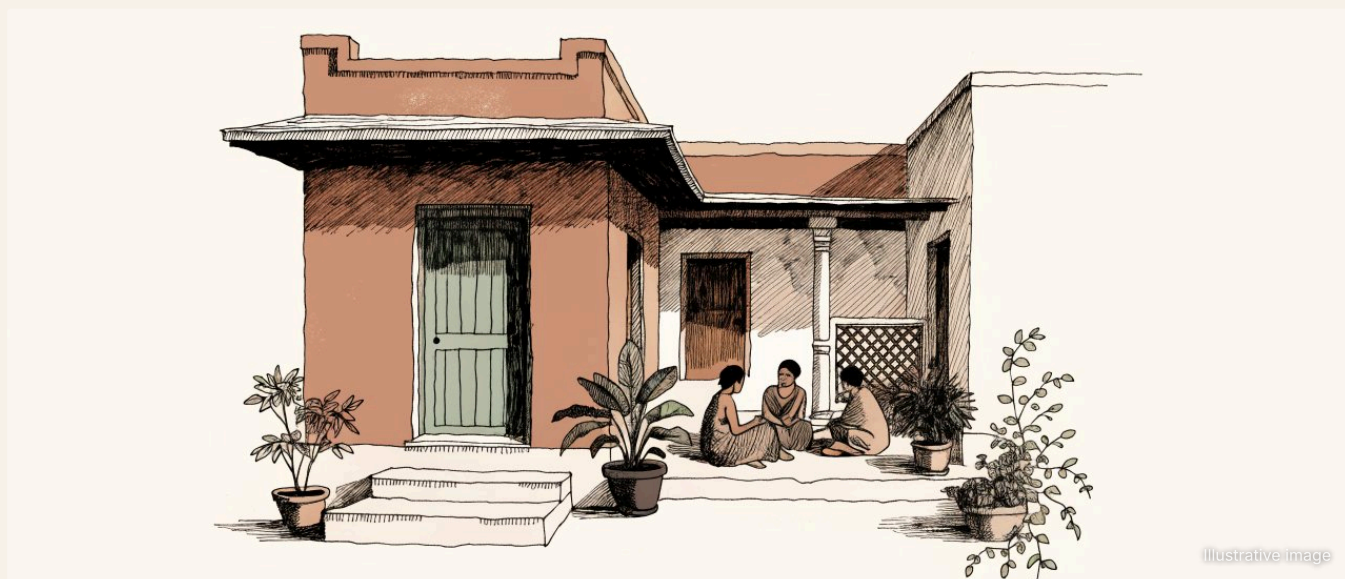
Record who designed, who inspected and who approved each change. Ask the local authority which certificates apply.

Footing to finish

The next NirmanDost guide follows construction stages, inspection releases and handover.

Found a mistake?

Tell us at nirmandost.in. Keep source editions and local applicability with every technical check.



Illustrative image



NirmanDost

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