Chapter B1: Planning and Estimating

The course's own whiteboard summaries, key numbers and common traps for the lessons open so far (21 of 21). Separate from the PrepPass book.

For your own study. Please do not share.

B1.1 Which document wins

About 4 minutes of narration.

BOARD 1 Three voices — B1.1

- Drawings: what and where
- Specifications: quality
- Shop drawings: the fabricator's detail

BOARD 2 Shop drawings and the contract — B1.1

✓ Reviewed for the design concept

- Not a contract document

Does not replace plans or specs

✗ ~~Stamped, so the design changed~~

BOARD 3 Addendum or change order — B1.1

Document	When
Addendum	Before signing
Change order	After signing

The line: the signature

BOARD 4 Order of precedence — B1.1

- Look for the stated order

Stated order governs

Defaults below are contract practice, not code

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BOARD 5 Later, and more specific B1.1

- Later over earlier
- Addendum over original drawings
- Specific over general

✗ ~~The earliest document controls~~

BOARD 6 Quality, figures and scale B1.1

- Quality: specs over drawings

FAR 52.236-21(a), federal contracts

- Figured over scaled
- Large-scale detail over small-scale plan

BOARD 7 When a conflict remains B1.1

Written RFI before you build

- Cite the sheet and detail
- Ask for a reply by a date

✗ ~~Assume, guess, cheaper, let the sub pick~~

Key numbers and formulas B1.1

- Does not replace plans or specs
- The line: the signature
- Stated order governs
- Written RFI before you build

Common traps: each line is a wrong belief B1.1

✗ Stamped, so the design changed
✗ The earliest document controls
✗ Assume, guess, cheaper, let the sub pick

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Why the tempting answers fail (from the section practice)

B1.1

1. The written specifications call for Type X gypsum board, but the plan detail simply notes '5/8 in drywall.' In the contract documents, how are such conflicts typically resolved? B1.1

   Right: The specifications generally govern over the drawings for material quality, but the contractor should seek written clarification. Specifications generally govern quality, and you still ask in writing.

   - The drawings always override the specifications, so the plan detail settles the material and no clarification is needed: Drawings do not always override, and clarification is still needed.
   - The lowest-cost interpretation automatically applies, so the contractor may install the cheaper board without asking: Cost does not settle a conflict.
   - Whatever the crew installs first becomes the standard, and the rest of the job is built to match that installation: Installation order sets no standard.

2. Two days before bids are due, the architect issues a document that changes the window schedule for all bidders. What is this document BEST called? B1.1

   Right: An addendum. Issued to bidders before signing, it is an addendum.

   - A punch list: A punch list is for the end of the job.
   - A submittal: A submittal comes from the contractor.
   - A change order: A change order follows the signed contract.

3. When contract documents conflict and there is no special precedence clause, which GENERAL rule do most construction contracts apply? B1.1

   Right: Later addenda and modifications generally take precedence over the base documents they change, and more specific or detailed provisions govern over general ones.. Later governs earlier, and specific governs general.

   - The earliest drawing revision controls over any later addenda, so the original set fixes the scope and nothing issued afterward can change it.: Later addenda revise the earlier documents, not the reverse.
   - General notes always override specific detail notes, so the broad requirements on the cover sheet govern whatever a detail shows.: Specific notes govern over general ones, not the reverse.
   - The contractor's estimate governs over the drawings, so the quantities the bidder priced set what the work actually includes.: An estimate is not a contract document.

4. A bid set's specification calls for one grade of exterior plywood. Addendum 2, issued later, calls for a different grade. The contract has no special precedence clause. Which document normally controls? B1.1

   Right: Addendum 2, because it was issued later. A later document revises an earlier one, so the addendum normally controls.

   - The grade the framing sub usually stocks: A subcontractor's habit has no standing in the contract documents.
   - The grade that costs the owner the least: Price does not decide precedence between contract documents.
   - The specification, because it came first: Being first is the reason it was revised; earlier text gives way to later text.

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5. A floor plan drawn at 1/4 in = 1 ft and a detail drawn at 1-1/2 in = 1 ft show the same stair curb differently. No other document addresses it. Under the usual order of precedence, which is followed? B1.1

   Right: The large-scale detail, since it is more specific. Specific governs general, and a large-scale detail is the more specific drawing.

   - The small-scale plan, since it was drawn first: Drawing order is not the test; the small plan is the more general drawing.
   - Whichever one is easier for the crew to build: Ease of building does not settle a conflict in the documents.
   - An average of the two conflicting dimensions: Averaging creates a third answer that neither drawing shows.

6. After applying the order of precedence, a contractor still cannot tell which of two details the designer intended. What is the BEST next step? B1.1

   Right: Send a written RFI and wait for the answer. An unresolved conflict goes to the design team in writing before the work is built.

   - Get a verbal answer from the owner on site: A verbal answer leaves no record and may not come from the designer.
   - Ask the sub to pick and document the choice: The subcontractor has no authority to settle a design conflict.
   - Build the cheaper detail and note it later: Choosing the cheaper reading is building over a known conflict.

B1.2 Specs, submittals, and "or equal"

About 4 minutes of narration.

BOARD 1 How specifications are organized B1.2

- Filed by MasterFormat division

Construction Specifications Institute

- Roughly structure to finishes

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BOARD 2 Seven divisions

B1.2

Div	Covers
03	Concrete
04	Masonry
05	Metals
06	Wood, plastics, composites
07	Thermal and moisture
08	Openings
09	Finishes

BOARD 3 Three kinds of submittal

B1.2

- Shop drawings: made for this job
- Product data: catalog sheets
- Samples: physical pieces

BOARD 4 Who reviews what, in what order

B1.2

Fabricator prepares

Contractor coordinates and marks

Design professional reviews

✗ ~~Forward it unopened~~

BOARD 5 Or equal

B1.2

- Contractor shows it performs

Approved before ordering

✗ ~~Same type, so install it~~

BOARD 6 Delivered product against submittal

B1.2

- Delivery matches reviewed submittal

Unapproved substitute = defect

- Differs? Resolve in writing first

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Key numbers and formulas B1.2

- Design professional reviews
- Approved before ordering
- Unapproved substitute = defect

Common traps: each line is a wrong belief B1.2

✗ Forward it unopened

✗ Same type, so install it

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Why the tempting answers fail (from the section practice) B1.2

1. The specifications name a specific product but add the phrase 'or equal.' A subcontractor wants to use a different brand. What is the BEST procedure? B1.2

   Right: Submit the proposed product for the design professional's approval before ordering. Approval by the design professional comes before ordering.

   - Let the supplier decide which product is equal: A supplier cannot decide what is equal.
   - Install the substitute immediately since 'or equal' allows any brand of the same general type to be used: Or equal does not skip approval.
   - Ignore the phrase and only the named product is permitted: The clause does allow a proposal.

2. Before forwarding a fabricator's shop drawings to the architect, what is the general contractor's PRIMARY responsibility? B1.2

   Right: Review and coordinate the drawings with field conditions and other trades, then stamp them. Coordinate with the field and trades, then mark the review.

   - Forward them unopened to save time, leaving the review entirely to the architect: That skips the coordination.
   - Approve them on the architect's behalf so fabrication can be released sooner: Approval is the architect's.
   - Redesign the connections to reduce cost before the architect ever sees them: Redesign is not the contractor's job here.

3. Which statement BEST distinguishes shop drawings, product data, and samples as types of submittals? B1.2

   Right: Shop drawings are contractor/fabricator-prepared drawings of specific items; product data are manufacturer catalog cut sheets; samples are physical examples of the actual material.. Drawn for the job, printed by the maker, and a physical piece.

   - Samples are the contract drawings, and shop drawings are the written specifications, so the architect issues both of them at the start of the project.: Samples are physical pieces, and specifications are written.
   - Shop drawings are manufacturer catalog sheets, while product data are hand-drawn field sketches made by the crew in the field as the work is laid out.: This swaps shop drawings and product data.
   - They are all the same document under three different names, so submitting any one of them satisfies the entire submittal requirement for the item.: They are three different things.

4. Under CSI MasterFormat, cast-in-place structural concrete work is specified under which division? B1.2

   Right: Division 03 - Concrete. Division three is concrete.

   - Division 06 - Wood, Plastics & Composites: Division six is wood and plastics.
   - Division 04 - Masonry: Division four is masonry.
   - Division 09 - Finishes: Division nine is finishes.

5. Structural steel framing and steel joists are specified under which CSI MasterFormat division? B1.2

   Right: Division 05 - Metals. Division five is metals.

   - Division 06 - Wood, Plastics & Composites: Division six is wood, plastics and composites.
   - Division 08 - Openings: Division eight is openings.
   - Division 03 - Concrete: Division three is concrete.

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6. Match each work item to its CSI MasterFormat division: (i) built-up roofing and wall insulation, (ii) interior painting and ceramic tile, (iii) exterior aluminum windows. B1.2

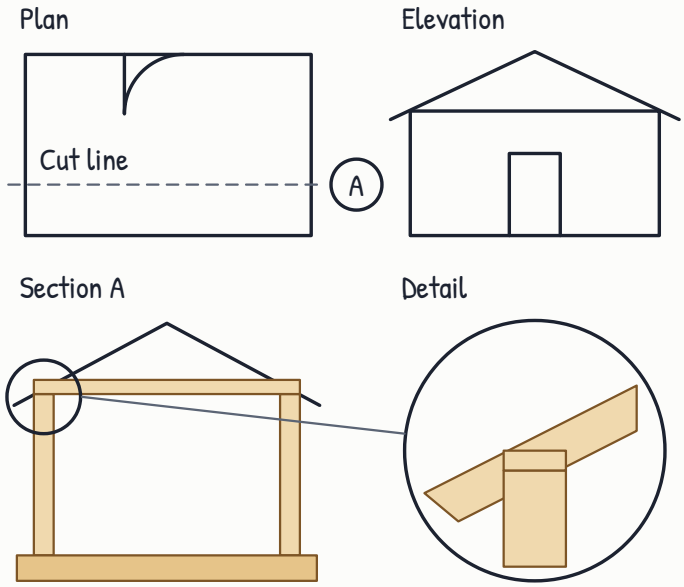
   Right: (i) 07, (ii) 09, (iii) 08. Roofing and insulation 07, paint and tile 09, windows 08.

   - (i) 08, (ii) 07, (iii) 09: 08 is openings and 09 is finishes, so roofing is not 08 and windows are not 09.
   - (i) 09, (ii) 07, (iii) 05: 09 is finishes, not roofing, and 05 is metals, not windows.
   - (i) 05, (ii) 08, (iii) 07: 05 is metals, 08 is openings and 07 is roofing, so none of these fit.

B1.3 How the sheets relate

About 4 minutes of narration.

BOARD 1 Four ways to draw one house B1.3



Schematic. Not to scale.

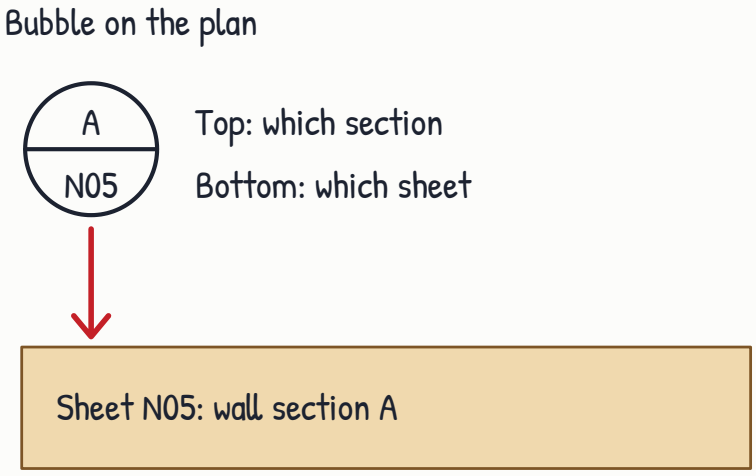
BOARD 2 Which view answers which question B1.3

You want	Look at
Location of walls, rooms	Plan
Outside face	Elevation
Layers, heights	Section
One small joint	Detail
Building on the lot	Site plan

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BOARD 3 Bubbles are addresses

B1.3

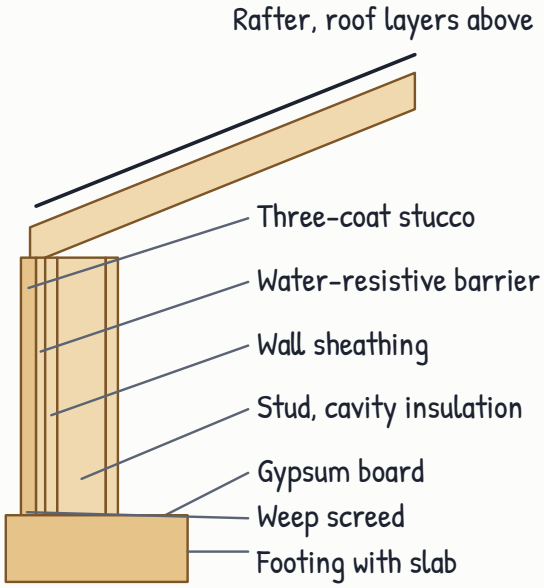


Training drawing. Not for construction.

✗ ~~Section N05 on sheet A~~

BOARD 4 Follow one marker across the set

B1.3



Training drawing. Not for construction. Simplified to fit a phone.

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BOARD 5 Reading the set in order B1.3

N01 Site
N02 Foundation
N03 Floor
N04 Elevations
N05 Section
N06 Schedules
N07 Roof framing

BOARD 6 What changed, and when B1.3

- Cloud: the changed area
- Delta triangle: revision number

Build from the latest

BOARD 7 Put it together B1.3

- View type: what can it show?
- Follow bubbles and tags

Right sheet first

Key numbers and formulas B1.3

- Build from the latest
- Right sheet first

Common traps: each line is a wrong belief B1.3

✗ Section N05 on sheet A

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Why the tempting answers fail (from the section practice) B1.3

1. Which drawing type shows a building as if cut vertically to reveal interior heights, floor and wall assemblies, and how components connect? B1.3

   Right: A section, a vertical cut through the building.. A section is a vertical cut.

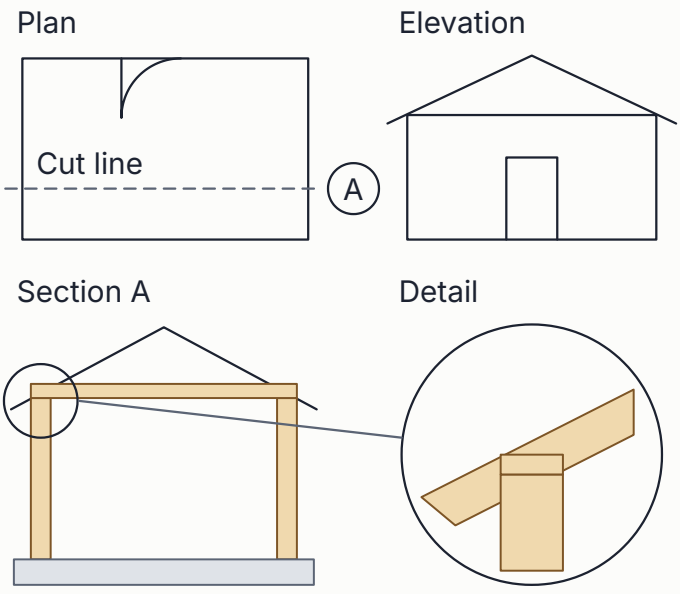
   - An exterior elevation, a straight-on view of a building face.: An elevation does not cut through.
   - A floor plan, which is a horizontal cut viewed from above.: A plan is a horizontal cut.
   - A site plan showing the building footprint on the lot.: A site plan shows the lot.

2. On construction drawings, what does a 'revision cloud' with a triangular 'delta' symbol indicate? B1.3

   Right: An area of the drawing that has been changed, with the delta noting the revision number.. A cloud marks the changed area, and the delta gives the revision.

   - The location of a survey benchmark elevation used as the datum for the site.: A benchmark has its own mark.
   - The true-north orientation of the site, from which the bearings are measured.: North is shown with an arrow.
   - A required fire-rated wall assembly and the hourly rating it must meet.: Ratings are noted differently.

3. In the figure, the dashed line marked Cut line on the plan produces which of the other three views? B1.3



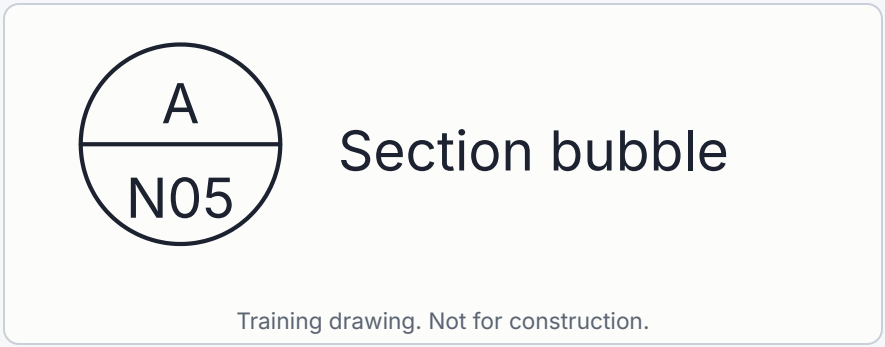
Schematic. Not to scale.

   Right: Section A. The section marker A at the cut line names the vertical slice shown as Section A.

   - Elevation: The elevation is the outside face of the building, not a slice.
   - Detail: The detail enlarges a circled part of the section; the cut line does not produce it.
   - Plan: The plan is the sheet carrying the cut line, not the view it produces.

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4. The section bubble on this foundation plan reads A over N05. Where does it send the reader? B1.3



Right: To section A on sheet N05. The top of the bubble names the section and the bottom names the sheet it is drawn on.

- To window 5 on the N05 schedule: Window tags are circles on the floor plan, and N05 is a wall section.
- To section N05 on sheet A: This swaps the two parts of the bubble; there is no sheet A.
- To note 5 on this same sheet: Note 5 covers sample values and has nothing to do with the bubble.

5. An estimator wants to see how many layers make up an exterior wall from footing to roof. Which kind of drawing shows this BEST? B1.3

Right: A wall section. A section is a vertical slice, so it shows the layers and how they stack.

- A site plan: A site plan locates the building on the lot and shows no wall assembly.
- A door schedule: A schedule lists doors by tag and does not show wall construction.
- A floor plan: A plan is a horizontal slice and shows a wall as a thickness, not its layers bottom to top.

6. Which drawing is the BEST place to find the outside appearance of a wall, including where its windows sit relative to the roofline? B1.3

Right: An exterior elevation. An elevation is a straight-on view of the outside face.

- A roof framing plan: A framing plan shows members from above, not the exterior face.
- A finish schedule: A finish schedule lists room finishes and contains no view of the wall.
- A foundation plan view: A foundation plan is drawn at the base of the building and shows no window heights.

B1.4 Scales and figured dimensions

About 4 minutes of narration.

BOARD 1 Two kinds of scale B1.4

Scale	Example	Used for
Architect's	1/4 in = 1 ft	Plans
Engineer's	1 in = 20 ft	Site work

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BOARD 2 Three scales in one set

B1.4

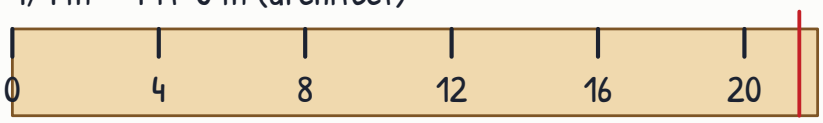
N01	1 in = 20 ft
N02, N03, N07	1/4 in = 1 ft
N04	3/16 in = 1 ft
N05	3/4 in = 1 ft

- Bigger fraction: more room per foot

BOARD 3 The quarter inch scale

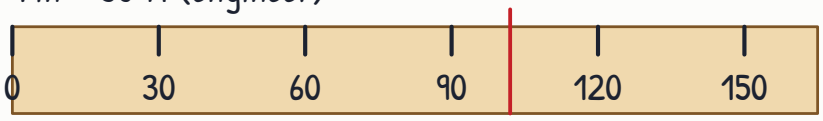
B1.4

1/4 in = 1 ft-0 in (architect)



5-3/8 in = 21 ft 6 in

1 in = 30 ft (engineer)



3.4 in = 102 ft

Examples only. Rulers are drawn to fit, not to true size.

Feet = paper inches x 4

BOARD 4 The engineer's scale

B1.4

Feet = paper inches x scale

3.4 x 30 = 102 ft

✗ ~~3.4 x 4 = 13.6 ft~~

BOARD 5 Scaled or figured

B1.4

Scaled	Figured
21'-6"	21'-8"

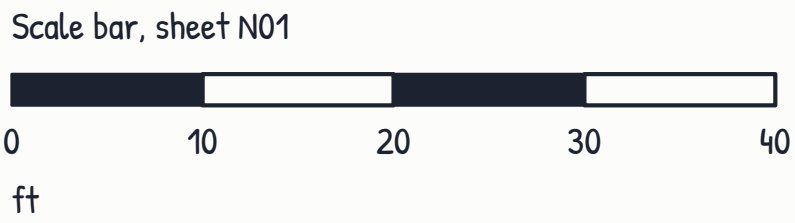
Figured governs

- Two figures disagree: RFI

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BOARD 6 Reduced prints and scale bars

B1.4



Training drawing. Not for construction.

On screen or reduced print: use the bar

BOARD 7 Your turn

B1.4

- Read the scale
- Feet per paper inch
- Multiply

Figure printed? Use it

Your turn: worked step by step in lesson B1.4.

Key numbers and formulas

B1.4

- Feet = paper inches x 4
- Feet = paper inches x scale
- 3.4 × 30 = 102 ft
- Figured governs
- Figure printed? Use it

Common traps: each line is a wrong belief

B1.4

✗ 3.4 × 4 = 13.6 ft

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Why the tempting answers fail (from the section practice) B1.4

1. On a drawing at 1/8 in = 1 ft-0 in, a wall measures 4 in on the paper. How long is the wall? B1.4

   Right: 32 ft. Eight eighths in an inch, so 8 ft per inch: 4 × 8 = 32 ft.

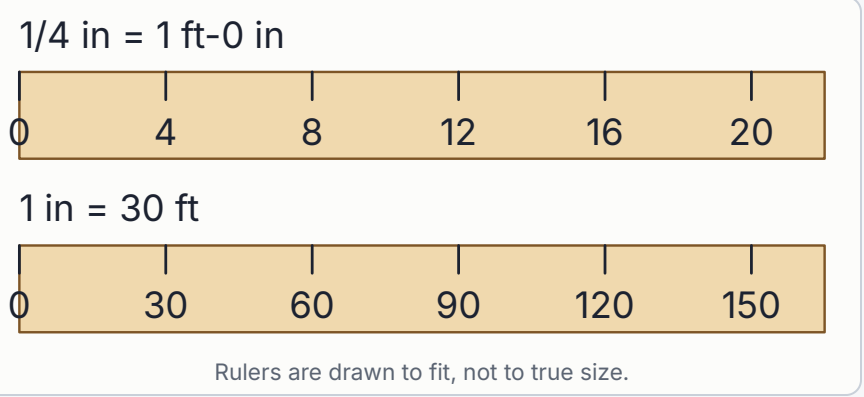
   - 16 ft: That is the quarter inch rule. At an eighth, one inch is 8 ft.
   - 8 ft: That is one inch at this scale, not four.
   - 64 ft: That uses 16 ft per inch.

2. On a civil drawing using an engineer's scale of 1 inch = 20 feet, a property line measures 4.5 inches on the paper. What is its actual length, and how does an engineer's scale differ from an architect's scale? B1.4

   Right: 90 feet; the engineer's scale divides the inch into decimal units (e.g., 10, 20, 30, 40, 50, 60 per inch), whereas the architect's scale is based on feet-and-inches fractions.. 4.5 × 20 = 90 ft, and engineer's scales use decimal parts.

   - 900 feet; the engineer's scale multiplies every inch by 200, so a civil site plan is read at ten times the ratio printed in its title block and the bar scale printed on the sheet is read the same way: The scale is 20 ft per inch, not 200.
   - 20 feet; the two scales are identical in how they divide the inch, so a civil drawing and a floor plan may be measured with either one of them so either scale may be used on either kind of sheet: The scale is not read as 20 ft in all.
   - 4.5 feet; the engineer's scale uses fractions of an inch that each equal one foot, so the paper measurement is read directly as the field length with no further conversion needed at all: That ignores the scale.

3. Using the 1/4 in = 1 ft-0 in scale shown, a line measures 3 in on the paper. What length does it represent? B1.4



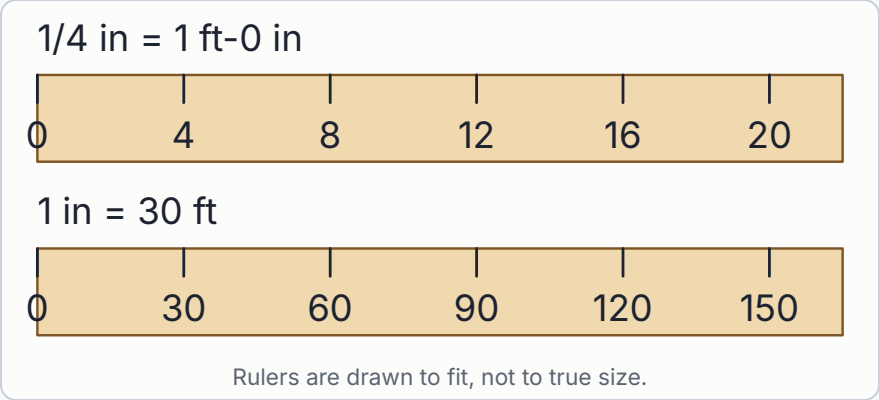
Rulers are drawn to fit, not to true size.

   Right: 12 ft. Each inch is 4 ft at this scale, so 3 × 4 = 12 ft.

   - 48 ft: This multiplies by 16, as if each quarter inch were 4 ft.
   - 9 ft: This uses 3 ft per inch, which is not the scale shown.
   - 3 ft: This reads inches as feet and ignores the scale.

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4. Using the 1 in = 30 ft scale shown, a property line measures 2.5 in on the paper. What length does it represent? B1.4

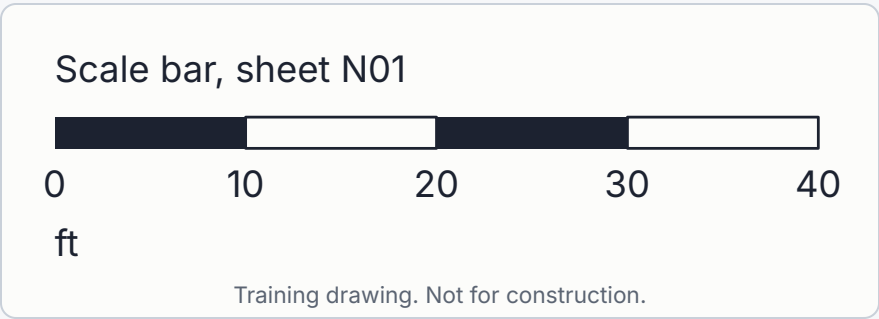


Rulers are drawn to fit, not to true size.

Right: 75 ft. 2.5 × 30 = 75 ft.

- 60 ft: This drops the half inch and reads only 2 × 30.
- 90 ft: This rounds 2.5 in up to 3 in before multiplying.
- 25 ft: This uses 10 ft per inch, not the 30 ft shown.

5. On this sheet's scale bar, how many feet does one black or white segment represent? B1.4

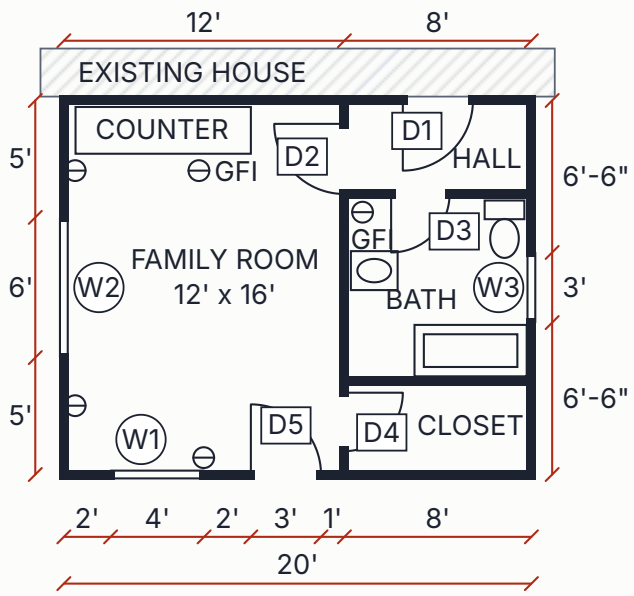


Training drawing. Not for construction.

Right: 10 ft. The bar is marked 0, 10, 20, 30 and 40 ft, with one segment between each pair of marks.

- 40 ft: That is the length of the whole bar.
- 20 ft: That is the distance across two segments.
- 5 ft: There are no 5 ft divisions on this bar.

6. On a reduced print of this sheet, a ruler scales the family room's east-west size at about 11 ft 9 in. What size should the estimator use? B1.4



Training drawing. Not for construction. Simplified to fit a phone.

Right: 12'-0", the figured size printed on the plan. Figured dimensions govern over scaled ones, and the room is labeled 12'-0" x 16'-0".

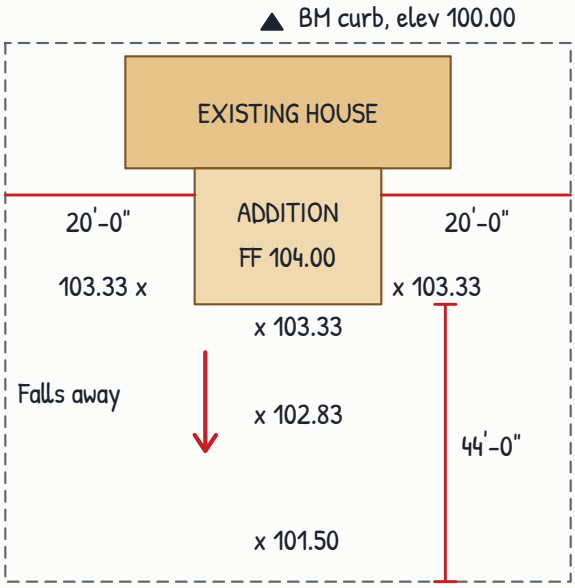
- 16'-0", the larger size printed in the label: 16'-0" is the north-south size of the room, not east-west.
- 11'-10-1/2", halfway between the two: Splitting the difference produces a size no document shows.
- 11'-9", the size measured with the ruler: A scaled reading on a reduced print is the least reliable number on the sheet.

B1.5 Sheet walk: site and foundation

About 4 minutes of narration.

BOARD 1 The site plan

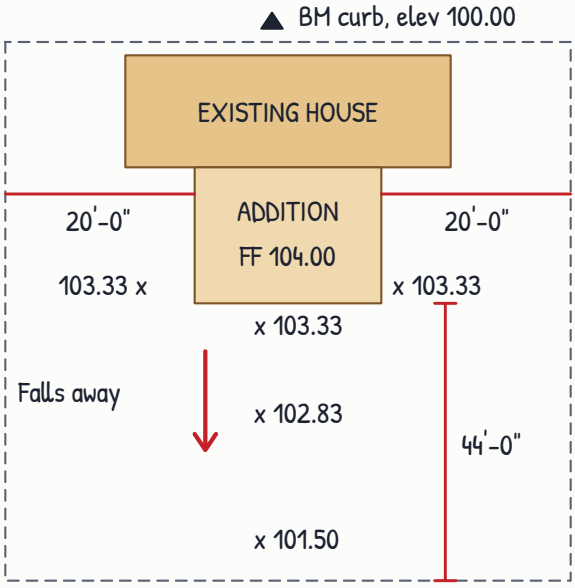
B1.5



Training drawing. Not for construction. Simplified to fit a phone.

BOARD 2 Benchmark and elevations

B1.5



Training drawing. Not for construction. Simplified to fit a phone.

BM curb 100.00

FF 104.00

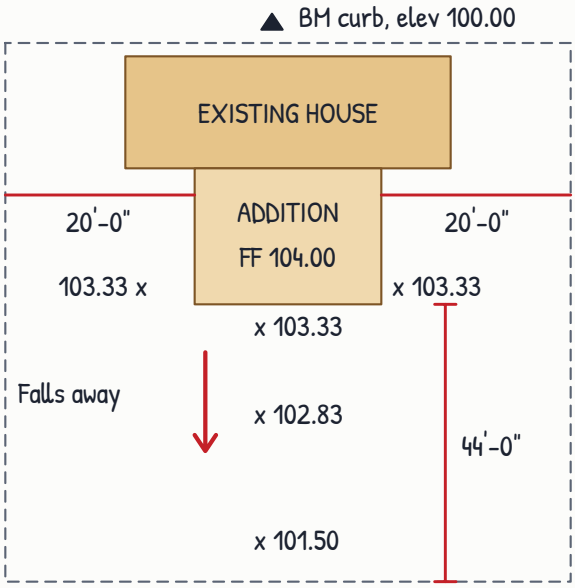
104.00 - 100.00 = 4.00 ft

Everything ties to one benchmark

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BOARD 3 Spot elevations and fall

B1.5



Training drawing. Not for construction. Simplified to fit a phone.

104.00 - 103.33 = 0.67 ft

0.67 x 12 = about 8 in

103.33 - 102.83 = 0.50 ft

Sample values for this set

BOARD 4 Utilities and digging

B1.5

- W = water, S = sewer

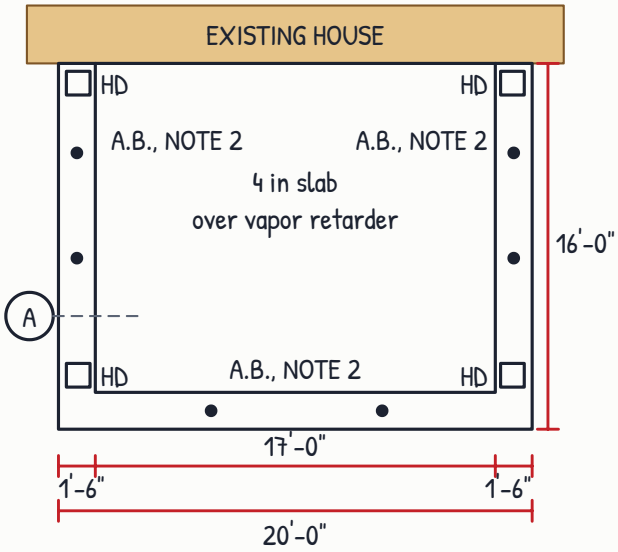
Call 811 / DigAlert before digging

N01 note 6

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BOARD 5 The foundation plan

B1.5



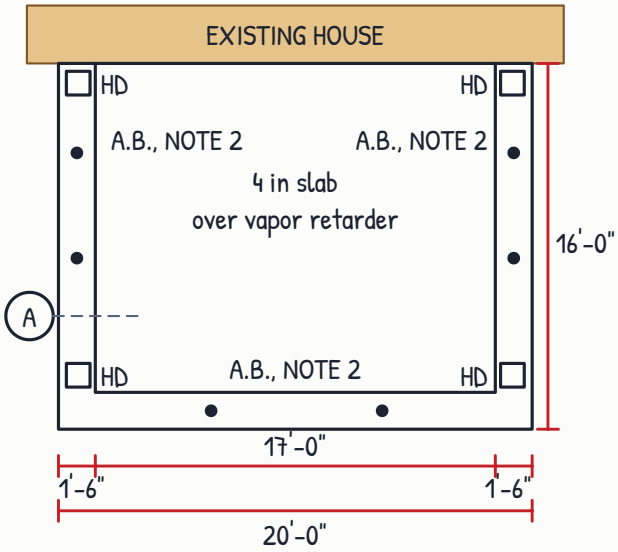
Bubble A / N05: section at the west wall

Training drawing. Not for construction. Simplified to fit a phone.

N02 notes 1 and 2

BOARD 6 Hold-downs and strings

B1.5



Bubble A / N05: section at the west wall

Training drawing. Not for construction. Simplified to fit a phone.

Four HD: two each on W and E

1'-6" + 17'-0" + 1'-6" = 20'-0"

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BOARD 7 Section A and the walk back B1.5

- North, scale, what it shows
- Notes, strings

Then follow the bubbles

BOARD 8 Your turn B1.5

BM 100.00

FF 104.00

Grade at wall 103.33

South string: 1'-6", 17'-0", 1'-6"

Your turn: worked step by step in lesson B1.5.

Key numbers and formulas B1.5

- 104.00 - 100.00 = 4.00 ft
- Everything ties to one benchmark
- 104.00 - 103.33 = 0.67 ft
- 0.67 × 12 = about 8 in
- 103.33 - 102.83 = 0.50 ft
- Call 811 / DigAlert before digging
- Four HD: two each on W and E
- 1'-6" + 17'-0" + 1'-6" = 20'-0"
- Then follow the bubbles

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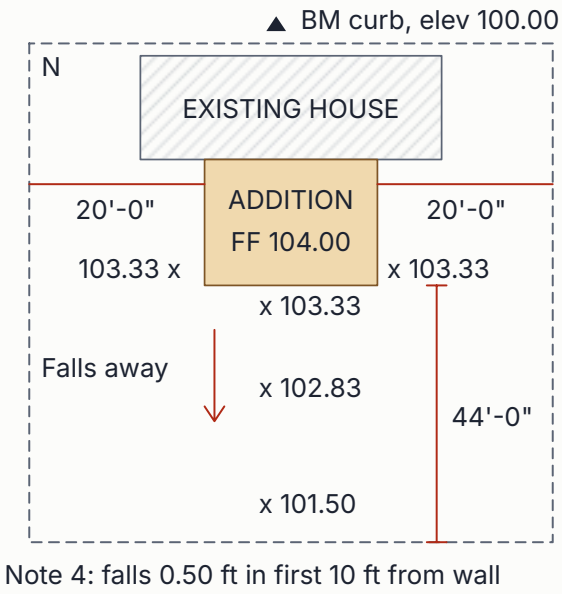
Why the tempting answers fail (from the section practice) B1.5

1. Before starting sitework, the crew needs a consistent reference for all elevations across the project. Which practice BEST establishes this? B1.5

   Right: Set a fixed benchmark and reference all elevations to that datum. One fixed benchmark ties all elevations.

   - Use the finished floor of an adjacent building without verification: An unverified surface is not a job datum.
   - Estimate grades by eye and adjust later: Eyeballing piles up errors.
   - Measure heights from the top of the nearest fence each day: A fence can move.

2. How far above the benchmark is the finished floor of the addition? B1.5



Note 4: falls 0.50 ft in first 10 ft from wall

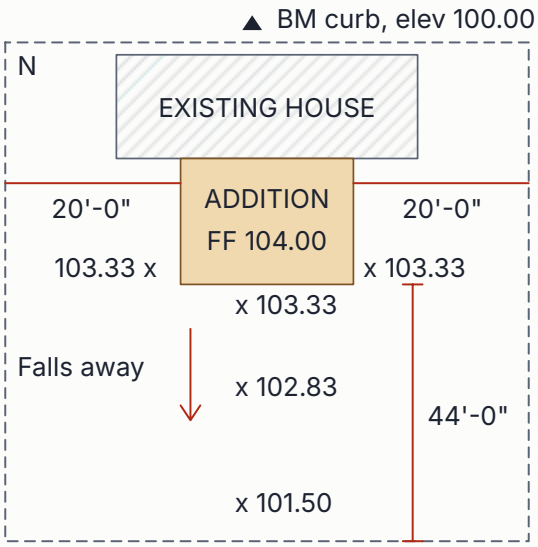
Training drawing. Not for construction. Simplified to fit a phone.

Right: 4.00 ft. FF 104.00 minus BM 100.00 is 4.00 ft.

- 0.67 ft: That is finished floor above grade at the wall, not above the benchmark.
- 1.50 ft: 1.50 ft is how far the 101.50 spot near the rear line sits above the benchmark, not the floor.
- 3.33 ft: That is finish grade at the wall above the benchmark, not the floor.

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3. How far is the finished floor above the finish grade at the addition's walls? B1.5



Note 4: falls 0.50 ft in first 10 ft from wall

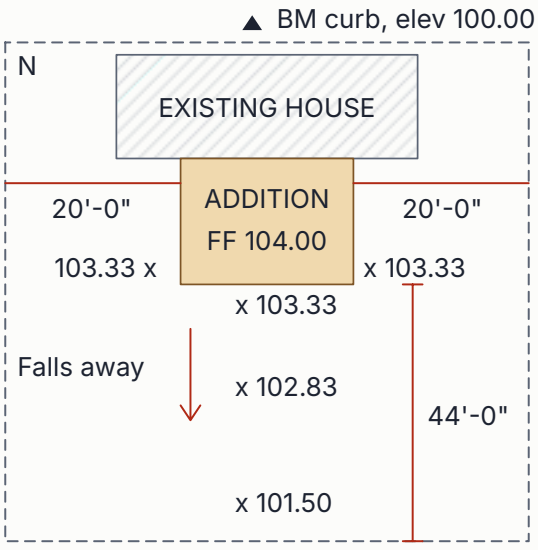
Training drawing. Not for construction. Simplified to fit a phone.

Right: 8 in. 104.00 - 103.33 = 0.67 ft, and 0.67 × 12 is about 8 in.

- 6 in: 6 in is the fall of the grade in the first 10 ft, a different measurement.
- 4 in: This converts 0.33 ft, the decimal part of 103.33, instead of 104.00 - 103.33.
- 12 in: This rounds the 0.67 ft difference up to a full foot.

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4. Per the spot elevations and notes, how much does finish grade fall in the first 10 ft from the addition's wall? B1.5



Note 4: falls 0.50 ft in first 10 ft from wall

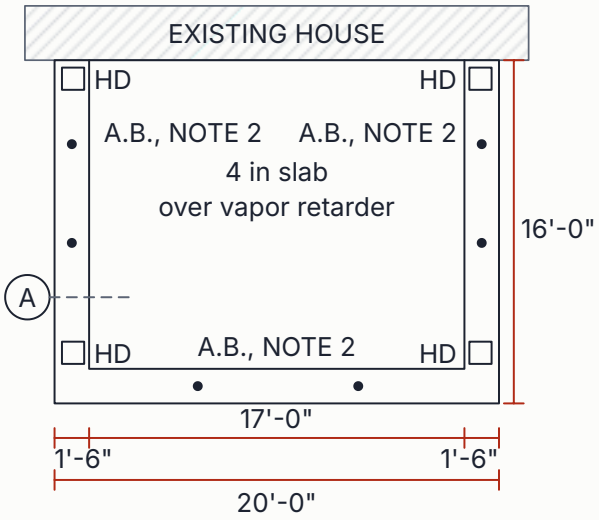
Training drawing. Not for construction. Simplified to fit a phone.

Right: 0.50 ft. 103.33 - 102.83 = 0.50 ft, which also matches site plan note 4.

- 1.83 ft: This is the fall from the wall to the 101.50 spot near the rear line.
- 0.67 ft: This is floor to grade at the wall, not the fall of the grade.
- 0.33 ft: This is the decimal part of the wall spot elevation, not a fall.

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5. According to the foundation notes, on which walls of the addition does the continuous footing run? B1.5



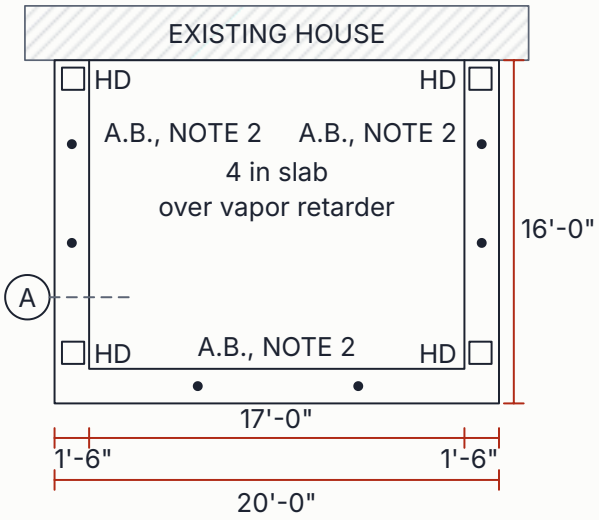
Bubble A / N05: section at the west wall
Note 1: footing on west, south, east walls

Training drawing. Not for construction. Simplified to fit a phone.

Right: West, south and east. Note 1 lists the west, south and east walls.

- North, south and east: The north side is the existing house, and the note does not list it.
- All four of the walls: The note names three walls; the north side abuts the existing house.
- North and south only: This leaves out the two side walls the note names.

6. How many hold-downs are shown on this foundation plan? B1.5



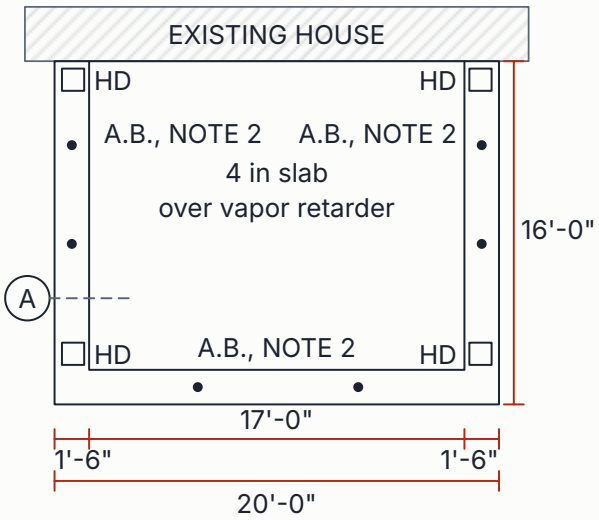
Bubble A / N05: section at the west wall
Note 1: footing on west, south, east walls

Training drawing. Not for construction. Simplified to fit a phone.

Right: 4. One HD symbol appears at each end of the east and west walls.

- 6: The south wall's bolt marks are not hold-downs.
- 2: That counts only one wall's hold-downs.
- 3: No wall on the sheet has an odd number of hold-downs.

7. In the south dimension string, what is the distance between the two footing widths? B1.5



Bubble A / N05: section at the west wall
Note 1: footing on west, south, east walls

Training drawing. Not for construction. Simplified to fit a phone.

Right: 17'-0". The string reads 1'-6" + 17'-0" + 1'-6" = 20'-0".

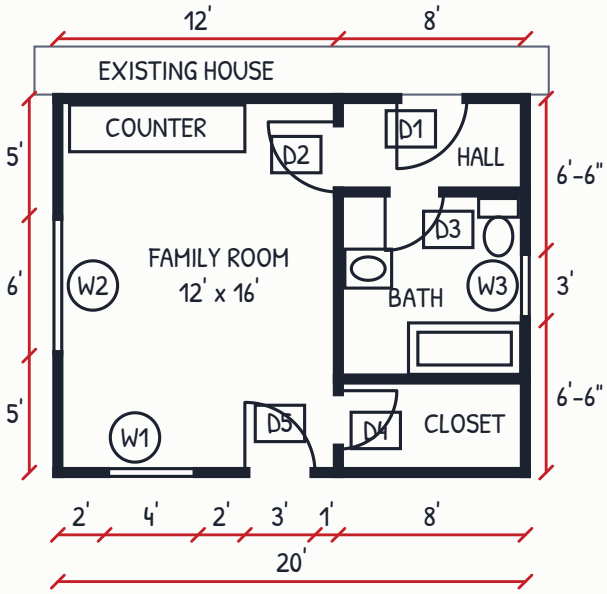
- 16'-0": 16'-0" is the north-south overall of the addition.
- 20'-0": 20'-0" is the overall, which includes both footing widths.
- 18'-6": This subtracts only one of the 1'-6" footing widths from 20'-0".

B1.6 Sheet walk: floor plan and schedules

About 4 minutes of narration.

BOARD 1 Read the plan before the details

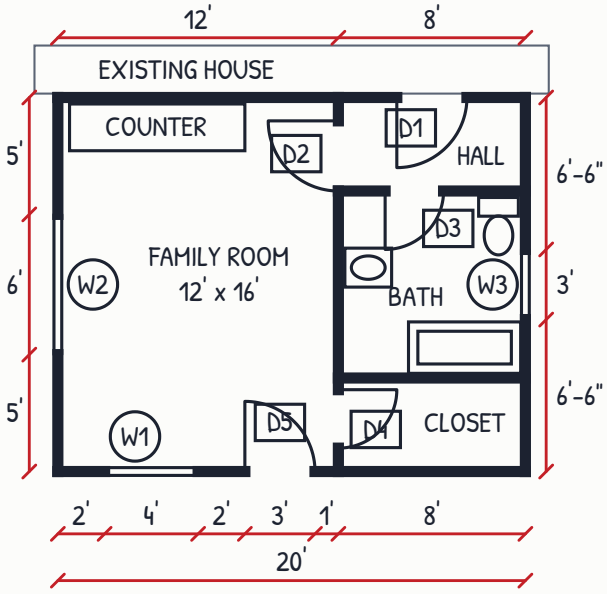
B1.6



Training drawing. Not for construction.

BOARD 2 Tags point to schedules

B1.6



Training drawing. Not for construction.

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BOARD 3 The door schedule

B1.6

Tag	Size	Type	Glz
D1	3-0 x 6-8	Solid, to house	N
D2	3-0 x 6-8	Hollow, int.	N
D3, D4	2-6 x 6-8	Hollow, int.	N
D5	3-0 x 6-8	Ext., full glass	Y

✓ D5 is the one door with safety glazing

BOARD 4 The window schedule

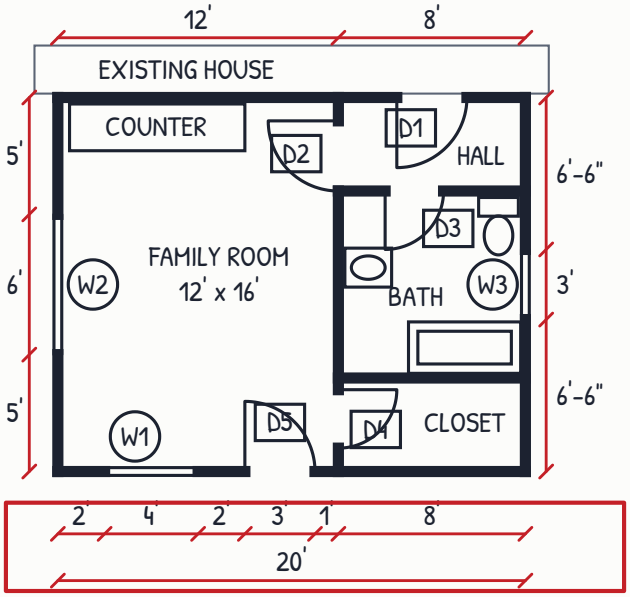
B1.6

Tag	W x H	Glz	Egress
W1	4-0 x 4-0	N	Y
W2	6-0 x 4-0	N	N
W3	3-0 x 3-0	Y	N

✗ ~~W2 is 4 ft wide~~

BOARD 5 Add the strings

B1.6



Training drawing. Not for construction.

Your turn: worked step by step in lesson B1.6.

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BOARD 6 Nominal size is not clear opening

B1.6

Sizes are nominal unit sizes

- Nominal: the unit you order
- Net clear: the open space with the sash open

✗ ~~Y in Egress proves the size~~

✓ Get the maker's data

BOARD 7 The finish schedule

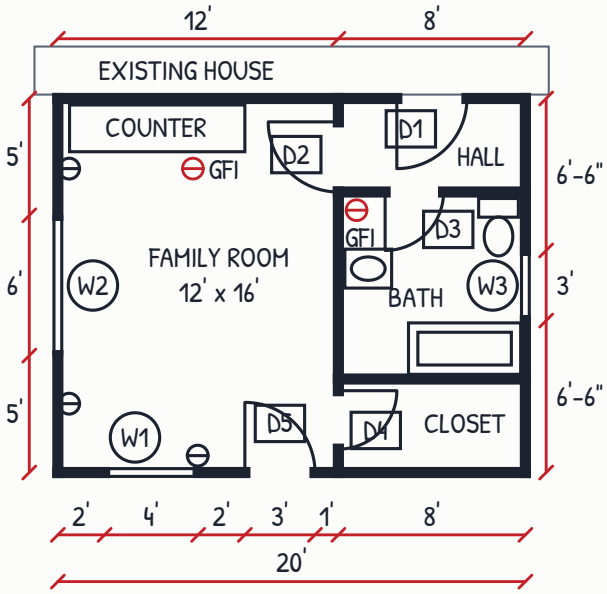
B1.6

Room	Floor	Base	Walls
Family, hall, closet	LVP	Painted wood	Paint on gyp
Bath	Ceramic tile	Tile	Tile at tub, paint

- Ceilings: paint

BOARD 8 Legends are local

B1.6



Training drawing. Not for construction. Legend applies to this sample set only.

Common traps: each line is a wrong belief

B1.6

✗ W2 is 4 ft wide

✗ Y in Egress proves the size

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Why the tempting answers fail (from the section practice) B1.6

1. Which window does the schedule mark as an egress window? B1.6

   Window schedule, sheet N06. Sizes are nominal unit sizes, not net clear openings.

Tag	Size (W x H)	Type	Safety glazing	Egress
W1	4'-0" x 4'-0"	Slider, family room south	N	Y
W2	6'-0" x 4'-0"	Slider, family room west	N	N
W3	3'-0" x 3'-0"	Fixed, obscure, bath east	Y	N

   Right: W1. W1 shows Y in the Egress column; W2 and W3 show N.

   - W2: W2 is the larger slider, but its Egress column reads N.
   - W3: W3 is a fixed obscure unit with N under Egress.
   - W1 and W2: Only W1 shows Y; W2 reads N under Egress.

2. Which door on the schedule requires safety glazing? B1.6

   Door schedule, sheet N06

Tag	Size	Type	Safety glazing	Egress
D1	3'-0" x 6'-8"	Solid core, connection to house	N	-
D2	3'-0" x 6'-8"	Hollow core, interior	N	-
D3	2'-6" x 6'-8"	Hollow core, interior	N	-
D4	2'-6" x 6'-8"	Hollow core, interior	N	-
D5	3'-0" x 6'-8"	Exterior, full glass	Y	N

   Right: D5. D5, the exterior full-glass door, is the only door with Y under Safety glazing.

   - D4: D4 is a hollow-core interior door, marked N.
   - D2: D2 is a hollow-core interior door, marked N.
   - D1: D1 is a solid-core connection to the house, marked N.

3. What is the size of window W2 as listed, width by height? B1.6

   Window schedule, sheet N06. Sizes are nominal unit sizes, not net clear openings.

Tag	Size (W x H)	Type	Safety glazing	Egress
W1	4'-0" x 4'-0"	Slider, family room south	N	Y
W2	6'-0" x 4'-0"	Slider, family room west	N	N
W3	3'-0" x 3'-0"	Fixed, obscure, bath east	Y	N

   Right: 6'-0" x 4'-0". The window schedule lists W2 at 6'-0" x 4'-0".

   - 3'-0" x 3'-0": That is the listed size of W3.
   - 4'-0" x 4'-0": That is the listed size of W1.
   - 4'-0" x 6'-0": This swaps width and height; the column heading is W x H.

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4. A checker wants to know whether W1 meets the net clear size for an escape opening. What does this sheet's note tell the checker? B1.6

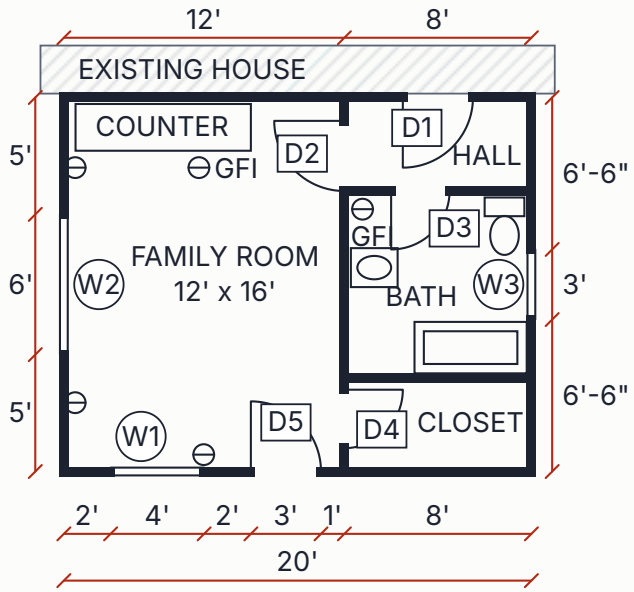
Window schedule, sheet N06. Sizes are nominal unit sizes, not net clear openings.

Tag	Size (W x H)	Type	Safety glazing	Egress
W1	4'-0" x 4'-0"	Slider, family room south	N	Y
W2	6'-0" x 4'-0"	Slider, family room west	N	N
W3	3'-0" x 3'-0"	Fixed, obscure, bath east	Y	N

Right: Listed sizes are nominal, so get the maker's clear opening data. The note says sizes are nominal unit sizes, not net clear openings.

- Egress is marked Y, so the size no longer needs to be checked: A Y in a column does not prove the opening's actual clear size.
- U-factor per Title 24 calc settles the clear opening question: U-factor concerns heat transfer and says nothing about clear opening size.
- Listed sizes are net clear, so the schedule alone answers it: The note says the opposite: sizes are not net clear openings.

5. In the south dimension string, how far is window W1's opening from the west end of the addition? B1.6



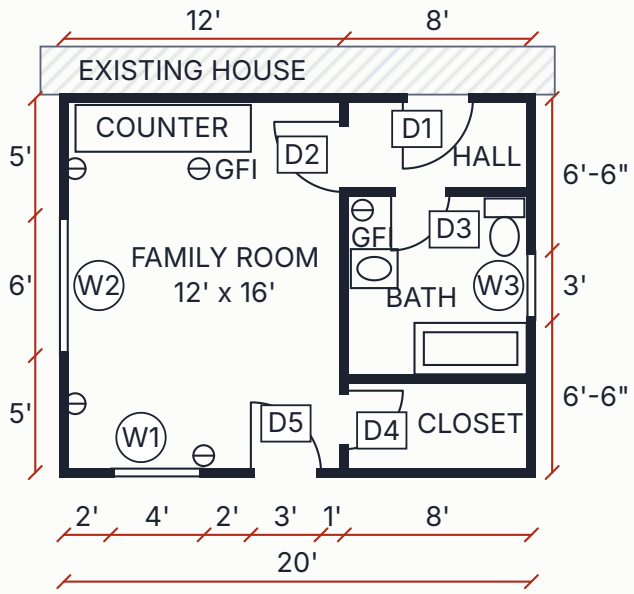
Training drawing. Not for construction. Redrawn to fit a phone. Whole-foot dimensions drop the inches.

Right: 2'-0". The string starts 2'-0" and the next part, 4'-0", is the W1 opening.

- 3'-0": 3'-0" is the width of door D5's opening in the same string.
- 8'-0": 8'-0" is the last part of the string, at the east end.
- 4'-0": 4'-0" is the width of W1 itself.

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6. On this plan, a circle with a bar is a receptacle, and the same symbol marked GFI is a GFCI receptacle. How many GFCI receptacle symbols appear? B1.6



Training drawing. Not for construction. Redrawn to fit a phone. Whole-foot dimensions drop the inches.

Right: 2. The symbol marked GFI appears once at the counter and once in the bath.

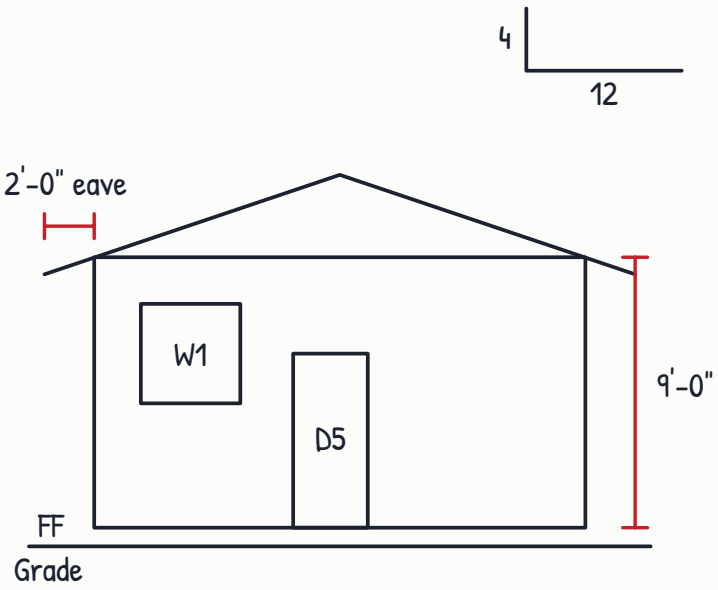
- 5: Five is the count of all receptacle symbols, GFI or not.
- 3: Three is the count of plain receptacles in the family room.
- 1: This misses one of the two GFI marks, at the counter or in the bath.

B1.7 Sheet walk: walls and roof

About 4 minutes of narration.

BOARD 1 The south elevation

B1.7



Training drawing. Not for construction. Simplified to fit a phone. Not to scale.

BOARD 2 Rise and ridge

B1.7

Rise = run x slope / 12

10 x 4 / 12 = 3'-4"

✗ ~~Run = 20 ft~~

9'-0" + 3'-4" = 12'-4"

BOARD 3 The west elevation

B1.7

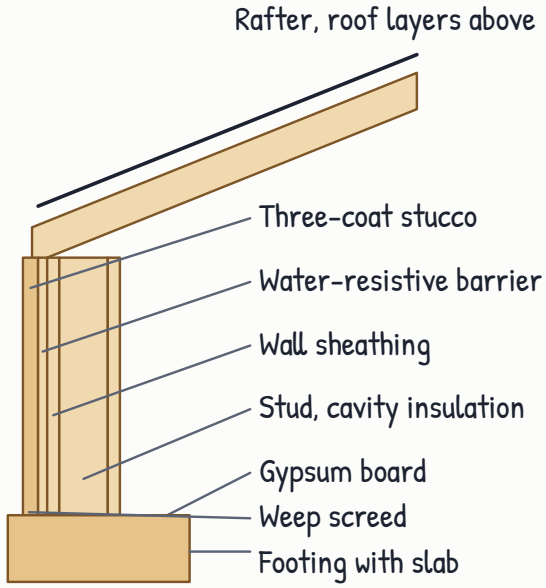
- Three-coat stucco
- Weep screed at the base
- Asphalt shingle roof covering
- Soffit under the overhang

Rake: 1'-0" at south

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BOARD 4 Layers in the wall section

B1.7



Training drawing. Not for construction. Simplified to fit a phone.

BOARD 5 Layers tell you what to order

B1.7

Each layer = a line item

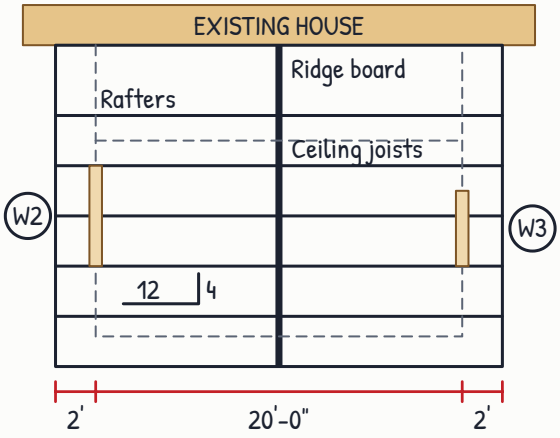
N05: layers exaggerated. Do not scale.

- Sheathing, underlayment, covering
- Soffit vent, baffle

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BOARD 6 The roof framing plan

B1.7



16 ft north-south; 1 ft rake at south
Ridge board, not a beam
Headers over W2 and W3
2x8 rafters @ 24 in o.c.

Training drawing. Not for construction. Simplified to fit a phone.

BOARD 7 Why ridge board matters

B1.7

✗ ~~Ridge board carries the roof~~

Ceiling joists tie the rafters

24 ft x 17 ft with overhangs

BOARD 8 Your turn

B1.7

Span 20'-0"

Slope 4 in 12

Plate 9'-0"

- Sheets disagree: RFI

Your turn: worked step by step in lesson B1.7.

Key numbers and formulas

B1.7

- Rise = run x slope / 12
- 10 × 4 / 12 = 3'-4"
- 9'-0" + 3'-4" = 12'-4"
- Rake: 1'-0" at south
- Each layer = a line item
- Ceiling joists tie the rafters

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Common traps: each line is a wrong belief B1.7

✗ Run = 20 ft

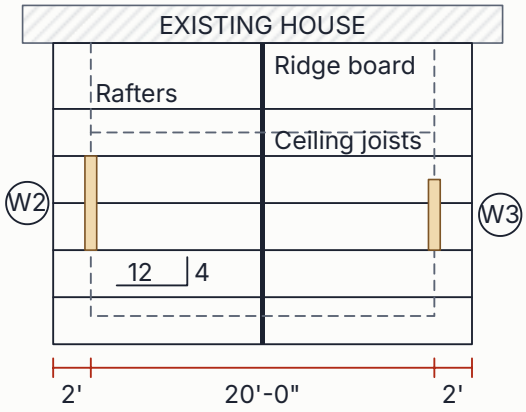
✗ Ridge board carries the roof

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Why the tempting answers fail (from the section practice)

B1.7

1. From this framing plan, the ridge sits at mid-width of the 20'-0" building and the slope is 4 in 12. What is the rise from plate to ridge? B1.7



16 ft north-south; 1 ft rake at south
Ridge board, not a beam
Headers over W2 and W3
2×8 rafters @ 24 in o.c.
Ceiling joists: 2×8 @ 24 in, tie the rafters

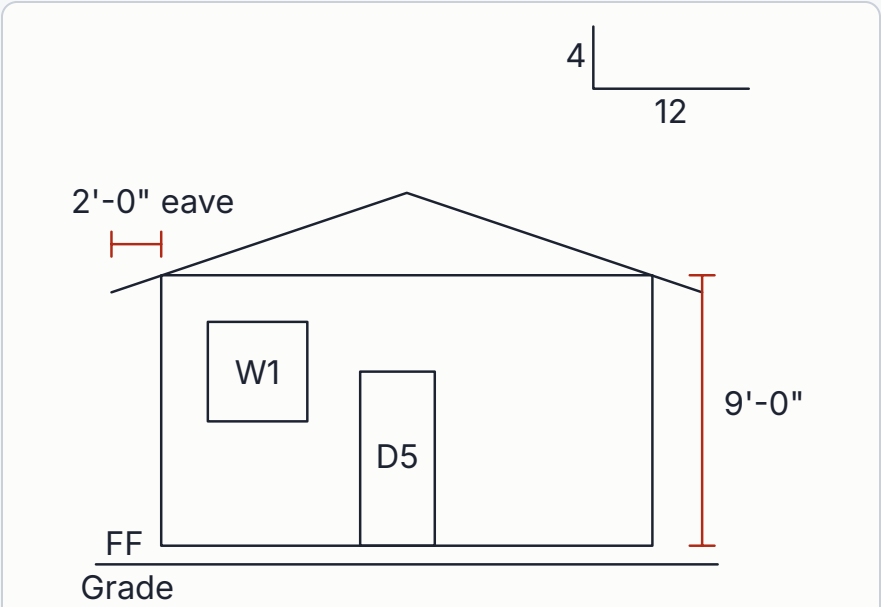
Training drawing. Not for construction. Simplified to fit a phone.

Right: 3'-4". The run is 10 ft, and 10 × 4/12 = 3.33 ft, or 3'-4".

- 4'-0": This is the rise of a 12 ft run: the 10 ft run with the 2 ft eave added.
- 2'-8": This is the rise of an 8 ft run, not a 10 ft run.
- 6'-8": This uses the full 20 ft span as the run.

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2. The rise above the plate is 3'-4". Using the plate height dimensioned on this sheet, how far is the ridge above finished floor? B1.7

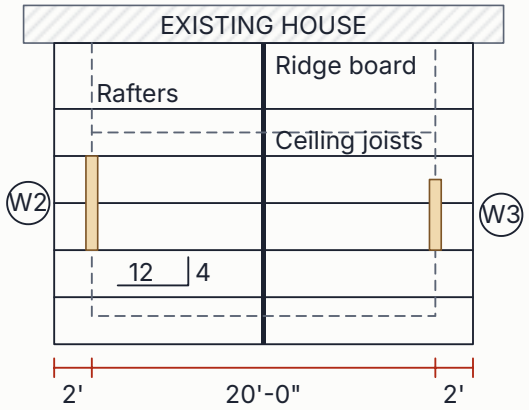


Training drawing. Not for construction. Simplified to fit a phone. Not to scale.

Right: 12'-4". The plate is 9'-0" above FF, and 9'-0" + 3'-4" = 12'-4".

- 11'-0": This adds the 2'-0" eave to the plate height instead of the rise.
- 9'-0": This is only the plate height and ignores the rise.
- 13'-4": This adds an extra foot, as if the plate were 10'-0" high.

3. What member size and spacing does this sheet give for the rafters? B1.7



16 ft north-south; 1 ft rake at south
Ridge board, not a beam
Headers over W2 and W3
2×8 rafters @ 24 in o.c.
Ceiling joists: 2×8 @ 24 in, tie the rafters

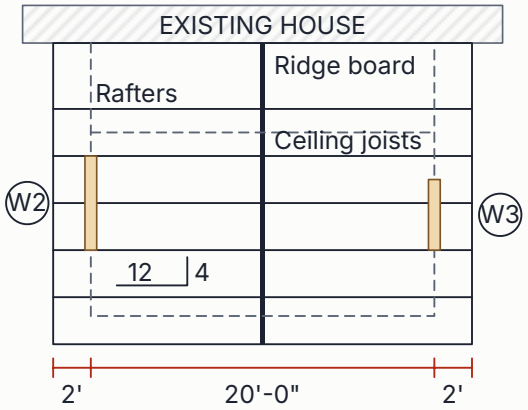
Training drawing. Not for construction. Simplified to fit a phone.

Right: 2×8 at 24 in o.c.. The rafter callout reads 2×8 rafters @ 24 in o.c.

- 2×10 at 16 in o.c.: Neither the size nor the spacing appears on the sheet.
- 2×6 at 24 in o.c.: The sheet gives 2×8, and no 2×6 member appears.
- 2×8 at 16 in o.c.: The member size matches, but the spacing is 24 in.

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4. This sheet calls the ridge member a ridge board, not a beam. Per its callouts, what ties the rafters together? B1.7



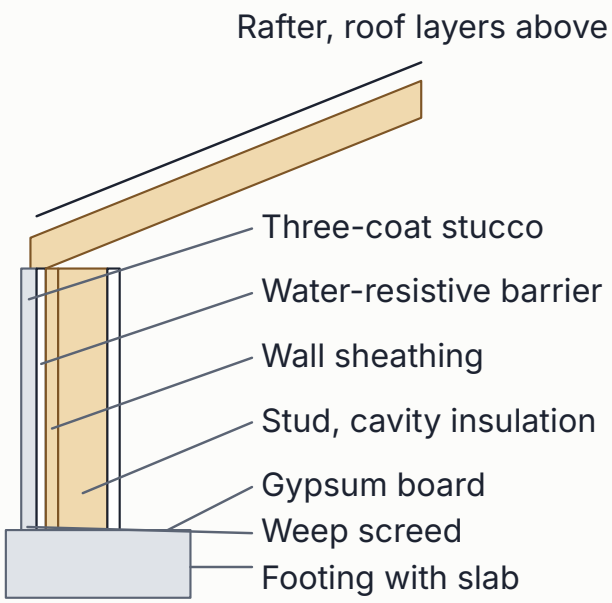
16 ft north-south; 1 ft rake at south
Ridge board, not a beam
Headers over W2 and W3
2×8 rafters @ 24 in o.c.
Ceiling joists: 2×8 @ 24 in, tie the rafters

Training drawing. Not for construction. Simplified to fit a phone.

Right: The 2×8 ceiling joists. The callout reads 2×8 ceiling joists @ 24 in o.c. tie the rafters.

- The double wall top plates: Top plates carry rafter ends but are not called out as the tie.
- The W2 and W3 headers: Headers span W2 and W3 and do not tie opposing rafters.
- The 2x ridge board: A ridge board only connects opposing rafters; the sheet says it is not a beam.

5. As labeled on this section, which layer sits directly behind the three-coat stucco? B1.7

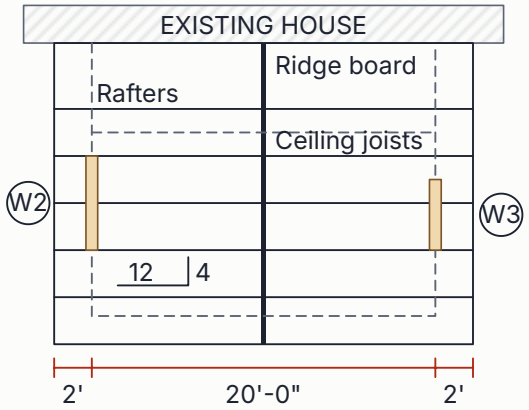


Training drawing. Not for construction. Simplified to fit a phone.

Right: Water-resistive barrier. Going inward, the labels read stucco, water-resistive barrier, wall sheathing.

- Exterior wall sheathing: Sheathing is the next layer in, behind the barrier.
- Cavity insulation: Insulation sits between the studs, inside the sheathing.
- Interior gypsum board: Gypsum board is the interior face of the wall.

6. Which windows have headers called out on this sheet? B1.7



16 ft north-south; 1 ft rake at south
Ridge board, not a beam
Headers over W2 and W3
2×8 rafters @ 24 in o.c.
Ceiling joists: 2×8 @ 24 in, tie the rafters

Training drawing. Not for construction. Simplified to fit a phone.

Right: W2 and W3. The leader reads Headers over W2 and W3, and both tags appear at the headers.

- W2 only: The callout and tags also put a header at W3.
- W1 and W2: W1 is in the south wall, and no header is drawn there.
- W1 and W3: W1 has no header on this sheet.

B1.8 Plan review: code problems

About 4 minutes of narration.

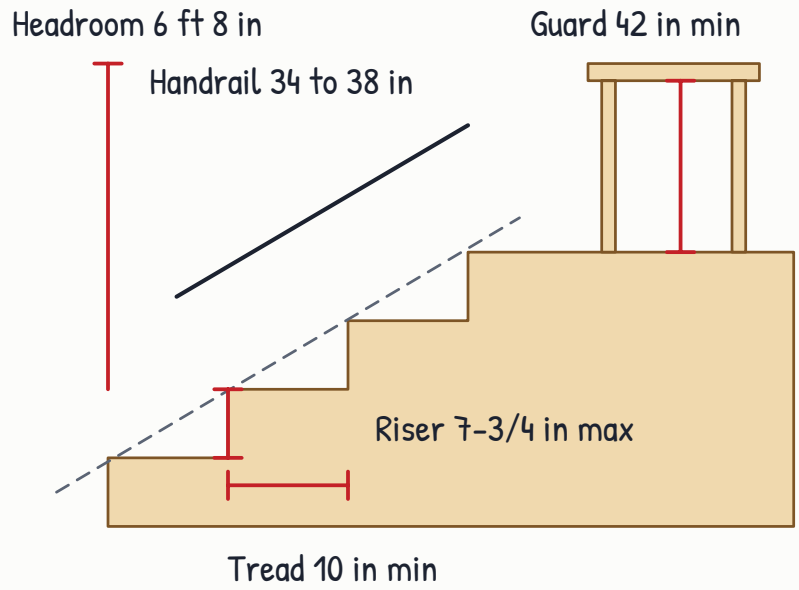
BOARD 1 Illegal, but drawn perfectly B1.8

- Hallway: 36 in min
- Habitable ceiling: 7 ft min

CRC R318.6, R313.1

BOARD 2 Stairs on a detail

B1.8



Statewide CRC values. Schematic, not to scale.

✗ ~~Handrail at 42 in~~

BOARD 3 Guards

B1.8

- Required above 30 in

CRC R321.1.1

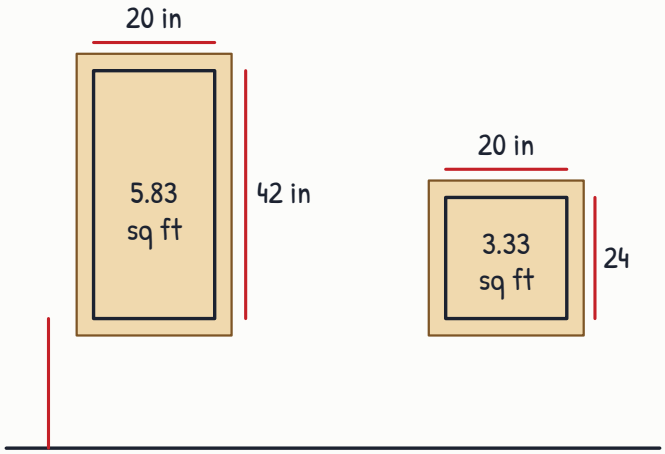
4 in sphere must not pass

CRC R321.1.3

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BOARD 4 Escape openings

B1.8



Minimums: 20 in wide, 24 in high, 5.7 sq ft

Statewide CRC values. Net clear opening shown.

CRC R319.1, R319.2

BOARD 5 Reading the schedule like a checker

B1.8

Tag	Type	Check
D5	Full glass	Safety glazing

CRC R324.4.1

W3	Fixed	Cannot be an escape opening
W1	Slider	Needs maker's data

BOARD 6 What else to scan

B1.8

- Smoke, CO alarms

CRC R310, R311

- Attic access 22 x 30 in

CRC R807.1

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BOARD 7 Write it up

B1.8

Cite it in an RFI

- Change order if scope moves
- ✗ ~~Wait for the final inspection~~
- ✗ ~~Have the owner approve it~~

Key numbers and formulas

B1.8

- 4 in sphere must not pass
- Cite it in an RFI

Common traps: each line is a wrong belief

B1.8

✗ Handrail at 42 in
✗ Wait for the final inspection
✗ Have the owner approve it

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Why the tempting answers fail (from the section practice) B1.8

1. During plan review of a two-story dwelling, you find the open side of an interior stair landing 40 inches above the floor below has no guard shown. What is the BEST action before construction proceeds? B1.8

   Right: Flag it and require the plans be corrected to show a compliant guard, since the walking surface is more than 30 inches above the floor below. The guard must show on the plans, as 40 in is over the trigger.

   - Wait until the final inspection to raise the issue, since the inspector will see the open side then and can call for whatever the built conditions turn out to need: Late-stage rework is the cost of waiting.
   - Nothing, guards are only required on exterior decks, where a fall would land on the grade outside rather than on a finished floor inside the house itself: The rule is not limited to exterior decks.
   - Ignore it because the framer will add one in the field once the landing is built and the open side of it becomes plain to see from the stair just below it: Do not leave a required guard to the field.

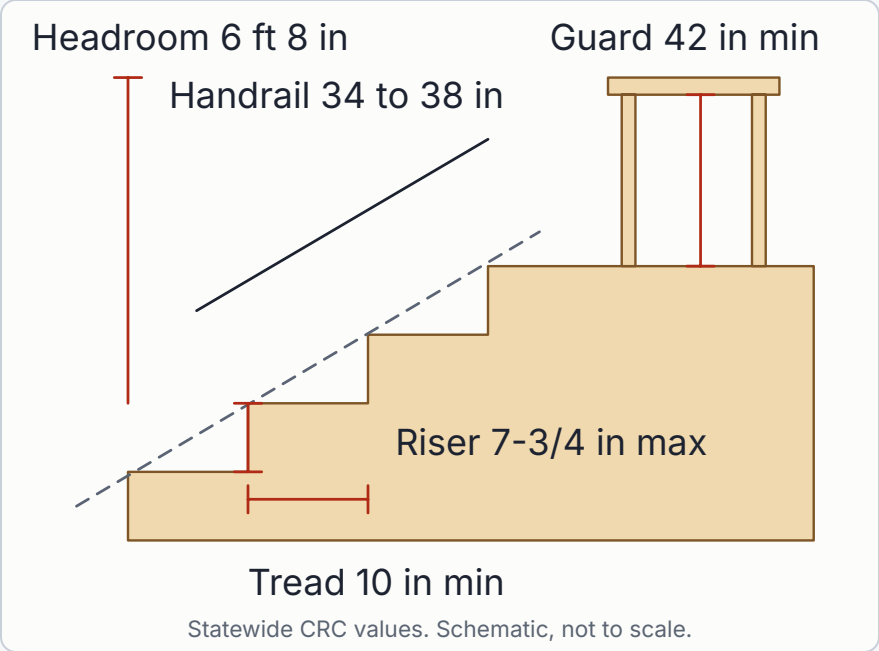
2. A deck guard detail shows vertical balusters spaced so a 5-inch sphere can pass between them. What is the BEST correction? B1.8

   Right: Tighten the spacing so a 4-inch sphere cannot pass through. A 4 in sphere must not pass.

   - Approve it; baluster spacing is the framer's choice: Spacing is regulated: a 4 in sphere must not pass, so it is not the framer's choice.
   - Approve it; only the 42-inch guard height matters: Height and openings both must pass.
   - Require spacing wide enough for a 6-inch sphere for drainage: That loosens the opening the wrong way.

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3. A stair detail on a plan set shows 8 in risers and 10-1/2 in treads. Using the limits on this figure, what is the plan review finding? B1.8



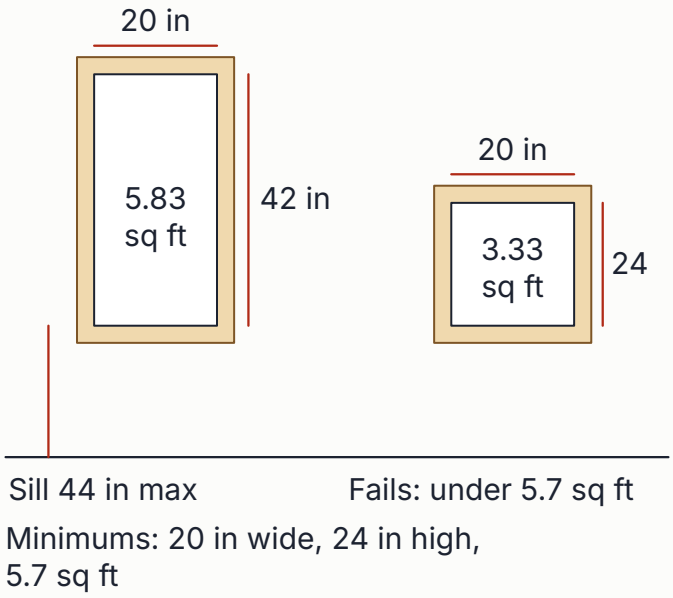
Statewide CRC values. Schematic, not to scale.

Right: The riser is over the 7-3/4 in maximum. 8 in exceeds the 7-3/4 in riser limit; the tread meets the 10 in minimum.

- Both riser and tread are within limits: The 8 in riser is above the 7-3/4 in maximum.
- Both riser and tread are out of limits: Only the riser fails; the tread passes.
- The tread is under the 10 in minimum: 10-1/2 in is deeper than the 10 in minimum, so the tread passes.

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4. A second-floor bedroom window has a net clear opening 22 in wide by 30 in high, with the sill 40 in above the floor. Using the tests on this figure, what is the finding? B1.8



Statewide CRC values. Net clear opening shown.

Right: It fails: the area is under 5.7 sq ft. 22 × 30 = 660 sq in, or 4.58 sq ft, which is under 5.7 sq ft.

- It fails: the 30 in height is too short: 30 in is taller than the 24 in minimum height.
- It passes all of the required tests: Width, height and sill pass, but the area does not.
- It fails: the 22 in width is too narrow: 22 in is wider than the 20 in minimum width.

5. Suppose a revised schedule changed D5 to N under Safety glazing, keeping its full-glass type. What should the plan checker flag? B1.8

Door schedule, sheet N06

Tag	Size	Type	Safety glazing	Egress
D1	3'-0" x 6'-8"	Solid core, connection to house	N	-
D2	3'-0" x 6'-8"	Hollow core, interior	N	-
D3	2'-6" x 6'-8"	Hollow core, interior	N	-
D4	2'-6" x 6'-8"	Hollow core, interior	N	-
D5	3'-0" x 6'-8"	Exterior, full glass	Y	N

Right: Glazing in a door is a hazardous location. CRC R324.4.1 treats glazing in door panels as a hazardous location, and D5 is full glass.

- The door's 3'-0" width is below the code: Width is not the issue created by the revision.
- Exterior doors must be solid core wood: The code has no such rule, and the schedule calls D5 full glass.
- Its 6'-8" height is below the code: Height is not what the revision changed. The glazing column is.

6. The schedule lists W3 as fixed. If someone proposed counting W3 as a required escape opening, why would that fail? B1.8

Window schedule, sheet N06. Sizes are nominal unit sizes, not net clear openings.

Tag	Size (W x H)	Type	Safety glazing	Egress
W1	4'-0" x 4'-0"	Slider, family room south	N	Y
W2	6'-0" x 4'-0"	Slider, family room west	N	N
W3	3'-0" x 3'-0"	Fixed, obscure, bath east	Y	N

Right: An escape opening has to be operable. CRC R319.1 requires an operable emergency escape and rescue opening, and W3 is fixed.

- Obscure glass is never allowed in a bath: Obscure glazing in a bath is not the reason, and the code does not bar it.
- Windows on an east wall cannot be egress: The code has no rule tied to compass direction.
- Its 3'-0" x 3'-0" size is under 5.7 sq ft: 3'-0" x 3'-0" is 9 sq ft, over 5.7 sq ft; the problem is that a fixed unit cannot open.

B1.9 Finding coordination errors across sheets, and writing the RFI

About 5 minutes of narration.

BOARD 1 Why compare sheets B1.9

- Parts against overall
- Tag against schedule
- Plan against section

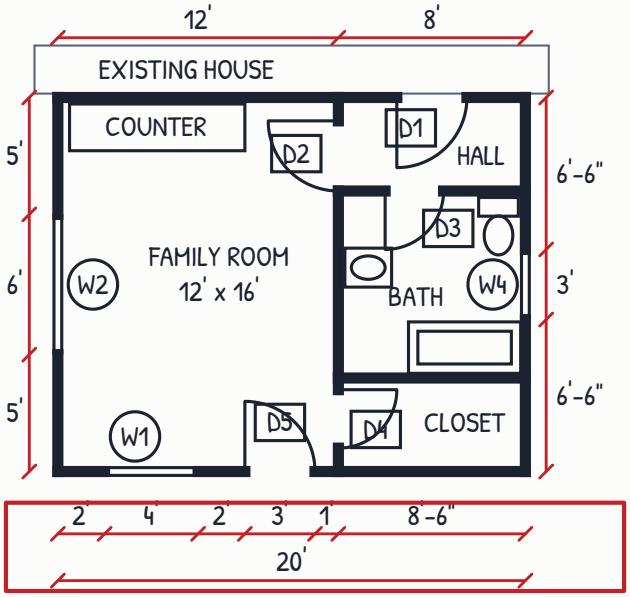
Compare, then ask in writing

Training sheets with planted errors

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BOARD 2 Error one: the string does not close

B1.9



Training drawing. Not for construction.

BOARD 3 Do not pick a number yourself

B1.9

✗ ~~Scale it and pick~~

✓ Ask, and get the answer in writing

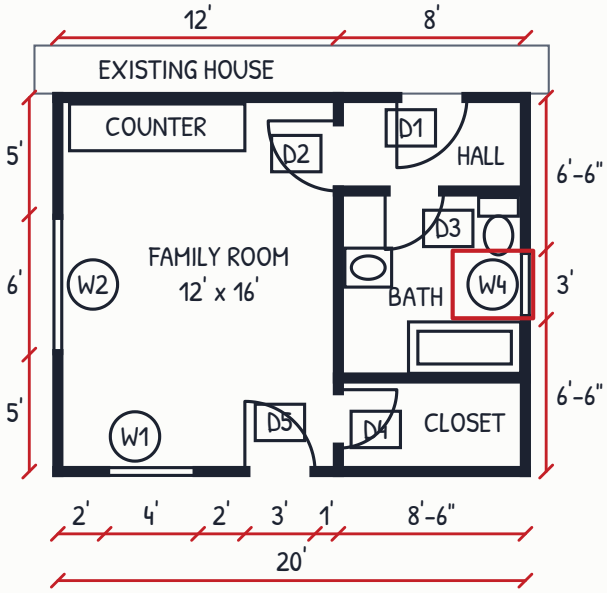
FAR 52.236-21(a) is one example

B&P §7109(b): willful, material, prejudicial, no consent

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BOARD 4 Error two: a tag with no row

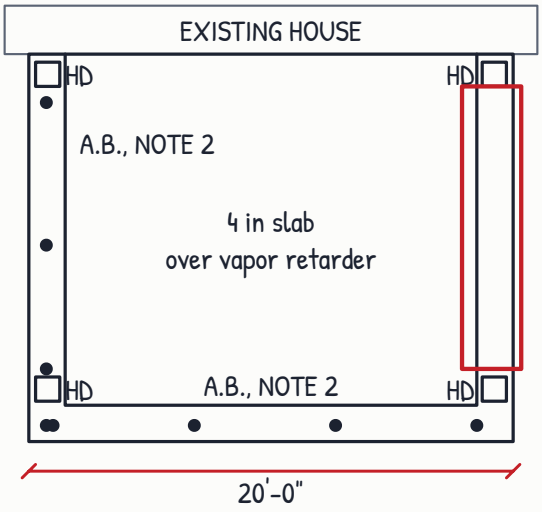
B1.9



Training drawing. Not for construction.

BOARD 5 Error three: bolts missing on one wall

B1.9



A.B. = anchor bolts in the sill

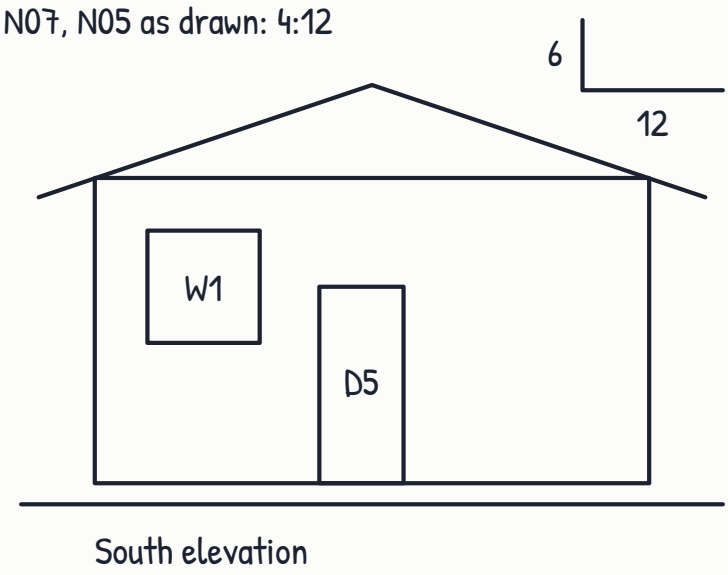
A / N05: section through the west wall

Training drawing. Not for construction. Simplified from N02 to fit a phone.

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BOARD 6 Error four: the slope symbol

B1.9



Training drawing. Not for construction. Simplified from N04 to fit a phone. Not to scale.

Your turn: worked step by step in lesson B1.9.

BOARD 7 Write the RFI

B1.9

Sheet N03, south dimension string

Parts = 20'-6", overall = 20'-0"

Which is correct? Which part changes?

- Work on hold · answer needed by
- Log it: date, question, answer

BOARD 8 After the answer

B1.9

✗ ~~RFI = change order~~

- Scope, cost or time changes: change order
- Update every sheet it touches

Add · chase · compare · ask

Key numbers and formulas

B1.9

- Compare, then ask in writing
- Which is correct? Which part changes?
- Add · chase · compare · ask

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Common traps: each line is a wrong belief B1.9

✗ Scale it and pick

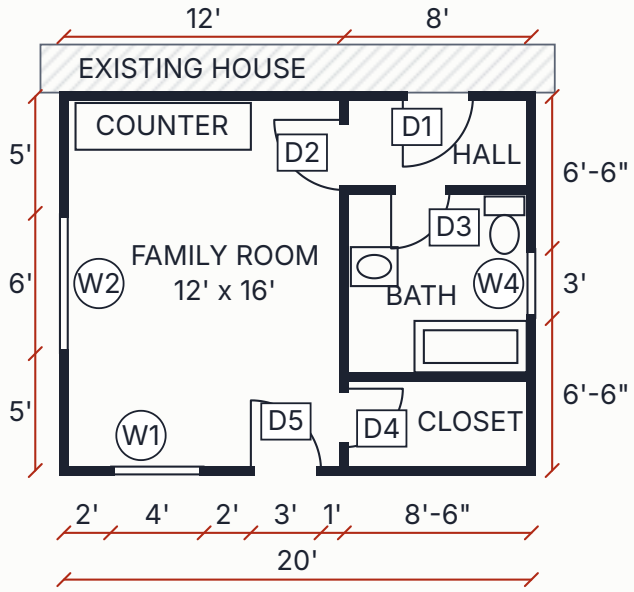
✗ RFI = change order

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Why the tempting answers fail (from the section practice)

B1.9

1. This sheet has exactly two coordination errors. Tap both, or use the list. The window schedule lists W1, W2 and W3. B1.9



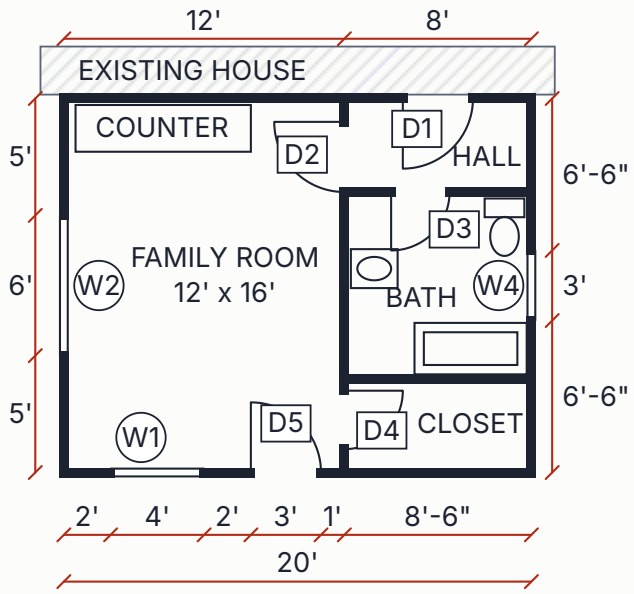
Training drawing. Not for construction. Redrawn to fit a phone. Whole-foot dimensions drop the inches.

Right: South string, all six parts. The parts total 20'-6", and the overall reads 20'-0".

- East window tag: W4 has no row in the schedule.
- North string, 12 ft and 8 ft: 12 + 8 = 20 ft, so it closes.
- West string, 5, 6 and 5 ft: 5 + 6 + 5 = 16 ft, so it closes.
- Door tag D5: D5 has a row, and sits in the 3 ft gap of the south string.

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2. Add the south dimension string on this sheet and compare it with the overall below it. By how much do the parts overrun? B1.9

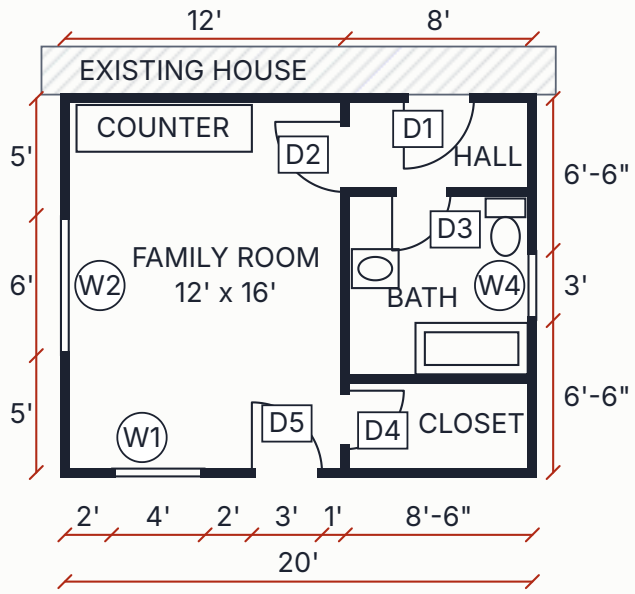


Training drawing. Not for construction. Redrawn to fit a phone. Whole-foot dimensions drop the inches.

Right: 6 in. 2 + 4 + 2 + 3 + 1 + 8-1/2 = 20'-6" against an overall of 20'-0".

- 3 in: The string total differs from the overall by twice this.
- 12 in: This would need a 9'-0" last part; the sheet shows 8'-6".
- 18 in: No part of the string accounts for a difference this large.

3. The bath window on this sheet is tagged W4. The N06 window schedule lists W1, W2 and W3. What is the coordination problem? B1.9



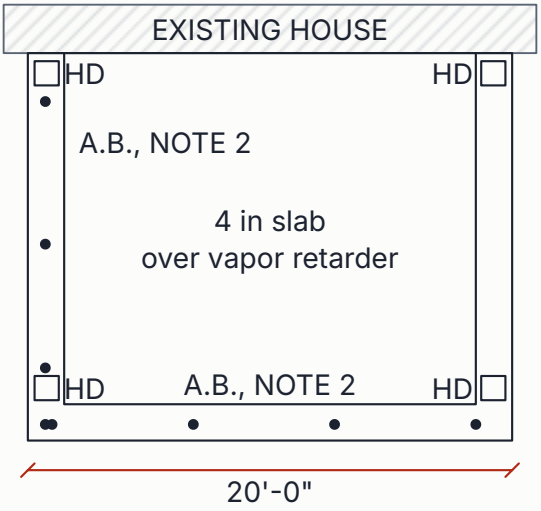
Training drawing. Not for construction. Redrawn to fit a phone. Whole-foot dimensions drop the inches.

Right: The tag on the plan has no schedule entry. W4 appears on the floor plan and nowhere in the schedule, so the size and type are unknown.

- W1 is shown twice in the window schedule: The schedule lists each of its three windows once.
- The tag should be a square instead of a circle: Per the sheet, window tags are circles and door tags are squares.
- The window is missing from the floor plan: The window is drawn; its tag is the problem.

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4. On this sheet, anchor bolt callouts are not consistent. Which wall has lost its A.B. callout and bolt marks? B1.9



A.B. = anchor bolts in the sill
A / N05: section through the west wall

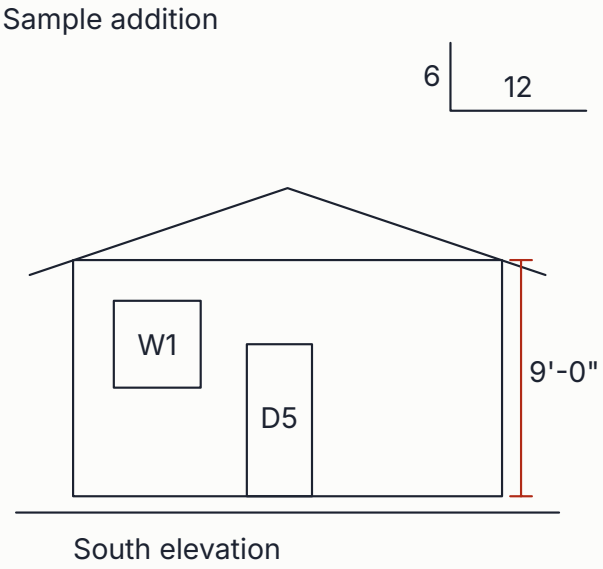
Training drawing. Not for construction. Simplified from N02 to fit a phone.

Right: The east wall. The west and south walls keep A.B., NOTE 2; the east wall shows none along its length.

- The north wall: The north side has no footing on this plan; it abuts the existing house.
- The south wall: The south wall still shows A.B., NOTE 2 and its bolt marks.
- The west wall: The west wall still shows A.B., NOTE 2 and its bolt marks.

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5. The roof framing plan N07 shows a 4 in 12 slope. What does the slope symbol on this elevation read? B1.9



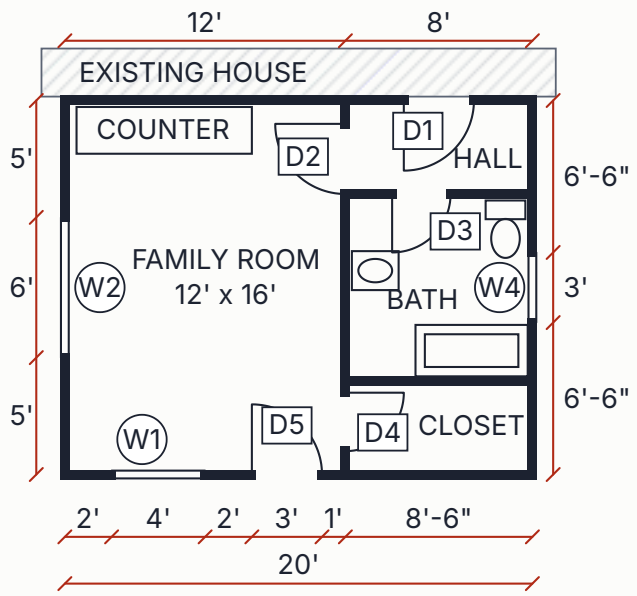
Training drawing. Not for construction. Simplified from N04 to fit a phone. Not to scale.

Right: 6 in 12, so the sheets disagree. The symbol here reads 6 over 12 against the 4 in 12 on N07.

- 8 in 12, so the sheets disagree: They do disagree, but the number on the symbol is 6.
- 4 in 12, so the sheets agree: The symbol on this sheet reads 6, not 4.
- No slope is shown on this sheet: A slope symbol appears to the right of the south elevation.

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6. A framer notices the 8'-6" part of the south string before layout. What should happen FIRST? B1.9

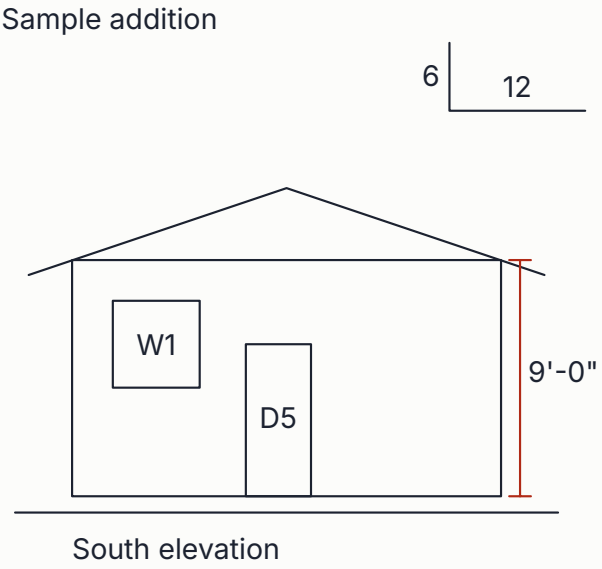


Training drawing. Not for construction. Redrawn to fit a phone. Whole-foot dimensions drop the inches.

Right: Send an RFI citing the sheet and the conflict. A written RFI names the conflict and gets an answer before the work is built.

- Scale the print to find which number is right: Scaling a print does not overrule figures or resolve a conflict.
- Hold the 8'-6" and let the 20'-0" overall go: That builds one reading of a conflict without an answer.
- Hold the 20'-0" and shorten any other part: That also picks a reading without asking the designer.

7. The run from eave wall to ridge is 10 ft. If the symbol on this sheet were built instead of the 4 in 12 on N07, how much higher would the ridge be? B1.9



Training drawing. Not for construction. Simplified from N04 to fit a phone. Not to scale.

Right: 1'-8". 6:12 gives a 5'-0" rise, 4:12 gives 3'-4", and the difference is 1'-8".

- 0'-8": This is the rise difference over a 4 ft run, not 10 ft.
- 5'-0": This is the 6 in 12 rise itself, not the difference.
- 3'-4": This is the 4 in 12 rise itself, not the difference.

8. During construction you find the architectural drawings show a beam at one size but the structural drawings show a larger size for the same beam. What is the BEST first action? B1.9

Right: Submit a request for information (RFI) so the design team resolves the conflict in writing. An RFI gets a written answer from the design team.

- Let the framer pick whichever is easier to install with the material that is already stacked on the deck: Convenience does not settle a conflict.
- Build with the smaller architectural size to save cost and keep the beam line matching the ceiling shown: Picking the smaller size without an answer is at your own risk.
- Average the two sizes and proceed: An average matches neither drawing.

B1.10 Title 24, permits and CALGreen

About 4 minutes of narration.

BOARD 1 One code, thirteen parts B1.10

2025 edition, effective 1/1/2026

- Part 2: Building (CBC)
- Part 2.5: Residential (CRC)

BOARD 2 The other parts

B1.10

Part	Code
3	Electrical
4	Mechanical
5	Plumbing
6	Energy
7	Wildland-Urban Interface
9	Fire
11	CALGreen

BOARD 3 Which rules on this job

B1.10

- Which edition?
- Which local amendments?
- Parcel designations?
- What else does the permit trigger?

CBC 11B on applicable projects

BOARD 4 When you need a permit

B1.10

- Shed: up to 120 sq ft
- Fence: up to 7 ft
- Paint, tile, carpet, cabinets

✗ ~~Exempt means no code applies~~

Local rules can be stricter

BOARD 5 Permits expire

B1.10

Start within 12 months

- Written extensions: up to 180 days each
- Stopped for 12 months: also invalid

Model R105.5 says 180 days; California adopts R105.5.1

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BOARD 6 CALGreen on the job B1.10

Divert a required minimum percentage

- Documentation on any path
- ✗ ~~Landfill it and pay the fee~~
- Fixture flow limits too

BOARD 7 Put it together B1.10

200 sq ft workshop

Over 120 sq ft: permit

- CRC + local amendments
- Parts 3 and 5 for trades
- Start within 12 months

Key numbers and formulas B1.10

- Start within 12 months
- Divert a required minimum percentage
- Over 120 sq ft: permit

Common traps: each line is a wrong belief B1.10

✗ Exempt means no code applies

✗ Landfill it and pay the fee

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Why the tempting answers fail (from the section practice) B1.10

1. The California Residential Code is which part of Title 24? B1.10

   Right: Part 2.5. The CRC itself states it is Part 2.5 of the California Building Standards Code.

   - Part 2: Part 2 is the California Building Code.
   - Part 6: Part 6 is the California Energy Code.
   - Part 11: Part 11 is CALGreen.

2. A designer needs the state's energy efficiency standards. Which Title 24 part contains them? B1.10

   Right: Part 6. Part 6 is the California Energy Code.

   - Part 9: Part 9 is the California Fire Code.
   - Part 5: Part 5 is the California Plumbing Code.
   - Part 7: Part 7 is the California Wildland-Urban Interface Code.

3. CALGreen is the common name for which Title 24 part? B1.10

   Right: Part 11. The Building Standards Commission lists Part 11 as the Green Building Standards Code, also called CALGreen.

   - Part 3: Part 3 is the California Electrical Code.
   - Part 2.5: Part 2.5 is the California Residential Code.
   - Part 4: Part 4 is the California Mechanical Code.

4. Under the statewide CRC text, which of these needs a building permit? (Local rules can be stricter.) B1.10

   Right: A one-story detached shed of 200 sq ft. R105.2 exempts one-story detached accessory structures only up to 120 sq ft.

   - A one-story detached shed of 100 sq ft: At 100 sq ft this falls inside the 120 sq ft exemption.
   - Painting and carpet in an existing house: R105.2 exempts painting, carpeting and similar finish work.
   - A fence 6 ft high along the rear lot line: R105.2 exempts fences not over 7 ft high.

5. Under the California section of the CRC, a permit becomes invalid if authorized work has not started within how long after it is issued? B1.10

   Right: 12 months. R105.5.1 sets 12 months, with written extensions possible.

   - 90 days: 90 days does not appear in the section.
   - 180 days: 180 days is the model text in R105.5, and the most each extension can add.
   - 5 years: 5 years does not appear in the section.

6. A project must meet CALGreen construction waste requirements. What is the general contractor's BEST approach to demonstrate compliance during the job? B1.10

   Right: Divert a required minimum percentage of construction and demolition debris from landfill and keep documented records of recycling and reuse. Divert the minimum and keep the records.

   - Send all debris to the landfill and pay a fee, treating the tipping charge as the entire cost of handling the construction and demolition waste on the job: A tipping fee is not diversion.
   - Burn scrap on site to reduce hauling, on the theory that whatever leaves the job as smoke never has to be trucked away or weighed at a disposal facility: Burning is not a method.
   - Assume the demolition sub handles it with no documentation, since the sub already owns the dumpsters and alone decides where each load is taken and weighed: No records means no proof.

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B1.11 Scope, allowances and contracts

About 4 minutes of narration.

BOARD 1 Price what is shown and implied

B1.11

- Slab: forms, vapor retarder, steel, base
- Bath: permit, GFCI, fan
- Bedroom window: escape rules

Missed = built for free

BOARD 2 Assumptions and exclusions

B1.11

Write assumptions and exclusions

- Hazmat, unknown conditions

✗ ~~Said it out loud, so it counts~~

BOARD 3 Allowance or contingency

B1.11

Line	Holds money for
Allowance	A named item, not yet picked
Contingency	Unknown risk

✗ ~~Either one is just profit~~

BOARD 4 Three contract types

B1.11

Type	Best for	Quantity risk
Lump sum	Defined scope	Contractor
Unit price	Measurable unknowns	Owner, by the unit
Cost-plus	Design not finished	Mostly owner

BOARD 5 Value engineering

B1.11

Same required performance, lower cost

✗ ~~Rebid the trades, keep the gap~~

- Change goes through documents

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BOARD 6 When the job changes B1.11

Signed before the changed work

✗ ~~Just do it, settle up later~~

✗ ~~RFI answer equals change order~~

- Change directive: price settled later

BOARD 7 Home improvement overlay B1.11

- Own statute: see Law and Business

Write, sign, then build

Key numbers and formulas B1.11

- Missed = built for free
- Write assumptions and exclusions
- Same required performance, lower cost
- Signed before the changed work
- Write, sign, then build

Common traps: each line is a wrong belief B1.11

✗ Said it out loud, so it counts

✗ Either one is just profit

✗ Rebid the trades, keep the gap

✗ Just do it, settle up later

✗ RFI answer equals change order

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Why the tempting answers fail (from the section practice)

B1.11

1. A grading and utility project has uncertain quantities of rock excavation that cannot be measured accurately until digging begins. Which contract type is BEST suited? B1.11

   Right: Unit-price, paying an agreed rate per unit (e.g., per cubic yard) for the actual measured quantities.. Pay the rate for measured quantities.

   - Lump-sum, because the total is fixed regardless of quantities.: Lump sum forces a guess at the quantity.
   - A single fixed guaranteed maximum with no measured quantities, so the rock excavation is absorbed inside that one capped number: A fixed maximum without measuring does not match the unknown.
   - Cost-plus with no fee cap for the entire project, billing every hour and every load of rock as it is excavated and hauled: Open-ended cost-plus gives no control here.

2. When is a cost-plus-fee contract MOST appropriate? B1.11

   Right: When work must begin before the design is complete, and the owner accepts paying documented actual costs plus an agreed fee.. Fast-track or unfinished design fits cost-plus.

   - When the owner wants the contractor to carry all cost risk at one fixed price set before work starts.: That describes a lump sum.
   - When the scope is fully defined and all quantities are certain before bidding, so bidders can price the work exactly.: A defined scope suits a lump sum.
   - When public-works law forbids any other arrangement and leaves the owner no choice of contract type.: Public-works law does not require it.

3. How do an 'allowance' and a 'contingency' differ in a bid? B1.11

   Right: An allowance is a placeholder dollar amount for a specified item not yet selected (e.g., light fixtures or tile), while a contingency is a reserve for unforeseen conditions or scope uncertainty.. Placeholder for a named item, against a reserve for risk.

   - An allowance covers unknown emergencies, while a contingency is a firm price for a selected finish that the owner has already picked from a sample board.: This swaps the two.
   - A contingency is used only on public works and an allowance only on private jobs, so the two never appear together in the same bid or schedule of values.: Both appear on public and private work.
   - They are identical; both simply cover the contractor's profit, and either line may be moved into overhead or markup once the contract has been signed.: Both hold money for unpriced work. Neither one is profit, and neither is overhead.

4. What is the PRIMARY purpose of value engineering on a construction project? B1.11

   Right: To analyze the functions of the work and find lower-cost ways to achieve the required performance without sacrificing needed quality or function.. Same function at a lower cost.

   - To transfer all project risk onto the subcontractors, so that every cost overrun is absorbed below the general contract.: That shifts risk, it is not value engineering.
   - To delay the schedule so materials can be reordered at a better price, letting the savings fall to the contractor at closeout.: Delay is not the point.
   - To increase the contractor's markup after the contract is awarded, by rebidding the trades and keeping the difference.: Keeping the difference is not the point.

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5. What typically triggers a change order, and how is it documented? B1.11

   Right: A change in scope, an owner-directed modification, or unforeseen conditions triggers it; it is a written, signed amendment adjusting the contract price and/or time.. A written, signed change to price, time or both.

   - It is the contractor's internal cost estimate and needs no owner signature, so the superintendent can price and proceed with the extra work alone without waiting for the design team.: A change order needs the owner's signature.
   - It is a document issued to all bidders before bids are due to modify the scope, so every bidder prices the revised work on the same basis before the date bids are due.: That is an addendum.
   - Any RFI automatically becomes a change order the moment it is answered, so the answer alone adjusts the contract price and the completion date without any further paperwork.: An RFI does not change the contract.

6. On a lump-sum contract, the takeoff comes in light and the job needs more framing than the contractor priced, with no change in the documents. Who normally bears that cost? B1.11

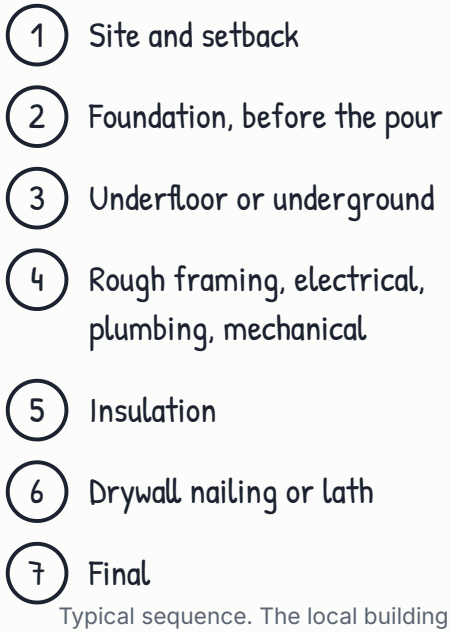
   Right: The contractor who priced the work. A lump sum puts quantity risk on the contractor when the scope has not changed.

   - The designer who drew the framing plan: The drawings did not change; the takeoff was short.
   - The lumber yard that supplied the wood: The supplier delivered what was ordered and did not price the job.
   - The owner who accepted the bid price: The owner agreed to a fixed price for the shown scope.

B1.12 Inspections and the iron rule

About 4 minutes of narration.

BOARD 1 The sequence B1.12



Typical sequence. The local building department sets the list.

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BOARD 2 The iron rule

B1.12

Not covered until approved

CRC R109.1 note, R109.4

✗ ~~Photos stand in for inspection~~

✗ ~~Owner signs off instead~~

BOARD 3 What the code says

B1.12

- Foundation: before concrete
- Slab: before concrete or subfloor
- Rough systems: before covering
- Frame: after roughs approved
- Lath, gypsum: before taping
- Final: before occupancy

BOARD 4 Who calls, and who decides

B1.12

Permit holder or agent requests

R109.3

Official approves before going on

R109.4

- Certificate before occupancy

R110.1

BOARD 5 Failed, then what

B1.12

- Correct, then reinspect

✗ ~~Move on, fix it later~~

- Approved set on site

R106.3.1

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BOARD 6 Schedule around it B1.12

- Roughs, then frame
- Then insulation, then board

Inspection is an activity

Key numbers and formulas B1.12

- Not covered until approved
- Permit holder or agent requests
- Official approves before going on
- Inspection is an activity

Common traps: each line is a wrong belief B1.12

✗ Photos stand in for inspection
✗ Owner signs off instead
✗ Move on, fix it later

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Why the tempting answers fail (from the section practice) B1.12

1. Which statement BEST reflects required inspection timing for concealed work? B1.12

   Right: Foundation reinforcement and forms must be inspected before concrete is placed, and underground plumbing must be inspected before the trench is backfilled.. Foundation before the pour, piping before backfill.

   - Concealed work is inspected only once, at the final inspection before occupancy, when the building is complete and ready for use.: A single final cannot verify concealed work.
   - Underground piping should be backfilled immediately and inspected by re-excavation only if a problem is suspected during later testing.: Backfilling first buries the work.
   - Footings may be poured first and the reinforcing inspected later after stripping the forms from the cured concrete.: Pouring first hides the steel.

2. During interior work, in what order must inspections generally occur before the walls are closed up? B1.12

   Right: Rough framing and rough mechanical/electrical/plumbing are inspected and approved before insulation, and insulation is inspected before drywall covers it.. Roughs, then insulation, then drywall, each inspected first.

   - Only a single final inspection is required; the intermediate inspections are optional and may be waived by the contractor to keep the job moving on the next project.: Intermediate inspections are not optional.
   - Insulation is installed and inspected first, then rough framing, then the MEP rough-in is run through the studs that were already insulated before the cover goes on.: That puts insulation first.
   - Drywall may be hung before the rough MEP inspection to keep the schedule moving, and the inspector reviews the concealed work from photographs sent in by the crew.: Photos do not replace an inspection.

3. Under CRC R109.1.1, when is the foundation inspection made? B1.12

   Right: Before concrete, with forms and steel in place. R109.1.1 places it after excavation, forms and reinforcing are in place and prior to placing concrete.

   - Before forms and steel, once trenches are dug: R109.1.1 also needs the forms and reinforcing in place.
   - After the pour, with forms still on the footing: The concrete then covers the steel the inspector must see.
   - After stripping forms, before backfill goes in: Stripping comes after the pour, so the steel is already covered.

4. Under CRC R109.4, may a crew work past an inspection point before it is approved? B1.12

   Right: No, not without the building official's approval. R109.4 bars work beyond each inspection point until the building official approves it.

   - Yes, as long as photos are kept in the file: Photos do not replace the required approval.
   - Yes, as long as the work stays easy to reopen: R109.4 has no exception based on how easily work can be reopened.
   - No, not without the owner's written approval: The owner cannot stand in for the building official.

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5. Under CRC R109.3, whose duty is it to tell the building official that work is ready for inspection? B1.12

   Right: The permit holder or their agent. R109.3 puts the notice on the permit holder or their agent.

   - The inspector assigned to that area: The inspector responds to the request and does not track the job.
   - The owner, whoever holds the permit: The duty follows the permit, so an owner who does not hold it is not named.
   - The designer who stamped the plans: The designer has no notice duty under this section.

6. Under CRC R109.1.6, when is the final inspection made? B1.12

   Right: After the work is complete, before occupancy. R109.1.6 calls for it after the permitted work is complete and prior to occupancy.

   - After rough-ins, before walls are closed: Most of the permitted work is still ahead at that point.
   - After drywall, before the finishes go on: Finish work remains, and the final waits until the permitted work is complete.
   - After the owner has moved into the home: Occupancy comes after the final, not before it.

B1.13 Pre-pour walk, special inspection

About 3 minutes of narration.

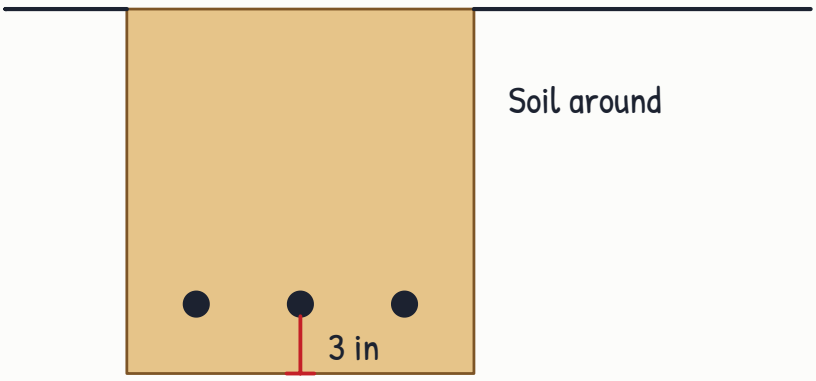
BOARD 1 Walk it before the truck comes B1.13

- Footprint, setbacks
- Square: equal diagonals
- Bars: size and spacing
- Anchor bolts, cover

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BOARD 2 Cover

B1.13



Bars held up on supports, not on the dirt

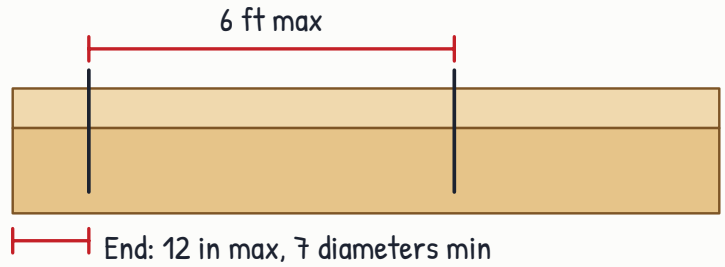
Schematic. Statewide CRC value.

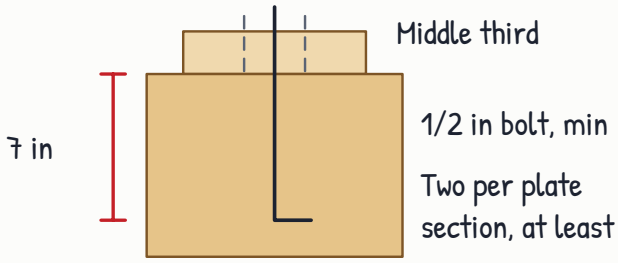
CRC R403.1.3.5.3

✗ ~~Bars touching soil bond better~~

BOARD 3 Anchor bolts

B1.13





Statewide CRC minimum. Cities may amend foundation bolting.

CRC R403.1.6, R403.1.6.1

BOARD 4 Special inspection B1.13

In addition to the department

- Employed by owner side, not contractor

CBC 1704.2

- Statement of special inspections
- Continuous or periodic

BOARD 5 When the field does not match the plans B1.13

Resubmit as an amended set

CRC R106.4

✗ ~~Owner signs, so it is amended~~

Wrong delivery: stop, verify

Key numbers and formulas B1.13

- In addition to the department
- Resubmit as an amended set
- Wrong delivery: stop, verify

Common traps: each line is a wrong belief B1.13

✗ Bars touching soil bond better

✗ Owner signs, so it is amended

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Why the tempting answers fail (from the section practice)

B1.13

1. On a foundation inspection, you see anchor bolts set roughly 8 ft apart with the nearest bolt about 20 inches from the end of each sill plate section. Based on typical residential requirements, what is the MOST likely deficiency? B1.13

   Right: Spacing exceeds the maximum and end bolts are set too far from the plate ends. 6 ft and 12 in limits are both exceeded.

   - Bolts are spaced too closely and there are too many, so the sill plate is over-drilled and weakened along its length: The fault is too far apart, not too close.
   - The bolt diameter is the only concern, since a larger bolt would carry the shear load whatever the spacing: Layout is out, whatever the bolt size.
   - Anchor bolts are not required for wood sill plates, because the weight of the framing above holds the plate down: Wood sill plates must be anchored.

2. During a field inspection you notice the delivered floor joists are one size smaller than the joists specified on the approved structural plans. What is the BEST first step? B1.13

   Right: Stop that installation and verify the discrepancy against the plans and structural engineer before proceeding. Stop, verify, and ask the engineer.

   - Install them anyway to keep the schedule and note it later in the daily report so the engineer can look at the framing after the fact: Do not install it and note it later.
   - Order paint so finishes can start on schedule: Paint does nothing for a structural problem.
   - Cut the joists to fit and add extra nails: Field modification risks the structure.

3. During a pre-pour inspection of a footing formed directly against earth, you check the reinforcing steel. Which condition is MOST important to verify before concrete is placed? B1.13

   Right: That the bars have adequate concrete cover and are held off the soil. Check cover, and that bars are held off the soil.

   - That the bars are tied with the maximum number of ties at every bar crossing point: Tie count is not the key check.
   - That the bars touch the soil for a solid bond between the steel and the ground below: Touching soil leaves no cover.
   - That the bars are painted for identification: Paint does nothing here.

4. During construction a contractor makes a change that no longer matches the approved plans. Under CRC R106.4, what must happen? B1.13

   Right: Resubmit it as amended construction documents. R106.4 requires noncomplying changes to be resubmitted for approval as an amended set.

   - Note the change on the final punch list: A punch list does not obtain building department approval.
   - Have the owner sign an internal change form: An owner's signature does not amend what the department approved.
   - Tell the inspector at the final inspection: Mentioning it at the end does not amend the approved set.

5. An inspector fails a footing because required bolts were left off the pre-pour setup. What is the BEST response? B1.13

   Right: Correct it and get it reinspected before the pour. Work may not pass the inspection point until the correction is approved (R109.4).

   - Pour on schedule and note it for the final: The final is not a substitute for this inspection.
   - Pour on schedule and core-drill the bolts later: That covers failed work before it is approved.
   - Ask a different inspector to look at it again: Shopping for an inspector does not fix the missing bolts.

6. How does a special inspection relate to the building department's own inspection? B1.13

   Right: It adds to the department's own inspection. Special inspection by an approved agency is added to the department's inspection, not swapped for it.

   - It replaces the department's inspection entirely: The department's inspection still applies.
   - It is done only when the owner requests one: It is required by the code and the structural documents where they call for it.
   - It is done by the contractor's own foreman: It is performed by an approved agency, not the contractor's staff.

B1.14 Coordinating the job

About 4 minutes of narration.

BOARD 1 Why a general contractor exists B1.14

Right trade, place, time

- Materials and information ready
- Solve clashes on paper

BOARD 2 Sequence follows physics B1.14

Underground

Slab

Walls

Ask: what does this step need?

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BOARD 3 Inside a wall

B1.14

Rough-ins

Insulation

Drywall

Paint

✗ ~~Insulation before rough-ins~~

BOARD 4 Long-lead items

B1.14

- Trusses, windows, millwork, steel

Find early, order early

- Dates around delivery

BOARD 5 Meetings and the master schedule

B1.14

One master schedule

Regular, documented meetings

✗ ~~Each sub sets its own dates~~

✗ ~~Verbal direction only~~

BOARD 6 Paperwork that keeps the job moving

B1.14

- Daily report: today on site
- Submittal log: what is approved
- RFI log: what is open

BOARD 7 Closing out the job

B1.14

Punch list: what remains

- Corrected before final payment

✗ ~~A place to approve changes~~

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Key numbers and formulas B1.14

- Right trade, place, time
- Ask: what does this step need?
- Find early, order early
- One master schedule
- Regular, documented meetings
- Punch list: what remains

Common traps: each line is a wrong belief B1.14

✗ Insulation before rough-ins

✗ Each sub sets its own dates

✗ Verbal direction only

✗ A place to approve changes

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Why the tempting answers fail (from the section practice)

B1.14

1. You are preparing a critical path schedule. Which sequence of activities BEST reflects proper project coordination for a slab-on-grade building? B1.14

   Right: Run underground plumbing, then pour the slab, then frame walls. Underground, then slab, then walls.

   - Frame walls, then pour footings, then run underground plumbing: Framing needs footings, and underground goes before the slab.
   - Install roofing, then pour footings, then excavate: Excavation comes before footings and roofing.
   - Paint interior, then set door frames, then rough electrical: Paint does not come before roughs.

2. A general contractor coordinates multiple subcontractors on a commercial project. Which practice BEST prevents schedule conflicts and duplicated work between trades? B1.14

   Right: Holding regular coordination meetings and maintaining an updated master schedule that sequences and de-conflicts each trade. One schedule and regular meetings.

   - Sharing only verbal instructions on the job site, since the foremen who need the sequence are all present at the morning huddle and can pass it along to their crews: Verbal-only direction leaves no record.
   - Letting each sub set its own dates independently, on the assumption that each trade knows its own work best and will fit around whoever is already in the space: Each sub's own dates ignore the others, so two trades end up wanting the same space.
   - Assigning all coordination to the owner: This gives up the contractor's main job.

3. Near the end of a project, the owner and architect walk the building and create a list of incomplete or defective items to be corrected before final payment. What is this document BEST called? B1.14

   Right: A punch list. It lists what is left to finish or correct.

   - A daily report: That records one day on site.
   - A submittal log: That tracks product reviews.
   - A bid addendum: That revises bid documents.

4. Custom windows have a lead time of several months. When should they be identified and ordered? B1.14

   Right: Early, with order dates in the schedule. Long-lead items are found early and their order dates are scheduled.

   - Once the slab is poured, to confirm sizes: A lead time of months from the pour runs past the date the openings need windows.
   - During framing, to measure the openings: Waiting until framing starts risks the window date setting the finish.
   - Once rough-ins pass, to avoid damage: The building should already be closed in by that point.

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5. Which sequence is correct for the inside of an exterior wall? B1.14

   Right: Rough-ins, insulation, drywall, then paint. Rough-ins go in first, then insulation, then the board that covers them, then the finish.

   - Drywall, rough-ins, insulation, then paint: Drywall would cover the cavity before the rough-ins go in.
   - Insulation, rough-ins, paint, then drywall: Rough-ins need the open cavity, and paint goes on the board.
   - Rough-ins, drywall, insulation, then paint: Insulation cannot go in after the wall is closed.

6. What is a punch list for? B1.14

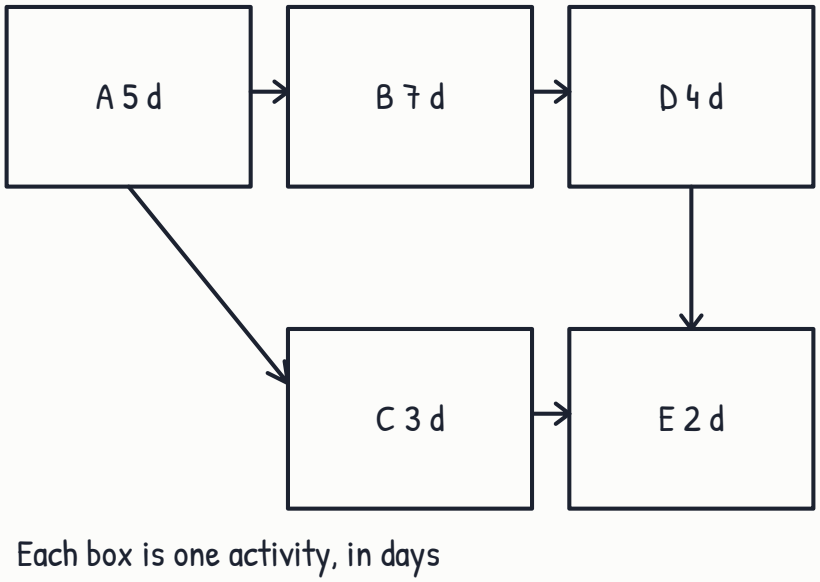
   Right: Recording remaining items near completion. It lists the small items left to finish or correct as the job closes out.

   - Recording the daily hours of the framing crew: Hours are kept in time records.
   - Recording the sub bids at the start of the job: Bids are compared before the work begins.
   - Recording the approved plan changes on the job: Approved changes are recorded as amendments and change orders.

B1.15 Critical path, float, and crashing

About 4 minutes of narration.

BOARD 1 The network B1.15



Example network. Times in days.

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BOARD 2 Forward pass B1.15

EF = ES + duration

ES = latest EF of predecessors

Project: 18 days

BOARD 3 Backward pass B1.15

LS = LF - duration

- D: LS 12
- C: LS 13

LF = earliest LS of successors

BOARD 4 Float B1.15

Float = LS - ES

Critical: A-B-D-E, 0 float

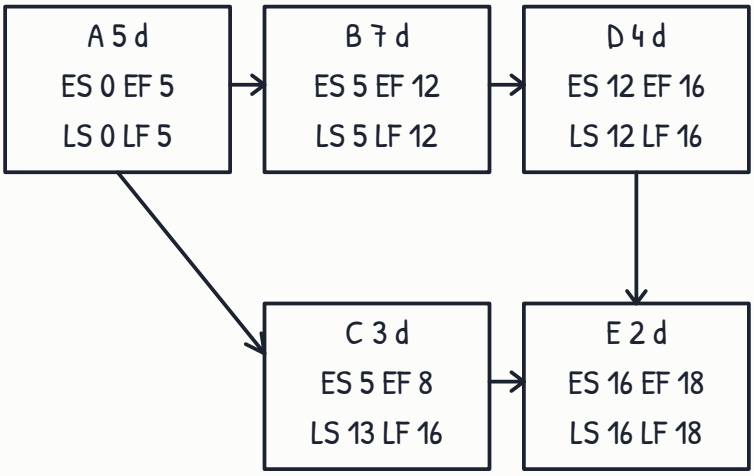
C: 13 - 5 = 8 days

✗ ~~Critical path has the most float~~

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BOARD 5 Delays

B1.15



Float on C: 13 − 5 = 8 days

Critical: A–B–D–E, 18 days

Example network. Times in days.

C late 5 d	No change
C late 10 d	Slips 2 d

The critical path can move

BOARD 6 Crashing

B1.15

B: 2 d for $1,200

C: 2 d for $400

✗ ~~Crash the cheaper C~~

Buy critical days

BOARD 7 Crashing has a cost

B1.15

- Overtime, second crew, premium delivery
- Cheapest critical day first

Recheck after each day

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BOARD 8 Your turn B1.15

P 4 d

Q 6 d, after P

R 2 d, after P

S 3 d, after Q and R

Your turn: worked step by step in lesson B1.15.

Key numbers and formulas B1.15

- EF = ES + duration
- ES = latest EF of predecessors
- Project: 18 days
- LS = LF - duration
- LF = earliest LS of successors
- Float = LS - ES
- Critical: A-B-D-E, 0 float
- C: 13 - 5 = 8 days
- The critical path can move
- Buy critical days
- Recheck after each day

Common traps: each line is a wrong belief B1.15

✗ Critical path has the most float

✗ Crash the cheaper C

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Why the tempting answers fail (from the section practice) B1.15

1. In critical path method (CPM) scheduling, which statement is correct? B1.15

   Right: The critical path is the longest path through the network and has zero float; delaying any critical activity delays the whole project, while delaying a non-critical activity only within its float does not.. Longest path, zero float, and float absorbs only non-critical delay.

   - Activities on the critical path have the most float and can slip freely without affecting the finish date, because the float on that path is what absorbs every delay the job runs into that the estimator priced into the bid: Critical activities have no float.
   - Float is the extra profit margin built into the project schedule, set aside at bid time and released to the contractor as each scheduled activity is reported complete on the application for that particular line of work: Float is slack, not profit.
   - The critical path is the shortest chain of activities in the network.: It is the longest chain, not the shortest.

2. Activities: A (3 days) starts the job. B (5 days) and C (2 days) both follow A. D (6 days) follows B. E (3 days) follows both C and D and ends the job. What is the project duration? B1.15

   Right: 17 days. The longest path is A-B-D-E: 3 + 5 + 6 + 3 = 17 days.

   - 14 days: This leaves out A or E from the longest path.
   - 8 days: This is the shorter path A-C-E.
   - 19 days: This adds all five durations as if nothing runs in parallel.

3. Activities: A (3 days) starts the job. B (5 days) and C (2 days) both follow A. D (6 days) follows B. E (3 days) follows both C and D and ends the job. Which path is critical? B1.15

   Right: A-B-D-E. It is the longest chain and has zero float.

   - A-C-D-E: D follows B, not C, in this network.
   - A-C-E: This path totals 8 days, far shorter than 17.
   - A-B-C-E: C does not follow B in this network.

4. Activities: A (3 days) starts the job. B (5 days) and C (2 days) both follow A. D (6 days) follows B. E (3 days) follows both C and D and ends the job. How much total float does C have? B1.15

   Right: 9 days. Path A-C-E is 8 days against a 17-day job, so C can slip 9 days.

   - 2 days: That is C's duration, not its float.
   - 7 days: This subtracts C's own 2 days from its 9 days of float.
   - 0 days: Zero float belongs to activities on the critical path.

5. Activities: A (3 days) starts the job. B (5 days) and C (2 days) both follow A. D (6 days) follows B. E (3 days) follows both C and D and ends the job. C is delayed 4 days. What happens to the finish date? B1.15

   Right: It does not change. C has 9 days of float, so a 4-day delay is absorbed.

   - It moves out by 4 days: Only a delay on the critical path passes straight to the finish.
   - It moves out by 9 days: 9 days is C's float, not a delay to the job.
   - It holds, but E starts 4 days late: E still starts on day 14, when D finishes; C ends on day 9 with the delay.

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6. Activities: A (3 days) starts the job. B (5 days) and C (2 days) both follow A. D (6 days) follows B. E (3 days) follows both C and D and ends the job. Crashing B costs $900 per day and crashing C costs $200 per day. To finish one day earlier, what should be crashed? B1.15

   Right: B, at $900 for the one day. Only the critical path shortens the job, and B is on it.

   - C, at $200 for the one day: C has float, so shortening it does not move the finish.
   - Neither, as no day is gained: Crashing B does gain a day, since no other path takes over.
   - Both, at $1,100 for the day: The money spent on C buys nothing.

B1.16 Takeoff discipline and concrete: slabs, footings, piers, tons of base

About 4 minutes of narration.

BOARD 1 A takeoff is a habit B1.16

- Fixed order, nothing skipped
- Write each number with its unit

Feet first

Cubic yards last

BOARD 2 Two conversions B1.16

inches / 12 = feet

4 in = 4/12 = 0.33 ft

18 in = 1.5 ft

1 cu yd = 27 cu ft

✗ ~~Divide by 3 or 9~~

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BOARD 3 A slab

B1.16



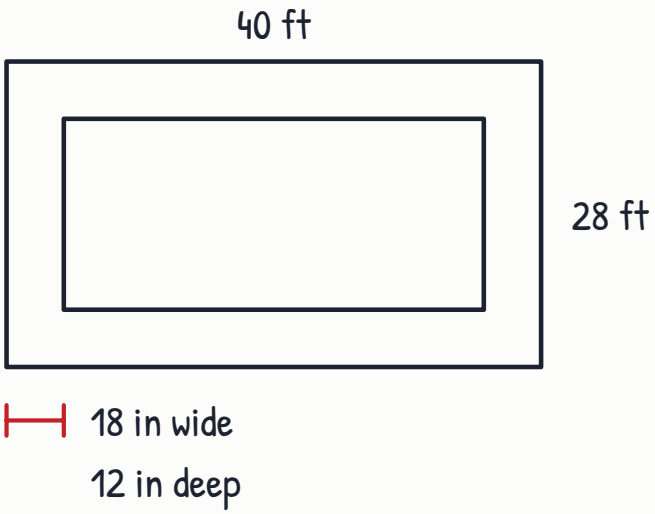
Example figures. Original drawing.

Volume = L x W x T (feet)

Your turn: worked step by step in lesson B1.16.

BOARD 4 A continuous footing

B1.16



Example figures. Original drawing.

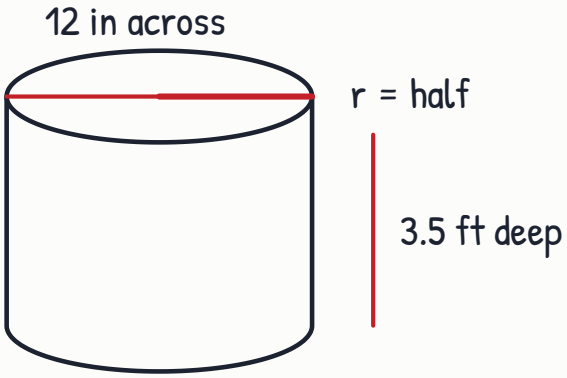
✗ ~~Area instead of perimeter~~

Your turn: worked step by step in lesson B1.16.

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BOARD 5 A round pier

B1.16



V = pi x r x r x depth

One pier = 2.75 cu ft

Your turn: worked step by step in lesson B1.16.

BOARD 6 Tons of base

B1.16

30 x 40 x 0.5 = 600 cu ft

Example weight: 100 lb per cu ft

600 x 100 = 60,000 lb

60,000 / 2,000 = 30 tons

BOARD 7 Waste comes after

B1.16

Net x (1 + waste)

5.93 x 1.10 = 6.52 cu yd

✗ ~~5.93 / 0.90 = 6.59~~

Round up to what you can buy

BOARD 8 Ask if it looks right

B1.16

Feet first. Shape next. Divide by 27 last.

Slab	Area x thickness
Footing	Perimeter x section
Pier	Radius, squared

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Key numbers and formulas

B1.16

- Feet first
- Cubic yards last
- inches / 12 = feet
- 4 in = 4/12 = 0.33 ft
- 18 in = 1.5 ft
- 1 cu yd = 27 cu ft
- Volume = L x W x T (feet)
- V = pi x r x r x depth
- One pier = 2.75 cu ft
- 30 × 40 × 0.5 = 600 cu ft
- 600 × 100 = 60,000 lb
- 60,000 / 2,000 = 30 tons
- Net x (1 + waste)
- 5.93 × 1.10 = 6.52 cu yd
- Round up to what you can buy

Common traps: each line is a wrong belief

B1.16

✗ Divide by 3 or 9

✗ Area instead of perimeter

✗ 5.93 / 0.90 = 6.59

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Why the tempting answers fail (from the section practice) B1.16

1. A concrete slab is 30 ft by 40 ft and 4 inches thick. How many cubic yards of concrete are required? B1.16

   Right: About 14.8 cubic yards. 30 × 40 × 4/12 = 400 cu ft. 400 / 27 = 14.8 cu yd.

   - About 8.9 cubic yards: That needs a thickness of about 2.4 in.
   - About 12.0 cubic yards: 12 cu yd would be 324 cu ft. This slab is 400 cu ft.
   - About 4.4 cubic yards: That is well under half the volume.

2. A continuous concrete footing is 18 inches wide, 12 inches deep, and 120 ft long. How many cubic yards of concrete are needed? B1.16

   Right: About 6.7 cubic yards. 1.5 × 1 × 120 = 180 cu ft. 180 / 27 = 6.7 cu yd.

   - About 2.2 cubic yards: That divides by 81, an extra factor of 3.
   - About 13.3 cubic yards: That is double the right answer.
   - About 20.0 cubic yards: That divides by 9. Use 27.

3. A round drilled pier is 24 inches in diameter and 18 ft deep. Using pi = 3.1416, what is the APPROXIMATE volume of concrete required to fill it? B1.16

   Right: 2.1 cubic yards. r = 1 ft. 3.1416 × 1 × 18 = 56.55 cu ft. 56.55 / 27 = 2.1 cu yd.

   - 1.05 cubic yards: That uses half the depth.
   - 8.4 cubic yards: That uses the diameter as the radius.
   - 56.5 cubic yards: That stops at cubic feet.

4. A gravel base 40 ft by 60 ft is placed 6 inches thick. If compacted gravel weighs about 100 pounds per cubic foot, approximately how many tons are required? B1.16

   Right: 60 tons. 40 × 60 × 0.5 = 1,200 cu ft. 1,200 × 100 = 120,000 lb. 120,000 / 2,000 = 60 tons.

   - 90 tons: Too high: the weight is 120,000 lb.
   - 30 tons: That is half of the right answer.
   - 45 tons: That is 3/4 of the right answer.

5. When performing a quantity takeoff from a set of plans, which practice BEST reduces costly estimating errors? B1.16

   Right: Systematically measuring each assembly, cross-checking scale against noted dimensions, and applying consistent waste factors. A fixed method, checks against noted dimensions, and consistent waste catch most errors.

   - Rounding every dimension down to the nearest foot to save material, keeping the bid price lower: Rounding down leaves the job short.
   - Estimating only from memory of similar past jobs, without opening the current set of plans at all: Memory does not see this job's drawings.
   - Counting only the most expensive materials and guessing the rest as a single lump allowance at the end: A lump guess hides real quantities.

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6. When preparing a material takeoff, why does an estimator add a waste/allowance factor to the net measured quantities? B1.16

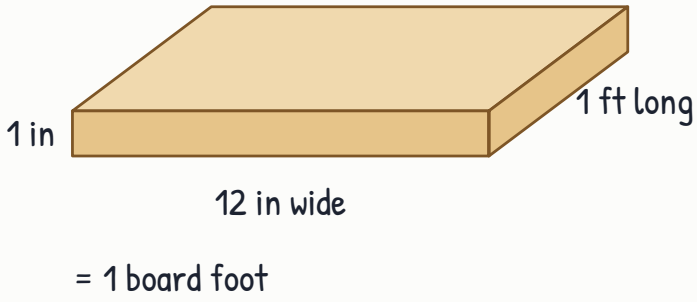
   Right: To cover material lost to cuts, breakage, trimming, and overlap so enough is delivered. Waste covers what is lost in the work.

   - To increase the profit margin built into the bid: Profit is a separate line.
   - So the plans do not have to be measured accurately, since the waste factor will make up for any shortfall later: Waste does not replace measuring.
   - Because building codes require a fixed 20 percent surplus on every material ordered for a permitted job: No code sets a surplus like this.

B1.17 Lumber: board feet and piece counts

About 4 minutes of narration.

BOARD 1 What a board foot is B1.17



Schematic. Not to scale.

BF = T x W x L / 12

BOARD 2 One piece, then the order B1.17

2 x 8 x 16 / 12 = 21.33

x 24 = 512 BF

✗ ~~Forgot to divide by 12~~

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BOARD 3 Shortcut per lineal foot

B1.17

Size	BF per lineal ft
2x4	0.667
2x6	1.0
2x8	1.333
2x10	1.667
2x12	2.0

BOARD 4 Pricing per thousand

B1.17

Cost = BF / 1,000 x price per MBF

6 x $600 = $3,600

✗ ~~6,000 x $600~~

BOARD 5 Now your turn on board feet

B1.17

12 pieces, 2x10 x 14 ft

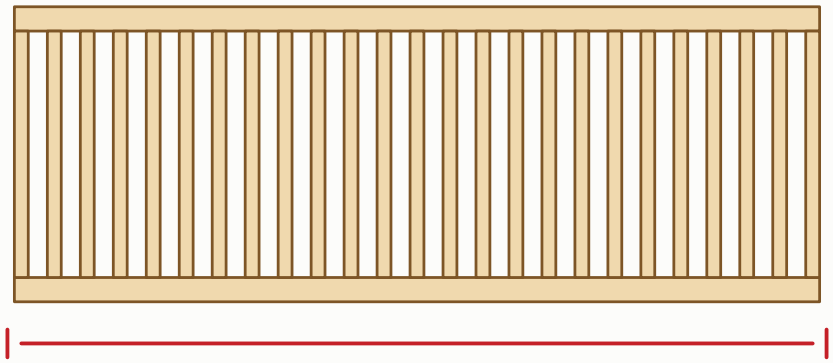
$1.10 per BF

Your turn: worked step by step in lesson B1.17.

BOARD 6 Counting studs

B1.17

24 spaces + 1 = 25 studs



32 ft = 24 spaces

Schematic. Openings and corners not shown.

Spaces + 1

✗ ~~Stop at 24~~

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BOARD 7 Adders, plates and joists

B1.17

- Openings, corners: add

Plates: 3 x wall length

Joists: lay out along the long side

BOARD 8 Now your turn on a count

B1.17

28 ft wall, 16 in o.c.

2-stud corner added

Bottom plate + double top plate

Your turn: worked step by step in lesson B1.17.

Key numbers and formulas

B1.17

- BF = T x W x L / 12
- 2 × 8 × 16 / 12 = 21.33
- x 24 = 512 BF
- Cost = BF / 1,000 x price per MBF
- 6 x $600 = $3,600
- Spaces + 1
- Plates: 3 x wall length
- Joists: lay out along the long side

Common traps: each line is a wrong belief

B1.17

✗ Forgot to divide by 12

✗ 6,000 x $600

✗ Stop at 24

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Why the tempting answers fail (from the section practice) B1.17

1. How many board feet are contained in ten framing members that are each 2 inches thick, 6 inches wide, and 12 feet long? B1.17
   Right: 120 board feet. (2 × 6 × 12) / 12 = 12 BF, times 10.
   - 100 board feet: That would need 10 BF each.
   - 144 board feet: That would need 14.4 BF each.
   - 60 board feet: That is five pieces.
2. A supplier quotes framing lumber at $650 per thousand board feet (MBF). A job requires 8,000 board feet. What is the estimated material cost before tax? B1.17
   Right: $5,200. 8,000 / 1,000 = 8, and 8 x $650 = $5,200.
   - $650: That is the price for one MBF.
   - $3,250: That prices 5,000 board feet.
   - $52,000: Divide by 1,000 first.
3. A straight fence run is 240 ft long with posts spaced 8 ft on center. Counting both end posts, what is the MINIMUM number of posts required? B1.17
   Right: 31 posts. 240 / 8 = 30 spaces, plus 1.
   - 32 posts: That is one too many.
   - 240 posts: That confuses feet with posts.
   - 30 posts: That counts spaces, not posts.
4. A slab is 24 ft wide. Reinforcing bars run in one direction spaced 12 inches on center, with a bar at each edge. What is the MINIMUM number of bars in that direction? B1.17
   Right: 25 bars. 24 spaces + 1.
   - 12 bars: That divides by the wrong figure.
   - 24 bars: 24 is the spaces. A bar at each edge means one more.
   - 23 bars: That subtracts instead of adds.
5. A 24-ft wall is framed with studs at 16 inches on center, with a stud at each end and no openings, PLUS a 2-stud corner assembly added at one end. What is the MINIMUM stud count? B1.17
   Right: 21 studs. 18 spaces + 1, plus the 2-stud corner.
   - 19 studs: That leaves off the corner.
   - 24 studs: That is a rough rule of thumb.
   - 18 studs: That leaves off the end stud.
6. A 40-ft wall is framed with studs at 24 inches on center, with a stud at each end and no openings. What is the MINIMUM stud count? B1.17
   Right: 21 studs. 20 spaces + 1.
   - 30 studs: That uses 16 in spacing.
   - 20 studs: 20 is the spaces. A stud at each end means one more.
   - 40 studs: That is a one-per-foot rule of thumb.

B1.18 Sheets, block and bags

About 4 minutes of narration.

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BOARD 1 One pattern

B1.18

Area

Area / coverage = units

Net x (1 + waste)

Round up, last

Rates are trade practice, supplied by the question

BOARD 2 Sheets

B1.18

4x8	32 sq ft
4x10	40 sq ft
4x12	48 sq ft

400 / 32 = 12.5

13 sheets

✗ ~~Divide by 8~~

BOARD 3 Drywall covers more than walls

B1.18

Walls = perimeter x height

Ceiling = L x W

640 / 32 = 20 sheets

✗ ~~Walls only: 14 sheets~~

BOARD 4 Waste, then round

B1.18

13.13 x 1.10 = 14.44

15 sheets

✗ ~~Net / 0.90~~

BOARD 5 Block and brick

B1.18

Blocks = area x 1.125

320 x 1.125 = 360

Bricks = area x 6.75

200 x 6.75 = 1,350

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BOARD 6 Ceiling tile and bags

B1.18

384 / 8 = 48 tiles

1,500 / 50 = 30 bags

2.5 x 3 = 7.5: 8 bags

BOARD 7 Your turn

B1.18

24 ft x 8 ft

1.125 blocks per sq ft

5% waste

Your turn: worked step by step in lesson B1.18.

Key numbers and formulas

B1.18

- Area / coverage = units
- Net x (1 + waste)
- Round up, last
- 400 / 32 = 12.5
- 13 sheets
- Walls = perimeter x height
- Ceiling = L x W
- 640 / 32 = 20 sheets
- 13.13 × 1.10 = 14.44
- 15 sheets
- Blocks = area x 1.125
- 320 × 1.125 = 360
- Bricks = area x 6.75
- 200 × 6.75 = 1,350
- 384 / 8 = 48 tiles
- 1,500 / 50 = 30 bags
- 2.5 × 3 = 7.5: 8 bags

Common traps: each line is a wrong belief

B1.18

✗ Divide by 8

✗ Walls only: 14 sheets

✗ Net / 0.90

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Why the tempting answers fail (from the section practice) B1.18

1. A room is 12 ft by 20 ft with 8 ft ceilings. You will hang 4 ft by 8 ft gypsum board on all four walls and the ceiling, ignoring openings and waste. What is the MINIMUM number of full sheets needed? B1.18
   Right: 24 sheets. 752 / 32 = 23.5, rounded up.
   - 20 sheets: 752 / 32 = 23.5, which is more.
   - 16 sheets: That counts walls only.
   - 30 sheets: 30 sheets is far above 752 / 32 = 23.5, which rounds up to 24.
2. A wall is 9 ft high and 40 ft long and will be covered with 4×8 sheathing panels. Ignoring openings, what is the MINIMUM number of full sheets (round up)? B1.18
   Right: 12 sheets. 360 / 32 = 11.25, rounded up.
   - 11 sheets: 360 / 32 = 11.25, and 11 leaves a gap. Round up.
   - 45 sheets: That divides by the panel length.
   - 360 sheets: That confuses square feet with sheets.
3. A concrete masonry wall is 10 ft high and 30 ft long, built with standard 8×8×16 CMU. Using the rule of 1.125 blocks per square foot of wall face, what is the MINIMUM number of blocks (before waste)? B1.18
   Right: 338 blocks. 300 × 1.125 = 337.5, rounded up.
   - 375 blocks: 375 uses 1.25 blocks per square foot. The stem says 1.125.
   - 300 blocks: That is one per square foot.
   - 169 blocks: That uses half the wall.
4. A brick veneer wall is 9 ft high and 24 ft long. Using about 6.75 modular bricks per square foot of wall face, what is the APPROXIMATE brick count (before waste)? B1.18
   Right: 1,458 bricks. 9 × 24 = 216 sq ft, and 216 × 6.75 = 1,458.
   - 1,296 bricks: 1,296 uses 6.0 bricks per square foot. The stem says about 6.75.
   - 972 bricks: 972 uses 4.5 bricks per square foot. The stem says about 6.75.
   - 216 bricks: That leaves out the factor.
5. A suspended acoustical ceiling covers a room 20 ft by 24 ft using 2 ft by 4 ft lay-in tiles. Ignoring waste, how many tiles are required? B1.18
   Right: 60 tiles. 480 / 8 = 60.
   - 30 tiles: That uses a tile twice the size.
   - 120 tiles: That uses a 2×2 tile.
   - 480 tiles: That stops at square feet.
6. A CMU wall requires 450 blocks. Using a rule of about 3 bags of mortar per 100 blocks, what is the MINIMUM number of mortar bags to order? B1.18
   Right: 14 bags. 4.5 × 3 = 13.5, rounded up.
   - 13 bags: 4.5 × 3 = 13.5, and 13 falls short. Round bags up.
   - 5 bags: That uses 1 per 100.
   - 27 bags: That uses 6 per 100.

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B1.19 Labor: hours to dollars

About 3 minutes of narration.

BOARD 1 From quantity to hours

B1.19

Hours = qty / units per hour

Hours = qty x hours per unit

1,200 / 40 = 30

Rates: trade practice, not code

BOARD 2 Labor-hours are not clock hours

B1.19

Labor-hours = workers x days x hrs

5 x 4 x 8 = 160

✗ ~~Labor-hours = duration~~

BOARD 3 Burden

B1.19

Burdened = wage x (1 + burden)

$30 x 1.40 = $42

✗ ~~$30 + 0.40~~

BOARD 4 From hours to days

B1.19

Crew hrs = labor-hrs / crew

Days = crew hrs / 8

80 / 4 / 8 = 2.5: 3 days

BOARD 5 Equipment and unit prices

B1.19

- Rental, delivery, fuel, operator

Cost = qty x unit price

400 x $8.50 = $3,400

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BOARD 6 Your turn

B1.19

4,800 sq ft at 60 / labor-hr

$30 wage, 40% burden

Crew of 4, 8-hr days

Your turn: worked step by step in lesson B1.19.

Key numbers and formulas

B1.19

- Hours = qty / units per hour
- Hours = qty x hours per unit
- 1,200 / 40 = 30
- Labor-hours = workers x days x hrs
- 5 × 4 × 8 = 160
- Burdened = wage x (1 + burden)
- $30 × 1.40 = $42
- Crew hrs = labor-hrs / crew
- Days = crew hrs / 8
- 80 / 4 / 8 = 2.5: 3 days
- Cost = qty x unit price
- 400 x $8.50 = $3,400

Common traps: each line is a wrong belief

B1.19

✗ Labor-hours = duration

✗ $30 + 0.40

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Why the tempting answers fail (from the section practice) B1.19

1. A crew of 4 workers completes a task in 6 working days at 8 hours per day. At a fully burdened rate of $45 per hour, what is the estimated labor cost? B1.19
   Right: $8,640. 4 × 6 × 8 = 192 hours, times $45.
   - $2,160: That counts one worker.
   - $6,480: That uses 3 workers.
   - $10,800: That is 240 labor-hours, not 192.
2. A crew must install 1,500 square feet of flooring at a production rate of 50 square feet per labor-hour. What is the MINIMUM total labor-hours the estimate should include for this task? B1.19
   Right: 30 labor-hours. 1,500 / 50 = 30.
   - 75 labor-hours: That uses 20 square feet per labor-hour.
   - 15 labor-hours: That is clock hours for two workers.
   - 60 labor-hours: That is double the right figure.
3. A crew of 3 workers works 5 days at 8 hours per day. At a fully burdened rate of $52 per hour, what is the estimated labor cost? B1.19
   Right: $6,240. 3 × 5 × 8 = 120, times $52.
   - $2,080: That counts one worker.
   - $12,480: That doubles the crew.
   - $1,560: That uses 30 hours.
4. A tile installer prices work at $9.50 per square foot installed. For a job of 850 square feet, what is the estimated installed cost? B1.19
   Right: $8,075. 850 x $9.50 = $8,075.
   - $80,750: That misplaces the decimal.
   - $7,225: $7,225 uses $8.50 per square foot. The stem says $9.50.
   - $859.50: That adds instead of multiplying.
5. Your takeoff shows 14 cubic yards of concrete needed, and the supplier quotes $185 per cubic yard delivered. What is the estimated material cost for the concrete? B1.19
   Right: $2,590. 14 x $185 = $2,590.
   - $199: That adds instead of multiplying.
   - $1,850: That uses 10 cubic yards.
   - $25,900: That misplaces the decimal.
6. A painter rolls one coat at a rate of 150 square feet per hour. For a single coat on 3,000 square feet, what is the MINIMUM number of labor-hours to include in the estimate? B1.19
   Right: 20 hours. 3,000 / 150 = 20.
   - 200 hours: That uses 15 square feet per hour.
   - 15 hours: That uses 200 per hour.
   - 45 hours: That uses about 66 per hour.

B1.20 Bid build-up and markup

About 4 minutes of narration.

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BOARD 1 The six buckets

B1.20

1 Material
2 Labor
3 Equipment
4 Subcontracts
5 Overhead
6 Profit

BOARD 2 Checking subcontract scope

B1.20

- Line by line against your scope

Nothing doubled, nothing missed

✗ ~~Lowest quote wins, unread~~

BOARD 3 Overhead

B1.20

- Fixed: rent, insurance, licenses
- Variable: moves with volume

Rate = annual overhead / annual direct

100,000 / 500,000 = 20%

BOARD 4 Building the bid

B1.20

Direct: 20 + 10 + 2 + 8 = $40,000

+ 10% OH = $44,000

+ 10% profit = $48,400

State the base for profit

BOARD 5 Markup is not margin

B1.20

- Markup: profit / cost
- Margin: profit / price

20% markup = 16.7% margin

Price = cost / (1 - margin)

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BOARD 6 Schedule of values

B1.20

Lump sum split into line items

- Bill against work completed

✗ ~~It is the closeout list~~

BOARD 7 The sanity check

B1.20

Price / unit = check

Catches decimals, gaps, doubles

BOARD 8 Your turn

B1.20

M 15,000 L 9,000

E 1,000 S 5,000

OH 10%, then profit 10%

Your turn: worked step by step in lesson B1.20.

Key numbers and formulas

B1.20

- Nothing doubled, nothing missed
- Rate = annual overhead / annual direct
- 100,000 / 500,000 = 20%
- Direct: 20 + 10 + 2 + 8 = $40,000
- + 10% OH = $44,000
- + 10% profit = $48,400
- 20% markup = 16.7% margin
- Price = cost / (1 - margin)
- Lump sum split into line items
- Price / unit = check
- Catches decimals, gaps, doubles

Common traps: each line is a wrong belief

B1.20

✗ Lowest quote wins, unread

✗ It is the closeout list

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Why the tempting answers fail (from the section practice) B1.20

1. Direct costs on a job are $12,000 in materials and $8,000 in labor. If you add 15 percent for overhead and profit, what is the total bid price? B1.20
   Right: $23,000. $20,000 × 1.15 = $23,000.
   - $26,000: $26,000 adds 30%. The stem says 15%.
   - $22,000: That is not 15% of the whole base.
   - $21,200: That is wrong base and rate.
2. Your total job cost is $18,000 and you want a 25 percent gross profit MARGIN on the selling price. What is the correct selling price? B1.20
   Right: $24,000. $18,000 / 0.75 = $24,000.
   - $23,000: $23,000 leaves a margin under 25%. Divide cost by 0.75.
   - $20,250: $20,250 leaves a margin under 25%. Divide cost by 0.75.
   - $22,500: That is a 25% markup.
3. A job costs $16,000 and is sold for $20,000. What is the gross MARGIN percentage on the selling price? B1.20
   Right: 20%. $4,000 profit / $20,000 price = 20%.
   - 80%: That is cost over price.
   - 25%: That is the markup on cost.
   - 16%: 16% has no base here. $4,000 / $20,000 is 20%.
4. Your direct cost on a job is $9,000. You apply a 30 percent markup ON COST. What is the selling price? B1.20
   Right: $11,700. $9,000 × 1.30 = $11,700.
   - $9,270: That adds only 3%.
   - $12,857: That is a 30% margin.
   - $11,000: A rounded figure with no basis.
5. A contractor's annual overhead is $120,000 and expects about $600,000 in direct job costs for the year. To recover overhead evenly, approximately what percentage should be added to each job's direct cost for overhead? B1.20
   Right: 20%. $120,000 / $600,000 = 20%.
   - 25%: That divides by the wrong base.
   - 5%: 5% of $600,000 is $30,000, far short of $120,000.
   - 12%: 12% of $600,000 is $72,000, short of $120,000.
6. On a lump-sum project, what is the PRIMARY purpose of the schedule of values? B1.20
   Right: It breaks the total contract price into line-item values so that progress payments can be measured against the work actually completed.. It splits the price so payments follow the work.
   - It records attendance at the weekly safety meetings and is kept in the jobsite safety file rather than with the contract's payment documents.: That is a safety record.
   - It is the closeout list of defective items to correct before final payment, prepared by the architect after walking the building near the end.: That is the punch list.
   - It lists every subcontractor's bid bond amount so the owner can confirm each trade was bonded before the surety releases the contract documents.: That belongs on bond forms.

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B1.21 Takeoff lab: price the addition

About 4 minutes of narration.

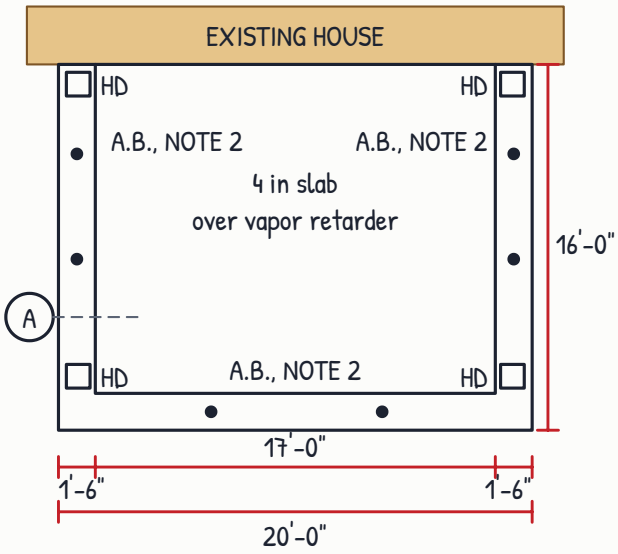
BOARD 1 The job

B1.21

- Concrete: N02, N05
- Roof: N04, N07
- Floors: N03, N06
- Wall finish: N03, N04, N06

BOARD 2 Concrete: the slab

B1.21



Bubble A / N05: section at the west wall

Training drawing. Not for construction. Simplified to fit a phone.

20 x 16 x 4/12 = 106.7 cu ft

✗ ~~20 x 16 x 4~~

BOARD 3 Concrete: the thickened edge

B1.21

8 + 12 - 4 = 16 in

16 + 16 + 17 = 49 ft

1.5 x 16/12 x 49 = 98 cu ft

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BOARD 4 Your turn: concrete

B1.21

Slab 106.7 cu ft

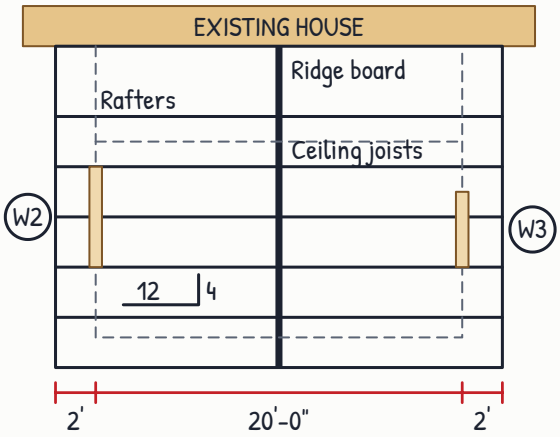
Edge 98 cu ft

cu yd = cu ft / 27

Your turn: worked step by step in lesson B1.21.

BOARD 5 Roof: plan area

B1.21



16 ft north-south; 1 ft rake at south

Ridge board, not a beam

Headers over W2 and W3

2x8 rafters @ 24 in o.c.

Training drawing. Not for construction. Simplified to fit a phone.

(2 + 20 + 2) x (16 + 1)

24 x 17 = 408 sq ft

✗ ~~320 sq ft, no overhang~~

BOARD 6 Roof: slope and squares

B1.21

4:12 = 1.054

Factor = root(12² + rise²) / 12

Your turn: worked step by step in lesson B1.21.

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BOARD 7 Floors

B1.21

Room	Floor	Sq ft
Family room	Plank	192
Hall	Plank	32
Closet	Plank	32

Plank 256 sq ft

Bath	Tile	64

BOARD 8 Wall finish: the south wall

B1.21

✗ ~~6'-8" = 6.8 ft~~

180 - 16 - 20 + 33.3

= 177.3 sq ft

Key numbers and formulas

B1.21

- 20 × 16 × 4/12 = 106.7 cu ft
- 8 + 12 - 4 = 16 in
- 16 + 16 + 17 = 49 ft
- 1.5 × 16/12 × 49 = 98 cu ft
- cu yd = cu ft / 27
- (2 + 20 + 2) x (16 + 1)
- 24 × 17 = 408 sq ft
- Factor = root(12^2 + $rise^2$) / 12
- Plank 256 sq ft
- 180 - 16 - 20 + 33.3
- = 177.3 sq ft

Common traps: each line is a wrong belief

B1.21

✗ 20 × 16 × 4

✗ 320 sq ft, no overhang

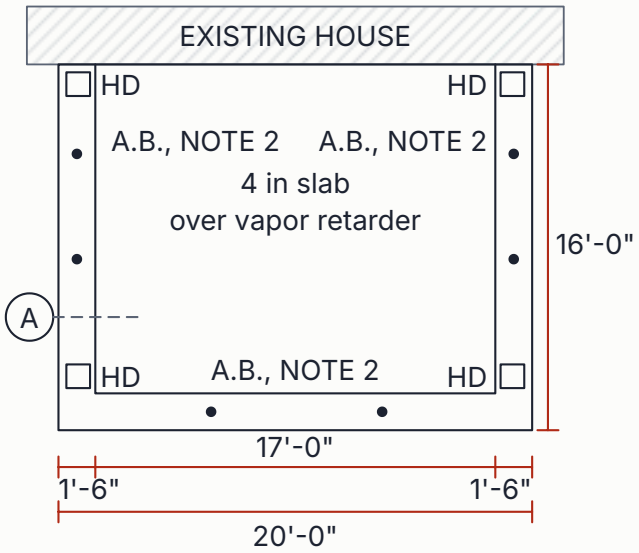
✗ 6'-8" = 6.8 ft

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Why the tempting answers fail (from the section practice)

B1.21

1. Using the overall dimensions and slab thickness on this sheet, what is the slab volume before any thickened edge or waste? B1.21



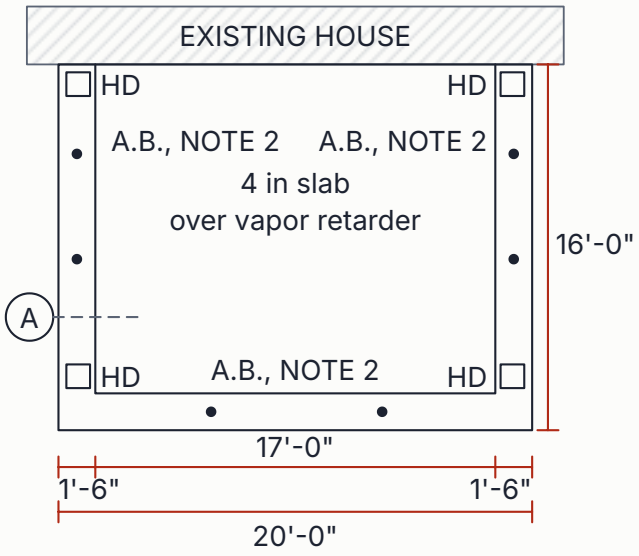
Bubble A / N05: section at the west wall

Training drawing. Not for construction. Simplified to fit a phone.

Right: 106.7 cu ft. 20 × 16 x (4/12) = 106.7 cu ft.

- 1,280 cu ft: This leaves the thickness as 4 instead of converting to feet.
- 320 cu ft: This is the slab's plan area in square feet, not a volume.
- 80.0 cu ft: This uses a 3 in slab; the sheet calls for 4 in.

2. The thickened edge is 18 in wide and runs 16 in below the slab along 16 ft + 16 ft + 17 ft of wall. What is its volume? B1.21



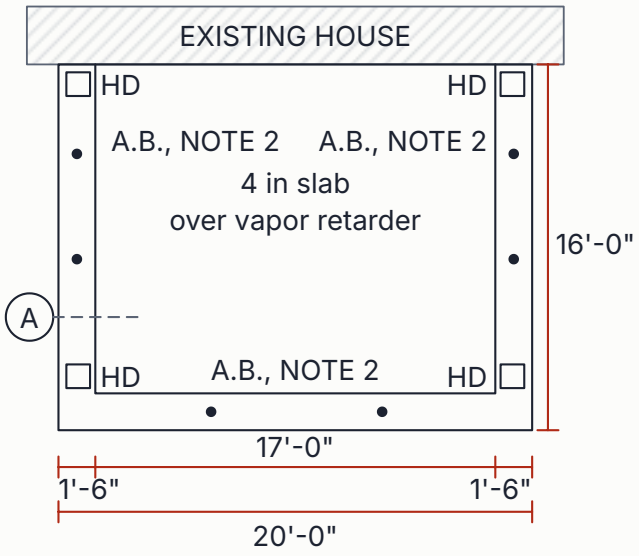
Bubble A / N05: section at the west wall

Training drawing. Not for construction. Simplified to fit a phone.

Right: 98 cu ft. 1.5 x (16/12) x 49 = 98 cu ft.

- 130.7 cu ft: This uses a 24 in width, not the 18 in stated.
- 1,176 cu ft: This leaves the 16 in depth unconverted.
- 73.5 cu ft: This uses 12 in of depth, not the 16 in stated.

3. The slab comes to 106.7 cu ft and the thickened edge to 98 cu ft. In cubic yards, before waste, what is the concrete total? B1.21



Bubble A / N05: section at the west wall

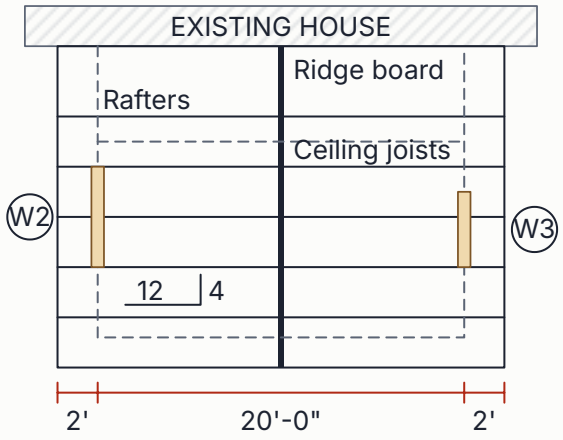
Training drawing. Not for construction. Simplified to fit a phone.

Right: 7.58 cu yd. (106.7 + 98) / 27 = 7.58 cu yd.

- 22.74 cu yd: This divides by 9, which converts square feet to square yards.
- 3.63 cu yd: This counts only the thickened edge.
- 3.95 cu yd: This counts only the slab.

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4. Using the dimensions on this sheet, what is the plan area of the roof including the eaves and rake? B1.21



16 ft north-south; 1 ft rake at south
Ridge board, not a beam
Headers over W2 and W3
2×8 rafters @ 24 in o.c.

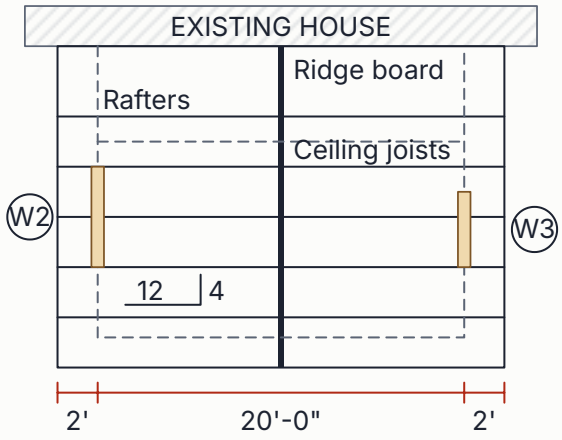
Training drawing. Not for construction. Simplified to fit a phone.

Right: 408 sq ft. (2 + 20 + 2) = 24 ft by (16 + 1) = 17 ft, or 408 sq ft.

- 432 sq ft: This adds a rake at both the north and south ends; the north abuts the house.
- 320 sq ft: This is the building area, without the overhangs.
- 384 sq ft: This adds the eaves but leaves out the 1 ft south rake.

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5. The roof plan area is 408 sq ft, and the slope factor for 4 in 12 is 1.054. How many squares of roofing is that before waste? B1.21



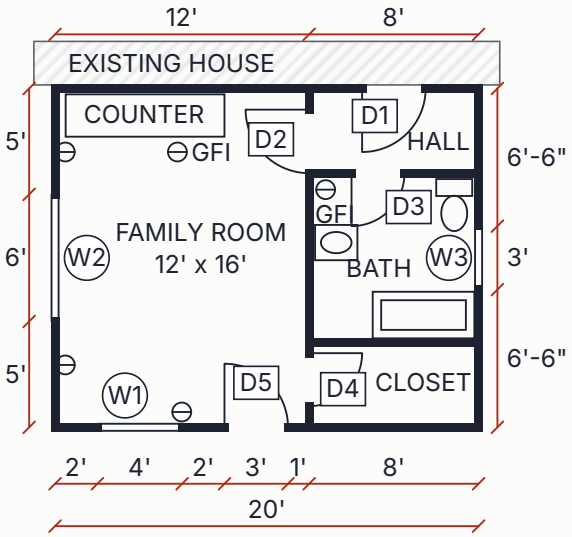
16 ft north-south; 1 ft rake at south
Ridge board, not a beam
Headers over W2 and W3
2×8 rafters @ 24 in o.c.

Training drawing. Not for construction. Simplified to fit a phone.

Right: 4.3 squares. 408 × 1.054 = 430 sq ft, and 430 / 100 = 4.3 squares.

- 3.9 squares: This divides by the slope factor instead of multiplying.
- 4.1 squares: This is the plan area in squares, without the slope factor.
- 43 squares: This divides by 10 instead of 100.

6. N06 lists luxury vinyl plank in the family room, hall and closet. Using the sizes on this sheet, how many square feet of plank is that before waste? B1.21



Hall 8' x 4'. Closet 8' x 4'. Bath 8' x 8'.

Training drawing. Not for construction. Simplified to fit a phone.

Right: 256 sq ft. 192 + 32 + 32 = 256 sq ft (12×16, 8×4 and 8×4).

- 224 sq ft: This leaves out either the hall or the closet.
- 192 sq ft: This is the family room alone.
- 320 sq ft: This is the whole addition, including the tiled bath.

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