

How to Build a Deck

A plain-English companion to your SimpleBlueprints plan set

For low, single-level backyard decks, attached or freestanding.

How to use this guide

Your plan set tells you *what* to build. It gives the sizes, the spacing, the footing diameters, the board layout and the hardware for your deck specifically. This guide tells you *how* to build it, and *why* each part is the way it is, in the order you will actually do the work.

Read it once through before you order anything. Then keep it beside the plans and read each section again on the morning you start that part of the job.

Three rules govern everything that follows.

The sheets win over this guide. This guide is general. It has to be, because it ships with every deck we draw. Your plan set was generated for your deck. Any time a number here and a number on your sheets disagree, the sheets are right.

Your building department wins over both. Codes are amended locally. Frost depth, snow load, soil bearing and inspection requirements are all local numbers. Where this guide says "check locally", it means it.

If it is not clear, stop and ask. A question costs a phone call. A guess costs a rebuild. Your inspector will answer questions before you build, and would much rather do that than fail you afterwards.

Who this is for

Someone who can use a circular saw and a drill, who has built something before, and who has never framed a deck. If you have framed decks, skip to the chapters on the parts you want a second opinion on.

What this covers, and what it does not

This guide covers single-level decks with a walking surface roughly six feet or less above the ground, either attached to the house with a ledger or standing free on their own posts.

It does not cover multi-level decks, decks above a living space, roofs over decks, decks on steep or unstable ground, or anything that needs an engineer's stamp. If your project has grown into one of those, this guide will still be useful background, but the design work belongs with a professional.

Where the numbers come from

The structural requirements described here follow the International Residential Code, chapter R507, which is the deck chapter, and the American Wood Council's *Prescriptive Residential Wood Deck Construction Guide*, known as DCA 6. Where a hardware rule is specific to a connector, it comes from the manufacturer. This guide describes what those documents require and explains what it means in practice. It does not reproduce their tables. Your plan

set already carries the numbers those tables produce for your deck.

One note on code families, because it causes real confusion at the permit counter.

Residential decks are governed by the International *Residential* Code, not the International *Building* Code. They are different documents and the deck provisions live in the IRC. If a set of plans cites the IBC for a backyard deck, that is a sign the drawings were not made against the code your inspector is reading.

Three kinds of box

Three kinds of boxed note appear throughout. They mean different things and it is worth learning them now.

STOP. Something that must not be got wrong, because it cannot be fixed later or because it is what makes the deck safe. Read every one of these.

ON THE JOB. A technique that makes the work faster, more accurate or less frustrating. Skip these if you are experienced.

YOUR SHEETS SAY. A number that is specific to your deck and lives on your plan set rather than in this book. Go and look it up.

The whole job, in order

Every step below has its own chapter. This page is here so you can see the shape of the project, work in the right order, and tick things off. Working out of order is where most first builds go wrong.

Before you touch the ground

- [] Confirm the deck size, height and position against your plan set.
- [] Get your permit, and write down which inspections it requires.
- [] Call the utility locate service and wait for the marks.
- [] Order lumber, hardware and concrete. Stack the treated lumber to dry.

Layout and footings

- [] Set batter boards and string lines. Square the footprint.
- [] Mark each footing centre and check it from two directions.
- [] Dig to the depth your building department requires.
- [] Book the footing inspection, if your permit needs one, before you pour.
- [] Pour, set the post bases, grade the soil away from the house.
- [] Wait about a week for the concrete.

Frame

- [] Stand the posts long and brace them plumb.
- [] Install and flash the ledger, or build the second beam if freestanding.
- [] Carry the beam height out to the posts, cut them, set the beam.

- [] Hang the joists, then square the frame and add the rim.
- [] Add blocking, including behind every guard post.
- [] Tie the joists down and fit the lateral load connection.
- [] Book the framing inspection. Do not cover anything before it.

Surface and safety

- [] Lay decking from the outer edge back toward the house.
- [] Cut and hang the stairs, anchored top and bottom.
- [] Build the guards and the handrail.
- [] Book the final inspection.

After

- [] Let the wood dry, then seal it.
- [] Re-tighten the through-bolts after the first season.

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Part One: Before you start

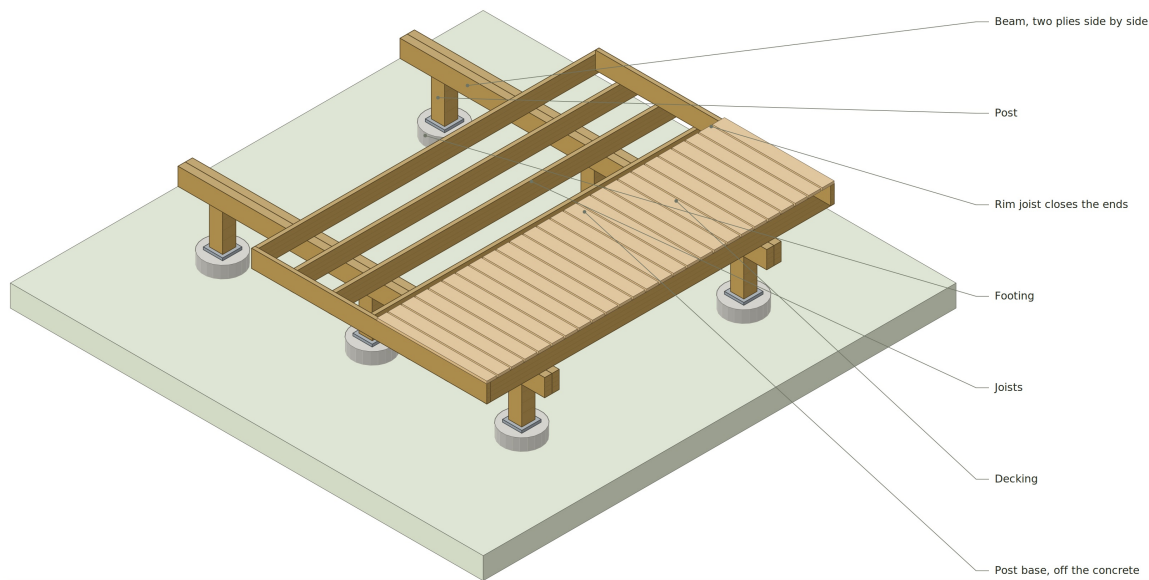
1. How a deck works

Before you cut anything, it helps to understand a deck as a single chain that carries weight to the ground. Every part in that chain hands its load to the next one down. If any link is undersized, or connected with the wrong fastener, the deck tells you eventually. Usually it starts as a bounce.

The load path, top to bottom

You and your furniture stand on the **decking**. The decking spans between **joists**, the repeating boards on edge underneath it. The joists carry that load outward to a **beam** and, on an attached deck, inward to a **ledger** bolted to the house. The beam sits on **posts**. Each post stands on a **footing**, a pad of concrete wide enough to spread the load over soil that can hold it.

That is the whole structure. Everything else, the railing, the stairs, the fascia, hangs off that chain or sits on it.



The parts of a deck

Load runs down this chain: decking to joists, joists to the beams, beams to the posts, posts to the footings, footings to the soil.

Two things follow from this that beginners often miss. First, every connection in the chain matters as much as the members themselves. A correctly sized joist held by a half-nailed hanger is a weak joist. Second, load spreads outward as it goes down: the footing is wide because it is the last chance to spread the weight before it reaches dirt.

The eight connections that hold it up

The members get the attention, but the deck is really a chain of connections, and a chain fails at its weakest link rather than at its thinnest member. Every one of these has its own chapter, and this book is organised around getting them right in the order you build them.

#	CONNECTION	CHAPTER	WHAT FAILS IF IT IS WRONG
1	Footing to soil	8	The footing sinks or heaves and the deck racks
2	Post to footing	8	The post end rots, or lifts off in wind
3	Beam to post	11	The beam slides or rolls off its bearing
4	Joist to beam	13	Joists slide, lift or roll over on edge
5	Ledger to house	10	The deck comes off the wall. This is the one that kills people
6	Joist to ledger	12	The hanger tears out under load
7	Deck to house, sideways	13	The deck pulls away from the wall under a crowd
8	Guard post to frame	16	Someone leans on the railing and goes over it

Read that list again before your framing inspection. It is very close to what the inspector is actually checking, and all eight disappear under decking.

STOP. Connections 5, 7 and 8 are the three that injure people. If you are going to be fussy about one part of this project, be fussy about those.

The parts, named

You will see these terms on your sheets and throughout this guide.

- **Ledger.** The board bolted flat to the house that carries the inside edge of an attached deck.
- **Rim joist.** The outer joists that form the perimeter of the frame. The one at the far edge is sometimes called the outside rim or the end rim.
- **Field joist.** The regular repeating joists between the rims.
- **Beam.** The main horizontal member the joists land on, usually built up from two or three boards fastened together to act as one.
- **Post.** The vertical member carrying the beam down to a footing.
- **Footing.** The concrete base under the post.
- **Post base** or **saddle.** The galvanized bracket that anchors the post to the footing and holds the end of the post up off the concrete.
- **Post cap.** A bracket on top of the post that cradles the beam.
- **Joist hanger.** The bracket that holds a joist end against a ledger or rim.
- **Blocking.** Short pieces cut to fit between joists, used to stop joists twisting and to give bolts something solid to grab.
- **Decking.** The boards you walk on.
- **Guard.** The barrier around the edge that stops people falling off. Most people call it the railing.
- **Baluster.** The vertical infill pieces in the guard.
- **Stringer.** The sawtooth board that carries stair treads.
- **Tread** and **riser.** The board you step on, and the height you step up.

Attached or freestanding

There are two ways to hold up the house side of a deck.

An **attached** deck hangs that edge from a ledger lagged or bolted through the house wall into the framing behind it. It uses less material and it is the common choice. Its whole risk sits in one detail: water getting behind the ledger, or bolts that never reached solid wood. More decks fail there than anywhere else.

A **freestanding** deck replaces the ledger with a second beam on its own row of posts and footings. Nothing structural touches the house, so there is no hole to flash and no ledger to fail. It costs more in posts, footings and concrete, and it needs attention to bracing so it cannot sway.

Your plan set already specifies which one you have. Build what it shows. If you are choosing between the two and your wall is brick, stucco, stone veneer or anything you cannot confirm has solid framing behind it, freestanding is the safer build and it removes the single riskiest connection on the project.

2. What you are signing up for

Most first-time deck builders underestimate elapsed time, not effort. The work itself is straightforward. The waiting is what surprises people.

A realistic schedule

For a small backyard deck, working weekends, here is roughly how the calendar runs. Times are for two people.

STAGE	HANDS-ON TIME	THEN YOU WAIT
Permit application	An hour, plus a trip	Days to weeks, depending on your department
Utility locate	One phone call	Usually two to three working days, and it is free
Layout and string lines	2 to 3 hours	Nothing
Digging footings	1 to 2 hours per hole by hand	Footing inspection, if your permit requires one
Pouring footings	Half a day	Concrete cures for about a week before you load it
Posts and beam	Half a day	Nothing
Ledger	Half a day	Nothing
Joists and blocking	A full day	Framing inspection before you cover anything
Decking	A full day	Nothing
Stairs	Half to a full day	Nothing
Guards	A full day	Final inspection
Sealing	2 to 3 hours	Treated lumber needs weeks to months to dry first

Add it up and a small deck is three to five working days of labour spread across four to eight weeks of calendar.

The cure week is the one that catches people. Concrete reaches most of its strength in about seven days and keeps gaining for a month. You can set post bases and stand posts sooner, but do not hang the weight of a beam and a frame on green concrete. Plan the weekend after the pour for something else.

What drives the cost

Lumber is usually about half the bill. Hardware and fasteners are a bigger share than people expect, often fifteen to twenty percent, because every connection on a deck is a rated galvanized bracket and the nails that go with it. Concrete, the permit and the tools you have to buy or rent make up the rest.

Your plan set includes a material list with quantities. Prices move, so price it at your own yard before you commit.

Get help for two hours

You can build almost all of a small deck alone. Two moments are much easier, and much safer, with a second person: lifting the built-up beam onto the posts, and holding the far end of long boards. Line someone up for those.

3. Permits and inspections

Do you need one

Almost certainly, if the deck is attached to the house or if the walking surface is more than 30 inches above the ground. Many jurisdictions also require a permit regardless of height once the deck passes a certain size. Rules on freestanding ground-level decks vary widely.

STOP. Check with your building department before you assume either way. Building without a required permit tends to surface at the worst moment, which is when you sell the house.

What they will want

Usually your plan set, a site plan showing where the deck sits on the lot, and an application. Some departments want a soil statement or a survey.

Two things this guide cannot tell you, and you should not guess at:

- **Your setbacks.** How close the deck may come to your property lines is set by local zoning, not by building code, and it varies street by street.
- **Your frost depth and design loads.** Frost depth is local. So is snow load. Both change the sizes on the drawings.

Your building department publishes all of these, usually in a one-page deck handout. Ask for it. It is the single most useful document you can get before you start, and it is free.

The inspections, and why the order matters

Most jurisdictions inspect a deck twice or three times.

Footing inspection, after the holes are dug and before concrete goes in. The inspector is checking depth, diameter and that you are bearing on undisturbed soil. Once the concrete is in, nobody can see any of that.

Framing inspection, after the frame, hardware and stairs are complete and before the decking goes down. This is the important one. The inspector is looking at the ledger fastening and flashing, the hangers and whether every hole is filled, the post to beam connection, the joist to beam ties, the guard post connections and the stair stringer attachment. Every one of those disappears under decking.

Final inspection, once guards, stairs and handrails are complete.

Book them when your permit tells you to, and do not run ahead. The most expensive mistake on a deck is covering a connection the inspector has not seen.

Make the inspector's job easy

Have the approved plans on site. Leave the hardware packaging out so the model numbers are visible. Point out anything you did differently from the drawings rather than hoping it goes unnoticed. Inspectors deal with people trying to hide things all day. Being straightforward with them is worth a great deal.

4. Working safely

Nothing here is dramatic. The injuries that actually happen on deck projects are boring and preventable.

STOP. Call before you dig. In the United States and Canada, dial 811 and ask for a utility locate. It is free, it takes a few days, and it marks buried gas, electric, water and communication lines. Hitting a gas line while augering a footing hole is the one genuinely dangerous thing on this project.

Safety glasses for every cut, and hearing protection for any extended run with a circular saw. A circular saw runs around 105 dBA at the operator's ear, and NIOSH puts the safe limit for a whole working day at 85. Above 100 the safe exposure is measured in minutes, and the damage doesn't come back.

Cut treated lumber outside, stand upwind, and wear a dust mask. Wash your hands before you eat. Never burn treated offcuts, and don't use them as garden edging or animal bedding.

Most deck injuries are backs and dropped loads, not saws. A three-ply 2x10 beam twelve feet long is close to 180 pounds of wet lumber, and there's no clever way to carry that alone. Two people, or walk it up in stages on the posts and some blocking.

Leave the temporary bracing alone until the frame is locked. A post braced with two scrap 2x4s is holding until the beam is bolted and the rim is on, and the gap between "it looks stable" and "it is stable" is where people get hurt. If anyone else is on site, write "do not remove" on the braces.

Cover open footing holes with plywood overnight. A dug hole is a broken ankle waiting for a child or a dog.

Then watch the forecast before you pour. Fresh concrete and heavy rain do not mix, and neither does a hard freeze in the first day or two.

5. Tools

You do not need everything on this list, but you do need a plan for each row. Rent the auger. Borrow the miter saw if you can.

Layout and digging

TOOL	NOTES
Tape measure, 25 ft	A second short one saves walking
Mason's string and stakes	Cheap, and the whole layout depends on it
Batter boards	Two stakes and a crosspiece at each corner, made on site from scrap
Line level or laser level	A laser makes the post height step much easier
4 ft spirit level	The single most used tool after the tape
Post level	The two-axis kind that straps to a post, worth the small cost
Framing square and speed square	Marking cuts and checking corners
Chalk line	For anything that has to look straight
Post-hole digger, or a rented auger	An auger pays for itself past about four holes
Shovel, wheelbarrow, tamper	For spoil, concrete and backfill

Cutting and fastening

TOOL	NOTES
Circular saw	The main saw. A sharp framing blade, not the one it came with
Miter saw	Optional, but makes square repeat cuts much faster
Jigsaw or handsaw	For finishing the inside corners of stringer cuts
Drill and impact driver	Two bodies beats swapping bits all day
Spade bits and auger bits	For bolt holes, sized to the bolt
Socket set and a ratcheting wrench	For carriage bolts and lag screws
Hammer, 20 to 22 oz	Hanger nails are driven, not screwed
Chisel, sharp	For paring a post notch flat
Clamps	Two large ones, for holding a beam while you bolt it

Useful, not essential

A magnet on a stick for dropped fasteners. A pencil that is not a carpenter's pencil, for fine layout marks. A cordless work light if you are finishing after dark in autumn.

6. Lumber, fasteners and hardware

Choosing lumber

Everything structural and anything within six inches of the ground should be pressure-treated and rated for the exposure it will see. Treatment comes in grades: ground contact rated material is what you want for posts, and for anything that will stay damp. Framing above grade can be the standard above-ground grade, but many builders use ground contact throughout for the small extra cost.

The walking surface can be something nicer.

MATERIAL	WHAT TO KNOW	UPKEEP
Pressure-treated pine or fir	Cheapest, strong, fine as decking too. Often wet when you buy it	Clean and re-seal every year or two
Cedar or redwood	Naturally rot resistant, softer, dents more easily	Seal regularly or it greys
Composite	Wood fibre and plastic. No splinters, no stain, more expansion	Wash occasionally. Never seal
PVC	All plastic, lightest maintenance, most expensive, moves the most with heat	Wash only

Two habits that make a visible difference:

Sort the pile at the yard. Sight down each board before you load it. Reject anything with a twist, a large edge knot in the middle of its length, or a crack running in from the end. You are allowed to do this and the yard expects it.

ON THE JOB. Crown your joists. Almost every board has a slight bow along its edge. Look down each one, find the high side, and install it crown up. Traffic and time flatten it. A joist installed crown down starts as a dip and only gets worse.

If your decking or framing arrives soaking wet, sticker it. Stack it with scrap strips between the layers so air moves, out of direct sun, for a week or two. Wet treated lumber shrinks as it dries, so boards laid tight today open up later.

Fasteners: the metal matters

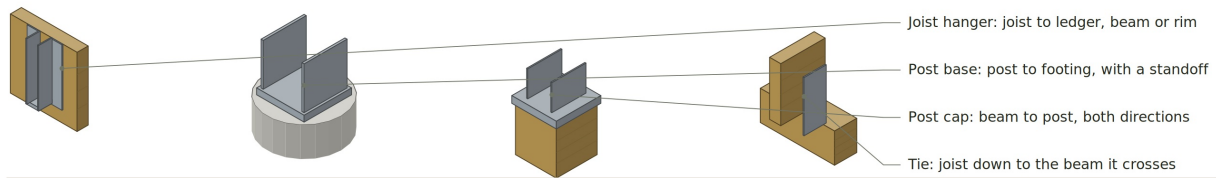
Modern pressure treatment is corrosive to ordinary steel. Every nail, screw, bolt and bracket that touches treated wood must be hot-dipped galvanized or stainless steel. Electroplated screws from the bargain bin will streak rust down your new deck within a season and lose strength within a few.

Do not let aluminium touch treated lumber either. That includes aluminium flashing directly against a treated ledger, which is a common and avoidable mistake. Use copper, stainless or a compatible coated product.

Deck screws and drywall screws are not structural. They fasten decking and trim. They do not fasten a frame together, they do not fill a joist hanger, and they do not replace a bolt.

The hardware, by what it does

Your plan set names the hardware for your deck and says how many of each. This table is here so you recognise them in the aisle and know how each one fails when it is installed wrong.



The connectors this book keeps mentioning

Each one is made for a specific joint and is rated only when it is fastened the way its maker specifies. Use the nails or screws named on the packet, not whatever is in the bucket.

HARDWARE	WHAT IT DOES	HOW IT FAILS
Joist hanger	Lets a butt joint carry real load by wrapping the joist end and tying it to the ledger or rim	Wrong size for the joist depth, or holes left empty. A partly nailed hanger carries a fraction of its rating
Concealed or face-mount hanger	Hides inside the joint for a clean outside edge	Rated lighter than a standard hanger. Only where the plan calls for it
Post base	Anchors the post to the footing and lifts the end grain clear of the concrete	No standoff, so the post end sits in water. Or anchored into concrete that had not cured
Post cap or saddle	Cradles the beam on the post and ties the two together against sliding and uplift	Sized for a different post or beam width, so it never seats fully
Hurricane or seismic tie	Locks each joist down to a dropped beam so it cannot slide, lift or roll	Treated as optional. It resists uplift, it does not replace proper bearing
Hold-down or tension tie	Ties guard posts, and the deck itself, back into solid framing so a shove or a sway is carried deep into the structure	Installed without the blocking behind it, so there is nothing for it to grab
Stair stringer connector	Carries the stair load into the deck rim	Replaced with toenails. Stairs pull away from the deck over time
1/2 in carriage bolts	Through-bolt the heavy connections: post to beam, guard post to rim	No washer under the nut, or never re-tightened after the wood dries and shrinks
1/2 in lag screws	Fasten the ledger where you cannot reach the back of the wall	Biting into sheathing instead of framing. Or driven with a hammer instead of turned
Structural connector screws	Code-rated screws that replace bolts or hanger nails in specific applications	Any screw that is not the labelled structural product. Ordinary screws are not equivalent
Joist hanger nails	The short fat nails that fill a hanger	Substituting roofing nails or deck screws. The hanger is only rated with the fastener it was tested with

Buy the hardware and the fasteners in the same corrosion class, and buy the fastener the connector manufacturer specifies. This is the cheapest part of the deck to get right and one of the most common places it goes wrong.

Concrete, and how much

Your plan set gives footing diameter and your building department gives depth. Those two numbers give you volume.

A cylinder's volume in cubic feet is the radius in feet, squared, times 3.14, times the depth in feet. Work it once per hole size and multiply.

Worked example: a 12 inch diameter hole, 36 inches deep. The radius is 0.5 ft, so $0.5 \times 0.5 \times 3.14 \times 3 = 2.36$ cubic feet per hole. Four of those is 9.4 cubic feet.

An 80 lb bag of concrete mix yields about 0.6 cubic feet. A 60 lb bag yields about 0.45. So those four holes need roughly 16 of the 80 lb bags. Buy ten percent more than the arithmetic says, because holes are never as neat as cylinders.

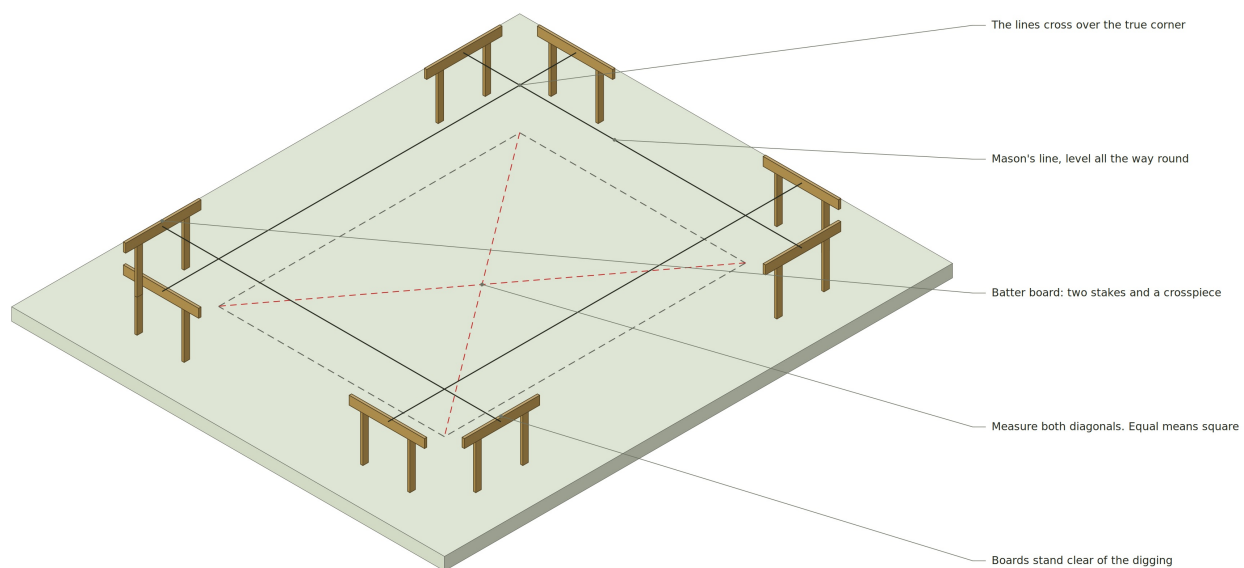
Past about 25 or 30 bags, price a small delivery of ready-mix. Mixing forty bags by hand in a wheelbarrow is a genuinely miserable day.

If your deck has footings in two different diameters, and some do, calculate each size separately. Do not average them.

Part Two: Building it

7. Layout: getting square before you dig

Everything downstream follows the lines you set now. A frame that starts a half inch out of square ends with decking that fans, a railing that will not line up and a stair that lands crooked. This is the cheapest stage to be fussy at.



Batter boards and string lines

Set these before you dig. The strings cross over each corner and the boards stand clear of the holes, so the layout survives the digging. Equal diagonals mean the rectangle is square.

Set the string lines

Work from a fixed reference. On an attached deck that is the house wall, which is already straight and is not going to move. On a freestanding deck, pick the edge you most want to look parallel to something, usually the house or a fence.

Drive batter boards a couple of feet outside each corner of the deck: two stakes with a crosspiece nailed across them. Run mason's string between them to mark the outside edges of the deck frame. Batter boards matter because they let you slide the string sideways an inch without pulling stakes, and you will slide it more than once.

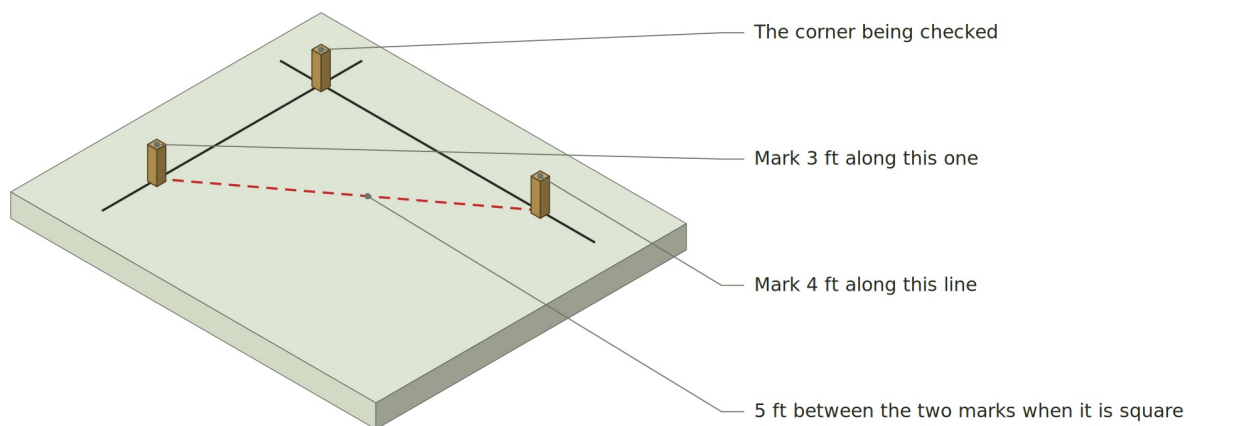
Pull the strings tight. A sagging string reads long and lies to you.

Prove it is square, twice

Two independent checks, and do both.

Measure the diagonals first. Corner to corner, both ways. When the two numbers match, the corners are at 90 degrees. If they do not match, slide one string along its batter board and measure again. This check is the most reliable one you have, and it takes thirty seconds.

Then check a corner with 3-4-5. Measure three feet along one line and four feet along the other, and mark both. The straight distance between those two marks reads exactly five feet when the corner is square. Any multiple of 3-4-5 works, and bigger is more accurate: use 6-8-10 or 9-12-15 on a longer run, because a small angular error shows up more over a longer leg.



Squaring a corner with 3-4-5

Measure 3 ft along one line and 4 ft along the other. When the corner is square the distance between those two marks is exactly 5 ft. Any multiple works, and a bigger triangle is a sharper check: use 6-8-10 if you can.

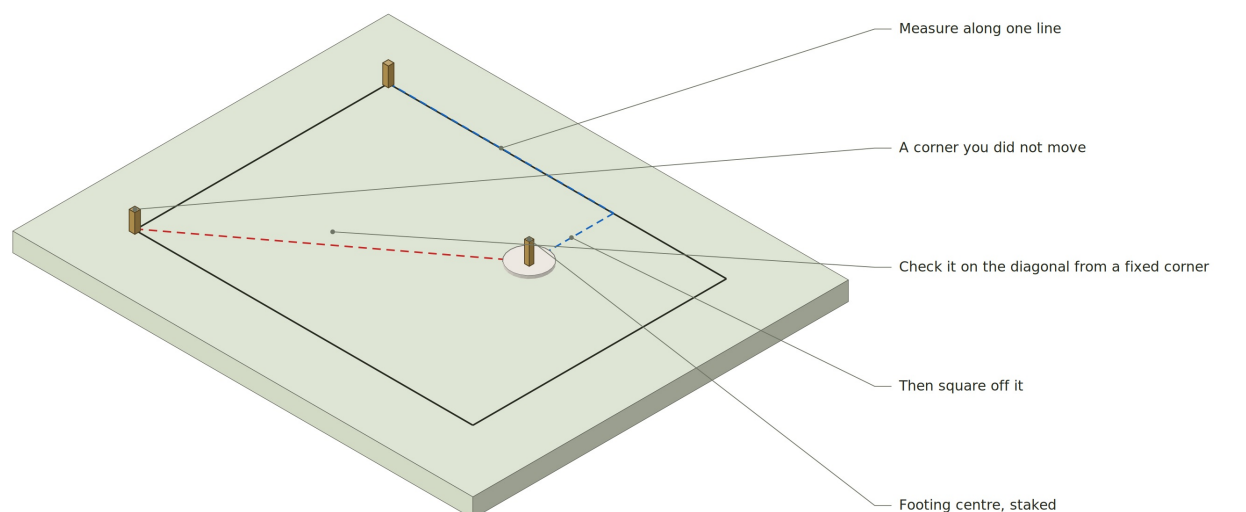
Sloped yards

If your ground falls away, hold the dumb end of the tape up so the tape is level when you pull the measurement. A tape laid along sloping ground measures the slope, not the distance, and reads long downhill. Over ten feet of run on a noticeable slope that error is easily an inch.

Mark the footing centres

Your plan set's footing layout gives you the centre of each footing measured from fixed

points, usually the corners of the ledger or the corners of the frame, with diagonals as well as square offsets. Use both. Measuring a post centre from two directions and confirming it with the diagonal is how you catch a mistake before it is a hole in the ground.



Marking a footing centre

Two measurements square off the string lines put the centre roughly right. A third, diagonally back to a fixed corner, is what proves it. Check every footing this way before a shovel touches the ground.

Mark each centre with a stake or a spray dot, then stand back and look at the pattern. Post rows should look parallel from across the yard. Your eye will catch a misplaced one faster than your tape will.

Take a photo of the finished layout with the strings up. It is genuinely useful an hour later when a string gets knocked.

8. Footings

Footings are the part you can't fix later. They're also the part the inspector cannot see once concrete is in, which is why the footing inspection happens before the pour and not after.

Why depth matters

When wet soil freezes it expands, and it lifts whatever is sitting in it. That is frost heave.

It pushes a footing up over the winter and lets it drop again in spring. On a freestanding deck the whole thing may rise and settle together and nothing tears. On an attached deck, one edge is bolted to a house that is not moving, so the deck racks, the ledger works against its bolts, and after a few winters something gives.

So an attached deck's footings reach below the depth at which the ground freezes where you live, or bear on solid rock. The code sets two conditions and the deeper one wins: at least 12 inches below undisturbed ground, and below the frost depth your jurisdiction publishes (IRC R403.1.4).

Get that local number from your building department rather than estimating it. Nationally it runs from zero in southern Florida and along the Gulf coast, through 18 to 30 inches across

much of the mid-Atlantic and the Pacific Northwest, to 42 inches in Chicago and the Twin Cities, to 60 inches and more in northern Minnesota and Maine. Minnesota divides its own state in two and writes 42 inches in the south against 60 in the north. A neighbour's guess is not a source.

The IRC does allow an exception for decks that are not supported by a dwelling: a freestanding deck does not need frost-depth footings. Local amendments can remove that exception, so confirm with your inspector rather than assuming.

Why diameter matters

Diameter is about soil, not frost.

Each post carries the slice of deck around it, which is called its tributary area, and the footing has to spread that load over enough soil that the soil can hold it. The numbers climb faster than people expect. On ordinary 1,500 psf soil under a 40 psf deck, a post carrying 40 square feet of deck needs a 16 inch round footing, and one carrying 80 square feet needs 22 inches. Move the same deck onto dense gravelly soil rated at 3,000 psf and those two drop to 12 and 16 inches. Minimum thickness through most of that table is 6 inches (IRC Table R507.3.1).

Unless your soil has been tested, the drawings assume the conservative bearing value, which is why the footings can look larger than you expected.

YOUR SHEETS SAY. Footing diameter, and there may be more than one. If your deck has two, that is deliberate: an interior beam line carries deck from both sides, so its footings are wider. Check each hole against the plan before you dig it, not after.

Digging

Dig to the full depth, and dig the sides reasonably straight. The bottom matters more than the sides: you want to bear on undisturbed soil, not on the loose material you just dropped back in. Scrape the bottom clean and flat.

A clamshell digger and a digging bar will get you through four or five holes in soft ground. Past that, or in clay, rent a powered auger for the day. A one-man auger takes 8 and 12 inch bits comfortably; anything wider, or ground with rock in it, wants the two-man machine and a second person who knows it is going to kick when the bit catches.

Four things will stop you, and all four are easier to recognise before you are standing in the hole.

A rock you can lever out, remove, then fill the void with compacted soil or gravel before you pour. A rock you cannot move that fills most of the hole bottom is usually good bearing, and you can pour onto it, but tell your inspector. Do not pour concrete around a rock that is sitting on loose fill.

Roots under about an inch, cut and keep going. A major root from a mature tree is a reason to move the footing, which usually means moving a post, which usually means a call to us or to your designer. Do not cut a structural root from a tree you want to keep.

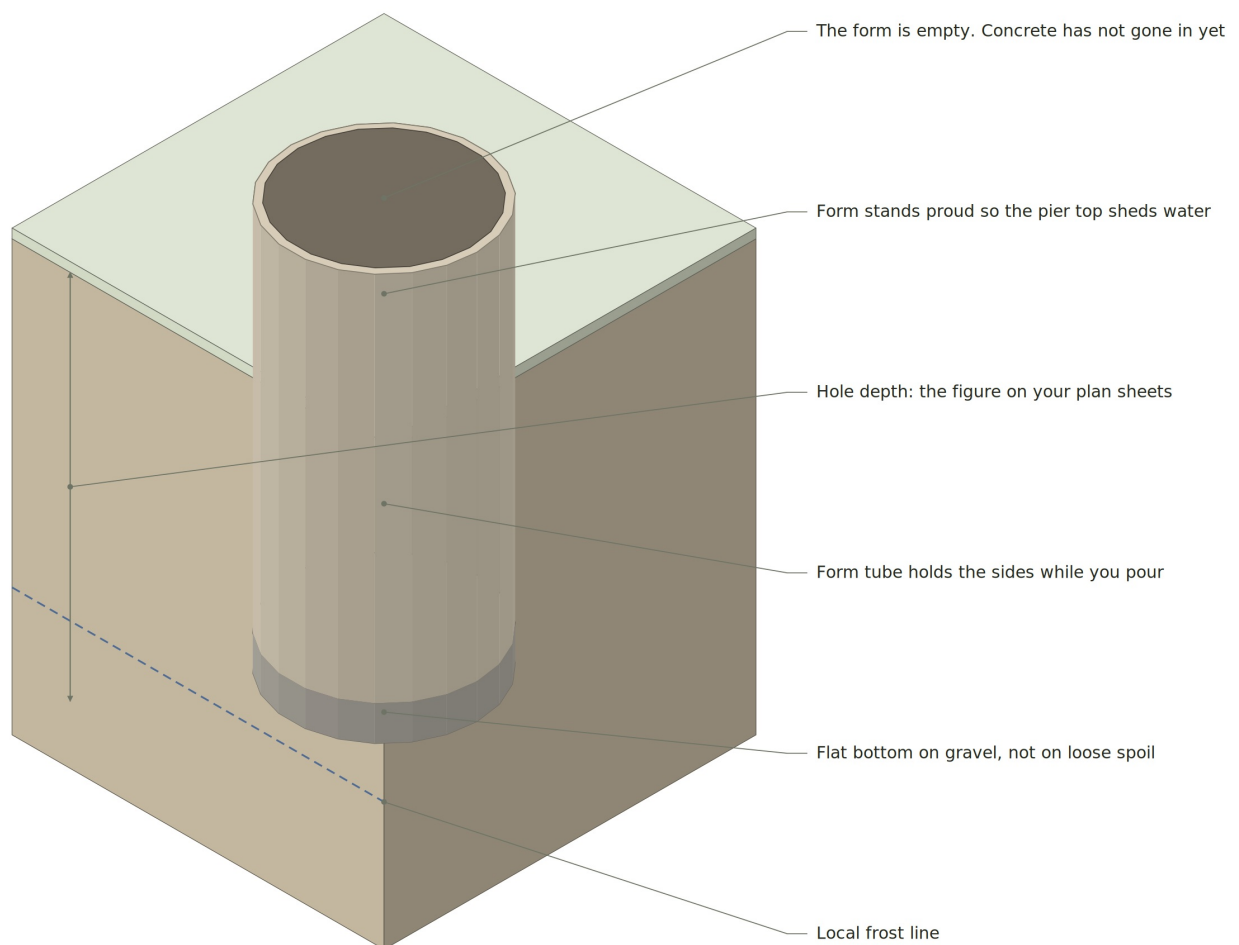
A little seepage is fine and the concrete will displace it. Standing water is not: bail it out first, because concrete poured into water comes out weak and segregated. If a hole refills as fast

as you bail it, you have a groundwater situation and it is worth a conversation with your building department before you continue.

Soft or made ground. If the bottom of the hole is fill, ash, old topsoil or anything that crumbles in your hand, keep going until you reach something that does not. If you cannot, stop and get advice. A footing on fill is not a footing.

Forms and pouring

A cardboard tube form keeps the hole round and stops the sides collapsing inward as you pour. Cut it so it stands one to two inches proud of the finished grade. That small lip keeps the post base out of standing water and stops soil washing against the post.



The hole, before the pour

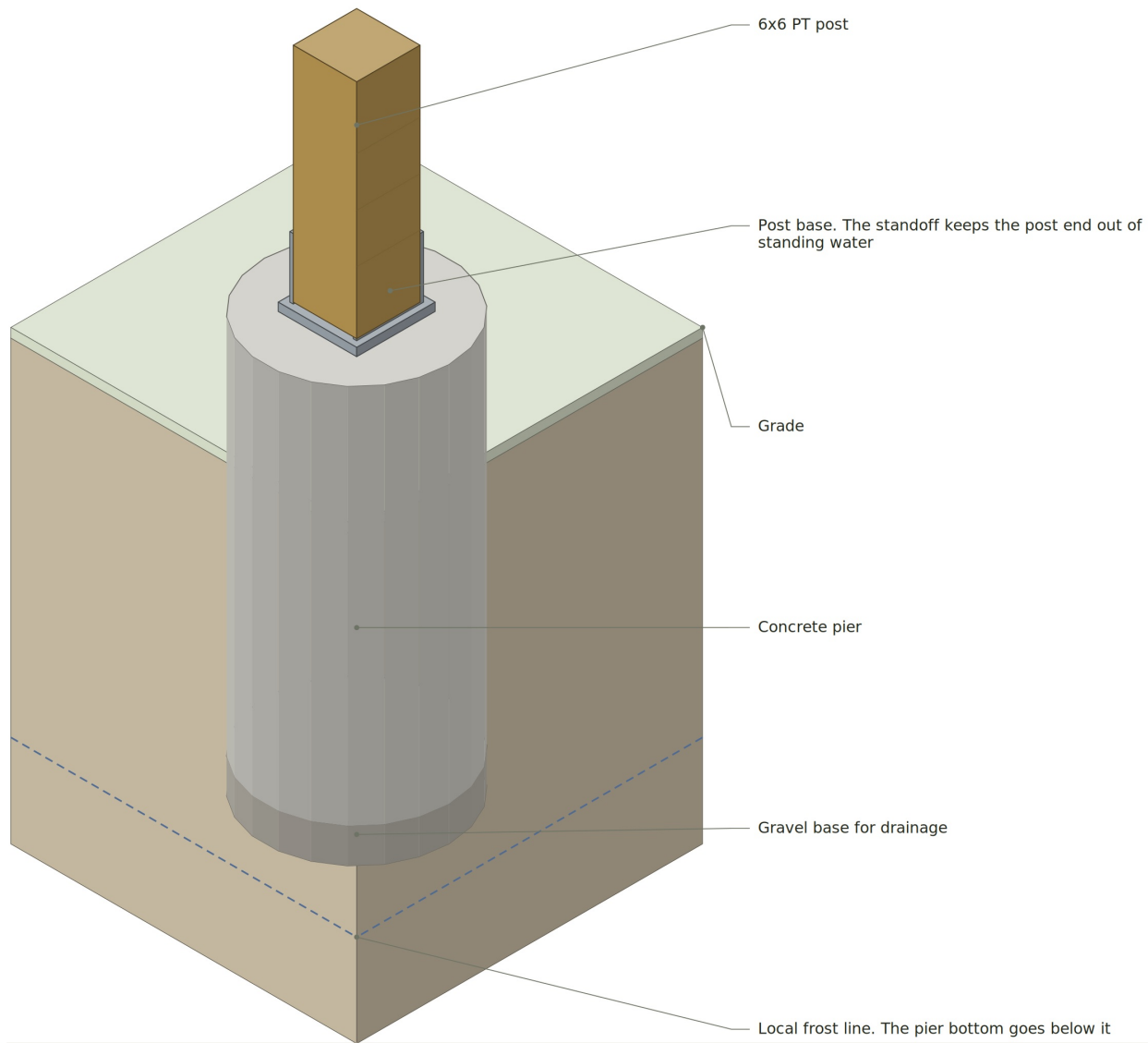
Flat bottom, gravel for drainage, and the form standing proud of grade so the top of the pier sheds water. Your sheets give the diameter; the local frost line sets how deep the bottom has to go.

Buy the concrete before you start, and buy too much. A hole 36 inches deep holds about 2.4 cubic feet of concrete at 12 inches across, 4.2 cubic feet at 16 inches, and 6.5 at 20. An 80 pound bag of standard premix yields 0.60 cubic feet, so those holes take roughly 4, 7 and 11 bags each. Sixty pound bags yield 0.45 and you will need a third more of them. Add ten percent for the tube lip and for what ends up on the grass. Running one bag short in the middle of a pour is a bad afternoon.

Mix to the bag's water ratio, not to what looks easy to pour. Wet concrete is easier to place and weaker when it sets. A wheelbarrow and a mortar hoe will handle two bags at a time, which is fine for a few holes; past fifteen or twenty bags, rent the mixer. Fill in stages and work a stick or a length of rebar up and down through it to release trapped air, especially around the edges.

Screed the top flat and, if you want to be tidy, slope it slightly away from the centre so water sheds off.

Setting the post base



Footings, post base and post

The post stands on the base, not in the concrete. Your sheets give the diameter and the depth; your local frost line can push the depth deeper.

Two ways, and both are accepted.

Wet set. Push the anchor bolt or the base itself into the concrete while it is still plastic,

position it, and let it set. Strongest and cheapest, but you are working against the clock: in warm weather the mix can begin to stiffen inside the hour, and concrete is not forgiving once it does.

Bolt down. Let the footing cure, then drill it with a hammer drill and a masonry bit and install an expansion or epoxy anchor, then bolt the base on. Easier to place precisely against a string line, and easier to adjust if a hole ended up slightly off centre.

Whichever you use, the base must have a standoff, the small raised plate that holds the bottom of the post about an inch clear of the concrete. Wood sitting directly on concrete wicks water and rots from the end grain up, and it is invisible until the post is soft.

Before the concrete sets, lay a long straight board with a level on it across the post bases and check they are close to a common plane. They do not have to be identical, because you cut the posts to height later, but bases at wildly different heights make that step harder than it needs to be.

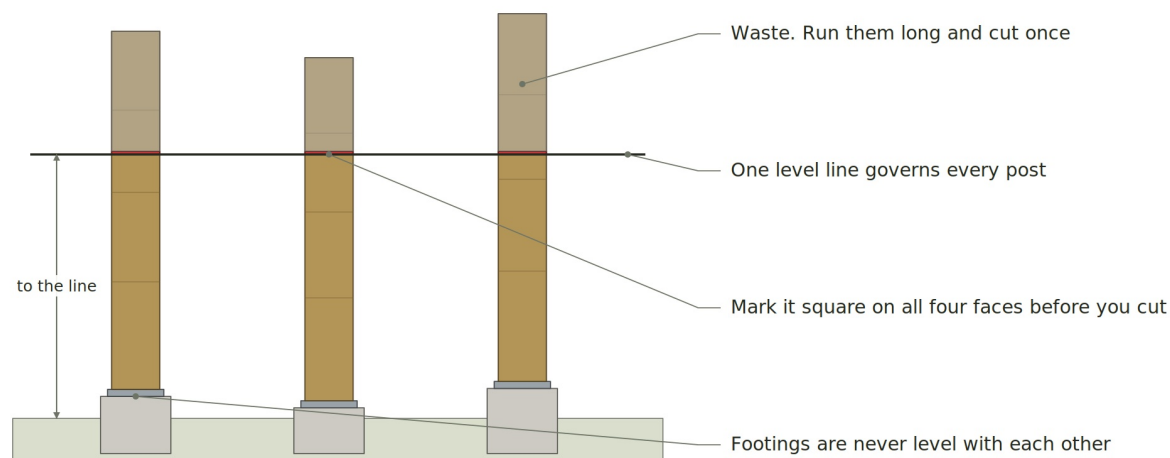
While the holes are open

Grade the soil under and around the deck so it falls away from the house. Six inches of fall over the first ten feet is the code's own figure and a good target (IRC R401.3). The spoil from your footing holes is exactly the right material and it is already sitting next to you. Doing this now costs nothing. Doing it after the deck is built means working on your knees under joists.

Then wait. Standard premix is rated at 4,000 psi at 28 days and most of that strength arrives in the first week, which is where the usual advice to give it a week before you load it comes from.

9. Posts

Stand them long



Setting the posts to height

Stand every post long, mark them all from one level line, then cut. Footings are never perfectly level with each other, so a post cut to a calculated length before it goes up puts that error straight into the beam.

Stand each post in its base, plumb it, brace it, and leave it running well past its final height. You'll cut them all to height in one pass later, once the ledger is on and the frame height is fixed. A long post is a five minute trim. A short post is firewood.

Plumb means vertical in both directions, so check two adjacent faces. A post level that straps on and shows both axes at once makes this a one-person job. Brace each post with two scrap 2x4s running to stakes driven in the ground, at roughly 90 degrees to each other.

Respect the weight while you are doing it. A 6x6 that has just come off the treatment truck is still saturated, and a 10 foot one runs close to 150 pounds. The same post is under 90 once it has dried out, but you are lifting it wet. Walk it up hand over hand rather than lifting it flat, or get a second person.

Fasten the post to its base only after it is plumb and braced, and consider using screws first so you can still adjust. Many builders dry-fit at this stage, pull the posts to cut and notch them, then fix them permanently.

4x4 or 6x6

Your plan specifies which, and the published limits are worth knowing anyway. A 4x4 deck post is good to 8 feet of height and a 6x6 to 14 feet (AWC DCA 6, Table 3).

Height is not the only thing that decides it. A 6x6 is also what you need if the beam is going to sit in a notch, and the arithmetic is the reason. A 4x4 actually measures 3-1/2 inches square, so cutting a 1-1/2 inch notch into it leaves 2 inches of wood carrying the deck. A 6x6 measures 5-1/2, and the same notch leaves 4.

Do not substitute downward. If your plan says 6x6, a 4x4 is not a cost-saving, it is a different structure.

Bracing taller posts

As exposed post height grows, a deck can sway even when every connection is tight. An attached deck borrows the house's stiffness through the ledger. A freestanding deck has nothing to borrow, so it resists sway through diagonal bracing at the posts instead.

Your plan shows bracing if your deck needs it, and the height at which your set calls for it is on the sheets. If braces are drawn, they are structural and they are not optional.

10. The house connection: ledger or freestanding

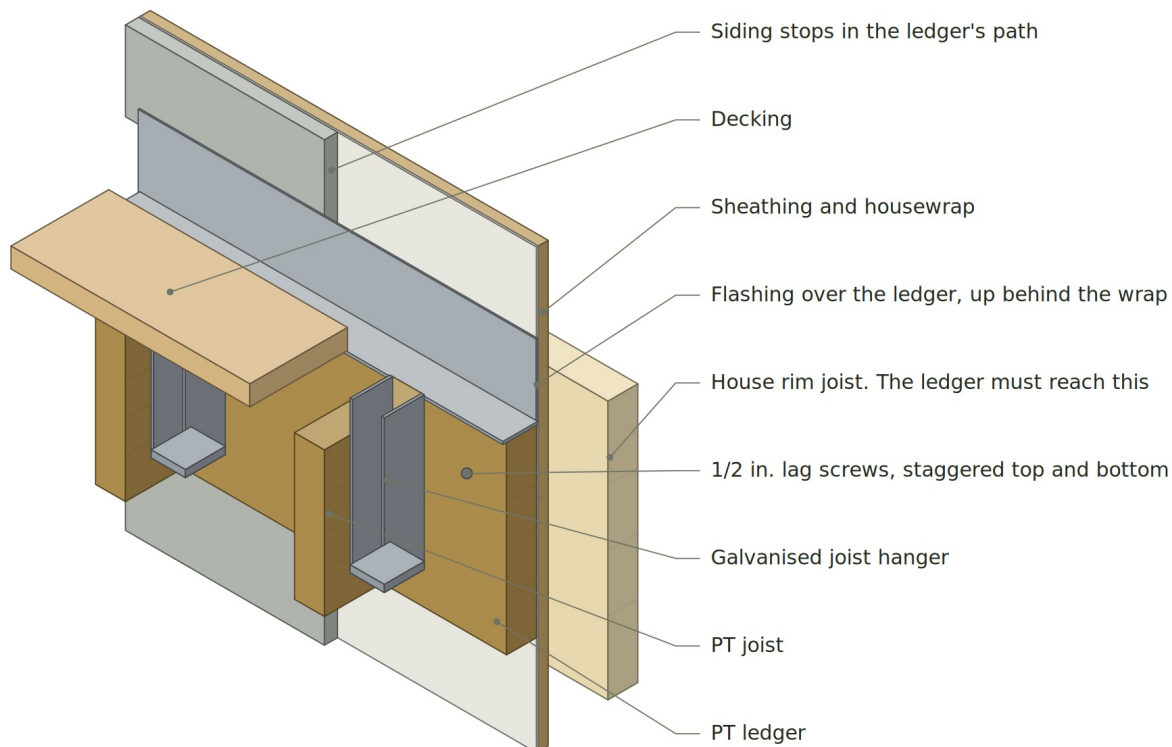
This chapter covers the single most consequential decision on the deck. Build what your plan shows.

If your deck is attached: the ledger

The ledger does two demanding jobs at once. It carries roughly half the weight of the deck, and it lives in the one place on the whole structure where water wants to collect. Both jobs have to be done properly, and the second one is the one that fails.

STOP. Find out what is behind the siding before you drill anything. The ledger must fasten through the sheathing and into the solid framing behind it, usually the band joist of the house floor. Fastening into sheathing or siding alone is not a connection. It will hold for a while, which is the dangerous part.

Pull the siding back along the full run of the ledger and look. You are confirming there is continuous solid wood there, and finding out how thick it is, because that sets how long your lag screws need to be.



Ledger to a wood framed wall

Cut away to show the frame. The ledger carries the whole deck, so it has to reach the house rim joist, not just the sheathing.

Some walls cannot take a standard ledger at all. Brick veneer, stone veneer and stucco are not structural and cannot carry a deck. Walls with thick foam sheathing need a specific detail so the fasteners are not bridging a soft gap. Cantilevered floors and bay windows are not suitable backing. If any of that describes your wall, the correct answer is usually to build the deck freestanding, and it is a far better outcome than a ledger you are not sure about.

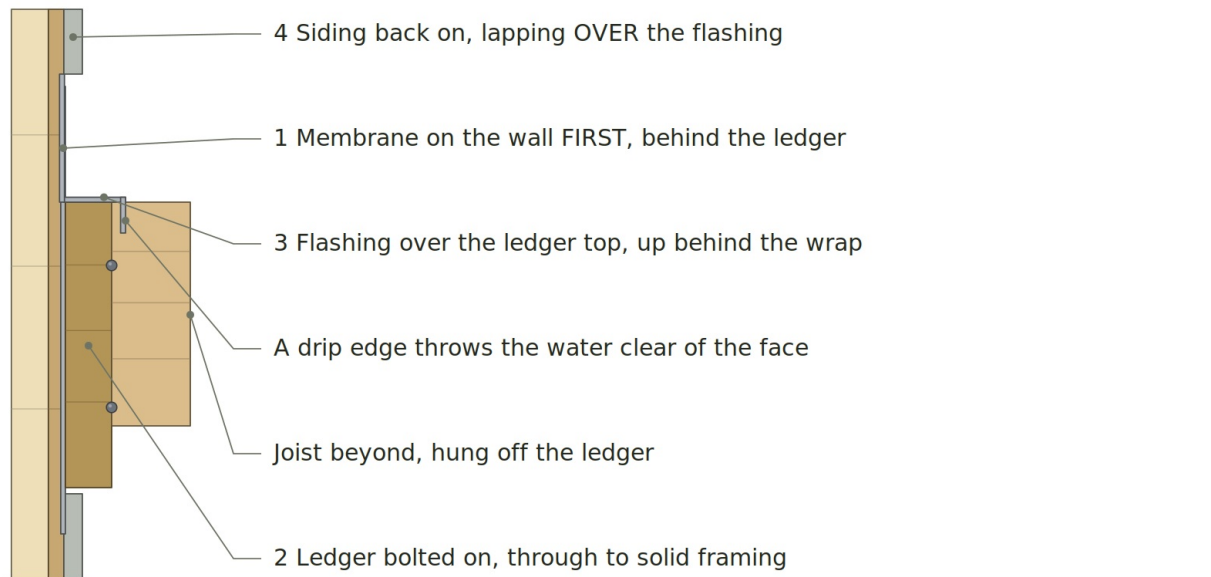
Fastening. Half inch lag screws or through-bolts, in two staggered rows, at the spacing your plan's ledger schedule gives. The spacing is not arbitrary and it is not a constant: it comes from the code table and depends on how far your joists span, because a longer joist delivers more load into each foot of ledger. Use the number on your sheets.

Lag screws are turned in with a wrench or a socket, never driven with a hammer. Drill the pilot properly: a clearance hole through the ledger itself, sized so the shank passes freely,

and a smaller pilot into the house framing sized for the threads. Getting this wrong either splits the wood or leaves the threads cutting nothing. Every lag gets a washer under its head. Where you can reach the back of the band joist from inside, through-bolts with a washer and nut are stronger than lags and are worth the trip into the basement.

Flashing, which is what actually keeps it standing. Water running down the wall must be directed out over the top of the ledger and down its face, never behind it. The order matters: a membrane or waterproof tape goes on the wall behind the ledger first, then the ledger, then a metal flashing that tucks up under the house wrap or siding above and bends down over the ledger's top edge with a drip edge. Water then runs down the outside of the ledger and away.

Seal the fastener penetrations. Leave a gap at the wall when you lay decking later so water and debris can drain instead of sitting against the wall.



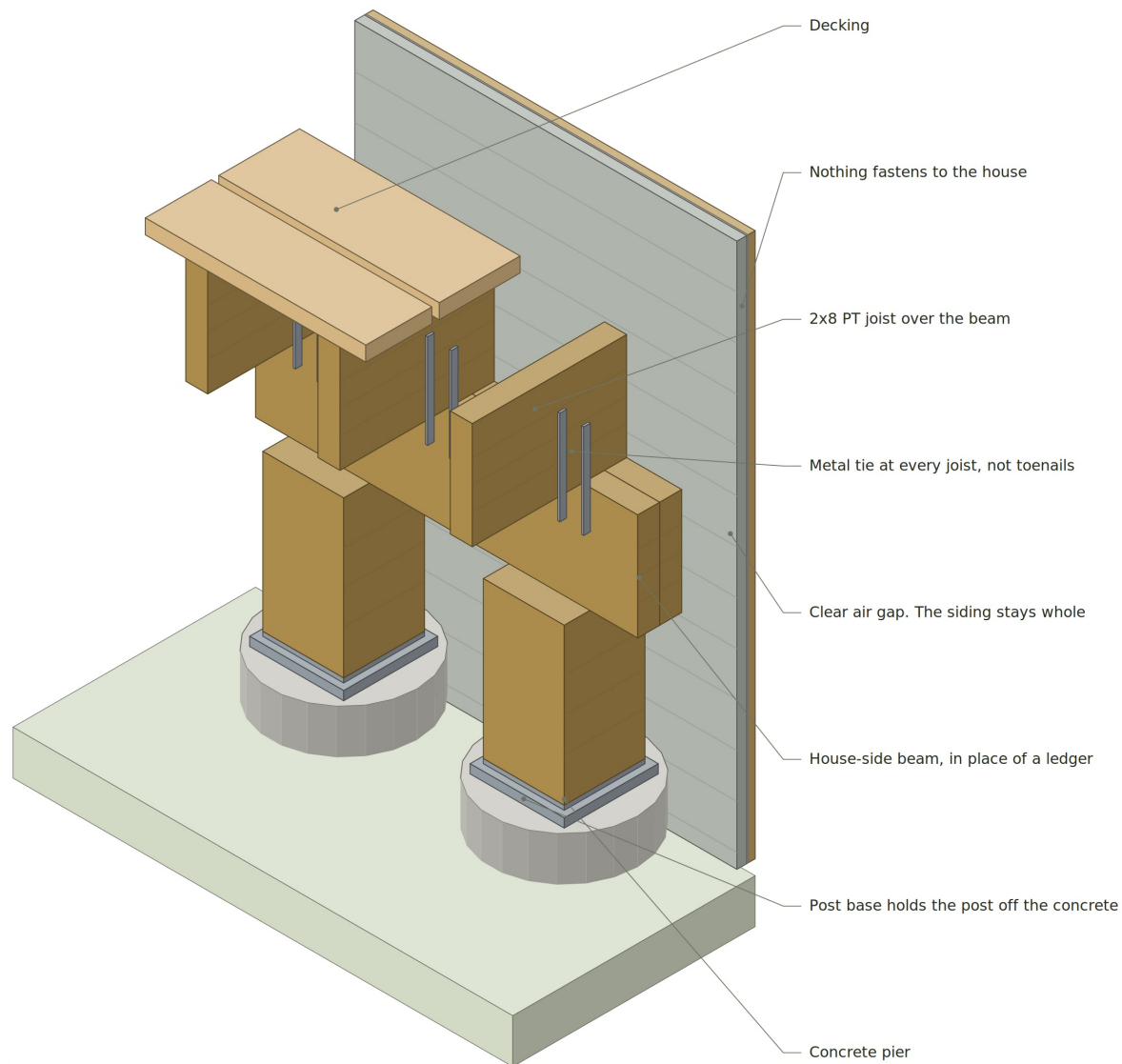
The order the water layers go on

Water runs down the wall and has to be led out over the ledger and down its face, never behind it. Get the order wrong and the flashing funnels water into the wall.

And remember the metal compatibility rule: no bare aluminium against treated lumber.

If your deck is freestanding: a second beam

A freestanding deck replaces the ledger with a second beam on its own posts and footings, usually set a short distance out from the house rather than touching it. Nothing structural attaches to the wall, which removes the flashing problem and the band joist question entirely.



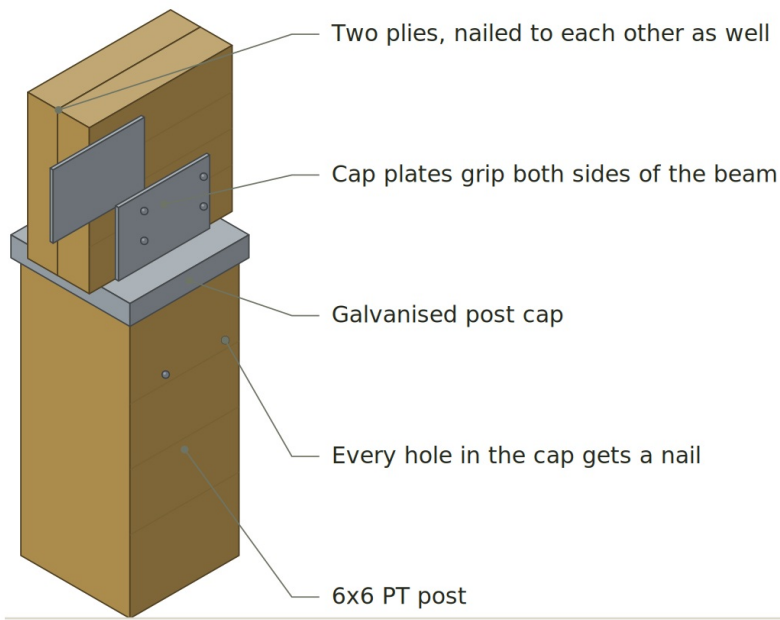
Free-standing at the house

No ledger, no flashing, no fastener into the wall. A second beam on its own posts carries the house side, and the deck stands clear of the siding.

Build it the same way as the outer beam line, described next. The two things to pay attention to are bracing, because there is no house to lean on, and keeping the deck surface clear of the wall so the house can drain and the deck can move.

11. Beams

The beam is the spine. It gathers everything the joists collect and hands it to the posts.



Beam on a post

The cap ties the beam to the post in both directions. Fill every nail hole the manufacturer provides: a cap with two nails in it is not the cap that was tested.

Kinds of beam

Built-up is the common one: two or three pieces of 2x lumber fastened together so they act as a single member. **Solid timber**, a single 4x or 6x, is stronger and heavier and more expensive. **Single ply** is only for short spans and light loads.

A beam also sits one of two ways. A **dropped** beam rests on top of the posts and the joists run over it. This is simpler and stronger and is what most low decks use. A **flush** beam hangs between the joists with hangers so its top is level with them, which buys headroom underneath and costs you a row of hangers and a deeper beam.

Your plan shows which you have.

Fastening the plies together

A built-up beam only works if the plies are joined well enough to share load.

A two-ply beam is nailed in two rows with 10d or 3 inch common nails at roughly 16 inch spacing, driven from both faces so they alternate, and staggered so you are not splitting along one grain line. A three-ply beam needs bolts, not nails alone. Follow the exact pattern on your sheets.

If the beam has to be made from more than one length, put the splice directly over a post, never out in a span, and keep bolts back from board ends and edges.

Build the beam with all crowns facing up, and mark the crown on each board before you assemble so you cannot get one backwards.

Carrying the beam height out to the posts

This is the step that sets the height of the whole deck, and there is a trick to it that makes it easy.

Rest one end of a long straight joist on the ledger at its finished height. Run it out over a post. Put a level on top. Raise and lower the free end until it reads level, then mark the post where the underside of that joist crosses it. That mark is the top of the beam.

Do it at each post. Snap a line. Then cut them all in one pass, or pull them and cut them on the ground.

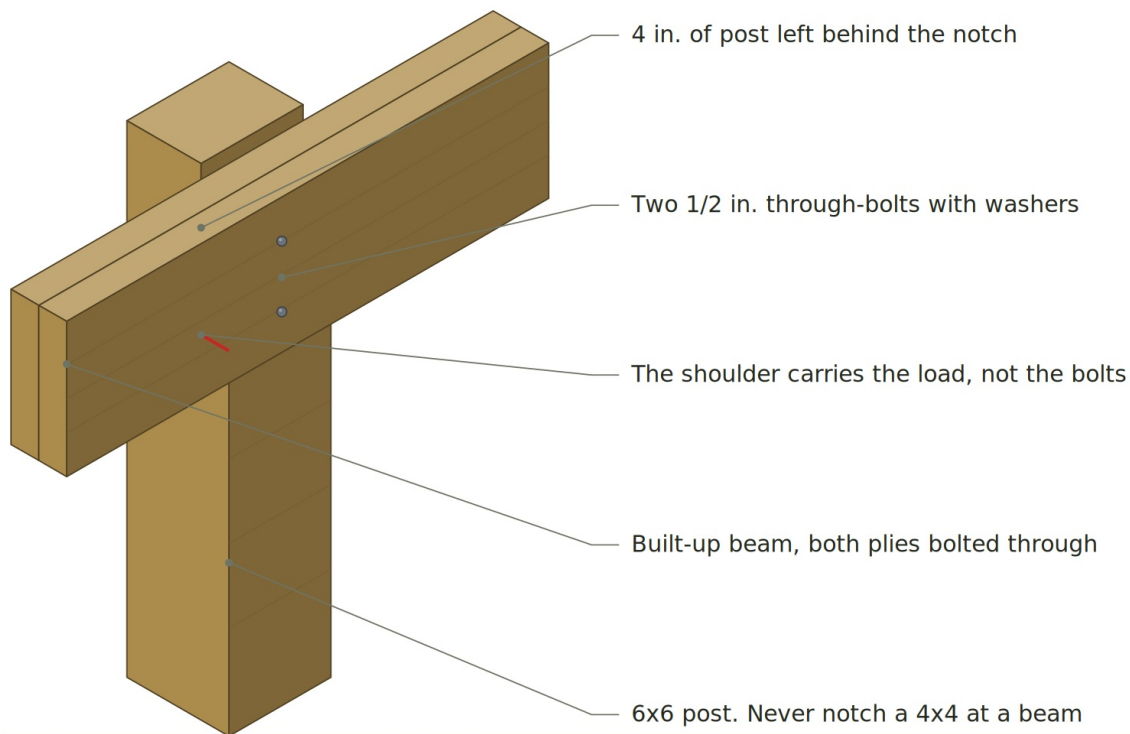
On a freestanding deck there is no ledger to work from, so establish the height at one post from the door threshold or from wherever you want the deck surface, and carry it across with a level and a straight board, or a laser.

One height rule regardless: keep the finished deck surface at least an inch or two below the interior floor and below the bottom of the door threshold, so rain and snowmelt run away from the house rather than into it.

Mounting the beam to the posts

The beam has to be locked to the post so it cannot slide or lift. Setting it on top is not enough. Two accepted methods:

Notched post. The post is cut so the beam drops into a notch and bears on the full shoulder of the remaining wood, then it is fixed with two half inch through-bolts. The load is carried by the wood shoulder, not by the bolts. The bolts stop it moving. Notching is for 6x6 posts; a notched 4x4 does not leave enough section.



Beam in a notched post

The beam bears on the wood shoulder. The bolts only stop it sliding and lifting. Notch a 6x6, never a 4x4: a 1-1/2 in. notch leaves 4 in. of a 6x6 and only 2 in. of a 4x4.

Cutting a clean notch: mark the notch depth and height on the post. Set your circular saw to the notch depth and make the two shoulder cuts. Then make a row of closely spaced cuts between them, an inch or less apart. Knock the waste out with a hammer and pare the seat flat with a sharp chisel. Check the beam sits down tight on the shoulder across its full width before you drill for bolts. A beam bearing on a high spot at one end is carrying on a corner.

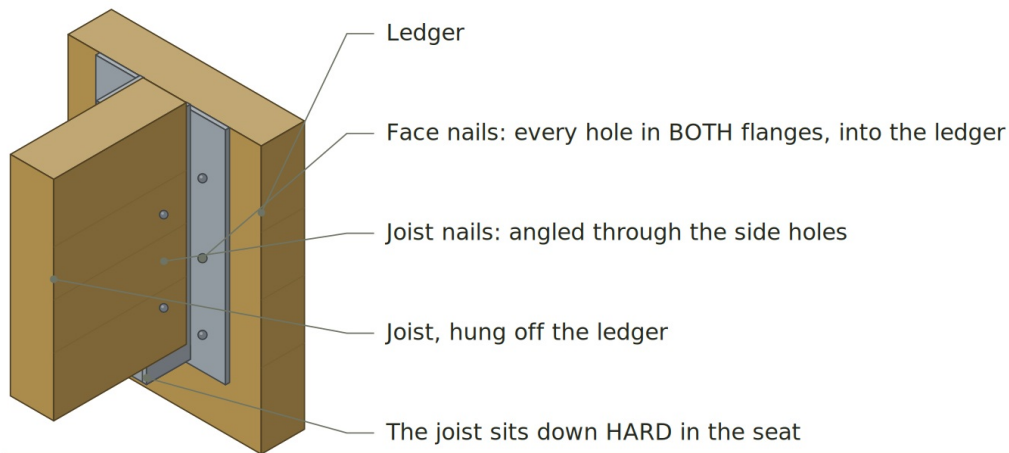
Post cap. A galvanized bracket sits on top of the full post and cradles the beam, tying them together against sliding and uplift. No notch, no lost section, and it is the better answer when your post is a 4x4 or when you are not confident in your notch.

Never bolt a beam to the side of an unnotched post and call it done. Bolts in that arrangement are carrying the deck in shear through two pieces of steel rather than through wood bearing, and it is not an accepted connection.

Brace the beam to the posts and to the ground while you fit the rims, snug enough to hold and loose enough to adjust. Confirm square again with the diagonals before you commit to the bolt holes.

12. Joists and framing

With the beam set and the ledger on, the frame goes together quickly. This is the satisfying day.

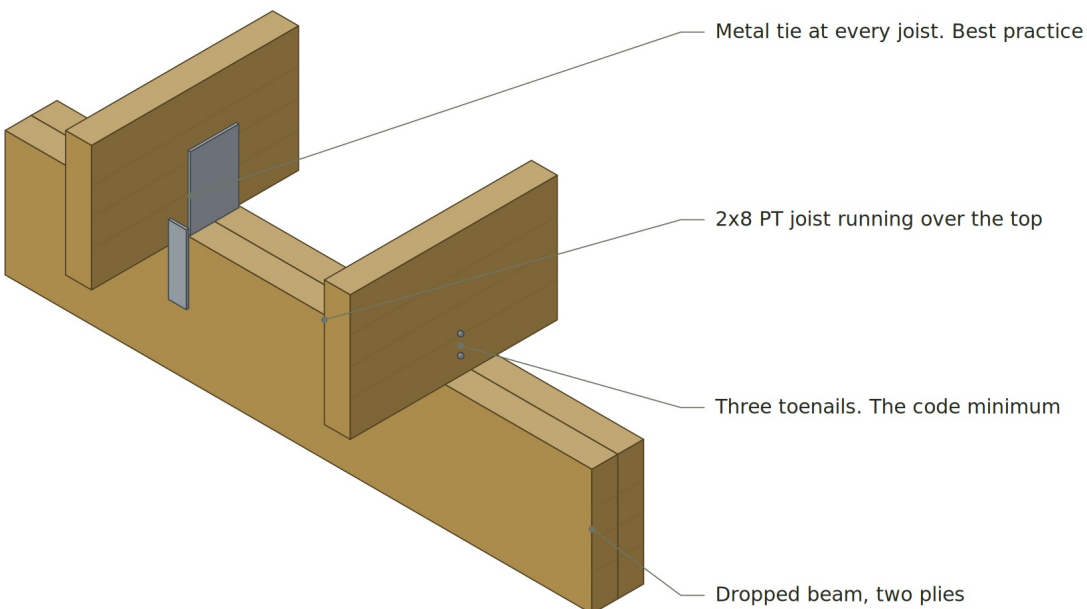


Nailing a joist hanger

Every hole the manufacturer punched is a hole that gets a fastener, in the size they specify. The angled nails through the joist are the ones people skip, and they are what stops the joist pulling out of the seat.

Rims first, then the field

Set the outside rim joists, check the frame is square by measuring the diagonals, and tack it in that position. Then fill in the field joists at the spacing on your plan, measured centre to centre, not gap to gap.



Joists over a dropped beam

A joist resting on a beam still has to be fastened to it. The code minimum is three toenails. A metal tie at every joist is stronger and is what inspectors expect.

YOUR SHEETS SAY. Joist spacing, measured centre to centre. It is not a style choice: it is set by what your decking can span and by the load.

If you change it, you change what the decking can do. Wider spacing with decking that cannot bridge it gives you a bouncy, flexing surface. If you plan to run your decking at 45 degrees for looks, remember the diagonal run across joists is longer than the straight one, and the spacing usually has to tighten accordingly. Decide that before you frame, not after.

Using joist hangers

The hanger is what lets a butt joint carry real load. Four rules, and all four matter.

Match the hanger to the joist depth. A 2x8 joist takes a 2x8 hanger, and the joist should sit down in the seat with its top flush. A hanger one size up does not "work anyway"; it leaves the joist unsupported across part of the seat.

Fill every hole. Each round hole in a hanger is meant to hold a fastener and the hanger is only rated when they are all driven. A half-nailed hanger carries a fraction of its published capacity. To put a number on it: a common face-mount hanger for a 2x8 takes ten nails, six through the flanges into the header and four through the joist, all of them 0.148 by 3 inch, which is a 10d common. Ten holes, ten nails, every hanger.

STOP. This is the single most common framing inspection failure on decks, and it is entirely avoidable. Count the holes, then count the nails.

Use the fastener the manufacturer specifies, which means joist hanger nails or the structural connector screws named on the packaging. Roofing nails are too soft. Deck screws are brittle in shear and are not rated for this at all. The bracket was tested with one specific fastener and it is only as strong as that test.

Nail into the joist face too, not just into the ledger or rim, so the joist is tied to the bracket from both directions. On the hangers most deck plans call for, those joist nails are driven at an angle so they pass through the joist and bite into the header behind it. That angle is the whole point of the design, and a nail driven straight in gives up most of what you paid for.

Hang high, shim from below

Push each joist up so its top is dead flush with the top of the rim or ledger before you nail. A joist a hair low reads as a dip in the finished decking. A hair high reads as a ridge, and both are visible in raking light forever.

If a joist runs shallow, slip a thin shim under it in the hanger seat to bring the top flush rather than letting it sit low. Leave a sixteenth of play where the joist end meets the header so you can nudge it, and no more than an eighth, which is the manufacturer's published maximum for that gap. A joist jammed in dead tight gives you nowhere to go; a joist cut short leaves the hanger carrying load it was never tested for.

Before you fasten anything permanently, sight along all the joist tops from one end. Plane or shim anything that stands proud.

Where joists cross a dropped beam

Run them long past the beam and just tack them at first. With all of them up, run a string or a long level across the tops and confirm the frame is flat and level. Then snap a line across the joist ends, cut them all off straight in one pass, and add the outer rim. You get a far straighter edge than cutting each joist to a measurement.

Blocking

Blocking is short pieces of the same material cut to fit between joists. It does three jobs: it stops deep joists twisting and rolling, it stiffens the whole deck against bounce, and it gives bolts something solid to grab where guard posts attach.

Put it where your plan shows it. If your plan shows blocking behind guard posts, that blocking is structural and it is not optional.

If your deck has two beam lines

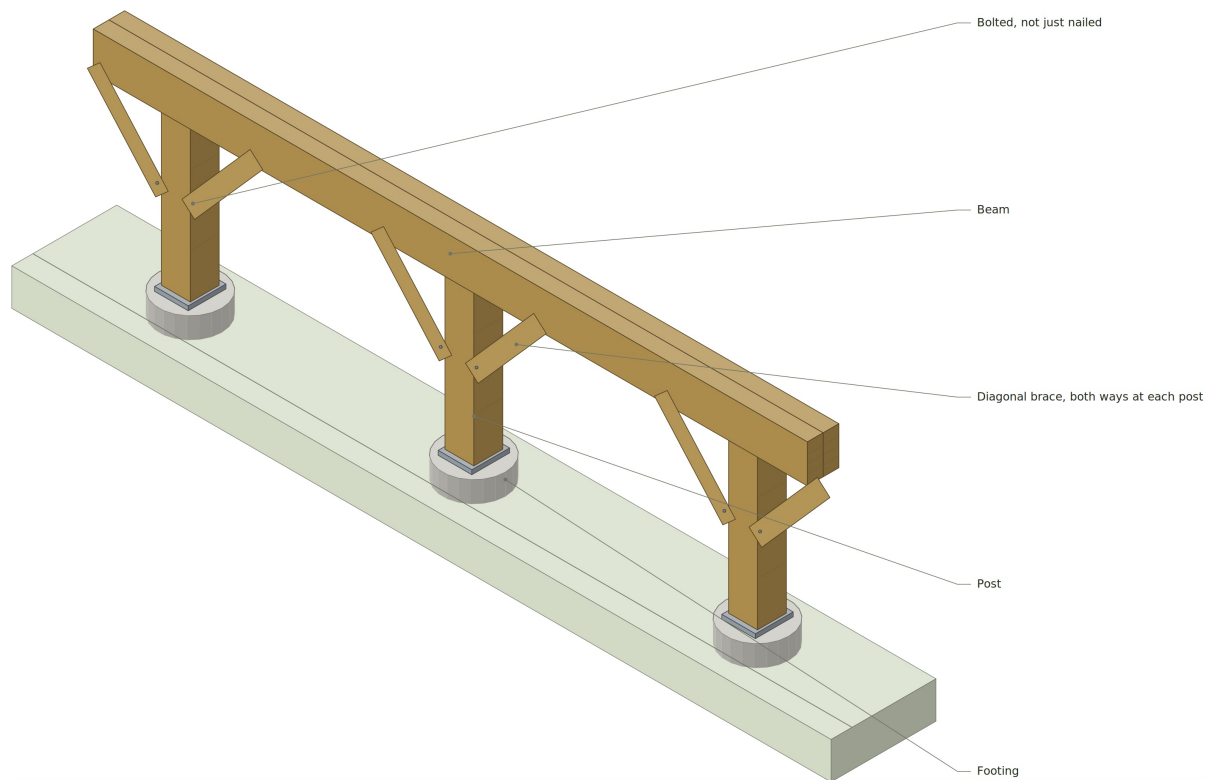
Larger decks often carry a second, interior beam line rather than one long span. If yours does, three things change and they are easy to miss:

- There are more posts and more footings, and the interior ones may be a different diameter, because an interior beam carries deck from both sides.
- The joists cross two beams rather than one, so they need tying down at both.
- The order of work is the same but there is more of it, and the interior beam has to be set to exactly the same height as the outer one. Carry the height across with the same long joist and level method, and check it before you cut posts.

Your framing plan shows the second beam line and its posts. If you are looking at your plan and counting more posts than this guide's general description suggests, that is why.

13. Tying it down: uplift and lateral load

Gravity holds the deck down. Nothing holds it sideways, or up, unless you install something that does. These connections are invisible once the decking is on, and they are what a framing inspector looks hardest at.



Bracing a freestanding deck

An attached deck leans on the house. A freestanding one has nothing to lean on, so a diagonal at each post turns a hinge into a triangle. Your sheets say where the braces go and what size they are.

Joists to the beam

Where joists run over a dropped beam, they still have to be fastened so they cannot slide sideways, lift in wind, or roll over on edge. Toenailing is the code minimum. A metal tie at every joist is far stronger, it is what good builders use, and many inspectors now expect to see it. Ties are cheap. Use them.

The deck to the house

An attached deck also needs a connection that resists the deck being pushed or pulled away from the house, separately from the ledger bolts that hold it up. This is the lateral load connection, and it is one of the newer requirements in the deck code. It usually takes the form of rated hold-down devices installed at specific points, tying deck framing back into the house floor framing.

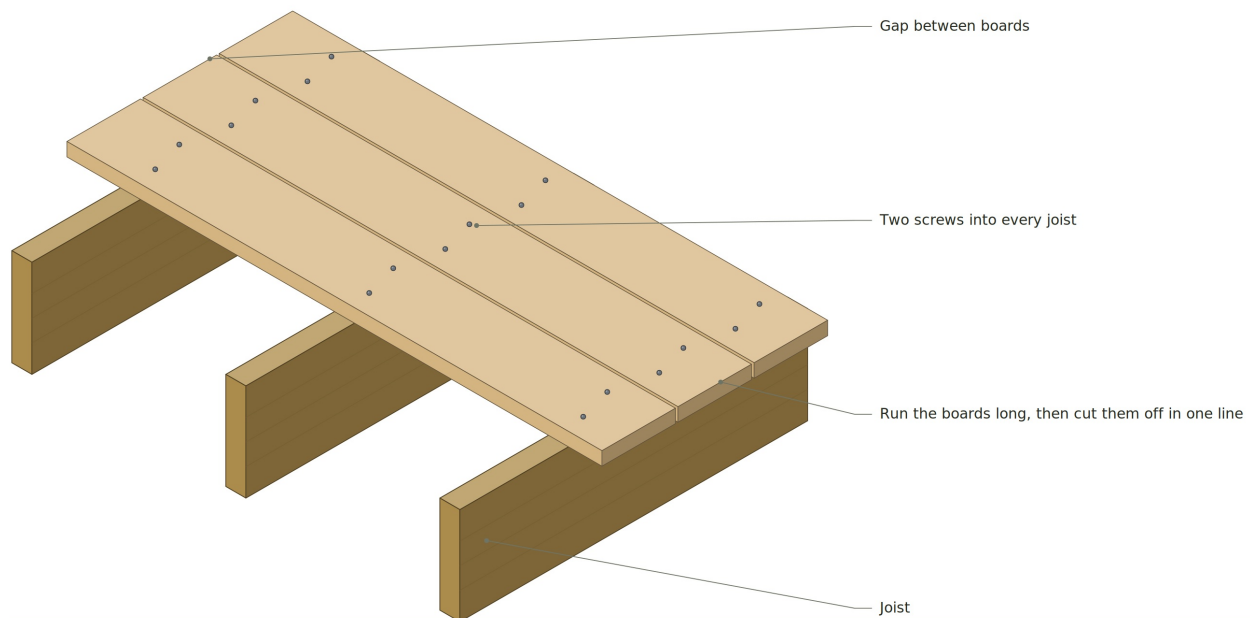
STOP. Your plan shows the device and its locations if your deck needs one. It is not a detail to improvise, and it is not one to skip because it looks like overkill. It exists because decks have pulled off houses while full of people.

Guard posts

Covered in chapter 16, but worth flagging here because the blocking has to go in now, while the joist bays are still open.

14. Decking

The frame is structure. The decking is the part everyone looks at, so a few habits are worth the extra hour.



Fastening and gapping the decking

Two screws into every joist the board crosses, kept in from the ends so the board does not split. Gap the boards so water and grit fall through instead of sitting on the frame.

Start at the outside edge

Lay the first full board along the outer edge of the deck and work back toward the house. Two reasons. The outer edge is the line everyone's eye follows, so you want your straightest reference there. And the board that has to be ripped narrow to fit, or scribed around an uneven wall, ends up at the house where it is least visible and easiest to fit.

Pick your straightest board for that first course. Snap a chalk line on the joists and fasten to the line rather than to the board.

Keep it parallel as you go

Every few rows, measure from the last board you laid back to the house at both ends of the deck. If the two numbers are drifting apart, the run is going out of parallel.

ON THE JOB. Do not fix drift in one board. Open or close the gap by a hair across the next several boards and fan it back. A gradual correction is invisible. A single big one is a wedge that everyone sees.

Gaps and fastening

Use a consistent spacer at every joist as you fasten: a purpose-made deck spacer, or a nail of the right thickness. A 10d common is 0.148 inch across the shank and a 16d is 0.162, which is why a handful of nails out of the box is the oldest gauge on the job. Roughly an eighth of an inch suits dry treated lumber. Wet treated lumber will shrink and open up further, so lay it

closer. Composite has its own number and its own expansion behaviour, so follow the manufacturer rather than this guide.

Two fasteners at every joist crossing. Not one. Use a #8 or #10 exterior screw about 2-1/2 inches long, which puts roughly an inch and a quarter into the joist under a 5/4 board. Stagger end joints so they do not all line up, and make sure every board end lands on a joist with enough bearing to hold two fasteners.

While you're buying, the arithmetic on quantity is worth doing before the trip rather than during it. A 5/4x6 board is 5-1/2 inches wide, so with a gap it covers about 5-5/8, which is 2.1 boards for every foot of deck width. Two screws per joist crossing on 16 inch centres comes out near 1.6 screws per square foot. Buy ten percent over on both.

Pre-drill near the ends of boards, especially hardwoods and anything brittle, so nothing splits.

Hidden clips or top screws. Clips sit in a groove in the board edge and leave a clean top with no visible heads. They cost more, go slower and need grooved boards. Top screws are faster, stronger and visible, so use colour-matched or stainless heads and keep the lines straight. Either is fine. Do both consistently.

Finishing the edge

Run the boards slightly long over the outer edge as you go, then snap a chalk line and cut them all off in one pass with a circular saw set just past the board thickness. A single cut line looks far better than twenty individually measured ends.

Around posts and at the wall

Notch decking around guard posts rather than butting short pieces to them. If a notch ends up with a visible gap, a small trim collar at the post base covers it.

Leave a small gap at the house wall so water drains rather than pooling against the ledger.

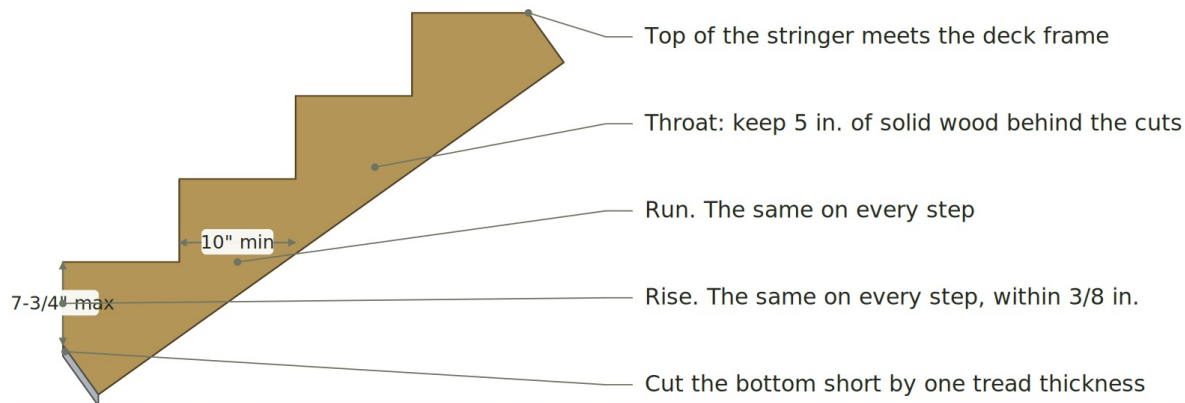
Border boards and fascia

A border board around the perimeter hides the cut ends of the field decking. It usually needs extra blocking under the seam, so decide before you frame.

A fascia is trim fastened to the outside of the rim joists to hide the framing. It adds thickness to the outside of the frame, so you either build the frame slightly smaller by that thickness or let the decking overhang and cover the fascia's top edge. Either way, decide before you cut joists, because it changes their length. Keep the top of the fascia at or just below the decking surface so water sheds off the boards rather than behind the trim.

15. Stairs

Stairs intimidate first-timers more than anything else on the deck. They are just one piece of arithmetic repeated.



Laying out a stair stringer

Mark the same rise and run for every step, then cut the bottom of the stringer short by one tread thickness. Leave at least 5 in. of solid wood behind the cuts.

Rise and run

The **total rise** is the vertical distance from the finished deck surface to the finished surface of whatever the stairs land on. Measure it after the decking is down, or account for the decking thickness, because getting this wrong by one board thickness throws every step.

Divide the total rise by a target step height to get a whole number of risers, then divide the total rise by that number to get the exact riser height. Every riser in a flight must be the same within 3/8 inch from the largest to the smallest, and the same goes for tread depth (IRC R311.7.5). An uneven step is a genuine trip hazard, it is the classic inspection failure, and your foot notices a quarter inch even when your eye does not.

Code caps the riser at 7-3/4 inches, requires a tread depth of at least 10 inches, and sets the minimum stair width at 36 inches clear. The landing at the bottom is at least 36 by 36. Your plan set gives the exact figures for your deck height. If your ground level differs from the plan, recalculate rather than fudging the bottom step.

Cutting stringers

Set a framing square with your rise on one leg and your run on the other. Stair gauges, the small clamps that lock onto the square, make the setting repeatable and are worth the few dollars. Step the square down the board, tracing the sawtooth, marking every step from the same setting so they all match.

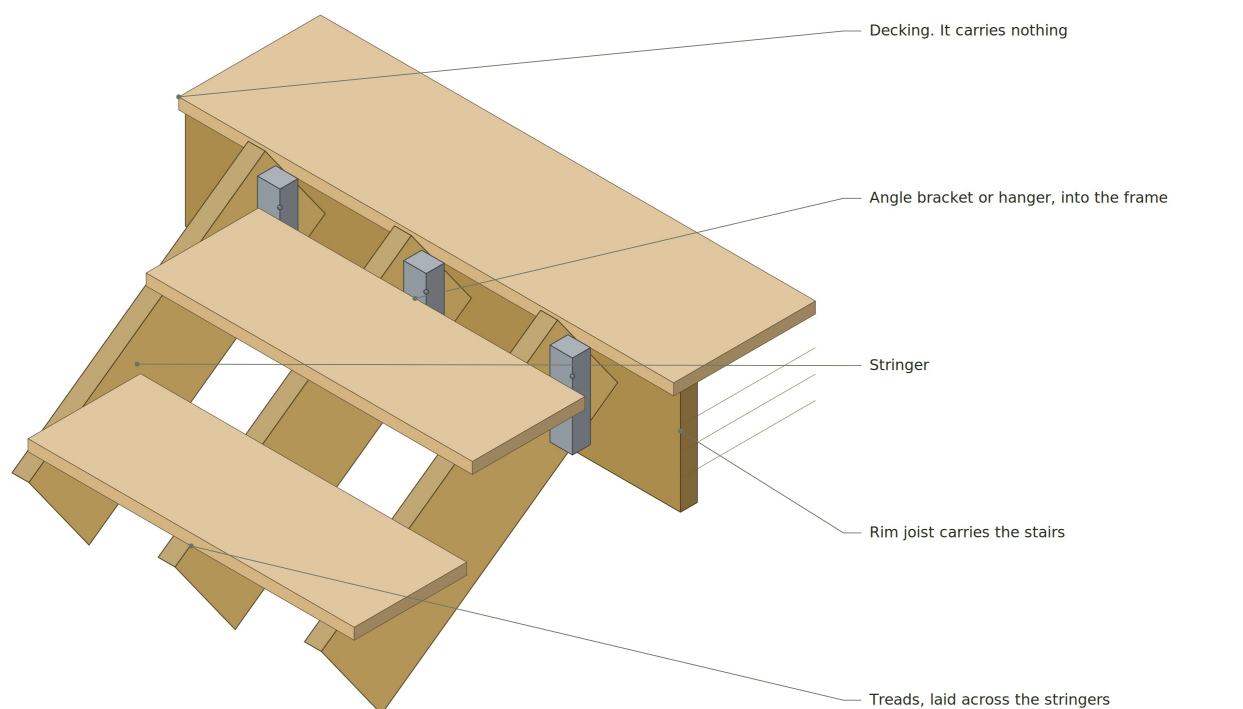
STOP. Drop the stringer. Trim the bottom of the stringer by the thickness of one tread. Without it, the first step up from the ground is one tread thickness taller than all the others, every riser in the flight is then unequal, and it is an inspection failure. This one detail catches more first-timers than anything else on the deck.

Cut the notches with a circular saw, stopping right at the lines. Do not overcut into the corner: finish the inside corners with a jigsaw or a handsaw. An overcut is a stress riser exactly where the stringer is weakest.

Cut one stringer first, put it in place, and check it against the real deck and the real landing before you cut the rest. Then use it as the template.

Anchoring, top and bottom

The top of the stringers has to be locked to the deck frame, not just nailed against it. Use rated stringer connectors, adjustable brackets, or hang them from a header fastened to the rim, whichever your plan shows. Toenails alone will let the stairs creep away over a few seasons.



Where the stairs meet the deck

The stringers hang off the deck frame, never off the decking. The top riser is measured from the finished deck surface, not from the top of the frame, and the bottom of the flight needs its own solid landing.

Pin the bottom of the stringers to the landing too, so the whole flight cannot kick out.

The landing

Stairs need something solid and stable underfoot. A poured pad or a single large slab is ideal because it moves as one piece, which keeps that critical first riser height constant. Loose pavers or compacted stone settle unevenly over time and the bottom step slowly becomes a different height from the rest.

Risers and openings

A riser board closes the vertical face at the back of each step. It is optional on an open stair for looks, but it stiffens the flight and it is the simplest way to close the triangular opening formed by the tread, the riser line and the stringer, which code limits. Fasten it to the stringer faces behind each tread.

Handrails

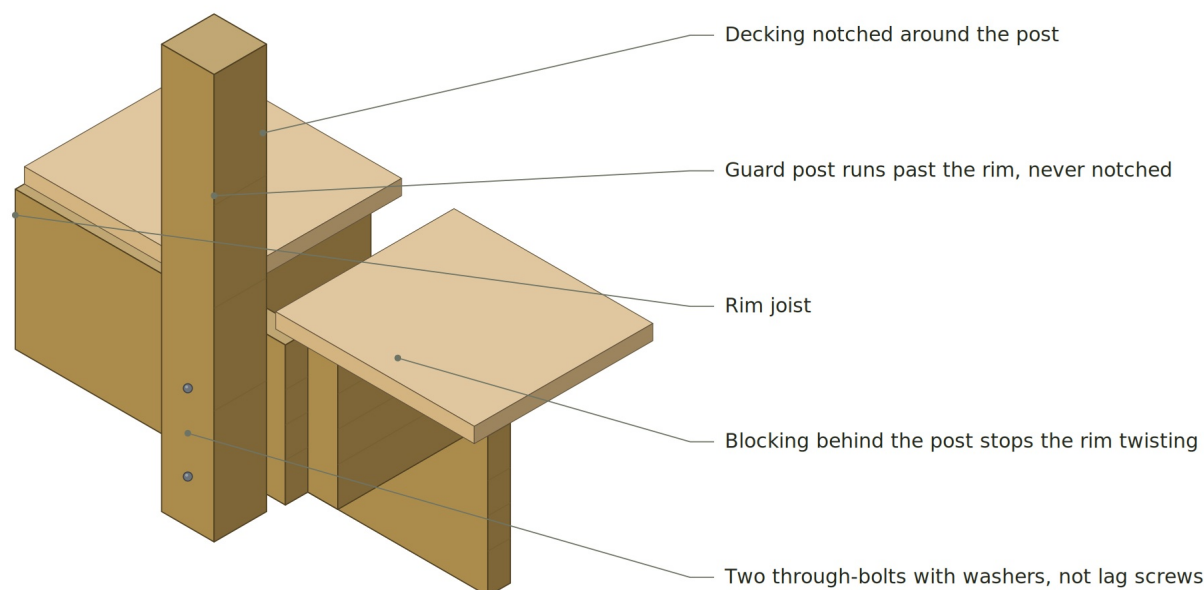
A flight with four or more risers needs a graspable handrail, mounted at a height between 34 and 38 inches above the nosings. Graspable has a specific meaning: a 2x4 laid flat on top of a guard is not a handrail, because you cannot close your hand around it. Use a purpose-made handrail profile or a round section within the sizes code allows.

16. Guards and railings

The guard is the safety barrier. Most people call it the railing. On a low deck it may not be required at all, but where it is required it has to survive a hard sideways shove from an adult, which is a bigger load than people expect.

When you need one, and how tall

A guard is required when the walking surface is more than 30 inches above the ground below. Many low decks fall under that line and legally need nothing, though a rail can still be worth having.



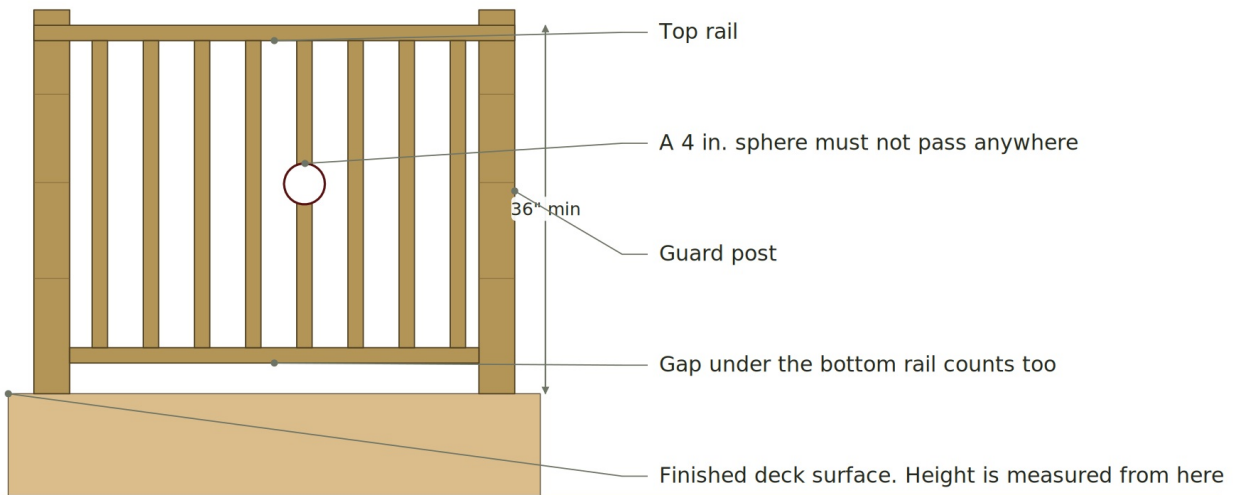
Guard post at the rim

Through-bolts, not lag screws, and a block behind the post so the rim cannot twist. The top of a guard has to resist a 200 lb push in any direction.

Where one is required: at least 36 inches tall on the deck, measured from the decking surface. Alongside stairs the guard can be lower, and where a handrail sits on top of it the handrail height governs.

Openings in the guard must be small enough that a 4 inch sphere cannot pass through anywhere. On stairs, the triangular opening at the bottom formed by the tread, riser and bottom rail is limited to a 6 inch sphere, and the other stair guard openings are held to a slightly larger figure than the 4 inch deck limit. In practice, if you keep every gap under 4 inches everywhere you are comfortably inside all of these.

Two details people forget: measure the gap at the widest point, which on a stair is not where you think, and check the gap between the last baluster and the post, which is where an odd spacing usually lands.



Baluster spacing and the 4 inch rule

A 4 in. sphere must not pass through any opening in the guard, including the gap under the bottom rail. Space the balusters so the widest gap is under 4 in., and measure the gap, not the centres.

There's a load figure behind all of this that explains why guard posts get the hardware they do. Code requires the top of the guard to resist a 200 pound concentrated load applied in any direction (IRC R301.5). That is one adult falling against it, and it is why a guard post bolted through a rim with nothing behind it fails: the bolts are trying to lever against an inch and a half of wood.

Attaching the posts, which is the whole job

A guard is only as strong as its post connection, and the load is trying to pull the fasteners straight out of the wood. Code is explicit that you cannot rely on nails in withdrawal for this. A post that is surface-screwed to the outside of the rim, or toenailed, or notched around the rim, will work loose.

The connection that works has three parts:

1. **Bolt the post through the rim joist** with two half inch carriage bolts, offset vertically rather than side by side, with washers under the nuts.
2. **Solid blocking behind it**, between the joists, so the bolts pass through real wood rather than into an empty bay.
3. **A hold-down or tension device** tying that blocking back into the framing, so a shove is carried deep into the deck rather than held by two bolts in one board.

Notching a 4x4 guard post at the connection is no longer permitted, because the notch is exactly where it would snap.

The blocking has to go in while the joist bays are open, which is why guard post locations are

decided at framing, not when you get to the railing.

Inside or outside the rim

Posts can mount inside the rim joists or on the outside face. Inside posts have to be set before the decking goes down, and the decking notches around them. Outside posts are typically fitted after decking. Both are accepted. Your plan shows one; if you want the other, decide before you frame, because it changes blocking, decking width and rail lengths.

Kit railings

Aluminium, composite and cable systems mount differently. Surface-mounted posts bolt down through the decking into framing, and they are only as strong as what those bolts reach. They must land in solid framing or in blocking installed for the purpose, never in decking alone and never over an empty bay. Plan the post positions with the framing, add the blocking, and follow the manufacturer's base detail exactly, because that is what the system was tested with.

Building a wood guard

Set the posts first and get them plumb. Run the top and bottom rails between them. Pre-drill and countersink for a clean result. Then fit the balusters: cut a story stick or mark an even layout first rather than measuring each gap, and let any odd remainder land next to a post where it is least visible.

Lay the cap rail flat across the posts with seams landing over a post and corners mitred. Stand back and sight down it before you fasten it off.

17. Finishing up

The final inspection

Call for it once guards, stairs and handrails are complete. Have the approved plans on site.

Sealing, and why you should wait

If you built with pressure-treated lumber it is probably still wet from the treatment process. Sealing wet wood traps the moisture and the finish fails.

The test is simple: sprinkle water on the decking. If it beads and sits, the wood is still too wet. If it soaks in within a minute or so, it is ready. That is usually a few weeks to a few months depending on your climate and the season.

When it is ready, clean the surface, let it dry a day, and apply a quality exterior stain or sealer on a mild dry day with no rain forecast. Cedar benefits from sealing too. Composite and PVC need nothing but a wash.

Annual routine

- Sweep, and keep leaves out of the board gaps so water drains.
- Wash once or twice a year to clear dirt, pollen and early mildew.
- Re-seal wood when water stops beading, usually every one to three years.

- Once a year, look underneath with a torch. Check the ledger and its flashing, the post bases, and that hangers, bolts and ties are tight and free of rust.
- Tighten any guard post that has started to move, the day you notice it.

The five minute check

Push hard on the railing. Bounce gently in the middle of the deck. Look at where the deck meets the house. Firm, quiet and dry means everything is fine. Spongy, loose or wet means look closer before anyone leans on it.

Wood shrinks as it dries, so bolts that were tight in June may need a turn in September. Check the through-bolts at the beam and at the guard posts after the first season.

Part Three: Reference

When it goes wrong

Everyone hits at least one of these. None of them are disasters if you catch them at the right moment.

At layout

The diagonals will not match. You are probably moving the wrong string. Fix one line as your reference, usually the one along the house, and adjust the other two only. If they still will not converge, one of your side lengths is wrong. Re-measure the sides before you chase the diagonal.

The house wall is not straight. Older houses often are not. Square the deck to itself, and take the small variation at the wall in the last decking board, where you can scribe it. A deck that is square to a bowed wall is a deck that is not square.

At the footings

A hole hits rock at 24 inches and you need 36. Stop. Rock is usually good bearing but "usually" is not a decision you should make alone. Call your inspector. In many jurisdictions bearing on sound rock is acceptable at less than frost depth because rock does not heave. They will tell you what they need to see.

A footing ended up two inches off its mark. Usually fine, because the post can sit slightly off-centre on the footing as long as it bears well within it and the beam still lands where the plan shows. Anything more than a couple of inches, or anything that moves the post out from under the beam line, needs a second opinion before you build on it.

You poured before the footing inspection. Own up immediately. Some departments will accept photographs with a tape in the hole. Some will make you dig one back out. Both are better outcomes than having it discovered at final.

At the frame

A joist is bowed and will not sit flush. Crown it up, fasten one end, and pull it into line with a clamp or a bar as you fasten the other. Serious bows belong in the offcut pile or

become blocking.

The frame is square but the decking is drifting. It is the fastening, not the frame. Go back to measuring from the last board to the rim at both ends every few rows and fan the gap.

You cut a post short. You cannot splice a deck post. Replace it. A post with a block under it or a scab plated to the side is not a post, and an inspector will find it.

A hanger is the wrong size. Take it off and replace it. The extra nail holes in the ledger are cosmetic. An undersized hanger is not.

At the ledger

There is no solid framing behind the siding. Stop and change the plan. This is the point at which the deck becomes freestanding. It is more work and more concrete, and it is not a failure. It is the correct answer to what you found.

The band joist is thinner than your lag screws need. Lag length is set by how far the threads have to penetrate solid wood. If it is thin, through-bolt from inside instead, or go freestanding.

At the stairs

The bottom step is taller than the others. You forgot to drop the stringer by one tread thickness, or your landing settled. If the stringers are already cut, and the difference is one tread thickness, you can usually adjust at the landing by raising its surface. If not, recut. Do not leave it.

The stairs do not land where the plan shows. Your ground level differs from the drawing. Recalculate the rise from your actual measurement rather than spreading the difference into one step.

At inspection

You failed on something small. Normal, and it is not personal. Fix it, call for a re-inspection, and ask the inspector to look at anything similar elsewhere on the deck while they are there.

The inspector asks for something not on the plans. Local amendments are real and they outrank a general drawing. Ask them to point you at the provision, do the work, and keep the note with your paperwork.

Quick reference

Common requirements, gathered in one place for the moment you are up a ladder and cannot find the page. These follow the International Residential Code. Local amendments, frost depth, snow load and soil bearing are all local, and your plan set and your building department carry the numbers that apply to your deck.

ITEM	COMMON REQUIREMENT
Guard required	Walking surface more than 30 in. above the ground
Guard height, deck	36 in. minimum, no maximum
Guard openings, deck	No 4 in. sphere may pass
Stair guard, bottom triangle	No 6 in. sphere may pass
Stair riser	7 3/4 in. maximum, and within 3/8 in. across the flight
Stair tread depth	10 in. minimum, and within 3/8 in. across the flight
Stair width	36 in. minimum clear. Bottom landing at least 36 x 36 in.
Handrail	Required at 4 or more risers, 34 to 38 in. above the nosings, graspable
Ledger fasteners	1/2 in. lag screws or bolts, two staggered rows, spacing per your plan
Ledger to veneer	Not permitted on brick, stone or stucco veneer
Post to beam	Notched 6x6 with two 1/2 in. through-bolts, or a rated post cap
Joist to dropped beam	Toenails are the minimum; a rated tie at every joist is better
Joist hangers	Every hole filled, with the fastener the manufacturer specifies
Guard top load	Must resist 200 lb applied in any direction
Decking fasteners	Two at every joist crossing
Board gap, dry treated lumber	About 1/8 in. Wet lumber closer, composite per manufacturer
Footing depth, attached deck	Below the local frost line
Footing depth, freestanding	Frost depth not required by the IRC, subject to local amendment
Post base	Must hold the post end clear of the concrete
Concrete before loading	Allow about a week
Metal, everywhere	Hot-dipped galvanized or stainless. No bare aluminium against treated wood

Glossary

Baluster. The vertical infill pieces between guard posts and rails.

Band joist. The framing member at the perimeter of the house floor. On an attached deck this is what the ledger fastens into. Also called the rim board.

Batter board. A temporary crosspiece on two stakes, set outside a corner, that lets you slide a layout string without moving stakes.

Beam. The main horizontal member carrying the joists down to the posts.

Blocking. Short pieces fitted between joists to stop twisting, stiffen the frame, and give bolts solid wood to pass through.

Built-up beam. A beam made from two or three pieces of 2x lumber fastened together to act as one member.

Cantilever. The part of a joist or a deck extending past its last support. Limits are on your plan.

Crown. The slight natural bow along a board's edge. Joists are installed crown up.

Decking. The boards forming the walking surface.

Dropped beam. A beam sitting on top of the posts, with joists running over it.

Drop the stringer. Trimming the bottom of a stair stringer by one tread thickness so the first step matches the rest.

Fascia. Trim fastened to the outside of the frame to hide the rim joists.

Field joist. A regular repeating joist between the rims.

Flashing. Metal or membrane that directs water out and away from the ledger so it cannot sit behind it.

Flush beam. A beam hung between the joists so its top is level with them.

Footing. The concrete base that spreads a post's load onto the soil.

Freestanding deck. A deck carried entirely by its own posts and beams, with no structural connection to the house. Also called a floating deck.

Frost heave. The lifting of ground, and anything sitting in it, when wet soil freezes and expands.

Frost line. The depth to which soil freezes locally. Published by your building department.

Graspable. A handrail profile you can close your hand around. A flat 2x laid on top of a guard is not graspable.

Guard. The barrier around a raised deck that stops people falling off. Commonly called the railing.

Hold-down, tension tie. A connector that carries pull-out load from a guard post, or lateral load from the deck, deep into the framing.

Hurricane tie. A bracket locking a joist down to the beam it sits on, so it cannot lift or roll.

Joist. A board on edge, evenly spaced, supporting the decking.

Joist hanger. A galvanized bracket holding a joist end against a ledger or rim.

Lag screw. A large screw turned into solid framing, used at the ledger where you cannot reach the back of the wall.

Lateral load connection. The connection resisting a deck being pushed or pulled away from the house, separate from the ledger bolts carrying its weight.

Ledger. The board bolted to the house carrying the inside edge of an attached deck.

Nosing. The front edge of a stair tread, where it projects past the riser below.

On centre (o.c.). Spacing measured from the centre of one member to the centre of the

next, not from gap to gap.

Plumb. Vertical. Posts are set plumb, checked on two adjacent faces.

Post base. The bracket anchoring a post to its footing and holding the end grain off the concrete.

Post cap, saddle. The bracket on top of a post that cradles the beam.

Pressure-treated. Lumber treated to resist rot and insects, and corrosive to ordinary steel fasteners.

Rim joist. An outer joist forming the edge of the frame.

Rise and run. The height of a step and its depth.

Standoff. The small raised plate in a post base that lifts the post's end grain above the concrete.

Stringer. The sawtooth-cut board carrying stair treads.

Tread. The board you step on.

Tributary area. The slice of deck a single post or footing carries. A larger slice means a larger post and a wider footing.

Undisturbed soil. Ground that has not been dug and backfilled. Footings bear on it.

A last word

A deck is not a difficult thing to build. It is a sequence of straightforward steps, each of which rewards taking an extra ten minutes: to check the diagonal, to fill the last hanger hole, to look down the joists before the decking goes on.

Work in order, keep the plans in your hand, ask your inspector when you are not certain, and the deck you get will be square, quiet underfoot and safe for thirty years.

Questions about anything in your plan set? Send us a message through Etsy. We would rather answer before you cut than after.

SimpleBlueprints