Same openings—different treatments. The openings in the upright wall use a rim-board header, while the nonbearing gable-end wall on the slab doesn't need a header.

Exterior Wall Headers

Sorting out the options for efficiency and performance

BY MIKE GUERTIN

When our company began building high-performance homes regularly in the late 1980s, we looked for ways to use as little wood in exterior walls as possible while still maintaining a strong frame. Until then, we framed headers for window and door openings like most framers in our area—a double 2x12 with a 1/2-inch plywood spacer for a 2x4 wall. With the header installed directly below the double 2x4 top plate on an 8-foot-high wall, the bottom of the header put the finished window head jamb at about 6 feet 10 inches off the finished floor.

Like a number of progressive builders, we experimented with reducing the size of the lumber and the number of plies used to build headers based on the loads they needed to support. In some cases, we moved the headers into the floor framing above the opening, while in other cases, we eliminated structural headers on some openings all together. By doing so, we decreased the thermal bridging, increased the space for insulation, and improved the energy efficiency. Plus we saved labor and lumber.

DO HEADERS MAKE A WALL STRONGER?

In most cases, there is no structural advantage to installing headers where they aren't required or to using larger headers than what is needed to support the load. And there can be downsides. Oversized or unnecessary headers cost more than properly sized headers or alternative headers. And large-depth lumber headers are more likely to result in drywall cracks as green wood dries out or as dried lumber expands and contracts with seasonal humidity changes.

When I look at the prescriptive options available right in the code, I'm surprised so many framers still frame the way I did 40 years ago. But homebuilders and framers are notoriously slow to change practices. Some argue that beefier headers appear stronger and impress clients. Another argument is that it's easier to use the same sized headers throughout a house, regardless of whether a header will be for a large patio door or a narrow window. Thoughtful header design does take planning. But that little bit of extra work pays off in reduced lumber costs, fewer call-backs, and improved energy efficiency.

Photos by Mike Guertin

TABLE R602.7(1)
GIRDER SPANS[a] AND HEADER SPANS[a] FOR EXTERIOR BEARING WALLS
(Maximum spans for Douglas fir-larch, hem-fir, Southern pine and spruce-pine-fir[b] and required number of jack studs)

GIRDERS AND HEADERS SUPPORTING	SIZE	GROUND SNOW LOAD (psf)[e]																	
		30						50						70					
		Building width[c] (feet)																	
		12		24		36		12		24		36		12		24		36	
		Span[f]	NJ[d]	Span[f]	NJ[d]	Span[f]	NJ[d]	Span[f]	NJ[d]	Span[f]	NJ[d]	Span[f]	NJ[d]	Span[f]	NJ[d]	Span[f]	NJ[d]	Span[f]	NJ[d]
Roof and ceiling	1-2 × 6	4-0	1	3-1	2	2-7	2	3-5											
HEADER, TYP.	1-2 × 8	5-1	2	3-11	2	3-3	2	4-4											
	1-2 × 10	6-0	2	4-8	2	3-11	2	5-2	2	4-0	2	3-4	3	4-7	2	3-6	3	3-0	3
Roof, ceiling and one center-bearing floor	1-2 × 6	3-3	1	2-7	2	2-2	2	3-0										1-10	2
	1-2 × 8	4-1	2	3-3	2	2-9	2	3-9										2-4	3
	1-2 × 10	4-11	2	3-10	2	3-3	3	4-6										2-9	3
	1-2 × 12	5-9	2	4-6	3	3-10	3	5-3	2	4-2	3	3-6	3	4-10	3	3-10	3	3-3	4
	2-2 × 4	3-3	1	2-6	1	2-2	1	3-0	1	2-4	1	2-0	1	2-8	1	2-2	1	1-10	1
	2-2 × 6	4-10	1	3-9	1	3-3	2	4-5											2
	2-2 × 8	6-1	1	4-10	2	4-1	2	5-7											2
	2-2 × 10	7-3	2	5-8	2	4-10	2	6-8											2
	2-2 × 12	8-6	2	6-8	2	5-8	2	7-10											3
ROOF, CEILING AND ONE FLOOR (CENTER BEARING)	3-2 × 8	7-8	1	6-0	1	5-1	2	7-0	1	5-6	2	4-8	2	6-5	1	5-1	2	4-4	2
	3-2 × 10	9-1	1	7-2	2	6-1	2	8-4											2
	3-2 × 12	10-8	2	8-5	2	7-2	2	9-10											2
	4-2 × 8	8-10	1	6-11	1	5-11	1	8-1											2
	4-2 × 10	10-6	1	8-3	2	7-0	2	9-8											2
	4-2 × 12	12-4	1	9-8	2	8-3	2	11-4											2
ROOF, CEILING AND ONE FLOOR (CLEAR SPAN)	4-2 × 12	11-2	2	8-6	2	7-2	2	10-5											2

For SI: 1 inch = 25.4 mm, 1 pound per square foot = 0.0479 kPa.

a. Spans are given in feet and inches.

b. Spans are based on minimum design properties for No. 2 grade lumber of Douglas fir-larch, hem-fir, Southern pine, and spruce-pine-fir.

c. Building width is measured perpendicular to the ridge. For widths between those shown, spans are permitted to be interpolated.

d. NJ = Number of jack studs required to support each end. Where the number of required jack studs equals one, the header is permitted to be supported by an approved framing anchor attached to the full-height wall stud and to the header.

e. Use 30 psf ground snow load for cases in which ground snow load is less than 30 psf and the roof live load is equal to or less than 20 psf.

f. Spans are calculated assuming the top of the header or girder is laterally braced by perpendicular framing. Where the top of the header or girder is not laterally braced (for example, cripple studs bearing on the header), tabulated spans for headers consisting of 2 × 8, 2 × 10, or 2 × 12 sizes shall be multiplied by 0.70 or the header or girder shall be designed.

1 Start by finding the example's structural scenario in "**Girders and Headers Supporting**" column.

2 Next, find the **snow load** (in this case, **30 psf**)...

3 ...then the **building width** (32 feet, rounded up to wider **36 feet** listing).

4 Following down the "Span" column, find an equal or longer header span (for the 3'-2" example, choose longer 3'-3" span).

5 Last, in the "**Size**" column, find listings of "**1-2x10**" or "**2-2x6s**" for the 3'-3" span. Note: These are the minimum size headers for that opening in that configuration. Also, be aware of the number of required jacks (NJ) for each side of the span.

Note: Rows omitted from table to highlight example

See lateral bracing for headers illustration on page 36

Navigating the header span table. IRC table R602.7(1) is easy to use. Above, we size a 3'-2" exterior header in a 32-foot-wide, two-story building with less than a 30-psf snow load, and with the second floor supported by a center bearing wall. Find "Roof, ceiling and one center-bearing floor" in the far-left column **(1)**. Find the column for a 30-psf snow load **(2)**, then the column for a 36-foot-wide building (next listing up from 32 feet) **(3)**. Find the span for a 3-3 header (up from 3-2) **(4)**. In the "Size" column to the left, find listings for 1-2x10 or 2-2x6s **(5)**. These are the minimum size headers for that opening in that configuration.

DO YOU EVEN NEED A HEADER?

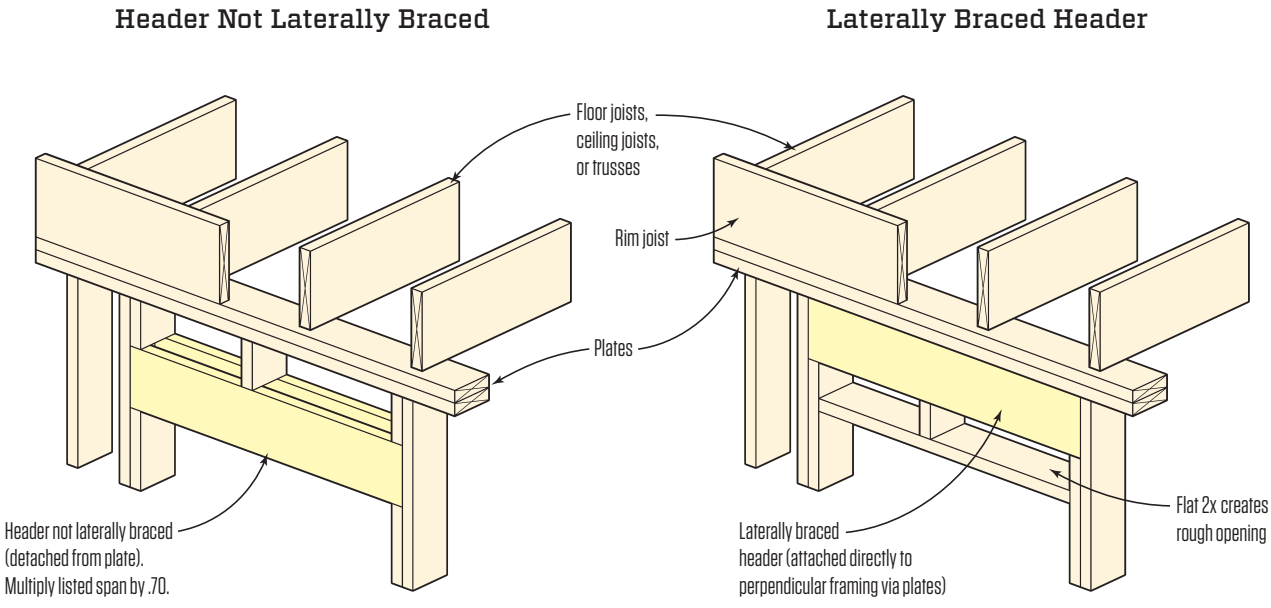
For several code cycles, there has been a subsection for nonbearing walls (2018 IRC R602.7.4). It says: "Load-bearing headers are not required in interior or exterior nonbearing walls. A single flat 2-inch by 4-inch member shall be permitted ... for openings up to 8 feet in width." There is a limitation that the space between the flat head board and the bottom of the top plate can't exceed 24 inches.

So we don't need a structural header unless the walls bear the ends of floor joists, roof rafters, trusses, or a concentrated load. And in most cases, you don't even need to install cripples or blocking between the top plate and the flat rough-opening head board. Besides eliminating the header, you can also skip structural jack studs because there is no load for them to bear, saving even more lumber.

Stack framing 24 inches on-center—where joists, rafters, and trusses align with studs—has become more common as energy codes call for greater wall insulation and builders opt for 2x6 walls. When a window unit is less than 22 inches wide, the code does not require a header in 24-inch-on-center framing. I've framed houses where the design called for accent windows over kitchen cabinets or narrow windows in a corner to cast light into otherwise dark spaces. In those cases, we purposely sized the window units to fit between studs, thereby eliminating headers and jack studs. We simply installed the horizontal head and sill boards with the normal stud spacing to box out the rough openings.

SIZING UP HEADERS

The code tables help you determine the right-sized header for the opening width and the load it supports in a conventionally framed house. In the 2012 IRC and earlier versions, the header span table for exterior bearing walls was published in the middle of Chapter 5, "Floors"—not a logical place when you're thinking about part of the wall framing. Earlier tables included only 2-ply, 3-ply, and 4-ply



Lateral header bracing. Footnote (f) to the table on page 35 notes that spans in the table assume that the headers are attached to lateral bracing, typically in the form of floor joists, ceiling joists, or trusses attached directly to the top plate. When the header is not attached directly to the top plate (and the bracing), the header span is reduced by multiplying the listed span by 0.70.

headers. A new table was added in the 2012 IRC for single-ply headers. In the 2015 IRC, a single exterior-wall header table, R602.7(1), was published in Chapter 6, "Walls," which united all of the disparate parts. The same table appears in the 2018 IRC, although the allowable spans differ slightly from those in the 2015 IRC.

The header table R602.7(1) (see page 35) is pretty easy to follow once you understand how the information is broken up into the series of columns and rows. The table rows in the left column list combinations of the number of floors, the ceiling and roof, and whether there is a clear span from one side to the other or there is a center bearing wall or beam supporting floor joists in the middle of the building.

The column information is divided into sections by snow load (30, 50, and 70 psf) and is further divided by the building width (20, 28, and 36 feet in the 2015 IRC, and 12, 24, and 36 feet in the 2018 IRC). While the width options are limited to three in each table, it is important to point out that footnote (c) permits us to interpolate if the building width is between the listed widths. Or if you don't want to interpolate a header size for, say, a 26-foot-wide house, you can just use the header spans for the next-larger building width—28 feet in the 2015 IRC or 36 feet in the 2018 IRC.

I approach the table by first locating the row group that matches the floor and roof framing of the house I'm building. The example on page 35 has a header supporting an opening in an exterior wall that supports a roof, a ceiling, and a floor with a center bearing wall. Then I match the header span from the house plans or window schedule with the span lengths listed on the table under the proper snow load for my area. From there, I look back to the header size column to see what header will work. The headers are listed by the number of plies (1 through 4) and the lumber size (2x4 through 2x12).

The header span table doesn't differentiate between wood species like the floor-joist and rafter span tables do in Chapters 5 and 7. D-fir, hem-fir, SYP, and SPF are all grouped together in the header table. Also note that the header spans can change from one IRC version to the next. As lumber-rating authorities change the capacity of one or more species, the IRC tables reflect those changes with changes to header spans. So if your code jurisdiction adopts a more recent version of the IRC, you may have to change your header sizes according to the revised table.

HOW MANY JACKS?

When choosing the type of header to use, pay close attention to the number of jack studs that are required for each header assembly in the header span table. Next to each header span column is a column labeled "NJ," for number of jacks. Always use the number of jacks listed in the NJ column next to each span.

Most framers are familiar with double jacks being used on wide openings for patio doors, doors with sidelights, and mulled windows, but you'll find cases in the 2018 IRC table where double jacks are required on openings as narrow as 2 feet under certain snow-load and floor-span combinations. Note that in the example on page 35, a single 2x10 header actually requires three jacks,

Illustration: Tim Healey

Figure R602.7.1(1)
Single-Member Header in Exterior Bearing Wall

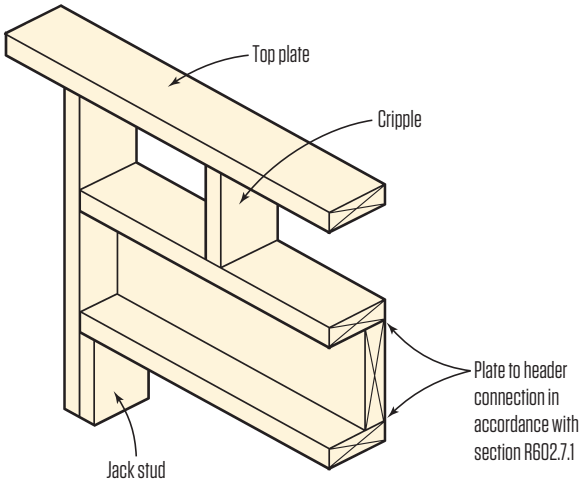
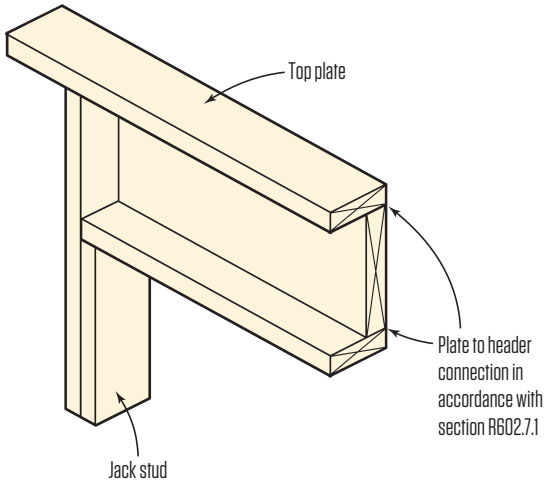


Figure R602.7.1(2)
Alternative Single-Member Header Without Cripple



Single-ply headers. The IRC has a specific subsection for headers made from a single lumber ply. The header must be attached to flat 2-by boards on the top and bottom with cripples between the flat 2-by and the top plate. The code also lists an alternative where the plate takes the place of the top flat 2-by.

while the double-2x6 option requires two jacks. These multiple jack requirements are going to be a big change for many framers and inspectors to get used to.

CHECK THE FOOTNOTES

The code always seems to tuck away important information in the footnotes to its tables. A new footnote (f) to the header span table in the 2018 IRC notes that spans listed assume that the top of the header is laterally braced by perpendicular framing, which would typically be floor joists, ceiling joists, or trusses. Headers are laterally braced through their direct connection to the underside of the plate, which is connected to the perpendicular framing members (see illustrations, facing page).

The footnote goes on to say that when the top of the header is not laterally braced, then the spans of headers made of 2x8s, 2x10s, and 2x12s must be reduced by multiplying the listed header span by 0.70. Framers will typically run into this span reduction when a header is installed lower than the top plate with cripple studs inserted between the header and the top plate. As an example, for a header without lateral bracing with a span listed in the table at 4 feet 2 inches, you would multiply that span by 0.70 for a reduced span of 2 feet 11 inches. The lesson here (if you are working under the 2018 IRC) is to frame the headers tight to the underside of the top plate, and then cripple the rough opening down to a flat 2-by at the head of the rough opening to avoid the span reduction and to keep header size to a minimum.

SINGLE-PLY HEADERS

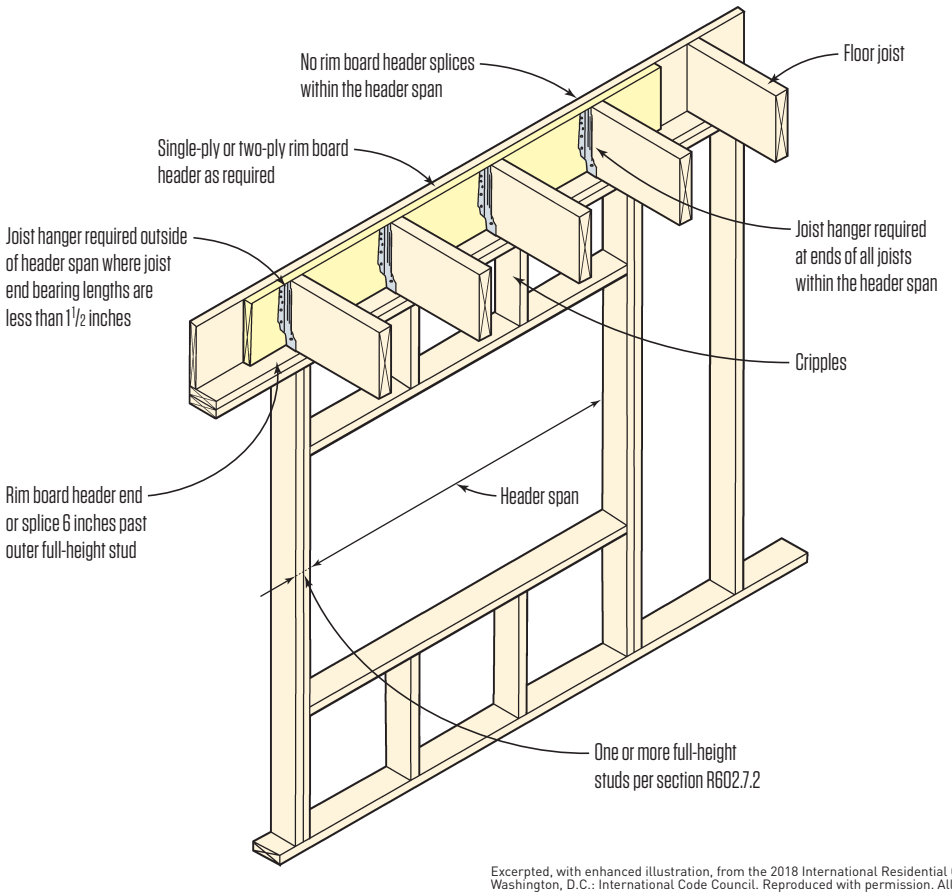
While the 2018 IRC includes single-ply header options in the span tables, subsection R602.7.1 and figures R602.7(1) and (2) (see illustrations, above) address special considerations for single-ply headers. These sections require that you install flat 2-by boards at the top and bottom of single-ply headers. The exception is when the header is sandwiched tight to the top plate. In that instance, the plate acts as the flat 2-by. These stipulations may influence your decision to use single-ply headers—in some cases, the amount (and cost) of lumber can be more than using a properly sized double-ply header. Another interesting note is that single-ply headers are not listed as choices on the header table for interior walls, R602.7(2).

RIM-BOARD HEADERS

When our company was looking into ways of increasing the efficiency of our framing, we wondered why we needed to frame a header into the wall when we potentially had a header above the top plate in the form of a rim board (see photos, page 39). Often, the rim board can bridge a window or door span, provided you follow a couple of code requirements. Subsection R602.7.2 and companion figure R602.7.2 in the 2015 and 2018 IRC illustrate requirements for creating a rim-board header (see illustration, page 38).

Rim-board headers are sized according to the same span table used to size regular headers, so they can be single ply, double ply, or more. There can be no joints in a rim-board header anywhere over the opening or within 6 inches beyond the outer bearing stud.

Figure R602.7.2
Rim Board Header Construction



Rim-joist headers. Often, the rim joist above an opening can fulfill the header requirement. Spans follow the same header span table as regular headers, and the material can't have a joint over the opening. Also, the header must extend 6 inches beyond the opening, and the number of full-height studs on each side must equal half the number of studs displaced by the opening.

The number of outer studs framing the rough opening at each end (and supporting the rim header) must equal half the number of studs displaced within the opening based on the maximum stud spacing permitted by the code in table R602.3(5), "Size, Height and Spacing of Wood Studs." This part is easier than it sounds. As an example, if the opening in a 2x6 framed wall is 6 feet wide, two studs would fall within the opening with a 24-inch-on-center stud layout. You would then need to add one additional full-height stud on each side of the opening, doubling the number of supporting studs. Even though these studs are full-height, they are functioning as jack studs, and for the most part, the number of supporting studs should match the number of jacks listed in the "NJ" column of the header span table R602.7(1).

According to figure R602.7.2, joist hangers are required for all joists within the main header span. But when joists align with the supporting studs at the ends of the header, hangers are not needed provided there is at least 1½ inches of top plate for the joists to bear on.

BOX HEADERS

A box header is made by installing a structural panel on the outside face of the framing (for a one-sided box header) or on the inside and outside faces of the framing (for a two-sided box header). The panels span between the top plate of a wall and a flat 2-by at the head of a rough opening. When nailed according to the code schedule, the sheathing and framing work together as a header, eliminating the need for a lumber header. Box headers use a minimal amount of lumber, so there is more space for insulation. You just need to follow the conditions outlined in figure R602.7.3 (see illustration, page 40).

Minimizing the size of headers means increased insulation in the wall. A rim-joist header allows full-depth wall insulation in the spaces above a door opening, where there would have been solid lumber years ago (above left). An LVL installed inside the regular rim joist acts as a header for the window opening below (above right).

To create a box header, first frame in the cripple studs between the top plate and a flat 2-by at the head of the rough opening with jack studs supporting the ends of the flat 2-by head. Make sure that the structural sheathing and the top plate continue through the opening with no joints. Follow the fastening schedule of 8d common nails spaced 3 inches apart and driven into the plates and cripples. The sheathing must be a nominal 1/2 inch thick, and the strength axis must run parallel to the wall length. If you are already framing with structural sheathing, then single-sided box headers are easy to incorporate. And even if you typically sheathe walls with 7/16-inch panels, you can substitute 15/32-inch sheathing where needed. The tiny difference in thickness shouldn't cause any problems.

The code lists opening spans for 9- and 15-inch-tall box headers. But box headers can't be used in all situations. They're allowed only for walls that support just a roof and ceiling, or for walls supporting a roof, ceiling, and a floor with an interior center bearing wall. In many cases, the exterior wall sheathing alone can span an opening for a single-sided box header. Take the example of a first-floor 3-foot 2-inch header in a two-story 26-foot-wide house with a center bearing wall. A single-ply 9-inch-tall box header is good for up to a 4-foot span, and a 15-inch-tall box header works for spans up to 5 feet.

Two-sided box headers offer greater spans, but they throw a wrinkle into the fabrication. If you apply an interior structural panel to the face of the studs, you will need to pad out all the studs to match the plane of the panel before installing drywall. If you're framing walls with 2x6s, another option is ripping 1/2 inch off the plate, tops of the king studs, and the head board. All that finicky detail is probably more work than the benefit gained from getting a wider span.

MIX AND MATCH HEADERS

There is no rule that says that all the headers in a building have to be the same. You can select the header option that best suits each given situation. Each opening in a wall may be addressed in a different way. On the first floor of a two-story house, you may have no structural headers for openings in the gable wall, and then use box headers or rim-joist headers in the load-bearing walls. And for wide openings, you may prefer a conventional header. On the second floor, nonbearing openings again may not need headers. But openings in second-floor bearing walls may get properly sized single or double headers, or you may opt for box headers because there's likely no rim board above.

ENGINEERED-LUMBER HEADERS

LVL, LSL, PSL, and glue-laminated headers are usually more consistent in manufactured height and less prone to shrinking and swelling than headers made from dimensional lumber, so many builders have migrated towards using them. Engineered-lumber manufacturers provide header span tables that are similar to the ones listed in the IRC, making it easy to size a header for an opening.

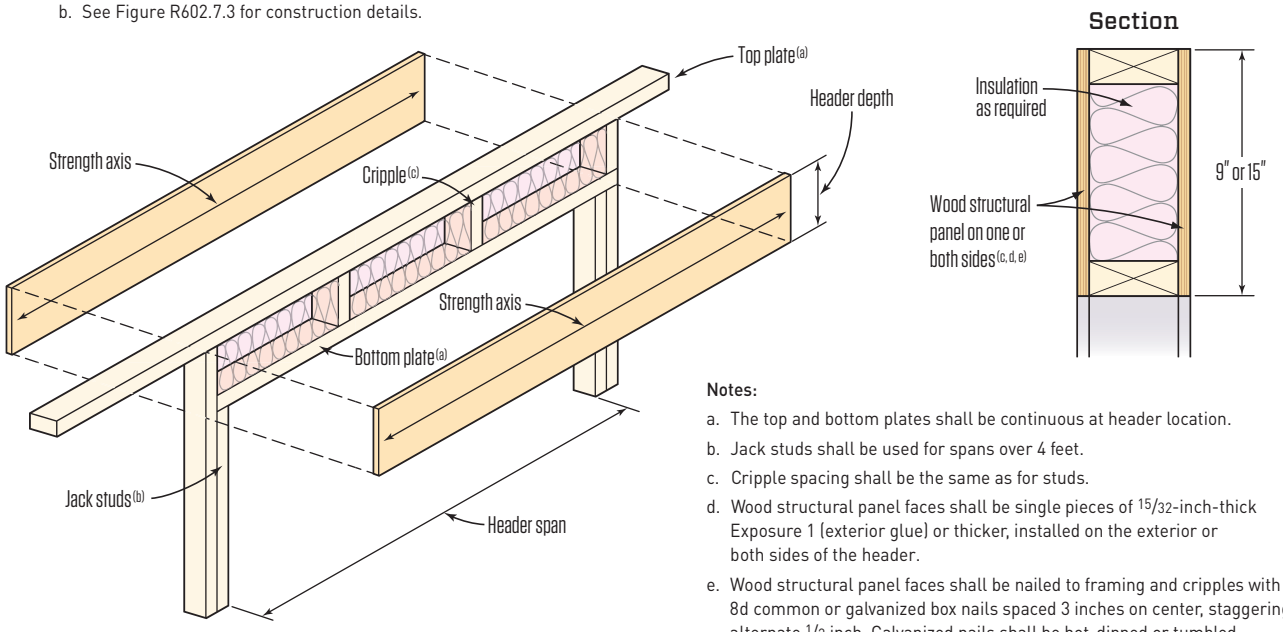
I've used engineered lumber for single-ply headers and for rim-board headers following the same measures outlined in the code for these header options. In many cases, the engineered-lumber headers

Table R602.7.3
Maximum Spans For Wood Structural Panel Box Headers[a]

Header Construction[b]	Header Depth (inches)	House Depth (feet)				
		24	26	28	30	32
Wood structural panel — one side	9	4	4	3	3	—
	15	5	5	4	3	3
Wood structural panel — both sides	9	7	5	5	4	3
	15	8	8	7	7	6

a. Spans are based on single story with clear-span trussed roof or two story with floors and roof supported by interior walls.

b. See Figure R602.7.3 for construction details.



For SI: 1 inch = 25.4 millimeters, 1 foot = 304.8 millimeters

Notes:

a. The top and bottom plates shall be continuous at header location.

b. Jack studs shall be used for spans over 4 feet.

c. Cripple spacing shall be the same as for studs.

d. Wood structural panel faces shall be single pieces of 15/32-inch-thick Exposure 1 (exterior glue) or thicker, installed on the exterior or both sides of the header.

e. Wood structural panel faces shall be nailed to framing and cripples with 8d common or galvanized box nails spaced 3 inches on center, staggering alternate 1/2 inch. Galvanized nails shall be hot-dipped or tumbled.

Box headers. In certain situations, sheathing attached with a strict nailing schedule can be combined with a framed opening to create a box header. Box headers can be 9 or 15 inches tall, and the structural sheathing can be on one side or both sides. A separate span table is included for single-sided and double-sided box headers.

can span greater distances compared with similar-sized dimensional-lumber headers. Some companies also make engineered-lumber headers in a laminated sandwich with rigid insulating foam as a core or face for the header. Before choosing to use an engineered-lumber header, check the manufacturer instructions for any special use conditions that might not be not covered in the code.

HEADER CONSTRUCTION

When building headers from multiple plies, you should always follow the fastening schedule in IRC table R602.3(1). But the information there is limited. The only nailing schedule for a header is for a two-ply header with a 1/2-inch spacer, presumably for 2x4 wall construction. That table calls for 16d common nails at 16 inches on-center or 16d box nails at 12 inches on-center. I run two rows of nails for headers made from 2x6s to 2x10s. For 2x12 headers, I add a third row of nails in the middle.

But more often than not, I'm framing headers for 2x6 walls. In that case, I make double headers by sandwiching 1 1/2-inch rigid foam insulation between layers of 2-by or LVL stock. Because nails won't reach the outer plies, I use 5- or 5 1/2-inch FastenMaster FlatLok or HeadLok screws or 5-inch Simpson Strong-Tie SDWS screws. The low-profile screw heads flush out with the lumber surfaces, so they don't interfere with sheathing or drywall. I space the screws roughly 16 inches apart and about 2 inches down from the edges of the header.

Mike Guertin is a builder and remodeler in East Greenwich, R.I., and a presenter at JLC Live, Deck Expo, and the Remodeling Show. Follow him on Instagram @mike_guertin.