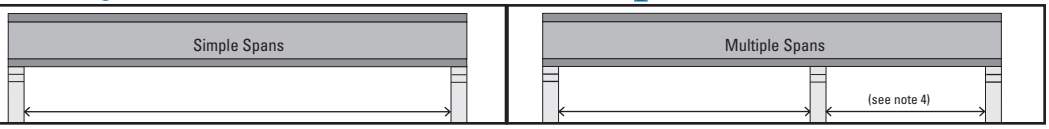
System Performance

The ultimate goal in the design of a floor or roof system is the end user's safety and satisfaction. **Although joists used at spans indicated in this guide meet or exceed minimum code criteria and will safely support the loads imposed on them, judgement must be used to adequately meet user expectation levels.** These expectations may vary from one user to another.

- The specifier should consider the meaning of a given deflection limit in terms of allowable deflection and the effects this could have on the system. For example, L/360 (span/360) for a 30′ span is 1″ of deflection. L/240 would be 1-1/2,″ and L/180 would be 2″ of deflection. Consideration might also be given to cases in which a joist with a long span parallels a short span or a foundation end wall. For example, a 30′ span with up to 1″ of allowable live load deflection could be adjacent to an end wall with no deflection, causing a noticeable difference in floor levels under full design load.
- **A stiffer floor will result from using a live load deflection limit of L/480** versus the code minimum L/360. A roof system with less total load deflection than the code required L/180 may be achieved by using a criterion of L/240.
- In addition to more stringent deflection limits, several other factors may improve overall floor performance. **Reducing joist spacing and/or increasing the subfloor thickness will lessen deflection between adjacent joists and increase load sharing. For increased floor stiffness, we recommend gluing the subfloor to the joists** before nailing or screwing rather than nailing alone. For additional stiffness, glue tongue and groove joints. Surfaces must be clean and dry before gluing.
- As with any construction, it is essential to follow proper installation procedures. Joists must be plumb and anchored securely to supports before system sheathing is attached. Supports for multiple span joists must be level. To minimize settlement when using hangers, joists should be firmly seated in the hanger bottoms. Leave a 1⁄16″ gap between joist end and header.
- **Vibrations may occur in floor systems with very little dead load**, as in large empty rooms. A ceiling attached to the bottom of the joists will generally dampen vibration as will interior partition walls running perpendicular to the joists. If a ceiling will not be attached to the bottom of the joists, vibration can be minimized by nailing a continuous 2 x 4 perpendicular to the bottom of the joists at midspan running from end wall to end wall. Where future finishing of the ceiling is likely, x-bridging or Wood I Beam blocking panels may be used in place of the 2 x 4.

GPI and WI Series Joists–Residential Floor Span Charts

Span Illustrations



40 PSF Live Load + 10 PSF Dead Load — Improved Performance[1] (L/480)

Joist	Joist Depth	Spacing (Simple Span) 12″ o.c.	16″ o.c.	19.2″ o.c.	24″ o.c.	Spacing (Multiple Span) 12″ o.c.	16″ o.c.	19.2″ o.c.	24″ o.c.
GPI 20	9½″	17′-01″	15′-07″	14′-09″	13′-10″	18′-07″	17′-01″	16′-02″	14′-05″
	11⅞″	20′-05″	18′-08″	17′-08″	16′-06″	22′-03″	20′-05″	18′-09″	16′-09″
GPI 40	9½″	18′-00″	16′-06″	15′-07″	14′-06″	19′-08″	18′-00″	16′-06″	14′-09″
	11⅞″	21′-06″	19′-08″	18′-07″	17′-01″	23′-06″	20′-10″	19′-00″	17′-00″
	14″	24′-04″	22′-03″	21′-00″	18′-11″	26′-08″	23′-01″	21′-01″	18′-10″
GPI 65	11⅞″	23′-03″	21′-03″	20′-00″	18′-08″	25′-06″	23′-03″	21′-11″	20′-06″
	14″	26′-05″	24′-02″	22′-09″	21′-03″	29′-00″	26′-05″	25′-00″	20′-08″
	16″	29′-04″	26′-09″	25′-03″	23′-07″	32′-02″	29′-04″	25′-11″	20′-08″
WI 40	9½″	18′-00″	16′-06″	15′-07″	14′-01″	19′-07″	17′-02″	15′-08″	14′-00″
	11⅞″	21′-06″	19′-07″	18′-02″	16′-03″	23′-00″	19′-11″	18′-02″	16′-02″
	14″	24′-04″	22′-01″	20′-02″	18′-00″	25′-06″	22′-01″	20′-01″	18′-00″
WI 60	11⅞″	22′-08″	20′-08″	19′-06″	18′-03″	24′-08″	22′-06″	21′-02″	19′-01″
	14″	25′-09″	23′-06″	22′-02″	20′-09″	28′-01″	25′-07″	23′-08″	19′-09″
	16″	28′-07″	26′-01″	24′-07″	23′-00″	31′-02″	28′-01″	24′-09″	19′-09″
WI 80	11⅞″	24′-11″	22′-08″	21′-04″	19′-11″	27′-01″	24′-08″	23′-03″	21′-08″
	14″	28′-03″	25′-09″	24′-03″	22′-08″	30′-10″	28′-00″	26′-05″	23′-11″
	16″	31′-04″	28′-06″	26′-11″	25′-01″	34′-02″	31′-01″	29′-03″	23′-11″

40 PSF Live Load + 20 PSF Dead Load — Improved Performance[1] (L/480)

Joist	Joist Depth	Spacing (Simple Span) 12″ o.c.	16″ o.c.	19.2″ o.c.	24″ o.c.	Spacing (Multiple Span) 12″ o.c.	16″ o.c.	19.2″ o.c.	24″ o.c.
GPI 20	9½″	17′-01″	15′-07″	14′-09″	13′-03″	18′-07″	16′-02″	14′-09″	13′-02″
	11⅞″	20′-05″	18′-08″	17′-02″	15′-04″	21′-08″	18′-09″	17′-01″	15′-03″
GPI 40	9½″	18′-00″	16′-06″	15′-01″	13′-06″	19′-01″	16′-06″	15′-00″	13′-05″
	11⅞″	21′-06″	19′-01″	17′-05″	15′-07″	22′-00″	19′-00″	17′-04″	15′-06″
	14″	24′-04″	21′-02″	19′-03″	17′-03″	24′-04″	21′-01″	19′-03″	17′-01″
GPI 65	11⅞″	23′-03″	21′-03″	20′-00″	18′-08″	25′-06″	23′-03″	21′-06″	17′-02″
	14″	26′-05″	24′-02″	22′-09″	21′-03″	29′-00″	25′-11″	21′-06″	17′-02″
	16″	29′-04″	26′-09″	25′-03″	22′-03″	32′-02″	25′-11″	21′-06″	17′-02″
WI 40	9½″	18′-00″	15′-09″	14′-04″	12′-10″	18′-01″	15′-08″	14′-03″	12′-09″
	11⅞″	21′-00″	18′-02″	16′-07″	14′-10″	21′-00″	18′-02″	16′-06″	14′-09″
	14″	23′-04″	20′-02″	18′-05″	16′-05″	23′-03″	20′-01″	18′-04″	16′-04″
WI 60	11⅞″	22′-08″	20′-08″	19′-06″	17′-05″	24′-08″	21′-04″	19′-05″	16′-05″
	14″	25′-09″	23′-06″	21′-08″	19′-04″	27′-04″	23′-08″	20′-07″	16′-05″
	16″	28′-07″	25′-09″	23′-06″	19′-10″	29′-08″	24′-09″	20′-07″	16′-05″
WI 80	11⅞″	24′-11″	22′-08″	21′-04″	19′-11″	27′-01″	24′-08″	22′-09″	18′-02″
	14″	28′-03″	25′-09″	24′-03″	21′-02″	30′-10″	28′-00″	24′-11″	19′-11″
	16″	31′-04″	28′-06″	26′-06″	21′-02″	34′-02″	30′-00″	24′-11″	19′-11″

NOTES:

1. These span charts are based on uniform loads, as noted above; live load deflection is limited to L/480 **for better performance.** Floor performance is greatly influenced by the stiffness of the floor joists. Experience has shown that joists designed to the code minimum live load deflection (L/360) will result in a floor which may not meet the expectations of some end users. G-P strongly recommends floor spans for Wood I Beam joists be limited to those given above, which are based on L/480 live load deflection. (One-third stiffer than required by code.)
2. Spans are clear distances between supports, and are based on composite action with glued-nailed APA Rated Sheathing or Sturd-I-Floor of minimum thickness 19/32″ (40/20 or 20 oc) for joist spacing of 19.2″ or less, or 23/32″ (48/24 or 24 oc) for a joist spacing of 24″. Adhesive must meet APA AFG-01 or ASTM D3498. Apply a continuous line of glue (about 1/4″ diameter) to top flange of joists. All surfaces must be clean and dry. If sheathing is nailed only (not recommended), reduce spans by 12″.
3. **Minimum end bearing length is 1-3/4″. Minimum intermediate bearing length is 3-1/2″.**
4. End spans of multiple-span joists must be at least 40% of the adjacent span.
5. For loading other than that shown above, refer to Uniform Load Tables, use G-P FASTBeam® selection software, or contact G-P Engineered Lumber Technical Services.
6. Not all products are available at all distribution centers; contact G-P for availability.

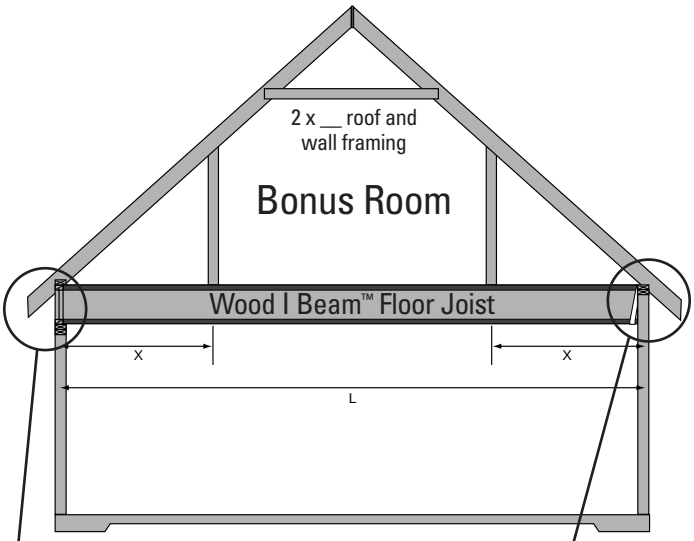
Bonus Room Floor Joist Selection Guide

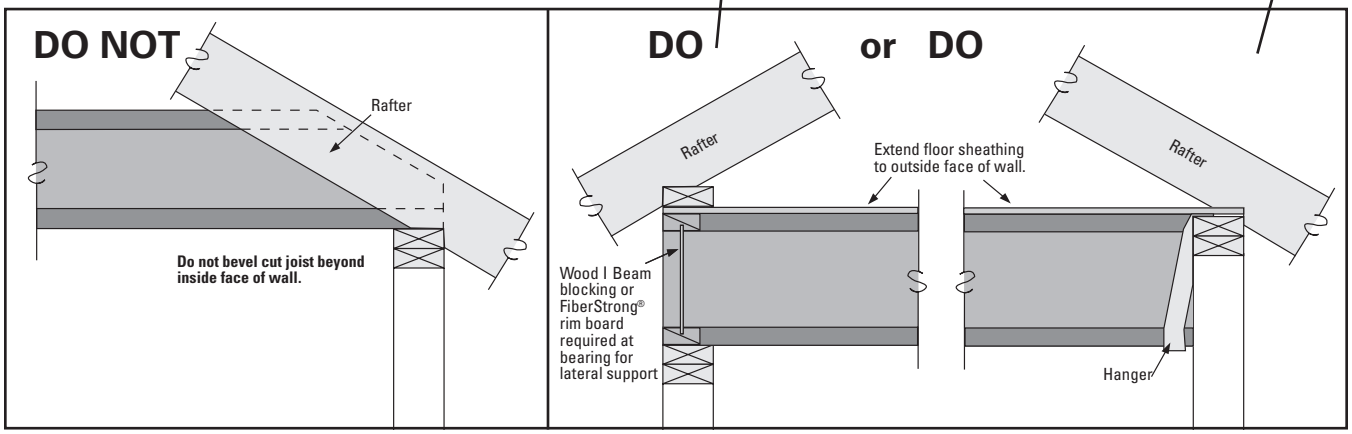
L (Span)	X (Kneewall Location)	WI Joists (Series – Depth)				GPI 65 (Depth)			
		Spacing				Spacing			
		12″ o.c.	16″ o.c.	19.2″ o.c.	24″ o.c.	12″ o.c.	16″ o.c.	19.2″ o.c.	24″ o.c.
20′	4′	60-11⅞″	60-14″	60-16″	80-16″	11⅞″	14″	14″	16″
	5′	60-14″	60-14″	60-16″	80-16″	11⅞″	14″	16″	16″
	6′	60-14″	60-14″	60-16″	80-16″	11⅞″	14″	14″	16″
22′	4′	60-14″	60-16″	80-16″	80-16″	14″	16″	16″	Call G-P
	5′	60-14″	60-16″	80-16″	Call G-P	14″	16″	16″	Call G-P
	6′	60-14″	60-16″	80-16″	Call G-P	14″	16″	16″	Call G-P
24′	4′	60-16″	80-16″	Call G-P	Call G-P	16″	16″*	Call G-P	Call G-P
	5′	60-16″	80-16″	Call G-P	Call G-P	16″	Call G-P	Call G-P	Call G-P
	6′	60-16″	80-16″	Call G-P	Call G-P	16″	Call G-P	Call G-P	Call G-P
	7′	60-16″	80-16″	Call G-P	Call G-P	16″	Call G-P	Call G-P	Call G-P
26′	4′	80-16″	Call G-P	Call G-P	Call G-P	16″	Call G-P	Call G-P	Call G-P
	5′	80-16″	Call G-P	Call G-P	Call G-P	16″*	Call G-P	Call G-P	Call G-P
	6′	80-16″	Call G-P	Call G-P	Call G-P	16″*	Call G-P	Call G-P	Call G-P
	7′	80-16″	Call G-P	Call G-P	Call G-P	16″*	Call G-P	Call G-P	Call G-P

*Under these conditions, live load deflection meets building code, but does not meet L/480. Worst case is L/467.

Design Parameters:

1. Glued and nailed floor sheathing.
2. Deflection limits: L/240 total load, L/480 live load, unless noted otherwise.
3. Roof loads of 30 PSF live load at 115% (snow load).
4. Roof dead load of 12 PSF (asphalt shingles).
5. Roof rafter slope between 8/12 and 12/12.
6. Kneewall weight of 40 PLF.
7. Attic storage load of 20 PSF live load (outside the kneewalls).
8. Floor live load of 40 PSF (between the kneewalls).
9. Attic and floor dead load of 10 PSF.
10. Straight gable roof framing. No hip framing is permitted.
11. For all other conditions, call Georgia-Pacific Engineered Lumber.





Performance Based Joist Selection Guide

Determine span, select desired performance level, choose joist option.

Performance Criteria	Live Load Deflection	Total Load Deflection	Max Joist Spacing	Recommended Sheathing/Sturd-I-Floor®
1. Code allowed minimum*	L/360	L/240	24″	23/32″ 48/24 APA® Rated Sheathing (glue is recommended)
2. Improved performance	L/480	L/360	19.2″ (24″ for WI 80)	23/32″ G-P *Plus*™ Plywood Sturd-I-Floor® 24″ o.c. or 48/24 APA® Rated Sheathing, glued and nailed
3. High performance	L/600	L/480	16″ (19.2″ for WI 80)	7/8″ G-P ToughPly™ plywood, glued and nailed

Product Selection Guide based on joist span. Determine span, select desired performance level, choose joist option.
Products above the bold line in each column are limited to 1/2″ live load deflection when fully loaded.

Floor Span	Joist	1. CODE ALLOWED MINIMUM* Depth	Spacing	2. IMPROVED PERFORMANCE Depth	Spacing	3. HIGH PERFORMANCE Depth	Spacing
14′	GPI 20	9½″	24″ o.c.	9½″	19.2″ o.c.	9½″	16″ o.c.
	40 Series	9½″	24″ o.c.	9½″	19.2″ o.c.	9½″	16″ o.c.
	WI 60	11⅞″	24″ o.c.	11⅞″	19.2″ o.c.	11⅞″	16″ o.c.
	GPI 65	11⅞″	24″ o.c.	11⅞″	19.2″ o.c.	11⅞″	16″ o.c.
	WI 80	11⅞″	24″ o.c.	11⅞″	24″ o.c.	11⅞″	19.2″ o.c.
15′	GPI 20	11⅞″	24″ o.c.	11⅞″	19.2″ o.c.	11⅞″	16″ o.c.
	40 Series	11⅞″	24″ o.c.	9½″	19.2″ o.c.	9½″	16″ o.c.
	WI 60	11⅞″	24″ o.c.	11⅞″	19.2″ o.c.	11⅞″	16″ o.c.
	GPI 65	11⅞″	24″ o.c.	11⅞″	19.2″ o.c.	11⅞″	16″ o.c.
	WI 80	11⅞″	24″ o.c.	11⅞″	24″ o.c.	11⅞″	19.2″ o.c.
16′	GPI 20	11⅞″	24″ o.c.	11⅞″	19.2″ o.c.	11⅞″	16″ o.c.
	40 Series	11⅞″	24″ o.c.	11⅞″	19.2″ o.c.	11⅞″	16″ o.c.
	WI 60	11⅞″	24″ o.c.	9½″	19.2″ o.c.	11⅞″	16″ o.c.
	GPI 65	11⅞″	24″ o.c.	11⅞″	19.2″ o.c.	11⅞″	16″ o.c.
	WI 80	11⅞″	24″ o.c.	11⅞″	24″ o.c.	11⅞″	19.2″ o.c.
17′	GPI 20	11⅞″	19.2″ o.c.	11⅞″	19.2″ o.c.	11⅞″	16″ o.c.
	40 Series	14″	24″ o.c.	11⅞″	19.2″ o.c.	11⅞″	16″ o.c.
	WI 60	11⅞″	24″ o.c.	11⅞″	19.2″ o.c.	11⅞″	16″ o.c.
	GPI 65	11⅞″	24″ o.c.	11⅞″	19.2″ o.c.	11⅞″	16″ o.c.
	WI 80	11⅞″	24″ o.c.	11⅞″	24″ o.c.	11⅞″	19.2″ o.c.
18′	GPI 20	11⅞″	16″ o.c.	11⅞″	16″ o.c.	11⅞″	12″ o.c.
	40 Series	14″	24″ o.c.	11⅞″	19.2″ o.c.	14″	16″ o.c.
	WI 60	11⅞″	24″ o.c.	11⅞″	19.2″ o.c.	11⅞″	16″ o.c.
	GPI 65	11⅞″	24″ o.c.	11⅞″	19.2″ o.c.	11⅞″	16″ o.c.
	WI 80	11⅞″	24″ o.c.	11⅞″	24″ o.c.	11⅞″	19.2″ o.c.
19′	GPI 20	11⅞″	12″ o.c.	11⅞″	12″ o.c.	Does not work	
	40 Series	14″	19.2″ o.c.	14″	19.2″ o.c.	14″	16″ o.c.
	WI 60	14″	24″ o.c.	11⅞″	19.2″ o.c.	14″	16″ o.c.
	GPI 65	11⅞″	24″ o.c.	11⅞″	19.2″ o.c.	14″	16″ o.c.
	WI 80	11⅞″	24″ o.c.	11⅞″	24″ o.c.	14″	19.2″ o.c.
20′	40 Series	NOTE: Please refer to "Improved Performance" or "High Performance"		14″	19.2″ o.c.	14″	16″ o.c.
	WI 60			14″	19.2″ o.c.	14″	16″ o.c.
	GPI 65			11⅞″	19.2″ o.c.	14″	16″ o.c.
	WI 80			14″	24″ o.c.	14″	19.2″ o.c.
21′	40 Series			14″*	16″ o.c.	14″	12″ o.c.
	WI 60			14″	19.2″ o.c.	16″	16″ o.c.
	GPI 65			14″	19.2″ o.c.	16″	16″ o.c.
	WI 80			14″	24″ o.c.	14″	19.2″ o.c.
22′	40 Series			14″*	12″ o.c.	14″	12″ o.c.
	WI 60			14″	19.2″ o.c.	16″	12″ o.c.
	GPI 65			14″	19.2″ o.c.	16″	16″ o.c.
	WI 80			14″	24″ o.c.	16″	19.2″ o.c.
23′	40 Series			14″*	12″ o.c.	Does not work	
	WI 60			16″	19.2″ o.c.	16″	12″ o.c.
	GPI 65			16″	19.2″ o.c.	16″	16″ o.c.
	WI 80			16″	24″ o.c.	16″	16″ o.c.
24′	WI 60			16″	16″ o.c.	Does not work	
	GPI 65			16″	19.2″ o.c.	16″	12″ o.c.
	WI 80			16″	19.2″ o.c.	16″	16″ o.c.

*Not Recommended. Experience suggests the end user may not be satisfied with the minimum system performance.

NOTES:

1. Table assumes normal residential loads of 40 PSF live load and 10 PSF dead load except for "High Performance" column. High Performance system is based on 40 PSF live load, 20 PSF dead load.
2. Table assumes simple span applications.
3. If load bearing walls from above do not stack directly to walls or beams below, call G-P.
4. Many combinations of series, depth and on center spacing can provide desired performance levels; the recommendations in this table are based on performance, costs and installation factors. For other options contact Georgia-Pacific.

Layout Guide for 19.2″ o.c. Spacing

1	19 3/16″	6	115 3/16″	11	211 3/16″
2	38 3/8″	7	134 3/8″	12	230 3/8″
3	57 5/8″	8	153 5/8″	13	249 5/8″
4	76 13/16″	9	172 13/16″	14	268 13/16″
5	96″ (8′)	10	192″ (16′)	15	288″ (24′)