Variables and Assumptions

Post_Height := 44in

Flooring_thickness := 0.75in

Plywood_thickness := 0.75in

Joist_depth := 9.25in

Blocking_width := 1.5in

Blocking_length := 13in

Bottom_compression_zone := 1.7in

$$\text{Fastener\_arm} := \text{Joist\_depth} - \frac{\text{Bottom\_compression\_zone}}{2} = 8.4\cdot\text{in}$$

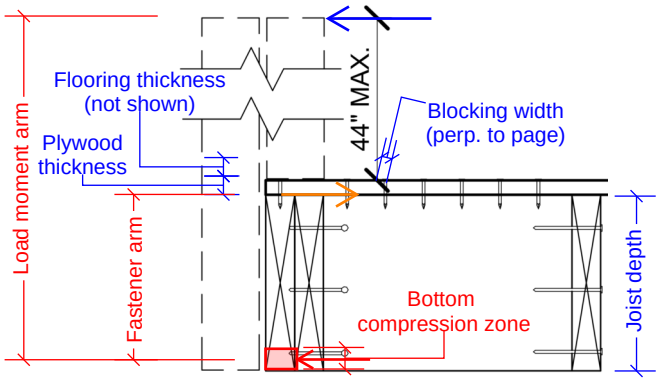


Diagram with least conservative moment arm

$$\text{Load\_moment\_arm} := \text{Post\_Height} + \text{Flooring\_thickness} + \text{Plywood\_thickness} + \text{Fastener\_arm} = 53.9\cdot\text{in}$$

$$\text{Fastener\_arm\_conservative} := \frac{2\cdot\text{Joist\_depth}}{3} = 6.17\cdot\text{in}$$

$$\text{Load\_moment\_arm\_conservative} := \text{Post\_Height} + \text{Flooring\_thickness} + \text{Plywood\_thickness} \ldots + \text{Fastener\_arm\_conservative} = 51.67\cdot\text{in}$$

$$\text{Load\_moment\_arm\_blocking} := \text{Post\_Height} + \text{Flooring\_thickness} + \frac{\text{Plywood\_thickness}}{2} = 45.13\cdot\text{in}$$

Assume wood is SPF No. 2 or better (SG=0.42)

$F_{cperp} := 425\text{psi}$

$C_D := 1.6$

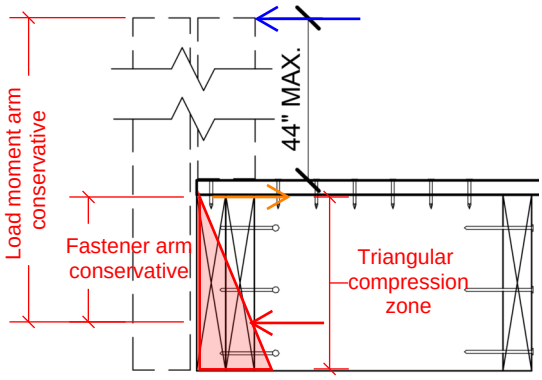


Diagram with conservative moment arm
(triangular compression zone)

Fastener Capacities (See AWC Connection Calculator Results)

10d Common Nail in single shear installed into floor joist through plywood (conservatively assume capacity for 15/32 in. plywood)

$z_{10plywood} := 131\text{lbf}$

16d Common Nail in single shear installed into floor joist through blocking, toe-nail

$z_{16} := 191\text{lbf}$

$C_{tn} := 0.83$

$z_{16tn} := C_{tn}\cdot z_{16} = 159\ \text{lbf}$

16d Common Nail in single shear installed into end grain of blocking through floor joist

$z_{16eg} := 128\text{lbf}$

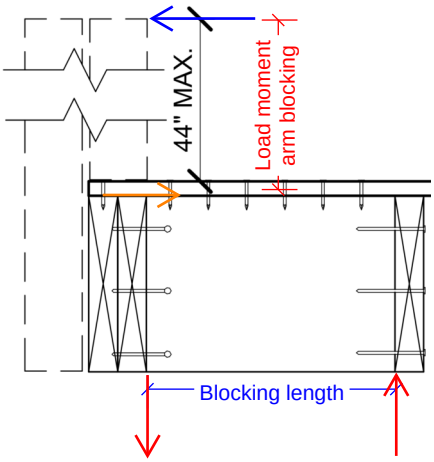


Diagram with blocking reactions

SMA

Outward Load on post

$Outward\_Load := 200\,lbf$ ←

$Shear_{plywood} := Outward\_Load \cdot \frac{Load\_moment\_arm}{Fastener\_arm} = 1283.333 \cdot lbf$ →

Determine shear in nails between plywood and joists or blocking using moment arm with compression zone at bottom of joist

$Compression := Shear_{plywood} - Outward\_Load = 1083\,lbf$ ←

Check compression in edge member

$Bottom\_compression\_zone\_check := \frac{Compression}{F_{cperp} \cdot Blocking\_width} = 1.7 \cdot in$

$Comp\_zone\_check := \frac{Bottom\_compression\_zone}{Bottom\_compression\_zone\_check} = 1$

Actual compression zone depth is approximately equal to assumed compression zone depth, so no need to iterate calculation again.

$Shear_{plywood\_conserv} := Outward\_Load \cdot \frac{Load\_moment\_arm\_conservative}{Fastener\_arm\_conservative} = 1676 \cdot lbf$

Determine shear in nails between plywood and joists or blocking using conservative moment arm with compression zone triangular distribution over height of joist.

Determine number of nails required between plywood and joist or blocking using the conservative and least conservative moment arms between the shear plane and center of compression zone

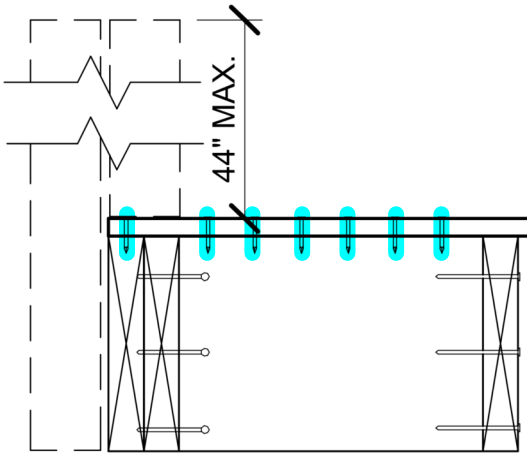
Using least conservative moment arm

$num\_plywood\_nails := \frac{Shear_{plywood}}{z_{10plywood}} = 9.8$

Using conservative moment arm

$num\_plywood\_nails\_conservative := \frac{Shear_{plywood\_conserv}}{z_{10plywood}} = 12.8$

Use (12) 10d nails between plywood and joist or blocking



SMA

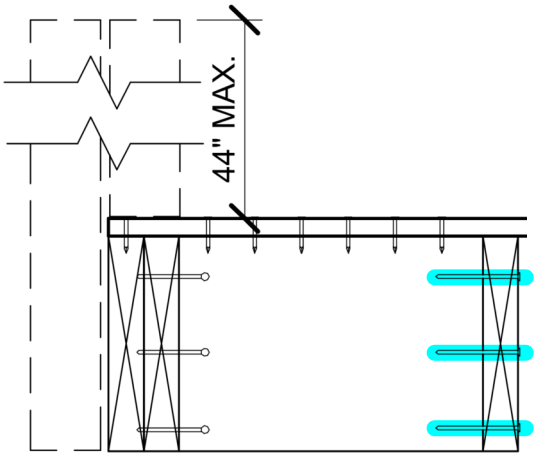
Determine number of nails required between blocking and joists, installed into end grain

$$Blocking\_shear := \frac{Outward\_Load \cdot Load\_moment\_arm\_blocking}{Blocking\_length} = 694\ lbf$$

$$num\_blocking\_nails\_eg := \frac{Blocking\_shear}{z_{16eg}} = 5.4$$

Note that shear in blocking from moment caused by outward load exceeds potential shear in blocking due to downward load

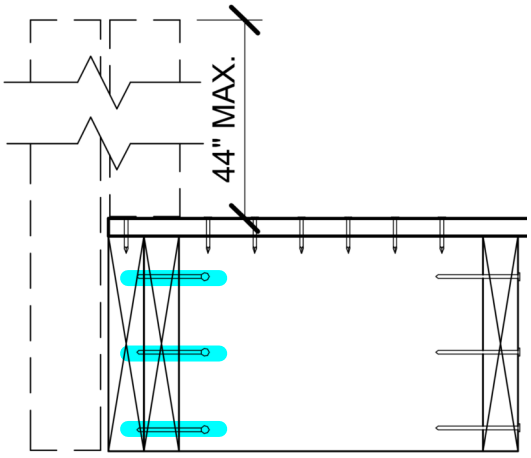
Use (6) 16d nails between blocking and joists, installed into end grain



Determine number of nails required between joist or blocking and edge member, installed as toe-nail

$$num\_toenails := \frac{Blocking\_shear}{z_{16tn}} = 4.4$$

Use (6) 16d nails between joist or blocking and edge member, installed as toe-nail, (3) on each side of blocking



SMA

Design Method	Allowable Stress Design (ASD)
Connection Type	Lateral loading
Fastener Type	Nail
Loading Scenario	Single Shear

Main Member Type	Spruce-Pine-Fir
Main Member Thickness	-- Other (in inches) -- 9.25
Side Member Type	Plywood (Structural 1 grade)
Side Member Thickness	15/32 in.
Nail Type	Common Wire
Nail Size	10d (D = 0.148 in.; L = 3 in.)
Load Duration Factor	C_D = 1.6
Wet Service Factor	C_M = 1.0
End Grain Factor	C_eg = 1.0
Temperature Factor	C_t = 1.0
Diaphragm Factor	C_di = 1.0

Z10plywood = Single shear capacity of 10d common nail installed from plywood into main member

Connection Yield Modes

Im	913 lbs.
Is	235 lbs.
II	321 lbs.
IIIm	335 lbs.
IIIs	131 lbs.
IV	172 lbs.

Adjusted ASD Capacity	**131 lbs.**

- Nail bending yield strength of 90000 psi is assumed.
- The Adjusted ASD Capacity does not apply for toe-nails installed in wood members.
- Length of tapered tip is assumed to be two times the nail diameter for calculating dowel bearing length in the main member.
- The Adjusted ASD Capacity only applies for nails that have been driven flush with the side member surface. It does not apply for nails that have been overdriven into the side member.

The Connection Calculator was designed and created by Cameron Knudson, Michael Dodson and David Pollock at Washington State University. Support for development of the Connection Calculator was provided by American Wood Council.

Design Method	Allowable Stress Design (ASD)
Connection Type	Lateral loading
Fastener Type	Nail
Loading Scenario	Single Shear

Main Member Type	Spruce-Pine-Fir
Main Member Thickness	-- Other (in inches) -- 9.25
Side Member Type	Spruce-Pine-Fir
Side Member Thickness	1.5 in.
Nail Type	Common Wire
Nail Size	16d (D = 0.162 in.; L = 3.5 in.)
Load Duration Factor	C_D = 1.6
Wet Service Factor	C_M = 1.0
End Grain Factor	C_eg = 1.0
Temperature Factor	C_t = 1.0
Diaphragm Factor	C_di = 1.0

Z16 = Single shear capacity of 16d common nail installed from side member into main member

Connection Yield Modes

Im	789 lbs.
Is	592 lbs.
II	291 lbs.
IIIm	286 lbs.
IIIs	227 lbs.
IV	191 lbs.

Adjusted ASD Capacity	**191 lbs.**

- Nail bending yield strength of 90000 psi is assumed.
- The Adjusted ASD Capacity does not apply for toe-nails installed in wood members.
- Length of tapered tip is assumed to be two times the nail diameter for calculating dowel bearing length in the main member.
- The Adjusted ASD Capacity only applies for nails that have been driven flush with the side member surface. It does not apply for nails that have been overdriven into the side member.

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Design Method	Allowable Stress Design (ASD)
Connection Type	Lateral loading
Fastener Type	Nail
Loading Scenario	Single Shear

Main Member Type	Spruce-Pine-Fir
Main Member Thickness	-- Other (in inches) -- 9.25
Side Member Type	Spruce-Pine-Fir
Side Member Thickness	1.5 in.
Nail Type	Common Wire
Nail Size	16d (D = 0.162 in.; L = 3.5 in.)
Load Duration Factor	C_D = 1.6
Wet Service Factor	C_M = 1.0
End Grain Factor	C_eg = 0.67
Temperature Factor	C_t = 1.0
Diaphragm Factor	C_di = 1.0

Z16eg = Single shear capacity of 16d common nail installed from side member into end grain of main member

Connection Yield Modes

Im	529 lbs.
Is	397 lbs.
II	195 lbs.
IIIm	192 lbs.
IIIs	152 lbs.
IV	128 lbs.

Adjusted ASD Capacity	**128 lbs.**

- Nail bending yield strength of 90000 psi is assumed.
- The Adjusted ASD Capacity does not apply for toe-nails installed in wood members.
- Length of tapered tip is assumed to be two times the nail diameter for calculating dowel bearing length in the main member.
- The Adjusted ASD Capacity only applies for nails that have been driven flush with the side member surface. It does not apply for nails that have been overdriven into the side member.

While every effort has been made to insure the accuracy of the information presented, and special effort has been made to assure that the information reflects the state-of-the-art, neither the American Wood Council nor its members assume any responsibility for any particular design prepared from this on-line Connection Calculator. Those using this on-line Connection Calculator assume all liability from its use.

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