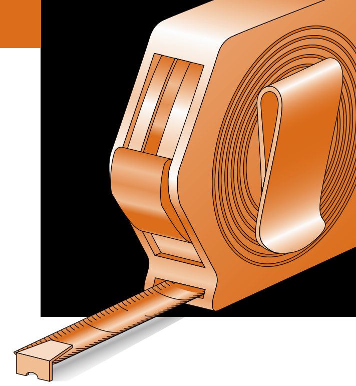


Shear Transfer At Engineered Wood Floors

Introduction

Over the last couple of decades the use of engineered wood products for the fabrication of light-weight wood floor systems has increased in popularity. APA PRI I-joists, *APA EWS* glulams, APA Performance Rated Rim Board, and laminated veneer lumber (LVL) are light weight and feature precision, high strength, and superior quality.

As the use of these products expands beyond conventional construction, it is inevitable that questions will arise concerning their use in engineered applications. One such question concerns the use of APA joists and APA Performance-Rated Rim Board around the perimeter of the structure in engineered applications where the wood floors are designed as diaphragms and the walls above are designed as shear walls.

In such applications, the engineered wood product forming the rim joist/board around a floor system is subject to a number of loads not normally considered in conventional, non-engineered applications. These additional engineering considerations include:

- Diaphragm perimeter nailing
- Transfer of shear wall forces from the walls above into the foundation/wall framing below

Mixing Engineered Wood Products and Sawn Lumber – Preventing Incompatibilities

Mixing engineered wood products and sawn lumber in a roof or floor system should never *be done without a careful analysis of the potential consequences.*

Engineered wood products are manufactured at very low moisture contents (5% or lower) and to a high degree of dimensional accuracy. Sawn lumber products, on the other hand, are sized and sold at moisture contents often in excess of 16%. When used together on a job site, the engineered wood products have a tendency to expand due to increased moisture content while the sawn lumber products are subject to shrinkage as they dry out. In situations where lumber and engineered wood products are used together in floor or roof systems, this differential shrinkage can lead to situations that must be considered by the design professional.

The use of sawn lumber blocking or rim boards in conjunction with wood I-joists in a floor system is a classic example. In such situations blocking and rim board materials are used, at least in part, to assist the wood I-joist in distributing vertical loads through the floor system into the structure below. As the building materials in the structure reach an equilibrium moisture content with their surroundings, sawn lumber blocking and rim board shrink while the I-joists do not. As a result, lumber components are not "available" to carry the applied vertical load that they were designed to carry, thus overloading the I-joists.

This is one of the reasons that engineered wood products are manufactured in depths different from nominal sawn lumber products. A nominal 2 x 10 may not easily be used to block a 9-1/2-inch-deep I-joist. Sawn lumber is not effective for such applications and should never *be used without careful consideration.*

There are applications, such as diaphragm blocking, "squash" blocks, backer or filler blocking where sawn lumber is acceptable for use in conjunction with engineered wood products.

ENGINEERED WOOD SYSTEMS
APA EWS

- Shear transfer of diaphragm loads to the foundation/wall framing below

Such design forces result in attachment requirements that often exceed normal fastening found in the building codes. The challenge to the designer is to detail these critical connections such that all of the applied loads are transferred through the connection in an economical and practical way.

Capacity of APA Engineered Wood Rim Boards

APA Rim Board (and Rim Board Plus): All three of the major model building codes are consistent in prescriptively requiring the rim joist to be attached to structural framing below with 8d common toe nails spaced at 6" on center. While this attachment schedule is sufficient to develop 180 to 200 lb per linear foot of rim board required for the conventional construction provisions of the building codes, it falls short of developing the actual lateral load capacity of the APA Rim Board products which exceeds 1000 lb per linear foot. (The actual lateral load capacity for APA Rim Board is 2300 plf for 1"-thick product and 3000 plf for 1-1/8"-thick board.) Spacing toenails closer than 6" on center to increase the shear capacity of the rim board must be viewed with extreme caution. Closer spacing may cause splitting in some rim board products, and an increased load capacity may not actually be achieved using this technique.

Code-required minimum nailing into the edge of a rim board product to anchor the perimeter of the floor diaphragm and other framing from above can only develop 180 to 200 lb per lineal foot depending on the grade of the rim board. This is sufficient capacity to meet the conventional construction requirements of the codes. Additional nailing into the edge of engineered wood rim board products may actually reduce the capacity of the connection due to the potential for splitting.

Framing anchors or blocking as shown in Details A1 and B1, along with the information in the Appendices may be used to develop the additional capacity required.

APA PRI I-joists: Similar to rim board products, PRI I-joists when used as rim joists have considerably more capacity than the code-required nailing – 8d common toe nails at 6" on center – will develop. By virtue of their flanges, however, I-joists are considerably easier to attach to structural framing both above and below the joist.

On I-joists with 1-1/2" wide flanges there is sufficient room to place a double row of nails in both the top and bottom flanges. I-joists with flanges 2-5/16" and wider can easily accommodate four staggered rows of nails. The full lateral load capacity of the I-joist (1000 plf) may be achieved in most cases. Table 1 is provided to aid the designer in selecting, for various flange widths and PRI series, the appropriate nailing schedules required to achieve the desired design load. (Note that the 1000 plf capacity mentioned above and shown in Table 1 below is a factored load and, as such, already includes a 1.6 adjustment for duration-of-load.)

Diaphragm Perimeter Nailing

In conventional non-engineered construction applications the floor or roof diaphragm is prescriptively described in the building codes. In these applications the floor sheathing – normally wood structural panel sheathing – is attached to the floor perimeter framing with 8d nails at 6 inches on center. In engineered applications, the design loads and geometry of the structure may dictate a diaphragm perimeter nailing schedule of 4, 2-1/2, or even 2 inches on center. The performance of some engineered wood products, such as engineered wood rim boards can be adversely impacted by these closer nail spacing schedules. It is important in such applications to develop design details to accommodate these loads and their corresponding close nailing schedules.

Details A1 and A2 illustrate methods that may be used to accommodate 4, 2-1/2, or 2 inches-on-center diaphragm perimeter nailing requirements. (See Appendix A for nail capacities.)

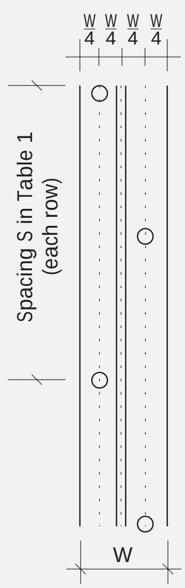
(Note that in these and subsequent Details some required nailing is deleted for clarity. Only nailing appropriate for transferring loads or providing potential interference is shown.)

TABLE 1

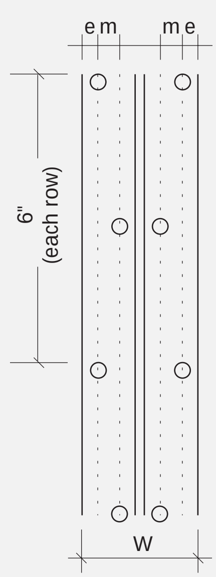
LATERAL CAPACITY OF FACE-NAILED PRI I-JOIST FLANGES

Joist Designation: Flange Width in.	Joist Designation: PRI Series	Nail Size	Maximum Flange Nailing in Web (No. of rows at spacing (S))	Total No. of Nail per foot	Maximum Capacity (plf) Flange Specific Gravity 0.42	0.46	0.49
1-1/2 or 1-3/4	9-1/2" PRI-20, 9-1/2" PRI-30, 11-7/8" PRI-20, 11-7/8" PRI-30 or 9-1/2" PRI-50, 11-7/8" PRI-50, 14" PRI-50, 16" PRI-50	8d common, 10d box, or 12d box	2 rows at 12"	2	248	256	264
			2 rows at 6"	4	496	512	528
			2 rows at 4"	6	736	768	784
			2 rows at 3"	8	984	1000	1000
		10d common, 12d common, or 16d sinker	2 rows at 12"	2	272	280	288
			2 rows at 6"	4	536	560	576
			2 rows at 4"	6	808	840	864
		16d common	2 rows at 12"	2	384	400	408
			2 rows at 6"	4	768	800	816
2-5/16 or 2-1/2 or 3-1/2	14" PRI-70, 16" PRI-70 or 9-12/" PRI-40, 9-1/2" PRI-60, 11-7/8" PRI-40,11-7/8" PRI-60, 14" PRI-40, 14" PRI-60, 16" PRI-40, 16" PRI-60 or 11-7/8" PRI-80, 14" PRI-80, 16" PRI-80	8d common, 10d box, or 12d box	2 rows at 12"	2	248	256	264
			2 rows at 6"	4	496	512	528
			2 rows at 4"	6	736	768	784
			2 rows at 3"	8	984	1000	1000
		10d common, 12d common, or 16d sinker	2 rows at 12"	2	272	280	288
			2 rows at 6"	4	536	560	576
			2 rows at 4"	6	808	840	864
			4 rows at 6"	8	1000	1000	1000
		16d common	2 rows at 12"	2	384	400	408
			2 rows at 6"	4	768	800	816

Notes:
Values given above include a 1.6 duration of load adjustment for high wind and seismic design. (Subject to local code variations.)
The above values are based on the assumption that the nailing does not cause excessive splitting of the flange.



Double Row Nailing
(1-1/2" min. width)



4 Row Nailing
(2-5/16" min. width)

W	e	m
2-5/16"	5/16"	7/16"
2-1/2"	3/8"	1/2"
3-1/2"	3/8"	1/2"

Shear transfer of diaphragm loads to the foundation/wall framing below

In cases where either Detail A1 or A2 is used to transfer higher diaphragm shear values into the diaphragm perimeter framing (the rim board), it is essential that the attachment schedule at the base of this framing be adjusted to accommodate the additional load into the foundation or framing below. The minimum nailing recommendations published in the model building codes for rim board to framing connections are insufficient to transfer the additional diaphragm loads that precipitated the use of 4, 2-1/2, or even 2-inch-on-center diaphragm perimeter nailing schedules. Care must be taken when installing these additional fasteners to prevent splitting of the framing members. In addition, nail and lumber specifications must provide for a minimum depth of penetration that allows full connection capacity.

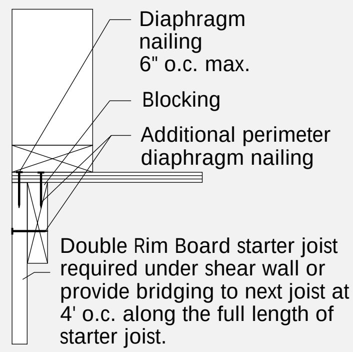
Details B1 through B4 are provided to give the designer some examples of methods used to accommodate these loads. (See Appendices A, B and C for nail capacities.)

Transfer of shear wall forces from the walls above into the foundation/wall framing below

In engineered construction, lateral loads are transferred from the roof and floor diaphragms, through the shear walls, and eventually down into the foundation. Because most wood structures today are platform framed (i.e., the interior and exterior walls sit on the floor below), special detailing is required to transfer the forces from shear walls above to the walls or foundation below. As previously discussed, it is not always possible to transfer these forces from a shear wall above directly to the rim board below because of the possibility of splitting the framing forming the rim board.

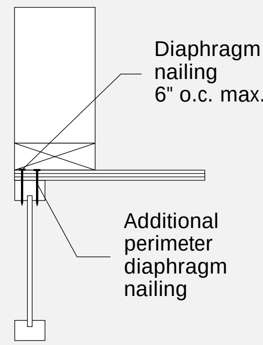
DETAIL A1

DIAPHRAGM PERIMETER NAILING (APPENDIX A) – APA RIM BOARD



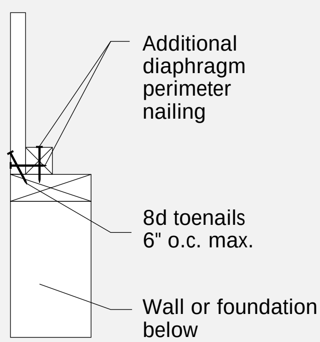
DETAIL A2

DIAPHRAGM PERIMETER NAILING (APPENDIX A) – APA I-JOIST RIM BOARD



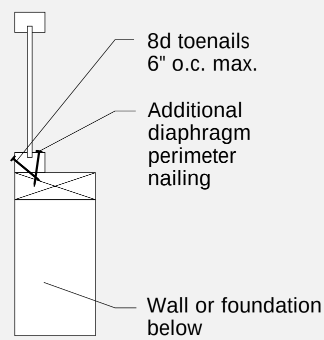
DETAIL B1

DIAPHRAGM PERIMETER NAILING (PANEL-TO-LUMBER, APPENDIX A; LUMBER-TO-LUMBER, APPENDIX B) – APA RIM BOARD



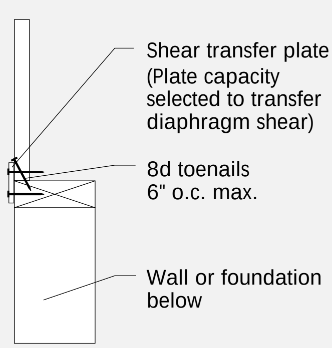
DETAIL B2

DIAPHRAGM PERIMETER NAILING (APPENDIX B) – APA I-JOIST RIM BOARD



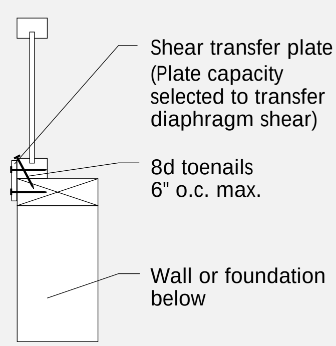
DETAIL B3

DIAPHRAGM PERIMETER NAILING USING FRAMING ANCHORS (APPENDIX C) – APA RIM BOARD



DETAIL B4

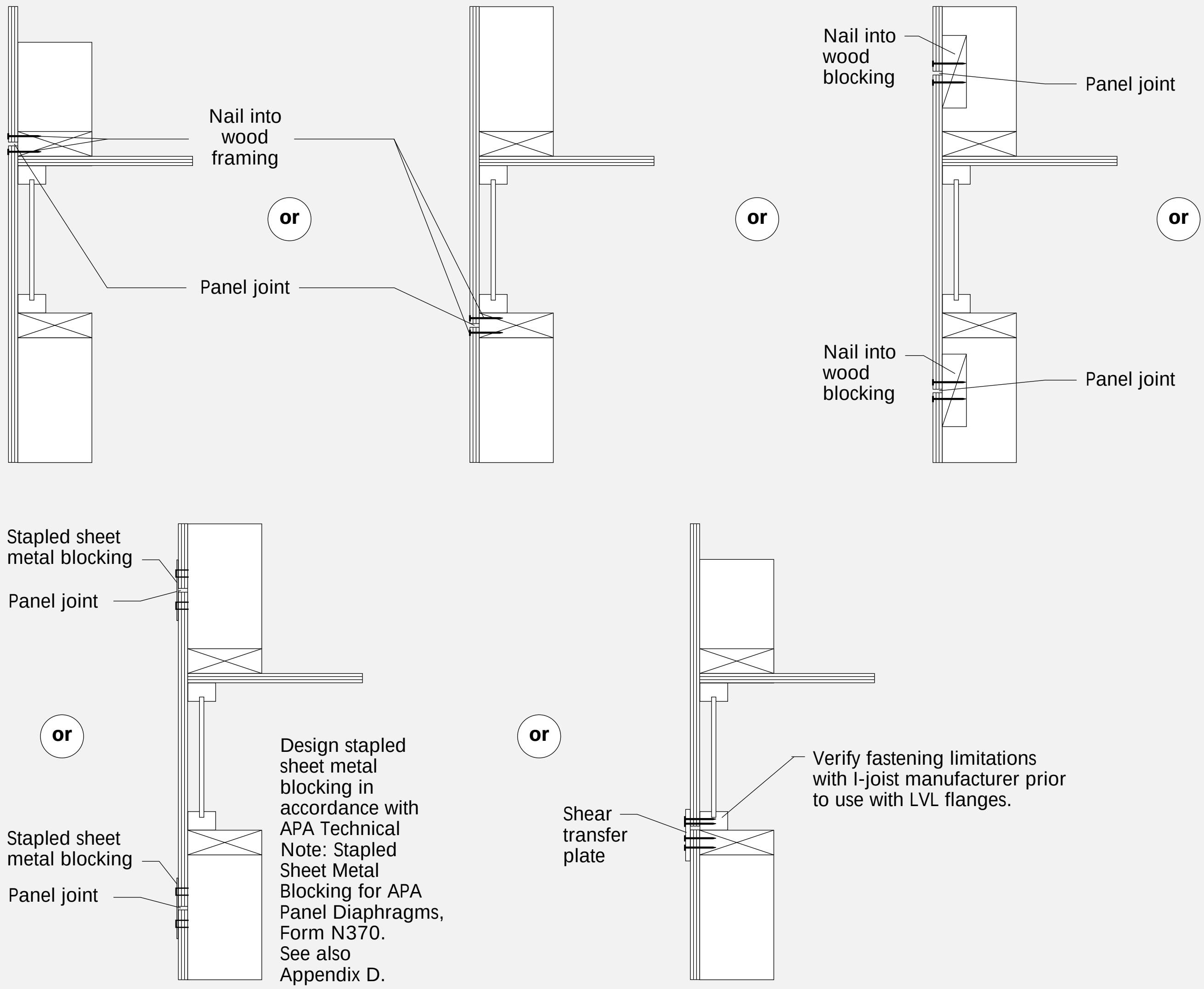
DIAPHRAGM PERIMETER NAILING USING FRAMING ANCHORS (APPENDIX C) – APA I-JOIST RIM BOARD



Note: Place shear transfer plates between toe nails to prevent splitting of framing.

DETAIL C1

TRANSFER OF SHEAR WALL FORCES BETWEEN FLOORS (PANEL-TO-LUMBER, APPENDIX A; METAL CONNECTORS-TO-LUMBER, APPENDIX B; SHEET METAL BLOCKING, APPENDIX D) – APA I-JOIST RIM BOARD

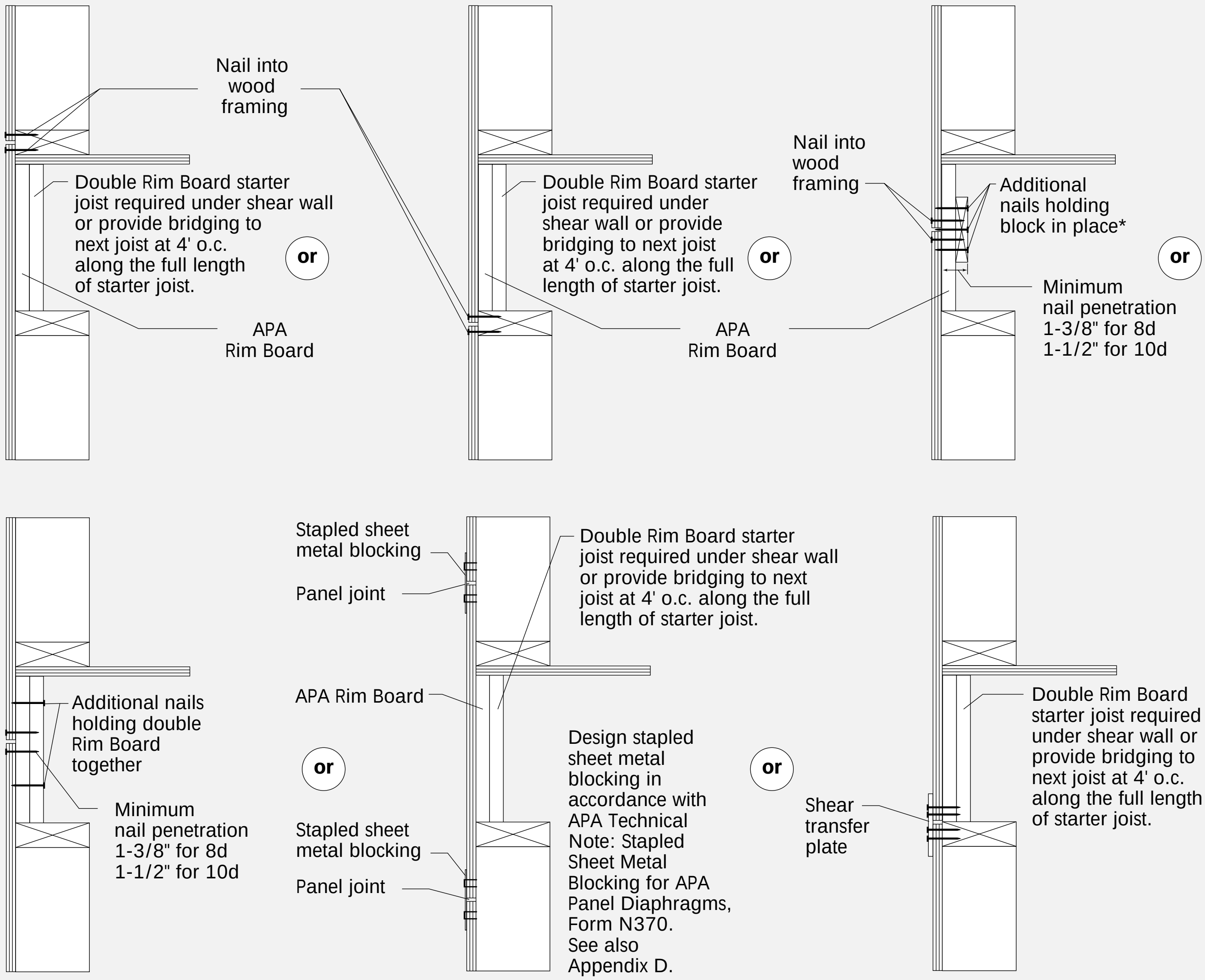


For this reason, various methods have been developed to safely transfer forces around this critical connection. Details C1 and C2 follow the same pattern, in that they provide for all shear panel edges to occur over and be attached to common framing. Note that prior to making connections into the side of LVL flanges at engineered wood I-joists, the I-joist manufacturers should be contacted for fastener limitations. If connections are made at the web of the I-joist or at an APA Rim Board, backer blocking should be attached to insure minimum nail penetration into framing (8d shear nailing requires 1-3/8" while 10d nailing requires 1-1/2"). (See Appendices A and B for nail capacities.)

Similar attachment must be provided in those areas when shear wall shear transfer nailing is not accommodated by the fastener details described in Details C1 and C2. Detail C3 shows the transfer of shear wall forces "around" the floor-diaphragm-to-rim-board connection and directly into the rim board itself. At the bottom of the rim board additional nailing is required to transfer the shear wall forces into the foundation below. In Details C4 and C5 these shear wall forces are shown being transferred directly into the sill plate. (See Appendices A and B for nail capacities.)

DETAIL C2

TRANSFER OF SHEAR WALL FORCES BETWEEN FLOORS (PANEL-TO-LUMBER, APPENDIX A; METAL CONNECTORS-TO-LUMBER, APPENDIX B; SHEET METAL BLOCKING, APPENDIX D) – APA RIM BOARD



*Engineering analysis using European Yield Method (*1991 National Design Specification,* American Forest and Paper Association) may prove additional blocking unnecessary. If shear wall occurs over starter joist, double rim board may take place of additional blocking.

Framing Anchors

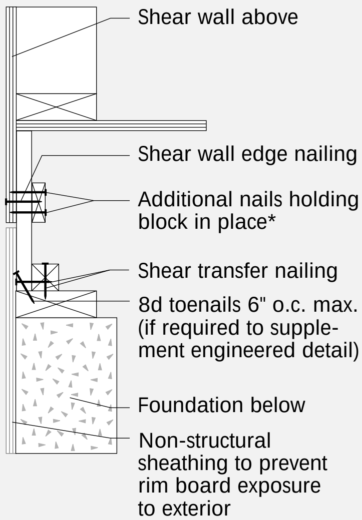
In addition to the direct attachment methods, framing anchors may also be used to transfer forces between the various elements of the structural frame. It is important to install all framing anchors in accordance with manufacturer’s recommendations. If necessary to nail into I-joist flanges parallel to the gluelines when installing framing anchors, check with the I-joist manufacturer for nailing limitations. (See Appendix C for nail capacities.)

Design Example

An engineer is tasked with designing a two-story, platform-framed wood structure with a tile roof. As the structure is located in an area of high seismicity (Zone 4) and because of the mass of the roof, it is determined that the shear walls sitting on the second floor have a design

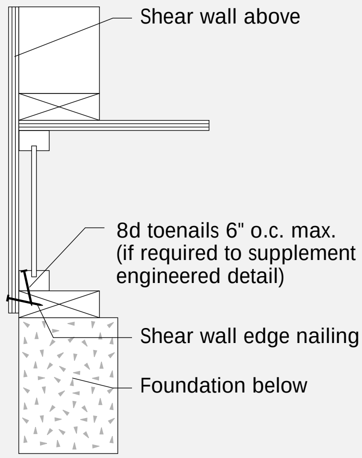
DETAIL C3

TRANSFER OF SHEAR WALL FORCES AT FOUNDATION (APPENDIX A) – APA RIM BOARD



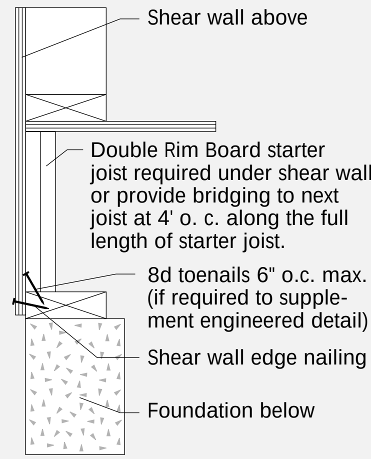
DETAIL C4

TRANSFER OF SHEAR WALL FORCES AT FOUNDATION (APPENDIX A) – APA I-JOIST RIM BOARD



DETAIL C5

TRANSFER OF SHEAR WALL FORCES AT FOUNDATION (APPENDIX A) – APA RIM BOARD



*Engineering analysis using European Yield Method (*1991 National Design Specification,* American Forest and Paper Association) may prove additional blocking unnecessary. If shear wall occurs over starter joist, double rim board may take place of additional blocking.

requirement of 380 pounds per foot. The shear load along the edge of the second floor diaphragm parallel to the shear wall in question is 175 pounds per linear foot in the direction under consideration.

Since the capacity of the APA Performance Rated Rim Board with the minimum code-required nailing is 180 pounds per linear foot, no additional fastening is required at the perimeter of the diaphragm along this edge.

The engineer has selected 7/16 inch OSB for use as wall sheathing. Because all of the capacity at the floor sheathing-to-rim board connection available to transfer the diaphragm shear has been effectively utilized, the engineer knows that it is important not to apply any additional load to that connection. As such, it is decided to use the wall sheathing to transfer the shear wall forces “around” the rim board utilizing one of the methods shown in Detail C2.

The third option in Detail C2 is selected. The shear walls are being attached with 8d nails. The engineer decides to use this same size nail to transfer the shear stresses between floors as follows:

- With 7/16-inch-thick APA OSB wall sheathing (a side member 7/16" thick) and a main member made up of two layers of 1-1/8 inch APA OSB Rim Board (a depth of penetration of 1-3/8 inches is required to develop the nail capacities) an unadjusted single nail capacity of 73 pounds per nail can be found in Appendix A.
- Applying the adjustment factor for seismic applications (Appendix A, Footnote c) the design capacity of single fastener equals 73 x 1.6 = 117 pounds per fastener.
- Number of fasteners required per foot = 380/117 = 3.25 fasteners per foot.
- Distance between fasteners = 12/3.25 = 3.69 inches. *Use 3 inches on center*.

Had it been decided to use the first option in Detail C2 and the bottom plate was spruce-pine-fir the calculations would be as follows:

- With 7/16-inch-thick OSB wall sheathing (a side member 7/16" thick) and a spruce-pine-fir main member, an unadjusted single nail capacity of 67 pounds per nail can be found in Appendix A.
- Applying the adjustment factor for seismic applications (Appendix A, Footnote c) the design capacity of single fastener equals 67 x 1.6 = 107 pounds per fastener.
- Number of fasteners required per foot = 380/107 = 3.55 fasteners per foot.
- Distance between fasteners = 12/3.55 = 3.38 inches. *Use 3 inches on center.*

APPENDIX A

FACE NAIL CAPACITIES FOR ATTACHMENT OF WOOD STRUCTURAL PANELS (LB/NAIL)
(Use for transfer-of-shear nailing shown in Details A1 or A2, B1, and C1, C2, C3, C4, or C5.)

Nail Size (length x diameter)	Specific Gravity of MAIN MEMBER (G)	Thickness of Wood Structural Panel SIDE MEMBER (in.)				
		5/16	3/8	7/16	15/32	19/32
8d (2-1/2" x 0.131")	G ≥ 0.50	110	114	117	118	128
	0.50 > G ≥ 0.46	107	109	112	115	125
	0.46 > G ≥ 0.42	102	104	107	110	120
10d (3" x 0.148")	G ≥ 0.50	133	136	139	141	152
	0.50 > G ≥ 0.46	128	131	134	136	147
	0.46 > G ≥ 0.42	123	125	128	131	141

Notes:

1. Nail penetration into the main member of 1-3/8" for 8d nails and 1-1/2" for 10d nails is required to use the values listed above.
2. The Main Member is the member that receives the point of the fastener. The Side Member is the member that supports the head of the fastener.
3. Values given above include a 1.6 duration of load adjustment for high wind and seismic design. (Subject to local code variations.)
4. Main Member OSB values are based on Douglas fir-Larch species.
5. Main Member Structural I plywood values are based on Douglas fir-Larch species. Main Member Plywood Rated Sheathing values are based on plywood with an effective specific gravity of 0.42.
6. Side Member wood structural panel values are appropriate for all grades of plywood and OSB.
7. Above calculations are based on the 1997 edition of the National Design Specification for Wood Construction (NDS), except as noted in Note 1.
8. Specific Gravity (G) of common framing members:

Species	G
Douglas fir-Larch	0.50
Hem-Fir	0.43
Englemann Spruce-Lodgepole Pine (MSR 1650f and higher)	0.46
Southern Pine	0.55
Spruce-Pine-Fir	0.42
Spruce-Pine-Fir (E of 2,000,000 and greater MSR and MEL)	0.50
Structural I Plywood	≥0.50
OSB	≥0.50
Plywood Rated Sheathing	≥ 0.42

9. When the Main Member is an LVL I-joist flange, contact I-joist supplier for appropriate specific gravity.

FACE-NAIL CAPACITIES FOR I-JOIST FLANGES AND LUMBER FRAMING (LB/NAIL)
(Use for transfer-of-shear nailing shown in Details B1, B2, and C3.)

Nail Size (length x diameter)	Specific Gravity of SIDE MEMBER (G)	Specific Gravity of MAIN MEMBER (G)	Thickness of SIDE MEMBER (in.)				
			1	1-1/8	1-1/4	1-3/8	1-1/2
8d (2-1/2" x 0.131")	G ≥ 0.50	G ≥ 0.50	149	136	123	112	99
		0.50 > G ≥ 0.46	142	131	118	107	94
		0.46 > G ≥ 0.42	136	125	114	102	88
	0.50 > G ≥ 0.46	G ≥ 0.50	142	131	118	107	94
		0.50 > G ≥ 0.46	138	126	115	102	91
		0.46 > G ≥ 0.42	131	120	109	99	86
	0.46 > G ≥ 0.42	G ≥ 0.50	133	125	114	102	91
		0.50 > G ≥ 0.46	130	120	109	99	88
		0.46 > G ≥ 0.42	126	115	106	94	83
10d (3" x 0.148")	G ≥ 0.50	G ≥ 0.50	189	189	186	173	158
		0.50 > G ≥ 0.46	181	181	178	165	154
		0.46 > G ≥ 0.42	173	173	170	157	146
	0.50 > G ≥ 0.46	G ≥ 0.50	181	181	178	165	154
		0.50 > G ≥ 0.46	174	174	171	160	147
		0.46 > G ≥ 0.42	166	166	165	152	141
	0.46 > G ≥ 0.42	G ≥ 0.50	162	173	170	157	146
		0.50 > G ≥ 0.46	158	166	165	152	141
		0.46 > G ≥ 0.42	154	170	157	146	134

Notes:

1. Nail penetration into the main member of 1-1/2" for 8d nails and 1-5/8" for 10d nails is required to use the values listed above.
2. The Main Member is the member that receives the point of the fastener. The Side Member is the member that supports the head of the fastener.
3. Values given above include a 1.6 duration of load adjustment for high wind and seismic design. (Subject to local code variations.)
4. Above calculations are based on the 1997 edition of the National Design Specification for Wood Construction (NDS), except as noted in Note 1.
5. Specific Gravity (G) of common framing members:

Species	G
Douglas fir-Larch	0.50
Hem-Fir	0.43
Englemann Spruce-Lodgepole Pine (MSR 1650f and higher)	0.46
Southern Pine	0.55
Spruce-Pine-Fir	0.42
Spruce-Pine-Fir (E of 2,000,000 and greater MSR and MEL)	0.50
Structural I Plywood	≥ 0.50
OSB	≥ 0.50
Plywood Rated Sheathing	≥ 0.42

6. When the Main Member is an LVL I-joist flange, contact I-joist supplier for appropriate specific gravity.

CAPACITIES OF NAILED CONNECTIONS WITH METAL SIDE PLATES
(Use for transfer-of-shear nailing shown in Details B3, B4, C1, and C2, in accordance with manufacturer's recommendations.)

Nail Size (length x diameter)	Thickness/Gage of Metal Side Plates	Specific Gravity of MAIN MEMBER (G)	Thickness of Lumber Main Member (in.)				
			1	1-1/8	1-1/4	1-3/8	1-1/2
8d (2-1/2" x 0.131")	3/64" [18 gage]	G ≥ 0.50	94	106	118	130	141
		0.50 > G ≥ 0.46	88	99	110	122	133
		0.46 > G ≥ 0.42	82	91	102	112	122
	1/16" [16 gage]	G ≥ 0.50	96	107	120	131	144
		0.50 > G ≥ 0.46	90	101	112	123	134
		0.46 > G ≥ 0.42	83	93	104	114	123
	5/64" [14 gage]	G ≥ 0.50	98	109	122	134	146
		0.50 > G ≥ 0.46	91	102	114	125	138
		0.46 > G ≥ 0.42	85	94	106	117	126
10d (3" x 0.148")	3/64" [18 gage]	G ≥ 0.50	101	114	126	139	152
		0.50 > G ≥ 0.46	94	106	118	130	142
		0.46 > G ≥ 0.42	86	98	109	120	131
	1/16" [16 gage]	G ≥ 0.50	102	115	128	141	154
		0.50 > G ≥ 0.46	96	107	120	131	142
		0.46 > G ≥ 0.42	88	99	110	122	133
	5/64" [14 gage]	G ≥ 0.50	104	117	130	142	155
		0.50 > G ≥ 0.46	98	109	122	133	146
		0.46 > G ≥ 0.42	90	101	112	123	134

Notes:

1. The dowel bearing strength of steel = 45 ksi.
2. The Main Member is the member that receives the point of the fastener. The Side Plate is the member that supports the head of the fastener.
3. Values given above include a 1.6 duration of load adjustment for high wind and seismic design. (Subject to local code variations.)
4. Main Member OSB values are based on Douglas fir-Larch species.
5. Main Member Structural I plywood values are based on Douglas fir-Larch species. Main Member Plywood Rated Sheathing values are based on plywood with an effective specific gravity of 0.42.
6. Above calculations are based on the 1997 edition of the National Design Specification for Wood Construction (NDS).
7. Specific Gravity (G) of common framing members:

Species	G
Douglas fir-Larch	0.50
Hem-Fir	0.43
Englemann Spruce-Lodgepole Pine (MSR 1650f and higher)	0.46
Southern Pine	0.55
Spruce-Pine-Fir	0.42
Spruce-Pine-Fir (E of 2,000,000 and greater MSR and MEL)	0.50
Structural I Plywood	≥0.50
OSB	≥0.50
Plywood Rated Sheathing	≥ 0.42

8. When the Main Member is an LVL I-joist flange, contact I-joist supplier for appropriate specific gravity.

Stapled Sheet Metal Blocking

Recommended design shear values for stapled sheet metal blocking are given in Table D1. Panel edges between framing shall be supported by tongue-and-groove joints or panel clips. Recommendations are also applicable to two-layer systems where edge joints of the top layer are staggered from those of the bottom layer.

Performance is sensitive to staple over-driving, particularly when using 26-gage sheet metal strips. For this reason it is recommended that full inspection of workmanship be considered when sheet metal blocking is used. Staples should be driven so that the staple crown is flush with the top surface of the metal strip. *Install staples with crowns oriented perpendicular to the plywood face grain* or *panel major axis.*

TABLE D1

RECOMMENDED DESIGN SHEAR (LB PER STAPLE)[a]

APA Panel Grade	Gage		Minimum Panel Thickness (in.)				
	Staple	Sheet Metal[b]	5/16	3/8	15/32	19/32	23/32
APA Structural I Rated Sheathing	16	26	16	24	36	51	51
	16	24	16	24	36	51	51
	14[c]	24	–	–	50	75	75
APA Rated Sheathing	16	26	14	22	32	47	51
	16	24	14	22	32	47	51
	14[c]	24	–	–	45	68	75

(a) Based on normal duration of load.

(b) Strips 3" wide.

(c) 14-gage staples through 26-gage metal strips not recommended.

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