Wood Structural Panels Over Metal Framing

DESIGN/CONSTRUCTION GUIDE

APA

WOOD
The Natural Choice

Engineered wood products are a good choice for the environment. They are manufactured for years of trouble-free, dependable use. They help reduce waste by decreasing disposal costs and product damage. Wood is a renewable, recyclable, biodegradable resource that is easily manufactured into a variety of viable products.

A few facts about wood.

▪ ***We're growing more wood every day.*** Forests fully cover one-third of the United States' and one-half of Canada's land mass. American landowners plant more than two billion trees every year. In addition, millions of trees seed naturally. The forest products industry, which comprises about 15 percent of forestland ownership, is responsible for 41 percent of replanted forest acreage. That works out to more than one billion trees a year, or about three million trees planted every day. This high rate of replanting accounts for the fact that each year, 27 percent more timber is grown than is harvested. Canada's replanting record shows a fourfold increase in the number of trees planted between 1975 and 1990.

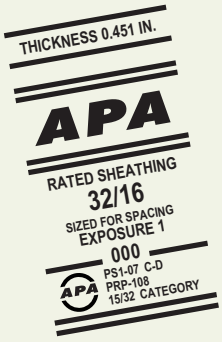
▪ ***Life Cycle Assessment shows wood is the greenest building product.*** A 2004 Consortium for Research on Renewable Industrial Materials (CORRIM) study gave scientific validation to the strength of wood as a green building product. In examining building products' life cycles – from extraction of the raw material to demolition of the building at the end of its long lifespan – CORRIM found that wood was better for the environment than steel or concrete in terms of embodied energy, global warming potential, air emissions, water emissions and solid waste production. For the complete details of the report, visit www.CORRIM.org.

▪ ***Manufacturing wood is energy efficient.*** Wood products made up 47 percent of all industrial raw materials manufactured in the United States, yet consumed only 4 percent of the energy needed to manufacture all industrial raw materials, according to a 1987 study.

Material	Percent of Production	Percent of Energy Use
Wood	47	4
Steel	23	48
Aluminum	2	8

▪ ***Good news for a healthy planet.*** For every ton of wood grown, a young forest produces 1.07 tons of oxygen and absorbs 1.47 tons of carbon dioxide.

Wood: It's the natural choice for the environment, for design and for strong, lasting construction.



NOTICE:
The recommendations in this guide apply only to products that bear the APA trademark. Only products bearing the APA trademark are subject to the Association's quality auditing program.

PANELS APPLIED TO METAL FRAMING OR DECKING

In roof, floor, and wall applications, wood structural panels are often applied directly to metal framing or decking. Wood structural panels have several features that make them an efficient, strong, and durable building material:

- It's easy to fasten wood panels to metal framing.
- Wood structural panels are easy to cut and install. This reduces time and cost in initial construction, simplifies interior finish and mechanical work, and permits modification of the structure later if desired.
- Wood structural panels work well with most metal framing layouts and are readily available.
- Wood structural panels lend themselves to panelized and prefabricated construction, further reducing on-site labor costs.
- Wood structural panels have high shear values for diaphragm roofs and floors, and for shear walls or bracing.
- Wood structural panels add to the thermal insulation of the assembly, virtually eliminating the vapor condensation problems associated with uninsulated metal and concrete roofs, walls and floor surfaces.
- Compared to concrete decks, wood structural panels save time, weight, and mess. Weight savings alone can save substantially on framing costs.

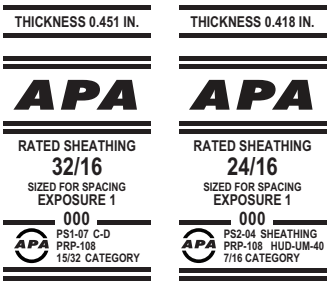
A variety of APA wood structural panels, including plywood and oriented strand board (OSB) can be applied over metal framing. For the applications described here, APA Rated Sheathing or APA Rated Sturd-I-Floor® meet the requirements for structural sheathing and flooring. These APA panels are *performance rated*. APA Performance Rated Panels are manufactured to conform to performance-based standards which provide product performance baselines, such as load-carrying capacity, for designated end uses.

This brochure describes typical assemblies for wood structural panels attached to metal framing in floor, wall, and roof construction.

CONTENTS

WOOD STRUCTURAL PANEL WALL SHEATHING

APA Rated Sheathing easily meets building code requirements for bending and racking strength without diagonal straps. Building paper or a code-recognized weather-resistive barrier is required behind siding (IRC Table R703.4). Rated Sheathing provides an excellent nail base for exterior siding. For information on installing exterior panel siding over nailable sheathing, refer to the *Engineered Wood Construction Guide*, Form E30.



The minimum APA Rated Sheathing thickness recommended for attachment to metal studs is as shown in Table 1.

FIGURE 1

WOOD STRUCTURAL PANEL WALL SHEATHING

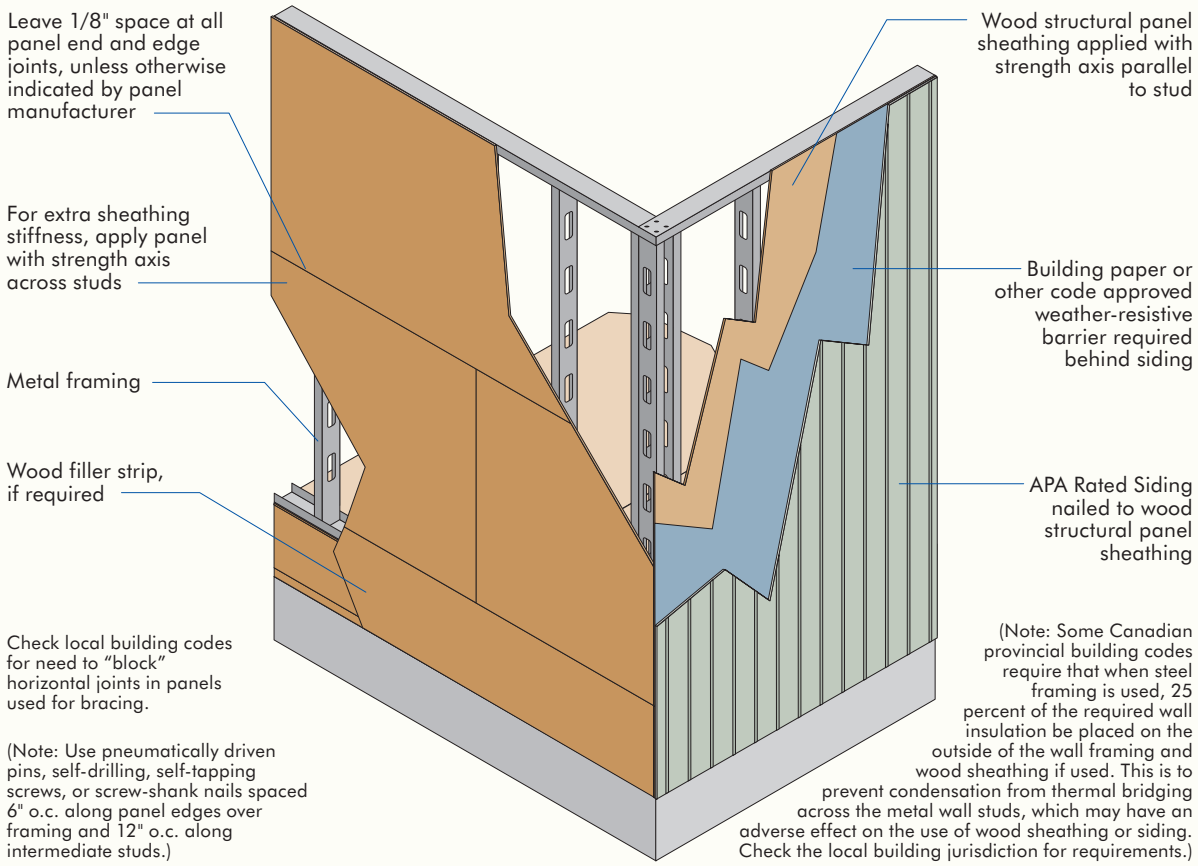


TABLE 1

APA RATED SHEATHING AND ATTACHMENT DIRECT TO METAL STUDS[a][b][c]

Minimum Properties for Attachment Screws[d] (for wind speeds above 85 mph)		Minimum Wood Structural Panel Span Rating	Minimum Nominal Panel Thickness (in.)	Maximum Wall Stud Spacing (in. o.c.)	Panel Fastener Spacing		Maximum Wind Speed (3-second gust) (mph)		
Minimum Head Diameter (in.)	Minimum Withdrawal Capacity from Metal Stud (lb)				Edges (in. o.c.)	Field (in. o.c.)	Wind Exposure Category		
							B	C	D
0.266	43	24/0	3/8	16	6	12	110	90	85
		24/16	7/16	16	6	12	110	100	90
						6	150	125	110
0.281	59	24/16	7/16	16	6	12	130	110	105
						6	150	125	110
				24	6	12	110	90	85
						6	110	90	85

(a) Panel strength axis parallel or perpendicular to supports. Three-ply plywood sheathing with studs spaced more than 16 inches on center shall be applied with panel strength axis perpendicular to supports.

(b) Table is based on wind pressures acting toward and away from building surfaces in accordance with Section 6.4.2.2 of ASCE 7. Lateral requirements shall be in accordance with Chapter 22 of the International Building Code. See fastener manufacturer for lateral design capacities.

(c) Wood structural panels with Span Ratings of Wall-16 or Wall-24 shall be permitted as an alternate to panels with a 24/0 Span Rating. Plywood Siding rated 16 oc or 24 oc shall be permitted as an alternate to panels with a 24/16 Span Rating. Wall-16 and Plywood Siding 16 oc shall be used with studs spaced a maximum of 16 inches on center.

(d) Use only fasteners as recommended by metal-framing manufacturer. Fasteners selected must have the minimum properties as shown in the table above.

FLOOR AND ROOF CONSTRUCTION

In roof construction, wood structural panels are used over metal framing as a nail base for the finish roofing. On floors, the panels are used as a subfloor, combination subfloor/underlayment (APA Rated Sturd-I-Floor), or as an underlayment for the flooring.

In floor construction, if a separate underlayment will be installed, the panel subfloor may be square-edged. For single-floor construction, use APA Rated Sturd-I-Floor 16, 20, 24, 32, or 48 oc with tongue-and-grooved edges. The panels can be manually or machine fastened directly to the metal framing either with hardened screw-shank nails, pneumatically driven pins, or with self-drilling, self-tapping screws.

Formed metal joists are available in a "C" or box section from 14- to 19-gauge sheet steel. Joist sizes usually vary from 1-3/4 inches x 7-1/4 inches to 2 inches x 11-3/8 inches, and can be spaced up to 48 inches o.c. Wood structural panels may also be used over heavier steel bar joists, as shown below.

FIGURE 2

APA RATED SHEATHING OVER JOISTS

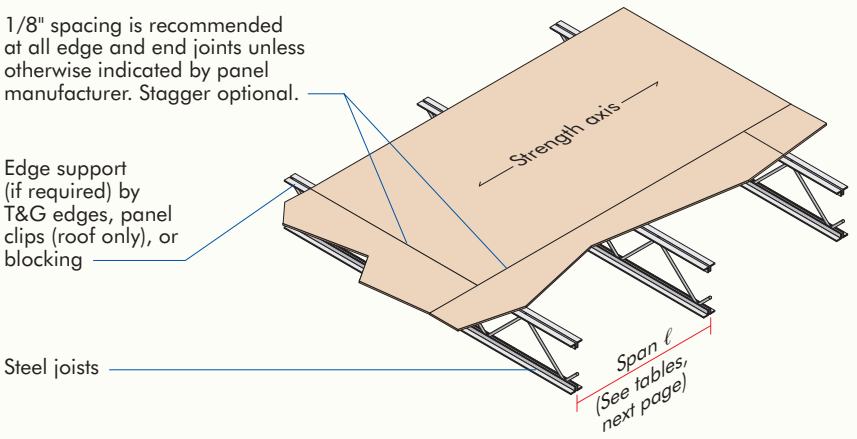
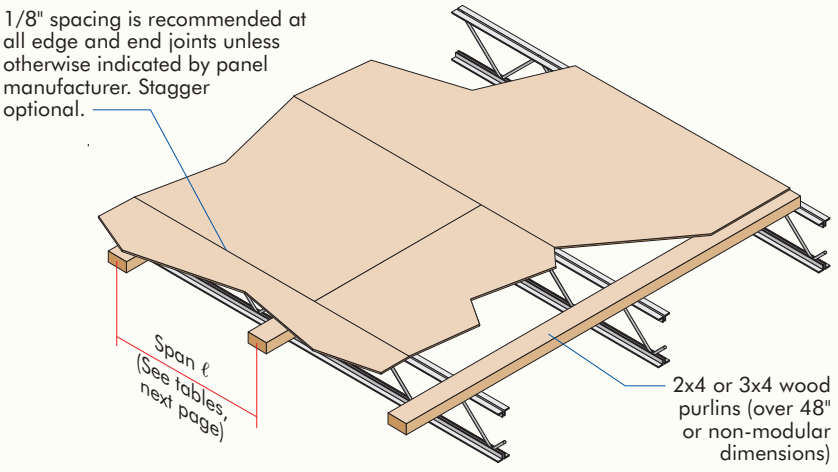


FIGURE 3

WOOD STRUCTURAL PANELS OVER PURLINS



Design Tables

Tables 2–4 are provided to aid the designer in selecting the proper panel for floor applications, while Tables 4 and 5 show panel recommendations for roof applications.

TABLE 2

RECOMMENDED UNIFORM FLOOR LIVE LOADS FOR APA RATED STURD-I-FLOOR AND APA RATED SHEATHING WITH STRENGTH AXIS PERPENDICULAR TO SUPPORTS

Sturd-I-Floor Span Rating	Sheathing Span Rating	Maximum Span (in. o.c.)	Allowable Live Loads (psf)[a] Joist Spacing (in. o.c.) 12	16	20	24	32	40	48
16 oc	24/16, 32/16	16	185	100					
20 oc	40/20	19.2	270	150	100				
24 oc	48/24	24	430	240	160	100			
32 oc	60/32	32		430	295	185	100		
48 oc		48			460	290	160	100	55

(a) 10 psf dead load assumed. Live load deflection limit is l/360.

TABLE 3

APA PANEL SUBFLOORING (APA RATED SHEATHING)[a]

Panel Span Rating	Minimum Panel Thickness (in.)	Maximum Span (in.)	Maximum Fastener Spacing (in. o.c.)[b] Supported Panel Edges	Intermediate Supports
24/16	7/16	16	6	12
32/16	15/32	16	6	12
40/20	19/32	19.2[c]	6	12
48/24	23/32	24	6	12
60/32	7/8	32	6	12

(a) For subfloor recommendations under ceramic tile, refer to the APA *Engineered Wood Construction Guide,* Form No. E30. For subfloor recommendations under gypsum concrete, contact manufacturer of floor topping.

(b) Use fastener recommended by metal-framing manufacturer.

(c) Span may be 24 inches if a minimum 1-1/2 inches of lightweight concrete is applied over panels.

TABLE 4

RECOMMENDED UNIFORM ROOF LIVE LOADS FOR APA RATED SHEATHING[a] AND APA RATED STURD-I-FLOOR WITH STRENGTH AXIS PERPENDICULAR TO SUPPORTS[b]

Panel Span Rating	Minimum Panel Thickness (in.)	Maximum Span (in.)		Allowable Live Loads (psf)[c]							
				Spacing of Supports Center-to-Center (in. o.c.)							
		With Edge Support[d]	Without Edge Support	12	16	20	24	32	40	48	60
APA Rated Sheathing[a]											
12/0	5/16	12	12	30							
16/0	5/16	16	16	70	30						
20/0	5/16	19.2	19.2	120	50	30					
24/0	3/8	24	19.2[e]	190	100	60	30				
24/16	7/16	24	24	190	100	65	40				
32/16	15/32	32	28	325	180	120	70	30			
40/20	19/32	40	32	—	305	205	130	60	30		
48/24	23/32	48	36	—	—	280	175	95	45	35	
60/32[f]	7/8	60	40	—	—	—	305	165	100	70	35
APA Sturd-I-Floor[g]											
16 oc	19/32	24	24	185	100	65	40				
20 oc	19/32	32	32	270	150	100	60	30			
24 oc	23/32	48	36	—	240	160	100	50	30	25	
32 oc	7/8	48	40	—	—	295	185	100	60	40	
48 oc	1-3/32	60	48	—	—	—	290	160	100	65	40

(a) Includes APA Rated Sheathing/Ceiling Deck.

(b) Applies to panels 24 inches or wider applied over two or more spans.

(c) 10 psf dead load assumed.

(d) Tongue-and-groove edges, panel edge clips (one midway between each support, except two equally spaced between supports 48 inches on center), lumber blocking, or other. For low slope roofs, see Table 5.

(e) 19.2 inches for 3/8-inch and 7/16-inch panels. 24 inches for 15/32-inch and 1/2-inch panels.

(f) Contact supplier for availability.

(g) Also applies to C-C Plugged grade plywood.

TABLE 5

RECOMMENDED MAXIMUM SPANS FOR APA PANEL ROOF DECKS FOR LOW SLOPE ROOFS[a] (Panel strength axis perpendicular to supports and continuous over two or more spans)

Grade	Minimum Nominal Panel Thickness (in.)	Minimum Span Rating	Maximum Span (in.)	Panel Clips Per Span[b] (number)
APA RATED SHEATHING	15/32	32/16	24	1
	19/32	40/20	32	1
	23/32	48/24	48	2
	7/8	60/32	60	2
APA RATED STURD-I-FLOOR	19/32	20 oc	24	1
	23/32	24 oc	32	1
	7/8	32 oc	48	2

(a) Low slope roofs are applicable to built-up, single-ply and modified bitumen roofing systems. *For guaranteed or warranted roofs contact membrane manufacturer for acceptable deck.*

(b) Edge support may also be provided by tongue-and-groove edges or solid blocking.

Fastener Schedules

When attaching wood structural panels to metal decking, the main purpose of the fasteners is to keep the panels flat. The fastener schedule should be at least the same as if the panel was applied to framing that is spaced in accordance with the panel's Span Rating. For example, a Rated Sheathing panel with a Span Rating of 32/16 should have fasteners spaced at 6 inches o.c. along the 4-foot ends and at 12 inches o.c. along lines spaced 32 inches o.c. between the panel ends (28 fasteners per panel). See Figure 4. If wind uplift is a consideration, additional fasteners may be required.

FIGURE 4

ROOF FASTENER SPACING FOR APA RATED SHEATHING PANEL AT PANEL EDGES AND IN PANEL FIELD (32 Span Rating shown as an example)

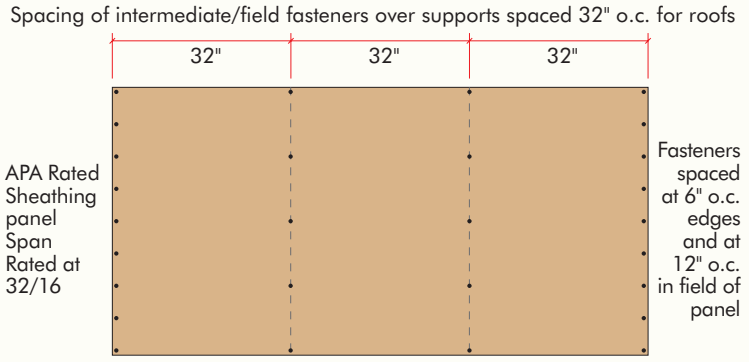


FIGURE 5

FLOOR FASTENER SPACING FOR APA RATED SHEATHING PANEL AT PANEL EDGES AND IN PANEL FIELD (16 Span Rating shown as an example)

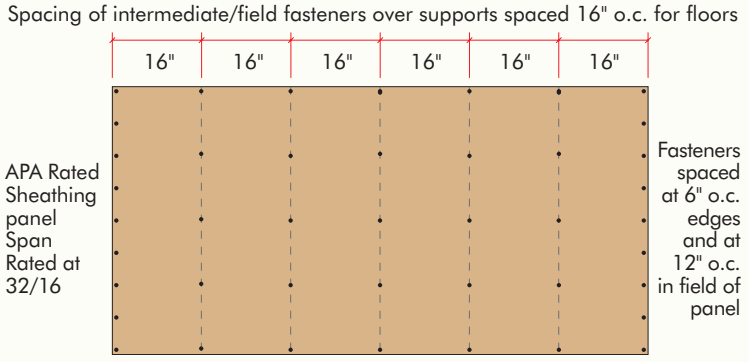


TABLE 6

RECOMMENDED MINIMUM FASTENING SCHEDULE FOR APA PANEL ROOF SHEATHING (Increased fastener schedules may be required in high wind or seismic zones)

Panel Thickness[b] (in.)	Fasteners[c] Maximum Spacing (in.)	
	Panel Edges	Intermediate
5/16 to 1	6	12[a]
1-1/8	6	12[a]

(a) For spans 48 inches or greater, space fasteners 6 inches at all supports.

(b) For stapling asphalt shingles to 5/16-inch and thicker panels, use staples with a 15/16-inch minimum crown width and a 1-inch leg length. Space according to shingle manufacturer's recommendations.

(c) Use fastener recommended by metal-framing manufacturer.

FASTENERS

Self-drilling, Self-tapping Screws

Contractors report self-drilling, self-tapping fasteners cut installation time in heavier gage studs by about 60 percent compared with conventional screws. These fasteners commonly are used to attach panels up to 1-1/8 inch thick to steel flanges up to 3/16 inch thick. However, since shank threads usually are provided on only a portion of self-drilling, self-tapping type fasteners (and screw-shank nails), it's important to specify the appropriate fastener length for a given panel thickness so that the threaded portion of the shank engages the steel framing. Several lengths and styles are available. Details may be obtained from fastener manufacturers.

Pneumatically-driven Steel Pins

Details and code approvals may be obtained from pin manufacturers.

Screw-shank Nails

Screw-shank nails can be used to fasten wood structural panels to lighter members, such as formed-steel joists. The nail must be long enough to assure proper attachment to the steel framing.

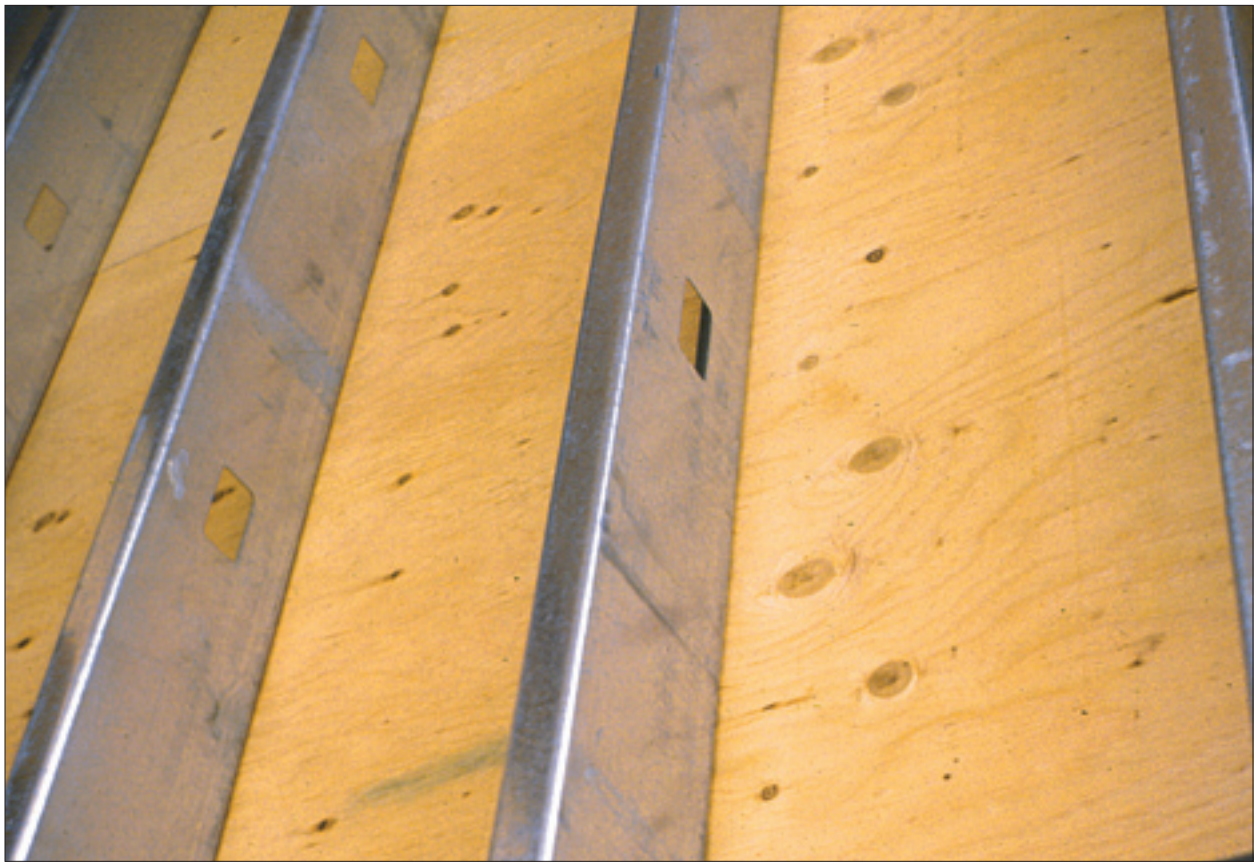
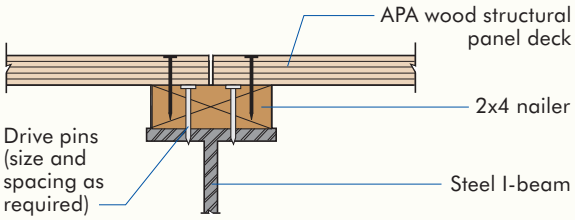


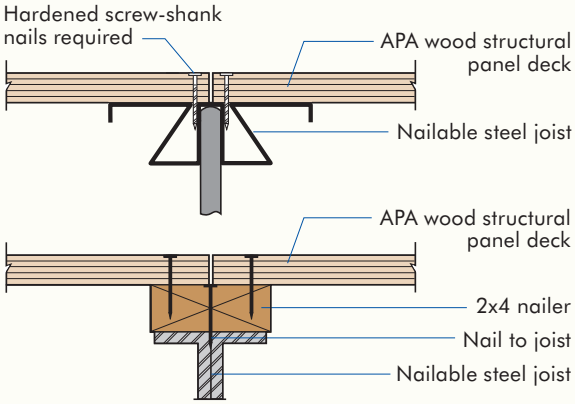
FIGURE 6

FASTENER RECOMMENDATIONS

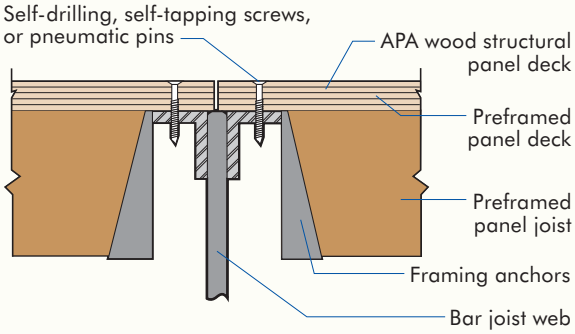
Nailer Anchored with Power Driven Fasteners



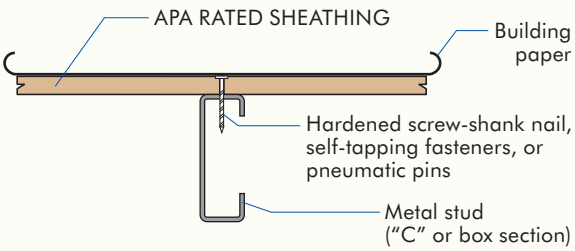
Panel Nailed to Nailable Steel Joists



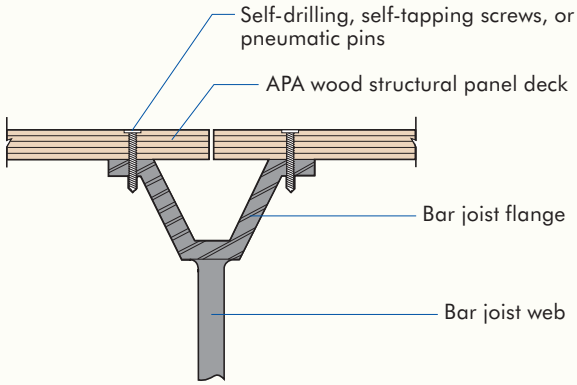
Preframed Panels Attached to Widely Spaced Joists



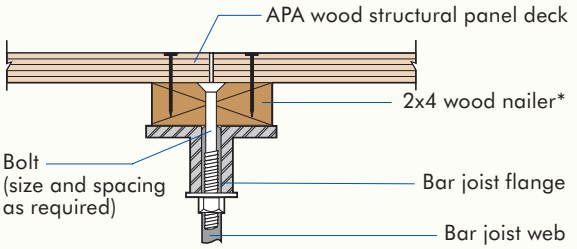
Wall Panel Attached Directly to Formed Steel Stud



Panel Attached Directly with Screws

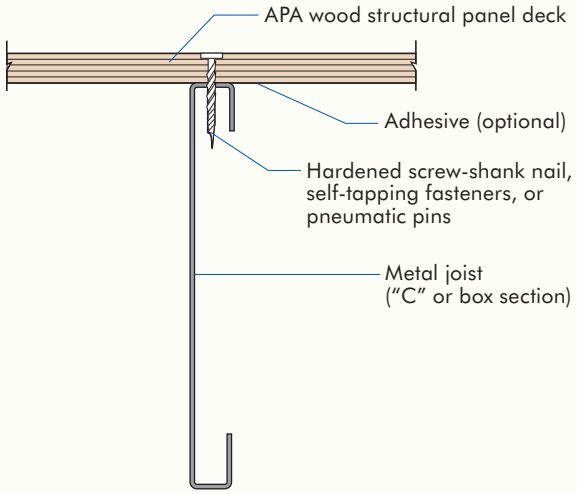


Nailer Bolted to Steel Joist



*Nailers installed across joists are suggested where non-modular spacings are used.

Floor Panel Attached Directly to Formed Steel Joist



ABOUT APA

APA is a nonprofit trade association whose member mills produce approximately 70 percent of the structural wood panel products manufactured in North America.

Founded in 1933 as the Douglas Fir Plywood Association and widely recognized today as the voice of the structural wood panel industry, APA performs numerous functions and services on behalf of panel product users, specifiers, dealers, distributors, schools, universities, and other key groups.

Among the most important of these functions is quality auditing. The APA trademark appears only on products manufactured by APA member mills and is the manufacturer's assurance that the product conforms to the standard shown on the trademark. For panels, that standard may be an APA performance standard, *Voluntary Product Standard PS 1-07, Structural Plywood* or *Voluntary Product Standard PS 2-04, Performance Standard for Wood-Based Structural-Use Panels.* APA maintains three quality testing laboratories in key producing regions, and a 42,000-square-foot research center at Association headquarters in Tacoma, Washington.

But quality validation is only one of APA's many functions. The Association also:

- Operates the most sophisticated program for basic panel research in the world.
- Maintains an international network of field representatives to assist panel product users, specifiers, dealers, distributors, and other segments of the trade.
- Conducts informational buyer and specifier seminars and provides dealer and distributor sales training.
- Publishes a vast inventory of literature on panel grades, applications, design criteria, and scores of other topics.
- Advertises and publicizes panel product systems and applications in national trade and consumer magazines.
- Works to secure acceptance of structural wood panel products and applications by code officials, insuring agencies and lending institutions.
- Develops and maintains industry performance and product standards.
- Conducts in-depth market research and development programs to identify and penetrate new panel markets.
- Works in conjunction with other wood product industry organizations on solutions to problems of common concern.

Always insist on panels bearing the ***mark of quality –*** the APA trademark. Your APA panel purchase or specification is your highest assurance of quality. It is also an investment in the many trade services and programs that APA undertakes on your behalf.

For More Information

For additional information on APA wood construction systems, contact APA, 7011 So. 19th Street, Tacoma, Washington 98466, or call the APA Product Support Help Desk at (253) 620-7400. APA's web site at **www.apawood.org** is your link to in-depth design and building support, including a library of more than 400 publications available for instant PDF download or hard-copy purchase.

Wood Structural Panels Over Metal Framing

We have field representatives in many major U.S. cities and in Canada
who can help answer questions involving APA trademarked products.
For additional assistance in specifying engineered wood products, contact us:

APA HEADQUARTERS

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APA

REPRESENTING THE ENGINEERED WOOD INDUSTRY