

ICC-ES Evaluation Report

ESR-2934

Reissued October 1, 2010

This report is subject to re-examination in one year.

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**DIVISION: 06 00 00—WOOD, PLASTICS AND
COMPOSITES**
Section: 06 17 36—Metal-Web Wood Joists
REPORT HOLDER:
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EVALUATION SUBJECT
SSW OPEN WEB TRUSSES
1.0 EVALUATION SCOPE
Compliance with the following codes:

- 2006 *International Building Code*® (IBC)
- 2006 *International Residential Code*® (IRC)

Properties evaluated

- Structural
- Fire resistance

2.0 USES

The SSW Trusses are used as structural members in both fire-resistance-rated and nonfire-resistance-rated roof and floor assemblies.

3.0 DESCRIPTION
3.1 General:

The SSW Open Web Trusses are Warren-style, pin-connected trusses that have parallel, tapered, double-tapered, or pitched-chord members. The trusses have wood chords, steel webs, bearing clips and steel pin web-chord connectors. There are six versions of the truss: SSW-42 Truss, SSW-43 Truss, SSW-44 Truss, SSW-62 Truss, and SSW-64 Truss. See Table 1 for a description of truss components. The trusses are as follows (the “H” suffix indicates a chord grade of 2850F-2.3E MSR lumber material):

- **SSW-42 and SSW-42H Truss:** The chords are nominally 2-by-4 [actual dimensions are 1½ inches by 3½ inches (38 mm by 89 mm)] solid-sawn lumber. The webs are steel tubing with pressed ends.

- **SSW-43 and SSW-43H Truss:** The chords are laminated machine stress rated (MSR) lumber with cross-sectional dimensions of 2½ inches by 3½ inches (54 mm by 89 mm). The webs are steel tubing with pressed ends.
- **SSW-44 and SSW-44H Truss:** The chords are laminated MSR lumber with cross-sectional dimensions of 3 inches by 3½ inches (76 mm by 89 mm). The webs are steel tubing with pressed ends.
- **SSW-62 and SSW-62H Truss:** The chords are solid-sawn MSR lumber with cross-sectional dimensions of 1½ inches by 5¼ inches (38 mm by 133 mm). The webs are steel tubing with pressed ends.
- **SSW-64 Truss:** The chords are laminated MSR lumber with cross-sectional dimensions of 3 inches by 5¼ inches (76 mm by 133 mm). The webs are steel tubing with pressed ends.

3.2 Materials:

3.2.1 Chords: The chords consist of either solid-sawn lumber or laminated lumber and have glued finger joints, which are manufactured and sample-tested daily in accordance with the manufacturer’s quality control manual, to form continuous chord members. Chords have routs in the wide face to accept web members, and the routs meet the tolerance requirements specified in the Standard Structures quality control manual.

3.2.1.1 Solid-sawn Lumber: Lumber is machine stress rated (MSR). Lumber grades meet the grading rules specified in the applicable codes, Table 4C of the NDS, and the Standard Structures quality control manual.

3.2.1.2 Laminated Lumber: Laminated chords are manufactured from laminated MSR lumber meeting ANSI A 190.1 requirements. Each piece of ripped laminated chord material meets visual grading rules specified in the Standard Structures quality control manual.

3.2.2 Webs: Web members consist of steel tubing conforming to ASTM A787-05 or ASTM A 513-08a, with minimum yield and tensile strength per the Standard Structures quality control manual.

3.2.3 Pin Connectors: The pins are available in 3½-inch and 5¼-inch (89 mm and 133 mm) lengths and have ⅜-inch, ⅝-inch, or ¾-inch (9.5 mm, 15.9 mm, or 19.1 mm) diameters. The ⅜-inch-diameter pins conform to SAE J429 Grade 5 specifications and the ⅝-inch- and ¾-inch-diameter pins conform to SAE J429 Grade 2 specifications, with minimum yield and tensile strengths as set forth in the Standard Structures quality control and procedures

manual. Standard Structures may substitute bolts of equal or greater strength and size for pins used for joining the webs to the chords.

3.2.4 Bearing Clips: Bearing clips are 0.095-inch-thick (2.4 mm), cold-formed, ASTM A 653 Type SS, Grade 40 steel.

3.2.5 Ridge Connector: The ridge connector is designed to resist axial compressive loads by direct bearing on the ridge connector seat. Axial tension forces located at the ridge of the top chord are resisted by the installation of holes, prepunched to accept six $1/4$ -by- $1\frac{1}{2}$ -inch (6.4 mm by 38 mm) screws, provided by the manufacturer, in each side of the ridge into the top chords of the truss. Ridge connectors are welded ASTM A 36 steel having a minimum yield strength of 36 ksi (248 MPa) and a minimum tensile strength of 58 ksi (400 MPa). The ridge connectors are factory-installed to one side of the truss, and the remaining connector bolts are provided for field installation as applicable to the design requirements. See Table 7 for ridge connector allowable axial loads.

4.0 DESIGN AND INSTALLATION

4.1 General:

Installation of SSW Open Web Trusses must comply with the applicable code requirements, the manufacturer's published installation instructions, and this report. The manufacturer's published installation instructions must be available at the jobsite at all times during installation.

4.2 Design:

Design of SSW Open Web Trusses must be in accordance with the applicable code requirements, accepted truss design principles, and the following requirements:

4.2.1 Chord Members: Refer to Table 2 of this report for section properties; refer to Table 3 of this report for the maximum allowable chord unit stresses. The top chord may be reinforced with a strip of $3/8$ -inch-thick (9.53 mm) or $1/2$ -inch-thick (12.7 mm), Exposure 1, rated plywood or OSB complying with DOC PS1 or DOC PS-2, as applicable, factory-glued to the top of the chord. The strip covers the full length of the top chord for the entire length of the truss and is used to prevent splitting of the chord caused by the installation of large-diameter or closely spaced nails. The reinforcement thickness is not included in the section properties used in design. The letter "r" in the model designation of the truss type (e.g., SSW-42r or SSW-44Hr) indicates the truss has a reinforced top chord.

4.2.2 Web Members: Refer to Table 4 of this report for the allowable tension and compression loads for web members.

4.2.3 Pin Connectors: The allowable load for the resultant parallel and perpendicular pin loading on the chord member must be determined using the Hankinson formula in accordance with the applicable code. Refer to Table 5 for the maximum allowable pin bearing loads on chord members.

4.2.4 Bearing Assembly: Refer to Table 6 of this report for allowable truss end reactions at supports with bearing clips. See Figure 1 for typical details of the bearing configuration.

4.2.5 Duration of Load: Allowable unit stress for the chords and pin-bearing loads may be adjusted by the load duration factor, C_D , for sawn lumber in accordance with Chapter 16 of the IBC and Section 2.3.2 of the NDS. The load duration factor for pin bearing loads must not exceed 1.33.

4.2.6 Repetitive Member Use: Where the truss installation configuration complies with the design limitations noted in the code for repetitive members, the allowable parallel-to-grain tension and compression stresses noted in Table 3 are permitted to be increased by 7 percent for MSR lumber chords.

4.2.7 Deflection: Deflection of a uniformly loaded truss must be approximated based on a uniformly loaded, simple-span beam-deflection formula. The moment of inertia of the truss must be determined from the geometric configuration of the top and bottom chord members without considering reduced areas from pins or routs.

4.3 Diaphragm Nailing:

When fastening a wood structural panel diaphragm to the top chord of all SSW series trusses, except for the SSW-44 and SSW-64, with 10d common nails closer than 3 inches (76 mm) on center in a row, trusses with a reinforced top chord, as described in Section 4.2.1, must be used.

The diaphragm nailing values in the applicable code are provided for wood material with a minimum specific gravity of 0.50. The SSW series of open web trusses conform to this requirement as confirmed in the Standard Structures quality control and procedures manual.

4.4 Fastener installation:

Fastener and diaphragm values must be determined using allowable design values as determined in the applicable code, the NDS, or an ICC-ES evaluation report for the respective chord material with the specific gravities consistent with those described in Section 4.3 of this report.

4.5 Fire-resistance-rated Assemblies:

Construction details are noted in Figure 2 for the assemblies described below.

4.5.1 One-hour Fire-resistance-rated Roof/Floor-ceiling Assembly: Wood structural panel sheathing, as required by the code, must be installed over SSW Open Web Trusses, spaced a maximum of 24 inches (610 mm) on center. The ceiling must consist of a base layer of $5/8$ -inch-thick (15.9 mm) Type X gypsum wallboard applied at right angles to SSW Open Web Trusses with $1/4$ -inch-long (32 mm), Type S drywall screws, spaced at 24 inches (610 mm) on center. A face layer of $5/8$ -inch-thick (15.9 mm), Type X gypsum wallboard, or Type X veneer base, must be applied at right angles to SSW Open Web Trusses and attached with $1\frac{7}{8}$ -inch (48 mm), Type S drywall screws, spaced at 12 inches (305 mm) on center at joints and intermediate supports. Face-layer joints must be offset 24 inches (610 mm) from base-layer joints. Type G drywall screws, $1\frac{1}{2}$ inches long (38 mm), must be spaced at 12 inches (305 mm) on center and installed 2 inches (51 mm) back from either side of the face-layer end joints. Using the same spacing as for the screw, alternate fasteners are permitted to be $1\frac{1}{8}$ -inch-long (48 mm) 6d cooler, box, or wallboard nails for the base layer, and $2\frac{3}{8}$ -inch-long (60 mm) 8d cooler, box, or wallboard nails for the face layer. Type G drywall screws, $1\frac{1}{2}$ inches long (38 mm), must still be required at the end joints of the face layer. Exposed wallboard joints must be treated with paper tape embedded in joint compound, which then must be covered with two coats of joint compound in accordance with ASTM C 840 and GA-216. Screw heads must be covered with two coats of joint compound.

4.5.2 Other Fire-resistive Assemblies: SSW Open Web Trusses are permitted to be used in lieu of the specified trusses in the one-hour fire-resistance-rated assemblies described in ICC-ES evaluation report [ESR-1338](#).

5.0 CONDITIONS OF USE

The SSW Open Web Trusses described in this report comply with, or are suitable alternatives to what is specified in, those codes listed in Section 1.0 of this report, subject to the following conditions:

- 5.1 Installation must comply with this report, the manufacturer's published installation instructions, and the applicable code. In the event of a conflict between the manufacturer's published installation instructions and this report, this report governs.
- 5.2 Structural design information for the use of Standard Structures Inc. SSW Open Web Trusses must be indicated on the construction documents submitted with the permit application. The construction documents and the design configurations must be consistent with this report, and must be prepared by a registered design professional where required by the statutes of the jurisdiction in which the project is to be constructed.
- 5.3 Cutting of SSW Open Web Truss components is not permitted.

5.4 Evaluation of the SSW Open Web Trusses is limited to interior dry-use conditions. Dry conditions of use for sawn lumber are those conditions of use in which the moisture content remains less than 19 percent.

5.5 The SSW Open Web Trusses are manufactured in Windsor, California, under a quality control program with inspections by APA—The Engineered Wood Association (AA-649).

6.0 EVIDENCE SUBMITTED

Data in accordance with the ICC-ES Acceptance Criteria for Pin-connected Open-web Trusses with Wood Chords and Tubular Steel Webs (AC306), dated April 2007.

7.0 IDENTIFICATION

Each SSW Open Web Truss must be marked with the name of the manufacturer (Standard Structures Inc.); the product trade name; the truss series; the plant number or address; the evaluation report number (ESR-2934); and the name of the inspection agency (APA-EWS).

TABLE 1—COMPONENTS OF SSW TRUSSES

COMPONENTS	
CHORDS	MSR 2400F-2.0E MSR 2850F-2.3E
PINS	$\frac{3}{8}$ " Diameter $\frac{5}{8}$ " Diameter $\frac{3}{4}$ " Diameter
WEBS	1.000"—O.D. 19GA 1.000"—O.D. 16GA 1.000"—O.D. 14GA 1.125"—O.D. 13GA 1.500"—O.D. 13GA 2.000"—O.D. 13GA
BEARINGS CLIPS	Bearing (A-1) Bearing (A-2) Bearing (A-3)
RIDGE CONNECTORS	RC-2 RC-3 RC-4

For SI: 1 inch = 25.4 mm.

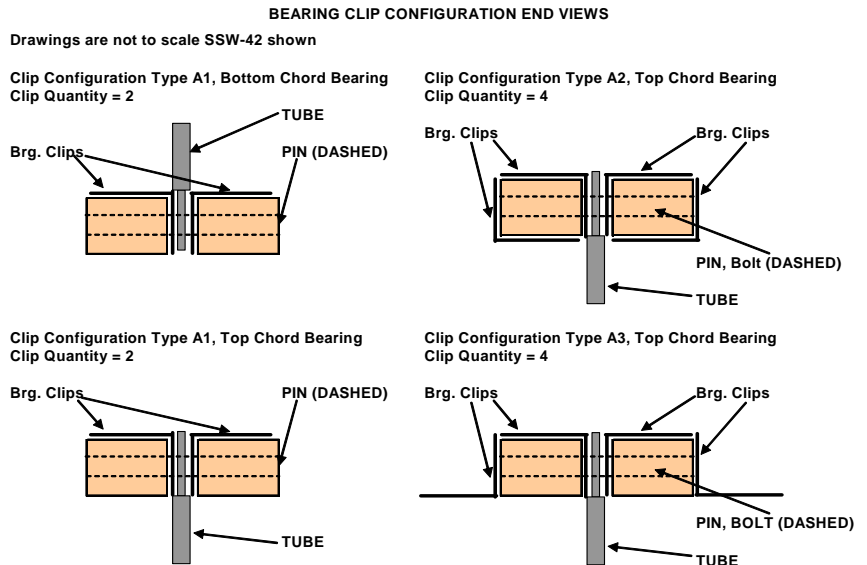


FIGURE 1—BEARING DETAILS FOR SSW TRUSSES

TABLE 2—CHORD SECTION PROPERTIES OF SSW TRUSSES

CHORD SIZE (inches)	PIN DIAMETER (inches)	ROUT WIDTH (inches)	NET AREA (inches ²)		SECTION MODULUS (inches ³)	MOMENT OF INERTIA (inches ⁴)
			TENSION	COMPRESSION		
SSW-42, SSW-42H						
2 x 4 (1½" x 3½")	no pin	no rout	5.2500	5.2500	1.3125	0.9844
	0.3750	0.4300	3.4538	4.6050	1.0793	0.8499
	0.6250	0.4300	2.6863	4.6050	0.9514	0.8010
	0.6250 at Bearing	0.5000	2.6250	4.5000	0.9297	0.7827
SSW-43, SSW-43H						
3 x 4 (2⅛" x 3½")	no pin	no rout	7.4375	7.4375	2.6341	2.7987
	0.3750	0.4300	5.3725	6.5238	2.2385	2.4414
	0.6250	0.4300	4.6050	6.5238	2.1106	2.3924
	0.7500	0.4300	4.2213	6.5238	2.0227	2.3470
	0.6250 at Bearing	0.5000	4.5000	6.3750	2.0625	2.3379
	0.7500 at Bearing	0.5000	4.1250	6.3750	1.9766	2.2935
SSW-44, SSW-44H						
4 x 4 (3" x 3½")	no pin	no rout	10.5000	10.5000	5.2500	7.8750
	0.3750	0.4300	8.0580	9.21000	4.5330	6.8940
	0.6250	0.4300	7.2913	9.21000	4.4051	6.8450
	0.7500	0.4300	6.9075	9.21000	4.3172	6.7996
	0.6250 at Bearing	0.5000	7.1250	9.00000	4.3047	6.6890
0.7500 at Bearing	0.5000	6.7500	9.00000	4.2188	6.6445	
SSW-62, SSW-62H						
2 x 6 (1½" x 5¼")	no pin	no rout	7.8750	7.8750	1.9688	1.4766
	0.3750	0.4300	5.4225	7.2300	1.6945	1.3344
	0.6250	0.4300	4.2175	7.2300	1.4937	1.2576
	0.6250 at Bearing	0.5000	4.1563	7.1250	1.4720	1.2393
SSW-64						
4 x 6 (3" x 5¼")	no pin	no rout	15.750	15.750	7.8750	11.8125
	0.3750	0.4300	12.6525	14.4600	4.4920	6.8863
	0.6250	0.4300	11.4475	14.4600	4.2912	6.8094
	0.7500	0.4300	10.8450	14.4600	4.1531	6.7380
	0.6250 at Bearing	0.5000	11.2813	14.2500	4.1908	6.6534
	0.7500 at Bearing	0.5000	10.6875	14.2500	4.0547	6.5830

For SI: 1 inch = 25.4 mm, 1 square inch = 645 mm², 1 cubic inch = 16,387 mm³.

TABLE 3—ALLOWABLE CHORD UNIT STRESSES OF SSW TRUSSES (psi)

LUMBER GRADE	TENSION PARALLEL TO GRAIN	COMPRESSION PARALLEL TO GRAIN	EXTREME FIBER IN BENDING ¹ (F _b)	MODULUS OF ELASTICITY (E X 10 ⁶)
SSW-42H, SSW-43H, SSW-62H, SSW-44H				
MSR 2850F-2.3E	2,300	2,150	2,850	2.30
SSW-42, SSW-43, SSW-62, SSW-44, SSW-64				
MSR 2400F-2.0E	1,925	1,975	2,400	2.00

For SI: 1 psi = 0.00689 MPa.

¹Flat use factor, C_{FU}, applicable per NDS 4.3.1, Table 4C.

TABLE 4—ALLOWABLE LOADS ON WEB MEMBERS OF SSW TRUSSES

DIAMETER (inches) -GAUGE NUMBER	WALL THICKNESS (inches)	PIN DIAMETER (inches)	COMPRESSION ⁽¹⁾ (lbf)			TENSION (lbf)
			Pin-to-Pin Length (inches)			
			16"	28"	36"	
1.000 - 19	0.038	5/8 3/8	1,590	1,285	1,240	1,440 885
			1,485	1,470	1,190	
1.000 - 16	0.061	5/8 3/8	2,300	2,750	2,055	2,345 2,160
			3,169	2,705	2,320	
1.000 - 14	0.078	5/8	5,370	3,700	2,805	3,530
1.125 - 13	0.095	5/8	7,170	5,775	4,735	4,335
1.500 - 13	0.095	3/4 5/8 5/8	N/A	N/A	N/A	6,775 6,605 5,032 ⁽²⁾
			8,375	7,030	6,495	
			N/A	N/A	7,220	
2.000 - 13	0.095	3/4	N/A	N/A	7,220	7,025

For SI: 1 inch = 25.4 mm, 1lbf = 4.448N.

¹For compression members with pin-to-pin lengths greater than shown, the allowable axial load will be reduced based on KL/r calculations.

²Tension design value when 1 1/2-inch diameter 13 gauge tubes are used in conjunction with 2-inch nominal thickness chords.

TABLE 5—ALLOWABLE PIN BEARING LOADS ON CHORD MEMBERS (pounds) ¹

CHORD MATERIAL	WOOD GRAIN TO ANGLE OF LOAD	OPEN WEB TRUSS SERIES											
		SSW-42, 42H		SSW-62, 62H		SSW-43, 43H		SSW-44, 44H		SSW-64			
		Pin Diameter (inches)											
		3/8	5/8	3/8	5/8	3/8	5/8	3/8	5/8	3/4	3/8	5/8	3/4
MSR ²	Perpendicular	713	1,188	1,123	1,871	713	1,188	713	1,188	1,425	1,123	1,871	2,245
	Parallel	2,252	3,753	3,548	5,913	2,252	3,753	2,252	3,753	4,503	3,548	5,913	7,095

For SI: 1 inch = 25.4 mm, 1lbf = 4.448N.

¹Values may be increased for duration of load in accordance with Section 2.3.2 of the NDS.

²Values are for Douglas Fir and Spruce-Pine-Fir 2.0E and higher.

TABLE 6—ALLOWABLE END REACTION OF SSW TRUSSES (pounds) ^{1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11}

BEARING	WEB ANGLE (deg)	PIN DISTANCE L _{BP} ⁽²⁾ (inches)	BEARING LENGTH (L _{BRG}) ⁽¹⁾ (inches)	SSW OPEN WEB TRUSS TYPES (lbf)				
				SSW-42 & 42H 1.5" x 3.5"	SSW-62 & 62H 1.5" x 5.25"	SSW-43 & 43H 2.125" x 3.5"	SSW-44 & 44H 3.0" x 3.5"	SSW-64 3.0" x 5.25"
WOOD (A1)	42	Pin over Bearing	2.75	---	3,450	3,980	4,600	---
	65	Pin over Bearing	2.75	---	3,890	3,860	5,180	---
	42	0.5	2.00	1,900 ⁽⁸⁾		3,010 ⁽⁸⁾		
	65	0.5	2.00	2,375 ⁽⁸⁾		3,700 ⁽⁸⁾	4,810 ⁽¹¹⁾	7,110 ⁽¹¹⁾
	42	0.5	2.75	2,310	2,850	---	---	---
	65	0.5	2.75	2,640	2,940	---	---	---
WRAP AROUND CLIPS ON WOOD (A2)	42	0.5	2.75	2,320	---	3,170	---	---
	65	0.5	2.75	2,510	---	3,530	---	---
WRAP AROUND CLIPS ON STEEL (A2)	42	0.5	2.75	3,660	---	4,130	---	---
	65	0.5	2.75	5,160	---	6,070	---	---
WINGED CLIPS ON WOOD (A3)	42	0.5	2.75	2,450	---	---	---	---
	65	0.5	2.75	2,920	3,630	---	---	---
BOTTOM CHORD BEARING (A1)	Vertical 90	Pin over Bearing	2.00	3,390 ⁽¹⁰⁾	---	5,190	5,190	5,190

For **SI**: 1 inch = 25.4 mm, 1lbf = 4.448N.

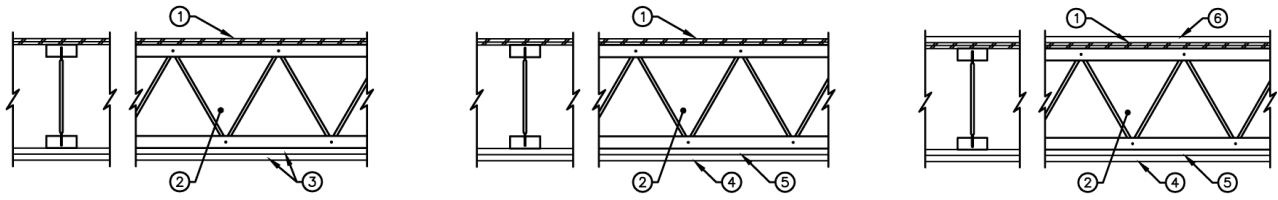
- ¹L_{BRG}: The distance from the nearest edge of the bearing surfaces to the end of the chord.
- ²L_{BP}: The distance from the centerline of the pin in the bearing assembly to the nearest edge of the bearing surface.
- ³Distance from centerline of pin to end of chord (3 1/4 inch minimum) except at bottom chord bearing and 2.00-inch bearing trusses (2 1/2 inch minimum).
- ⁴The maximum allowable reactions tabulated may not be increased for duration of loadings.
- ⁵For web angles between 42 and 65 degrees, linear interpolation is permissible.
- ⁶Value for 5/8" built-up bearing area with full depth A-1 clip
- ⁷Value for 5/8" built-up bearing area with standard A-1 bearing clip
- ⁸Values for top chord bearing trusses are reduced when the centerline of the bearing pin is 1.250-inches from face of support as follows: SSW-42, SSW-42H, 65 degree web angle equals 1,950 lbs, 42 degree web angle equals 1,625 lbs. SSW-43, SSW-43H, 65 degree web angle equals, 2,750 lbs, 42 degree web angle equals 2,400 lbs.
- ⁹SSW42 and SSW43 trusses may be installed with a minimum bearing length no less than 1 1/4-inches.
- ¹⁰When Centerline of pin is inside Face of Support (not on top of wall) the values decrease to 3,020 at 0.75-inches and 2,270 at 1.25-inches.
- ¹¹These values require a 3/4" diameter bearing assembly pin.

TABLE 7—RIDGE CONNECTOR ALLOWABLE AXIAL LOADS ^{1, 2, 3}

PRODUCT	AXIAL LOAD (lbf)
RC-2	12,195
RC-3	12,600
RC-4	12,600

For **SI**: 1lbf = 4.448N.

- ¹Custom applications based on load available.
- ²The published axial loads are for compression loads only.
- ³Maximum allowable axial tension loads are limited to 1950 lbf.



- ¹Plywood or APA structural panel
- ²SSW Truss
- ³Two layers of gypsum wallboard
- ⁴Face layer of gypsum wallboard
- ⁵Base layer of gypsum wallboard
- ⁶Carpet/Pad (light-weight concrete as required)

Note: See Section 4.5 for additional details.

FIGURE 2—FIRE ASSEMBLIES