

Wall Aspect Ratios for SIPs

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Question: A frequent question posed by design professionals is what wall aspect ratios are applicable to structural insulated panels (SIPs)? A wall aspect ratio is defined as the ratio of the height of the wall segment to its length measured parallel to the wall line. For example a wall segment having a height of 8 ft. and a length of 4 ft. has an aspect ratio of 2:1. Similarly, a wall with a height of 8 ft. and a length of 32 in. has an aspect ratio of 3:1. The length of the wall is also often referred to as the width of the wall.

Response: Aspect ratios applicable to SIP wall segments depend on whether the wall is being analyzed as a prescriptive braced wall in accordance with the 2012 International Residential Code (IRC) or as an engineered shear wall per the 2012 International Building Code (IBC). It is noted that the IRC and IBC provisions for SIPs only apply to SIPs with wood structural panel facings and a foam core.

Prescriptive Braced Wall Segments: The 2012 IRC identifies 16 distinct wall bracing methods in Section R602.10.4 with minimum braced lengths of 48 in. for some panel-type methods or an aspect ratio of 2:1. Section R602.10.4.2 provides for a continuous sheathing bracing method using wood structural panel sheathing (the CS-WSP method) that allows a braced length of 24 in. or an aspect ratio of 4:1 for an 8 ft. wall. But there are some limitations to this 24 in. element such as being next to a garage door in Seismic Design Categories (SDCs) A-C. The CS-WSP method also permits a braced wall length of 24 in. in an 8 ft. wall next to an opening less than or equal to a 64 in. high such as a window, which is shown in Table R602.10.5. Placed next to an opening up to a height of 80 in., such as a door, the minimum length is 32 in. or a 3:1 aspect ratio. Section R613.5.3 of the 2012 IRC states that SIP walls shall be considered as “continuous wood structural panel sheathing” (CSWSP method) for purposes of computing required wall bracing. Therefore, a SIP wall following the prescriptive requirements of the 2012 IRC can have a braced length as narrow as 24 in. or an aspect ratio of 4:1 under certain circumstances such as garage doors in low SDCs or applications next to windows up to and including 64 in. in height, or an aspect ratio of 3:1 adjacent to full height door openings up to 80 in. without limit.

Engineered Shear Walls: The 2012 IBC refers designers to the 2008 ANSI/AF&PA Special Design Provisions for Wind and Seismic (SDPWS) for requirements on the design of lateral force resisting systems including wood frame shear walls and wood frame diaphragms. Table 4.3.4 of the 2008 SDPWS provides maximum shear wall aspect ratios for 7 different wall sheathing types.

For blocked wood structural panels, the aspect ratio can be as high as to 3.5:1. For designs resisting seismic forces, the shear wall aspect ratio shall not exceed 2:1 unless the nominal unit shear capacity is multiplied by $2b/h$ where b is the length of the shear wall segment and h is the height.

There is no specific mention of SIPs as a wall sheathing type in Table 4.3.4 and an interpretation whether the SIP can be considered as a blocked wood structural panel system is necessary. It is SIPA's recommendation that SIPs are suitable for use at aspect ratios similar to blocked wood structural panels.

Summary: For residential construction, SIPs used in accordance with the wall bracing provisions of the 2012 IRC can be considered as being equivalent to continuously sheathed wood frame walls with aspect ratios as high as 4:1 under certain circumstances and 3:1 without limit.

For nonresidential construction governed by the 2012 IBC an interpretation is required as to whether the maximum shear wall aspect ratios of Table 4.3.4 of the 2008 ANSI/AF&PA SDPWS apply to SIPs. It is SIPA's recommendation that SIPs are suitable for use at aspect ratios similar to blocked wood structural panels.

