

Lateral Load Performance of Structural Insulated Panel Walls with Full Bearing— Phase 1

Structural insulated panels (SIPs) (Fig. 1), as defined in ANSI/APA PRS 610.1, are part of a structurally strong and energy-efficient construction system that utilizes the strength of wood structural panels and the energy attributes of foam plastic insulation to provide cost-effective solutions for compliance with governing building codes. However, the popularity of SIPs has been hindered by the lack of systematic evaluations of their lateral load performance in wall applications. Because SIP walls are required to bear on the cap and sill plates (so-called “restrained”) so that vertical loads from the story above can be transferred to the story below or to the foundation, it is imperative that the lateral load performance of SIP walls reflects this configuration. Unfortunately, most SIP walls have been evaluated in a manner similar to conventional light-frame walls (the oriented strandboard facers are not allowed to bear on either cap plate or sill plate, so-called “unrestrained”) and therefore the actual lateral load performance of SIP walls may not have been realistically characterized.

Background

In a 2010 pilot study conducted by APA–The Engineered Wood Association and the Structural Insulated Panel Association, SIP walls were tested in accordance with both monotonic and cyclic loading protocols, with the SIP walls constructed to bear on wood cap and sill plates. SIP walls so constructed were found to have a significantly higher over-strength factor and lower ductility than conventional walls. The research results led to the development of a lateral load test method specified in ANSI/APA PRS 610.1 for the qualification of SIP walls. However, the APA Standards Committee on



Figure 1—SIP panels used in wall construction.
(Photo courtesy of AFM Corporation.)

ANSI/APA PRS 610.1 was concerned about use of the test method for development of SIP lateral load design values because of insufficient data for a comprehensive evaluation.

Objective

The objective of this research project is to develop test data needed to characterize the lateral load performance of SIP walls with full bearing. Phase 1 of the project involves structural testing of 24 full-size SIP walls of various configurations that will bracket a range of SIP wall configurations commonly used in the field.

Approach

The SIP wall variables that are considered for testing include test protocol (monotonic and cyclic), nail size for panel connections, nail spacing, wall bearing type,

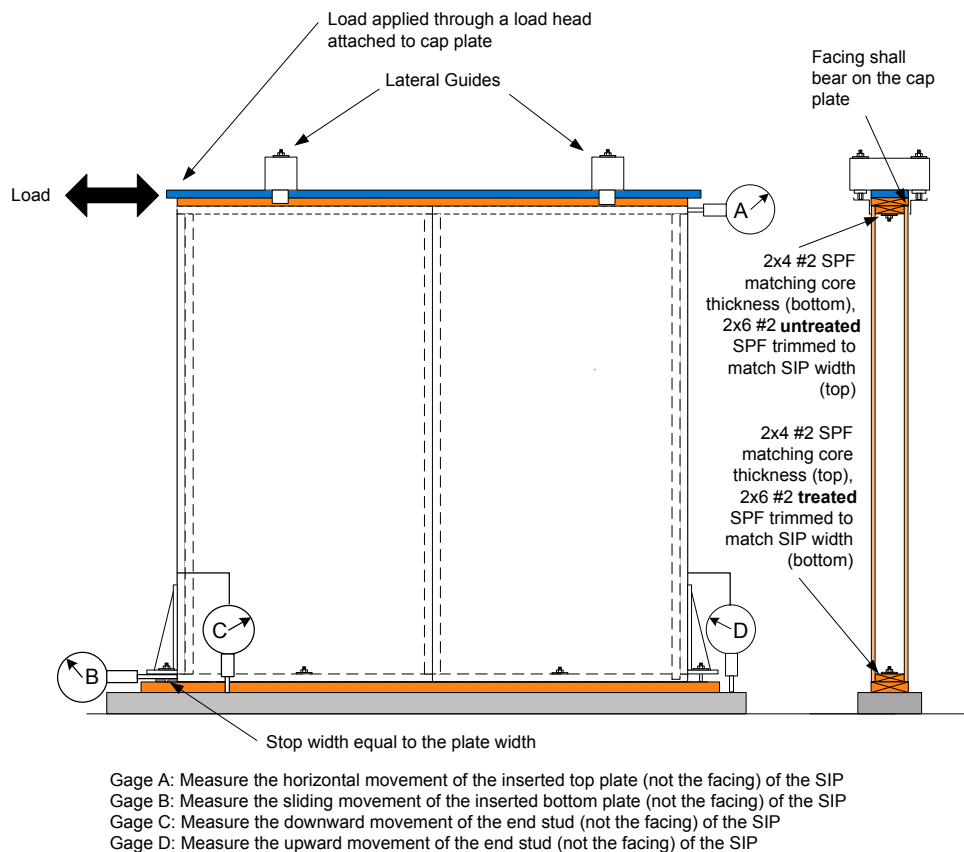


Figure 2—Test setup for basic wall configuration.

spline type, number of panel joints, and SIP thickness. All SIP panels will be supplied by a SIP manufacturer from the same production run, whenever possible, to minimize material variability. Twenty-four SIP wall tests will be conducted through at the APA Research Center in Tacoma, Washington, using the ASTM E 2126 CUREE cyclic test method, with an exception of using the ASTM E 72 monotonic test method for the first test series. All walls will be tested under restrained boundary conditions, which include restrained cap and sill plates (Fig. 2).

Expected Outcomes

Results from this project are expected to provide a systematic evaluation of SIP wall racking performance due to variation in SIP wall configuration. A final report will document the research findings. Results of this project may guide further evaluations focusing on significant effects identified from this Phase 1 project.

Timeline

The study plan will be developed by May 2015. SIP material will be manufactured and delivered by August

2015, with lab testing and data analysis completed by August 2016. The final report will be prepared by December 2016.

Cooperators

APA—The Engineered Wood Association
 Structural Insulated Panel Association (SIPA)
 USDA Forest Service, Forest Products Laboratory

Contact Information

B.J. Yeh
 APA—The Engineered Wood Association
 Tacoma, Washington
 (253) 620-7467; Borjen.yeh@apawood.org

Tom Williamson
 Structural Insulated Panel Association
 Vancouver, Washington
 (360) 901-7106; Tomwilliamson@live.com

Xiping Wang
 USDA Forest Service, Forest Products Laboratory
 Madison, Wisconsin
 (608) 231-9461; xwang@fs.fed.us