R-CONTROL SIPs

SIP No. 2067

Subject: **Seismic Performance**

Date: **February 2008 (Revised January 2015)**

R-Control SIPs have a history of performance in seismic events. In particular, a number of R-Control SIP structures were located close to the epicenter of the magnitude 6.9 earthquake that struck Kobe, Japan in 1995 (please refer to R-Control SIP Project Profile on the Kobe Earthquake). A review of these structures after the earthquake demonstrated that the inherent performance of R-Control SIPs in seismic events is exceptional.

R-Control SIPs develop their shear strength from the use of outer facings of 7/16" OSB manufactured in conformance with the PS2 standard for sheathing. Each R-Control SIP wall panel is connected to base plates, top plates, and vertical boundary members with fasteners, typically 8d nails. The 8d nails provide for the transfer of the shear loads from the OSB facings to the wood plating materials while the adhesive bond of the OSB to the Foam-Control EPS core provide resistance for the OSB from buckling. This performance is identical to conventionally built OSB sheathed shear walls where the OSB provides shear resistance by using fasteners to transfer shear loads to the framing members.

In order to ensure the performance of R-Control SIPs in seismic events, R-Control SIPs have been evaluated side by side with OSB sheathed conventional walls. The testing was conducted by the leader in the development of shear wall design data for light frame walls, APA – The Engineered Wood Association. The testing consisted of building a high capacity conventional OSB sheathed 2X shear walls and comparing the performance to R-Control SIPs.

The conventional wall consisted of 2X framing members spaced 24" o.c., 4X bottom and top plates, and 4X vertical boundary members. The walls were sheathed on both sides with 7/16" OSB attached with 8d cooler nails in two staggered rows with spacing at 2" o.c. The 4X members were necessary due to the high capacity that was anticipated for the testing. The 4X6's were No. 2 Douglass-fir larch.

In a similar fashion, R-Control SIP walls were built using the same 4X bottom and top plates and 4X vertical boundary members. The R-Control SIP spline also consisted of a 4X. Please refer to R-Control SIP details SIP-101b for the plate connection and SIP-102k for the spline connection. The intention of the testing was to compare side by side the performance of conventional OSB sheathed shear walls and R-Control SIPs.

Since the International Building Code has a restriction on the application of adhesives for attachment of shear wall sheathing, the application of R-Control Low VOC Do-All-Ply Sealant was modified to ensure that the R-Control SIP facing was only attached to the plating lumber with fasteners. The modified R-Control Low VOC Do-All-Ply application consisted of sealant being applied between the 4X plating and the Foam-Control EPS instead of between the 4X plating and the OSB facing of the R-Control SIP.

The testing was conducted following a seismic test protocol developed by the Structural Engineering Association of Southern California (SEAOSC). The test consists of imposing a simulated seismic event to a shear wall and recording the response. The test protocol consists of 72 cycles of loading for the shear wall. A sample of the test data is shown in Figure 1. Note that the resulting loads and deflection for the conventional shear wall and the R-Control SIP wall appear nearly identical.

To further analyze the results, a "backbone" curve was extracted from the test data. The backbone curve is used to compare two tests to each other by comparing the load versus deflection performance of the walls. The backbone test data is shown in Figure 2. The load versus deflection of the conventional shear wall and the R-Control SIP wall appear very similar.

A final check on the comparative results was to calculate the cumulative dissipated during the testing (see Figure 3). Again the performance of R-Control SIPs is nearly identical to the performance of the conventional shear wall.

A structural review of the APA testing and the deflection requirements for shear walls as stated in ICC-ES AC04 acceptance criteria for Sandwich Panels suggests a design limit of 920 plf for the R-Control SIP assembly as described in this bulletin.

Please refer to the R-Control SIP Load Design Chart #6 for information on wall shear loads.

It is recommended that R-Control SIPs be treated as equivalent to conventional light frame shear walls with OSB sheathing for performance in seismic events.

Figure 1