

Report No. CMEC 25-001
LATERAL BEHAVIOR OF LIGHT-FRAME WOOD SHEAR WALLS
ASSEMBLED WITH ELASTOMERIC ADHESIVE UNDER
MONOTONIC AND CYCLIC LOADING

**Prepared
for**

**Climate Adhesive
2734 Miller Rd.
Kalamazoo, MI 49001**

By

**Composite Materials and Engineering Center
Washington State University
January 20, 2026**

This report is for the exclusive use of the client named herein. The test results in this report are relevant only to the material tested. CMEC Test Lab (TL-246) is responsible for all the information provided in this report, except information that has been provided by the customer. CMEC authorizes the client to reproduce this report only if reproduced in its entirety. CMEC assumes no liability to any party for any loss, expense, or damage occasioned by the use of this report.

Report No. CMEC 25-001
LATERAL BEHAVIOR OF LIGHT-FRAME WOOD SHEAR WALLS
ASSEMBLED WITH ELASTOMERIC ADHESIVE UNDER
MONOTONIC AND CYCLIC LOADING

for

Climate Adhesive
2734 Miller Rd.
Kalamazoo, MI 49001

Introduction

The Composite Materials and Engineering Center (CMEC), at Washington State University in Pullman, WA, performed a series of tests on a light-framed wall with and without the Climate Adhesive product. The tests were conducted according to the guidelines of the ASTM E 2126-19 *Standard Test Methods for Cyclic (Reversed) Load Test for Shear Resistance of Vertical Elements of the Lateral Force Resisting Systems for Buildings*. A typical 8ft x 8ft wall system is shown in Figure 1.



Test Materials

Three types of wall sheathing were tested that included 15/32" CD plywood, 3/8" CD plywood, and 7/16" Huber ZIP OSB. The wall sheathing sizes were nominal 4ft wide by 8ft long and either 1/2" or 5/8" thick. The wall framing material was 2x4 and 2x6 dimensional lumber, #2 & BTR Douglas Fir-Larch.

Climate Adhesive shipped their Adhesive-NS product to the test lab in advance, and was installed by their technicians (on site) during fabrication of the walls. The Climate NS product came in a sausage tube and is shown in Figure 2. The framing nails and sheathing nails used during construction of the walls were purchased locally. The nails used for wood framing construction were a GripRite, bright-coated, 0.131" diameter x 3" long nail, while the sheathing nails were a GripRite, bright-coated, 0.131" diameter x 2-1/2" long nail. A picture of each type of nail is shown in Figure 3.

Various fasteners were used to secure the wall to the test fixturing and included Simpson Strong-Tie HTT4 12-3/8 in., 11-Gauge hold-downs with 5/8" bolts (Grade 307A); Simpson BPS 5/8-3 3" bearing plate washers; 1/2" bolts (Grade 307A), washers, and nuts; and Simpson Strong-tie SDS #10 x 1-1/2" structural screws.



Figure 2. Climate Adhesive – NS.



(a)



(b)

Figure 3. GripRite nails used for the construction of the walls. (a) Framing Nails, and (b) Sheathing Nails.

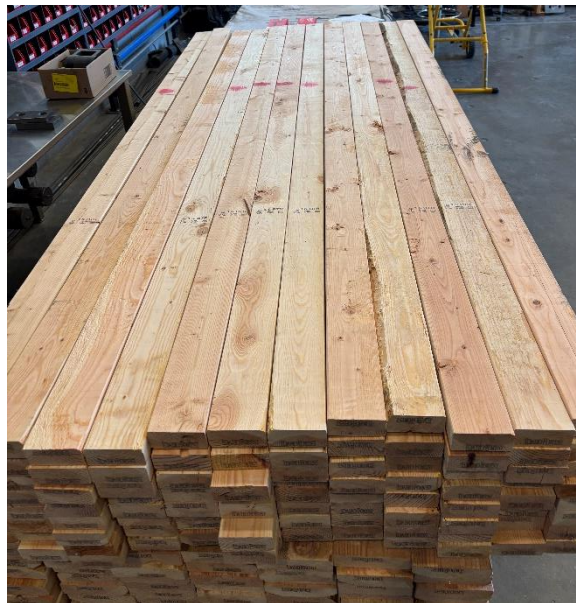


Figure 4. Lumber unit as-received containing 2x4 and 2x6 dimensional lumber from Idaho Forest Group, #2 & BTR DF-L.

Shear Wall Construction

The walls were framed in two different configuration types of 24in. on center and 16in. on center. There was a total of five configurations of walls and are listed in Table 1.

Table 1. Five wall configurations tested for Climate Adhesive.

Framing Type	Sheathing Type	Nail Schedule	Adhesive
2x4, 16in. On Center	15/32" CD Plywood	8d Nail, 6"/12" spacing, 3/8" edge distance	None
2x4, 16in. On Center	15/32" CD Plywood	8d Nail, 6"/12" spacing, 3/8" edge distance	Climate NS
2x6, 24in. On Center	3/8" CD Plywood	8d Nail, 6"/12" spacing, 3/8" edge distance	Climate NS
2x6, 24in. On Center	7/16" ZIP OSB	8d Nail, 6"/12" spacing, 3/8" edge distance	Climate NS
2x6, 24in. On Center	7/16" ZIP OSB	8d Nail, 6"/12" spacing, 3/8" edge distance	None

The nailing schedule was very similar between the 2x4 and 2x6 walls for the framing and the sheathing both, and is detailed in Appendix A1. The 2x4 walls contained two extra studs as they were on a 24" spacing. All the sheathing was nailed on with the 8d nails and a 6" spacing around the perimeter with a 3/8" edge distance, and 12" spacing in the field, even for the walls with the adhesive. For three of the wall sets, the Climate adhesive was applied to each stud member and each plate with a 1/4" bead before the sheathing was nailed on and is detailed in Appendix A2. These walls were allowed to cure for a minimum of 28 days before testing them. The walls without adhesive were sheathed and tested within 24 hours, per the standard.

The Simpson hold-downs were installed in the bottom of each corner in the wall using the 5/8" bolts and were elevated 1-1/2" above the bottom plate to prevent prying action when the wall deflected, and were installed with 18 of the Simpson #10 structural screws as shown in Figure 5. There were also four 1/2" bolts that secured the bottom plate of the wall to the testing fixture. These bolts were positioned in the middle of each stud bay as shown in Figure 5 and Figure C1 in Appendix C. All bolts connecting the wall assembly to steel fixtures were finger tight plus a 1/4 turn with a wrench.

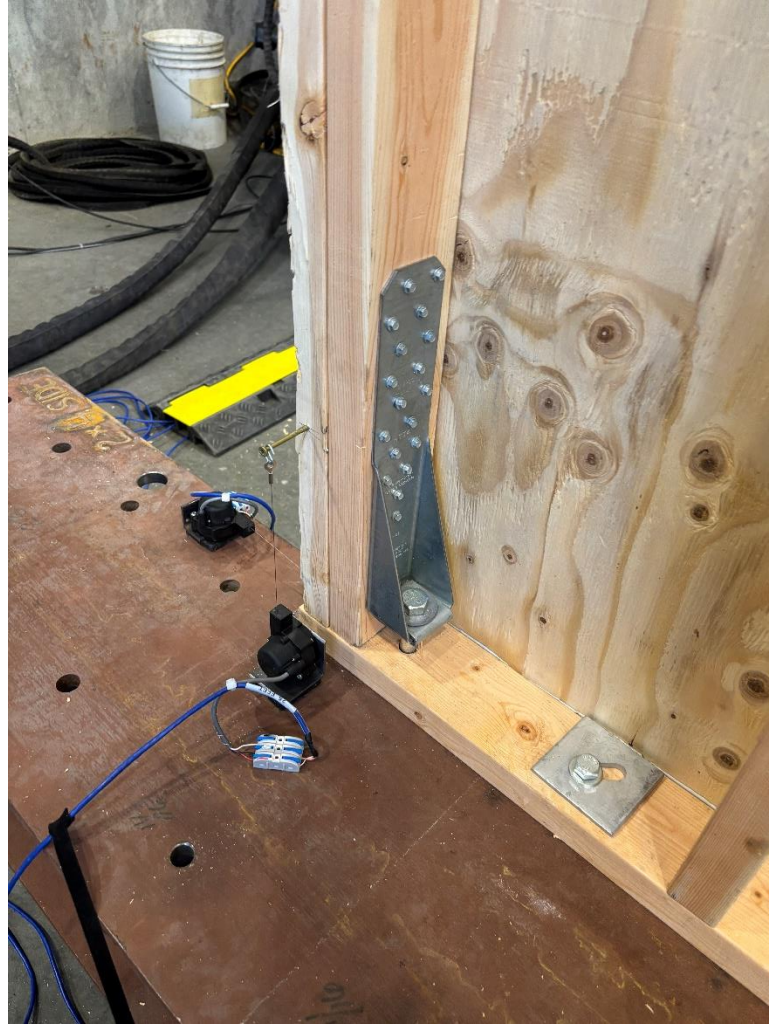


Figure 5. Simpson hold-down attachment to double end stud with 5/8" bolt and Simpson 3" bearing plate washer with 1/2" bolt securing shear wall to the fixture.

Test Methods

Figure 6 shows the test setup of the wall with the fixturing in the lab. The wall was bolted to a rigid and reinforced, 14" I-beam that was bolted to the strong floor in the lab. The wood framing of the walls lined up with edge of the I-beam which allowed the sheathing panels to rotate beyond the support to prevent them from bearing on the fixturing. A 3" C-channel load beam was screwed to the top of the wall (centered) with (18) Simpson 1/4" x 3" long SDS screws. This C-channel also provided a pinned connection to the hydraulic actuator and out-of-plane bearing plates. The wall was braced for out-of-plane movement. String potentiometers were used to measure displacements of the walls at five different locations, shown in Figure 6. Horizontal displacement measurements were obtained at the top of the wall opposite from the hydraulic actuator (#5) and at the bottom of the wall for determining the slip between the bottom plate and the hollow steel beam to which the walls were attached (#2). An additional displacement for incidental

slip of the I-beam attached to the strong floor (#1). Vertical displacement measurements were obtained at the bottom of the wall at both corners to determine the amount of uplift or crushing at these locations (#3, #4). The applied loads and displacement measurements were recorded at a rate of 100 Hz throughout testing using a computer-based data acquisition system.

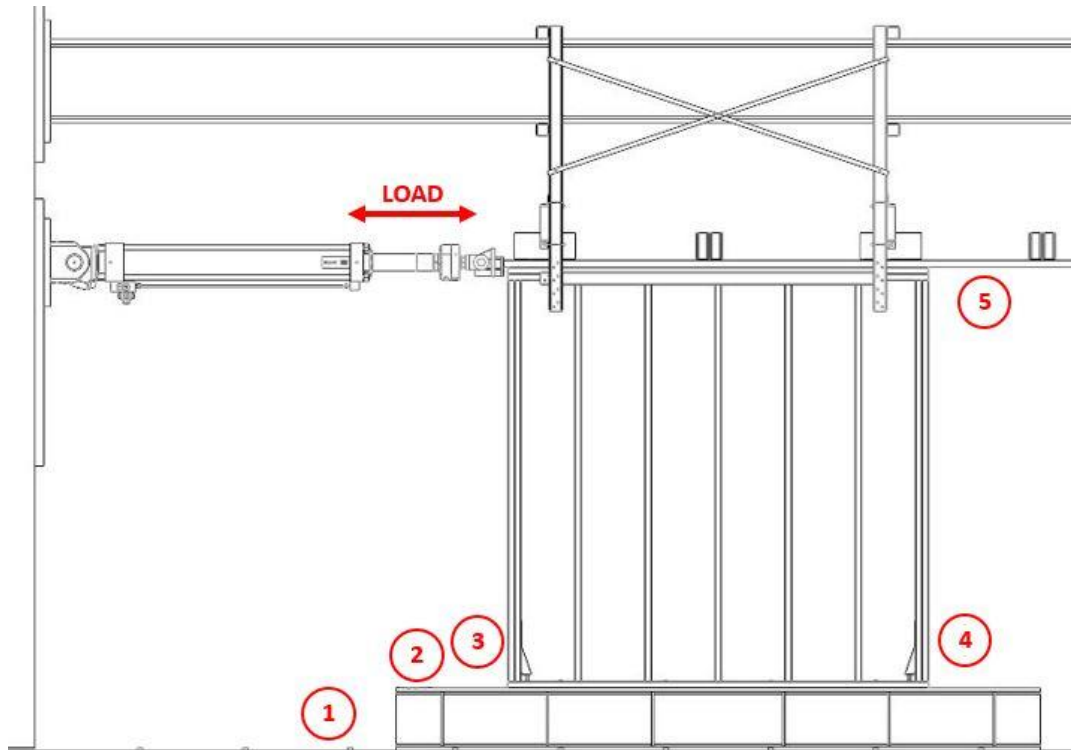


Figure 6. Shear wall diagram with five data collection locations with string potentiometers.

The walls were tested according to ASTM E 2126-19 *Standard Test Methods for Cyclic (Reversed) Load Test for Shear Resistance of Vertical Elements of the Lateral Force Resisting Systems for Buildings*. Walls #1, #4, #8, #12, and #16 were constructed and tested monotonically to obtain the load-displacement curve used to develop a CUREE protocol according to Section 8.6, Method C of the standard to determine the displacement parameters for the subsequent cyclic wall tests for each type of configuration. Figure 7 shows the steps and cycles used during the testing for the cyclic walls.

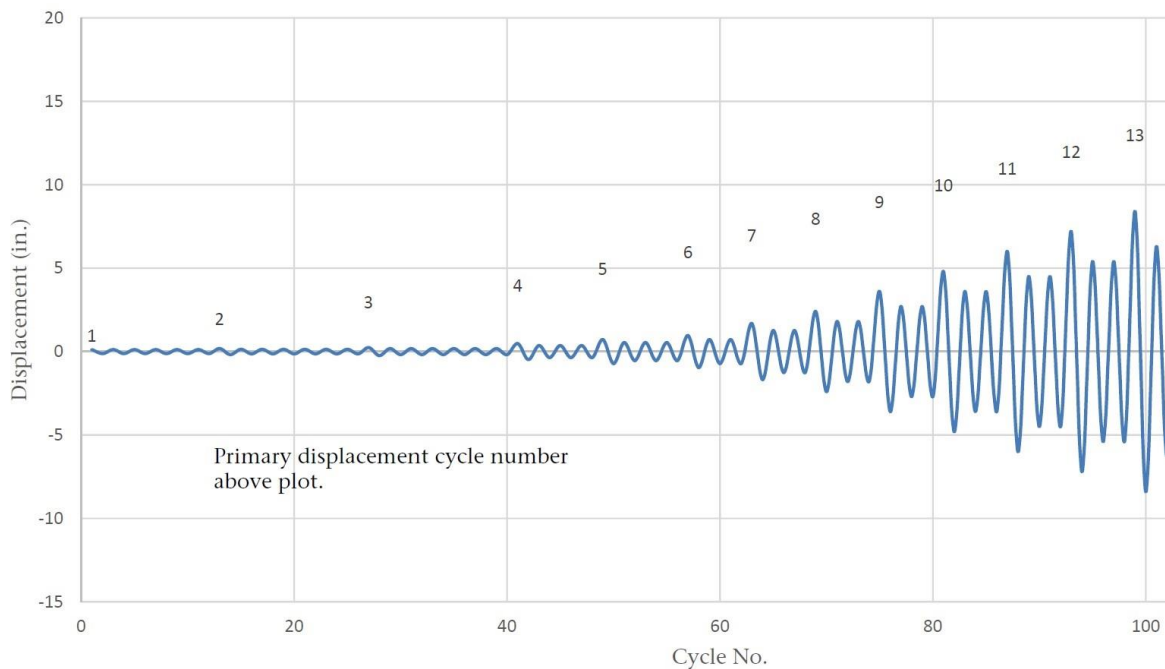


Figure 7. Plot of CUREE protocol example of displacements and amplitudes during the cyclic testing with the primary amplitudes numbered.

The displacement protocols and cycles used during the testing of the shear walls are presented in Tables 2 to 7. The rate of displacement was maintained constant at 0.25 in./sec for all cyclic wall tests, which was requested by the client and falls within the acceptable range of 0.04 to 2.5 in./sec described in the standard. This displacement rate also meets the cyclic frequency range of 0.2 to 0.5 Hz per the standard. The monotonic wall test for each set of walls was used to develop these load protocols.

Table 2. Displacement protocol for Wall #2 and #3: nails only, 15/32" CD Plywood.

Step	Primary Amplitude (in.)	# of Cycles	Trailing Amplitude (in.)	# of Cycles	Rate (in/sec)
1	0.120	6			0.25
2	0.180	1	0.135	6	0.25
3	0.240	1	0.180	6	0.25
4	0.480	1	0.360	3	0.25
5	0.720	1	0.540	3	0.25
6	0.960	1	0.720	2	0.25
7	1.680	1	1.260	2	0.25
8	2.400	1	1.800	2	0.25
9	3.600	1	2.700	2	0.25
10	4.800	1	3.600	2	0.25
11	6.000	1	4.500	2	0.25
12	7.200	1	5.400	2	0.25
13	8.400	1	6.300	2	0.25

Table 3. Displacement protocol for Wall #5, #6, and #7: 2x4 adhesive and nails, 15/32" CD Plywood.

Step	Primary Amplitude (in.)	# of Cycles	Trailing Amplitude (in.)	# of Cycles	Rate (in/sec)
1	0.091	6			0.25
2	0.136	1	0.102	6	0.25
3	0.181	1	0.136	6	0.25
4	0.362	1	0.272	3	0.25
5	0.543	1	0.407	3	0.25
6	0.724	1	0.543	2	0.25
7	1.267	1	0.950	2	0.25
8	1.810	1	1.358	2	0.25
9	2.715	1	2.036	2	0.25
10	3.620	1	2.715	2	0.25
11	4.525	1	3.394	2	0.25
12	5.430	1	4.073	2	0.25
13	6.335	1	4.751	2	0.25

Table 4. Displacement protocol for Wall #9, #10, and #11: 2x6 adhesive and nails, 3/8” CD Plywood.

Step	Primary Amplitude (in.)	# of Cycles	Trailing Amplitude (in.)	# of Cycles	Rate (in/sec)
1	0.073	6			0.25
2	0.109	1	0.082	6	0.25
3	0.146	1	0.109	6	0.25
4	0.291	1	0.218	3	0.25
5	0.437	1	0.328	3	0.25
6	0.582	1	0.437	2	0.25
7	1.019	1	0.764	2	0.25
8	1.456	1	1.092	2	0.25
9	2.184	1	1.638	2	0.25
10	2.912	1	2.184	2	0.25
11	3.640	1	2.730	2	0.25
12	4.368	1	3.276	2	0.25
13	5.096	1	3.822	2	0.25

Table 5. Displacement protocol for Wall #9, #10, and #11: 2x6 adhesive and nails, 3/8” CD Plywood.

Step	Primary Amplitude (in.)	# of Cycles	Trailing Amplitude (in.)	# of Cycles	Rate (in/sec)
1	0.073	6			0.25
2	0.109	1	0.082	6	0.25
3	0.146	1	0.109	6	0.25
4	0.291	1	0.218	3	0.25
5	0.437	1	0.328	3	0.25
6	0.582	1	0.437	2	0.25
7	1.019	1	0.764	2	0.25
8	1.456	1	1.092	2	0.25
9	2.184	1	1.638	2	0.25
10	2.912	1	2.184	2	0.25
11	3.640	1	2.730	2	0.25
12	4.368	1	3.276	2	0.25
13	5.096	1	3.822	2	0.25

Table 6. Displacement protocol for Wall #13, #14, and #15: 2x6 adhesive and nails, ZIP OSB.

Step	Primary Amplitude (in.)	# of Cycles	Trailing Amplitude (in.)	# of Cycles	Rate (in/sec)
1	0.073	6			0.25
2	0.110	1	0.083	6	0.25
3	0.147	1	0.110	6	0.25
4	0.294	1	0.220	3	0.25
5	0.440	1	0.330	3	0.25
6	0.587	1	0.440	2	0.25
7	1.028	1	0.771	2	0.25
8	1.468	1	1.101	2	0.25
9	2.202	1	1.652	2	0.25
10	2.936	1	2.202	2	0.25
11	3.670	1	2.753	2	0.25
12	4.404	1	3.303	2	0.25
13	5.138	1	3.854	2	0.25

Table 7. Displacement protocol for Wall #17, and #18: 2x6 nails only, ZIP OSB.

Step	Primary Amplitude (in.)	# of Cycles	Trailing Amplitude (in.)	# of Cycles	Rate (in/sec)
1	0.120	6			0.25
2	0.180	1	0.135	6	0.25
3	0.240	1	0.180	6	0.25
4	0.480	1	0.360	3	0.25
5	0.720	1	0.540	3	0.25
6	0.960	1	0.720	2	0.25
7	1.680	1	1.260	2	0.25
8	2.400	1	1.800	2	0.25
9	3.600	1	2.700	2	0.25
10	4.800	1	3.600	2	0.25
11	6.000	1	4.500	2	0.25
12	7.200	1	5.400	2	0.25
13	8.400	1	6.300	2	0.25

Testing Results and Discussion

The monotonic walls (Wall #1, #4, #8, #12 and #16) were pushed with the hydraulic actuator at 0.5 in./min until at least 80% post-peak loads were observed. As mentioned, these walls were tested to obtain the load-displacement curves shown below, which were used to determine the CUREE protocols for the subsequent cyclic walls of the same type. Figures 8 to 12 show the results of the monotonic wall tests. Walls without adhesive performed as expected with large deflections and shallow slopes. The walls that contained adhesive were stronger and reached higher peak load until sudden failure, indicating stronger but more brittle failures.

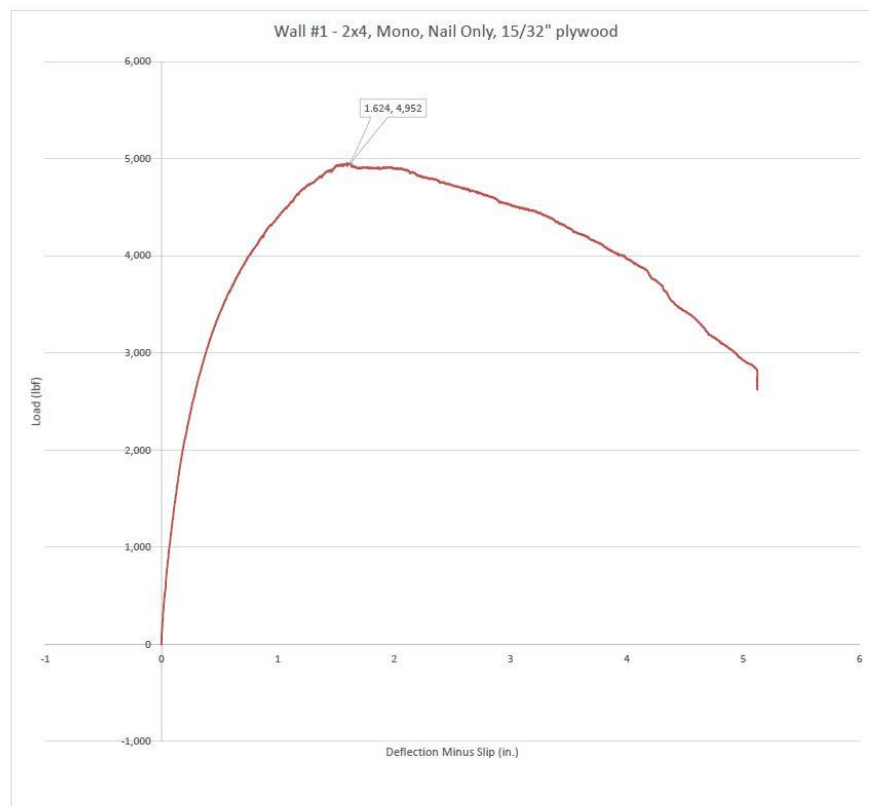


Figure 8. Strength plot of monotonic Wall #1 as it was pushed to failure.

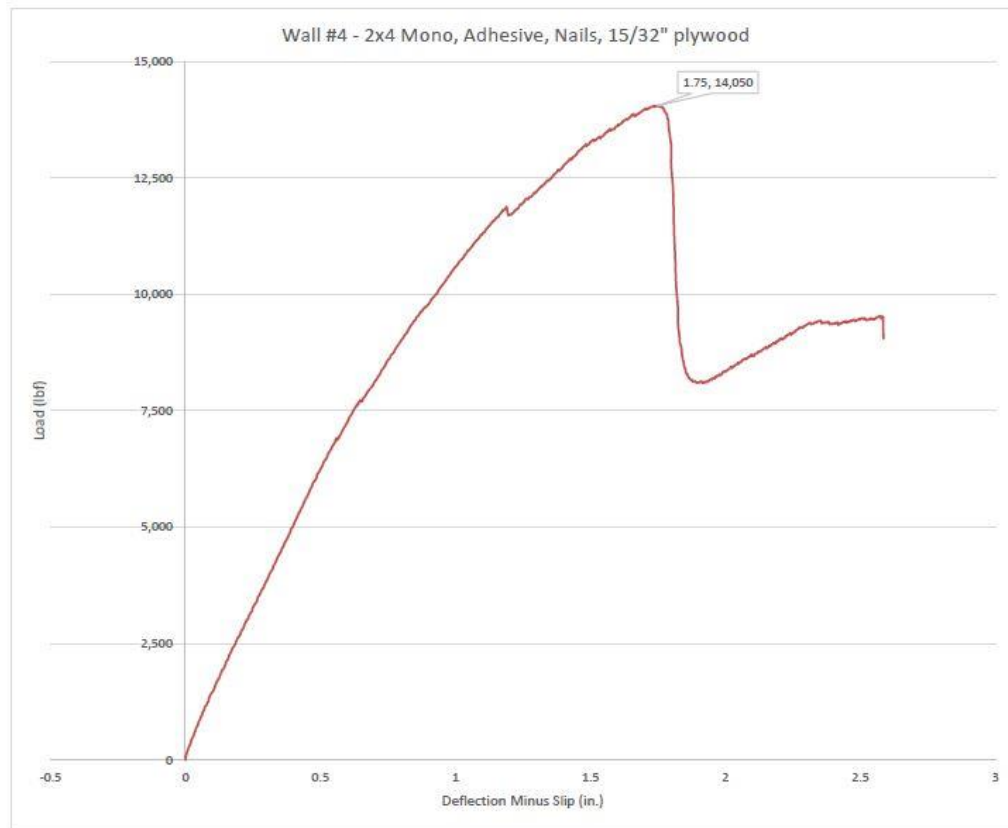


Figure 9. Strength plot of monotonic Wall #4 with adhesive, as it was pushed to failure.

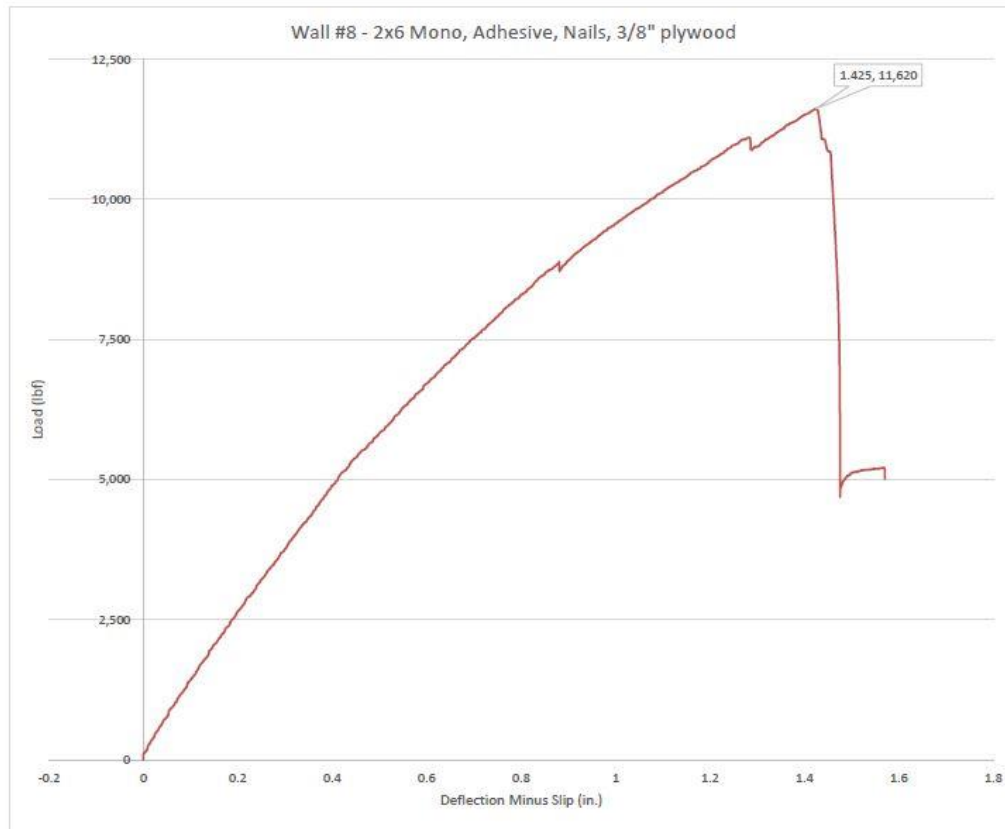


Figure 10. Strength plot of monotonic Wall #8 with adhesive, as it was pushed to failure.

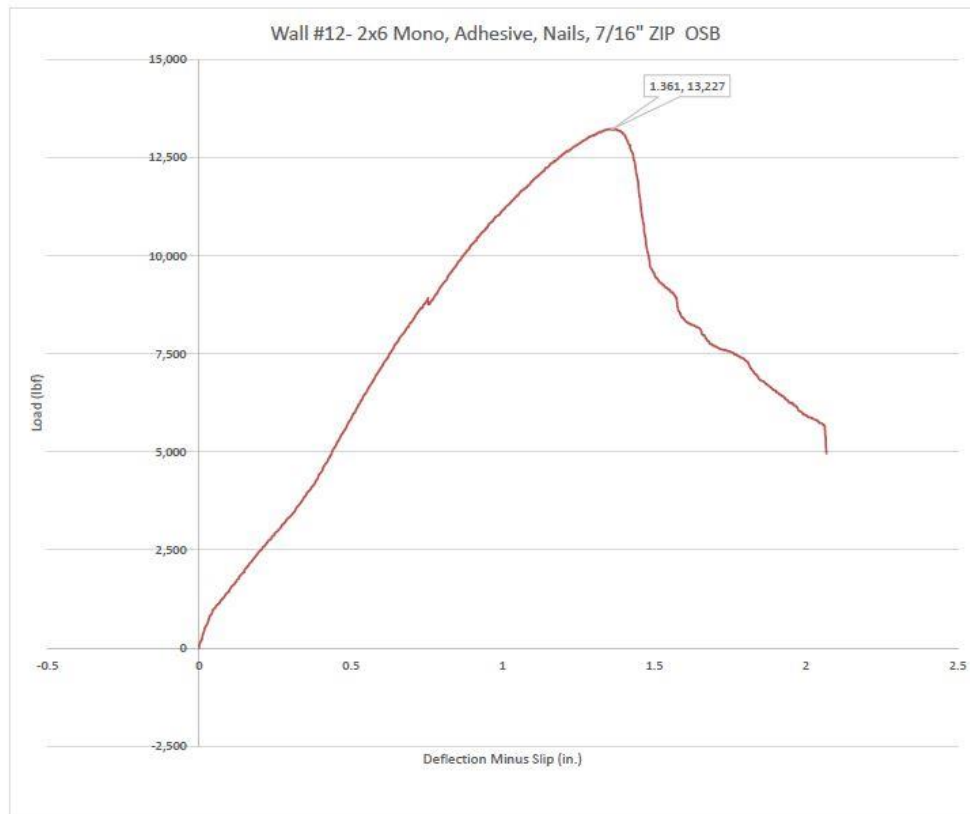


Figure 11. Strength plot of monotonic Wall #12 with adhesive, as it was pushed to failure.

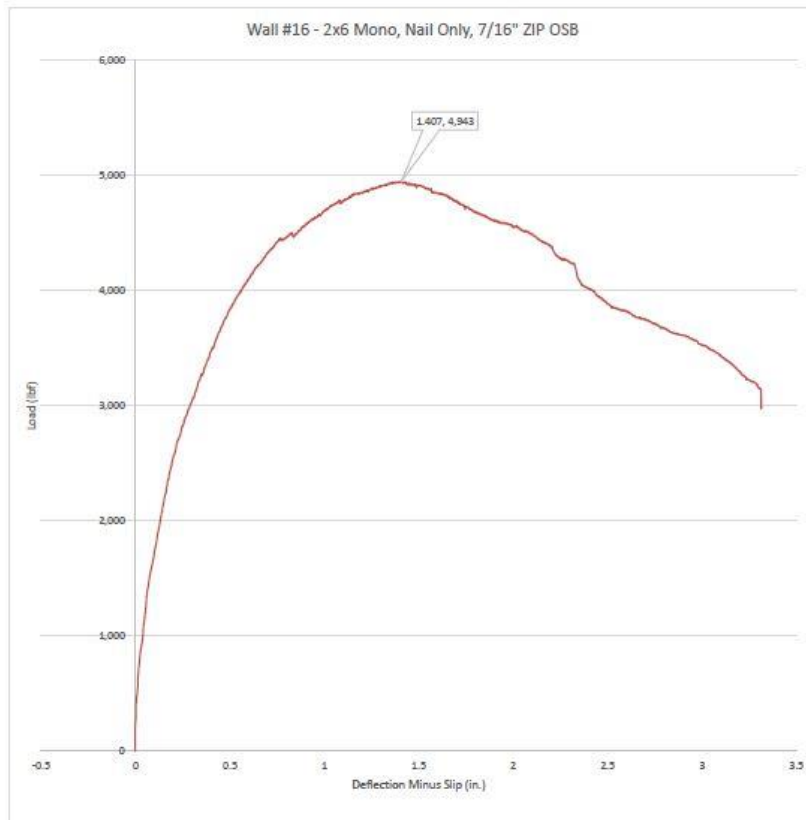


Figure 12. Strength plot of monotonic Wall #16 as it was pushed to failure.

Table 8 is a summary of results for each monotonic wall configuration tested data and includes maximum loads, deflections at maximum load, and 80% post-peak data.

Table 8. Monotonic test data and wall performance parameters.

Wall ID	Framing Type	Fastening Method	Sheathing Type	Max. Load (lbf)	Max Defl. @ Peak Load (in.)	80% Max Load (lbf)	Defl. @ 80% Post-Peak (in.)
1	2x4	Nails Only	15/32" Plywood	4,957	1.622	3,966	3.974
4	2x4	Nails + Adhesive	15/32" Plywood	14,054	1.752	11,243	1.810
8	2x6	Nails + Adhesive	3/8" Plywood	11,626	1.426	9,300	1.456
12	2x6	Nails + Adhesive	ZIP OSB	13,242	1.363	10,593	1.468
16	2x6	Nails Only	ZIP OSB	4,947	1.408	3,958	2.445

Results of the cyclic loading tests for the walls are presented in Table 9. This table includes data for maximum load, and maximum unit shear load capacity for each wall configuration tested. The results presented in this report have not been adjusted for rigid body rotation, only the displacement of the top plate (corrected for bottom plate slip) was utilized (other than the shear modulus (G) terms, as prescribed by the standard).

The cyclic ductility ratio presented in Table 9 is the ratio of the deflection at the failure load divided by the deflection at the yield load (as determined by Section 9 of ASTM E2126-19). Wall #10 was an anomaly and the Negative Cyclic Ductility could not be calculated because of the manner in which it failed. The average ductility ratio for the non-adhesive walls were around 6.0 which is to be expected for light-framed shear walls with OSB or plywood sheathing. The addition of the Climate Adhesive-NS product to the sheathing made a stronger but less ductile system. The average ductility ratio for all the adhesive walls were around 2.0 which implies low ductility and higher demand for a building envelope with this product during a seismic event, as it would not be as effective in dissipating energy through the framing system into the fasteners (i.e., low seismic response modification factor, R-factor). Table 9 presents the ductility ratios for all wall specimens.

Load and displacement behavior curves of each tested wall are presented in Appendix B. These plots include the fitted Envelope Curve for positive and negative response and the Equivalent Energy Elastic-Plastic (EEEP) curve as determined according to Section 9.1.4 of the standard. In general, the walls with adhesive were able to resist higher capacities of load but created steep, narrow peaks in the hysteresis curves indicating reduced energy dissipation capacity, limited displacement capacity, and low ductility. The areas under the curves were minimized which indicates that the adhesive did not allow for nails to provide ductility and energy dissipation for the wall.

The primary mode of failure for each wall is detailed in Table 10. The adhesive walls had quite a few nail pull-through failures and brittle sill plate, top plate, or double end stud failures. This behavior is attributed to the presence of adhesive at the sheathing-framing interface, which restrains relative slip and rotation between the sheathing and framing. As a result, the nails are prevented from undergoing ductile bending and withdrawal mechanisms typical of nails-only systems. Consequently, a larger portion of the load is transferred directly into the framing members, leading to brittle failure modes.

Photographs of typical test information and failures are presented in Appendix C. The moisture content and specific gravity of the wood framing members are presented in Table 11 which were taken after each test.

Table 9. Results from reverse cyclic shear wall testing for all cyclic walls.

Wall ID	Framing Type	Fastening Method	Sheathing Type	Max Positive Load (lbf)	Max Negative Load (lbf)	Positive Shear Strength (plf)	Negative Shear Strength (plf)	Positive 0.4 Peak Secant Shear Modulus (G'_{ASD}) (lb/in/ft)	Positive 1.4ASD Shear Modulus (G_a) (lb/in/ft)	Negative 0.4 Peak Secant Shear Modulus (G'_{ASD}) (lb/in/ft)	Negative 1.4ASD Shear Modulus (G_a) (lb/in/ft)	Shear Stiffness at Peak Positive (G'_{Peak}) (lb/in/ft)	Shear Stiffness at Peak Negative (G'_{Peak}) (lb/in/ft)	Positive Cyclic Ductility Ratio (.80 post Peak) ($\Delta_{ult}/\Delta@P_{Yield}$)	Negative Cyclic Ductility Ratio (.80 post Peak) ($\Delta_{ult}/\Delta@P_{Yield}$)	80% Positive Peak Load (lbf)	80% Negative Peak Load (lbf)
2	2x4	Nails Only	15/32" Plywood	5,961	-5,688	745	-711	11,823	9,143	15,037	9,745	2,718	2,701	7.35	8.53	4,769	-4,550
3		Nails Only	15/32" Plywood	5,465	-5,155	683	-644	13,184	9,305	14,148	10,204	3,588	3,608	6.24	6.90	4,372	-4,124
5		Nails + Adhesive	15/32" Plywood	13,150	-12,682	1,644	-1,585	10,730	10,677	11,168	10,661	6,771	8,177	1.94	1.94	10,520	-10,146
6		Nails + Adhesive	15/32" Plywood	13,231	-9,929	1,654	-1,241	12,631	12,054	12,330	12,232	8,586	10,289	2.35	2.51	10,584	-7,943
7		Nails + Adhesive	15/32" Plywood	13,783	-12,206	1,723	-1,526	10,971	10,701	10,063	10,025	8,524	8,164	1.54	1.83	11,026	-9,764
9	2x6	Nails + Adhesive	3/8" Plywood	14,620	-12,479	1,827	-1,560	11,792	10,869	9,885	9,511	8,354	7,131	1.81	1.73	11,696	-9,983
10		Nails + Adhesive	3/8" Plywood	13,191	-12,666	1,649	-1,583	11,193	10,571	11,270	10,699	7,365	6,872	2.12	N/A	10,553	-10,133
11		Nails + Adhesive	3/8" Plywood	11,702	-10,376	1,463	-1,297	10,848	10,285	11,119	10,842	7,350	8,876	1.78	1.55	9,361	-8,301
13		Nails + Adhesive	ZIP OSB	11,656	-12,225	1,457	-1,528	17,108	15,505	20,906	19,499	10,713	11,915	2.10	2.77	9,325	-9,780
14		Nails + Adhesive	ZIP OSB	10,461	-9,941	1,308	-1,243	18,402	14,754	18,748	18,748	9,307	12,894	2.80	3.56	8,369	-7,953
15		Nails + Adhesive	ZIP OSB	10,944	-9,648	1,368	-1,206	10,690	11,152	16,029	16,029	9,895	10,418	1.75	1.93	8,755	-7,718
17		Nails Only	ZIP OSB	5,040	-5,393	630	-674	9,468	8,566	9,809	9,809	3,412	3,727	5.87	4.63	4,032	-4,314
18		Nails Only	ZIP OSB	5,218	-5,125	652	-641	12,913	10,562	16,391	13,014	3,408	3,455	5.93	6.00	4,175	-4,100

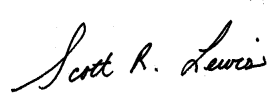
Table 10. Failure modes for each cyclic shear wall tested.

Wall ID	Framing Type	Fastening Method	Sheathing Type	Failure Modes
2	2x4	Nails Only	15/32" Plywood	Nail head withdrawal, nail head tear out at bottom and nail withdrawal.
3		Nails Only	15/32" Plywood	Nail head withdrawal, nail head tear out at bottom and top, nail withdrawal.
5		Nails + Adhesive	15/32" Plywood	Nail head pull through at bottom wall, sill plate failure across length, hold downs and sill plate washers bent.
6		Nails + Adhesive	15/32" Plywood	Nail withdrawal at center, nail head pull through @ bottom and center of wall, sill plate failure at actuator end.
7		Nails + Adhesive	15/32" Plywood	Complete failure of sill plate.
9	2x6	Nails + Adhesive	3/8" Plywood	Bottom sill plate failure, top plate failure, opposite actuator side sheathing release at center nail head pull through.
10		Nails + Adhesive	3/8" Plywood	Top plate failure, south bottom sill minor crack, stud failure at center.
11		Nails + Adhesive	3/8" Plywood	Bottom sill plate failure.
13		Nails + Adhesive	ZIP OSB	Nail head pull through at center stud, slight sill plate failure at actuator side and opposite actuator.
14		Nails + Adhesive	ZIP OSB	Nail head pull through at center stud, slight sill plate failure at actuator side and opposite actuator, center adhesive bead not fully adhered.
15		Nails + Adhesive	ZIP OSB	Nail head pull through at bottom edge, sill plate failure, opposite actuator side hold down wood failure.
17		Nails Only	ZIP OSB	Nail head pull through at center, nail withdrawal at center.
18		Nails Only	ZIP OSB	Nail head pull through at center, nail withdrawal at center.

Table 11. Lumber moisture content and specific gravity (#2 & BTR DF-L).

Wall ID #	Moisture Content	Specific Gravity
001	12.4%	0.61
002	12.2%	0.47
003	13.3%	0.72
004	11.0%	0.55
005	12.3%	0.58
006	12.3%	0.58
007	11.1%	0.48
008	11.0%	0.64
009	9.7%	0.48
010	10.4%	0.58
011	10.6%	0.53
012	10.1%	0.53
013	11.1%	0.61
014	10.1%	0.50
015	9.6%	0.51
016	11.7%	0.53
017	12.6%	0.48
018	11.6%	0.50
Average	11.3%	0.55

Testing conducted by Joshah Jennings and Scott R. Lewis



Report prepared by:



Joshah Jennings
Scientific Lab Manager
ICC Quality Manager

Reviewed and validated by

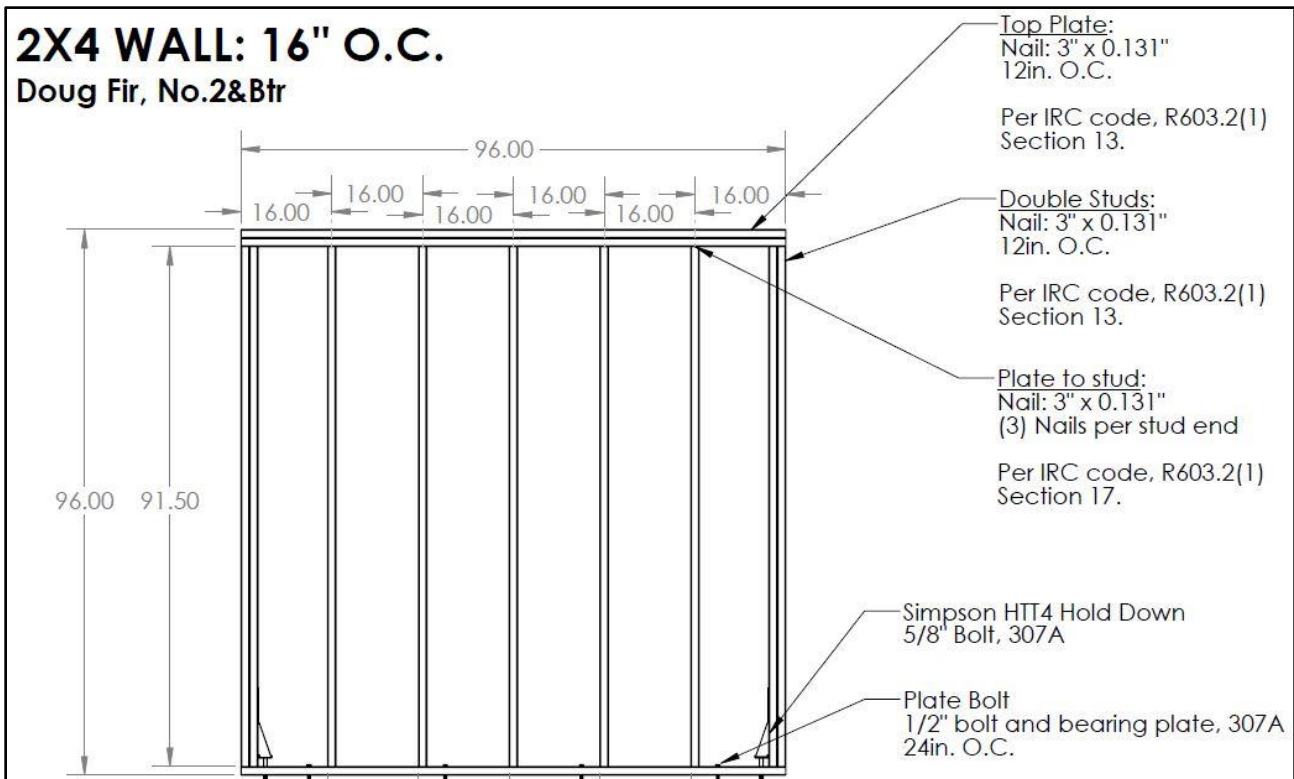
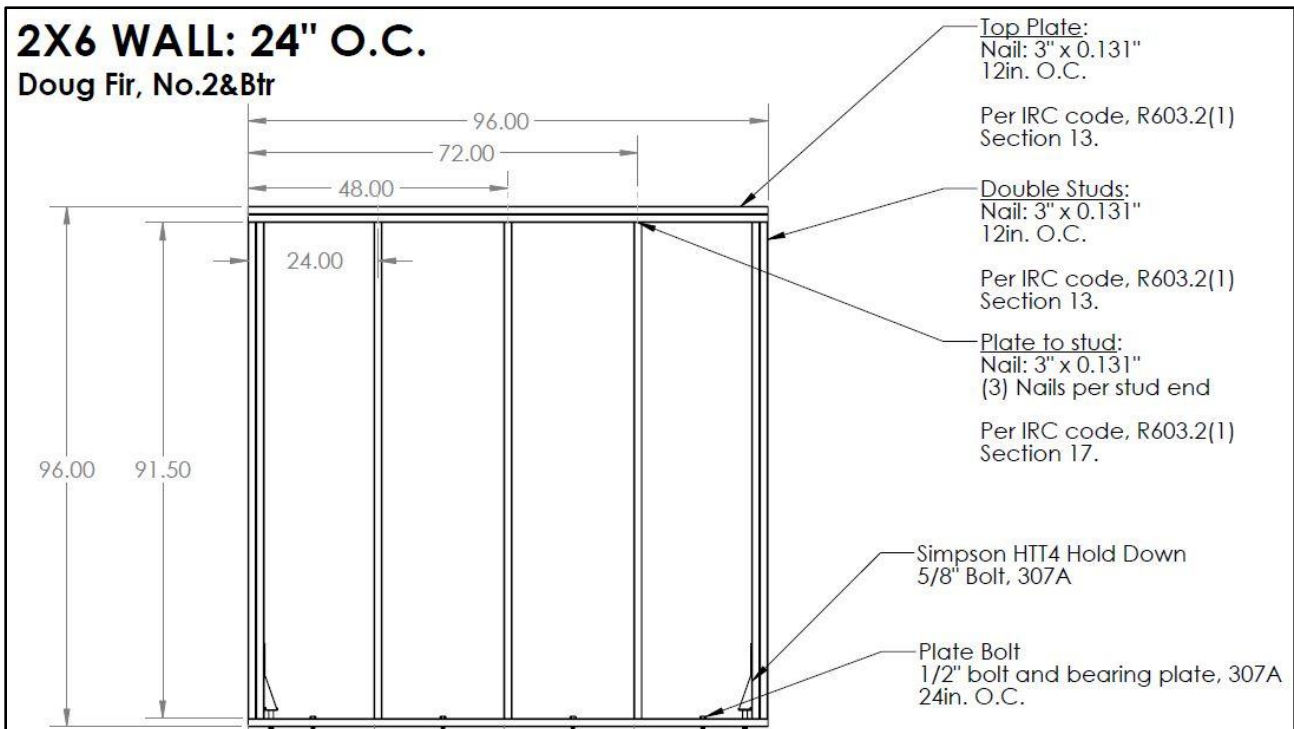


Pouria Bahmani, Ph.D., P.E.
P.E. Licenses: State of Washington, License No. 54651
ICC Technical Director
Washington State University



Appendix A: Framing and Adhesive Application Details.

A1. Framing and nailing schedule for 2x6 and 2x4 walls.



A2. Detailed instructions provided by Climate Adhesive for applying their adhesive.

9/10/2025

To: Washington State University
Attn: Joshah Jennings
CMEC Scientific Lab Manager

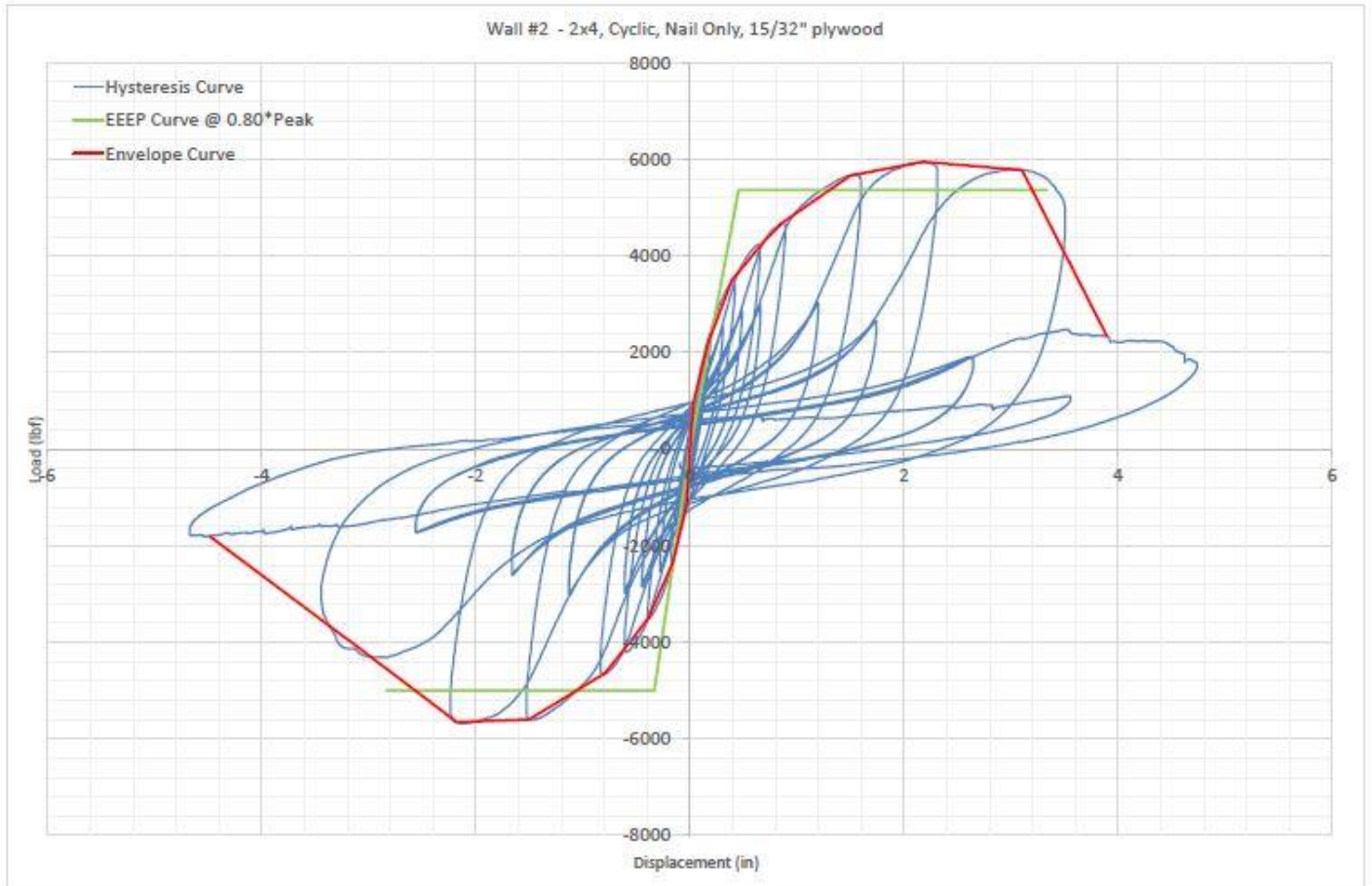
From: Robb Connell
National Sales Manager
Climate, Inc.
2734 Miller Rd.
Kalamazoo, MI 49009

Re: Climate NS Adhesive Installation Instructions for shear wall Specimens

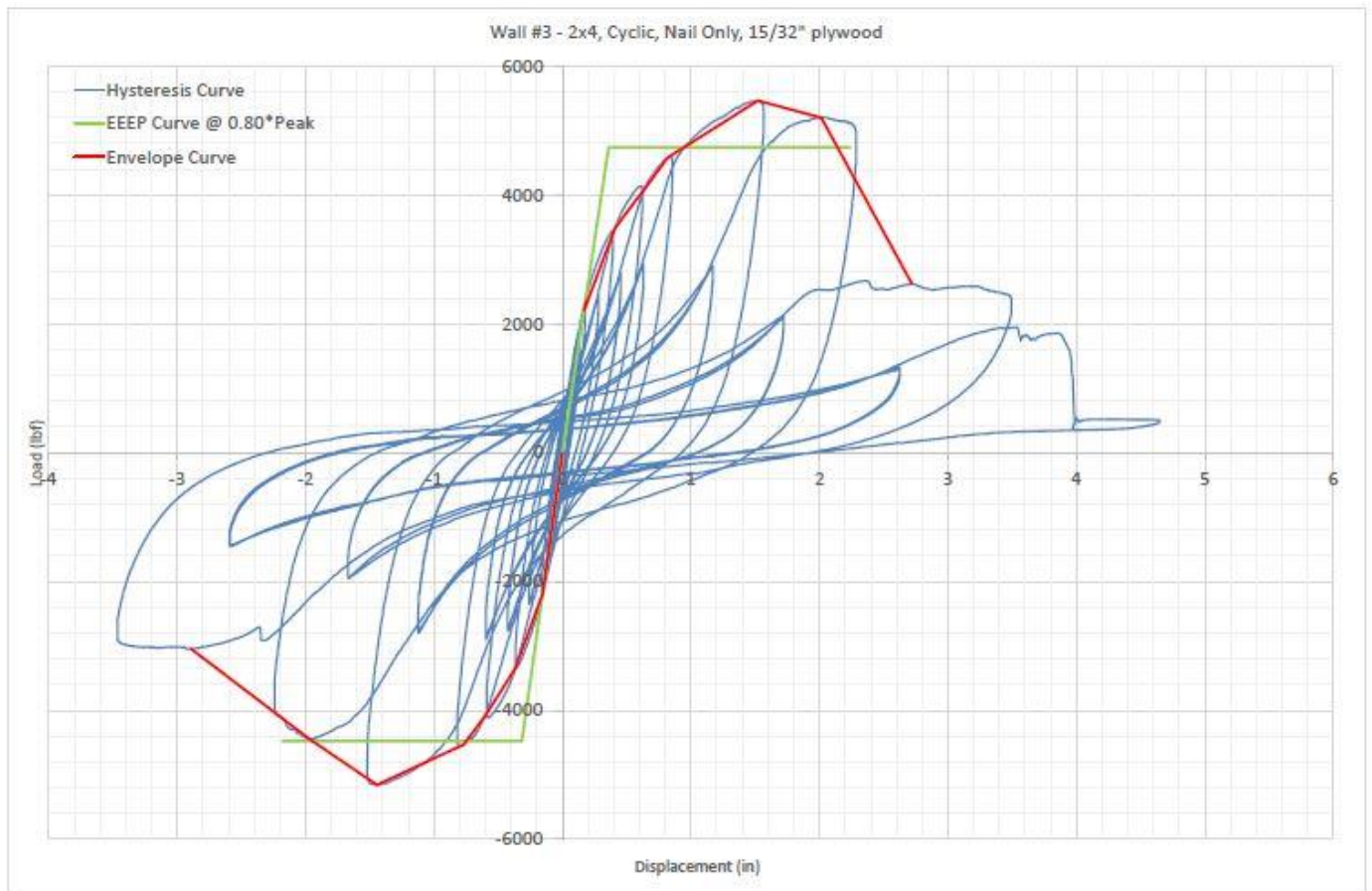
1. Install sausage tube in barrel of sausage gun
2. Remove metal clasp on end of the sausage with scissors
3. Screw cap on end of sausage gun
4. Cut plastic tip to a diameter of $\frac{1}{4}$ "
5. Install a $\frac{1}{4}$ " bead of adhesive to all framing members
6. At the center stud two $\frac{1}{4}$ " beads shall be installed on either side of the center line of the stud so as to facilitate adhesion of the two sections of sheathing that meet at this location
7. Installation of sheathing may commence at this point

Appendix B:

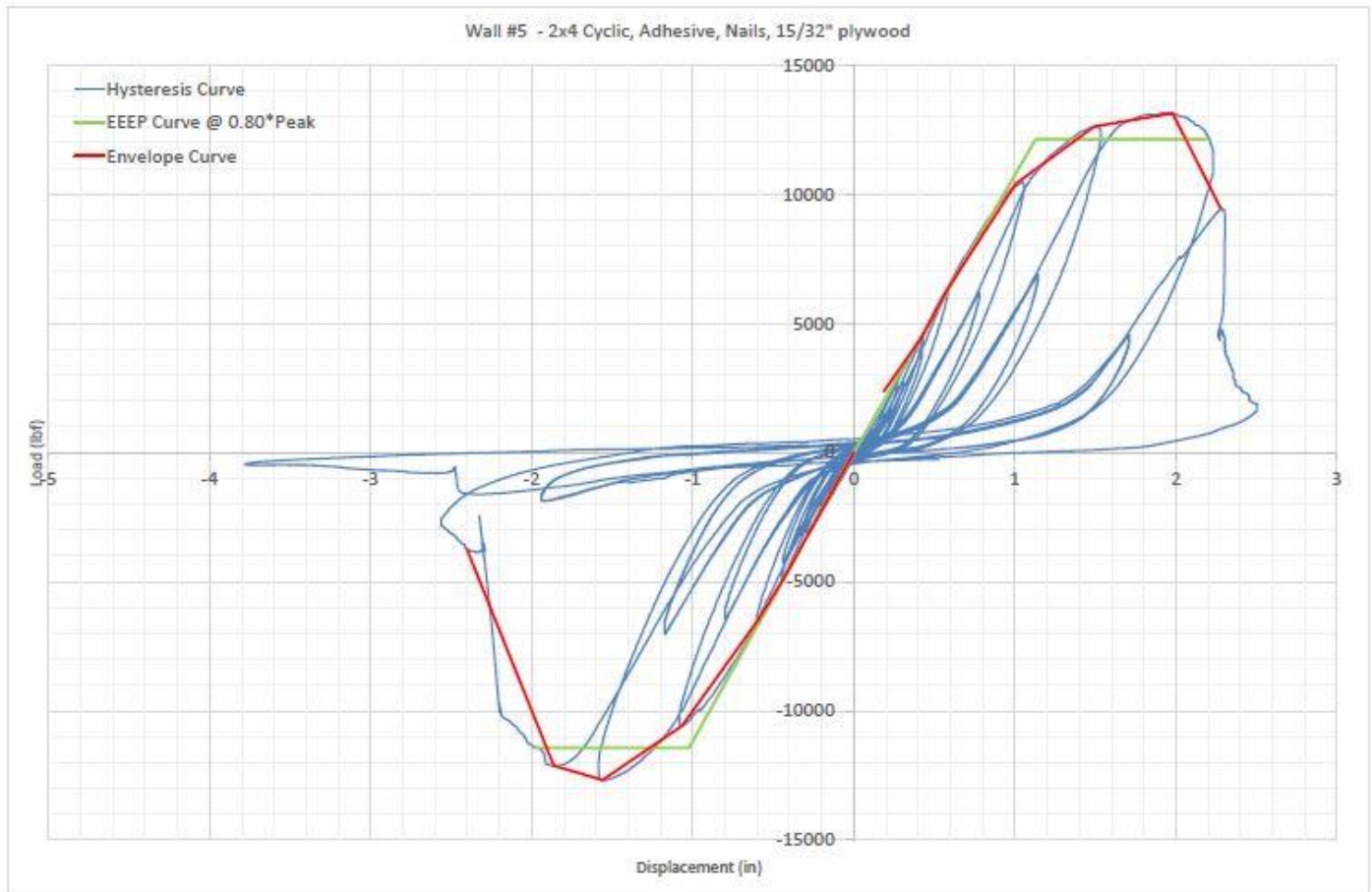
B1. Wall #2 hysteresis data, envelope curve, and EEEP curve.



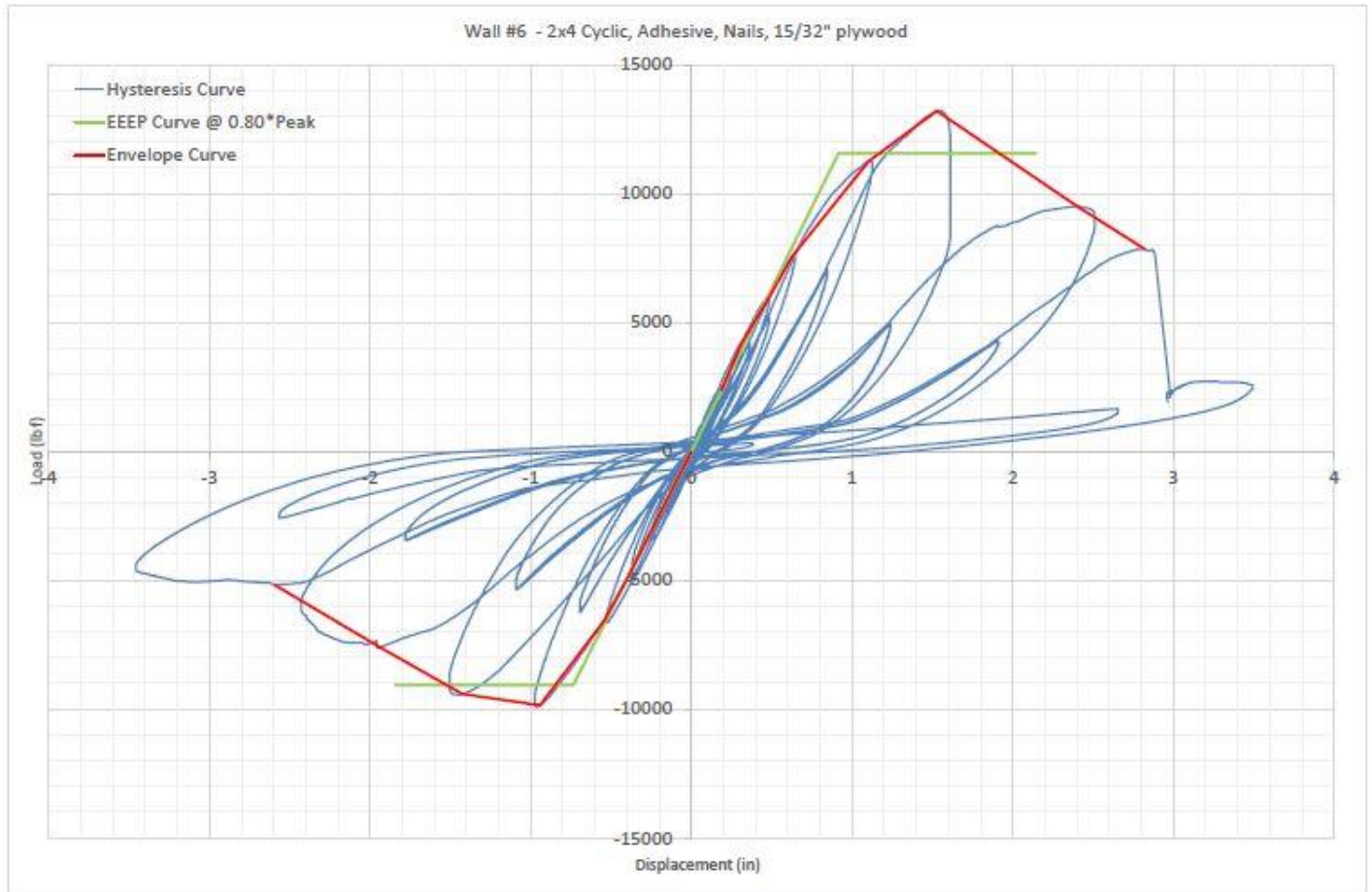
B2. Wall #3 hysteresis data, envelope curve, and EEEP curve.



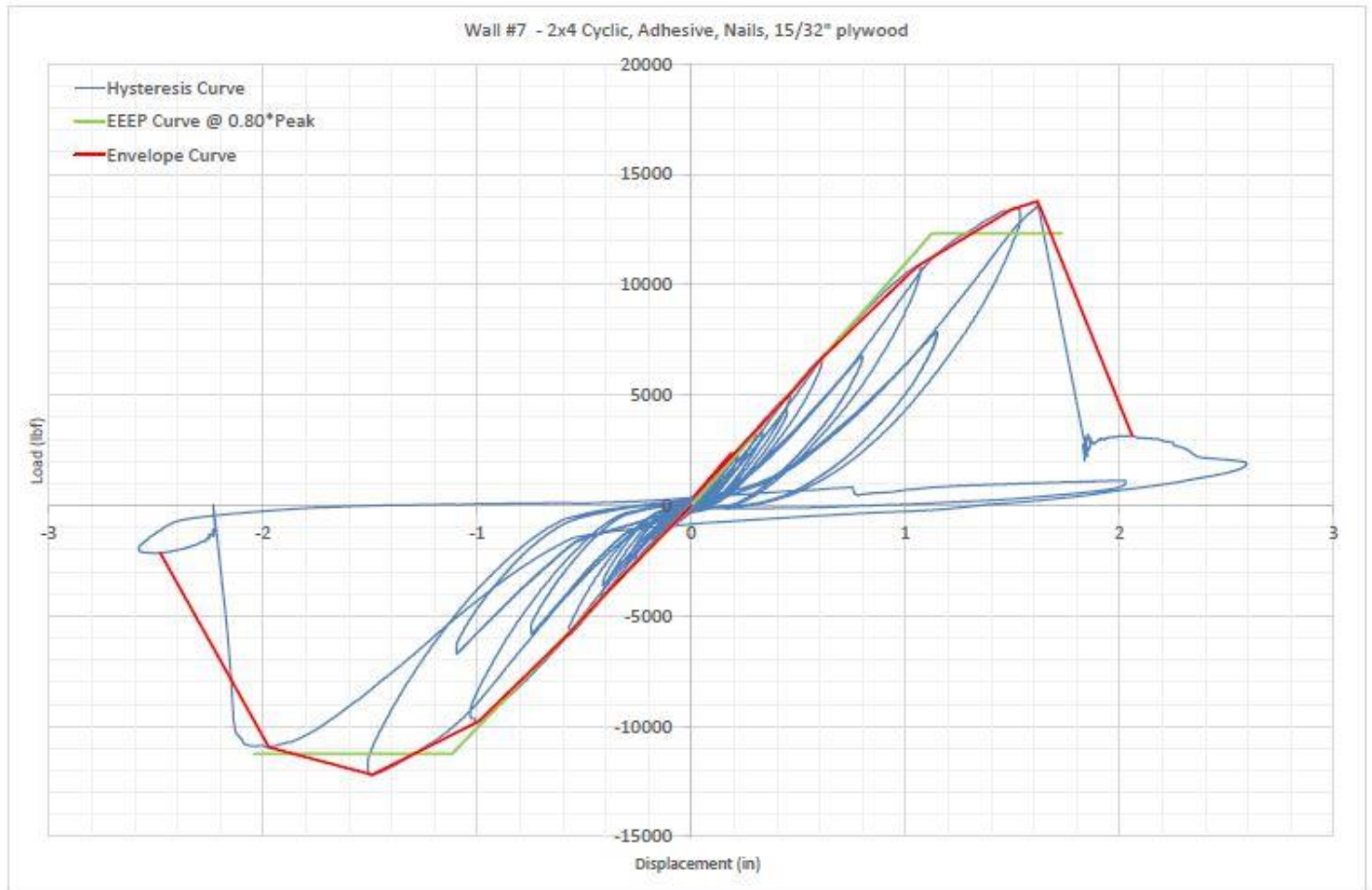
B3. Wall #5 hysteresis data, envelope curve, and EEEP curve.



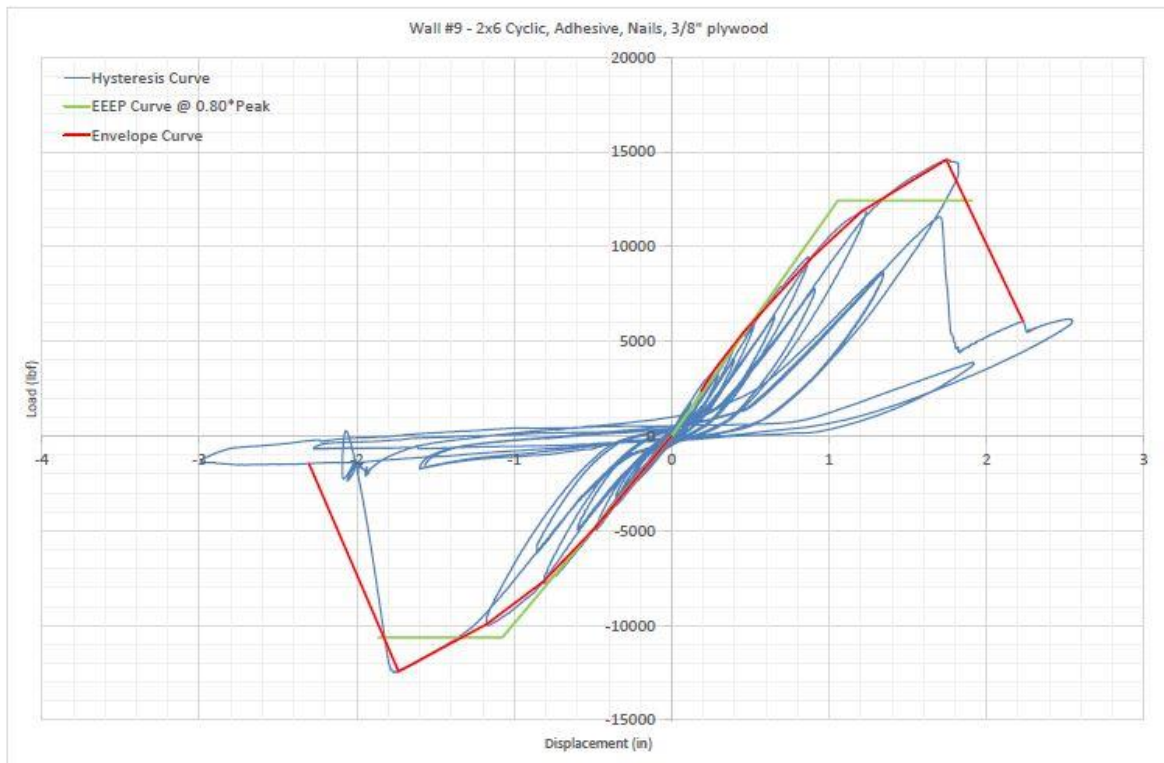
B4. Wall #6 hysteresis data, envelope curve, and EEEP curve.



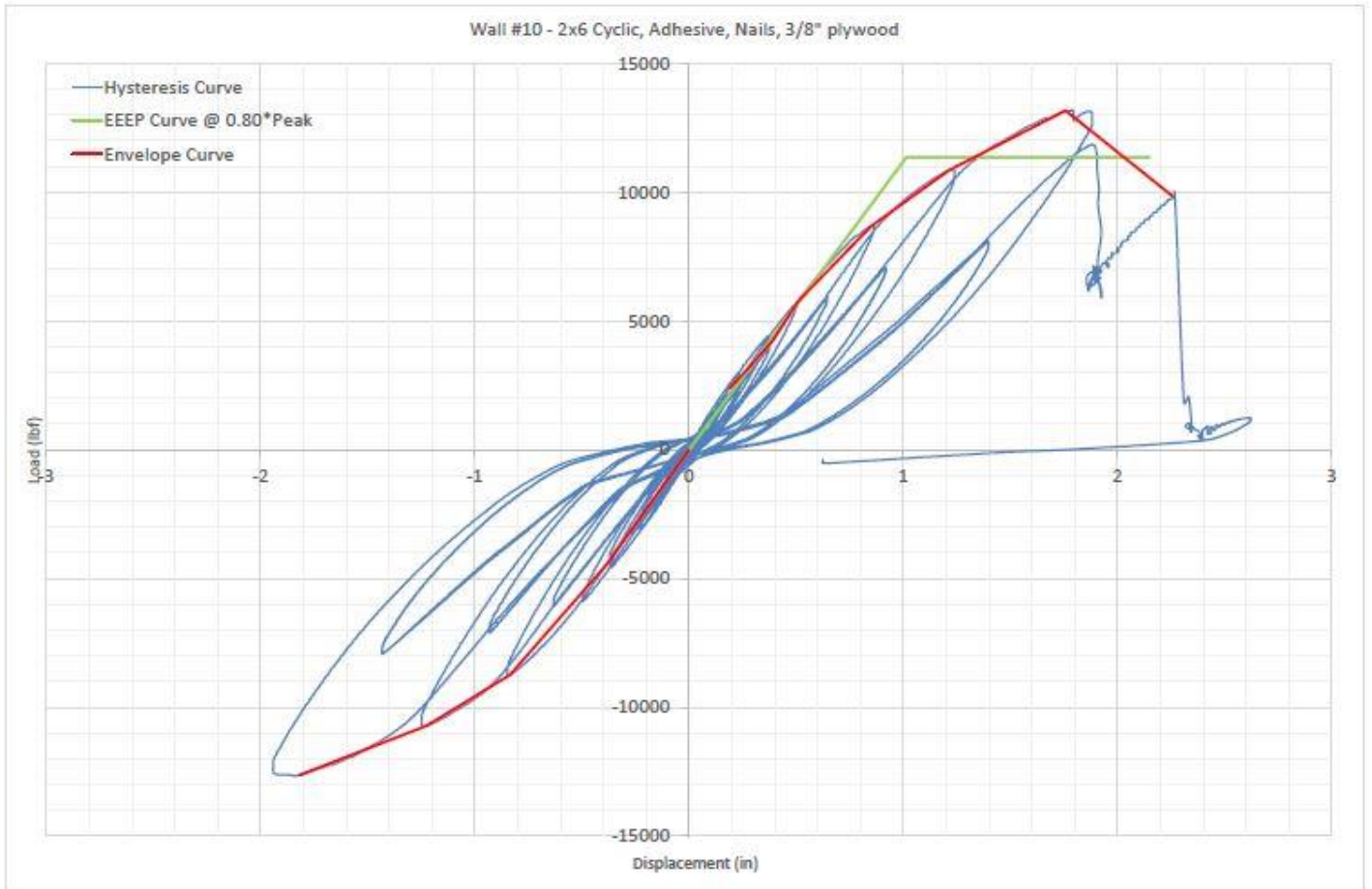
B5. Wall #7 hysteresis data, envelope curve, and EEEP curve.



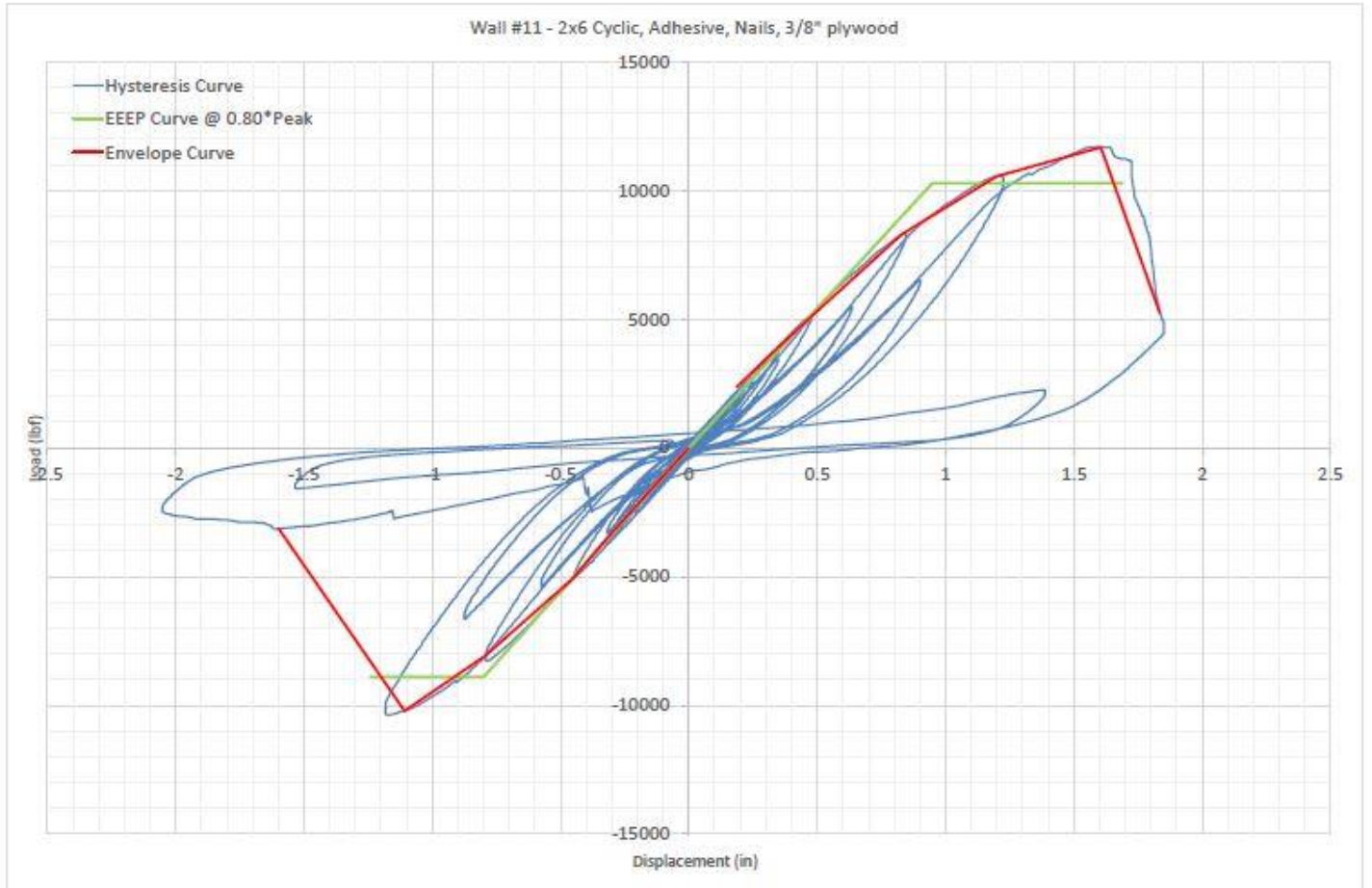
B6. Wall #9 hysteresis data, envelope curve, and EEEP curve.



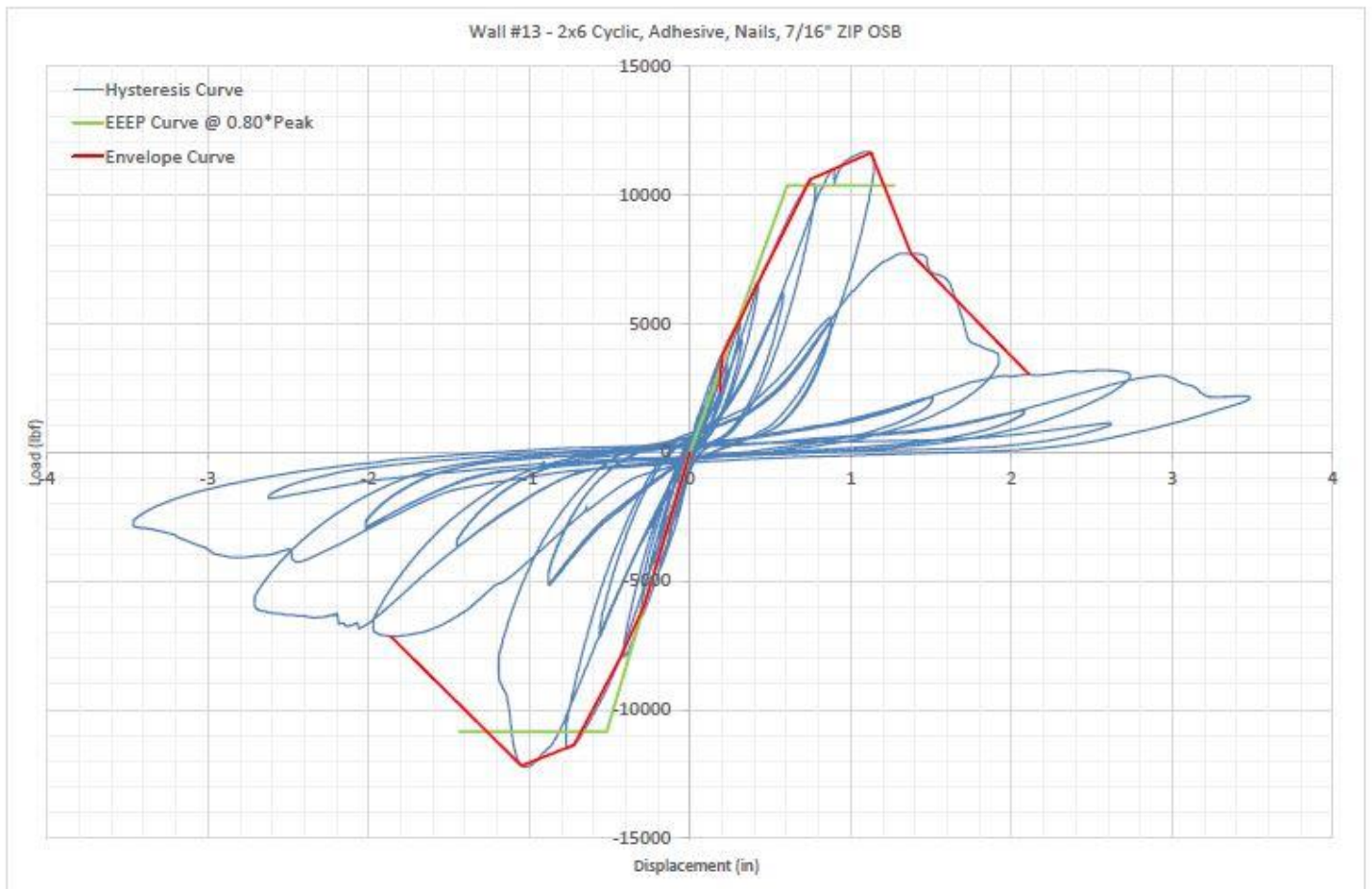
B8. Wall #10 hysteresis data, envelope curve, and EEEP curve.



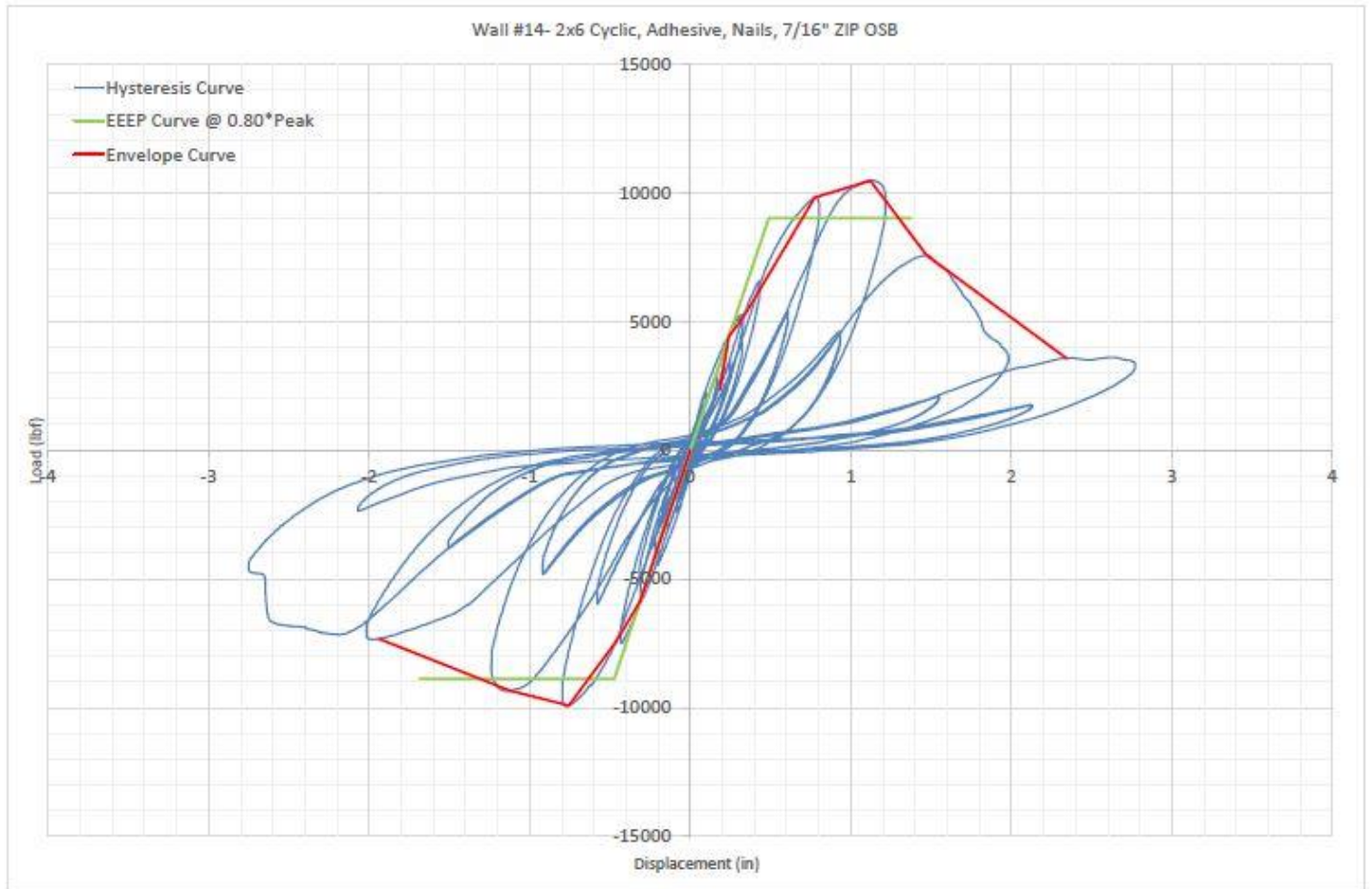
B9. Wall #11 hysteresis data, envelope curve, and EEEP curve.



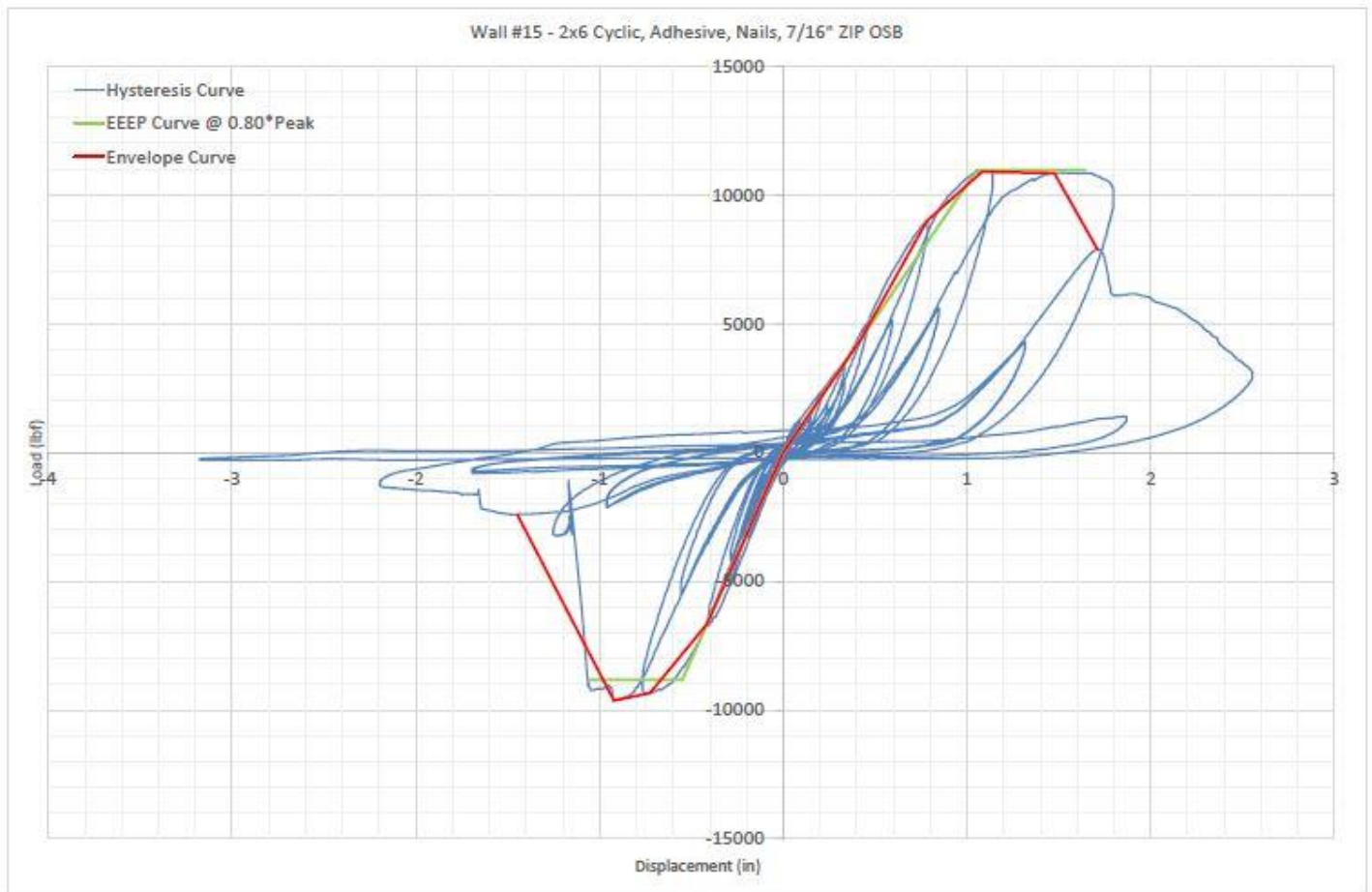
B10. Wall #13 hysteresis data, envelope curve, and EEEP curve.



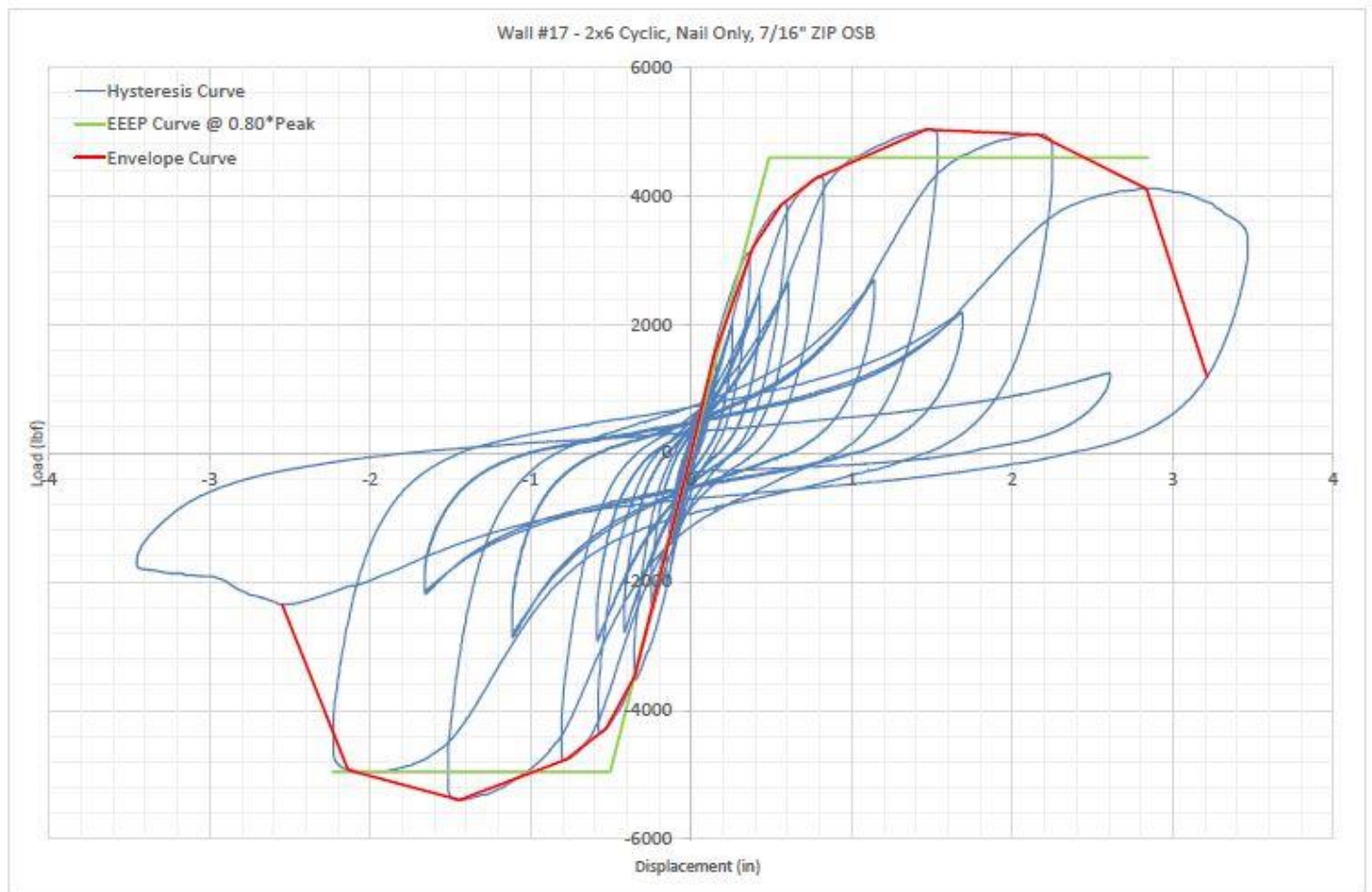
B11. Wall #14 hysteresis data, envelope curve, and EEEP curve.



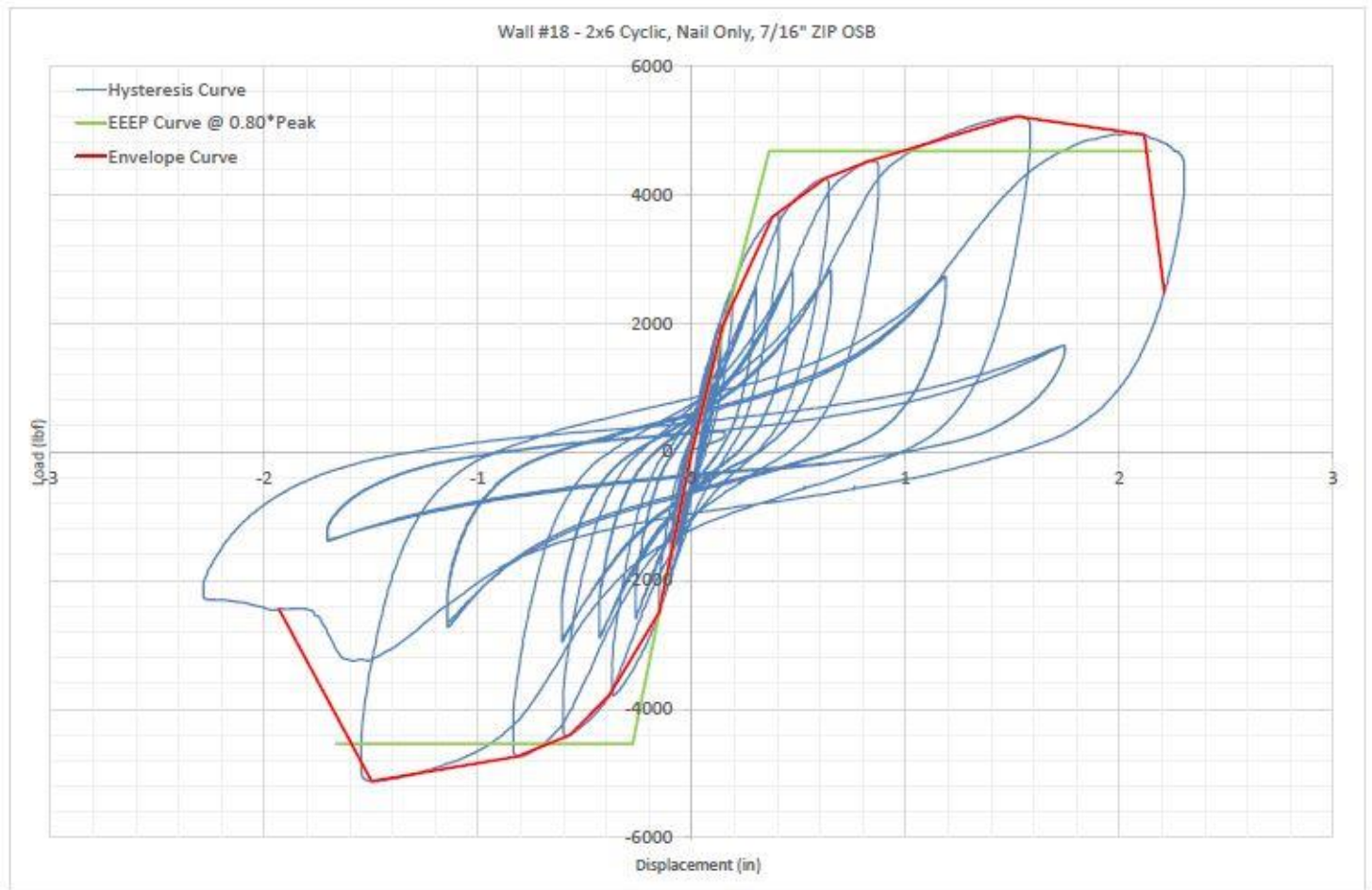
B12. Wall #15 hysteresis data, envelope curve, and EEEP curve.



B13. Wall #17 hysteresis data, envelope curve, and EEEP curve.



B14. Wall #18 hysteresis data, envelope curve, and EEEP curve.



Appendix C: Photographs of typical shear wall testing and failures.

C1. Typical shear wall setup with string potentiometers, bearing plate washers, and hold downs attached to the I-beam fixture in the test lab.



C2. Typical nail withdrawal failure and nail head tear out.



C3. Typical sill plate failure and double-stud end splitting – Brittle Failure.



Wall# 5: 2x4, Cyclic, Nails +Adhesive, 5/32" Plywood

C3. Typical glue-line failure.



Wall# 5: 2x4, Cyclic, Nails +Adhesive, 5/32" Plywood

C4. Typical sheathing separation and sill plate failure – Brittle Failure.



C5. Typical top plates failure (2x6 wall) – Brittle Failure.



C6. Non-typical failure of a glue-line at the center stud (2x6 wall). In this case (Wall #14), the center stud happened to have a lot of wane on the panel joint and provided less area for a full bead bond but did not affect the overall performance.



Wall# 14: 2x6, Cyclic, Nails
+Adhesive, ZIP OSB