APPENDIX B: CYCLIC TESTS WITH HOLD-DOWNS

Test:	10	10a
Testing Procedure:	Cyclic (ASTM E2126)	Cyclic (ASTM E2126)
Anchorage:	Hold-down	Hold-down
Material:	OSB	OSB
Date Constructed:	7/10/02	9/05/02
Date Tested:	7/31/02	9/16/02

Test 10 Observations:

-Nails pulled out of framing on the bottom plate, top plate, and end stud on the opposite side of the actuator.

-S-shaped nails were observed after testing.

-Mode of failure: The nails pulled out the framing and the end stud separating from the top plate.

Test 10a Observations:

-Nails on the bottom plate were the first nails to be damaged.

-Nail head pulled through sheathing along top plate and left end stud.

-Left end stud was observed to separate from the top plate after failure.

-Loud "popping" noises observed during the testing.

-**Mode of failure**: Nails tore through or pulled out of the framing, which allowed the end studs to pull away from the top plate

Note: This test was performed at a later date due to a fault in the testing of Test 9. The frame from Test 7 was salvaged and brought inside on 8/28/02. There was minimal damage to this frame because it was first tested with gypsum wallboard. Moisture content of the bottom plate was 20% when brought inside so it was replaced. The moisture content of the other framing materials was around 15%, so they were deemed to be satisfactory (refer to Test 16).

Note: It was observed that the top plate moved relative to the steel beam by a small amount during cycles.

Table B.1: EEEP and Performance Parameters for OSB Cyclic Tests

Specimen:		**Test Number**	
OSB with Hold-downs		**Test 10**	**Test 10a**
EEEP Parameters	**units**	**initial**	**initial**
Peak load, F_{peak}	Kips	2.123	2.298
	KN	9.444	10.221
Drift at peak load, Δ_{peak}	in.	3.078	2.870
	mm	78.19	72.89
Yield load, F_{yield}	Kips	1.903	2.018
	KN	8.464	8.975
Drift at yield load, Δ_{yield}	in.	0.484	0.775
	mm	12.31	19.67
Proportional limit, $0.4F_{peak}$	Kips	0.849	0.919
	KN	3.778	4.089
Drift at prop. limit, $\Delta@0.4F_{peak}$	in.	0.215	0.353
	mm	5.46	8.97
Failure load or $0.8F_{peak}$	Kips	1.699	1.840
	KN	7.555	8.183
Drift at failure, $\Delta_{failure}$	in.	4.491	4.671
	mm	114.07	118.65
Elastic stiffness, K_e $@0.4F_{peak}$	Kip/in.	3.930	2.600
	KN/mm	0.688	0.455
Work until failure	Kip·ft.	8.053	7.546
	KN·m	10.918	10.230
Load @ .32 in. (8.13 mm)	Kips	0.837	0.762
	KN	3.725	3.387
Load @ .48 in. (12.19 mm)	Kips	1.190	1.008
	KN	5.293	4.484
Load @ .96 in. (24.38 mm)	Kips	1.715	1.590
	KN	7.626	7.072
Load @ 1.6 in. (40.64 mm)	Kips	1.970	1.920
	KN	8.763	8.542

		Test 10		**Test 10a**	
EEEP Parameters	**units**	**negative**	**positive**	**negative**	**positive**
F_{yield}	Kips	-1.741	2.120	-1.840	2.196
	KN	-7.745	9.430	-8.183	9.766
v_{yield}	Kips/ft.	-0.435	0.530	-0.460	0.549
	KN/m	-6.353	7.735	-6.712	8.010
Δ_{yield}	in.	-0.686	0.430	-0.752	0.797
	mm	-17.43	10.92	-19.09	20.25
$\Delta_{failure}$	in.	-4.387	4.595	-4.411	4.932
	mm	-111.43	116.70	-112.03	125.28

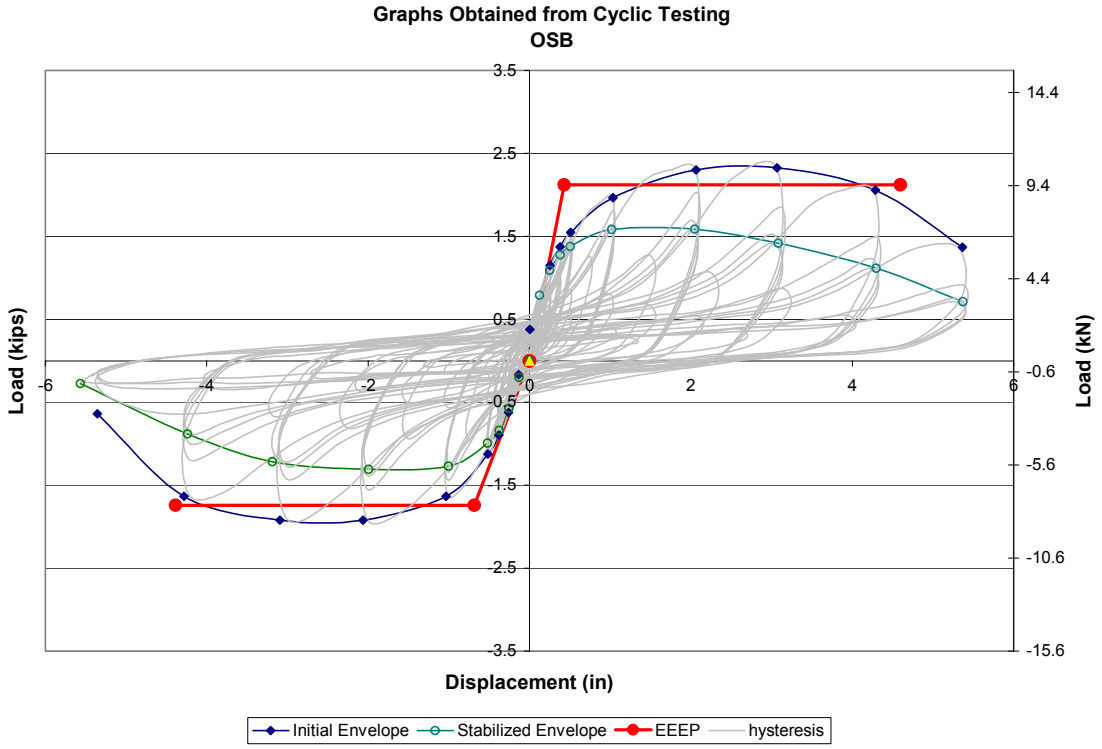

Figure B.1: Load-Displacement graph for OSB cyclic test (Test 10)

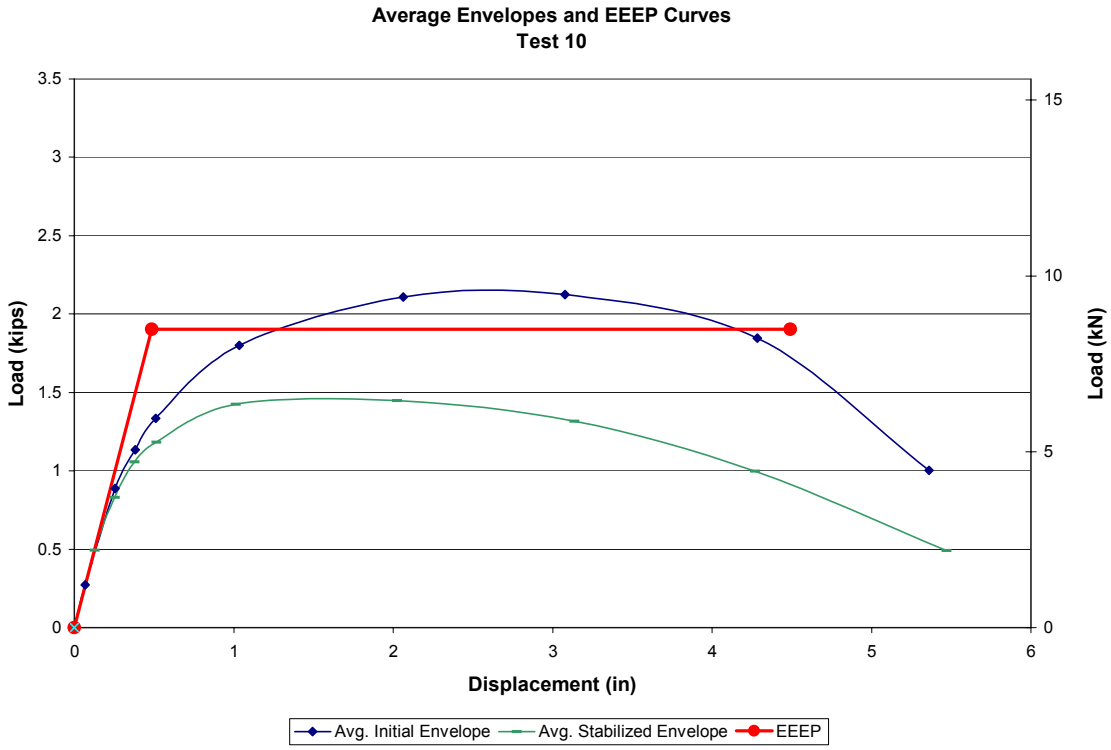

Figure B.2: Average envelope curve and EEEP curve (Test 10)

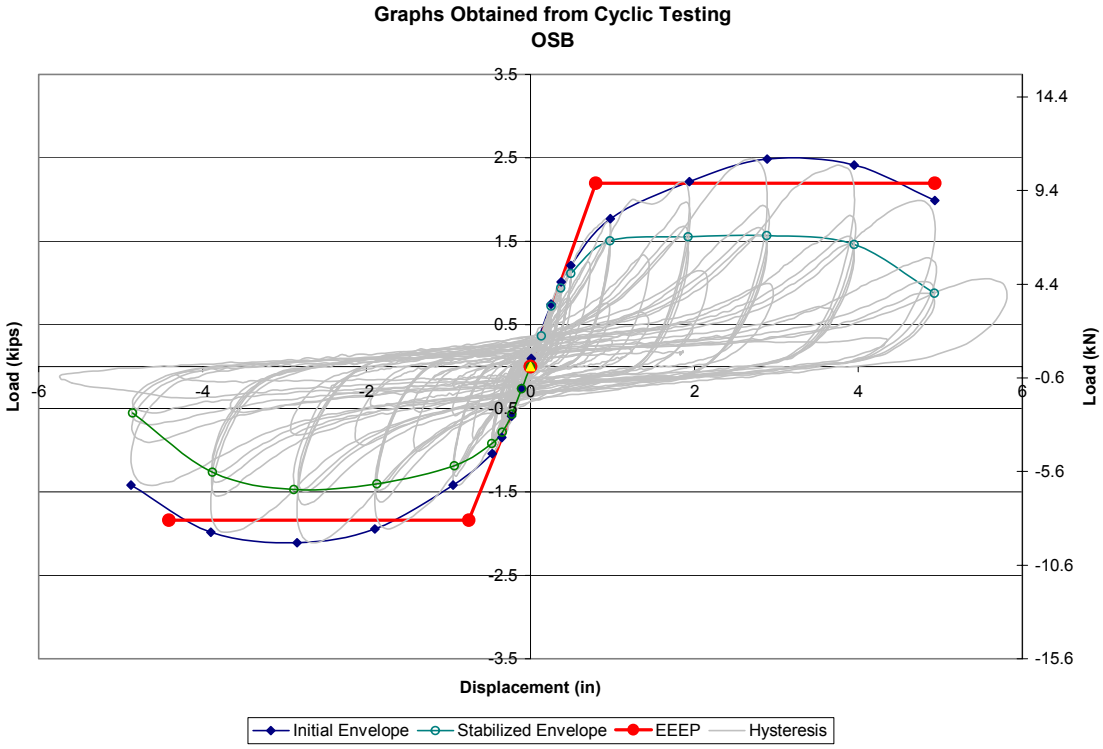

Figure B.3: Load-Displacement graph for OSB cyclic test (Test 10a)

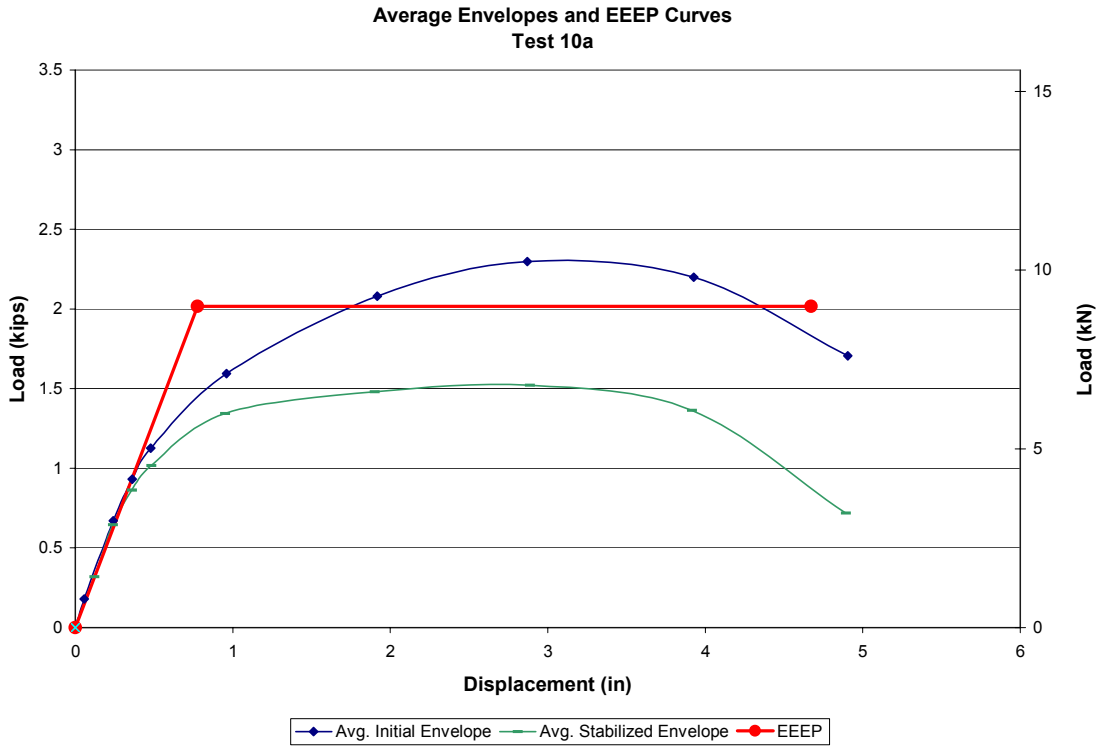

Figure B.4: Average envelope curve and EEEP curve (Test 10a)

Test:	11a	12
Testing Procedure:	Cyclic (ASTM E2126)	Cyclic (ASTM E2126)
Anchorage:	Hold-down	Hold-down
Material:	Hardboard	Hardboard
Date Constructed:	9/05/02	7/19/02
Date Tested:	9/16/02	8/01/02

Test 11a Observations:

-Nails most notably pulled out of framing in racking fashion along the bottom plate.

-The nails never caused any damage to the sheathing material, but instead always pulled out of the framing.

-Mode of failure: The nails pulled out the framing, which enabled the wall to deflect and the sheathing material could not resist the shear load because the nails could bend too easily.

Note: This test was performed at a later date due to a fault in the testing of Test 11. The frame from Test 16 was salvaged and brought inside after its test on 8/02/02. There was minimal damage to this frame because it was first tested with gypsum wallboard, which failed early in the cyclic protocol (refer to Test 16).

Test 12 Observations:

-Nails pulled out of the framing along the bottom plate and right end stud. The nails also started pulling out of the framing on the top plate near the actuator.

-The nails never caused any damage to the sheathing material, but instead always pulled out of the framing.

-The right end stud pulled away from the top plate.

-Mode of failure: The nails pulled out the framing, which enabled the wall to deflect and the sheathing material could not resist the shear load because the nails could bend too easily.

Table B.2: EEEP and Performance Parameters for Hardboard Cyclic Tests

Specimen:		**Test Number**	
Hardboard with Hold-downs		**11a**	**12**
EEEP Parameters	**units**	**initial**	**initial**
Peak load, F_{peak}	Kips	2.328	2.169
	KN	10.354	9.648
Drift at peak load, Δ_{peak}	in.	2.324	2.310
	mm	59.02	58.69
Yield load, F_{yield}	Kips	2.080	1.944
	KN	9.252	8.646
Drift at yield load, Δ_{yield}	in.	0.430	0.372
	mm	10.92	9.46
Proportional limit, $0.4F_{peak}$	Kips	0.931	0.868
	KN	4.141	3.859
Drift at prop. limit, $\Delta@0.4F_{peak}$	in.	0.192	0.165
	mm	4.89	4.20
Failure load or $0.8F_{peak}$	Kips	1.862	1.735
	KN	8.283	7.718
Drift at failure, $\Delta_{failure}$	in.	4.389	3.946
	mm	111.49	100.24
Elastic stiffness, K_e $@0.4F_{peak}$	Kip/in.	4.857	5.679
	KN/mm	0.850	0.994
Work until failure	Kip·ft.	8.088	6.064
	KN·m	10.966	8.221
Load @ .32 in. (8.13 mm)	Kips	1.065	1.051
	KN	4.736	4.675
Load @ .48 in. (12.19 mm)	Kips	1.271	1.283
	KN	5.655	5.708
Load @ .96 in. (24.38 mm)	Kips	1.872	1.837
	KN	8.326	8.170
Load @ 1.6 in. (40.64 mm)	Kips	2.192	2.131
	KN	9.751	9.477

		Test 11a		**Test 12**	
EEEP Parameters	**units**	**negative**	**positive**	**negative**	**positive**
F_{yield}	Kips	-2.063	2.140	-1.857	2.080
	KN	-9.177	9.519	-8.262	9.252
v_{yield}	Kips/ft.	-0.516	0.535	-0.464	0.520
	KN/m	-7.527	7.808	-6.776	7.588
Δ_{yield}	in.	-0.455	0.490	-0.471	0.409
	mm	-11.56	12.45	-11.96	10.39
$\Delta_{failure}$	in.	-4.362	4.417	-4.064	3.828
	mm	-110.80	112.18	-103.24	97.24

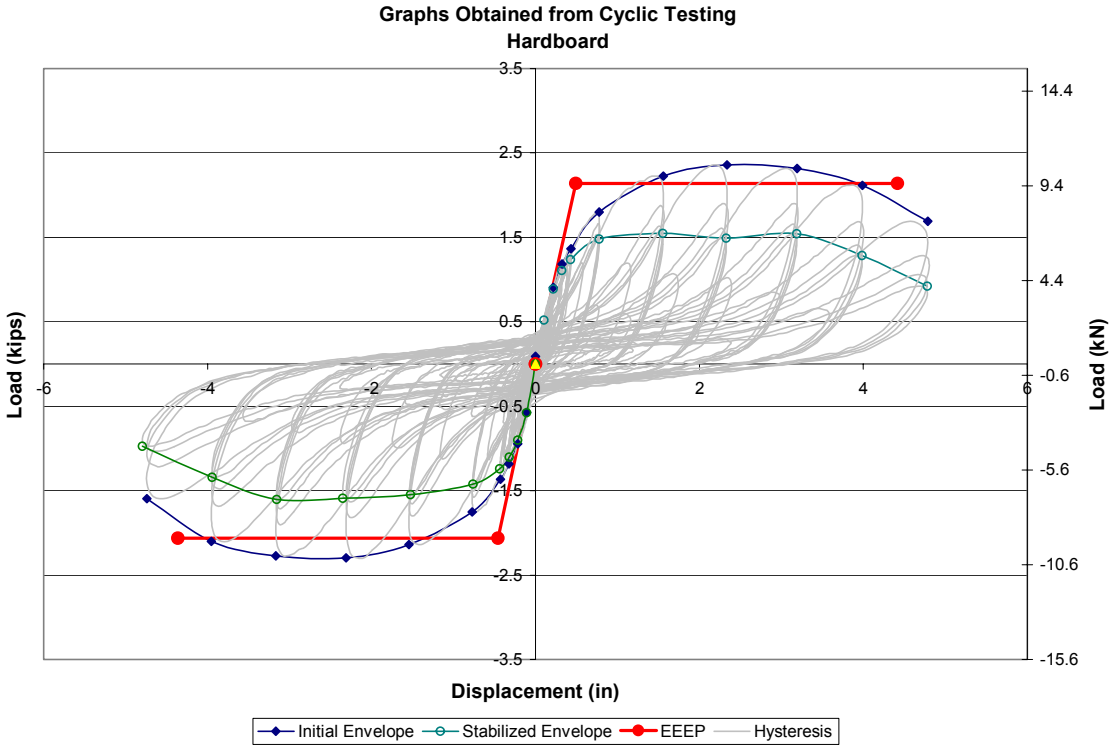

Figure B.5: Load-Displacement graph for Hardboard cyclic test (Test 11a)

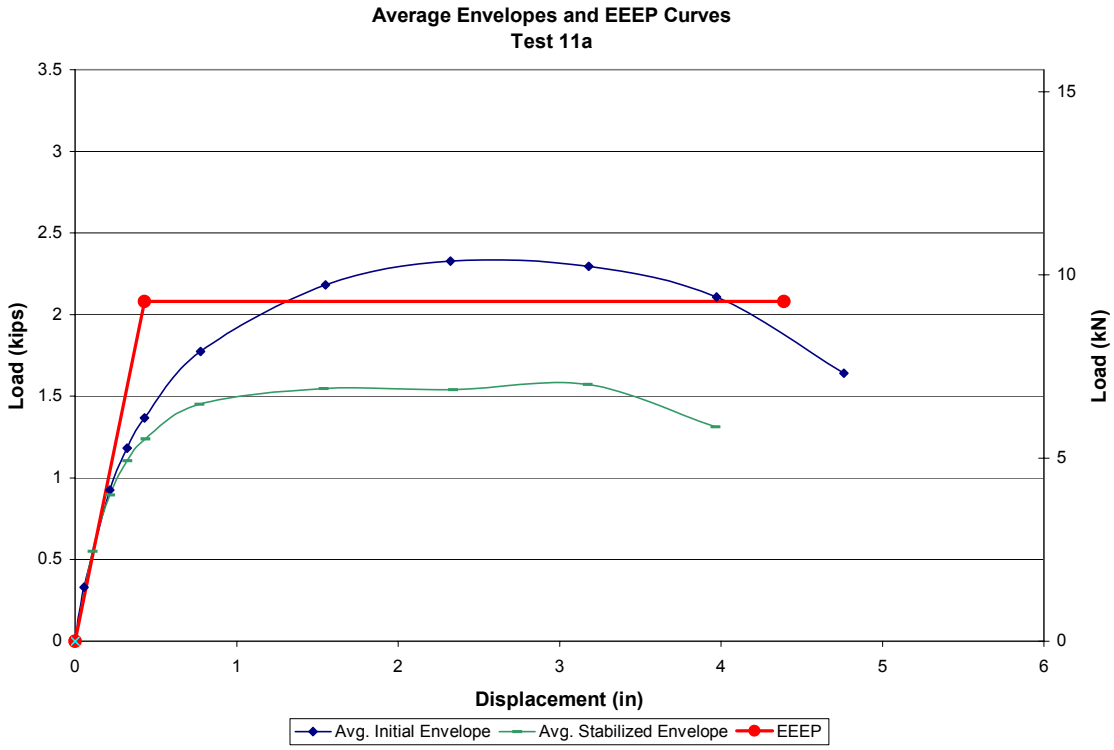

Figure B.6: Average envelope curve and EEEP curve (Test 11a)

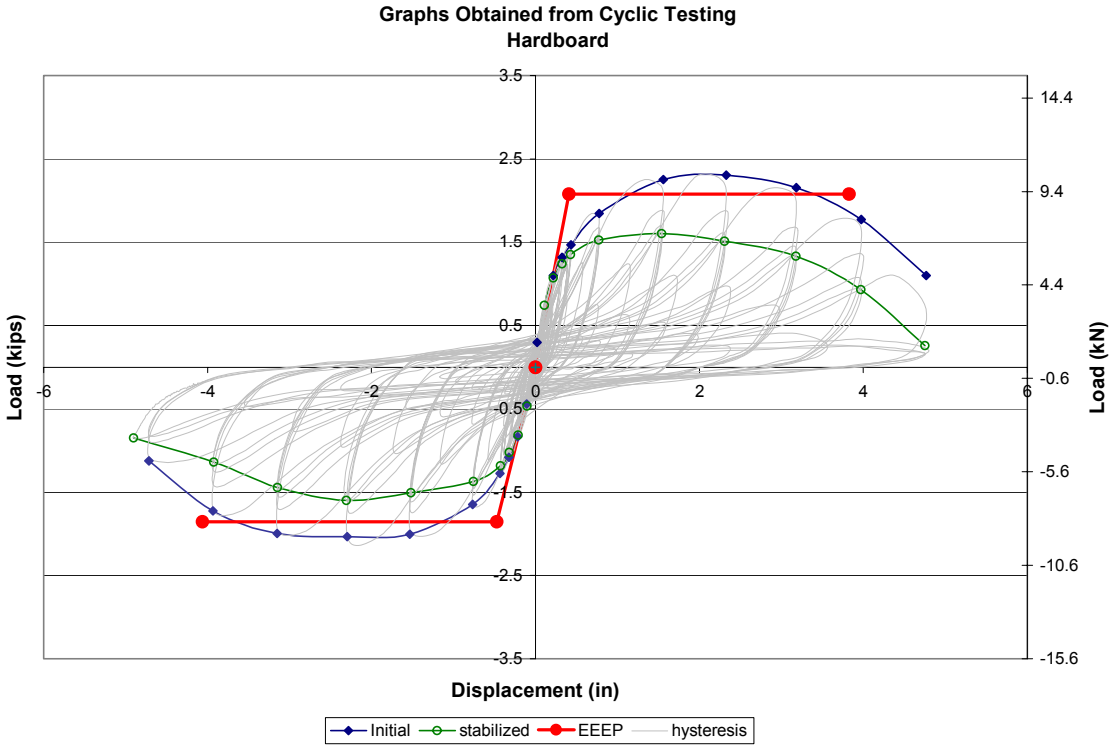

Figure B.7: Load-Displacement graph for Hardboard cyclic test (Test 12)

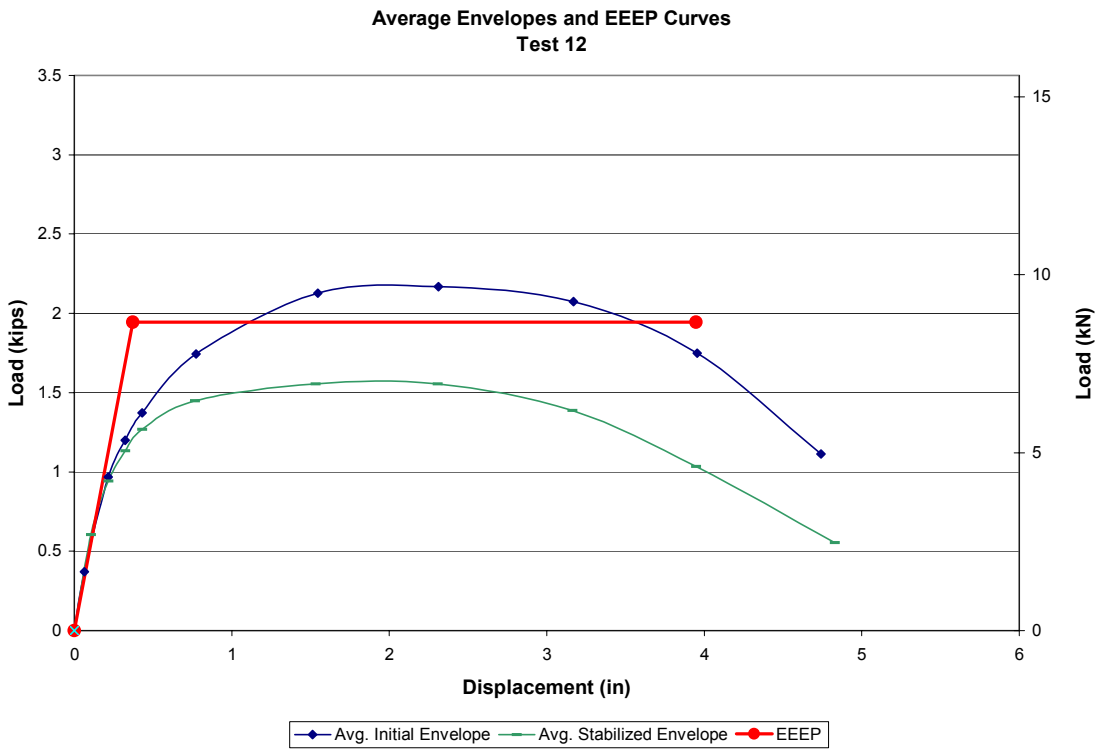

Figure B.8: Average envelope curve and EEEP curve (Test 12)

Test:	13	14a
Testing Procedure:	Cyclic (ASTM E2126)	Cyclic (ASTM E2126)
Anchorage:	Hold-down	Hold-down
Material:	Fiberboard	Fiberboard
Date Constructed:	7/30/02	9/05/02
Date Tested:	8/01/02	9/16/02

Test 13 Observations:

-Nails either tore through the sheathing or the nail head sank through the sheathing around the entire perimeter of the wall.

-On the bottom plate, the nail head sunk through the sheathing and then tore through sheathing.

-**Mode of failure:** The nails could easily tear through the sheathing, which basically caused the sheathing to be ineffective since it wasn't resisting the shear force from the racking of the frame.

Test 14a Observations:

-Nails either tore through the sheathing or the nail head sank through the sheathing around the entire perimeter of the wall.

-Some of the nails along the end stud near the actuator were observed to fall out of the framing during testing.

-**Mode of failure:** The nails could easily bore a hole in the sheathing, which basically caused the sheathing to be ineffective since it wasn't resisting the shear force from the racking of the frame.

Table B.3: EEEP and Performance Parameters for Fiberboard Cyclic Tests

Specimen:		**Test Number**	
Fiberboard with Hold-downs		**Test 13**	**Test 14a**
EEEP Parameters	**units**	**initial**	**initial**
Peak load, F_{peak}	Kips	1.385	1.530
	KN	6.163	6.807
Drift at peak load, Δ_{peak}	in.	2.583	2.452
	mm	65.60	62.27
Yield load, F_{yield}	Kips	1.195	1.370
	KN	5.315	6.094
Drift at yield load, Δ_{yield}	in.	0.490	0.534
	mm	12.44	13.56
Proportional limit, $0.4F_{peak}$	Kips	0.554	0.612
	KN	2.465	2.723
Drift at prop. limit, $\Delta@0.4F_{peak}$	in.	0.227	0.194
	mm	5.77	4.93
Failure load or $0.8F_{peak}$	Kips	1.108	1.224
	KN	4.930	5.446
Drift at failure, $\Delta_{failure}$	in.	3.744	4.828
	mm	95.11	122.62
Elastic stiffness, K_e $@0.4F_{peak}$	Kip/in.	2.440	3.411
	KN/mm	0.427	0.597
Work until failure	Kip·ft.	3.149	5.515
	KN·m	4.269	7.477
Load @ .32 in. (8.13 mm)	Kips	0.482	0.606
	KN	2.144	2.697
Load @ .48 in. (12.19 mm)	Kips	0.647	0.801
	KN	2.879	3.563
Load @ .96 in. (24.38 mm)	Kips	1.050	1.209
	KN	4.672	5.377
Load @ 1.6 in. (40.64 mm)	Kips	1.300	1.474
	KN	5.784	6.557

		Test 13		**Test 14a**	
EEEP Parameters	**units**	**negative**	**positive**	**negative**	**positive**
F_{yield}	Kips	-1.211	1.249	-1.346	1.375
	KN	-5.386	5.556	-5.989	6.115
v_{yield}	Kips/ft.	-0.303	0.312	-0.337	0.344
	KN/m	-4.418	4.557	-4.912	5.015
Δ_{yield}	in.	-0.497	0.659	-0.311	0.551
	mm	-12.62	16.75	-7.90	14.00
$\Delta_{failure}$	in.	-3.747	3.742	-4.773	4.883
	mm	-95.17	95.05	-121.23	124.02

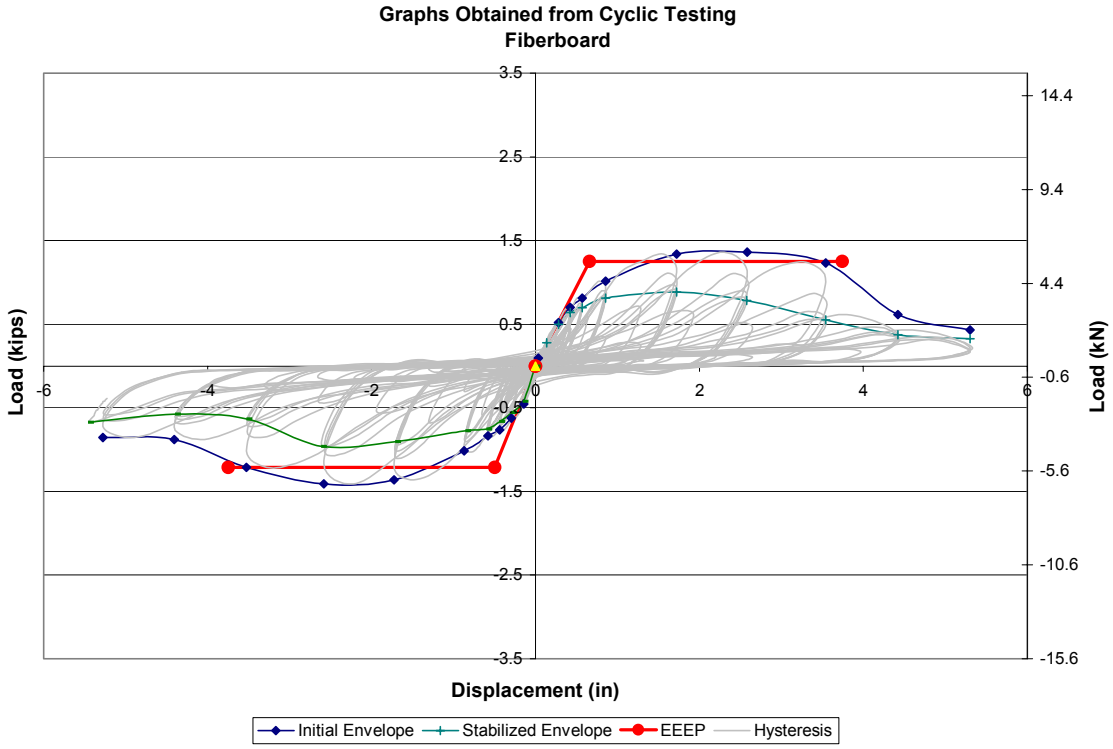

Figure B.9: Load-Displacement graph for Fiberboard cyclic test (Test 13)

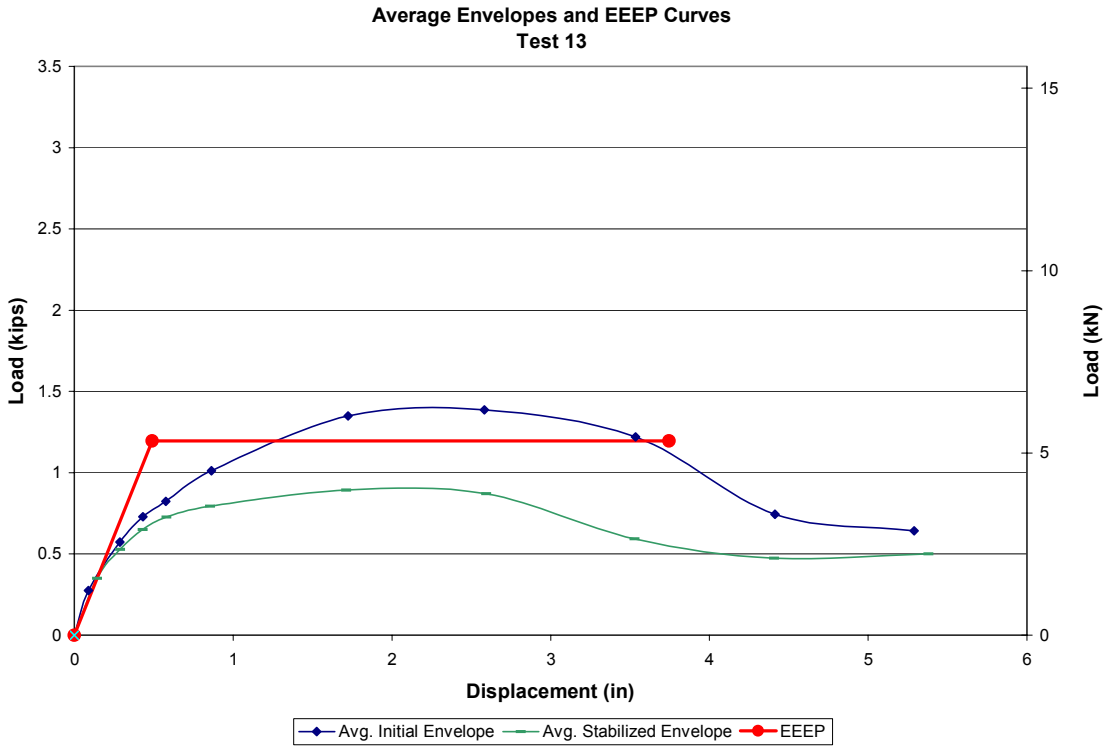

Figure B.10: Average envelope curve and EEEP curve (Test 13)

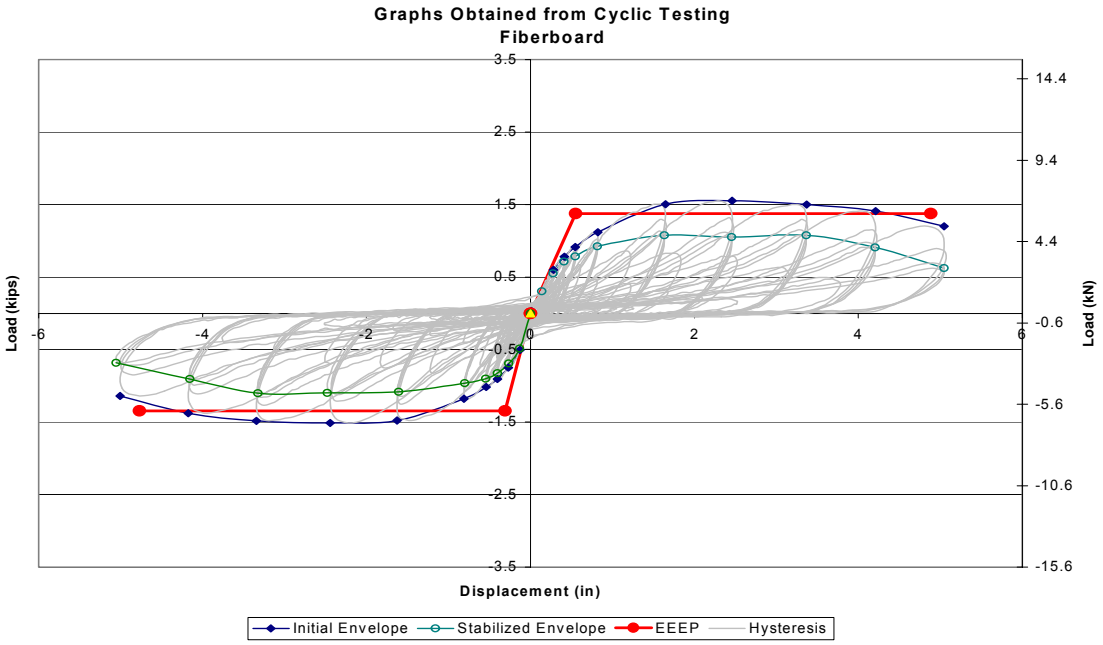

Figure B.11: Load-Displacement graph for Fiberboard cyclic test (Test 14a)

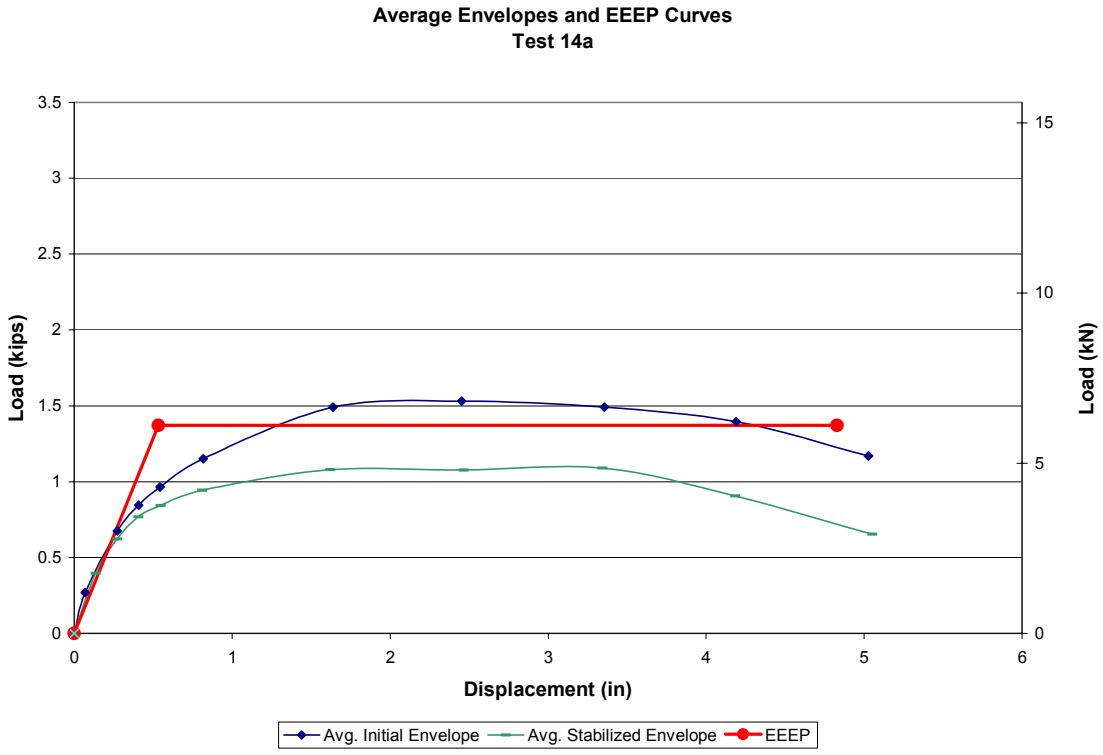

Figure B.12: Average envelope curve and EEEP curve (Test 14a)

Test:	15	16
Testing Procedure:	Cyclic (ASTM E2126)	Cyclic (ASTM E2126)
Anchorage:	Hold-down	Hold-down
Material:	Gypsum	Gypsum
Date Constructed:	7/12/02	7/12/02
Date Tested:	8/02/02	8/02/02

Test 15 Observations:

-The nails tore through the sheathing on the bottom plate, and then pulled through sheathing along the edges until the entire sheathing panel fell off the frame.

-Mode of failure: The nails could easily pull through the sheathing or tear through the sheathing, leaving nothing for the nails to hold, so the sheathing panel fell off.

Test 16 Observations:

-The nails tore through the sheathing on the bottom plate, and then pulled through sheathing along the edges until the entire sheathing panel fell off the frame.

-Mode of failure: The nails could easily pull through the sheathing or tear through the sheathing, leaving nothing for the nails to hold, so the sheathing panel fell off.

Table B.4: EEEP and Performance Parameters for Gypsum Cyclic Tests

Specimen:		**Test Number**	
Gypsum with Hold-downs		**Test 15**	**Test 16**
EEEP Parameters	**units**	**initial**	**initial**
Peak load, F_{peak}	Kips	0.838	0.842
	KN	3.730	3.746
Drift at peak load, Δ_{peak}	in.	1.706	1.720
	mm	43.32	43.69
Yield load, F_{yield}	Kips	0.699	0.739
	KN	3.109	3.287
Drift at yield load, Δ_{yield}	in.	0.250	0.330
	mm	6.35	8.38
Proportional limit, $0.4F_{peak}$	Kips	0.335	0.337
	KN	1.492	1.499
Drift at prop. limit, $\Delta@0.4F_{peak}$	in.	0.120	0.143
	mm	3.05	3.63
Failure load or $0.8F_{peak}$	Kips	0.671	0.674
	KN	2.985	2.997
Drift at failure, $\Delta_{failure}$	in.	2.469	2.633
	mm	62.72	66.89
Elastic stiffness, K_e $@0.4F_{peak}$	Kip/in.	2.818	2.240
	KN/mm	0.493	0.392
Work until failure	Kip·ft.	0.998	1.256
	KN·m	1.353	1.703
Load @ .32 in. (8.13 mm)	Kips	0.418	0.377
	KN	1.861	1.675
Load @ .48 in. (12.19 mm)	Kips	0.519	0.487
	KN	2.311	2.168
Load @ .96 in. (24.38 mm)	Kips	0.738	0.716
	KN	3.282	3.184
Load @ 1.6 in. (40.64 mm)	Kips	0.824	0.822
	KN	3.665	3.657

		Test 15		**Test 16**	
EEEP Parameters	**units**	**negative**	**positive**	**negative**	**positive**
F_{yield}	Kips	-0.685	0.713	-0.670	0.809
	KN	-3.045	3.172	-2.980	3.598
v_{yield}	Kips/ft.	-0.171	0.178	-0.168	0.202
	KN/m	-2.497	2.602	-2.439	2.942
Δ_{yield}	in.	-0.225	0.275	-0.400	0.260
	mm	-5.72	6.98	-10.16	6.60
$\Delta_{failure}$	in.	-2.363	2.575	-2.533	2.733
	mm	-60.03	65.41	-64.35	69.42

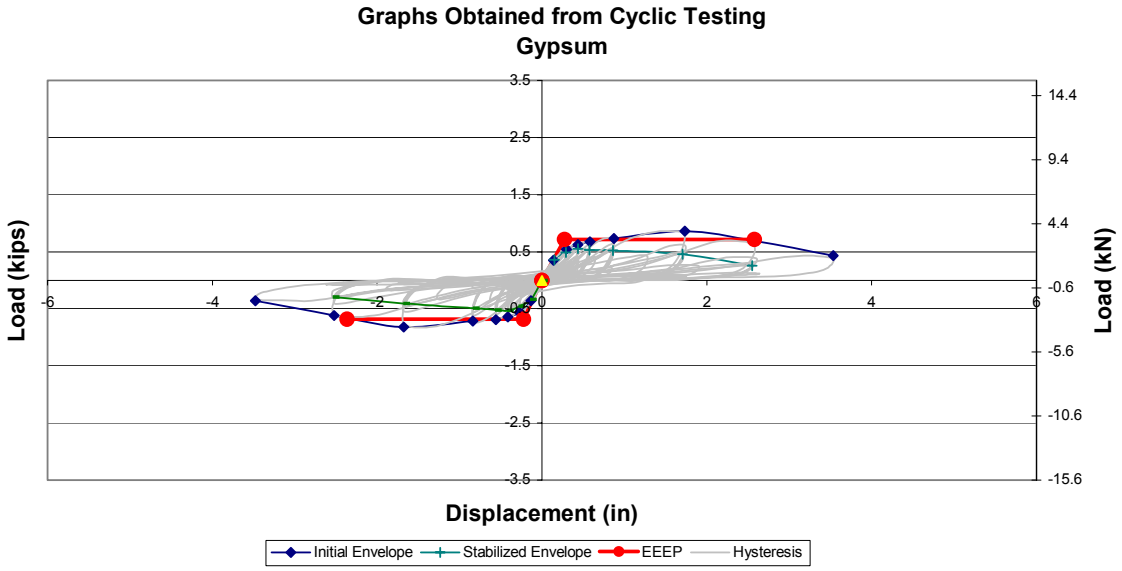

Figure B.13: Load-Displacement graph for Gypsum cyclic test (Test 15)

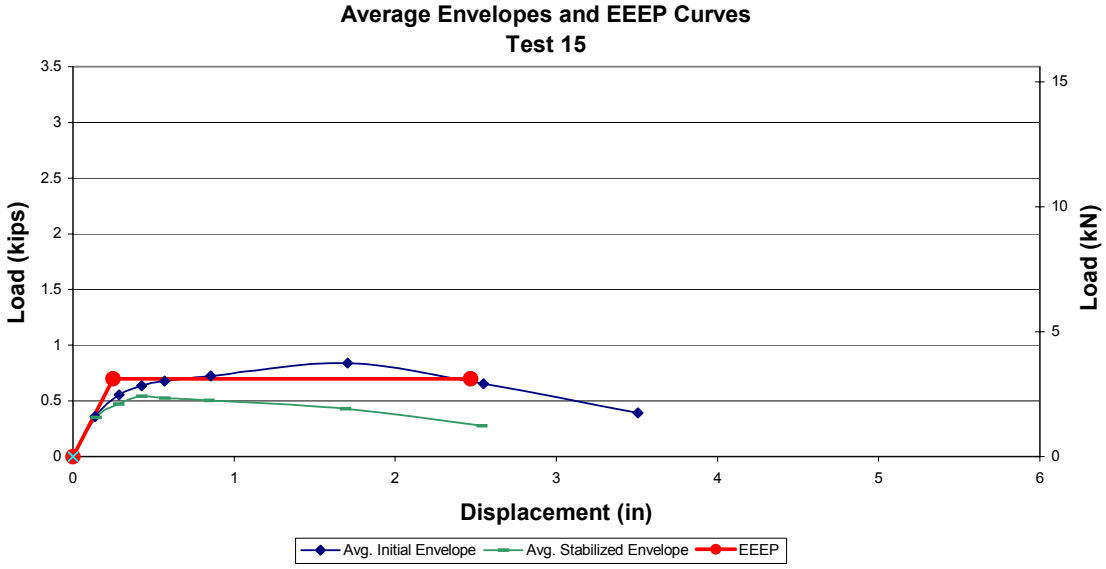

Figure B.14: Average envelope curve and EEEP curve (Test 15)

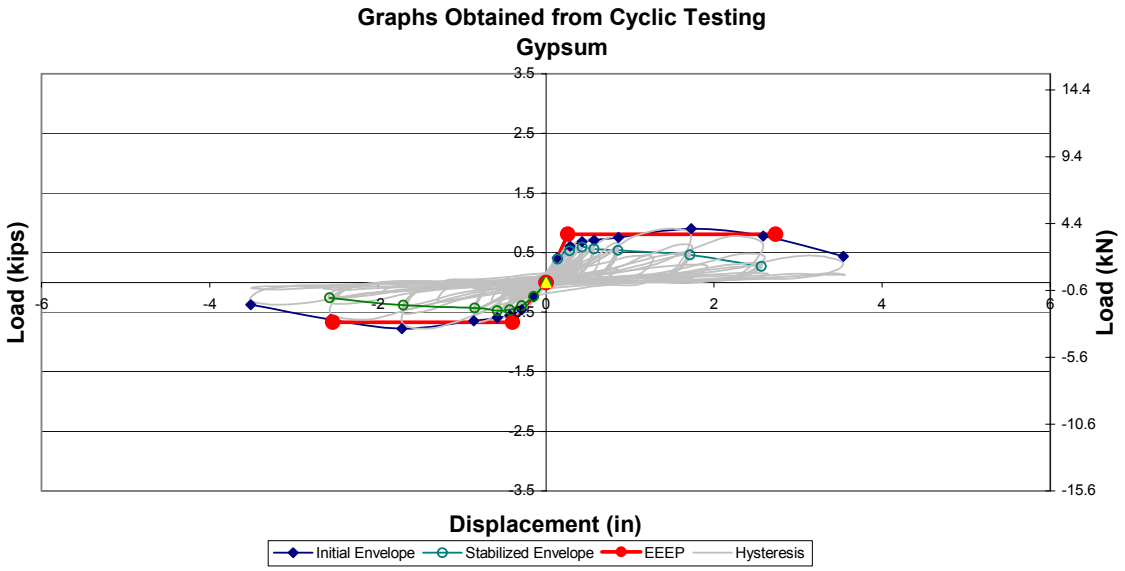

Figure B.15: Load-Displacement graph for Fiberboard cyclic test (Test 16)

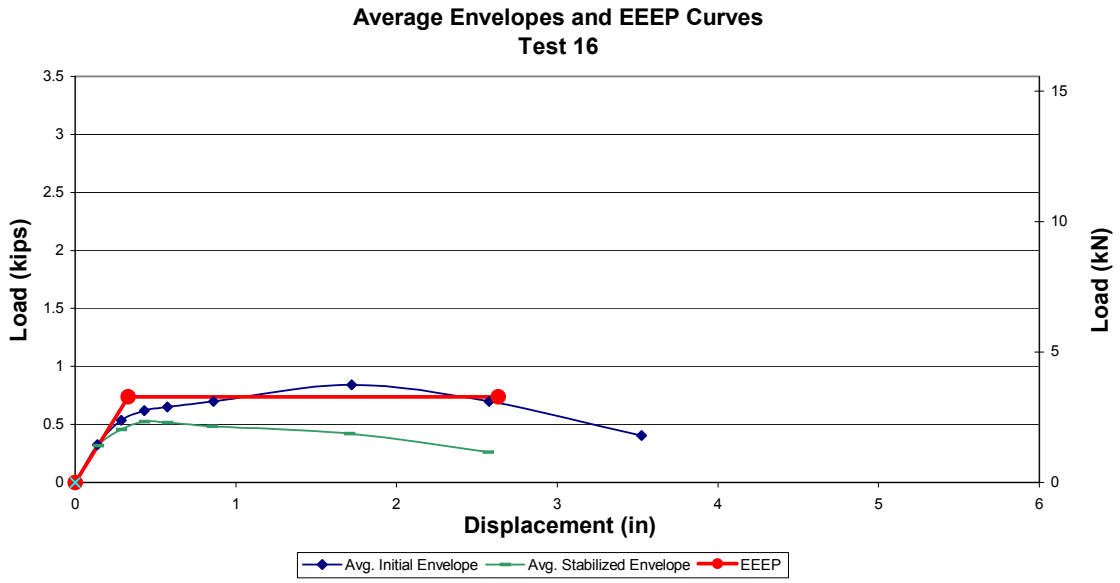

Figure B.16: Average envelope curve and EEEP curve (Test 16)

Test:	31	32
Testing Procedure:	Cyclic (ASTM E2126)	Cyclic (ASTM E2126)
Anchorage:	Hold-down	Hold-down
Material:	OSB/GWB	OSB/GWB
Date Constructed:	8/03/02	8/03/02
Date Tested:	8/05/02	8/05/02

Test 31 Observations:

-Nails in the OSB acted in typical behavior by pulling out of the framing or tearing through the sheathing along the bottom plate and along the right end stud.

-OSB nails were also observed to pull and tear through the sheathing along the top plate.

-Nail heads sank through gypsum sheathing along the bottom plate, then the left end stud. After failure, the nail heads sunk through the sheathing along the entire wall.

-Mode of failure: Nails tore through or pulled out of the framing, which allowed the end studs to pull away from the top plate

Note: The gypsum sheathing was observed to hit the stand that the vertical uplift string pot was supported on. However, there was no unordinary increase in load from the data readings.

Test 32 Observations:

-Basically the same reaction as observed in Test 31.

-OSB nails pulled out of framing in about half of the bottom plate, and tore through sheathing on other half.

-There was no damage to OSB nails on left end stud.

-Gypsum nails tore a straight line parallel with the edge of the gypsum along end studs.

-Mode of failure: The nails pulled out the framing tore through the sheathing, allowing the end stud to separate from the top plate.

Table B.5: EEEP and Performance Parameters for OSB/GWB Cyclic Tests

Specimen:		Test Number	
OSB & GWB with Hold-downs		**Test 31**	**Test 32**
EEEP Parameters	**units**	**initial**	**initial**
Peak load, F_{peak}	Kips	2.760	2.785
	KN	12.278	12.386
Drift at peak load, Δ_{peak}	in.	1.854	2.327
	mm	47.09	59.11
Yield load, F_{yield}	Kips	2.374	2.525
	KN	10.558	11.230
Drift at yield load, Δ_{yield}	in.	0.350	0.435
	mm	8.89	11.05
Proportional limit, $0.4F_{peak}$	Kips	1.104	1.114
	KN	4.911	4.955
Drift at prop. limit, $\Delta@0.4F_{peak}$	in.	0.117	0.192
	mm	2.96	4.87
Failure load or $0.8F_{peak}$	Kips	2.208	2.228
	KN	9.822	9.909
Drift at failure, $\Delta_{failure}$	in.	4.061	4.088
	mm	103.15	103.84
Elastic stiffness, K_e	Kip/in.	9.655	5.805
$@0.4F_{peak}$	KN/mm	1.691	1.016
Work until failure	Kip·ft.	8.982	9.340
	KN·m	12.178	12.663
Load @ .32 in. (8.13 mm)	Kips	1.213	1.223
	KN	5.397	5.441
Load @ .48 in. (12.19 mm)	Kips	1.557	1.547
	KN	6.925	6.879
Load @ .96 in. (24.38 mm)	Kips	2.277	2.236
	KN	10.129	9.945
Load @ 1.6 in. (40.64 mm)	Kips	2.622	2.616
	KN	11.663	11.636

		Test 31		**Test 32**	
EEEP Parameters	**units**	**negative**	**positive**	**negative**	**positive**
F_{yield}	Kips	-2.350	2.483	-2.450	2.600
	KN	10.453	11.043	-10.898	11.560
v_{yield}	Kips/ft.	0.588	0.621	-0.613	0.650
	KN/m	8.573	9.058	-8.920	9.470
Δ_{yield}	in.	-0.445	0.290	-0.414	0.456
	mm	11.30	7.37	-10.52	11.58
$\Delta_{failure}$	in.	-4.219	3.903	-4.119	4.057
	mm	-107.17	99.13	-104.63	103.04

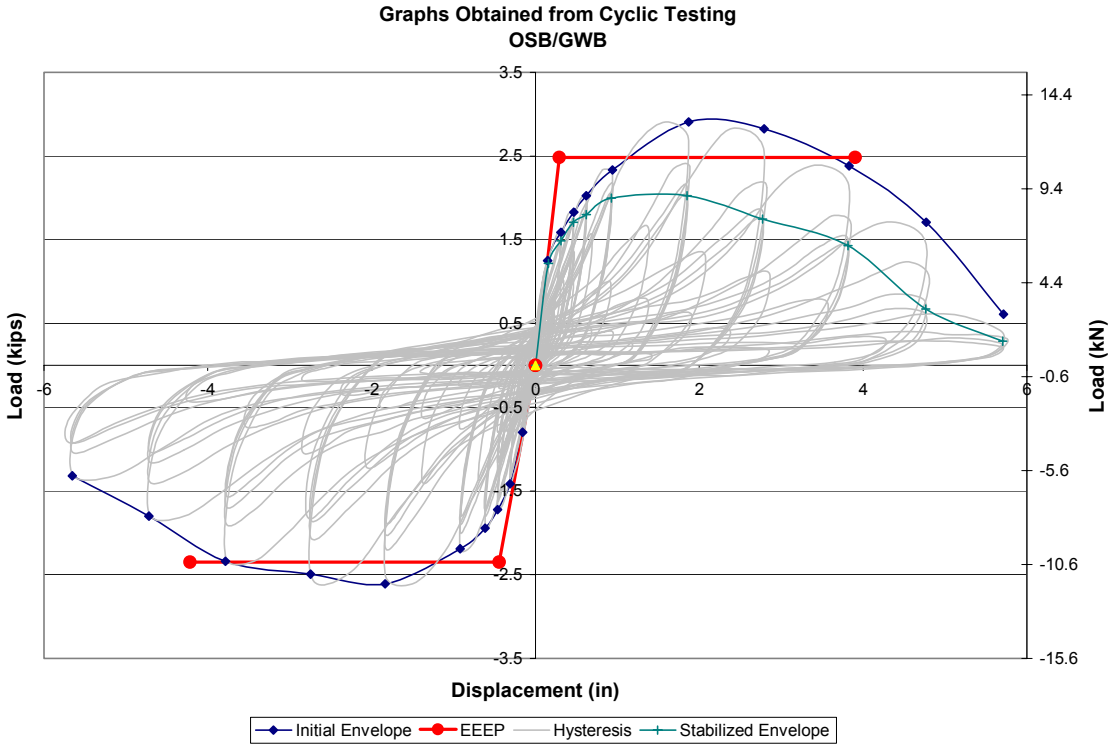

Figure B.17: Load-Displacement graph for OSB/GWB cyclic test (Test 31)

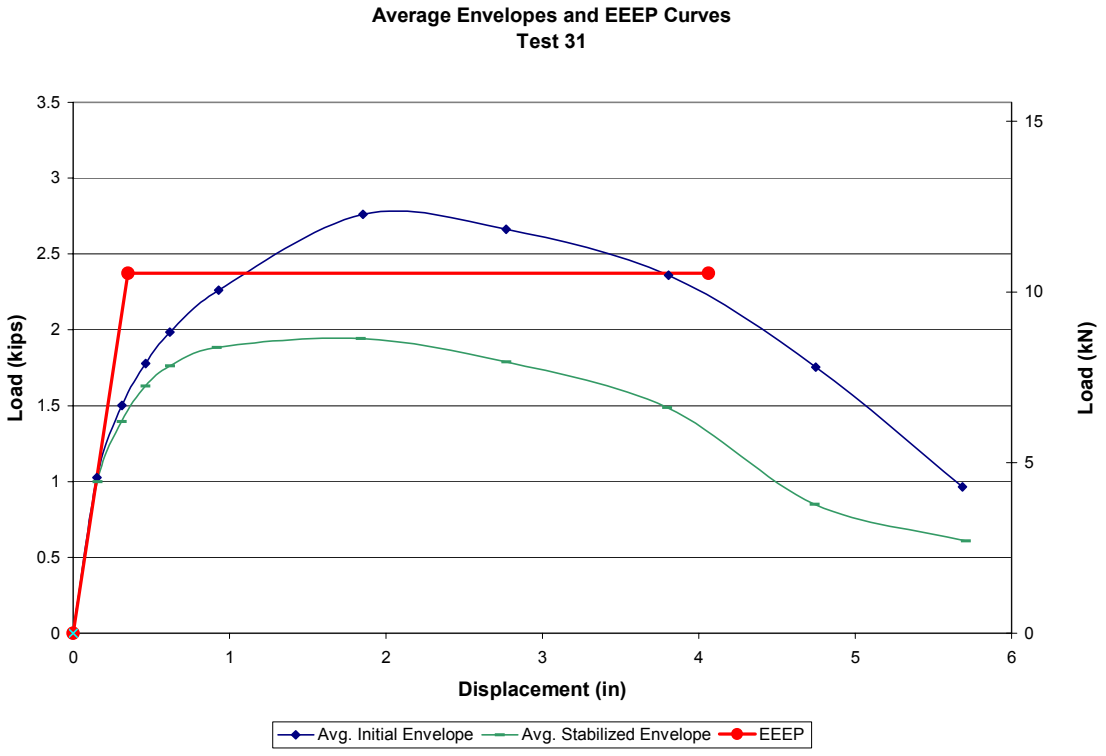

Figure B.18: Average envelope curve and EEEP curve (Test 31)

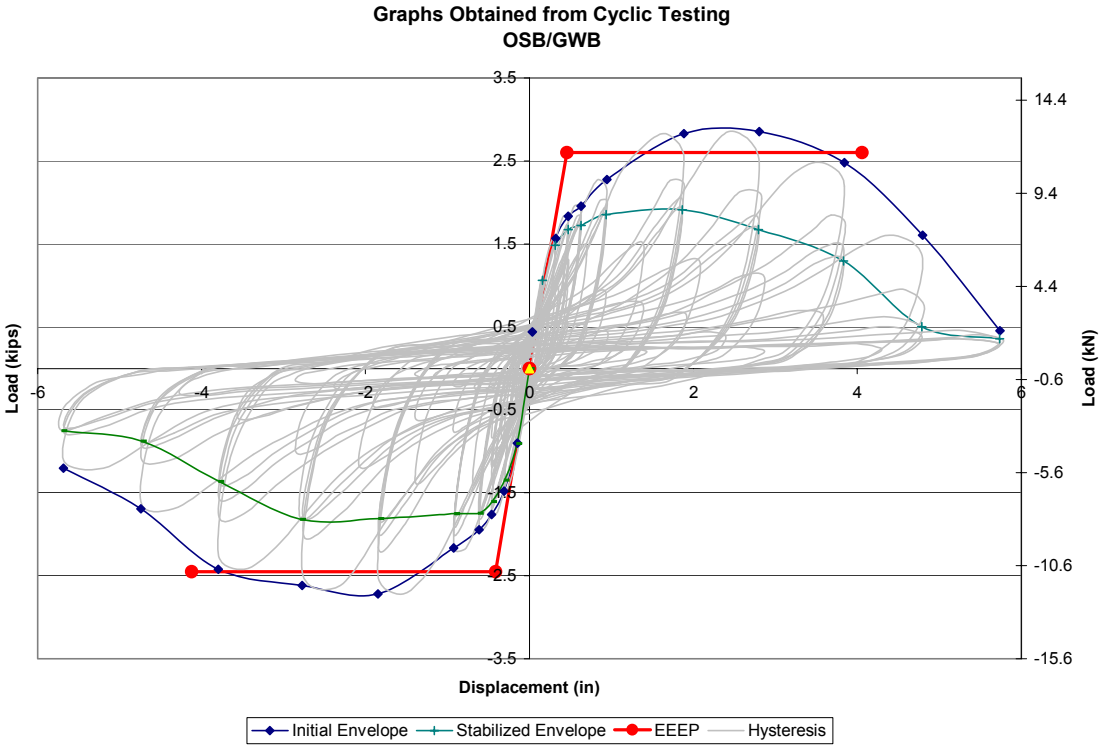

Figure B.19: Load-Displacement graph for OSB/GWB cyclic test (Test 32)

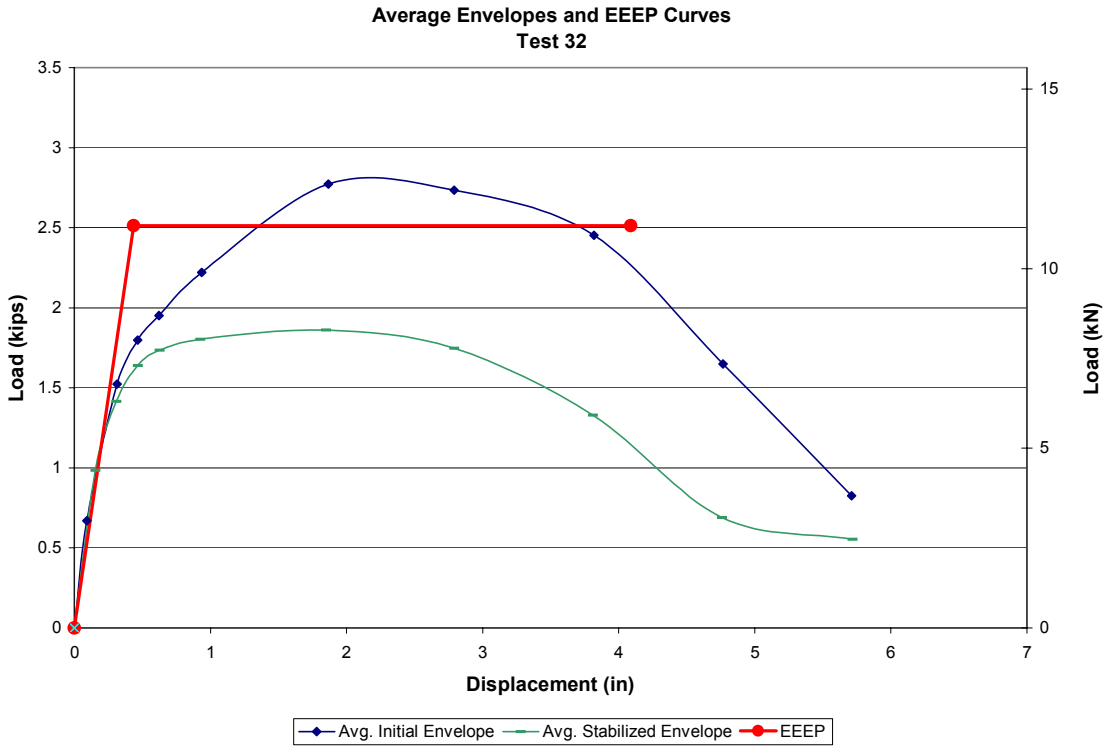

Figure B.20: Average envelope curve and EEEP curve (Test 32)

Test:	33	34
Testing Procedure:	Cyclic (ASTM E2126)	Cyclic (ASTM E2126)
Anchorage:	Hold-down	Hold-down
Material:	Hardboard/GWB	Hardboard/GWB
Date Constructed:	8/05/02	8/05/02
Date Tested:	8/06/02	8/06/02

Test 33 Observations:

-Hardboard nails pulled out of framing along the bottom plate and perimeter near the actuator (top right corner).

-The hardboard nails did not cause any damage to the sheathing panels.

-Gypsum nail heads sank through the sheathing along the bottom plate and the end studs.

-End stud had some separation from top plate, but this was observed after failure of the wall.

-Mode of failure: The nails pulled out the framing, which enabled the wall to deflect and the sheathing material could not resist the shear load because the nails could bend too easily.

Note: The edge of the gypsum hit the rods used to connect the vertical uplift string pot. However, there was no unordinary load found when analyzing the data.

Test 34 Observations:

-Hardboard nails pulled out of framing along the bottom plate and perimeter near the actuator (top right corner).

-The Hardboard nails did not cause any damage to the sheathing panels.

-Gypsum nail heads sank through the sheathing along the bottom plate and the end studs.

-End stud had some separation from top plate, but this was observed after failure of the wall.

-Mode of failure: The nails pulled out the framing, which enabled the wall to deflect and the sheathing material could not resist the shear load because the nails could bend too easily.

Note: Notches were cut in the gypsum in order to avoid hitting the rods used for the string pots as noted in Test 33.

Table B.6: EEEP and Performance Parameters for Hardboard/GWB Cyclic Tests

Specimen:		**Test Number**	
Hardboard & GWB with HD		**Test 33**	**Test 34**
EEEP Parameters	**units**	**initial**	**initial**
Peak load, F_{peak}	Kips	2.828	2.914
	KN	12.580	12.960
Drift at peak load, Δ_{peak}	in.	2.146	2.579
	mm	54.50	65.51
Yield load, F_{yield}	Kips	2.549	2.628
	KN	11.338	11.687
Drift at yield load, Δ_{yield}	in.	0.505	0.613
	mm	12.83	15.57
Proportional limit, $0.4F_{peak}$	Kips	1.131	1.165
	KN	5.032	5.184
Drift at prop. limit, $\Delta@0.4F_{peak}$	in.	0.224	0.272
	mm	5.70	6.90
Failure load or $0.8F_{peak}$	Kips	2.263	2.331
	KN	10.064	10.368
Drift at failure, $\Delta_{failure}$	in.	3.941	4.446
	mm	100.10	112.93
Elastic stiffness, K_e $@0.4F_{peak}$	Kip/in.	5.177	4.293
	KN/mm	0.907	0.752
Work until failure	Kip·ft.	7.209	8.155
	KN·m	9.774	11.055
Load @ .32 in. (8.13 mm)	Kips	1.298	1.216
	KN	5.772	5.409
Load @ .48 in. (12.19 mm)	Kips	1.724	1.664
	KN	7.668	7.400
Load @ .96 in. (24.38 mm)	Kips	2.320	2.321
	KN	10.319	10.326
Load @ 1.6 in. (40.64 mm)	Kips	2.719	2.733
	KN	12.094	12.155

		Test 33		**Test 34**	
EEEP Parameters	**units**	**negative**	**positive**	**negative**	**positive**
F_{yield}	Kips	-2.466	2.632	-2.505	2.750
	KN	-10.969	11.707	-11.143	12.231
v_{yield}	Kips/ft.	-0.616	0.658	-0.626	0.687
	KN/m	-8.997	9.602	-9.140	10.032
Δ_{yield}	in.	-0.416	0.594	-0.628	0.599
	mm	-10.57	15.09	-15.94	15.20
$\Delta_{failure}$	in.	-4.022	3.860	-4.507	4.385
	mm	-102.16	98.04	-114.49	111.37

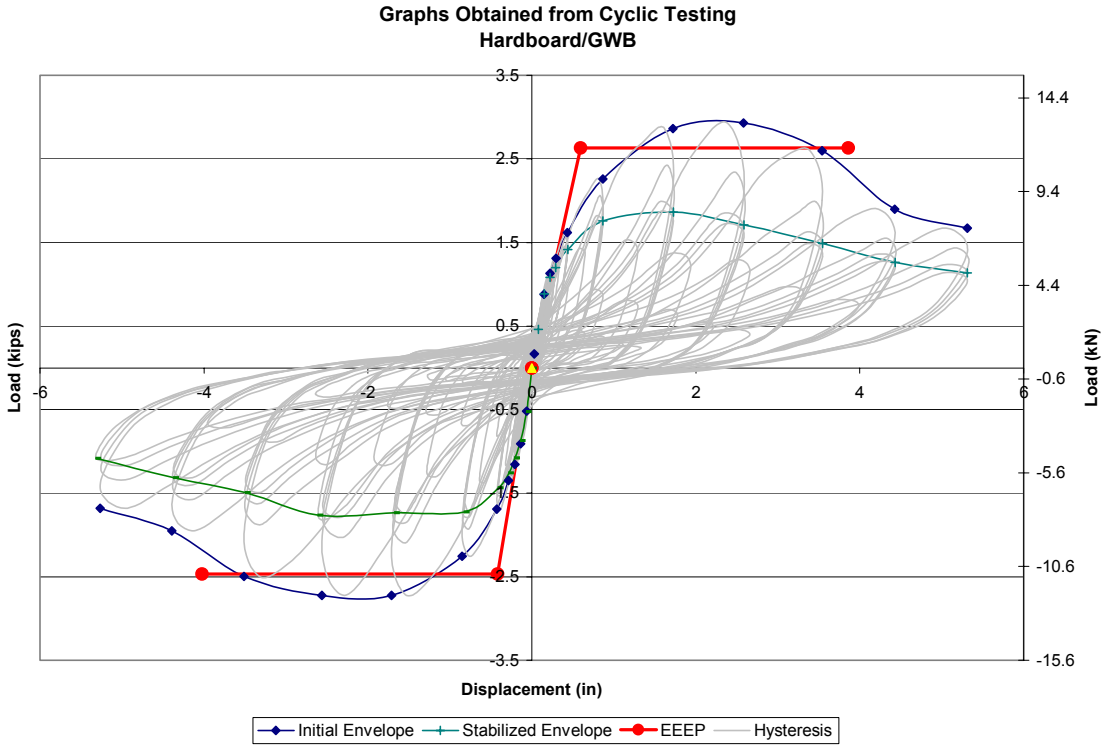

Figure B.21: Load-Displacement graph for Hardboard/GWB cyclic test (Test 33)

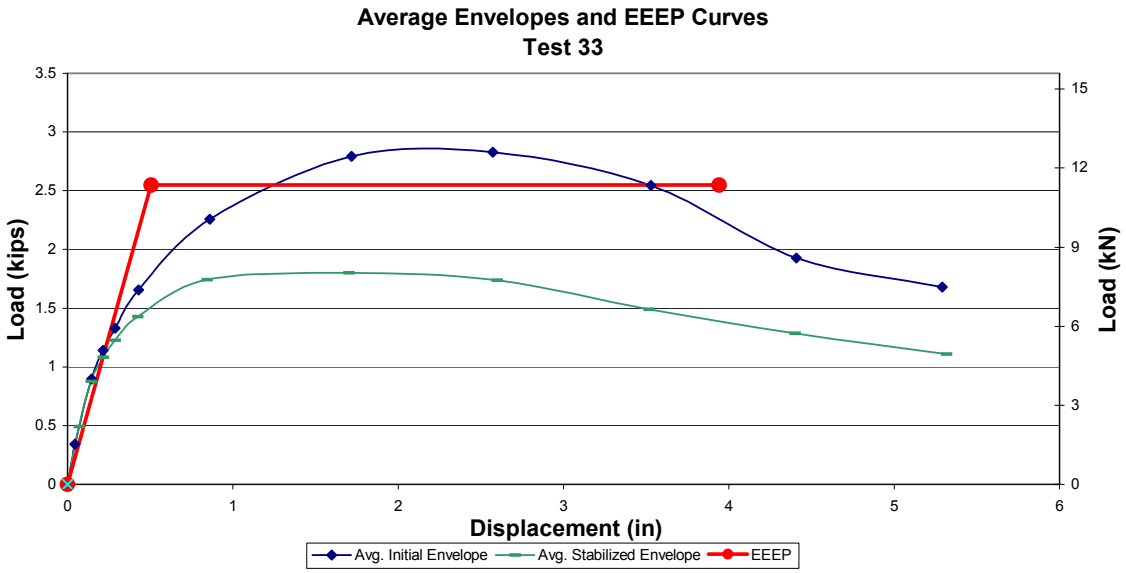

Figure B.22: Average envelope curve and EEEP curve (Test 33)

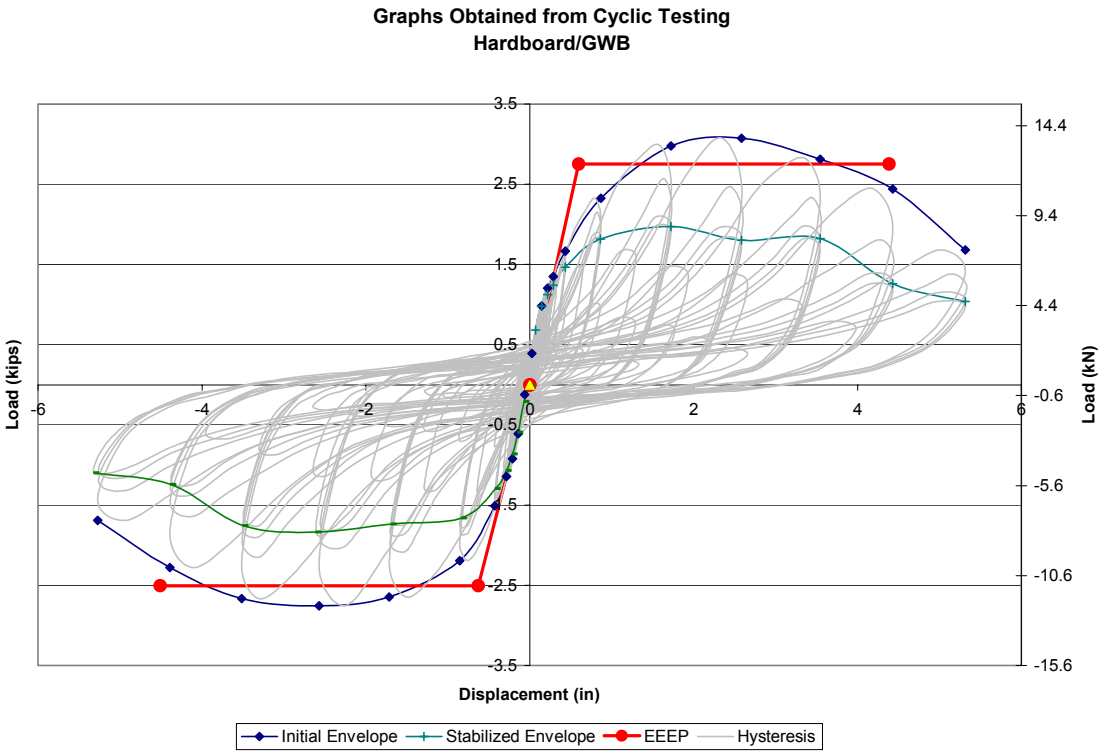

Figure B.23: Load-Displacement graph for Hardboard/GWB cyclic test (Test 34)

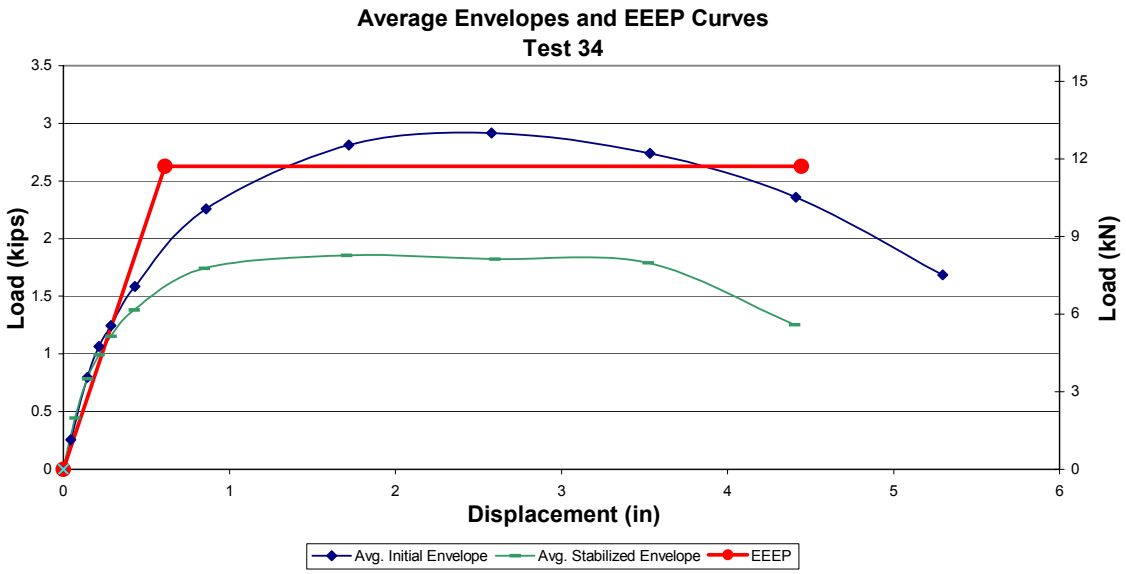

Figure B.24: Average envelope curve and EEEP curve (Test 34)

Test:	35	36
Testing Procedure:	Cyclic (ASTM E2126)	Cyclic (ASTM E2126)
Anchorage:	Hold-down	Hold-down
Material:	Fiberboard/GWB	Fiberboard/GWB
Date Constructed:	8/05/02	8/05/02
Date Tested:	8/06/02	8/06/02

Test 35 Observations:

-Nails tore through the sheathing on both sides of the walls.

-Basically the same performance was observed when the two sheathing materials were tested individually (Tests 13-16).

-Some separation of the right end stud from the top plate was observed during the test.

-Mode of failure: The nails could easily tear through sheathing materials, which caused the sheathing to be ineffective in resisting shear.

Note: The protocol was only set to run until a displacement of about four inches. This should have been increased, but the wall still failed, giving all of the desired information.

Test 36 Observations:

-Nails tore through the sheathing on both sides of the walls.

-Basically the same performance was observed when the two sheathing materials were tested individually (Tests 13-16).

-Some separation of the right end stud from the top plate was observed during the test.

-Mode of failure: The nails could easily tear through sheathing materials, which caused the sheathing to be ineffective in resisting shear.

Note: The protocol was only set run until a displacement of about four inches. This should have been increased, but the wall still failed, giving all of the desired information.

Table B.7: EEEP and Performance Parameters for Fiberboard/GWB Cyclic Tests

Specimen:		**Test Number**	
Fiberboard & GWB with HD		**Test 35**	**Test 36**
EEEP Parameters	**units**	**initial**	**initial**
Peak load, F_{peak}	Kips	2.086	2.025
	KN	9.278	9.006
Drift at peak load, Δ_{peak}	in.	1.940	1.979
	mm	49.27	50.26
Yield load, F_{yield}	Kips	1.844	1.804
	KN	8.202	8.023
Drift at yield load, Δ_{yield}	in.	0.345	0.376
	mm	8.77	9.56
Proportional limit, $0.4F_{peak}$	Kips	0.834	0.810
	KN	3.711	3.603
Drift at prop. limit, $\Delta@0.4F_{peak}$	in.	0.156	0.168
	mm	3.97	4.27
Failure load or $0.8F_{peak}$	Kips	1.669	1.620
	KN	7.422	7.205
Drift at failure, $\Delta_{failure}$	in.	3.856	3.700
	mm	97.94	93.99
Elastic stiffness, K_e $@0.4F_{peak}$	Kip/in.	5.875	4.798
	KN/mm	1.029	0.840
Work until failure	Kip·ft.	5.850	5.742
	KN·m	7.931	7.784
Load @ .32 in. (8.13 mm)	Kips	1.032	0.980
	KN	4.590	4.359
Load @ .48 in. (12.19 mm)	Kips	1.257	1.198
	KN	5.592	5.328
Load @ .96 in. (24.38 mm)	Kips	1.818	1.741
	KN	8.085	7.746
Load @ 1.6 in. (40.64 mm)	Kips	2.061	1.981
	KN	9.166	8.811

		Test 35		**Test 36**	
EEEP Parameters	**units**	**negative**	**positive**	**negative**	**positive**
F_{yield}	Kips	-1.757	1.931	-1.703	1.930
	KN	-7.814	8.590	-7.577	8.585
v_{yield}	Kips/ft.	-0.439	0.483	-0.426	0.483
	KN/m	-6.409	7.045	-6.215	7.041
Δ_{yield}	in.	-0.442	0.248	-0.604	0.195
	mm	-11.23	6.31	-15.35	4.96
$\Delta_{failure}$	in.	-3.711	4.002	-3.672	3.729
	mm	-94.25	101.64	-93.26	94.71

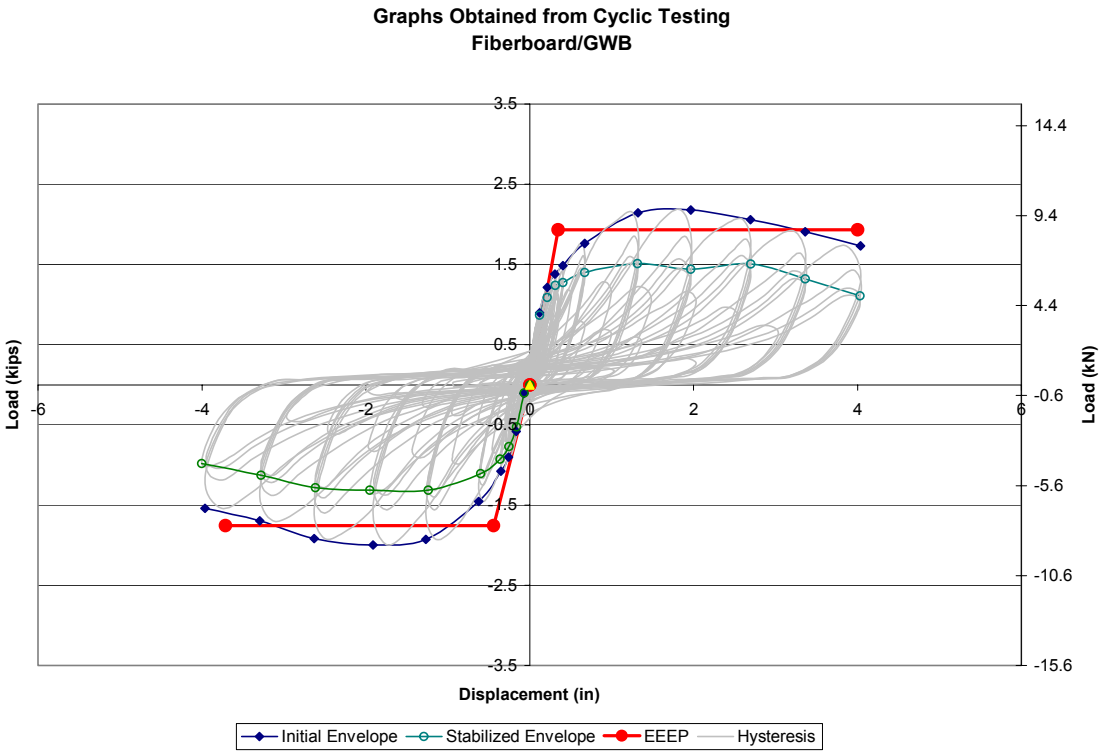

Figure B.25: Load-Displacement graph for Fiberboard/GWB cyclic test (Test 35)

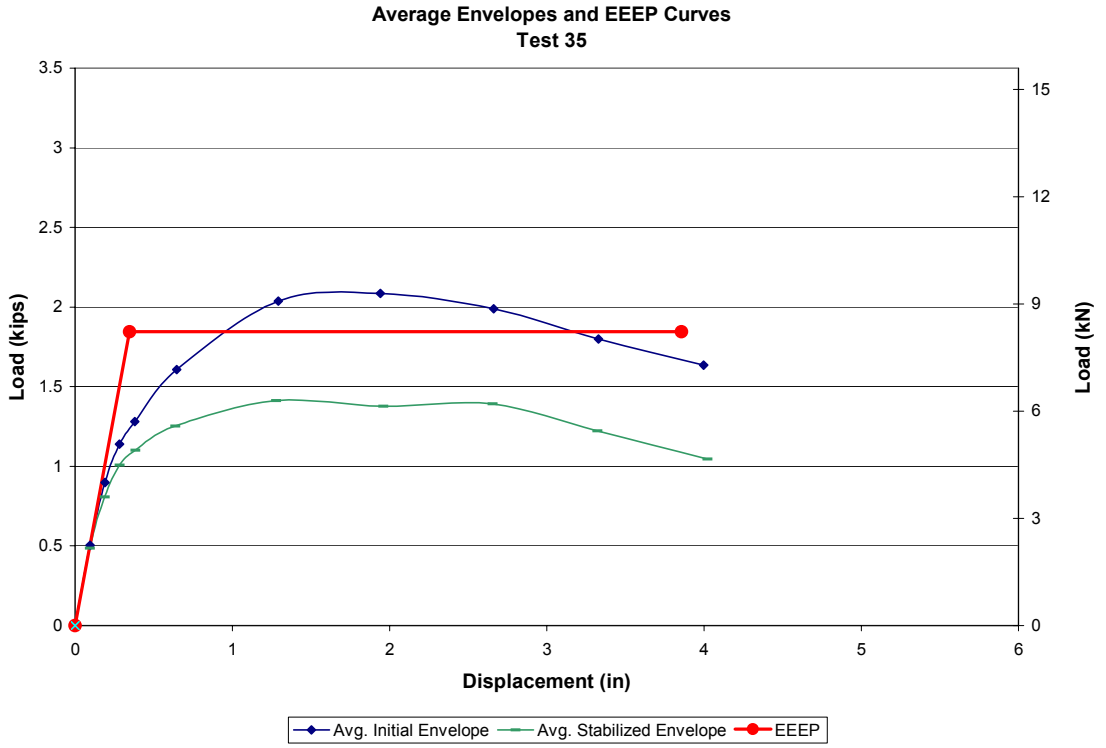

Figure B.26: Average envelope curve and EEEP curve (Test 35)

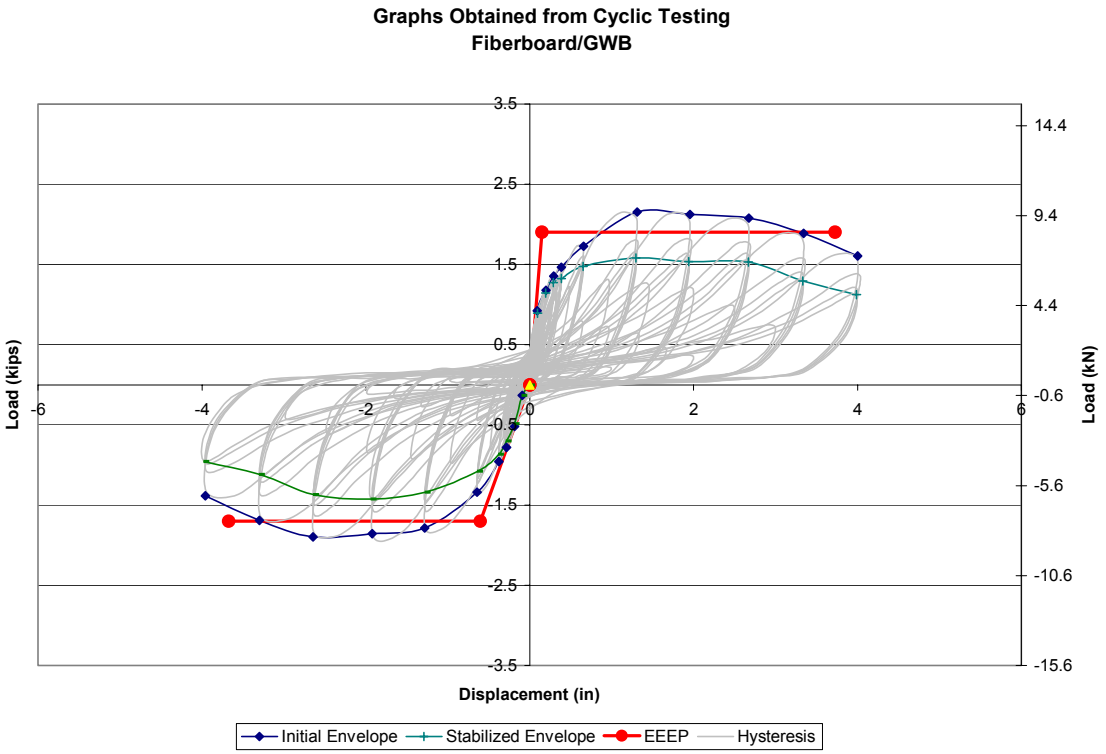

Figure B.27: Load-Displacement graph for Fiberboard/GWB cyclic test (Test 36)

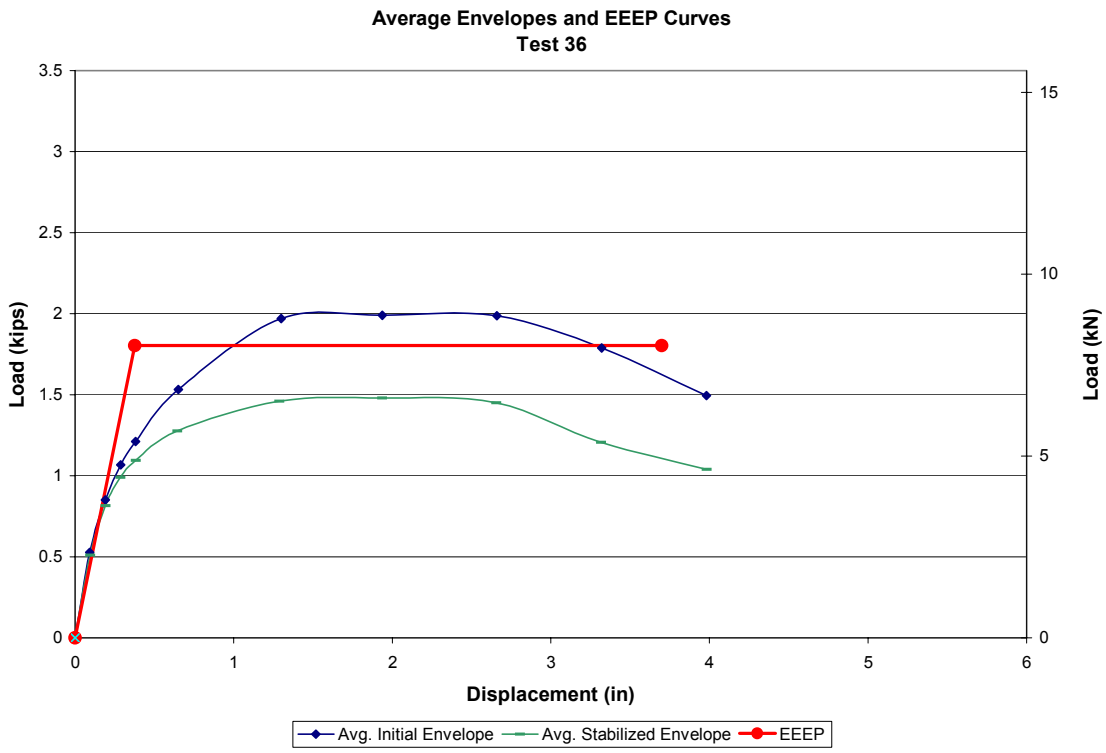

Figure B.28: Average envelope curve and EEEP curve (Test 36)