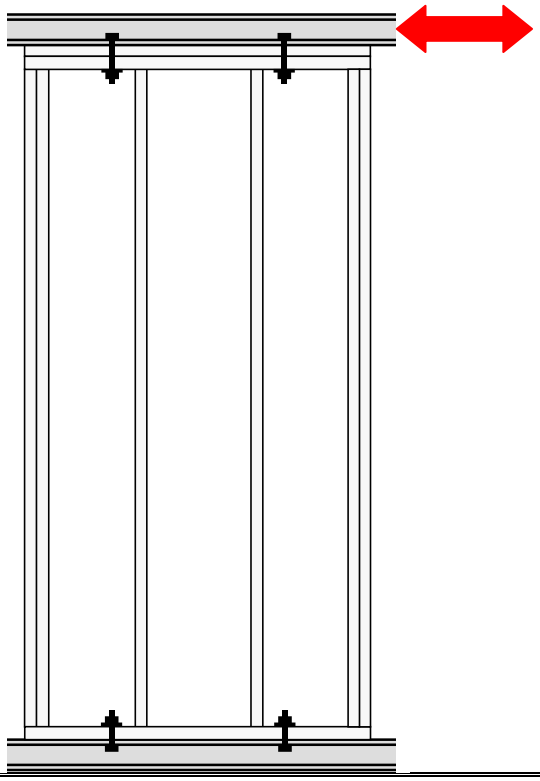
Walls 04IAc



Walls:	04IAc1	04IAc1re	04IAc2[3]
Manufactured:	**July 8, 1998**	**July 8, 1998**	
MOE data files:	4iac1s.prn	4iac3p.prn 4iac1s.prn	
MOE_{plates} (10^6 psi)		1.73	
MOE_{studs} (10^6 psi)	1.27	1.27	
$Density_{plates}$ (kg/m^3)		543	
$Density_{studs}$ (kg/m^3)	405	405	
Date tested:	**July 29, 1998**[1]	**July 29, 1998**[2]	**September 10, 1998**
Time tested:	11:59	15:24	14:26
LTC files:	30alexcy	30alexcy	30alexcy
Data files:	04IAc1.dat	04IAc1re.dat	04IAc2.dat
Excel files:	04IAc1_data 04IAc1_UTP	04IAc1re_data 04IAc1re_UTP	04IAc2_data 04IAc2_UTP
Photo files:	610-625	626-636	no pictures

[1] The edge distance was adequate but the bottom plate appeared weak and broke during the test.

[2] After 04IAc1 test, the bottom plate was replaced and sheathing was attached at 3 in. o. c. with ½-in. edge distance. The test was performed one hour after the repair.

[3] There is no record of the date of manufacture and framing properties.

Wall 04IAc1

Observations: The wall exhibited a very 'soft' performance similar to that of 04IAm monotonic tests. The sheathing did not move relative to the studs or the top plate as the graphs show. The uplift displacement of studs was symmetrical. The average peak load 720 lbf. (0.18 Kip/ft.) was reached at 1.5-in. amplitude. However, the strength degradation started during the same phase on the positive stroke. A brittle failure occurred at 1.8-in. amplitude.

Failure mode: The bottom plate ruptured in a brush mode from bending at the right shear bolt washer plate (Photo 610, 616). At the left end, the bottom plate split along the grain and ruptured from bending caused by work of sheathing nails (Photo 615). After that, sheathing unzipped from the bottom plate very quickly and the rest of the wall 'walked' away from the foundation as a rigid body (Photo 617). No nail fatigue was observed. Sheathing nails pulled heads through and tore through the edge at the bottom (Photos 623, 624). The test was stopped at 4.8-in. amplitude when the wall separated from the bottom plate entirely.

Wall 04IAc1re

Rationale: After the test of wall 04IAc1, the wall remained intact except for the bottom plate and unzipped sheathing at the bottom. It was intended to test the performance of a wall repaired after a seismic event. A new bottom plate was installed (with a higher MOE) and sheathing nails were driven along the bottom at 3 in. o. c. with the average edge distance of 1/2 in.

Observations: The wall was twice as stiff and almost 30% stronger than 04IAc1 wall. Similar to the previous test, it reached the peak load at 1.5-in. amplitude. The sheathing did not move relative to the studs or top plate as graphs show.

Failure mode: A brittle failure occurred at 2-in. amplitude. The bottom plate split along the grain and ruptured under the washer plates of shear bolts from bending caused by work of sheathing nails (Photo 627-629). Obviously, the 3-in. spacing of nails was the reason for the wood splitting. After the split, the sheathing unzipped from the bottom plate and the rest of the wall 'walked' away from the foundation as a rigid body similar to but at a slower rate than in the previous test. No nail fatigue was observed. Most of sheathing nails pulled heads through and some tore through the edge at the bottom (Photos 635, 636).

Wall 04IAc2

Observations: This wall performed similarly to 04IAc1 wall: the average peak load 753 lbf. (0.19-Kip/ft.) was maintained at 1.5-in. amplitude. The response was not symmetrical: on the negative stroke the peak was 830 lbf., and on the positive stroke it was only 677 lbf. There was a sudden load drop on the negative stroke during 1.8-in. phase. At that moment, sheathing started unzipping on the left end of the bottom plate. During the next phase, the sheathing started unzipping on the right end.

Failure mode: Typical for IAc walls: sheathing unzipped along the bottom. Nail tore through the sheathing edge. No nail fatigue.

General

Instrumentation: The diagonal pot wires and Sheathing #1 LVDT were removed before the end of the test to avoid their collapse.

Load transfer: The long distribution beam was used in these tests to eliminate the uplift of the caster from the floor on the positive stroke.

Table 04IAc1. Data summary.

Specimen		**04IAc1**	**Per unit length**	
Shear Bolts			**cyclic test**	
Wall length			**4.00ft.**	**1.219m**
Date:	7-29-1998 **Time:**	11:59		
EEEP Parameters		**units**	**initial**	**stabilized**
Peak unit load, v_{peak}		Kip/ft. KN/m	0.180 2.625	0.151 2.205
Drift at peak load, Δ_{peak}		in. mm	1.491 37.88	1.209 30.70
Yield unit load, v_{yield}		Kip/ft. KN/m	0.153 2.240	0.132 1.932
Drift at yield load, Δ_{yield}		in. mm	0.455 11.55	0.489 12.43
Proportional limit, $0.4v_{peak}$		Kip/ft. KN/m	0.072 1.050	0.060 0.882
Drift at prop. limit, $\Delta@0.4v_{peak}$		in. mm	0.213 5.41	0.223 5.67
Unit load at failure or $0.8v_{peak}$		Kip/ft. KN/m	0.144 2.100	0.121 1.764
Drift at failure, $\Delta_{failure}$		in. mm	1.896 48.17	1.663 42.24
Shear modulus, G $@0.4v_{peak}$		Kip/in. KN/mm	2.697 0.472	2.162 0.379
Work until failure per unit length		Kip·ft./ft. KN·m/m	0.207 0.920	0.247 1.098
Unit load, $v_{1/300}$ @ 0.32 in. (8.13 mm)		Kips/ft. KN/m	0.086 1.254	0.084 1.220
Unit load, $v_{1/200}$ @ 0.48 in.(12.19 mm)		Kips/ft. KN/m	0.107 1.566	0.101 1.478
Unit load, $v_{1/100}$ @ 0.96 in. (24.38 mm)		Kips/ft. KN/m	0.160 2.330	0.144 2.097
Unit load, $v_{1/60}$ @ 1.6 in. (40.64 mm)		Kips/ft. KN/m	0.169 2.464	0.124 1.810
EVDR $@v_{peak}$			0.170	0.163

SEAOSC parameters		**units**	**negative**	**positive**	**average**
Yield Limit State	v_{YLS}	Kips/ft. KN/m	-0.079 -1.146	0.088 1.284	0.083 1.215
	Δ_{YLS}	in. mm	-0.302 -7.67	0.299 7.59	0.300 7.63
	G'_{YLS}	Kip/in. KN/mm	2.081 0.364	2.356 0.413	2.218 0.388
Strength Limit State	v_{SLS}	Kips/ft. KN/m	-0.166 -2.419	0.194 2.831	0.180 2.625
	Δ_{SLS}	in. mm	-1.494 -37.95	1.488 37.80	1.491 37.88
	G'_{SLS}	Kip/in. KN/mm	0.887 0.155	1.043 0.183	0.965 0.169

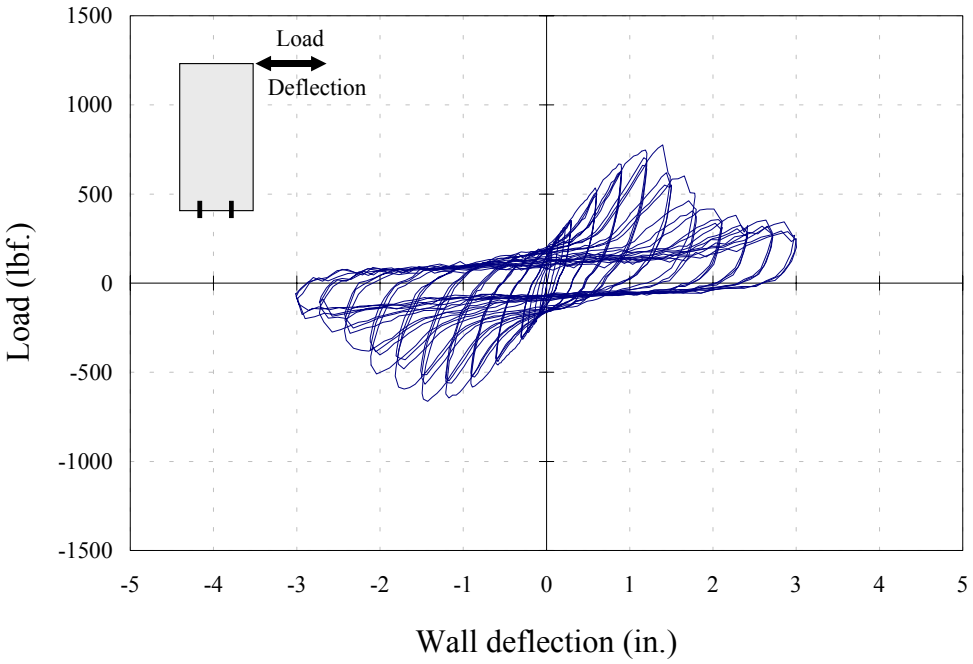


Figure 04IAc1- a. Observed load-deflection curve[1].

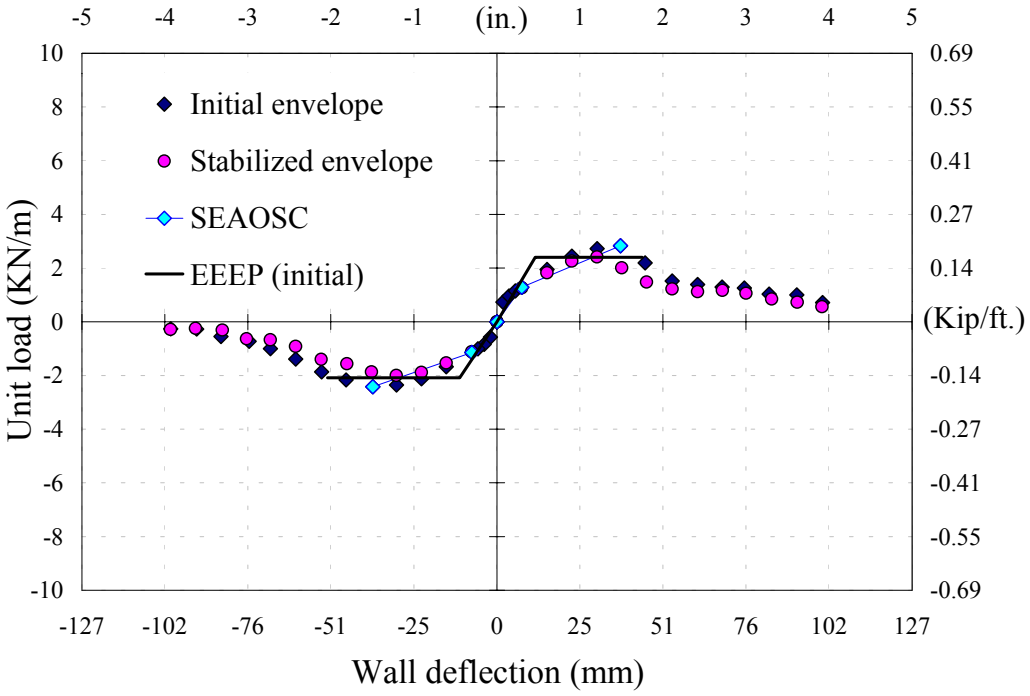


Figure 04IAc1- b. Envelopes, SEAOSC, and EEEP curves[2].

[1] The scale of the graph varies between test series.
[2] The scale of the graph is uniform between test series for comparison purposes.

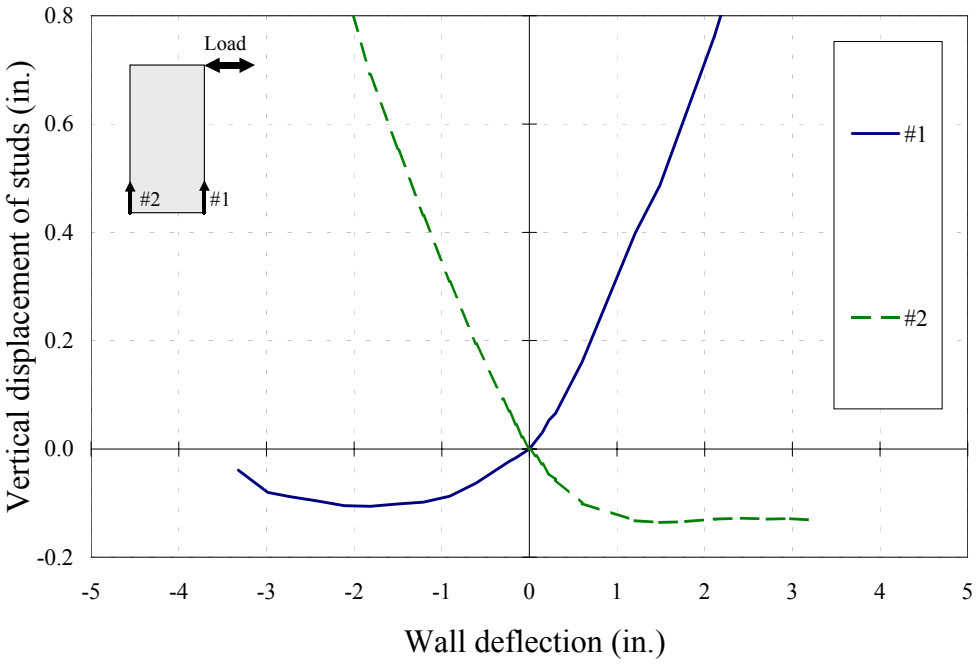


Figure 04IAc1- c. Vertical displacement of studs (initial envelope).

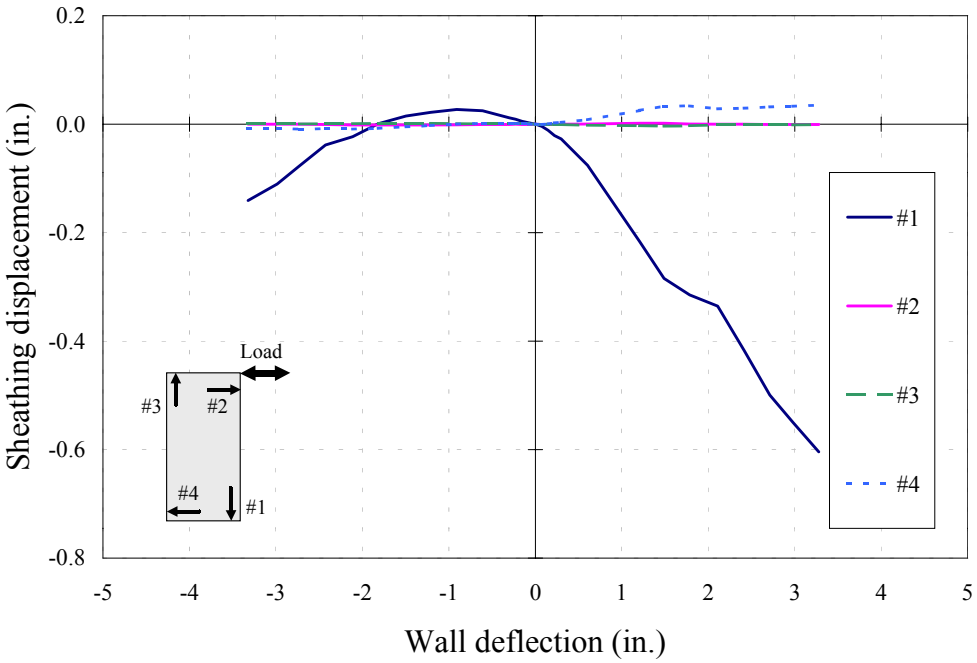


Figure 04IAc1- d. Sheathing displacement (initial envelope).

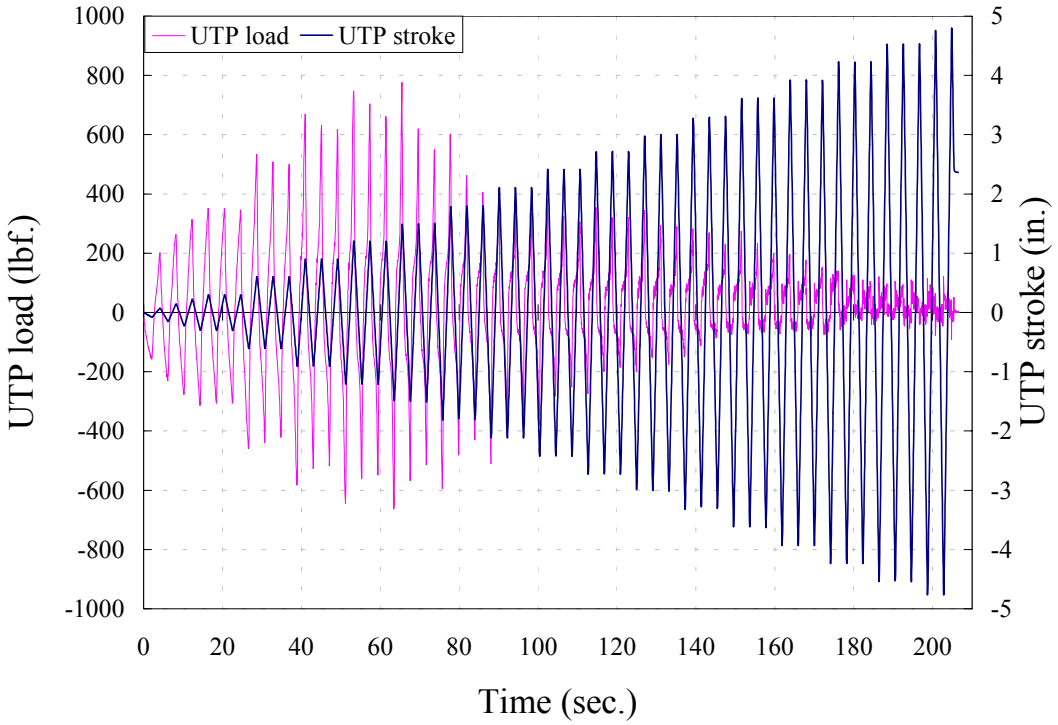


Figure 04IAc1- f. Load- and displacement-time record.

Table 04IAc1re. Data summary.

Specimen	**04IAc1re**	**Per unit length**	
Shear Bolts		**cyclic test**	
Wall length		**4.00ft.**	**1.219m**
Date: 7-29-1998 **Time:**	15:24		
EEEP Parameters	**units**	**initial**	**stabilized**
Peak unit load, v_{peak}	Kip/ft. KN/m	0.229 3.347	0.204 2.984
Drift at peak load, Δ_{peak}	in. mm	1.352 34.34	1.358 34.49
Yield unit load, v_{yield}	Kip/ft. KN/m	0.205 2.990	0.187 2.728
Drift at yield load, Δ_{yield}	in. mm	0.299 7.61	0.421 10.68
Proportional limit, $0.4v_{peak}$	Kip/ft. KN/m	0.092 1.339	0.082 1.194
Drift at prop. limit, $\Delta@0.4v_{peak}$	in. mm	0.134 3.41	0.184 4.68
Unit load at failure or $0.8v_{peak}$	Kip/ft. KN/m	0.183 2.678	0.164 2.387
Drift at failure, $\Delta_{failure}$	in. mm	2.258 57.35	2.035 51.69
Shear modulus, G $@0.4v_{peak}$	Kip/in. KN/mm	5.489 0.961	3.564 0.624
Work until failure per unit length	Kip·ft./ft. KN·m/m	0.382 1.699	0.350 1.557
Unit load, $v_{1/300}$ @ 0.32 in. (8.13 mm)	Kips/ft. KN/m	0.140 2.049	0.137 1.997
Unit load, $v_{1/200}$ @ 0.48 in.(12.19 mm)	Kips/ft. KN/m	0.166 2.425	0.159 2.321
Unit load, $v_{1/100}$ @ 0.96 in. (24.38 mm)	Kips/ft. KN/m	0.217 3.166	0.197 2.872
Unit load, $v_{1/60}$ @ 1.6 in. (40.64 mm)	Kips/ft. KN/m	**0.227** **3.308**	**0.195** **2.845**
EVDR $@v_{peak}$		0.136	0.123

SEAOSC parameters		**units**	**negative**	**positive**	**average**
Yield Limit State	v_{YLS}	Kips/ft. KN/m	-0.130 -1.901	0.144 2.098	0.137 1.999
	Δ_{YLS}	in. mm	-0.302 -7.67	0.296 7.52	0.299 7.59
	G'_{YLS}	Kip/in. KN/mm	3.453 0.605	3.886 0.681	3.667 0.642
Strength Limit State	v_{SLS}	Kips/ft. KN/m	-0.225 -3.283	0.234 3.411	0.229 3.347
	Δ_{SLS}	in. mm	-1.216 -30.88	1.488 37.80	1.352 34.34
	G'_{SLS}	Kip/in. KN/mm	1.481 0.259	1.256 0.220	1.357 0.238

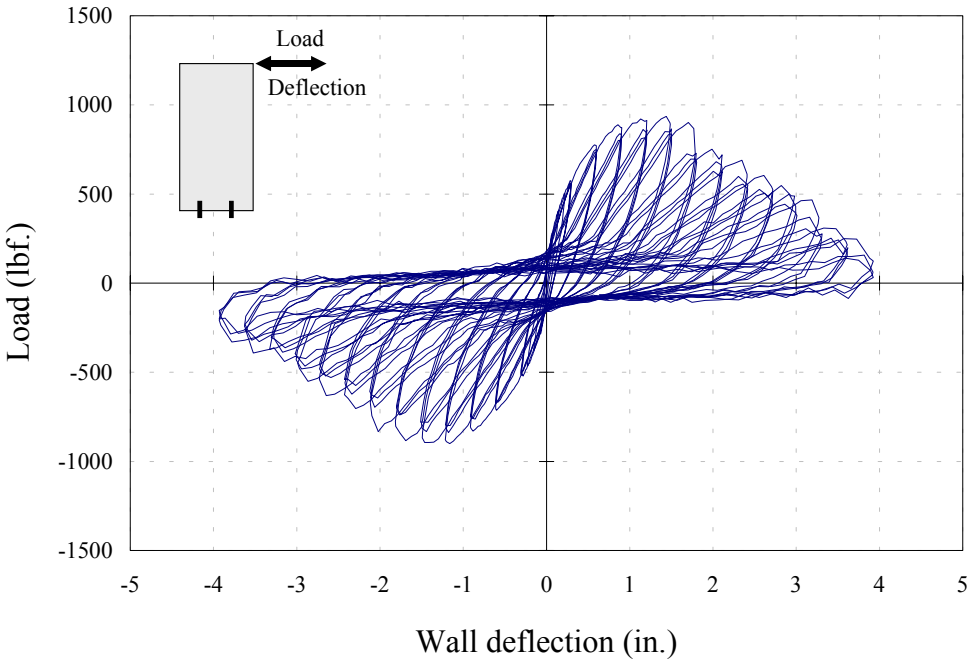


Figure 04IAc1re- a. Observed load-deflection curve.

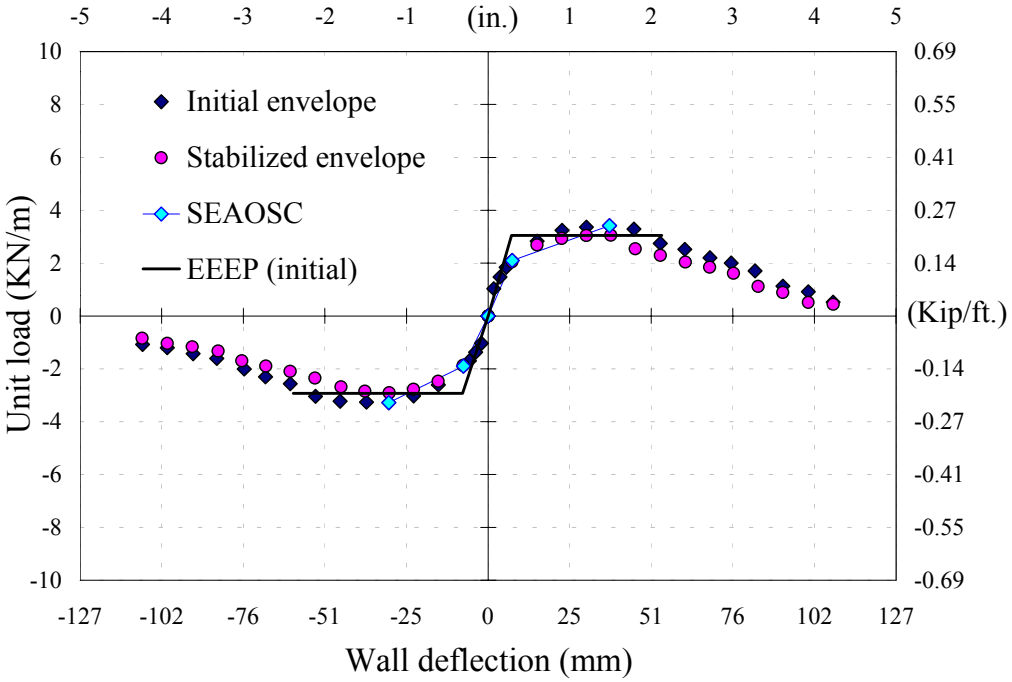


Figure 04IAc1re- b. Envelopes, SEAOSC, and EEEP curves.

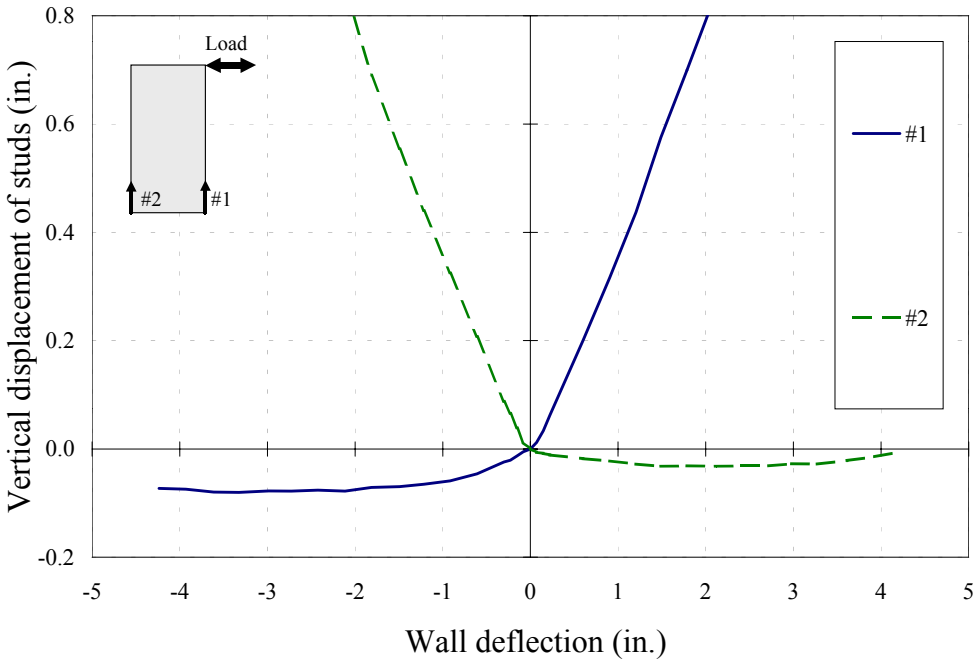


Figure 04IAc1re- c. Vertical displacement of studs (initial envelope).

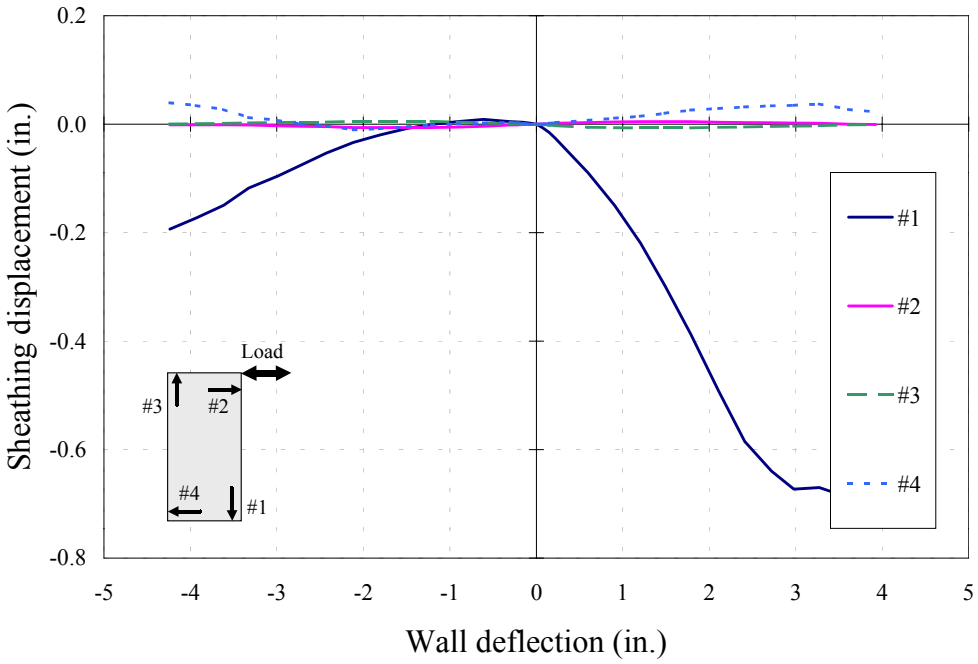


Figure 04IAc1re- d. Sheathing displacement (initial envelope).

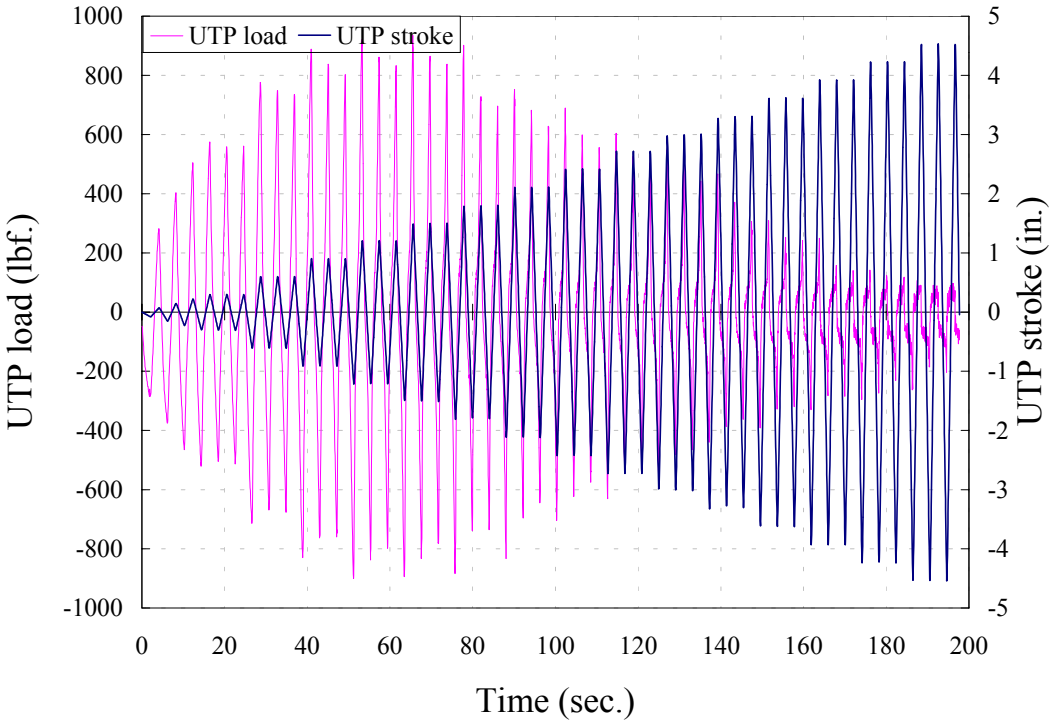


Figure 04IAc1re- f. Load- and displacement-time record.

Table 04IAc2. Data summary.

Specimen		**04IAc2**	**Per unit length**	
Shear Bolts			**cyclic test**	
Wall length			**4.00ft.**	**1.219m**
Date: 9-10-1998	**Time:**	14:26		
EEEP Parameters		**units**	**initial**	**stabilized**
Peak unit load, v_{peak}		Kip/ft. KN/m	0.188 2.749	0.163 2.386
Drift at peak load, Δ_{peak}		in. mm	1.351 34.30	1.358 34.49
Yield unit load, v_{yield}		Kip/ft. KN/m	0.166 2.425	0.146 2.124
Drift at yield load, Δ_{yield}		in. mm	0.525 13.33	0.507 12.87
Proportional limit, $0.4v_{peak}$		Kip/ft. KN/m	0.075 1.100	0.065 0.954
Drift at prop. limit, $\Delta@0.4v_{peak}$		in. mm	0.238 6.03	0.228 5.79
Unit load at failure or $0.8v_{peak}$		Kip/ft. KN/m	0.151 2.199	0.131 1.909
Drift at failure, $\Delta_{failure}$		in. mm	1.982 50.34	1.787 45.39
Shear modulus, G $@0.4v_{peak}$		Kip/in. KN/mm	2.547 0.446	2.301 0.403
Work until failure per unit length		Kip·ft./ft. KN·m/m	0.286 1.271	0.336 1.495
Unit load, $v_{1/300}$ @ 0.32 in. (8.13 mm)		Kips/ft. KN/m	0.091 1.321	0.089 1.303
Unit load, $v_{1/200}$ @ 0.48 in.(12.19 mm)		Kips/ft. KN/m	0.115 1.685	0.111 1.623
Unit load, $v_{1/100}$ @ 0.96 in. (24.38 mm)		Kips/ft. KN/m	0.170 2.474	0.153 2.231
Unit load, $v_{1/60}$ @ 1.6 in. (40.64 mm)		Kips/ft. KN/m	0.182 2.652	0.148 2.160
EVDR $@v_{peak}$			0.163	0.164

SEAOSC parameters		**units**	**negative**	**positive**	**average**
Yield Limit State	v_{YLS}	Kips/ft. KN/m	-0.099 -1.448	0.116 1.696	0.108 1.572
	Δ_{YLS}	in. mm	-0.302 -7.67	0.601 15.26	0.451 11.46
	G'_{YLS}	Kip/in. KN/mm	2.631 0.461	1.548 0.271	1.910 0.335
Strength Limit State	v_{SLS}	Kips/ft. KN/m	-0.207 -3.028	0.169 2.459	0.188 2.744
	Δ_{SLS}	in. mm	-1.494 -37.95	1.491 37.88	1.493 37.91
	G'_{SLS}	Kip/in. KN/mm	1.111 0.195	0.904 0.158	1.008 0.176

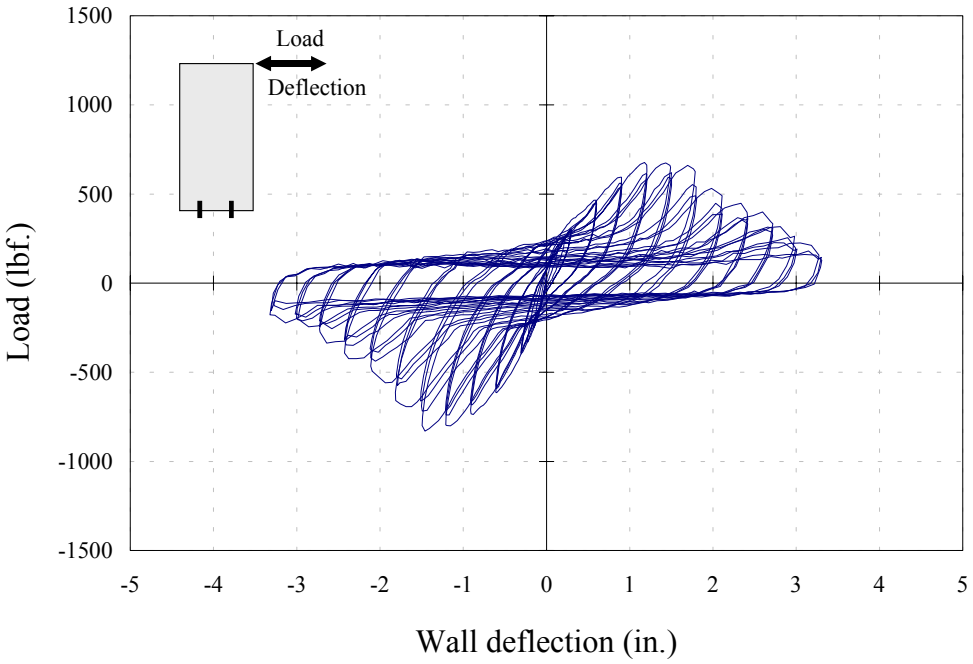


Figure 04IAc2- a. Observed load-deflection curve.

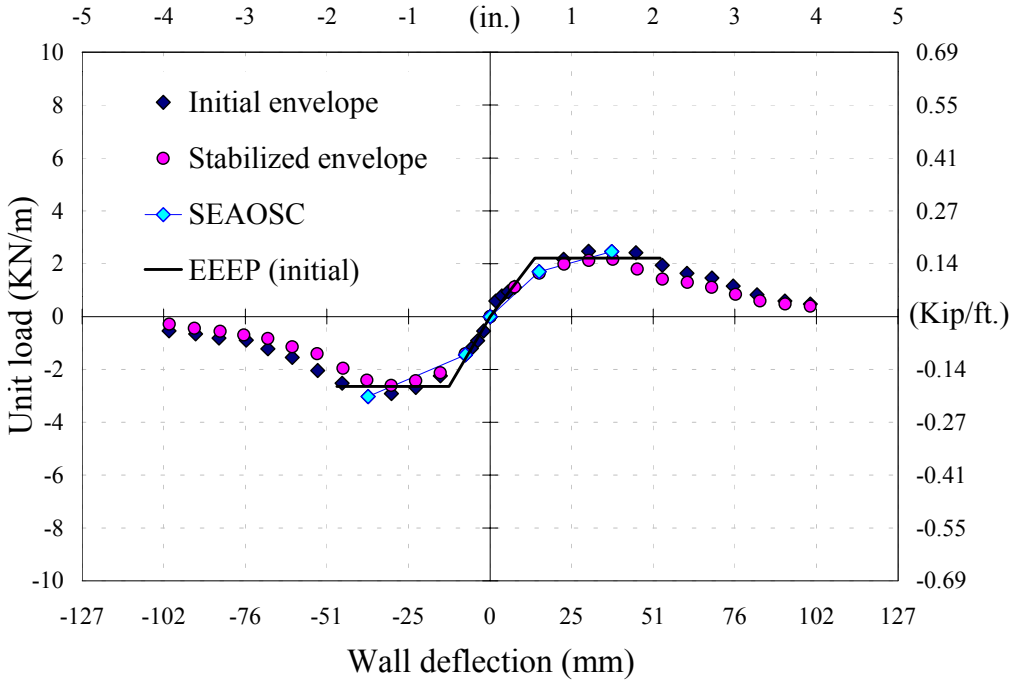


Figure 04IAc2- b. Envelopes, SEAOSC, and EEEP curves.

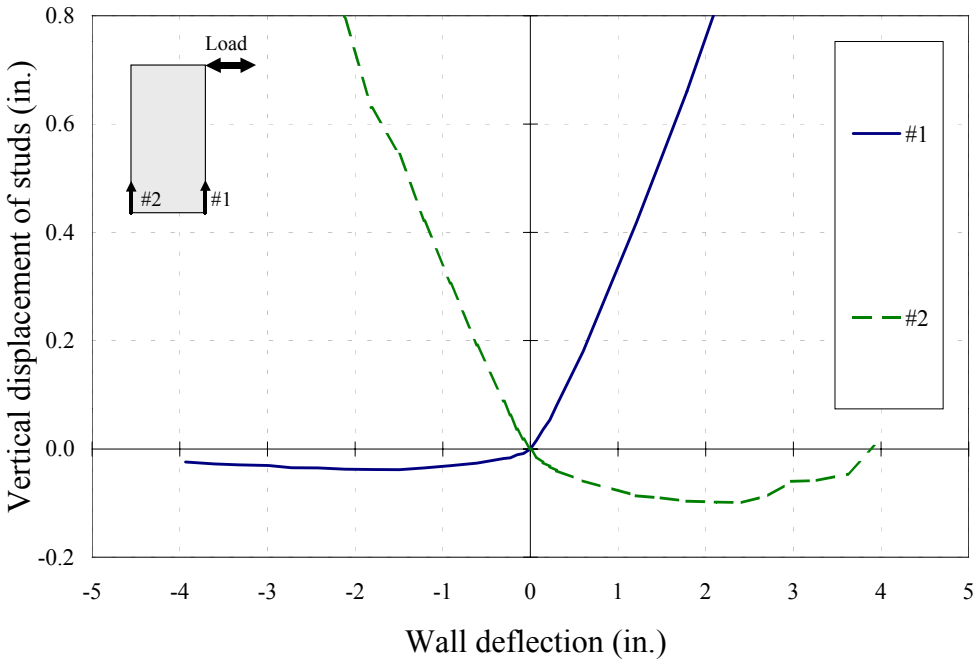


Figure 04IAc2- c. Vertical displacement of studs (initial envelope).

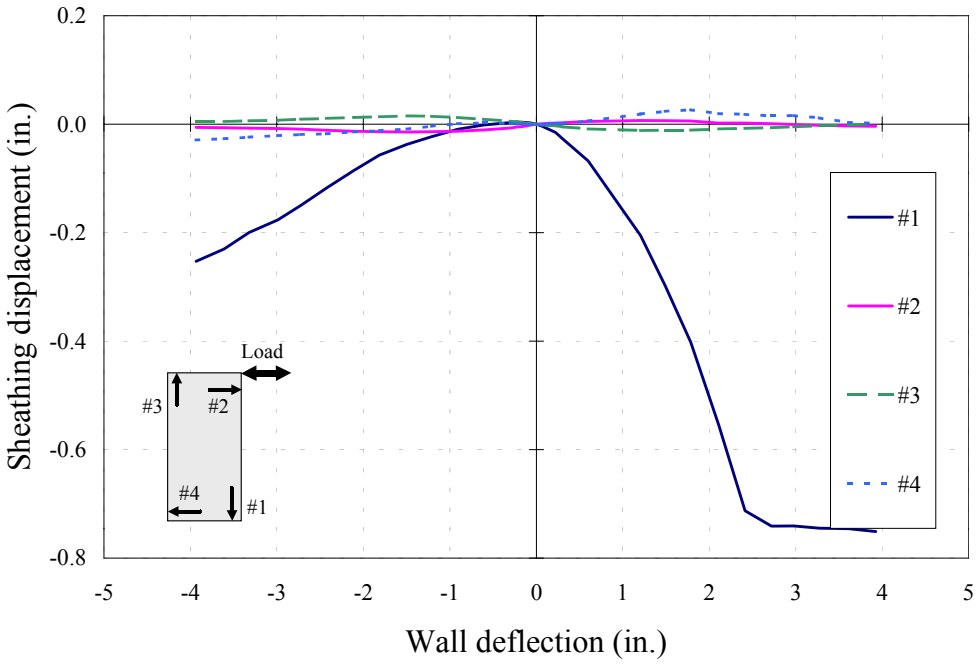


Figure 04IAc2- d. Sheathing displacement (initial envelope).

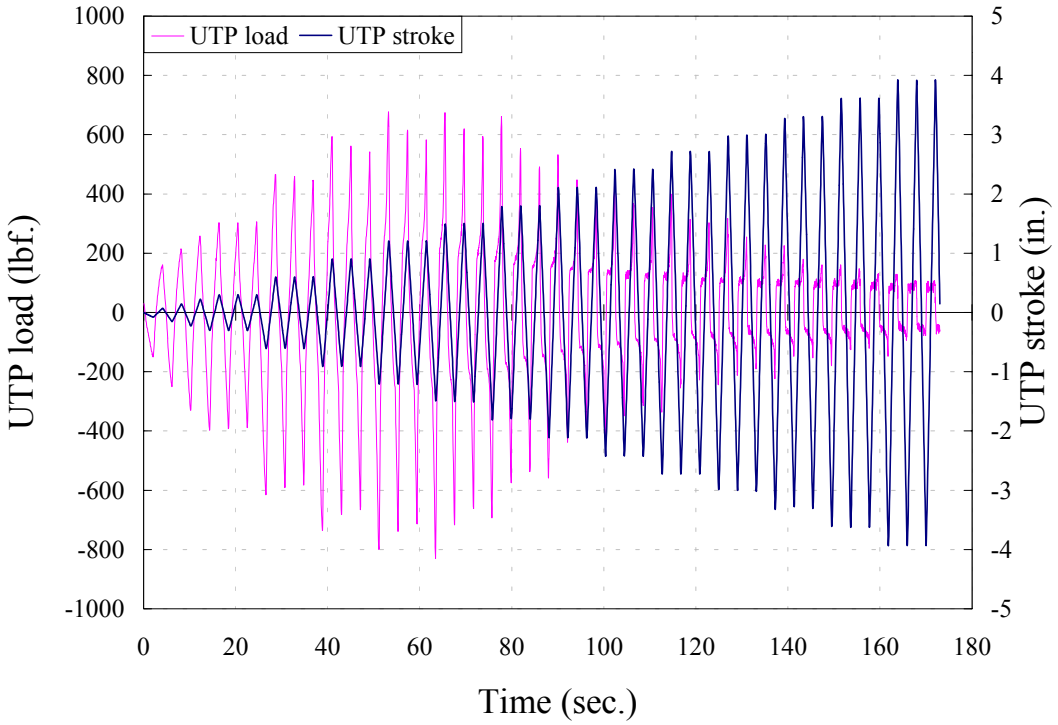


Figure 04IAc2- f. Load- and displacement-time record.