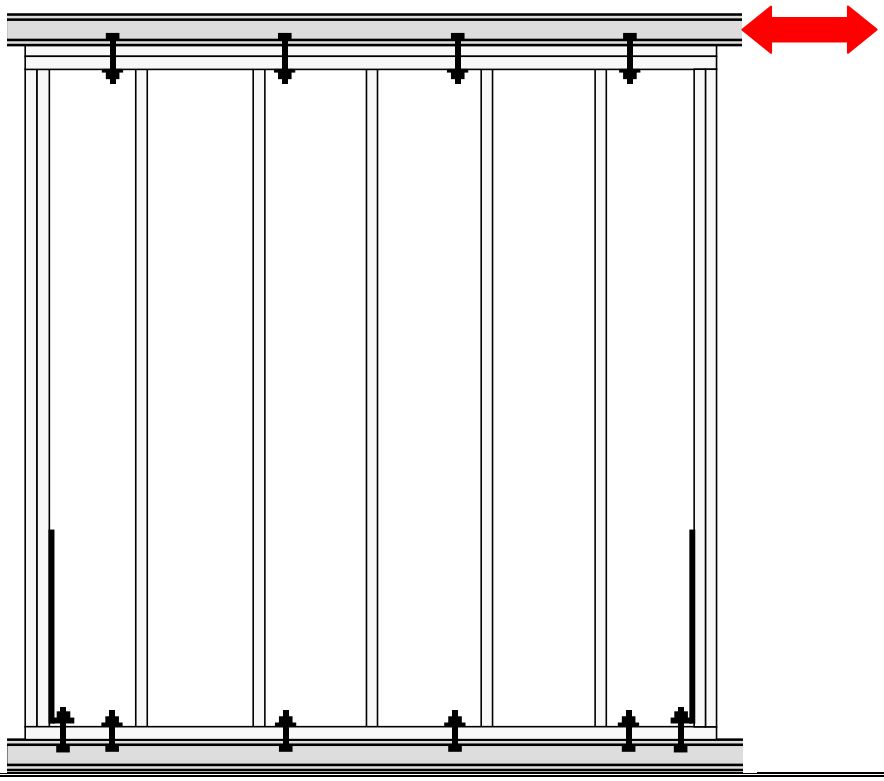
Walls 08FAc



Walls:	**08FAc1**	**08FAc2**
Manufactured:	**June 19, 1998**[1]	**June 19, 1998**[1]
MOE data files:	8fac1p.prn 8fac1s.prn	8fac2p.prn 8fac2s.prn
MOE_{plates} (10^6 psi)	1.79	1.92
MOE_{studs} (10^6 psi)	1.52	1.60
$Density_{plates}$ (kg/m^3)	547	582
$Density_{studs}$ (kg/m^3)	475	489
Date tested:	**August 3, 1998**	**August 3, 1998**
Time tested:	13:22	16:23
LTC files:	alex_cyc	30alex8
Data files:	08FAc1.dat	08FAc2.dat
Excel files:	08FAc1_data 08FAc1_UTP	08FAc2_data 08FAc2_UTP
Photo files:	729-739	740-748

[1] Sheathing attached with ½+¼-in. edge distance along the top and bottom plates.

Wall 08FAc1

Observations: The initial elastic stiffness was significantly higher than the stabilized (approx. 27%), and the latter was just slightly lower than the elastic stiffness in the corresponding monotonic tests. The negative and positive envelopes were almost symmetrical. The average peak load 4.4 Kips (0.55 Kips/ft.) was developed at 1.8-in. amplitude. The wall yielded for several cycles and the resistance degraded 20% at 2.8-in. amplitude.

Failure mode: Sheathing unzipped along the top plate where the nails tore through the edge (Photo 379). Most of the nails along the right end stud and along the bottom plate failed in fatigue (Photo 739). The left end stud separated from the top plate and sheathing nails pulled out of wood. The wood density of this stud was 420 kg/m^3 -- less than average.

Wall 08FAc2

Observations: This wall performed very similar to 08FAc1 wall. The average peak load 4.3 Kips (0.54 Kip/ft.) was reached at 1.8-in. amplitude. The wall yielded for several cycles and the resistance degraded 20% at 2.8-in. amplitude.

Failure mode: The failure mode was similar to that observed during 08FAc1 test. Sheathing unzipped along the top plate where the nails tore through the edge. It can be seen from the Photo 744 that the edge distance along the top plate was probably less than 3/8 in. The left end stud separated from the top plate and sheathing nails failed in fatigue. Most of the nails along the intermediate and the right end stud started pulling out of wood (Photo 745). Nails along the bottom plate failed in fatigue (Photos 742, 748).

General

Comparing the results of cyclic and monotonic tests (08FAc vs. 08FAm) the following conclusions were made:

1) Cyclic elastic stiffness (initial envelope) was 14% higher than the monotonic; stabilized stiffness was 17% less than monotonic.
2) Average cyclic strength (initial envelope) was 20% less than the monotonic strength; average stabilized strength was 30% less than the monotonic.

Most likely, the combined effect of the cyclic loading and the small edge distance of the sheathing-to-framing connections lead to the significant strength and ductility reduction. (See also comments to 12FAc series.) During the cycling, the sheathing nails start pulling out of wood or fail in fatigue provided the edge distance is adequate and the wood density is sufficient to hold the nails. Studs with low wood density allow the nail withdrawal easier.

Table 08FAc1. Data summary.

Specimen	**08FAc1**	**Per unit length**	
Tie-Down Anchors		**cyclic test**	
Wall length		**8.00ft.**	**2.438m**
Date: 8-03-1998 **Time:**	13:22		
EEEP Parameters	**units**	**initial**	**stabilized**
Peak unit load, v_{peak}	Kip/ft. KN/m	0.550 8.024	0.479 6.991
Drift at peak load, Δ_{peak}	in. mm	1.800 45.73	1.660 42.16
Yield unit load, v_{yield}	Kip/ft. KN/m	0.501 7.317	0.441 6.440
Drift at yield load, Δ_{yield}	in. mm	0.372 9.44	0.448 11.38
Proportional limit, $0.4v_{peak}$	Kip/ft. KN/m	0.220 3.210	0.192 2.796
Drift at prop. limit, $\Delta@0.4v_{peak}$	in. mm	0.163 4.14	0.195 4.94
Unit load at failure or $0.8v_{peak}$	Kip/ft. KN/m	0.440 6.420	0.383 5.593
Drift at failure, $\Delta_{failure}$	in. mm	2.835 72.01	2.675 67.94
Shear modulus, G $@0.4v_{peak}$	Kip/in. KN/mm	10.794 1.890	7.882 1.380
Work until failure per unit length	Kip·ft./ft. KN·m/m	1.379 6.134	1.299 5.779
Unit load, $v_{1/300}$ @ 0.32 in. (8.13 mm)	Kips/ft. KN/m	0.321 4.678	0.304 4.439
Unit load, $v_{1/200}$ @ 0.48 in.(12.19 mm)	Kips/ft. KN/m	0.384 5.600	0.356 5.196
Unit load, $v_{1/100}$ @ 0.96 in. (24.38 mm)	Kips/ft. KN/m	0.504 7.349	0.445 6.493
Unit load, $v_{1/60}$ @ 1.6 in. (40.64 mm)	Kips/ft. KN/m	0.545 7.951	0.477 6.957
EVDR $@v_{peak}$		0.134	0.124

SEAOSC parameters		**units**	**negative**	**positive**	**average**
Yield Limit State	v_{YLS}	Kips/ft. KN/m	-0.315 -4.604	0.265 3.871	0.290 4.237
	Δ_{YLS}	in. mm	-0.302 -7.67	0.220 5.58	0.261 6.62
	G'_{YLS}	Kip/in. KN/mm	8.363 1.465	9.659 1.691	8.909 1.560
Strength Limit State	v_{SLS}	Kips/ft. KN/m	-0.551 -8.044	0.547 7.975	0.549 8.010
	Δ_{SLS}	in. mm	-1.816 -46.14	2.112 53.65	1.964 49.89
	G'_{SLS}	Kip/in. KN/mm	2.428 0.425	2.070 0.362	2.235 0.391

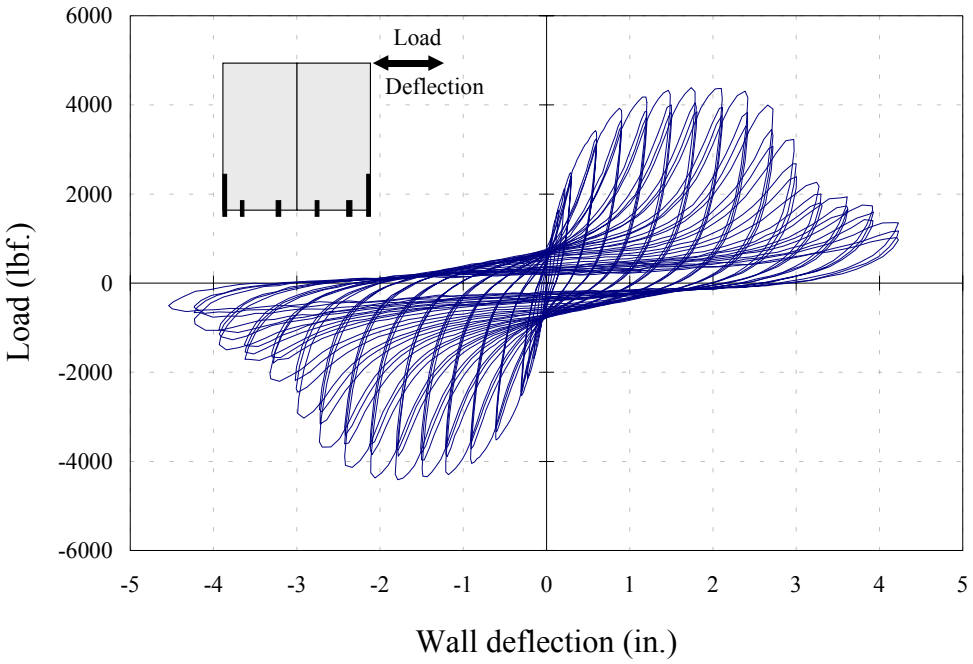


Figure 08FAc1- a. Observed load-deflection curve[1].

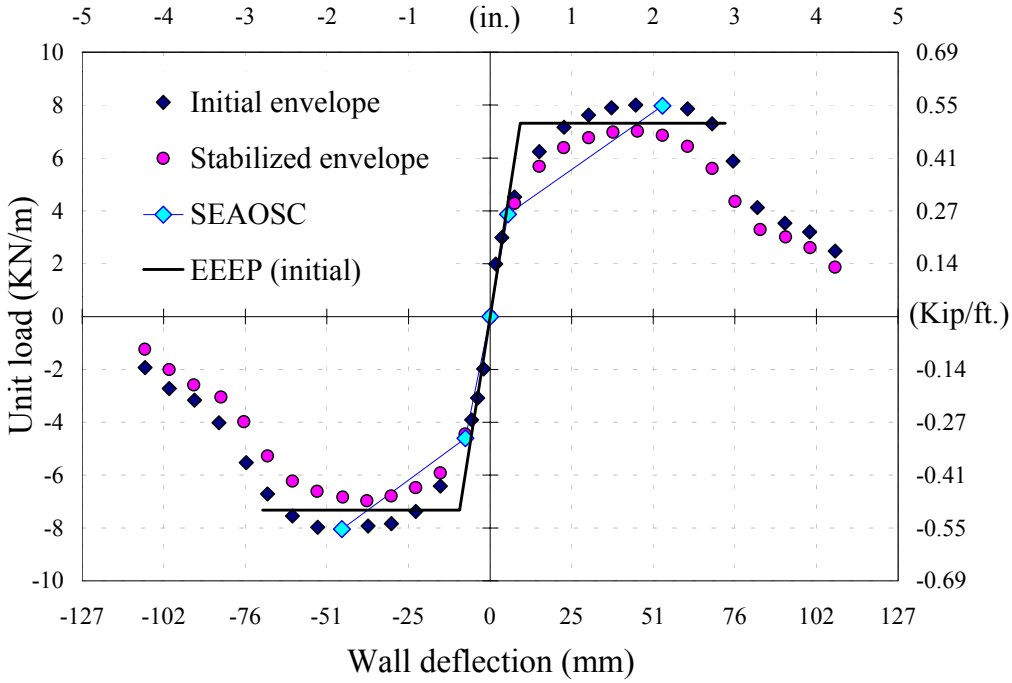


Figure 08FAc1- b. Envelopes, SEAOSC, and EEEP curves[2].

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

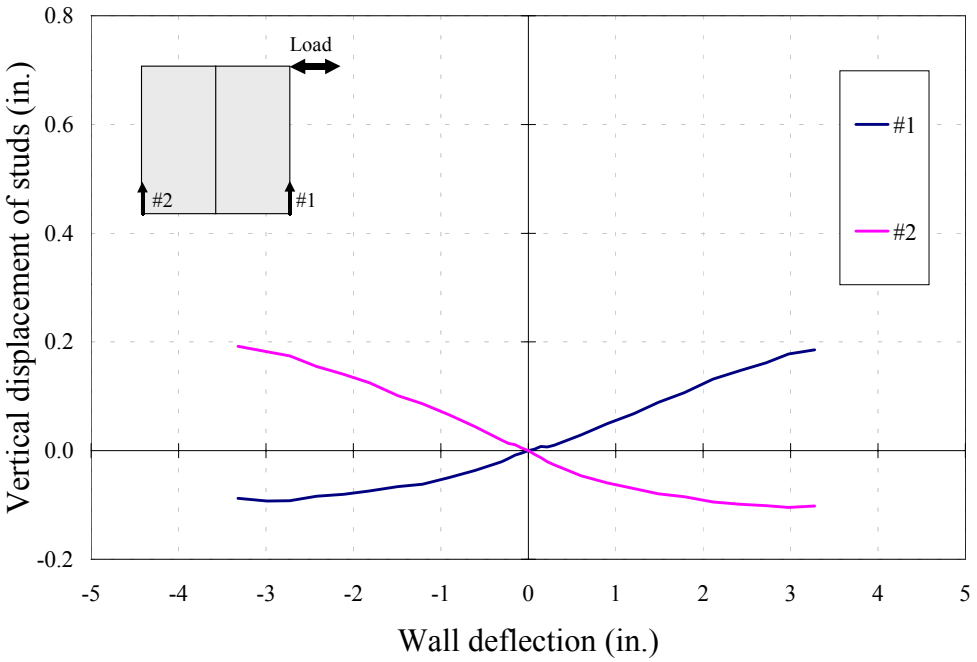


Figure 08FAc1- c. Vertical displacement of studs (initial envelope).

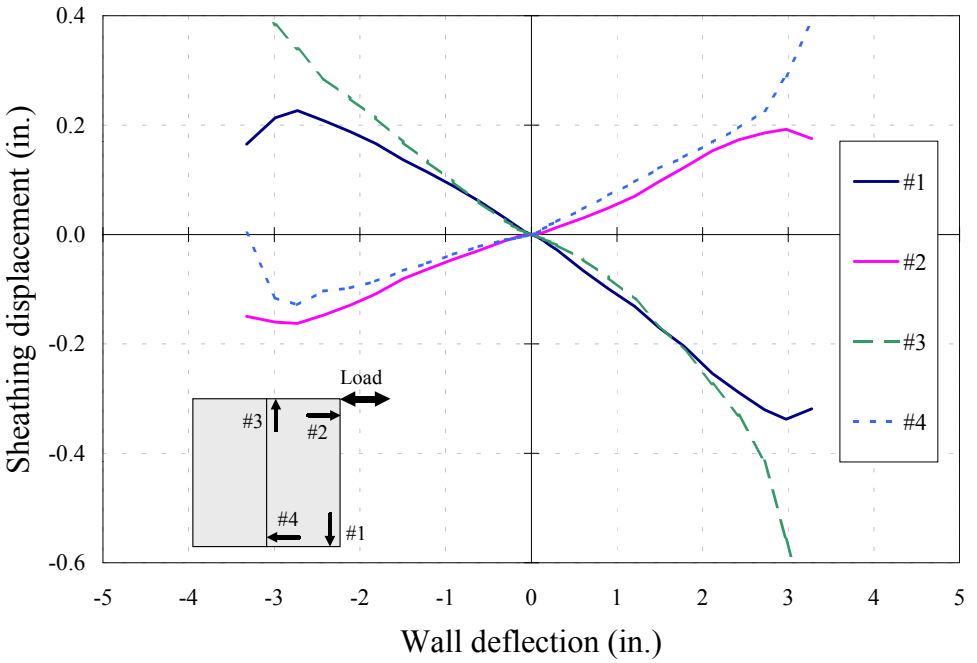


Figure 08FAc1- d. Sheathing displacement (initial envelope).

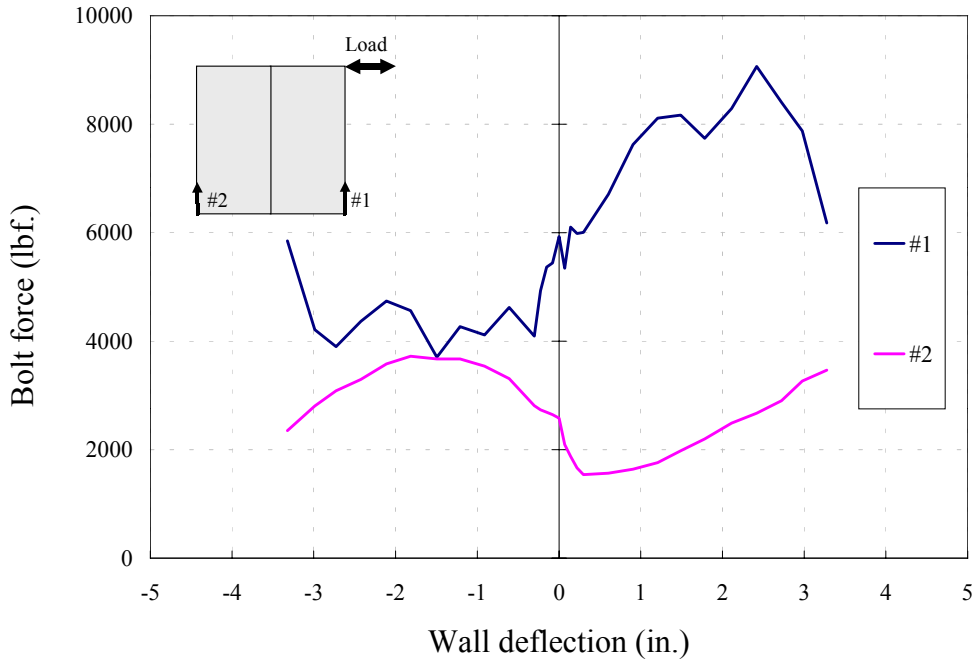


Figure 08FAc1- e. Forces in anchor bolts (initial envelope).

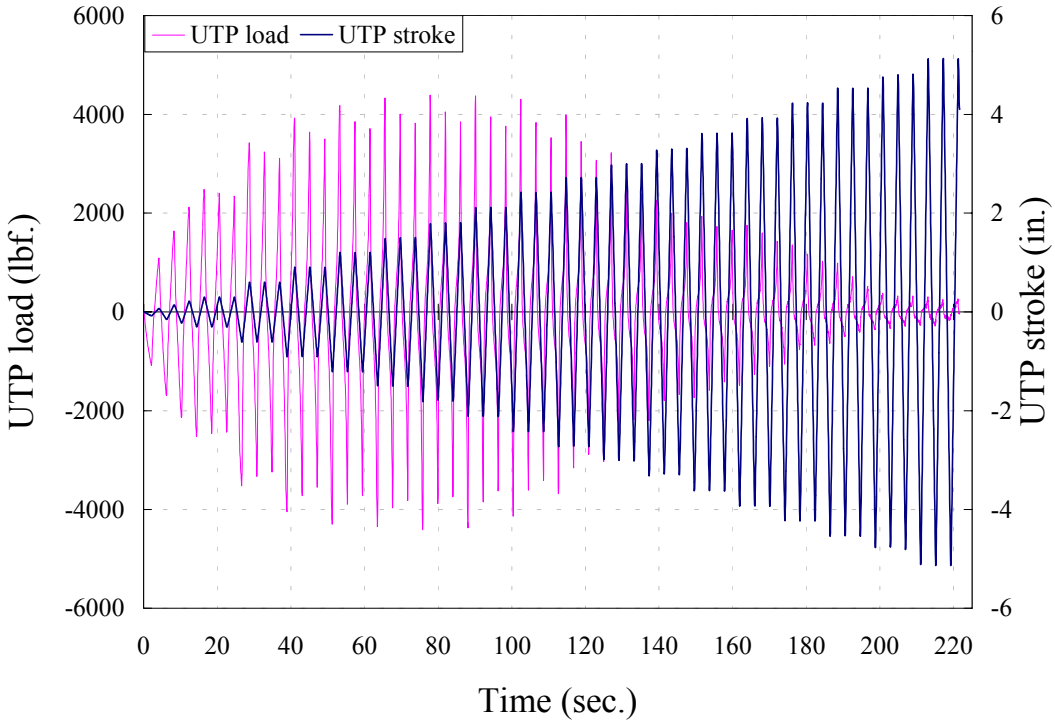


Figure 08FAc1- f. Load- and displacement-time record.

Table 08FAc2. Data summary.

Specimen	**08FAc2**	**Per unit length**	
Tie-Down Anchors		**cyclic test**	
Wall length		**8.00ft.**	**2.438m**
Date: 8-03-1998 **Time:**	16:23		
EEEP Parameters	**units**	**initial**	**stabilized**
Peak unit load, v_{peak}	Kip/ft. KN/m	0.540 7.888	0.473 6.903
Drift at peak load, Δ_{peak}	in. mm	1.802 45.76	1.507 38.29
Yield unit load, v_{yield}	Kip/ft. KN/m	0.489 7.138	0.432 6.303
Drift at yield load, Δ_{yield}	in. mm	0.382 9.69	0.458 11.64
Proportional limit, $0.4v_{peak}$	Kip/ft. KN/m	0.216 3.155	0.189 2.761
Drift at prop. limit, $\Delta@0.4v_{peak}$	in. mm	0.169 4.28	0.201 5.10
Unit load at failure or $0.8v_{peak}$	Kip/ft. KN/m	0.432 6.310	0.378 5.522
Drift at failure, $\Delta_{failure}$	in. mm	2.865 72.77	2.694 68.43
Shear modulus, G $@0.4v_{peak}$	Kip/in. KN/mm	10.357 1.814	7.539 1.320
Work until failure per unit length	Kip·ft./ft. KN·m/m	1.402 6.236	1.318 5.861
Unit load, $v_{1/300}$ @ 0.32 in. (8.13 mm)	Kips/ft. KN/m	0.305 4.446	0.291 4.249
Unit load, $v_{1/200}$ @ 0.48 in.(12.19 mm)	Kips/ft. KN/m	0.368 5.373	0.343 5.009
Unit load, $v_{1/100}$ @ 0.96 in. (24.38 mm)	Kips/ft. KN/m	0.492 7.182	0.437 6.381
Unit load, $v_{1/60}$ @ 1.6 in. (40.64 mm)	Kips/ft. KN/m	0.536 7.829	0.470 6.865
EVDR $@v_{peak}$		0.139	0.126

SEAOSC parameters		**units**	**negative**	**positive**	**average**
Yield Limit State	v_{YLS}	Kips/ft. KN/m	-0.294 -4.292	0.261 3.811	0.278 4.051
	Δ_{YLS}	in. mm	-0.305 -7.74	0.223 5.66	0.264 6.70
	G'_{YLS}	Kip/in. KN/mm	7.722 1.352	9.380 1.643	8.422 1.475
Strength Limit State	v_{SLS}	Kips/ft. KN/m	-0.551 -8.044	0.530 7.731	0.540 7.888
	Δ_{SLS}	in. mm	-1.816 -46.14	1.787 45.39	1.802 45.76
	G'_{SLS}	Kip/in. KN/mm	2.428 0.425	2.371 0.415	2.400 0.420

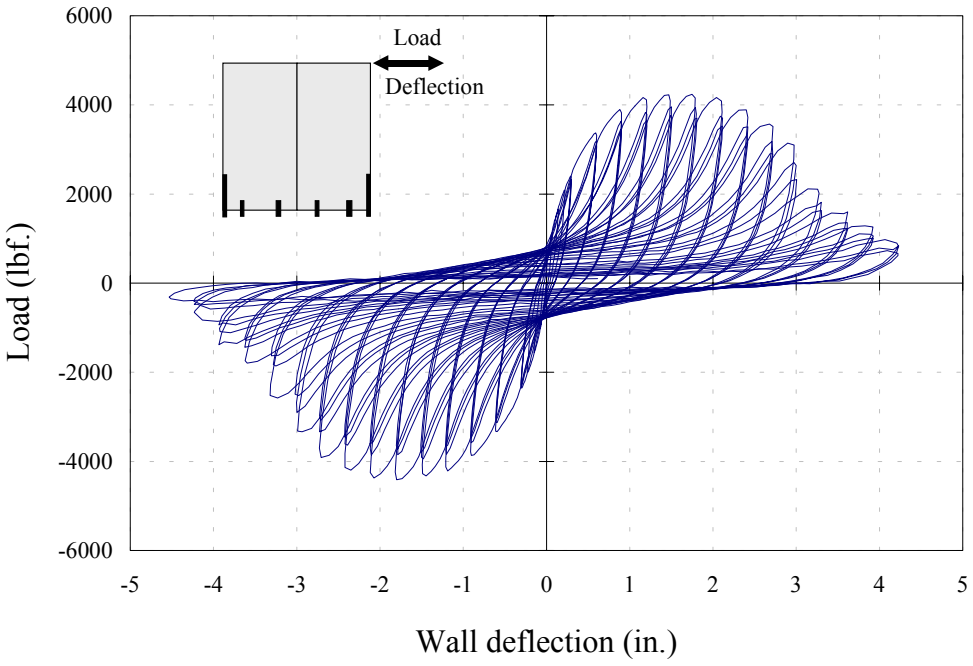


Figure 08FAc2- a. Observed load-deflection curve.

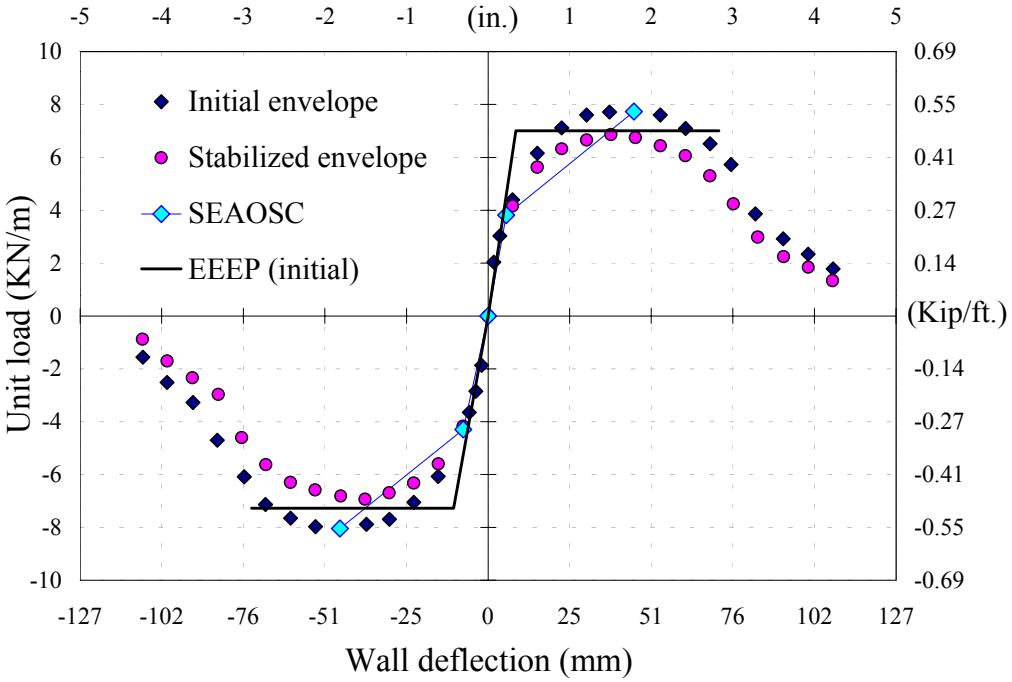


Figure 08FAc2- b. Envelopes, SEAOSC, and EEEP curves.

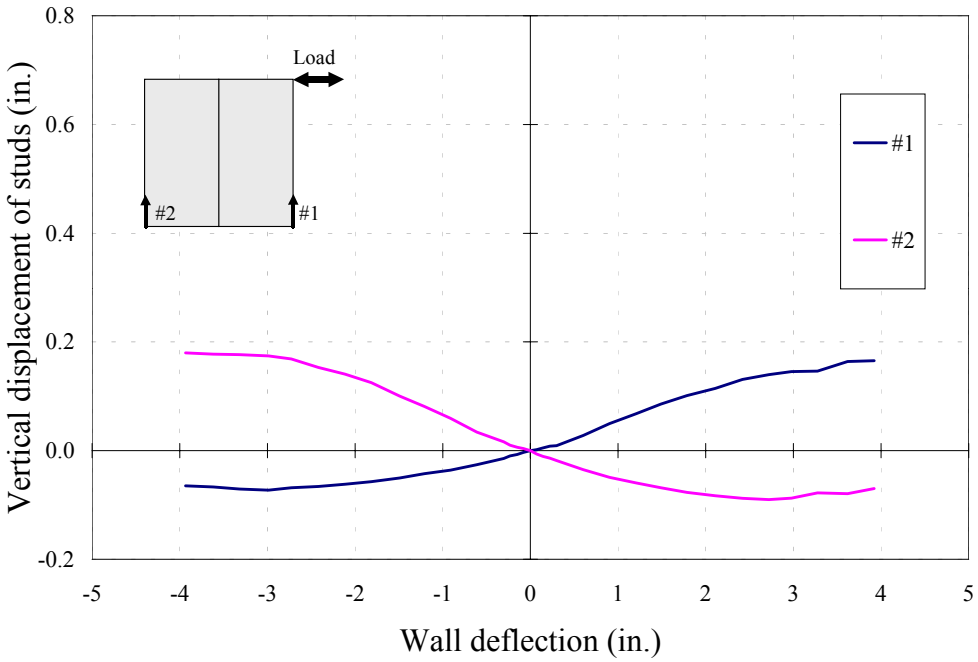


Figure 08FAc2- c. Vertical displacement of studs (initial envelope).

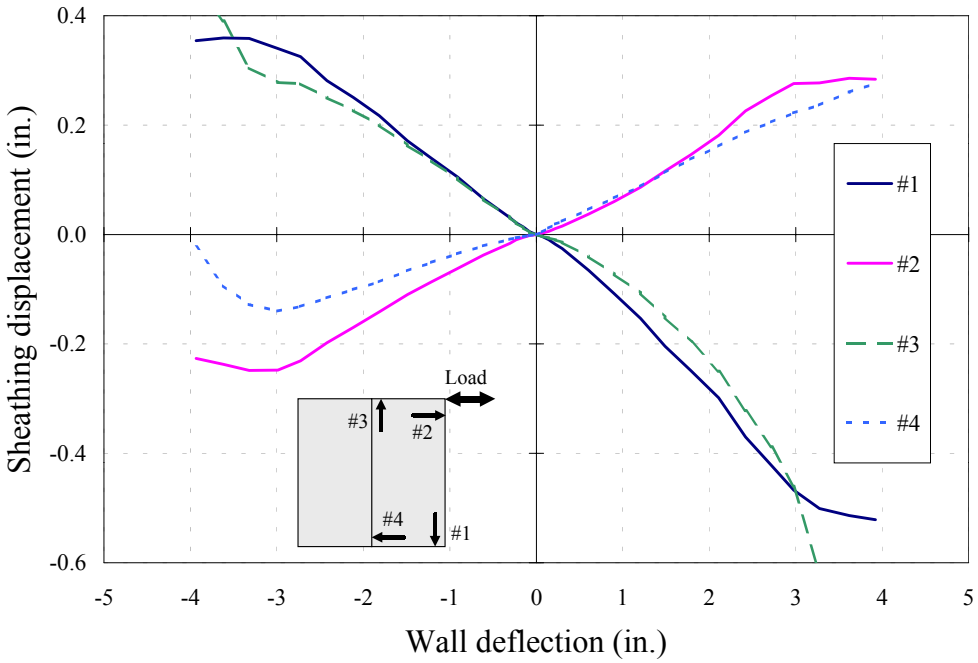


Figure 08FAc2- d. Sheathing displacement (initial envelope).

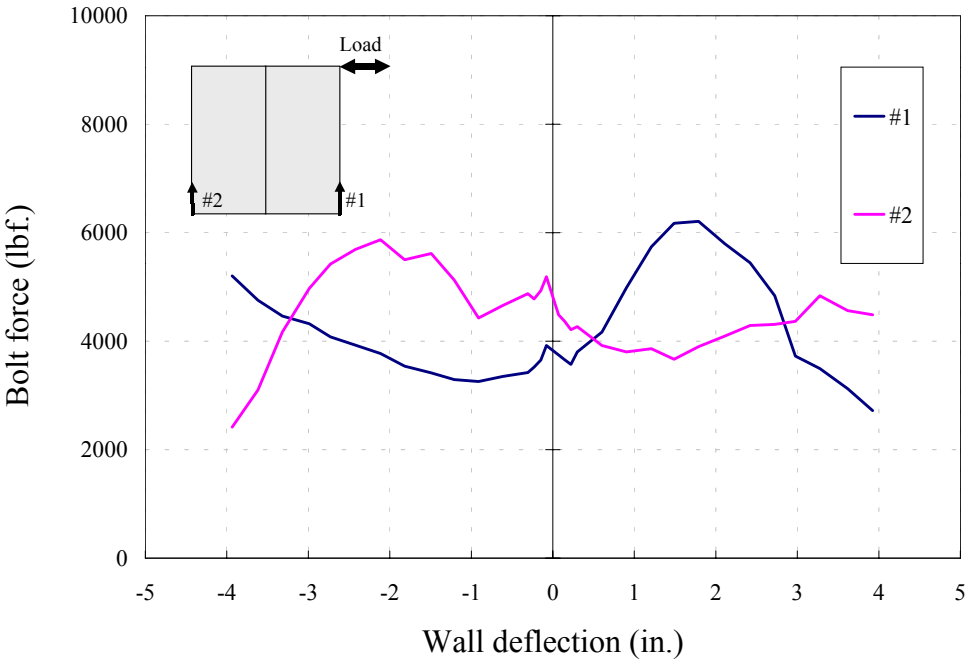


Figure 08FAc2- e. Forces in anchor bolts (initial envelope).

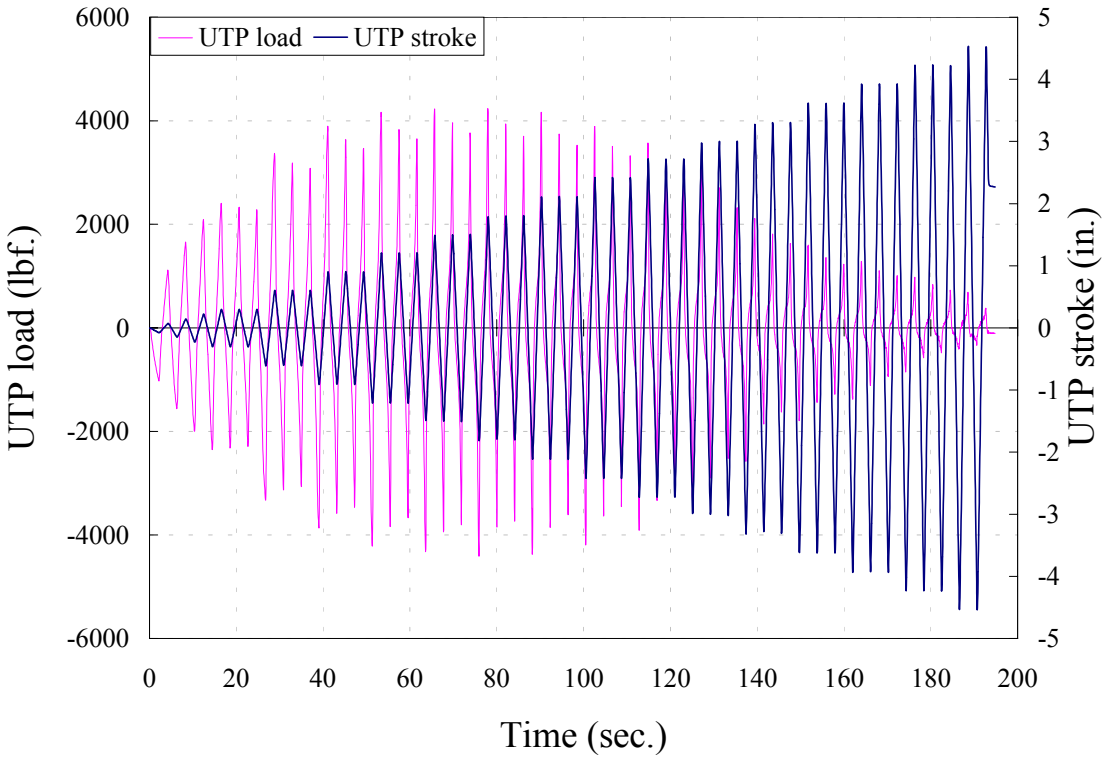


Figure 08FAc2- f. Load- and displacement-time record.