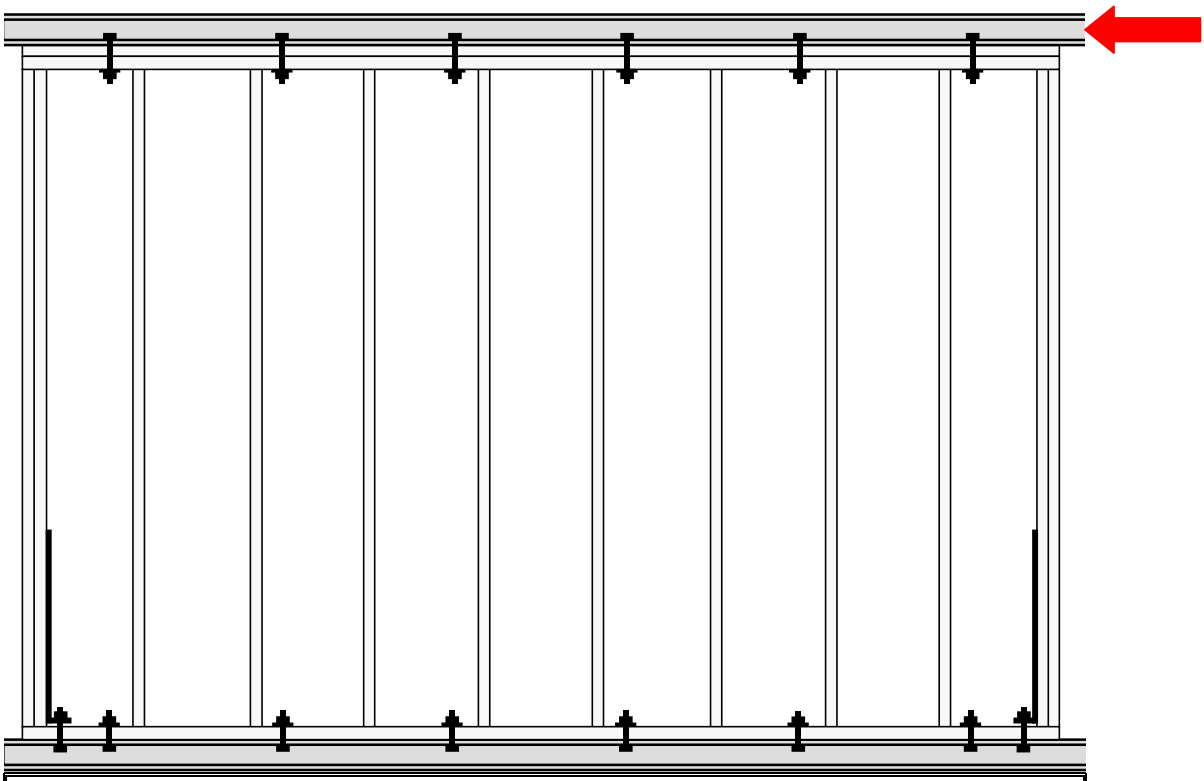
Walls 12FAm



Walls:	12FAm1	12FAm2
Manufactured:	**June 17, 1998**[1]	**June 23, 1998**[1]
MOE data files:	12fam1p.prn 12fam1s.prn	12nam1p.prn 12nam1s.prn
MOE_{plates} (10^6 psi)	1.83	2.02
MOE_{studs} (10^6 psi)	1.69	1.43
$Density_{plates}$ (kg/m^3)	526	588
$Density_{studs}$ (kg/m^3)	515	456
Date tested:	**July 13, 1998**	**August 19, 1998**[2]
Time tested:	17:02	14:25
LTC files:	utp-alex	alex-m12
Data files:	12FAm1.dat	12FAm2.dat
Excel files:	12FAm1_data	12FAm2_data
Photo files:	411-429	no pictures

[1] Sheathing attached to the top and bottom plate with ¾-in. edge distance.

[2] Tie-down anchors were attached 2.5 hours before the test.

Wall 12FAm1

Observations: The wall exhibited a rigid behavior with well-developed plastic region. The peak load (8143 lbf.) was observed at 3.15-in. deflection. Then, the resistance decreased gradually, without noticeable load drops. The 20% load reduction was observed at 4.6-in. deflection. The frame racked and all three panels of sheathing rocked (Photos 418, 423). Figure 12FAm1-d illustrates the uniform displacement of panels corners relative to the studs. After the gaps between the sheets closed, a considerable amount of friction was exerted between adjacent panel edges accompanied with a squeaky sound. The studs did not separate from the plates until failure.

Failure mode: As seen on Photos 422 and 425, the first panel of sheathing unzipped at the top plate and the intermediate stud. General view is shown in Photo 427. The right end stud separated from the top plate (Photo 426); sheathing nails pulled through the sheathing. All studs acquired S-shape due to sheathing rotation during the test (see Photo 412).

The excellent performance of this specimen was likely due to the high quality of sheathing connections (3/4-in. edge) and high density of framing lumber (520 kg/m^3).

Instrumentation: Tension bolt #2 was calibrated and installed instead of the damaged one to measure uplift force on tension side. Load range of UTP controller was set up at 22000 lbs.

Wall 12FAm2

Observations: Comparison of load-deflection curves of walls 12FAm1 and 12FAm2 showed that until 1.5-in. deflection, the walls resisted the same load. They had the same elastic stiffness (13.4 Kips/in.). However, this wall was only 90% as strong as 12FAm1 wall. It reached the peak load 7353 lbf. at 2.1-in. deflection, then gradually decreased the resistance, and at 3.45-in. deflection a quick degradation started.

Failure mode: The first sheathing panel unzipped along the bottom plate and the right end stud. The sheathing nails along the end stud pulled out of wood while the stud separated from the top plate. At the bottom, the nails tore though the panel edge. Then, the second panel unzipped at the bottom with nails tearing through the edge.

Discussion: Figure 12FAm-d confirms that there was a lot of racking displacement similar to wall 12FAm1. The right-bottom corner of the sheathing (Channel #1) moved away from the bottom plate 3 times as much as the opposite corner. At 3.45-in. deflection, the corner translated 1.0 in. up from the bottom plate. That was the moment of the entire separation or the first panel from the framing and the fast load drop on the load-deflection curve. Figure 12FAm1-c shows that the intermediate stud (Channel #2) separated at his moment from the bottom plate.

Density of framing: The possible reason for the early degradation of the wall. The right end stud had density 393 kg/m^3, while the top plate had 630 kg/m^3. The big difference in the density of the studs and the plates might lead to the observed failure mode. The wood in the studs was not as strong as in the plates, therefore the nails pulled out of wood along the weak stud and tore though the edge of the bottom plate.

Table 12FAm1. Data summary.

Specimen **12FAm1**	**Per unit length**	
Tie-down Anchors	**monotonic test**	
Wall length	**12.00ft.**	**3.657m**
Date: 7-13-1998.	**Time:**	17:02
	units	**12FAm1**
Peak unit load, v_{peak}	Kip/ft. KN/m	0.679 9.903
Drift at peak load, Δ_{peak}	in. mm	3.147 79.92
Yield unit load, v_{yield}	Kip/ft. KN/m	0.601 8.764
Drift at yield load, Δ_{yield}	in. mm	0.538 13.67
Proportional limit, $0.4v_{peak}$	Kip/ft. KN/m	0.271 3.961
Drift at prop. limit, $\Delta@0.4v_{peak}$	in. mm	0.243 6.18
Unit load at failure or $0.8v_{peak}$	Kip/ft. KN/m	0.542 7.903
Drift at failure, $\Delta_{failure}$	in. mm	4.597 116.76
Shear modulus, G $@0.4v_{peak}$	Kip/in. KN/mm	8.929 1.564
Work until failure per unit length	Kip·ft./ft. KN·m/m	0.217 0.963
Unit load, $v_{1/300}$ @ 0.32 in. (8.13 mm)	Kips/ft. KN/m	0.312 4.555
Unit load, $v_{1/200}$ @ 0.48 in.(12.19 mm)	Kips/ft. KN/m	0.375 5.485
Unit load, $v_{1/100}$ @ 0.96 in. (24.38 mm)	Kips/ft. KN/m	0.491 7.186
Unit load, $v_{1/60}$ @ 1.6 in. (40.64 mm)	Kips/ft. KN/m	0.594 8.679

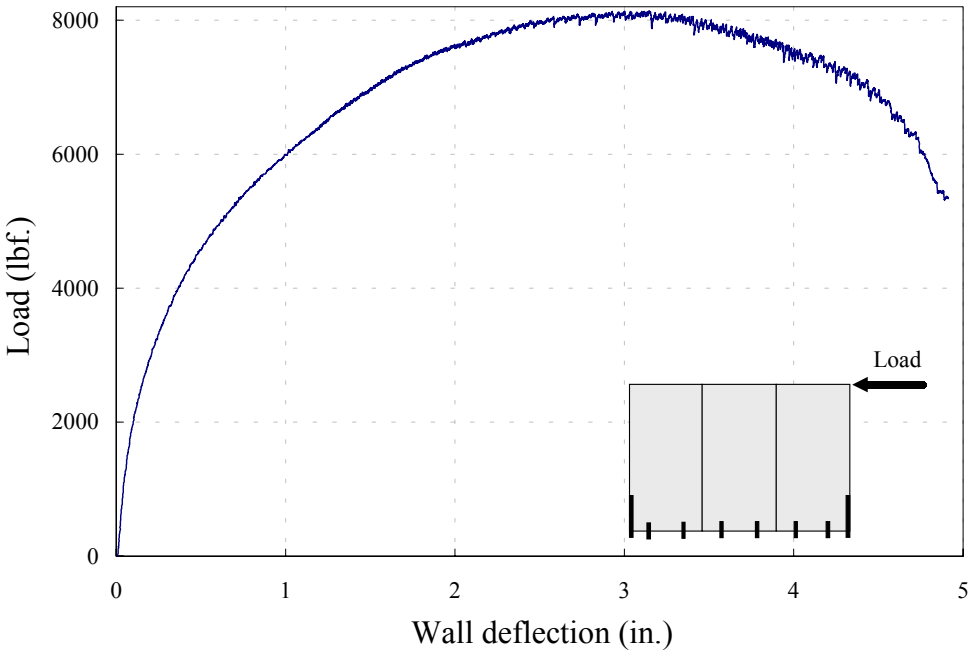


Figure 12FAm1- a. Observed load-deflection curve[1].

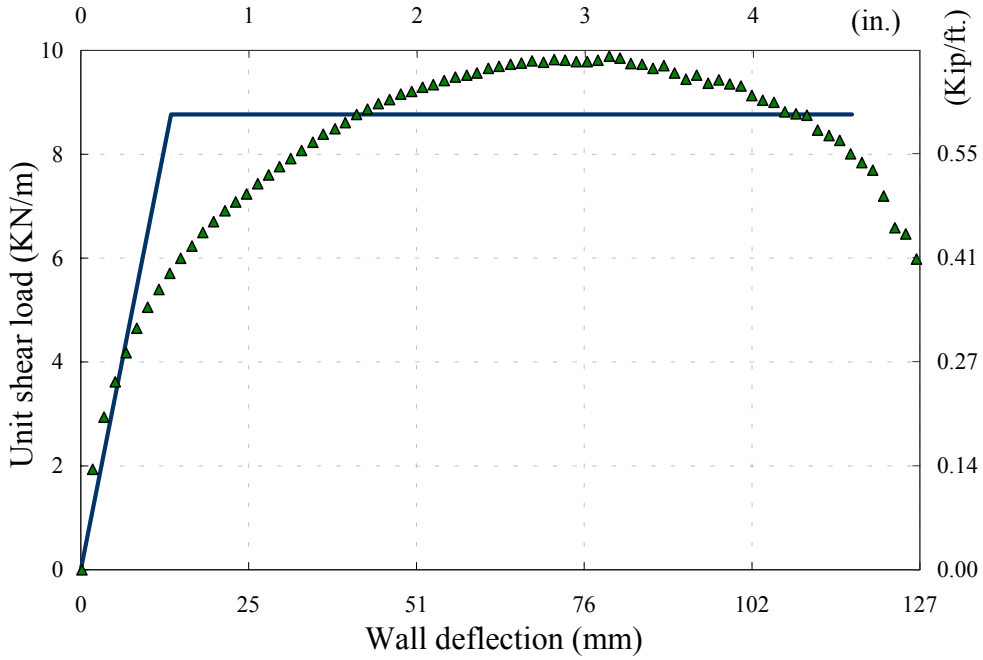


Figure 12FAm1- b. Unit load-deflection and EEEP curves[2].

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

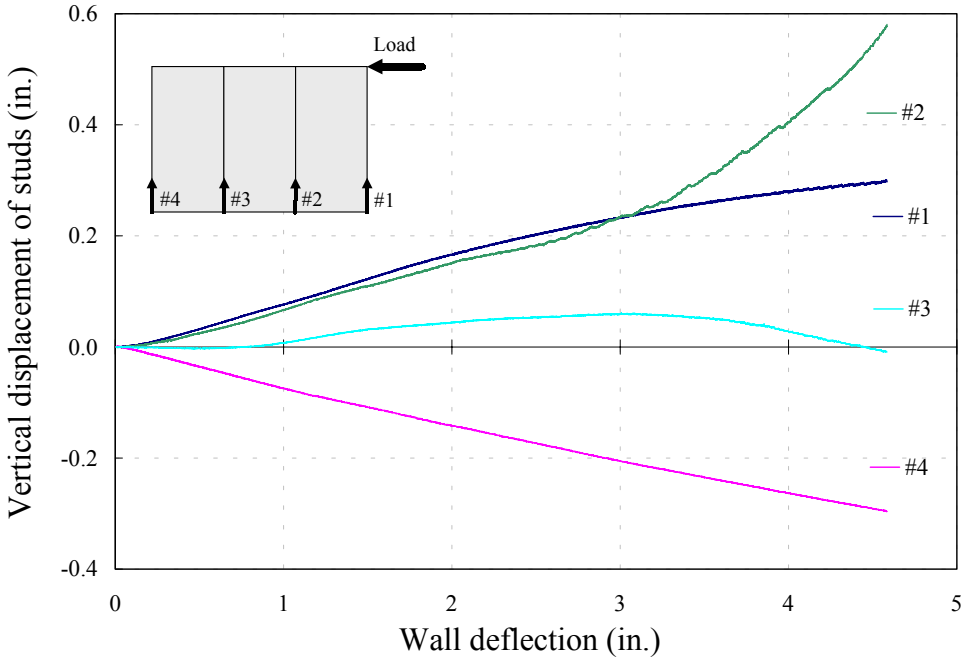


Figure 12FAm1- c. Vertical displacement of studs.

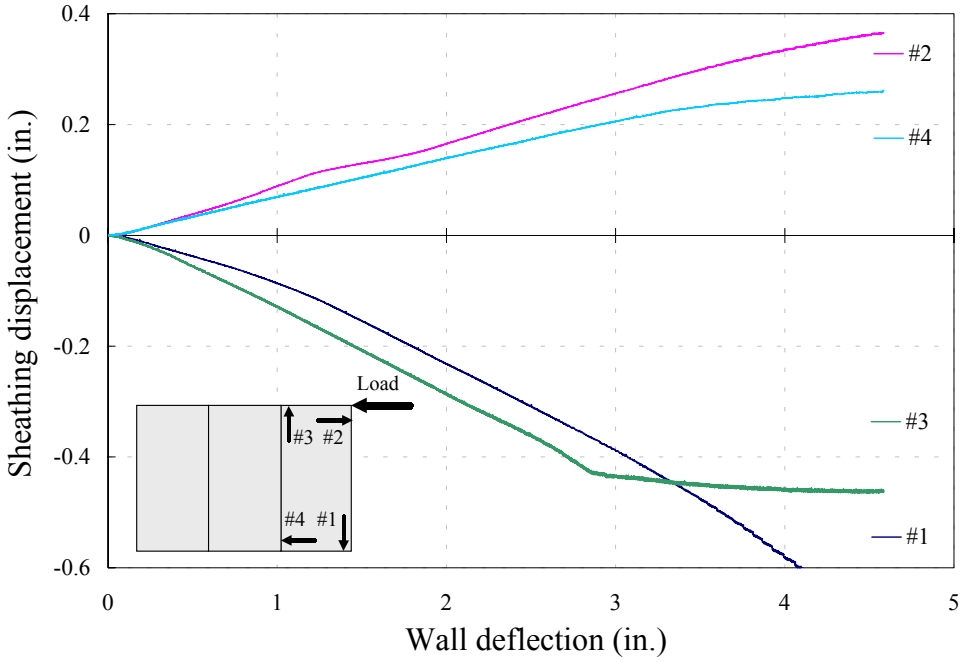


Figure 12FAm1- d. Sheathing displacement.

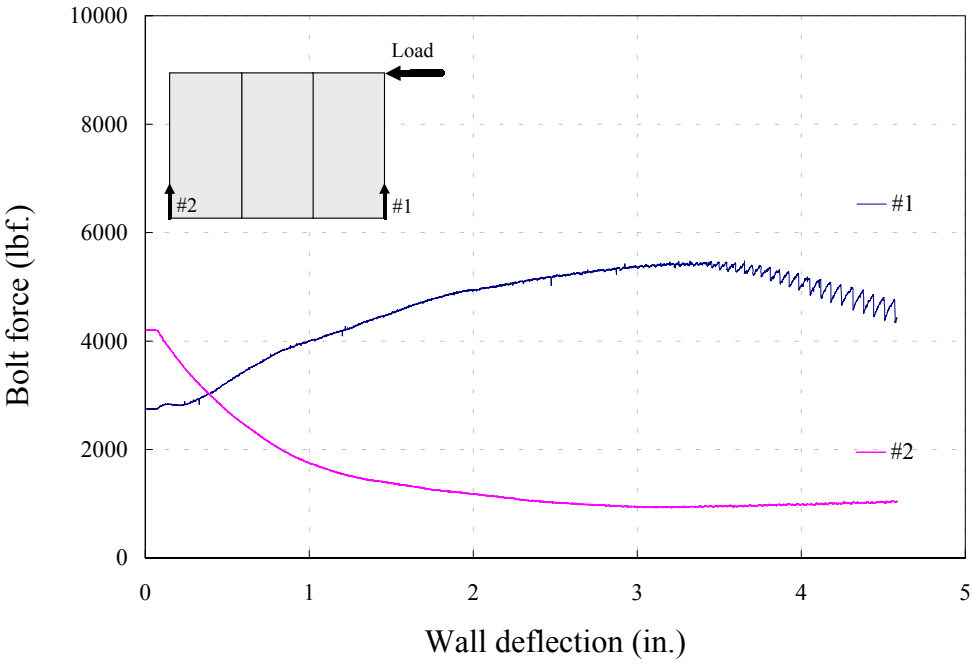


Figure 12FAm1- e. Forces in anchor bolts.

Table 12FAm2. Data summary.

Specimen **12FAm2**	**Per unit length**	
Tie-down Anchors	**monotonic test**	
Wall length	**12.00ft.**	**3.657m**
Date: 8-18-1998.	**Time:**	14:25
	units	**12FAm2**
Peak unit load, v_{peak}	Kip/ft. KN/m	0.613 8.942
Drift at peak load, Δ_{peak}	in. mm	2.106 53.50
Yield unit load, v_{yield}	Kip/ft. KN/m	0.549 8.015
Drift at yield load, Δ_{yield}	in. mm	0.492 12.50
Proportional limit, $0.4v_{peak}$	Kip/ft. KN/m	0.245 3.577
Drift at prop. limit, $\Delta@0.4v_{peak}$	in. mm	0.220 5.58
Unit load at failure or $0.8v_{peak}$	Kip/ft. KN/m	0.489 7.132
Drift at failure, $\Delta_{failure}$	in. mm	3.434 87.21
Shear modulus, G $@0.4v_{peak}$	Kip/in. KN/mm	8.925 1.563
Work until failure per unit length	Kip·ft./ft. KN·m/m	0.146 0.649
Unit load, $v_{1/300}$ @ 0.32 in. (8.13 mm)	Kips/ft. KN/m	0.304 4.450
Unit load, $v_{1/200}$ @ 0.48 in.(12.19 mm)	Kips/ft. KN/m	0.377 5.518
Unit load, $v_{1/100}$ @ 0.96 in. (24.38 mm)	Kips/ft. KN/m	0.503 7.357
Unit load, $v_{1/60}$ @ 1.6 in. (40.64 mm)	Kips/ft. KN/m	0.585 8.549

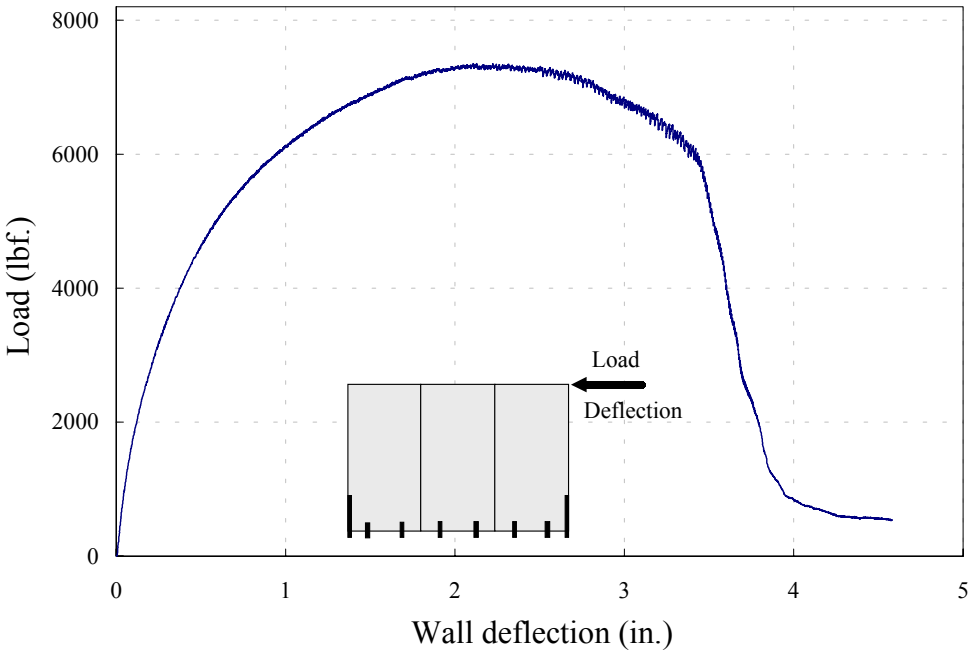


Figure 12FAm2- a. Observed load-deflection curve.

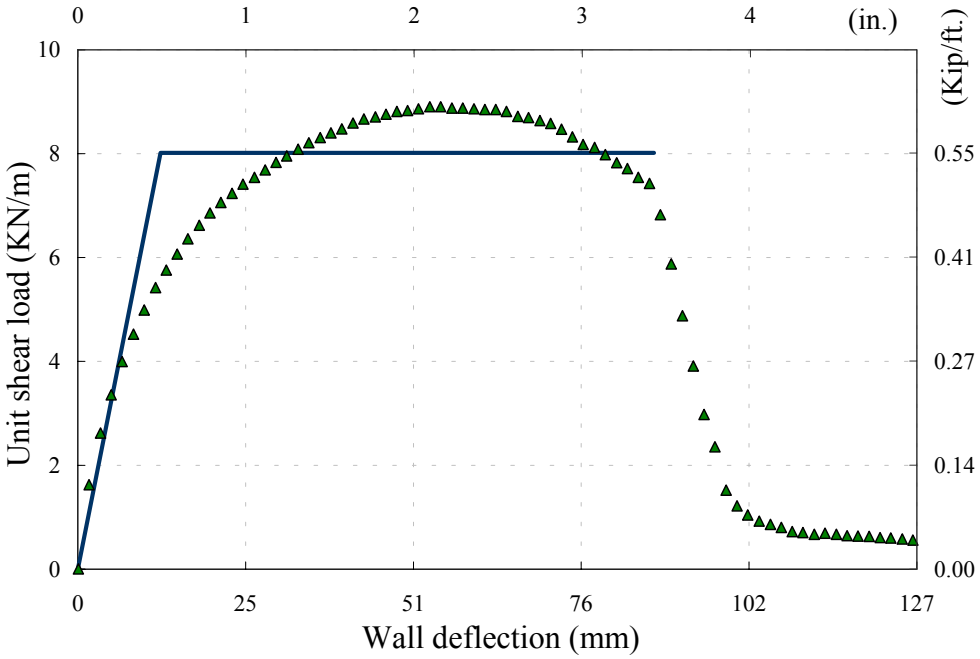


Figure 12FAm2- b. Unit load-deflection and EEEP curves.

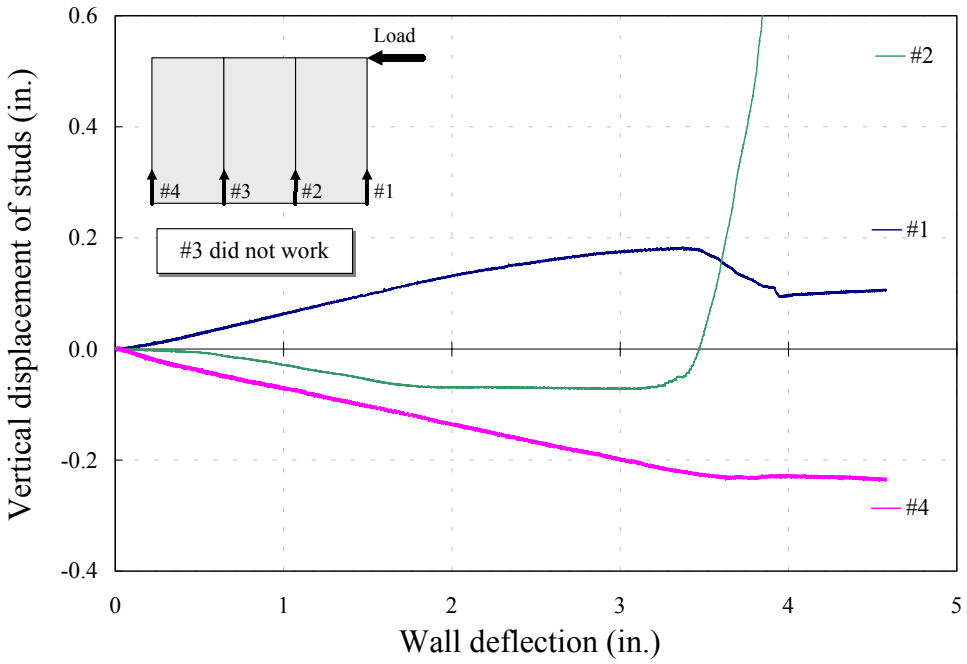


Figure 12FAm2- c. Vertical displacement of studs (initial envelope).

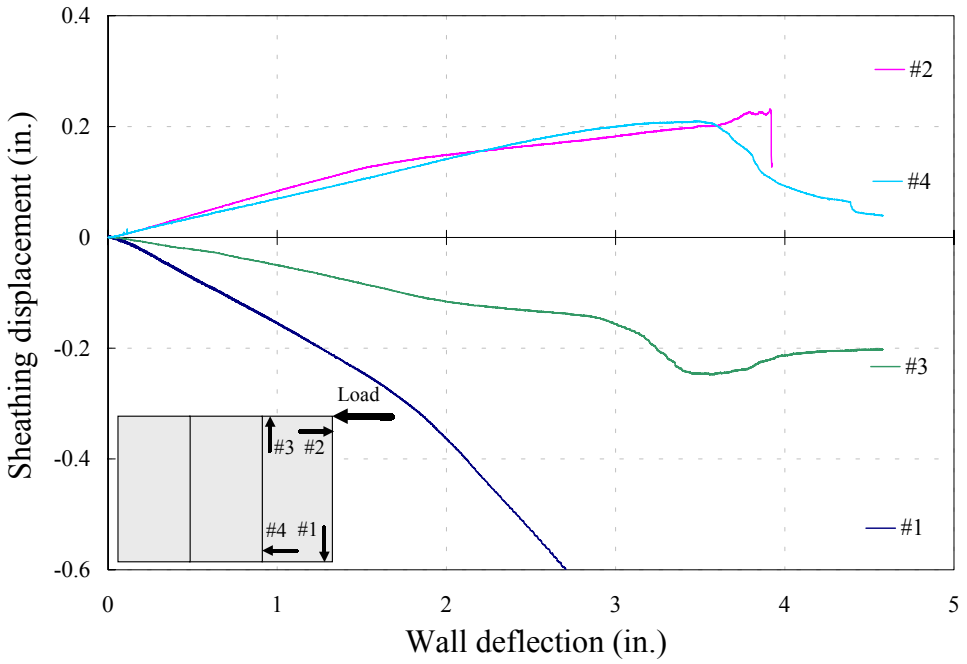


Figure 12FAm2- d. Sheathing displacement.

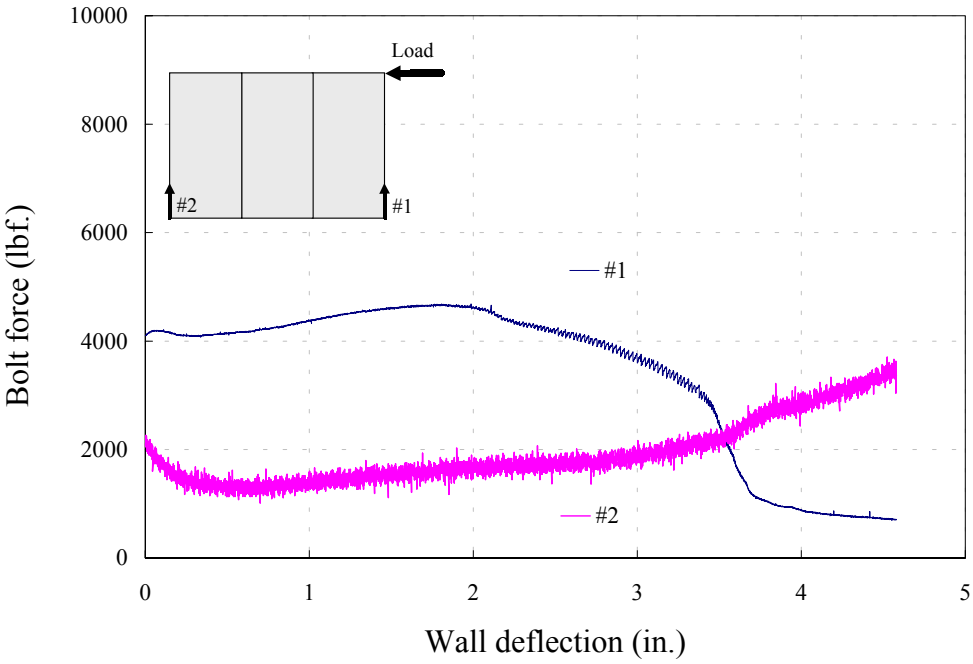


Figure 12FAc2- e. Forces in anchor bolts.