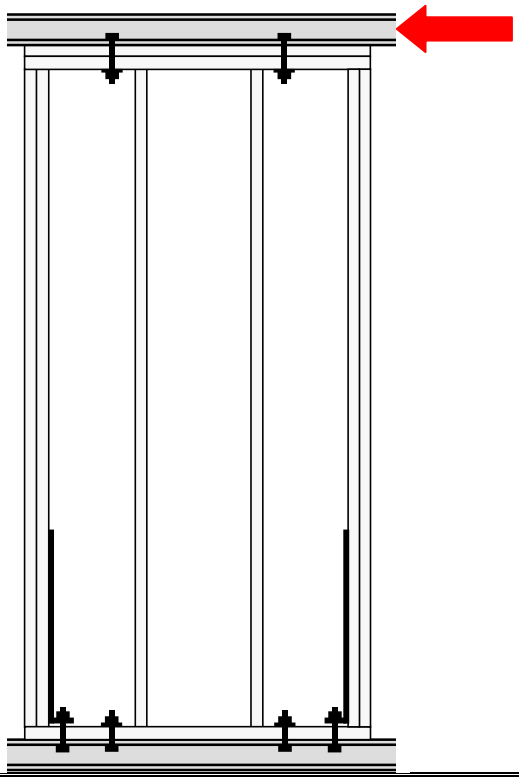
Walls 04FAm



Walls:	**04FAm1**	**04FAm2**
Manufactured:	**June 18, 1998**[1]	**June 18, 1998**[1]
MOE data files:	4fam1s.prn	4fam2s.prn
MOE_{plates} (10^6 psi)		
MOE_{studs} (10^6 psi)	1.77	1.74
$Density_{plates}$ (kg/m^3)		
$Density_{studs}$ (kg/m^3)	488	486
Date tested:	**July 15, 1998**	**July 17, 1998**
Time tested:	10:40	18:24
LTC files:	utp_alex	utp_alex
Data files:	04FAm1.dat	04FAm2.dat
Excel files:	04FAm1_data	04FAm2_data
Photo files:	430-442	467-478

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

Wall 04FAm1

Observations: The wall exhibited a rigid behavior. Performance until the peak load was similar to other FAm walls. The peak load 2342 lbf. (0.59 Kips/ft.) was observed at 1.9-in. deflection. Then, the resistance decreased quickly. The 20% load reduction was observed at 2.5-in. deflection. After 1.3-in. deflection, nails pulled out of the right end stud with a squeaking sound. This phenomenon was reflected in the load-deflection curve. Rotation of the sheathing around the left corner can be seen on Photo 439. Figure 08FAm1-d reveals that the right-bottom corner separated from the framing faster than the other three corners, which lead to the panel separation from the bottom plate.

Failure mode: Sheathing unzipped along the bottom plate and the right end stud (Photo 434). Sheathing nails tore through the edge at the bottom and pulled out of wood at the end stud (Photos 435, 437). The end stud separated from top plate (Photos 436, 440). The track of the right caster (Photo 441) shows that the stud separation started at the failure (approximately 2-in. deflection).

Wall 04FAm2

Observations: Comparison of load-deflection curves of walls 04FAm1 and 04FAm2 showed that until 1.9-in. deflection, the walls performed similarly. In elastic region, wall 04FAm1 was 16% stiffer than wall 04FAm2. However, wall 08FAm2 reached the peak load later (at 2.6-in deflection) and yielded gradually unlike 04FAm1 wall. The 20% load reduction occurred only after 4.1-in deflection.

Failure mode: Failure mechanism was different from the first wall: most of the nails in the right end stud did not pull out of wood, but pulled through the sheathing (Photo 473). The sheathing also unzipped at the bottom plate (Photo 471). The end stud separated from top plate.

General

Overall, it can be concluded that both walls provided satisfactory performance due to high quality of sheathing attachment. The differences were likely due to variation of material properties. Metriguard data showed that the density of the right end stud in wall 04FAm1 was 445 kg/m^3, while the density of the corresponding stud in wall 04FAm2 was 520 kg/m^3. The lower density of wood was the likely reason for the nail withdrawal. Comparison of the sheathing displacement graphs showed that during 04FAm2 test, the sheathing nails along the perimeter worked more evenly. During 04FAm1 test, the separation at the bottom dominated, and the capacity reserve of other nails along the perimeter was underused.

Instrumentation: The diagonal measurement via the pulley (Photo 431) used in earlier tests including 04FAm1 was cumbersome and not very reliable. The inaccuracy became especially noticeable during the tests of narrow walls because of amplifying effect. The system was simplified for 04FAm2 test (Photos 467, 469).

Data acquisition: The load range at the UTP controller was set at 5500 lbf.

Table 04FAm1. Data summary.

Specimen **04FAm1**	**Per unit length**	
Tie-down Anchors	**monotonic test**	
Wall length	**4.00ft.**	**1.219m**
Date: 7-15-1998.	**Time:**	10:40
	units	**04FAm1**
Peak unit load, v_{peak}	Kip/ft. KN/m	0.586 8.544
Drift at peak load, Δ_{peak}	in. mm	1.931 49.04
Yield unit load, v_{yield}	Kip/ft. KN/m	0.508 7.419
Drift at yield load, Δ_{yield}	in. mm	0.407 10.34
Proportional limit, $0.4v_{peak}$	Kip/ft. KN/m	0.234 3.418
Drift at prop. limit, $\Delta@0.4v_{peak}$	in. mm	0.188 4.76
Unit load at failure or $0.8v_{peak}$	Kip/ft. KN/m	0.464 6.771
Drift at failure, $\Delta_{failure}$	in. mm	2.458 62.43
Shear modulus, G $@0.4v_{peak}$	Kip/in. KN/mm	9.993 1.750
Work until failure per unit length	Kip·ft./ft. KN·m/m	0.096 0.425
Unit load, $v_{1/300}$ @ 0.32 in. (8.13 mm)	Kips/ft. KN/m	0.309 4.540
Unit load, $v_{1/200}$ @ 0.48 in.(12.19 mm)	Kips/ft. KN/m	0.368 5.411
Unit load, $v_{1/100}$ @ 0.96 in. (24.38 mm)	Kips/ft. KN/m	0.496 7.297
Unit load, $v_{1/60}$ @ 1.6 in. (40.64 mm)	Kips/ft. KN/m	0.573 8.422

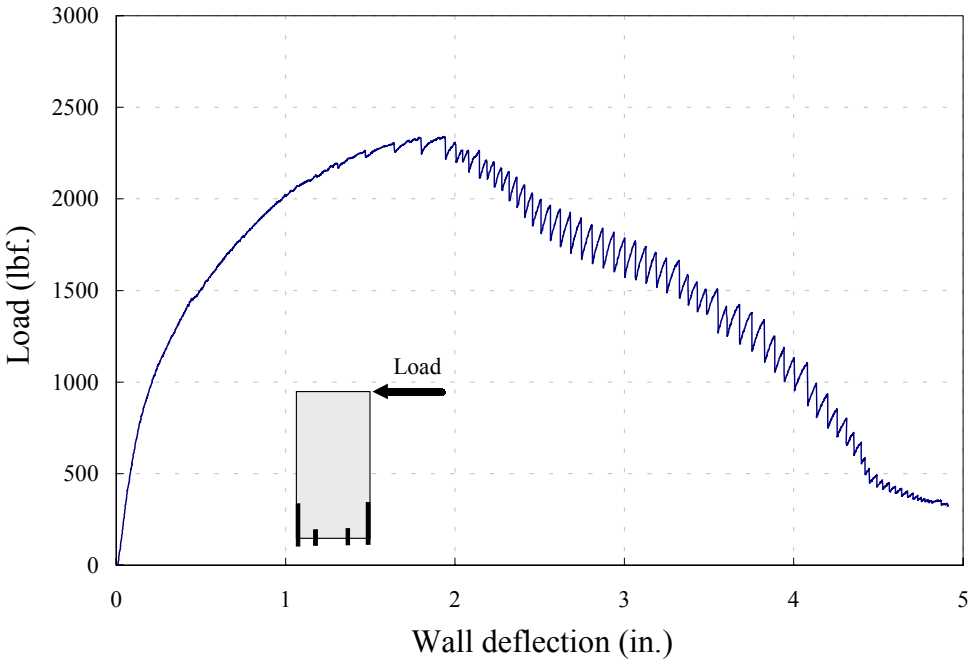


Figure 04FAm1- a. Observed load-deflection curve[1].

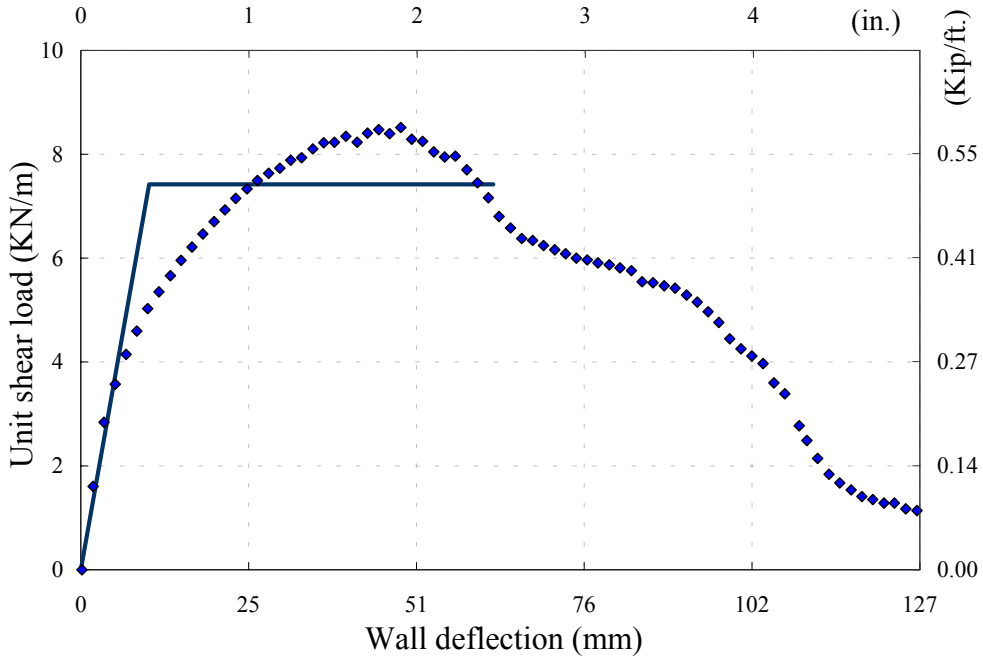


Figure 04FAm1- b. Unit load-deflection and EEEP curves[2].

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

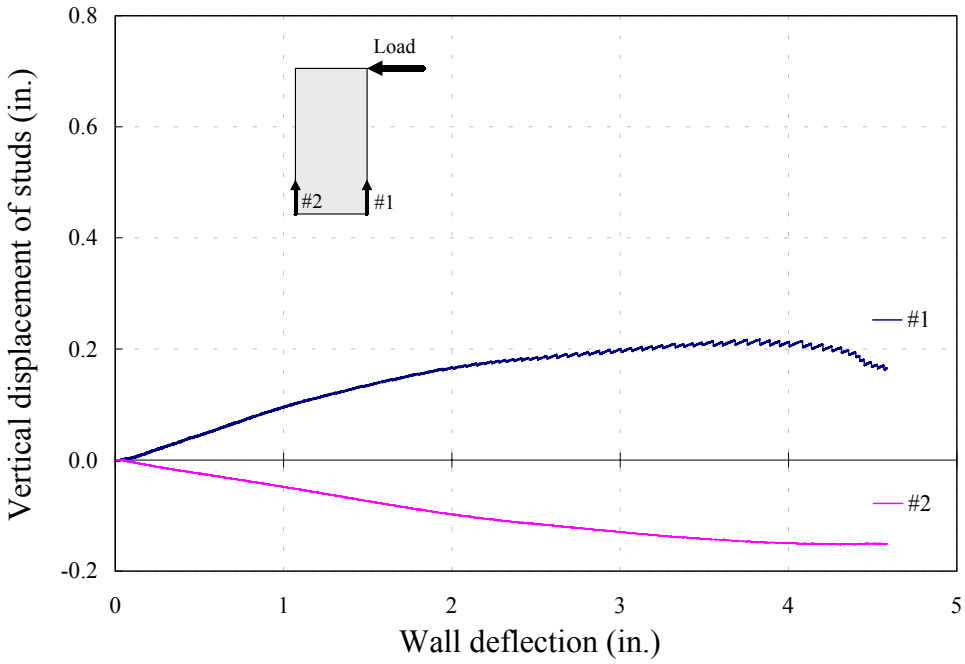


Figure 04FAm1- c. Vertical displacement of studs.

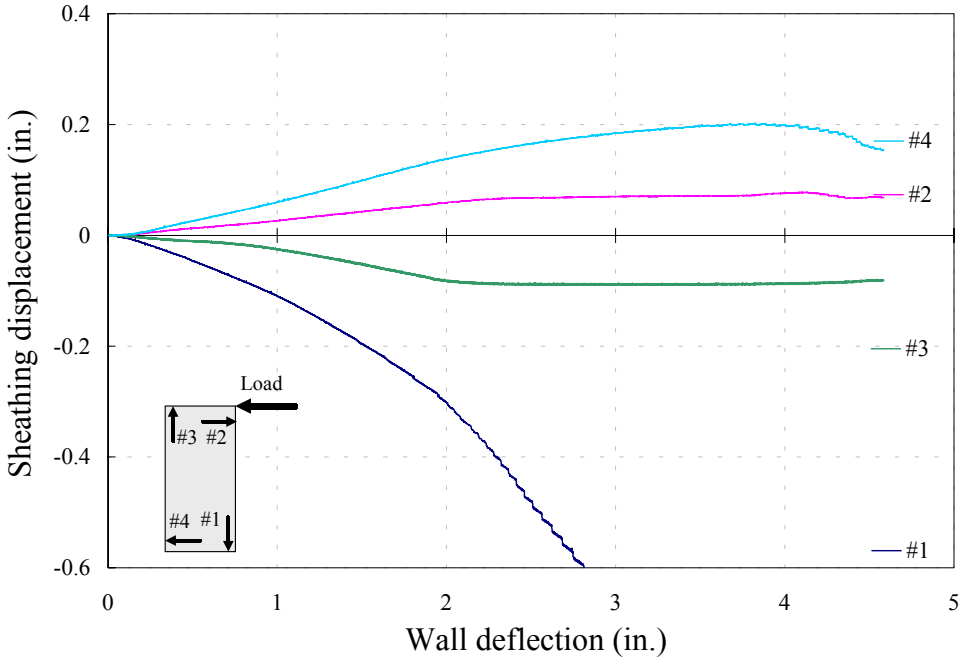


Figure 04FAm1- d. Sheathing displacement.

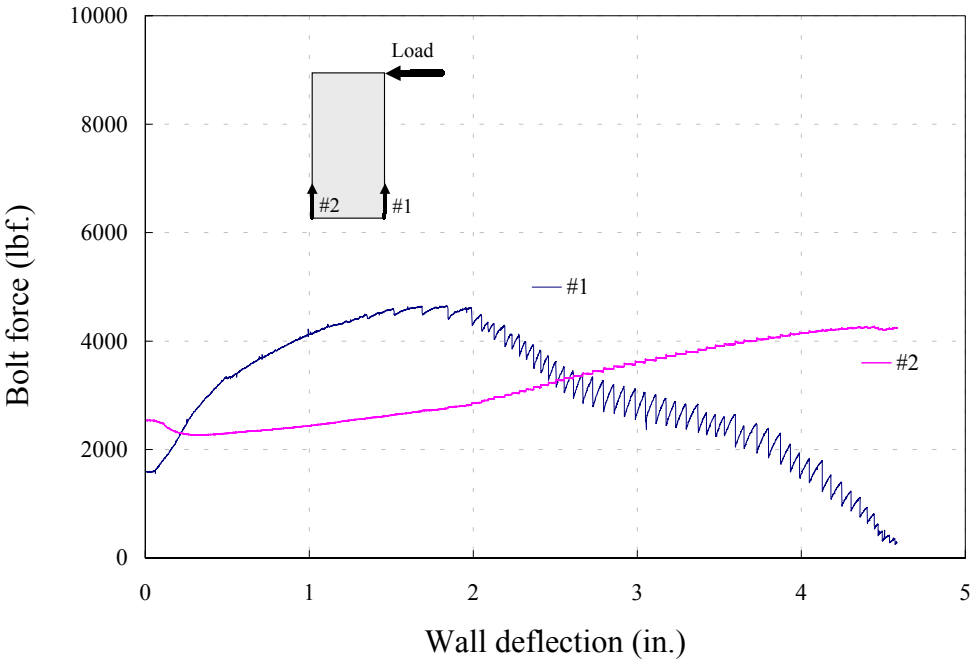


Figure 04FAm1- e. Forces in anchor bolts.

Table 04FAm2. Data summary.

Specimen **04FAm2**	**Per unit length**	
Tie-down Anchors	**monotonic test**	
Wall length	**4.00ft.**	**1.219m**
Date: 7-17-1998.	**Time:**	18:24
	units	**04FAm2**
Peak unit load, v_{peak}	Kip/ft. KN/m	0.606 8.847
Drift at peak load, Δ_{peak}	in. mm	2.566 65.19
Yield unit load, v_{yield}	Kip/ft. KN/m	0.543 7.926
Drift at yield load, Δ_{yield}	in. mm	0.518 13.16
Proportional limit, $0.4v_{peak}$	Kip/ft. KN/m	0.243 3.539
Drift at prop. limit, $\Delta@0.4v_{peak}$	in. mm	0.231 5.88
Unit load at failure or $0.8v_{peak}$	Kip/ft. KN/m	0.481 7.027
Drift at failure, $\Delta_{failure}$	in. mm	4.151 105.45
Shear modulus, G $@0.4v_{peak}$	Kip/in. KN/mm	8.384 1.468
Work until failure per unit length	Kip·ft./ft. KN·m/m	0.176 0.784
Unit load, $v_{1/300}$ @ 0.32 in. (8.13 mm)	Kips/ft. KN/m	0.293 4.305
Unit load, $v_{1/200}$ @ 0.48 in.(12.19 mm)	Kips/ft. KN/m	0.356 5.231
Unit load, $v_{1/100}$ @ 0.96 in. (24.38 mm)	Kips/ft. KN/m	0.475 6.981
Unit load, $v_{1/60}$ @ 1.6 in. (40.64 mm)	Kips/ft. KN/m	0.558 8.205

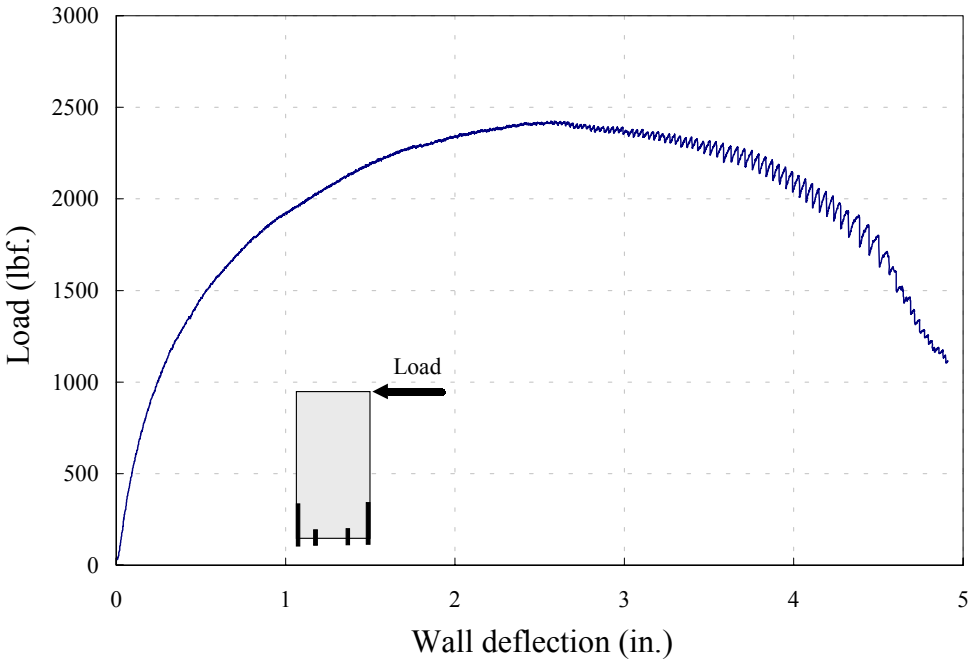


Figure 04FAm2- a. Observed load-deflection curve.

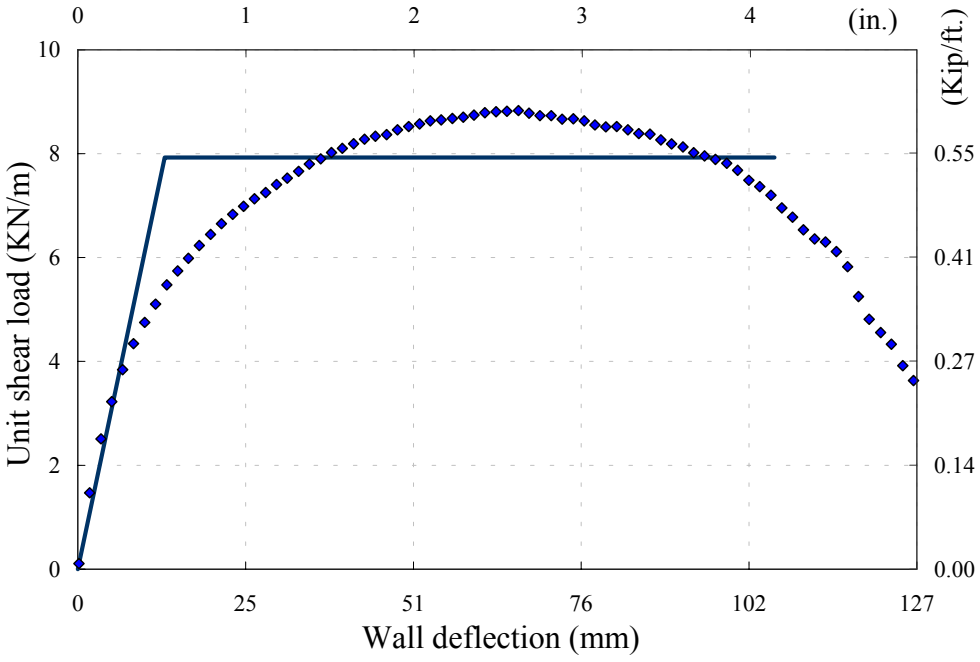


Figure 04FAm2- b. Unit load-deflection and EEEP curves.

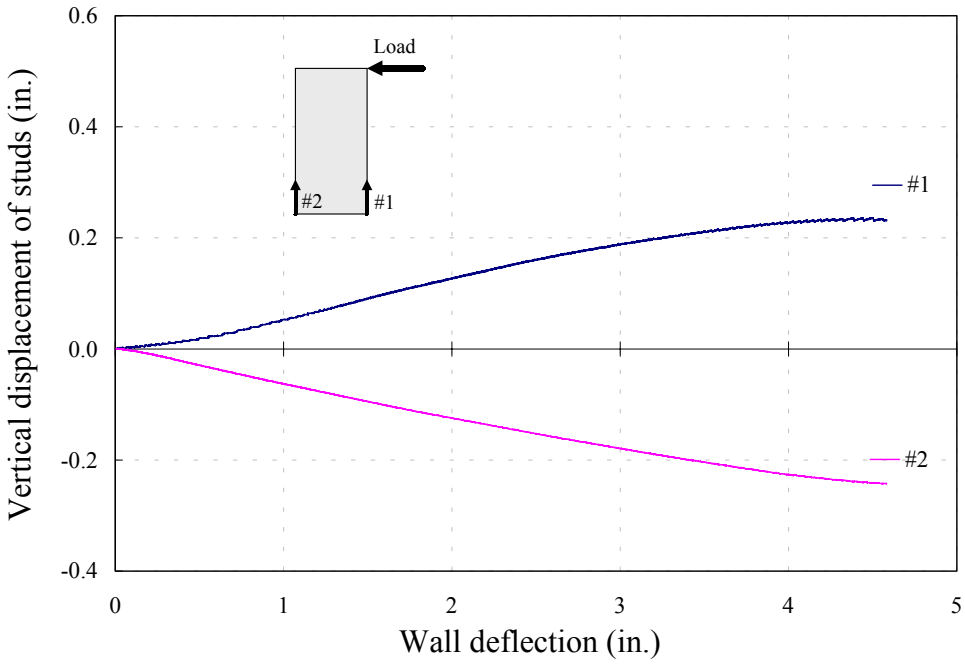


Figure 04FAm2- c. Vertical displacement of studs (initial envelope).

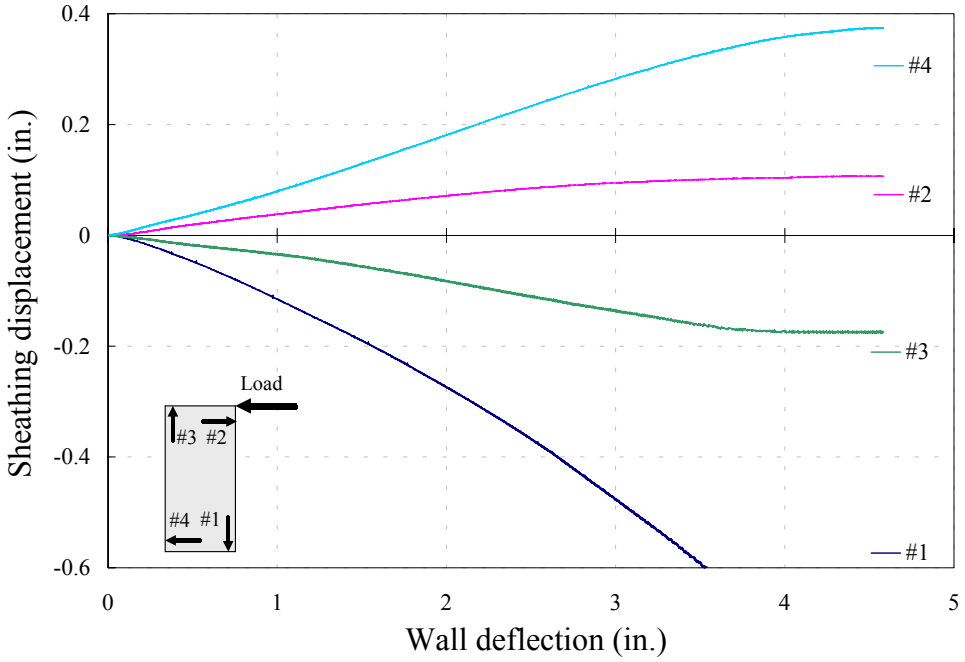


Figure 04FAm2- d. Sheathing displacement.

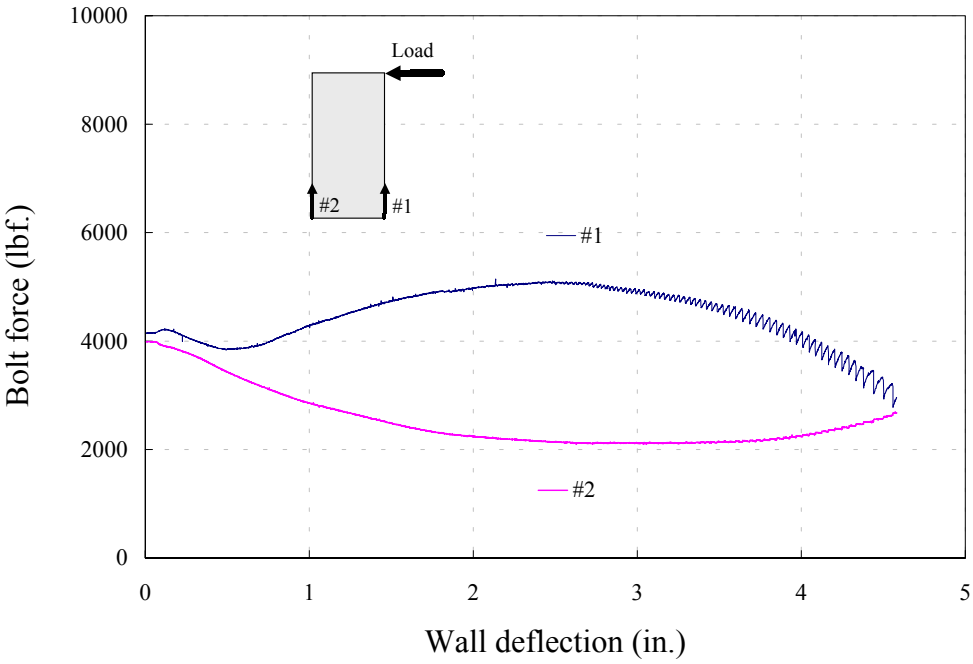


Figure 04FAm2- e. Forces in anchor bolts.