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Providing Quality Control, Testing, Inspection and Certification Services to the Building Industry

PFS TEST REPORT #93-65
RACKING RESISTANCE, IMPACT LOAD AND ACCELERATED AGING TESTS OF THE "NAILER"

FOR

THE MILLENNIUM GROUP
WATERLOO, WISCONSIN

BY:

PFS CORPORATION
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MADISON, WISCONSIN

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PFS TEST REPORT #93-65
RACKING RESISTANCE TESTS ON WALL PANELS

FOR

THE MILLENNIUM GROUP
WATERLOO, WISCONSIN

GENERAL

Racking resistance tests on wall panels were conducted on February 14-28, 1994, at PFS Corporation, Madison, Wisconsin. Testing was conducted in accordance with ASTM E 72-80, Section 14. The panels were constructed according to the client instructions and include a unique construction materials fastening device herein referred to as the Nailer.

The Nailer is designed to be a construction materials fastening component and can be used as a drywall support clip for ceiling and corner fastening of drywall and drywall-to-wood construction. The Nailer's dimensions consist of an approximate 2.125 in.-by-1.5 in.-by-0.10 in. thick rectangle with a projecting tab. On the backside of the main rectangle is a centrally-located approximate 0.28-in.-wide-by-2.125-in.-long.-by-0.10-0.60-in.-thick rib. The projecting tab is approximately 1.5-in.-wide-by-0.94-in.-high-by-0.78-0.58-in.-thick. The projecting tab is located approximately 0.56 in. from the main rectangle end.

DESCRIPTION

Ten nominal 8-ft.-by-8-ft. wall panels were tested. Three wall panel frames were constructed of nominal 2-in.-by-3-in. SPF stud grade lumber. Four wall panel frames were constructed of nominal 2-in.-by-4-in. SPF stud grade lumber. Three wall panel frames were constructed of nominal 2-in.-by-6-in. SPF stud grade lumber. A nominal 8-ft. SPF stud grade member was nailed flatwise with five 16d common nails 2 ft. o.c. at the center of each 8-ft.-by-8-ft. wall panel frame. Nailers were stapled on both sides of the flatwise stud member every 16 in. o.c. with 1/2-in. staples by a Duo-Fast hand stapler, Model CT 859A (see photos). Each wall panel frame was covered on both sides of the flatwise stud member with 1/2-in. gypsum wallboard. The gypsum wallboard was fastened to the wall panel frames and Nailer with 1-1/4-in. drywall screws. Spacing for the drywall screws was 12 in. o.c. for each stud member.

TEST PROCEDURES

The load was applied at one top corner of the wall with a 10-ton Enerpac hydraulic ram to a 4x4 wood member reinforced with an angle iron for stiffness. This was firmly bolted to the top plates of the specimen. Load measurements were determined using an Enerpac L-10 load cell.

Dial indicators, accurate to .001 in. were located in the other three corners in accordance with Figure 1 to measure slippage and apparent deformation of the wall. The actual deformation of the wall was determined by subtracting the deformation readings of dial gauges #2 and #3 from dial gauge #1.

The load was applied continuously throughout the test at a uniform rate of 400 lbs. per minute for all loading increments. Each specimen was loaded until a deflection of 1/8 in. occurred and loading continued to ultimate failure.

The test setup is shown in Figure 1.

TEST RESULTS

WALL PANELS (2-in.-by-3-in. frame)			
Test No.	**Maximum Load**	**Load @ 1/8 in. Deflection**	**Failure Characteristics**
1 2 3	990 1,000 1,040	380 480 410	As panels shifted under load, gypsum broke away from screw fasteners on SPF stud members. 1/2-in. staples fastening Nailer to stud pulled slightly away from stud.
Avg.:	1,010	423	
Avg. (lb./ft.): 126			

WALL PANELS (2-in.-by-4-in. frame)			
Test No.	**Maximum Load**	**Load @ 1/8 in. Deflection**	**Failure Characteristics**
1 2 3 *4	750 650 700 900	170 90 190 358	As panels shifted under load, gypsum broke away from screw fasteners on SPF stud members. 1/2-in. staples fastening Nailer to stud pulled slightly away from stud.
Avg.:	750	202	
Avg. (lb./ft.): 94			
*Cycled Nailers from Procedure E of aging test used.			

WALL PANELS (2-in.-by-6-in. frame)			
Test No.	**Maximum Load**	**Load @ 1/8 in. Deflection**	**Failure Characteristics**
1 2 3	750 630 725	250 110 90	As panels shifted under load, gypsum broke away from screw fasteners on SPF stud members. 1/2-in. staples fastening Nailer to stud pulled slightly away from stud.
Avg.:	702	150	
Avg. (lb./ft.): 88			

See Tables 1-10 for test data. Load versus deflection graphs are shown in Figures 2-4.

Tests Conducted and
Report Prepared By:

Allan R. Adams
Laboratory Technician

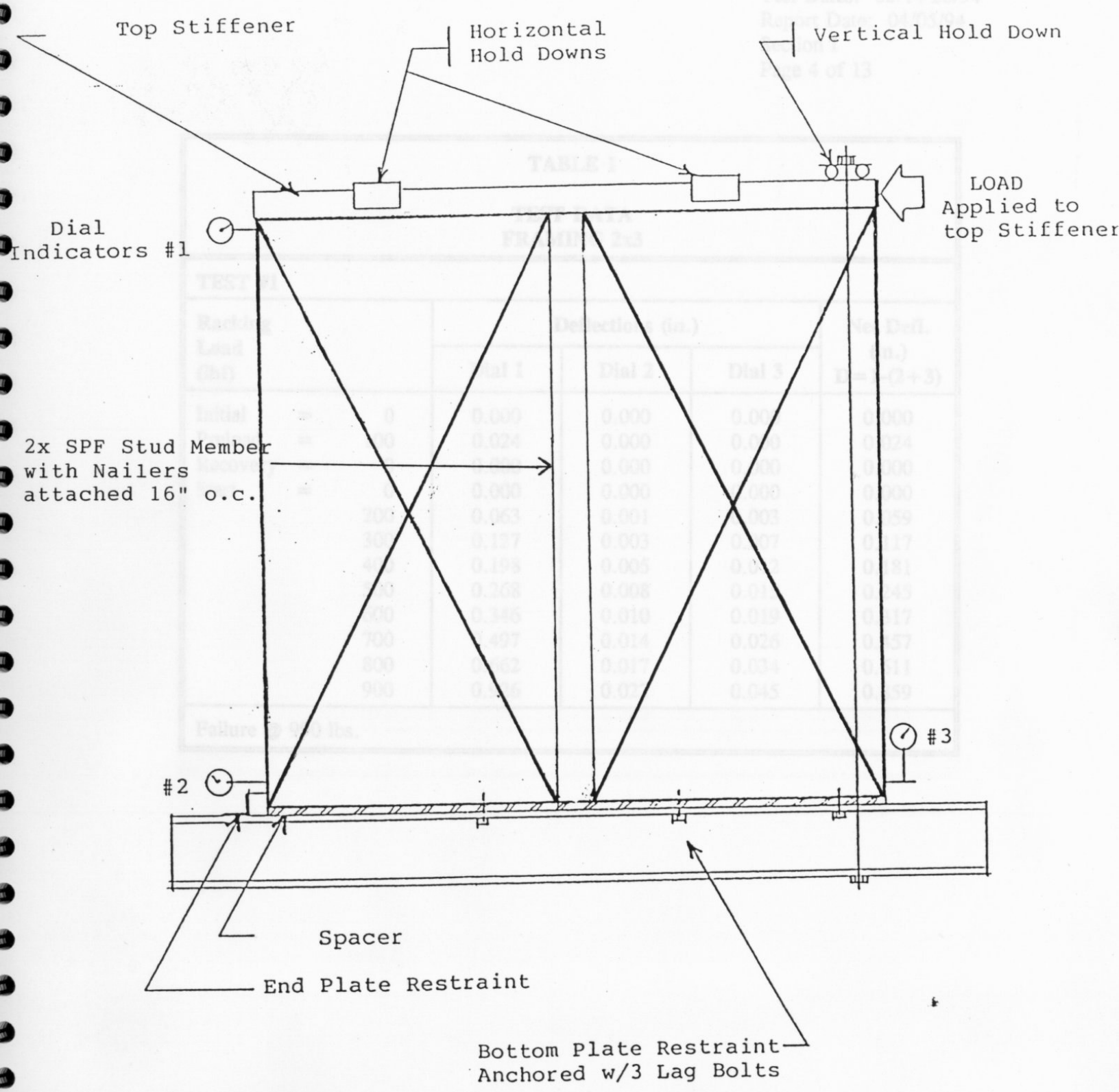
Tests Witnessed and
Report Reviewed By:

James Van Schoyck
Laboratory Manager

Report Reviewed By:

Richard M. Reinhard, P.E.
Technical Director

04/11/95
93-65/pb



RACKING TEST SET-UP

FIGURE 1

TABLE 1

TEST DATA
FRAMING 2x3

TEST #1

Racking Load (lbf)			**Deflections (in.)**			**Net Defl. (in.) D=1-(2+3)**
			Dial 1	**Dial 2**	**Dial 3**	
Initial	=	0	0.000	0.000	0.000	0.000
Preload	=	100	0.024	0.000	0.000	0.024
Recovery	=	0	0.000	0.000	0.000	0.000
Start	=	0	0.000	0.000	0.000	0.000
		200	0.063	0.001	0.003	0.059
		300	0.127	0.003	0.007	0.117
		400	0.198	0.005	0.012	0.181
		500	0.268	0.008	0.015	0.245
		600	0.346	0.010	0.019	0.317
		700	0.497	0.014	0.026	0.457
		800	0.662	0.017	0.034	0.611
		900	0.926	0.022	0.045	0.859

Failure @ 990 lbs.

TABLE 2

TEST DATA
FRAMING 2x3

TEST #2

Racking Load (lbf)			**Deflections (in.)**			**Net Defl. (in.) D=1-(2+3)**
			Dial 1	**Dial 2**	**Dial 3**	
Initial	=	0	0.000	0.000	0.000	0.000
Preload	=	100	0.028	0.001	0.002	0.025
Recovery	=	0	0.000	0.000	0.000	0.000
Start	=	0	0.000	0.000	0.000	0.000
		200	0.078	0.004	0.006	0.068
		300	0.147	0.007	0.011	0.129
		400	0.216	0.010	0.015	0.191
		500	0.293	0.014	0.019	0.260
		600	0.379	0.018	0.025	0.336
		700	0.465	0.023	0.029	0.413
		800	0.568	0.027	0.035	0.506
		900	0.683	0.033	0.042	0.608
		1000	0.917	0.044	0.057	0.816

Failure @ 1000 lbs.

TABLE 3

TEST DATA
FRAMING 2x3

TEST #3

Racking Load (lbf)			**Deflections (in.)**			**Net Defl. (in.) D=1-(2+3)**
			Dial 1	**Dial 2**	**Dial 3**	
Initial	=	0	0.000	0.000	0.000	0.00
Preload	=	100	0.017	0.000	0.002	0.02
Recovery	=	0	0.000	0.000	0.000	0.00
Start	=	0	0.000	0.000	0.000	0.00
		200	0.042	0.000	0.005	0.04
		300	0.081	0.002	0.008	0.07
		400	0.134	0.003	0.012	0.12
		500	0.202	0.005	0.016	0.18
		600	0.286	0.006	0.022	0.26
		700	0.382	0.008	0.029	0.35
		800	0.533	0.010	0.038	0.49
		900	0.710	0.013	0.048	0.65
		1000	1.016	0.017	0.062	0.94

Failure @ 1040 lbs.

TABLE 4

TEST DATA
FRAMING 2x4

TEST #1

Racking Load (lbf)			Deflections (in.)			Net Defl. (in.) D=1-(2+3)
			Dial 1	Dial 2	Dial 3	
Initial	=	0	0.000	0.000	0.000	0.00
Preload	=	100	0.082	0.000	0.013	0.07
Recovery	=	0	0.000	0.000	0.000	0.00
Start	=	0	0.000	0.000	0.000	0.00
		200	0.170	0.001	0.023	0.15
		300	0.276	0.001	0.035	0.24
		400	0.355	0.001	0.042	0.31
		500	0.507	0.002	0.055	0.45
		600	0.678	0.003	0.068	0.61
		700	0.978	0.004	0.087	0.89

Failure @ 750 lbs.

TABLE 5

TEST DATA
FRAMING 2x4

TEST #2

Racking Load (lbf)			Deflections (in.)			Net Defl. (in.) D=1-(2+3)
			Dial 1	Dial 2	Dial 3	
Initial	=	0	0.000	0.000	0.000	0.00
Preload	=	100	0.164	0.006	0.013	0.15
Recovery	=	0	0.000	0.000	0.000	0.00
Start	=	0	0.000	0.000	0.000	0.00
		200	0.256	0.009	0.019	0.23
		300	0.370	0.014	0.027	0.33
		400	0.548	0.019	0.037	0.49
		500	0.802	0.025	0.051	0.73
		600	1.120	0.032	0.070	1.02

Failure @ 650 lbs.

TABLE 6

TEST DATA
FRAMING 2x4

TEST #3

Racking Load (lbf)			**Deflections (in.)**			**Net Defl. (in.) D=1-(2+3)**
			Dial 1	**Dial 2**	**Dial 3**	
Initial	=	0	0.000	0.000	0.000	0.00
Preload	=	100	0.074	0.002	0.008	0.06
Recovery	=	0	0.000	0.000	0.000	0.00
Start	=	0	0.000	0.000	0.000	0.00
		200	0.150	0.003	0.015	0.13
		300	0.234	0.005	0.023	0.21
		400	0.364	0.007	0.033	0.32
		500	0.507	0.009	0.044	0.45
		600	0.843	0.014	0.067	0.76

Failure @ 700 lbs.

TABLE 7

TEST DATA
FRAMING 2x4 (CYCLED NAILER)

TEST #4

Racking Load (lbf)			Deflections (in.)			Net Defl. (in.) D=1-(2+3)
			Dial 1	Dial 2	Dial 3	
Initial	=	0	0.000	0.000	0.000	0.00
Preload	=	100	0.017	0.001	0.000	0.02
Recovery	=	0	0.000	0.000	0.000	0.00
Start	=	0	0.000	0.000	0.000	0.00
		200	0.051	0.004	0.002	0.05
		300	0.096	0.007	0.004	0.09
		400	0.167	0.012	0.005	0.15
		500	0.249	0.019	0.007	0.22
		600	0.356	0.027	0.010	0.32
		700	0.480	0.035	0.013	0.43
		800	0.635	0.045	0.016	0.57

Failure @ 900 lbs.

TABLE 8

TEST DATA
FRAMING 2x6

TEST #1

Racking Load (lbf)			Deflections (in.)			Net Defl. (in.) D=1-(2+3)
			Dial 1	Dial 2	Dial 3	
Initial	=	0	0.000	0.000	0.000	0.00
Preload	=	100	0.068	0.002	0.007	0.06
Recovery	=	0	0.027	0.001	0.003	0.02
Start	=	0	0.000	0.000	0.000	0.00
		200	0.108	0.003	0.013	0.09
		300	0.205	0.004	0.023	0.18
		400	0.310	0.005	0.034	0.27
		500	0.470	0.006	0.050	0.41
		600	0.754	0.007	0.078	0.67
		700	1.261	0.010	0.122	1.13

Failure @ 750 lbs.

TABLE 9

TEST DATA
FRAMING 2x6

TEST #2

Racking Load (lbf)			Deflections (in.)			Net Defl. (in.) D=1-(2+3)
			Dial 1	Dial 2	Dial 3	
Initial	=	0	0.000	0.000	0.000	0.000
Preload	=	100	0.127	0.003	0.010	0.114
Recovery	=	0	0.000	0.000	0.000	0.000
Start	=	0	0.000	0.000	0.000	0.000
		200	0.238	0.004	0.018	0.216
		300	0.354	0.005	0.027	0.322
		400	0.510	0.006	0.039	0.465
		500	0.736	0.007	0.058	0.671
		600	1.236	0.010	0.095	1.131

Failure @ 630 lbs.

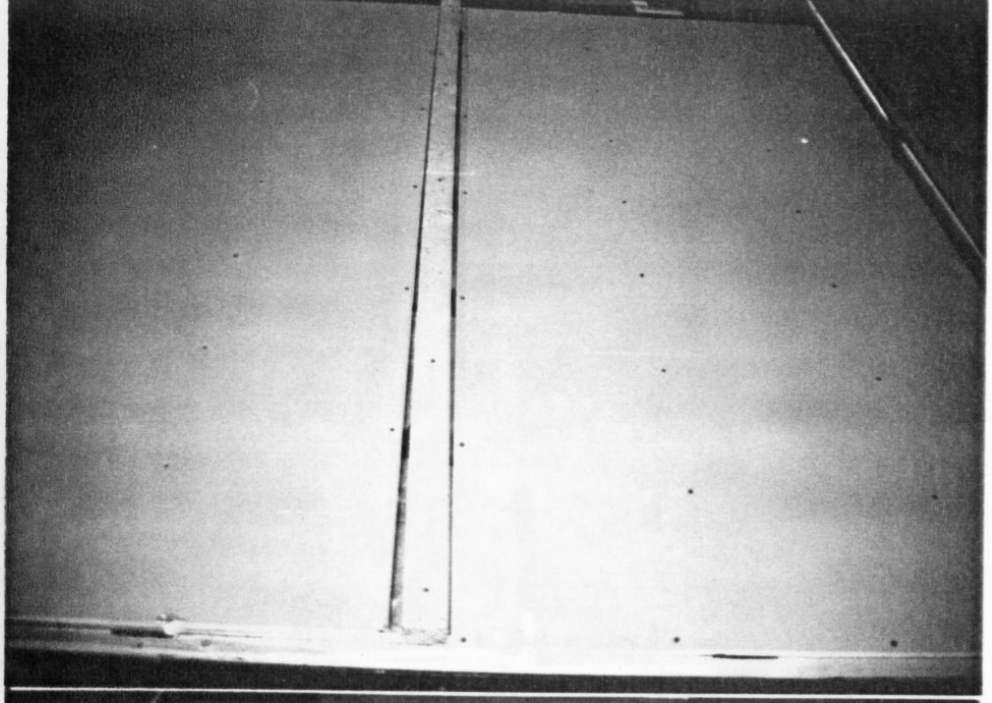
TABLE 10

TEST DATA
FRAMING 2x6

TEST #3

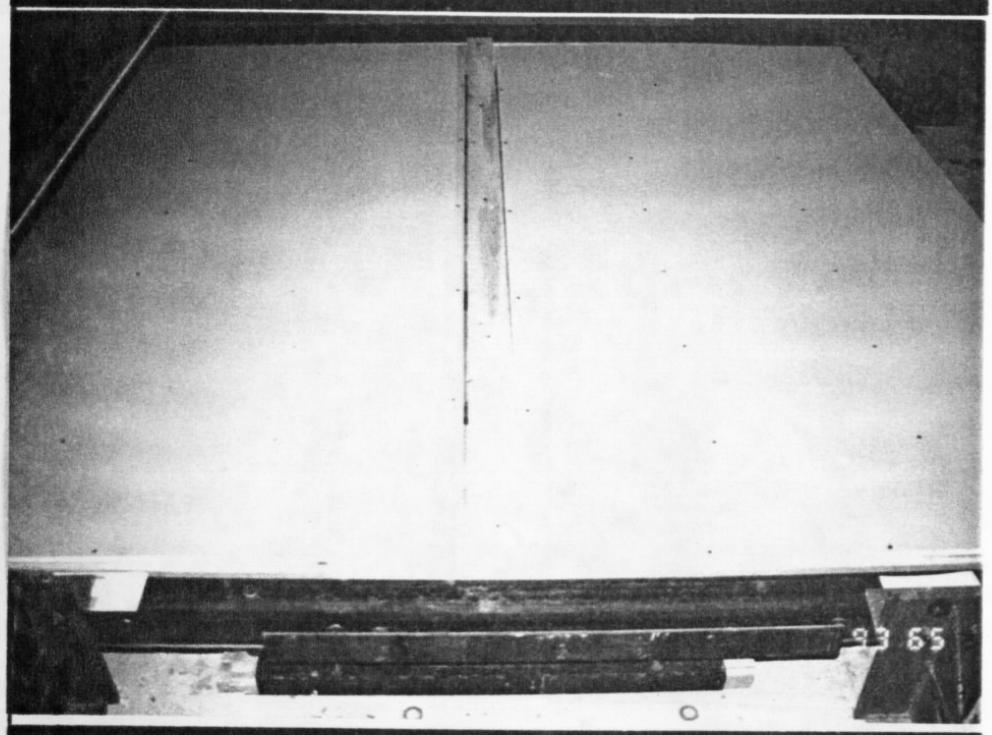
Racking Load (lbf)			Deflections (in.)			Net Defl. (in.) D=1-(2+3)
			Dial 1	Dial 2	Dial 3	
Initial	=	0	0.000	0.000	0.000	0.000
Preload	=	100	0.154	0.007	0.015	0.132
Recovery	=	0	0.000	0.000	0.000	0.000
Start	=	0	0.000	0.000	0.000	0.000
		200	0.271	0.011	0.024	0.236
		300	0.475	0.017	0.038	0.420
		400	0.648	0.023	0.049	0.576
		500	0.808	0.030	0.059	0.719
		600	1.081	0.039	0.072	0.970
		700	1.665	0.055	0.105	1.505

Failure @ 750 lbs.



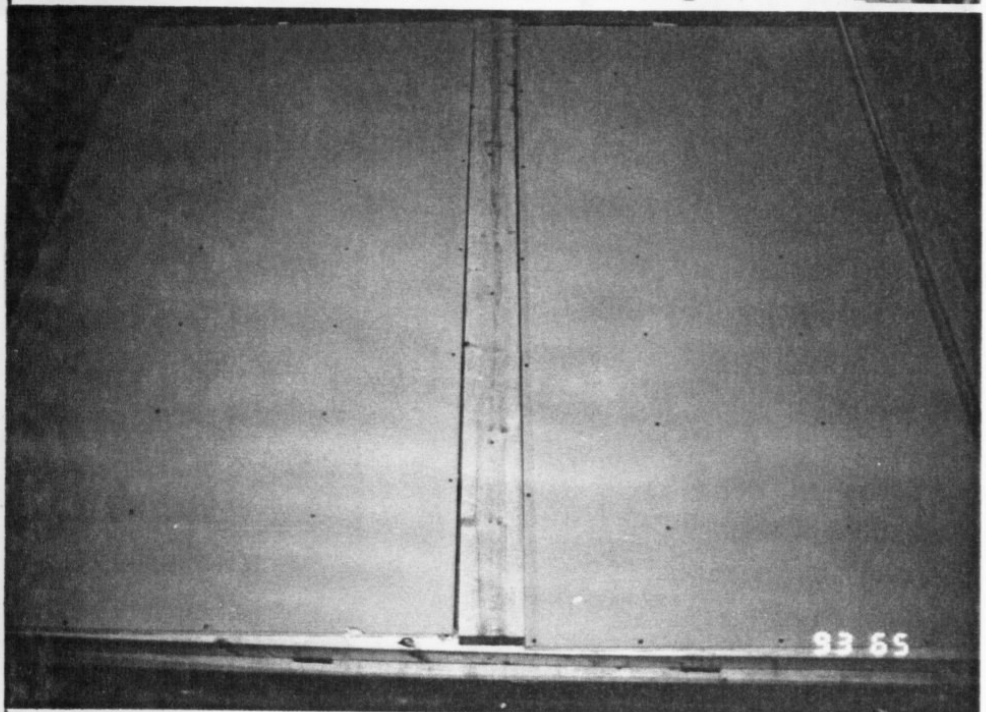
PFS TEST REPORT #93-65
MILLENNIUM GROUP
1. Racking Test - typical failure 2-in.-by-3-in. Framing members with center stud flatwise for

Nailer attachment.



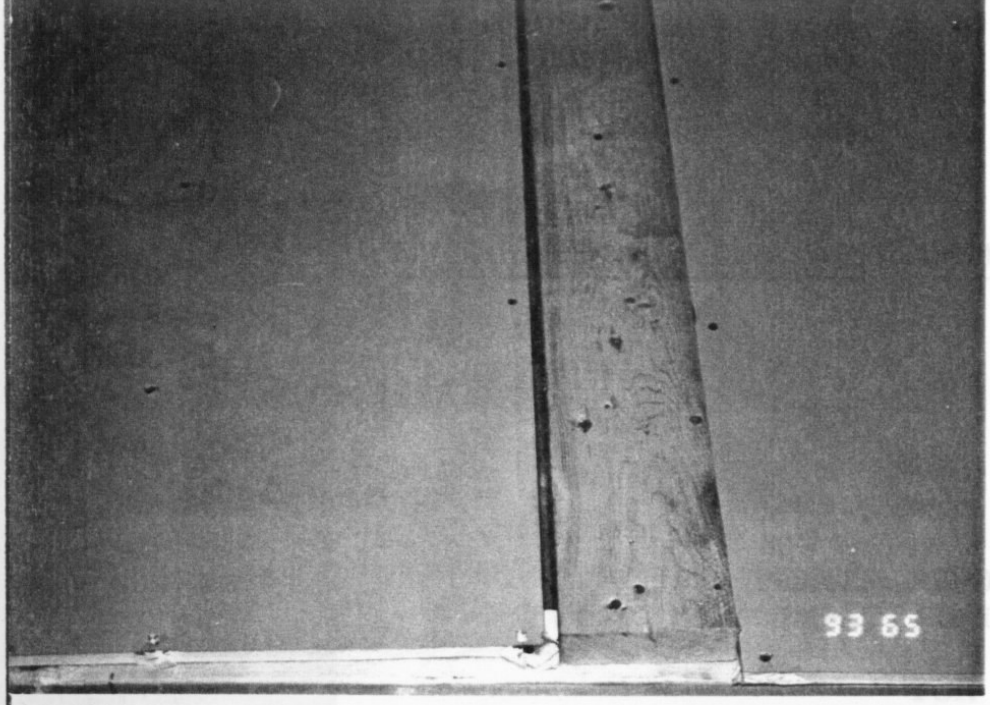
PFS TEST REPORT #93-65
MILLENNIUM GROUP
2. Racking Test - typical failure 2-in.-by-4-in. Framing members with center stud flatwise for

Nailer attachment.



PFS TEST REPORT #93-65
MILLENNIUM GROUP
3. Racking Test - typical failure 2-in.-by-6-in. Framing members with center stud flatwise for

Nailer attachment.



PFS TEST REPORT #93-65
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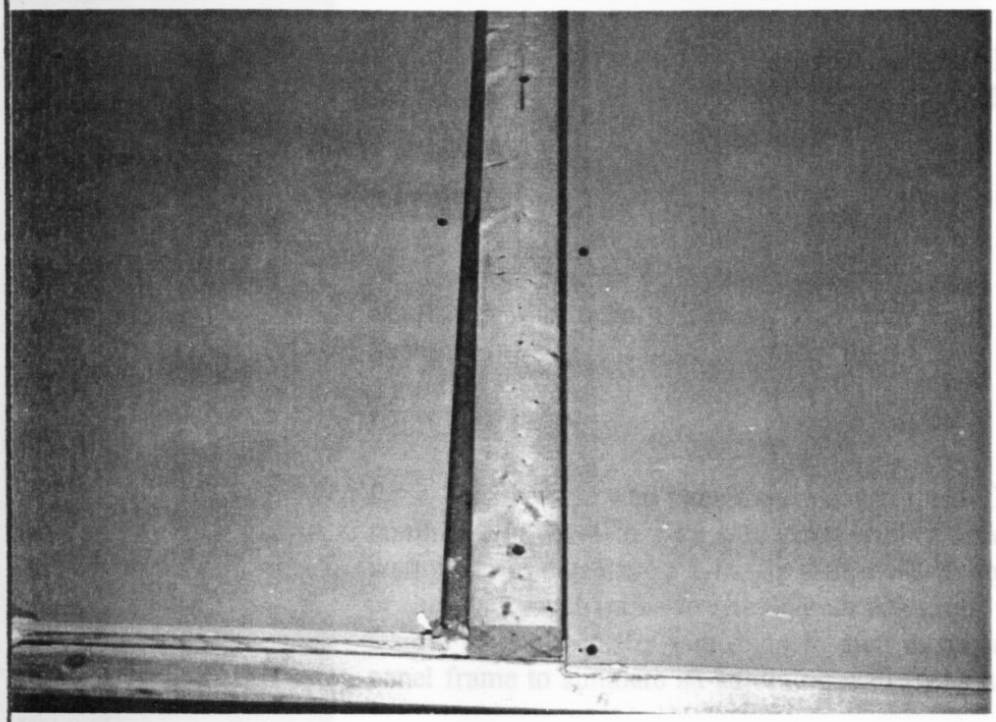
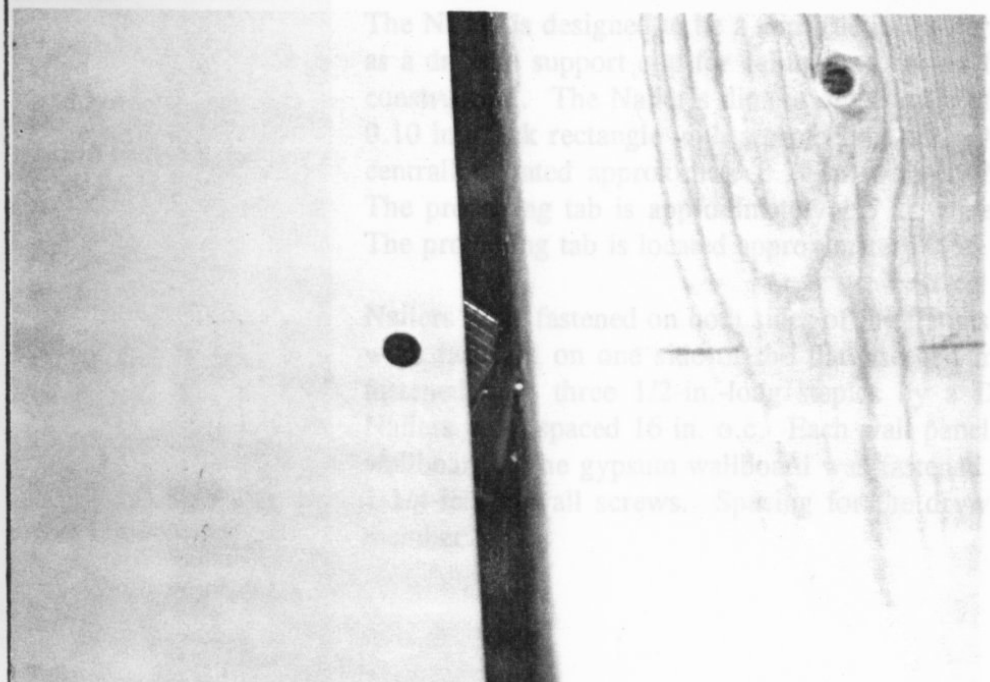
4. Racking Test - closer view of gypsum broke away from drywall screws.



PFS TEST REPORT #93-65
MILLENNIUM GROUP
5. Racking Test--another view of gypsum broke away from drywall screws; Nailer pull slightly away from stud.



PFS TEST REPORT #93-65
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6. Racking Test - close-up view of Nailer slightly pulled away from stud at failure.