baywind@inetmail.att.net

09/20/2007 01:10 PM

To Ben.Yousefi@SMGOV.NET, Carl Sramek <SramekCA@aol.com>, dvandorpe@vcaengineers.com, david.pomerleau@idsse.com,

cc

bcc

Subject Shear Walls and Diaphragms with Staples as Fasteners

Dear Committee Members and Correspondents:

Cyclic tests of 8 ft. x ft. panels using 15/32 in. structural I plywood panels fastened with 8d common nails at 3 in. o.c. and 16 gage x 2 inch leg staples with 7/16 in. crown were tested at a ICC-ES accredited laboratory last Wednesday and Thursday.

The test results were as anticipated. The staples perform miserably with deflection/load limited to 1.20 in. and Strength Limit State about 50 per cent of the 8d nails comparison.

The staples should not be allowed in the State of California, much less in Los Angeles County.

The decision is now up to your Committee or L.A. City and County 2007 CBC to make and to act.

Volunteers helped me to construct the panels. The $3,000 lab cost was paid by me as a gift to the people of California.

The attachments provide supporting data (graphs and background) as well as a copy (for reference) of my comments e-mailed 8/20/07 to all Committee Members and Correspondents.

Comments will be appreciated.

Ben Schmid, S.E. 825, Fellow SEAOC

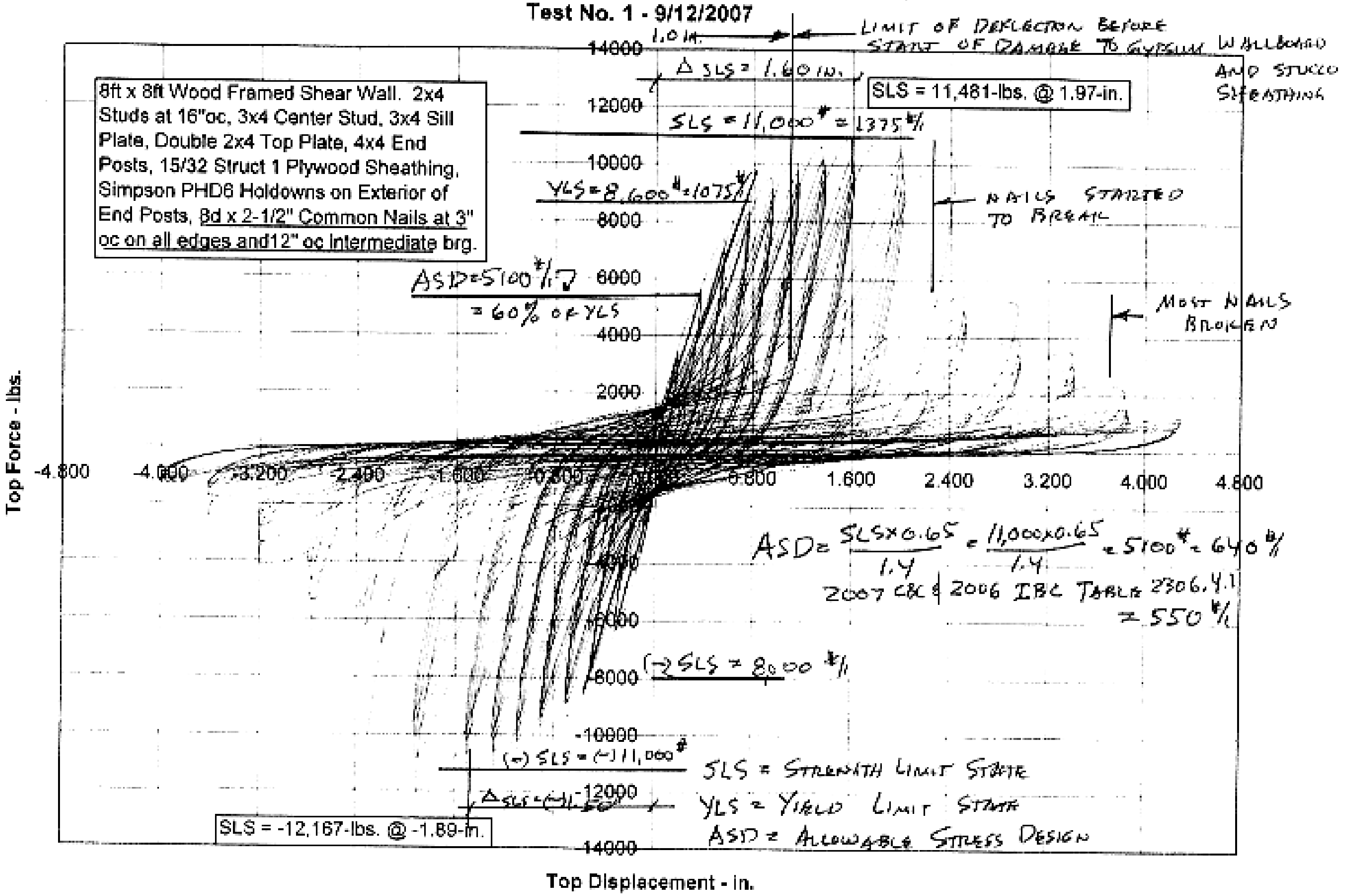
Schmid Exhibits _2_-Shear Walls-Diaphrams w-Staples.pdf Schmid- Exhibits _6_-Background.pdf

Schmid 8-20-07 e-mail re Shear Walls-Diaphragms w-Staples.pdf

ICC APPROVED FOR CYCLIC TESTING OF PANELS
"SPECIALIZED TESTING LABORATORY"
TIM FOSTER, 10600 PIONEER BLVD SANTA FE SPRINGS, CA 90670

9/17/07
NOTATION BY: [signature]
BEN SCHMID S.E. #825
FELLOW, SEAOC

Ben Schmid, S.E. - Racking Shear Test Program
8ft x 8ft Wood Framed Shear Wall (FME = ~0.80-in.)
Test No. 1 - 9/12/2007



ICC APPROVED FOR CYCLIC TESTING OF PANELS
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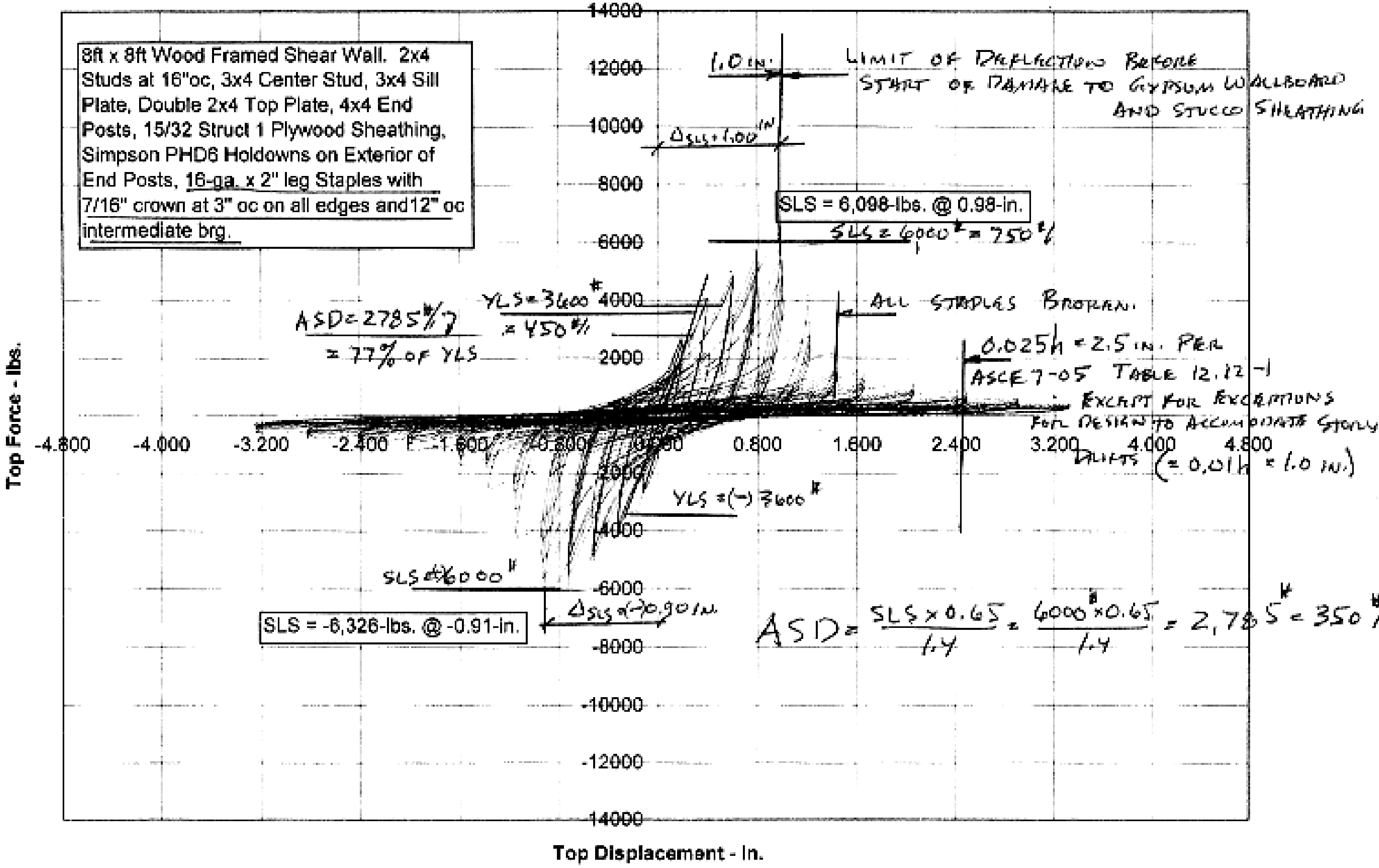
Ben Schmid, S.E. - Racking Shear Test Program
8ft x 8ft Wood Framed Shear Wall (FME = ~0.80-in.)
Test No. 2 - 9/13/2007



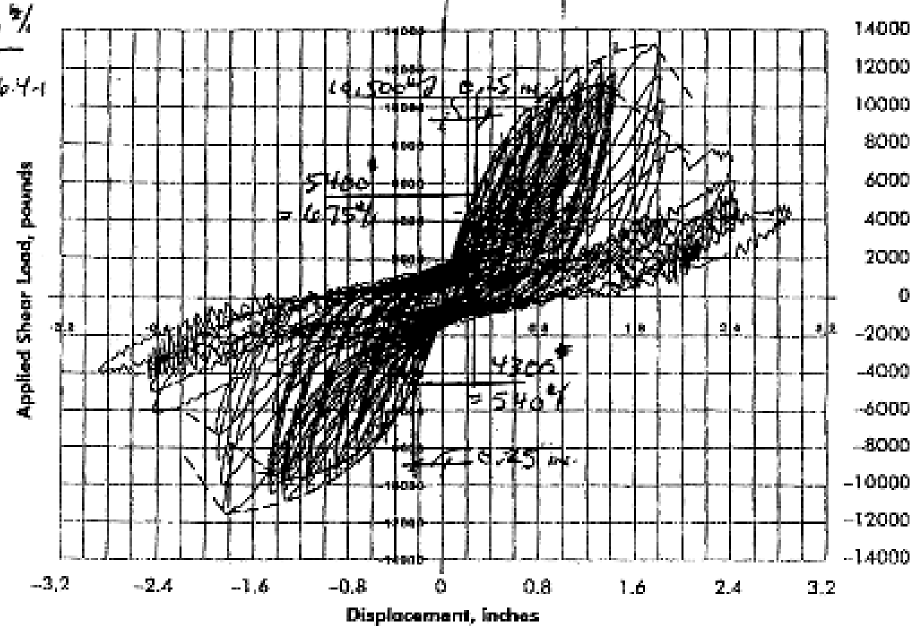
15/32" PLYWOOD
w/ 8d NAILS @ 3" o.c.

Δ = 1.0 IN. = C_d = 4 x 0.25 in. = 1.0 IN. FOR R=6
= 10,500# = 1300#/ ÷ 3 x Ω_o = 440#/

FIGURE B3

Load–displacement curve for cyclic load shear wall test (Test BLS.2A)

v = 550#/
CBC
TABLE 2306.4.1

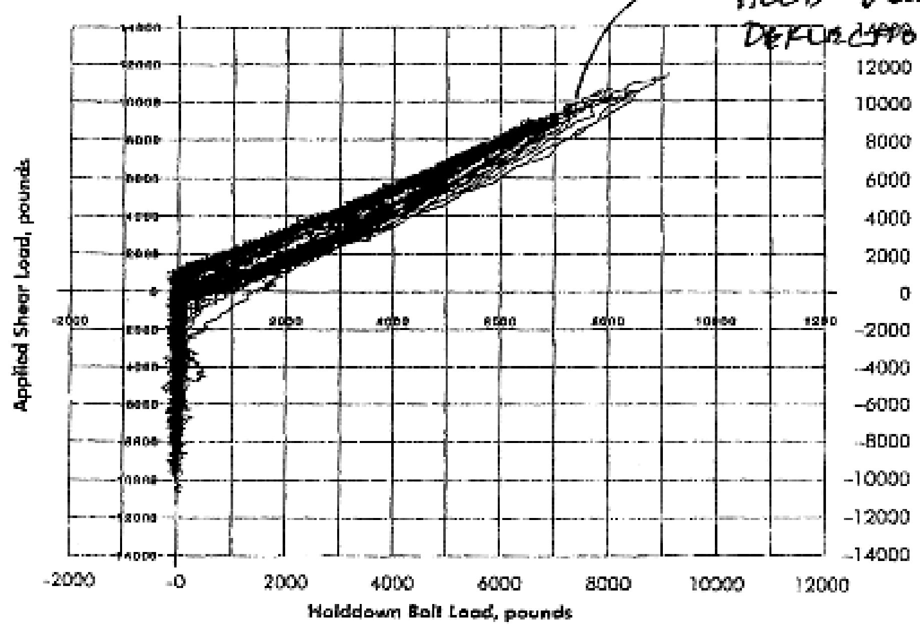


440#/ / 550#/ = 80%

FIGURE B4

Typical hold-down load vs. shear wall load (Test BLS.1A)

WE NOW HAVE HOLD-DOWNS w/ 1/8 DEFLECTION AT 10,000 LBS

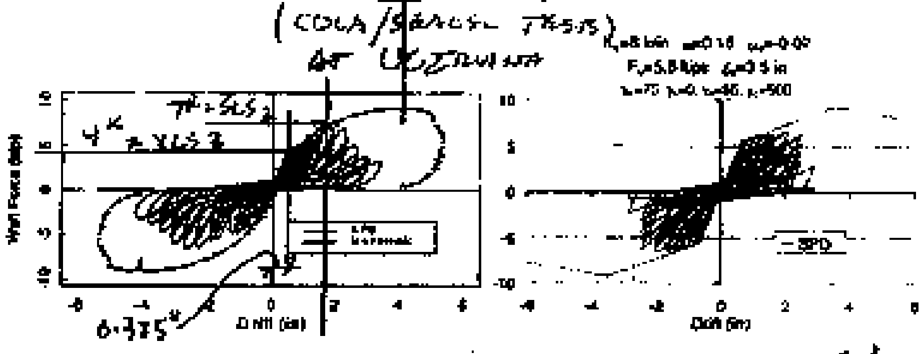


IDENTICAL TEST w/ 8d NAILS @ 3" o.c. w/ 15/32" PLYWOOD PERFORMED AT UC IRVINE IN 1997 AND REPORTED BY JOHN ROSE OF APA (REPORT 158) MARCH, 1998

CUREE REPORT, TASK 1.5.3, 2000

Simulation of Deterioration

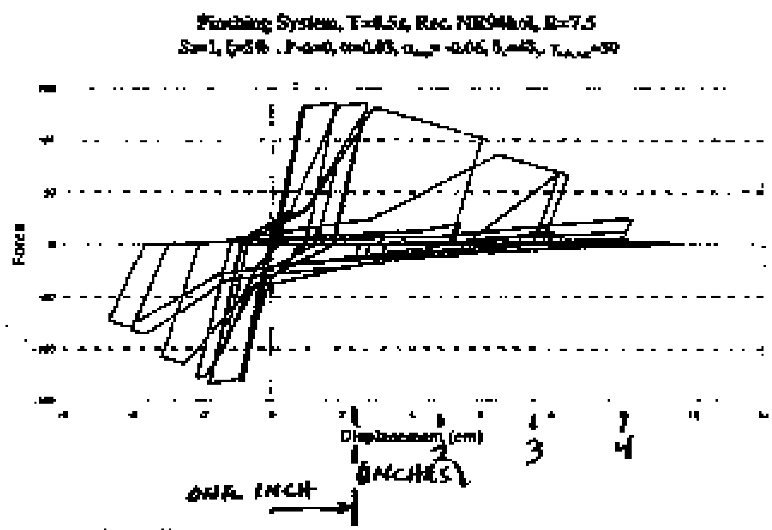
SPD Protocol — USED IN CYCLIC TESTS 9/12/07 & 9/13/07



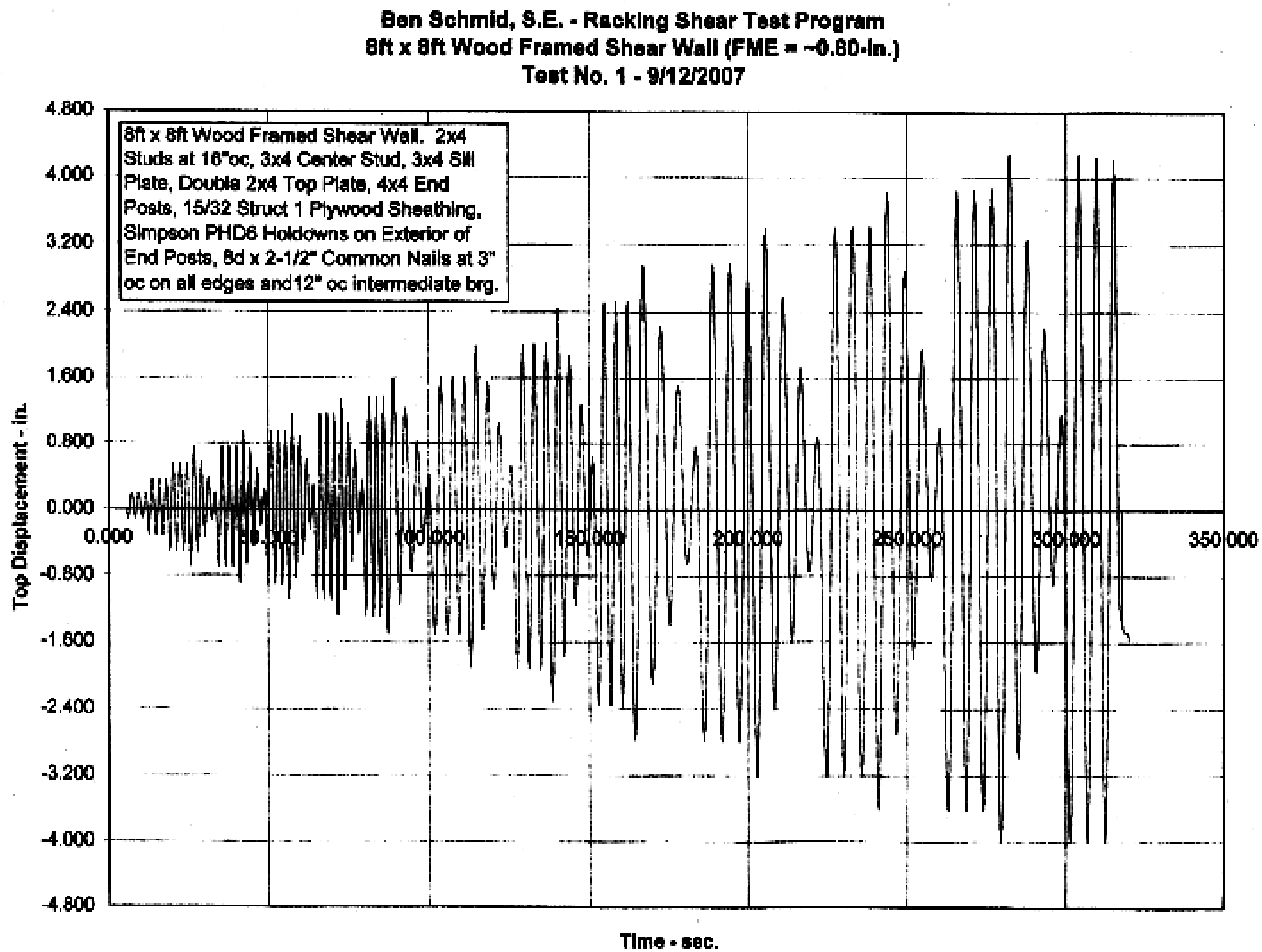
Experimental Results

Model Simulation

Time History Response, Deteriorating System



DEFLECTION LIMIT
BEFORE EXTENSIVE
DAMAGE TO GYPSUM
WALLBOARD AND STUCCO OCCURS


Ben Schmid, S.E. - Racking Shear Test Program
8ft x 8ft Wood Framed Shear Wall (FME = ~0.80-in.)
Test No. 1 - 9/12/2007
8ft x 8ft Wood Framed Shear Wall. 2x4 Studs at 16"oc, 3x4 Center Stud, 3x4 Sill Plate, Double 2x4 Top Plate, 4x4 End Posts, 15/32 Struct 1 Plywood Sheathing, Simpson PHD6 Holdowns on Exterior of End Posts, 8d x 2-1/2" Common Nails at 3" oc on all edges and12" oc intermediate brg.
Top Displacement - in.
4.800
4.000
3.200
2.400
1.600
0.800
0.000
-0.800
-1.600
-2.400
-3.200
-4.000
-4.800
0.000
50.000
100.000
150.000
200.000
250.000
300.000
350.000
Time - sec.

NOTE: OFFICE BUILDINGS CAN ACCOMODATE 2½" (0.025h) STORY DRIFT EASILY W/ T-BAR CEILINGS & SLIP JOINTS AT WALLS INTERSECTING EXTERIOR WALLS.

WOOD FRAME: Δ_{MAX} = 0.0075h TO 0.010h

DAMAGE STARTS AT Δ OF 0.010h FOR GYPSUM WALLBOARD & STUCCO.

TABLE 12.12-1 ALLOWABLE STORY DRIFT, $\Delta_a^{a,b}$

Structure	Occupancy Category		
	I or II	III	IV
Structures, other than masonry shear wall structures, 4 stories or less with interior walls, partitions, ceilings and exterior wall systems that have been designed to accommodate the story drifts.	$0.025h_{sx}$[c]	$0.020h_{sx}$	$0.015h_{sx}$
Masonry cantilever shear wall structures[d]	$0.010h_{sx}$	$0.010h_{sx}$	$0.010h_{sx}$
Other masonry shear wall structures	$0.007h_{sx}$	$0.007h_{sx}$	$0.007h_{sx}$
All other structures	$0.020h_{sx}$	$0.015h_{sx}$	$0.010h_{sx}$

[a] h_{sx} is the story height below Level x.
[b] For seismic force–resisting systems comprised solely of moment frames in Seismic Design Categories D, E, and F, the allowable story drift shall comply with the requirements of Section 12.12.1.1.
[c] There shall be no drift limit for single-story structures with interior walls, partitions, ceilings, and exterior wall systems that have been designed to accommodate the story drifts. The structure separation requirement of Section 12.12.3 is not waived.
[d] Structures in which the basic structural system consists of masonry shear walls designed as vertical elements cantilevered from their base or foundation support which are so constructed that moment transfer between shear walls (coupling) is negligible.

12.11.2.2.7 Walls with Pilasters. Where pilasters are present in the wall, the anchorage force at the pilasters shall be calculated considering the additional load transferred from the wall panels to the pilasters. However, the minimum anchorage force at a floor or roof shall not be reduced.

12.12 DRIFT AND DEFORMATION

12.12.1 Story Drift Limit. The design story drift (Δ) as determined in Sections 12.8.6, 12.9.2, or 16.1, shall not exceed the allowable story drift (Δ_a) as obtained from Table 12.12-1 for any story. For structures with significant torsional deflections, the maximum drift shall include torsional effects. For structures assigned to Seismic Design Category C, D, E, or F having horizontal irregularity Types 1a or 1b of Table 12.3-1, the design story drift, Δ, shall be computed as the largest difference of the deflections along any of the edges of the structure at the top and bottom of the story under consideration.

12.12.1.1 Moment Frames in Structures Assigned to Seismic Design Categories D through F. For seismic force–resisting systems comprised solely of moment frames in structures assigned to Seismic Design Categories D, E, or F, the design story drift (Δ) shall not exceed Δ_a/ρ for any story. ρ shall be determined in accordance with Section 12.3.4.2.

12.12.2 Diaphragm Deflection. The deflection in the plane of the diaphragm, as determined by engineering analysis, shall not exceed the permissible deflection of the attached elements. Permissible deflection shall be that deflection that will permit the attached element to maintain its structural integrity under the individual loading and continue to support the prescribed loads.

12.12.3 Building Separation. All portions of the structure shall be designed and constructed to act as an integral unit in resisting seismic forces unless separated structurally by a distance sufficient to avoid damaging contact under total deflection (δ_x) as determined in Section 12.8.6

12.12.4 Deformation Compatibility for Seismic Design Categories D through F. For structures assigned to Seismic Design Category D, E, or F, every structural component not included in the seismic force–resisting system in the direction under consideration shall be designed to be adequate for the gravity load effects and the seismic forces resulting from displacement to the design story drift (Δ) as determined in accordance with Section 12.8.6 (see also Section 12.12.1).

EXCEPTION: Reinforced concrete frame members not designed as part of the seismic force–resisting system shall comply with Section 21.9 of ACI 318.

Where determining the moments and shears induced in components that are not included in the seismic force–resisting system in the direction under consideration, the stiffening effects of adjoining rigid structural and nonstructural elements shall be considered and a rational value of member and restraint stiffness shall be used.

12.13 FOUNDATION DESIGN

12.13.1 Design Basis. The design basis for foundations shall be as set forth in Section 12.1.5. ✓ — SAN. EXCEPT C–F

12.13.2 Materials of Construction. Materials used for the design and construction of foundations shall comply with the requirements of Chapter 14. Design and detailing of steel piles shall comply with Section 14.1.8. Design and detailing of concrete piles shall comply with Section 14.2.3.

12.13.3 Foundation Load-Deformation Characteristics.

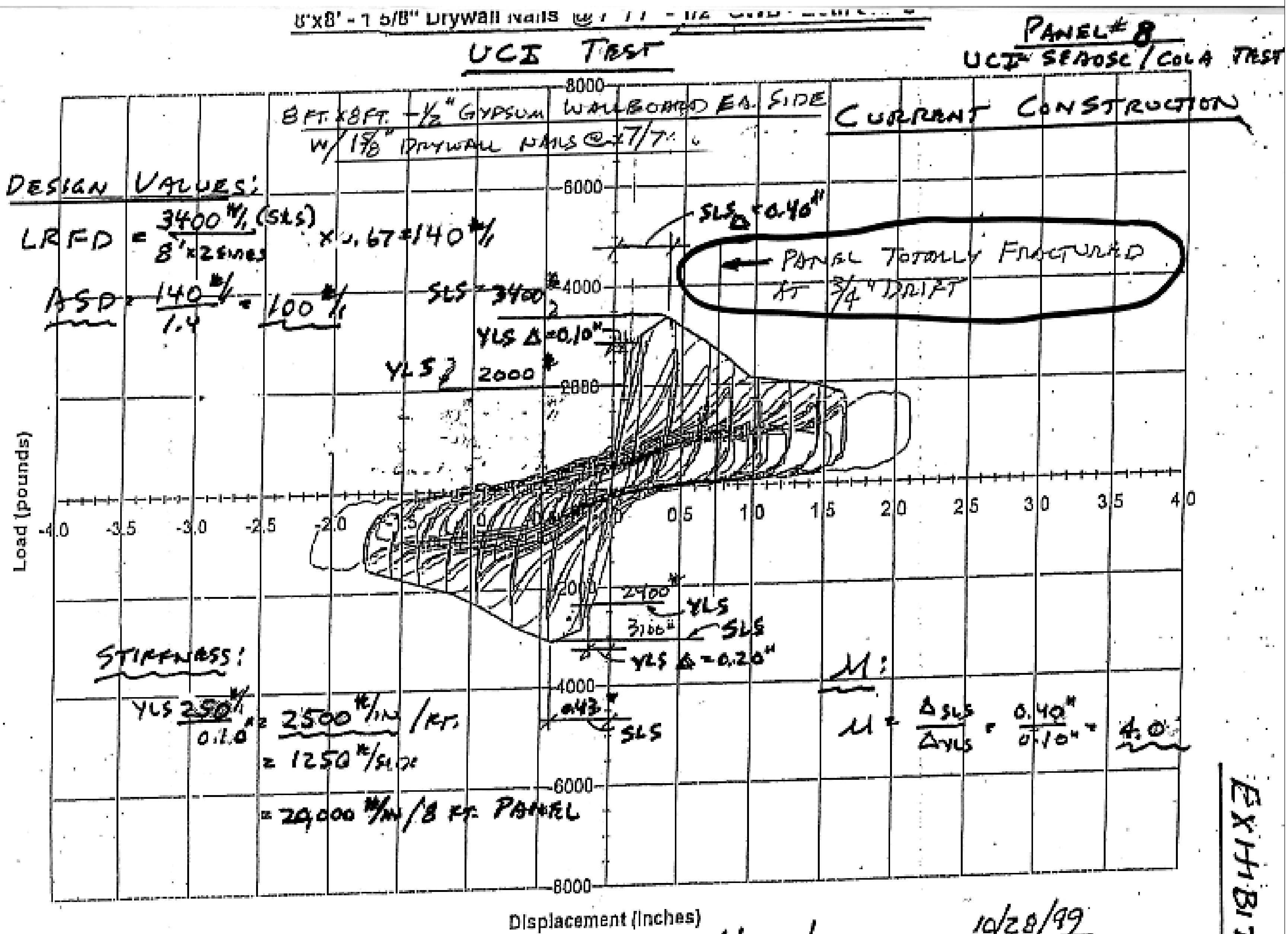
Where foundation flexibility is included for the linear analysis procedures in Chapters 12 and 16, the load-deformation characteristics of the foundation-soil system (foundation stiffness) shall be modeled in accordance with the requirements of this section. The linear load-deformation behavior of foundations shall be represented by an equivalent linear stiffness using soil properties that are compatible with the soil strain levels associated with the design earthquake motion. The strain-compatible shear modulus, G, and the associated strain-compatible shear wave velocity, v_S, needed for the evaluation of equivalent linear stiffness shall be determined using the criteria in Section 19.2.1.1 or based on a site-specific study. A 50 percent increase and decrease in stiffness shall be incorporated in dynamic analyses unless smaller variations can be justified based on field measurements of dynamic soil properties or direct measurements of dynamic foundation stiffness. The largest values of response shall be used in design.

12.13.4 Reduction of Foundation Overturning. Overturning effects at the soil-foundation interface are permitted to be reduced by 25 percent for foundations of structures that satisfy both of the following conditions:

a. The structure is designed in accordance with the Equivalent Lateral Force Analysis as set forth in Section 12.8.
b. The structure is not an inverted pendulum or cantilevered column type structure.

Overturning effects at the soil-foundation interface are permitted to be reduced by 10 percent for foundations of structures designed in accordance with the modal analysis requirements of Section 12.9.

ASCE 7-05



TEST REPORT NO. 1

10/28/99

EXHIBIT C

INTERIOR WALLS CURRENT CONSTRUCTION

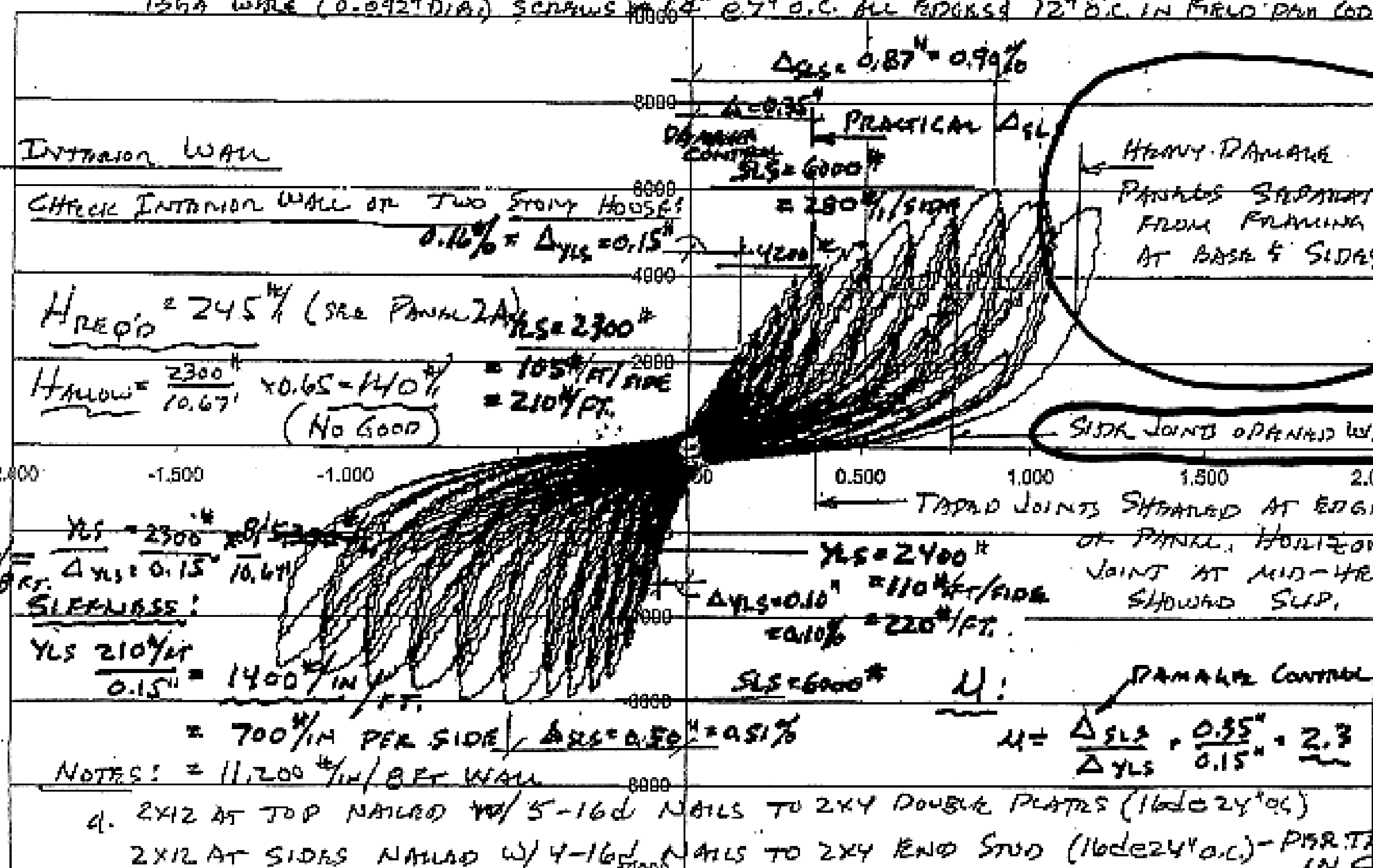
(COMPARE WITH UCI/COLA TEST # 8)

B. SCHMID RESEARCH PROGRAM

Panel 6B - Wood Frame Panel 8-ft. High x 10ft.-8in. Long (8/6/01) 2x4 PANELS

1/2" GYPSUM WALLBOARD BOTH SIDES W/3 1/2" RETURN AT EA. END AND AT THE TOP

13GA WIRE (0.092" DIA) SCREWS W/ 1 5/8" @ 7" O.C. ALL EDGES & 12" O.C. IN FIELD PER CODE



DESIGN VALUES:

5. PANEL CYCLED USING SEAOSC/COLA - ICBO PROTOCOL W/FMB (FIRST MAJOR EVENT) = 1/2

$LRFD = \frac{6,000\text{ \#/1 (SLS)}}{10.67' \times 2\text{ SIDES}} \times 0.65 = 180\text{ \#/1 / SIDE}$

$ASD = \frac{180\text{ \#/1}}{1.4} = 130\text{ \#/1}$ (WITH RETURNS AT TOP OF WALL)

LOED TESTING • 10600 Pioneer Boulevard, Suite G • Santa Fe Springs, California 90670 • (562)903-0032 Fax (562)903-3554

Photo 1:
View of 16 ga. stapled shear wall after test showing plywood loose at top and bottom with staples sheared at surface between back of plywood and face of studs.

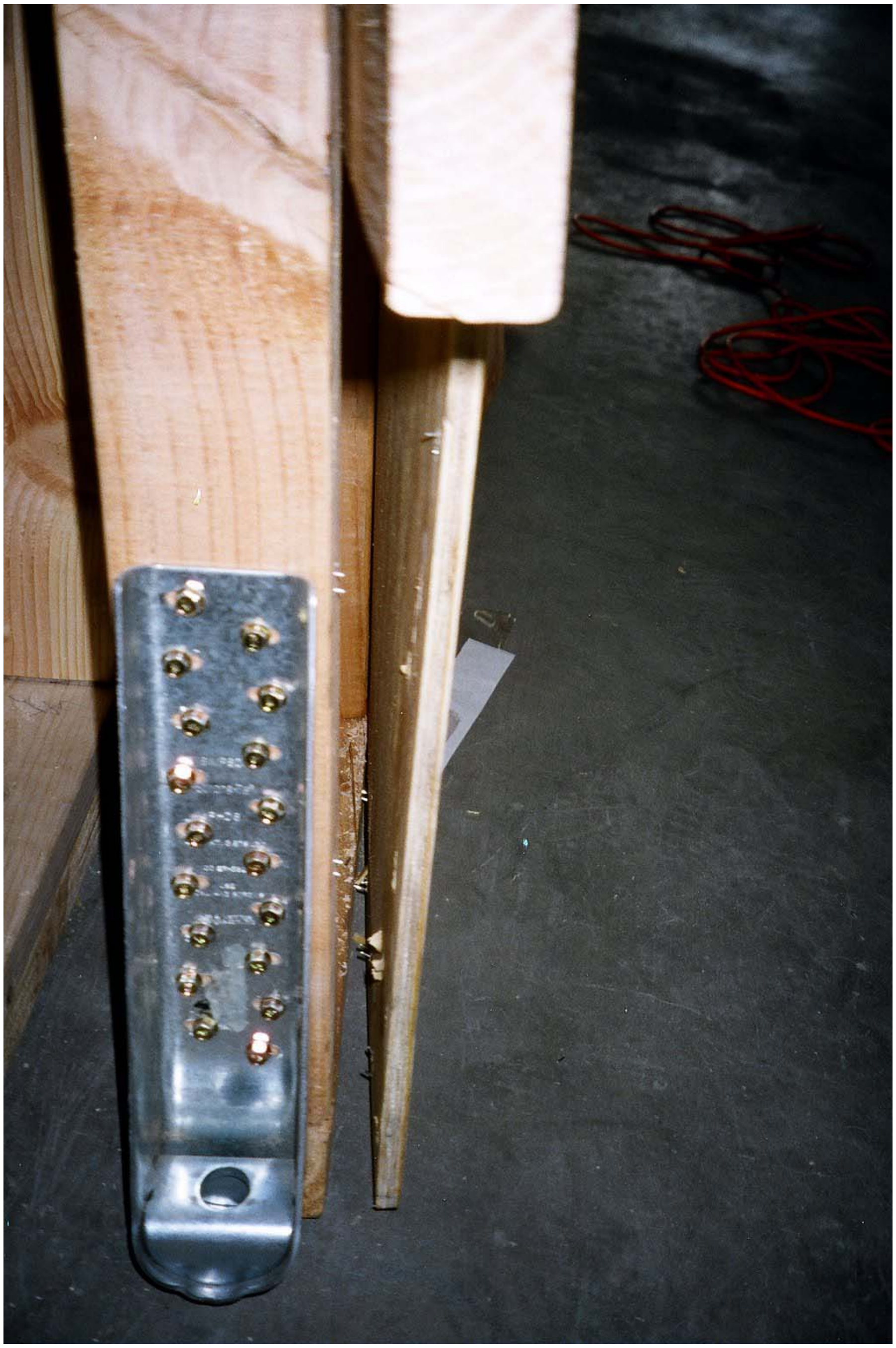


Photo 2:
View of left corner at Hold-Down with staples sheared flush with end-post. Staples at adjacent stud still holding panel to wood frame. Total of approximately 30 out of 224 staples held panels to frame.

Photo 3:
View of right edge of right panel, removed to show back side, with 8 staples that were still attached to the frame. No other staple legs were visible.

Photo 4:
View of stud with staple legs sheared after flexing to form a ¾ inch slot. The adjacent panel shows 7/16 inch staple crowns at 3 inches on center with no visible sign of distress.

Subject: Shear Walls and Diaphragms with Staples as Fasteners
From: Ben Schmid <baywind@inetmail.att.net>
Date: Mon, 20 Aug 2007 15:32:54 -0800
To: Ben.Yousefi@SMGOV.NET, Carl Sramek <SramekCA@aol.com>, dvandorpe@vcaengineers.com, david.pomerleau@idsse.com, dsaldana@cityofsanmarino.org, ealexani@dpw.lacounty.gov, EYamamot@simivalley.org, fsegovia@tornet.com, fnishioka@torrnet.com, gd.mayer@ventura.org, halamedd@dpw.lacounty.gov, Ifa.kashefi@lacity.org, James Lai <jslai@sbcglobal.net>, jameson.lee@lacity.org, jon@jsrengineering.com, Les.cho@SMGOV.NET, rlseng@pacbell.net, mdudar@dpw.lacounty.gov, mehran@sbise.com, Mikhail.Gershfeld@apawood.org, ccc-miro.lhotsky@verizon.net, Nick.delliquadri@lacity.org, parmstrong@interwestgrp.com, philip_yin@longbeach.gov, quan.nghiem@lacity.org, rich/geary@cox.net, ritani@dpw.lacounty.gov, sfairvine@aol.com, skalhor@dpw.lacounty.gov, steve.ikkanda@lacity.org, slam@dpw.lacounty.gov, tkoutsouros@vcacodegroup.com, Tim.McCormick@SMGOV.NET, fredschott@yahoo.com, truong_huynh@longbeach.gov, cei0107@yahoo.com, ykao@montereypark.ca.gov, HHuang@tustinca.org

Subject: Shear Walls and Diaphragms with Staples as Fasteners

Dear Committee Members and Correspondents:

I was unable to attend the Tuesday, August 14th meeting because I was attending the two-day ICC meeting in Atlanta, Georgia regarding a new Standard and Residential Construction in High Wind Regions.

When I returned Thursday, I obtained the 65 page ESR-1539 report by ISANTA for review through e-mail from Michael Gershfeld, representing the APA organization. I have thoroughly reviewed the report, comments from Phillip Yin, Long Beach Building Department, sent August 13th and Tom Van Dorpe, sent August 15. I concur with the comments by Phillip and Tom regarding the use of staples in chemically treated wood. Page 3, Paragraph 5.7 of Conditions of Use states that "Use of fasteners in chemically treated wood is outside the scope of this report. Paragraph 2304.9.5 of the 2007 CBC requires fasteners in preservative-treated wood to be hot-dipped zinc coated per ASTM A153 or stainless steel. This requirement for nails in exterior sill plates has not been enforced locally because experience has shown that 8d common and larger diameter nails have not deteriorated after 20 or more years embedded in treated sill plates. Galvanizing staples becomes a moot requirement because of the following rejection of shear walls and diaphragms.

This writer proposes that staples listed under shear walls and diaphragms, subject to Seismic Design Categories (SDC) C, D, E and F, be eliminated in 2007 CBC Tables 2306.3.1, 23.06.3.2 and 2306.4.1 Staples were not listed in similar 2001 CBC Tables. The staple shear values included in the 2007 CBC match those listed in ESR-1539.

Reasons:

1. ESR-1539 Paragraph 1.0 Evaluation Scope does not include being in compliance with the 2006 IBC and thus may not be applicable.

2. The 2007 CBC was adopted in totality from the 2006 IBC, except for special provisions added for various California Agencies. In so doing, no Structural Engineers in California appraised the introduction of staples as fasteners for shear walls and diaphragms.

3. ICC had added staple values directly from ESR-1539, reissued September 1, 2005. The addition was done without consultation or requested review by local Structural Engineers adjacent to the Whittier Office.

4. If Southern California Structural Engineers had been asked for a review and group opinion, staples would have been rejected for SDC C, D, E and F before publication of the 2006 IBC.

5. The basis for denial comes from review of ESR-1539, a 65-page report on fasteners. Rejection is based on the following:

a. Paragraph 3.2.3, Page 2, Staple Bending Moments (m) provides the following:

16 ga. staples = 3.6 in.-lbs.
15 ga. staples = 4.0 in.-lbs.
14 ga. staples = 4.3 in.-lbs.

b. Paragraph 3.3.2, Page 2, Nail Bending Strength (Fy) provides the following yield strengths:

8d common nails, 0.131 in. dia. = 100 ksi
10d common nails, 0.148 in. dia. = 90 ksi

With this data (although not given in ESR-1539, the nail bending moment is:

Bendable Moment M = S x Fy and S = 0.098 x d^3

8d nails: 0.098 x 0.131^3 x 100,000 lbs./sq.in. = 22.5 in.-lbs. =
6 times 16 ga. staples <>

10d nails: 0.098 x 0.148^3 x 90,000 lbs./sq.in. = 28.6 in.-lbs. =
6 times 14 ga. staples

c. The lateral load equations for nailed connectors are given in Appendix A, Page 59 and for staples on Page 60. These equations are for static loading. Cyclic testing, using 8 foot square wood framed panels, based on SPD (protocol from COLA/SEAOSC/UC Irvine) were performed by SEAOSC and APA in 2000. The APA test results for nails are as stated in Table 2306.4.1.

d. From panel testing by SEAOSC/COLA/UC Irvine, CUREE and Dan Dolan, nails near the corners of the panels were found to be bent on both axis. During cyclic loading on the frames, combined uplift or down-thrust of the plywood against the frame, coupled with shear along the edges, causes the nails to flex on both axis. Per Paragraph 5.3 on Page 3, "all staples shall be installed with the crowns of the staples parallel to the long direction of the framing members." Thus, the flat part of the staple is in bearing with both the plywood and stud. When the staple is bent on both axis at the corners, shear strength is lost. This condition is not given in the staple equations (for static loading) on Page 60 of the report.

due to rain

6. If cyclic testing is to be attempted, it should follow the SDP Protocol that was used for shear panel values accepted in the Los Angeles Basin. The tests would be performed on 8 foot by 8 foot panels with 2 x 4 studs at 16 inch O.C., 2 x 4 sill, double 2 x 4 top plates and 4 x 4 end posts, as were tests made for nailed panels. The panels should be moistened [both plywood and oriented strand board (OSB)] to obtain the swelling that often occurs at the job site, before and after installation. The sheathing should be dried, that left the nail heads protruding above the sheathing, then tested per the cyclic protocol. This test is expected to result in decreased shear value greater than the 5% lost with nailed fasteners in OSB. Staples would be expected to lose their clamping action.

7. We should appreciate that Michael Gershfeld put the report on e-mail so we would all have the opportunity to evaluate it.

8. As Registered Structural Engineers and Building Officials, we cannot permit the use of staples with static load values to be used in the Los Angeles Basin, due to the high Geologic activity in Southern California.

Ben Schmid, S.E. 825

Attachments:

ESR-1539, Pages 2, 3, 59 and 60 (4 pages)
CUREE Task 1.5.3, Cyclic Test Data for SPD Protocol (1 page)
APA Test Report, including Schmid Tests with SPD Protocol (3 pages)
2007 CBC, Tables 2306.4.1, 2306.3.1 and 2306.3.2 (5 pages)

-----Original Message-----
Subject: RE: Another New Amendment
From: Mikhail Gershfeld <Mikhail Gershfeld@apawood.org>
Date: Mon, 13 Aug 2007 09:14:13 -0700

Dear committee members and correspondents,

As per our discussion last meeting with regards to staple values. I am attaching an ESR-1539 report by ISANTA (International, Staple, Nail and Tool Association) for your review. This report provides detailed information on performance of different fasteners.

I hope this information is helpful

MG

ESR1539 attach.pdf	**Content-Type:** application/pdf **Content-Encoding:** base64

CUREE Test attach.pdf	**Content-Type:** application/pdf **Content-Encoding:** base64

APA Test attach.pdf	**Content-Type:** application/pdf **Content-Encoding:** base64

2007 CBC Tables attach.pdf	**Content-Type:** application/pdf **Content-Encoding:** base64

"Nick Delli Quadri" <Nick.DelliQuadri@lacity.org>

09/20/2007 03:24 PM

To <sfairvine@aol.com>, "Carl Sramek" <SramekCA@aol.com>, <Mikhail.Gershfeld@apawood.org>, <dsaldana@cityofsanmarino.org>, <richgeary@cox.net>,

cc

bcc

Subject Re: Shear Walls and Diaphragms with Staples as Fasteners

Ben,

Thank you and the others for doing the cyclic testing. LADBS will be amending the 2007 CBC code for LA to not allow stapled structural wood shear panels with Department approved cyclic testing.

Nick Delli Quadri, SE
Los Angeles Department of Building and Safety

>>> <baywind@inetmail.att.net> 9/20/2007 1:35 PM >>>
Dear Committee Members and Correspondents:

Cyclic tests of 8 ft. x ft. panels using 15/32 in. structural I plywood panels fastened with 8d common nails at 3 in. o.c. and 16 gage x 2 inch leg staples with 7/16 in. crown were tested at a ICC-ES accredited laboratory last Wednesday and Thursday.

The test results were as anticipated. The staples perform miserably with deflection/load limited to 1.20 in. and Strength Limit State about 50 per cent of the 8d nails comparison.

The staples should not be allowed in the State of California, much less in Los Angeles County.

The decision is now up to your Committee or L.A. City and County 2007 CBC to make and to act.

Volunteers helped me to construct the panels. The $3,000 lab cost was paid by me as a gift to the people of California.

The attachments provide supporting data (graphs and background) as well as a copy (for reference) of my comments e-mailed 8/20/07 to all Committee Members and Correspondents.

Comments will be appreciated.

Ben Schmid, S.E. 825, Fellow SEAOC

baywind@inetmail.att.net

10/04/2007 11:30 AM

To Craig Comartin <ccomartin@comartin.net>, Fred Schott <fredschott@sbcglobal.net>, Bill Warren <bill@sesol.com>, Don Jephcott <dkjephcott@juno.com>, Henry Huang

cc

bcc

Subject Shear Walls and Diaphragms with Staples as Fasteners

Dear Committee Members and Correspondents:

The CEAOC Building Code Committee, at the annual convention, September 26, unanimously passed a motion to remove staples as fasteners for Shear Walls and Diaphrams, Tables 2306.3.1, 2306.3.2 and 2306.4.1 from the 2007 California Building Code. The motion is dependent upon an identical shear wall panel cyclic test based upon the CUREE protocol. The test is scheduled to be made by October 23, 2007, at the same ICC Certified Laboratory as performed the reported tests of September 12 and 13, 2007.

The original tests reported by Ben Schmid, Fellow SEAOC, showed the Strength Limit State (SLS) for the 16 ga. staples occurred at 1 inch drift (0.01h). The SLS for the 8d common nails at the same spacing was twice the strength and at 1.6 inch drift (0.016h). The noted cyclic test data for the staples and nails are included as attachments.

Concern was expressed that damage to staples from earthquake lateral forces cannot be visibly evaluated because the staple crowns show no distress regardless of movement or failure of the legs. Common nails, on the other hand, reveal the degree of distress by nail heads bent and with lateral displacement of the shaft as a slot in the outer surface of the plywood.

Four photos (included as attachments) taken October 1, 2007 after removing the plywood from the frame show the typical shearing of the staple legs while the crown is unaffected.

Your comments will be appreciated.

Ben Schmid, S.E. 825 Schmid Exhibits _2_-Shear Walls-Diaphrams w-Staples.pdf 10-1-07 Photos (4).pdf