Civil Engineering
at JOHNS HOPKINS UNIVERSITY

Sheathing Braced Design of Wall Studs

August 2009 Update

www.ce.jhu.edu/bschafer/sheathedwalls

for

AISI Committee on Framing Standards

Design Methods Subcommittee

Charlotte, NC

Overview

- Work Plan Summary
- New work since last report (April 2009)
  - Single column with sheathing testing (through 8’)
  - 8’x8’ full wall testing (axial)
- Conclusions

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Basic summary of work plan

- Literature summary
  - existing methods
  - existing predictive capabilities
- Computational modeling
  - to support testing
  - to support design method creation

- Phase 1 testing
  - 8' wall, single stud type, different sheathing configurations, axial only
  - Fastener translational stiffness/strength tests
  - Single column with sheathing tests
- Phase 2 testing
  - Axial + bending tests, 8' wall, final details TBD
  - Axial + bending single member tests, w/ sheathing
- Development of new design methods
  - identify limit states, potential design methodologies, calcs, examples

red = added to initial work plan

Basic summary of work products

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- Computational modeling
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red = added to initial work plan

blue = comment on work product

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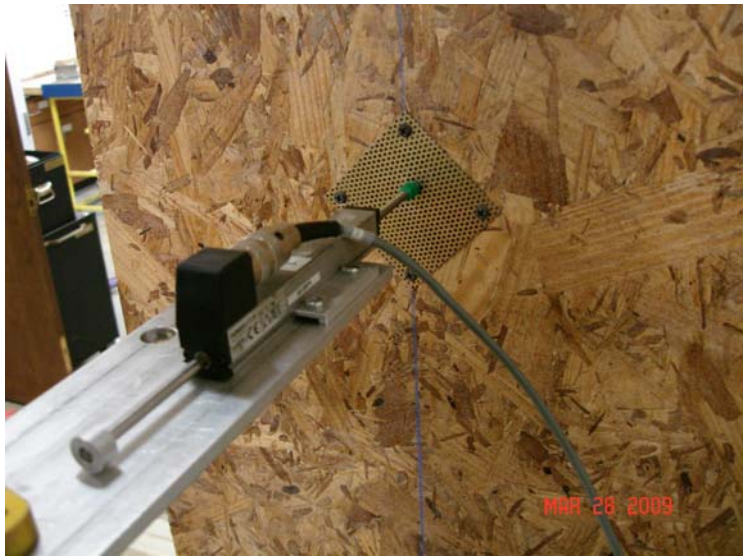
Single column testing

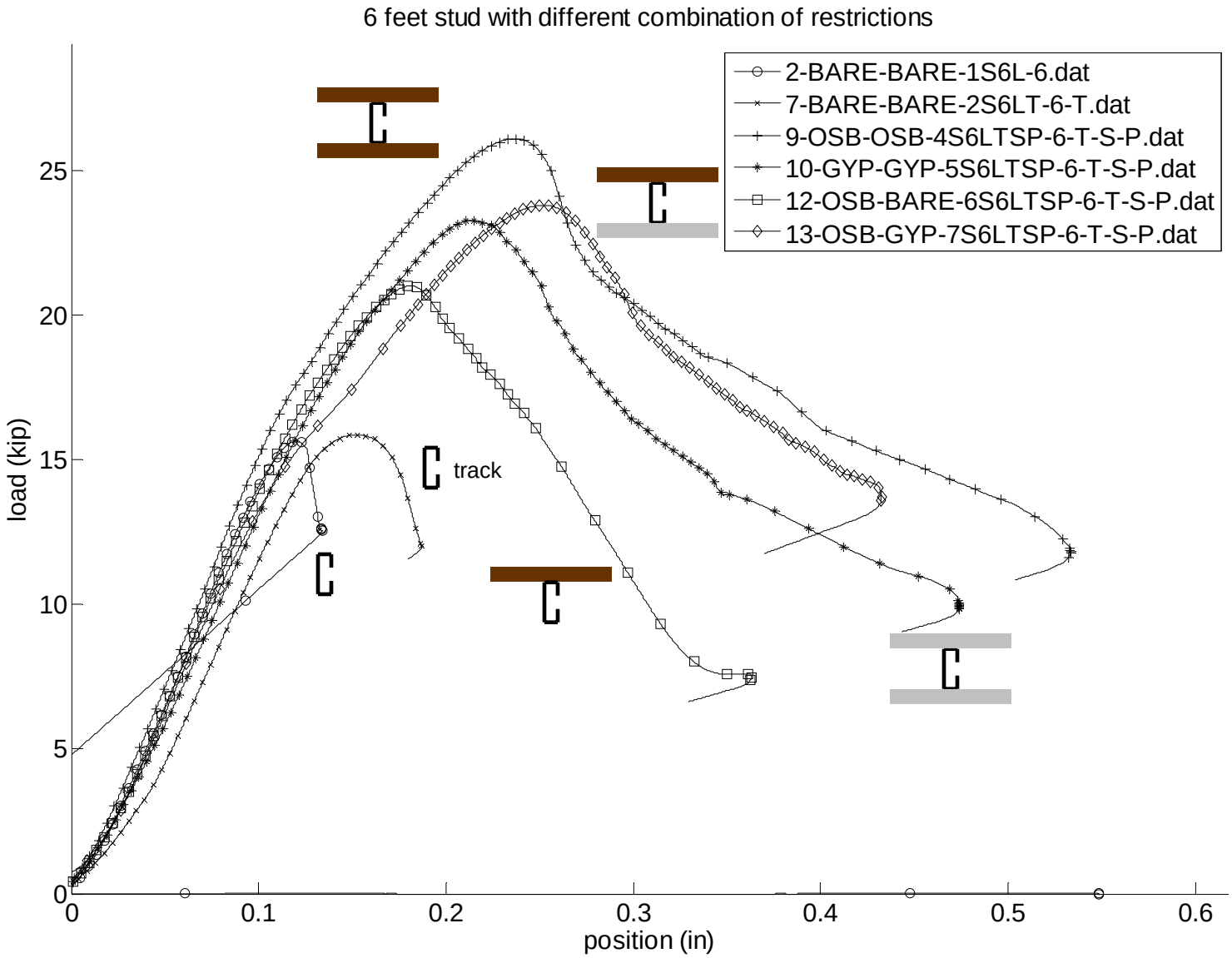


single column testing (cont.)

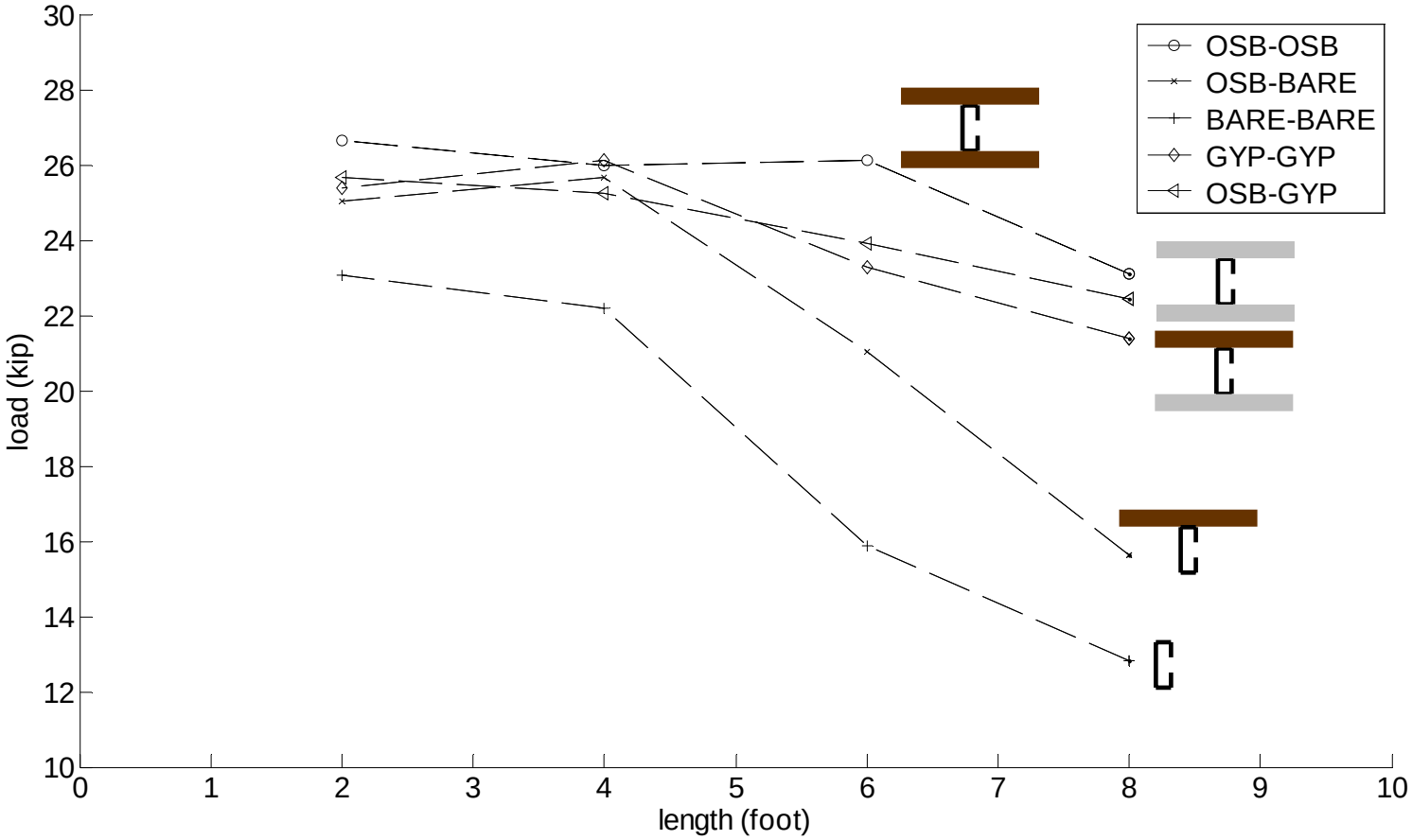
Testing Details

- 2′, 4′, 6′ and 8′ (8′ still in progress)
- 362S162-68 (50 ksi) studs
- 362T125-68 (50 ksi) track
- OSB (7/16 in., rated 24/16, exposure 1)
  Simpson #8 x 1 15/16″
- Gypsum (½ in. Sheetrock).
  Simpson #6 x 1 5/8″

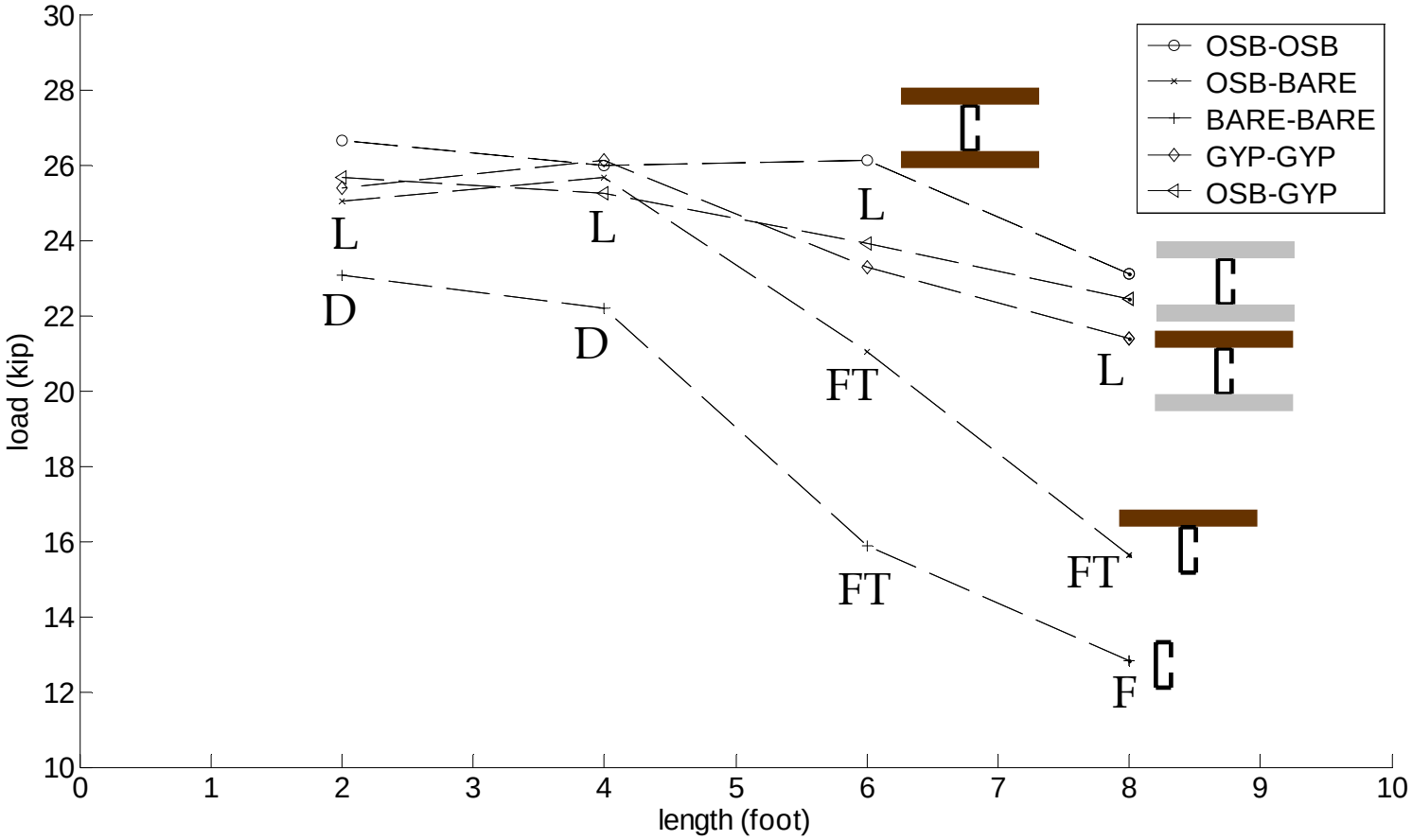
Stud response w/ sheathing (L= 6ft)



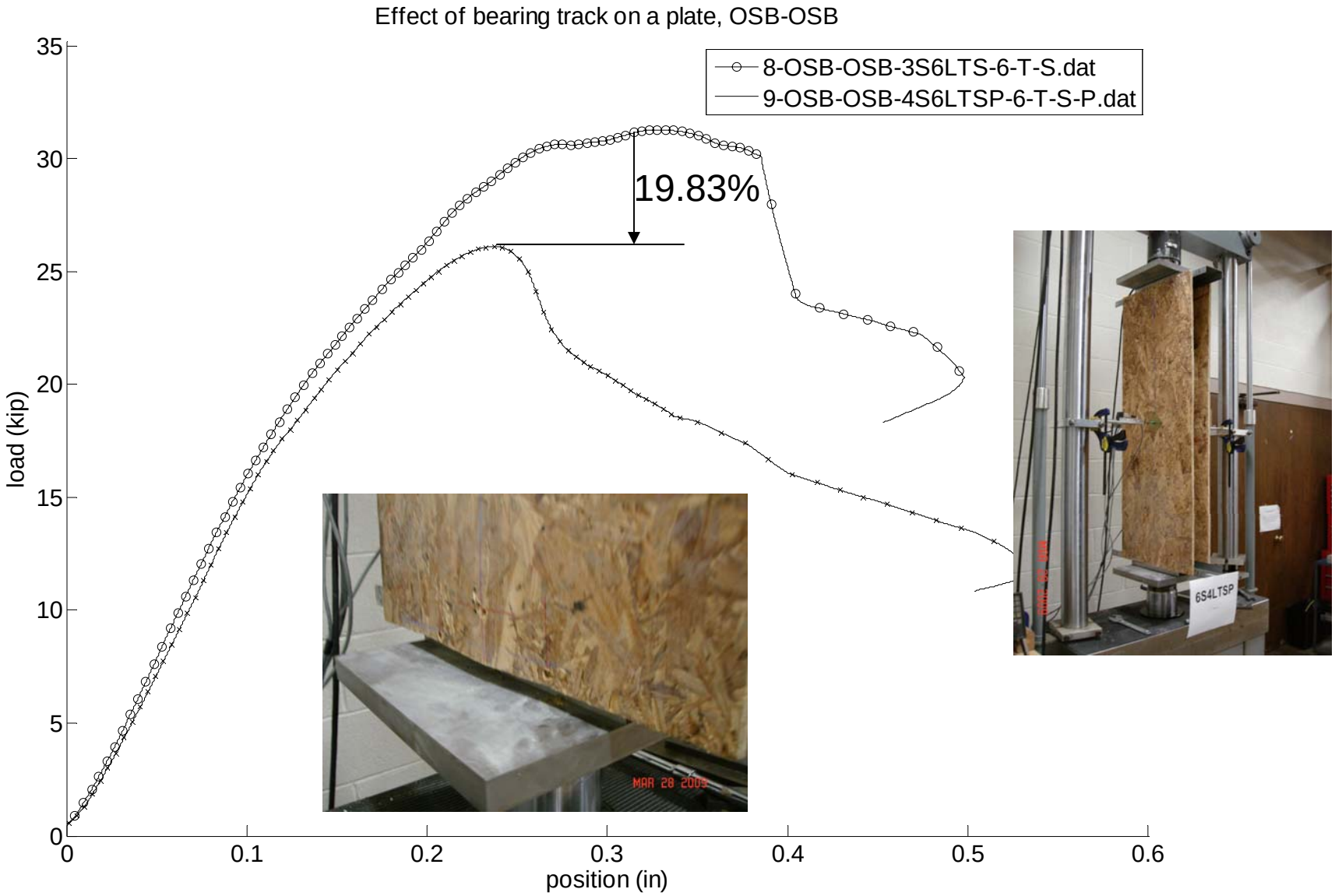
single column test summary



single column test summary



Isolating composite action



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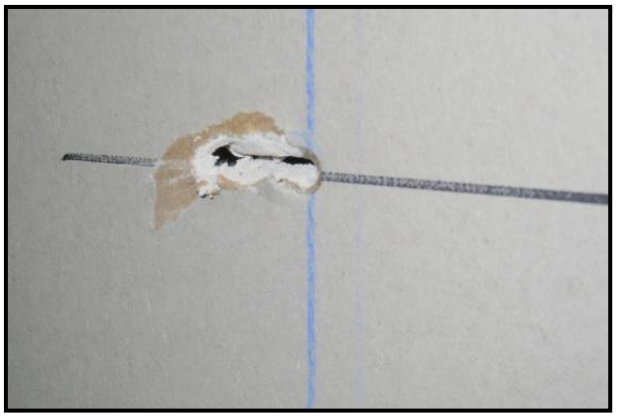
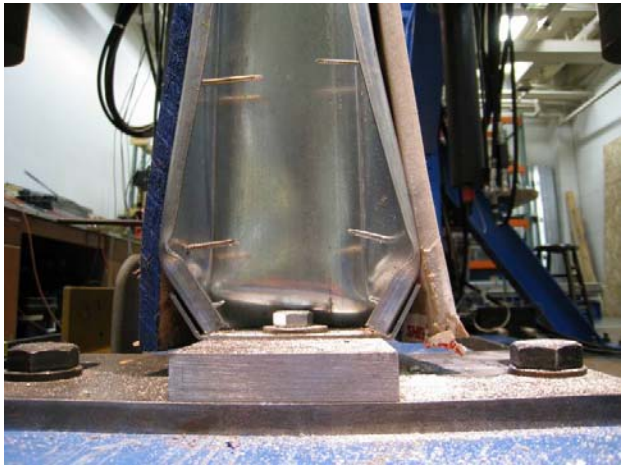
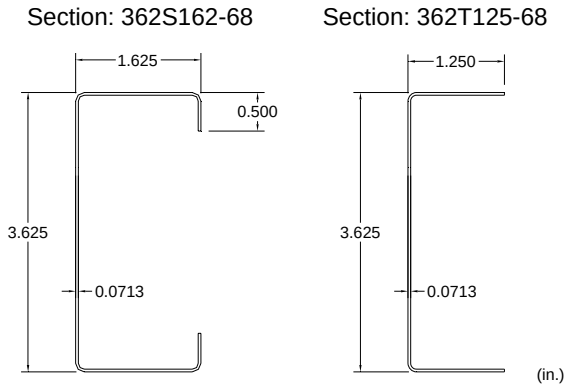
Full-scale wall testing





Full-scale wall testing details



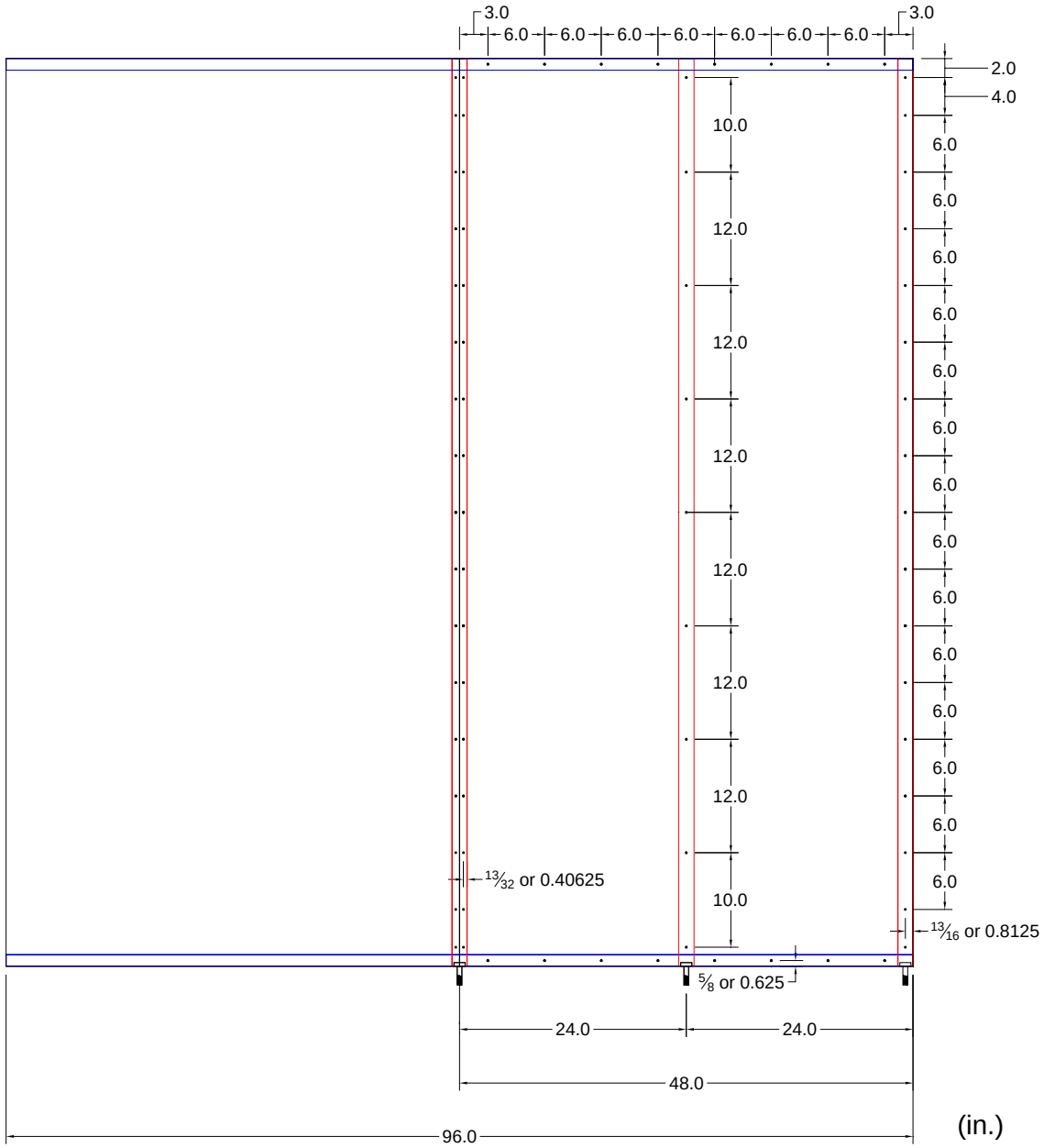
Sheathing configurations:

- Bare-Bare
- OSB-Bare
- Gyp-Gyp
- OSB-Gyp
- OSB-OSB

Details:

7/16 in. OSB
w/ #8 screws

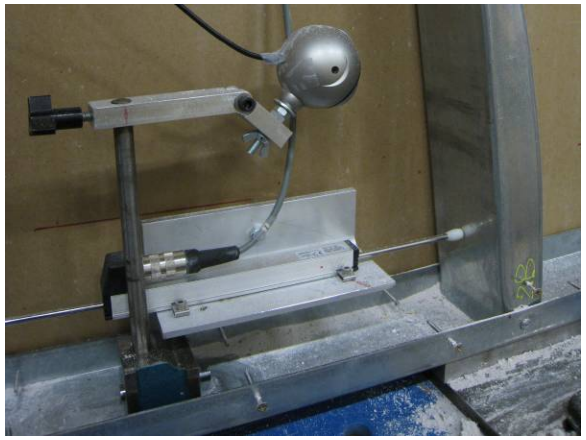
½ in. Gypsum
w/ #6 screws



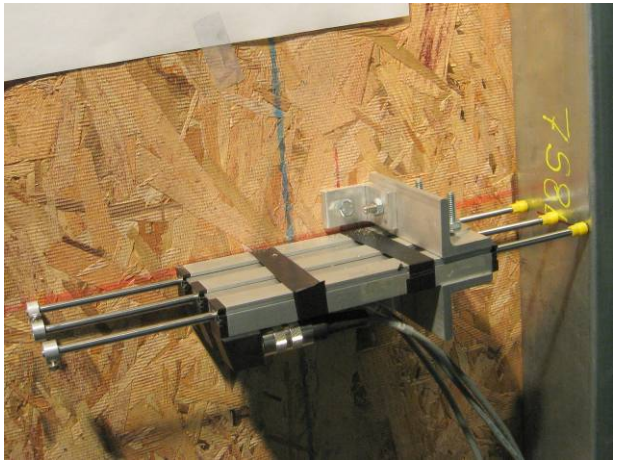
Sensors

a) String Pot, checking actuator displacement

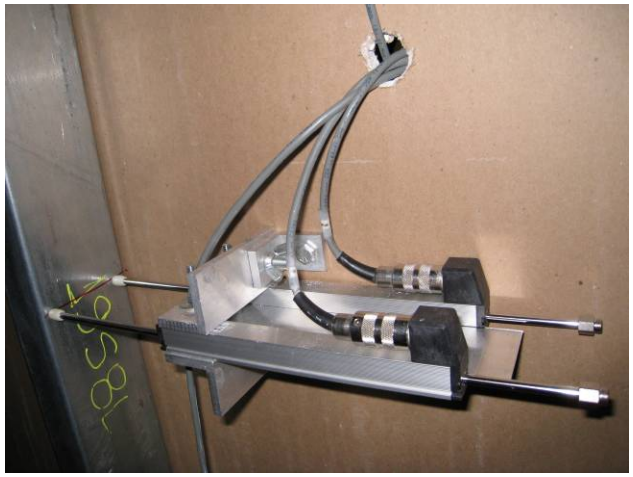
b) PT checking displacement out of the wall plane



c) PT checking local buckling at the end of stud and webcam

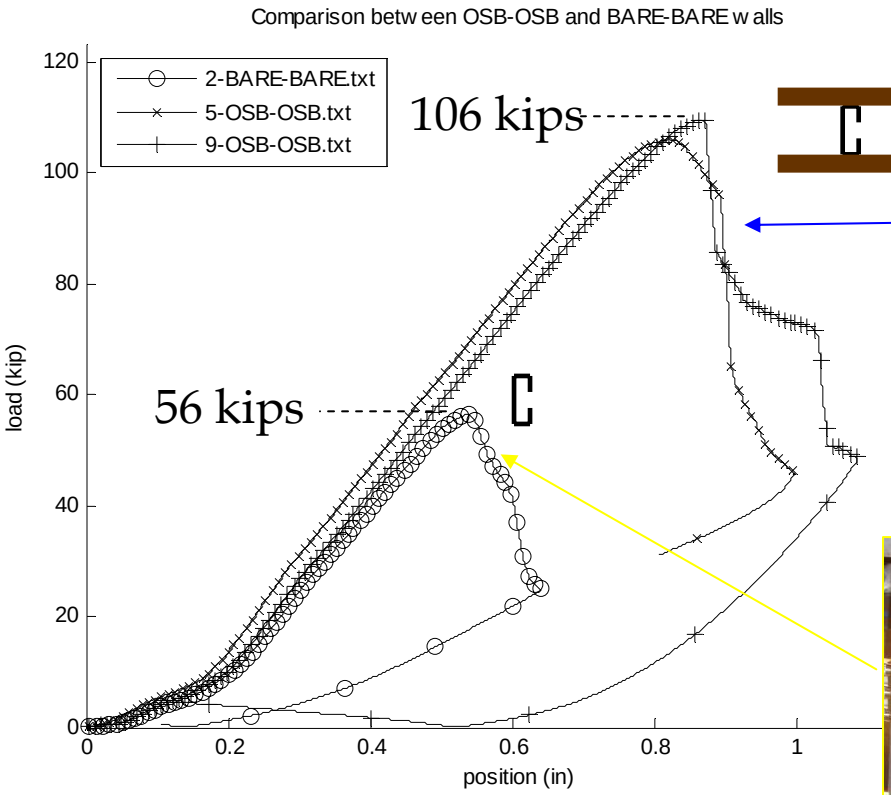


d) PT checking flexural, torsional and local buckling



e) PT checking flexural and torsional buckling

Typical P-Δ response and failure



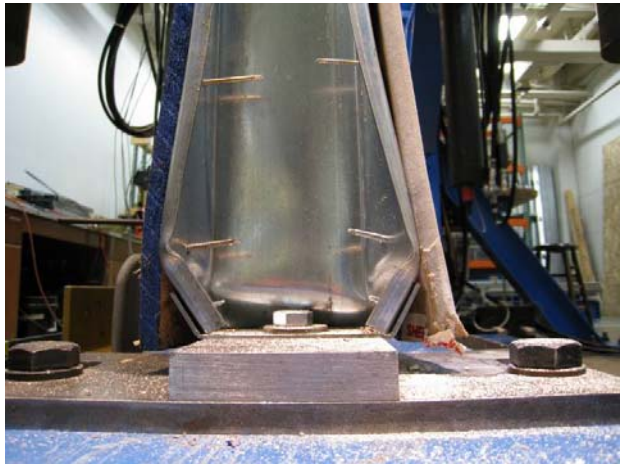
movie

Summary of failure modes

Bare-Bare: FT

OSB-Bare: FT

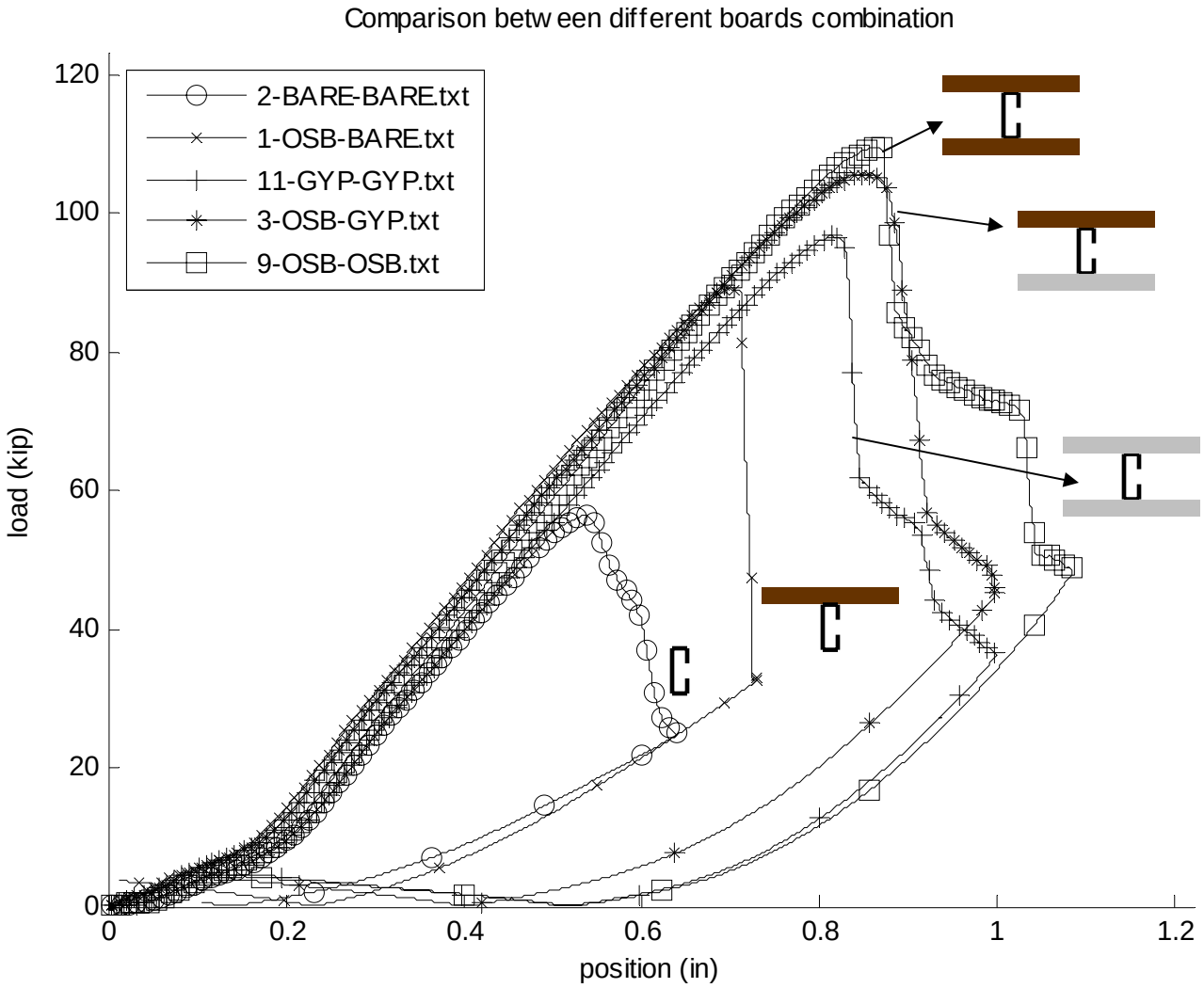
OSB-Gyp: L + D
Gyp removed in picture



OSB-Gyp: L

OSB-OSB: L

Full-scale wall tests (P-Δ)



Full-scale wall tests (summary)

Specimen	Peak Load (kips)	Limit State	Mean	COV
2-BARE-BARE	56.33	FT and F	56.33	-
12-OSB-BARE	81.57	FT	87.67	0.06
1-OSB-BARE	89.21	FT		
6-OSB-BARE	92.23	FT		
7-GYP-GYP	94.07	Local	96.39	0.02
11-GYP-GYP	96.66	Local		
4-GYP-GYP	98.44	Local		
10-OSB-GYP	103.05	Local	104.92	0.02
3-OSB-GYP	105.71	Local		
8-OSB-GYP	105.99	Local		
5-OSB-OSB	106.04	Local	107.80	0.02
9-OSB-OSB	109.55	Local		

5X1Column

64.2

78.2

106.8

112.2

115.4

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Current work

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blue = actively working on now..

Conclusions

- Significant progress has been made towards the goal of creating a sheathing braced design method
  - component level experimental data completed
  - single member axial data completed
  - full-scale wall axial data completed
  - initial design methodology determined
  - development of axial load design method now underway
- Behavior of sheathing braced columns with dis-similar sheathing now better understood, and all member limit states L,D,F,FT have been observed in testing. (Restrained FT behavior gives some pause).
- Beam-column work is now initiating to provide the final phase of the research.