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

www.ce.jhu.edu/bschafer/sheathedwalls
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

www.ce.jhu.edu(bschafer/sheathedwalls)

• Literature summary
  – existing methods (summary report, corrections to Simaan and Pekőz)
  – existing predictive capabilities (Mathcad form, being extended)

• Computational modeling
  – to support testing (CUFSM and preliminary ABAQUS)
  – to support design method creation (reliability study on 2a, fastener spacing studies, fastener demands in bending due to torsion not begun yet)

• Phase 1 testing
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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)

6 feet stud with different combination of restrictions

- 2-BARE-BARE-1S6L-6.dat
- 7-BARE-BARE-2S6LT-6-T.dat
- 9-OSB-OSB-4S6LTSP-6-T-S-P.dat
- 10-GYP-GYP-5S6LTSP-6-T-S-P.dat
- 12-OSB-BARE-6S6LTSP-6-T-S-P.dat
- 13-OSB-GYP-7S6LTSP-6-T-S-P.dat
single column test summary
single column test summary
Isolating composite action

Effect of bearing track on a plate, OSB-OSB

- 8-OSB-OSB-3S6LTS-6-T-S.dat
- 9-OSB-OSB-4S6LTSP-6-T-S-P.dat

19.83%
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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

Comparison between OSB-OSB and BARE-BARE walls

106 kips

56 kips

load (kip)

position (in)
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 ($P-\Delta$)

Comparison between different boards combination:

- 2-BARE-BARE.txt
- 1-OSB-BARE.txt
- 11-GYP-GYP.txt
- 3-OSB-GYP.txt
- 9-OSB-OSB.txt
# Full-scale wall tests (summary)

<table>
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<tr>
<th>Specimen</th>
<th>Peak Load (kips)</th>
<th>Limit State</th>
<th>Mean</th>
<th>COV</th>
<th>5X1Column</th>
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</tbody>
</table>
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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.