AISI-COFS JHU Field Trip

October 6, 2008
### Schedule

1:30 – Introduction and overview to JHU project (106 Latrobe Hall)

2:00 – Lab demonstrations including ancillary testing (16 Latrobe Hall)
+ Discussion and demonstration of the new multiple degree of freedom testing rig
(Note, this demo will be simplified due to Saturday’s damage)
(Note, smart ideas for repairs are encouraged!)
+ Discussion of construction and testing details for full-scale wall tests
(Note, a full scale wall test was planned, but cannot be conducted due to Sat.’s damage)
+ Discussion and demonstration of ‘Winter’-style fastener stiffness tests
+ Discussion of supplementary column tests with end details

2:30 – Additional project findings, ancillary tests discussion (106 Latrobe Hall)

3:00 – Ancillary column test (16 Latrobe Hall)
+ Demonstration of column test with one-sided end detail
+ Demonstration of column test without one-sided end detail (as time allows)

4:30 – Wrap-up (106 Latrobe Hall)
+ Project oversight...
+ Discussion of ‘next steps’ in the project
+ Feedback from participants

>5 SSMA technical committee conference call

### RFP

- The *Wall Stud Standard* currently has the following limitation:

  “Wall stud assemblies using a sheathing braced design shall be designed assuming that identical sheathing is attached to both sides of the wall stud and connected to the bottom and top horizontal members of the wall to provide lateral and torsional support to the wall stud in the plane of the wall. Wall studs with sheathing attached to both sides that is not identical shall be permitted to be designed based on the assumption that the weaker of the two sheathings is attached to both sides.”

- The objective of this project is to broaden the provisions for the sheathing braced design of wall studs in compression and bending to include similar, dissimilar and single-sided sheathing
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 stiffness tests (new addition)
  - Column end detail tests (new addition)
- Phase 2 testing
  - Axial + bending tests, 8’ wall, details TBD
  - Beam-column end detail tests (new addition)

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AISI Design Methods for Sheathing Braced Design of Wall Studs in Compression

B.W. Schafer

report to AISI-COFS Design Methods Committee

April 2008
Overview

• Part of the AISI-COFS funded project on the design of sheathed walls with dis-similar sheathing.
• Presentation developed from a report of the same name
• Project updates, including full report available at
  www.ce.jhu.edu/bschafer/sheathedwalls
• Report covers
  – Examination of sheathing stiffness ‘k’
  – Initial summary of known demands and limit states on a sheathed wall stud in compression

AISI Design Methods

- 1962 AISI Design Manual
  - Winter’s method
  - discrete spring model

  - Simaan and Peköz
  - shear diaphragm model

- 2007 AISI-COFS Wall Stud Standard (S211)
  - “simplified”
  - discrete spring model
1962 AISI Specification

• “The safe load-carrying capacity of a stud may be computed on the basis that the wall material or sheathing (attached to the stud) furnishes adequate lateral support to the stud in the plane of the wall, provided the wall material and its attachments to the stud comply with the following requirements:”

\[
\begin{align*}
f_A &= \frac{E I}{A^2} f_y^2 \\
L_{r_{max}} &= \frac{E I}{A^2} f_y^2 \\
&= \frac{8EI_y k}{A^2 f_y^2} \\
&= \frac{ LR_y^2}{2r_i}
\end{align*}
\]
1962 AISI Specification

- “The safe load-carrying capacity of a stud may be computed on the basis that the wall material or sheathing (attached to the stud) furnishes adequate lateral support to the stud in the plane of the wall, provided the wall material and its attachments to the stud comply with the following requirements:

\[
\frac{a_{\text{max1}}}{2} = \frac{8EI,k}{A^2 f_y^2}
\]

\[
a_{\text{max2}} = \frac{Lr_a}{2r_1}
\]

\[
k_{\text{min}} = \frac{f_y^2 aA^2}{240,000,000 I_2}
\]
1962 AISI Specification

- “The safe load-carrying capacity of a stud may be computed on the basis that the wall material or sheathing (attached to the stud) furnishes adequate lateral support to the stud in the plane of the wall, provided the wall material and its attachments to the stud comply with the following requirements:

\[ a_{max1} = \frac{8EI_2k}{A^2f_y^2} \]
\[ a_{max2} = \frac{Lr_2}{2r_1} \]

- fastener spacing, \( a \), must be less than

\[ k_{min} = \frac{f_y^2aA^2}{240,000,000I_2} \]

- fastener-sheathing stiffness, \( k \), must be at least:

\[ F_{min} = \frac{keP}{2\sqrt{EI_2k/a - P}} \]

Fasteners must have at least this much strength:

\[ k_{act} = k_{id} \]

1. assume \( k_{act} = k_{id} \) only under first denominator term
2. remove 2 under the radical in first term as well
3. remaining \( k_{act} = k \)

Fastener strength (continued)

\[ F_{min} = \frac{ek_{act}P}{2\sqrt{2EI_2/a k_{act} / \sqrt{k_{id}} - P}} \]

- Brace forces resulting from Example 11 of 1962 design manual
- Winter’s 1962 equation without empirical modification
- Winter’s 1962 equation

\[ F_{min} = \frac{keP}{2\sqrt{EI_2k/a - P}} \]

Fasteners must have at least this much strength:
Summary of 1962 Specification

• The fastener-sheathing stiffness must insure the following condition is met
  \[ P_{cr2}(k@a,(KL)_2 = L) \geq A_f \]

• The fastener-sheathing strength must insure the following condition is met
  \[ F_{min} = e^{\frac{k}{\sqrt{k/2k_{id}}}} - 1 \text{ where } k_{id} = P^2a/8EI_2 \]

• In addition to insure adequate performance in the face of potential defects
  \[ P_{cr2}(k = 0,(KL)_2 = 2a) \geq P_{cr1}((KL)_h = L) \]

• If the above conditions are met \( P_{cr} = P_{cr1} \) (strong-axis).

Critique of 1962 Specification

• The fastener-sheathing stiffness must insure the following condition is met
  \[ P_{cr2}(k@a,(KL)_2 = L) \geq A_f \] useful, but arbitrary, does not even insure that strong axis controls

• The fastener-sheathing strength must insure the following condition is met
  \[ F_{min} = e^{\frac{k}{\sqrt{k/2k_{id}}}} - 1 \] couched in something theoretical, but in the end empirical, not wholly consistent with current approaches

• In addition to insure adequate performance in the face of potential defects
  \[ P_{cr2}(k = 0,(KL)_2 = 2a) \geq P_{cr1}((KL)_h = L) \] arbitrary, realistic?

• If the above conditions are met \( P_{cr} = P_{cr1} \) (strong-axis).

Underlying theory not directly applicable, no torsional-flexural buckling check, to my knowledge none of us have ever even done a k test?!
1980 to 2004 AISI Specification

• Also known as the Simaan and Peköz method, or the shear diaphragm model, or the “D4 method”. Existed from 1980 to 2004 in Spec. Section D4. Abandoned in favor of a return to Winter’s method, more or less.

• Why was the method abandoned?
• What can we learn from the “mistakes”?

D4 method summary

• The method was abandoned for numerous practical reasons, and now can be seen to have a serious theoretical limitation

• However, lots of great and complicated mechanics in the D4 method. Torsional-flexural buckling is treated thoroughly (even for dis-similar and one-sided sheathing).

• The role of shear in deforming the sheathing is real, but have to be careful with how that actually braces the stud
2007 AISI-S211 Wall Stud Standard

• “Wall stud assemblies using a sheathing braced design shall be designed assuming that identical sheathing is attached to both sides of the wall stud and connected to the bottom and top horizontal members of the wall to provide lateral and torsional support to the wall stud in the plane of the wall.”

• “Both ends of the stud shall be connected to restrain rotation about the longitudinal stud axis and horizontal displacement perpendicular to the stud axis.” Further, in B1.2(b) it is prescribed that the global buckling load of a stud, with fasteners spaced distance “a” apart shall be determined ignoring any sheathing contribution (i.e. $k = 0$) over a distance of $2a$, i.e.:

$$P_{cr}(k = 0, (KL)_x = L, (KL)_y = 2a, (KL)_z = 2a)$$

$P_{cr}$ by AISI-S211-07

• It is assumed that the sheathing provides enough stiffness that $P_{cr}$ ignoring the sheathing over a length equal to twice the fastener spacing, $a$, is always less than $P_{cr}$ considering the sheathing:

- buckling across a defective fastener
- buckling of the stud engaging all fasteners

assumed

$<$
$P_{cr}$ by AISI-S211-07

- It is assumed that the sheathing provides enough stiffness that $P_{cr}$ ignoring the sheathing over a length equal to twice the fastener spacing, $a$, is always less than $P_{cr}$ considering the sheathing:

  
  \[
  \min P_{cr}\left(k = 0, (KL)_i = 2a\right) < \min P_{cr}\left(k @ a, (KL)_i = L\right)
  \]

  
  validity of assumption depends on the stiffness $k$, as $k \to 0$ definitely not a valid assumption
$P_{cr}$ by AISI-S211-07

- It is assumed that the sheathing provides enough stiffness that $P_{cr}$ ignoring the sheathing over a length equal to twice the fastener spacing, $a$, is always less than $P_{cr}$ considering the sheathing:

\[
\min P_{cr}(k = 0, (KL)_a = 2a) \leq \min P_{cr}(k = 0, (KL)_a = L, (KL)_h = 2a)
\]

we have done some preliminary reliability studies on this ‘2a’ business, see supplementary materials on the web page.

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 stiffness tests (new addition)
    - Column end detail tests (new addition)

- Phase 2 testing
  - Axial + bending tests, 8’ wall, details TBD
    - Beam-column end detail tests (new addition)
### Phase 1 testing

- Wall tests
- Fastener stiffness tests
- Column with end detail tests

### Preliminary Phase 1 Test Matrix

**Excerpted from the proposal and our Sept 10, 2007 meeting**

**Table 1** Preliminary proposal for Phase 1 testing: varying sheathing types on a control wall configuration

<table>
<thead>
<tr>
<th>Control Configuration</th>
<th>8' x 8' Panel with 362S162-68 (50ksi) with 12 in. stud spacing and 12 in. fastener spacing</th>
</tr>
</thead>
</table>

**we will meet with the TG before we build the first wall, but it is good now to discuss this initial notion of the test matrix as we intend to commence the testing this fall. My concerns: not generic enough, too much gypsum, P vs P+M?**
excerpted from our Sept 10, 2007 meeting
potential discussion (construction)

- construction tips/thoughts
  - stud tight to track
  - alignment with simple jig
  - fastener alignment (pre-drilled holes vs. some error)
  - finish to flush, no big problem
- tie-ing the wall up and down
- installation of second face sheets when wall is in place in the testing rig
potential discussion (testing)

- how to monitor internal deformations (other than strain gauges)
- interest in load distribution, we have some additional information from the testing
  - example, early drywall test as it twisted the torsional moment to restrain the wall was showing up in the lateral actuators

potential discussion

- bottom beam retrofit
  - for axial load testing
- bottom beam re-design
  - re-build and be a bit smarter, thoughts welcome
Phase 1 testing

• Wall tests
• Fastener stiffness tests
• Column with end detail tests
Phase 1 testing

- Wall tests
- Fastener stiffness tests
- Column with end detail tests

Recall paucity of available data

$k$ Values as Determined by Tests—The tabulation below indicates the approximate magnitude of $k$ values of a few common types of wall sheathing materials, tested in accordance with the procedure outlined above using one type of steel stud and two alternate types of attachment.

<table>
<thead>
<tr>
<th>Material Description</th>
<th>Range of $k$ Values</th>
</tr>
</thead>
<tbody>
<tr>
<td>1/2&quot; Standard Density Wood and Cane Fiber Insulating Board</td>
<td>290—605</td>
</tr>
<tr>
<td>1/2&quot; Paper Face Insulating Board</td>
<td>915—1460</td>
</tr>
<tr>
<td>3/8&quot; Gypsum Board Sheathing</td>
<td>775—1555</td>
</tr>
<tr>
<td>5/16&quot; Medium Density Compressed Wood Fiber Board</td>
<td>2010—4360</td>
</tr>
<tr>
<td>5/32&quot; High Density Compressed Wood Fiber Board</td>
<td>3900—7360</td>
</tr>
</tbody>
</table>

The above values are indicative only; the $k$ values for any specific construction will depend upon the particular type of wall sheathing material and the method of attachment employed, also the type of steel stud to which attachment $k$ value.
and complications in interpretation

![Graph showing typical experimental responses (F) vs. displacement](image)

Figure 6: Typical experimental responses (F) vs. displacement by Fiorino et al. [2]

and none of us have ever done the stupid test!

Recall earlier fastener stiffness tests

![Diagram of fastener stiffness tests](image)
Recall earlier fastener stiffness tests we have compiled all available test data, see supplementary materials on the web page.

Phase 1 testing

- Wall tests
- Fastener stiffness tests
- Column with end detail tests
idea of ancillary column tests

- study “2a” vs. actual KL
- study failure mode in isolation and compare
- separate boundary condition effects from fastener stiffness effects
- study system vs. single member effects
- nice extension to isolated beam-columns is possible

(student $ through another project)
Schedule

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+ Demonstration of column test without one-sided end detail (as time allows)

4:30 – Wrap-up (106 Latrobe Hall)
+ Project oversight...
+ Discussion of ‘next steps’ in the project
+ Feedback from participants

>5 SSMA technical committee conference call

Notes from Lab tour #1 (as needed)

- side rots
- stagger along seam
- no track-shed-shed
- guide grips vs shed-track ends
- shed-shed-grip
- sheathing screws to track
- flip shed in x test (Helen)
- measure/document end gaps
- beam bending questions
- dry wall horizontal w/b blocking
- float top/bottom of drywall? born noisy
- humidity for boards.
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  – Column end detail tests (new addition)

• Phase 2 testing
  – Axial + bending tests, 8’ wall, details TBD
  – Beam-column end detail tests (new addition)
Basic summary of work products

• Literature summary
  – existing methods (summary report, corrections to Simaan and Peköz)
  – existing predictive capabilities (Mathcad form, ready-to-go)

• Computational modeling
  – to support testing (CUFSM and preliminary ABAQUS)
  – to support design method creation (reliability study on 2a, fastener spacing)

• Phase 1 testing
  – 8’ wall, single stud type, different sheathing configurations, axial only
  – Fastener stiffness tests (rig in good shape, prelims done)
  – Column end detail tests (rig in good shape, prelims in process)

• Phase 2 testing
  – Axial + bending tests, 8’ wall, details TBD
  – Beam-column end detail tests

• Development of new design methods
  – identify limit states, potential design methodologies, calcs, examples
### Preliminary computational models
(begin with elastic buckling analysis)

362S162-58(50ksi) 8’ long

<table>
<thead>
<tr>
<th></th>
<th>Local buckling</th>
<th>Dist buckl</th>
<th>Dist buckl</th>
<th>Global flex</th>
<th>Global flex-tors</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>CUFSM</strong></td>
<td>60.33</td>
<td>73.63</td>
<td>150.5</td>
<td>11.13</td>
<td>11.61</td>
</tr>
<tr>
<td><strong>Abaqus</strong></td>
<td>59.46</td>
<td>76.35</td>
<td>166.26</td>
<td>11.33</td>
<td>11.80</td>
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</table>

![Graphical representation of computational models](image)
Preliminary computational models
(begin with elastic buckling analysis)

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![Diagram image]
Preliminary computational models
(begin with elastic buckling analysis)

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<th>Dist buck2</th>
<th>Global flex</th>
<th>Global flex-tors</th>
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</table>

Now consider $\infty$ fastener stiffness

consider perfect fasteners, but discretely spaced

362S162-58(50ksi) 8 ft tall, 24 in. spacing

<table>
<thead>
<tr>
<th>Model</th>
<th>Screw spacing</th>
<th>Local buckling</th>
<th>Dist buck1</th>
<th>Dist buck2</th>
<th>Global flex mode1</th>
<th>Global flex mode3</th>
<th>Global dist/flex length 96”</th>
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</thead>
<tbody>
<tr>
<td>CUFSM contin</td>
<td>62.19</td>
<td>118.77 mode1</td>
<td>235.93 mode3</td>
<td>60.57</td>
<td>534.71</td>
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<td></td>
<td>continu</td>
<td>60.78</td>
<td>106.63</td>
<td>189.73</td>
<td>60.67</td>
<td>546.45</td>
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<tr>
<td></td>
<td>3”</td>
<td>59.64</td>
<td>104.6</td>
<td>186.04</td>
<td>60.67</td>
<td>546.05</td>
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<td></td>
<td>4”</td>
<td>59.57</td>
<td>102.88</td>
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<td>Wall sheathed</td>
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<td>97.78</td>
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<td>OSB</td>
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<td>155.20</td>
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<td>600.58</td>
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</table>
### Now consider $\infty$ fastener stiffness

<table>
<thead>
<tr>
<th>Model</th>
<th>Screw spacing</th>
<th>Dist buckl1</th>
<th>Dist buckl2</th>
<th>Global flex-tors</th>
<th>Global dist+flex</th>
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Now consider $k$ fastener stiffness

### Now consider $k$ fastener stiffness

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$k_\phi$ less than 12 in., no benefit assumed

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<td>1.42</td>
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</table>

Computational models

- Models with one-sided sheathing also examined, results to date are provided online in the supplemental report. This work is in progress, some difficulties with an element in ABAQUS that we have recently addressed will improve issues.

- For now, we see that we have a tool to examine fastener spacing and other effects with some detail, specifically we see
  - local buckling is not sensitive to these issues
  - distortional buckling may be sensitive, depends to some extent on amount of $k$ available
  - global buckling is sensitive, but ends may be as important as spacing along the studs

- Extension to nonlinear collapse analysis begun, but work is only at the very beginning.
Basic summary of work products

- Literature summary
  - existing methods (summary report, corrections to Simaan and Peköz)
  - existing predictive capabilities (Mathcad form, ready-to-go)

- Computational modeling
  - to support testing (CUFSM and preliminary ABAQUS)
  - to support design method creation (reliability study on 2a, fastener spacing)

- Phase 1 testing
  - 8’ wall, single stud type, different sheathing configurations, axial only
  - Fastener stiffness tests (rig in good shape, prelims done)
  - Column end detail tests (rig in good shape, prelims in process)

- Phase 2 testing
  - Axial + bending tests, 8’ wall, details TBD
  - Beam-column end detail tests

- Development of new design methods
  - identify limit states, potential design methodologies, calcs, examples

---

Scenario

![Scenario](Image)

Figure 1 – Example studied (Design Manual – COFS (2001))
Correlated and uncorrelated cases

- **correlated**
  - if a spring on left hand side (ks1) is no good, the spring on the right hand side (ks2) is also no good

- **uncorrelated**
  - no relation between ks1 and ks2

- $P_f$ for a spring varied from 0 to 10%
Correlated results

Probability associated to each spot (double spring)

Probability of failure (%)

mean

mean + std

mean - std

mean of the ‘2a’ assumption

fast. spac.=16in.

uncorrelated results

Probability associated to each spring

Probability of failure (%)

mean

mean + std

mean - std

mean of the ‘2a’ assumption

fast. spac.=16in.
Basic summary of work products

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- Development of new design methods
  - identify limit states, potential design methodologies, calcs, examples
Up to date work on bracing a stud

When sheathing $k$ matters?

- If $k_{\text{sheathing}} < 10k_{\text{fastener}}$... probably matters

\[
k_{\text{total}}(\alpha) = \frac{1}{k_{\text{fastener}}} + \frac{1}{k_{\text{sheathing}}(\alpha)}
\]

![Graph showing the relationship between $k_{\text{sheathing}}$, $k_{\text{fastener}}$, and $k_{\text{total}}$]
Limit states (abridged)

• Stud
  – Global buckling (F, T, FT – including sheathing)
    • should the stud be checked assuming defective fastener?
  – Local buckling (probably ignore sheathing)
  – Distortional buckling (probably including sheathing)
    • should the stud be checked assuming a defective fastener?

• Connections
  – Stud-fastener-sheathing connection
  – Track-fastener-sheathing connection
  – Stud-to-track connection

• Sheathing

• Construction loads (requires all-steel check)
<table>
<thead>
<tr>
<th>Time</th>
<th>Event Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1:30</td>
<td>Introduction and overview to JHU project (106 Latrobe Hall)</td>
</tr>
<tr>
<td>2:00</td>
<td>Lab demonstrations including ancillary testing (16 Latrobe Hall)</td>
</tr>
<tr>
<td></td>
<td>+ Discussion and demonstration of the new multiple degree of freedom testing rig</td>
</tr>
<tr>
<td></td>
<td>(Note, this demo will be simplified due to Saturday’s damage)</td>
</tr>
<tr>
<td></td>
<td>(Note, smart (not smart a**) ideas for repairs are encouraged!)</td>
</tr>
<tr>
<td></td>
<td>+ Discussion of construction and testing details for full-scale wall tests</td>
</tr>
<tr>
<td></td>
<td>(Note, a full-scale wall test was planned, but cannot be conducted due to Sat.’s damage)</td>
</tr>
<tr>
<td></td>
<td>+ Discussion and demonstration of “Winter”-style fastener stiffness tests</td>
</tr>
<tr>
<td></td>
<td>+ Discussion of supplementary column tests with end details</td>
</tr>
<tr>
<td>3:30</td>
<td>Additional project findings, ancillary tests discussion (106 Latrobe Hall)</td>
</tr>
<tr>
<td>4:00</td>
<td>Ancillary column test (16 Latrobe Hall)</td>
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<tr>
<td></td>
<td>+ Demonstration of column test with one-sided end detail</td>
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<tr>
<td></td>
<td>+ Demonstration of column test without one-sided end detail (as time allows)</td>
</tr>
<tr>
<td>4:30</td>
<td>Wrap-up (106 Latrobe Hall)</td>
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<tr>
<td></td>
<td>+ Project oversight...</td>
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<td>+ Discussion of ‘next steps’ in the project</td>
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<td>+ Feedback from participants</td>
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</table>

>5 SSMA technical committee conference call

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Notes from Lab tour #2 (as needed)
Schedule

1:30 – Introduction and overview to JHU project (106 Latrobe Hall)

2:00 – Lab demonstrations including ancillary testing (16 Latrobe Hall)
+ Discussion and demonstration of the new multiple degree of freedom testing rig
(Note, this demo will be simplified due to Saturday’s damage)
+ Discussion of construction and testing details for full-scale wall tests
(Note a full scale wall test was planned, but cannot be conducted due to Sat.’s damage)
+ Discussion and demonstration of 'Winter'-style fastener stiffness tests
+ Discussion of supplementary column tests with end details

3:30 – Additional project findings, ancillary tests discussion (106 Latrobe Hall)

4:00 – Ancillary column test (16 Latrobe Hall)
+ Demonstration of column test with one-sided end detail
+ Demonstration of column test without one-sided end detail (as time allows)

4:30 – Wrap-up (106 Latrobe Hall)
+ Project oversight...
+ Discussion of 'next steps' in the project
+ Feedback from participants

>5 SSMA technical committee conference call

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 stiffness tests (new addition)
    – Column end detail tests (new addition)

• Phase 2 testing
  – Axial + bending tests, 8’ wall, details TBD
    – Beam-column end detail tests (new addition)
### Literature summary
- Summarize existing design methods
- Summarize existing test data
- Perform preliminary computational modeling
- Finalize "control configuration" for testing
- Provide predictions for "control configuration"

### Fabrication of testing rig*
- Fabrication of testing rig

### Phase 1 Testing
- Control configuration w/ varied sheathing
  - Specimen fabrication
  - Testing
  - Post-processing and data reduction
  - Comparison with design methods
  - Recommendations and summary

### Phase 2 Testing
- Fastener spacing, stud thickness, stud spacing
  - Specimen fabrication
  - Testing
  - Post-processing and data reduction
  - Comparison with design methods
  - Recommendations and summary

### Computational modeling and design methods
- Modifications/development of design model
- Development of computational FEA model
- Validation studies
- Parametric studies and prediction
- Comparison of design methods
- Ballots for AISI-COFS
- Design examples

---

*The testing rig employed in this proposal is being developed primarily through already awarded NSF funding to the PI.*
### Next steps?

- Rehabilitation/retrofit of testing rig
- Axial wall tests
- Fastener stiffness tests
- Column tests
- FE nonlinear collapse modeling

### Final feedback?
Schedule

1:30 – Introduction and overview to JHU project (106 Latrobe Hall)

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(Note, this demo will be simplified due to Saturday’s damage)
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+ Project oversight...
+ Discussion of ‘next steps’ in the project
+ Feedback from participants

>5 SSMA technical committee conference call