INTRODUCTION
As the popularity of mass timber products like cross-laminated timber (CLT) for use in tall timber buildings continues to rise in North America, so has the implementation of CLT-Concrete Composite (TCC) diaphragms. While CLT diaphragms have shown satisfactory structural performance without a concrete topping, the improved fire and acoustic performance of TCC diaphragms have urged designers to utilize a concrete topping on CLT diaphragms. This poster summarizes ongoing experimental testing being performed at Oregon State University to characterize the shear performance of CLT panel-to-panel plywood spline connection systems with and without a concrete topping.

BACKGROUND
Variables:
- CLT-only v. CLT-concrete
- Fastener type (16d Common Nails @ 3 in. O.C., and SDW22338 screws)
- Screw spacing (4 in., 6 in., and 8 in. O.C.)
- SDWH27X00G-RP1 screw for CLT-concrete composite connection; screws angled at 45 or 90 degrees
- Slab thickness (2 ½ in. and 4 in.)

Parameters:
Load-displacement curves will determine elastic stiffness (K) as well as yield, peak, and failure loads (Fy, Fmax, and Fult) with corresponding displacements (Dy, Dmax, and Dult), along with ductility ratios (D) for each connection system.

MATERIALS AND METHODS
Test Specimen:
3 panels - 2 ft. x 2 ft. DF CLT (V1)
2 splines - 23/32 in. CDX Structural I DF plywood (6 in. x 24 in.)

Test and Loading Protocol:
Test Method C (CUREE loading protocol)

PRELIMINARY RESULTS
Load-Displacement Curve (014):

Results for Cyclic Testing of CLT-only Specimen w/ 16d Common Nails:

<table>
<thead>
<tr>
<th>ID</th>
<th>Fy (lb.)</th>
<th>Dy (in.)</th>
<th>K (lb./in.)</th>
<th>Fmax (lb.)</th>
<th>Dmax (in.)</th>
<th>Fult (lb.)</th>
<th>Dult (in.)</th>
<th>D (Dult/Dy)</th>
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<tr>
<td>011</td>
<td>4,200</td>
<td>0.08</td>
<td>42,000</td>
<td>9,900</td>
<td>1.13</td>
<td>8,000</td>
<td>1.57</td>
<td>18.8</td>
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<td>012</td>
<td>3,900</td>
<td>0.12</td>
<td>24,000</td>
<td>9,900</td>
<td>1.54</td>
<td>9,000</td>
<td>1.56</td>
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<tr>
<td>013</td>
<td>4,300</td>
<td>0.11</td>
<td>38,000</td>
<td>9,000</td>
<td>1.10</td>
<td>8,500</td>
<td>1.17</td>
<td>10.6</td>
</tr>
<tr>
<td>014</td>
<td>4,000</td>
<td>0.10</td>
<td>31,000</td>
<td>8,800</td>
<td>1.16</td>
<td>7,100</td>
<td>1.57</td>
<td>15.5</td>
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<tr>
<td>Ave.</td>
<td>4,100</td>
<td>0.10</td>
<td>34,000</td>
<td>9,400</td>
<td>1.23</td>
<td>8,200</td>
<td>1.47</td>
<td>14.5</td>
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<td>S. Dev.</td>
<td>170</td>
<td>0.01</td>
<td>6,800</td>
<td>480</td>
<td>0.20</td>
<td>740</td>
<td>0.17</td>
<td>3.0</td>
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<tr>
<td>COV</td>
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<td>0.12</td>
<td>0.20</td>
<td>0.05</td>
<td>0.15</td>
<td>0.09</td>
<td>0.12</td>
<td>0.2</td>
</tr>
</tbody>
</table>

Failure Modes:
1) Mode III, fastener yielding
2) Plywood bearing
3) CLT bearing
4) Nail pullout

FUTURE WORK
- Three additional CLT-only connection systems – testing complete, analysis pending
- Sixteen CLT-concrete composite connection systems – specimen assembly taking place, completion and analysis of testing expected in June 2019
- Understand failure and damage progression for each system to guide recommendations for designing these connection systems

ACKNOWLEDGEMENTS
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