

Current CLT Research and CLT Testing Capabilities at UMaine

Maine Forest Products Council Meeting

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Presentation Summary

- **Who are we?**
- **CLT Objectives for UMaine**
- **Recent CLT Research**
 - Lumber/SCL Hybrid CLT
 - CLT in Blast Applications
- **CLT Testing Capabilities**
- **Conclusion**

ASCC - Introduction

- 100,000 ft² R&D facility
- Established in 1996 – Current lab opened 2000
- \$125 million in contracts since 2001
- 68 full-time staff/faculty
- 30 graduate/100 undergraduate students



CLT – UMaine's Objectives

- To become the leader in the region for CLT information, R&D, and commercialization facilitation.
- Coordinate efforts answering the important questions that a developer/investor needs answered when considering siting a CLT plant in Maine.
- Put our world-class, ISO 17025 accredited wood composites laboratory to work supporting the CLT industry.
- Educate students (e.g. engineers and wood scientists) that can support a CLT manufacturer in Maine

PRG-320

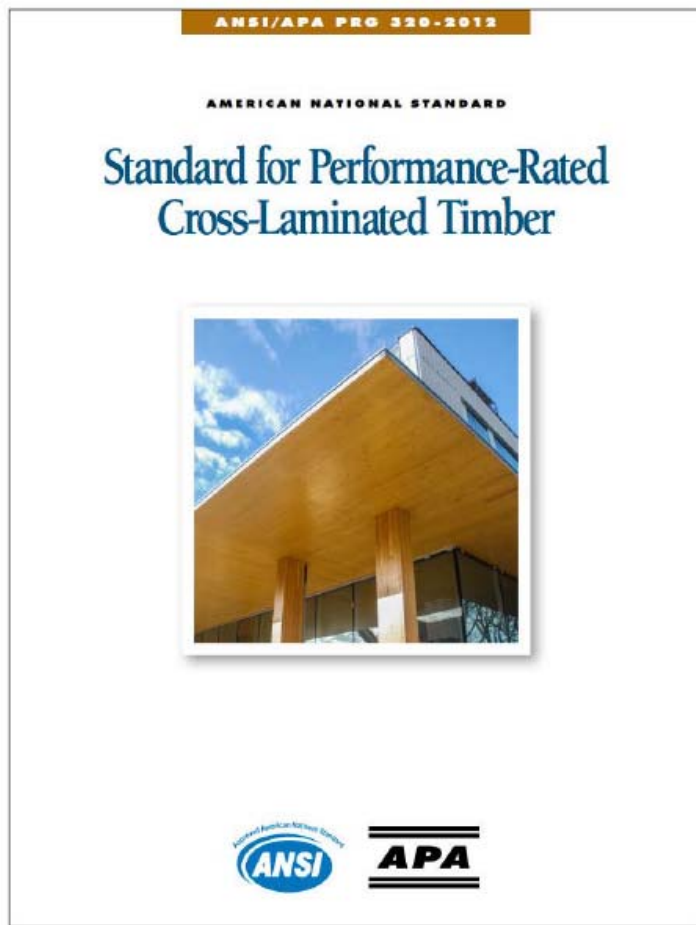


TABLE A1.
ALLOWABLE DESIGN PROPERTIES^(a,b,c,d) FOR PRG 320 CLT (for use in the U.S.)

| CLT Grades | Major Strength Direction | | | | | | Minor Strength Direction | | | | | |
|------------|--------------------------|--------------------------------------|------------------------|------------------------|------------------------|------------------------|--------------------------|---------------------------------------|-------------------------|-------------------------|-------------------------|-------------------------|
| | F _{b,0} (psi) | E ₀ (10 ³ psi) | F _{t,0} (psi) | F _{c,0} (psi) | F _{v,0} (psi) | F _{s,0} (psi) | F _{b,90} (psi) | E ₉₀ (10 ³ psi) | F _{t,90} (psi) | F _{c,90} (psi) | F _{v,90} (psi) | F _{s,90} (psi) |
| E1 | 1,950 | 1.7 | 1,375 | 1,800 | 135 | 45 | 500 | 1.2 | 250 | 650 | 135 | 45 |
| E2 | 1,650 | 1.5 | 1,020 | 1,700 | 180 | 60 | 525 | 1.4 | 325 | 775 | 180 | 60 |
| E3 | 1,200 | 1.2 | 600 | 1,400 | 110 | 35 | 350 | 0.9 | 150 | 475 | 110 | 35 |
| E4 | 1,950 | 1.7 | 1,375 | 1,800 | 175 | 55 | 575 | 1.4 | 325 | 825 | 175 | 55 |
| V1 | 900 | 1.6 | 575 | 1,350 | 180 | 60 | 525 | 1.4 | 325 | 775 | 180 | 60 |
| V2 | 875 | 1.4 | 450 | 1,150 | 135 | 45 | 500 | 1.2 | 250 | 650 | 135 | 45 |
| V3 | 975 | 1.6 | 550 | 1,450 | 175 | 55 | 575 | 1.4 | 325 | 825 | 175 | 55 |

- E1: 1950f-1.7E Spruce-pine-fir MSR lumber in all parallel layers and No. 3 Spruce-pine-fir lumber in all perpendicular layers
- E2: 1650f-1.5E Douglas fir-Larch MSR lumber in all parallel layers and No. 3 Douglas fir-Larch lumber in all perpendicular layers
- E3: 1200f-1.2E Eastern Softwoods, Northern Species, or Western Woods MSR lumber in all parallel layers and No. 3 Eastern Softwoods, Northern Species, or Western Woods lumber in all perpendicular layers
- E4: 1950f-1.7E Southern pine MSR lumber in all parallel layers and No. 3 Southern pine lumber in all perpendicular layers
- V1: No. 2 Douglas fir-Larch lumber in all parallel layers and No. 3 Douglas fir-Larch lumber in all perpendicular layers
- V2: No. 1/No. 2 Spruce-pine-fir lumber in all parallel layers and No. 3 Spruce-pine-fir lumber in all perpendicular layers
- V3: No. 2 Southern pine lumber in all parallel layers and No. 3 Southern pine lumber in all perpendicular layers

Table 1. Allowable Design Properties^(a) for Laminations Used in SmartLam CLT (for Use in The U.S.)

| CLT Grade | Major Strength Direction | | | | | | Minor Strength Direction | | | | | |
|-----------|--------------------------|--------------------------------------|------------------------|------------------------|------------------------|------------------------|--------------------------|---------------------------------------|-------------------------|-------------------------|-------------------------|-------------------------|
| | F _{b,0} (psi) | E ₀ (10 ³ psi) | F _{t,0} (psi) | F _{c,0} (psi) | F _{v,0} (psi) | F _{s,0} (psi) | F _{b,90} (psi) | E ₉₀ (10 ³ psi) | F _{t,90} (psi) | F _{c,90} (psi) | F _{v,90} (psi) | F _{s,90} (psi) |
| APA V4 | 775 | 1.1 | 350 | 1,000 | 135 | 45 | 775 | 1.1 | 350 | 1,000 | 135 | 45 |

Recent CLT Research at UMaine

- **Hybrid SPF-s / LSL**
 - SPF-s in Maine: 390 million BF in 2015
 - Laminated Strand Lumber
 - Most massive timber product made in the U.S.?
 - Use two of Maine's strengths: Solid sawn lumber & wood composites

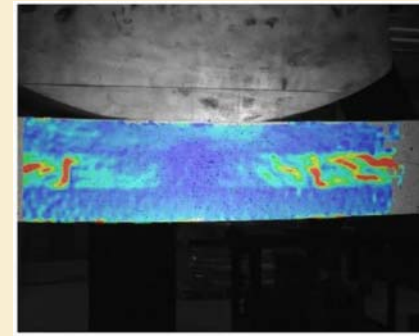
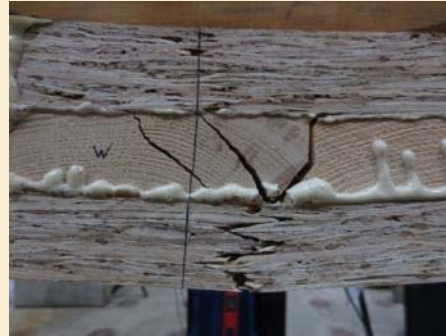


- **Blast resistant buildings (Woodworks)**



SPFs/LSL Hybrid CLT

- Results summary



- 22% higher mean bending stress at failure when LSL used in the core



STRUCTURAL PERFORMANCE OF HYBRID CROSS-LAMINATED
TIMBER PANELS USING LAMINATED STRAND LUMBER AND
NORTHEASTERN U.S. SPRUCE

Nicholas Willey¹, William Davids², Roberto Lopez-Anido³, Stephen Shaler⁴,
Douglas J. Gardner⁵, Russell Edgar⁶, Mehdi Tajvidi⁷

Blast Resistant CLT

- Interest in CLT hotels on Army bases with blast standards



Courtesy Lend Lease



Manufacturing Capabilities



- 4' x 8' Press
- 3' x 3' Press
- Roller coater
- Resin blenders
- Complete Strand Composites Pilot Line
- 90' and 230' Strong Floor

Testing Capabilities

- Testing of many aspects of CLT. Mechanical properties, adhesive durability, creep, etc...



- ISO 17025 Accredited Testing Laboratory

Conclusion

- CLT is a train that won't stop moving.
- UMaine is committed to moving CLT technologies forward
- Maine – Is it the right place for the next CLT plant in the U.S.?