CROSS LAMINATED TIMBER IN THE UNITED STATES: PAST, PRESENT, AND FUTURE

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Benefits of Mass Timber

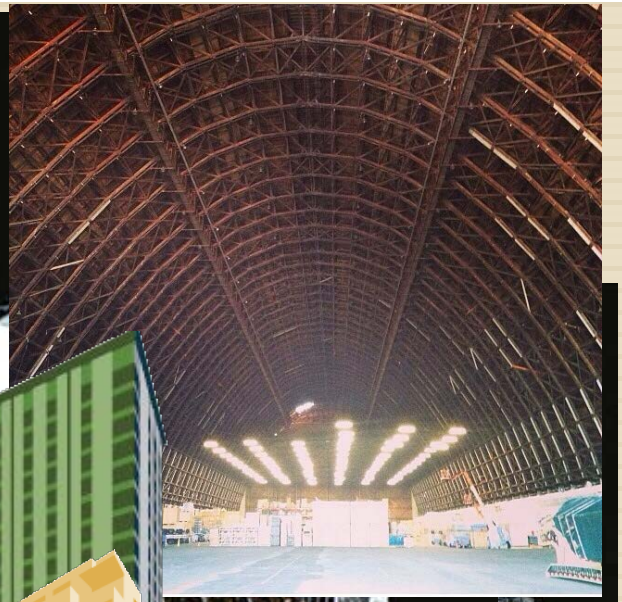
- Sustainable
- Low Carbon Footprint
- Rapid Construction
- Less Waste
- Thermal Performance/Energy Efficient
- Fire Protection
- Cost Effectiveness

TALL WOOD BUILDINGS !!!!!

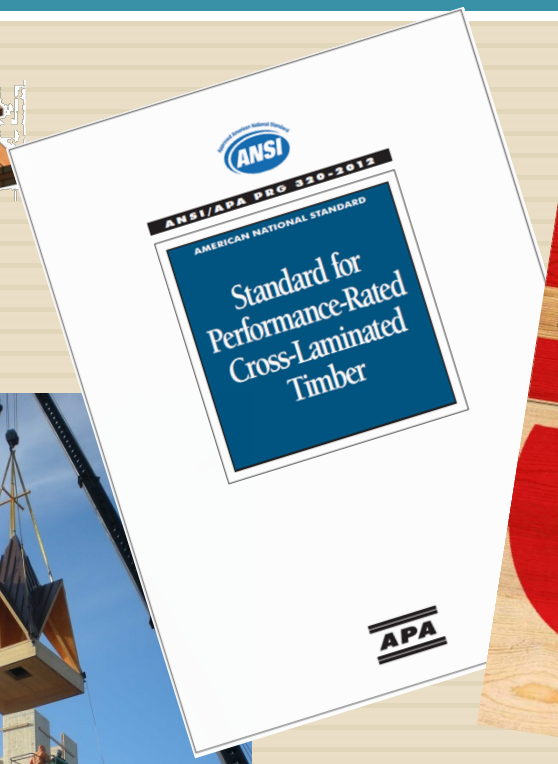
Tall Wood Buildings in US

Tall Wood Buildings in US

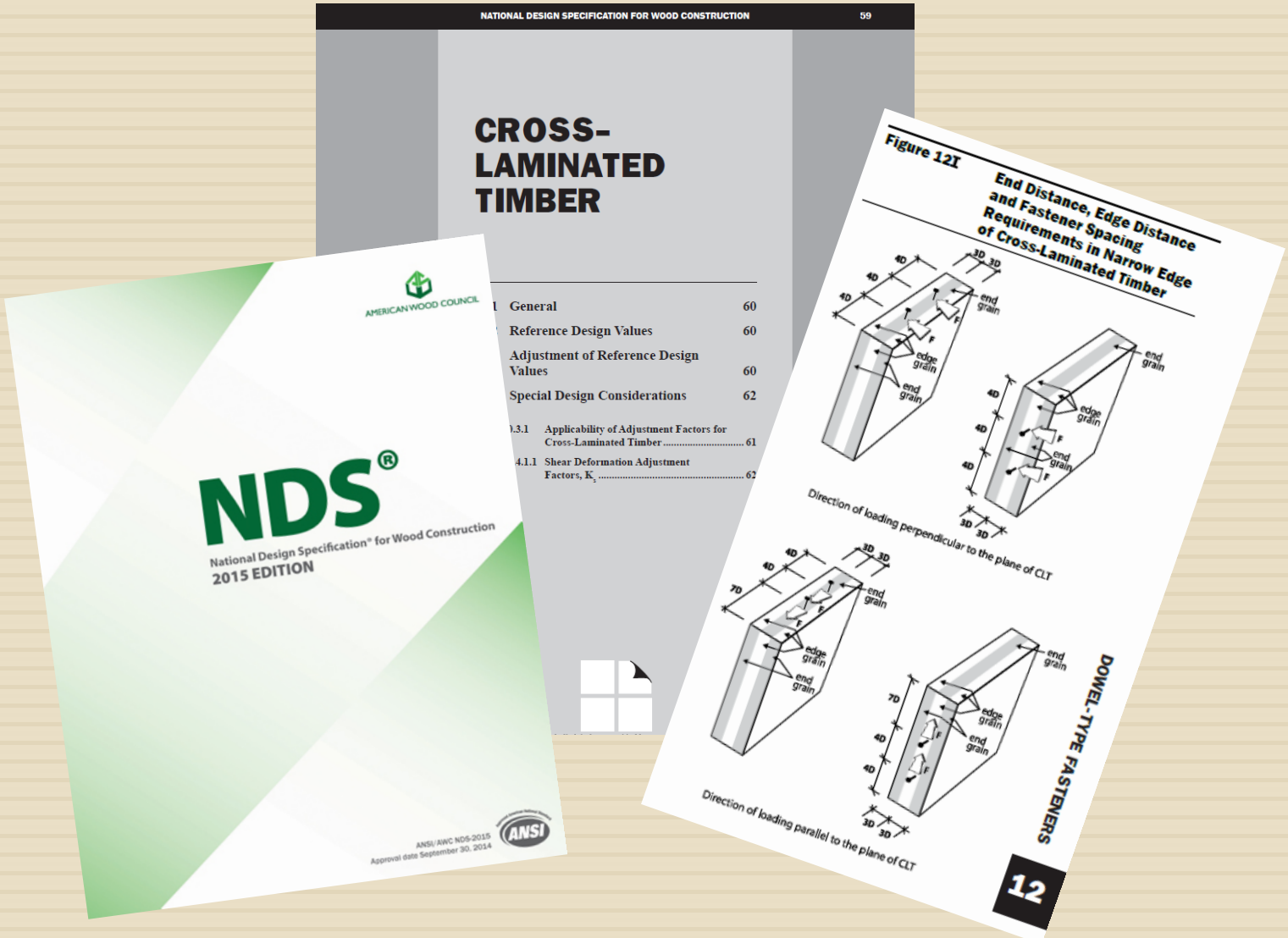
- 1,025' X 235’ footprint
- 183’ High



Recent Developments



Design Milestones



Design Milestones

- CLT is recognized as Type IV Construction

- ICC Board

Future of U.S. Tall Wood Buildings

Forum

Cross-Laminated Timber for Seismic Regions: Progress and Challenges for Research and Implementation

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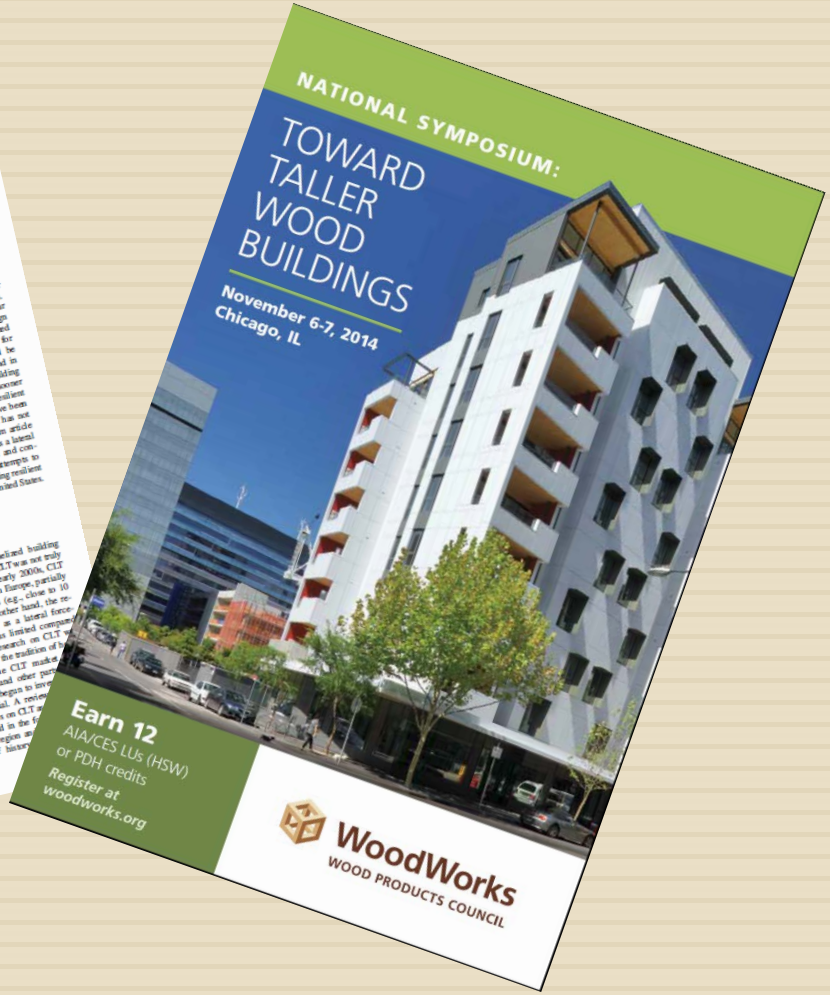
Introduction

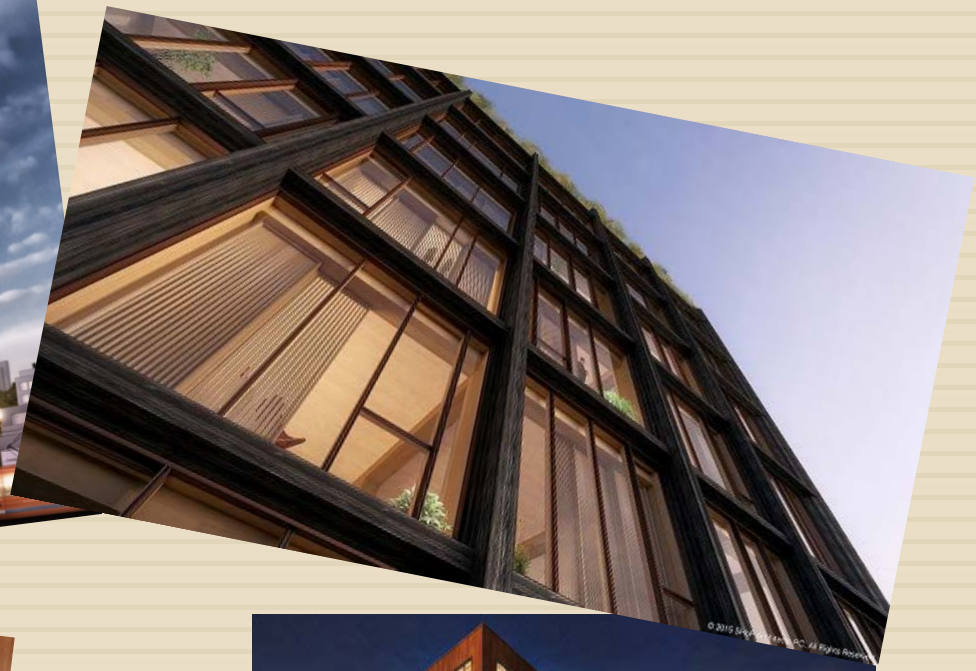
Cross-laminated timber (CLT) is a relatively new heavy timber construction material (also referred to as massive timber) that originated in central Europe and quickly spread to building applications around the world over the past two decades. Using dimension lumber typically in the range of 1× or 2× sizes) glue laminated with each lamination layer oriented at 90° to the adjacent layer, CLT panels can be manufactured into virtually any size (with one dimension limited by the width of the press), precut and pregrooved into desirable shapes, and then shipped to the construction site for quick installation. Panelized CLT buildings are robust in resisting gravity load (compared to light-frame wood buildings) because CLT walls are effectively like solid wood pieces in load bearing. The design of CLT for gravity is relatively straightforward for residential and light commercial applications where there are plenty of wall lines in the floor plan. However, the behavior of panelized CLT systems under lateral load is not well understood especially when there is high seismic demand. Compared to light-frame wood shear walls, it is relatively difficult for panelized CLT shear walls to achieve similar levels of lateral deflection without paying special attention to design details, i.e., connections. A design lacking ductility or energy dissipating mechanism will result in high acceleration amplifications and excessive global overturning demands for multistory buildings, and even more so for tall wood buildings. Although a number of studies have been conducted on CLT shear walls and building assemblies since the 1990s, the wood design community's understanding of the seismic behavior of panelized CLT systems is still in the learning phase, hence the impetus for this article and the tall CLT building workshop, which will be introduced herein. For example, there has been a recent trend to engineering to improve resiliency, which seeks to design a building system such that it can be restored to normal functionality sooner after an earthquake than previously possible, i.e., it is a resilient system. While various resilient lateral system concepts have been explored for concrete and steel construction, this forum article presents a review of past research developments on CLT as a lateral force-resisting system, the current trend toward design and construction of tall buildings with CLT worldwide, and attempts to summarize the societal needs and challenges in developing resilient CLT construction in regions of high seismicity in the United States.

CLT as Lateral Force-Resisting System: A Comprehensive Review

Although CLT has been in existence as a panelized building material for close to 20 years, construction using CLT was not truly widespread until about a decade ago. After the early 2000s, CLT construction began to see significant increase in Europe, partially because of its ability to enable taller buildings (e.g., close to 10 stories) using a sustainable material. On the other hand, the research and understanding of panelized CLT as a lateral force-resisting system in high seismic regions was limited compared to other lateral structural systems. Early research on CLT was mainly conducted in Europe, perhaps due to the tradition of [illegible] timber architecture and the interest in the CLT market [illegible] Recently, researchers in North America and other parts of the world, e.g., Asia and New Zealand, have begun to investigate the potential of using this sustainable material. A review of research studies published through 2014 that focus on CLT as a lateral force resisting system is summarized in the following. The lateral load resisting system is summarized in the following. The studies are organized by geographical region in the following, and research initiatives, providing a brief history [illegible]



Future of U.S. Tall Wood Buildings



US CLT Research

- USDA NIFA
- ARS
- FPL - CAWS
  - Performance Based Design of CLT
  - NEES-Soft CLT Repair Option
  - Seismic Design Parameters for CLT
  - Rocking Shear Walls (UW-Milwaukee)
  - Mechanically Laminated CLT
  - Instrumentation of Promega Building
  - LCA of CLT
  - Supply Chain Analysis
- Forest Service Wood Innovation Awards
- NEEScr - CLT

Where is the future?

Topics Areas for Workshop

- **Resistance to Lateral Loads**
- **Building Performance:**
  - **Durability**
  - **Sound,**
  - **Vibration**
  - **LCA**
- **Fire Safety**
- **Material Resources and Other Research Topics**

Tallest US Wood Structures