

Build on a Green Foundation

INNOVATION, CODE ADVANCE GREEN BUILDING

Whereas using steel increases emissions, using wood can reduce emissions.

✓ Innovative uses of engineered wood and heavy timbers that allow wood to replace steel in many applications will be on display at Cal Poly's Construction Innovations Center.

By Allan Hauck, Ph.D.

While using more wood to address climate change may seem counter-intuitive, breakthroughs in seismic technology and engineered wood stand to lead to significant reductions in greenhouse gas emissions.

Buildings require tremendous amounts of energy to construct and operate. Most of the energy used to extract, manufacture and transport steel comes from burning fossil fuels which increases emissions, however steel has strength characteristics that make it a common building material. Steel provides critical seismic capacity, but using steel has significant energy and environmental impacts.

Wood is renewable, recyclable and energy-efficient, but traditional wood construction offers limited seismic performance in mid- to high-rise structures. The energy to grow wood comes from the sun, but commercial building codes require steel for earthquake protection.

Now, however, innovation on display at Cal Poly's Construction Innovations Center (CIC) has overcome wood's seismic shortcomings, clearing the way to replacing steel with wood in certain applications and lowering a building's carbon footprint.

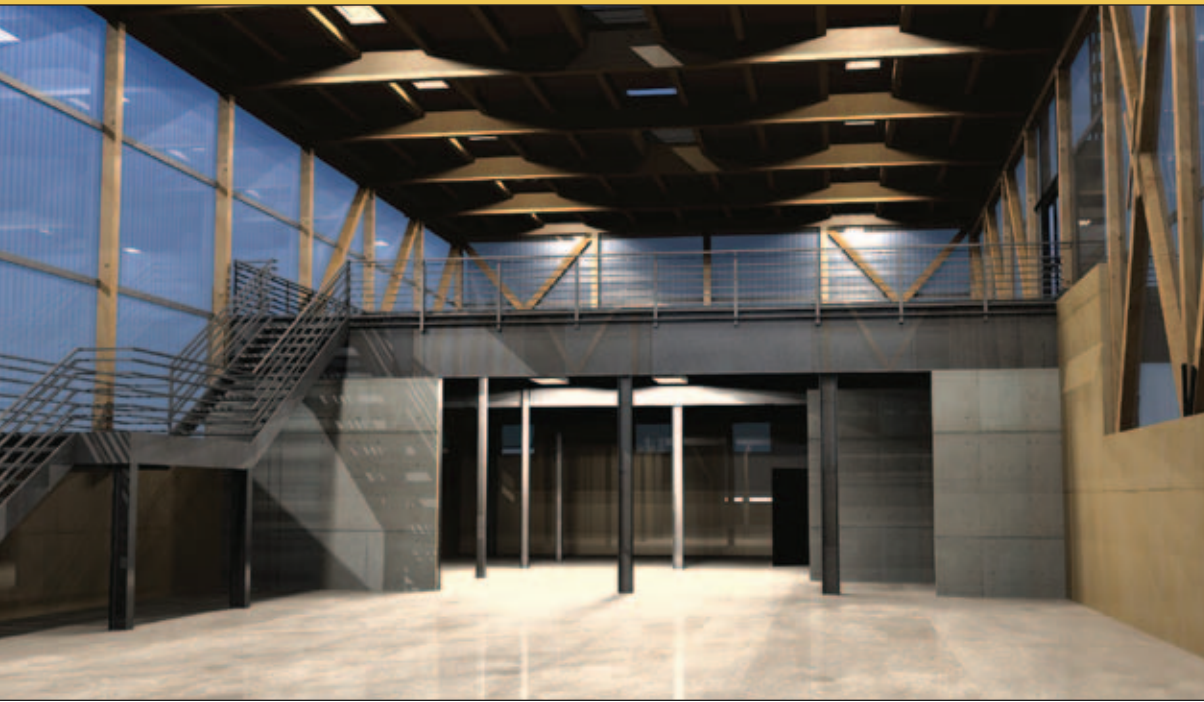
Stronger wood opens new opportunities

Engineered wood products have made wood stronger and become popular in architecture with large open spaces or exposed structural elements, such as schools, churches and mountain resorts. Manufactured products like glulams and paralams, which bind small pieces of wood to create beams, allow wood to be used across longer spans. We can show three different examples of heavy timbers in one building at the Simpson Strong-Tie Materials Demonstration Lab which is now under construction as the final component of the CIC.

The key to better seismic performance lies in an innovative connector system that accommodates the lateral movement associated with earthquakes. In the Simpson Strong-Tie Lab, heavy timbers are connected with spaced steel connectors and bolts designed to move with earthquake forces, essentially allowing heavy timber brace frames to provide effective seismic resistance. The connectors provide a ductile joint between the timber members, but don't break so the building can maintain its structural integrity in the event of an earthquake. After a severe earthquake, bolts can be replaced and structural integrity restored if necessary.

The technology employed at the CIC is not yet part of California's building code, but this kind of innovation often paves the way for code changes. Much like low-flow toilets needed to be proven in a lab before they became code-required and helped to conserve millions of gallons of water, seismic connectors now in





the lab may help to reduce greenhouse gas emissions by leading to code changes that allow wood to replace steel in a greater range of applications. Whereas using steel increases emissions, using wood can reduce emissions.

Green building standards typically focus on water and energy efficiency, though each of the more than 70 voluntary standards in the country has its own goals and influences. Most are points-based, with specific features in a building's design worth pre-determined values and point totals translating to levels such as gold, silver and bronze.

Green building becoming mandatory

Unlike most green building standards, California's CAL Green, which goes into effect January 1, 2011, is mandatory and based on an ANSI-approved process. Putting the standard through a rigorous independent review process removes bias and incorporates the best available science. CAL Green is one of the few green building standards to require life cycle assessment, the most comprehensive scientific methodology that can be applied to the selection of building materials and assemblies.

Because CAL Green is mandatory, it has greater potential to achieve water, energy and emissions savings than voluntary green building programs. Builders can only use materials approved by code, which means building codes can ultimately affect material selection and markets. Wood outperforms steel from an energy and emissions perspective, so it will be critical to capitalize on opportunities to replace

steel with wood as the building code evolves. Innovations now in the lab must be codified or we will miss out on an opportunity to realize significant carbon emission reductions.

Green building is driving advances in wood technology and seismic performance all over the world. In Japan, a full-scale, seven-story wood-framed condominium building not only survived a simulated 7.5 magnitude earthquake, it came through with only minor drywall damage. In British Columbia, the building code now allows wood framing in buildings up to eight stories tall.

California can go a long way toward reducing greenhouse gas emissions by making similar changes to its building code. CAL Green mandates reductions in energy and water use that lead to sustainability, lets builders advance green building without incurring certification costs and gives policymakers an alternative to tying green building targets to voluntary programs. ■



« Stronger engineered wood products allow wood to span greater distances and reduce dependency on fossil fuel intensive building materials like steel.

Putting the standard through a rigorous independent review process removes bias and incorporates the best available science.

» Innovations that start in the lab may drive green building and result in more energy-efficient structures with lower carbon footprints.