Blast Resistant Wood Structures

High strength, energy absorbing materials for blast and disaster resistant construction

In partnership with the US Army Corps of Engineers ERDC, the UMaine Composites Center developed blast-resistant structures with coated wood framing members, panels and subassemblies.

These blast-resistant construction materials are economically coated to enhance the construction material's ductility and energy dissipation capacity.

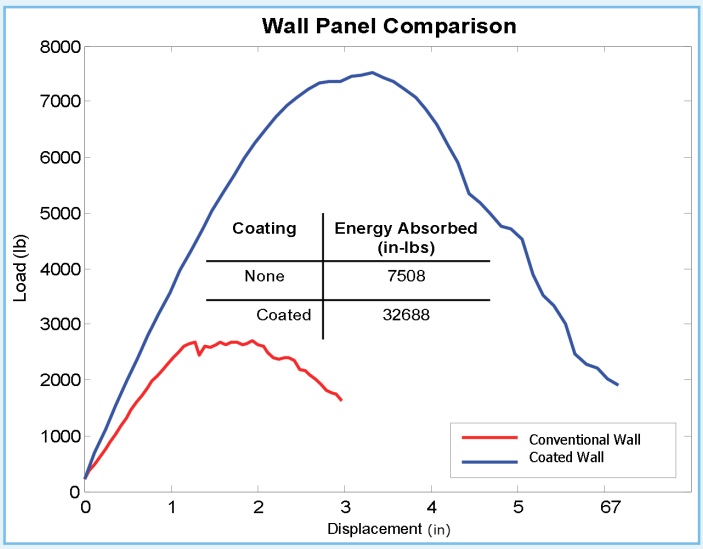
Laboratory and field testing have both indicated that these high performace, blast resistant materials are 6-7 times more energy absorbing than conventional wood and wood-based composites.

The system of panelized wall, roof and floor sections is lightweight enough to be handled manually and ductile enough to dissipate energy from blasts. The system meet and exceeds Unified Facilities Criteria for Inhabited Temporary Structures.

The images above show conventional construction (top) vs blast resistant construction (bottom) after truck bomb equivalent blast per UFC 4-0-10-01 DOD Antiterrorism Standards For Expeditionary Structures (Primary Gathering).

Advantages of Blast Resistant Wood Structures:

- **Superior blast resistance.**
- **Cost-efficiencies.**
- **Ease of assembly.**
- **Environmental durability.**
- **Rapid deployment.**
- **High strength to weight ratios.**
- **Protection from moisture absorption, termites, ants, and biodegradation.**



Uncoated wall panel fails in tension quickly, thus allowing little energy absorption. Coated wall panel assemblies show 2.4 times more strength and 4.4 times more energy absorption than uncoated panels.

Applications of Blast Resistant Wood Structures:

- **Improved earthquake, hurricane and tornado resistance in residential and commercial construction.**
- **Military force protection.**
- **Protection of government buildings for homeland security.**
- **Reinforced structures for corrections facilities.**

For more information, contact: Dr. Habib Dagher, P.E. hd@maine.edu +1 (207) 581-2123
Learn more at composites.umaine.edu

Lab Testing of Blast Performance


Test setup for 2x4 studs


Failure mode of uncoated stud


Failure mode of coated stud

Coated 2x4's have 2.3 times more strength and 6.7 more energy absorption than conventional #2 grade studs.

Coated wall panel assemblies show 2.4 times more strength and 4.4 times more energy absorption than uncoated panels.

The coating unlocks energy that exists inside the wood in a manner that has not been used before. This allows otherwise brittle wood to become ductile.

Wall Panels

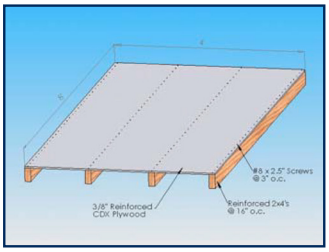
The 4'x8' walls have coated studs spaced at 16" o.c and are fastened to coated plywood with #8x2.5" screws.

Coated Studs

Conventional No. 2 grade studs are coated to optimize bending strength and significantly reduce variability resulting in better predictability.

Connection System

In reinforced wood framed buildings, connections of walls to the floor and roof are weak links. To take advantage of the increased strength and ductility of the coated wall panels and studs, simple connections which are strong and flexible enough to force flexural failure of the panels have been developed.



Ease of Assembly: A 12'x20' blast-resistant modular structure for force protection may be easily installed. After the foundation is level, the structure takes 90 minutes for 12 personnel to install.

Field Testing at Fort Polk, Louisiana, July/August 2007

After a 33' stand off blast, uncoated panels (left) versus coated panels (right.)

Left: Blast-resistant modular structure for force protection remained intact after 75' standoff blast.