


2011 Wood Structures Symposium
UMass, Amherst

Sustainable Building Materials: Emerging Technologies

By
Dr. Pegg L. Clouston, Ph.D., M.A.Sc., P.Eng.
Associate Professor
Building and Construction Technology
Dept. of Environmental Conservation
clouston@eco.umass.edu



Environmental Conservation



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Emerging technologies

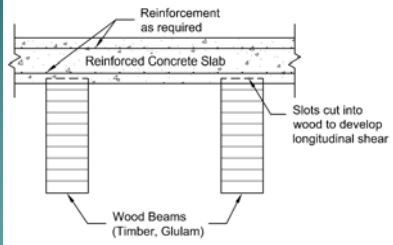
- Wood-concrete composites
- Laminated Bamboo Lumber




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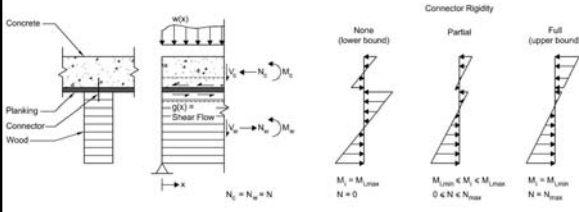
Wood-concrete composites

- Hybrid composite construction method
- Used since 1930s (timber bridges)



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Composite action



- Partial composite action → depends on fastener
- Analysis: Eurocode 5
– Clouston and Schreyer (2008) ASCE Practice Periodical on Structural Design and Construction, Vol. 13, No. 4

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Benefit of composite action

Wood	Wood-concrete composite	
		
	Strength	Stiffness
→	Increase up to	Increase up to
	2 times	4 times

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Commercial shear connectors

Bertsche connector



SFS Intec
VB Screws

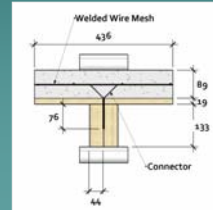
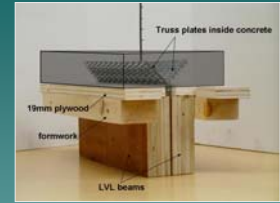


HBV system

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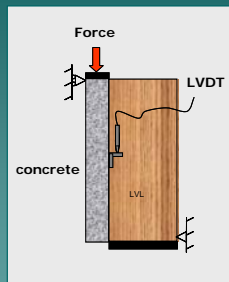
UMass Truss-Plate System

- ◆ Commercial truss plates
- ◆ 2 side-by-side 1.9E ES LVL
- ◆ 19mm plywood permanent formwork



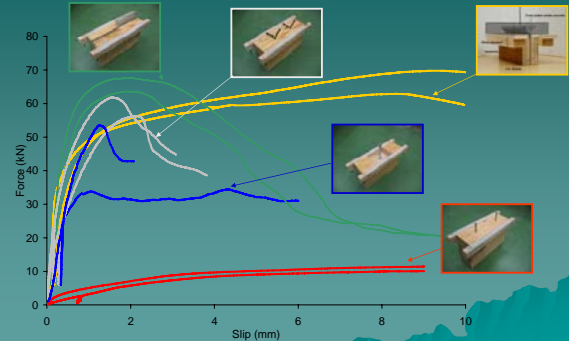
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Push out test setup



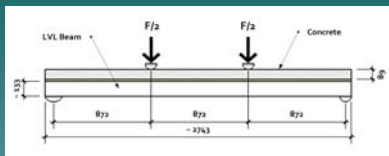
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Load-slip results

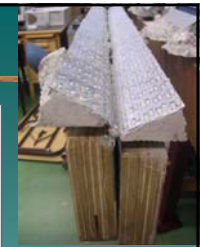
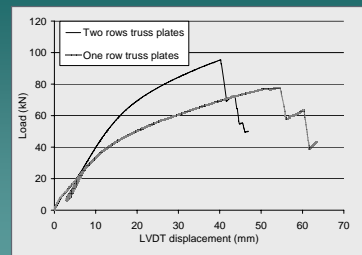


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Beam Tests Setup



Beam Test Results



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WCCs and Mill Restoration



MASS MoCA – Museum of Contemporary Art

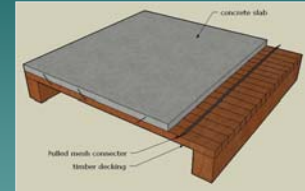
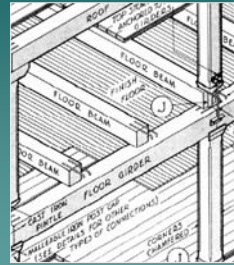
* reuse of bricks, natural stone, timber



19th century paper mill

WCCs and Mill Restoration

Standard mill construction



- Clouston and Schreyer (2011) Journal of Constructed Environment

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Wood-concrete bridge project

- ◆ Long-term performance in extreme climates



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UMass Research on bio-based composites

- ◆ Bamboo



- ◆ fastest growing plant currently known
- ◆ 3-8 years to maturity
- ◆ Specific strength greater than steel or wood

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Biobased materials are the future

- ◆ Wood, hemp, flax, bamboo + biopolymers
- ◆ Automotive, sport, building products
- ◆ Technological road map for U.S. DOE
 - 10% of all basic chemical building blocks will be renewable sources by 2020
 - **50% by 2050**



Laminated wood bike frame
Sylvan Cycles

Laminated Bamboo Lumber study



- Mahdavi, Clouston and Arwade (2011)
Journal of Materials in Civil Engineering, Vol. 23, No. 7

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Student projects ...



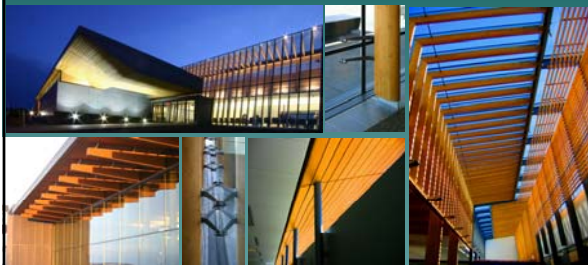
More information ...

Contact me: *Dr. Pegg L. Clouston*
clouston@eco.umass.edu



Wood engineering

- ◆ More structurally demanding applications today



Prince George Airport, British Columbia, Equilibrium Engineering Inc.

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Contemporary uses of wood ...



Richmond Olympic Speed Skating Oval, British Columbia, 2010

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