“Trees have the yearning to live again, perhaps to provide the beauty, strength and utility to serve man and even to become an object of great artistic worth.”
-George Nakashima

Cheryl A. Ciecko
ALA, AIA, LEED AP, CSI, GGP
Senior Technical Director - WoodWorks

Cheryl A. Ciecko
ALA, AIA, LEED AP, CSI, GGP
WoodWorks - Senior Technical Director / Architect
The Wood Products Council

Learning Objectives
At the end of this program, participants will be able to:

1. Examine the relationship between wood and human health through a recent scientific study, and review of concepts of biophilia.
2. Evaluate cost studies of recent educational projects using wood structure with case study examples.
3. Dispel forestry myths and discover the facts regarding North American Forests.
4. Consider a variety of case study examples of innovative projects for learning, healing, and inspiration.
Learning Objectives

- Biophilia
  - History
  - Learning
  - Healing
- Costs - Financial
- Costs – Environmental
  - Forests
- Aesthetics

History of Wood Structures

- Nara, Japan (c.711)
- The Fairbanks House (c.1636)
- Gol Stave Ch (c.1235)
- Parlange Plantation (c. 1750)

Wood Multi-story Structures

- Wood Construction 1914 to 1917

- Many Glacier Lodge, Glacier National Park, Montana

Moving forward... means looking back.

- Many Glacier Hotel, Glacier Nat’l Park, MT

Butler Brothers Building 1906-1908

- Butler Square today...

- 9 Stories  500,000 s.f.

Industrial Revolution

- Alternating current
- Internal combustion engines
- Refrigeration/canning
- Mass produced steel
- Telephones
- Soap

Design for the 20th Century

- Man conquering nature and the elements.
- Increase in the separation a building provided from the world around it

Buildings devoid of nature

Design for the 21st Century?

- 88% of life spent indoors
- Environments associated with stress

Biophilia = “love of living systems”

“the connections that human beings subconsciously seek with the rest of life”

Social psychologist Erich Fromm/Edward Wilson 1980s

Emotional connection...

when people see and touch wood...

Evidence Based Design - Healthcare

Based on study of room views on patient outcomes

Healthcare facilities in Canada experienced positive patient response due the humanism incorporated in the architecture of the facilities

Schools in Japan - built with wood because students respond positively

Daylighting  Plants  Views
Recent Study – Univ. of B.C. / FPI

David Fell, PhD

Wood and Human Health

Research objectives:

• Does wood reduce stress in the built environment?

Conclusions

1. “...the presence of visual wood surfaces in a room lowered sympathetic nervous system (SNS) activation.

2. Wood is a new tool for practitioners of evidence based design

Wood = Health Benefits

• “Stress, as measured by sympathetic nervous system activation, was lower in the wood room in all periods of the study.”

Select Health Benefits of Nature

Healthcare

- lower pain perception
- faster recovery
- fewer reported illnesses
- fewer sick days

Schools

- greater attention
- greater creativity
- lower aggression
- better interpersonal relations
- Decreased absenteeism

Evidence Based Design

Evidence Based Design & Daylighting
Select Health Benefits of Nature

Retail
- Draw shoppers
- Boost Sales
- Shoppers stay longer
- Shoppers visit more frequently
- Improved image perception

2012 Terrapin Bright Green LLC
Evidence Based Design & Daylighting

Building Schools with Wood Design

Shirayama School, Takefu, Fukui

Ben Nakamura
Architect/Professor
Kogakuin University

Why Wood?: Learning Atmosphere

Cumulated fatigue experienced by teachers

Japanese Study – in Wood Schools teachers experience less fatigue.

Fatigue Experienced by Students

Japanese Study

Three prisons, one school...

MO State Penitentiary
Prison-Styria, Austria

Evelyn Grace Academy, London, UK
Seodaemun Prison Hall, Seoul, Korea
Evelyn Grace Academy, London

“Jagged angles of bare concrete, glass and silver spray painted aluminum…”

Architect: Zaha Hadid

“…wanted a grown-up building. Neutral & functional rather than playful and childish.”

Richmond Christian School, BC

…and a non-institutional environment that would be visually warm and welcoming.

“non-institutional…visually warm & welcoming. “

Integration of Biophilic Materials

Users connect with the structure --- not just the material

Creating… true biophilic design

Surrey City Center- StructureCraft Builders, B.C.
Learning Objectives

- Biophilia
  - Learning
  - Healing
- Costs – Financial
  - Durability
- Costs – Environmental
  - Forests
- Aesthetics

EL DORADO HIGH SCHOOL
GIVING STUDENTS THE “WOW” THEY DESERVE
Feel Good About Cost!

Budget Targets met w/ Wood

“...our response was to look at other framing types. That's where we found considerable savings.”

J. Richard Brown, Engineering Consultants, Little Rock

El Dorado High Schools – $43 million

322,500sf
Converted 40% to wood - saving $2.7 mil.

Saved 5% of original $60 million budget.

Compression ring = 16 ft. dia.

5 ft. deep glulam beams w/ unique steel tension rod system across 55 ft space...

Construction Materials Price Index
Change in producer prices. December 2003 = 100

CLASSROOMS CONVERTED TO WOOD

$134 per s.f.

521,760 sq ft of plywood
632,928 bd ft of dimension lumber
230,000 bd ft of glulam beams
134,376 linear feet of wood joists

Main Street Corridor – 24 ft wide

2,200 seat basketball arena

$60k saved from steel to wood, 165’ span

Cost Benefits – Materials & Labor

<table>
<thead>
<tr>
<th>Size</th>
<th>Length</th>
<th>Price</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>2x4</td>
<td>8’</td>
<td>$2.25</td>
<td>SPF Canadian Studs</td>
</tr>
<tr>
<td>2x4</td>
<td>9’</td>
<td>$2.95</td>
<td>SPF Canadian Studs</td>
</tr>
<tr>
<td>2x4</td>
<td>10’</td>
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<tr>
<td>3 5/8</td>
<td>8’</td>
<td>$4.16</td>
<td>20 ga Metal Stud (.52 lin ft)</td>
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<td>20 ga Metal Stud (.52 lin ft)</td>
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<tr>
<td>3 5/8</td>
<td>10’</td>
<td>$5.20</td>
<td>20 ga Metal Stud (.52 lin ft)</td>
</tr>
<tr>
<td>2x6</td>
<td>12’</td>
<td>$7.68</td>
<td>Sel Str D Fir (.64 lin ft)</td>
</tr>
<tr>
<td>6</td>
<td>12’</td>
<td>$8.76</td>
<td>20 ga Metal Stud (.73 lin ft)</td>
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</table>

WHAT ABOUT INSTALLED COSTS?

Totem Lumber - Chicago Prices – April 2012

EL Dorado High School – WOW!

$2.7 million savings due to use of wood framing!

Newport Elementary School

INFORMATION PROVIDED BY ARCHITECT JERRY BRACKETT
Newport Elementary School

Area = 124,632 sf

INFORMATION PROVIDED BY ARCHITECT JERRY BRACKETT

Initial Estimates Show Little Savings

<table>
<thead>
<tr>
<th>PROJECT NAME</th>
<th>Newport Elementary School</th>
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<tbody>
<tr>
<td>DATE</td>
<td>10/25/2008</td>
</tr>
<tr>
<td>ESTIMATE AMOUNT</td>
<td>$1,981,344</td>
</tr>
<tr>
<td>BUILDING AREA</td>
<td>124,632 sf</td>
</tr>
<tr>
<td>COST / SF</td>
<td>$134.84</td>
</tr>
</tbody>
</table>

Estimated Steel Cost - $143 / SF
Estimated Wood Cost - $142 / SF

Actual Cost was $114.20 / SF

INFORMATION PROVIDED BY ARCHITECT JERRY BRACKETT

Roof System

- Closed cell polyurethane insulation R-21.4
- Reduced R-value due to reduced air infiltration provided by closed cell insulation
- If exposed closed polyurethane requires intumescent coating, use 5/8" type X gypsum board
- No sprinkler system required - Volume between "I" joists less than 160 cubic feet; NFPA 13, 8.15 5/8" type X gypsum board provides more protection for wood roof construction

INFORMATION PROVIDED BY ARCHITECT JERRY BRACKETT

Feel Good Good About Durability

- What are the most durable building materials?
- Are concrete and steel buildings most durable?

INFORMATION PROVIDED BY ARCHITECT JERRY BRACKETT

Minneapolis Demolition Survey

Wood buildings are the oldest to be demolished...

INFORMATION PROVIDED BY ARCHITECT JERRY BRACKETT

Structural System = Long Useful Life?

- No Relationship!

INFORMATION PROVIDED BY ARCHITECT JERRY BRACKETT

Reasons for demolition
- Changing Land values
- Lack of suitability
- Lack of maintenance

INFORMATION PROVIDED BY ARCHITECT JERRY BRACKETT
**Age of demolished steel & concrete buildings?**

Less than 50 years!

*Fire Damaged Plant – Lebanon, PA  Cabrini Green Housing – Chgo*

**Durable materials = longest service life?**

Fulton County Stadium, Atlanta, Georgia

1963 - 1997

**Modern Timber Bridges – 100 yr. Life!**

*Fulton County Stadium, Atlanta, Georgia*

**Durable Walls**

High Traffic Areas – Wood Walls?
- Abuse resistant gypsum
- Wood panel backing

**Designing for Durability**

*Interior Wall Corridor Interior Wall Classroom Exterior Walls and Bathrooms*

**Glulam Top & End Flashing**

*www.apawood.org*
Glulam Connection Details

St. Cloud Regional Airport, MN
Architectural Alliance
Minneapolis, MN
Photos by SEH Inc.

Flashing to guard against moisture...

Blackfeet Community College - MT

More information...

Feel Good About Fire Performance

Heavy Timber resists fires through charring and maintains strength

www.apawood.org
**Heavy Timber Fire Design**

Char protects the inner core.

![Char protects the inner core.](http://www.awc.org/pdf/tr10.pdf)

**Fire Resistive Construction Resources**

Superior Fire Resistance

![Superior Fire Resistance](http://www.atc-glulam.org/shopcart/Pdf/superior%20fire%20resistance.pdf)

---

**Learning Objectives**

- Biophilia
  - Learning
  - Healing
- Costs — Financial
  - Durability
- Costs — Environmental
  - Forests
- Aesthetics

**Carbon – the #1 Environmental issue**

[www.calforestfoundation.org](http://www.calforestfoundation.org)

---

**How Trees “Absorb” Carbon Dioxide**

Photosynthesis

\[
\text{SUN} + \text{CO}_2 + \text{water} \rightarrow \text{sugar} \rightarrow \text{O}_2 \rightarrow \text{C}_6\text{H}_{12}\text{O}_6
\]

**What is wood?**

Wood is 50% carbon by weight

\[
\text{sugar} \rightarrow \text{C}_6\text{H}_{12}\text{O}_6 \rightarrow \text{(C}_6\text{H}_{10}\text{O}_5)_n
\]
**Carbon Stored**

**Sustainable forestry**

Clearcutting ≠ Deforestation in sustainable forestry.

**Natural Events**

Deforestation NOT caused by Logging.

**Deforestation**

- Deforestation NOT caused by Logging.
- Agriculture & Cattle Ranching

Agriculture

Cattle Ranching 65-70% -

Logging 2-3%

**Feel Good About Our Forests**

The State of America’s Forests

**Specify Certified Wood Products**

Forest Land Ownership

Private = 57%

Public = 43%
Mountain Pine Beetle Epidemic

Coal Mining = Deforestation

Feel Good about Carbon Savings

Learning Objectives

- Biophilia
  - Learning
  - Healing
- Costs – Financial
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- Costs – Environmental
  - Forests
- Aesthetics

The Uses for Wood are Endless
Wood in Healthcare/ Schools

Gilroy High School, CA

Chase Lake Elementary – Edmonds, WA

Glulam for innovative designs

Univ. of British Columbia – Michael Smith Building

Photos courtesy McFarland Marceau Architects Ltd.
Ann Reid Early Childhood Center

Wight & Company, Darien, IL

Albert Lea High School, MN

Case Study: APA Lit. #8115
Architect/Eng.: DLR Group,
Minneapolis, MN
Size: 270,000sf built in 2000
Cost: $27 million

University Facilities

Roosevelt University, CA
Bethel University, MN

Crawford Bay Elementary-
Secondary School

Crawford Bay, BC

Architect:
Witmar Abele, KMBR
Architects Planners Inc.

Kroon Hall, Yale University
School of Forestry & Environmental Studies, New Haven, CT

Architect: Centerbrook Architects & Planners LLP, and Hopkins Architects
Beaverton Library, Oregon

Whistler Library, Whistler, B.C.

Whistler Library, Whistler, B.C.

Healthcare

Thunder Bay Regional Health Sciences Center

Herrington Recovery Center – Oconomowoc, WI

2010 Green Building Award

Owner: Rogers Memorial Hospital
Arch: TWP Architecture
S.E.: Puliara Wirth Torke, Inc.

Willson Hospice House – Albany, GA

Perkins & Will, Atlanta, GA
Jim Roof Creative Photography

Photos: Tom Davenport
Surrey Family YMCA

Banff Recreational Center

Photos courtesy of Structurlam

Myrick Hixon EcoPark Building - WI

Whole Trees Architecture, Stoddard, WI

Performing Arts: Royal Conservatory of Music, Koerner Concert Hall
Toronto, ON

Transportation: Canada Border Service Agency Building
Fort Erie, ON

Architect: Kuwabara Payne McKenna Blumberg Architects

Architect: NORR Limited Architects and Engineers

Engineers: Blackwell Bowick Partnership Inc.

Jackson Hole International Airport
Jackson, Wyoming
Architects: Gensler
Project Type: Airport Expansion & Renovation

Jackson Hole International Airport

2010 - LEED Silver Certification
Building Size: 115,578 s.f.
Const. Cost: $30.6 million
Learning Objectives

- Biophilia
  - Learning
  - Healing
- Costs – Financial
  - Durability
  - Fire
- Costs – Environmental
  - Forests
- Aesthetics

The benefits of using wood...

- Cost
- Faster construction time
- Fire Resistance
- Aesthetics
- Sustainability

BIOPHILIA

SCHOOL INITIATIVE
- Quarterly E-Bulletins
- Webinars
- Case Studies
- Technical Assistance - FREE

Mid-Rise Initiative
Marseille Condos
Seattle, WA
PB Architects

Free Technical Assistance

Wood in Healthcare/ Schools

How can you help us continue to offer and improve these programs??

Questions?

THANK YOU!!!

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cheryl@woodworks.org

www.naturallywood.org

www.woodworks.org