Design Trends for Raising Your Game!

Exceeding Cost and Performance Objectives with Wood Framed Schools

[Name]
[Title]
WoodWorks – Wood Products Council
Goals for Designing School Facilities

• Enhance learning environment
  • Effective acoustics, lighting, ventilation, hypoallergenic
  • Calming aesthetics

• Minimize up front cost
  • Lower cost materials
  • Reduced labor time

• Reduce long term costs
  • Energy efficient
  • Low maintenance

• Encourages school pride
  • Reduce Environmental Impact
  • Unique Design
  • Expressive Aesthetics
Virtual Tour of School Facilities

- Duke Lower and Middle Schools, Durham, NC
- James Park Elementary, BC
- El Dorado High School, El Dorado, AR
- Bethel School District, Tacoma, WA
- Rosa Parks Elementary, Redmond, WA
- Crawford Bay Elementary-Secondary, CA
- Cayucos Elementary, Cayucos, CA
- Minch Elementary, Las Vegas, NV
Duke Lower and Middle School

Location: Durham, NC

Completed: 2009

Architect: DTW Architects and Planners
Size:
3 Middle School Bldgs.
2 Lower School Bldgs.

Cost:
Middle School $130/sf
Lower School $112/sf
“Stress, as measured by sympathetic nervous system activation, was lower in the wood room in all periods of the study.”
Biophilia

WOOD IN HUMAN ENVIRONMENT: RESTORATIVE PROPERTIES OF WOOD IN THE BUILT INDOOR ENVIRONMENT
Source: David Robert Fell report; Wood and Human Health fact sheet
Rosa Parks Elementary School

Location: Redmond, WA

Completed: 2006

Size: 66K sf
550 Students

Architect: Mahlum Architects
Learning Atmosphere

Japanese Study

Student impressions of school buildings by factor scores

Approaching the Design and Planning for School Capital Program with Wood, Mikio Moronuki, Director, Research Center for Educational Facilities, Tomoe Corporation, Japan
Learning Atmosphere

Japanese Study

Cumulated fatigue experienced by teachers

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Crawford Bay Elementary-Secondary School K-12

Location: Crawford Bay, BC, Canada

Completed: 2004

Architect: KMBR Architects Planners
Project: James Park Elementary, Port Coquitlam, BC
Completed: 2012
Size: 2 story
370 Students
Day Lighting and Ventilation
Richmond Christian School K-12

Location: Richmond, BC Canada

Completed: 2008

Size: 38K sf

Architect: KMBR Architects Planners
El Dorado High School

Location: El Dorado, AR

Completed: 2011

Size: 322.5 K sf
1600 students

Cost: $134/sf

Architect: CADM Architecture
Designers accustomed to steel and concrete often design buildings of Type IIA or IIB construction. However, nearly identical height and areas can be achieved with wood framing in Type IIIA or IIB.
“We did a cost analysis and found that we were able to save about $60K by changing the roof construction from steel to wood.” - Dunn
Carbon Benefits

- Volume of wood used: 4,340 cubic meters / 153,140 cubic feet of lumber, panels, and engineered wood
- U.S. and Canadian forests grow this much wood in: 13 minutes
- Carbon stored in the wood: 3,660 metric tons of CO₂
- Avoided greenhouse gas emissions: 7,780 metric tons of CO₂
- **TOTAL POTENTIAL CARBON BENEFIT:** 11,440 metric tons of CO₂

**EQUIVALENT TO:**
- 2,100 cars off the road for a year
- Energy to operate a home for 970 years

Source: US EPA
Carbon Benefits
“Nationwide, we appear to have a drop-out issue in high schools, and we’re not immune to the problem in El Dorado. We wanted something that would attract young people—not only with the course offerings, curriculum and activities, but with an appealing facility” - Dunn
Cayucos Elementary
K-8
Location: Cayucos, CA
Completed: 2009
Architect: RRM Design Group
Construction Speed
Bethel School District, Tacoma, WA

Architect: Erickson McGovern

Engineer: PCS Structural Solutions

Contractor: Babbit Neuman Construction Company
Project: Clover Creek Elementary K-6
Completed: 2012
Size: 63K sf
645 students
Cost: $197/sf
Lower Construction Costs

## Bethel School District by the Numbers
- 215 square miles in unincorporated Pierce County, near Tacoma, Washington
- 17,500 students
- 17 elementary schools
- 56 middle schools
- Three high schools
- One alternative school
- Pierce County Skills Center
- Bethel Learning Center

*Source: Bethel School District, 2012*

### Comparing the Cost of New Construction

<table>
<thead>
<tr>
<th>BSD Elementary Schools</th>
<th>Completion Date</th>
<th>Total Square Feet</th>
<th>Construction Cost per Square Foot</th>
<th>Average Cost*</th>
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</thead>
<tbody>
<tr>
<td>Nelson Elementary</td>
<td>2009</td>
<td>63,495</td>
<td>$241.73</td>
<td>$240.12</td>
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<tr>
<td>Frederickson Elementary</td>
<td>2009</td>
<td>64,569</td>
<td>$218.05</td>
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<tr>
<td>Clover Creek Elementary</td>
<td>2012</td>
<td>63,121</td>
<td>$197.70</td>
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</table>

<table>
<thead>
<tr>
<th>BSD Junior High/Middle Schools</th>
<th>Completion Date</th>
<th>Total Square Feet</th>
<th>Construction Cost per Square Foot</th>
<th>Average Cost*</th>
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<tbody>
<tr>
<td>Liberty Middle School</td>
<td>2009</td>
<td>98,431</td>
<td>$222.99</td>
<td>$269.32</td>
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<tr>
<td>Spanaway Middle School</td>
<td>2008</td>
<td>100,899</td>
<td>$187.26</td>
<td></td>
</tr>
</tbody>
</table>

*Source: Office of Superintendent of Public Instruction, Washington State

*Average Construction Cost for New Schools in Western WA, 2008 - 2012*
Project: Bethel Learning Center

Completed: 2012

Size: 5.5K sf

Cost: $349/sf
Project: Nelson Elementary
Completed: 2009
Size: 63.5K sf
600 Students
Cost: $241/sf
Service Life and Durability

Source: Demolition Study – Forintek Canada Corporation, Vancouver, B.C., Canada
Service Life and Durability

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Service Life and Durability

Demolition study (service life of buildings)

- Findings suggest no significant relationship between the structural system and the actual useful life of the building.

Reasons for demolition:

1. Changing land value
2. Building does not meet current needs
3. Lack of maintenance of non-structural components

Lessons:

- Determine realistic service life
- Find balance between building’s intended use and adaptability
  - Buildings designed for all purposes don’t lend themselves to efficient/sustainable design
Project: Thompson Elementary K-6
Completed: 2006
Size: 65K sf
550 Students
Cost: $169/sf
Improved Energy Efficiency

“Bethel spends 34% less per student than the average for all peer districts”

<table>
<thead>
<tr>
<th>DISTRICT</th>
<th>Issaquah</th>
<th>Bethel</th>
<th>Everett</th>
<th>Highline</th>
<th>Bellevue</th>
<th>Northshore</th>
<th>Edmonds</th>
<th>Puyallup</th>
<th>AVERAGE*</th>
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<tbody>
<tr>
<td>FTEs**</td>
<td>16,557</td>
<td>17,016</td>
<td>17,744</td>
<td>17,852</td>
<td>18,156</td>
<td>18,444</td>
<td>19,802</td>
<td>20,623</td>
<td>19,380</td>
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<tr>
<td>Utility Cost</td>
<td>$4,694,760</td>
<td>$2,743,345</td>
<td>$4,200,651</td>
<td>$5,478,627</td>
<td>$6,067,571</td>
<td>$4,070,702</td>
<td>$4,004,658</td>
<td>$5,437,839</td>
<td>$4,718,712</td>
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<tr>
<td>Utility Cost/FTE</td>
<td>$284</td>
<td>$161</td>
<td>$237</td>
<td>$307</td>
<td>$334</td>
<td>$221</td>
<td>$202</td>
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<td>$244</td>
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<td>High Schools</td>
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<td>Middle Schools</td>
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<td>Elementary Schools</td>
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<td>30</td>
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<td>32</td>
<td>32</td>
</tr>
</tbody>
</table>

Source: 2011/2012 budgets, Office of Superintendent of Public Instruction, Washington State
*Average includes data for three school districts not shown
**Full-time equivalent

Between 2004 and 2011, BSD reduced kilowatt usage by more than 7.6 million kilowatts and saved $4.3 million in utility costs—equivalent to the cost of electricity for 15 of the District’s elementary schools for one year.
Project: Spanaway Middle School
Grade 7-9
Completed: 2008
Size: 101K sf
1000 Students
Cost: $187/sf
Jacob E. Manch Elementary

Location: Las Vegas, NV

Completed: 2009

Size: 70K sf

Architect: SSA Architecture
Project: Samuel Brighouse Elementary, Richmond, BC

Completed: 2011

Size: 50.6K sf
505 Students

Architect: Perkins + Will
Project:
The Brief Open Academy, Norwhich, UK
Completed: 2011
Size: 102K sf
Project: Franklin Elementary, Franklin WV
Completed: Under Construction
Size: 40K sf 2 Stories
Architect: MSES Architects
Questions?

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