

Greening the Structural Systems of Buildings

What are the gaps and how can graduate
education address them?

Research team

Christine Theodoropoulos, UO Architecture
Chris Knowles, OSU Wood Science and Engineering
Jennifer Allen, PSU Sustainable Industries
Corey Griffin, PSU Architecture
Brian Lockyear, UO Architecture
Kate Kamke, OSU Wood Science and Engineering

Project sponsors

Oregon BEST
Oregon Forest Resources Institute
Oregon State University
Portland State University
University of Oregon

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Project objectives

- 1) Identify **informational and material gaps** that limit the ability of building design and construction professionals in Oregon to use environmentally responsible materials in the structural systems of buildings
- 2) Develop a **green building materials curriculum** for graduate and continuing professional education

Project approach

Interviews, focus group meetings and a curriculum development workshop with over 40 of Oregon's green building experts.

Performance criteria

How do design teams establish performance criteria for materials used in the structural systems of green building projects?

code

cost

height, size, form

program – structural bay size required

“Picking the structural system and then having to make it green are separate conversations.”

Improving system sustainability

How do design teams improve the green aspects of the chosen material and system?

minimize material quantity

minimize carbon footprint

replace Portland cement with flyash

“I'm not sure if sustainability itself chooses the system as much as once the system is chosen we're getting a lot better at extracting every drop of sustainability out of it.”

Green advocates

Who are the primary advocates for a greener-than-standard performance objective?

owner/developer
design team
materials specifiers

“If everybody is... working collaboratively, but the electrical engineering isn't on that wavelength, that's going to have a major impact on how efficient that system is, and it may have impact on other systems.”

LEED certification and structures

How has LEED certification informed structural design decisions?

no impact on structural system selection

lack of benchmarks for structures

promotes use of recycled content

availability and cost of FCS timber is a problem

“As far as structural system selection goes, LEED is pretty much a just a side note.”

“Right now LEED doesn't care if I specify a design really lazily, and I have 50% more steel in the building.”

Other measures of green?

What other criteria do project teams use to define green structures performance?

material efficiency, reducing overdesign
durability and life-cycle service
systems synergies (thermal, acoustic, finishes)

“thinking about what system will help us support other MEP and architectural aspects.”

“If you can give credit for those buildings that are designed beyond the [seismic] code..., in the event that something does happen... you don't have to tear that building down and rebuild it again.”

“The most sustainable thing you can do is build really good buildings that people will want to keep for a long time.”

Design constraints

What design constraints pose the greatest challenges?

cost

code and regulation compliance

availability of green materials

construction time, methods, or quality

understanding of green material options

time available to evaluate materials

“It takes a team that already has a very good database on green building materials and their availability,....that has already developed a high-performance building and understands where the benefits are, where the pitfalls are, and how to maximize performance with the least effort. It takes more time to design the building appropriately.”

Information sources and reliability

What information sources do you use?

Environmental Building News

Internet searches

Consultants and other design professionals

How do you determine information reliability?

Skeptical of product manufacturers/representatives

Local vendors, contractors more reliable

Third party certification ideal but often not available

“The validity of the information is directly proportional to the amount of eyes that are on it.”

Information adequacy

Is available information about structural materials adequate?
information is not adequate

What kinds of information are needed?

building information modeling (BIM) data

Data for materials from other countries

post-occupancy measurement and verification

carbon footprint labels

network of contractors to share green practices

Graduate curriculum recommendations

What topics should a curriculum include?

- theories and ethics of sustainability
- economics of sustainability/life-cycle analysis
- collaborative design methods
- analysis tools

What formats should continuing professional education take?

- interdisciplinary studies of integrated design
- design based workshops or charrettes
- case studies
- distance learning, time flexible

“If we do this out of concrete or steel that's going to cost you this much more per square foot but we don't say well but you are going to buy less of this and not have a ceiling.

It takes an educated contractor and design team to be able to help the contractor access the cost transfers to understand the real net effect cost of something.

I think a lot of green initiatives or materials or integrated systems get marked off before the real costs are understood.”