Sustainable Buildings and Green Materials

Past, Present and Future

Brendan Trayner, Ph.D.

February 25, 2014
AUMA - Edmonton
1st LEED Certified

Who are we?
St. John’s Ambulance - Edmonton

1st LEED Silver

Who are we?
Greenstone Building - Yellowknife
1st LEED Gold

Who are we?
NEW buildings – annual energy consumption targets for an office building in Alberta

Conventional Office building [1.8 GJ/m²]

70% by 2015 [.54 GJ/m²]

80% by 2020 [.36 GJ/m²]

90% by 2025 [.18 GJ/m²]

Carbon Neutral by 2030 [no fossil fuel energy to operate]

- 5,000 m² at 1.8 GJ/m² = 9000 GJ = 270,000 L of Gasoline, 414,000 kilos of coal to generate the energy required
EPCOR Water

Current Office/Laboratory Projects
Gilead Labs

Current Office/Laboratory Projects
What are some of our approaches?

1. Building Form and Orientation
2. High-performance envelope
3. Shading the South
4. Opening the North
5. Operable Windows
6. Green Walls / Green Roofs
7. Daylit Workplaces
8. Low-energy vertical circulation
9. Re-using Existing Buildings
10. Good Material Selections
What is the take home message?

• We firmly believe that sustainability should be integrated at every level of design.

• To do this we need products and materials that:
  ▫ Have low embodied energy.
  ▫ Do not contain potentially hazardous materials in the final product or use them during manufacturing.
  ▫ Are socially ethical.
  ▫ Are manufactured locally and sustainably.

• We make thousands of decisions on each project-
  Make it easy for us to want to choose your products.
How are we classifying sustainable buildings in North America?

• Leadership in Energy and Environmental Design (LEED)

• Living Building Challenge – Full and Petal Certification
What is LEED?

- LEED is the “Esperanto” of the Green Building World.
- A language that many have learned across our industry.
- LEED has more and more have become a set of “minimum” standards.
- The future goes beyond LEED.
Living Building Challenge

- Developed by the International Living Future Institute. Most advanced measurement of sustainability in the built environment.

- The LBC acts to diminish the gap between current limits and ideal solutions.

Canadian Example

Jim Pattison Centre of Excellence in Sustainable Building Technologies and Renewable Energy Conservation – Penticton, BC
Mosaic Centre for Conscious Community and Commerce
We’re evolving!

CANMET C2000
LEED
LBC

GROUNDBREAKING SUSTAINABLE BUILDINGS.
Let’s Talk Material Rating
LEED: Building Material and Sustainability Classifications

- Indoor Environmental Quality (IEQ) credits.
  - Low volatile organic compounds emitting materials
    - adhesives and sealants
    - paints and coatings
    - flooring systems
- Rapidly Renewable materials.
- Certified Wood.
- Recycled Content
LBC Material Petal Requirements

- RED LIST compounds
- Embodied Carbon Footprint
- Responsible Industry
- Appropriate Sourcing
- Conservation + Reuse
• We must advocate through our design and specifications for the creation and adoption of third-party certified standards for sustainable resource extraction and fair labour practices.

• Applicable raw materials include stone and rock, metal, minerals, and timber.
• Material conservation Management Plan:
  ▫ The goal is to reduce or eliminate the production of waste during four phases - **design**, **construction**, **operation**, and **end of life** in order to conserve natural resources.

<table>
<thead>
<tr>
<th>Material</th>
<th>Minimum Diverted/Weight^{57}</th>
</tr>
</thead>
<tbody>
<tr>
<td>Metals</td>
<td>95%</td>
</tr>
<tr>
<td>Paper and Cardboard</td>
<td>95%</td>
</tr>
<tr>
<td>Soil, and biomass</td>
<td>100%</td>
</tr>
<tr>
<td>Rigid Foam, carpet &amp; insulation</td>
<td>90%</td>
</tr>
<tr>
<td>All others - combined weighted average^{58}</td>
<td>80%</td>
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</table>
- LBC - Red List
  - Asbestos
  - Halogenated Flame Retardant
  - Petrochemical Fertilizers and Pesticides
  - Wood treatments containing Creosote

Chlorinated Polyethylene

Phthalates

Pentachlorophenol

Formaldehyde

Freon-11

Freon-12

CFCs

Neoprene

PVC
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<th>Max. Distance</th>
<th>Materials or Services</th>
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<tbody>
<tr>
<td>7</td>
<td>20,004 km</td>
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<td>Renewable Technologies&lt;sup&gt;53&lt;/sup&gt;</td>
<td>Divisions: 42&lt;sup&gt;54&lt;/sup&gt;, 48</td>
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| 5    | 5,000 km      | Assemblies that actively contribute to project performance<sup>55</sup> and adaptable reuse once installed | Divisions: 08 (all exterior products), 14<sup>*</sup>, 22<sup>56</sup>, 23<sup>*</sup>, 26<sup>*</sup>, 33<sup>*</sup>, 44<sup>*</sup>, 46<sup>*</sup>  
Sections: 07 33 00<sup>57</sup>, 07 50 00<sup>*</sup>, 10 22 00<sup>*</sup>, 01 70 00<sup>*</sup>, 44 40 00<sup>*</sup> |
| 4    | 2,500 km      | Consultant Travel<sup>58</sup>                                                        | -                                |
| 3<sup>59</sup> | 2,000 km  | Light or low-density materials                                                          | Sections: 07 31 00, 07 40 00, 09 50 00, 09 60 00 |
| 2    | 1,000 km      | Medium weight and density materials                                                    | Divisions: 06<sup>60</sup>, 08 (all interior products)  
Sections: 07 32 00, 09 20 00, 09 30 00, 12 30 00 |
| 1    | 500 km        | Heavy or high-density materials                                                        | Divisions: 03, 04, 05<sup>*</sup><sup>61</sup>, 31<sup>62</sup>, 32<sup>63</sup> |
How can we get past the “Greenwash”?
• A few rating systems are available...
Cradle to Cradle Certification

1. 100% Renewable Energy Use
2. Water Stewardship clean water output
3. Social Responsibility positive impact on community
4. Material Reutilization recyclability / compostability
5. Material Health impact on human & environmental
Mosaic Centre - Challenges

• Materials Petal?
Example - Linoleum
Linoleum

- Marmoleum™
- More local suppliers/manufacturers?
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Up and coming bio-materials
Self-healing Concrete
Bricks Grown from Bacteria

- Can be grown in ambient temperatures.
- Water used is in a close loops system and reused in the manufacturing process – can use seawater!
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Questions?

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Nanocellulose

- Transparent
- Absorbative.
- Strong.

- Structural elements, insulation (biofoam), glass.
Algae bioreactor façade
Afexa Life Sciences (Formally CVT)

Recent Laboratory Projects
Canadian Examples

VanDusen Botanical Garden Visitors Center – Vancouver, BC
Commonly Used Biomaterials