Green Assessment Tools: The Integration of Building Envelope Durability

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• Closing the loop
• Green Rating Tools
• Building Envelope Durability
• Review of 4 Green Rating Tools
Environmental Impact of Buildings*

- ~ 38% of total Canadian energy use\(^1\)
- ~ 30% of total Canadian greenhouse gas emissions \(^2\)
- 40% (3 billion tons annually) of raw materials use globally \(^3\)

* Commercial and residential
What is “Green” Design?

In General:

Design and construction practices that significantly reduce or eliminate the negative impact of buildings on the environment and occupants.
What does “Green” look like?
How do we know what we’ve designed is Green?

Or

How do we avoid “Green Washing”?
Table 4: Development of Building Rating Tools

- 1990 – BREEAM UK released
- 1993 – BEPAC developed
- 1996 – BREEAM Canada introduced
- 1993 – BEPAC developed
- 1998 – BREEAM/Green Leaf developed
- 1998 – GBTool-1 applied
- 1998 – LEED-NC launched
- 2001 – LEED-BC recommendation
- 2002 – CHPS operational
- 2002 – LABS 21 available
- 1993 – BEPAC developed
- 2003 – Green Star introduced
- 2004 – BOMA Go Green launched
- 2004 – LEED Canada operational
- 2004 – BOMA Go Green Plus released
- 2004 - CASBEE disseminated
- 2004 – GreenGuide for Health Care piloted
- 2004 - LEED-CI, LEED-EB launched

Green Rating Tools
Their Purpose

- Define “green building”, minimize – greenwash.
- Promote integrated, whole-building design practices
- Recognize environmental leadership in the building industry
Green Rating Tools
Their Purpose

• Stimulate green competition

• Raise consumer awareness of green building benefits

• Transform the building market
Green Rating Tools
Their Limitations

- Additional cost
- Do not fit all building types
- Used to compare fundamentally different building traits.

In the end, they provide a number to compare with other assessed or base case buildings.
Green Rating Tools
So, Which One Do I Use?

Level 1
Greenspec®
BEES 3.0 ®

Level 2
Energy Simulation
EE4, DOE2, etc.
Costing
natural lighting

Level 3
Green Globes
GBTool™
BuiltGreen™
The Focus of Green Tools

Site Selection, Use and Planning
The Focus of Green Tools

Energy efficiency and renewable energy

Passive Design Approach

PASSIVE
- Orientation
- Shape & Form
- Solar Control
- Passive heat/cool, Daylighting
- Glazing Area
- Thermal mass
- Airflow
- Natural ventilation/Wind driven ventilation
- Vegetation and other site opportunities
- Engineering systems

LOW ENERGY
- HIGH ENERGY

LOW COST
- HIGH COST

Goals:
- Human well being
  - Comfort
  - Daylighting
  - Noise
  - Indoor air quality
- Energy
The Focus of Green Tools

Safeguarding water and water efficiency
The Focus of Green Tools

Conservation of materials and resources
The Focus of Green Tools

Indoor air quality
What about the Durability?

- Lessons learned from “Leaky Condominiums”, Best practice guides, experience?
- Cost to Owners & Environment?
- Impact on:
  - Maintenance & Renewals
  - Potential Health effects
  - Disruption of Use
  - Sustainability
What does a “Durable” building look like?
Case Study

The Chesapeake Bay Foundation's Philip Merrill Environmental Center

“The Importance of Building Envelope Commissioning for Sustainable Structures”
Daniel Lemieux & Paul Totten
Durability Definitions

**Durability**
The ability of a building or any of its components to perform its required **functions** in its **service environment** over a **period of time** without unforeseen **cost** for maintenance or repair.

Durability is **not** a material property.

**Service Life**
The actual **time** during which the building or any of its components performs without unforeseen costs or disruption for maintenance and repair.
How to Assess Durability?

- National, Regional Codes?
- Best Practice guides?
- CSA S478-95 Standard?
- ISO 15686 Standard?

When to Assess Durability?

- Design?
- Construction?
- After Occupancy?
A Proposed Method to Assess Durability?

This method builds upon principles outlined in the ISO and CSA standards.

**Schematic Design Phase** – establish building DSL

**Design Development Phase** – establish assembly DSL (e.g., equal to structure, ½ life, etc.).

Considerations include:

- Life cycle Analysis and Life cycle cost
- Initial building budget and Operating budget
- Best practice design principles and historical performance
Proposed Method to Assess Durability?

- **Construction Document Phase** – select materials to reflect the preliminary service lives and consider:
  - Environmental conditions
  - Maintenance difficulty and frequency
  - Result of failure
  - Detailing for replacement and renewal

- **Tender and Pre-Construction Phase** – reevaluate the service lives – presents big hurdle due to current method of assessing materials (initial vs. LCA).
Proposed Method to Assess Durability?

- **Construction Phase** – establish quality control and assurance protocols.

- **Post Construction Phase** – evaluate assemblies for performance and address deficiencies.
Integration of Durability
Review of 4 Tools

Green Globes
Environmental Assessment of Buildings

GBTool™

BuiltGreen™

LEED®

Morrison Hershfield green
Canadian adaptation of BREEAM system (UK)

In 2000, BREEAM Green Leaf™ became Green Globes

In 2004, BOMA adopted under Go Green (further Go Green Plus)

On-line, questionnaire-driven tool.

1000 points available in seven areas of assessment

buildings rating (1 to 5)
• Reduce Energy Demand – Building Envelope  
  (based on best practices – design/field review)

• Low Impact Systems & Materials  
  (selection based on LCA – Athena)

• Building Durability, Adaptability and Disassembly  
  (conserve resources, extend life of building)
Integration of Durability

Developed by NRCan for Green Building Challenge (GBC)

Requires benchmark building

Divided into “Performance issues”, then into “Performance Categories”

Scoring - negative to positive points (Unsatisfactory, standard, best practices)

Doesn’t rate building, outputs allow comparison to other buildings
Integration of Durability

- Control of moisture in the building
  (Rainscreen principle & service life of materials)

- Protection of materials from destructive elements
  (Durability of components and environmental stresses)

- Development of construction process quality control measures

- Appointment of commissioning agent and development of commissioning protocols
  (including Bldg. Envelope)

GBTool – 2002
Integration of Durability

Based on the Built Green™ Colorado program, adopted NRCan’s EnerGuide

Available in Alberta and BC

Three levels of achievement, Bronze, Silver and Gold

Points awarded on EnerGuide rating, additional points selected from seven areas of checklist

$160/home
Program encourages the use of “durable” materials that have a longer life cycle and require less maintenance, but does not discuss the principles behind durability, envelope design, performance, or service environment.
Developed by USGBC (licensed & implemented by CaGBC)

Four levels of certification: Certified, Silver, Gold, Platinum.

5 major categories (+ Innovation)

Prerequisites & optional credits

$3000 - $15,000
Integration of Durability

Materials and Resources credit 8.0 – Durable Building

- Credit uses the principles outlined in the CSA S478-95 (R2001) *Guideline on Durable Buildings*
Keys for Integrating Durability

- Using the available tools.
- Establishing the DSL and creating a Durability plan early
- Reviewing and updating it often
- Considering material properties, installation, service environment & embodied energy.
- Following best practices
- Using an Integrated Design Process
Thank you

“The kind of thinking that has gotten us into this situation is not the kind of thinking that will get us out of it”

Albert Einstein