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Green Assessment Tools: The Integration of Building Envelope Durability

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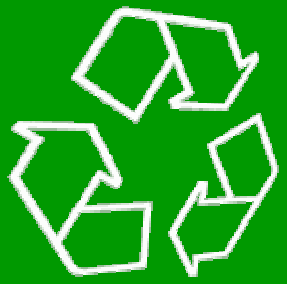
OUTLINE

- Closing the loop
- Green Rating Tools
- Building Envelope Durability
- Review of 4 Green Rating Tools



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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

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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.

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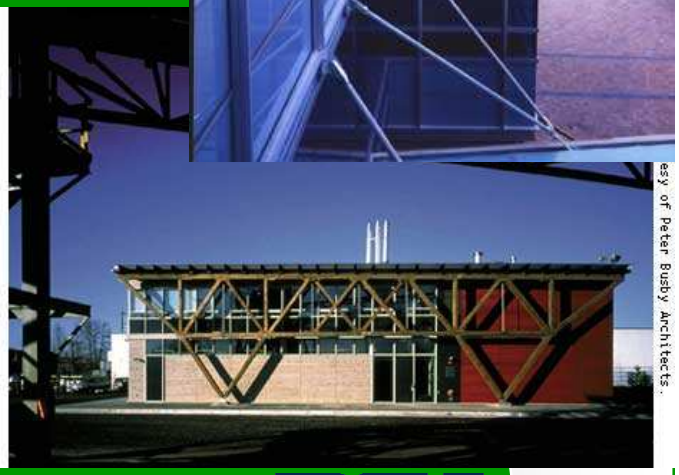
What does “Green” look like?



esy of Peter Busby Architects.

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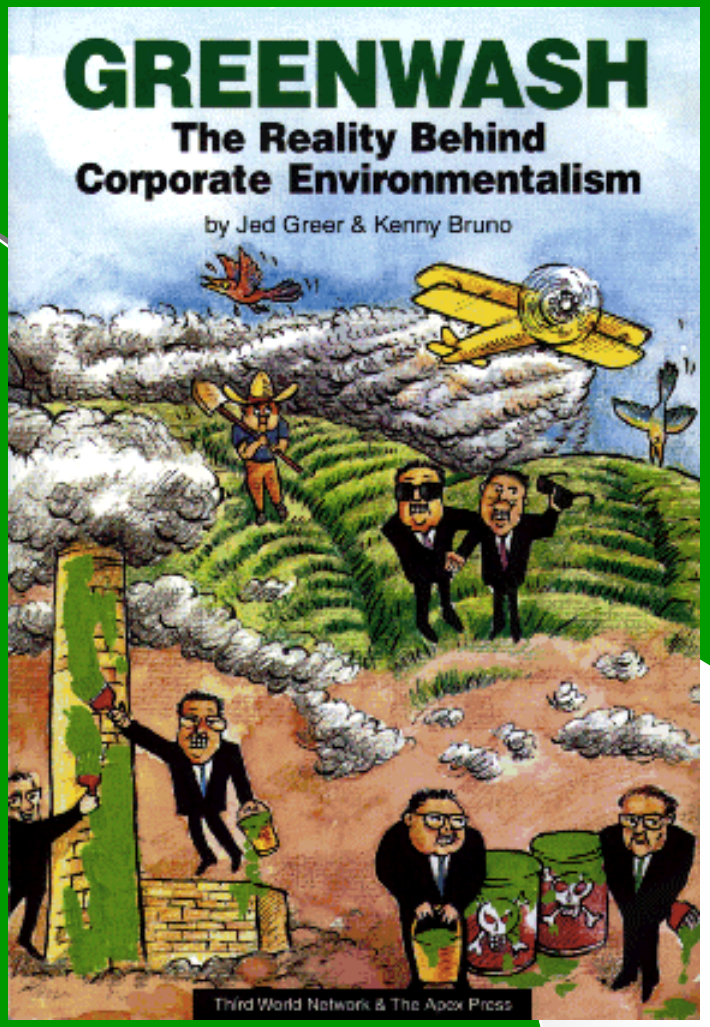
How do we know what we've designed is Green?

Or

How do we avoid "Green Washing"?



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The History of Green Rating Tools

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

Assessment of Tools for Rating the Performance of Existing Buildings: A Report on the Options, for GVRD, Innes Hood Consulting, April 2006

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Green Rating Tools
Their Purpose

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

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Green Rating Tools
Their Purpose

- Stimulate green competition
- Raise consumer awareness of green building benefits
- Transform the building market

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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.

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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™

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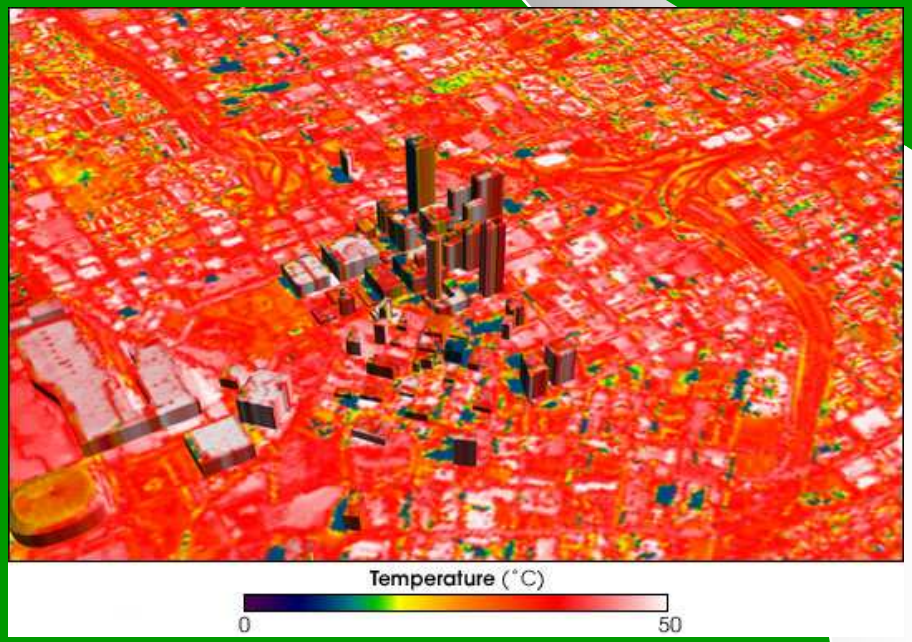
The Focus of Green Tools

Site Selection, Use and Planning



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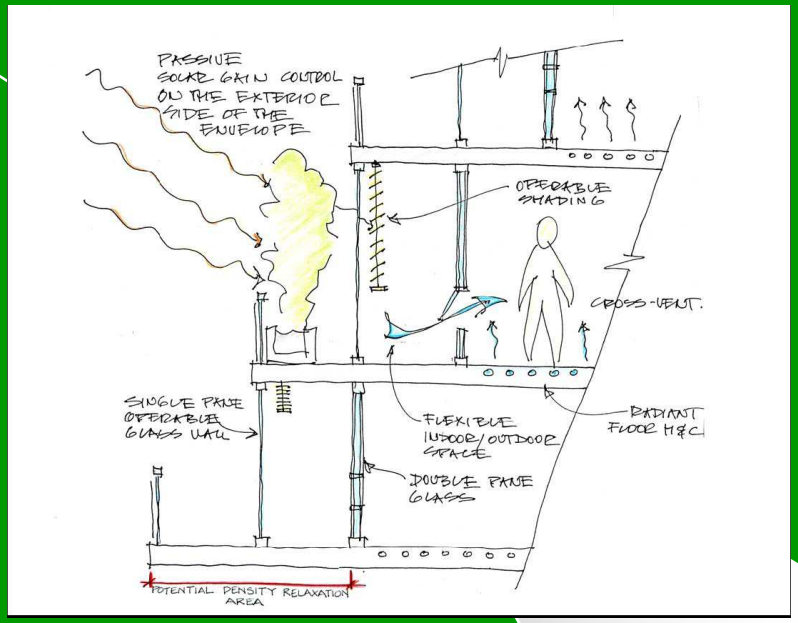
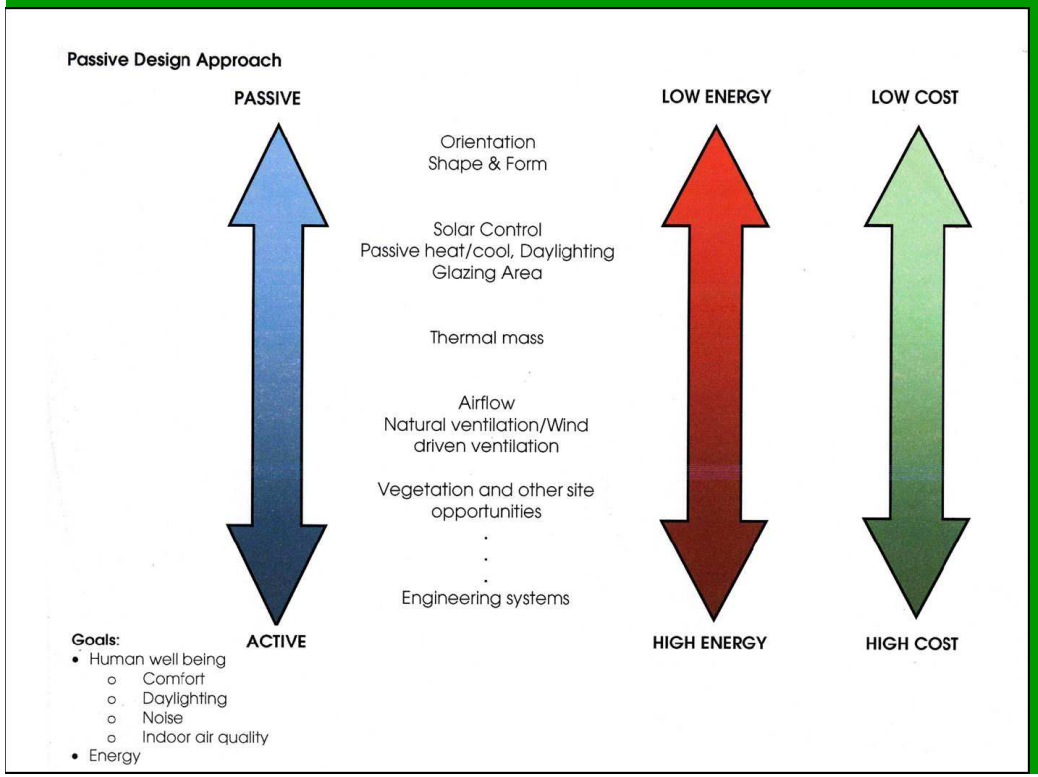
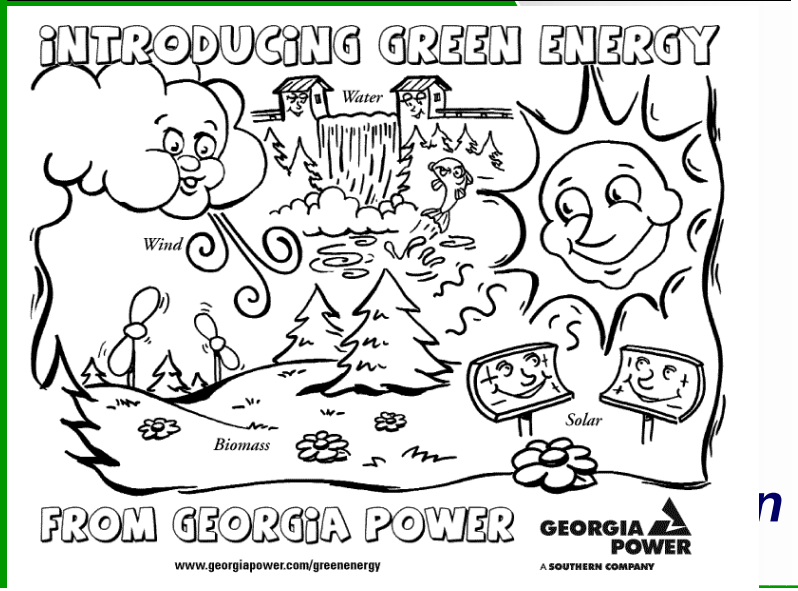
The Focus of Green Tools

Energy efficiency and renewable energy

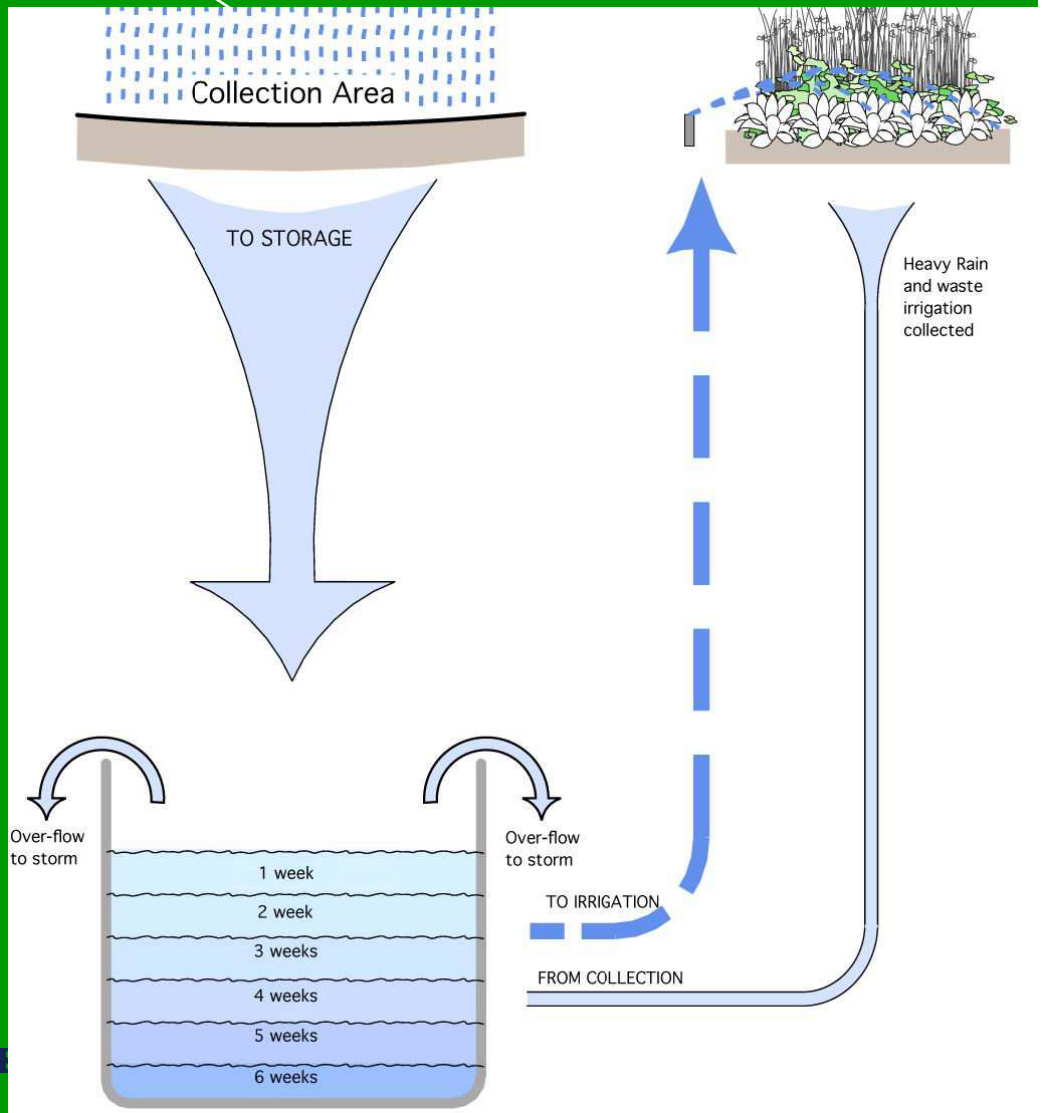






The Focus of Green Tools

Safeguarding water and water efficiency



The Focus of Green Tools

Conservation of materials and resources

Ecological footprint

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The Focus of Green Tools

Indoor air quality

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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

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What does a “Durable” building look like?

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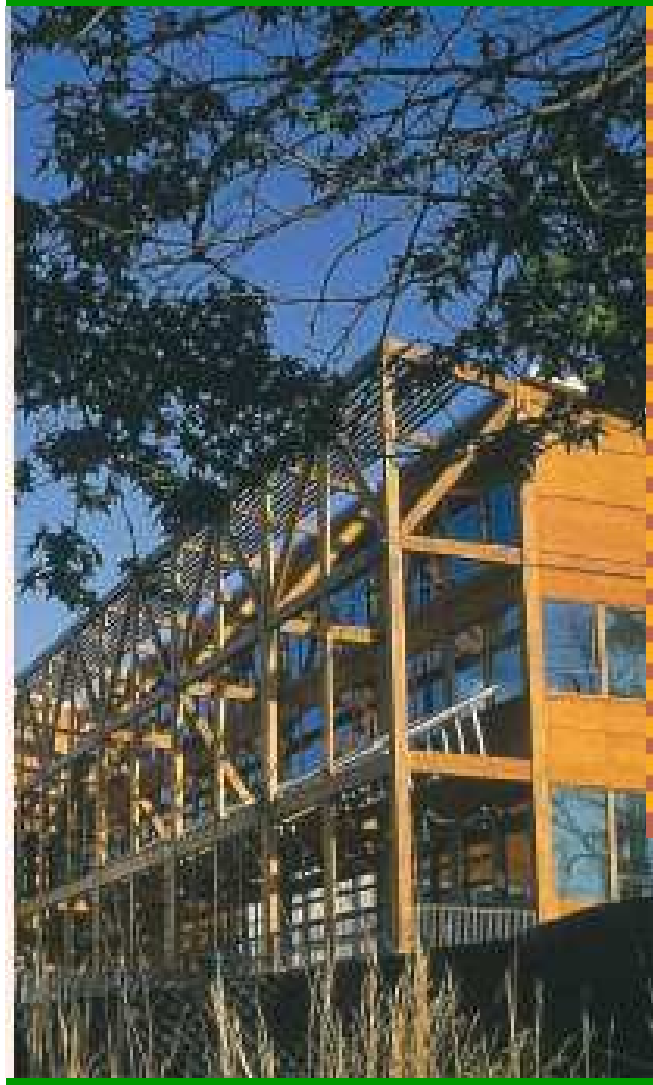
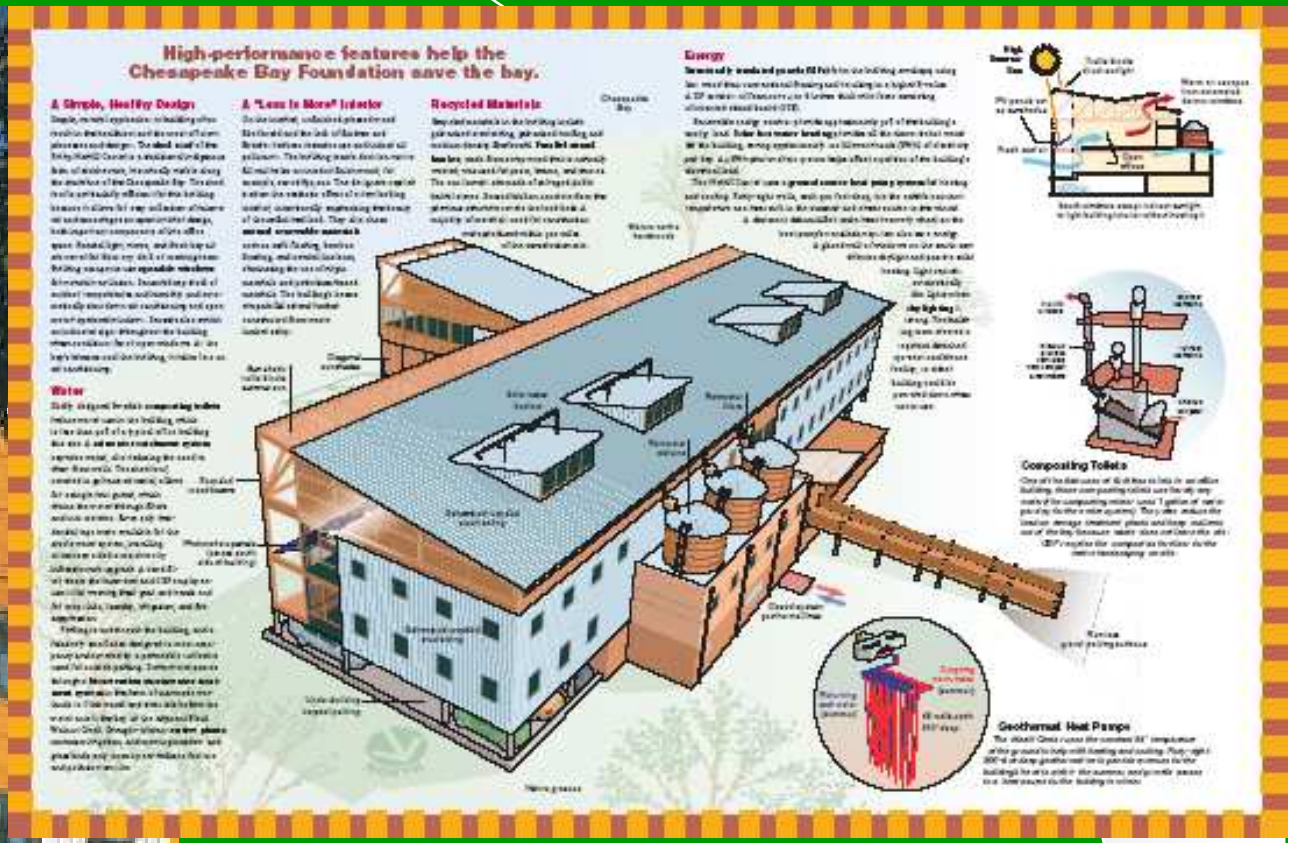
Case Study

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?

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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

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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** – revaluate the service lives – presents big hurdle due to current method of assessing materials (initial vs. LCA).

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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™

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Integration of Durability

Green Globes

Environmental Assessment of Buildings

- 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)

$250

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Integration of Durability

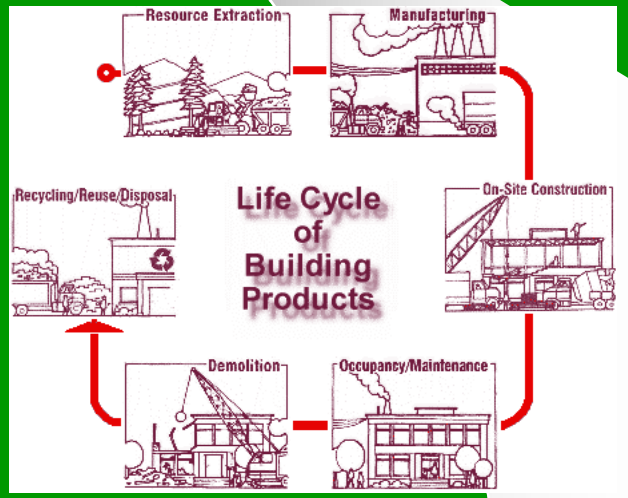
Green Globes

Environmental Assessment of Buildings

- ***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)



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Integration of Durability

GBTool™

- 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

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Integration of Durability

GBTool™

GBTool – 2002

- ***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)

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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

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Integration of Durability

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.

Integration of Durability

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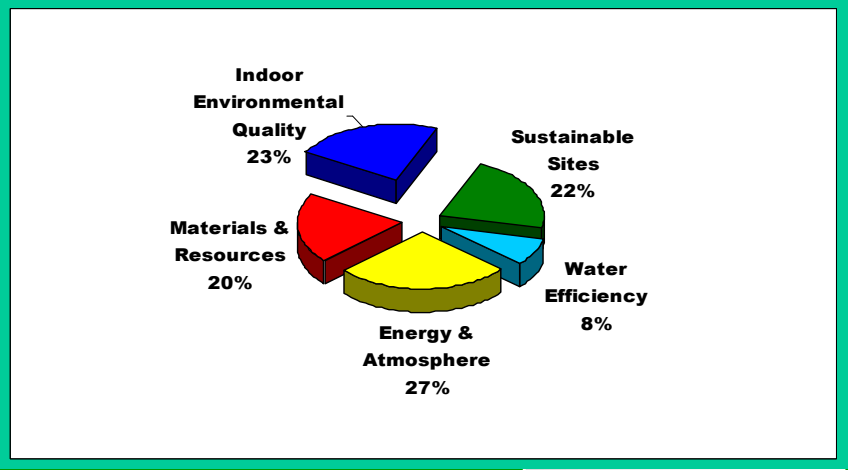

- Developed by USGBC (licensed & implemented by CaGBC)
- Four levels of certification: Certified, Silver, Gold, Platinum.
- 5 major categories (+ Innovation)
- Prerequisites & optional credits

$3000 - $15,000

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Integration of Durability

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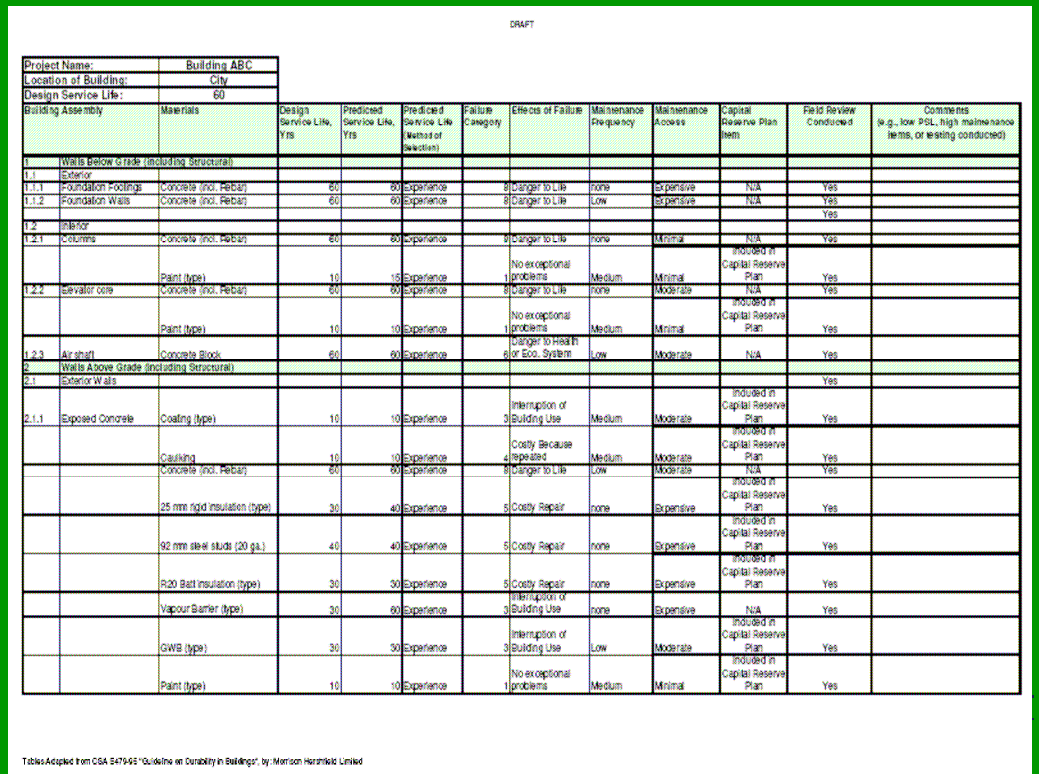
Materials and Resources credit 8.0 – Durable Building

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



DRAFT

Project Name:	Building ABC
Location of Building:	City
Design Service Life:	60

Building Assembly		Materials	Design Service Life, Yrs	Predicted Service Life, Yrs	Predicted Service Life (Method of Selection)	Failure Category	Effects of Failure	Maintenance Frequency	Maintenance Access	Capital Reserve Plan Item	Field Review Conducted	Comments (e.g., low PSL, high maintenance items, or testing conducted)
1	Walls Below Grade (including Structural)											
1.1	Exterior											
1.1.1	Foundation Footing	Concrete (incl. Rebar)	60	60	Experience	8	Danger to Life	none	Expensive	N/A	Yes	
1.1.2	Foundation Walls	Concrete (incl. Rebar)	60	60	Experience	8	Danger to Life	Low	Expensive	N/A	Yes	
											Yes	
1.2	Interior											
1.2.1	Columns	Concrete (incl. Rebar)	60	60	Experience	8	Danger to Life	none	Minimal	N/A	Yes	
		Paint (type)	10	10	Experience	1	No exceptional problems	Medium	Minimal	Included in Capital Reserve Plan	Yes	
1.2.2	Elevator core	Concrete (incl. Rebar)	60	60	Experience	8	Danger to Life	none	Moderate	N/A	Yes	
		Paint (type)	10	10	Experience	1	No exceptional problems	Medium	Minimal	Included in Capital Reserve Plan	Yes	
1.2.3	Air shaft	Concrete Block	60	60	Experience	6	Danger to Health or Eco. System	Low	Moderate	N/A	Yes	
2	Walls Above Grade (including Structural)											
2.1	Exterior Walls										Yes	
2.1.1	Exposed Concrete	Coating (type)	10	10	Experience	3	Interruption of Building Use	Medium	Moderate	Included in Capital Reserve Plan	Yes	
		Caulking	10	10	Experience	4	Costly Because Repeated	Medium	Moderate	Included in Capital Reserve Plan	Yes	
		Concrete (incl. Rebar)	60	60	Experience	8	Danger to Life	Low	Moderate	N/A	Yes	
		25 mm rigid insulation (type)	30	40	Experience	5	Costly Repair	none	Expensive	Included in Capital Reserve Plan	Yes	
		92 mm steel studs (20 ga.)	40	40	Experience	5	Costly Repair	none	Expensive	Included in Capital Reserve Plan	Yes	
		R20 Batt insulation (type)	30	30	Experience	5	Costly Repair	none	Expensive	Included in Capital Reserve Plan	Yes	
		Vapour Barrier (type)	30	60	Experience	3	Interruption of Building Use	none	Expensive	N/A	Yes	
		GWB (type)	30	30	Experience	3	Interruption of Building Use	Low	Moderate	Included in Capital Reserve Plan	Yes	
		Paint (type)	10	10	Experience	1	No exceptional problems	Medium	Minimal	Included in Capital Reserve Plan	Yes	

Tables Adapted from CSA S478-95 "Guideline on Durability in Buildings", by: Morrison Hershfield Limited

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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

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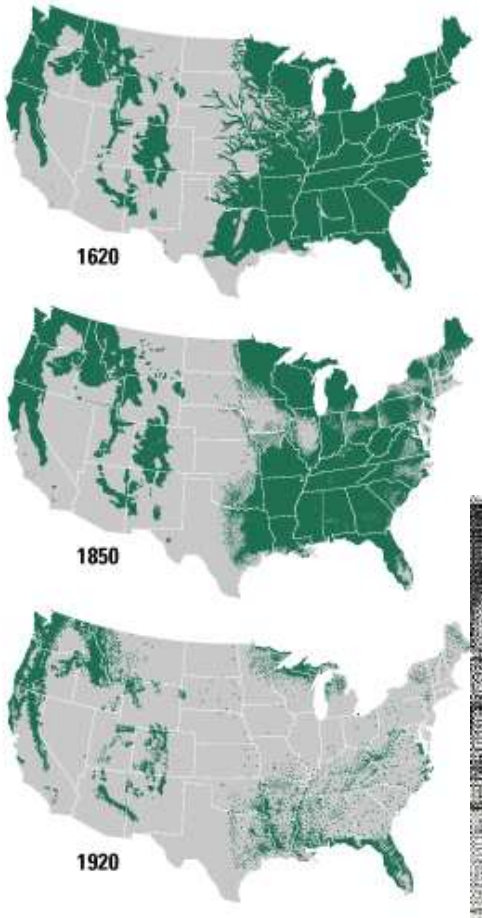
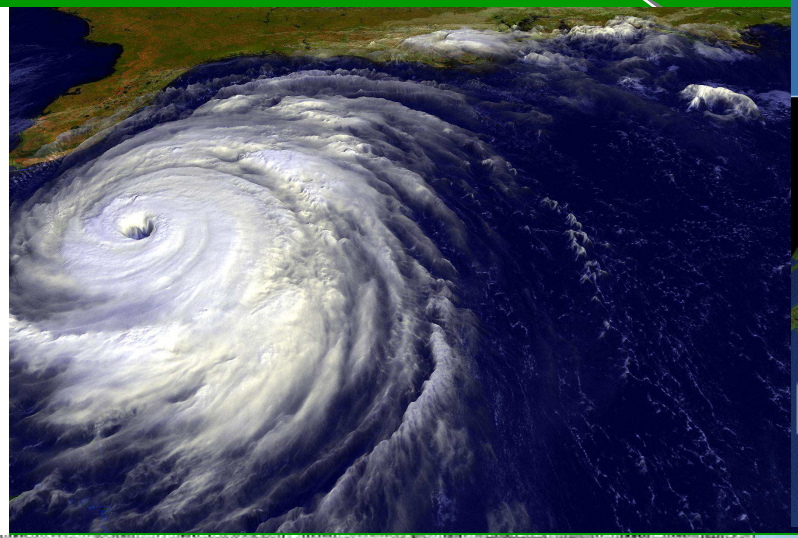
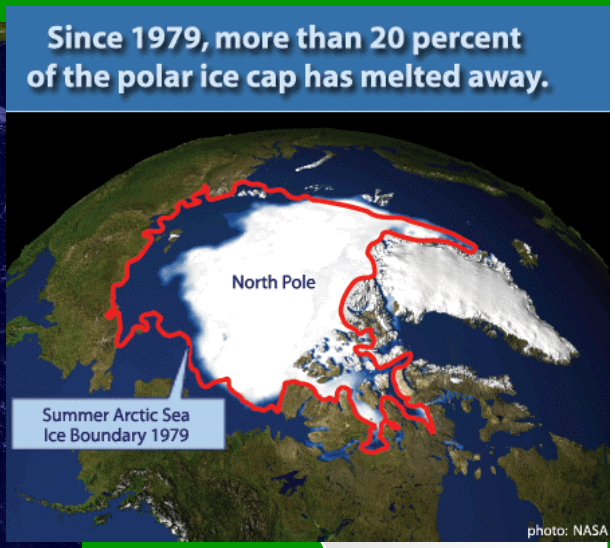
Thank you

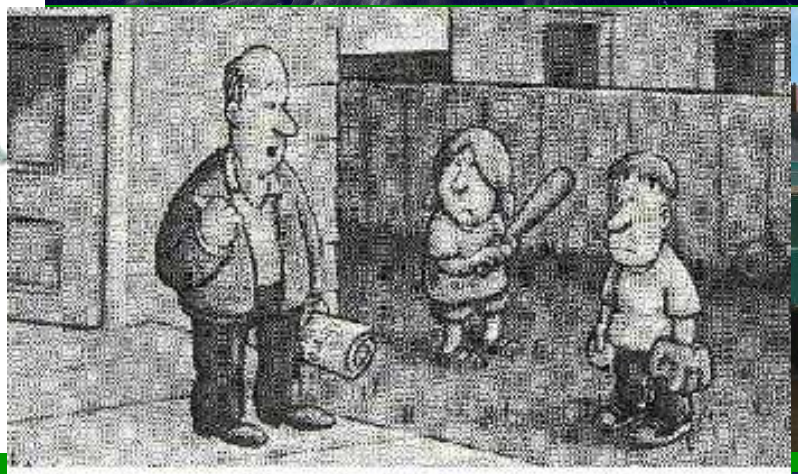
"The kind of thinking that has gotten us into this situation is not the kind of thinking that will get us out of it"

Albert Einstein









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