Notes from the field

(well, from Waterloo Canada)

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Overview

- A case study project incorporating a range of energy efficient, durability and environmental features
- Raised theoretical and practical issues
- Commercial / MURB lessons

Background

- Urban in-fill site in Waterloo, Ontario
- Owners desire an apartment building with office
- City offers tax holiday for mixed use projects

Objectives

- Financially sound investment
  - Retain ownership and control
  - A place for owners to live/retire
  - Polled contractors: $117-140/sf range
- Objectives:
  - Low maintenance & Durable
  - As energy efficient as practical
  - Healthy and Pleasant

Concept and Constraints

- Parking and parking access limited site design, and building size
- Result: 5 storey building with 11 rental units and ground floor office space
- Severely constrained financing due to size of building
  - Elevator, 2 stairwells
  - Fire safety systems

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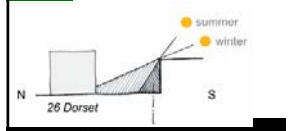
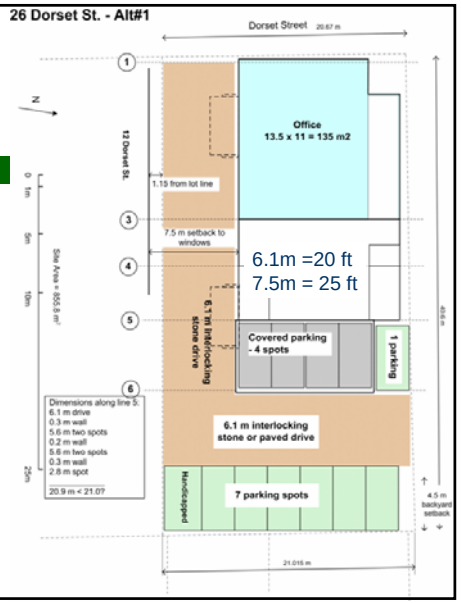
Site

- Most solar access maintained





Existing Site

Concept

Enclosure

- **Continuous air barrier, insulation, and drainage plane behind ventilated cladding**
- **Impact resistant, non-combustible finish**
- **Avoid thermal bridges!**

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Commercial Enclosure: Simple Layers

- Structure
- Air Barrier
- Insulation
- Rain Control
- Finish

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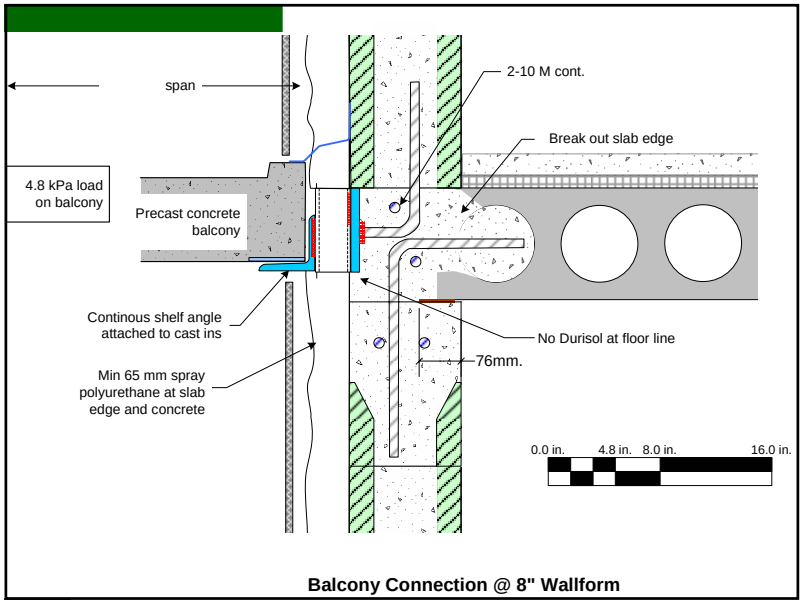
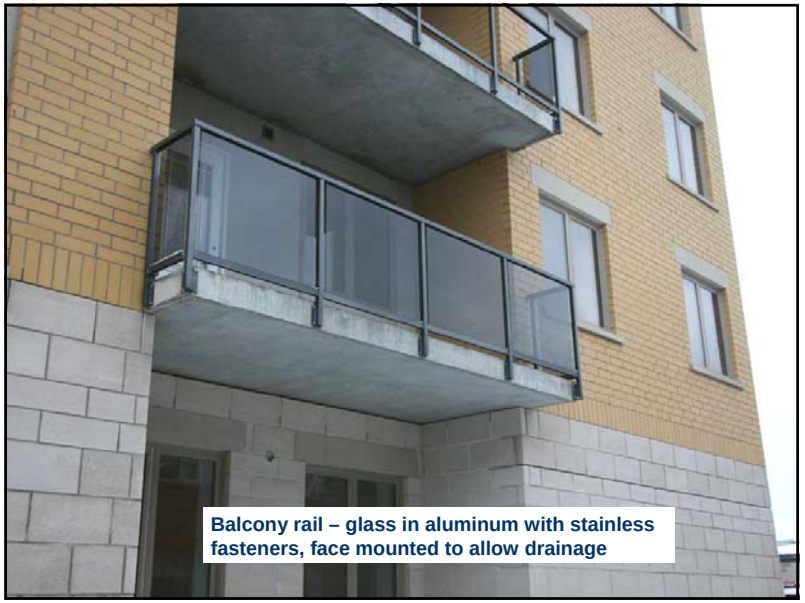


Balcony Connection @ 8" Wallform



Cladding

- Desired light weight, impact resistant, non-combustible low cost cladding
- EIFS has does not meet these requirements
  - Transitions to spray foam? Draining?
- Developed fiber-cement panel system
- Elastomeric textured coating used to cover screws
- Special joint details

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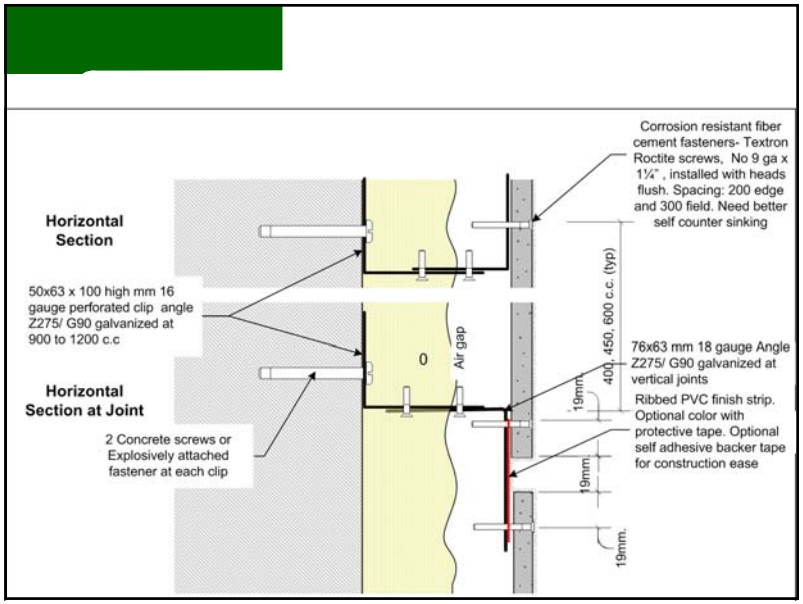

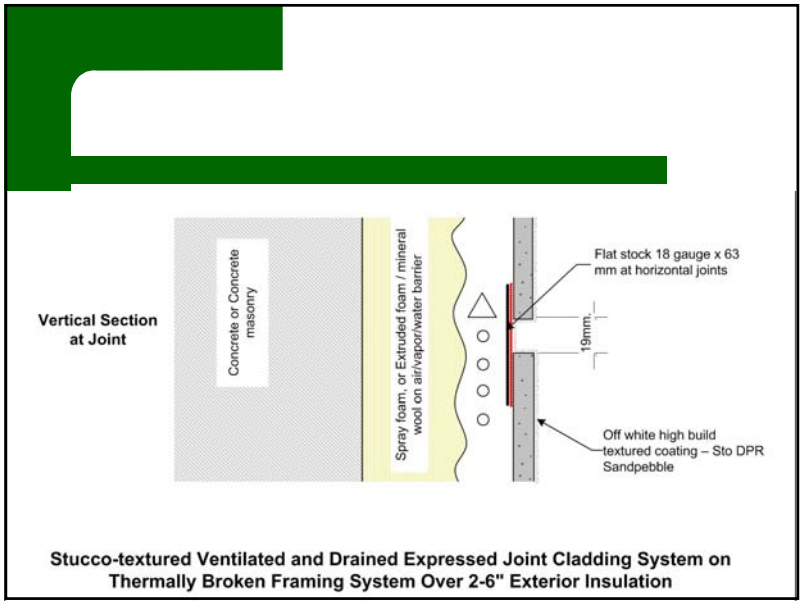

Stucco-textured Ventilated and Drained Expressed Joint Cladding System on Thermally Broken Framing System Over 2-6" Exterior Insulation

Mechanical System

- Heating
  - Radiant heated floor system
- Cooling
  - Ductless mini-splits for cooling
- Ventilation
  - Single point power exhaust w/ passive distributed make-up

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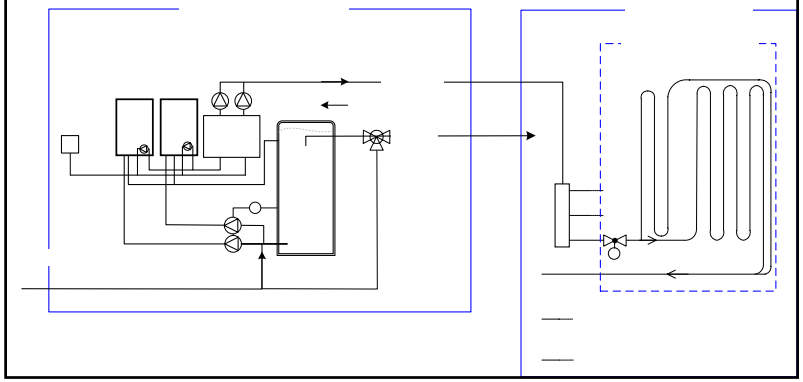
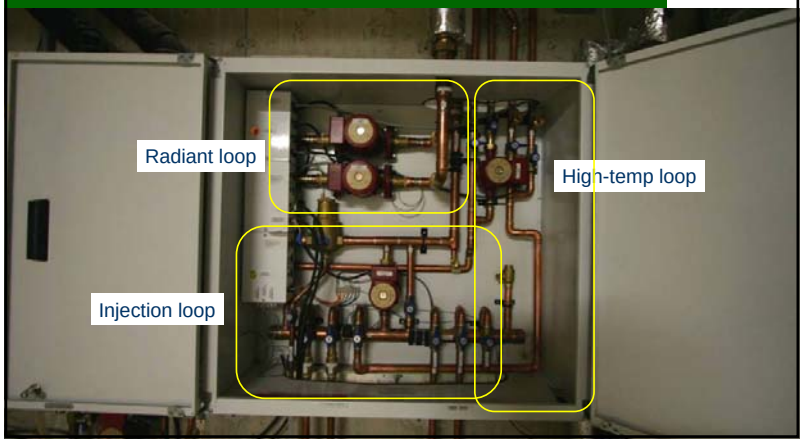
Heating schematic



Dual boilers and pumps, quick change out possible, battery operation possible

Mixing / Control Box



Radiant flooring design

- Tube spacing on floor topping
  - What is needed for comfort? Heat output?
- Design to keep water flowing most of the time and temperature low to distribute hot spots (solar gain, appliances)

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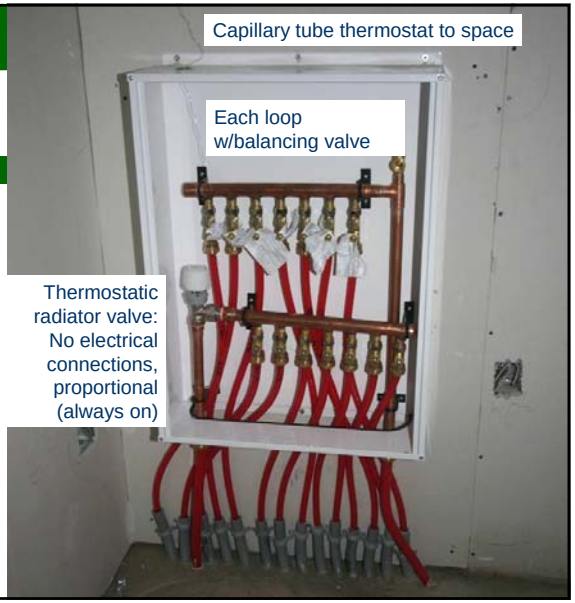
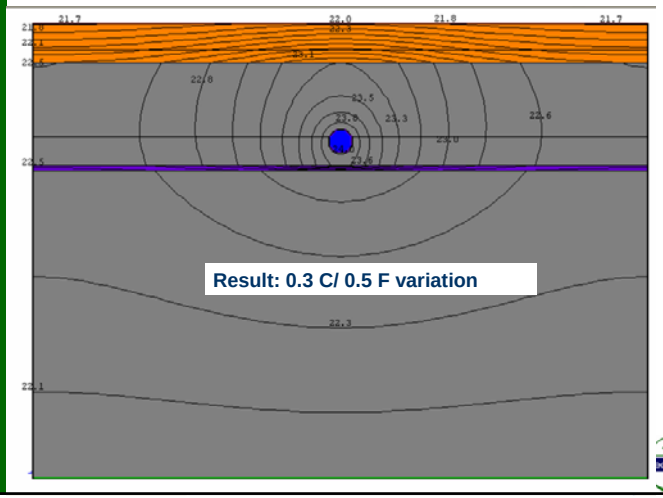
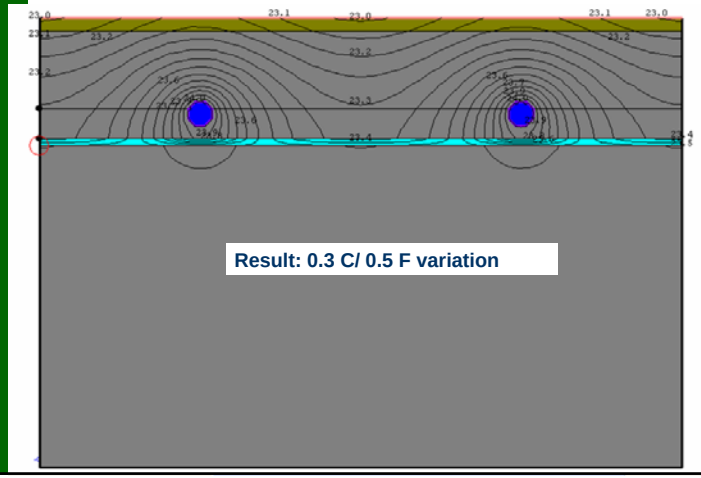


300 mm/12” w/wood



150 mm / 6” w/tile



Ventilation

- Isolation of suites was priority one
  - Better IAQ, better known ventilation rates
  - Sound control, no smoke/fire/odor issues
- Continuous exhaust from bathroom
  - Boost for showers, cooking, drier
- Heat recovery difficult/$ for small flows
- Passive air inlet
  - Will incoming air be cold?

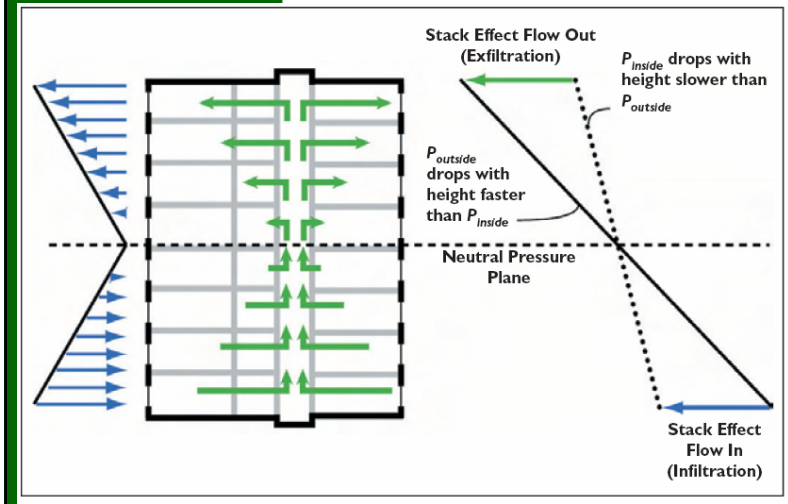


Figure 1: Stack effect. Interior airflows in tall buildings compromise smoke control, fire safety, indoor air quality, comfort and energy use.

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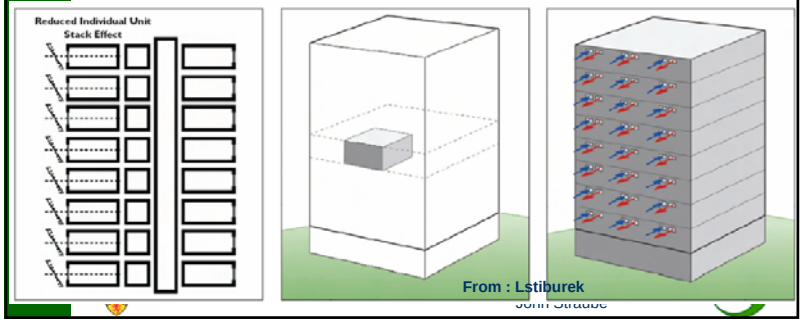
Compartmentalization



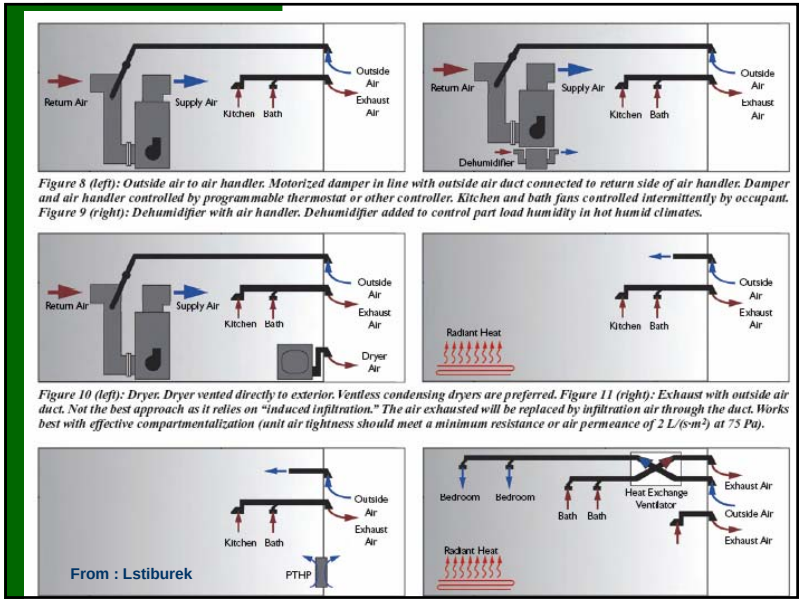
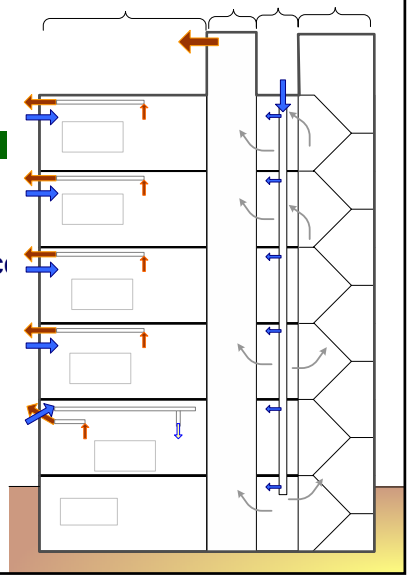


Figure 8 (left): Outside air to air handler. Motorized damper in line with outside air duct connected to return side of air handler. Damper and air handler controlled by programmable thermostat or other controller. Kitchen and bath fans controlled intermittently by occupant. Figure 9 (right): Dehumidifier with air handler. Dehumidifier added to control part load humidity in hot humid climates.

Figure 10 (left): Dryer. Dryer vented directly to exterior. Ventless condensing dryers are preferred. Figure 11 (right): Exhaust with outside air duct. Not the best approach as it relies on "induced infiltration." The air exhausted will be replaced by infiltration air through the duct. Works best with effective compartmentalization (unit air tightness should meet a minimum resistance or air permeance of 2 L/(s·m²) at 75 Pa).

Dorset

- Lowest cost
- Low energy
- HRV's would reduc



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Elevator exhaust

Electrical

- CFL everywhere
- Efficient fans and few of them
- Motion sensors in stairwells (95% saving over CFL)
- Outdoor motion sensors for parking (security)

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Predicted Consumption

- Current MURB in Ontario about 250 kWh/m2/yr and office 300
- Projected 105 kWh/m2/yr= 35 kBtu/ft2/yr
- 80% is heating and cooling, 20% electric
- Monitoring is planned

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Internal moisture control

- Each wet room has a floor drain for plumbing bursts
- Waterproof membrane under tiles used in standing water areas / sprayed walls

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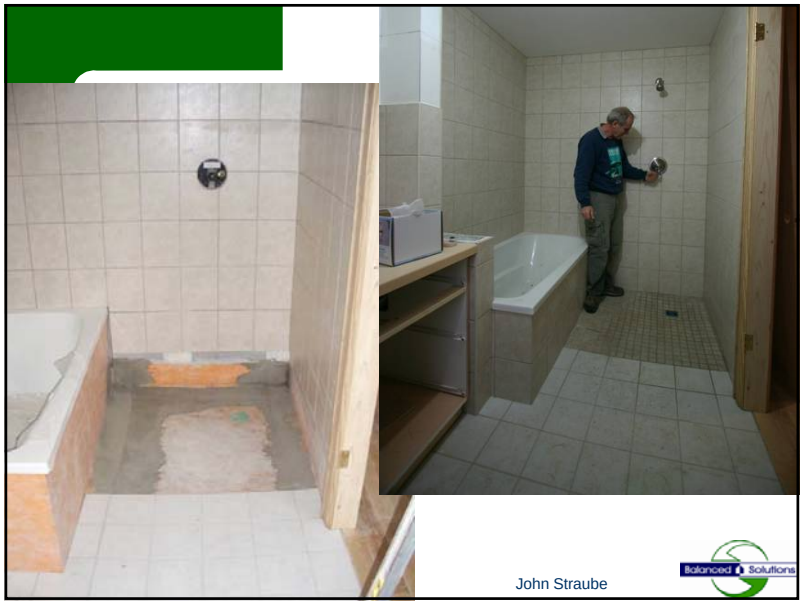

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Sound control

- Floating floors of gypcrete on foam
- Airtight suite doors
- Durisol suite demising walls
- Only low sone (0.3) fans
- Airtight windows

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Green roof

- Occupant amentity, heat island reduction, neighborhood contribution
- Low cost and simple
  - Inverted roof fully adhered (expensive)
  - Drainage mat
  - 4” Extruded foam
  - Water retention membrane (MS20)
  - Landscape cloth
  - Soil or pavers or gravel

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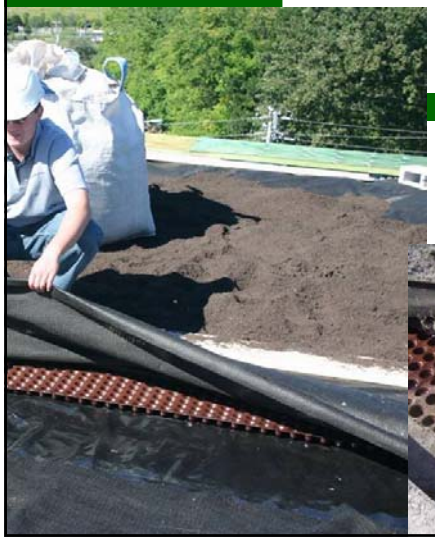

Cosella-Doerken MS20

Green Roof

- Add’l =$5/sf

Lessons Learned

- Can build durable, energy efficient for same or less than typical
- This requires many things
  - directed choices/trade-offs at concept stage
  - Committed owner / design team
  - Involvement in quality control and compromises throughout process
  - Do mockups, even for small jobs
  - There are many reasons why not, find the reason why.

Website

University of Waterloo

Building Engineering Group

www.civil.uwaterloo.ca/beg

Building Science Textbook at

www.johnstraube.ca