

Reaching for LEED™ Gold – Case studies of greening existing buildings in Vancouver



Ting Pan, LEED® AP

About us



Green Building & Sustainable Community Consulting Company

Values-based

**8 people with backgrounds in
project management, architecture,
mechanical engineering, academic
research, and education**

**Design workshop facilitation, LEED
project management, building
simulations, research, and policy**

**60 active LEED projects, over 12
million SF of residential,
commercial, & institutional projects**

Real and Perceived Challenges

- Choose between Green and Perseveration?
- Creative Solutions
- Time
- Budget



Case Study #1: The Friedman Building



The original building and the addition formerly housed the Faculty of Anatomy and research labs on UBC Campus.

Case Study #1: The Friedman Building



The new building is home for the School of Audiology and Speech Sciences and the Physical Therapy Division, School of Rehabilitation Sciences



UBC Friedman Renovation

LEED Canada Summary Scorecard

Last Updated: April, 2009

Y	Y?	N?	N	Total Project Score	Possible Points
4	1	5	22	41	70

Certified 26 to 32 points Silver 33 to 38 points Gold 39 to 51 points Platinum 52 or more points

7	1	4	2	Sustainable Sites	Possible Points
Y	Y?	N?	N		
1				Prereq 1 Erosion & Sedimentation Control	1
1				Credit 1 Site Selection	1
			1	Credit 2 Development Density	1
				Credit 3 Redevelopment of Contaminated Sites	1
1				Credit 4.1 Alternative Transportation, Public Transportation Access	1
1				Credit 4.2 Alternative Transportation, Bicycle Storage & Changing Rooms	1
		1		Credit 4.3 Alternative Transportation, Alternative Fuel Refueling Stations	1
			1	Credit 4.4 Alternative Transportation, Parking Capacity	1
			1	Credit 5.1 Reduced Site Disturbance, Protect or Restore Open Space	1
1				Credit 5.2 Reduced Site Disturbance, Development Footprint	1
	1			Credit 6.1 Stormwater Management, Rate and Quantity	1
			1	Credit 6.2 Stormwater Management, Treatment	1
1				Credit 7.1 Landscape & Exterior Design to Reduce Heat Islands, Non-Roof	1
			1	Credit 7.2 Landscape & Exterior Design to Reduce Heat Islands, Roof	1
1				Credit 8 Light Pollution Reduction	1

7	1	1	1	5	Materials & Resources	Possible Points
Y	Y?	N?	N			
1					Prereq 1 Storage & Collection of Recyclables	1
1					Credit 1.1 Building Reuse, Maintain 75% of Existing Walls, Floor & Roof	1
1					Credit 1.2 Building Reuse, Maintain 95% of Existing Walls, Floor & Roof	1
			1		Credit 1.3 Building Reuse, Maintain 50% of Interior Non-Structural Elements	1
1					Credit 2.1 Construction Waste Management, Divert 50% from Landfill	1
1					Credit 2.2 Construction Waste Management, Divert 75% from Landfill	1
			1		Credit 3.1 Resource Reuse, Specify 5%	1
				1	Credit 3.2 Resource Reuse, Specify 10%	1
				1	Credit 4.1 Recycled Content, Specify 7.5% (post-consumer + 1/2 post industrial)	1
				1	Credit 4.2 Recycled Content, Specify 15% (post-consumer + 1/2 post industrial)	1
				1	Credit 5.1 Local/Regional Materials, 10% Extracted & Manufactured Regionally	1
				1	Credit 5.2 Local/Regional Materials, 20% Extracted & Manufactured Regionally	1
				1	Credit 6 Rapidly Renewable Materials	1
				1	Credit 7 Certified Wood	1
				1	Credit 8 Durable Building	1

4	1	1	1	Water Efficiency	Possible Points
Y	Y?	N?	N		
1				Credit 1.1 Water Efficient Landscaping, Reduce by 50%	1
1				Credit 1.2 Water Efficient Landscaping, No Potable Use or No Irrigation	1
			1	Credit 2 Innovative Wastewater Technologies	1
1				Credit 3.1 Water Use Reduction, 20% Reduction	1
1				Credit 3.2 Water Use Reduction, 30% Reduction	1

13	1	2	Indoor Environmental Quality	Possible Points
Y	Y?	N?	N	
1				Prereq 1 Minimum IAQ Performance
1				Prereq 2 Environmental Tobacco Smoke (ETS) Control
1				Credit 1 Carbon Dioxide (CO ₂) Monitoring
			1	Credit 2 Increase Ventilation Effectiveness
1				Credit 3.1 Construction IAQ Management Plan, During Construction
1				Credit 3.2 Construction IAQ Management Plan, Before Occupancy
1				Credit 4.1 Low-Emitting Materials, Adhesives & Sealants
1				Credit 4.2 Low-Emitting Materials, Paints
1				Credit 4.3 Low-Emitting Materials, Carpet
1				Credit 4.4 Low-Emitting Materials, Composite Wood
1				Credit 5 Indoor Chemical & Pollutant Source Control
1				Credit 6.1 Controllability of Systems, Perimeter
1			1	Credit 6.2 Controllability of Systems, Non-Perimeter
1				Credit 7.1 Thermal Comfort, Comply with ASHRAE 55-2004
1				Credit 7.2 Thermal Comfort, Permanent Monitoring System
1				Credit 8.1 Daylight & Views, Daylight 75% of Spaces
1				Credit 8.2 Daylight & Views, Views for 90% of Spaces

5	12	Energy & Atmosphere	Possible Points	
Y	Y?	N?	N	
1				Prereq 1 Fundamental Building Systems Commissioning
1				Prereq 2 Minimum Energy Performance
1				Prereq 3 CFC Reduction in HVAC&R Equipment
3			7	Credit 1 Optimize Energy Performance
			1	Credit 2.1 Renewable Energy, 5%
			1	Credit 2.2 Renewable Energy, 10%
			1	Credit 2.3 Renewable Energy, 20%
			1	Credit 3 Best Practice Commissioning
1				Credit 4 Ozone Depletion
			1	Credit 5 Measurement & Verification
1				Credit 6 Green Power

5	Innovation & Design Process	Possible Points		
Y	Y?	N?	N	
1				Credit 1.1 Innovation in Design: Green Bldg Education
1				Credit 1.2 Innovation in Design: Green Housekeeping
1				Credit 1.3 Innovation in Design: Exemplary Performance - 40% Reduction
1				Credit 1.4 Innovation in Design: Green Power 100% for 2 years
1				Credit 2 LEED™ Accredited Professional

LEED Analysis by: RECOLLECTIVE Consulting (www.recollective.ca)

Challenges and Solutions

- Energy Conservation Measures
 - More efficient air handling units
 - Double-paned thermally-broken aluminum windows
 - Insulation increased in part of the building and on the entire roof
 - Interior glazing and clerestories to allow for daylighting and reduced artificial lighting
 - Low-flow plumbing fixtures to reduce hot water demand
 - Heat recovery for Air Handling Unit #1

LEED Gold Upgrade Study
for the UBC Friedman Renovation



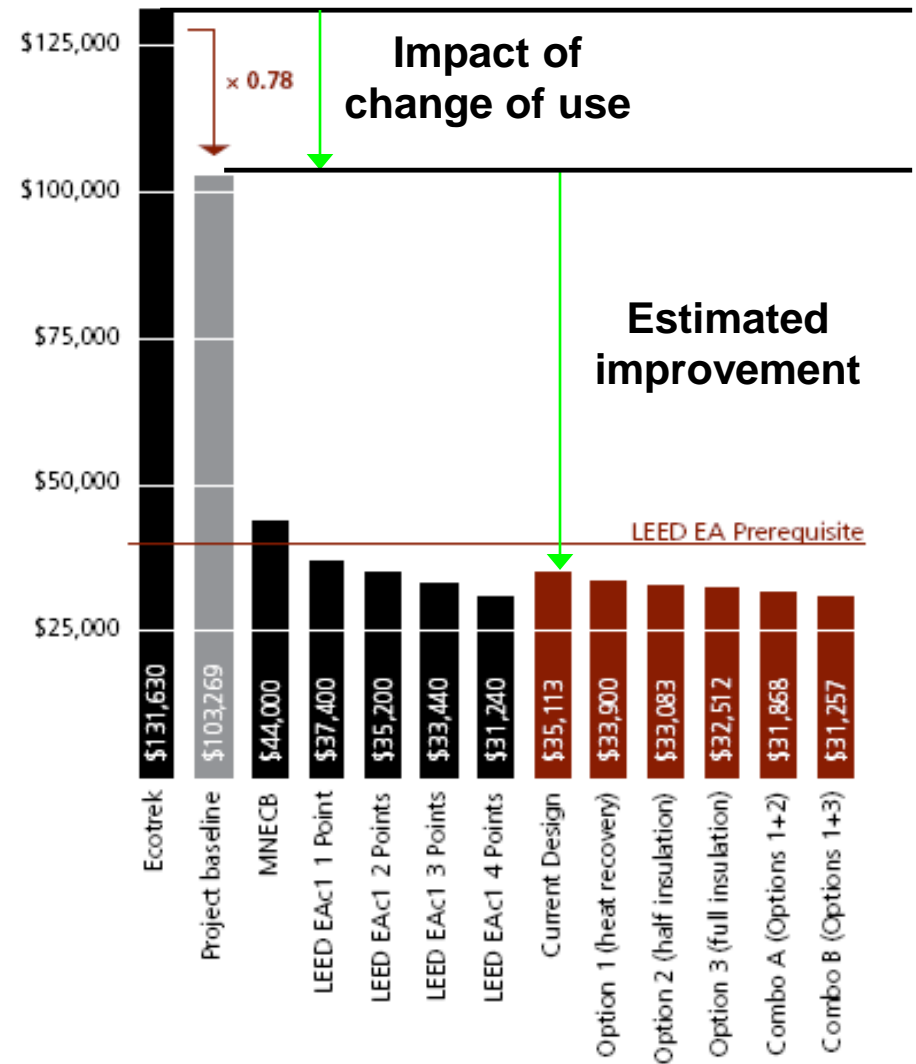
Prepared June 2008 for the University of British Columbia by:

 **RECOLLECTIVE**
Buildings • Community • Ecology

 **MCW**
MCW Consultants Ltd.

ACTON OSTRY ARCHITECTS INC

- The study reveals the hidden energy savings that are invisible in LEED
- Additional upgrades would only provide marginal improvements
- Few cost effective options that could help the project earn more than 4 points or 29% better than MNECB



Preliminary Life Cycle Analysis



TOTAL IMPACTS BY BUILDING COMPONENT	Primary Energy (MJ) TOTAL	GWP (tonnes) TOTAL	Weighted Resource Use (tonnes) TOTAL	Air Pollution Index TOTAL	H2O Pollution Index TOTAL
COLUMNS & BEAMS	719953	38	290	4338	32.00
INTERMEDIATE FLOORS	6843104	539	4945	73398	144.95
EXTERIOR WALLS	3930381	245	1822	47830	319.05
WINDOWS	0	0	0	0	0.00
INTERIOR WALLS	0	0	0	0	0.00
ROOF	0	0	0	0	0.00
WHOLE BUILDING	11493438	822	7056	125566	495.99

- Weighted resource use 70% less
- Solid waste diversion 1.5 million kg
- Global warming potential 822 tonnes of carbon dioxide equivalent
- Primary energy 11.5 million MJ
- Water use savings from manufacturing and construction 0.5 million litres
- Coal savings from manufacturing 559,746 kg

Case Study #2: The Salt Building



1943



2003



2008

2009



Case Study #2: The Salt Building

- Rehabilitation project - adapted for contemporary use: bakery, café, brewpub and restaurant
- Part of redevelopment of Vancouver's Southeast False Creek (SEFC), Olympic Village site



Case Study #2: The Salt Building

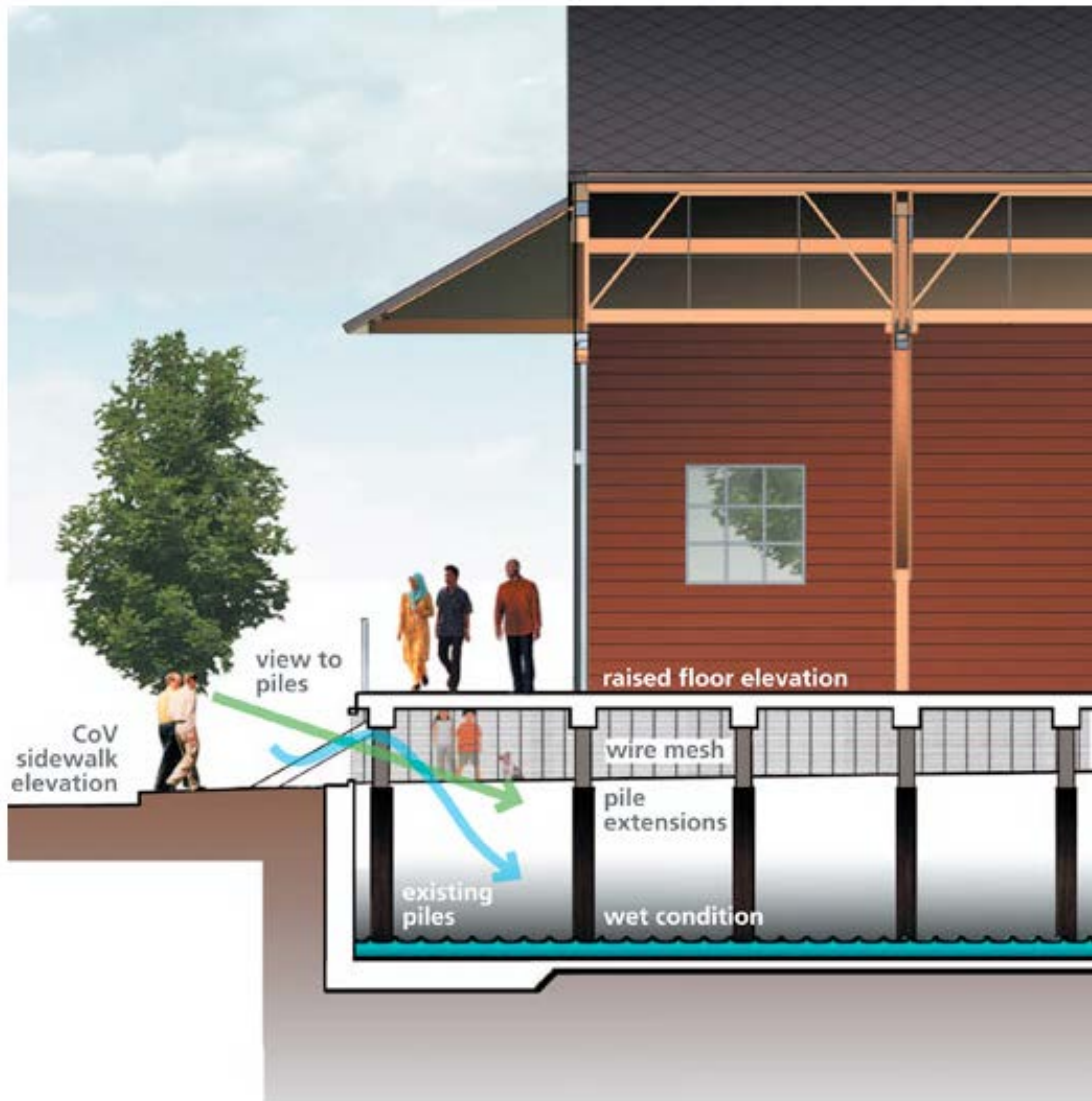
- Character-defining Elements:



Monitor roof, with a clerestory containing a row of 15-pane windows and cedar ventilation louvres



Large, open interior space, interrupted only by a row of columns down the centre



- Exposed piles supporting the building
- Wetland beneath building



The Salt Building

LEED Canada CS Progress Report

Last updated: Aug 31, 2009



Y	Y?	N?	N	43	5	1	21	Total Project Score & Rating	GOLD	Possible Points 70
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Certified 26 to 32 points Silver 33 to 38 points Gold 39 to 51 points Platinum 52 or more points

6	4	1	3	Sustainable Sites				Possible Points 14			
Y	Y?	N?	N	Y	Y?	N?	N	Y	Y?	N?	N
1				Prereq 1	Erosion & Sedimentation Control			1			
				Credit 1	Site Selection			1			
	1			Credit 2	Development Density			1			
1				Credit 3	Redevelopment of Contaminated Sites			1			
				Credit 4.1	Alternative Transportation, Public Transportation Access			1	1		
				Credit 4.2	Alternative Transportation, Bicycle Storage & Changing Rooms			1	1		
				Credit 4.3	Alternative Transportation, Alternative Fuel Refueling Stations			1			
	1			Credit 4.4	Alternative Transportation, Parking Capacity			1			
			1	Credit 5.1	Reduced Site Disturbance, Protect or Restore Open Space			1	1		
			1	Credit 5.2	Reduced Site Disturbance, Development Footprint			1	1		
		1		Credit 6.1	Stormwater Management, Rate and Quantity			1			
	1			Credit 6.2	Stormwater Management, Treatment			1	1		
				Credit 7.1	Landscape & Exterior Design to Reduce Heat Islands, Non-Roof			1			
			1	Credit 7.2	Landscape & Exterior Design to Reduce Heat Islands, Roof			1			
	1			Credit 8	Light Pollution Reduction			1	1		

8			6	Materials & Resources				Possible Points 14			
Y	Y?	N?	N	Y	Y?	N?	N	Y	Y?	N?	N
				Prereq 1	Storage & Collection of Recyclables						
				Credit 1.1	Building Reuse, Maintain 75% of Existing Walls, Floor & Roof						1
				Credit 1.2	Building Reuse, Maintain 95% of Existing Walls, Floor & Roof			1			1
				Credit 1.3	Building Reuse, Maintain 50% of Interior Non-Structural Elements			1			1
				Credit 2.1	Construction Waste Management, Divert 50% from Landfill			1			1
				Credit 2.2	Construction Waste Management, Divert 75% from Landfill			1			1
				Credit 3.1	Resource Reuse, Specify 5%			1			1
				Credit 3.2	Resource Reuse, Specify 10%			1			1
				Credit 4.1	Recycled Content, Specify 7.5% (post-consumer + 1/2 post industrial)			1			1
				Credit 4.2	Recycled Content, Specify 15% (post-consumer + 1/2 post industrial)			1			1
				Credit 5.1	Local/Regional Materials, 10% Extracted & Manufactured Regionally			1			1
				Credit 5.2	Local/Regional Materials, 20% Extracted & Manufactured Regionally			1			1
				Credit 6	Rapidly Renewable Materials			1			1
				Credit 7	Certified Wood			1			1
				Credit 8	Durable Building			1			1

2			3	Water Efficiency				Possible Points 5			
Y	Y?	N?	N	Y	Y?	N?	N	Y	Y?	N?	N
				Credit 1.1	Water Efficient Landscaping, Reduce by 50%		1	1			
				Credit 1.2	Water Efficient Landscaping, No Potable Use or No Irrigation			1			
				Credit 2	Innovative Wastewater Technologies			1			
				Credit 3.1	Water Use Reduction, 20% Reduction			1			
				Credit 3.2	Water Use Reduction, 30% Reduction			1			

11			4	Indoor Environmental Quality				Possible Points 15			
Y	Y?	N?	N	Y	Y?	N?	N	Y	Y?	N?	N
				Prereq 1	Minimum IAQ Performance						
				Prereq 2	Environmental Tobacco Smoke (ETS) Control						
				Credit 1	Carbon Dioxide (CO ₂) Monitoring			1			1
				Credit 2	Increase Ventilation Effectiveness			1			1
				Credit 3.1	Construction IAQ Management Plan, During Construction			1			1
				Credit 3.2	Construction IAQ Management Plan, Before Occupancy			1			1
				Credit 4.1	Low-Emitting Materials, Adhesives & Sealants			1			1
				Credit 4.2	Low-Emitting Materials, Paints			1			1
				Credit 4.3	Low-Emitting Materials, Carpet			1			1
				Credit 4.4	Low-Emitting Materials, Composite Wood			1			1
				Credit 5	Indoor Chemical & Pollutant Source Control			1			1
				Credit 6.1	Controllability of Systems, Perimeter			1			1
				Credit 6.2	Controllability of Systems, Non-Perimeter			1			1
				Credit 7.1	Thermal Comfort, Comply with ASHRAE 55-2004			1			1
				Credit 7.2	Thermal Comfort, Permanent Monitoring System			1			1
				Credit 8.1	Daylight & Views, Daylight 75% of Spaces			1			1
				Credit 8.2	Daylight & Views, Views for 90% of Spaces			1			1

12			5	Energy & Atmosphere				Possible Points 17			
Y	Y?	N?	N	Y	Y?	N?	N	Y	Y?	N?	N
				Prereq 1	Fundamental Building Systems Commissioning						
				Prereq 2	Minimum Energy Performance						
				Prereq 3	CFC Reduction in HVAC&R Equipment						
				Credit 1	Optimize Energy Performance			10			
				Credit 2.1	Renewable Energy, 5%			1			1
				Credit 2.2	Renewable Energy, 10%			1			1
				Credit 2.3	Renewable Energy, 20%			1			1
				Credit 3	Best Practice Commissioning			1			1
				Credit 4	Ozone Depletion			1			1
				Credit 5	Measurement & Verification			1			1
				Credit 6	Green Power			1			1

4	1			Innovation & Design Process				Possible Points 5			
Y	Y?	N?	N	Y	Y?	N?	N	Y	Y?	N?	N
				Credit 1.1	Innovation in Design: Water Use Reduction 40%			1			1
				Credit 1.2	Innovation in Design: Green Building Education			1			1
				Credit 1.3	Innovation in Design: 100% Underground Parking			1			1
				Credit 1.4	Innovation in Design: Construction Waste Management			1			1
				Credit 2	LEED™ Accredited Professional			1			1

LEED Analysis by: RECOLLECTIVE Consulting | www.recollective.ca



Challenges and Solutions

- **Strategies**

- In-slab radiant flooring system was introduced
- Single-paned clerestory windows retained, repaired or replicated
- Louvers are retained and functional as much as possible; some are sealed
- More openings cut into the existing shell to allow for natural light and view access as well as to serve as a public venue

- **LEED Implications**

- Energy model shows the project is achieving 8 out of 10 energy points
- Natural ventilation through selected louvers in the clerestory also contribute to energy performance
- View access credit can be achieved; but daylight model indicates not enough daylight to achieve the credit

Challenges and Solutions

- Strategies

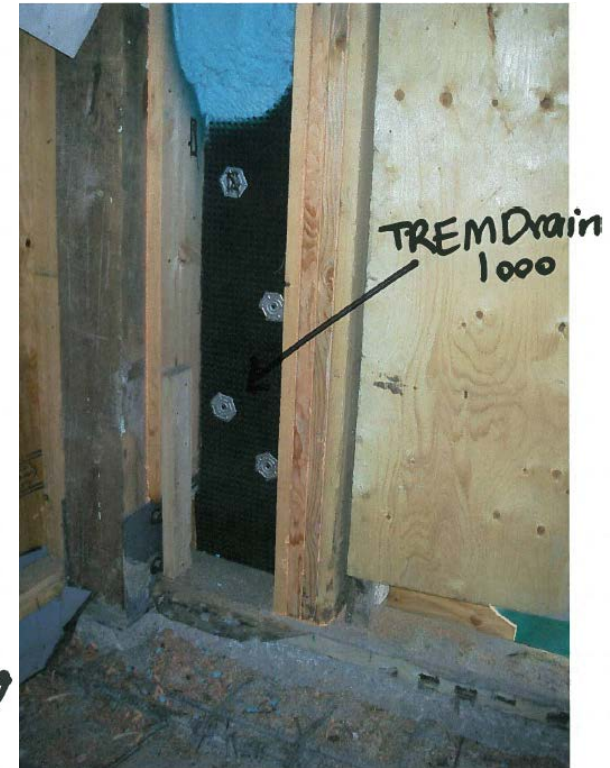
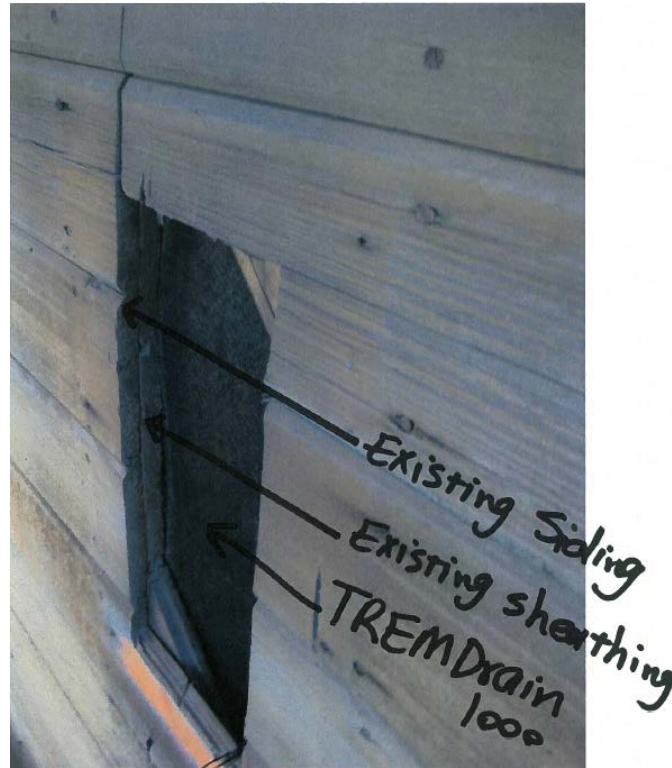
- Reduce exterior illumination to minimize light pollution even though it is a historic landmark
- Retain and reuse existing materials including wood siding, floor, roof, trusses

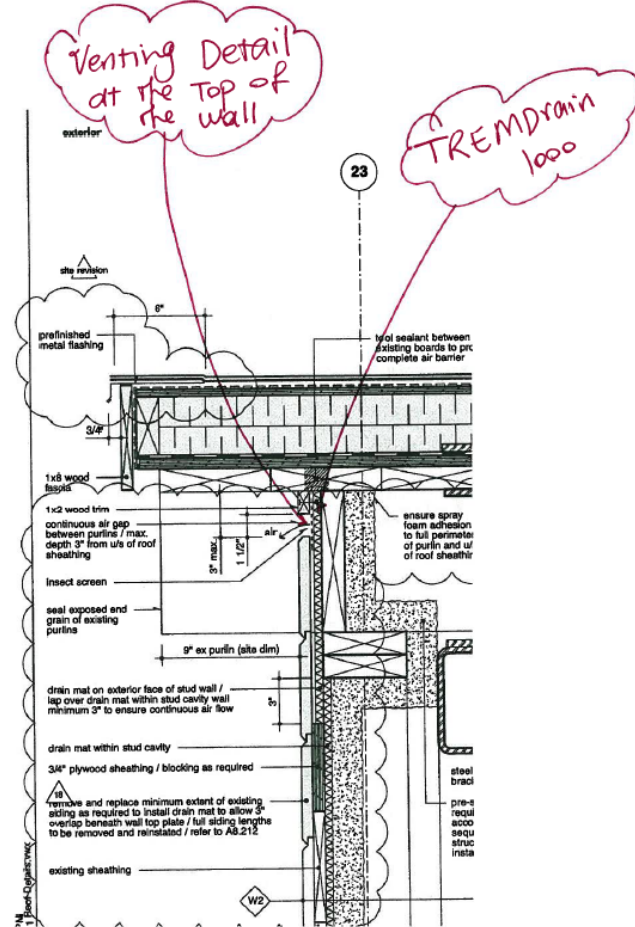
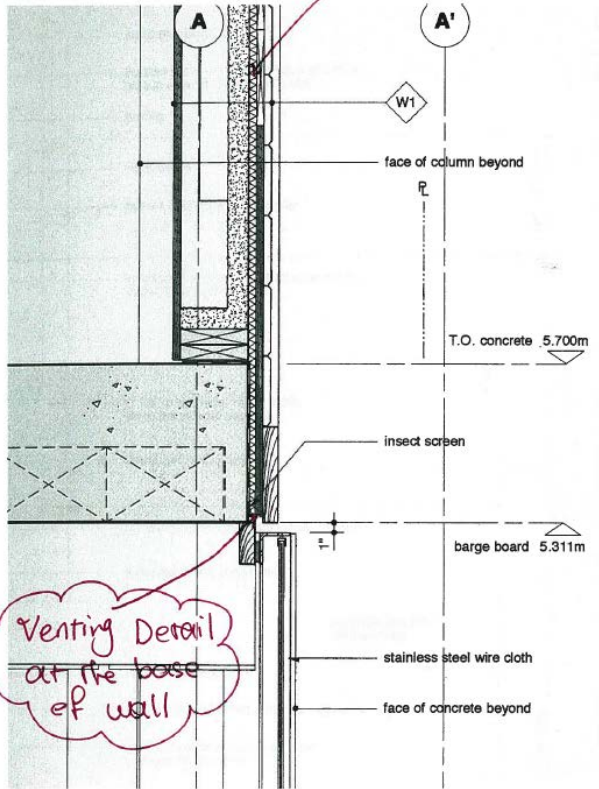
- LEED Implications

- Illuminated signs are downlighted and shielding is designed to meet the Light Pollution Reduction credit requirement
- Retain enough structural and shell elements to achieve Building Reuse credit

Challenges and Solutions

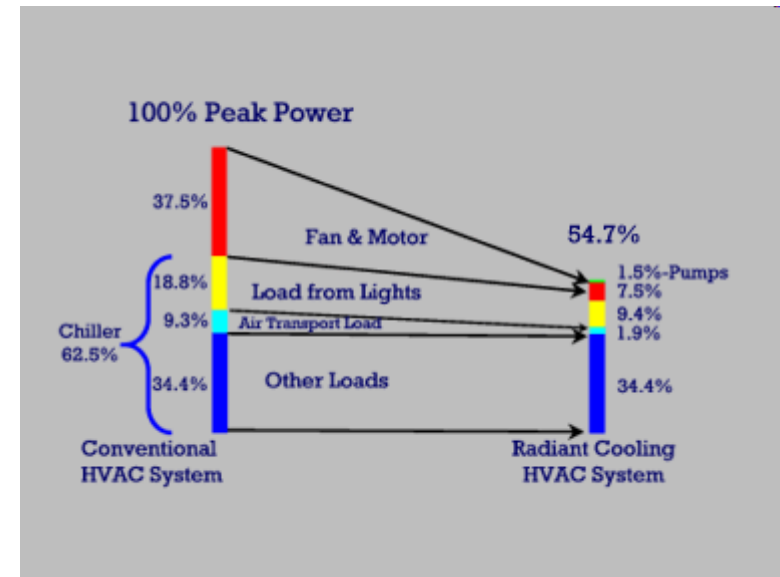
- Envelope upgrade
 - Thermal performance
 - Heritage values
 - Moisture issue





Energy Performance: Actual and Modeled

- Why does the energy score vary so wildly for these two projects?
 - HVAC: Radiant heating and cooling system vs. forced air system
 - Energy source: District Energy System vs. Steam Plant
- The proposed design is compared to a reference model, not the pre-renovation condition



Courtesy of Lawrence Berkeley National Laboratory

Success and Lessons Learned

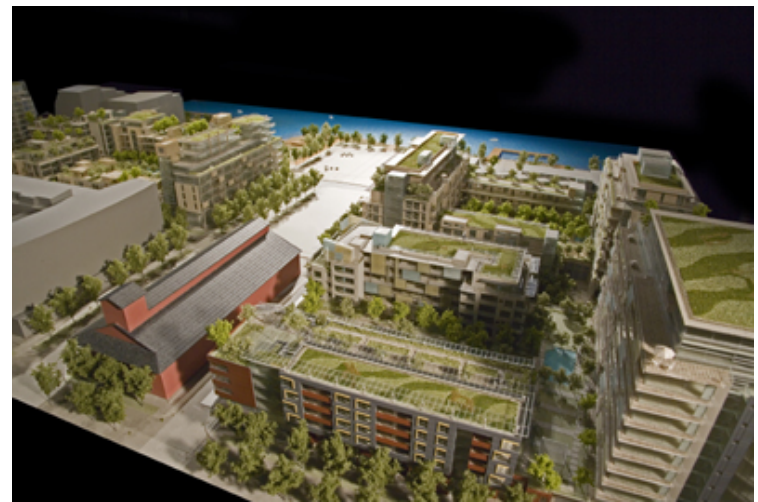
- Integrated Design Process
 - Set reasonable expectations
 - Communicate priorities
 - Establish working relationships
 - Challenging to follow through given the time pressure or budgetary limitation



Success and Lessons Learned

- Site Context

- Chosen site (urban, campus, contaminated site, etc.)
- Decisions made before project starts (energy source, district energy system, project boundary, etc.)
- Could have a positive or negative impact on LEED scorecard
- Pre-existing conditions (structural loads, opening locations, building envelope, etc.) could limit the selection of design strategies



Success and Lessons Learned

- Assumptions
 - Engage the right stakeholders at the beginning
 - Provide opportunities to clarify LEED credit requirements and interpretations.
 - Every project is different. A preliminary LEED feasibility study is helpful in understanding the challenges and establishing team expectations.



Photo credit: Commonwealth Historic Resource Management

Success and Lessons Learned

- LEED Rating System: designed with new commercial office building in mind
- Major limitations when applied to existing buildings:
 - Energy Performance: actual improvement is not accounted for
 - Building Reuse: challenging and time-consuming to document at times; high percentage threshold to earn a point
 - Innovation in Design Credits: the only places to acknowledge cultural and social values and Life Cycle benefits



Success and Lessons Learned

- Benefits:
 - Encourage Integrated Design Process
 - Relatively comprehensive
 - Follow-through from design to construction
 - Recognition and sense of accomplishment



Success and Lessons Learned

- Decision making process: choose the “right” thing or the “LEED” thing?
 - Meet the intent of the credits
 - Aim to provide the best value to the clients, and most environmental benefits to the users and the community





Thanks!

Contact: Ting Pan ting@recollective.ca