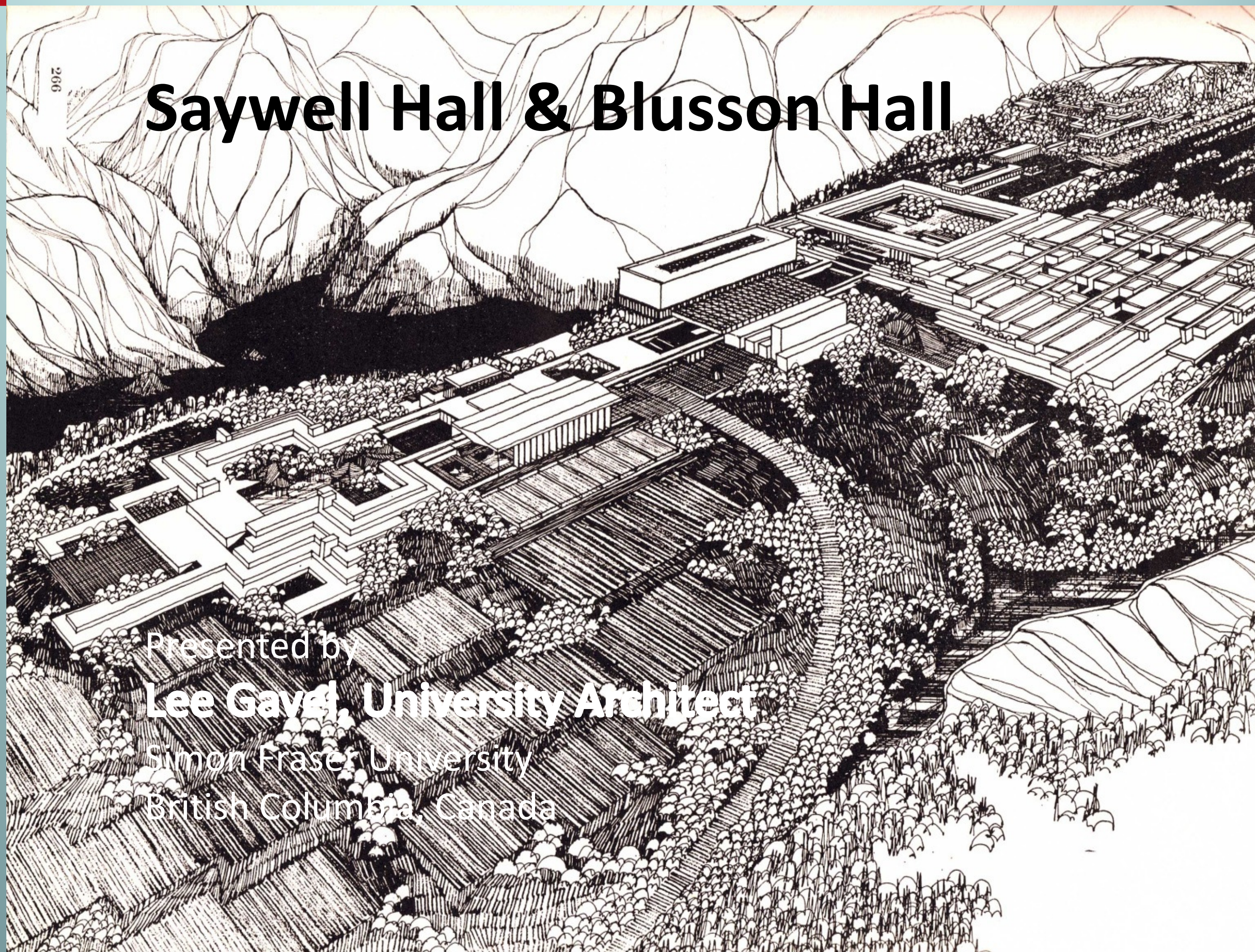
Johns Hopkins University Homewood Campus

Association of University Architects - 2010 Conference
Monday - June 21st

SFU

Saywell Hall & Blusson Hall



Presented by

Lee Gavel, University Architect

Simon Fraser University

British Columbia, Canada

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The Story — "An Investment in Design"

Simon Fraser University is consistently ranked as the top comprehensive university in Canada. As such it is competing with larger research institutions including medical schools, and typically with a much larger research facility base. In order to remain competitive SFU needed to construct additional research facilities for the social sciences including CL3 (BSL) level 3 labs and in particular a building to serve the needs of a newly created Faculty of Health Sciences. As a public institution, limited funding was available from the province and SFU took a very progressive step as one of the first institutions in Canada to implement an institutional bond issue. The funding plan was such that the project needed to proceed in two phases separated by approximately a year. With funding in place the next hurdle was to locate a site that complemented the master plan of the university and resolve the locational conflict between the hard sciences and social sciences with respect to the new faculty.

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The Site

Architecturally, Simon Fraser University is iconic. The campus was laid out according to the master plan drawn up by the firm of Erickson Massey Architects in 1964. The campus was recently recognized by the Royal Architectural institute of Canada, for enduring excellence and national significance. The campus is organized as a series of buildings along a central axis forming a mega structure anchored by an academic quadrangle. It is located on top of Burnaby Mountain, surrounded by forests, with the east west central axis aligned with the height of land and academic buildings falling away down the slopes north and south.

This unique campus plan presents both opportunities and constraints as new facilities must be carefully integrated with the existing structures, in order to complement and not detract from the original plan. The new project was able to be carefully inserted in such a manner so as to bring forward the strengths of the interconnected internal pedestrian system and create new public spaces and courtyards. A further consideration was to avoid interference with the President and senior administration offices located immediately above and beside the site.

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2007 PRIX DU XX^{E} SIÈCLE

The Royal Architectural Institute of Canada recognizes

Simon Fraser University

for its enduring excellence and national significance to Canadian Architecture.

ARCHITECT:

Erickson/Massey Architects

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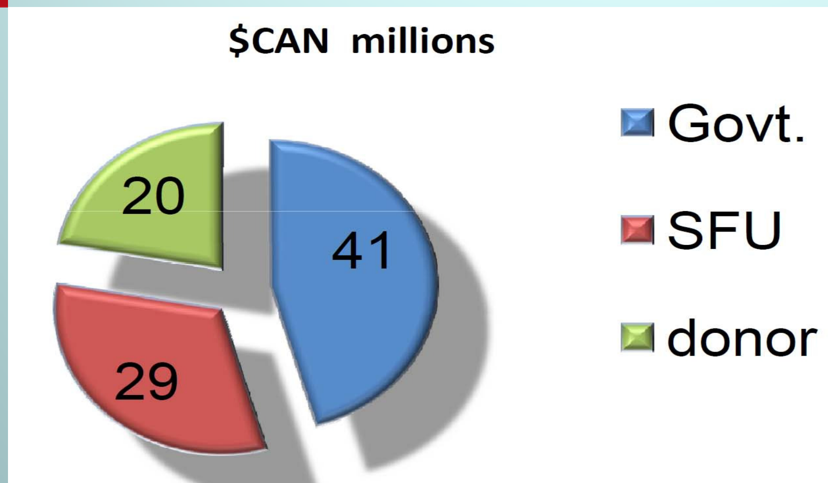

Funding

Of the $90M budget, $41M was provided by the Province of British Columbia; the balance was provided by SFU and donations

Program.

The net building areas are comprised of approximately 30% wet labs, 25% office spaces, and the remainder for teaching spaces and dry labs.

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The Strategy

Executive management of the project and development of a delivery strategy was led by the University Architect's office which was also responsible for selection of the site and defining the design guidelines for the consulting architects and engineers.

The economic climate at the initiation of the project was extremely upbeat. The Vancouver real estate market was extremely hot. Vancouver had just been awarded the 2010 Winter Olympic Games and construction was taking place throughout the entire region. At the same time, China was emerging as an industrial superpower that was absorbing raw materials at a rapidly escalating rate. The resulting construction experience was frenetic. It was a dream for the Contractor but a nightmare for the Owner. At times construction resources were simply unavailable, so project schedules were impossible to maintain. Double digit inflation made a mockery of budgets established only months before.

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Remembering 2006 newspaper headlines (the good old days):

Construction booms even as prices for material soar!

Rate of Price Escalation in Public Construction Costs Continues Unabated According to…

CONTRACTORS STRUGGLE WITH RISING MATERIALS PRICES

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Previously our project delivery process was design, bid, build, - designing a building, and then publicly tendering a single stipulated sum contract. The new reality challenged our traditional process which would obviously not produce effective results. Construction escalation exceeded 1% per month. Certain trades were next to impossible to hire, and no general contractor firm was interested in submitting competitive tenders for a project. Escalation was taking a huge bite out of our budgets. We had to build more quickly or risk losing more of our budget to escalation.

The public funding for the project was to come in two phases over two years. The first major decision was to employ the same design team for both buildings, although in a strict sense they were two different projects. This allowed the urban design and massing to be resolved up front. The next major strategic choice was to engage a single contractor on a construction management basis, in order to accelerate the design cycle with contractor input early on. By utilizing "Construction Management at Risk" the university would be able to get early contractor advice, incrementally tender and commit to the work allowing for adjustment in scope as costs became known, but ultimately to have fully transferred the construction and financial risk to a third party.

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“Construction Manager at Risk”

In this approach a prequalified construction manager is selected by tender on the basis of percentage markups and fee, assists with the design, tenders the sub trade packages, and ultimately takes on the construction risk in a stipulated sum contract. Having the general contractor on board to provide constructability and cost estimating services made it easier to line up key sub trades at the earliest possible time to maintain and even accelerate the schedule through fast-tracking.

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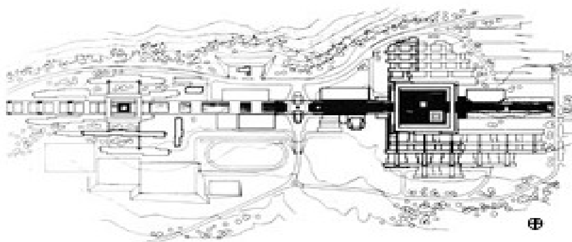
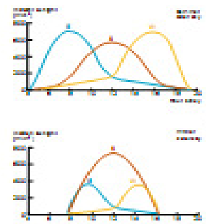
Site + Form

the **site** for the ASSC project is a former parking lot adjacent to the main campus bus loop / waiting area. Since incorporating the U-Pass transit pass into student fees, busses have replaced cars and parking needs have been reduced. This allows SFU to replace an asphalt parking lot with a green-roofed building and landscaped courtyard.

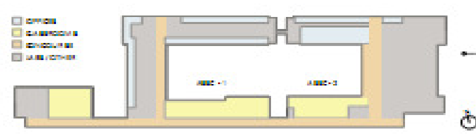


Arthur Erickson's **original campus plan** organized SFU along a strong east-west axis running along the spine of Burnaby Mountain.



orienting buildings **east-west** (so that most of their facades face north or south) is a time-honoured sustainable design strategy. Even without any external shading devices, buildings with this orientation are less intensely heated by the sun in summer and receive more free solar heating in winter.

the **building form** chosen for the ASSC project combines the courtyard form of the original Academic Quadrangle (AQ) with the strong east-west axis of the larger campus. The fully-glazed south-facing main concourse runs the entire length of the project, acting as a giant passive solar collector in winter while providing a protected pathway from the Bus Loop at the east end of the project to the AQ. **Horizontal shading devices and fritted clerestories** prevent the space from overheating in summer.



whenever possible, **classroom and office spaces** are located along the north facades. This allows abundant daylight in without the need to deploy blinds to prevent glare.

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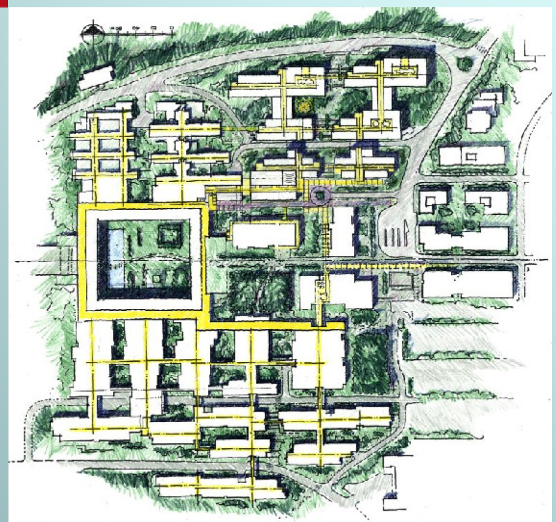

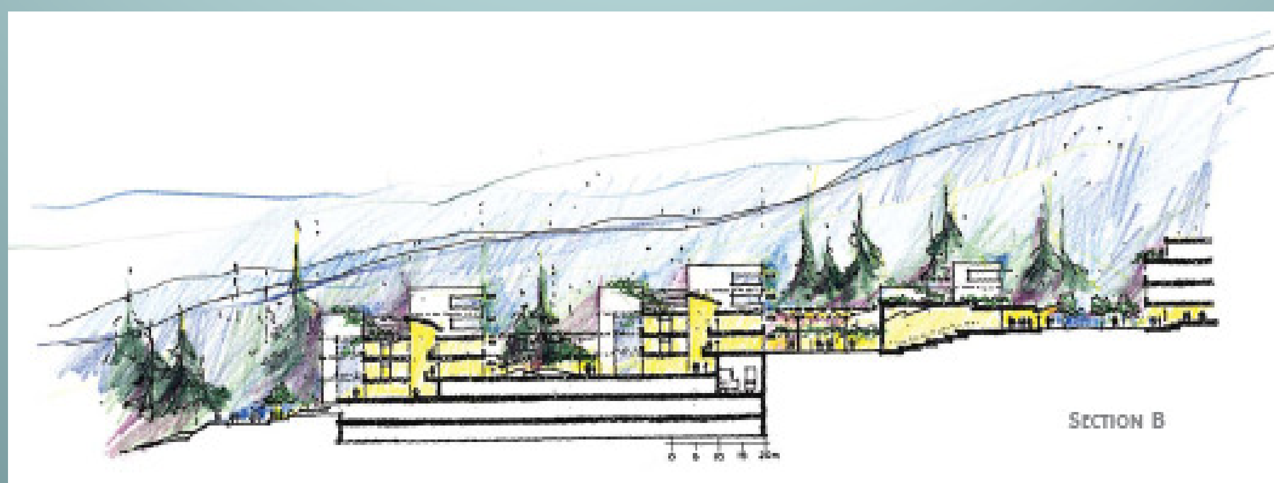

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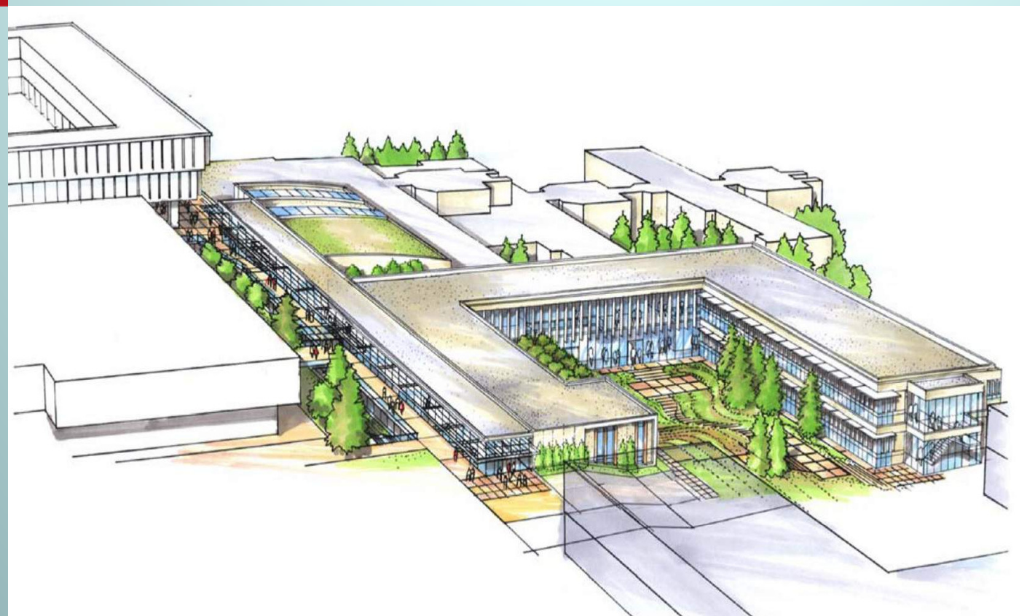

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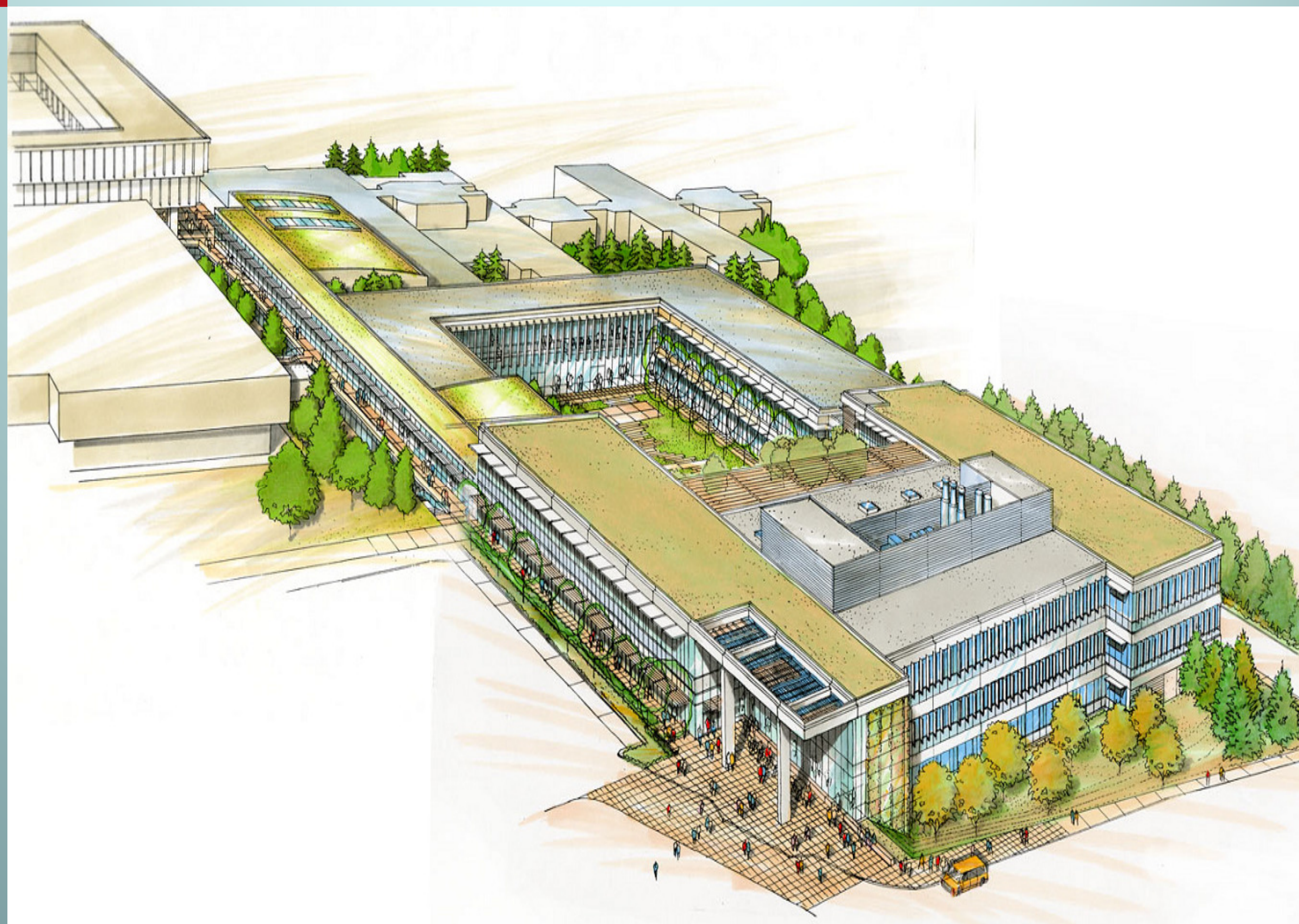

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Design

The precedent architectural style of the campus is west coast modern, with the palette of materials restricted to concrete as a primary material, with glass, tile and wood as accents. Buildings are typically two to three stories in height with roofs developed as visible elements due to the slope of the mountain. Sustainability was a major goal.

The instruction given to the design team was to provide us with a functional building that accommodated our program, facilitated the exchange of knowledge, complemented our campus design (as opposed to confronting it), and all within a contextual contemporary 21st century sustainable design.

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Blusson Hall main entrance

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LIGHTING

The design of Blusson Hall includes narrow floor plates that allow daylight into all areas of the building. Furthermore, each building elevation was extensively studied with Ecotect modeling software in order to develop the most effective solar strategy for each orientation, resulting in the use of horizontal, vertical, and angled sunshades depending up the sun's path.

Additional features include a wooden canopy sunshade that welcomes visitors to the building, deciduous trees that provide additional shading, and a fully glazed south-facing main concourse that acts as a giant solar collector in the winter.

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Saywell Hall Interior Concourse

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Saywell Hall exterior walkway

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Blusson Hall Courtyard looking east.

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Saywell Hall Atrium looking west

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Blusson Hall East Elevation

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32	20	17	Draft Project Score LEED V. 2.1	Certified 26-32 Silver 33-38 Gold 39 -51 Platinum 52+	Possible Points

4	2	8	Sustainable Sites		Possible Points 14
Y	?	N			
Y			Prereq 1	**Erosion & Sedimentation Control**	0
		N	Credit 1	**Site Selection**	1
		N	Credit 2	**Urban Redevelopment**	1
		N	Credit 3	**Brownfield Redevelopment**	1
Y			Credit 4.1	**Alternative Transportation,** Public Transportation Access	1
		N	Credit 4.2	**Alternative Transportation,** Bicycle Storage & Changing Rooms	1
		N	Credit 4.3	**Alternative Transportation,** Alternative Fuel Vehicles	1
		N	Credit 4.4	**Alternative Transportation,** Parking Capacity	1
		N	Credit 5.1	**Reduced Site Disturbance,** Protect or Restore Open Space	1
		N	Credit 5.2	**Reduced Site Disturbance,** Development Footprint	1
	?		Credit 6.1	**Stormwater Management,** Rate and Quantity	1
	?		Credit 6.2	**Stormwater Management,** Treatment	1
Y			Credit 7.1	**Landscape & Exterior Design to Reduce Heat Islands,** Non-R	1
Y			Credit 7.2	**Landscape & Exterior Design to Reduce Heat Islands,** Roof	1
Y			Credit 8	**Light Pollution Reduction**	1

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

8	7	2	Energy & Atmosphere		Possible Points 17
Y	?	N			
Y			Prereq 1	**Fundamental Building Systems Commissioning**	0
Y			Prereq 2	**Minimum Energy Performance**	0
Y			Prereq 3	**CFC Reduction in HVAC&R Equipment**	0
Y			Credit 1.1	**Optimize Energy Performance,** 15% New / 5% Existing	1
Y			Credit 1.2	**Optimize Energy Performance,** 20% New / 10% Existing	1
Y			Credit 1.3	**Optimize Energy Performance,** 25% New / 15% Existing	1
Y			Credit 1.4	**Optimize Energy Performance,** 30% New / 20% Existing	1
Y			Credit 1.5	**Optimize Energy Performance,** 35% New / 25% Existing	1
	?		Credit 1.6	**Optimize Energy Performance,** 40% New / 30% Existing	1
	?		Credit 1.7	**Optimize Energy Performance,**45% New / 35% Existing	1
	?		Credit 1.8	**Optimize Energy Performance,** 50% New / 40% Existing	1
		N	Credit 1.9	**Optimize Energy Performance,** 55% New / 45% Existing	1
		N	Credit 1.10	**Optimize Energy Performance,** 60% New / 50% Existing	1
Y			Credit 2.1	**Renewable Energy,** 5%	1
	?		Credit 2.2	**Renewable Energy,** 10%	1
	?		Credit 2.3	**Renewable Energy,** 20%	1
	?		Credit 3	**Additional Commissioning**	1
Y			Credit 4	**Ozone Depletion**	1
Y			Credit 5	**Measurement & Verification**	1
	?		Credit 6	**Green Power**	1

5	4	4	Materials & Resources		Possible Points
Y	?	N			
Y			Prereq 1	**Storage & Collection of Recyclables**	
		N	Credit 1.1	**Building Reuse,** Maintain 75% of Existing Shell	
		N	Credit 1.2	**Building Reuse,** Maintain 100% of Existing Shell	
		N	Credit 1.3	**Building Reuse,** Maintain 100% Shell & 50% Non-Shell	
Y			Credit 2.1	**Construction Waste Management,** Divert 50%	
Y			Credit 2.2	**Construction Waste Management,** Divert 75%	
	?		Credit 3.1	**Resource Reuse,** Specify 5%	
		N	Credit 3.2	**Resource Reuse,** Specify 10%	
Y			Credit 4.1	**Recycled Content,** Specify 5% pc + pi	
	?		Credit 4.2	**Recycled Content,** Specify 10% pc +pi	
Y			Credit 5.1	**Local/Regional Materials,** 20% Manufactured Locally	
	?		Credit 5.2	**Local/Regional Materials,** of 20% Above, 50% Harvested Locally	
	?		Credit 6	**Rapidly Renewable Materials**	
Y			Credit 7	**Certified Wood**	

11	3	1	Indoor Environmental Quality		Possible Points
Y	?	N			
Y			Prereq 1	**Minimum IAQ Performance**	
Y			Prereq 2	**Environmental Tobacco Smoke (ETS) Control**	
Y			Credit 1	**Carbon Dioxide (CO_2) Monitoring**	
	?		Credit 2	**Increase Ventilation Effectiveness**	
Y			Credit 3.1	**Construction IAQ Management Plan,** During Construction	
Y			Credit 3.2	**Construction IAQ Management Plan,** Before Occupancy	
Y			Credit 4.1	**Low-Emitting Materials,** Adhesives & Sealants	
Y			Credit 4.2	**Low-Emitting Materials,** Paints	
Y			Credit 4.3	**Low-Emitting Materials,** Carpet	
Y			Credit 4.4	**Low-Emitting Materials,** Composite Wood	
Y			Credit 5	**Indoor Chemical & Pollutant Source Control**	
Y			Credit 6.1	**Controllability of Systems,** Perimeter	
y			Credit 6.2	**Controllability of Systems,** Non-Perimeter	
Y			Credit 7.1	**Thermal Comfort,** Comply with ASHRAE 55-1992	
	?		Credit 7.2	**Thermal Comfort,** Permanent Monitoring System	
	?		Credit 8.1	**Daylight & Views,** Daylight 75% of Spaces	
		N	Credit 8.2	**Daylight & Views,** Views for 90% of Spaces	

2	3	0	Innovation & Design Process		Possible Points
Y	?	N			
Y			Credit 1.1	**Innovation in Design:**	
	?		Credit 1.2	**Innovation in Design:**	
	?		Credit 1.3	**Innovation in Design:**	
	?		Credit 1.4	**Innovation in Design:**	
Y			Credit 2	**LEED Accredited Professional**	

YES	?	NO	OVERALL LEED RATING
32	20	17	

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MATERIALS

The materials in Blusson Hall were chosen for their beauty, durability and environmental properties. The exposed architectural concrete substitutes fly ash for 30-50% of the cement, thereby reducing the energy needed to make concrete and diverting a waste product from landfills. Fritted glass allows daylight through while reducing solar heat gain year round. Glulam window backup is made from locally sourced FSC certified wood. Low-VOC carpet, paint and adhesives are used throughout the building in order to improve indoor air quality. Furthermore, materials serve as way-finding devices that provide continuity between the building and the campus. For example, wood is used in all public circulation and interactive gathering places.

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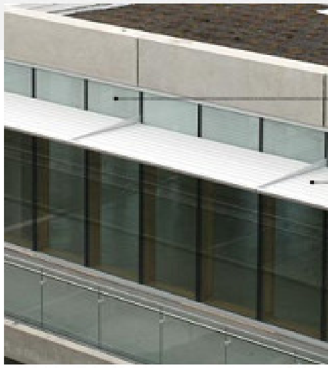
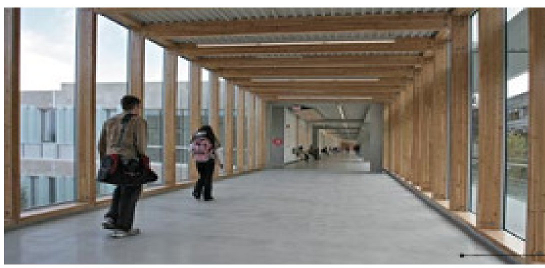
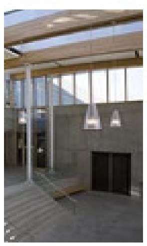
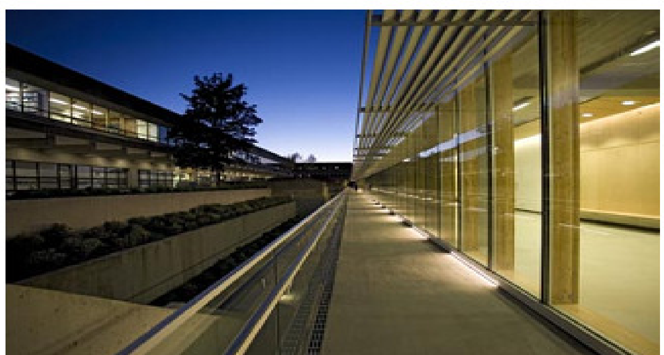
Materials









fritted glass clerestories allow daylight through while reducing solar heat gain year round; translucent glass vertical fins shade east and west facades.

sunshade louvres made of **aluminum** help to shade summer sun while allowing winter sun in to warm the building.

double glazing units with low-e coating allow daylight through while reducing heat loss for energy savings.

exposed **architectural concrete** substitutes fly ash for 30-50% of the cement, reducing the energy needed to make concrete and diverting a waste product from landfills.

prodema is a long-lasting, weatherproof, exterior cladding product made entirely from wood and forestry by-products.

glulam window backup made from FSC (Forest Stewardship Council) certified wood is sourced locally and uses non-VOC adhesives.

steel used in architectural columns, internal wall framing, and reinforcement bars for the structural concrete has an average of 50% recycled content.

polished concrete floors do not require additional materials to achieve a durable finished surface.

energy efficient lighting fixtures including T5s, L.E.D., and Exterior Ceramic Metal Halides together with **occupancy sensors and controls** reduce energy consumption.

low-VOC carpet, paint and adhesives were used throughout the project in order to improve indoor air quality.

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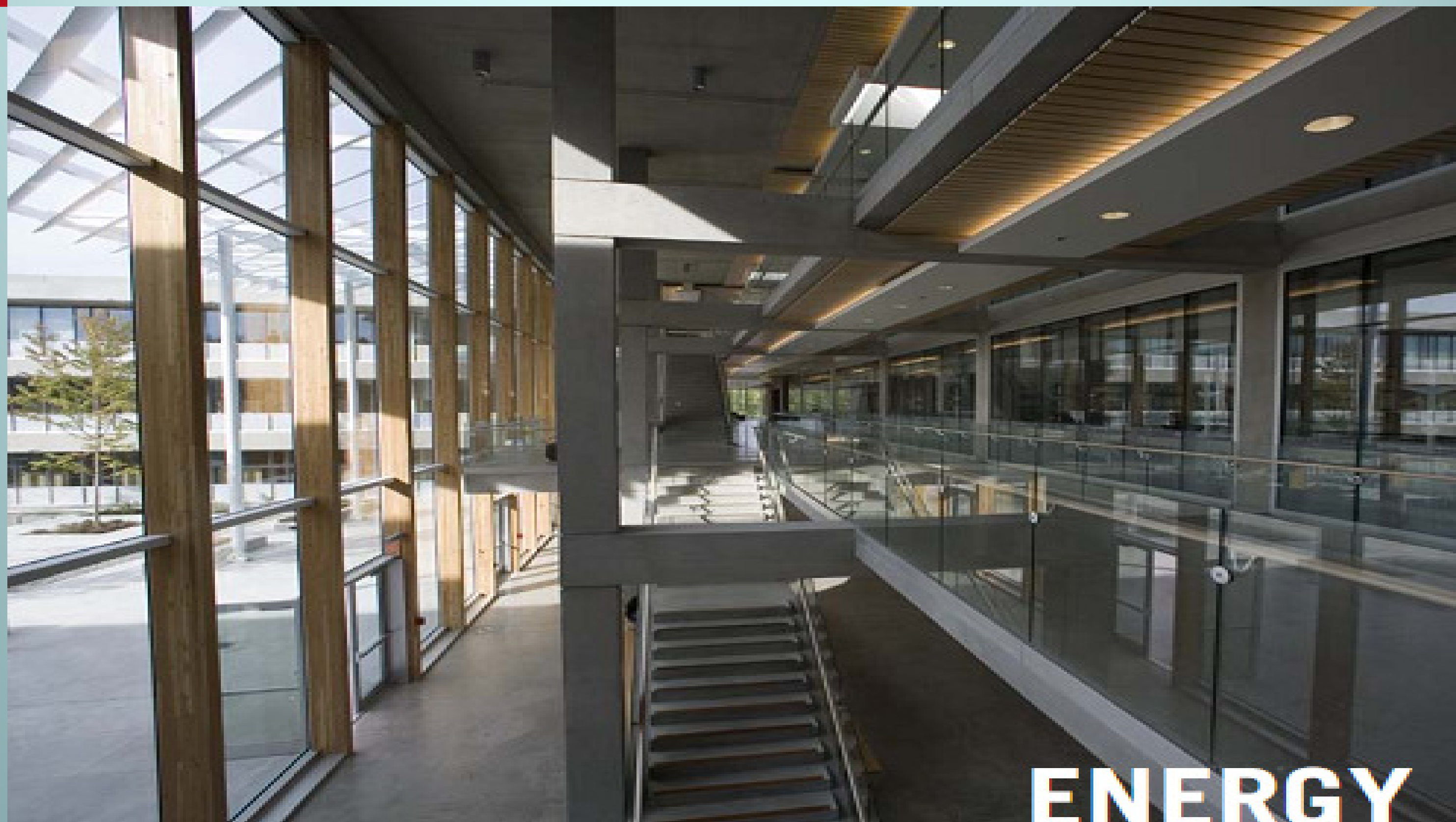

Blusson Hall is designed to reduce energy consumption by half when compared to the national standard. This is obtained through the use of green roofs that reduce the buildings heating and cooling loads, the incorporation of natural ventilation, which allows the mechanical systems to be turned off during shoulder seasons, and the use of recovered waste heat, which reduces the amount of energy required to condition the air.

Furthermore, air in the lecture theatre is supplied from an under floor plenum, which improves air circulation and uses less energy by not forcing air great distances. Energy efficient fixtures, occupancy sensors and lighting controls are also used throughout the building.

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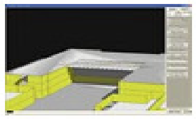

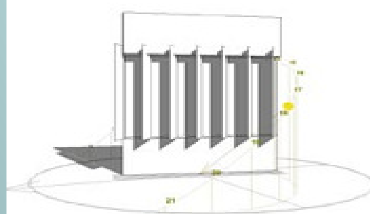

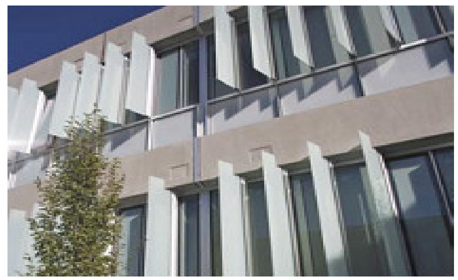

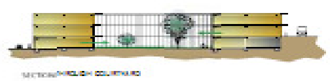

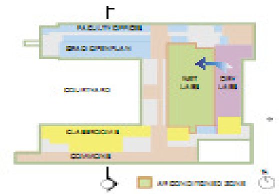

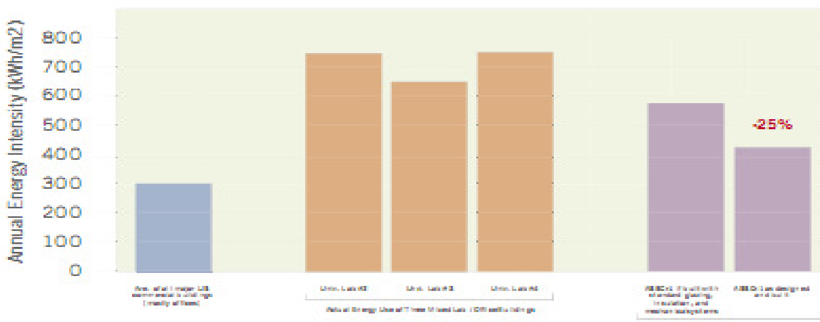

Energy

solar design

The design of SFU ASSC balances the desire for lots of abundant daylight and views with the need to control unwanted solar heat gain in summer and control glare for computer-related work all year long. Ecotect building modelling software was used to explore external solar shading appropriate for each facade. Horizontal sun shades of precast concrete and aluminum were used on south facades. East and west facades received an updated variant of the vertical fins of the original Academic Quadrangle building – replacing precast with translucent glass panels, and canting them to the north to both improve their shading effectiveness in early morning and late afternoon sun, and to allow unobstructed views to the mountains to the north.

The west facade of ASSC-2, facing the courtyard, presented a special design challenge. For the benefit of occupants of the adjacent wet laboratories and those passing through the triple-height N-S concourse, this facade needed to provide an unobstructed view to the landscaped courtyard. Canted vertical fins would obstruct the horizontal sweep of this view. Instead, a courtyard canopy was developed with aluminum fins oriented in such a way as to block 100% of the summer afternoon sun before 5pm, and yet allow morning direct sun to strike the courtyard and allow light from overcast skies through. The canopy also helps define a social space for outdoor tables or receptions.

mechanical engineering strategies

High Efficiency (Turbocor) Chiller: Oil free magnetic bearings in chiller reduce friction loss and energy consumption. This reduces noise level and power consumption by reducing bearing friction loss in compressors. It also improves part-load performance compared to conventional centrifugal chiller (25% more efficient at 50% part load based on COP values). This was the first turbocor installation in British Columbia.

Chilled Water Load Sharing for ASSC-1 & 2: Chilled water systems in ASSC-1 & 2 are interconnected. In shoulder seasons the two buildings' chilled water system operate as one system, only to separate during peak cooling season. The chillers are synchronized to provide chilled water in the two buildings. This strategy reduces the number of hours individual chillers are running in part load conditions (it is more efficient for chillers to run in full load than part load).

Utilization of Relief Air as Lab Makeup Air: 100% of lab air is exhausted. Lab makeup air is comprised of approximately 60% of outdoor air and 40% of relief air from North Wing Classrooms and Offices. Instead of using 100% outdoor air as makeup air, using relief air from classrooms reduces energy required to condition outdoor air while maintaining safety and ventilation requirements in labs.

Heat Recovery: Waste heat from lab exhaust air is recovered by using heat recovery coil in lab high plume (Strobic) exhaust fans and waste heat from office relief air is recovered by using heat recovery wheel in air handling units. This recovered heat is used to preheat cold incoming outdoor air, reducing the energy required.

Waste Heat Capture: Waste heat from equipment that requires 24-hour cooling is captured to heat supply air in the North Wing, reducing simultaneous heating and cooling in the building.

Night Set Back: The mechanical system is turned down or shut off after hours, eliminating energy consumption.

On-Demand Ventilation: Carbon dioxide sensors in classrooms and lecture theatre shuts off the air supply when rooms are not occupied.

energy performance

Laboratories are intensive users of energy, both because of the lab equipment itself (refrigerators, etc.) and of the need to condition large volumes of air (to ensure occupant safety in case of accidental chemical spills). In ASSC-1, the daylighting-friendly design and solar shading work together with efficient T5 lighting and daylighting controls to reduce lighting-related energy consumption; low-flow fume hoods reduce the volume of air to be exhausted (while still ensuring safety), and heat recovery captures heating or cooling energy that would otherwise be lost with this exhaust air. These approaches are projected to reduce energy consumption by 25% compared with standard construction. ASSC-2 goes further, collecting the labs into one wing while keeping classrooms and offices in the N and S wings, allowing a strategy where only the wet laboratories are mechanically cooled, while the offices and classrooms are naturally ventilated.

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WATER CONSERVATION

Blusson Hall has an extensive water conservation and management strategy. 90 percent of the project has a green roof or is landscaped. These plants and soils absorb rainfall and release it slowly back into the environment. The green roofs also provide thermal insulation in the winter, cooling in the summer, and contribute significantly to the storm water management.

Excess storm water is also stored in a 70,000 litre cistern buried under the complex's courtyard that provides irrigation water during the dry summer months. Low flow fixtures and low water demand landscaping also helps reduce water use.

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Water

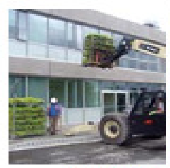
the rainy winters of British Columbia sometimes tax the capacity of municipal storm water systems. At the same time, despite this abundant rainfall, drinking water is increasingly in short supply.

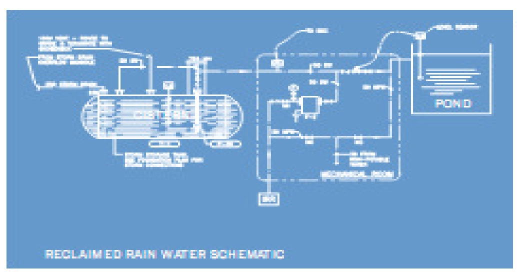
the ASSC project is designed to:

- minimize storm water runoff
- capture and store excess rain water for irrigating landscaping during dry spells
- use city water as sparingly as possible via:
  - efficient plumbing features and
  - low-water-demand landscaping

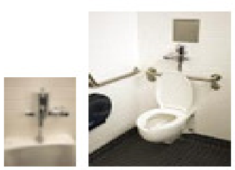
over 80% of the original site was parking lot and driveways, where essentially all of the incident rainfall went immediately into the city storm water system. Over 80% of the finished ASSC project is green roof or landscaped courtyard. These soils and plants absorb rainfall and release it slowly back into the environment.

the **green roofs** also provide thermal insulation in winter and keep the campus cooler in summer through evaporation.





the **courtyard water feature** and the **cistern** (buried underneath the courtyard) provide storage for over 50,000 gallons of rainwater. This water is then used instead of city water for irrigating landscaping as needed.



water-efficient plumbing fixtures are used throughout the project.

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The Payoff:

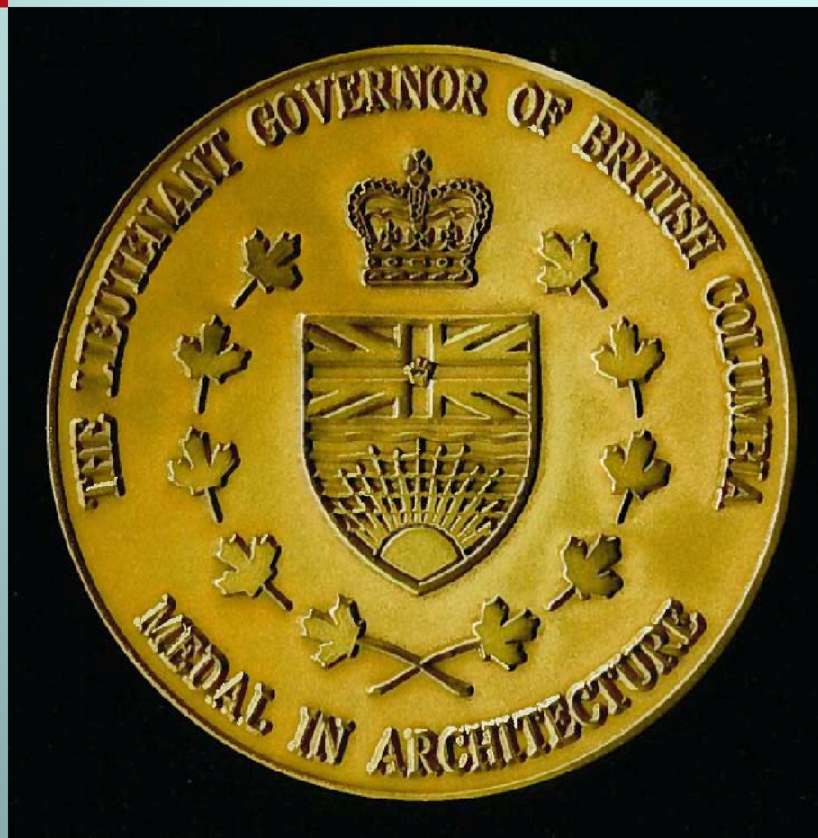
Recognition for the University

Increased donations for naming rights

Enhanced reputation through demonstrated leadership in sustainable design and low energy use building design brings lower operating costs

More attractive facilities boost student applications, enhances faculty recruitment and also helps to foster care and respect for the campus by the students.

SFU



Questions?

INVESTING IN DESIGN
JOHNS HOPKINS
TOWSON · UMBC

SFU

Credits

Architects :	Busby Perkins & Will
Structural:	Fast & Epp
Mechanical:	Stantec
Electrical:	Acumen
Landscape:	Phillips Farevaag Smallenberg
Photo Credits:	Enrico Dagostini, Nic Lehoux
Construction:	Bird Construction

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