Social Architecture

AMS Student Nest, University of British Columbia

THE PROCESS
OF BUILDING
CULTURE BY DESIGN

Better Process = Better Buildings

B+H

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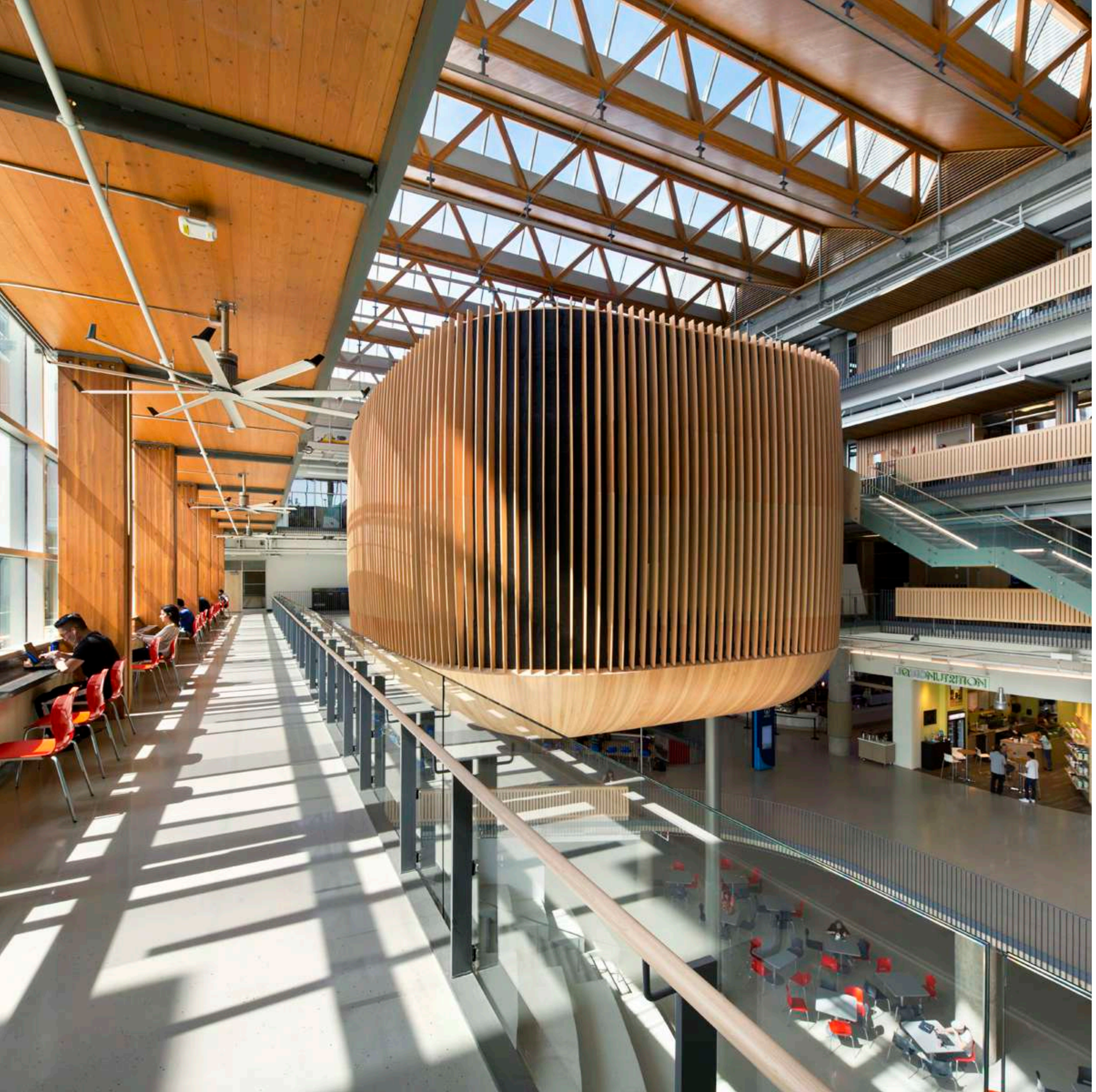
The design of the AMS Student Nest was a collaborative process between B+H and DIALOG. The design team is formally identified as "DIALOG + B+H Associated Architects."



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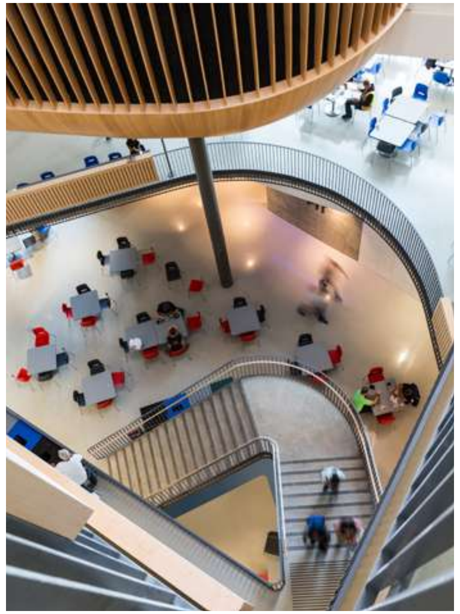

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Can architecture influence how people interact and learn?

We're convinced that it can. Drawing on our extensive experience designing innovative post-secondary learning environments and collaborative workplaces, we ensured that the Nest's architecture would support the social aims of our clients - namely, to create a student centre that would foster a culture of sustainability and shared striving.

INTRODUCTION

Social Architecture

How Buildings Can Help Build a Culture of Continual Improvement

By Kevin Stelzer and Douglas Birkenshaw

To say that our environments shape us is hardly a radical idea, but in the realms of education and research, the statement raises interesting questions. Can we design environments that help people learn, collaborate and innovate? Can architecture enhance productivity? Can it foster a culture of continual improvement?

At B+H, we've had the privilege of working with several post-secondary clients who sought answers to those questions. In *Social Architecture*, we explain why our response to all of the above is a resounding "yes."

Looking up through the Agora to the Cross-Laminated Timber skylights in the AMS Student Nest

Most of this publication is a case study about the **AMS Student Nest**, the **University of British Columbia's new Student Union Building**, which we designed in collaboration with DIALOG.* Our clients on that project were UBC's students – most of the funding for the Nest came from student fees. UBC's students wanted a building that would be an exemplar of environmental, social, and economic sustainability. They envisioned the Nest as a hub of engagement where people would enjoy coming together to learn new skills, exchange ideas, study, and socialize.

Before we get into the specifics of the Nest, however, we would like to explain what we mean by "Social Architecture," and how we developed this concept through our work on previous post-secondary projects – two schools of engineering in particular.

*The design team on this project is formally identified as "DIALOG + B+H Associated Architects."

THINKING BEYOND THE PROGRAM

It used to be that the program was the primary driver in the design of academic buildings: if a facility could accommodate the class sizes and types of teaching and research to be conducted within it, it was doing its job. **How well buildings meet their programmatic requirements will always be a key criterion, but it has become increasingly clear that the best centres of learning and research do much more than that. Simply put, they can help build the culture that their clients aspire to create.** When a physical environment is sensitively organized and configured, it can enhance productivity, and its design can increase the likelihood of chance encounters that can spark innovation. An inspiring building with extensive measurement and verification systems built into it can also prompt its occupants to set the bar high in areas such as sustainability – and then set it even higher. Social Architecture encompasses all of these aims.

SOCIAL ARCHITECTURE IN ACTION

Two B+H engineering school projects are referenced alongside the AMS Student Nest as examples of Social Architecture:

Integrated Learning Centre (ILC)
Queen's University

Queen's University's Integrated Learning Centre (ILC) in Kingston, Ontario, teaches engineering students building principles and sustainable strategies by example. Sandwiched between two existing buildings at Queen's, this three-storey, 100,000-sf space for six engineering faculties is a terraced horseshoe of learning environments organized around a central atrium. **With generous stairways linking the levels around the atrium and implementation space for broad, multidisciplinary teams, the design encourages the six disciplines to interact and collaborate, as opposed to staying within their respective 'silos'.** In this "Live Building," exposed and extensively monitored building systems turn the entire facility into a teaching tool. The ILC illustrates a wide spectrum of engineering principles and enables students to analyze the building's performance in real time and over time by many different metrics, and to see how adjustments to building systems affect performance.

It is also one of the first facilities of its kind specifically designed to address the growing industry perception of engineering students as technically competent, but less adept in the teamwork and communication skills that would make them expert problem solvers. In its design and its curriculum, the ILC reflects the principles of the CDIO Initiative, an engineering pedagogical framework developed by the Massachusetts Institute of Technology and three Swedish technology institutes.* CDIO stands for **Conceive**, **Design**, **Implement**, and **Operate**. The building had to support

Integrated Learning Centre (ILC)
Queen's University

*Chalmers Institute of Technology Gothenburg; Linkoping Institute of Technology, and Royal Institute of Technology

Ed Lumley Centre for Engineering Innovation (CEI)
University of Windsor

Ed Lumley Centre for Engineering Innovation (CEI)
University of Windsor

the pedagogical emphasis on presentation and communication, and promote the cognitive and practical activities associated with the ideal contemporary engineer: **Conceive** products that are conceptually and ethically excellent; **Design** excellent products through the utilization of advanced technologies and interdisciplinary processes; **Implement** these solutions through efficient manufacturing; and **Operate** the solution, testing it against the conceptions criteria for success.

Like the ILC, the 310,000-sf **Ed Lumley Centre for Engineering Innovation (CEI)** at the University of Windsor, in Windsor, Ontario, teaches the principles of engineering by transparently demonstrating them, and its design was informed by the CDIO educational model. **To support this building's deep sustainability agenda, extensive metering and systems monitoring enhance the ability of students, faculty and researchers to understand how well the CEI is performing, and how operational fine-tuning could improve that performance.** The design of the building fosters close interaction and communication – between instructors and students, and also among students. Key to this approach are many informal areas, such as lounges, a café, student-scheduled meeting rooms, and a green roof terrace, where individuals can meet, interact, learn, and collaborate in more informal settings.

Glue-laminated atrium truss, AMS Student Nest

Skylight truss overhang, AMS Student Nest

THE PRINCIPLES OF SOCIAL ARCHITECTURE

Social Architecture is not a new idea. In *City of Bits*, which was published in 1995, William J. Mitchell made the point that laboratories are much more than producers of product (i.e. patents, applied research, published papers, prototype technologies, etc.) They are also, significantly, social condensers that bring people together – places where programmed space and cultural evolution intermingle. What we have learned from our work on the ILC, the CEI and the AMS Student Nest is that there are **Four Essential Principles for Enhancing Productivity through Social Architecture:**

Transparency and Visibility: Generous access to natural light and views definitely boosts productivity, but being able to see and be seen by others is also important. In his book *The Appearance of Space,* George Baird argues that being seen in public is a mode of performance: we act differently when we know we're visible to others in a public setting than we do in more private settings. At Queen's University's ILC, the University of Windsor's CEI, and the University of British Columbia's AMS Student Nest, the idea of 'overlook' is important to how space is configured. All three are multi-level atrium buildings; in all three cases, people on the upper-level terraces surrounding the atrium have views down onto the open, lower-level circulation spaces, and people on those levels are aware that they are seen. People see others using the building's study areas, lounges, and places for socializing, and they feel comfortable using these different types of spaces the way others are using them. In areas for work or study, this results in mutually reinforced industriousness. In the more social spaces, it promotes not only informal conversations, but also high comfort levels for those engaging in 'collective solitary' activities, such as people watching or spending time on social media sites.

De-stratification, Ease of Vertical Circulation, and Differentiation of Spaces: Buildings that encourage chance encounters between people from different departments – or between individuals engaged in different activities – promote innovation. The AMS Student Nest is a five-storey atrium building, and a crucial element of its design was to make people want to explore all of its levels: for this reason, generous stairways link the levels, and paths of vertical circulation are clearly legible throughout the building. A student who comes to the building to try out the Nest's climbing wall, for example, might see others at work in the campus radio station's glass-walled broadcast booth and decide that she'd like to go on air herself.

At the Queen's and Windsor engineering schools, wide stairways also connect each level to the next, increasing the likelihood that someone working in one department will run into and exchange a few words with a coworker from another department on a different floor, and possibly gain a fresh insight into a problem or find a new collaborator. **We have found that a café is one of the best possible antidotes to stratification in research and learning environments.** Having a place where anyone in the building can meet up with colleagues for a coffee, either by chance or for an arranged meeting, greatly increases the likelihood of a productive exchange of ideas. At the AMS Student Nest, there was also considerable emphasis placed on creating spaces that would make all students feel welcome. There was recognition of the fact that many UBC students are recent immigrants, and that *all* new students are beginning their integration into a new culture.

In addition to spaces that would encourage interaction and integration, it was important for the Nest to provide quiet places of refuge: many students have little privacy at home and need places for calm study.

High Performance Buildings for Higher Productivity: Many studies have shown that people function better in buildings with superior indoor air quality, abundant natural light, and views to the outside, which are all characteristics of sustainable design. We believe that these qualities are fundamental to shaping successful learning and research environments. However, other important sustainable considerations are often overlooked – and they shouldn't be, because they have a direct bearing on how well buildings meet their occupants' needs and contribute to their sense of well-being. These include integrating a new building on campus with existing paths of circulation and with landscaping, and providing easy and readily apparent access to the world outdoors and to public transportation. Intense support for cycling – the Nest contains lockers, showers and a bicycle repair shop – underscores occupants' perception of a building as a sustainable asset.

Measurement and Verification (M&V) – the Importance of Progressive Informational Feedback: The ILC at Queen's University and the CEI at the University of Windsor are teaching tools for engineering students, and it is therefore essential for them to be extensively monitored in ways that make it possible for students and researchers to see how well these buildings are performing and assess how operational adjustments affect that performance.

Retro-commissioning and benchmarking are ongoing processes in these buildings, with the goal of perpetually upgrading building performance.

At first glance, M&V and progressive informational feedback may seem less central to a student union building such as the AMS Student Nest, but in fact it is vitally important to meeting this project's aims as well. UBC's students wanted the Nest to be an ever-more-sustainable catalyst of cultural change – a building that would inspire students to modify their own behaviour in environmentally responsible ways. (Modifications targeted by UBC's student union, the Alma Mater Society, include encouraging students to bring their own reusable containers and cutlery for meals instead of using disposables from the food court.) The Nest makes extremely efficient use of energy and resources, and is shown to do so by its monitoring system. It is also an extremely comfortable and appealing environment – and one that, by growing crops for its restaurants in its accessible rooftop gardens, is literally *seen* to be green.

By being a place of exceptional amenity and delight, the AMS Student Nest encourages UBC's students to view sustainability not as having to "do without," but as a means to a better quality of life.

B+H Principal Kevin Stelzer and former B+H Principal Douglas Birkenshaw led the B+H design teams on the University of British Columbia's AMS Student Nest [DIALOG + B+H Associated Architects], the University of Windsor's Ed Lumley Centre for Engineering Innovation, and Queen's University's Integrated Learning Centre.

How well buildings meet their programmatic requirements will always be a key criterion, but it has become increasingly clear that the best centres of learning and research do much more than that. Simply put, they can help build the culture that their clients aspire to create.

Is Social Architecture a utopian ideal or an attainable goal?

Our experience demonstrates that Social Architecture is eminently achievable, even when timelines and construction budgets are tight. We believe that an inclusive, consultative design process is invaluable to any project with a social agenda. On each project, we're committed to continual improvement in our practice of Social Architecture.

PART 1

DESIGN THAT BUILDS CULTURE

Social media and client input shaped this project. Design firms competed in online presentations, and after UBC students chose our team as the winner, we launched an ambitious consultative process to ensure that the building we designed would respond to the needs and aspirations of the students who would socialize, study and learn new skills within it.

A 'City' that is also a Living Room

By 2000, the University of British Columbia (UBC) had outgrown its Student Union Building (SUB), which dates from the late 1960s. Studies conducted by the Alma Mater Society (AMS), UBC's student union, indicated that a replacement building 50 per cent larger than the existing one would cost only about 25 per cent more than the sum required for a thorough renovation of the existing SUB. In a 2008 AMS-led referendum, **UBC's students voted to build a new Student Union Building, with most of its $107 million capital cost to come from student fees collected over the past 30 years and into the future.**

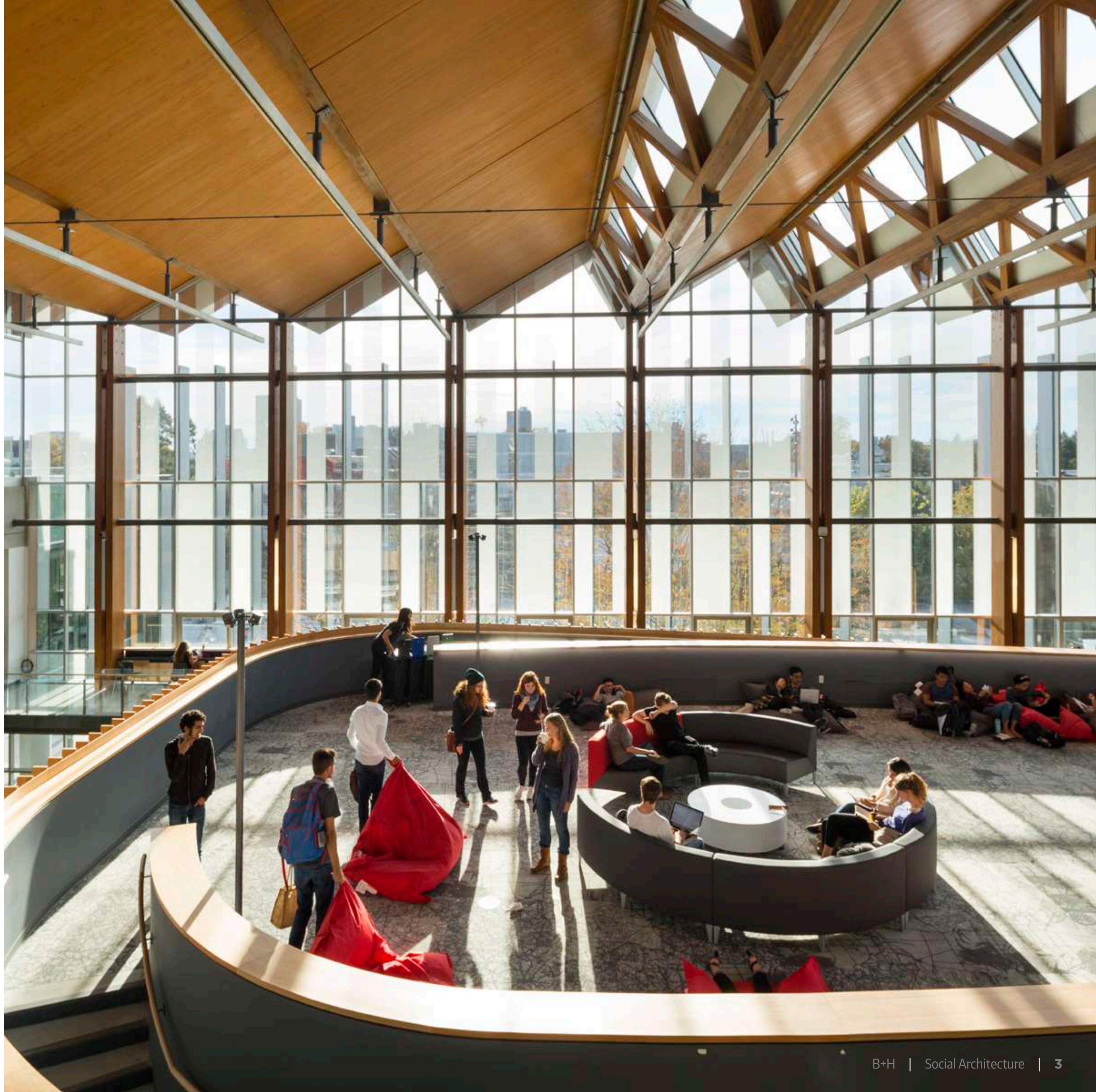
The students, in other words, were both the clients and the end users on this project. For a building that would house club rooms, support programs, study spaces, and student-operated food, beverage and retail services, they implemented an emphatically democratic design team selection process. First, pre-qualified proponents presented their approaches via YouTube videos. Then, in an online vote open to the entire student body, UBC's students shortlisted three teams. Taking the students' views, technical evaluation and cost into consideration, the AMS selected our team to design the building that would be known as the AMS Student Nest.

The client team's vision for what would become the AMS Student Nest was ambitious and inspiring. The students at UBC wanted a building that would be ecologically, socially, and financially sustainable. Through its AMS-operated food and retail outlets, room rental fees and other means of generating funds, the Nest was expected to turn a profit – and in turn fund student programs such as a health hotline. **Central to the students' aspirations for the Nest were the ideals of empowerment, advocacy, accessibility, diversity, and above all, community.**

We began to think of the Nest as a city: a focal point of human interaction, engagement and enlightenment that would 'belong' to its citizens. At the same time, it needed to be a comfortable, welcoming place – a city that was also a living room.

UBC's students were involved at every stage of the Nest's design. The iconic building that emerged from this intensely consultative process incorporates aspects of the Living Building Challenge and is targeting a LEED Platinum rating. The Nest will inspire students to make sustainable choices and enable them to play a role in making its energy performance and resource use even more exemplary over time.

Inevitably, future generations of UBC students will want to use the Nest in new and different ways. For that reason, **we have designed a building that is as flexible as it is memorable: it will adapt to changes in use that cannot even be imagined at this time.**



The Competition:
Online Democracy

In response to intensifying demand from UBC students for a new Student Union Building (SUB), the University established a roster of seven design teams via a Request for Proposal. These teams participated in a student-led design competition, largely conducted through social media, with each team establishing its own website for student engagement and developing YouTube videos. Based on this material, more than 2,400 UBC students voted online to select a shortlist of three teams. Our team was known as HBBH + BH, for Vancouver-based Hotson Bakker Boniface Haden Architects in joint venture with B+H Architects. (HBBH subsequently became DIALOG.) The Nest was the fourth collaboration between our firms on UBC projects. It is rare for two architectural practices to be so well aligned in their approach to urban design, programming and tectonics, and in their commitment to the democratic deployment of space. Ours has been, and continues to be, a mutually beneficial relationship.

In our YouTube campaign, "What's Your SUB?" we asked UBC's students lots of questions, and exciting ideas came flooding back to us. Instead of making a conventional presentation for our in-person shortlist interview, we turned it into a workshop and collected more feedback from our potential clients. Final selection rested with UBC's student union, the Alma Mater Society (AMS), and the comments from the students who participated in the vote were a significant factor in the AMS's decision. At a July 14, 2010 council meeting, AMS Vice President of Administration Ekaterina Dovjenko announced that our team had won the competition. "The AMS is confident that HBBH+BH is the right firm," Dovjenko stated in a media release, adding that we had demonstrated **"a deep understanding of students' needs."**

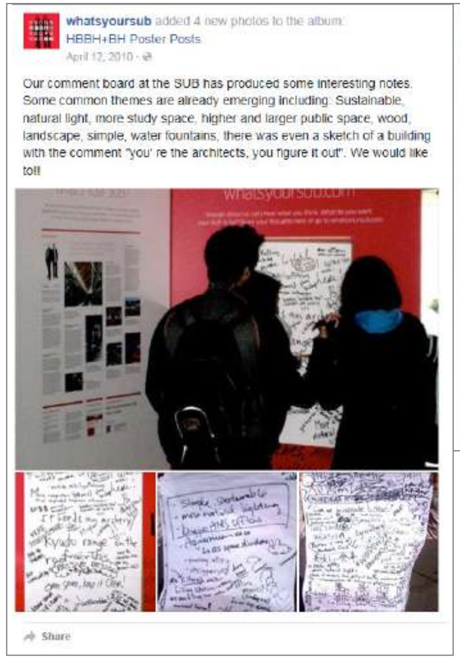
This image from the HBBH + BH stakeholder engagement campaign makes the point that changes in occupant behavior are as integral to achieving better building performance as sustainable technology is.

At the outset of the project, UBC's SUB Renewal Committee identified 10 goals for UBC's new Student Union Building to enhance:

1. Governance and the civic community on UBC campus
2. Student empowerment by providing opportunities for students to take on leadership goals
3. Advocacy for student issues and concerns to improve the student experience on campus
4. Services that fulfill student needs (nutritional, cultural, political, academic, recreational, and spiritual)
5. Community by creating more opportunities for student interaction and engagement
6. Student development by providing more opportunities for skill building and work experience
7. Institutional development by furthering the UBC's goals of providing a world-class education and experience
8. Environmental sustainability by reducing the energy and materials consumed in the building and operation of the SUB
9. Economic sustainability by providing entrepreneurship opportunities for students and expanding the AMS business
10. Diversity of users by addressing the needs of the current student body and anticipating the needs of the future student body

"I'm happy to announce that the chosen firm is HBBH+BH. They were phenomenal, very good in all aspects, and with very competitive costs."

AMS Vice President of Administration Ekaterina Dovjenko, AMS Student Council Meeting, July 14, 2010



Above: Posts on our What's Your SUB? Facebook page.

> "[They] really understood what it meant to do student consultation. They had unique ideas that we hadn't heard about and were excited about."
>
> Michael Duncan, AMS President (2008-2009) and SUB Review Committee Member, on what impressed him about our design competition YouTube presentation to UBC's student body.

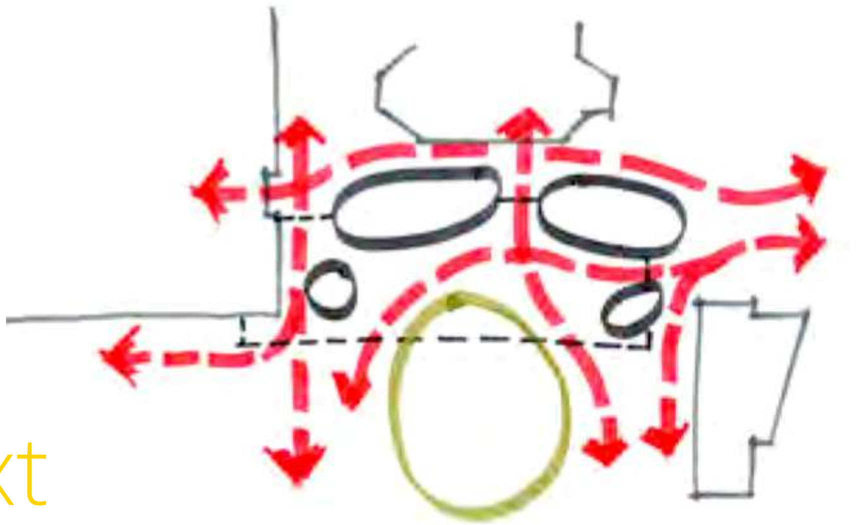
The Design Process: Inclusive and Decisive

The consultative process established during the competition intensified after we landed the job. Expanding on our initial "What's Your SUB?" series of YouTube videos, we set up a "What's Your SUB?" Facebook page. **During the six-month design process, we and the AMS conducted 20 public charrettes and workshops to analyze the project program, evaluate sustainable mandates, and prioritize items on a long and complex list of desirable objectives.** Using advanced design tools and life-cycle assessment programs made it possible to sort out what was most desirable – and what was truly achievable with the resources available. **During this period we also installed a satellite design office, known as the Design Cube, in the old SUB.** Through this outreach initiative, students, faculty and other interested members of the UBC community had a chance to speak directly with members of our design team, ask questions, and observe as the building that would become known as the AMS Student Nest transitioned from concept to reality.

Left and below: Inside the Design Cube, our satellite design office on the UBC campus; student engagement feedback poster; one of the design workshops our team conducted with UBC's students.

Questions raised during the workshops included:

1. What does a sustainable building mean?
2. What does it look like?
3. Is it certified; is it net-zero or net-positive?
4. Is it expensive?
5. Is it biodegradable?
6. Can it be disassembled and recycled?
7. How can the design of the building foster and further the goals of a model community?
8. How can what we build today serve UBC's students well for a century?



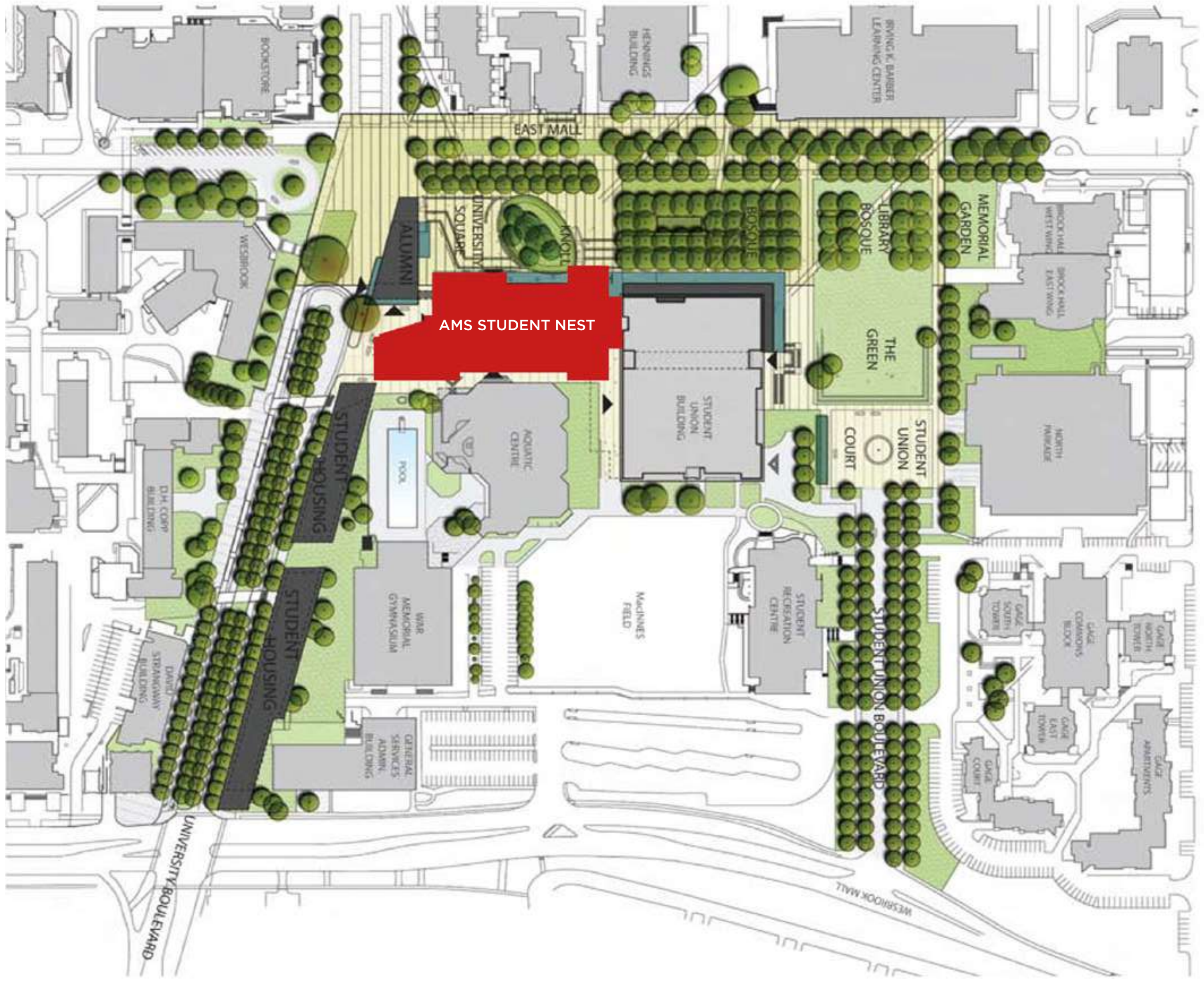
Campus Context

An integrated and extensive network of tree-lined boulevards and gracious plazas runs through the University of British Columbia's campus. **The AMS Student Nest faces onto the Knoll, a grassy hill that has been a cherished gathering place for relaxation – and for demonstrations – on campus for decades.** The Nest and the Knoll are central to UBC's new University Square, which includes an enhanced public square to the west, a new Arrival Plaza and Alumni Building to the south, and a new playfield, Transit Hub and Aquatic Centre to the east. The previous Student Union Building (SUB), located immediately north of the Nest, will be repurposed. The site designated for the Nest in the master plan was oblong and narrow.

Spread over five storeys to accommodate its complex program, the building is organized around a large, sky-lit atrium space, known as the Agora, which faces westward toward the Knoll. This symbolically important and well-loved part of the campus landscape became a key generator of the Nest's spatial organization: the curves of the terraced seating and stairs on the two lowest levels of the Agora 'extend' the hill's form into the building.

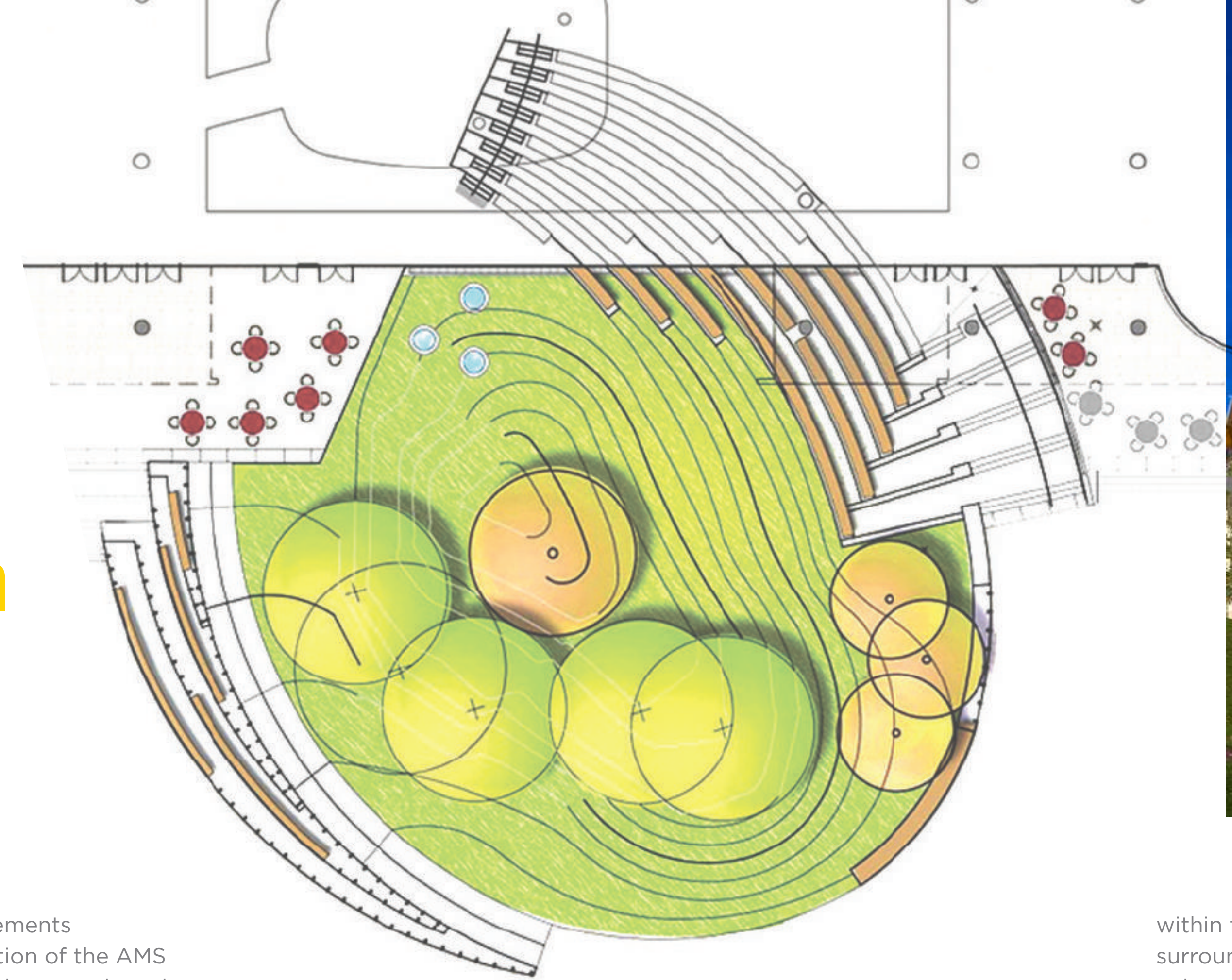
Horizontally and vertically porous, the Nest links into campus circulation routes and establishes new pathways that knit together the components of University Square. An analysis of the existing network of pedestrian flows in this part of the campus informed the design of the ground level plan in particular.

Our team designed a building that would be at once a new campus landmark and a contextual response. The strong vertical treatment of the new student union building's windows and the vertical fins on the atrium's hovering black-box theatre echo the emphatic verticality of the concrete-buttressed former SUB to the north and the refined vertical frit glass patterning of the new Alumni Building to the south. The Nest's zinc cowl roof on the east side harmonizes with the copper roof of the former SUB, and the Great Hall's versatile volume speaks to the form of the historic War Memorial Gym to the east.



Campus master plan showing the AMS Student Nest in context.

Design Drivers: How the Knoll and the Agora Shaped the Nest



Two pivotal, interconnected elements generated the spatial organization of the AMS Student Nest: the Knoll, a time-honoured outdoor gathering place and lounging spot for UBC students, and the Nest's five-storey central atrium, known as the Agora. **The Agora faces west toward the Knoll, and the terraced seating and stairs that sweep across the atrium's two lowest levels extend the curves of the hill into the building.**

A black-box theatre, held aloft on slender steel columns and screened by vertical Douglas fir fins, is the Agora's focal point. Serpentine couches and beanbag chairs furnish the informal lounge on the roof of this nest within the Nest. On the multi-storey mezzanine that surrounds the theatre, generous stairs connect the levels, enhancing the sense of community and inclusiveness.

The most public and open spaces within the Nest, including a wide range of food outlets and retail services and a crescent-shaped pub that can hold more than 400 people, are housed on the Agora's lowest two levels. In general, spaces become smaller and more specialized on the higher floors. One exception is the double-height Great Hall, located at the south end of the building on Levels 2 and 3. Level 2 spaces include bookable rooms, a student-run art gallery, and the Knoll-facing Bridge Lounge, an area for individual study. At the north end of the building, a climbing wall spans Levels 2 and 3. Club rooms and student union offices occupy much of the space on Levels 3 and 4. (There are 75 AMS-run clubs housed within the Nest's dedicated club precincts, 29 variously sized conference rooms, and four dance and movement spaces with sprung hardwood floors.) The west half of Level 4 contains a roof garden and a restaurant with an expansive terrace. (Food grown in the garden is served in the restaurant.) Level 5 is the roof, which houses solar thermal and photovoltaic panels on its sawtoothed western portion and the mechanical penthouse on its flat expanse to the east.

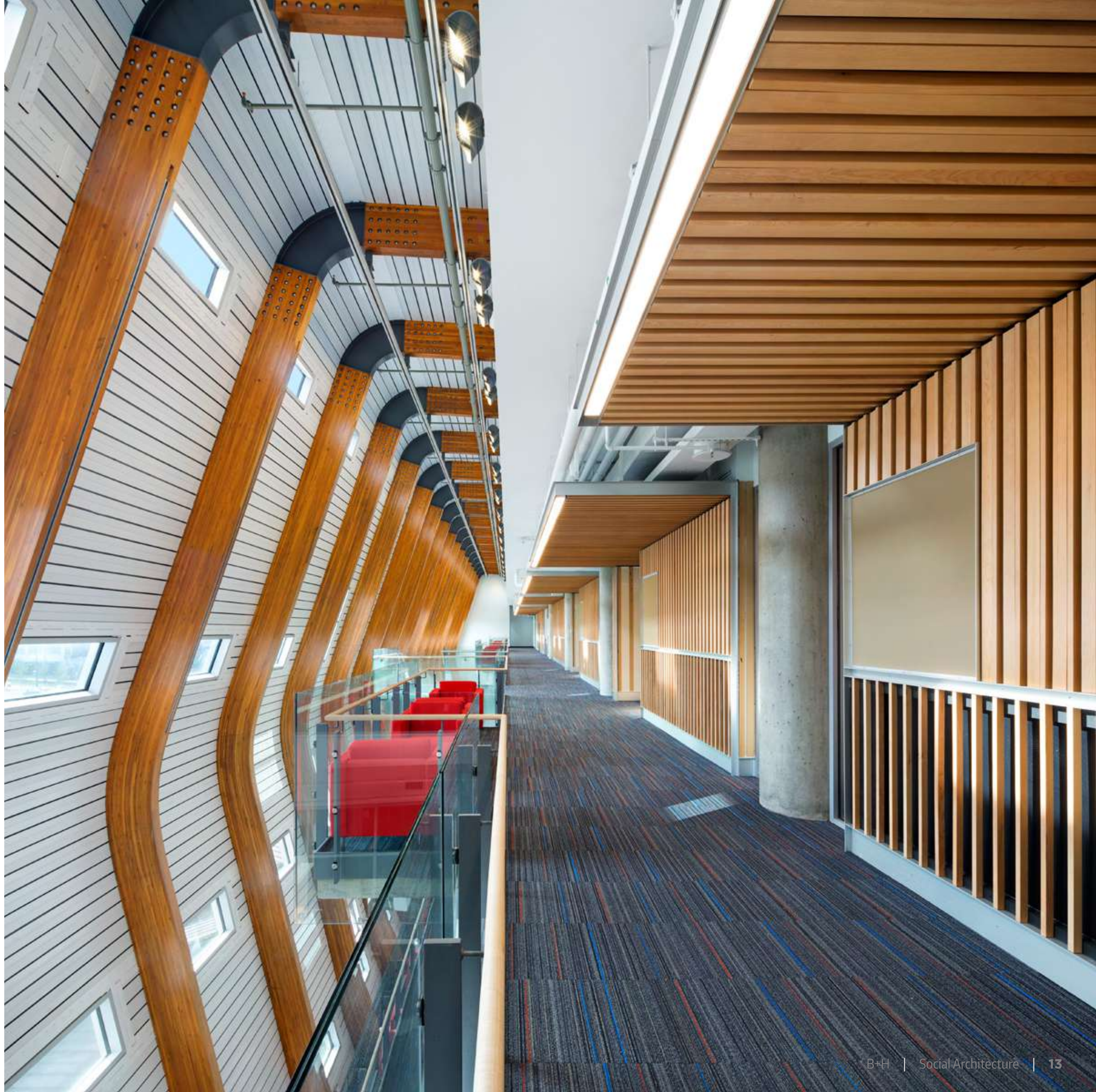
From Open to Enclosing: **The Nest's Spatial Spectrum**

The vertical progression from wide-open, public spaces on the lower floors to smaller and more specialized usage on the upper ones is only half of the Nest's spatial organization story: there is also an east-to-west spectrum of spaces within the building. **Spaces for socializing and communal use are concentrated along the Knoll-facing, fully glazed west façade, while quieter, fine-grained 'balcony' spaces for individual and small-group study are tucked away under the zinc cowl that extends down from the roof along the east façade.** In this way, the design ensures that students who want to use the Nest for quiet study won't be disturbed by those who are there for an informal beer with a few friends, or for a campus-wide social gathering.

DESIGNING FOR INNOVATION AND PRODUCTIVITY

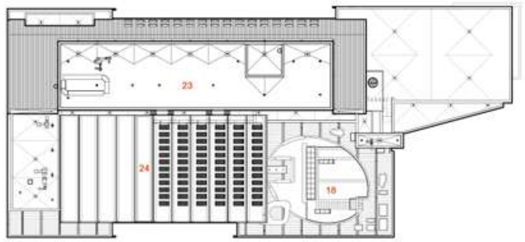
Promoting interaction between students and between students and faculty was a key objective in the design of the University of Windsor's Ed Lumley Centre for Engineering Innovation (CEI). Informal spaces such as comfortable lounges and a café occupy central and highly desirable real estate within the building because these common areas are where people from different disciplines tend to encounter one another: therefore they're often where collaborations get kick-started and problems get solved. The idea of 'overlook' was also important, especially in the CEI's atrium. People are most likely to be industrious in spaces where they can see others working – and *be* seen by their colleagues.

Right: East circulation zone in the Nest.



Plans and Sections

1 Nest
2 Great Hall
3 Lower Agora
4 Upper Agora
5 Knoll Steps
6 Pit Pub
7 Climbing Wall
8 Bridge Lounge
9 Art Gallery
10 AMS Food Services
11 CITR Radio
12 Bookable Rooms
13 Commercial-Retail Unit
14 Ubyssey Newspaper
15 Club Rooms
16 AMS Offices
17 AMS Forum
18 Roof Garden
19 Perch Restaurant
20 Graduate Student Services
21 Childminding
22 Water Cistern
23 Mechanical Penthouse
24 Sawtooth Roof / Solar Panels
25 Shower / Change Facilities for Cyclists



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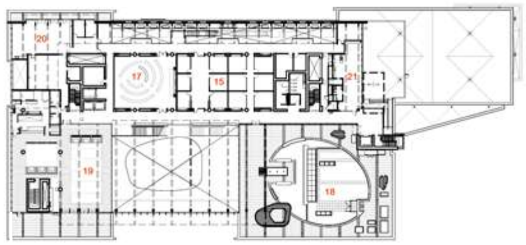
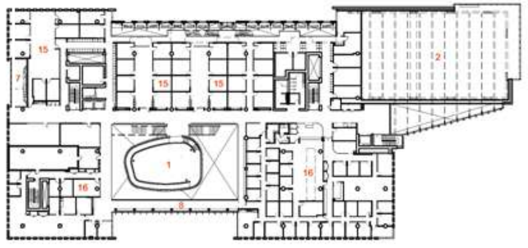
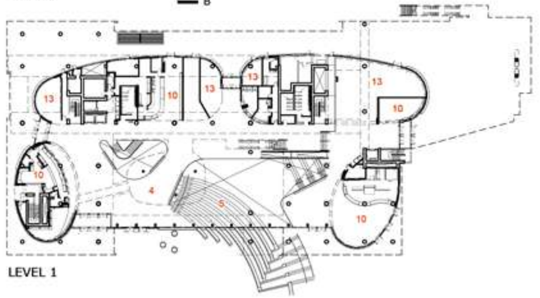


LEVEL 4

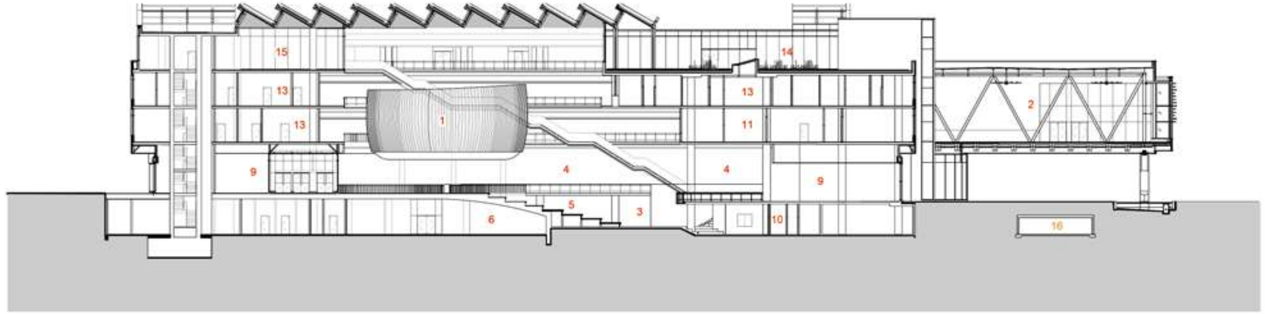


LEVEL 3

LEVEL 2

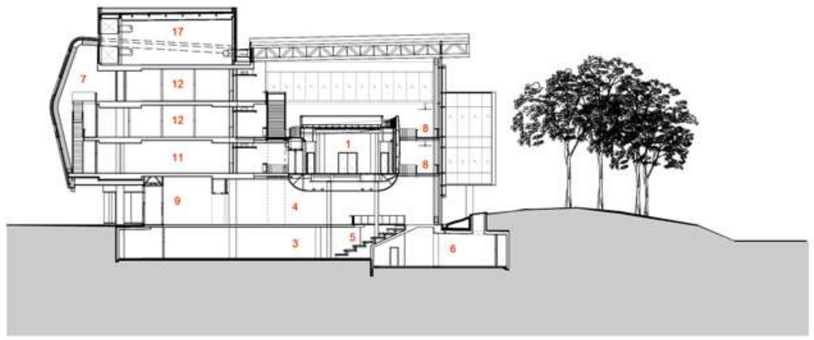


LEVEL 1



SECTION A-A

1 Nest
2 Great Hall
3 Lower Agora
4 Upper Agora
5 Knoll Steps
6 Pit Pub
7 East Lounge
8 Bridge Lounge
9 AMS Food Services
10 CITR Radio
11 Bookable Rooms
12 Club Rooms
13 AMS Offices
14 Roof Garden
15 Perch Restaurant
16 Water Cistern
17 Mechanical Penthouse



SECTION B-B

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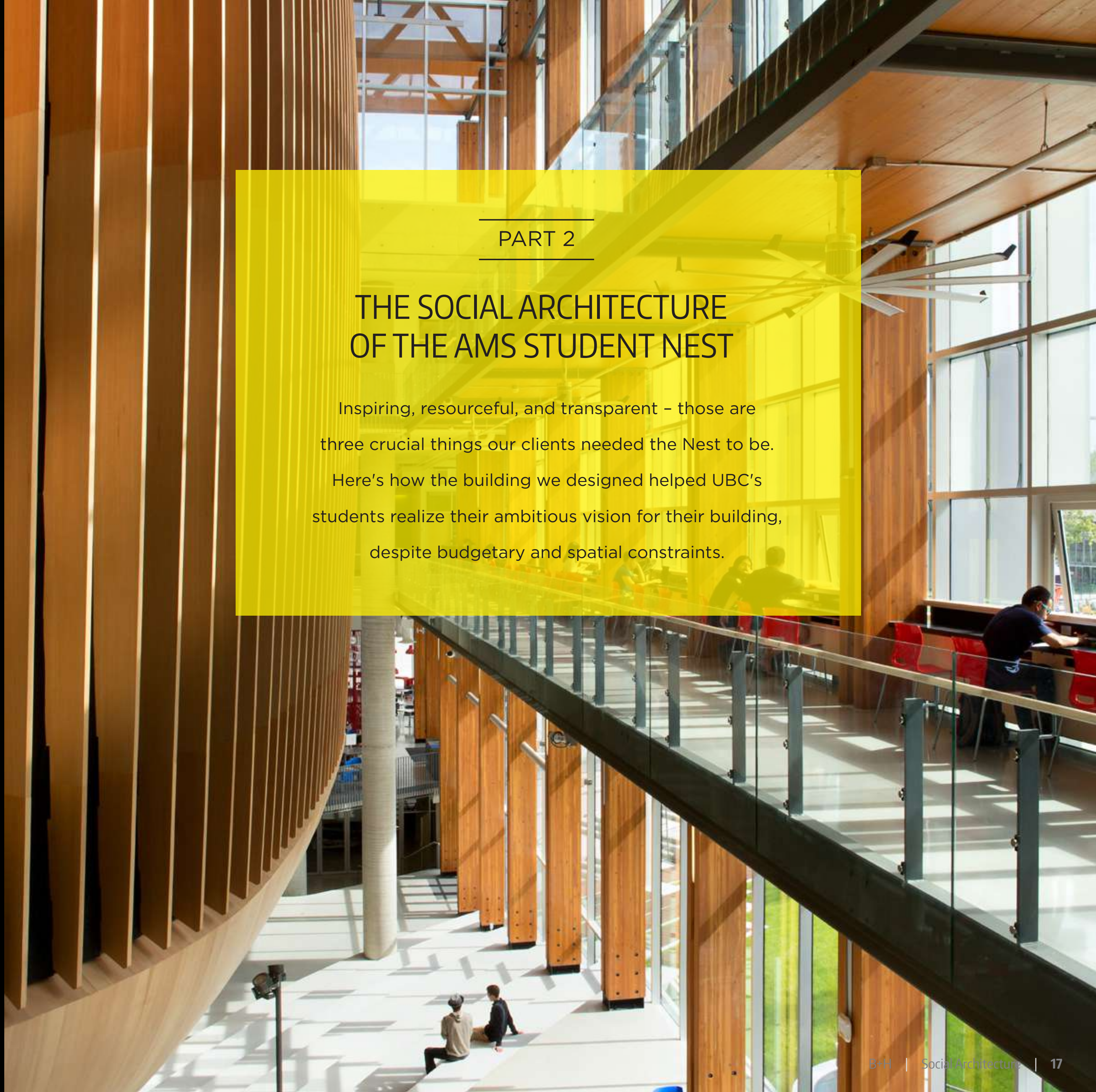


PART 2

THE SOCIAL ARCHITECTURE OF THE AMS STUDENT NEST

Inspiring, resourceful, and transparent – those are three crucial things our clients needed the Nest to be. Here's how the building we designed helped UBC's students realize their ambitious vision for their building, despite budgetary and spatial constraints.

Designing for a Culture of Continual Improvement

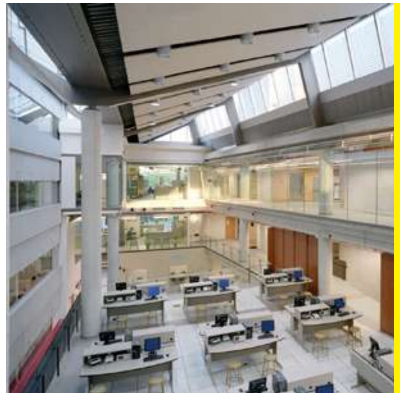
The consultative design process revealed that it was very important to UBC's students for the Nest to be a sustainable and regenerative building. **In addition to targeting a LEED Platinum rating – the highest level in North America's pre-eminent green building program – it incorporates aspects of the even more stringent Living Building Challenge.** The Nest's mechanical and water systems (discussed in detail in Part 3) are in the sustainable vanguard today, and they were specifically designed to allow for upgrades as new technologies emerge, with the goal of attaining net zero energy and water consumption over time.

The Alma Mater Society envisioned the Nest as a building that would, in all ways, support a culture of learning and continual improvement. **It was not enough for the Nest to be green: it had to set an inspiring and readily comprehensible example that would encourage UBC's students to raise the sustainability bar in their own lives.** For that reason, a Building Automation System monitors a wide spectrum of building performance indicators, and online displays throughout the building show how it is performing in real time – and how that performance stacks up against the usage patterns of a comparably sized structure built to code minimums. The intent is that when students see how well the Nest is already

doing, they will want to take actions to help it perform even better, such as wearing a sweater on cold days so that less energy will be required to heat the building.

Design and operations join forces to set compelling examples of a 'closed loop' approach to sustainability. AMS-run eateries within the building serve up ingredients grown in the Nest's rooftop gardens. A four-stream waste management system sorts waste, and two in-house composting systems process some of this material for use in the gardens. The Vermicompost organically produces soil-enriching material by feeding pre-consumer kitchen scraps to worms; as well, a six-metre-long anaerobic unit breaks down food scraps and compostable containers to produce compost for the Nest's landscaping and gardens. To encourage students to bring their own reusable containers and utensils for meals rather than rely on disposables, wash stations have been incorporated into the fast-food zones.

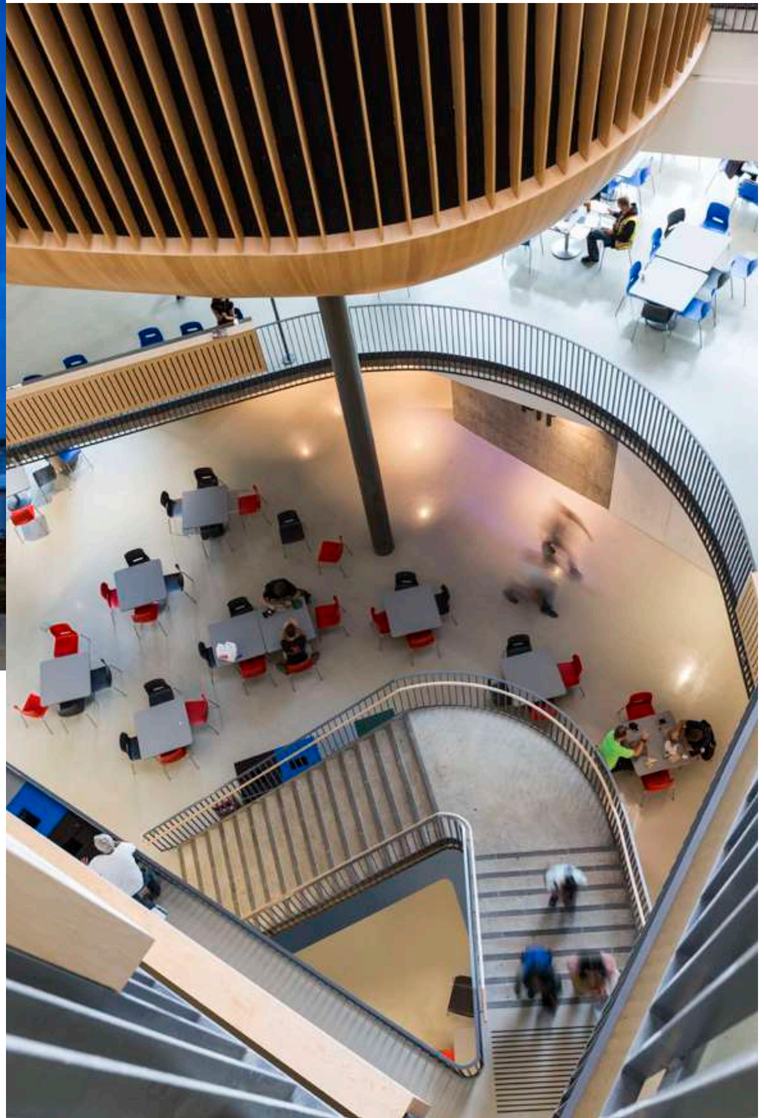
The project budget was managed with an intensive and frequent iterative costing model that integrated all the efficiencies achieved through passive measures in order to minimize spending on high-technology active measures. For example, high performance envelope assemblies were accurately simulated for thermal performance to ensure that the mechanical systems could be precisely downsized. **The integrated approach ensured that extremely high performance could be realized within the ambitious fiscal expectations of the budget.**



LEARNING FROM A "LIVE BUILDING"

Completed in 2004 and housing six faculties of engineering, the Integrated Learning Centre (ILC) at Queen's University is one of North America's first post-secondary projects to teach sustainability by example. The ILC's "Live Building" Initiative is a combination of exposed and monitored building systems designed to exhibit construction concepts and illustrate engineering principles. Instruments also monitor air quality heating, lighting and cooling systems using specially designed software integrated into the workings of the building. Monitoring produces real-time data for students to view, plus a database of archival records for study and analyses that can be accessed over the Internet.

'Expanding' a Tight Site



The Nest's site was ideal in some ways and challenging in others. As befits the symbolic heart of UBC student activity, the location is a central one: just north of University Boulevard, one of the campus's main circulatory arteries, the Nest faces west onto the Knoll and a new public square, and east toward a new playfield and transit hub. To the south, a new Alumni Building and a new arrival plaza, and to the north, the former Student Union Building – soon to be repurposed for other uses now that the Nest has superseded it – tightly hem in the site.

To make efficient use of every available square metre, the design team distributed the Nest's program over five levels, with the lowest one only partially below grade, and large portions of the highest floor occupied by the Perch restaurant and its outdoor terrace and the rooftop garden where food crops for the Nest's restaurants are grown. **The V-shaped, three-storey steel truss that elevates the Great Hall at the south of the building one floor above the ground saved a significant amount of space by making it possible to insert the vehicular access to the Nest – which forms part of the new arrival plaza – under the building.** This move also provides a covered space where students waiting for public transit can seek shelter in inclement weather.

PART 3

SUSTAINABLE DESIGN

The project's sustainability aspirations are extremely high – socially, economically, and environmentally. The Nest will be LEED Platinum, and it incorporates aspects of the Living Building Challenge. Minimizing energy and water consumption are priorities, and the building is designed to be adaptable over time to achieve net zero energy and water usage.

It All Starts **with Climate**

Weather is nature's way of transporting energy around the globe. **High-performance building design begins with an analysis of local climatic conditions – a tremendous source of 'free' energy waiting to be harnessed.** Vancouver's climate is more temperate than most of Canada's, and when we looked closely at the local psychrometrics – the physical and thermodynamic properties of gas-vapour mixtures – some valuable and unexpected information came to light. Although the region is famously rainy throughout most of the year, its summers are actually quite dry. Winds are consistently light, and generally from the east. (This was one of the surprises: prior to examining the data, we had expected the prevailing wind to be westerly.) Year round in Vancouver, clouds often obscure the sun.

From our analysis of the local climate, we were able to make three immediate assumptions about a sustainable architectural response:

First, Vancouver's temperate thermal range and mild, predictable breeze made passive ventilation an attractive possibility to explore.

Second, the prevalent cloud cover would compromise the effectiveness of photovoltaics as a renewable energy source. We therefore elected to emphasize solar thermal arrays, which collect heat without direct radiation, and use PVs as supplemental renewable source.

Third, the combination of heavy annual rainfall and mild summer drought would have to be addressed to determine the optimal ratio between on-site storage capacity for storm water and grey-water recycling.

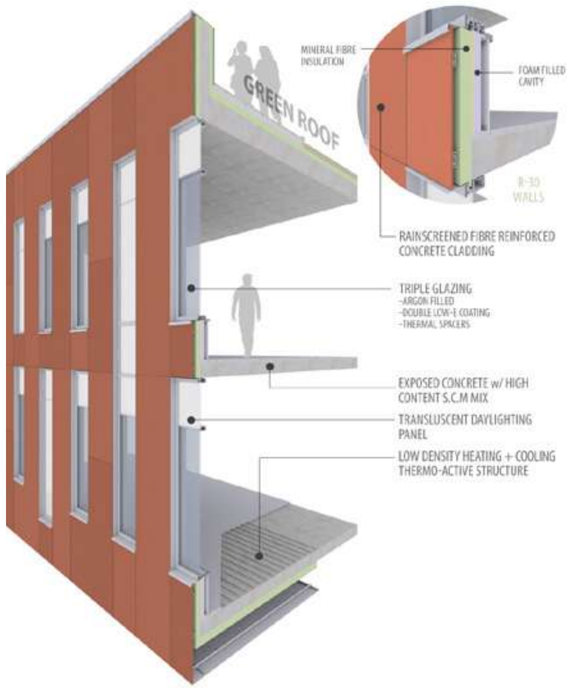
That third point had a major impact on the design of the AMS Nest's water management system. Initially, the clients were interested in using waterless fixtures and composting toilets to facilitate net zero water consumption within the building. With that approach, however, the cistern required to maintain an adequate grey water supply through the dry months of July and August would have to be extremely large – far larger than would be necessary throughout the rest of the year. We determined that ultra-high-efficiency fixtures were in fact a more appropriate option in Vancouver's climate: unlike waterless fixtures and composting toilets, they would make it possible to recycle much of the grey water within the AMS Nest, which in turn meant that the cistern could be 'right-sized' for the entire year.

The Envelope: Insulation and Orientation

It made sustainable sense to design the Nest from the outside in: a building with an extremely efficient envelope will have a lower energy consumption baseline than one that relies heavily on mechanical systems to move heat and air around in ways that keep occupants comfortable. Expected to achieve a LEED Platinum rating, the Nest is an ultra-low energy building with a targeted 90 $ekWh/m^{2/}$ annum energy intensity. An exceptionally well-insulated envelope stabilizes the interior environment by isolating it from intense summer heat and winter cold.

Optimizing a building's R Values may sound like an obvious thing to do, but in fact a high percentage of contemporary commercial, institutional and multi-unit residential buildings are still designed with an overly high window-to-wall ratio. Architecture's love affair with curtain-wall construction dates back to the middle of the 20th century, and this energy-consuming flame still burns. While it's true that today's state-of-the-art window systems are much more efficient than simple single-pane glazing, walls still provide significantly more insulation than expanses of transparent glass.

On the AMS Student Nest, we struck a delicate balance between views and light on one hand and thermal performance on the other by opting for a window-to-wall ratio of 40 per cent. That's roughly half the window-to-wall ratio of many recent office tower projects. But because so much of the Nest's glazing is on the five-storey atrium and the entire building is organized around this generous open space, natural light streams into virtually every part of this student centre.



NEST INSULATION VALUES	CODE MINIMUM INSULATION VALUES
Walls: R30 (RSI 5.3)	Walls: R12 (RSI 2.11)
Glazing: R6.5 (RSI 1.45) U value 0.153 (Imp.), U value 0.873 (Metric)	Glazing: R2 (RSI 0.352) U value 0.5 (Imp.) U value 2.8 (Metric)
Roof: R40 (RSI 7.04)	Roof: R20 (RSI 3.52)

Various cladding systems work in tandem to minimize the building's reliance on heating, ventilation, and air conditioning:

WALLS: The primary opaque wall assembly is a rainscreen UHSC (Ultra-High Strength Concrete) panel system. The panels are supported by fiberglass thermal clips that connect them to fiberglass-reinforced gypsum sheathing and structural studs. Each panel has an exterior cavity insulated with mineral wool and an inner, steel-stud cavity insulated with polyurethane spray foam.

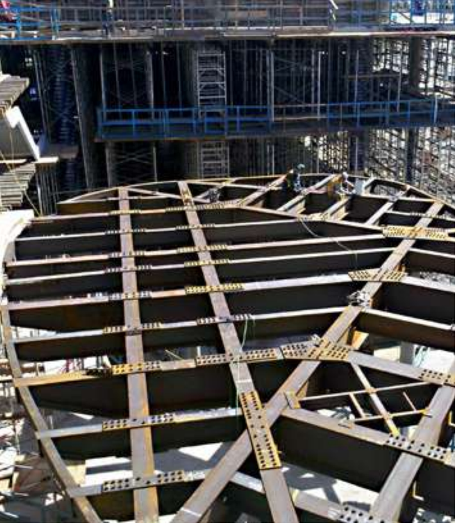
WINDOWS: The Nest's windows are triple-glazed units with double low-emissivity coatings. To optimize the thermal break, they are filled with argon, a gas less conductive than air. Of particular interest are the translucent clerestory window panels on the long west and east facades and the north end. These contain light-scattering glass micro-tubes that expand day-lighting opportunities by driving natural light deep into the floor plate.

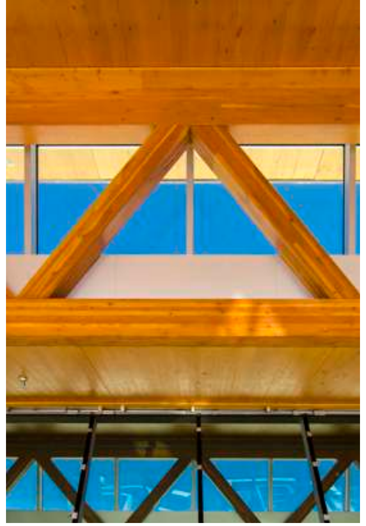
ROOF: In addition to being highly insulated, the largest portion of the Nest's roof is a durable assembly that is mandated to last 50 years. It consists of eight-inch-thick XPS insulation board topped with a fully adhered 3-ply mod-bit sheet waterproof membrane. This assembly's white top sheet reduces heat gain by providing high reflectance. As well, planted assemblies cover large portions of the Nests's roof with terraces. These range in style and weight from light, extensive green roof systems to deep, intensive planters.

On tight sites, the orientation that best responds to the context isn't always the one that would be ideal from a passive design standpoint. Orienting the AMS Student Nest to face west toward the Knoll made perfect sense symbolically and in terms of linking this new building into existing pedestrian circulation routes on campus, but making the long, west façade the most extensively glazed portion of the student centre posed challenges to achieving exceptional energy performance. We were able to compensate for this expansive western exposure by optimizing the Nest's massing and its volume-to-enclosure ratio perspective, designing an extremely efficient envelope, and incorporating solar shading.

In terms of sunlight, wind and even precipitation, the Nest's climatic exposure varies dramatically from facade to facade. Mitigating or embracing these exposure conditions is key conserving energy, and for that reason, the building envelope looks distinctly different on each side. Various façade glazing systems respond to the sunlight variations to enhance comfort and maximize daylighting. Advanced triple glazing reduces heat loss, and advanced solar shading reduces intense incident solar radiation. Careful deployment of daylight glazing helps distribute sunlight to the interior of the floor plates.

The philosophy that shaped the systems design was to configure a building that would afford comfort without any – or very little – mechanical intervention. For the most part, stack-effect passive ventilation draws cool air upward and through the building. Mechanical air conditioning is employed only where and when it is needed. In the warmest months of the year, a mechanical assist is needed in the zone along the glazed west wall of the atrium; it may also be required when the largest room within the Nest, the Great Hall, is filled with people for a major event.






Materials and Structure

The Nest's hybrid structure innovatively combines the robustness and thermal properties of concrete, the tensile strength of steel, and the natural beauty of wood.

Specifying locally sourced materials with low VOC emittance and high recycled content was also a key consideration on this LEED Platinum-targeting project.

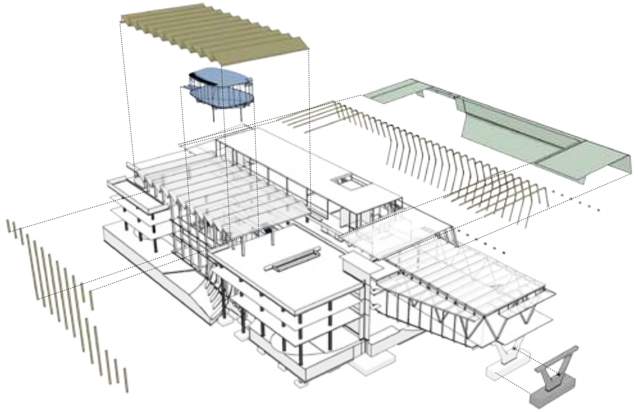
We selected concrete for the floor and column framing for its durability and its ability to integrate radiant heating and cooling coils. The Portland is a high percentage SCM mix (50 per cent), which greatly reduces the carbon footprint of the material while improving its strength.

Steel made it possible to incorporate light, long-span framing systems into the Nest. On this building's narrow, challengingly constrained site, it was crucial to use of every square foot efficiently. Lifting the Great Hall, the largest programmed volume within the Nest, one floor off the ground made it possible to insert the south vehicular access below it, which saved a significant amount of space. A three-story steel truss minimized both the weight and the amount of material required to achieve this long, column-free span.

While concrete and steel do the heaviest of the heavy lifting, engineered wood products lend warmth and natural beauty to the interior: they play an inestimable role in making the Nest feel like the 'living room' of UBC's student population. The long-span atrium trusses are composed of glue-laminated (glulam) chords. The roof decking for the atrium's saw-toothed skylights is cross-laminated timber (CLT) panels, and CLT panels also form the mezzanine walkways along the atrium's western edge.

Although wood's warmth and lightness made it a desirable material, it was essential not to compromise the fire rating of a 'vertical city' of a building, in which all five levels are openly interconnected.

Wood components were therefore used as discrete elements within the otherwise non-combustible construction. The design team performed a computer-simulated evacuation of the Nest to ensure that the wood structure would maintain the required one-hour fire rating, and that the potential exposed surface temperature of the wood would stay below the threshold for ignition. The timed-exit analysis (TEA) computer program was used to calculate the amount of time needed for occupants to evacuate the building, taking into consideration the time required fire detection and alarm, along with the response and travel times of the occupants. This information was based on building-specific characteristics of the design of the interior spaces, the types of users, and various types of events that could be in progress during various fire occurrence scenarios. This modeling determined that the ways in which we wanted to use wood and engineered-wood products did not compromise fire safety. **Ultimately, it was this modeling exercise that made it possible to shape the Nest as a transparent environment that is visually and physically connected across its five storeys.**



LEARNING FROM A "LIVE BUILDING"

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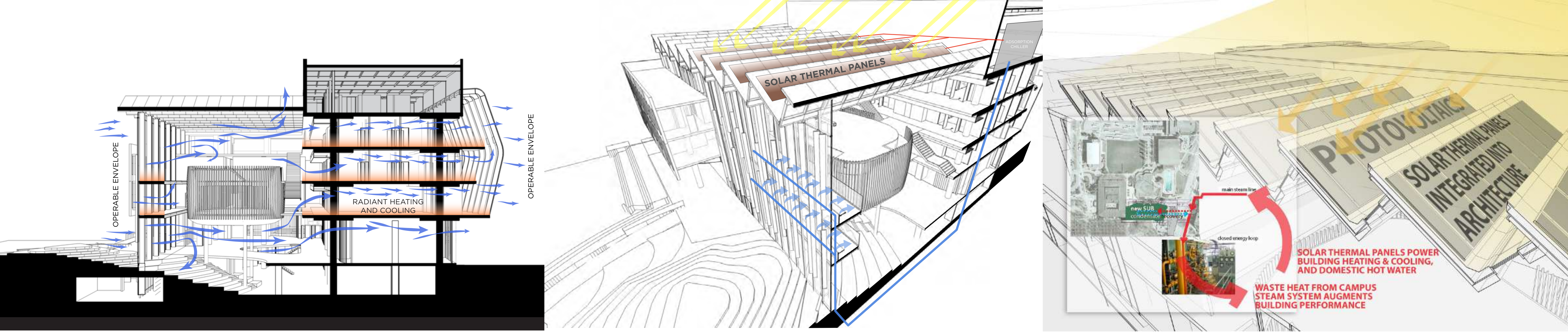


LEFT TO RIGHT: Low energy intensity systems; solar cooling diagram; solar energy generation

Energy Systems: Passive and Active

THE PASSIVE FRAMEWORK

The essence of the Nest's systems design was to configure the building so that comfort and efficient energy performance could be achieved with minimal mechanical intervention. First – as discussed on previous pages – we optimized the building from a massing, orientation and volume-to-enclosure ratio and deployed proven passive measures, including high insulation levels, façade-specific solar shading, and advanced window assemblies. We then implemented the lightest, most efficient mechanical measures. The stability of the interior environment, provided by the high-performance envelope, helps the thermal mass of the concrete act as an effective, slow-release heating element. The temperature of the structural deck can be tweaked throughout the day to anticipate loads, and use the reservoir of heat to reduce overall energy consumption.

On a building with the ultra-low energy consumption target of 90 ekWh/m^2/annum, it was important to make exemplary use of renewable energy sources. **Through passive ventilation strategies, the use of daylight harvesting in most spaces, and solar thermal and photovoltaic arrays, the design team was able to harness renewable energy in ways that would provide nearly one third of the building's energy demands.** The rooftop of the Agora is a sawtooth configuration in which solar thermal and photovoltaic panels are installed on the south-facing slopes and the north-facing expanses are glazed.

The heating system is a low-temperature water radiant thermo-active structure.

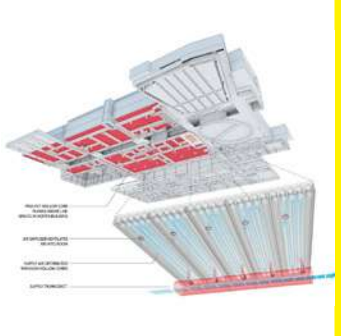
To the UBC students who were our clients, it was important not only to achieve impressive and continually improving energy performance, but to demonstrate sustainable leadership in tangible ways. To that end, we incorporated extensive monitoring and metering displays of the Nest's real-time energy performance into the building.

THE ACTIVE INTERVENTIONS

With alternative energy sources, matching supply to demand can be a daunting challenge: wind power tends to be most plentiful at night, when offices and institutional buildings have the fewest occupants, and solar photovoltaic arrays generate the most electricity when the sun is shining brightly – which is to say, precisely when the demand for artificial lighting is at its lowest in a day-lit building.

One of the most innovative aspects of the AMS Student Nest's mechanical system is its solar-driven adsorption chiller, which uses hot water during the peak summer months to cool the building. This unique synergy of energy demand and energy supply is very advantageous with respect to renewables, which typically provide challenging energy storage problems.

Two heat sources power the Nest's chiller. One is excess heat from UBC's district steam condensate return loop. Normally this would be waste heat, but the Nest's mechanical system puts it to use. The other heat source that powers the Nest's adsorption chiller is the array of solar thermal panels on the roof of the building; these panels also provide heat for the building's domestic hot water supply.



CEI'S INHERENTLY SUSTAINABLE STRUCTURE

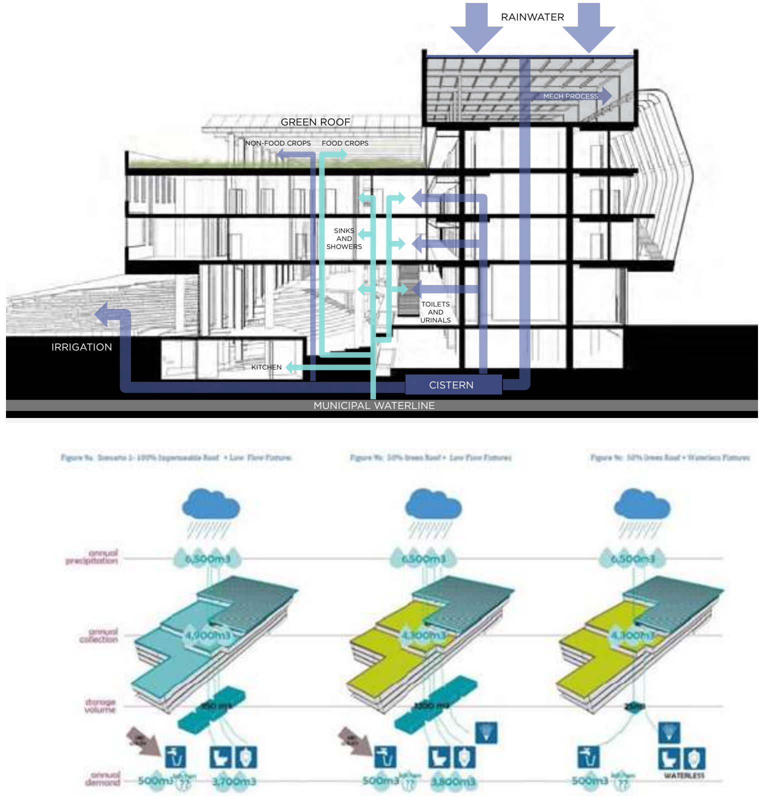
The University of Windsor's Centre for Engineering Innovation (CEI) was constructed with TermoBuild pre-cast hollowcore floor slabs, which reduce energy consumption through their integration of thermal mass and ventilation. By storing heat in the colder months and absorbing heat in warm weather, the concrete floor slabs reduce temperature fluctuation within the building. Within the slabs, fan-assisted ventilation pushes fresh air through a series of main ducts that branch off into smaller ducts, and the concrete warms or cools the air before it is supplied to the building's occupied spaces. The increased efficiency of the TermoBuild hybrid structural/ventilation system minimizes ductwork requirements because it ensures that smaller, off-the-shelf HVAC equipment is sufficient to keep building occupants comfortable year round. Fan power and capacity are greatly reduced.

Water Systems

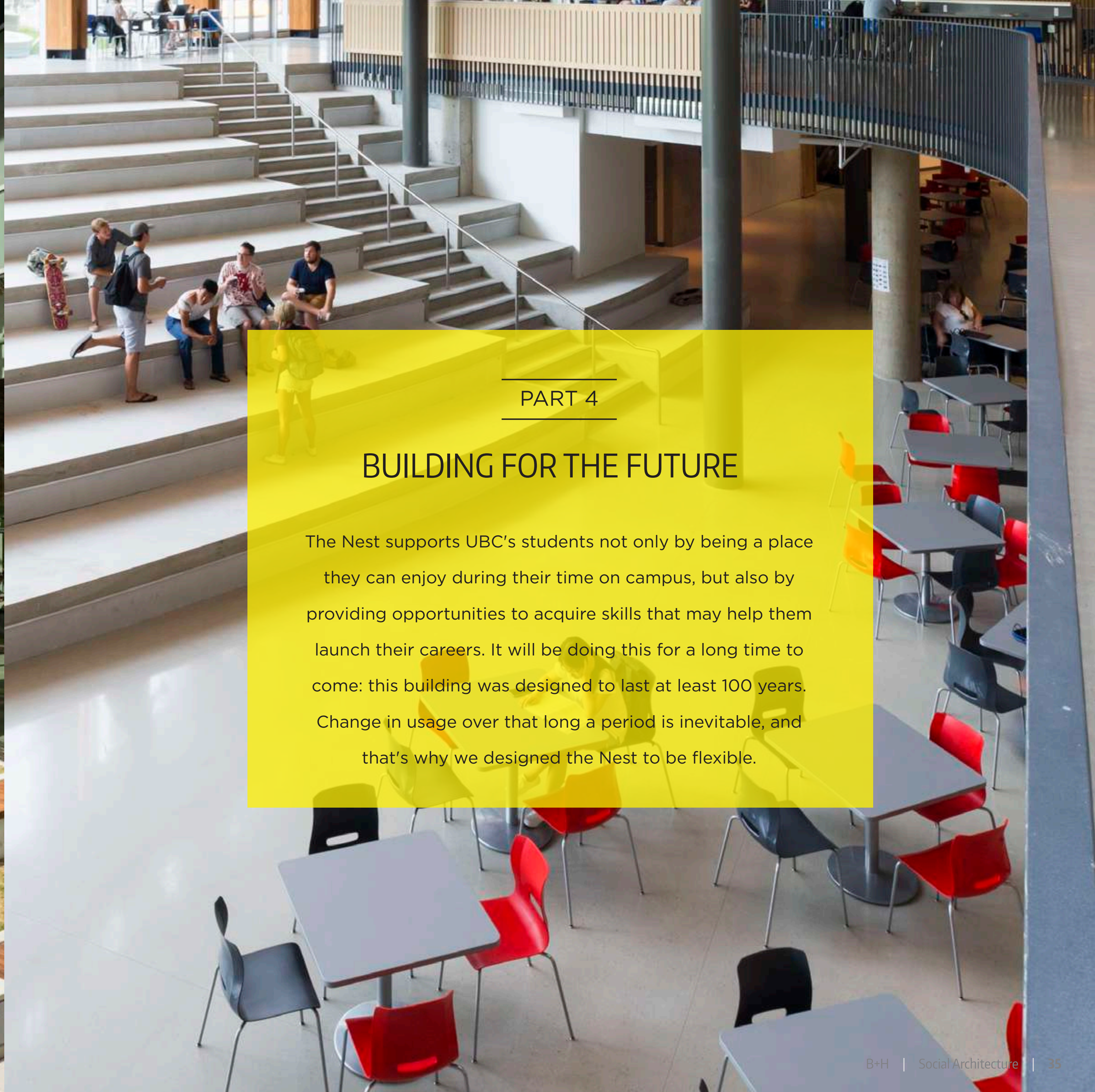
As noted earlier (please see p. 24, "It All Starts with Climate,") Vancouver receives significant amounts of precipitation most of the year but has surprisingly dry summers. **Designing appropriate water systems for the AMS Student Nest therefore became an act of balancing low water usage with maximum recycling volume.** Although the clients initially thought that installing waterless fixtures and composting toilets would be the most sustainable option, data analysis revealed that the cistern this type of system would need to provide adequate grey water through the dry months of July and August would have to be extremely large: its size would greatly exceed the water storage capacity required during the rest of the year. After reviewing this information, UBC's Alma Mater Society decided instead to go with ultra-high-efficiency fixtures and a smaller cistern.

One other key consideration in the design of the water systems was that the student food services group would be growing food crops on the Nest's roof for use in the building's restaurants. While harvested rainwater could certainly be used for the grey water recycling for toilets and urinals, mechanical process water (i.e. cooling tower) and the irrigation of non-food crops that would also be grown on the Nest's terraces, a healthy debate arose within the UBC community over the safety of using rainwater to irrigate the Nest's food crops. As it was, the building would have to use city-supplied potable water for its sinks, showers, and kitchen facilities. The Alma Mater Society decided that potable water was also the best choice for food-crops irrigation.

The Nest's water management system simultaneously makes extremely efficient use of harvested rainwater and minimizes the Nest's dependence on its municipal potable water connection. Recycling rainwater for non-potable uses has in fact reduced in the building's baseline potable water usage by more than 50 per cent.



Top: Water systems diagram, showing paths for potable water from the municipal waterline in light blue and grey water paths in dark blue. Bottom: Water systems capacity comparison diagrams (prepared by Halsall Sustainable Group).

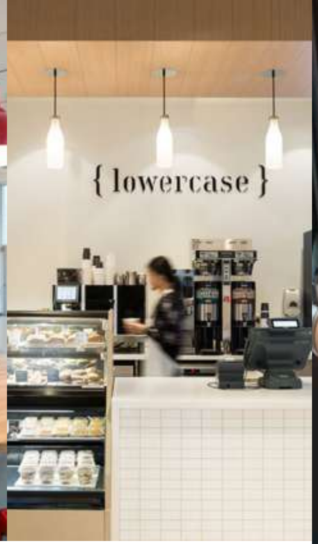


PART 4

BUILDING FOR THE FUTURE

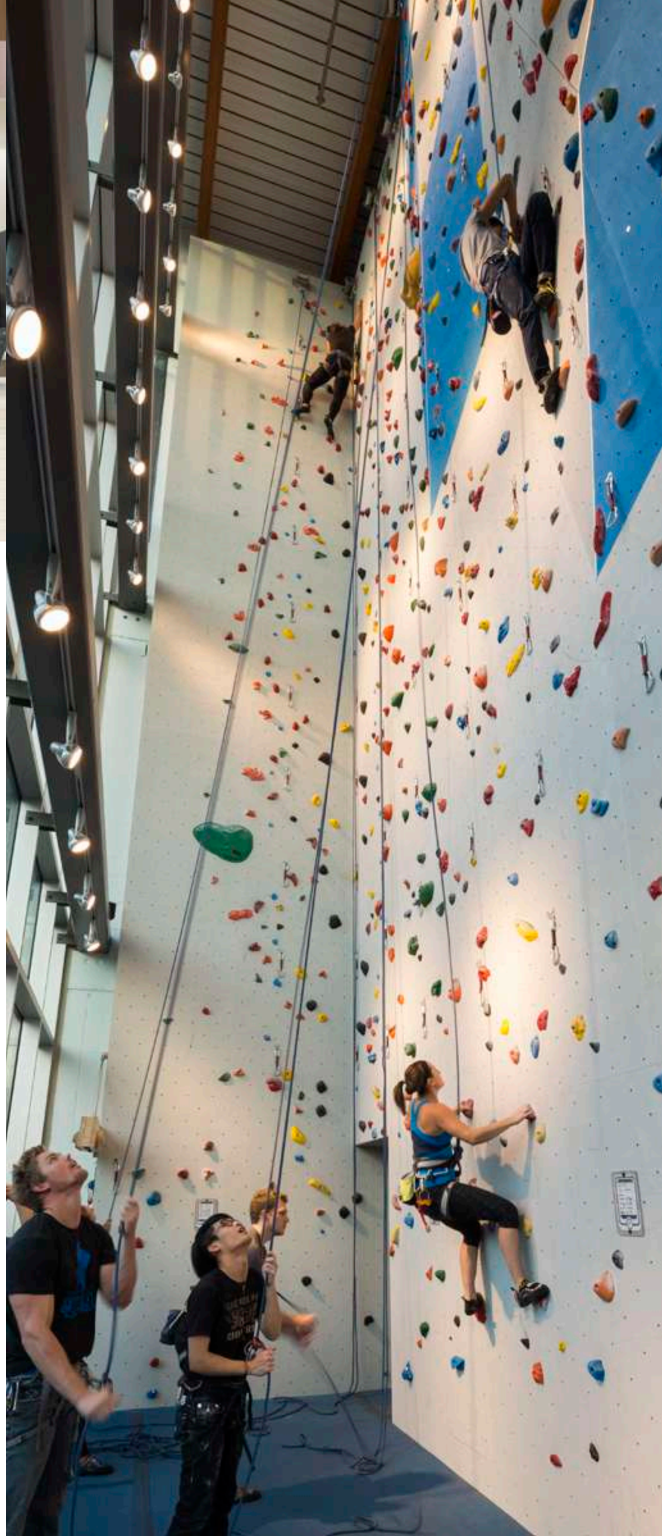
The Nest supports UBC's students not only by being a place they can enjoy during their time on campus, but also by providing opportunities to acquire skills that may help them launch their careers. It will be doing this for a long time to come: this building was designed to last at least 100 years. Change in usage over that long a period is inevitable, and that's why we designed the Nest to be flexible.

The Entrepreneurial AMS Student Nest



Student-run businesses within the Nest play a major role in meeting the Alma Mater Society's mission: "To improve the quality of the educational, social, and personal lives of the students of UBC." The Nest's nine AMS-owned eateries and bars, which include a "classic hamburger joint," food court-style sushi, pizza and healthy fast-food counters, a 400-seat pub, and the elegant rooftop-level Perch restaurant, employ more than 400 students and pay approximately $2 million annually in student wages. (There are also retail and fast-food outlet tenants in the Nest, including a hair salon, a wireless service provider, and a yogurt bar.)

Perch, which serves ethically sourced cuisine, B.C. craft beers, and local wines, offers great views of the North Shore Mountains from its polished yet informal sky-lit interior and terrace. **Like the Great Hall and other large spaces within the Nest, this restaurant was designed not only for general student use, but also to host revenue-generating events such as wedding receptions and banquets.**



Adaptable by Design

Most of the funding for the AMS Student Nest came from student fees collected over the previous 30 years. **The Alma Mater Society felt strongly that the most responsible way to use former UBC students' money was to construct a new student union building that would ably meet the needs of future generations for a long time to come.** Accordingly, the Nest's major construction systems were designed to 100-year durability, and major sub-systems such as roofing were designed to 50-year durability.

At a time when most post-secondary campuses are struggling to adapt aging building stock to new technologies and increasingly collaborative modes of study, it was clear that the Nest would have to be extremely flexible as well as durable. **It's impossible to predict how future generations of UBC students will want to use this building differently, but they will certainly want to transform it and make it their own.** To build adaptability into the Nest, our design team conceived it as a structural framework with large, open areas, particularly on the lower levels. On the upper levels, interior partitions divide the floor plates into club rooms, offices, meeting rooms and study areas, and many other smaller spaces. These non-structural partitions can be easily removed, added to, or shifted to respond to changing space usage patterns.

In the Great Hall, which can seat 600 or accommodate one thousand people standing, a partition wall can be raised out of the floor to divide the space into two rooms.

Timeline
and Project Team

CLIENT: UBC Alma Mater Society (AMS)

PROJECT TEAM, B+H Architects:
Principal-in-Charge: Douglas Birkenshaw
Project Director: Kevin Stelzer
Senior Designer, Envelope: Luca Visentin
Senior Designer: Amie Lee
Designers: Robin Proctor and Dan Levin

PROJECT TEAM, DIALOG*
Principal-in-Charge: Joost Bakker
Design Principal: Bruce Haden
Senior Designer, Planning: Kate Gerson
Project Architect: Andrew Larigakis
Sustainability Coordinator: Peter Atkinson
Contract Administrator: Deryk Whitehead
Contract Administrator: Duff Marrs
Production and Design: Kyle Bruce, Trevor Thimm, Jennifer Cutbill

Consultant Team:
Structural: Read Jones Christoffersen Ltd.
Mechanical: AME Group
Electrical: Applied Engineering Solutions
Landscape: PWL Partnership / PFS Studio
Interiors: B+H CHIL Design and DIALOG
Contractor: Bird Construction
Project Manager: MHPM & UBC Properties Trust
Code: LMDG Building Code Consultant

AREA: 255,000 sf
BUDGET: $107M

PROJECT CHRONOLOGY

April 2008
UBC's students approve construction of a new Student Union Building through an AMS-run campus wide-referendum

December 2008
Expression of Interest Submission

2009
Memorandum of Understanding developed between the AMS and UBC; UBC pre-qualifies seven design teams

March 2010
The seven pre-qualified design teams present their ideas for the new Student Union Building to UBC's students in YouTube presentations

April 2010
Online vote by UBC students to shortlist three design teams from the seven pre-qualified by the University

July 2010
UBC's Alma Mater Society selects HBBH+BH* as the winning design team

September 2010 to March 2011
Consultative Schematic Design process, including 20 workshops with UBC's students and the 'Design Cube' satellite design studio in the existing Student Union Building

June 2012
Ground breaking

September 2015
Completion

Construction photos on pages XIV, XV and 27, 28, 29. Brett Hitchins Photography. All Queen's University Integrated Learning Centre photos: Interior Images. All University of Windsor Ed Lumley Centre for Engineering Innovation photos: Toni Hafkenscheid. Photos on pages 4, 6 and 7: B+H. All other images: Ema Peter Photography.

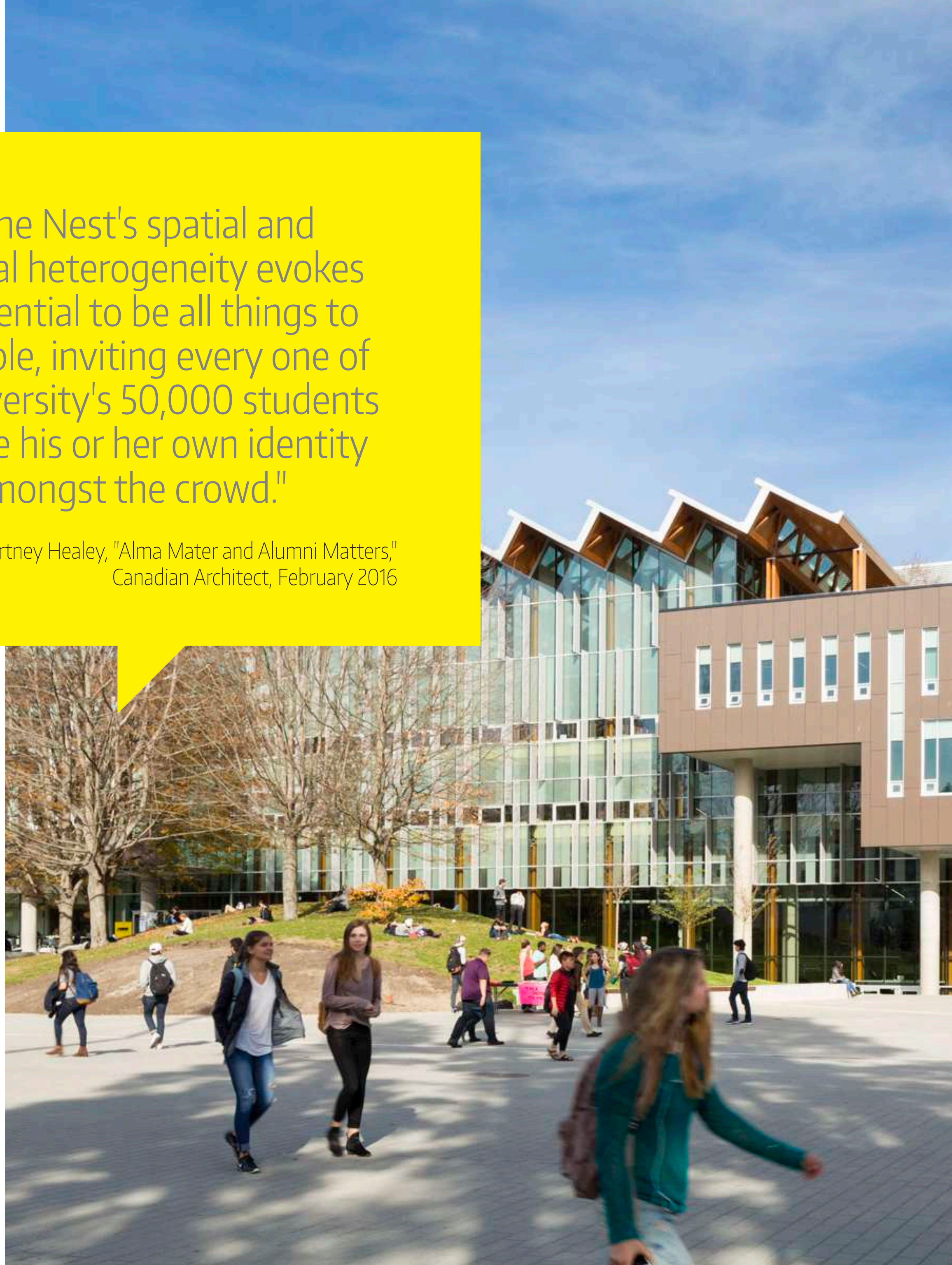
TermoBuild diagram, p. 34: TermoBuild. Water systems capacity comparison diagram, p. 35: Halsall Sustainable Group.

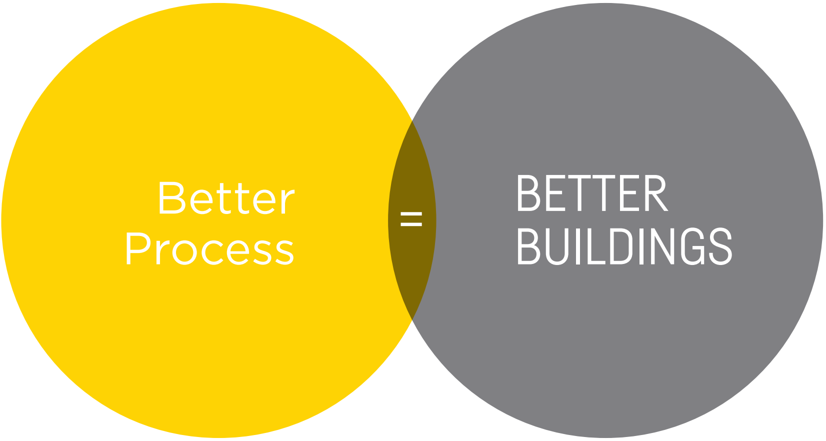
B+H Architects would like to thank AMS / Student Society of UBC Vancouver Archivist & Clerk of Council and Privacy Officer Sheldon Goldfarb and his assistants for providing research materials used in the assembly of this document.

***The winning Joint Venture team was Hotson Bakker Boniface Haden and B+H Architects (HBBH + BH). Hotson Bakker Boniface Haden subsequently became DIALOG.**

"...The Nest's spatial and material heterogeneity evokes its potential to be all things to all people, inviting every one of the university's 50,000 students to forge his or her own identity amongst the crowd."

– Courtney Healey, "Alma Mater and Alumni Matters," Canadian Architect, February 2016





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