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Bullitt Center

NIC LEHOUX

The six-story, 45,000-square-foot Bullitt Center has been referred to as the "world's greenest office building" because of its many environmentally friendly and energy-efficient features, including a rooftop photovoltaic array, rainwater collection, geothermal heat exchange, and composting toilets.

PROJECT SUMMARY

Located just east of downtown Seattle, the Bullitt Center is a six-story green building with more than 44,700 square feet of net rentable office space. The Bullitt Foundation, a nonprofit philanthropic organization with a focus on the environment, worked with local real estate firm Point32 to develop the $32.5 million building. Designed to meet the stringent requirements of the Living Building Challenge (LBC), the Bullitt Center produces all of its electricity on site via a 14,000-square-foot rooftop photovoltaic array. A variety of methods are used in the building to conserve and manage water, including the following: rainwater harvesting; a green roof and a bioswale to treat graywater; and composting toilets. Other green features include geothermal heating and cooling, the use of Forest Stewardship Council–certified wood, and the use of building materials and finishes that are free of 14 classes of toxic chemicals. In addition, although the building has no automobile parking spaces, there is ample bicycle parking in the basement and showers on every floor—except the first—for bicycle and jogging commuters.

QUICK FACTS

Location
Seattle, Washington

Project type
Office building

Site size
10,076 square feet

Land uses
Office

Keywords/special features
Living building challenge, sustainable development, energy-efficient design, rooftop solar panels, composting toilets, graywater reclamation, geothermal energy, rainwater collection and filtration, VOC-free finishes, net-zero energy consumption, net-zero water consumption, net-zero waste production, healthy place features

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www.bullittcenter.org

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The Bullitt Foundation is a seven-person, Seattle-based philanthropic organization founded by Dorothy S. Bullitt in 1952. Its mission is to protect the Pacific Northwest's natural environment and promote healthy and sustainable ecosystems, both urban and rural. For much of its history, the foundation was located in the carriage house on the former Bullitt family estate, but by 2007 it was ready for a new space. With the Bullitt organization being a foundation, asset management and long-term investment were major concerns in finding a new location; and given its focus on the environment, doing so in a sustainable way was of paramount importance. Based on these concerns, the foundation decided to build and own a 50,000-square-foot office building to house its new headquarters, while renting out 90 percent of the space to commercial tenants. The new building would have a 250-year life span and be occupied and operated by the foundation during its entire life. This plan freed the foundation from the restraints and requirements imposed by a traditional seven-to-ten-year development/investment cycle.

Sensors and timers regulate the amount of heat, light, and air in the building by automatically opening or closing windows and raising or lowering blinds. The design of the Bullitt Center also maximizes exposure to nature, with every workspace placed no farther than 30 feet from a source of fresh air and daylight.

Most important, the foundation wanted a building that would reflect its values and mission. The structure therefore needed to be built to the highest levels of sustainability. The building would be a demonstration project that would set a new standard for developers, architects, engineers, and contractors. Bullitt Foundation president Denis Hayes's first step was to review the building standards used by various green building certification programs such as Leadership in Energy and Environmental Design (LEED) and Energy Star. Because the Living Building Challenge (LBC) had the most difficult-to-reach standards at the time, and those that most closely resembled the scientific, ecology-based philosophy of the foundation, Hayes set LBC certification as a goal for the new building. The criteria necessary to attain LBC 2.0 certification included the following:

- Building must not use more energy than it can produce (net-zero energy);
- All water used on site must be collected from rainwater, and all wastewater and graywater must be managed and treated on site (net-zero water);
- Building construction cannot include any materials or chemicals on the LBC Red List (a list of 14 chemical groups, including asbestos, chlorofluorocarbons, and phthalates);
- Operable windows providing fresh air and daylight must be accessible to every building tenant;
- Building must meet standards of indoor air quality measured post-occupancy;
- Development must account for all embodied carbon from construction through offsets;
- All wood used in construction must be Forest Stewardship Council (FSC) certified;
- All building materials and products must be sourced locally; and
- The building operations plan must include actions to reduce or eliminate waste throughout the project's entire life cycle, including construction (net-zero waste).

Development Process and Team

Having all members of the development team work smoothly with each other is important for any project; however, it was absolutely essential for the Bullitt Center. Because the goals for the Bullitt Center had never been attempted on a commercial scale, lines of communication had to be as open and clear as possible. Each of the building's LBC components required well-planned integration with the other components. Team members therefore needed to be receptive to new ideas and encourage synergistic solutions to the challenges they faced.

All development team members were carefully vetted and in most cases were selected based on previous successful working relationships with other team members. The Bullitt Foundation started the process by bringing in Point32 as project manager. Point32 is a very small Seattle-based developer that brought a combination of deep environmental values, project management experience, and expertise in engineering, policy advocacy, and finance.

Bullitt's Hayes and Point32's managing partner, Chris Rogers, interviewed more than two dozen architecture and engineering firms in Washington, Oregon, and British Columbia before settling on four finalists. A volunteer selection committee including professors, independent architects, the author of the Living Building Challenge, consulting firms, and others interviewed the finalists and visited projects they made. They unanimously recommended the Miller Hull Partnership to Hayes, who hired it as project architect. Miller Hull had a long track record in green building, stretching back to its founding in the 1970s. David Miller, the co–managing partner, also chairs the architecture department at the University of Washington.

When Miller Hull was asked which of the finalist engineering firms it had worked with most productively in the past, it cited PAE, which was then added to the team. Finally, after a review of Seattle-based general contractors who seemed to comprehend the attention to detail and the exacting quality standards that would be required for the job, Hayes and Rogers settled on Schuchart Construction.

Representatives of Point32, Miller Hull, PAE, Schuchart, and the University of Washington's Integrated Design Lab met with Hayes every week for the next 12 months. Rather than a sequential process—from architect to engineer to contractor—all of the parties were involved in a deeply integrated design process, solving all the identified problems (and estimating their costs) before breaking ground.

Joe David of Point32 described the shared vision for the project thusly: "This was to be a quantum leap forward for the regional, national,

The Bullitt Center sits on a corner lot (foreground) along a major east–west arterial that cuts across Seattle's gridded street network. The site lies less than a mile and a half from downtown.

and global green building industry. We wanted to show what was possible given our current technology and where we are in the building industry."

The Site

The Bullitt Center sits on an oddly shaped lot along Madison Street, a major east–west arterial that cuts across Seattle's gridded street network. The site lies less than a mile and a half away from downtown and on the border of Seattle's Capitol Hill and Central District neighborhoods. Capitol Hill is Seattle's primary gay neighborhood and many of its businesses, until recently, served a mix of lesbian, gay, bisexual, and transgender clients along with members of the city's cultural creative class. In recent years, the lively, bohemian character of Capitol Hill and its proximity to downtown have made the neighborhood very appealing to a wide range of demographics. The area's prewar single-family homes are attractive to new families who wish to live in a walkable neighborhood, while newly constructed apartments and condominiums appeal to young technology workers. Land in the area is becoming so desirable that micro-housing (small efficiency units with minimum sizes of 220 square feet) is now a popular option. Immediately south of Capitol Hill is the Central District (the CD), which until recently was a racially diverse, low-income community with a reputation for crime. Seattle is one of the fastest growing cities in the United States, and demand for the CD's single-family bungalows is fueling rapid change in the neighborhood.

Originally, the site was the location of a single-story gay bar with a beaten-up asphalt parking lot for bar patrons. To the west of the site is an urban cluster of pre–World War II one- and two-story stores, warehouses, and office buildings surrounded by a mix of bungalows and low-rise apartment buildings. During the 1950s, 1960s, and 1970s, the middle class left Seattle for newer construction in suburban areas and this cluster fell into a state of disrepair and disuse. The area was rediscovered in the 1980s and 1990s with spaces becoming occupied by bars, nightclubs, restaurants, antique stores, and other retail uses. Since the 1990s, the area has gone through many boom-and-bust real estate cycles, but each cycle has brought with it more activity and liveliness. During the 2000s and 2010s, numerous mixed-use residential-over-retail buildings of about five and six stories have been built. Farther east of the site along Madison are a health food co-op supermarket and a Trader Joe's, both situated on the ground floors of new mixed-use residential structures.

The site itself is located at the corner of 15th Avenue and East Madison Street, immediately east of a small triangular park formed by the diagonal intersection of Madison with East Pike Street. Separating the park from the Bullitt Center is 15th Avenue. Running from southwest to northeast, Madison Street traverses up Capitol Hill, which gives the site a grade change. An alley running parallel to Madison and at a diagonal to East Pike creates the site's southeastern boundary. Pike and Pine (the street immediately north of Pike) form a corridor of restaurants and nightlife that define the Capitol Hill neighborhood. Both streets continue into the heart of downtown, with Pike Street terminating at Seattle's famous Pike Place Market.

Conducted largely by Point32, the site selection process was focused on finding a location close to downtown with all of the natural amenities necessary to achieve the LBC goals. A number of factors made the Madison Street location very appealing to the development team. The site is zoned for a maximum height of 65 feet, while the area immediately south has height limits of only 35 feet. The difference in heights is increased by the site's slope. Sitting on an adjacent lot is the Temple De Hirsch Sinai. The iconic building, while not a historic landmark, is unlikely to be torn down and replaced with a taller structure. As a result, the eastern, southern, and western sides of the site have unobstructed solar exposure, and the rooftop solar panels cannot be shaded by future construction unless the city enacts a change in zoning. The southern exposure creates numerous opportunities for passive heating and cooling, and the expansive views of downtown Seattle brought about by the slope are an added bonus. In addition, the downward slope into the neighboring park created opportunities for graywater infiltration.

Another important aspect of the site is that it is accessible by a wide range of transportation options. Multiple bus lines connect it to downtown and the surrounding neighborhoods. Two new rail transit lines, both less than a mile away from the site, are under construction as of early 2015, and Seattle also has various ride-sharing programs. The immediate neighborhood also is very supportive of car-sharing programs. It has a number of Zipcar stations, and Car2Go vehicles are generally offered on the streets; in addition, Seattle's bicycle-sharing program—Pronto! Cycle Share—has a station across Madison Street from the Bullitt Center. The various transportation options are crucial to the building as it has no accommodations for automobile parking.

SITE PLAN, FLOOR PLANS, AND SECTION DRAWINGS FOR THE BULLITT CENTER

Site plan, floor plans, and section drawings for the Bullitt Center. The street between the building and the adjacent park has been closed, improving pedestrian safety while providing better access to the park.

Planning and Design

The Bullitt Center is an irregularly shaped, five-sided, six-story building with a footprint that covers about 98 percent of the site. All aspects of the design process were guided by the performance goals. Rather than treat sustainability and design as separate pursuits, Miller Hull sought to integrate the two. For example, the heavy-timber beams used in construction serve as a carbon sink as well as structural supports while accentuating and defining the interior spaces. The most visually distinctive element in the design is the solar panel roof that overhangs on all sides, creating a unique look for the building while also contributing greatly to its sustainability. The spacing of photovoltaic panels hanging over the sidewalks is designed to give the array and the shadows it casts an aesthetic touch.

Windows and solar panels. The placement of windows and solar panels was informed by the work of the University of Washington Integrated Design Lab. With a team composed of university professors and architecture students, the lab studied the movement of light across the site. Thanks to this work, during the daytime the vast majority of light in the building comes from natural sources. Ninety percent of the lighting on floors three through six comes from natural sources during daylight hours. Because the LBC requirements include making sure that each building user is within 30 feet of fresh air and natural lighting, workstations are situated next to the windows while the break rooms and conference spaces are located in the middle (i.e., in those places with more limited access to natural light).

On the roof of the building sits a 14,000-square-foot photovoltaic array that contains 575 modules with a peak generating capacity of 242 kilowatts. In Seattle's climate, the array will generate about 250,000 kilowatt-hours (kWh) in an average year. In 2014, the building produced 243,761 kWh but consumed just 152,878. So, in 2014, in one of the cloudiest major cities in the contiguous 48 states, the six-story Bullitt Center produced 60 percent more electricity from the sun than it used.

Passive and geothermal heating and cooling. The windows are also part of a sophisticated passive heating and cooling process. The windows and the external blinds covering them are automatically controlled by sensors and timers to regulate the amount of light, heat, and air in the building. If temperatures get too hot, the windows open to circulate air through the building. The blinds may also be lowered or raised and tilted at various angles to minimize or maximize the building's heat gain and eliminate glare.

Another aspect of the building's heating and cooling process is the geothermal heat exchange system. A mix of water and glycol is pumped through 26 on-site wells that are 400 feet deep. At that depth, the ground retains a fairly constant temperature of about 55 degrees Fahrenheit. This warms the fluid returning from the building in the winter and cools it in the summer. In the winter, heat pumps extract energy from this fluid before returning it to the ground a few degrees cooler; on the hottest summer days, they can do the reverse. The heat pumps use this energy to boost the temperature

The Bullitt Center's 14,000-square-foot photovoltaic array on the roof comprises 575 modules with a peak generating capacity of 242 kilowatts (kW). In 2014, the building produced 243,761 kilowatt-hours (kWh) but consumed only 152,878 kWh.

of liquid circulated through the Bullitt Center's radiant heating system to the mid-90s. It is then pumped through a series of tubes embedded in each level's three-inch-thick concrete floor. The concrete absorbs the heat and radiates it out slowly. (On a few days each summer, cool water is circulated; the building remains comfortable without air conditioning.) The heat pumps also heat clean water in two 500-gallon tanks, which is used by the occupants for showers, dishwashers, and so on.

Green materials. The LBC protects the health of building users and those involved in building construction by requiring that LBC-certified buildings avoid any materials containing chemicals on the LBC Red List. The Red List is a list of 14 classes of chemicals that are known to negatively affect health or the environment. When the team explored the range of common building materials included in these 14 classes, they identified 352. This list includes volatile organic compounds (VOCs), heavy metals, and endocrine disrupters. Products on the Red List are not allowed to be permanent parts of the building, and no Red List products are allowed to be used in normal cleaning and operations functions.

Graywater filtration. The park also serves as the last step in the Bullitt Center's graywater filtration plan. The water from the sinks, showers, and dishwashers is collected and stored in the basement. From there it is filtered and then pumped to the constructed wetland, a small green roof located outside on a third-floor terrace. Comprising horsetails (*Equisetum*) planted in a bed of shale, the wetland adds a touch of greenery to the building's Madison Street facade. The hardy plants draw out nutrients, such as nitrogen and phosphorous. A complex system of microbes in the shale breaks down organic matter, while the plants consume the water and then release it into the atmosphere via their normal evapotranspiration processes. Any remaining graywater is then sent to a bioswale at the property's southwest side filled with crushed gravel that extends to the water table. Like the wetland, the bioswale is planted with horsetails. The remaining water then slowly soaks into the ground under the park where it eventually becomes part of the region's groundwater reserve.

Basement green systems. The basement is a major hub for the building's many green systems. It is the location of the following: the ten composting toilet bins and their leachate tanks; the 56,000-gallon rainwater cistern; the water filtration and ultraviolet purification system; the heat pump for the geothermal system; and graywater storage. (Any trace gas from the compost bins in the basement is vented on the roof.) The basement also is home to a collective server room, which also houses the "brain" of the Bullitt Center's nervous system. By concentrating each tenant's server resources in one room, the building is able to cut down on the energy consumption associated with mitigating the heat produced by the servers.

Vehicle/bicycle access. Unlike almost every other Class A office building in the nation, the Bullitt Center has no parking spaces for its tenants. However, it does have a loading bay, hidden on the alley-facing side of the building, for truck deliveries. Building users are encouraged to take mass transit, walk, or bike to the building. Ample bicycle parking in the basement and showers in each bathroom (except in the first-floor bathrooms) are meant to facilitate bike commuting. Although it is not difficult to find street parking in the surrounding neighborhoods, some of those who commute by automobile park their cars in nearby lots. Building tenants also refer their guests to those same nearby lots.

Visitors' center, entrances, and stairwell. Fronting the park at ground level, with its own entrance to the Bullitt Center, is a visitors' center, which is managed by the UW Integrated Design Lab. The visitors' center features exhibits on sustainable development, including energy, design, water, and materials.

The building's main entrance is along Madison Street at the northeast corner of the property. The entrance provides immediate access to a stairwell—encased in glass and jutting outward past the facade—that is a very dominant feature of the building. Called the "Irresistible Stairwell," the staircase is meant to present an irresistible alternative to taking the elevator. By taking the stairs, tenants and visitors engage in a bit of exercise while conserving electricity. Denis Hayes reports that since moving into the building, he has had to repeatedly use tighter notches on his belt to the point where he is now wearing his belt at the tightest possible notch.

Park. Prior to construction of the Bullitt Center, McGilvra Place Park was little more than a triangular traffic island comprising an elevated patch of grass surrounded by sidewalks and 11 mature London planetrees. While studying traffic patterns around the site, the development team noted that 15th Avenue, which separates the park from the site, was a very dangerous street. With a natural desire to head directly downtown, many drivers made an illegal left turn at a sharp angle onto Madison, or they attempted to shoot across

The building includes a highly visible, glass-enclosed stairway as part of the entrance feature, as well as a green roof above part of the lower level.

four busy lanes with no traffic signal. In response to these dangers—and in an effort to make the park more inviting and usable—the development team successfully lobbied the Seattle Department of Transportation (SDOT) to close 15th Street between East Madison and East Pike to car traffic and allow the Bullitt Foundation to create a public plaza that expands the park. Emergency services vehicles are still able to leap the curb if necessary and use the very short right-of-way, but private vehicles are forbidden.

While SDOT owns McGilvra Place Park, it allowed the Bullitt Foundation to make a number of improvements. As a result, the park itself became the first park in the world to receive LBC certification. All of the grass was replaced with native species that require no fertilizer, irrigation, or maintenance, and wooden benches are scattered throughout to provide places to sit. The new design also includes a concrete Ping-Pong table that creates activity in the summer. An open wireless network is a final touch that is intended to attract people to the park and encourage them to linger there.

Public Approvals

During the preconstruction planning phases, many of the building's performance goals had never been considered feasible. In fact, almost every element of the building had a legal or code-related hurdle to overcome. Among the challenges were the legality of the solar panels overhanging public sidewalks, the consumption of rainwater, graywater infiltration in an urban bioswale, and the use of composting toilets in commercial buildings. Overall, the involved public agencies were very supportive. Among the agencies involved were the Seattle Department of Planning and Development, Seattle City Light, Seattle Public Utilities, the aforementioned SDOT, and Seattle Parks and Recreation.

To encourage the development of more LBC buildings and to facilitate the completion of the Bullitt Center, the city of Seattle created the Living Building Pilot Program, which allows for specific departures from code requirements. As part of its participation in the program, the Bullitt Foundation had to submit all plans for the Bullitt Center to the city's Living Building and Deep Green Technical Advisory Group. All code variances and benefits from participation in the city's program were contingent on the decisions made by the advisory group. One of the bonuses given by the city through the Living Building Pilot Program was an extra ten feet of height. Rather than create a new floor, the heights of each floor were increased to 14 feet, which allowed for taller windows and more daylight.

Getting permission to allow the solar panels to hang over the sidewalks lining the site's perimeter was a challenge. One way to permit the overhang would have been to classify the panels as a sky bridge. This was the recommended approach by the city. However, a sky bridge would have required much more structural support than that needed for the panels and would have greatly increased the costs. Hayes successfully argued that the 75-foot-high panels formed an awning. As an awning, the overhang was much easier to build and get permitted. The foundation also made plans with the King County Wastewater Treatment Division to take away the compost produced on site. The building's solid wastes are mixed with the county's treated wastes and then used as fertilizer for nonfood agricultural products.

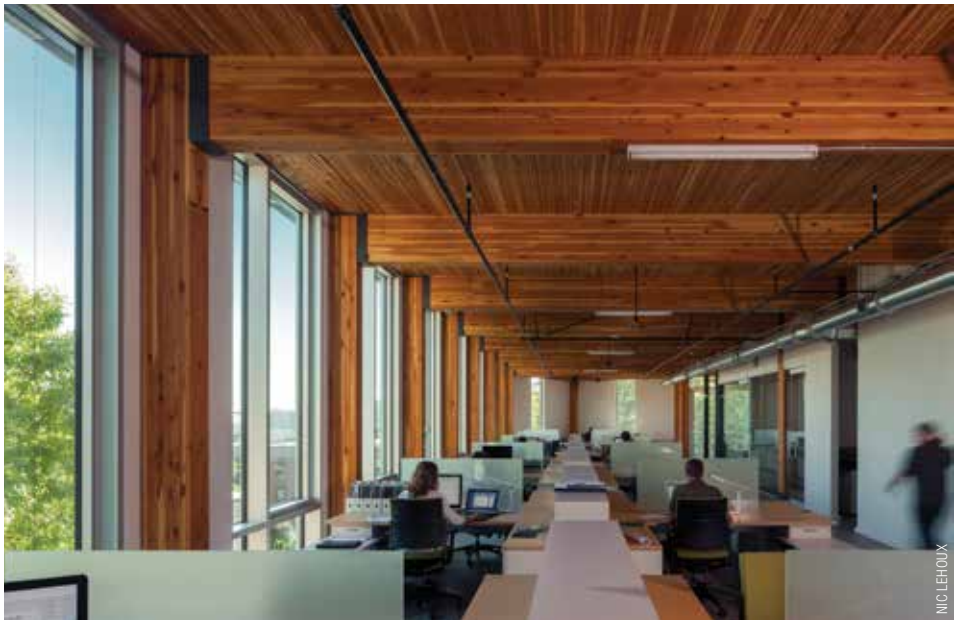
The Bullitt Center has systems to harvest and filter all rainwater that falls on the site. However, the permitting process necessary to allow the center to use the filtered and potable rainwater has been very slow moving. The glide path is clear and all the equipment is installed; but 18 months after construction was completed, the building manager still has not been certified to operate a public water district. (This was slowed down by an unrelated decision by the foundation to switch building managers midway after the first year.) The process involved meetings with the U.S. Environmental Protection Agency, the Washington State Department of Ecology, the Washington State Department of Health, the King County Department of Public Health, and Seattle Public Utilities. As of early 2015, the Bullitt Foundation is seeking approval from the Washington State Department of Ecology to become an independent water district.

Members of the public and residents from the surrounding neighborhoods were very enthusiastic overall about the project. The Bullitt Center is referred to as "the greenest office building in the world" in promotional materials, and this description was prominently displayed on a large sign at the site during construction. While the claim may seem hyperbolic, to the best knowledge of the development team no other Class A office building in the world has as many green building features as the Bullitt Center, and it is one of the first office buildings to be net zero in energy production, water consumption, and waste reduction.

Part of the Bullitt Foundation's mission includes public education and outreach. In addition to the required public meetings, the foundation offers free tours of the building six days a week; it did this even during construction. Even though there was a great deal of public support, some community members had criticisms. In particular, tenants of the apartment building immediately east of the lot lost their views of the city. (The owner of the apartment building had a right

of first refusal on the lot but chose not to exercise it.) Some residents were also concerned about the shadows that would be cast by the solar panels.

During the public approval process, the plan for the building included a vertical photovoltaic array hanging down the southern side of the building. Many members of the public who saw the plan found these solar panels to be unsightly. Given the costs associated with hanging the array, coupled with the negative feedback, the decision was made to remove the vertical panels from the plan and make up for the decrease in energy generation by driving the building's energy efficiency even higher. To achieve net-zero energy with just the rooftop panels, the building had to achieve an energy utilization index (EUI) rating of 15—an extremely high standard of performance (e.g., a LEED Platinum building might have an EUI in the mid-30s).



The use of heavy timber in the building's construction provides a strong aesthetic element for the interior while minimizing carbon-dioxide emissions that are the result of traditional concrete construction, and also serving as a carbon sink. In addition, every piece of wood in the structure has been certified by the Forest Stewardship Council.

Building Construction

Much of the construction methods used in the Bullitt Center involved standard industry practices, but there were several approaches that were relatively special to the process. These included the use of heavy-timber framing, the coordinated process by which green elements were integrated, and the selection process for materials used in the building.

Heavy-timber framing. The big structural difference between this building and more typical office buildings of this size was the use of heavy-timber framing. The basement and first two floors are made of concrete, while the top four floors use both steel beams for lateral support, and heavy timber to support the gravity load. The timber beams support the entire weight of the three-inch-thick concrete floors and the six-inch-thick wood substructure. The radiant heating and cooling tubes running through the concrete make it unable to provide any of the building's structural support. To qualify as "heavy timber," the beams were required to have a minimum thickness of six inches (measured in any direction) and columns were required to have a minimum dimension of eight inches. Both must retain their structural supportive capabilities in a fire for at least one hour.

The Bullitt Center is the first new heavy-timber building of its size constructed in Seattle since 1927. For this reason, Schuchart and structural engineering firm DCI had to reinvent construction techniques and methods that had been forgotten with the abandonment of heavy-timber construction. One challenge involved finding methods that take into account the shrinkage and distortions of wood over time, especially at the places where beams and columns meet. The team created special steel connectors—called buckets—that secure the horizontal beams to the vertical columns and transfer the weight from one to the other. Due to differences in the lengths of columns and beams, as well as the angle between the two, most of the connections between beam and column required a bucket specifically designed for that connection.

The Bullitt Foundation and Point32 chose heavy-timber construction for its environmentally friendly qualities. The development team wanted to minimize the use of concrete due to the high amount of greenhouse gases associated with its production. The Bullitt Center is the first office building in the United States to be "project certified" by the FSC. The forests where the trees came from are managed to promote biological diversity and minimize erosion. FSC techniques are intended to optimize the storage of carbon in the soil. The heavy timber in the building itself serves as a carbon sink (instead of a carbon source, like cement), and new trees planted in place of the old ones now continue the task of removing carbon from the air. In compliance with Red List limitations, all of the timber is minimally treated and no toxic substances were used in treating the timber.

Coordinated construction. The other major construction challenge was integrating all of the green features. Professor Rob Peña of UW's Integrated Design Lab has described the building as being "state-of-the-shelf" rather than state-of-the-art. Each element of the building's green infrastructure is commercially available and has been proven in other settings and situations. However, the Bullitt Center was one of the first to implement so many of these elements in such a large building, and on top of that, a building devoted to office uses. According to Joe David, "Nothing was created uniquely for the building; really, this was taking technologies that were already out there in the marketplace and then engineered to work in one place as a single system."

Very careful coordination and clear communication between all development team members were essential to integrate all of the elements in such a way to allow for both efficient construction and efficient, long-term operations. Contractors were brought in at the start of the design process so that more time was available for planning and then ensuring that there was time to respond to any necessary changes to those plans.

An example of this coordination can be found in how the geothermal wells were dug.

Work on the wells was scheduled to overlap with crucial elements of the building construction schedule. The original plans called for shallower wells spread further out on the property. However, the plans were modified so that the wells were concentrated closer together and dug to deeper depths. This minimized the space needed for digging the wells, thereby minimizing the potential for the work to interfere with the construction of the building itself.

Green materials selection. The other major construction challenge was finding products that did not use chemicals on the Red List. Point32's Joe David sourced and vetted all of the construction materials used in the Bullitt Center. As a result, he has compiled a list of more than 900 products that can be used in future projects. At every stage of the development process, finding compliant products was a challenge. Even tenant improvements are required to use Red-List-free products. The more the development team learned about how ubiquitous toxins are in materials, as well as the risks they pose to all who come into contact with them, the more the team members redoubled their efforts to find alternatives. In one case, their work inspired a supplier to change the formulation of a commonly used sealant to nontoxic chemicals. That reformulated sealant was then used in the Bullitt Center.

Development Finance

Total development costs for the Bullitt Center were $32,500,000, including land costs of $3,380,000, hard costs of $23,360,000, soft costs of $5,290,000, and finance costs of $470,000. The major sources of funding included equity supplied by the Bullitt Foundation, a bank loan from U.S. Bank, and new markets tax credits (NMTCs). The NMTC program supports investment in low-income neighborhoods by giving tax credits on federal income taxes to individuals and corporations that make equity investments in community development entities (CDEs). Community development entities are corporations that provide specific financial services to low-income communities, including serving as intermediary vehicles for the provision of loans. Through the NMTC program, U.S. Bank invested in three CDEs (Ecotrust, MBS Urban Initiatives CDE, and the Seattle Investment Fund) that, in turn, invested in the development of the Bullitt Center. Although these funds came in the form of a loan, the debt will be forgiven in 2018 if all terms of the loan are met.


JOHN STAMETS

The building during construction, highlighting the combination of concrete and heavy-timber framing used in the structure.

Management, Tenants, and Public Relations

While the sustainable design of the Bullitt Center was highly innovative, the ongoing operation of the building is equally important from a sustainable development perspective. In addition, the tenanting of the building involved a relatively unusual approach, and the impact of the building on the sustainable development movement has been a success story in its own right.

Operations and performance monitoring. Unico Properties is responsible for the building operations and tenant billing and employs a full-time, on-site building engineer for the center. The engineer handles all the typical responsibilities for maintaining an office building, but the engineer also has a set of responsibilities unique to the maintenance of the Bullitt Center's many green systems. This includes managing the composting process, filtering the rainwater, and monitoring electrical generation and consumption. The operator also must periodically churn the solid wastes in the composting bin and occasionally retrieve foreign objects that fall into the bins.

Unlike LEED and other green building certification processes, LBC projects are monitored for a year after construction before they can be certified. The monitoring of the performance of the Bullitt Center extended from January to December 2014 and, according to the foundation, the building has met all of its benchmarks.

To date, the energy produced by the building's solar panels is greater than the energy being used by the building. The Bullitt Center is currently net-positive in energy consumption. For eight months out of the year, the building has exported energy to the grid, instead of taking energy from it. EUI data provide another measure of the building's performance. According to Hayes, the average Seattle office building has an EUI in the mid-90s. New, more stringent Seattle city codes are now leading to EUIs in new buildings in the mid-50s. A well-managed LEED Platinum building in Seattle might be in the mid-30s. The Bullitt Center was designed to have an EUI of 15; through January 2015, its EUI is 9.4 and it is projected to be 11 when the building is fully occupied.

As mentioned previously, one of the LBC requirements was net-zero water use. Once the water district licensing has been granted, all water consumed at the Bullitt Center will come

from rainwater that has been collected and purified on site. Until then, water will continue to come from Seattle Public Utilities. The Bullitt Center has proved that it can meet the water demands of all the building's users through rainwater harvesting by collecting and filtering more rainwater than it takes in from municipal sources. Water is also conserved through the use of composting toilets. Since the building was first occupied, the toilets and composting processes have worked as expected. Less than half a cup of water is used to flush the toilets, and both liquid and solid wastes are disposed of in ways that improve or remediate environmental and ecologic processes.

Sustainable tenant practices. Bullitt Center tenants are also required to manage their water and electrical consumption and comply with the Red List. Development team member PAE designed the building's electrical system and also set the energy consumption limits (called plug allowances) for each floor and for each tenant. Before moving into the building, PAE conducted an energy audit on itself to make sure that it could comply with the plug allowances. The firm was surprised to discover that its workers far exceeded the allowances. To set an example for all of the other future Bullitt Center tenants, PAE implemented a number of changes to employee workstations and practices that reduced energy consumption per employee by 72 percent. Changes included replacing energy-intensive desktop computers with laptop computers that were paired with large monitors or terminals linked to a single server in the basement. They cut back to just one networked printer-copier and transitioned to much more efficient task lighting. PAE's other offices in San Francisco and Portland also have adopted these energy-saving practices and have likewise reduced their energy consumption.

To help tenants manage their energy and water consumption, the foundation has created Dashboard, a web application that displays consumption patterns in real time. Because one of the foundation's goals is to educate architects, engineers, contractors, developers, bankers, appraisers, and the public about what is possible with current green technologies, the information on Dashboard is available to all (www.bullittcenter.org/building/dashboard).

Rents and occupancy. The Bullitt Center's development schedule projected that the building would be fully occupied in 2015, and the building is well on its way to meeting this goal, with a current occupancy rate of 84 percent. The building has ten tenants as of early 2015, including the Bullitt Foundation, Point32, the UW Integrated Design Lab, the Seattle University Environmental Justice office, PAE Consulting Engineers, LUMA Lighting Design, SOLARC Engineering, the International Living Future Institute (the administrators of the Living Building Challenge), Intentional Futures (a product design and marketing firm), and architecture firm Hammer & Hand.

In addition, Point32 operates a coworking space on half of the fourth floor. The coworking space supplies tenants with a desk and the basic amenities provided by an office, including office supplies, on a monthly lease. PAE has signed a new lease to expand its presence in the building by relocating workers from other offices to the Bullitt Center's third floor.

Rent in the building is in the range of $28 to $30 per square foot triple net—lower than some other new office buildings in Seattle—but the actual costs of being in the Bullitt Center are even lower. Seattle City Light has agreed to purchase "metered, saved kilowatt-hours" from Bullitt Center—for the difference between its actual consumption and consumption in a building the same size built to code. It also purchases excess solar electricity for its avoided cost. The Bullitt Center, in turn, gives each of its tenants plug-load goals that, if met, will allow the building to be net energy neutral. To incentivize the tenants to be efficient, Bullitt Center management will pay the total energy bill for all tenants that meet their targets. In the first two years of operations, all tenants met their goals.

Due to the LBC requirements, some businesses are not appropriate for the Bullitt Center. Businesses that rely heavily on servers, for example, have energy needs that exceed what can be produced from rooftop solar panels; moreover, some water-intensive businesses, like coffeehouses and markets, might require more water than can be provided by rain. While these requirements limited the potential pool of tenants, it was the location of the building that made finding tenants a bit tricky. It is the first office building of its size in the culturally diverse neighborhood, and many potential tenants preferred to locate in the downtown business district.

Construction management
Schuchart
Seattle, Washington
www.schuchart.com

Structural engineer
DCI Engineers
Seattle, Washington
www.dci-engineers.com

Tenant improvements
Foushée & Associates
Bellevue, Washington
www.foushee.com

Lighting
Luma Lighting Design
Seattle, Washington
lumald.com

Water systems engineer
2020 Engineering
Bellingham, Washington
www.2020engineering.com

Landscape design
Berger Partnership
Seattle, Washington
www.bergerpartnership.com

Building operation
Unico Properties
Seattle, Washington
www.unicoprop.com

Solar engineering and commissioning
Solar Design Associates
Harvard, Massachusetts
www.solardesign.com

Solar installation
Northwest Wind and Solar
Seattle, Washington
www.nwwindandsolar.com

Video
www.youtube.com/user/ULITV

Interviewees
Salley Anderson, chief financial officer, Bullitt Foundation

Brian Court, partner, the Miller Hull Partnership

Joe David, project associate and sustainability program manager, Point32

Denis Hayes, president and CEO, Bullitt Foundation

Phil R. Johnson, associate principal, DCI Engineers

Brad Kahn, founder, Groundwork Strategies

Craig Miller, project manager, Foushée & Associates Inc.

Casey Schuchart, division manager, Schuchart

Justin Stenkamp, mechanical engineer and project manager, PAE Consulting Engineers

Public relations and education. The Bullitt Center was built not just to provide space for the Bullitt Foundation and other tenants, but also as a demonstration project. As noted on the Bullitt Center website, "The goal of the Bullitt Center is to drive change in the marketplace faster and further by showing what's possible today. The era of harm reduction, half steps, and lesser evils is behind us. As a society, we need to be bold in ways that were once unimaginable." The Bullitt Center website provides voluminous material about the building and its sustainable features for all to read and study, and the University of Washington Center for Integrated Design (CID) offers public and private tours of the building as well, with more than 500 tours thus far.

As a result of these and other communications efforts, the building has garnered substantial national and international attention from the media, the sustainable development community, and the general public, and the building's cutting-edge green features are what has drawn the attention. For example, FAST Company published an article in August 2013 with the title "Inside the Greenest Office Building in the World." The building has also been covered by the *New York Times*, CNN, the *Seattle Times, Time* magazine, *Architectural Record*, and many other media outlets.

Bullitt Center has also won numerous awards, including "Best Project in 2013" from *Engineering News Record* and "Sustainable Building of the Year" from *World Architecture News*. A panel assembled by *World Architecture News* deemed the building to be "the greenest commercial building in the world." Denis Hayes and the rest of the development team believe that one of the best features of the Bullitt Center is simply that it demonstrates what is possible given the current state of green building technology. Observes Hayes on the Bullitt Center's website, "In deciding to proceed with the Bullitt Center, we were trying to accelerate the pace of change by showing what's possible today, using only off-the-shelf products that any building project could choose. We combined these time-tested approaches in one building in a way that allowed for new synergies." For Hayes, the Bullitt Center's true accomplishment will be the degree to which it inspires future developments. Hayes hopes that structures like the Bullitt Center will help encourage discussions between architects and their clients about the positive impacts that green building technology can have on long-term investment returns and decreased operations costs, and also about what kind of built environment developers want to bequeath to their children.

The Bullitt Center includes a ground-level visitors' center that features exhibits on sustainable development. The visitors' center is managed by the University of Washington Integrated Design Lab.

In the end, the building has been a real educational and public relations success story for the Bullitt Foundation, raising its profile in the sustainable development movement while furthering the foundation's mission by providing a practical example of what is possible in sustainable development.

Observations and Lessons Learned

The success of the Bullitt Center was due in part to a number of factors. Denis Hayes believes that it was essential to start with extremely ambitious goals. He notes, "People would say this can't be done, but I would say you just haven't tried hard enough or maybe you don't have the right people in the room."

From the start, the energy consumption, water consumption, and waste production goals shaped and defined every aspect of the Bullitt Center's design and construction. Hayes believes that an incremental approach of adding green features at later stages of development is a formula for mediocrity. Instead, he argues that those who want to develop green buildings should "bite into the whole enchilada" and start with the highest and most aggressive goals in mind.

Given the aggressive goals, the development team learned another important lesson: the city of Seattle's planning and design codes lagged behind leading green technologies and practices. In many cases, the project's goals were illegal to implement. Fortunately, the city was supportive of the goals and created the Living Building Pilot Program to help the development team, as well as developers of future LBC projects, complete the permitting process.

To meet the project's goals, the development team realized that each of the building's users would play a crucial role in determining whether conservation goals were met. Early in the design process, the team tried to set up the building so that the most convenient default behavior was the behavior they sought. Furthermore, because the Bullitt Center's building operator also plays a crucial role in the ongoing maintenance and performance of the structure, the development team also believes it is important for building operators to play an active role in the design process. Their input early on could increase the efficiency of building operations, but it also gives them a much better understanding of how and why design decisions were made. This requires that the developer choose the architect, principal engineers, general contractor, key subcontractors, and the building operator before beginning the design process.

In working with each other, members of the development team learned that they had to listen and keep their minds open to unorthodox ideas. Because many of the owner's goals could not be met using any traditional strategy, it was necessary for team members to feel comfortable talking and sharing even the craziest of ideas, some of which turned out not to be crazy after all.

PROJECT INFORMATION

Development timeline

Site purchased	April 2008
Planning started	July 2009
Leasing started	January 2011
Construction started	July 2011
Project completed	March 2013

Land use plan	Percentage of site
Building	98
Landscaping/open space	2
Total	**100**

Office information

Office net rentable area (NRA)	44,766 sq ft
NRA occupied	84%
Number of tenants	10
Typical tenant size	3,500 sq ft
Typical annual rents	$28 to $30 per sq ft
Average length of lease	7 years

Tenants

International Living Futures Institute	1st floor
University of Washington Integrated Design Lab	1st and 2nd floors
Hammer & Hand	2nd floor
Seattle University Center for Environmental Justice and Sustainability	2nd floor
SOLARC Engineering	2nd floor
LUMA Lighting Design	3rd floor
PAE Engineering	3rd floor
CoWork Space/Point32	4th floor
Intentional Futures	5th floor
Bullitt Foundation	6th floor

Development cost information

Land costs	**$3,380,000**
Hard costs	
Preconstruction	$450,000
Construction	$18,160,000
Owner's direct costs	$2,940,000
Sales tax	$1,810,000
Total hard costs	**$23,360,000**
Soft costs	
Architecture and engineering	$2,550,000
Permits and municipal fees	$320,000
Utility expenses	$600,000
Testing and inspection	$140,000
Other (sales, leasing, legal, administration, property management, taxes, insurance, bonds, development services)	$1,680,000
Total soft costs	**$5,290,000**
Finance costs	**$470,000**
Total development costs	**$32,500,000**

About the Urban Land Institute

The mission of the Urban Land Institute is to provide leadership in the responsible use of land and in creating and sustaining thriving communities worldwide.

Established in 1936, the Institute today has more than 34,000 members, representing the entire spectrum of land use and development disciplines. Professionals represented include developers, builders, property owners, investors, architects, planners, public officials, real estate brokers, appraisers, attorneys, engineers, financiers, academics, and students.

ULI is committed to

- Bringing together leaders from across the fields of real estate and land use policy to exchange best practices and serve community needs;
- Fostering collaboration within and beyond ULI's membership through mentoring, dialogue, and problem solving;
- Exploring issues of urbanization, conservation, regeneration, land use, capital formation, and sustainable development;
- Advancing land use policies and design practices that respect the uniqueness of both the built and natural environment;
- Sharing knowledge through education, applied research, publishing, and electronic media; and
- Sustaining a diverse global network of local practice and advisory efforts that address current and future challenges.

Patrick L. Phillips, Global Chief Executive Officer

The development of this case study was generously underwritten in part by the law firm Allen Matkins.

About Allen Matkins

Allen Matkins is a California-based law firm specializing in serving the real estate industry. The firm has more than 200 attorneys in four major metropolitan areas of California: Los Angeles, Orange County, San Diego, and San Francisco. Its core specialties include real estate, real estate and commercial finance, bankruptcy and creditors' rights, construction, land use, natural resources, environmental, corporate and securities, intellectual property, joint ventures, taxation, employment and labor law, and dispute resolution and litigation in all these matters.

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ULI CASE STUDIES

The ULI Case Studies program highlights and showcases innovative approaches and best practices in real estate and urban development. Each case study provides detailed information regarding the ideas, plans, process, performance, and lessons learned for the development project. Each also includes project facts, timelines, financial data, site plans, photos, location maps, and online videos. For more information, visit the ULI Case Studies website at **www.uli.org/casestudies**.

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