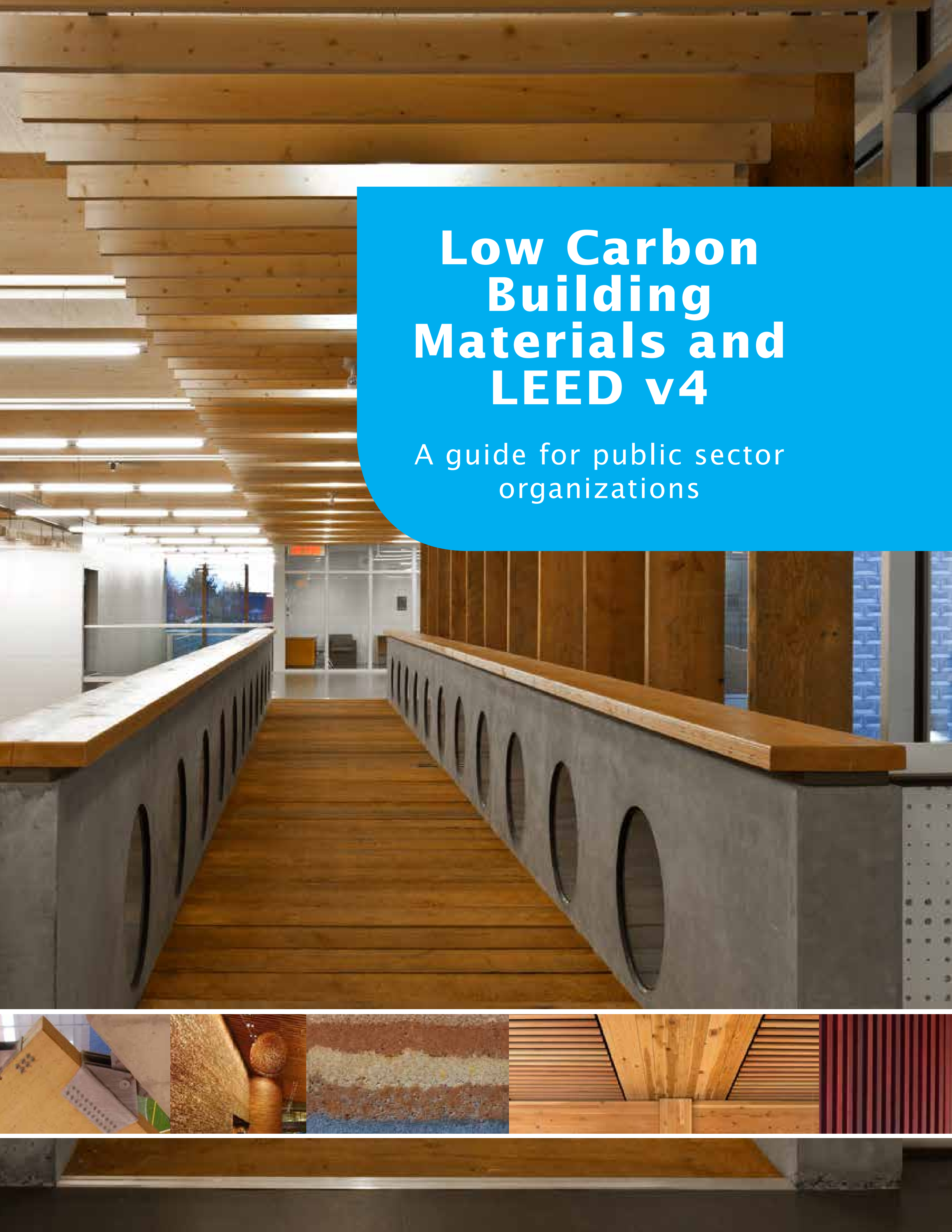


Low Carbon Building Materials and LEED v4

A guide for public sector organizations

Cover image: Bridge at L'École Mer et Montagne, Campbell River, B.C.
Photo: Derek Lepper

BRITISH COLUMBIA
Ministry of Environment and Climate Change Strategy

light house

EQUILIBRIUM Structural Engineers www.eqcanada.com

KAPOW CREATIVE

Ronald McDonald House BC Yukon, Vancouver B.C. (Photo courtesy of: Equilibrium, Photographer: Ema Peter).

Table of Contents

Low Carbon Building Materials and LEED v4: A guide for public sector organizations

Introduction....................................... 5

Why Embodied Carbon? 6

Using Wood and PLC in Building Design and Construction................................ 6

Leadership in Energy and Environmental Design 11

Low Carbon Building Materials and LEED v4... 13

Conclusion....................................... 17

Case Studies 20

WOOD INNOVATION & DESIGN CENTRE • University of Northern British Columbia, Prince George, B.C. (Photo: Ema Peter)

Low Carbon Building Materials and LEED v4: A guide for public sector organizations.

RONALD MCDONALD HOUSE • BC Women's and Children's Hospital Vancouver, B.C. (Photo: Ema Peter)

Introduction

The Government of British Columbia (B.C.) is committed to demonstrating leadership in climate action and clean economic growth. This includes promoting the use of low carbon materials in public sector building projects, as well as an increased focus on the embodied carbon of building materials an area historically neglected by the building industry.

B.C. government policy currently requires that all newly constructed public sector buildings achieve Leadership in Energy and Environmental Design (LEED®) Gold or equivalent certification[1]. The most recent iteration of LEED, known as LEED v4[2], has seen the most rigorous update of this green building rating system. LEED v4 rewards the use of low carbon building materials in ways previous versions did not. The Canada Green Building Council (CaGBC®[3]) through the Zero Carbon Buildings Initiative[4] has also highlighted low carbon building materials as one of the following four key components of a Zero Carbon Building:

- Zero Carbon Balance
- Efficiency
- Renewable Energy
- Low Carbon Materials

This move to promote the use of low carbon building materials is likely to receive increasing amounts of attention across the Canadian building industry.

B.C. has already established itself as a leader in the use of low carbon building materials with the Wood First Initiative[5] and the early acceptance of Portland-limestone cement (PLC). The B.C. forest industry accounts for approximately 6%[6] of B.C. jobs and PLC is manufactured in Metro Vancouver under the Canadian brand name Contempra®. By encouraging the use of low carbon building materials in public sector buildings, building owners, project managers and capital planners can contribute to B.C. industries, the communities they support and a low carbon future.

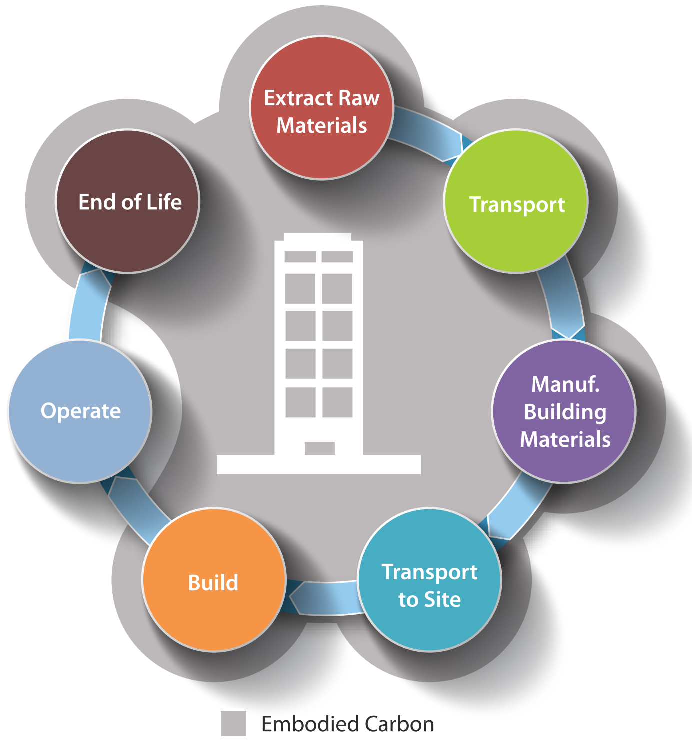
This guide will provide a high level overview of low carbon building materials, with a particular focus on wood and PLC, and will describe how to incorporate low carbon building materials into LEED v4 projects pursued by public sector organizations (PSOs).

This guide will provide a high level overview of low carbon building materials, with a particular focus on wood and PLC, and will describe how to incorporate low carbon building materials into LEED v4 projects.

1 Reducing Greenhouse Gas (n.d.). URL: http://www2.gov.bc.ca/gov/content?id=DF281B134D19469E98679E9A91CF043E
2 LEED v4, the Newest Version of LEED Green Building Program Launches at USGBC's Annual Greenbuild Conference (2013). URL: http://www.usgbc.org/articles/leed-v4-newest-version-leed-green-building-program-launches-usgbc's-annual-greenbuild-confe
3 Canada Green Building Council (2017). URL: www.cagbc.org
4 Zero Carbon Building Initiative (2016). URL: https://www.cagbc.org/zerocarbon
5 Wood First Initiative (n.d.). URL: http://www2.gov.bc.ca/gov/content/industry/forestry/supporting-innovation/wood-first-initiative
6 B.C's Forest Industry and the B.C. Economy in 2016 (2017). URL: https://www.cofi.org/wp-content/uploads/BC-Forest-Report-FINAL-Sept-2017.pdf

In B.C., the built environment accounts for 11% of GHG emissions.

Image 1: Embodied Carbon Process of Building Materials



Adapted from Circular Ecology[7]

Why Embodied Carbon?

In B.C., the built environment accounts for 11% of GHG emissions, providing government a significant opportunity through its leadership and procurement to influence supply chains, building professionals and other building owners. Buildings account for 78% of B.C.'s public sector emissions alone.

Embodied carbon (emissions) represents the GHG emissions associated with the manufacturing, maintenance and decommissioning of a building. Embodied carbon is calculated by tracking emissions through a life cycle assessment process (Image 1).

Using Wood and PLC in Building Design and Construction

By requiring project teams to consider low carbon building materials, such as wood and PLC, in government building projects, B.C. will continue to demonstrate leadership and commitment toward a low carbon future.

The Wood First Initiative has been celebrating the use of local B.C. wood for several years. The benefits of using wood include[8,9]:

- Wood is renewable.
- Trees absorb carbon dioxide while the tree is growing, converting it to carbon stored in the wood.

7 Embodied Energy and Carbon: The ICE Database (2016). URL: http://www.circularecology.com/embodied-energy-and-carbon-footprint-database.html#.WLDts-W8rJ0w
8 Canadian Wood Council (2017). Wood Advantages. URL: http://cwc.ca/design-with-wood/durability/woods-heritage/wood-advantages/
9 Forest Products Association of Canada (2011). Feel Good About Canadian Wood. URL: http://www.fpac.ca/publications/building_green__EN_web_v2.pdf

Image 2: *UBC currently boasts the tallest modern hybrid wood building in the world - Brock Commons Tallwood, which features 17-storeys of timber structure over a single concrete level. See case study in Appendix A. Please also refer to case study by naturally:wood[11] (Image courtesy of www.naturallywood.com).*

- When forest products are used in construction, they continue to store the carbon for the life of the structure and beyond, when wood fibre is recycled or reclaimed.
- Wood requires less energy to manufacture than other common building materials such as concrete and steel.
- Wood is durable.
- Wood products are locally produced. This contributes to the long term economic stability of neighbouring communities and generates job training and research collaborations between educational institutions and industry.
- Wood buildings can provide B.C. residents with a connection to nature.[10]

Wood can be incorporated into building design in many ways, as a structural component or architectural element.

Although there is a history of wood use in Canada as a structural material, in the past the decline of large timber availability and historical concerns about combustibility has resulted in building regulations that have until recently restricted wood-use to low-rise structures.[12] This has changed in recent years with advances in the fields of fire and timber engineering, which have aimed to address the strength, durability, resilience, and combustion concerns resulting in the use of wood in taller structures.[13]

Image 3: *The roof of the gym at the Doig River Community Centre features glulam beams with steel tension rods to create an aesthetically striking and efficient design (Image courtesy of Equilibrium).*

10 Kellert, S. & Calabrese, E. (2015). The Practice of Biophilic Design. URL: http://www.biophilic-design.com/
11 naturally:wood (2017). UBC Brock Commons. URL: http://www.naturallywood.com/emerging-trends/tall-wood/ubc-brock-commons
12 FPInnovations (2014). Technical Guide for the Design and Construction of Tall Wood Buildings in Canada. FPInnovations Special Publication SP-55E, 1st ed. Pointe-Claire, QC.
13 CSA (2014). Engineering Design in Wood. CSA 086-14. Mississauga, ON: Canadian Standards Association (CSA).

A note about wood and burning

When wood is exposed to fire it burns and forms a charred layer, which insulates the remainder of the timber section and preserves the load-carrying capacity of the uncharred residual area. Studies on the behaviour of timber under exposure to fire and on the rate of growth of the char layer have led to the development of design procedures that allow heavy timber elements to be provided with a fire resistance rating (FRR) (see Appendix B of Canadian Standards Association O86).

Image 4: *The Earth Systems Sciences Building at the University of BC makes use of timber-concrete composite systems, with concrete topping contributing to the performance of the cross-laminated timber floor panels and supporting glulam beams. The feature stair (above) cantilevers into the atrium, with glued-in HSK plates connecting CLT elements. For more information, refer to case study by naturally:wood[14] (Image courtesy of Martin Tessler).*

Image 5: *The Wood Innovation Design Centre at the University of Northern BC in downtown Prince George used the Shou Sugi Ban technique of creating a durable charred wood finish (Image courtesy of Ed White).*

14 naturally:wood (2017). Earth Sciences Building University of British Columbia. URL: http://www.naturallywood.com/project-gallery/earth-sciences-building-university-british-columbia

Image 6: *Vancouver Convention Centre, Vancouver, B.C. A LEED Platinum building with interior wood finishes (Image courtesy of naturallywood.com).*

Modern advances with engineered wood products have led to the development of a variety of structural forms, which may be generalized as:

- Light frame, using small dimensional lumber with timber decking or wood-based sheathing panels;
- Heavy timber post-and-beam with heavy timbers;
- Glue-laminated timber (glulam), or structural composite lumber products; and
- Mass timber, which uses large panel products for both horizontal floor or roof elements, and vertical load-bearing walls and shearwalls.

Architectural wood elements can add beauty and warmth to both the building interior and exterior. Ways to incorporate architectural wood elements into building design include[15,16]:

- Cladding (Image 5 - WIDC);
- Partitions, ceilings, and floors;
- Ceiling, wall and floor finishes (Image 6 -VCC);
- Millwork and trim;
- Doors; and
- Furniture.

Modern advances with engineered wood products have led to the development of a variety of structural forms.

15 Boddy, Trevor (2015). The Apostle of Wood. Canadian Architect Magazine. URL: https://www.canadianarchitect.com/features/1003730141/
16 Ehrlich, B. (2014). Cladding: More Than Just a Pretty Façade. Building Green, September 2, 2014. URL: https://www.buildinggreen.com/feature/cladding-more-just-pretty-fa-ade

PLC is structurally equivalent to regular Portland cement, though with a 10% reduction in embodied carbon.

Concrete is widely used in B.C. in the construction of buildings and infrastructure works. Large quantities of CO_2 are produced during the production and curing of cement, and globally are responsible for an estimated 5% of human-made GHG emissions.[17]

PLC (branded in Canada as Contempra®) is a relatively new product to the Canadian market and is associated with a 10% reduction in GHG emissions from manufacturing when compared to regular Portland cement. Although only available on the Canadian market since 2011, PLC has been used in Europe for over 25 years, where up to 35% limestone content is permitted.[18]

For limestone content below the 15% upper limit allowed in Canada, no reduction in structural properties is observed relative to regular Portland cement. This means that within Canada, PLC is structurally equivalent to regular Portland cement, though with 10% less embodied carbon. When PLC was first released, it was restricted from use in environments with sulphate exposure. Recent testing, however, has dispelled these concerns and has expanded the use of PLC to sulphate environments subject to the requirements of CSA A23.1.[19] PLC is National Building Code compliant, holds a CSA Registered Environmental Product Declaration (EPD) and currently accounts for well over 60% of the made-in-B.C. cement consumption in the Lower Mainland. According to the B.C. cement sector, PLC is priced the same as regular cement. It is available in B.C. from LefargeHolcim and Lehigh Hanson Canada.

Image 7: *Portland-limestone cement was used in the construction of the LEED Platinum Metrotower III in Burnaby, B.C. (Image courtesy of © Ledcor. All rights reserved).*

Image 8: *Portland-limestone cement was used in the construction of Telus Garden, a 22-storey office building in downtown Vancouver. The dramatic entrance features a sweeping roof with curved glulam beams (Image courtesy of Henriquez Partner Architects).*

17 Pacific Institute for Climate Solutions (2010). Reducing GHG Emissions in the Cement Industry. URL: http://pics.uvic.ca/sites/default/files/uploads/publications/Reducing%20GHG%20emissions%20in%20the%20cement%20industry.pdf
18 Lafarge (2017). Portland-Limestone Cement. URL: http://www.lafarge-na.com/wps/portal/na/en/2_3_B_1-PortlandLimestone_Cement
19 Cement Materials and Methods of Concrete Construction. CSA A23.1-14. Mississauga, ON: Canadian Standards Association (CSA).
20 Thomas, M. (2007). Optimizing the Use of Fly Ash in Concrete. Report IS548. Portland Cement Association (PCA). Skokie, IL.
21 Slag Cement Association (SCA). Farmington Hills, MI. URL: www.slagcement.org
22 Sirewall: Structural Insulated Rammed Earth (2016). URL: http://sirewall.com
23 Just Biofiber Structural Solutions (2014). URL: http://justbiofiber.ca/
24 Sutton, A., Black, D., & Walker, P. (2011). Straw Bale. URL: https://www.bre.co.uk/filelibrary/pdf/projects/low_impact_materials/IP15_11.pdf
25 Flahiff, Daniel (August 24, 2009). "Hemcrete®: Carbon Negative Hemp Walls". Inhabitat.

Beyond wood products and PLC, there are other low carbon building materials that may be applicable to PSO building projects. These include:

- Cement products with Supplementary Cementitious Materials, such as the addition of fly ash[20] or ground granulated blast furnace slab[21] (GGBFS) to concrete
- Rammed earth[22]
- Biofiber[23]
- Straw bale[24]
- Hempcrete[25]

Leadership in Energy and Environmental Design

Leadership in Energy and Environmental Design (LEED) is a building rating system that aims to reduce the environmental impact associated with building design, construction and operations. First released as a pilot in the United States in 1998 through the United States Green Building Council (USGBC), LEED was subsequently adapted for the Canadian market by Canada Green Building Council (CaGBC) in 2004. Today, LEED is the most commonly used building rating system in Canada with over 7,000 certified and registered projects. B.C. had the second highest number of LEED Gold and Platinum public buildings in Canada, with approximately 30% of the national total.

LEED version 4 (LEED v4) is the most recent version of the rating system, first released in the US in 2013 and made mandatory for Canadian projects as of November 1, 2016 (Table 1).

While public sector projects typically fall within the Building Design + Construction (BD+C) rating system, LEED now offers five separate rating systems (Table 2).

Image 9: *The BC Cancer Research Centre in Vancouver was one of the first LEED Canada certified projects, achieving LEED Gold certification in 2005 (Image courtesy of IBI Group).*

Table 1: Major events in the development of LEED in Canada.

Event	Date
Formation of CaGBC	2002
LEED Canada NC v1.0 is released	2004
LEED Canada CI v1.0 is released	2006
First major addendum to LEED Canada NCv1.0	2007
LEED Canada EB:OM is released	2009
LEED Canada NC 2009 is released	2010
LEED v4 is launched by USGBC	2013
LEEDv4 is required for all newly registered projects	November 1, 2016

Table 2: LEED project types

Building Design + Construction
Building Operations and Maintenance
Interior Design and Construction
Neighborhood Development
Homes

Table 3: Levels of LEED certification

Level of LEED Certification	Points
Certified	40-49
Silver	50-59
Gold	60-79
Platinum	80-110

Leadership in Energy and Environmental Design (LEED) is a building rating system that aims to reduce the environmental impact associated with building design, construction and operations.

Image 10: *Operations Centre, Gulf Islands National Park Reserve, Sidney, B.C. was the first project to be awarded LEED Platinum in B.C. (2006) (Image courtesy of McFarland Marceau Architects Ltd. and Willie Perez, P. Eng.).*

Image 11: *Gibsons Elementary School, LEED Canada 2009 Gold certified (Image courtesy of Ed White/KMBR).*

Prior to the release of LEED v4 all Canadian LEED projects registered with the CaGBC followed the Canadian-specific LEED rating system. With LEED v4 the USGBC chose to release one global standard with country specific Alternative Compliance Paths (ACPs) and standards. As of February 2017, Canadian ACPs that are applicable to the LEED v4 BD+C rating system are:

- LEED BD+C – LT, Sensitive Land Protection
- LEED BD+C Healthcare – SS, Places of Respite
- LEED BD+C – EA, Optimize Energy Performance
- LEED BD+C – MR, Legal Wood
- LEED BD+C Healthcare – EQ, Minimum IAQ Performance
- LEED BD+C Healthcare – EQ, Construction Indoor Air Quality Management Plan

Low Carbon Building Materials and LEED v4

Low carbon building materials can contribute directly or indirectly to many different LEED credits.[26] Wood products can help with energy efficient building design and building acoustics. They also provide an opportunity to explore biophilic design, the integration of nature and natural processes into the built environment, as an innovation strategy. Regional Priority credits, which are chosen based on a project's postal code, may also offer an opportunity to achieve LEED credits through the use of wood and/or PLC.

Tables 4 and 5 outline the nine LEED credits that can be achieved using low carbon building materials. These credits account for up to 24 points for all BD+C rating systems except Core + Shell, which is awarded up to a total of 25 points, and Healthcare, which is awarded up to 26 points.

Table 4: Low carbon building materials and LEED credits

Category	Credit	Points
Materials and Resources	Building Life-Cycle Impact Reduction	5 (6 for CS)
	Building Product Disclosure and Optimization - Environmental Product Declarations	2
	Building Product Disclosure and Optimization - Sourcing of Raw Materials	2
	Building Product Disclosure and Optimization - Material Ingredients	2
	Furniture and Medical Furnishings (Healthcare Only)	2
Indoor Environmental Quality	Low Emitting Materials	3
	Indoor Air Quality Assessment	2
Innovation	Innovation	5
Regional Priority	Regional Priority – MRc Building Life-Cycle Impact Reduction (all regions of B.C.)	1

Wood products can help with energy efficient building design and building acoustics. They also provide an opportunity to explore biophilic design, the integration of nature and natural processes into the built environment, as an innovation strategy.

26 LEED v4 BD+C Reference Guide

Table 5: Low carbon building materials and LEED credits explained

Category	Credit
Materials and Resources	**Building Life-Cycle Impact Reduction (2-5 points; 2-6 for CS projects)** This credit assesses the environmental impact of a building over its entire lifecycle, from cradle to grave. Using wood and/or PLC will help achieve Option 4: Life Cycle Assessment of this credit. Using an LCA tool, such as Athena's Impact Estimator for Buildings, will help prove compliance with this credit.
	Building Product Disclosure and Optimization - Environmental Product Declarations (1-2 points) This credit encourages the selection of building products that create a cycle of consumer demand and industry delivery of environmentally preferable products. Discussing what products are available and applicable to this credit is important to do early on with the design team. Wood products will have an advantage with this credit, as they often perform well in the applicable categories
	Building Product Disclosure and Optimization - Sourcing of Raw Materials (1-2 points) This credit encourages the use of products and materials that have been extracted and sourced responsibly and that provide information on product life cycle, including environmental, economic, and social impacts. For credit achievement calculation, products sourced (extracted, manufactured, purchased) within 100 miles (160 km) of the project site are valued at 200% of their base contributing cost. However, structure and enclosure materials may not constitute more than 30% of the value of compliant building products.

Table continued on next page...

Table 5: Low carbon building materials and LEED credits cont.

Category	Credit
Materials and Resources	**Building Product Disclosure and Optimization - Material Ingredients (1-2 points)** This credit encourages the use of products and materials that reduce harmful ingredients and that provide information on product life cycle, including environmental, economic, and social impacts. Early in design, identify products that qualify for this credit and discuss strategies with the design team.
	Furniture and Medical Furnishings (Healthcare only) (1-2 points) This credit requires project teams to consider the impacts that freestanding furniture may have on environmental and human health. This credit also includes soft medical furnishings, such as mattresses, making it imperative to consult early-on with the owner and operator. Early on in design, determine applicable furniture and discuss with team and owner. Wood and Sustainable Agriculture Network (SAN) certified products may have an advantage with this credit. Discuss what products are available and applicable to this credit early on with the design team. Wood products will have an advantage with this credit, as they often perform well in the applicable categories.
Category	**Credit**
Indoor Environmental Quality	**Low emitting materials (1-3 points)** This credit requires that all products on the inside of the primary and secondary air weatherproofing barriers meet low Volatile Organic Compound (VOC) requirements. This credit also requires that products claiming to have low VOCs be tested according to certain standards. Note that furniture that is part of the scope of the proejct is also required to meet the applicable credit requirements.

Table continued on next page...

Table 5: Low carbon building materials and LEED credits cont.

Category	Credit
Indoor Environmental Quality	**Indoor Air Quality Assessment (1-3 points)** This credit requires a flush-out or air testing of the building after construction ends. For the air testing requirement, with the ventilation running as during occupancy, the formaldehyde concentrations must not exceed 27 ppb. Testing for other contaminants such as Particulates, Ozone, VOCs, Carbon Monoxide are also required.
Innovation	**Innovation (1-5 points)** Using wood in LEED projects can help achieve Innovation points by achieving exemplary performance requirements from the Materials and Resources credits and by looking at wood as a biophilic material. Biophilic design looks at incorporating nature and natural processes into the built environment. Exposed wood, as a natural material, is considered an indirect experience of nature, and has been shown to help reduce stress levels and improve performance of building occupants. Using wood can help achieve an innovation credit through biophilic design, either through a credit of the WELL Building Standard, Feature 88 Biophilia, Qualitative or Feature 100, Biophilia, Quantitative, or the Living Building Challenge Imperative 09, Biophilic Environments.
Regional Priority	**Regional Priority (1-4 points)** This credit rewards projects for achieving other credits that have been deemed to be of special regional significance, such as those that are particularly important to a specific geographical area (e.g., protection and restoration of water resources). With regards to low carbon building materials, one Regional Priority credit is applicable for all regions of B.C. Achieving MRc Building Life-Cycle Impact Reduction rewards the project with a Regional Priority point.

Conclusion

B.C. continues to be a leader in low carbon building design and the use of low carbon building materials will contribute to reducing overall provincial emissions. The green building industry in Canada and the United States is also recognizing the benefits of using low carbon building materials and is starting to reward projects accordingly. Using wood and PLC affords opportunities for creating positive changes to building design that has to-date been largely overlooked. Exploring opportunities for integrating wood and PLC into public sector building projects will help B.C. to continue in its leadership role and help reduce CO2 emissions associated with building materials. Using low carbon building materials in LEED v4 projects can also help public sector organizations achieve points towards LEED Gold certification commitments, as well as support the Carbon Neutral Government mandate for PSOs to reduce their carbon footprint.

If you are interested in learning more, or for more detailed information on these credits, you can refer to our comprehensive guide for architects and builders.


Prince George Airport, Prince George, B.C. Photo: Equilibrium

LEED v4 and Low Carbon Building Materials

Case Studies

Case Studies

Case Study: Ronald McDonald House BC & Yukon

BC Women's and Children's Hospital, Vancouver, B.C.

Overview

Completed in 2014, the Ronald McDonald House at the BC Women's and Children's Hospital in Vancouver provides a home-like environment for children and their families while undergoing treatment away from home. This LEED® Gold certified project expanded the original 12-family Shaughnessy House to a 73-family facility divided into four residential units connected by communal links. The facility was the first use of tilt-up cross-laminated timber (CLT) construction with pre-installed ledgers provided for interior timber I-joist floors—a construction solution that contributed toward an early completion date two months ahead of schedule. 9-ply CLT panels were used to carry the weight of green roofs and planters.

How low carbon materials were used in the project

Ronald McDonald House BC & Yukon made extensive use of wood, a building material that has a lower embodied carbon footprint than other building materials. A strategy used by the team was an innovative use of CLT tilt-up panels to speed erection. The panels were formed in the shop with cuts and notches where necessary for connections and openings, then larger wall sections were assembled horizontally on the ground and raised into place. This consideration for the erection process helped to save time on site and reduced the need for work at height, contributing to worksite safety. Floor and roof structures used pre-engineered timber I-joists and CLT panels supported on beams and ledgers on CLT walls.

RONALD MCDONALD HOUSE
Vancouver, B.C.

Level of LEED obtained:
LEED ® Canada NC 2009 Gold

Wood related LEED credits achieved:
MRc5 - Regional Materials

CLIENT
Ronald McDonald House BC and Yukon

ARCHITECT
Michael Green Architecture (MGA). Initiated by McFarlane Green Biggar Architecture + Design.

STRUCTURAL ENGINEER
Equilibrium Consulting Inc.

MECHANICAL ENGINEER
AME Consulting Group

LEED CONSULTANT
Kane Consulting Partnership

CONTRACTOR
ITC Construction Group; CLT by Structurlam Products

OCCUPANTS
65 families and staff members

NUMBER OF STOREYS
4

GROSS FLOOR AREA
6,875m²

Photo: Ema Peter

Photo: Ema Peter

Photo: Ema Peter

Photo: Ema Peter

Leadership in Energy and Environmental Design (LEED®)

The project was certified under LEED Canada NC 2009 and achieved points for using recycled content in building materials and local materials. LEED credits that were supported by low carbon building materials include Materials and Resources credit 5 - Regional Materials, for which the project exceeded 30%, gaining two LEED points.

Notable Awards

- 2016 Governor General's Award in Architecture
- 2015 Lieutenant-Governor of B.C. Award in Architecture (Merit)
- 2015 Masonry Institute of BC – Award of Excellence – Low Rise

References

Canada Green Building Council (CaGBC). www.cagbc.org

Michael Green Architecture Ltd. (2017). Ronald McDonald House BC. Accessed Feb. 2017. URL: http://mg-architecture.ca/work/ronald-mcdonald-house-bc/

Case Study: Wood Innovation & Design Centre

University of Northern British Columbia (UNBC), Prince George, B.C.

Photo: Ed White

Overview

When completed in 2014 the new Wood Innovation & Design Centre (WIDC) in downtown Prince George was, at 6 storeys, one of the tallest modern timber buildings in North America. Built in part to house a new Master of Engineering in Integrated Wood Design program at UNBC, the building features an open atrium and demonstration space, a lecture theatre, a workshop and laboratory, and spaces for faculty offices and classrooms. The upper three storeys of the building were left unfinished as rental space to be fit out to meet tenants' requirements.

How low carbon materials were used in the project

Building services were hidden by staggering the elevation of the cross-laminated timber (CLT) floor panels, creating voids for ducting, sprinklers, and lighting. Wood slats are also used to finish the walls and ceiling of the lecture theatre, creating visual appeal and contributing to the acoustics of the room.

The building makes extensive use of wood materials: CLT roof and floor panels are supported on a frame of glulam columns and beams; lateral bracing is provided by CLT shearwalls and a CLT structural core; and the sparse timber cladding is a mixture of charred and natural western red cedar on structural insulated panels and glazing with laminated veneer lumber (LVL) mullions. Interior finishes include stained wooden panels and slats, and an exposed wood stair with edge-laminated LVL treads rising from the demonstration space.

WOOD INNOVATION & DESIGN CENTRE
Prince George, B.C.

Level of LEED obtained:
LEED ® Canada CS 2009 Gold

Wood related LEED credits achieved:
MRc5 - Regional Materials
IEQc4.4 - Low-Emitting Materials: Composite Wood and Agrifiber Products
IDc1.1 - Exemplary Performance: MRc5
IDc1.2 - Life Cycle Analysis of a High Rise Wood Building

CLIENT
Province of British Columbia
Ministry of Jobs, Tourism and Skills Training and Responsible for Labour

ARCHITECT
Michael Green Architecture (MGA)

STRUCTURAL ENGINEER
Equilibrium Consulting Inc.

MECHANICAL ENGINEER
MMM Group Ltd.

LEED CONSULTANT
MMM Group Ltd.

CONTRACTOR
PCL Constructors Westcoast Inc.

NUMBER OF STOREYS
6

GROSS FLOOR AREA
4,820m²

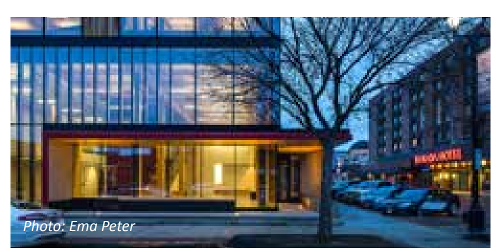


Photo: Ema Peter


Photo: Ema Peter


Photo: Ema Peter


Photo: Ed White

ENVIRONMENTAL IMPACT OF WOOD USE (Post-Construction Calculation)

VOLUME OF WOOD:
1519 cubic meters (53,623 cu ft.) of lumber and sheathing

U.S. AND CANADIAN FORESTS GROW THIS MUCH WOOD IN:
4 minutes

CARBON STORED IN THE WOOD:
1,099 metric tons of CO_2

AVOIDED GREEN HOUSE GAS EMISSIONS:
420 metric tons of CO_2

TOTAL POTENTIAL CARBON BENEFIT:
1,519 metric tons of CO_2

EQUIVALENT TO:

290 cars off the road each year

Energy to operate a home for 129 years

Based on: image by naturally:wood


Photo: Ed White

Leadership in Energy and Environmental Design (LEED®)

The Wood Innovation & Design Centre is certified LEED Gold under the LEED Canada 2009 Core and Shell rating system. The project achieved one Innovation in Design (ID) point for exemplary performance for using regional materials. To achieve this ID credit, at least 40% of the materials used on the project were extracted and manufactured within 800 km by road and 2,400 km by rail or water. An additional ID point was achieved by undertaking a life-cycle assessment of the building.

Awards

- 2016 Governor General's Award in Architecture
- 2015 RAIC Award of Excellence for Innovation in Architecture
- 2015 Lieutenant-Governor of B.C. Award in Architecture (Merit)
- 2015 AIBC Innovation Award

References

naturally:wood (2015). Case Study: Wood Innovation & Design Centre. naturally:wood, Vancouver, B.C.: Forest Innovation Initiative (FII).

Michael Green Architecture Ltd. (2017), Wood Innovation & Design Centre. Accessed Feb. 2017. URL: http://mg-architecture.ca/work/wood-innovation-design-centre/

WoodWorks (2015). Wood Innovation & Design Centre: A Technical Case Study. http://wood-works.ca/wp-content/uploads/151203-WoodWorks-WIDC-Case-Study-WEB.pdf

Case Study: L´École Mer et Montagne

Conseil Scolaire Francophone de la Colombie-Britannique. Campbell River, B.C.

Photo: Derek Lepper

Overview

The new building at École Mer et Montagne in Campbell River opened in 2012 and replaced an existing elementary school building, while retaining and seismically upgrading an existing gymnasium. The École provides classrooms for 100 children ranging from Kindergarten to Grade 8.

Reclaimed Douglas Fir 3x12 joists were salvaged from the existing building and repurposed throughout the new school for large portions of the roof and corridors. Left exposed to view from below, the reclaimed timbers add warmth and contribute toward reducing the environmental impact of the building.

Timber features heavily in the finishes as well, in bookcases and a trio of rotating display cases in the middle of the school, reclaimed timber benches, and through timber acoustic ceiling panels along the corridors and a Media and Technology space.

How low carbon materials were used in the project

The building structure uses light-frame timber joists supported primarily on stud shearwalls. The existing gym structure was reinforced with post-tensioned steel rods and reinforced with additional nailing in the existing timber shearwalls and diaphragm, allowing for their re-use in the new building.

The project has received particular attention for the use of reclaimed Douglas Fir joists from the previous school building. The combination of new and reclaimed timber materials for both structure and finishes contributed toward sequestering or avoiding an estimated 198 tonnes of carbon dioxide equivalent.

L'ÉCOLE MER ET MONTAGNE
Campbell River, B.C.

CLIENT
Conseil Scolaire Francophone de la Colombie-Britannique

ARCHITECT
McFarland Marceau Architects Ltd.

STRUCTURAL ENGINEER
Equilibrium Consulting Inc.

MECHANICAL ENGINEER
Bycar Engineering

CONTRACTOR
Newhaven Construction

NUMBER OF STOREYS
1 storey + mezzanine

GROSS FLOOR AREA
1,500m²

Photo: Derek Lepper

Photo: Derek Lepper

Photo: Derek Lepper

Photo: Derek Lepper

Photo: Derek Lepper

Awards

- 2012 Woodworks BC Award – Small Institutional
- 2012 VIREB Commercial Building Awards - Merit
- 2012 Canadian Wood Council - Green Building Award
- 2011 Wood Design Award – Citation

References

McFarland Marceau Architects (2014). Vancouver, B.C.. Accessed Feb 2017. URL: http://www.mmal.ca/campbell/description.html

McFarland, L. (2013). Presentation at WoodWorks! Alberta Winter Wood Design Seminar, March 19-20, 2013. URL: http://www.wood-works.ca/wp-content/uploads/content/AB/Events/larry%20mcfarland_march%202013%20presentation.pdf

Case Study: Blueshore Environmental Learning Centre

North Vancouver School District 44, Brackendale, B.C.

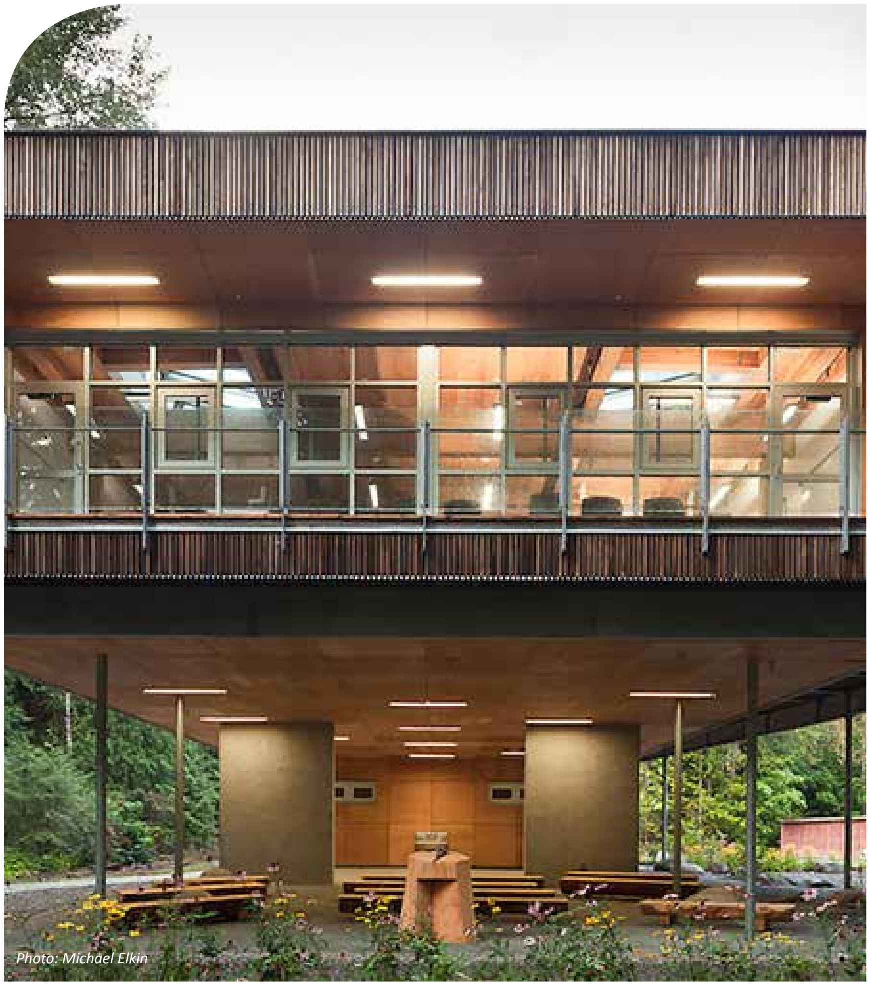


Photo: Michael Elkin

Overview

The BlueShore Environmental Learning Centre at the Cheakamus Centre in Brackendale is a striking timber structure raised up into the canopy of the surrounding forest. The classrooms are raised up on short concrete walls and steel columns to above the 200-year flood level of the nearby Cheakamus River. The covered ground level provides a sheltered gathering space from which classes can explore the surrounding area. The raised main building contains two classrooms and a large open multi-purpose room.

How low carbon materials were used in the project

Above the flood level, the structure is made up of a grid of glulam beams supporting cross-laminated timber panels at both floor and roof level. Wood is used in the cedar slat cladding that wraps the building, and for interior finishes, from the reclaimed Douglas Fir timbers that cover the soffit between glulam beams to the wooden millwork.

BLUESHORE ENVIRONMENTAL LEARNING CENTRE
Brackendale, B.C.

Level of LEED obtained:
LEED® Canada NC v1.0 Platinum

Wood related LEED credits achieved:
MRc5 - Regional Materials
MRc7 - Certified Wood
IEQc4.4 - Low-Emitting Materials: Composite Wood & Laminate Adhesives

CLIENT
School District 44, North Vancouver

ARCHITECT
McFarland Marceau Architects Ltd.

STRUCTURAL ENGINEER
Equilibrium Consulting Inc.

MECHANICAL ENGINEER
Stantec

LEED CONSULTANT
McFarland Marceau Architects Ltd.

CONTRACTOR
D.G.S Construction

NUMBER OF STOREYS
2

GROSS FLOOR AREA
950m²

Photo: Michael Elkin


Photo: Michael Elkin


Photo: Michael Elkin


Photo: Michael Elkin


Photo: Michael Elkin

Leadership in Energy and Environmental Design (LEED®)

The project was certified under LEED Canada NC 2009 and achieved points for using recycled content in building materials and using local materials. LEED credits that were supported by low carbon building materials include Materials and Resources credit 5 - Regional Materials, for which the project exceeded 30%, gaining two LEED points.

Notable Awards

- 2015 Canadian Wood Council Western Red Cedar Award
- 2013 Wood Design & Building Awards - Citation
- 2013 Lieutenant-Governor of British Columbia - Merit
- 2012 Holcim Award of Acknowledgement for Sustainable Construction
- 2012 Canadian Architect Awards of Excellence - Merit

References

McFarland Marceau Architects Ltd. (2014). BlueShore Financial Environmental Learning Centre at Cheakamus Centre. Accessed Feb 2017. URL: http://www.mmal.ca/northvan/page1.html

WoodWorks (2013). 2013 Wood Design Awards - Project Fact Sheet: Environmental Learning Centre, North Vancouver Outdoor School. Ottawa, ON: WoodWorks. URL: http://www.wood-works.ca/wp-content/uploads/content/BC/WDA/Winner2012/FactSheets/elc.pdf

Case Study: Brock Commons Tallwood House

University of British Columbia (UBC), Vancouver, B.C.

Photo: www.naturallywood.com

Overview

Brock Commons Tallwood House is a landmark 18-storey residence building at UBC in Vancouver, with 17 storeys of wood and concrete construction over a single storey concrete podium. At 53 metres, it is the tallest contemporary wood hybrid building in the world to-date. Brock Commons provides the University with over 400 student beds with a shared ground floor study and social space.

How low carbon materials were used in the project

Flat cross-laminated timber (CLT) floor plates were used with a grid of glulam columns and two concrete building cores. Dropped beams were avoided through the innovative use of two-way spanning CLT supported only on columns at each corner. The result is an open floor area interrupted only by the grid of columns and the building cores, reducing the impact of the structure on the end use of the space.

Erection of the timber elements was completed in less than 70 days, due largely to savings from off-site prefabrication. Careful design of the column connections allowed for quick installation of the floors and columns, facilitating the assembly of two storeys of structure per week. As the structure was installed prefabricated exterior wall panels were lifted into position with windows and cladding in place, closing the envelope as the building went up.

A Site-Specific Regulation from the British Columbia Building Safety & Standards Branch was required for approval of the building, which exceeds the code-specified height restriction of 6 storeys. To simplify the approval process, building cores were constructed using concrete rather than mass timber, and the timber structure was covered with multiple layers of gypsum board to provide fire resistance exceeding that which would be required for a similar steel or concrete building.

BROCK COMMONS TALLWOOD HOUSE
Vancouver, B.C.

Level of LEED® targeted:
LEED v4 BD+C Gold

CLIENT
University of British Columbia

ARCHITECT
Acton Ostry

TALL WOOD ADVISOR
Architekten Hermann Kaufmann

STRUCTURAL ENGINEER
Fast + Epp

LEED CONSULTANT
Stantec

FIRE AND CODE CONSULTANT
GHL Consultants

CONTRACTOR
Urban One Builders, Seagate Structures and Structurlam Products Ltd.

NUMBER OF STOREYS
18

GROSS FLOOR AREA
15,115m²

Leadership in Energy and Environmental Design (LEED®)

This project is targeting LEED v4 BD+C: NC Gold certification. A highlight credit that the project is pursuing is the new to LEED v4 credit, MRc Building Life-Cycle Impact reduction, Option 4, Whole-Building Life-Cycle Assessment.

References

Acton Ostry (2016). Construction Underway on World's Tallest Timber Tower. Acton Ostry Architects Inc. Vancouver, B.C..

CIRS (2016). Design and Preconstruction of a Tall Wood Building. Brock Commons: Code Compliance. University of British Columbia Centre for Interactive Research on Sustainability (CIRS). Vancouver, B.C..

Naturallywood.com Brock Commons http://www.naturallywood.com/emerging-trends/tall-wood/ubc-brock-commons

UBC (2016). Structure of UBC's tall wood building now complete. University of British Columbia website. URL: https://news.ubc.ca/2016/09/15/structure-of-ubcs-tall-wood-building-now-complete/

Case Study: TELUS Garden Office

Vancouver, B.C.

Photo: Henriquez Partners Architects; Photographer Ed White

Overview

TELUS Garden Office is part of the TELUS Garden complex in Vancouver. Completed in 2015, this project was the first Canadian project to be awarded LEED Platinum under the LEED Canada 2009 Core and Shell rating system. The project is the headquarters of TELUS and boasts many sustainability features including sky gardens, the use of low emitting materials and on-site renewable energy through photovoltaic panels.

How low carbon materials were used in the project

TELUS Garden was one of the first projects to be built in Vancouver using Portland-limestone cement (PLC), a cement product that has 10% less embodied carbon than regular Portland cement. PLC is branded in Canada under the name Contempra® and is manufactured in the Metro Vancouver region. PLC is created by adding 6-15% limestone with cement clinker.

The use of wood was also incorporated into the building with a 67 metre steel-glulam span creating an arched canopy, which is an integral architectural feature of the project.

TELUS GARDEN OFFICE
Vancouver, B.C.

Level of LEED obtained:
LEED® Canada CS 2009 Platinum

Wood related LEED credits achieved:
MRc5 - Regional Materials
MRc6- Certified Wood
IEQc4.4 - Low-Emitting Materials: Composite Wood & Agrifiber Products

CLIENT
Westbank Projects Corp.

ARCHITECT
Henriquez Partners Architect

STRUCTURAL ENGINEER
Glotman Simpson

LEED CONSULTANT
Icon/Light House Sustainable Building Centre

CONTRACTOR
Icon Construction

OCCUPANTS
Over 1900 for retail and office

NUMBER OF STOREYS
22

GROSS FLOOR AREA
47,000m²


Photo: Henriquez Partners Architects. Photographer Ed White


Photo: Henriquez Partners Architects. Photographer Ed White

Leadership in Energy and Environmental Design (LEED®)

The project was certified to LEED Canada Core and Shell Platinum. Just under 60% of all wood based materials were from Forest Stewardship Council (FSC®) sources, resulting in the achievement of Materials and Resources credit 6 (MRc6) - Certified Wood.

The project also achieved full points MRc4 - Recycled Content (30%) and for MRc5 - Regional Materials (37%).

Awards

- 2016 Architizer A+ Award

References

Canada Green Building Council (CaGBC). www.cagbc.org

http://henriquezpartners.com/work/telus-garden/

http://www.glotmansimpson.com/project/telus-garden-vancouver/

http://westbankcorp.com/press/telus-garden-wins-architizers-top-awards#.WLicNW_yu01

http://www.vancitybuzz.com/2015/09/telus-garden-office-tower-vancouver/

BRITISH COLUMBIA
Ministry of
Environment and
Climate Change Strategy

light house

EQUILIBRIUM
Structural Engineers
www.eqcanada.com

KAPOW
CREATIVE