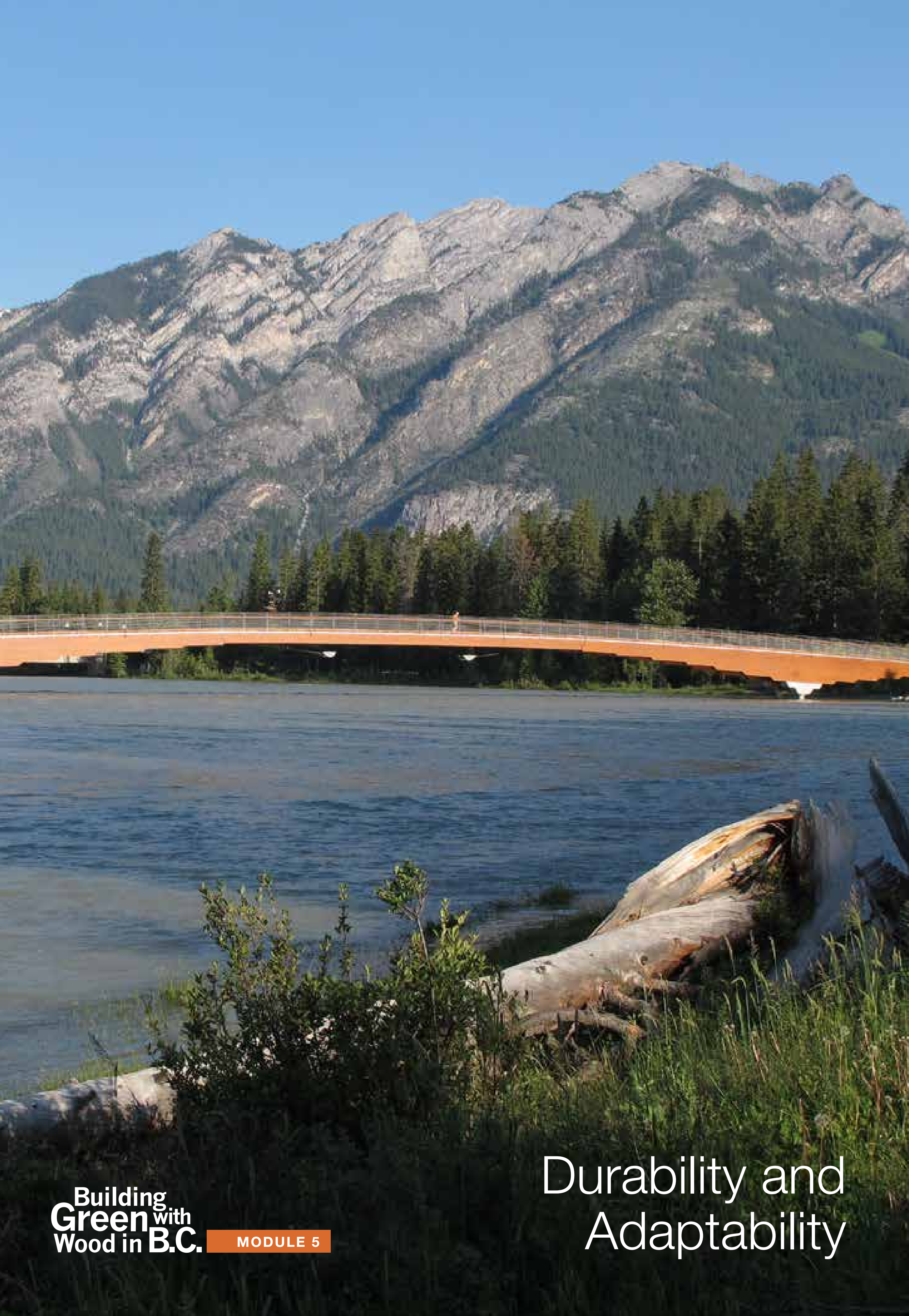


# Durability and Adaptability

Building Green with Wood in B.C.

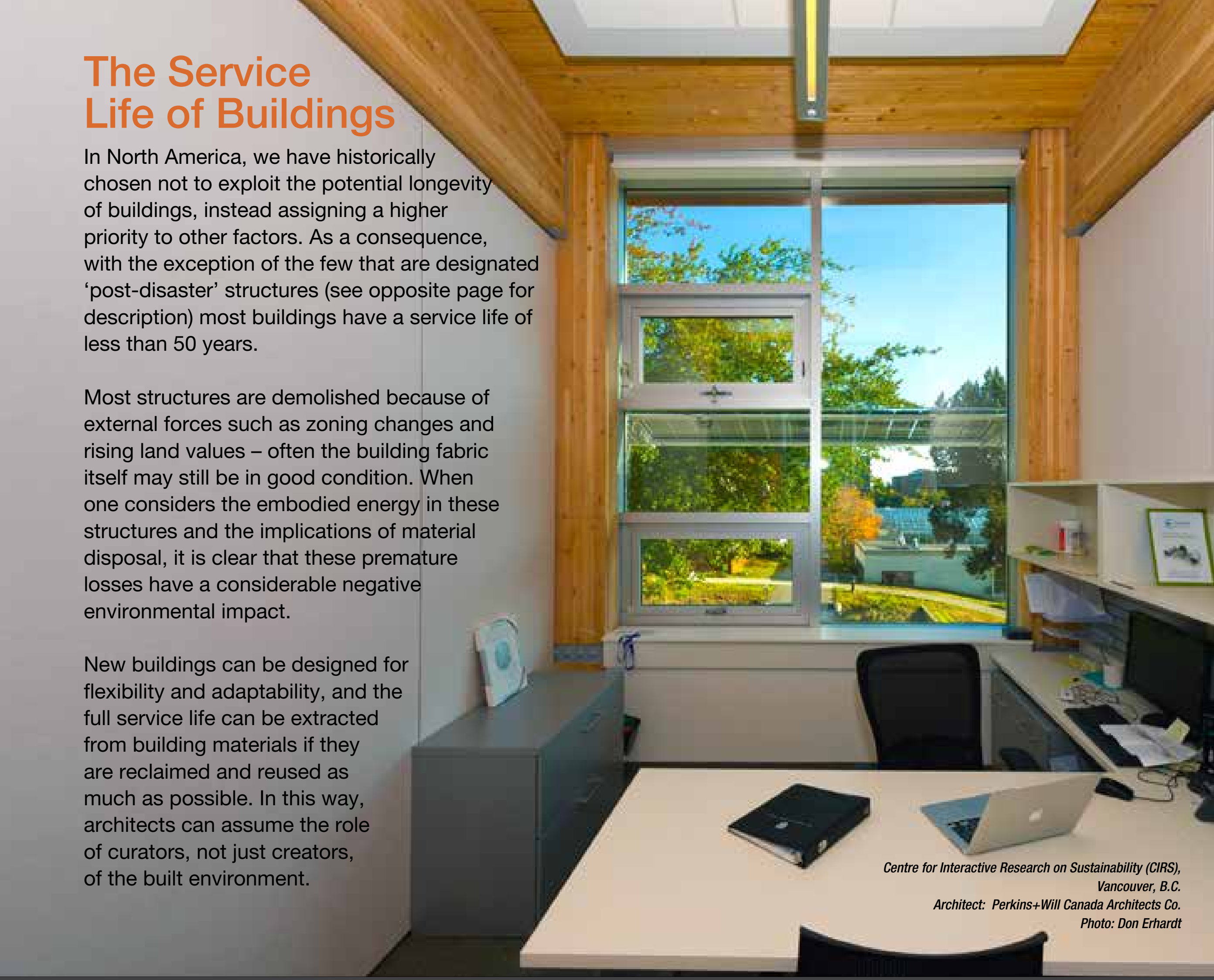
MODULE 5

# The Service Life of Buildings

In North America, we have historically chosen not to exploit the potential longevity of buildings, instead assigning a higher priority to other factors. As a consequence, with the exception of the few that are designated 'post-disaster' structures (see opposite page for description) most buildings have a service life of less than 50 years.

Most structures are demolished because of external forces such as zoning changes and rising land values – often the building fabric itself may still be in good condition. When one considers the embodied energy in these structures and the implications of material disposal, it is clear that these premature losses have a considerable negative environmental impact.

New buildings can be designed for flexibility and adaptability, and the full service life can be extracted from building materials if they are reclaimed and reused as much as possible. In this way, architects can assume the role of curators, not just creators, of the built environment.



*Centre for Interactive Research on Sustainability (CIRS), Vancouver, B.C.*
*Architect: Perkins+Will Canada Architects Co.*
*Photo: Don Erhardt*

# Durability of Materials and Structures

Designers can get maximum performance and service life out of every building material as long as they understand the necessary steps. Improperly detailed masonry and concrete may spall or crack, steel may rust, and wood may deteriorate. In each case, this compromises the integrity of a building and reduces its life expectancy.

Used properly, all of these materials are inherently durable and can endure for decades or even centuries. The most ancient wood buildings still in existence include eighth century Japanese temples, 11th century Norwegian stave churches, and the many medieval post-and-beam structures of England and Europe. These buildings endure partly because of their cultural significance, and partly because they were built and maintained properly.

For example, long posts supporting the multi-tiered roofs of stave churches were air dried for up to two years to prevent shrinkage and distortion after they were installed. Wood foundation beams were laid on a gravel-filled trench to protect the structure from long-term contact with water. Vertical planked walls were protected from the weather by large overhanging eaves, and shingle roofs were steeply pitched to shed rain and snow.

Although we need a more sophisticated understanding of building physics to ensure the integrity and longevity of materials and structures, the same basic principles still apply.

A recent example is the design of Vancouver's Millennium Line transit stations by a consortium of architects. They wanted to promote the use of wood in the platform canopy structures for its visual warmth and regional character but were concerned about durability in these highly exposed and largely unsupervised structures. As a result, they established the following parameters:

- To discourage vandalism wood members should be kept above a 10' datum level.

*Continued on next page....*

# Resilience and Post-disaster Design

*Brentwood Skytrain Station, Burnaby, B.C.*
*Architect: Perkins+Will Canada Architects Co.*
*Photo: Nic Lehoux*

The Millennium Line stations were designed as post-disaster structures for a 100-year service life, and had to be capable of resisting lateral forces 50 per cent higher than those specified in the building code. In recent years, wood has also become the structural system of choice in many other post-disaster facilities, notably fire halls and other public service buildings.

Wood lends itself to the construction of simple and economical shear walls that are a key component of post-disaster construction, and the lightness of wood structures reduces the amount of seismic forces the structure will attract in the event of a major earthquake – an important consideration particularly on the West Coast and in other regions prone to earthquakes.

Following earthquakes in Asia, anecdotal reports indicate that wood structures best maintained their structural integrity and contributed least to injury and loss of life.

On Vancouver Island, B.C., wood provided a cost-effective option for construction of the rural fire hall that houses the volunteer Oyster River Fire/Rescue Department in Comox. It meets a post-disaster standard, and has metal cladding on the exterior and the roof, drywall on the interior and a monitored alarm system.

***Left image:***
***The Centre for Interactive Research on Sustainability (CIRS) building at UBC in Vancouver***

***CIRS was designed to meet exemplary sustainability goals and high performance targets and to be both cost-effective and replicable. The overall design emphasizes simple forms and materials, exemplified by the exposed wood structure and visible connections. As this is an academic building, durability and flexibility were priorities. The regular rectilinear structural grid creates large column free interior spaces, which can be subdivided easily for different uses over the intended 100 year life of the building.***

*Oyster River Fire Hall, Comox, B.C.*
*Architect: Johnston Davidson Architecture + Planning Inc.*
*Photo: Bob Matheson*

***.....Continued from previous page***

- All wood products used should be dimensionally stable (kiln dried or engineered wood).
- All wood elements should be weather protected for durability.

The results are obvious throughout the line. At Brentwood Skytrain Station (shown at top of page), curved composite ribs support the roof structure, steel giving way to glulam at the 10' datum level. At Rupert, opposing glulam beams are connected by a steel knife plate that bridges the opening above the guideway. At Braid, projecting glulam beams are protected from weather by castellations in the metal roof.

Collectively these structures represent a significant contribution to a new composite architecture in Canadian public buildings, where the best attributes of wood and other materials are combined in a manner that contributes to the overall expression of the building.

***Wood is versatile and flexible, which makes it an easy construction material for renovations. The "Ardencraig" heritage house in Vancouver, British Columbia was renovated to create three separate residences in 2000.***

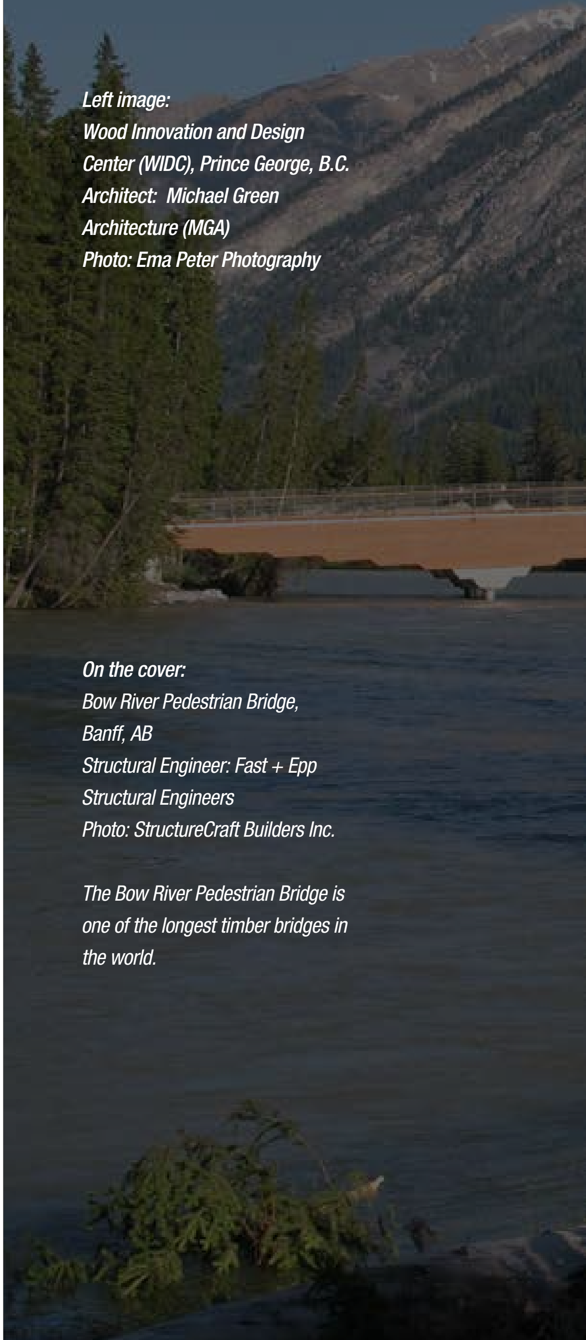
# Flexibility and Adaptability

Designing for flexibility and adaptability is also critical to secure the greatest value for the net energy embodied in building materials. Wood structures are typically easy to adapt to new uses because the material is so light and easy to work with. The inherent structural redundancy in light-weight wood-frame structures provides many opportunities for adaptation, while post-and-beam structures provide complete flexibility in the reconfiguration of non-load bearing partitions. The interior of the Wood Innovation and Design Center ("WIDC") in Prince George, B.C. is designed to be flexible and adaptable to accommodate tenants needs.

Wood also lends itself to dismantling. The structural concept used in WIDC is a "dry construction" design, virtually eliminating the use of concrete above the foundation with the exception of the mechanical penthouse. Dry systems help with the end-of-life story of the project. The building can be disassembled at the end of its functional life, and the wood products can be reused.

**Green buildings**

- Mitigate climate change
- Use less energy and water
- Use fewer materials
- Reduce waste
- Are healthy for people and the planet



*Left image:*
*Wood Innovation and Design Center (WIDC), Prince George, B.C.*
*Architect: Michael Green Architecture (MGA)*
*Photo: Ema Peter Photography*

*On the cover:*
*Bow River Pedestrian Bridge, Banff, AB*
*Structural Engineer: Fast + Epp Structural Engineers*
*Photo: StructureCraft Builders Inc.*

*The Bow River Pedestrian Bridge is one of the longest timber bridges in the world.*

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