



# 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 the materials in these structures and the embodied energy are taken into consideration, 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.

## Durability of Materials and Structures

Designers can get maximum performance and service life out of every building material as long as they understand it and are willing to work with it. Improperly detailed masonry and concrete may spall or crack, steel may rust, and wood may rot, and 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

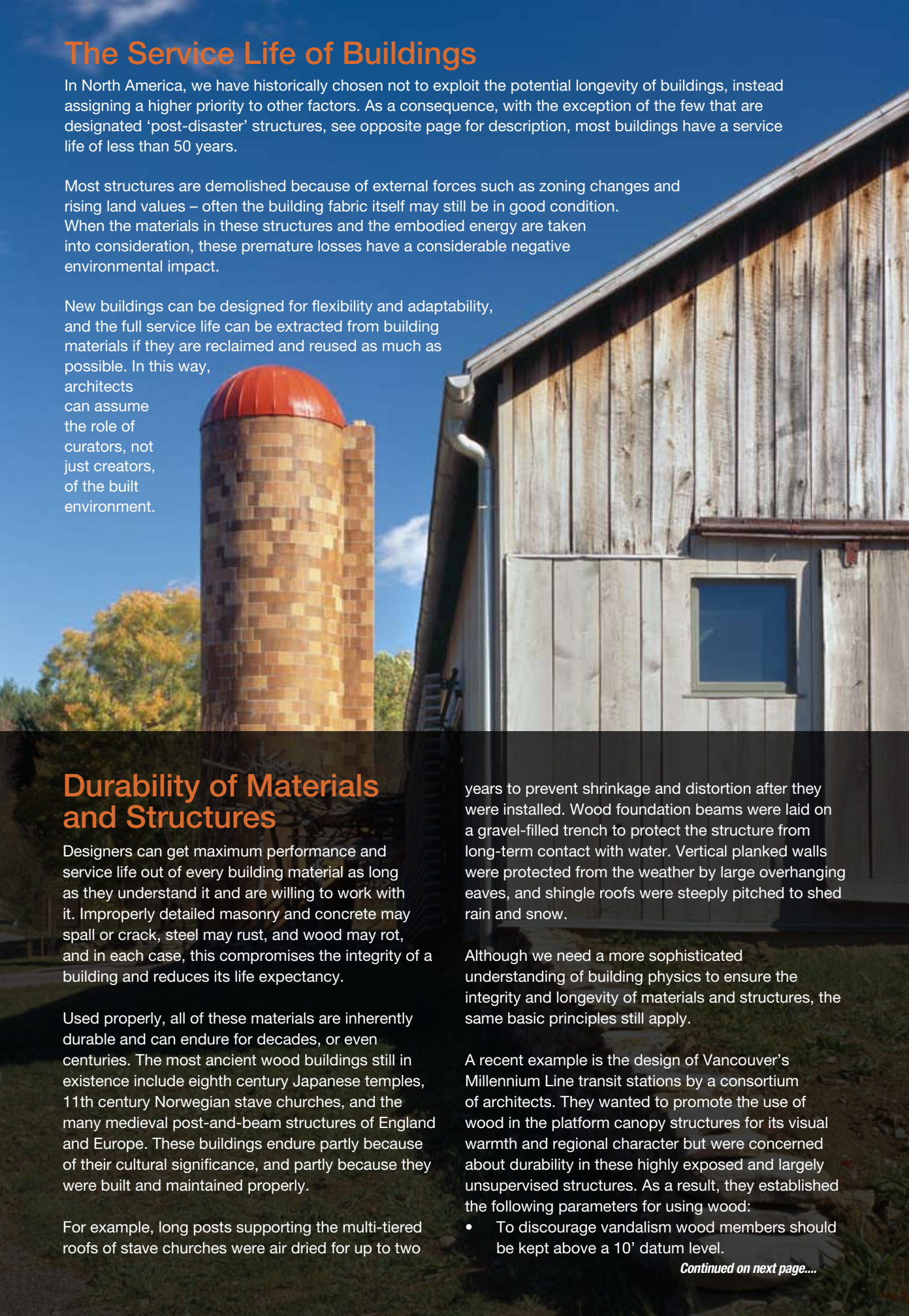
years to prevent shrinkage and distortion after they were installed. Wood foundation beams were laid on a gravel-filled trench to protect the structure from long-term contact with water. Vertical planked walls were protected from the weather by large overhanging eaves, and shingle roofs were steeply 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 for using wood:

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

*Continued on next page...*



# Post-Disaster Design

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 other regions prone to earthquakes.

In recent major earthquakes in Asia, the wood structures best maintained their structural integrity, and contributed least to injury and loss of life.



On Vancouver Island, BC, wood provided a cost-effective option for construction of the rural fire hall that houses the volunteer Oyster River Fire/Rescue 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 to keep it safe.

*The Barn at Fallingwater is a renovated 19th-century barn with a 1940s dairy barn addition. This adaptive reuse project is immediately adjacent to Frank Lloyd Wright's Fallingwater and is the first phase of a conference complex for Western Pennsylvania Conservancy. The Barn's interior is rich with recycled and salvaged materials that celebrate the region's agrarian heritage. More than 80 per cent of the construction debris was recycled.*



.....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 station (shown on the front cover), 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.



*The Fulton County Stadium in Atlanta, GA, was imploded in 1997 – just 32 years after it was built and shortly after it had been refurbished to host the baseball events for the 1996 Olympics. A clear example of premature demolition because the building could not meet changing needs.*

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





*Islandwood Environmental Interpretive Centre on Bainbridge Island, WA, (left) was designed so materials can be reclaimed at the end of the structure's service life.*

*On the cover: Brentwood Skytrain Station located in Vancouver, BC Canada was designed as a Post-Disaster Structure with a 100-year service life.*

## 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.

Wood also lends itself to dismantling. The Islandwood Environmental Interpretive Centre on Bainbridge Island in Washington state has a post-and-beam frame so partitions can be non-load bearing, with fully demountable bolted connections to permit full reclamation of the structure at the end of its service life. In contrast to other materials, reclaimed wood can often be reused for its original purpose (e.g. as structural members), with little or no loss of value.

