AMERICAN WOOD COUNCIL

Canadian Wood Council / Conseil canadien du bois

WOOD DESIGN BUILDING

Boardwalks and Bridges

EARN 0.1 ICC Continuing Education Unit (CEU)
and/or AIA/CES HSW 1 Learning Unit (LU)

ICCPP#1020 Course #11372OD, AIA/CES HSW#DES1000A

ICC PREFERRED EDUCATION PROVIDER

DES1000-A Boardwalks and Bridges

Description:
Wood's strength and durability, fire resistance, low-maintenance and energy-absorbing properties make it ideal for bridge applications and infrastructure projects – particularly for pedestrian and light traffic, but also for more impressive structures with heavier loading and longer spans. Increasingly, new landmark projects and research are proving timber bridges are a viable alternative to bridges made of other materials. Modern timber bridges combine the use of solid wood, plywood, laminated timbers like glued-laminated timber, laminated veneer lumber (LVL), parallel strand lumber (PSL) and cross-laminated timber (CLT). The course will explore designs that have evolved from historical approaches and developed as a result of modern technological advances in timber fabrication.

Learning Objectives:

After reading this article, you should be able to:

1) ***list*** some of the challenges and possible resolutions to building bridges and boardwalks with wood.
2) ***discuss*** how a wood bridge can be installed while addressing environmental concerns.
3) ***identify*** and ***describe*** the 2 examples of bridges using wood.
4) ***recall*** some of the components of wood bridges and boardwalks.

To receive credit, you are required to read the entire article and pass the test. Go to http://www.awc.org/education/ecourses for complete text and to take the test for free.

Boardwalks and Bridges

Wood delivers aesthetic appeal and meets the technical requirements of modern bridge construction

Wood's strength and durability, fire resistance, low-maintenance and energy-absorbing properties make it ideal for bridge applications and infrastructure projects – particularly for pedestrian and light traffic, but also for more impressive structures with heavier loading and longer spans. Increasingly, new landmark projects and research are proving timber bridges are a viable alternative to bridges made of other materials.

Above: Footbridge of Dreams, Princeton, BC

Modern timber bridges combine the use of solid wood, plywood, laminated timbers like glulam, laminated veneer lumber (LVL), parallel strand lumber (PSL) and cross-laminated timber (CLT). Many designs have evolved from historical approaches, while others have developed as a result of modem technological advances in timber fabrication.

The following two examples of pedestrian bridges adapt beautifully to their natural, park settings and are showcase structures within their respective communities.

Footbridge of Dreams, Princeton, BC

The early 20th century timber "Bridge of Dreams" across the Tulameen River in the town of Princeton, BC was the final link in the Kettle Valley Railroad and integral to sustaining the development of the BC interior. When the span was decommissioned in the 1960s, however, the town was left with three large relics – two concrete abutments and a central pier.

With the development of the Trans-Canada Trail (which often repurposes defunct railway corridors), the Trans Canada Trail Society's local chapter partnered with the town of Princeton in a shared vision to complete their portion of the trail with a crossing that would re-use the existing piers. On April 15, 2010 the bridge was officially opened to the public.

The design references the historic bridge's strong timber presence in the community with a double tied-arch timber scheme. The bridge consists of two spans, 31.5 meters each, with a shared platform at the center pier. The Douglas fir glulam arches feature a tapered cross section optimized to suit the varying axial and bending stresses. This enhances the visual profile, minimizes material, and was achieved economically by working with the laminator to strategically subtract laminations during layup. The 4.3 meter wide deck consists of pre-stressed panels of Douglas fir 2 x 4s set on edge and spaced to provide ventilation and drainage through the deck while in service.

The roof system, comprised of sawn timber purlins, corrugated metal deck, lumber strapping (shop laminated to match the curvature of the bridge) and parabolic shear bracing, was chosen to protect the timber components from direct weathering while acting as the main diaphragm for the structure. In response to durability concerns, a high-performance, low-VOC, water-based coating was applied to both the arches and timber deck.

OWNER
Town of Princeton
Princeton, BC

DESIGN-BUILD FIRM
StructureCraft Builders Inc.
Delta, BC

STRUCTURAL ENGINEER
Fast + Epp
Vancouver, BC

PHOTOGRAPHY
StructureCraft Builders
Town of Princeton, *Similkameen Spotlight*

The Nisqually Estuary Boardwalk Trail, Lacie, WA

This US Fish & Wildlife Service preserve is on the Nisqually River Delta near Puget Sound, between the cities of Tacoma and Olympia, Washington. The estuary project has over a mile of boardwalk, several viewing platforms, a bird blind, and five timber bridges from 30-50 ft in length. The preserve will eventually restore 762 acres of wildlife habitat by returning diked areas back to tidal influence.

The Nisqually Delta has been designated a National Natural Landmark because it is one of the best examples of coastal marsh remaining in the North Pacific. As of February 1, visitors now have access to a four-mile (round-trip) walk from the Refuge Visitor Center to the end of the boardwalk.

This project was originally designed solely as a boardwalk, but after the earthen dike was removed, the tidal flow began cutting channels. As these channels evolved, it was determined that the tidal currents would have eroded the deck supports if sufficiently-sized openings, placed at appropriate points, were not provided to allow for unrestricted tidal flow. It became evident that multiple bridges were necessary to span the channels. Truss-style timber bridges, using Douglas fir, were selected to minimize the weight of the structures, while also enhancing the aesthetic appeal.

The project had unique challenges that had to be overcome. In order to set the piers, all work had to be done during low tide. Due to the muddy condition of the underlying area, using a crane to install the bridges was not an option. Pre-assembled truss segments were trucked to the site, where they were lifted into place by helicopter. The 50-ft bridge was assembled in four sections, while the smaller bridges were each lifted in two sections.

Due to the coastal setting, all bridges were constructed from solid-sawn timber and then treated with a water-borne preservative. The deck was made using Port Orford cedar, which eliminated the need for preservative treatment because of its natural ability to handle the toughest environmental conditions.

CONSTRUCTION
Five Rivers Construction
Longview, WA

DESIGN AND MATERIALS
Western Wood Structures Inc.
Tualatin, OR

DESIGN/TECHNICAL ASSISTANCE
Ducks Unlimited, Pacific NW Field Office
Vancouver, WA

FOUNDATION SYSTEM
Pin Foundation
Gig Harbor, WA

GEOTECHNICAL SUPPORT
GeoEngineers
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