

Timber Bridges

DENIS MUSTAFA 16463
KRASIMIR GENCHEV 16505

Classification

There are two main types of timber bridges depending on their traffic:

- Timber bridges used for pedestrian traffic
- Timber bridges used for car/railway traffic

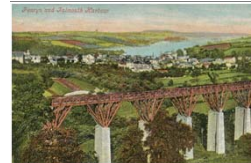


Timber bridges used for pedestrian traffic

Whistlestop Forest Service Bridge
Located: Chugach National Forest,
Alaska
Length: 280 feet/85,3 meters



Timber bridges used for car/railway traffic



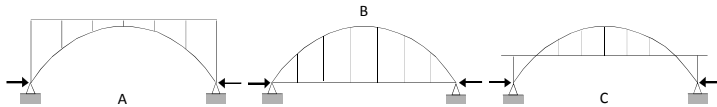
Collegewood (Timber railway bridge)
Located: Linking Plymouth and Truro, England.
Length: 291 meters

Keystone Wye (Timber vehicle bridge)
Located: Black Hills of South Dakota
Length: 290 feet/88.4 meters

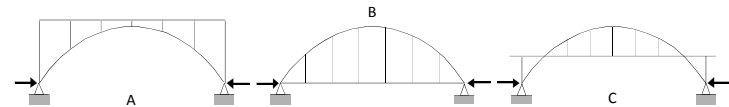


Structure

Most bridges utilize the arc in their structure because of its effectiveness.
Depending on where the road is located there are three types of arc structures:



Structure

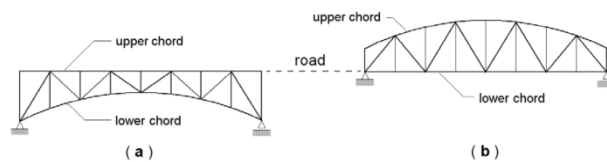


Here the arc is located under the deck, thus supporting it through compression.

Here the arc is located above the deck, which is suspended by tension members from the arc itself.

Here the arc is in an intermediate position, the loads are transmitted to the arc via vertical members and the arc takes them to the supports(axial compression).

Structure



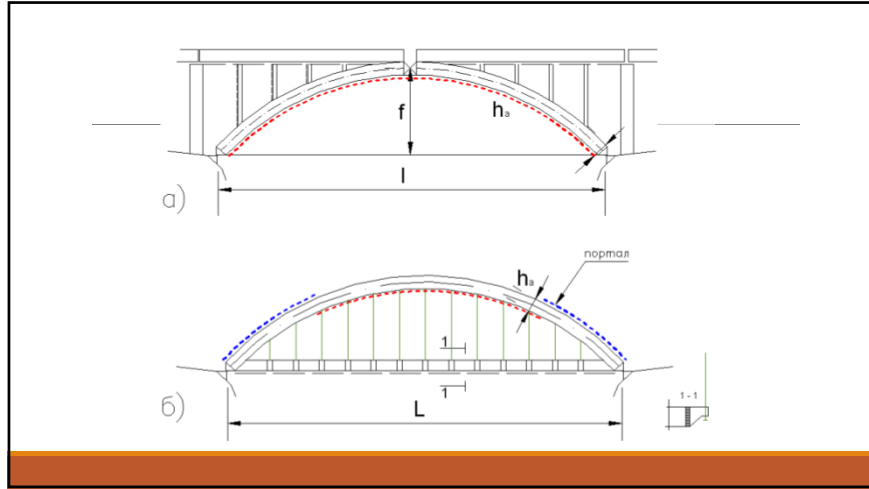
The alternative to arches for road bridges with span over 20 m, is trusses.
The parallel trusses may be placed below the deck (a) or above the deck (b).

Bracing System

Bracing has two main functions:

1. Take all loads acting perpendicular to the main plane and to transfer them to the supports.
2. Reducing the effective length of a compressed element.





Bridge Deck

The vast majority of timber footbridges have decks made of timber, from simple timber boards or planks to crossed layers of boards and various types of laminated decks. For road bridges the situation is more complex. We find that the standard building materials, that is, reinforced concrete, steel and timber, are used in many different combinations, from "pure" concrete decks to almost "pure" timber decks.



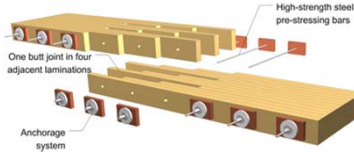
Bridge Deck

"Wennerbrücke"
 Located: Murau, Austria
 Length: 182 meters

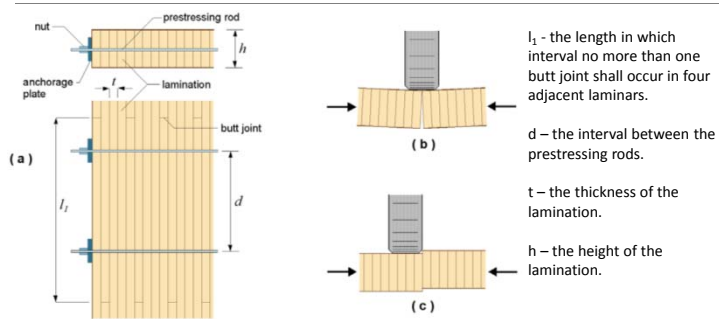


Bridge Deck

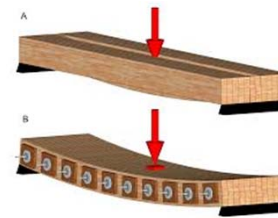
A very interesting alternative is a stress laminated timber deck. The idea comes from Canada where it was first used in 1976 by the Ontario Ministry of Transportation and Communication for rehabilitating deteriorated nail-laminated lumber bridge decks. The method was successful and it was soon recognized that it offered a variety of possibilities also for the construction of new bridges.



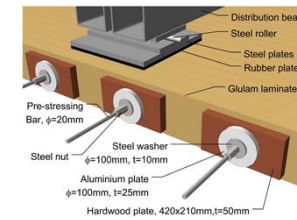
Bridge Deck



Bridge Deck



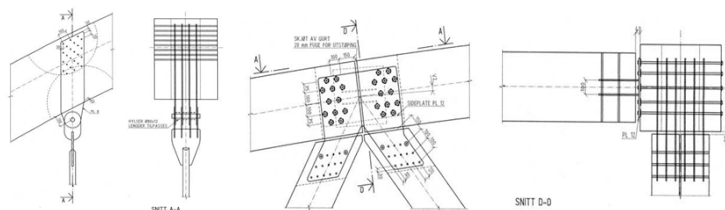
In case A no prestressing rods at play so only directly loaded beams deflect. When prestressing is applied, the load is distributed to several beams which deflect.



Connections and Details

Connections are a very important part in all timber structures, especially in timber bridges.

These are typical examples of such connections.



Connections and Details

The previous details are all from the Tynset bridge, located in Norway. It's total length is 124m.



Connections and Details

The connections may also add to the aesthetics of the bridge, not as important for the structure as their function but will non the less make some architects really happy with their design.



This is the connection in the middle of the bridges arc.



This is the connection at the end of two arcs to the support.

Connections and Details



Protection and Durability

Bridge structures are normally designed for a long service life, from 60 to 100 years. In Norway the normal service life for a timber bridge is 100 years.

The two main rules in timber constructions are:

1. Keep the water out.
2. Provide sufficient ventilation.

Protection and Durability

Another solution is mechanical protection. This means that horizontally placed metal cladding is used to protect the timber from rain/snow. An example of this can be found on the Tynset bridge.



Protection and Durability



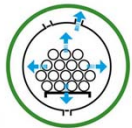
Another interesting example is the Fretheim bridge. Which shows off the copper cladding, plus the whole arc is protected with a ventilation blinds type cladding. This not only keeps rain/snow out but also the sun, while still providing ventilation. In this case the glulam is pressure salt impregnated. It can be argued that the glulam needs less to no chemical protection at all, thanks to the cladding type protection.

Protection and Durability

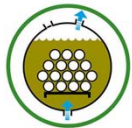


Protection and Durability

HIGH PRESSURE TREATMENT PROCESS



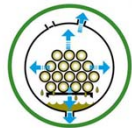
Timber loaded into treatment vessel. Initial vacuum applied and the timber cells are evacuated of air. Vacuum held.



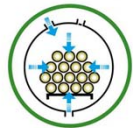
Cylinder flooded under vacuum with TANALITH wood preservative.



Hydraulic pressure applied, forcing the preservative deep into the structure of the timber.



Final vacuum extracts excess preservative solution, which is pumped back to storage.



Low pressure inside timber draws in surface solution when vented to atmosphere. Treated timber is left to dry.

Interesting Bridges

One such is the Mathematical Bridge in Cambridge, United Kingdom.



The interesting part is that although the bridge seems to be composed out of curved elements, there are no such elements. The arrangement of timbers is a series of tangents that describe the arc of the bridge.



Interesting Bridges

Another example is OAK's Accoya Wood Sneek Bridge in the Netherlands.



Thank you for the attention!
