Technical Department

CfE Technology : Structures

TCH 3-01a **"From my studies of technologies in the world around me, I can begin to understand the relationships between key scientific principles and technological developments."**

Bridges

Bridges are used to provide a means of crossing rivers, valleys, roads, railways and even seas.

The first bridges built by primitive people were simply tree trunks thrown across a stream.

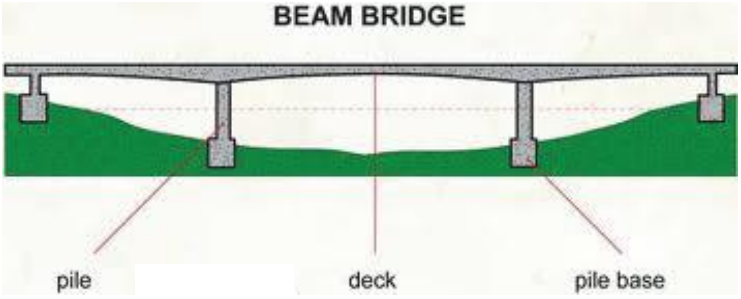
Engineers take great pride in the bridges they build and some of these bridges become national monuments, like the Forth Rail Bridge.

With all bridges, the problem for engineers is to design and build structures that will not sag, crack or break under the weight of the load they have to carry.

There are **six** basic types of bridge.

The Beam (or Girder) Bridge

This is the simplest type of bridge. Beams made from wood, iron, steel or steel reinforced concrete are laid across the gap to be scanned.



The downward force of the bridge's weight is supported by the ground. If the gap is too wide to be spanned by a single beam piers might be built at intervals to support a number of beams laid end to end.

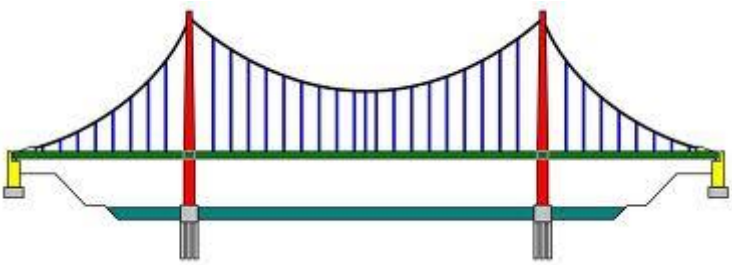
The Arch Bridge

In an arch bridge the weight is supported and spread to the sides by an archway.

The arch pushes on to the ground at each end of the bridge. The arch can be made from either brick, stone, concrete, wood, iron or steel.

The Suspension Bridge

Very large spans are often crossed by suspension bridges. In this type of bridge the deck is suspended from steel cables that hang between tall towers.



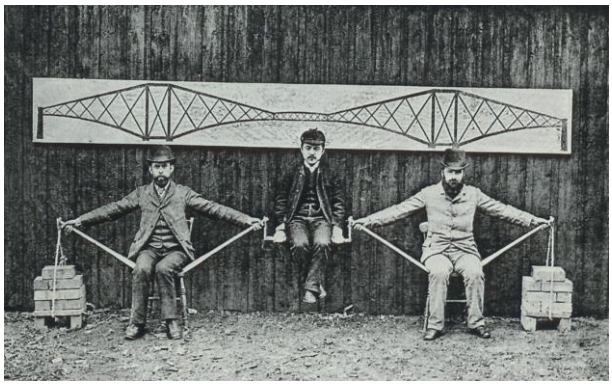
To take the strain, the ends of the cables are anchored in the banks. Old suspension bridges sometimes have chains rather than cables.

The Cantilever Bridge

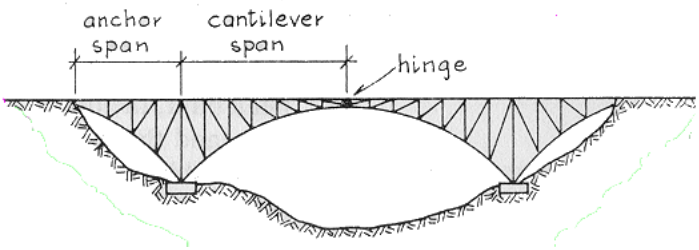
A cantilever is a beam that is anchored only at one end.

This means that the end of the beam away from the wall or is unsupported and that the locked anchor point must be able to hold all the weight placed on the beam.

This structure can also be used in bridges.



Benjamin Baker illustrated the structural principles of the suspended span cantilever in the photo on the left. The suspended span, where the man in the middle sits, is seen in the center. The need to resist compression of the lower chord is seen in the use of wooden poles while the tension of the upper chord is shown by the outstretched arms. The action of the outer foundations as anchors for the cantilever can be seen in the placement of the counterweights.

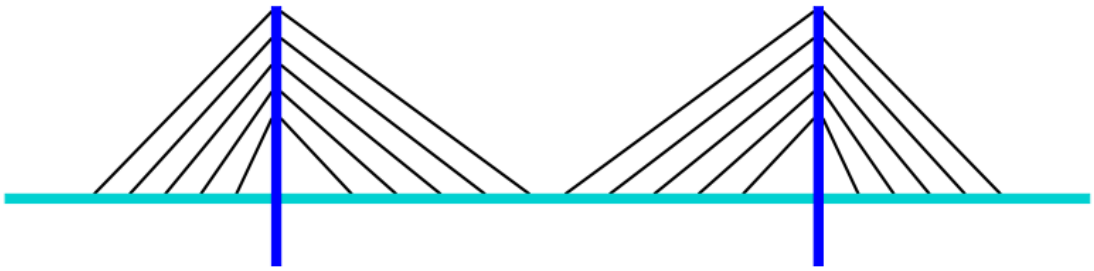


In cantilever construction, long rigid sections are used just like in a beam bridge. But instead of being attached to the river bank it is attached to cantilevers.

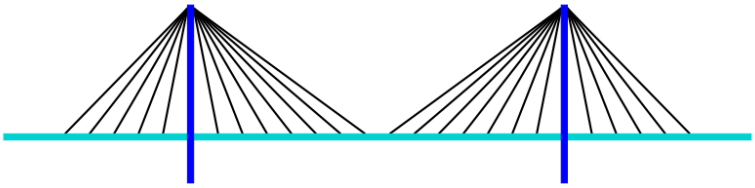
The Cable-Stayed Bridge

A cable-stayed bridge is a bridge that consists of one or more columns, with cables supporting the bridge deck.

There are two major classes of cable-stayed bridges: In a ***harp*** design, the cables are made nearly parallel by attaching them to various points on the tower(s) so that the height of attachment of each cable on the tower is similar to the distance from the tower along the roadway to its lower attachment.



In a ***fan*** design, the cables all connect to or pass over the top of the tower(s).



Compared to other bridge types, the cable-stayed is optimal for spans longer than typically seen in cantilever bridges, and shorter than those typically requiring a suspension bridge.

The Truss Bridge

A truss bridge is made by connecting pieces of metal together.

Truss bridges are one of the oldest types of modern bridges. The basic types of truss bridges shown have simple designs which could be easily produced by nineteenth and early twentieth century engineers. A truss bridge is economical to construct owing to its efficient use of materials.

The main types or truss bridge are: