

BRIDGES. PROBLEMS AND SOLUTIONS

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Engineers must consider many things – like the distance to be spanned and the types of materials available – before determining the size, shape, and overall look of a bridge. An incomplete structure is often subjected to stresses and oscillations that would not arise after completion.

Planning and executing the construction of a bridge is often very complicated, and in fact may be the most ingenious part of the entire enterprise.

Since ancient times, engineers have designed four major types of bridges to withstand all forces of nature: the beam bridge, the truss bridge, the arch bridge, and the suspension bridge. Five ingenious technological breakthroughs led us to the development in this area of construction of bridges.

The iron bridge. Darby's bridge was the first in the world to be made entirely of cast iron. The bridge's arch spans 100 feet and has five arch ribs, each cast in two halves.

The suspension bridge. These bridges in their simplest form were originally made from rope and wood. Modern suspension bridges use a box section roadway supported by high tensile strength cables. Also these bridges have a truss system beneath the roadway to resist bending and twisting.

Stronger chains. The main suspension cable in older bridges was often made from chain or linked bars, but modern bridge cables are made from multiple strands of wire. This contributes greater redundancy.

Building underwater. Where the towers are founded on underwater piers, caissons are sunk and any soft bottom is excavated for a foundation. If the bedrock is too deep to be exposed by excavation or the sinking of a caisson, pilings are driven to the bedrock or into overlying hard soil.

Wind. The open network of triangles makes the bridge very rigid, but it also allows the wind to blow right through the structure. In addition, engineers place several tuned mass dampers (TMDs) in each tower. The TMDs swing in the opposite direction of the wind sway.

Designs of bridges vary depending on the function of the bridge, the nature of the terrain where the bridge is constructed, the material used to make it and the funds available to build it.

In this way, it is one thing to design a bridge, but it is another thing to build it.