

# ARCH BRIDGES

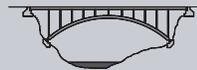


## ARCH BRIDGES

Arch bridges are one of the oldest types of bridges and have great natural strength. Instead of pushing straight down as in the case of a beam bridge, rigid frame bridge or truss, the load supported by of an arch bridge is carried along the curve of the arch to the supports at each end. These supports, called the abutments, transfer the load to the ground and keep the ends of the bridge from moving apart.

Arches use a curved structure which provides a high resistance to bending forces. Unlike girder and truss bridges, both ends of an arch are fixed in the horizontal direction and no horizontal movement is allowed in the bearing. Thus when a load is placed on the bridge, such as a passing car, horizontal forces occur in the bearings of the arch. Structurally there are three basic arch types: hinge-less, hinged and tied arches.

The hinge-less arch uses no hinges and allows no rotation at the foundations. As a result, significant horizontal, vertical, and bending forces are generated at the foundations. Special care must be taken in the design of the foundations for such a bridge. However, the hinge-less arch is a very stiff structure and experiences less deflection than other arches.



The two hinged arch uses hinged bearings which allow rotation at the bearings resulting in only horizontal and vertical forces developing. This is perhaps the most commonly used variation for steel arches and is generally a very economical design.



The tied arch is a variation on the arch which allows for smaller foundations. Rather than having the foundations resist the horizontal forces, a girder "ties" both ends of the arch together.

### 3.4.2 Where Are They Used

Arch spans are typically used to span deep canyons resulting in the abutments bearing against the canyon walls. However, the tied arch is a common form used to span rivers since it results in only vertical forces being applied to the abutments. The typical span length of arch bridges range from 40 to 150 meters. The longest arch span in the world is the New River Gorge Bridge with a main span of 518 meters.

### 3.4.3 What They Typically Cost

The typical cost of arch bridges ranges from \$4,000 to \$5,000 US per square meter.