

Suspension Bridge Design

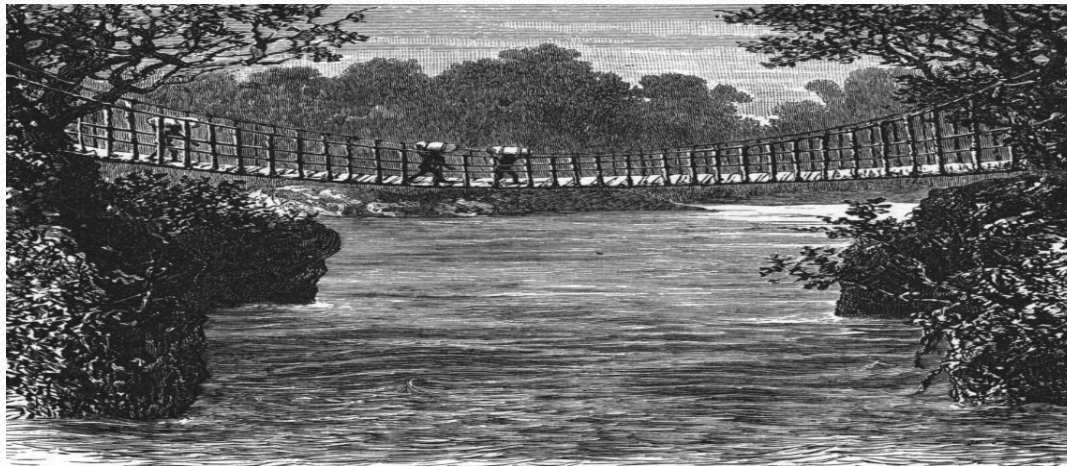


What you need to know

A suspension bridge is a type of bridge where the deck is hung below suspension cables on vertical suspenders. Suspension bridges are efficient at holding up a large amount of weight over a long span. A suspension bridge usually has two towers that hold up the horizontal cables. From these main horizontal cables hang vertical cables that are attached to the deck of the bridge. A suspension bridge must withstand forces of tension on its cables and large amounts of compression on its towers.

The History

Early suspension bridges were simple and crude with a narrow walkway that was suspended from chains or rope. Some of these early bridges are believed to have been used in the 7th century by the Mayans, and later in China and Tibet. However these theories weren't proved, the first suspension bridge design was drawn by Faust Vrancic in his book "Machinae Nove" in 1595.



Advantages and Disadvantages

Advantages of Suspension Bridges

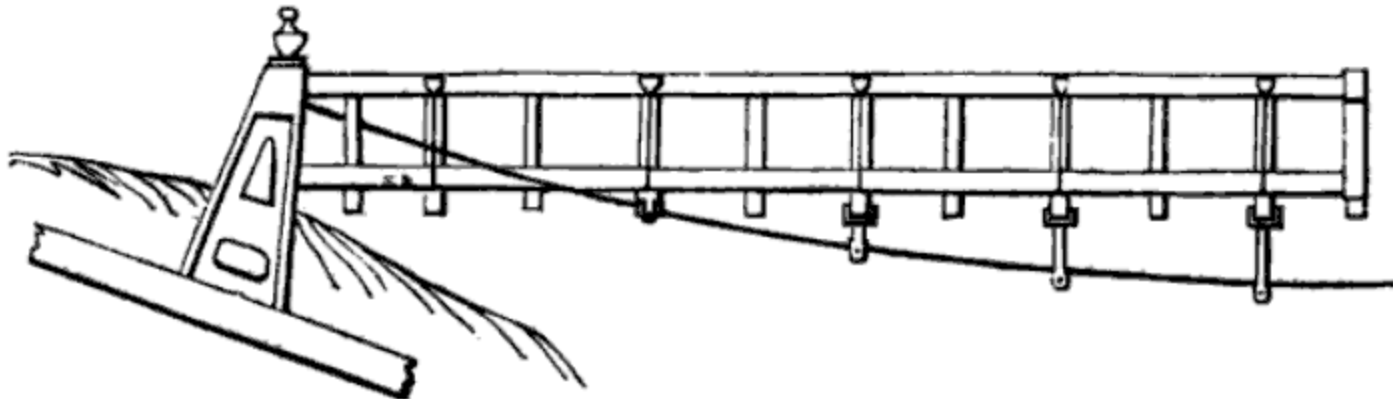
- They can span longer distances than any other type of bridge.
- They require less material to build, resulting in reduced construction cost.
- You don't have to shut down a waterway in order to build the bridge.
- They can withstand earthquakes better than stiff conventional bridges.

Disadvantages of Suspension Bridges

- Road deck can vibrate and even twist in high winds.
- The road deck lacks the stiffness required to carry heavy railroad traffic.
- Some areas of the bridge are difficult to install and maintain.

Under spanned Suspension Bridges

An under spanned suspension bridge is a lot like a normal suspension bridge except for the fact that the main cables run underneath the deck. This design is functional but it makes the road deck unstable and unable to hold up large amounts of weight.



The Road Deck

The road deck of a suspension bridge is very important. Most deck designs are made from open trusses that allow wind to pass through. It is important to build the deck aerodynamically or else it will twist and could snap. One of the more famous occasions of this happening was the Tacoma Narrows Bridge. The truss work of the deck was too flexible and it snapped in strong winds.



The Building Steps

1. First huge concrete caissons are sunk into the bedrock to provide a solid base for the towers.
2. Next the towers are constructed on top of the caissons.
3. Giant anchor points are created on both ends of the bridge to keep tension in the cables.
4. Then the main cables are strung across the span of the bridge.
5. A temporary walkway is constructed beneath the main cables so that construction can begin on the road deck.
6. Suspender cables are put into place as the road deck is built to provide strength.
7. When the road deck is finished, a layer of concrete is poured over the steel, followed by a layer of asphalt.



Here you can see the first stages of road deck construction on the Lions Gate Bridge. You can also see the suspender cables that connect the road deck to the main cables.

Corrosion

Corrosion is a major issue for suspension bridges. If the cables corrode enough they will break and the entire bridge could be lost. To combat corrosion, engineers have come up with many solutions. Some of the more popular methods are to use galvanized steel cables that won't rust, and to wrap the main cables in rubber to keep out moisture. Another way is to wrap the wire in thin steel cable then paint it with a special paint that can resist the elements. A strange method of battling corrosion is to ventilate the cables at all times. The Akashi-Kaikyo bridge in Japan uses this method.



This is the main cable before it's wrapped in galvanized steel wire.

Famous Suspension Bridges



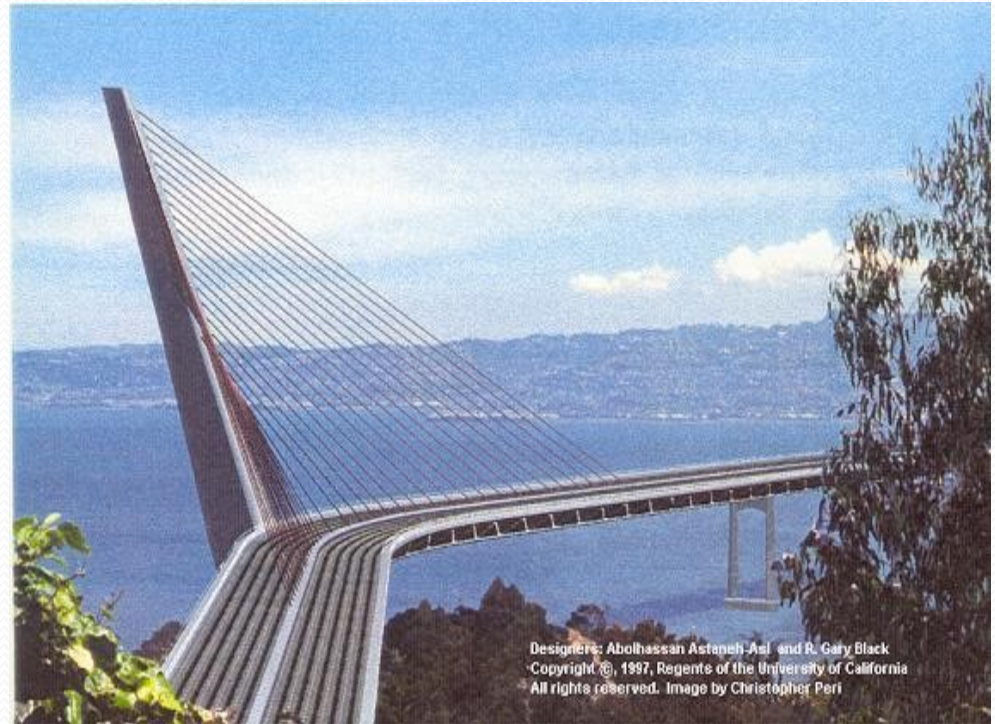
The Golden Gate Bridge in San Francisco

The Akashi-Kaikyo bridge in Japan
The longest bridge in the world at 6529 feet long.



Curved Cable Stayed Bridge

This is an innovative curved cable stayed bridge. It is designed to provide maximum support around turns where a whole new bridge would need to be built.



Verrazano-Narrows Bridge



The Verrazano-Narrows Bridge is the longest suspension bridge in the U.S. It is 4,260 feet long. It is a double decked bridge in New York City.

Waldo Hancock Bridge

This is the new Waldo Hancock Bridge. It replaced the old one in the background due to corrosion. This is one of the only suspension bridges in the country that has an observation tower in the top. I have been up in the tower and would strongly suggest seeing it for yourself.



Bibliography

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