TOPIC: Bridges

Subject: Civil Engineering – Introduction , Societal & Global Impact.

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Definition:

A **bridge** is a structure built to span a physical obstacle (such as a body of water, valley, road, or rail) without blocking the way underneath. It is constructed for the purpose of providing passage over the obstacle, which is usually something that is otherwise difficult or impossible to cross.

The *bridge*, a connecting structure, creates bonding between different disconnected parts of a country, two banks of the ocean or parts of two countries. A Bridge is a structural marvel which is generally used to pass any type of obstruction that can slow the life of people.

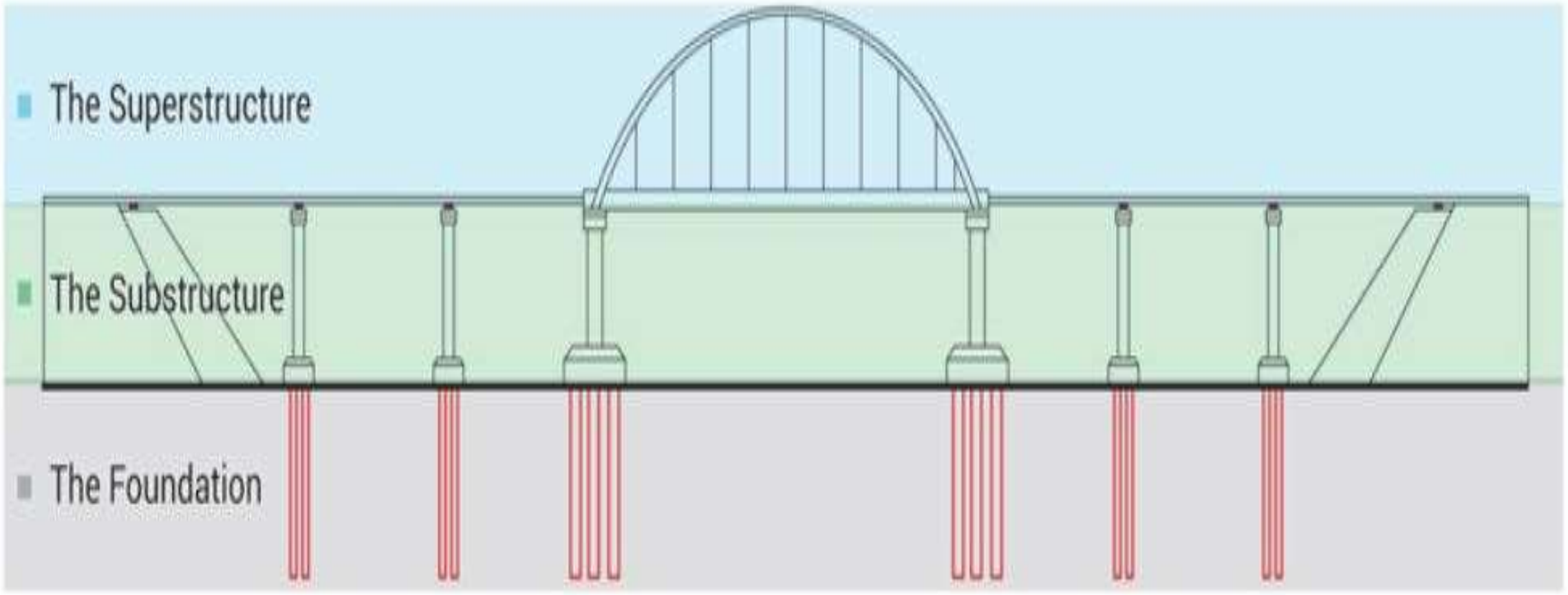
Main Parts of BRIDGE:

- **The main components of a bridge are the foundation, substructure, and the superstructure.**

- When **building a bridge**, the construction starts with laying the foundation. Then the sub-structure is made to give support for the heavy superstructure above it, which is actually used as the road or walkway.

- **Each of these core areas have other parts within them.**

- **The sub-structure includes piers and abutments, while the superstructure includes the girders, bearings and deck .**

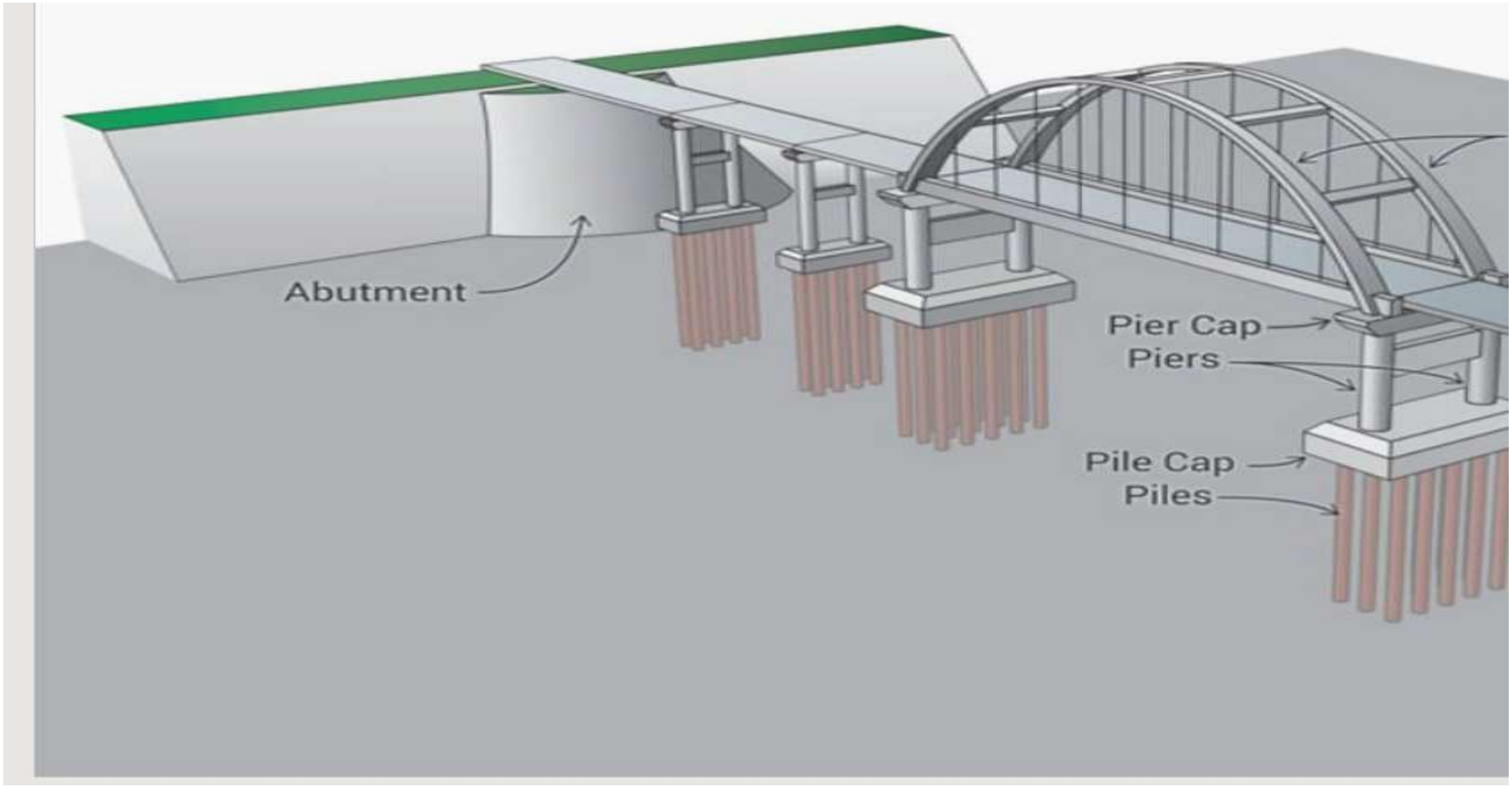

The Superstructure
The Substructure
The Foundation

The Foundation:

- **Piles:** Piles are usually laid to give support to a bridge and make up the initial foundation. The piles help the weight and stresses applied by the bridge to be transmitted evenly through the ground making it stable and strong.

- **Caps:** Caps provide additional load transferring capacity to the piles. They are also known as pile caps as they are placed right on top of the pile foundation. Caps are often made of very heavy concrete to give maximum strength to the upper part of the bridge.

- **Bents:** When piles and caps are set together they are called bents. Multiple bents form the foundation for the substructure.


Abutment
Pier Cap
Piers
Pile Cap
Piles

The Substructure:

- **Abutments:** Bridges have vertical supports at their approaching ends, functioning as retention walls for the ground. These are built from reinforced concrete and are capable of withstanding high levels of horizontal force. It acts as roadway approach.

- **Piers:** These are the intermediate vertical supports between bridge span.
  The main function of pier is to transfer vertical (superstructural) loads to the foundation.

- **Pier Caps:** Pier caps are also known as the headstock(head of the pier). They give the sufficient bearing area for the deck components .

The Superstructure

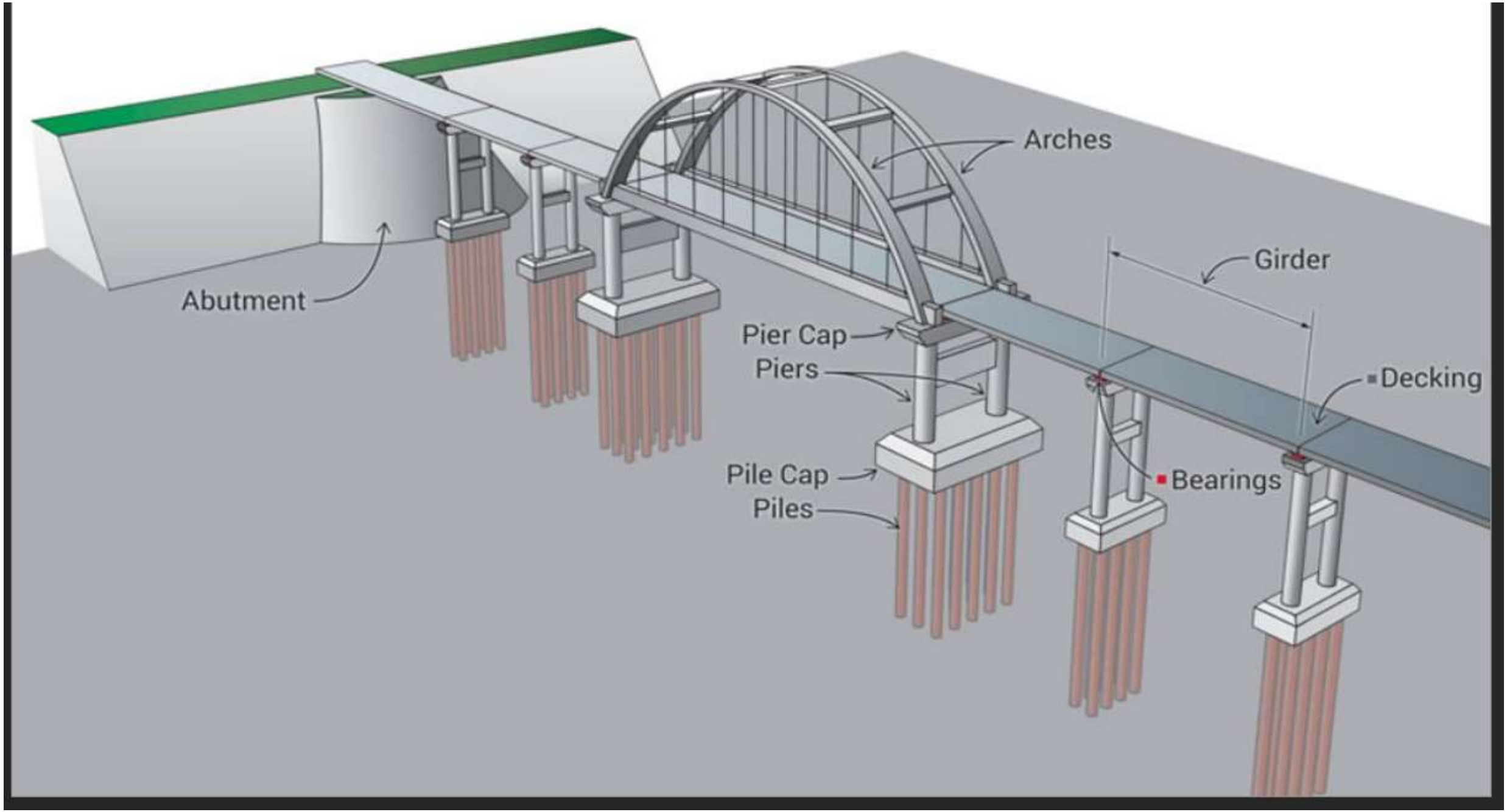
Girders: Girders joins all the pile caps together by extending over them. Girders are also referred as horizontal beams provided in horizontal direction to give support to the deck. Girders are mostly made from metal or concrete.

Bearings: Bearing is resting surface between bridge deck and pier cap .These are capable of transferring loads from the deck to the substructure. It is a device which supports the parts of superstructure .

Decks: Decks get the direct traffic load. Some basic decks can be made of concrete and also from metal. These include travel or walking paths, drainage systems, curbs, expansion components, sidewalks and approach slabs.

Barriers: Mainly as a safety and protection feature, bridges have barriers on the sides of their decks. These can be specially designed fixtures, ropes, rails, fences, or concrete walls for better aesthetics.

Arches: A bridge with arches has a lot of strength. Arches can help control the safety and load bearing ability of the bridge. The quantity of arches and materials used for construction is very important.


Arches
Girder
Abutment
Pier Cap
Piers
Decking
Pile Cap
Piles
Bearings

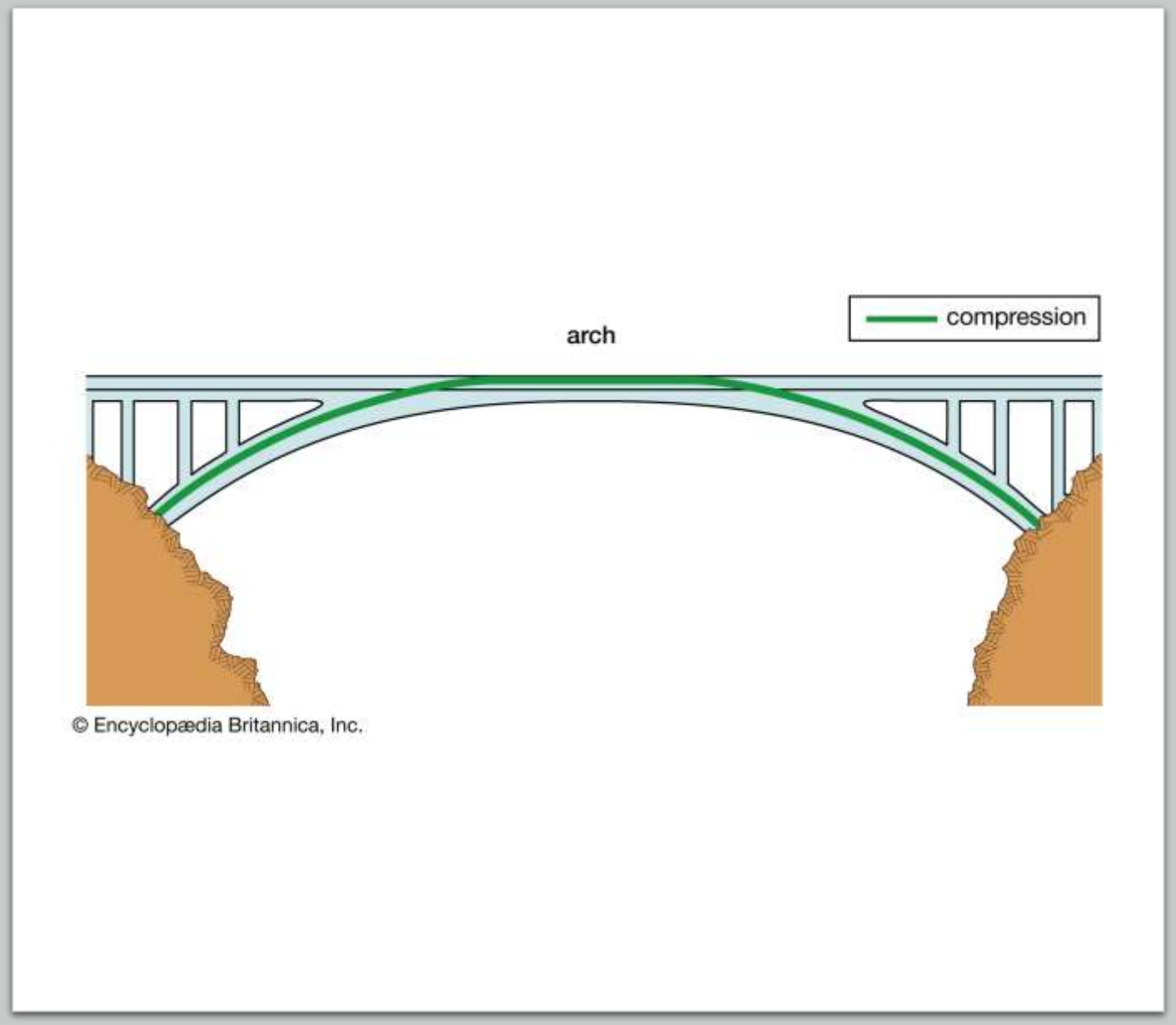
7 Different Types of Bridges

1. Arch Bridge
2. Beam Bridge
3. Cantilever Bridge
4. Cable-Stayed Bridge
5. Suspension Bridge
6. Tied-Arch Bridge
7. Truss Bridge

Arch Bridge

Above left: Arch bridge constructed using brick and stone.
Above right: a more modern arch bridge made using concrete.

- Arch bridges use one or more arches as the main structural component, with the arches positioned beneath the deck. This method dates back many thousands of years, with stone and brick being the most commonly used materials. However, in modern times you will see arch bridges constructed from concrete.
- Whatever material is used the principle remains the same: An arch bridge uses compression – downward pressure from the deck travels laterally towards the keystone and to the supporting structures at each end of the bridge (the abutments).



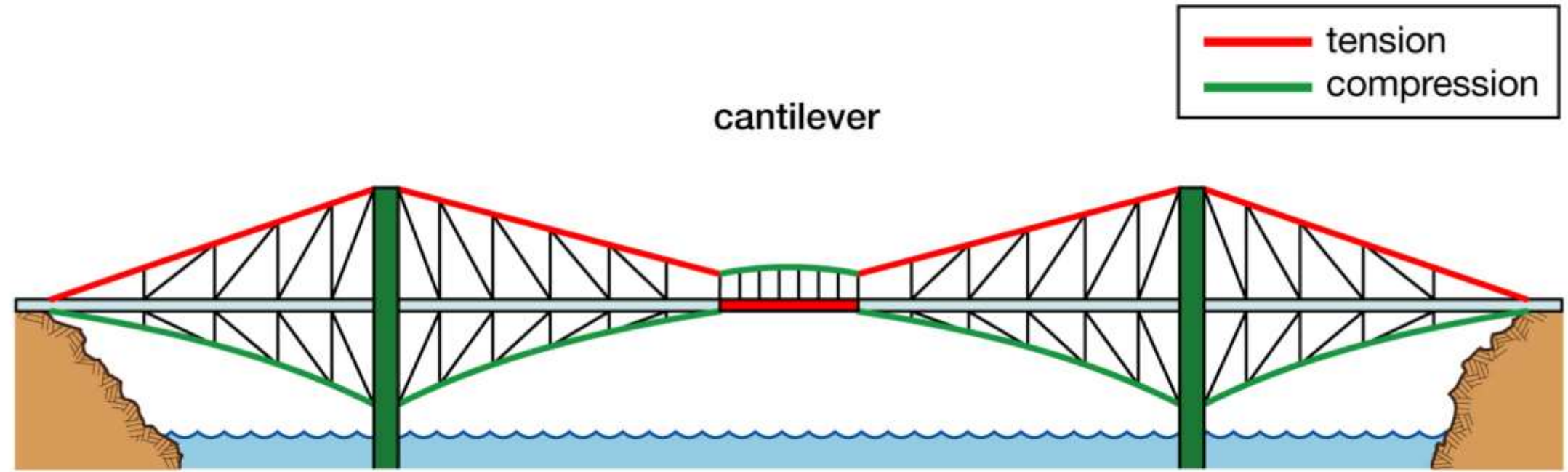
Beam Bridge

Beam bridge constructed using steel and concrete.

- The beam bridge is the simplest type of bridge. In its most basic form, all that is needed is a crossbeam long enough to cover the span, and support from abutments under each end. To achieve a longer continuous span, piers need to be added to provide extra support. When doing this it means you create a series of bridges joined together.
- A beam bridge may include several beams running in parallel to support the deck above. This is often referred to as a simply supported structure.

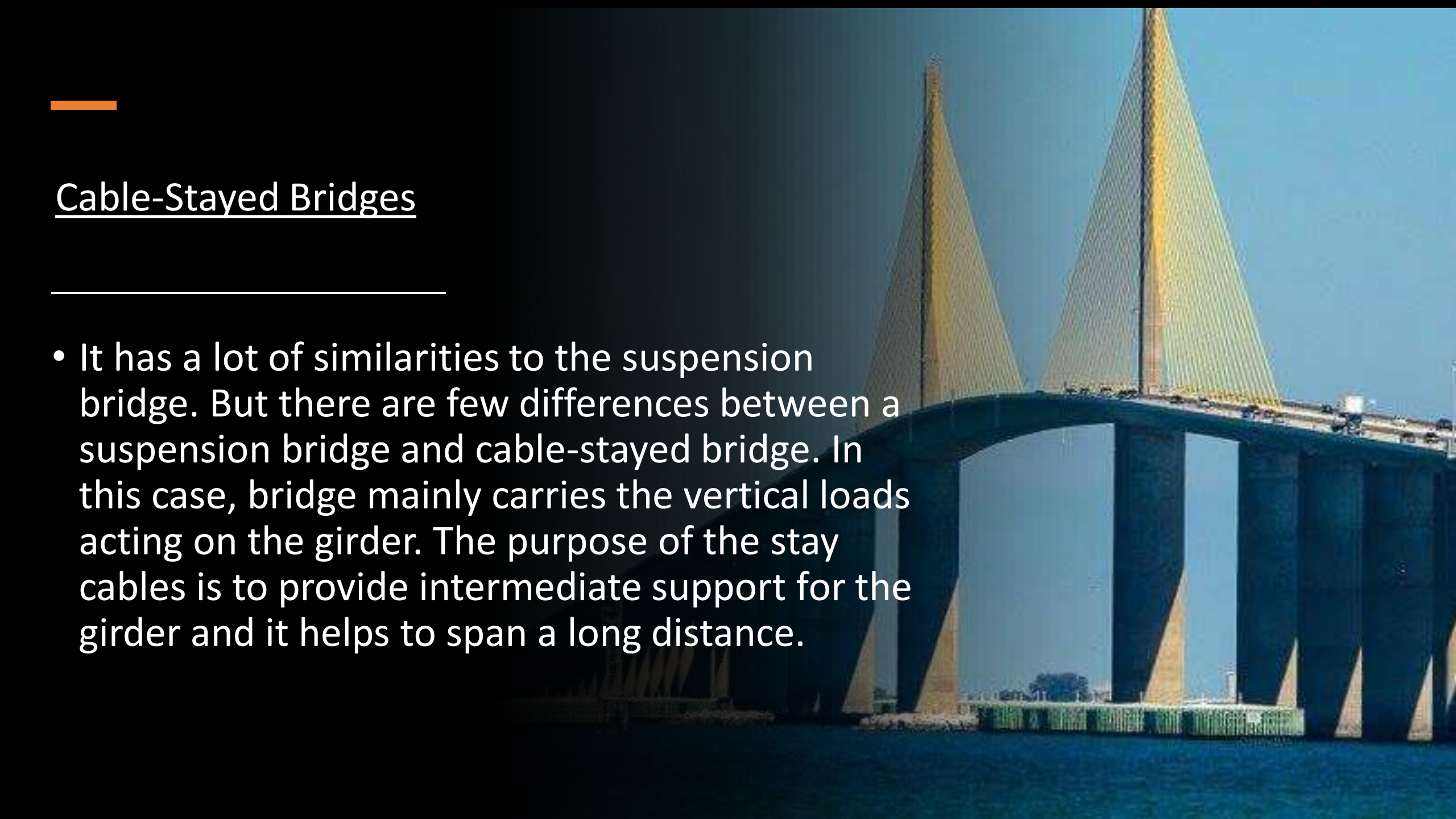
CANTILEVER BEAM

A beam is said to be cantilevered when it projects outward, supported only at one end. A cantilever bridge is generally made with three spans, of which the outer spans are both anchored down at the shore and cantilever out over the channel to be crossed. The central span rests on the cantilevered arms extending from the outer spans; it carries vertical loads like a simply supported beam or a truss—that is, by tension forces in the lower chords and compression in the upper chords. The cantilevers carry their loads by tension in the upper chords and compression in the lower ones. Inner towers carry those forces by compression to the foundation, and outer towers carry the forces by tension to the far foundations.



Cable-Stayed Bridges

- It has a lot of similarities to the suspension bridge. But there are few differences between a suspension bridge and cable-stayed bridge. In this case, bridge mainly carries the vertical loads acting on the girder. The purpose of the stay cables is to provide intermediate support for the girder and it helps to span a long distance.



SUSPENSION BRIDGE

- These are bridges where you see draping cord or cable going from one support to the other and then hanging from those draping cables are additional cables that are then attached to the deck to hold up the deck.

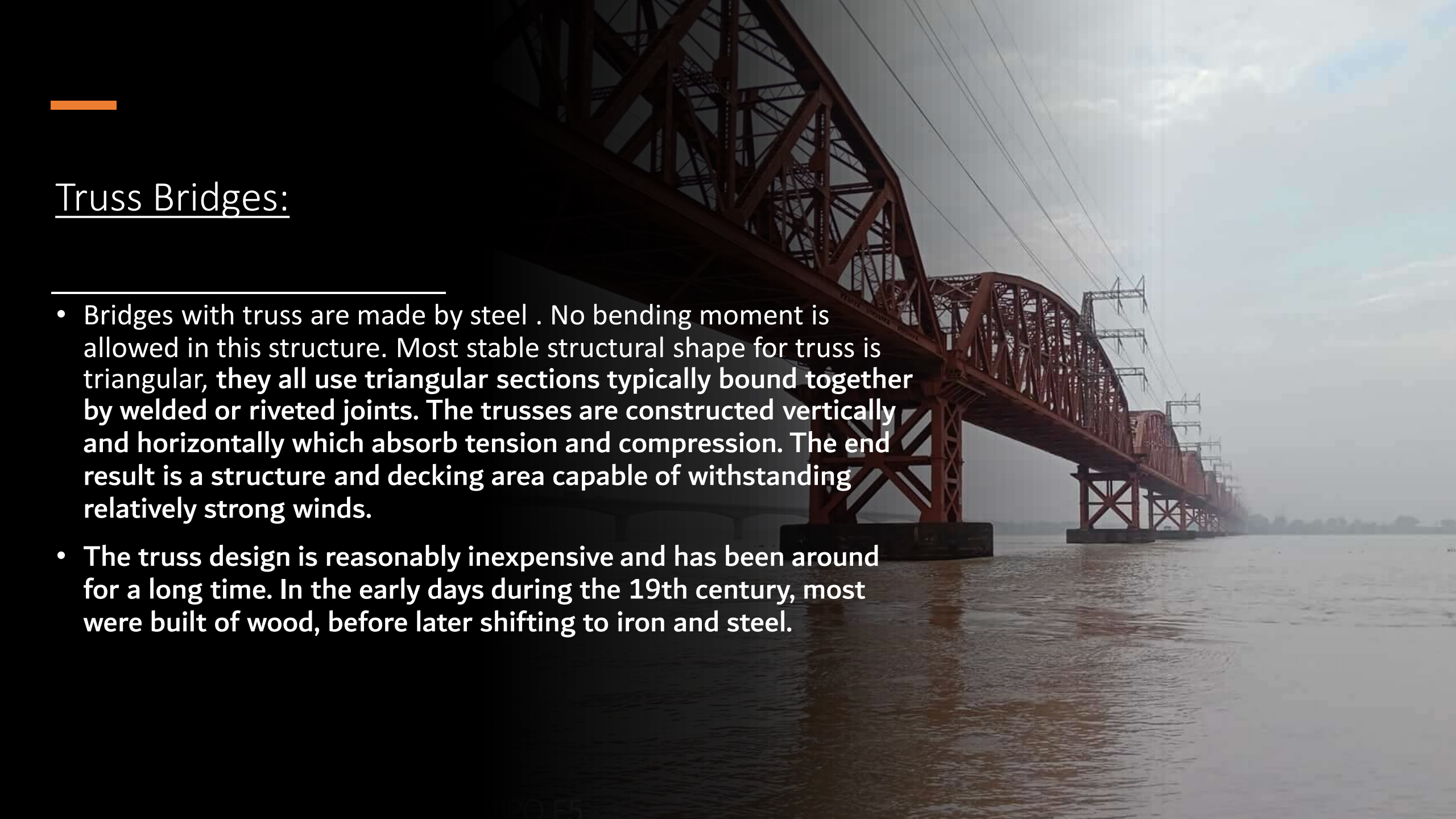
Well these particular cables are experiencing pure tension because it is experiencing a force that is stretching those cables.

Tied-Arch Bridge

- A tied-arch or bowstring bridge uses features seen in both a suspension bridge and an arched bridge. However, unlike a traditional arched bridge, the arch is positioned above the deck and uses vertical cables attached to support the deck.
  This arch (or bow) uses the tension of its vertical cables, together with the compression of the arch, to support the load – keeping the bridge very stable.

Truss Bridges:

- Bridges with truss are made by steel . No bending moment is allowed in this structure. Most stable structural shape for truss is triangular, **they all use triangular sections typically bound together by welded or riveted joints. The trusses are constructed vertically and horizontally which absorb tension and compression. The end result is a structure and decking area capable of withstanding relatively strong winds.**
- **The truss design is reasonably inexpensive and has been around for a long time. In the early days during the 19th century, most were built of wood, before later shifting to iron and steel.**



Importance of Bridge

1. Road or **railway** traffic can run **uninterrupted** in monsoon
2. Saving in **time** and **fuel**.
4. Distance **between** two **places** can be **reduced**.
5. Agriculture products, industrial products, and **raw materials** can reach the industries **quickly** which helps in the **economic development** of the area.
6. Construction of a **bridge** on **railway** alignment at level crossing **reduces** the number of **accidents**.
7.Bridges are important from a **military** point of **view**.


THANK YOU