

Technology III



Bridge Construction

Bridge Construction

Bridge design and construction



Based on materials...

- Timber
- Stone
- Brick
- Cast and wrought iron
- Steel
- Mass concrete
- Steel reinforced concrete



Bridge Construction

Purpose of a bridge

As a structure to allow people or vehicles to cross an obstacle such as river, sea, railway, highway, valley, etc.

A connection between two destinations

As an aqueduct to form a part of canal

A temporary structure or permanent structure



Bridge Construction

Two main elements

- Carriageway
- Support



Support from below

Arches / vaults

Beams cantilevered
/ supported

Lattice-style
engineered truss

Bridge Construction

Support from above

Needs a suspended system

Well-anchored cables

Inverted arches

Cable-stayed

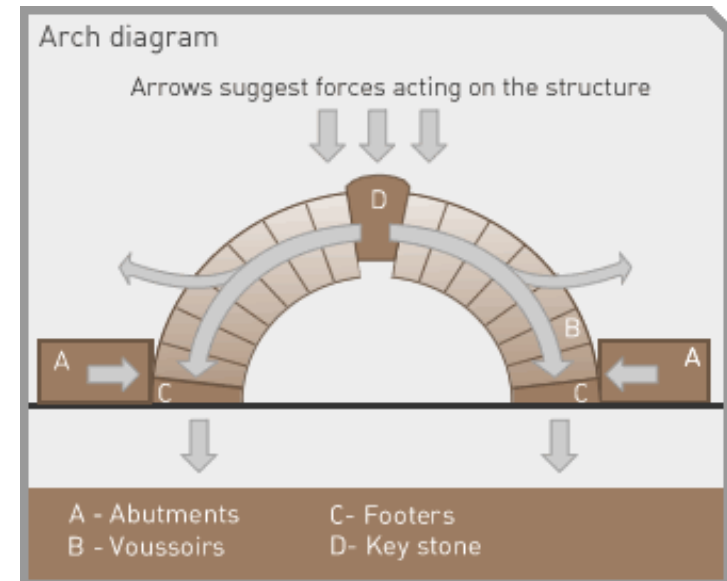


Bridge Construction

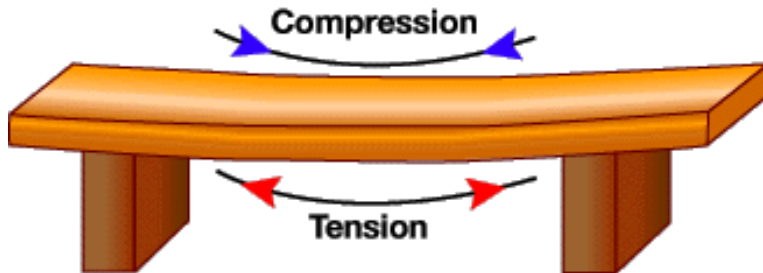
Design is responsive to the forces that act on bridges...

- Tension
- Compression
- Shear
- Torsion

Arch bridges perhaps the oldest



Bridge Construction



Compression at the top of deck
and tension at the bottom



Beam type bridges

- If the beam is designed with extra materials at top and bottom, it will become more efficient to handle loading.
- I-beams are more efficient than rectangular beams.

Bridge Construction

...and structural principles

- Arches
- Beams
- Cantilevers
- Pylons
- Cables
- Masts

Simple Beam Bridge



Arch Bridge



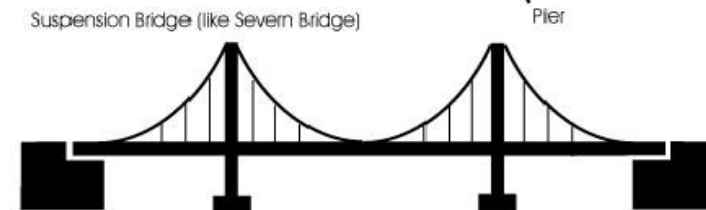
Cantilever bridge (like the Forth Rail Bridge)



Cable Stayed Bridge (like Second Severn Crossing)



Suspension Bridge (like Severn Bridge)



Bridge Construction

Timber bridges



Bridge Construction





Bridge Construction

Truss type beam bridges allows for greater efficiency.

Top and bottom chords contain more materials than the middle of truss (usually diagonal members)

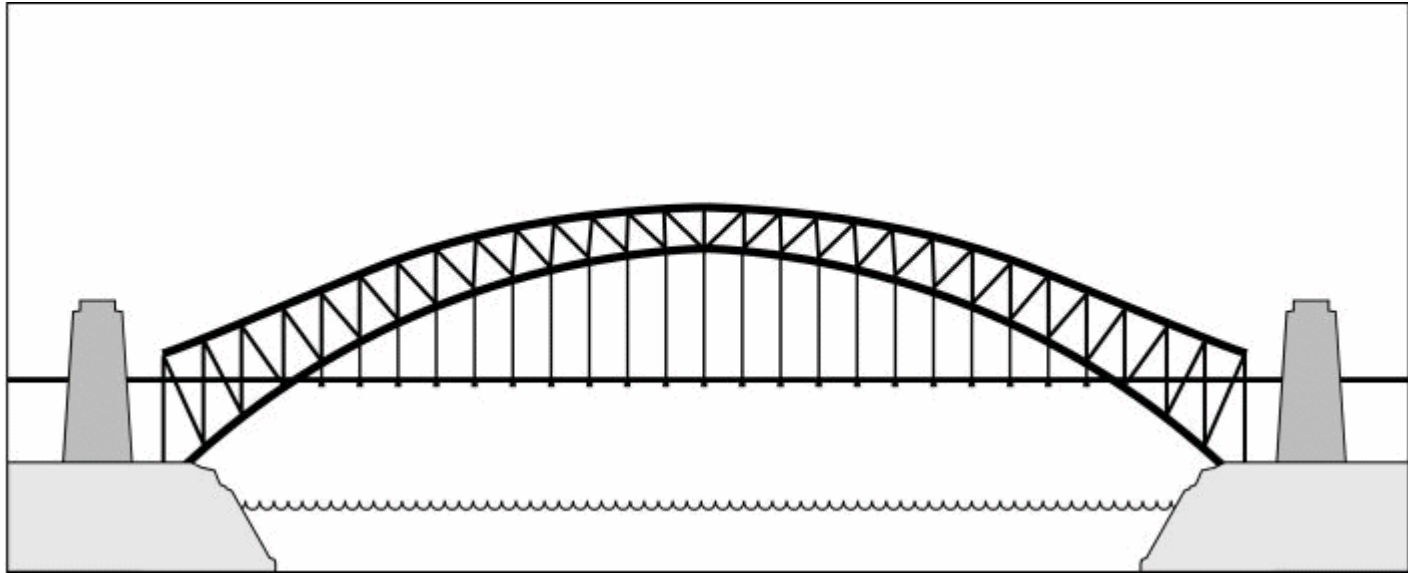
Trusses are usually made up with diagonals to form triangles.

Creates both a very rigid structure

Transfers the load from a single point to a considerably wider area.

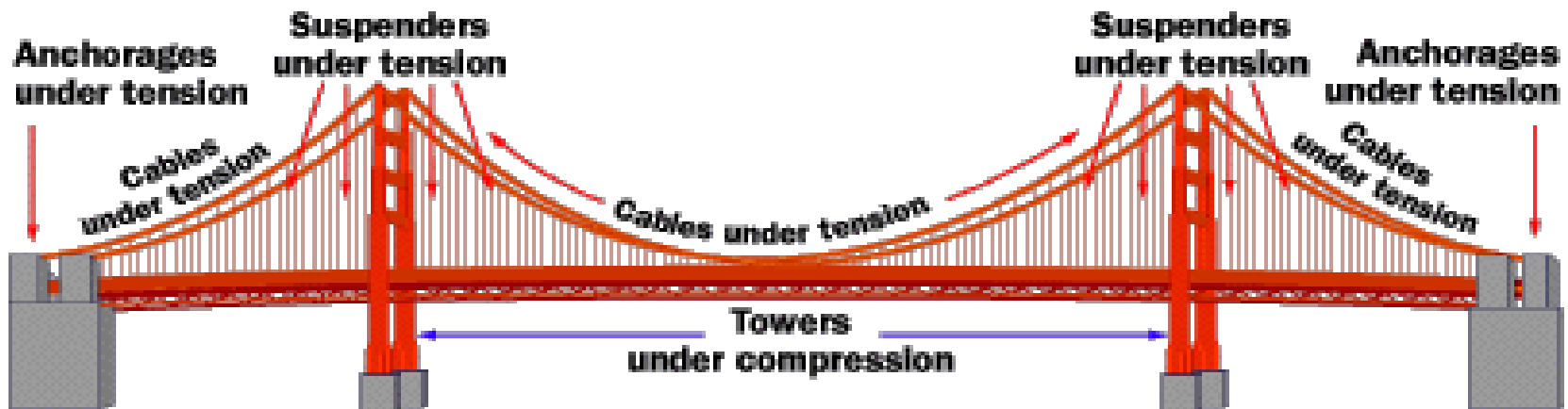


Bow-string bridge



Bridge Construction

- Cable Bridges
 - Suspension Bridge
 - Cables are strung across obstacle (river)
 - Deck is suspended from the cables
 - The towers support the majority weight of the bridge





Clifton Suspension Bridge, Bristol
Construction Started 1831
Completion 1864



The Severn Bridge, Opened in 1966



Bridge Construction



Cable Sorter



Cable Anchor



The catwalk suspended on the main cable

Bridge Construction



1.1m Diameter cable



Deck segments being transported under the bridge on sea



Deck segments being lifted into positions



Caissons & Cofferdams



Bridge Construction

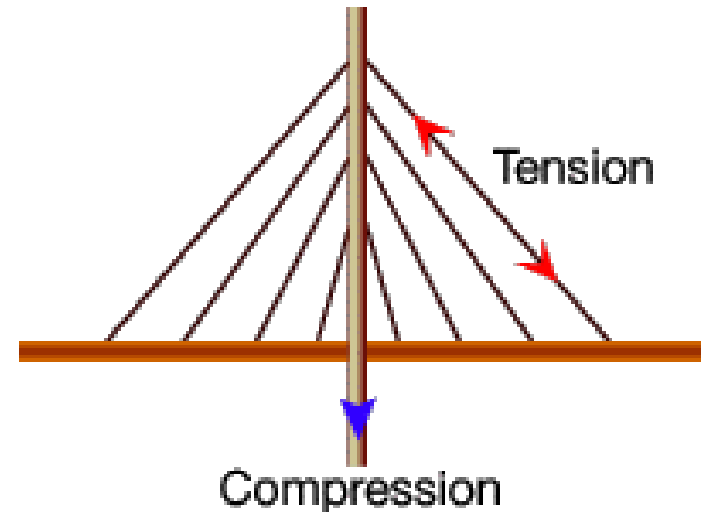
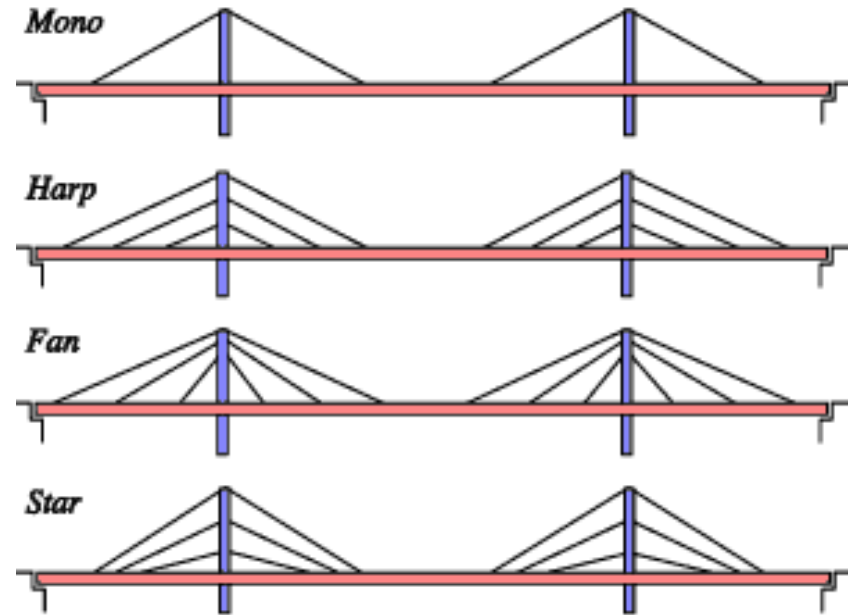
Cable Stayed Bridges

Do not require parabolic cables

Cables directly connect to deck from the pylon

Straight cables carry tension

Pylon carries compression to the foundation



Gulf of Corinth, Greece



Poole's 'Twin Sails' second opening bridge



Millau Viaduct

Bridge Construction



Second Severn Crossing, Opened in 1996



- **Main Span 456m**
- **Overall Length of the Structure 5128m**
- **Pylon height 137m**

Bridge Construction

Discussion



Evaluate the principle factors that will affect both the material choice and method of construction of bridges