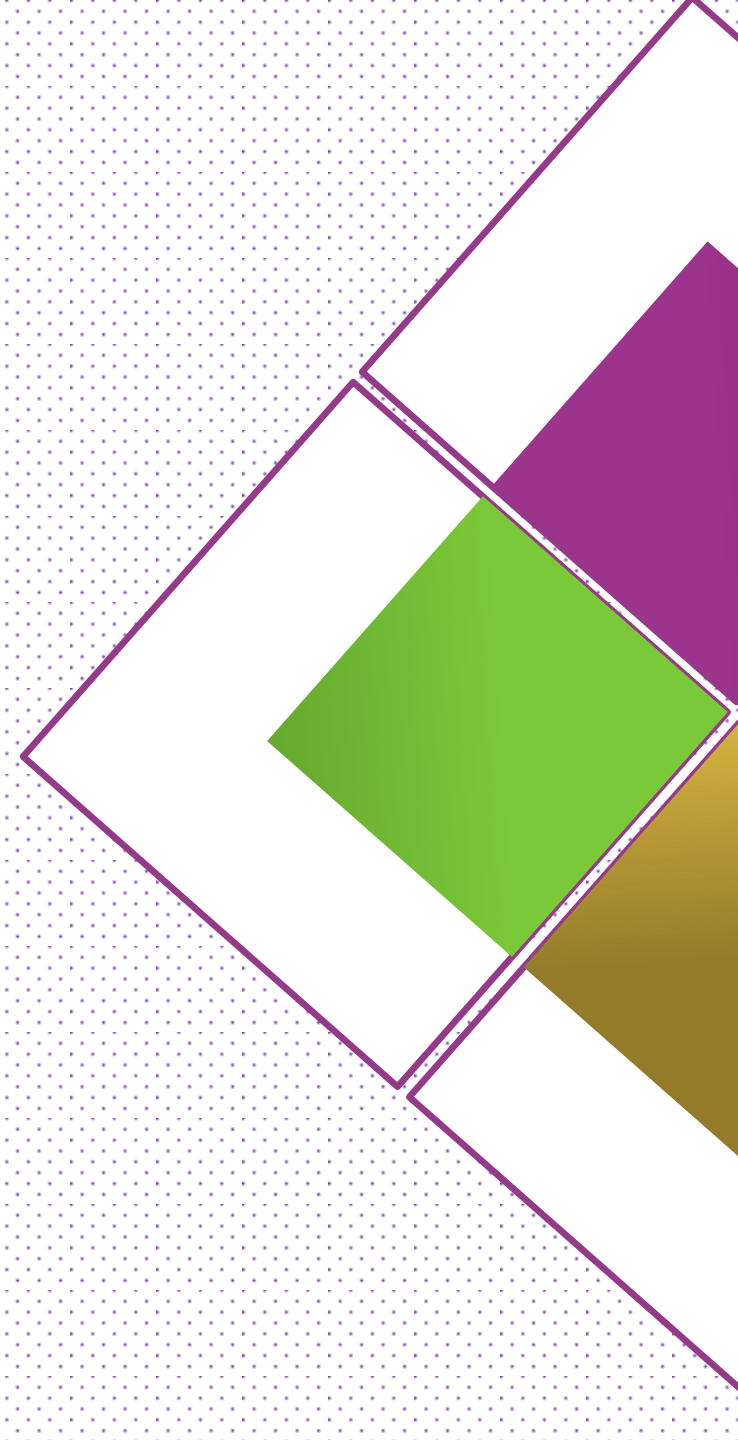


Bridges Construction

Eng. Ahmed Hany



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02

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Bridge life cycle with bridge engineer

04

Types of Bridges by structure

What is the Bridge?

A **bridge** is
a structure built to span a physical obstacle, such as a body of water, valley, or road, without closing the way underneath

Span Bridge should be more than 6.10 m

Design of **bridges** will vary depending on the **function** of the bridge and **nature of the area** where the bridge is to be constructed

Design Aspects

Design aspects of bridges

Safety and Comfort

Bridge shall satisfy **SAFETY** according to the requirements of designs code

Bridge shall satisfy **SERVICEABILITY** limits for the comfort of the users.
e.g. deflection , vibration

Aesthetic aspect

- ☐ Overall view of the bridge.
- ☐ Color of different elements.
- ☐ Handrail and lighting system.
- ☐ History of the region

Economic aspect

- ☐ Material
- ☐ Duration of construction
- ☐ Indirect cost (Traffic interruptions, Obstacles)

Environmental aspect

- ☐ During the construction
- ☐ For the end bridge (the effect of the bridge on the surrounding)

Bridge life cycle with bridge engineer

Bridge Studies

The required Studies for bridge location

Feasible studies

(Alternatives analysis)
Economics & Engineering &
Social & Environmental

Surveying and
mapping work

Traffic Studies

Bridge Studies

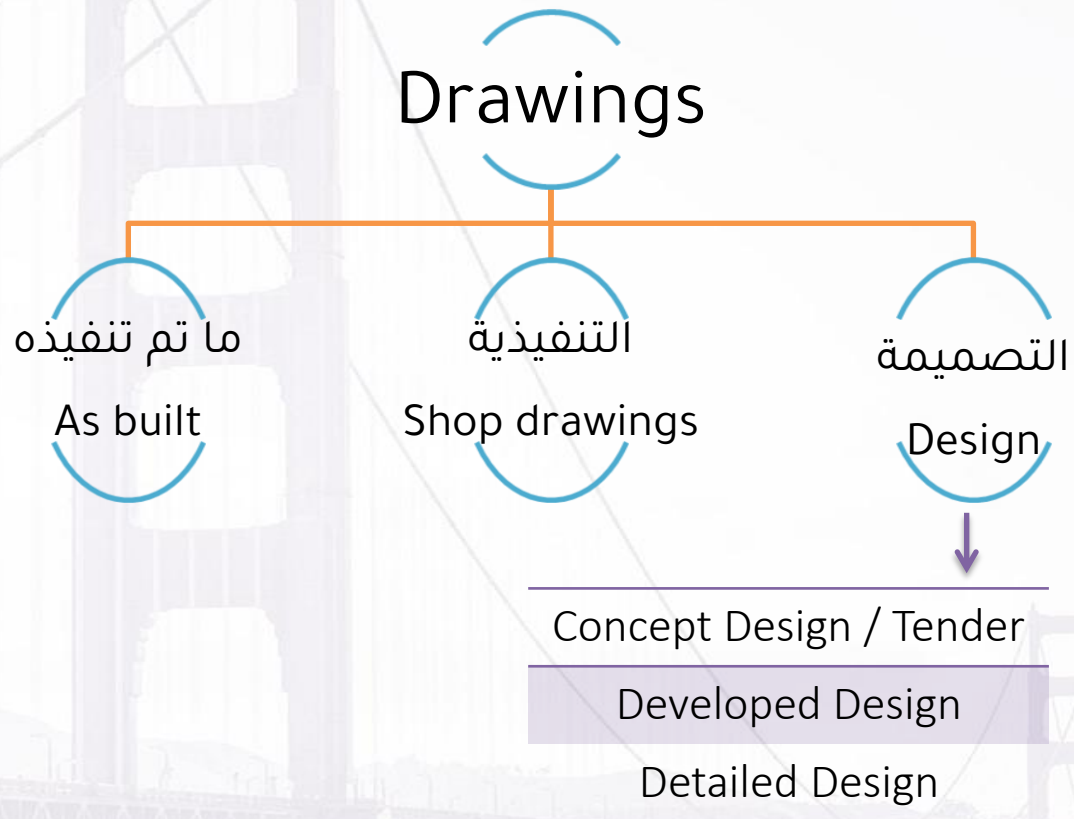
The required Studies for Engineering Design

Soil Studies
(Foundations
Inspection)

Hydrology
Studies

Surveying and
mapping work

Types of Drawings



Design

Geometrical drawings

Structure drawings

Shop drawings

Setting out drawings (Surveying)

Concrete elements dimensions

Steel reinforcement details

Traffic diversion plans

Geometrical drawings

1- General

(Project Location Map& Summary of road alignments& Legend)

2- Plan

(Alignment stations & N direction & Road Center line & Dimensions ...etc.)

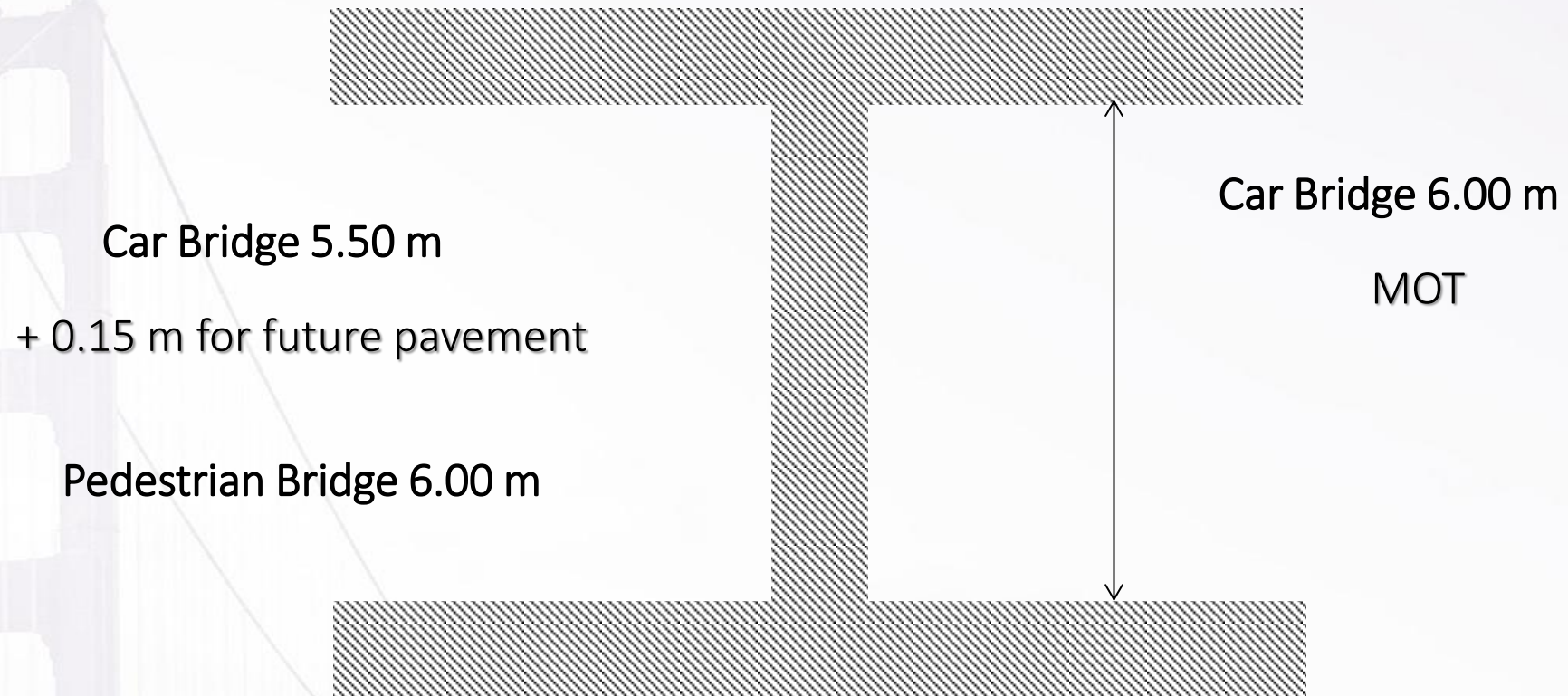
3- Profiles

(stations & ground level & Vertical Curve & Super elevation inf...etc.)

4- Cross Sections

(Typical cross sections & Cross section based on topographic terrain & Pavement details & Cut and fill slopes ...etc.)

Clearance drawing



Vertical clearance

Materials

concrete

Blinding/ Plain Concrete

20/25

Sub-Structure

(Footing / Piles / Pile Caps / abutment
/ Piers / diaphragms)

Super-Structure

(Main Girder/ Deck Slab/ Pile Caps /
abutment / Piers / diaphragms)

35/20

40/20

Approach slabs

Retaining walls

35/20

28/20

Concrete Class refer to cylinder compressive strength

At age 28 days / max aggregate size

High Yield Steel shall conform grade 60

a minimum tensile strength of 60 kg/mm²

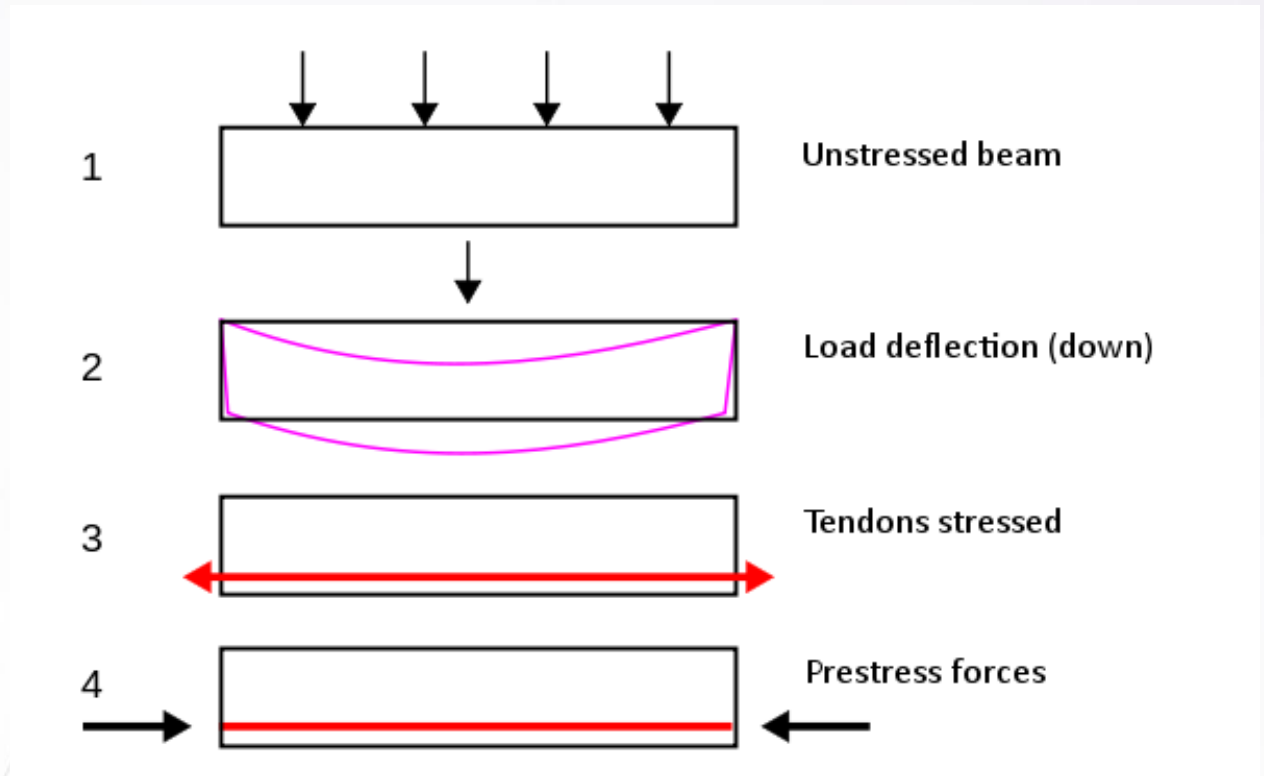
Minimum elongation = 12%

Materials

Pre-stressed

Steel grade 270

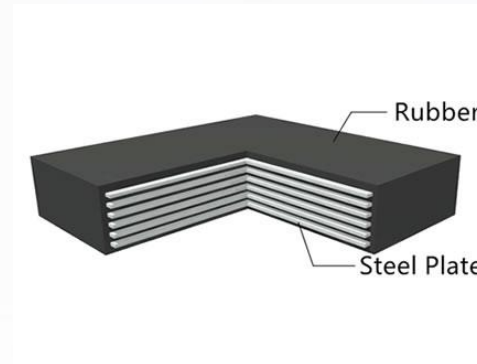
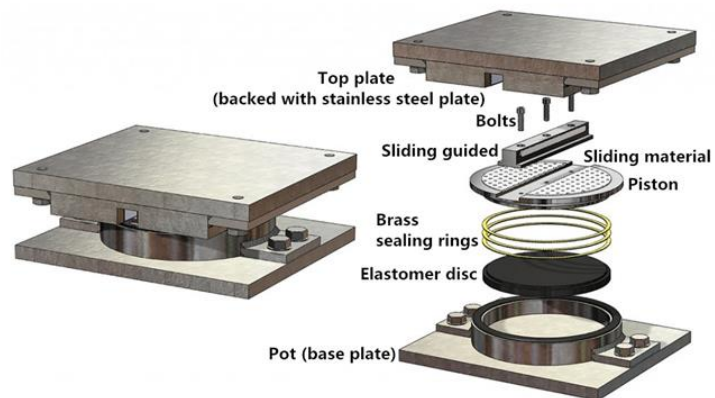
Ultimate Strengths = 1860 mpa



Materials

Bearing

Pot Bearing			Elastomeric Bearing	
FIXED	GUIDED	FREE / SLIDING	PLAIN Pads Thickness (19) mm or less	laminated Pads Thickness over (19) mm



Materials

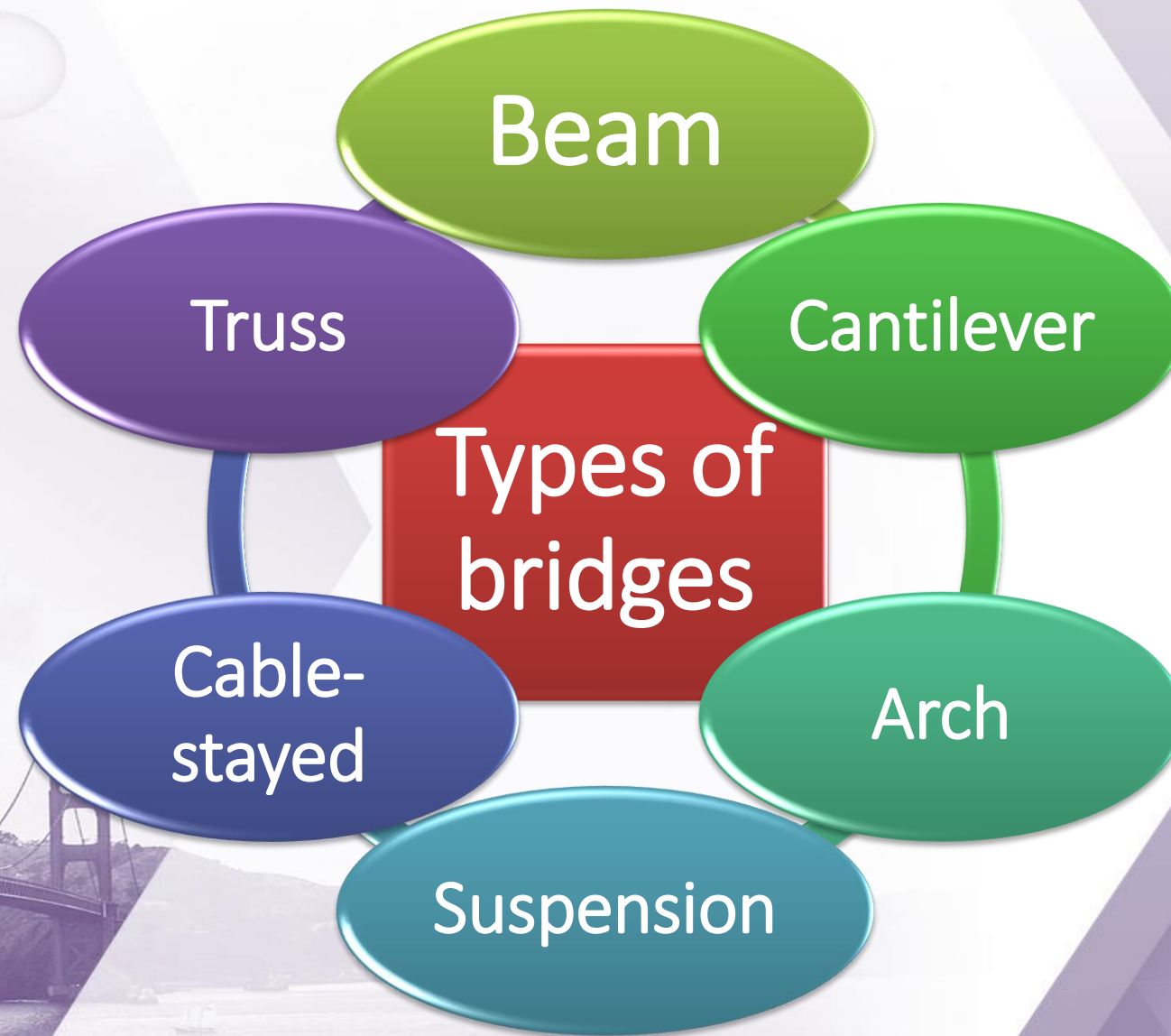
Expansion Joint

Small Movement Range Joint	Medium Movement Range Joints	Large Movement Range Joints
Movement less than 45 mm	Movement between 45 mm to 130 mm	Movement large than 130 mm
1- Steel Sliding Plate Joints. 2- Compression Seal Joints. 3- Asphalt Plug Joints. (Thermal) 4-Poured Sealant Joints.	1- Bolt-Down Panel Joints. ❑ Single Strip. ❑ Multiple Strip. 2- Strip Seal Joints. 3- Steel Finger Joints.	1- Modular Bridge Expansion Joints

- ❑ نسخة من المخططات التصميمية للجسر المراد.
- ❑ خطاب اعتماد وزارة النقل للشركة الموردة للمنتج.
- ❑ جميع الشهادات والاختبارات الأساسية للمنتج المراد اعتماده.
- ❑ مذكرة حسابية مقدمة مع المنتج مدون بها الحسابات المطلوبة ،
وجميع ال Checks المطلوبة.
- ❑ الدراسة الفنية من قبل الاستشاري والتوصية الفنية.
- ❑ رفع أصل المعاملة وكامل مرفقاتها

Types of Bridges By Structure

Types of Bridges By Structure

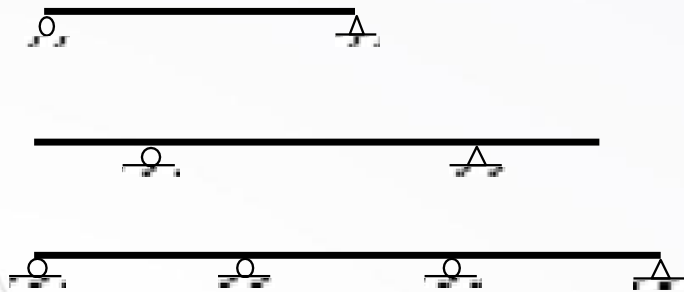


Beam/Girder Bridge

Simple

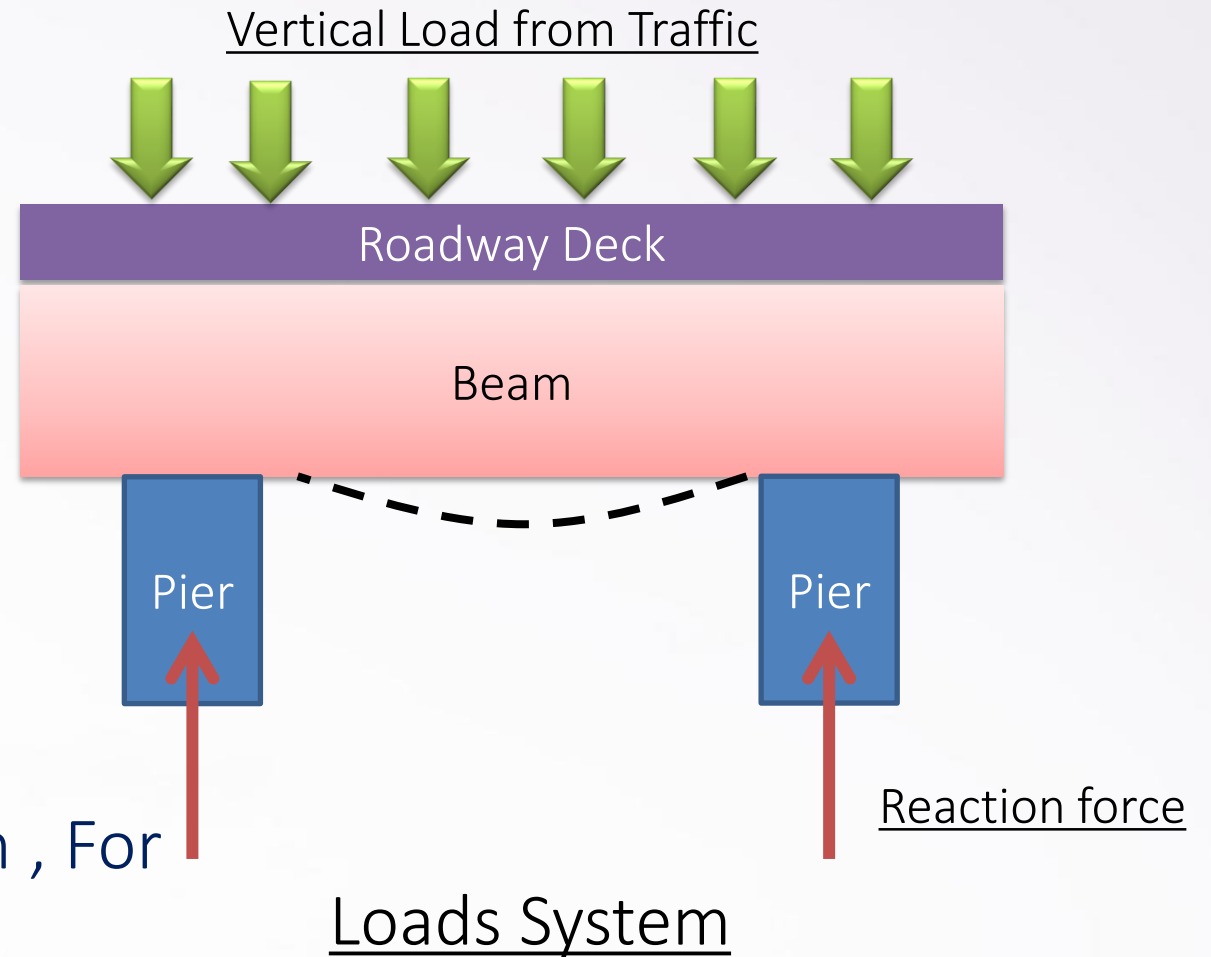
Cantilever

Continuous



Beams Type

- ☐ The most basic type of bridges
- ☐ Inexpensive to build
- ☐ Beam section (Box Girder up to 300 m , For PC Girder up to 45 m)





Upper: Steel Plate Girder Bridge
Lower: Prestressed Concrete I-Girder Bridge



Precast Pretensioned Prestressed Concrete Bridge
Simply-Supported Beam



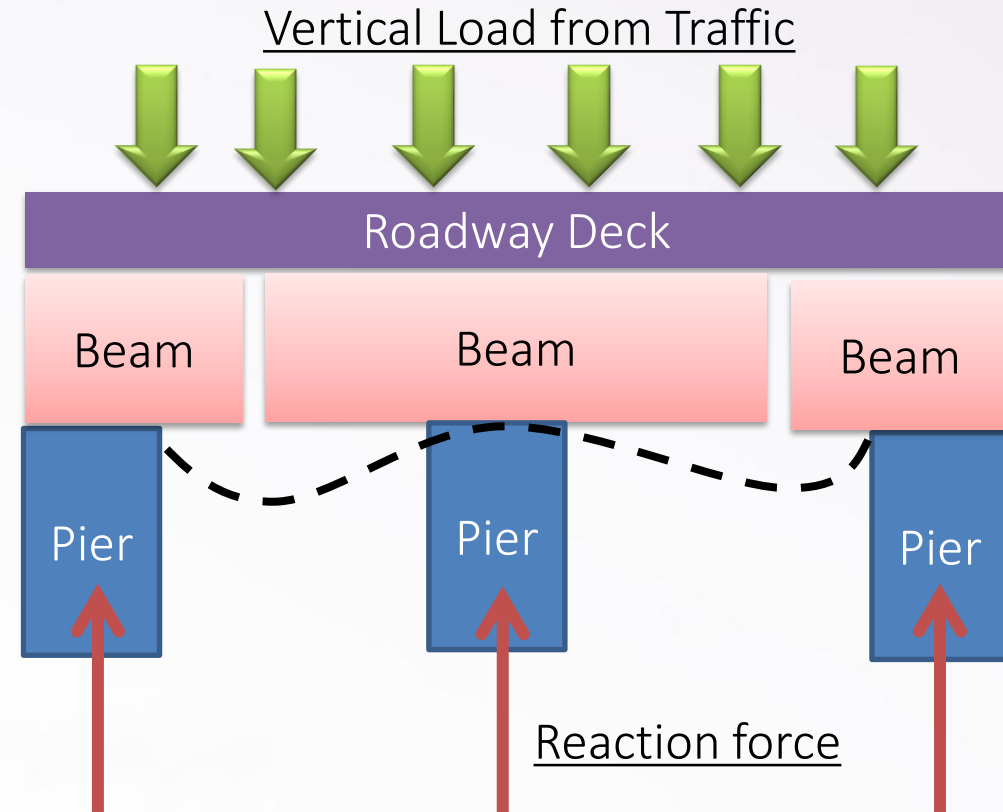
Precast segments Box Girder Bridge

Cantilever Bridge

❑ The Roadway is constructed out from the pier in two directions at the same time, So that the weight on both sides counterbalance each other

❑ Types of cantilever Bridges:

- 1- Steel Truss Cantilever.
- 2- Pre-stressed concrete Segmental Cantilever beam.



Loads System

Cantilever Bridge

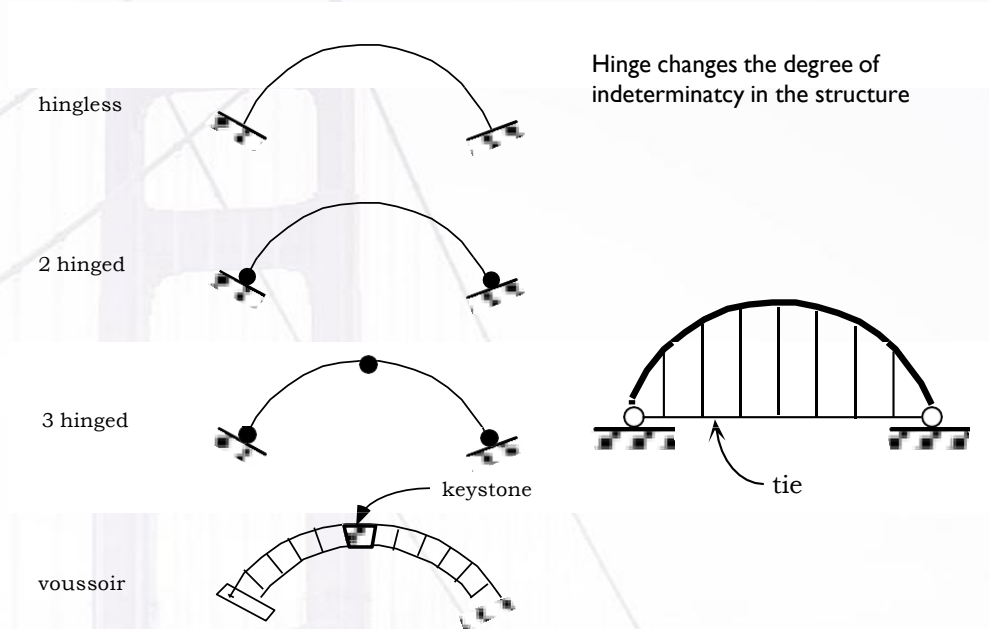


Steel Truss Cantilever Bridge



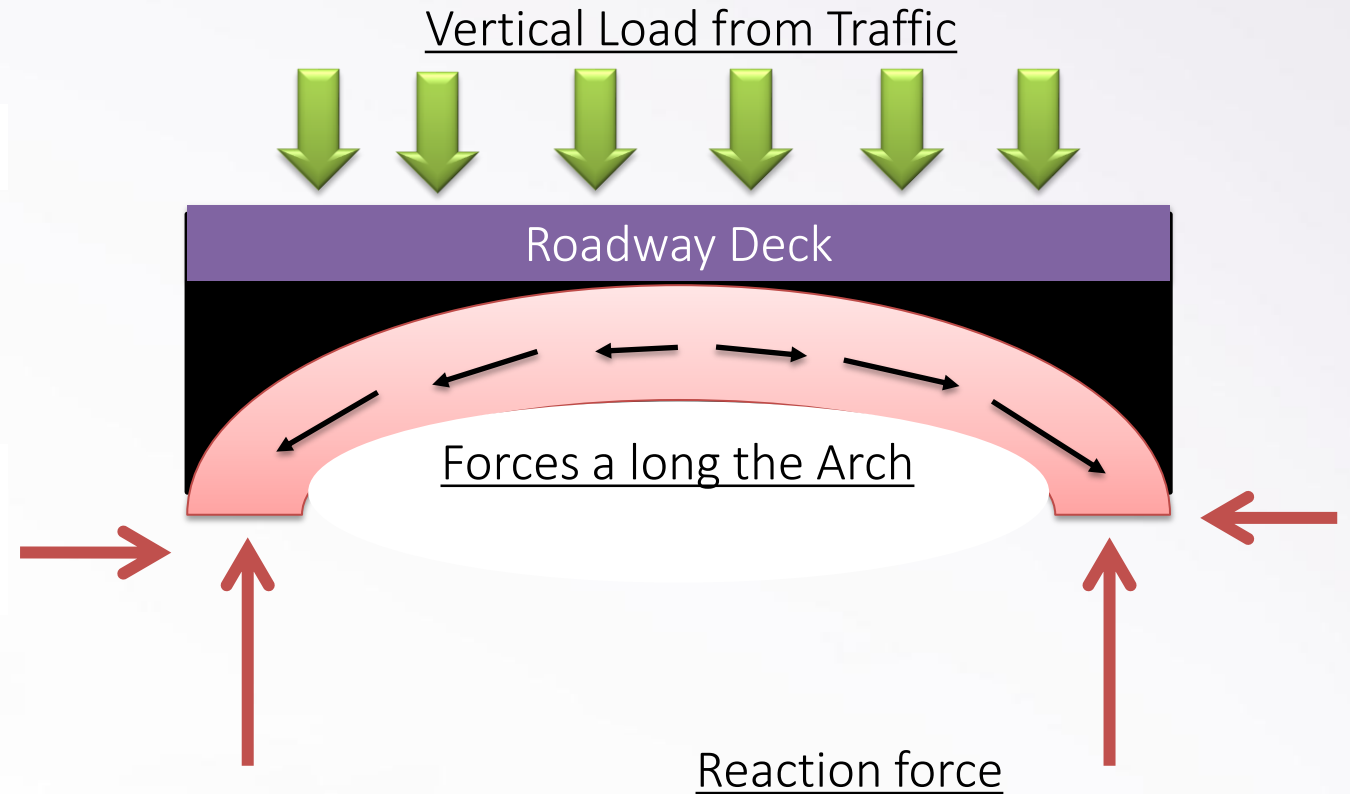
Pre-stressed concrete Segmental Cantilever Bridge

Structure Types



- ▣ Semi-circle (has vertical reaction force only)
- ▣ Flat arch (has vertical and horizontal forces at the support)
- ▣ Tied arch (tie resists tension force)

Materials: Masonry & Timber & Concrete & Steel



Loads System





Concrete

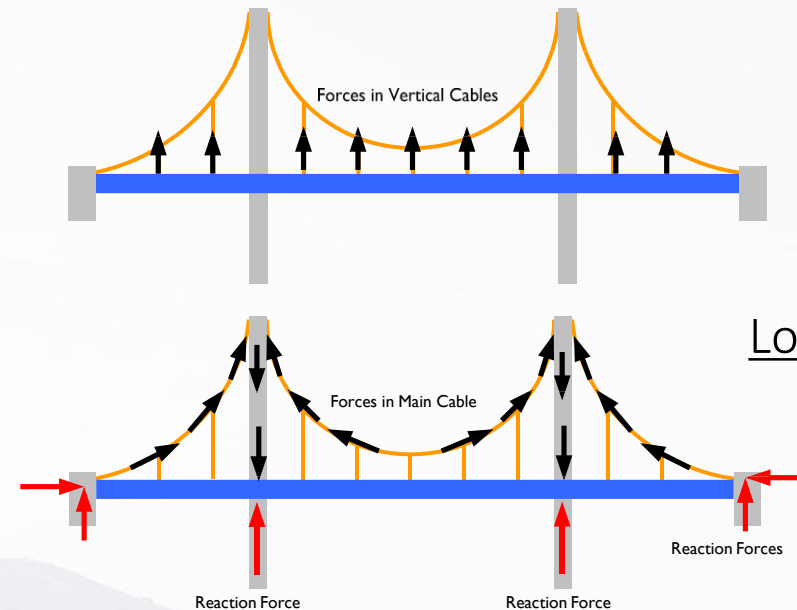
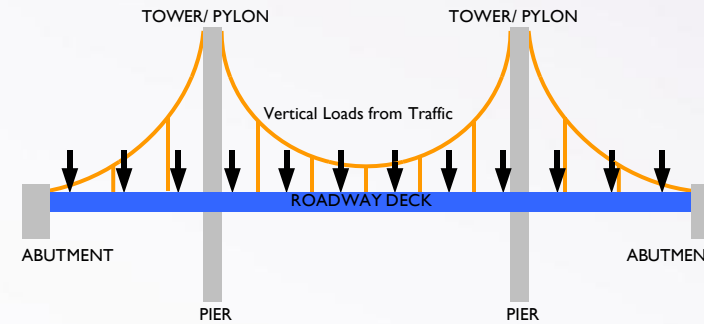
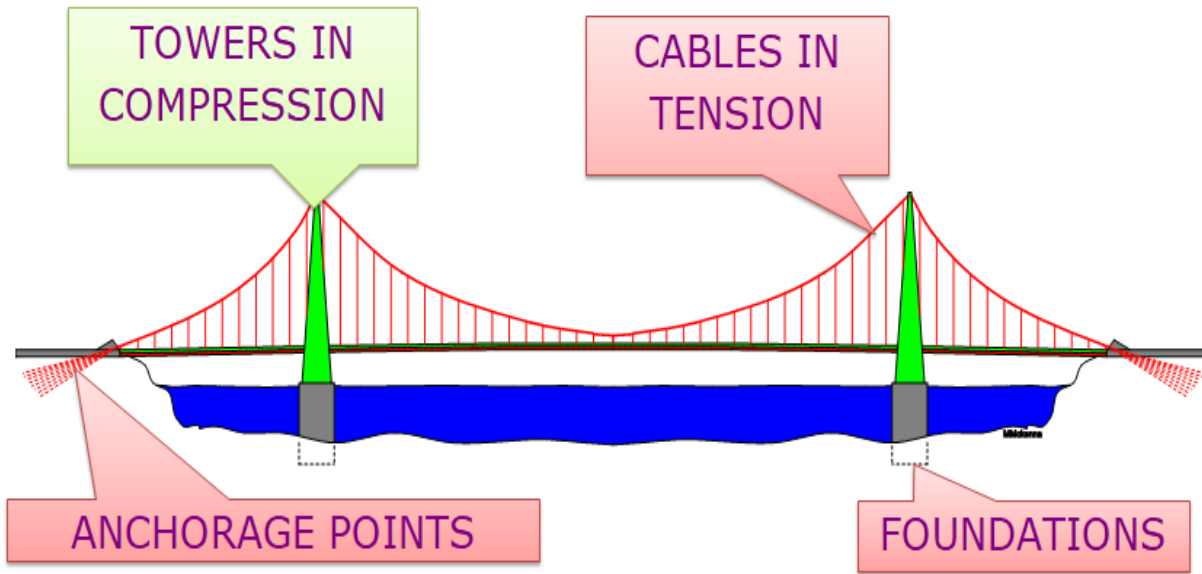


Steel

Suspension Bridge



- For span up to 300 m
- Suspension bridge needs to have very strong main cables
- Cables are anchored at the abutment
→ abutment has to be massive





Suspension Bridge

جسر جنق قلعة ١٩١٥

جسر جنق قلعة ١٩١٥

تركيا - بحر مرمرة - محافظة جنق قلعة

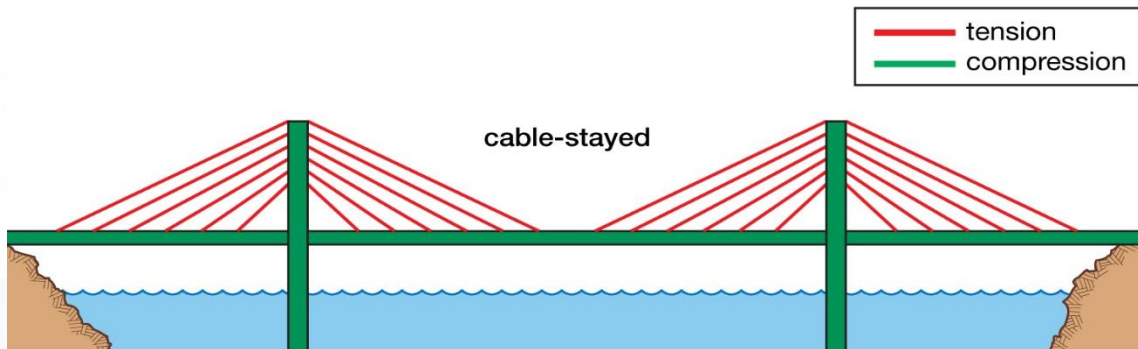
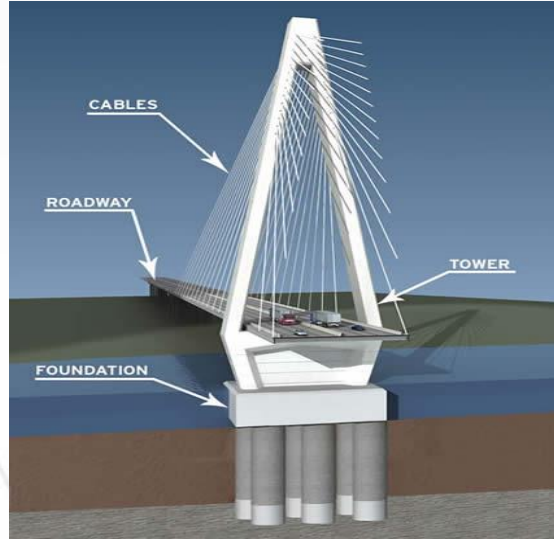
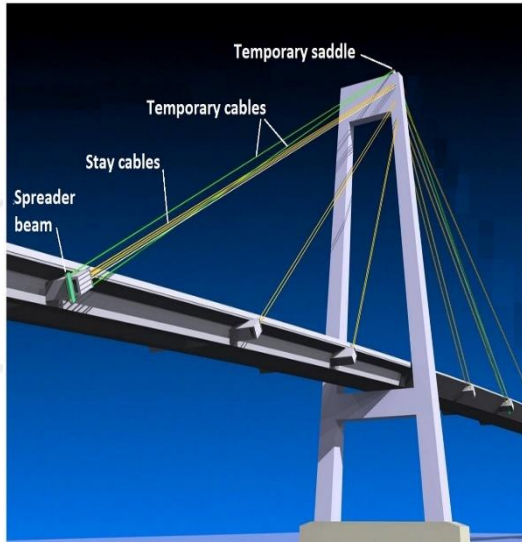
أطول الجسور المعلقة في العالم
متفوقا على جسر أكاشي كايكو في
طوكيو بـ ٣٢ م

اجمالي الطول ٤٦٠٨ م

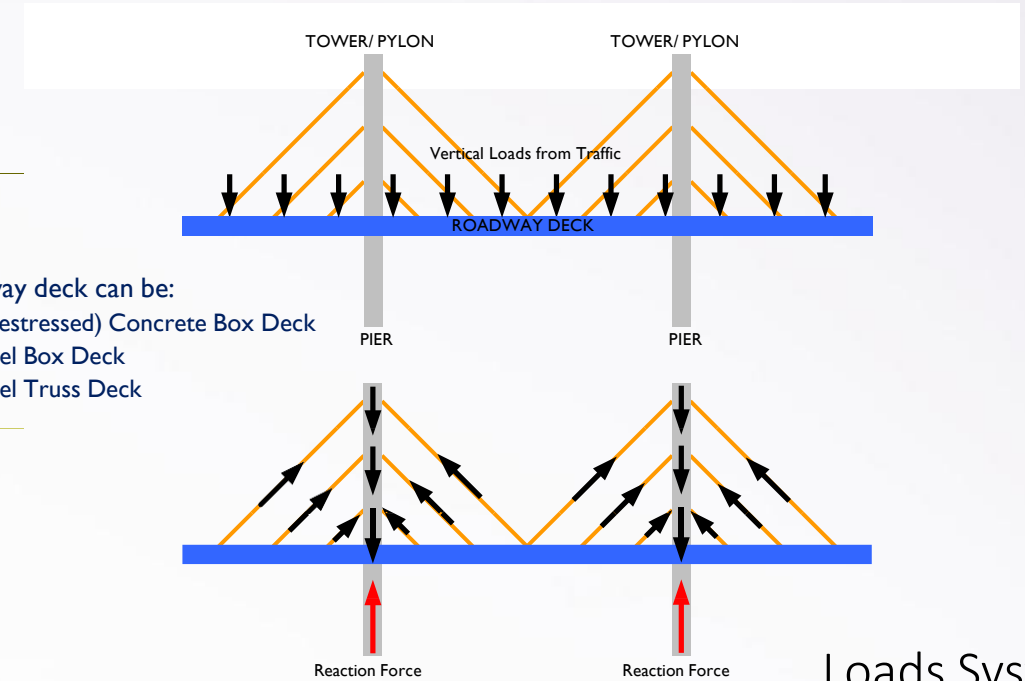
المسافة بين الركائز ٢٠٢٣ م



Cable-Stayed Bridge



Components



□ Roadway deck can be:

- (Prestressed) Concrete Box Deck
- Steel Box Deck
- Steel Truss Deck

- Cable-stayed bridge uses the prestressing principles but the prestressing tendons are external of the beam
- All the forces are transferred from the deck through the cables to the pylon

□ For span > 150 m

<https://structurae.net/en/structures/bridges/three-span-cable-stayed-bridges>



Rod Alfarq - Egypt



Russky Bridge - Russia

Cable-Stayed Bridge

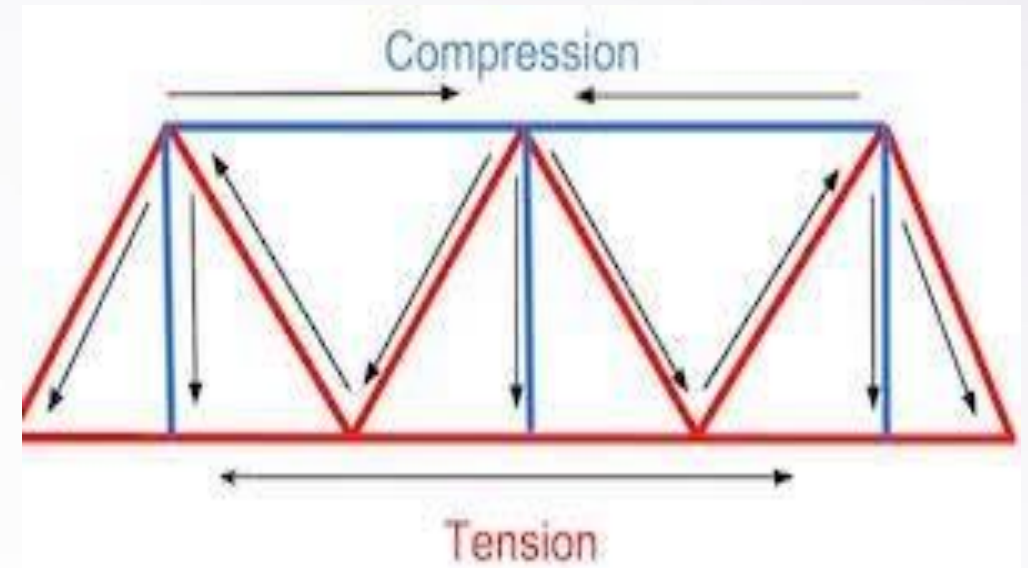


A **truss bridge** is a [bridge](#) whose load-bearing [super structure](#) is composed of a [truss](#), a structure of connected elements, usually forming triangular units

There are many types, some of them dating back hundreds of years.

Some of the more common designs:

- | | |
|--------------------|---------------------|
| 1- Allan truss. | 7- Brunel truss |
| 2- Bailey Truss | 8- Burr arch truss |
| 3- Baltimore truss | 9- Cantilever truss |
| 4- Bollman truss | 10- Fink truss |
| 5- Bowstring truss | 11- Howe truss |
| 6- Brown truss | 12- K- truss |





Allan truss Bridge



Bailey truss Bridge



Baltimore truss Bridge



Bollman truss Bridge



Bowstring truss Bridge



Brown truss Bridge



Brunel truss Bridge



Burr arch truss Bridge



Cantilever truss Bridge



Fink truss Bridge



Howe truss Bridge



K- truss Bridge

THANK you



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