Mustansiriyah University
College of Engineering
Highway & Transportation Department
4th Year Stage/ Lecture Notes
Subject Code: HTE403

Bridges Engineering

(SI Units)

Asst. Prof. Awadh E. Ajeel

Dr. Ahmed Hassan

2023-2024

1. Introduction to Bridges

1.1. Define of Bridge

A bridge is a construction made for carrying road traffic or other moving loads to pass through an obstacle or other constructions. As well as the interchanging to mitigate congestion delays at busy traffic intersections instead of using optical signals. Thus, the bridge is the key element in a transportation system.

1.2. Types of Bridges

Bridges can be classified according to its own properties into:

- Usage or functionality (pedestrian, highway, railway, aqueduct, viaduct, equipment, pipeline).
- Construction material (wood, stone, brick, concrete, steel, composite).
- Span life (temporarily, permanent, semi-permanent).
- Span length (short [< 50 m], medium [50 - 200 m], long [> 200 m]).
- Span arrangement (simple, cantilever, continuous).
- Horizontal arrangement (straight, skewed, curved).
- Vertical arrangement (flat, inclined).
- Movement (movable, fixed)
- Structural system (slab, beam, portal frame, arch, truss, cable-stayed, suspension).

Table 1.1: Typical Span Length for Various Types of Superstructures

Structural Type of Bridge	Material of Construction	Range of Spans (m)
Slab	Concrete	6 – 12
Beam	Concrete	12 – 300
	Steel	30 – 300
Arch	Concrete	90 – 420
	Steel	240 – 550
Truss	Steel	90 – 550
Cable Stayed	Steel	90 – 1100
Suspension	Steel	300 – 2000

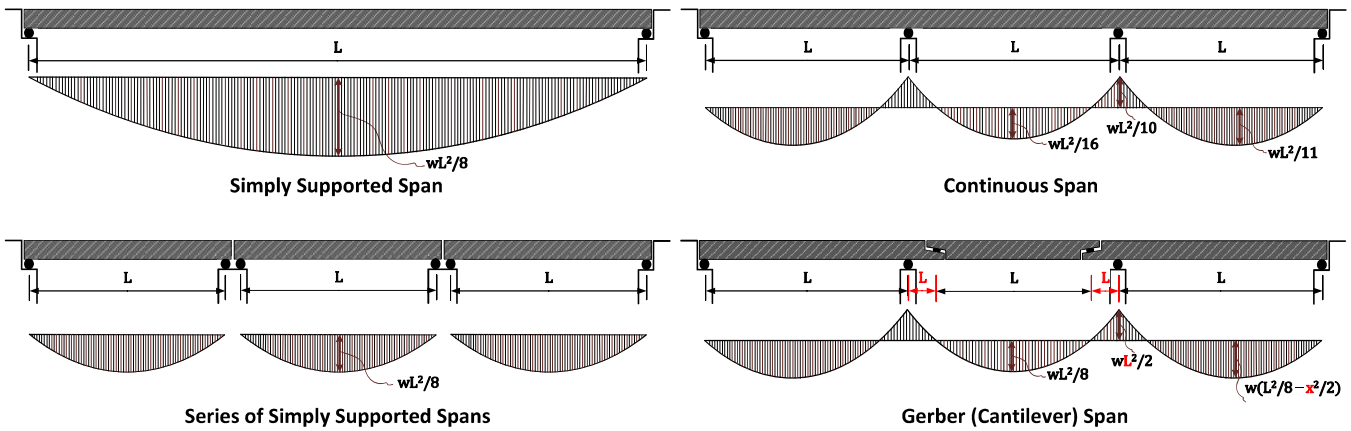
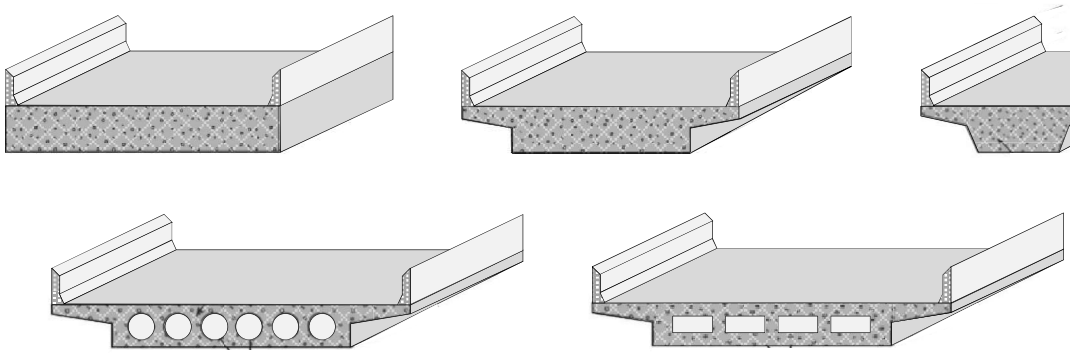


Figure 1.1: Supporting for Superstructures

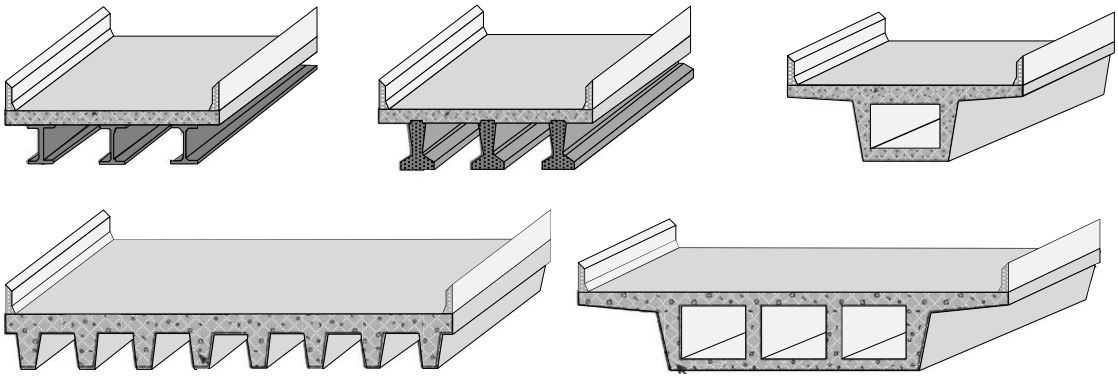
(Elevation)



(Section)

Figure 1.2: Slab Bridge

(Elevation)



(Section)

Figure 1.3: Beam Bridge

Figure 1.4: Arch Bridge

Figure 1.5: Truss Bridge

Figure 1.6: Cable Stayed Bridge

Figure 1.7: Suspension Bridge

1.3. Components of Bridge Structures

A bridge structure, regardless of the type and span length, consists of two major structural parts: ***superstructure*** and ***substructure***.

- ***Superstructure***: to cross over obstacle or traffic interchange. It consists of:
  - Bridge deck (slab which vehicles move on) including the sidewalks and traffic barriers (curbs, parapets, barrier, and railings) as well expansion joints to eliminate thermal strains effects.
  - Horizontal framing which supports the deck and consists of longitudinal and transverse beams (girders and diaphragms).
- ***Substructure***: to transfer the bridge loads into the soil. It consists of:
  - Bearing pads which are vibration isolators support the ends of longitudinal girders over the abutments, piers, and bents (pier cap).
  - Abutments and wing walls.
  - Columns (piers).
  - Foundation (spread footings, Piles).

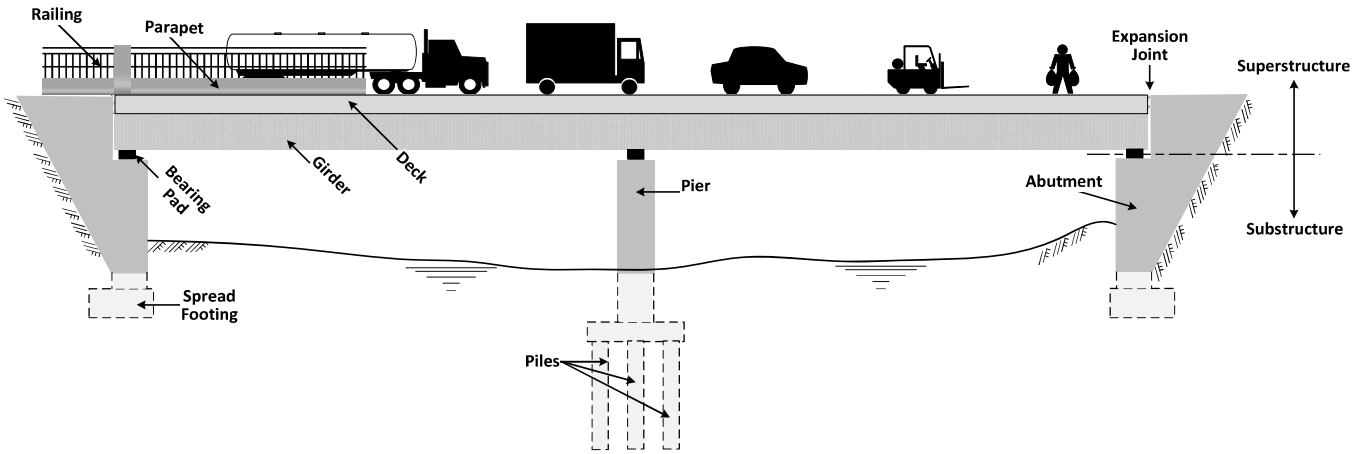


Figure 1.8: Typical Components of Beam Bridges

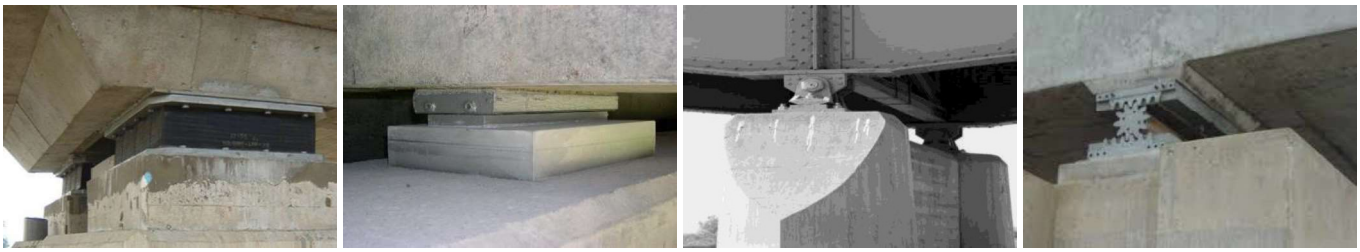


Figure 1.9: Typical Bearing System of Bridges

Figure 1.10: Typical Expansion Joints of Bridges