



Fundamentals of Bridge Design
Lecture I

Introduction and Type of Bridges

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Outline

- Introduction
- Components of Bridge
- Bridge Terminologies
- Layout of Bridge
- Waterway and Afflux

What is a bridge?

- Merriam-Webster Dictionary

  Bridge = Structure carrying a pathway or roadway over a depression or obstacle

- American Association of State Highway and Transportation Officials (**AASHTO**)

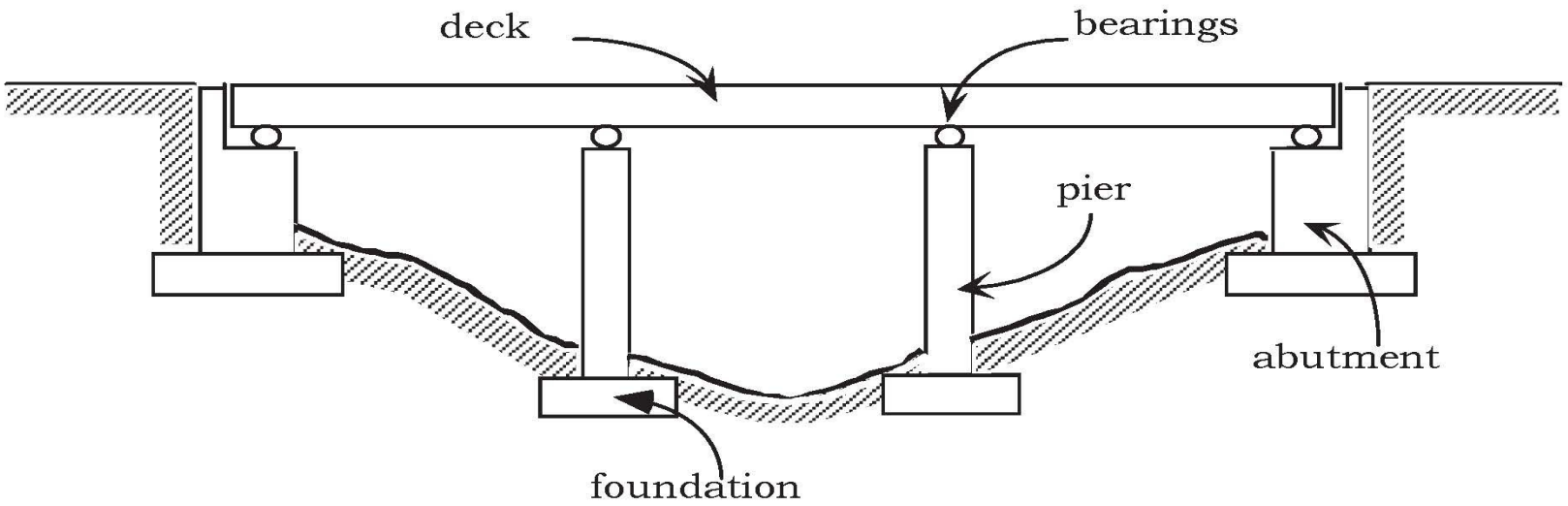
  Bridge = Any structure having an opening not less than 6100 mm (20ft) that forms part of a highway or that is located over or under a highway

- *Anything smaller is just a culvert*

- **A bridge is a key element in a transportation system for three reasons:**
  - It likely controls the capacity of the system
  - It is the highest cost per mile of the system
  - If the bridge fails, the system fails

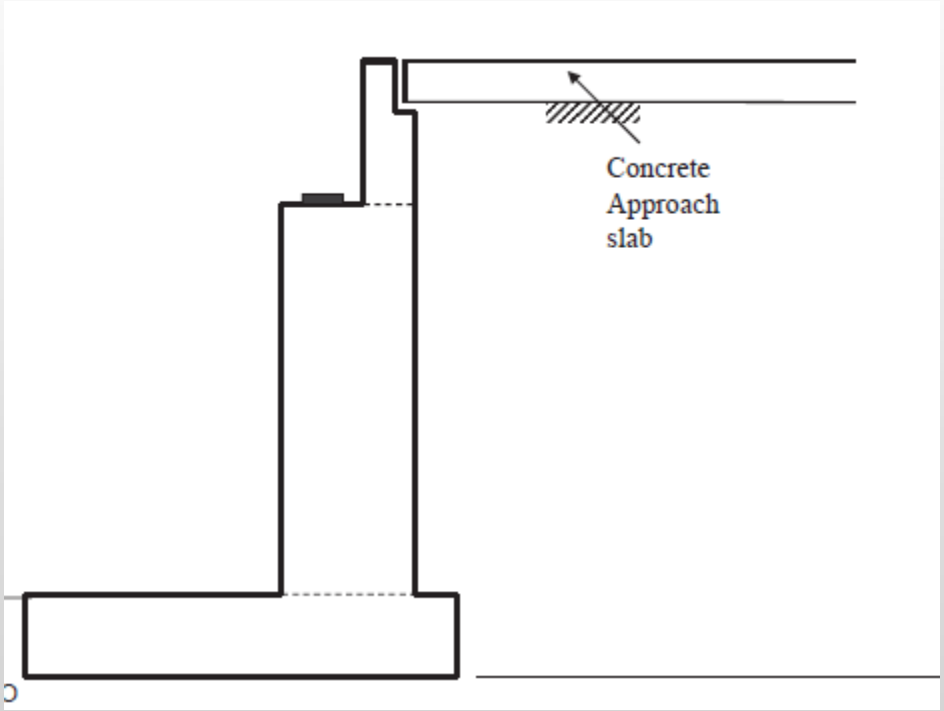
Components of Bridge

- Substructure
  - Foundation (Pile/ Spread Footing)
  - Pier (Column)
  - Abutment
- Superstructure
  - Any structures above bearing which support the roadway
  - Wearing Surface



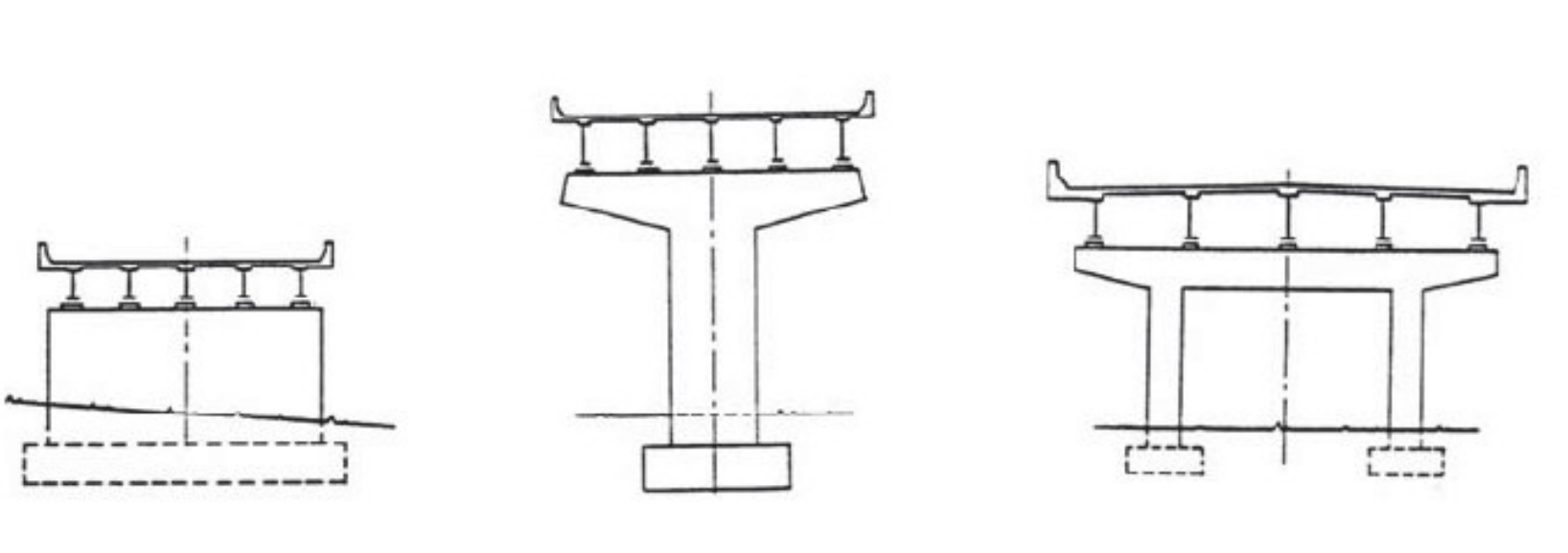
Bridge Terminologies

I. **Approach**: It is a part of a bridge length wise to the communication route at the ends of the bridge. It can be either a part of the bridge or a separated small bridge



Bridge Terminologies

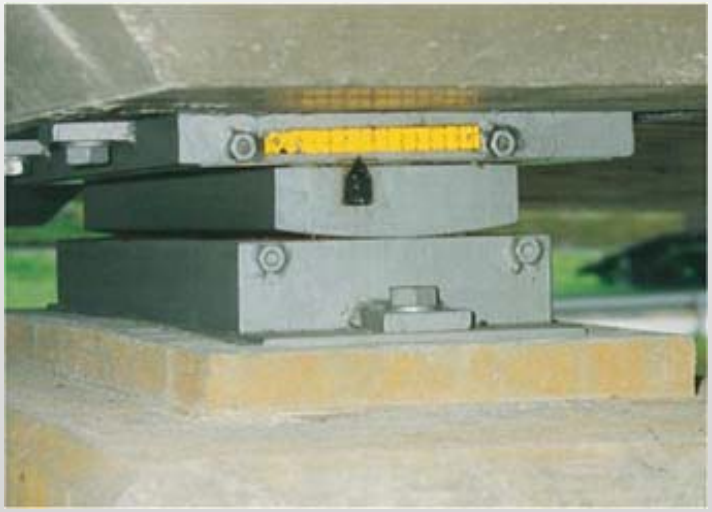
II. **Piers:** are structural elements, which sustain superstructure dead and live loads, carry their own weight and transmit all loads to the foundation soil. They are constructed of masonry or reinforced concrete.



Bridge Terminologies

III. **Bearings**: is a structural device positioned between bridge superstructure and substructure

- Roles of Bearing:
  - Transmit load from superstructure to substructure
  - Accommodate relative movements between superstructure and substructure





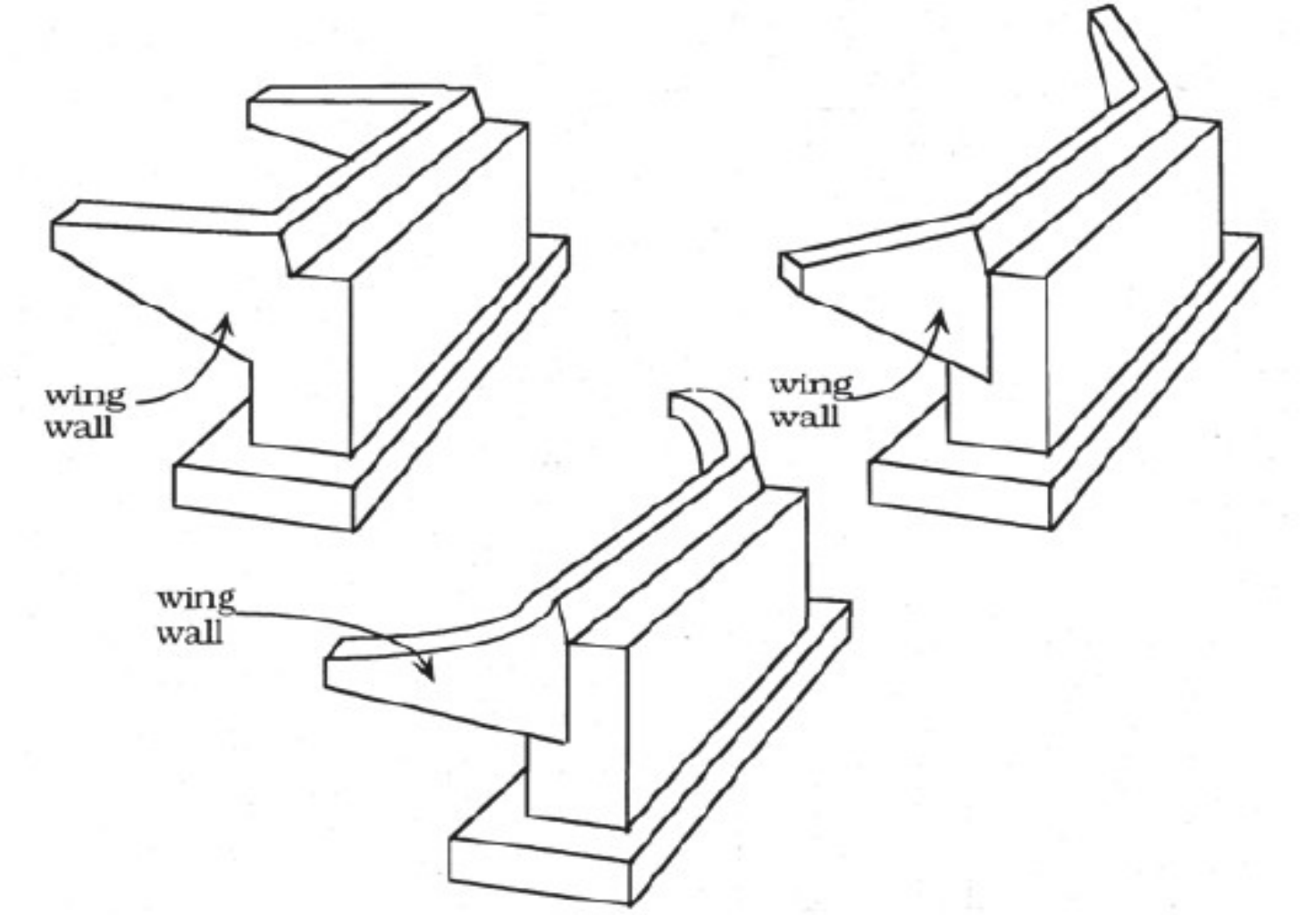
Bridge Terminologies

IV. **Abutments**: are particular types of walls (retaining walls) that support the end of a bridge superstructure. They resist loads from the bridge superstructure & earth pressure.

IV. **Wing Walls**: is a wall constructed at both sides of the abutment and used as:

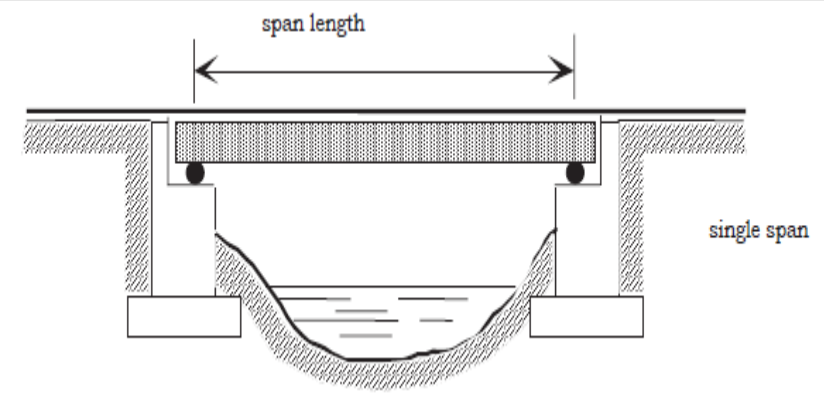
- To retain the lateral earth pressure.
- To guide the direction of the river flow.
- To prevent erosion of the bank of the river and the abutment.

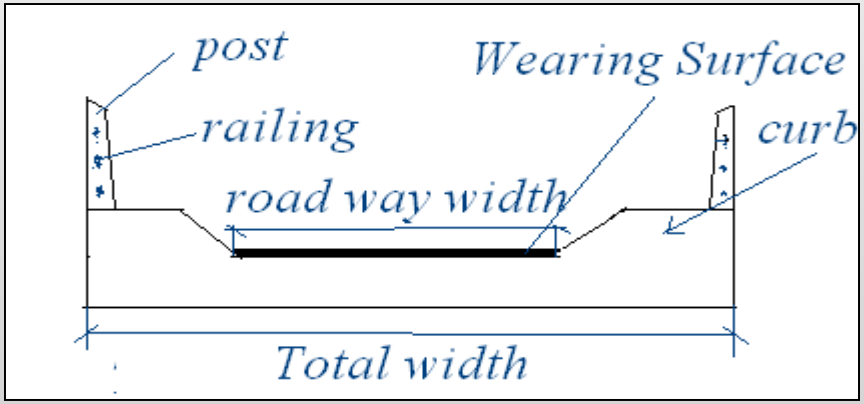
Abutment and Wing wall



Layout of Bridge

- **Free (clear) span**: perpendicular face to face distance between supported components
- **Span Length**: is the distance between the centers of bearings
- **Total width of a bridge**: is defined as the distance between the inside of the railings including walkways.





- The width of bridge for different number of lanes

Application	Width(m)
Two –lane in “urban” area	10.30
Two-lane in “Rural” area	7.30
Singe lane	4.20
Pedestrian	3.0

Waterway and Afflux

- **Waterway**: area through which the water flows under the superstructure of the bridge.
- **Natural waterway**: unobstructed area of the river.
- **Linear waterway**: the width of the water surface measured from edge to edge along the design high flood level.
- **Waterway afflux**: the vertical increase of water due to vertical supports.
- **Freeboard**:-The vertical distance between the crown and the level of the bottom of the girder.

- Free board above the MWT should not be less than

Discharge Q(m^3/s)	Vertical Clearance (m)
0-3.0	0.3
3.0-30.0	0.6
30.0-300.0	0.9
>300.0	1.2

- These should be increased for large floating debris or for navigational requirements.
- **Vertical clearance**-the height above roadways. (Min 5.3m)

The End