



# **SNS COLLEGE OF TECHNOLOGY**

**AN AUTONOMOUS INSTITUTION**

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COIMBATORE**

## **DEPARTMENT OF CIVIL ENGINEERING**

**19CET304-DESIGN OF STEEL STRUCTURES**

**III YEAR / VI SEMESTER**

### **Unit 5 :Plate Girder**



# Introduction

- A plate girder is a type of steel beam commonly utilized in constructing bridges.
- Plate girders are suitable for carrying heavy loads due to their increased depth and stiffness compared to other beam types.









# Plate Girders Definition

Plate girders are structural elements commonly used in bridge construction, industrial buildings, and other large structures.

They consist of welded steel plates that form a deep, rectangular section capable of supporting heavy loads.

Plate girders offer several advantages, including their high strength-to-weight ratio and flexibility in design.

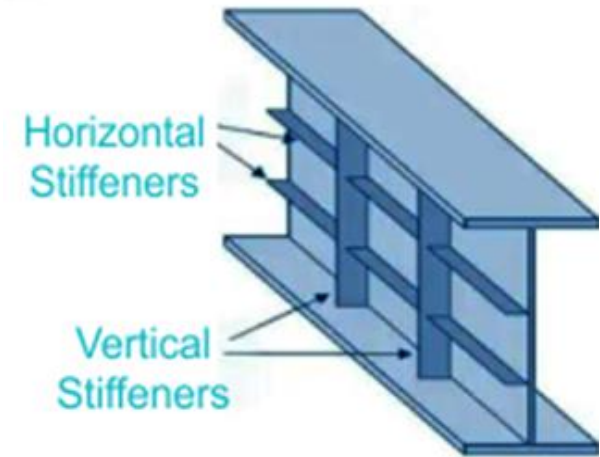
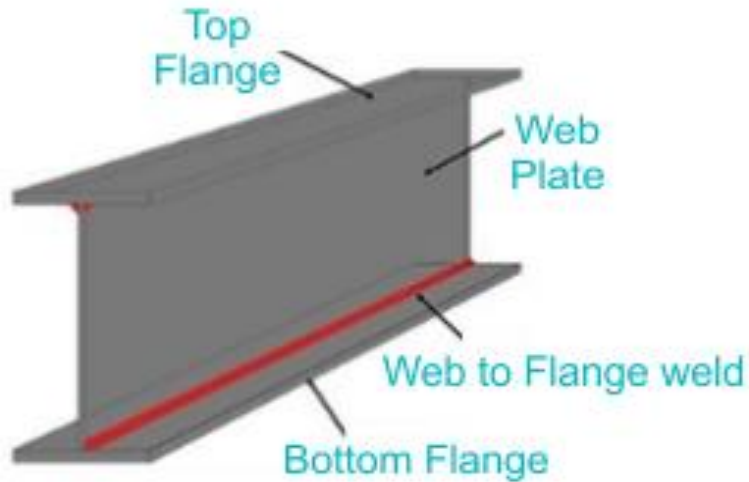


# What are Plate Girders?

- Plate girders in steel structures are built-up beam sections designed to support massive vertical loads over long spans with bending moments greater than the moment resistance of readily available rolled sections.
- The plate girder is a built-up beam composed of two flange plates fillet welded to a web plate to form an I-section.
- A typical plate girder diagram depicting its components is shown below.



# Components of Plate Girder





# Components of Plate Girders

- Web: Resists shear forces.
- Flanges: Top (compression) and bottom (tension) resist bending moments.
- Stiffeners: Prevent buckling; vertical and horizontal types.

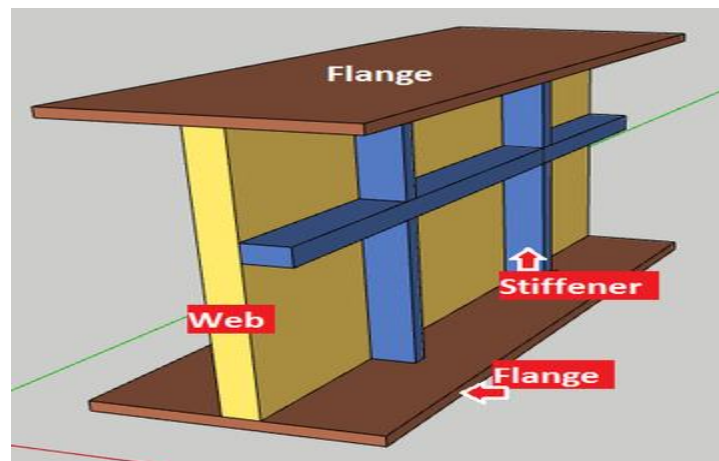




# Components of Plate Girder

## 1. Web

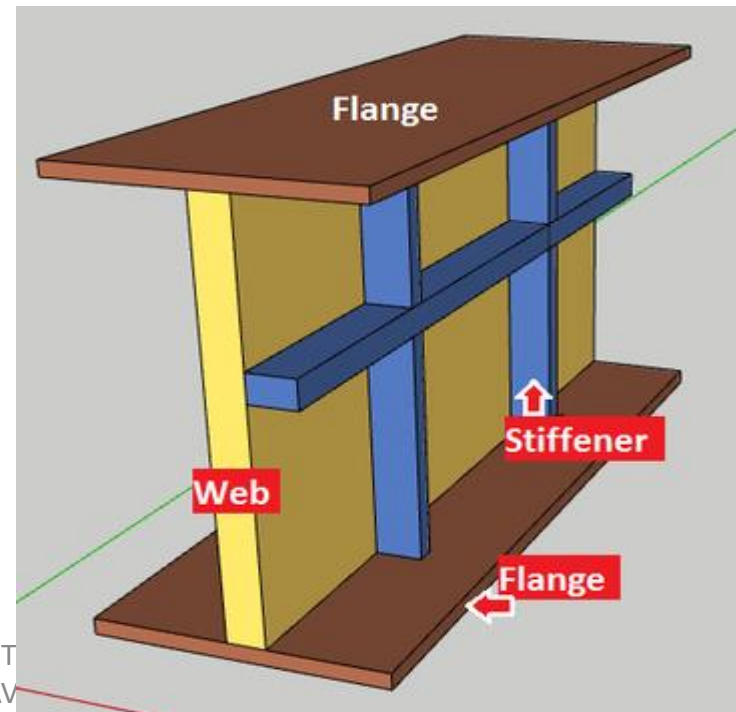
- **Function:** Resists **shear forces**.
- **Description:** The vertical plate that forms the main body of the girder.
- **Design Tip:** Often slender; stiffeners may be added to prevent buckling.





## 2. Flanges

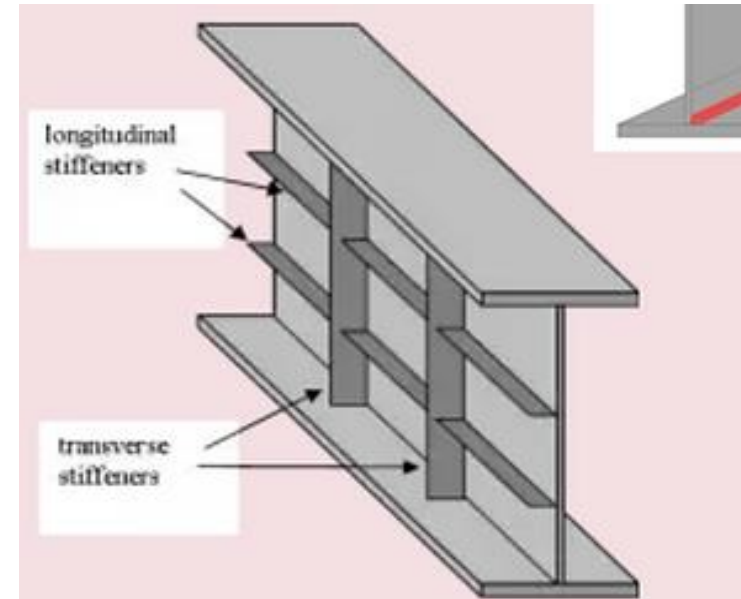
- **Function:** Resist **bending moments**.
- **Description:** Horizontal plates attached to the top and bottom of the web.
- **Design Tip:** Most of the girder's strength in bending comes from the flanges.





### 3. Stiffeners

- Used to reinforce the web and prevent buckling under load.
- **a. Transverse (Vertical) Stiffeners:**
  - Positioned vertically.
  - Resist shear buckling and support bearing at supports or concentrated loads.
- **b. Longitudinal (Horizontal) Stiffeners:**
  - Positioned horizontally.
  - Used when the web is very deep to resist local web buckling.





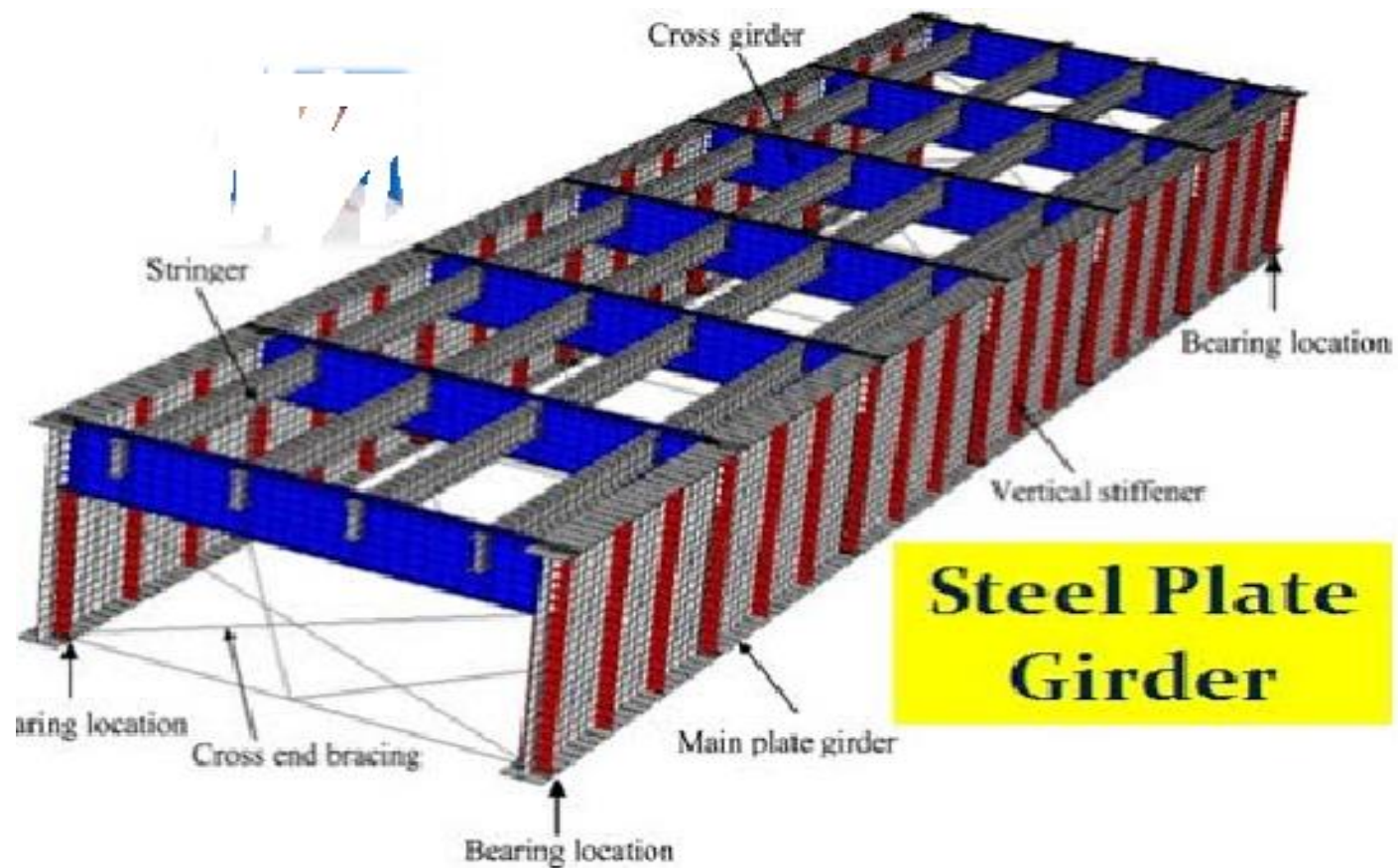
## 4. End Bearing Stiffeners

- Located at the supports.
- Transfer bearing loads directly to the flanges and web

## 5. Connection Elements

- **Bolts, welds, or rivets** that connect web to flanges and attach stiffeners.
- Critical for structural integrity





## Steel Plate Girder

# Types of Stiffeners

- Vertical Stiffeners:
  - End Stiffeners (Bearing Stiffeners)
  - Intermediate Stiffeners
- Horizontal Stiffeners:
  - Continuous and discontinuous
  - Increase web buckling strength

# Splices and End Connections

- Splices: Join flange or web plates for longer spans
- End Connections: Transfer loads to supports; typically with stiffeners

# Types of Plate Girders

## Riveted Plate Girders:

- They are connected by a mechanical method, [riveted](#), and plates are not welded together.
- In general, the web carries 90% of the shear acting on the riveted plate girders.
- The angle section riveted to the flange stabilises the connection between the web and the flange. Rivets must be designed to withstand horizontal shear.
- The rivets that connect the web and flange angles must be designed for horizontal shear and vertical loads that are applied to the flange when they transfer to the web



# Types of Plate Girders

## **Welded Plate Girders**

- o Welded plate girders are the most commonly used type of girder in construction due to their ease of manufacture and efficiency.
- o These sections are primarily used in the construction of bridges. The plate girder bridge is extremely stiff and can withstand extremely high loads while resisting lateral movements. This action is visible on railway bridges. Welded Plate Girders are also used to create box type girders.
- o There are empirical or approximation methods for determining the overall height, flange and web thickness of the welded plate girder.

# Advantages of Plate Girders

- They can transfer heavy loads.
- They have greater stability.
- Resistance to fatigue failures is high.
- When compared to truss bridges, they are simpler to build.
- Maintenance of the plate girders is simple.
- They facilitate speedy construction.

# Disadvantages of Plate Girders

- They are not suitable for supporting large spans.
- Architectural appearance is reduced by using plate girders.
- It becomes a little difficult to manage during the placement of the plate girders.
- The design must be strictly followed during production.

# Applications of Plate Girders

- Road and railway bridges
- Box and beam bridges
- Cranes and lifting structures
- Oil & gas platforms, ships, gantries