Reinforced Concrete Road Bridges

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Lecture-16

Overview

Reinforced Concrete T Beam Bridges

Reinforced Concrete T Beam Bridges

- The RCC T-beam bridge is the most commonly adopted type in the span range of 10 to 25m.
- The structure is so named because the main longitudinal girders are designed as T-beams integral with part of the deck slabs, which is cast monolithically with the girders
- RCC T-beam of span 20 m is very common

Different components of RCC T Beam Bridge

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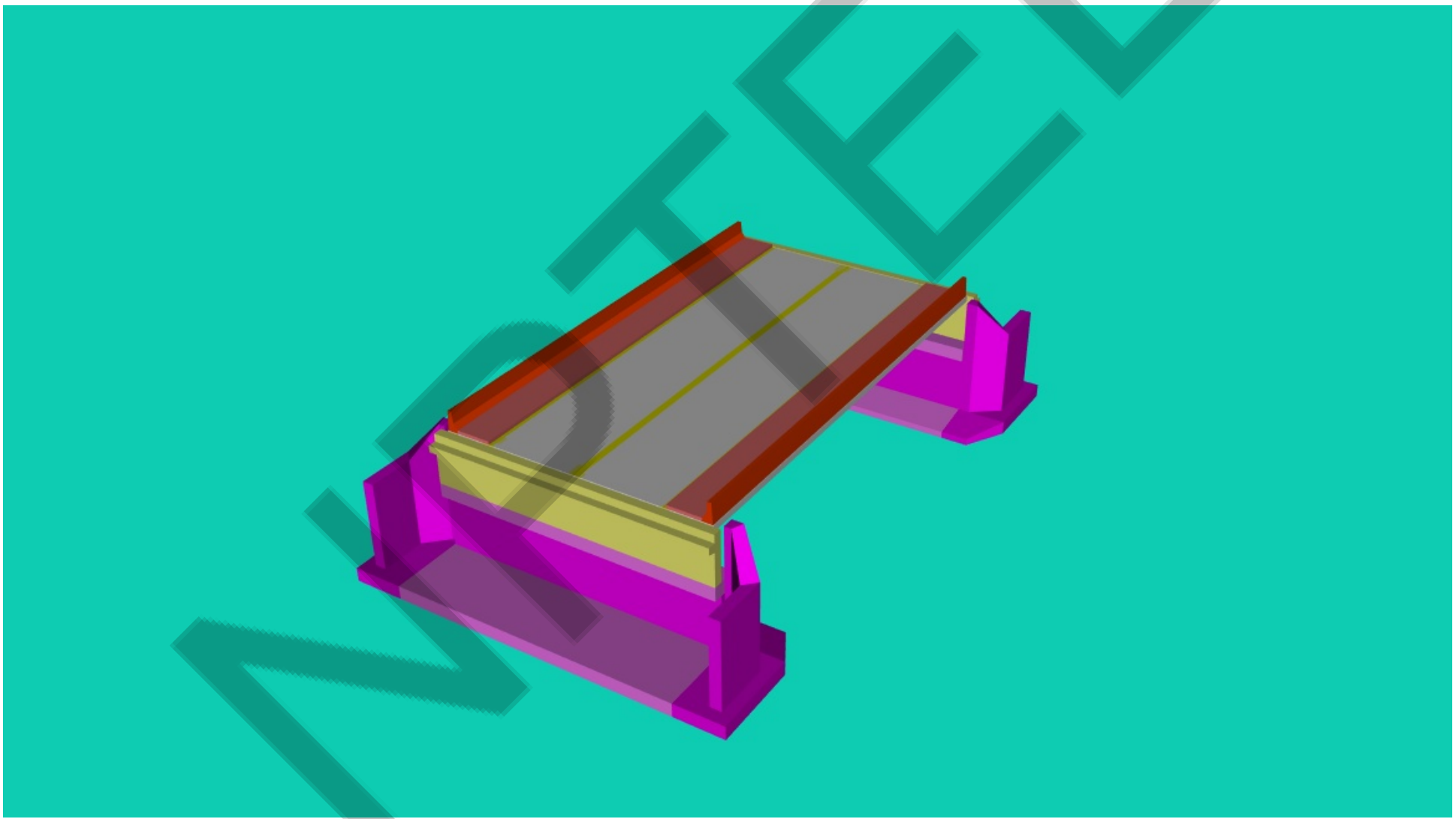
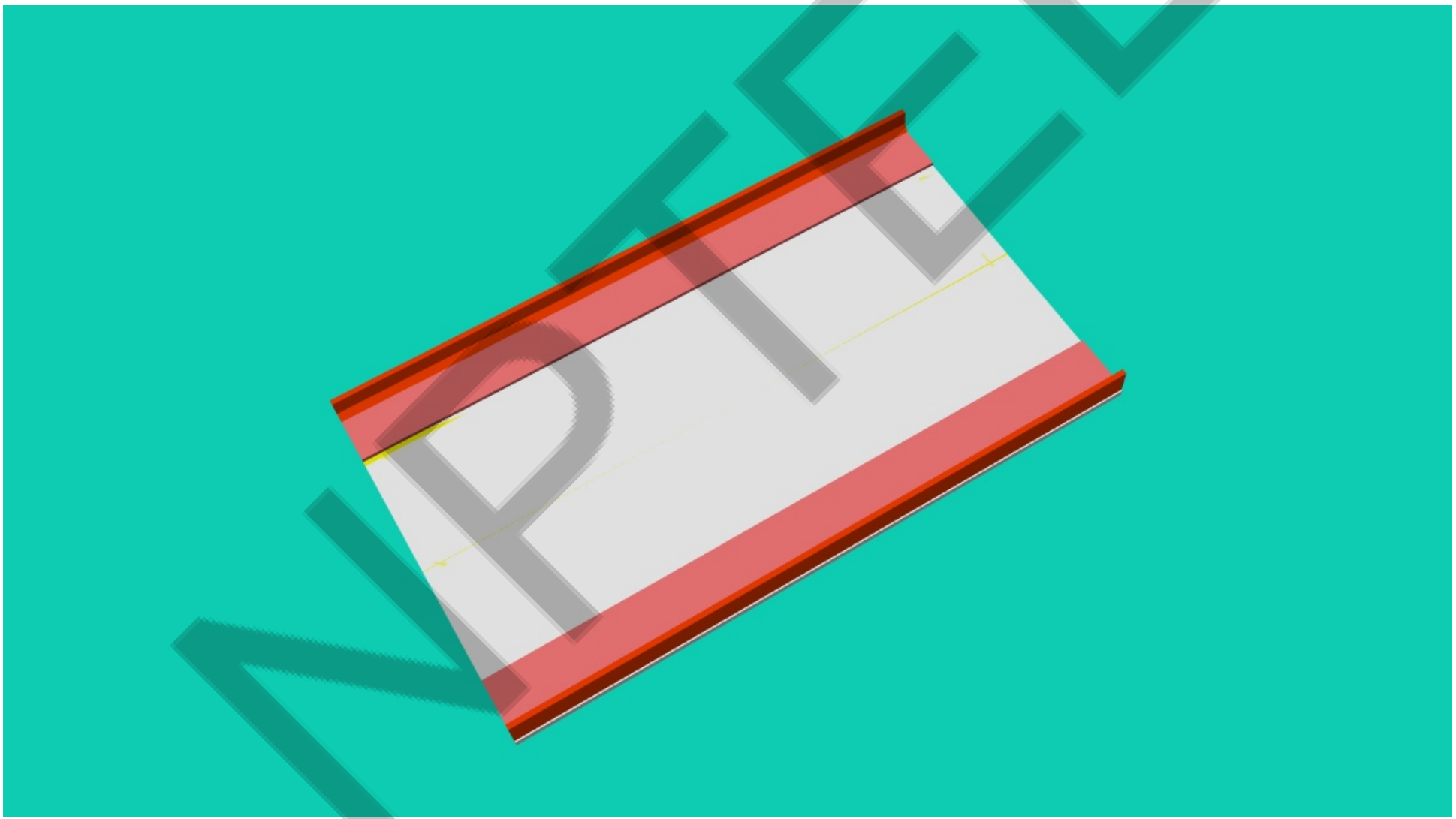
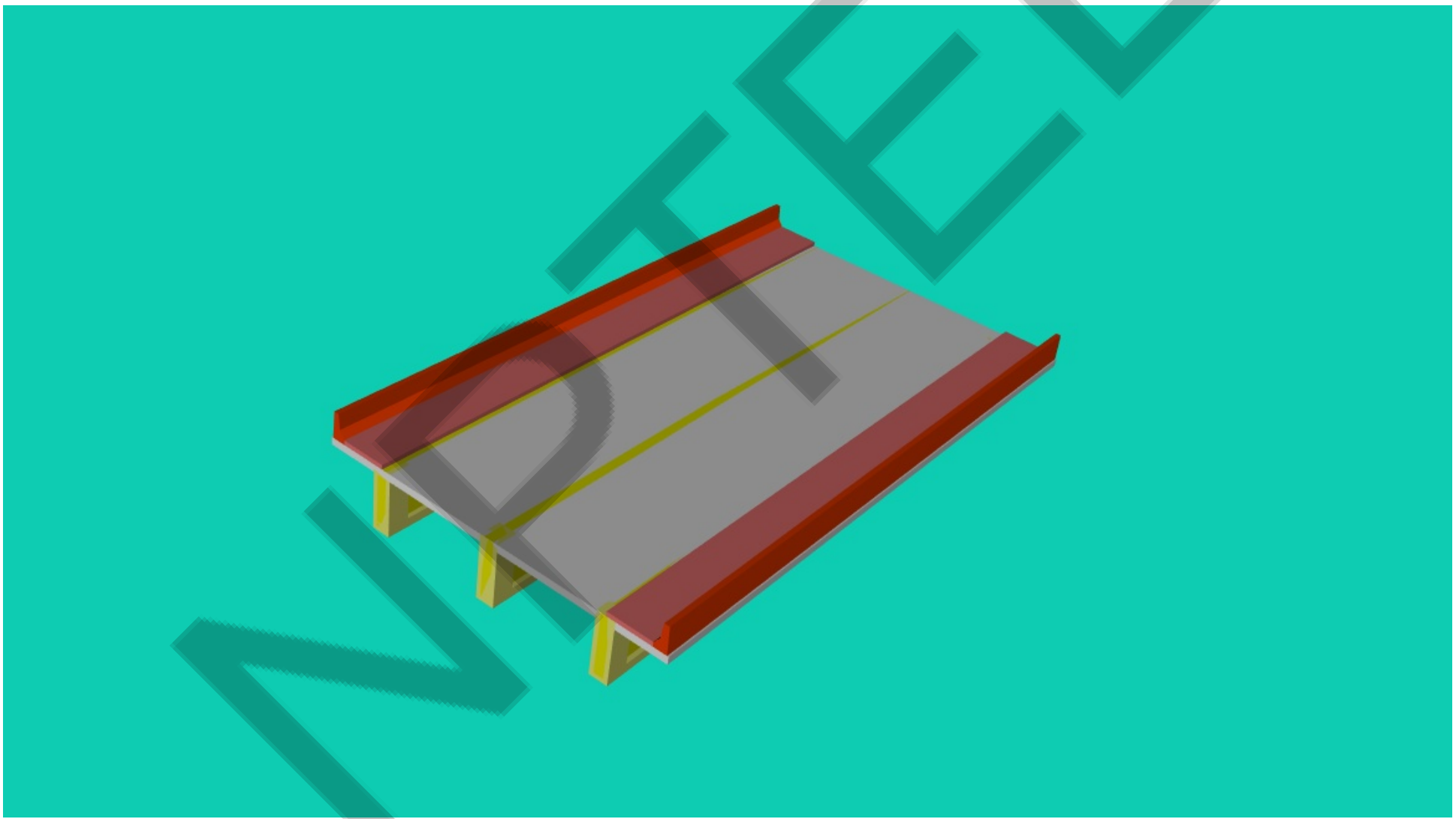


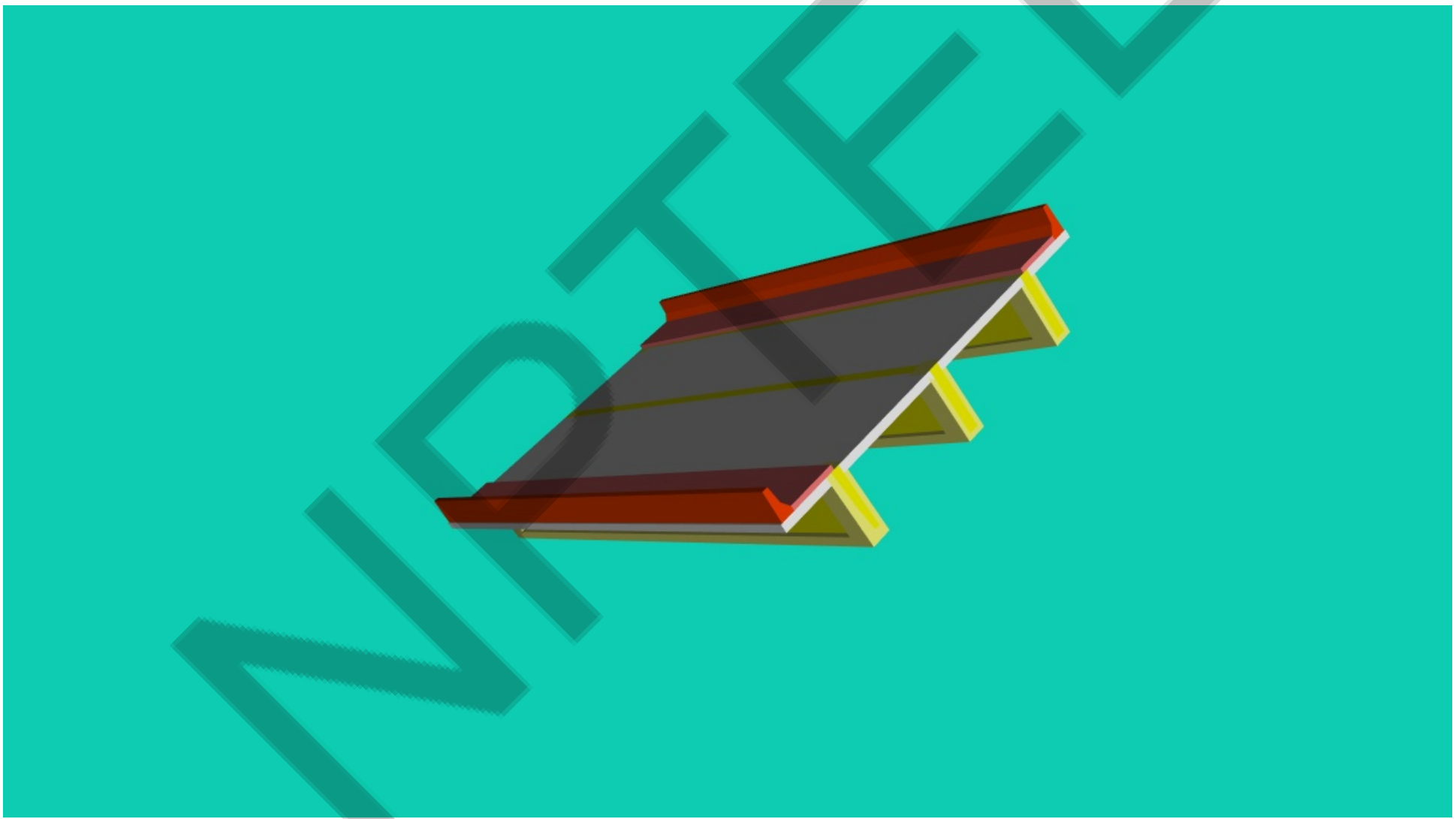
Different components of RCC T Beam Bridge



Different components of RCC T Beam Bridge

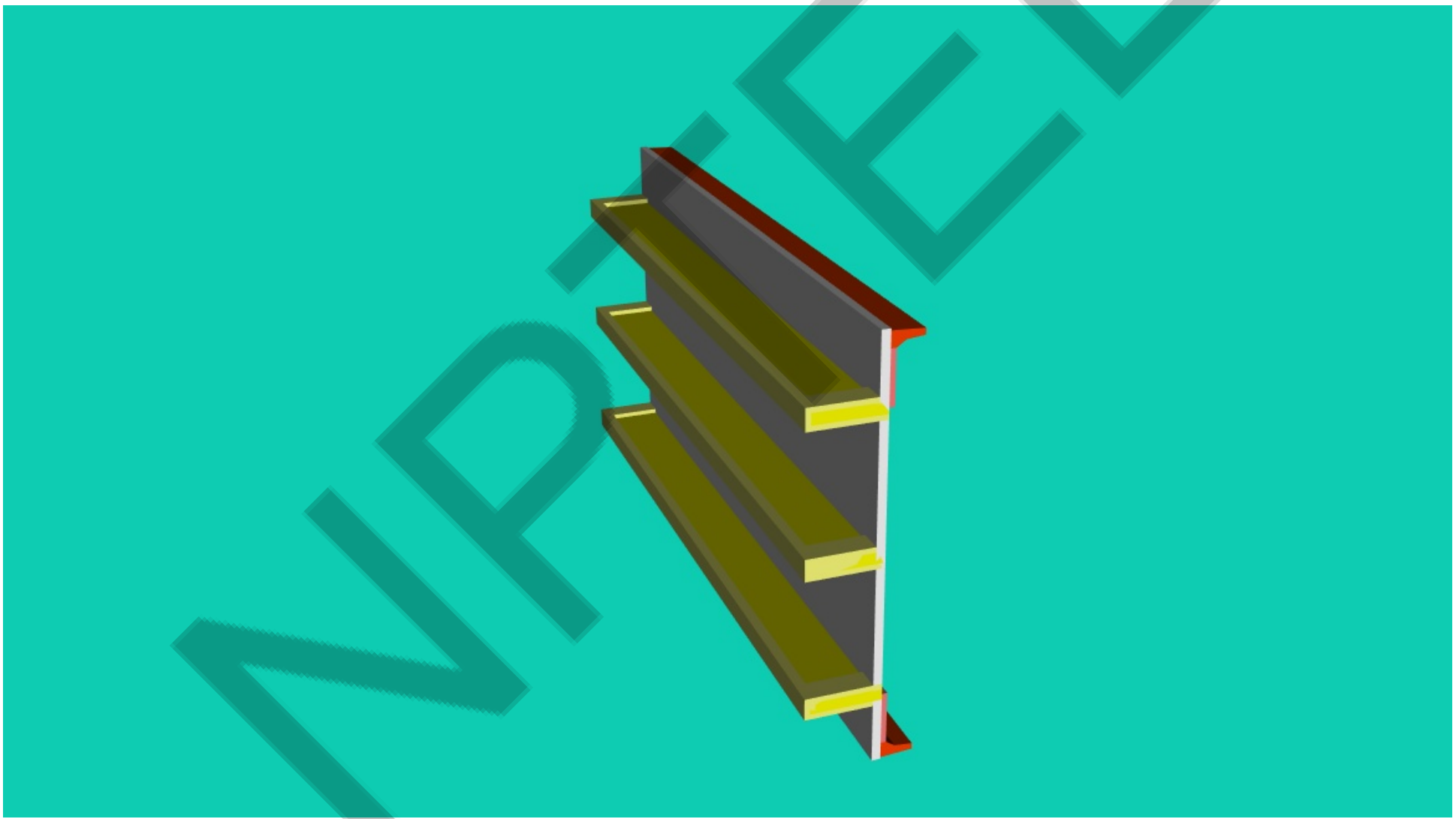


Different components of RCC T Beam Bridge

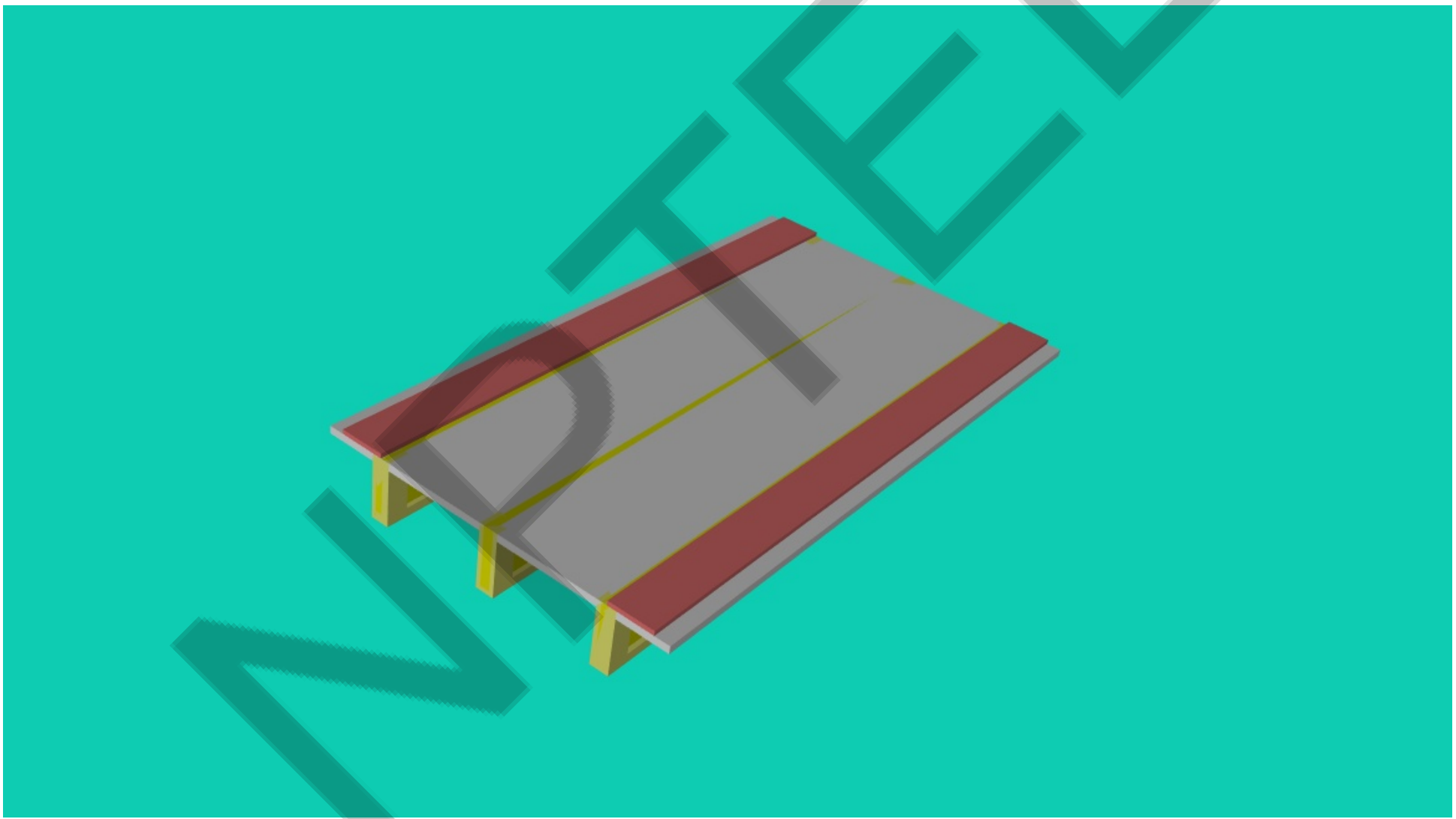


Different components of RCC T Beam Bridge

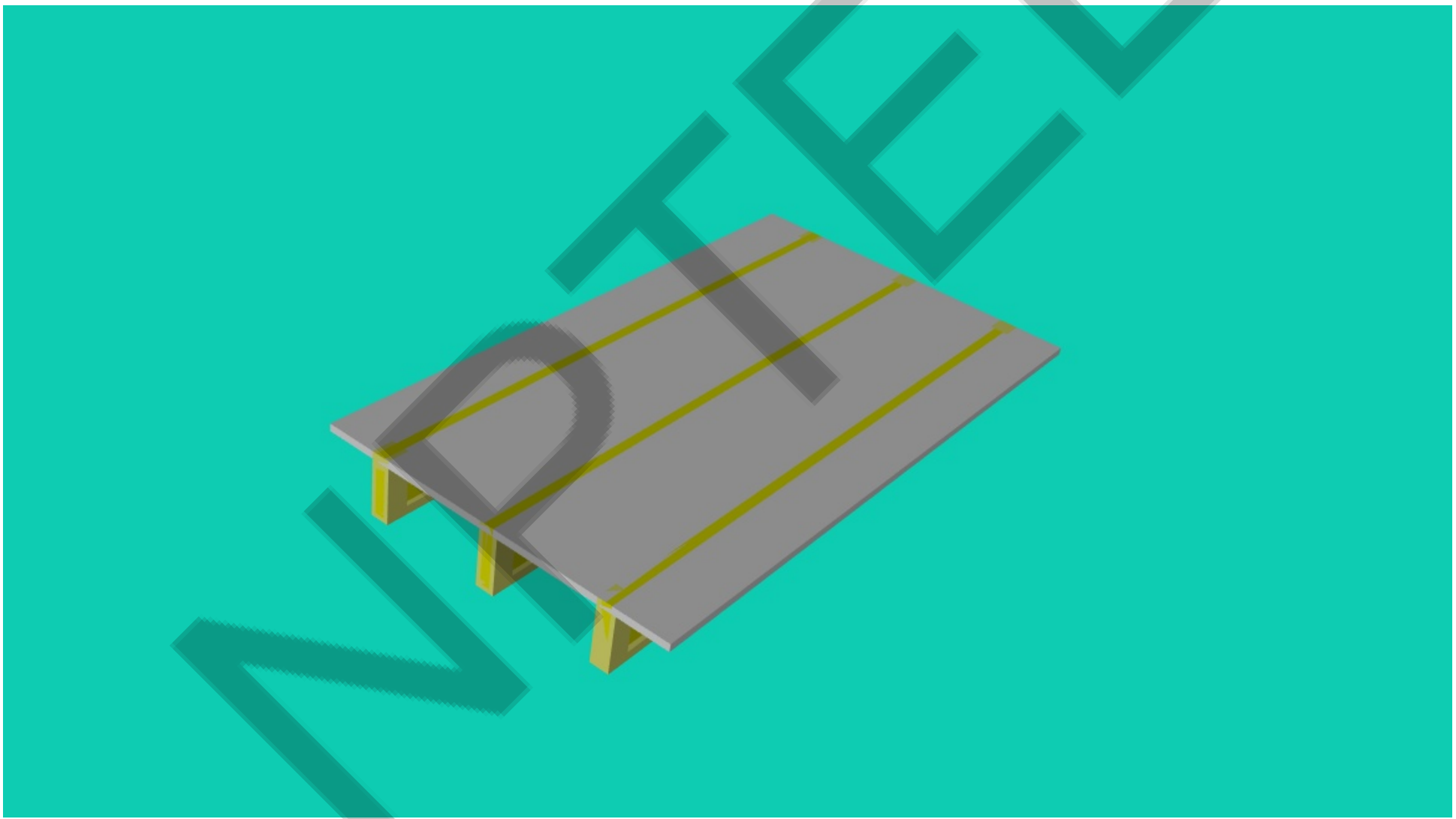
Different components of RCC T Beam Bridge



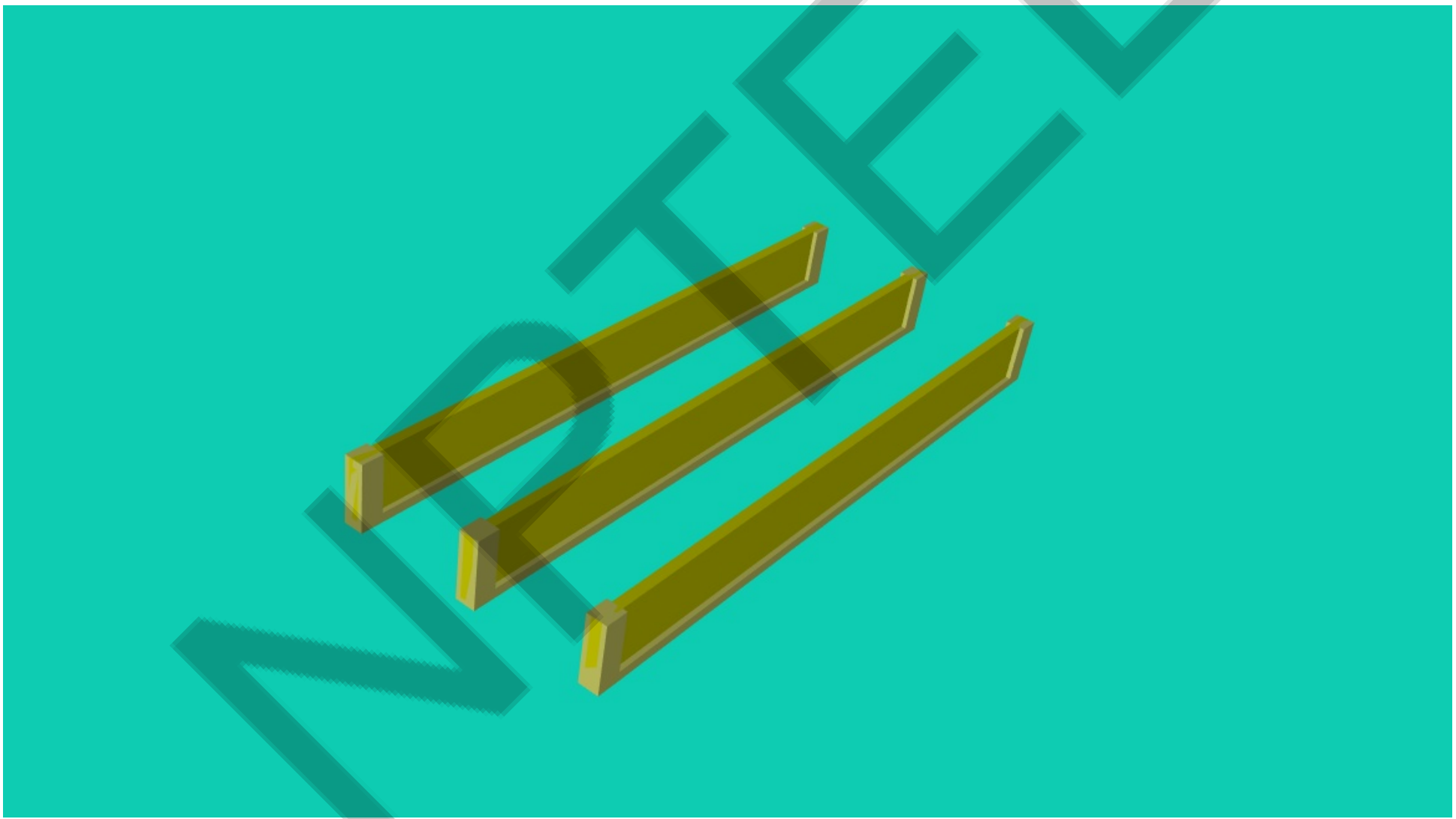
Different components of RCC T Beam Bridge



Different components of RCC T Beam Bridge



Different components of RCC T Beam Bridge



Type of superstructure

Type of superstructure

- The superstructure may be arranged to conform to one of the following three types:
  - Girder and slab type
  - Girder, slab and diaphragm type
  - Girder, slab and cross-beam type

RCC T Beam Bridges - 2 Girders

RCC T Beam Bridges - 2 Girders

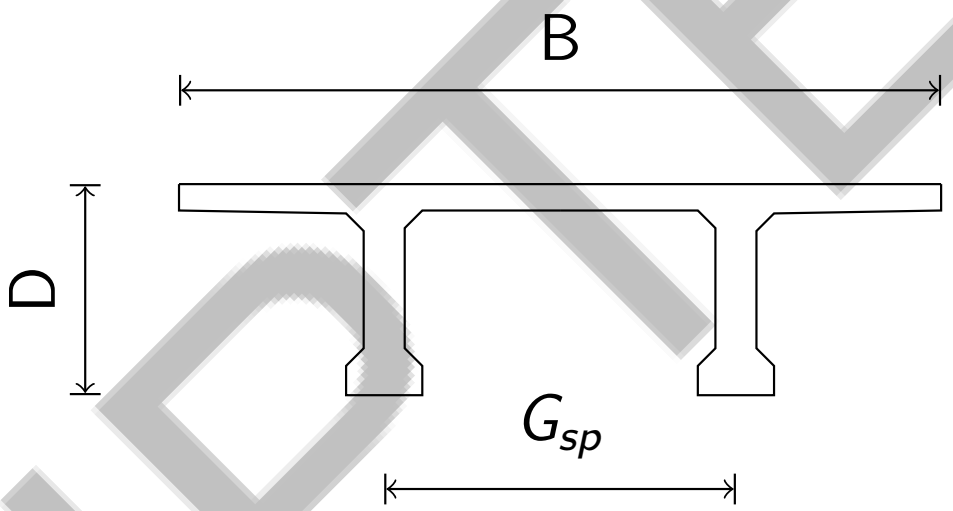


Figure 1: RCC T Beam : Span C/S

RCC T Beam Bridges - 2 Girders

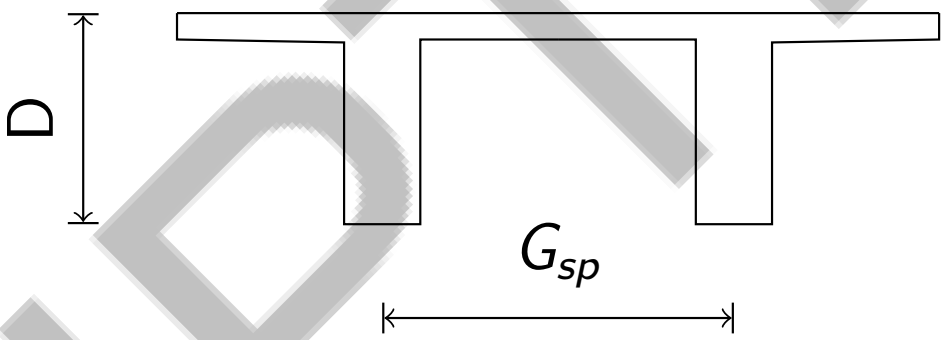


Figure 2: RCC T Beam : Support C/S

RCC T Beam Bridges - 2 Girders

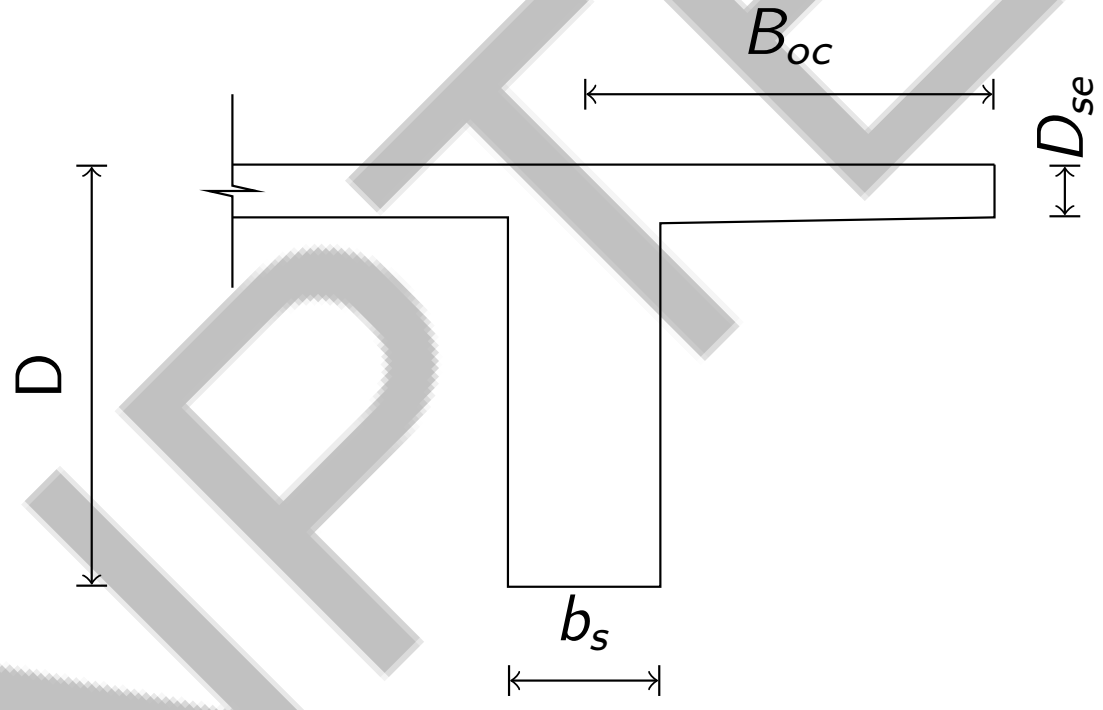


Figure 3: RCC T Beam : Support Cantilever C/S

RCC T Beam Bridges - 2 Girders

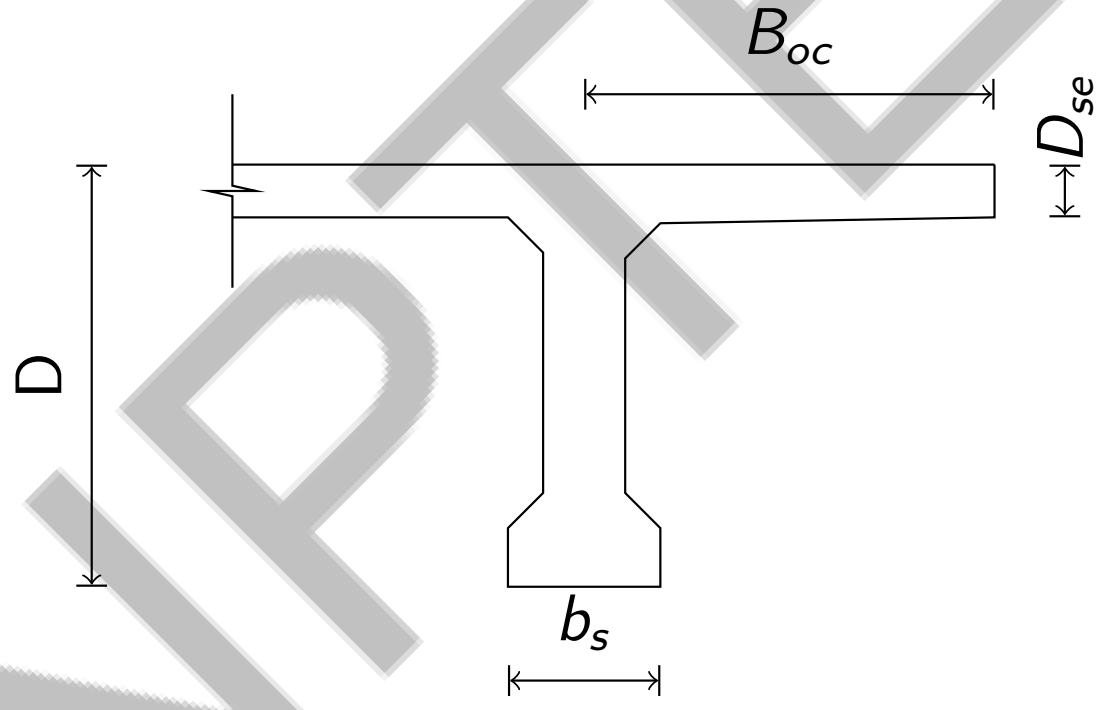


Figure 4: RCC T Beam : Span Cantilever C/S

RCC T Beam Bridges - 3 Girders

RCC T Beam Bridges - 3 Girders

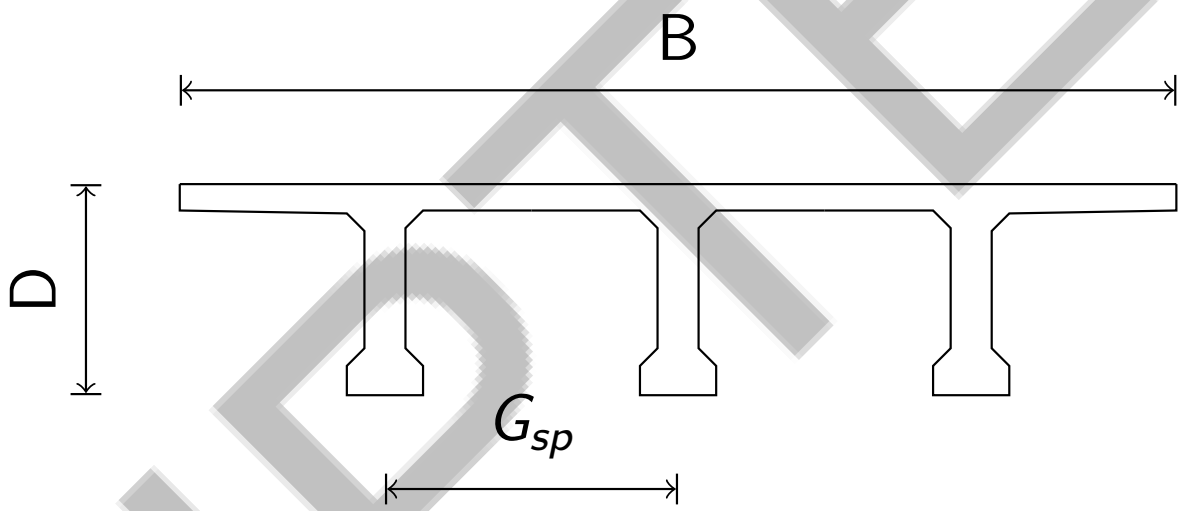


Figure 5: RCC T Beam : Span C/S

RCC T Beam Bridges - 3 Girders

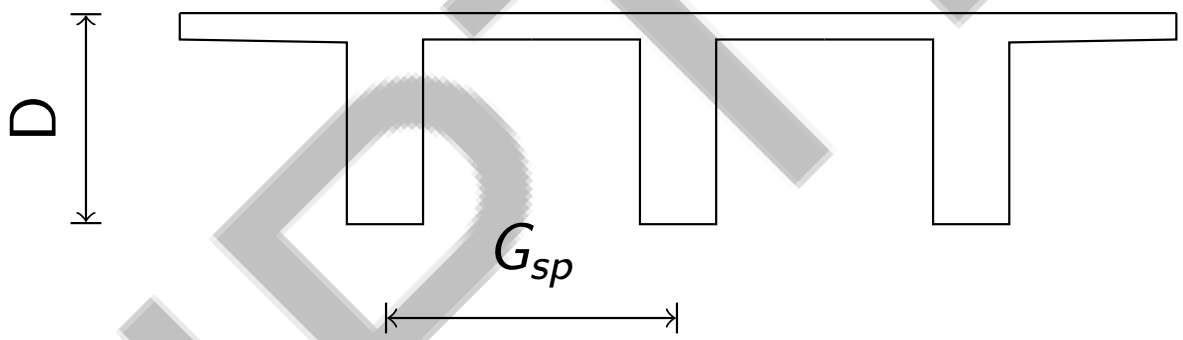


Figure 6: RCC T Beam : Support C/S

RCC T Beam Bridges - 3 Girders

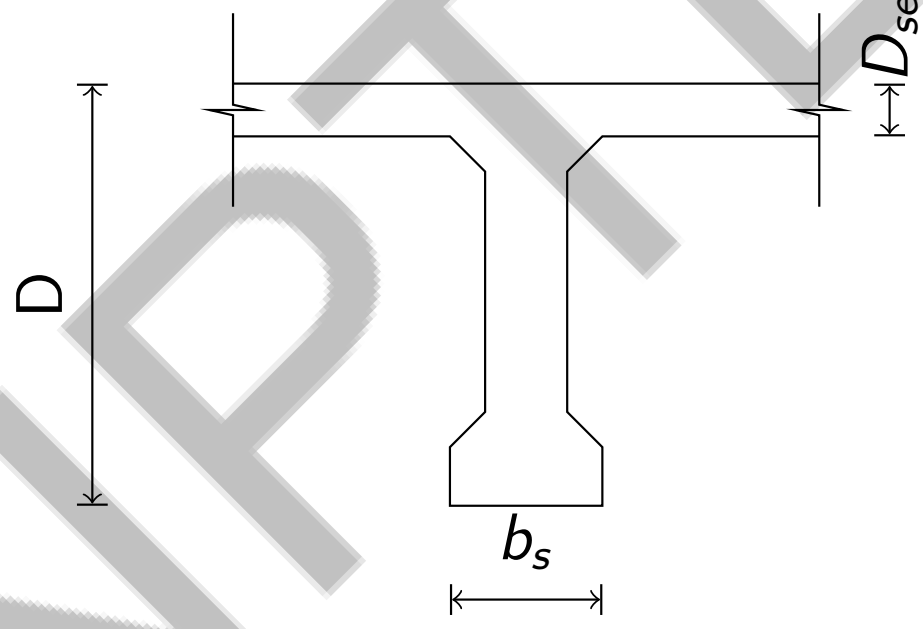


Figure 7: RCC T Beam : Intermediate girder C/S

RCC T Beam Bridges - 4 Girders

RCC T Beam Bridges - 4 Girders

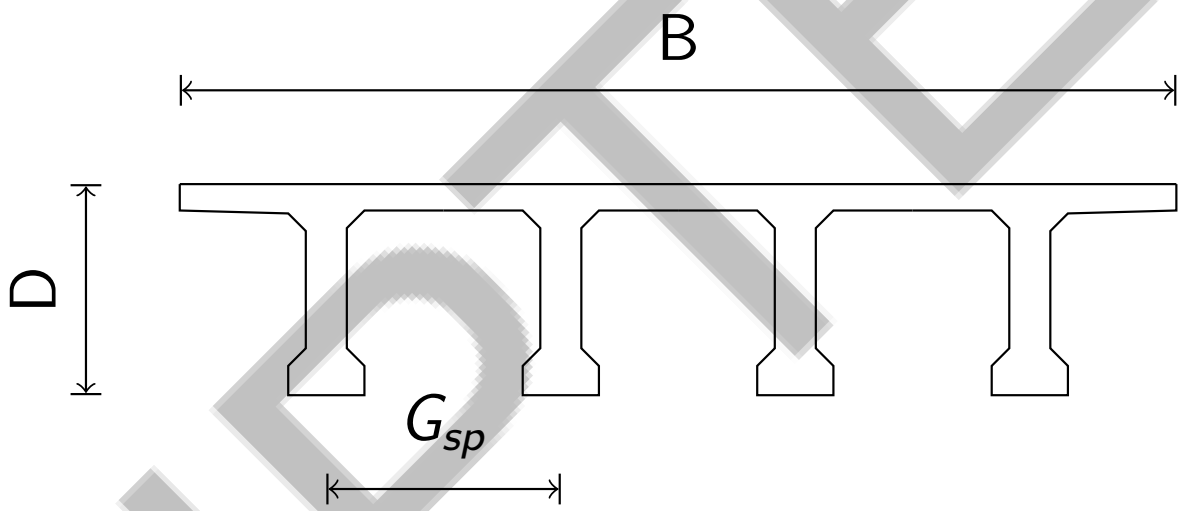


Figure 8: RCC T Beam : Span C/S

RCC T Beam Bridges - 4 Girders

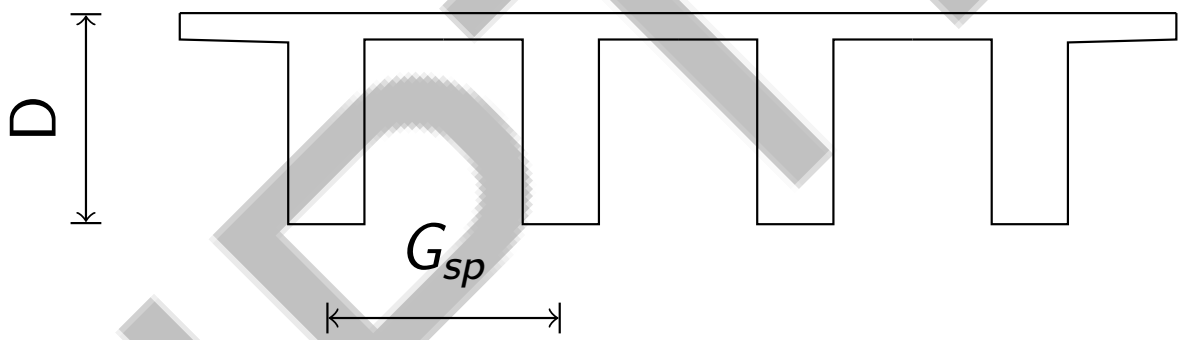


Figure 9: RCC T Beam : Support C/S

RCC T Beam Bridges - 5 Girders

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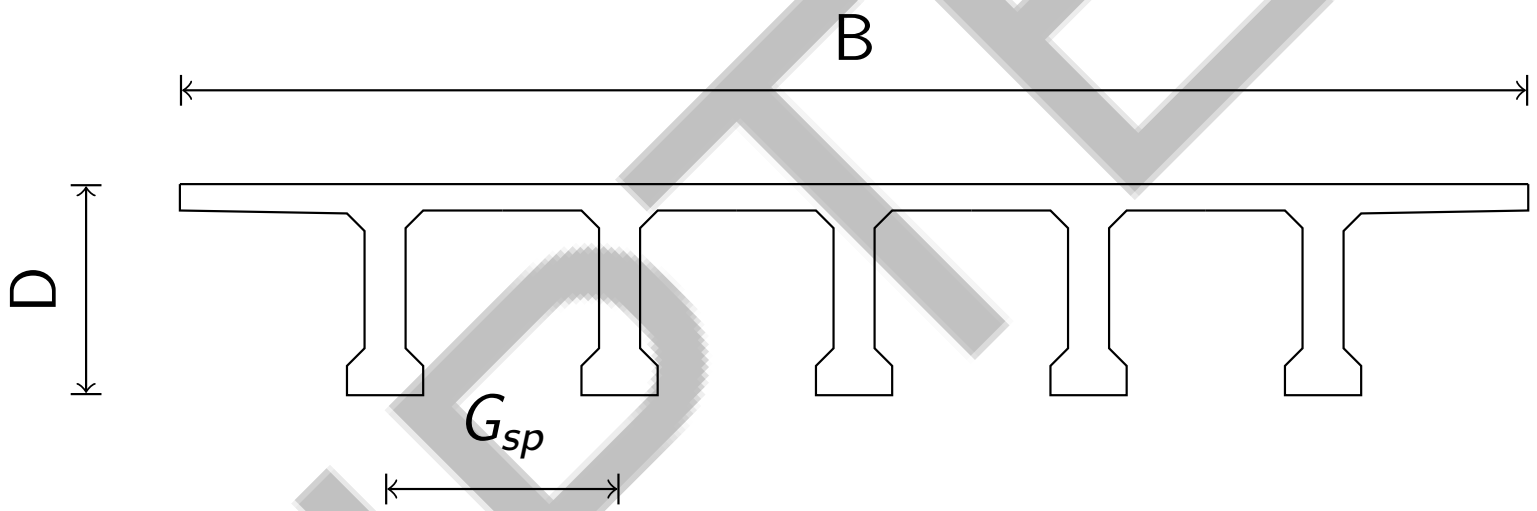

Figure 10: RCC T Beam : Span C/S

RCC T Beam Bridges - 5 Girders

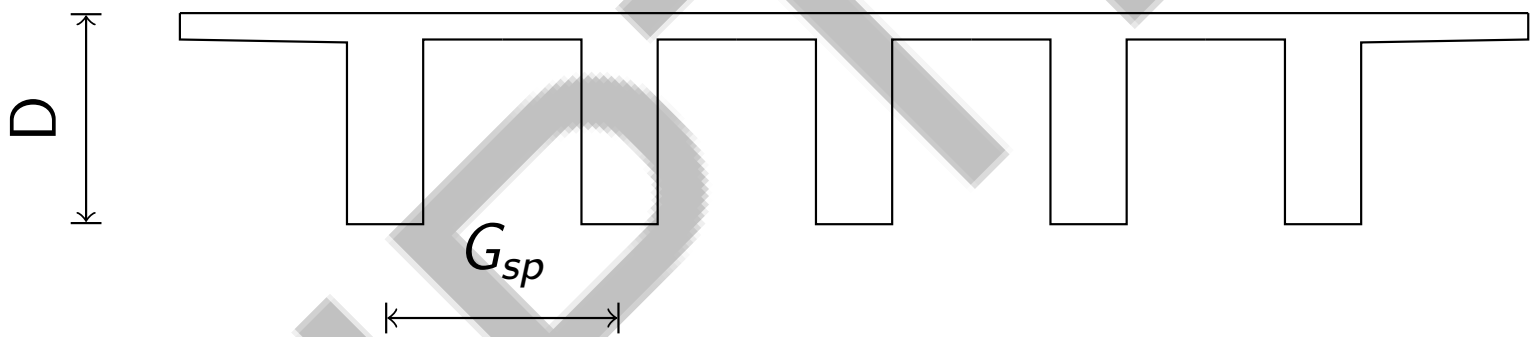

Figure 11: RCC T Beam : Support C/S

RCC T Beam Bridges - 6 Girders

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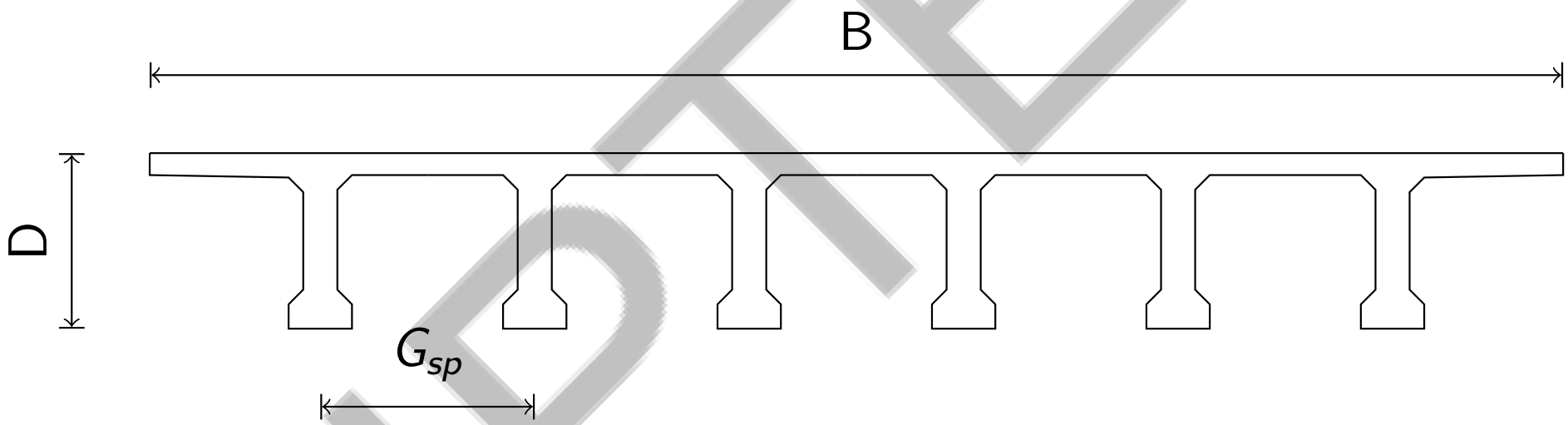

Figure 12: RCC T Beam : Span C/S

RCC T Beam Bridges - 6 Girders

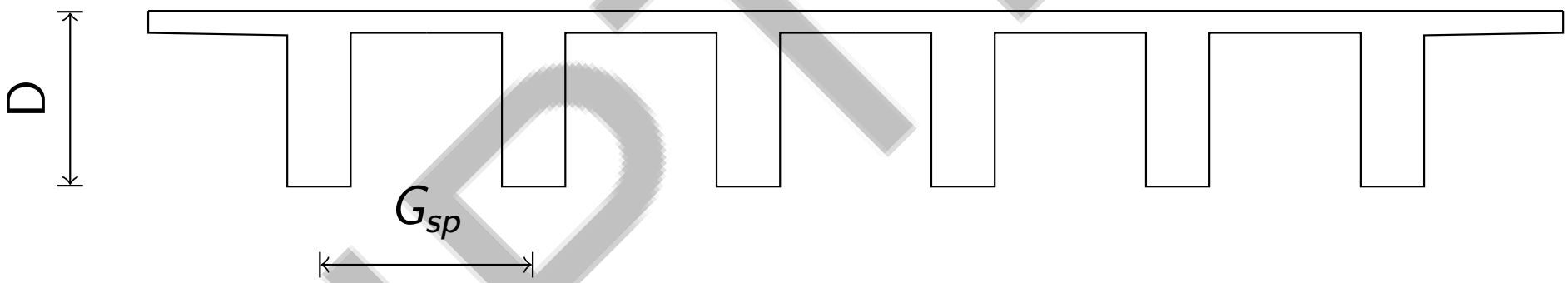

Figure 13: RCC T Beam : Support C/S

Thank you

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Lecture-17

Overview

1. RCC T Beam Bridge
2. Effect of concentrated loads on Deck Slabs

RCC T Beam Bridge

Problem statement

Problem : 1 Design a RCC T Beam bridge for the following parameters :

- Center to center span: 20.000 m
- Width of carriage way : 7500.0 mm
- Width of the foot path : 1500.0 mm on either side
- Width of crash barrier : 450.0 mm on either side
- Wearing coat: 100 mm
- Loading :
  (i) IRC Class A
  (ii) IRC Class 70R(Tracked)
  (iii) IRC Class 70R(Wheel)
- Materials : Concrete : M30, Steel : Fe500

Schematic deck cross-section

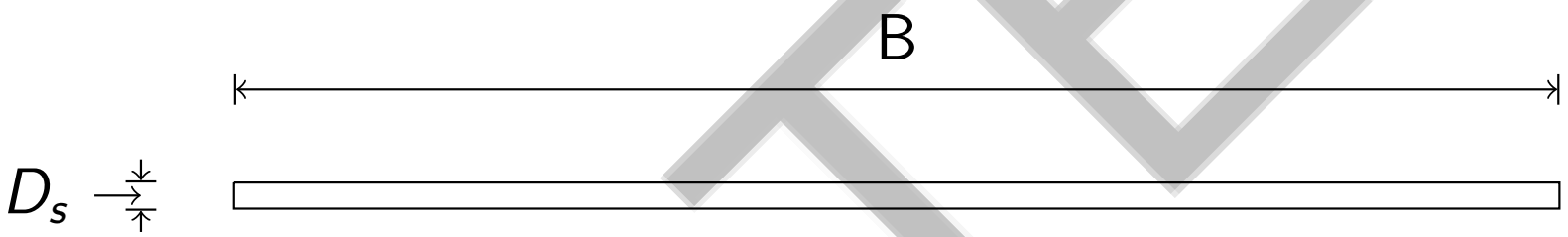

Figure 1: RCC T Beam : Deck C/S - schematic

RCC T Beam Bridge - 2 girders

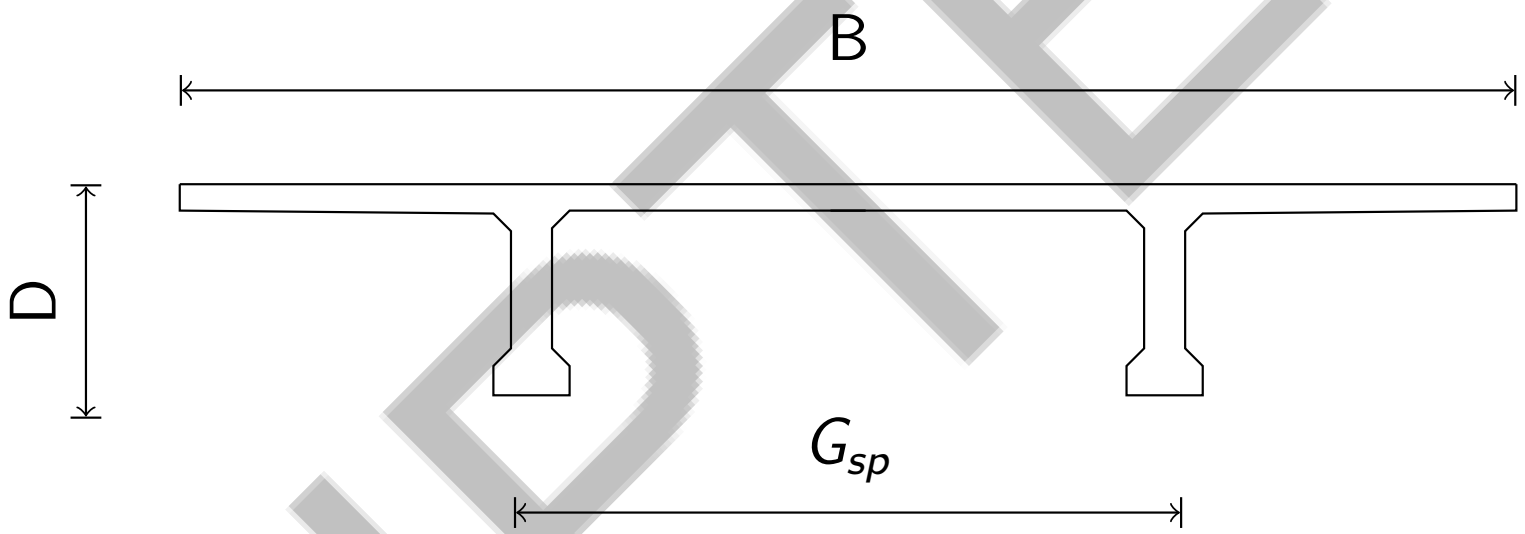

Figure 2: RCC T Beam : Span C/S

RCC T Beam Bridge - 3 girders

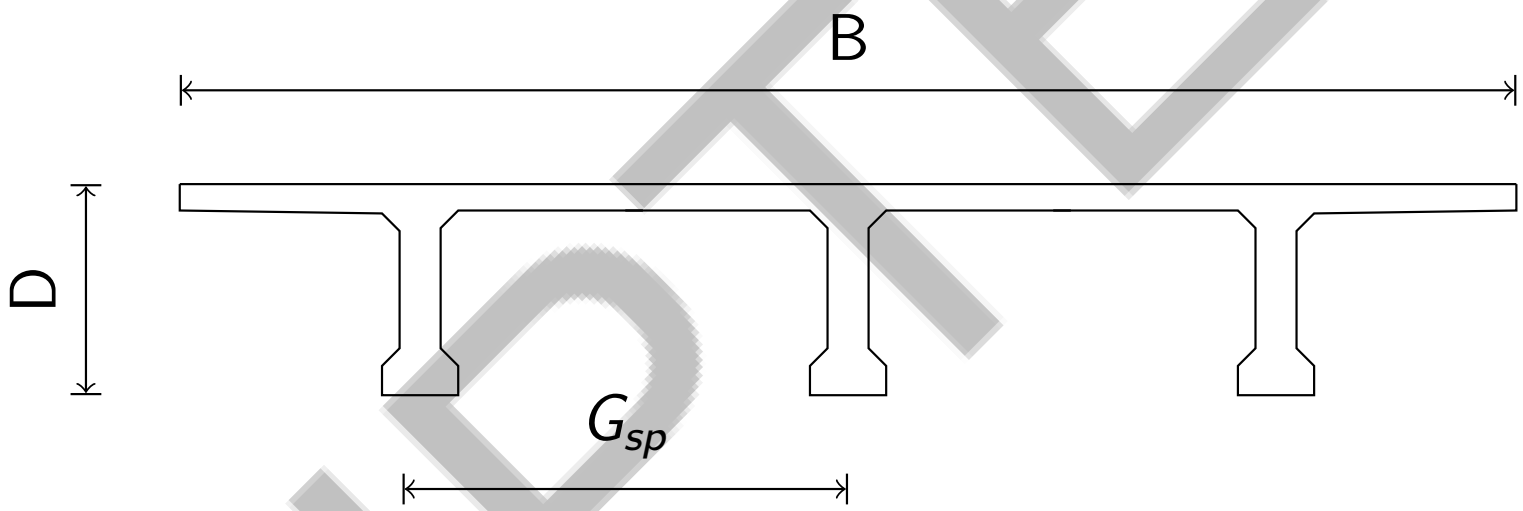

Figure 3: RCC T Beam : Span C/S

RCC T Beam Bridge - 4 girders

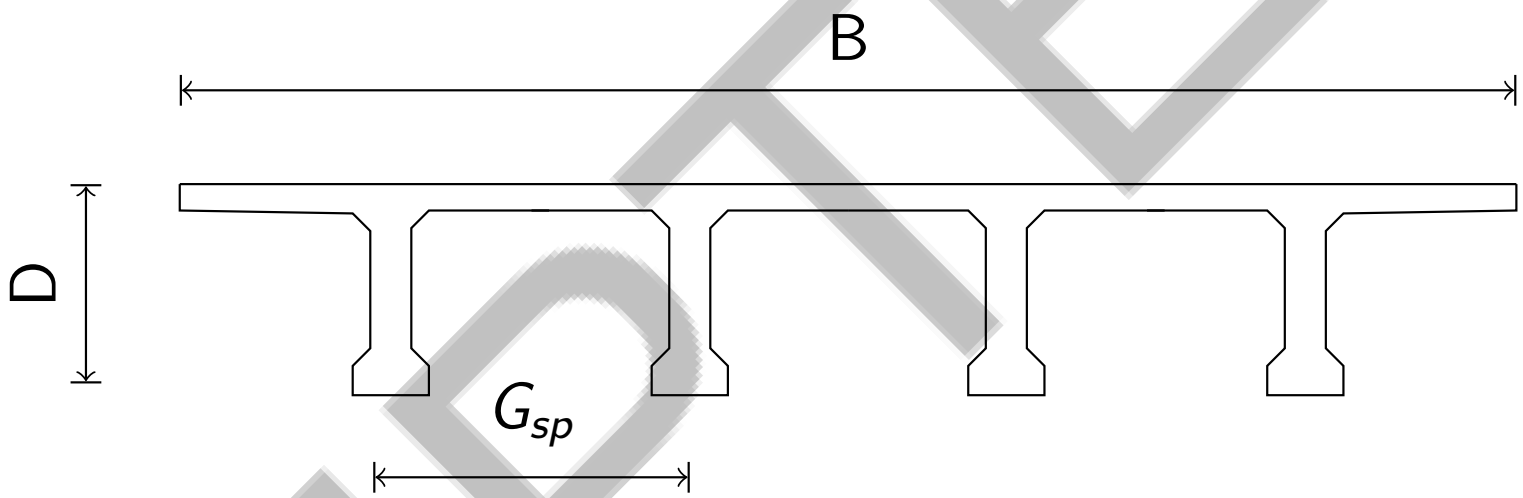

Figure 4: RCC T Beam : Span C/S

RCC T Beam Bridge - 5 girders

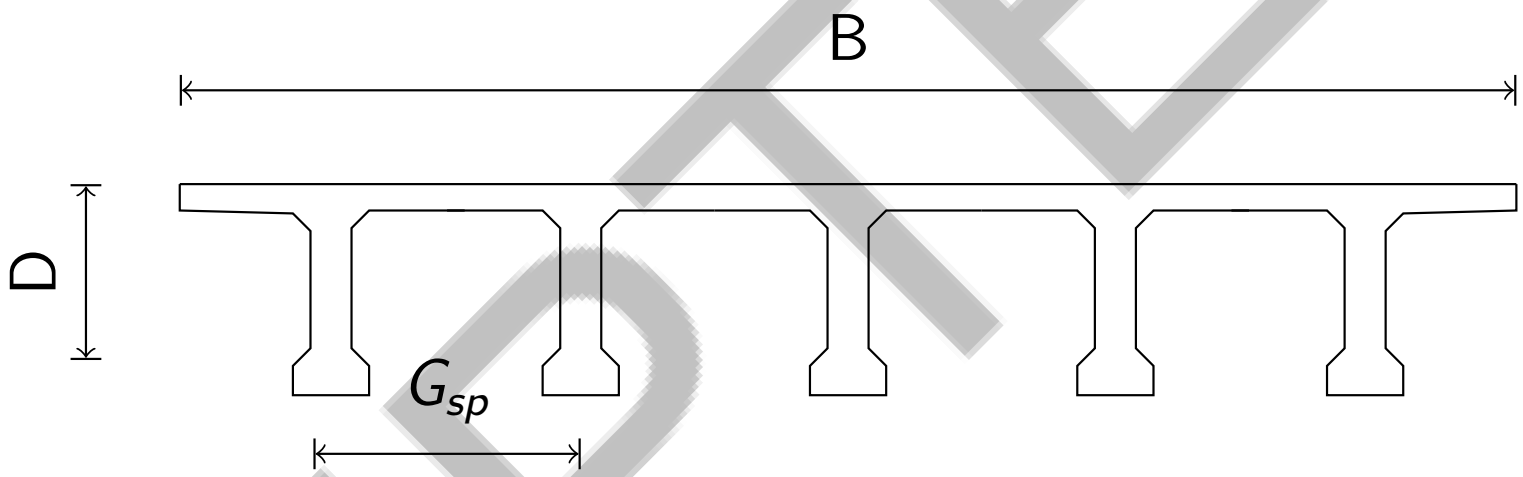

Figure 5: RCC T Beam : Span C/S

Schematic deck cross-section

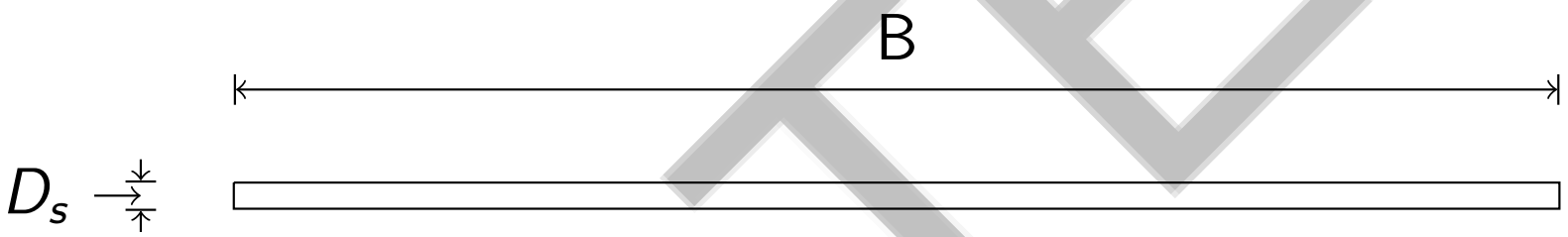

Figure 6: RCC T Beam : Deck C/S - schematic

Schematic deck cross-section

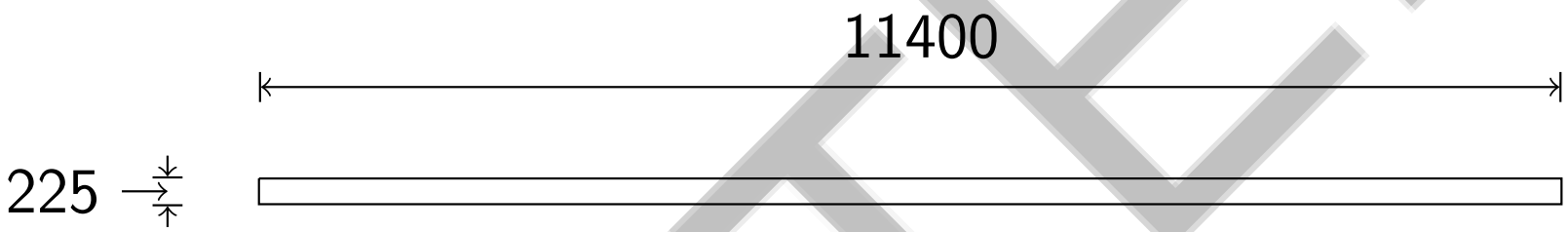

Figure 7: RCC T Beam : Deck C/S - schematic

Width of deck,B= $450.0 + 1500.0 + 7500.0 + 1500.0 + 450.0 = 11400.0\ mm$

RCC T Beam Bridge - 4 girders

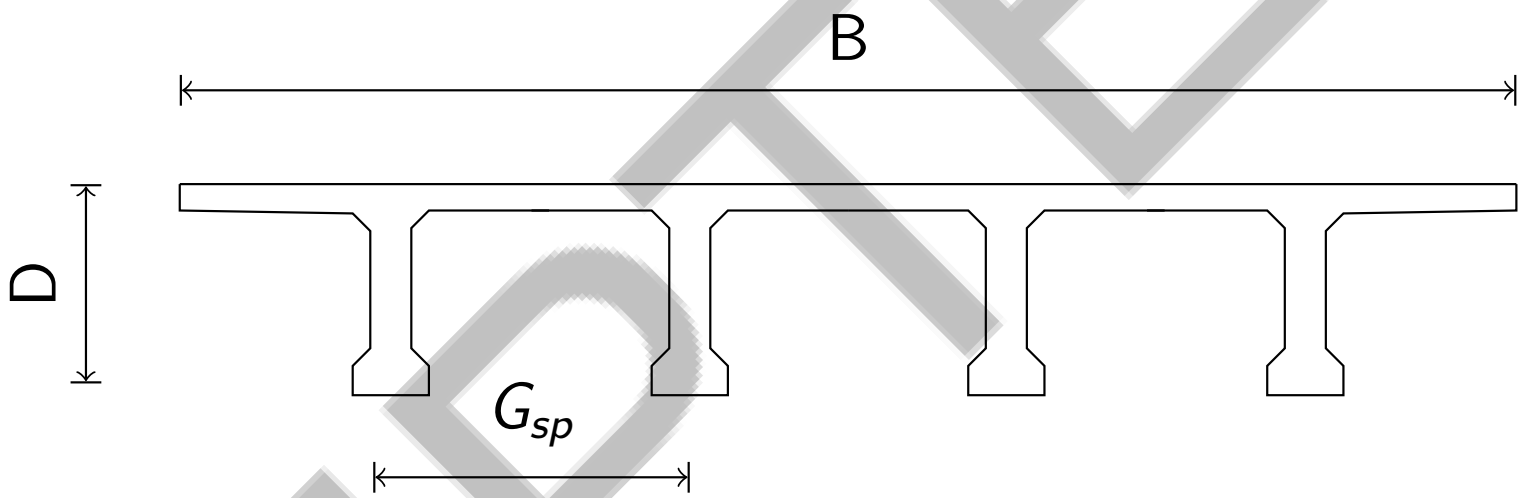

Figure 8: RCC T Beam : Span C/S

RCC T Beam Bridge - 4 girders

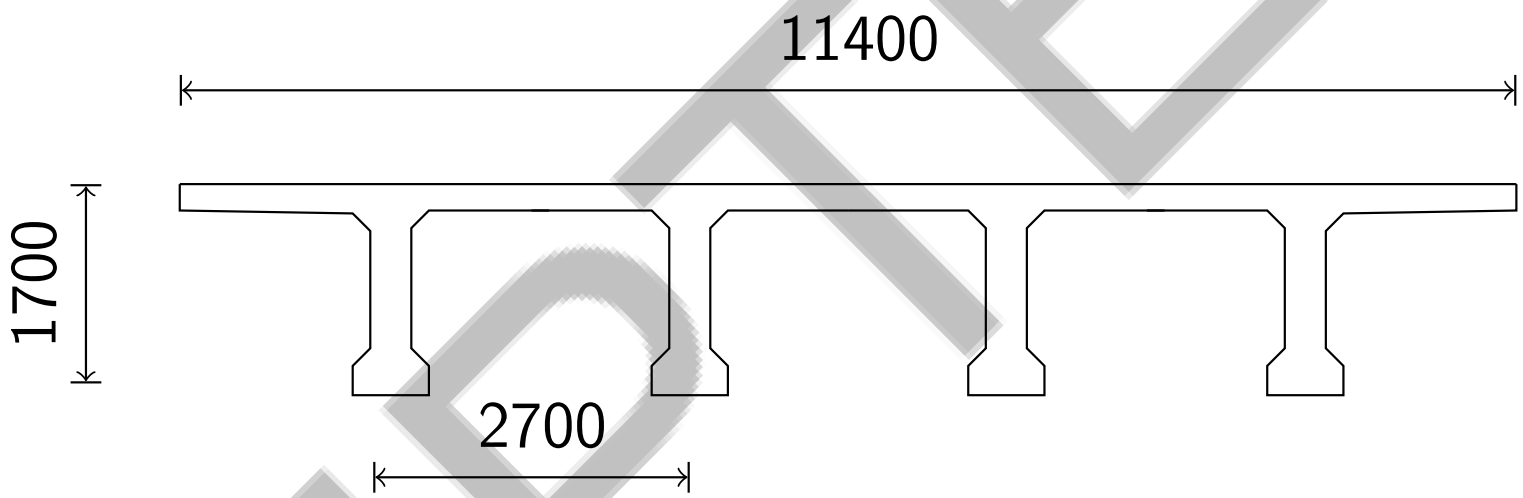

Figure 9: RCC T Beam : Span C/S

Effect of concentrated loads on Deck Slabs

Slabs spanning in two directions

- For slabs spanning in two directions, the moments in the two directions can be obtained by using curves given by M. Pigeaud

Slabs spanning in two directions

L and B span lengths in the long and short span directions

a and b dimensions of the tyre contact area in the long and short span directions

u and v dimensions of the load spread after allowing for dispersion through the deck slab

K the ratio of short span to long span

M_1 *and* M_2 the moments along the short and long spans

m_1 *and* m_2 the coefficients for moments along the short and long spans

μ Poission's ratio, generally taken as 0.15 for reinforced concrete

P load from the wheel under consideration

Thank you

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Lecture-18

Overview

1. RCC T Beam Bridge
2. Courbon's method of load distribution

RCC T Beam Bridge

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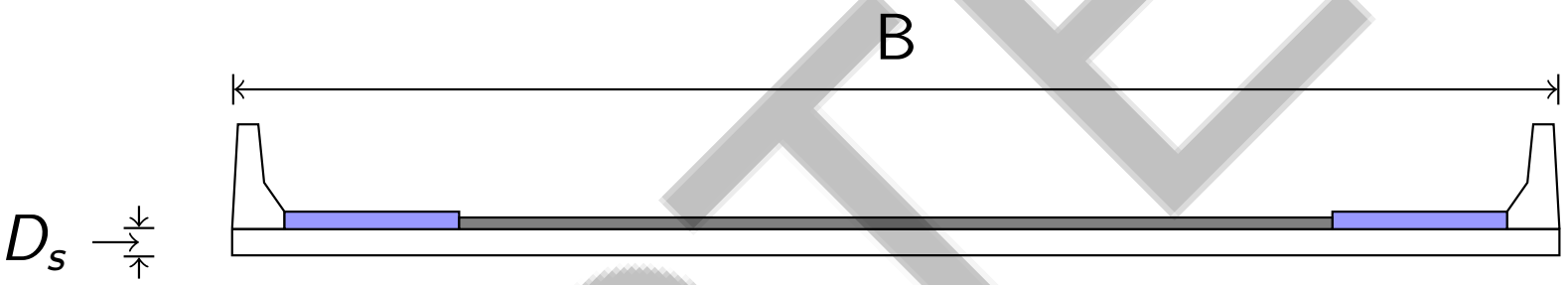
Schematic deck cross-section



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Schematic deck cross-section

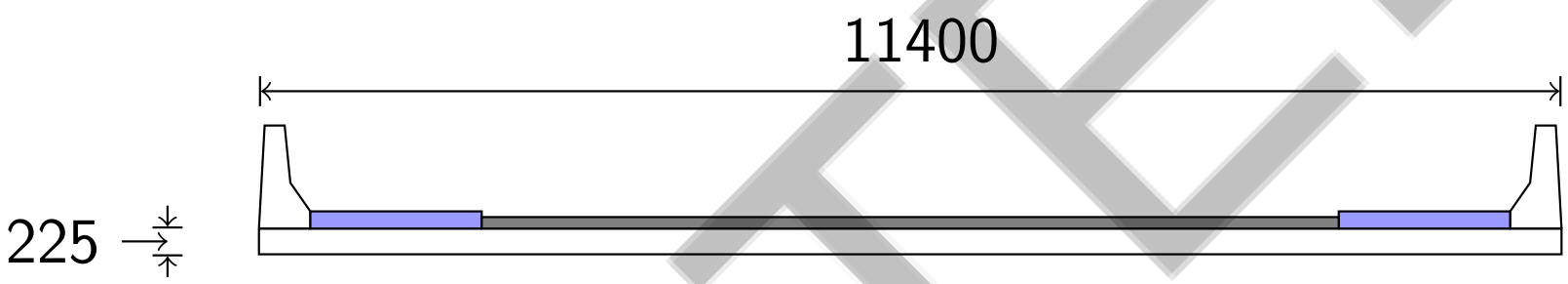


Figure 2: RCC T Beam : Deck C/S - schematic

Width of deck,B= $450.0 + 1500.0 + 7500.0 + 1500.0 + 450.0 = 11400.0\ mm$

RCC T Beam Bridge - 4 girders

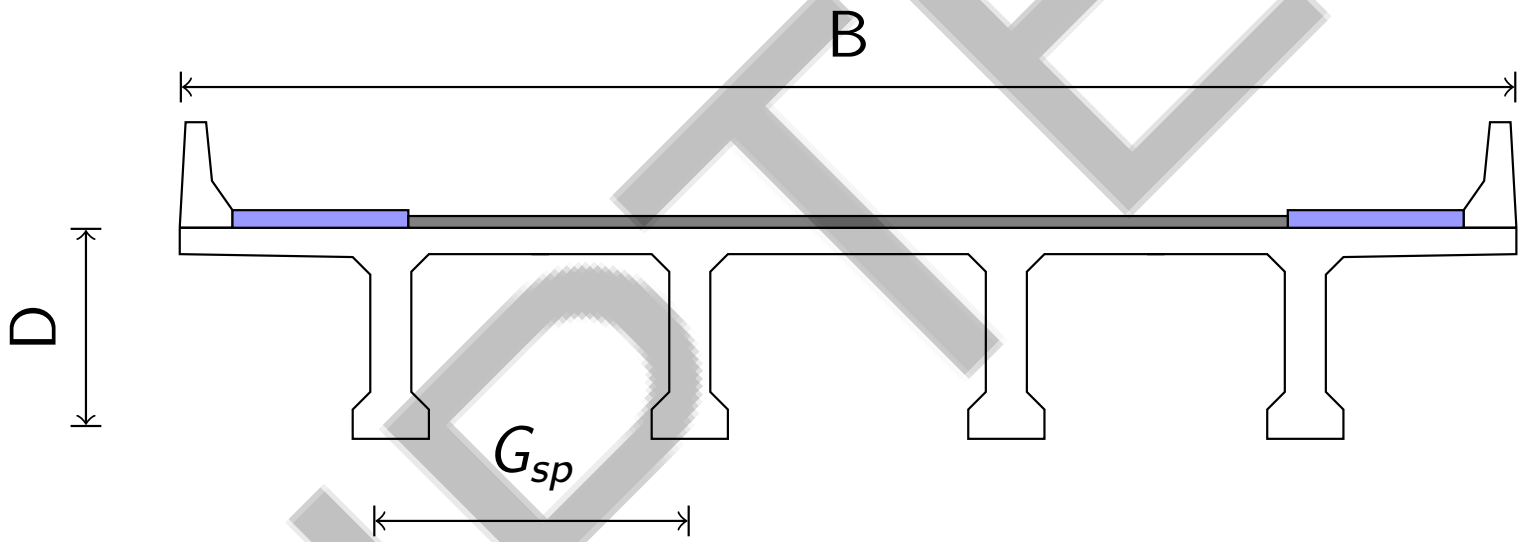


Figure 3: RCC T Beam : Span C/S

RCC T Beam Bridge - 4 girders

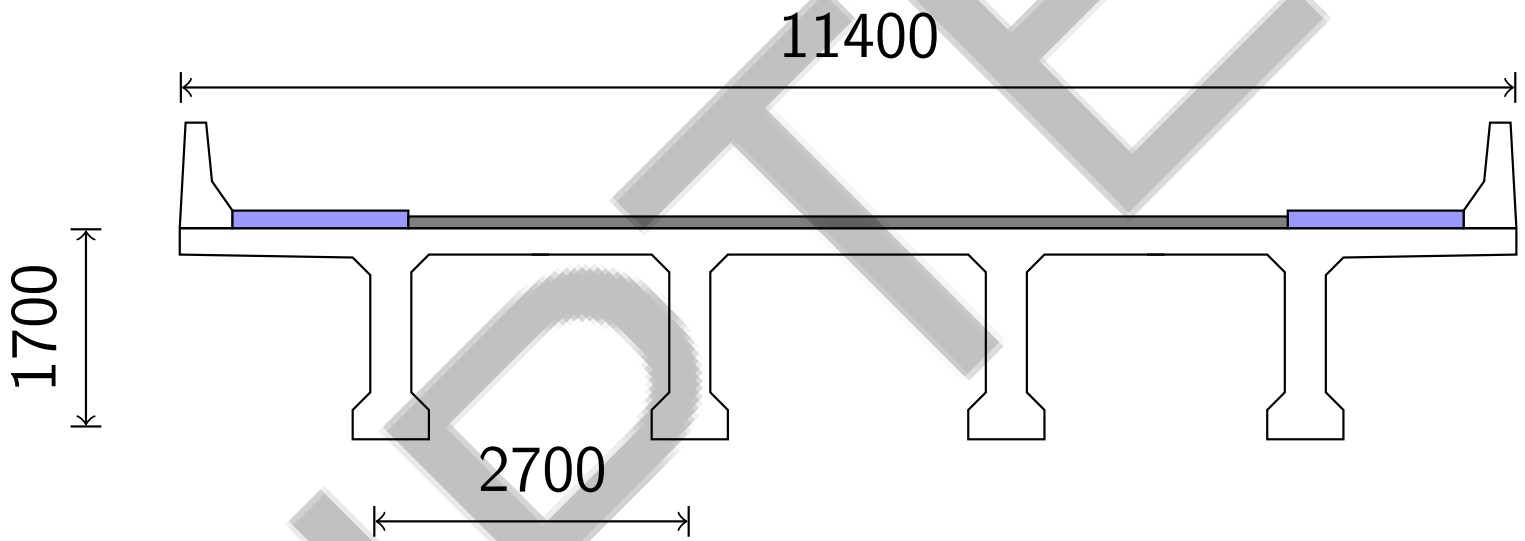


Figure 4: RCC T Beam : Span C/S

RCC T Beam Bridge - 4 girders

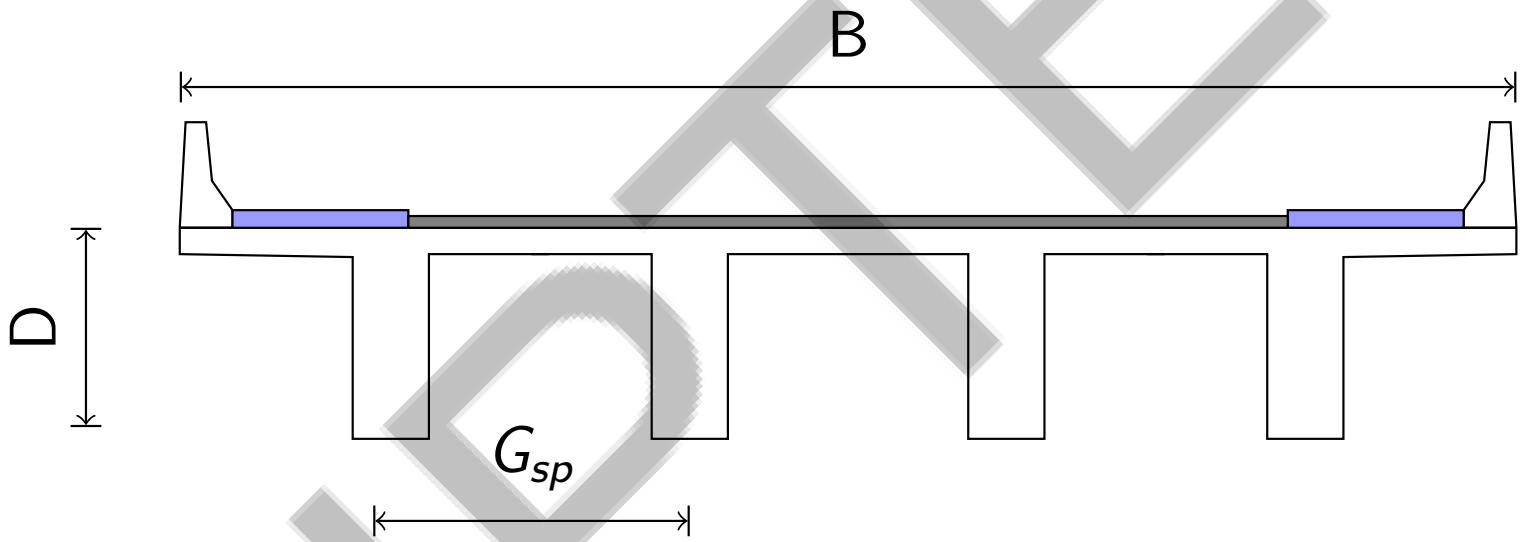


Figure 5: RCC T Beam : Support C/S

RCC T Beam Bridge - 4 girders

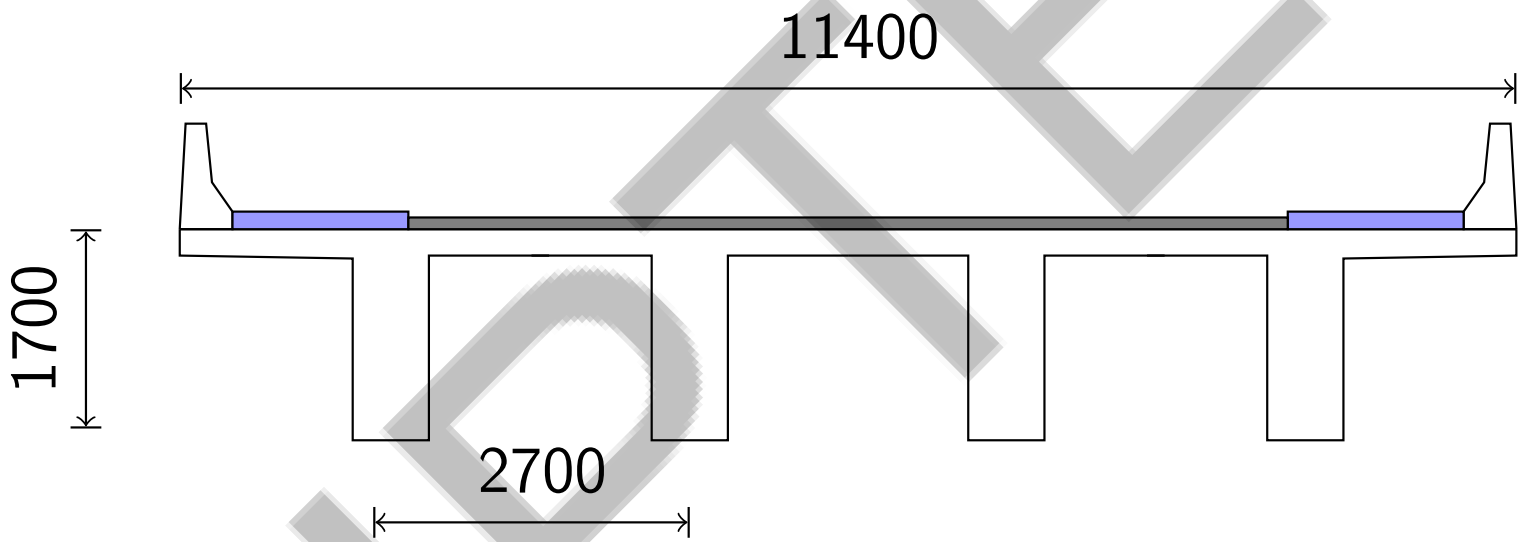
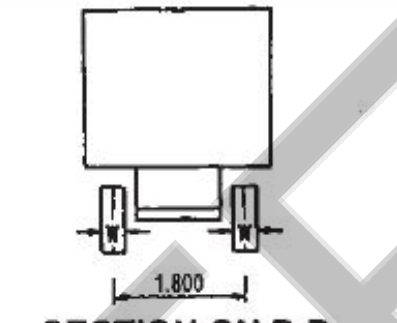
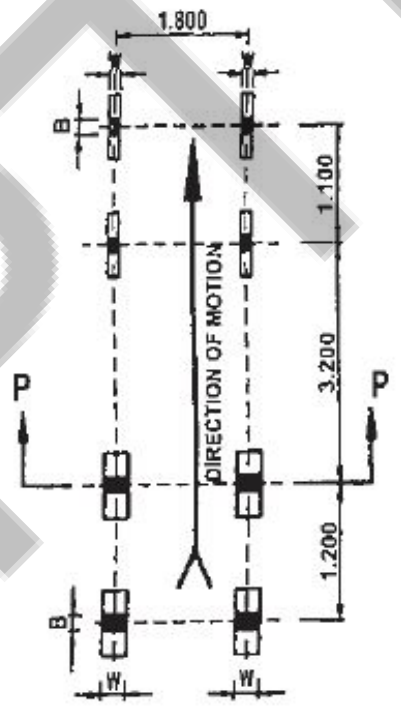


Figure 6: RCC T Beam : Support C/S

IRC Class A Loading



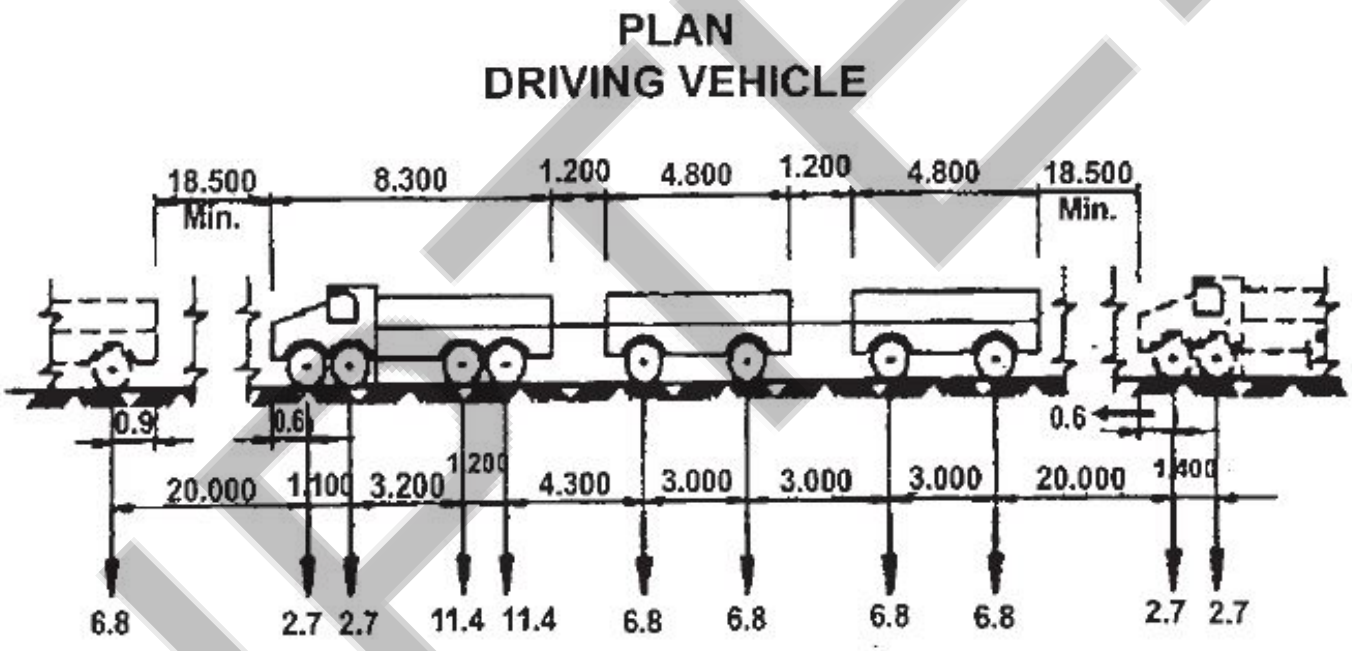
SECTION ON P-P



PLAN

DRIVING VEHICLE

IRC Class A Loading

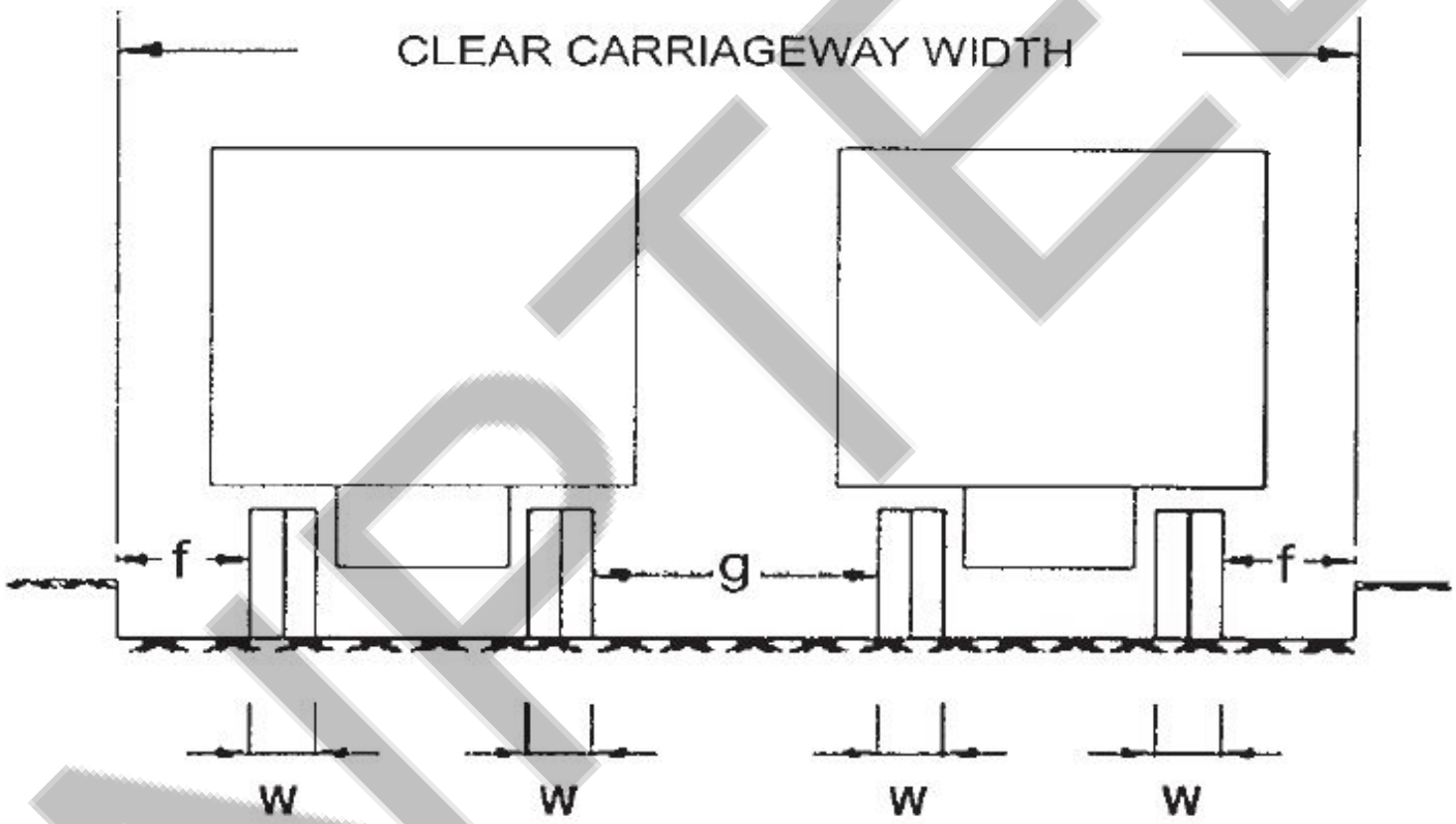


Class A Train of Vehicles

IRC Class A Loading

Axle load (tonne)	Ground contact area	
	B (mm)	W (mm)
11.4	250	500
6.5	200	380
2.7	150	200

IRC Class A Loading



IRC Class A Loading

Clear carriageway width	g	f
5.3 m(*) to 6.1 m(**)	Varying between 0.4 m to 1.2 m	150 mm for all carriageway width
Above 6.1 m	1.2 m	

IRC Class A Loading

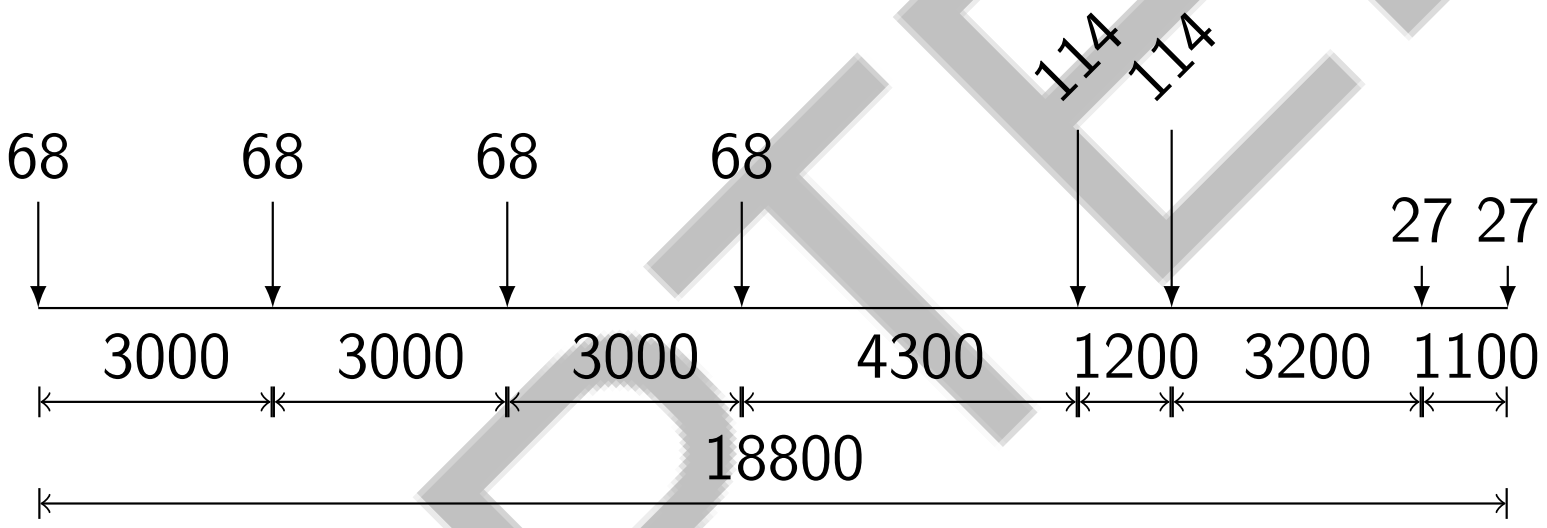


Figure 7: IRC Class A loading

RCC T Beam Bridge - 4 girders

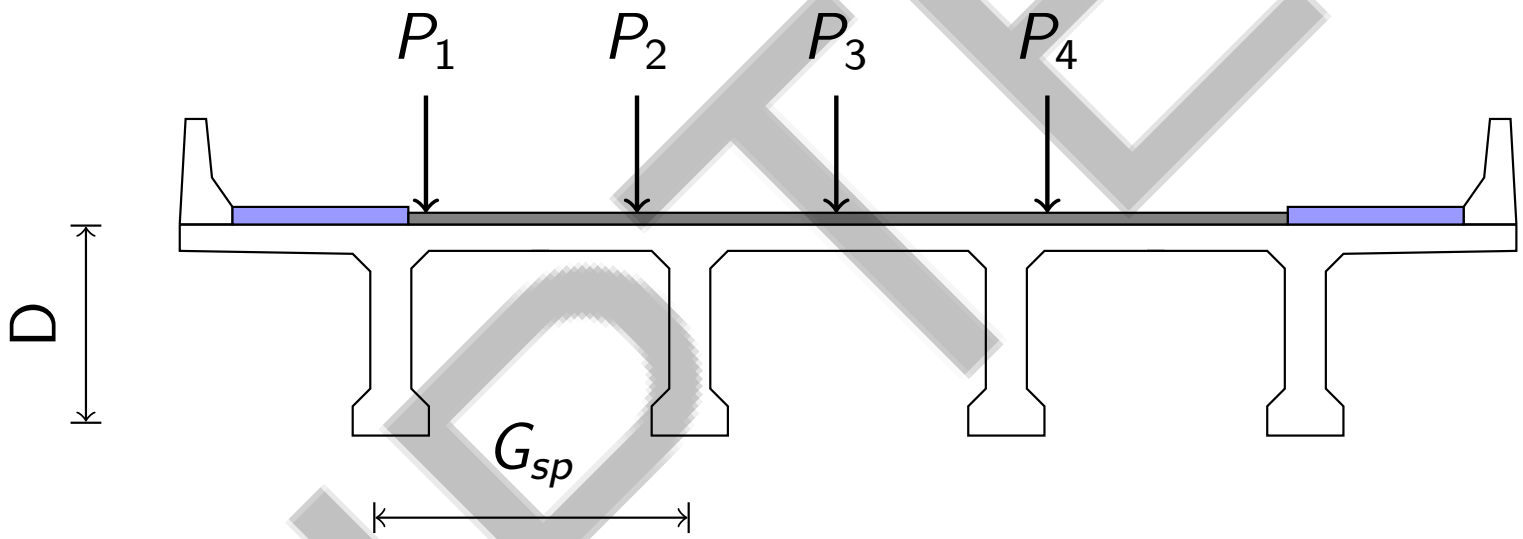


Figure 8: RCC T Beam : Span C/S

RCC T Beam Bridge - 4 girders

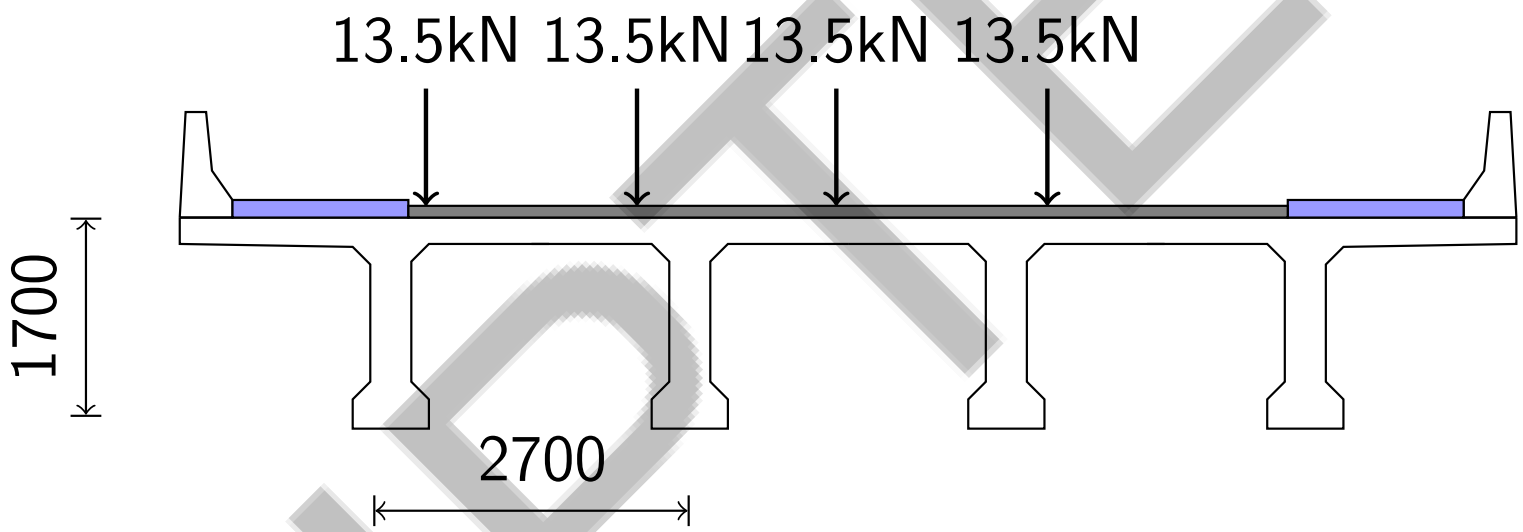


Figure 9: RCC T Beam : Span C/S

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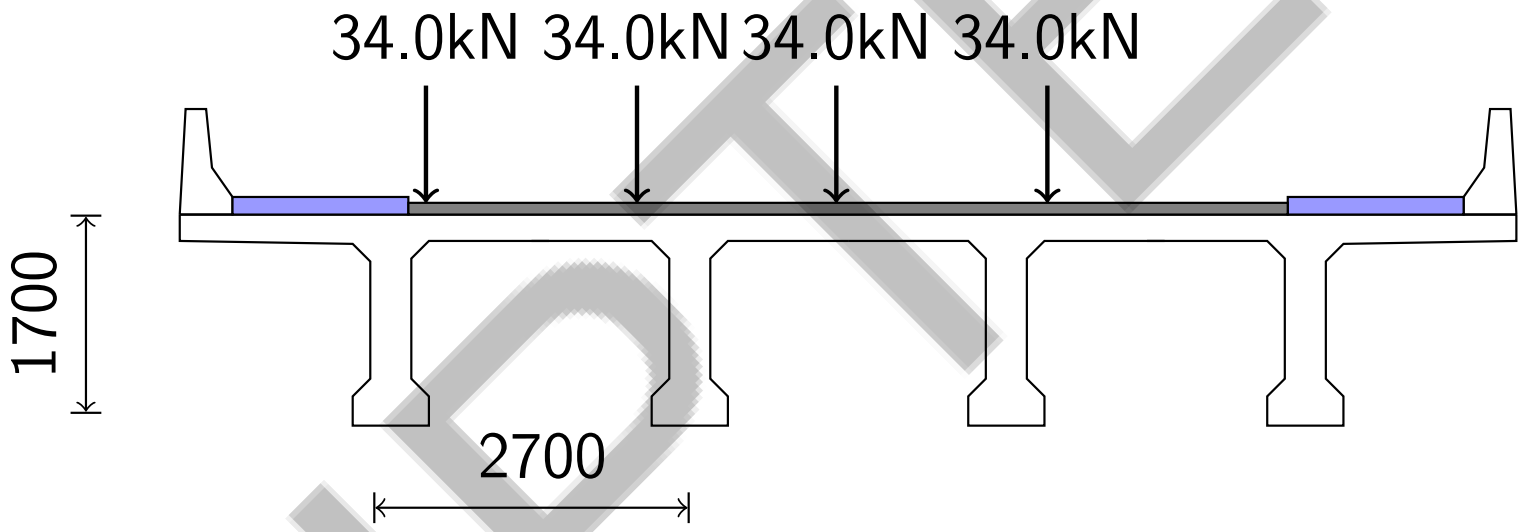
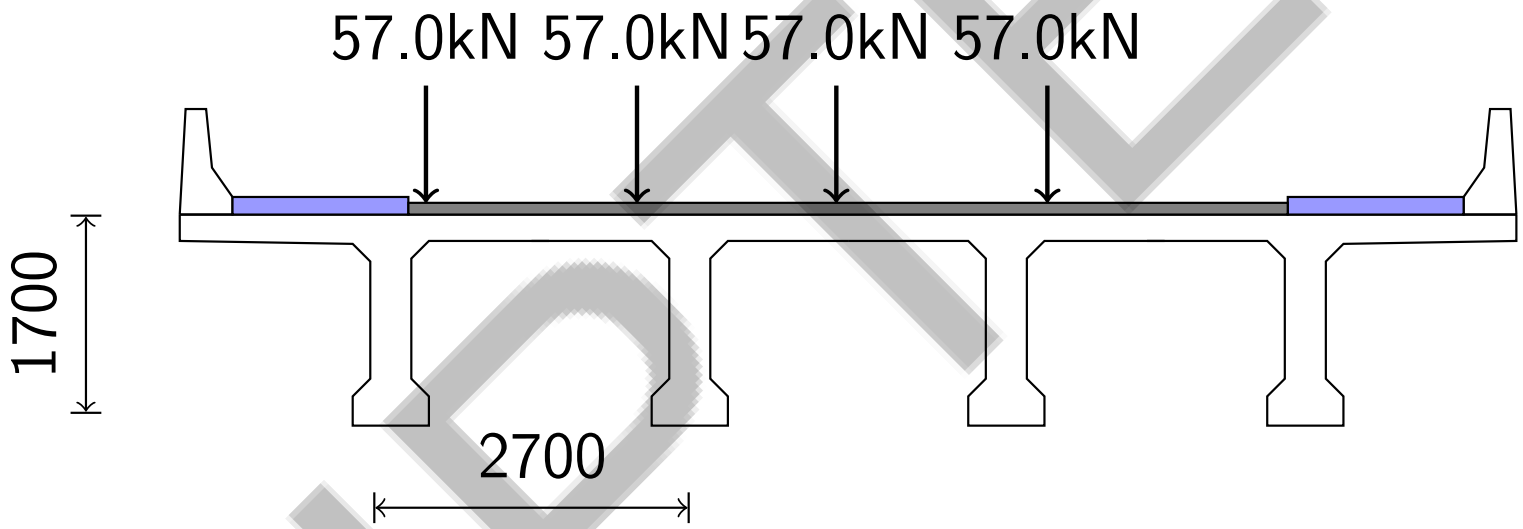


Figure 10: RCC T Beam : Span C/S

RCC T Beam Bridge - 4 girders



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RCC T Beam Bridge - 4 girders

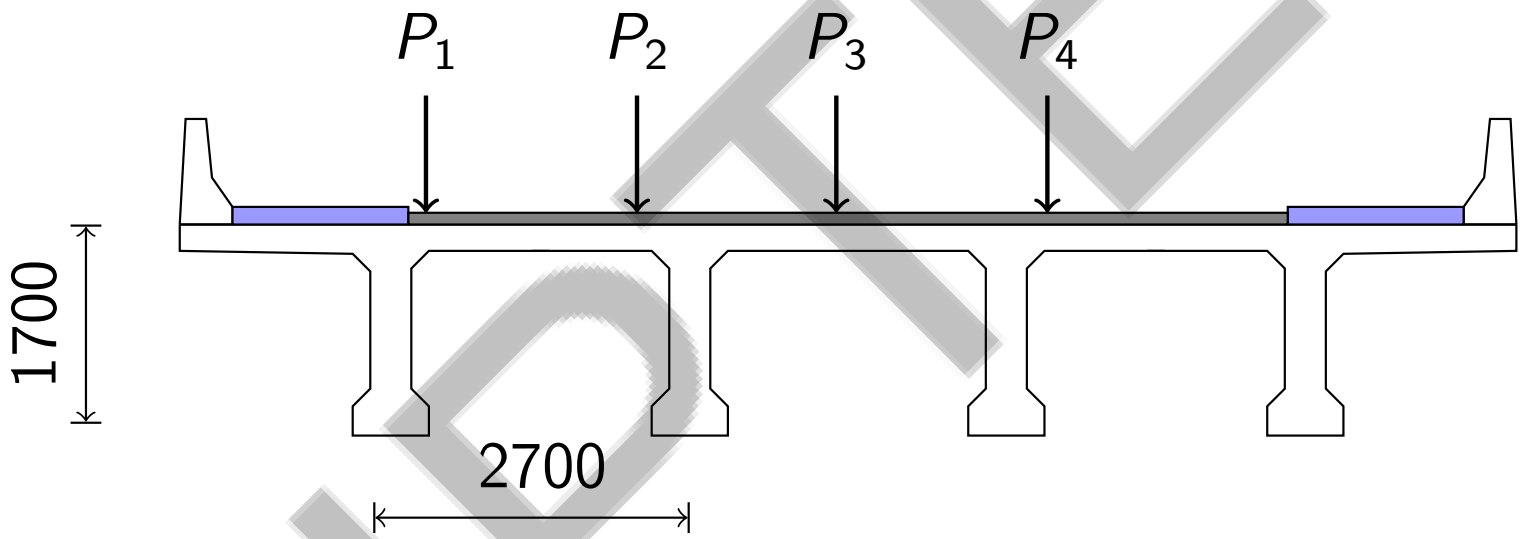

Figure 12: RCC T Beam : Span C/S

Courbon's method of load distribution

Courbon's method of load distribution

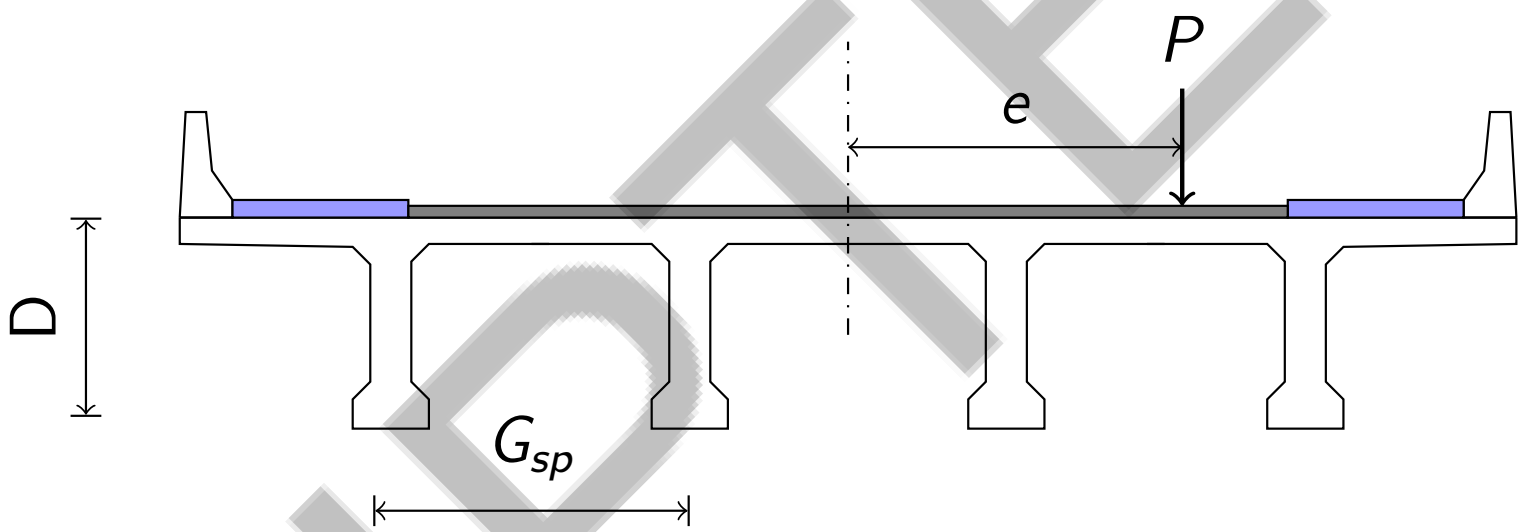

Figure 13: RCC T Beam : Span C/S

Courbon's Method

- According to Courbon's method, the reaction R_i of the cross beam on any girder i of a typical bridge consisting of multiple parallel beams is computed assuming a linear variation of deflection in the transverse direction
- The deflection will be maximum on the exterior girder on the side of the eccentric load
- The reaction R_i is then given by
-

$$R_i = \frac{PI_i}{\Sigma I_i} + \left[\frac{PI_i}{\Sigma I_i} \cdot \frac{e\ d_i\ \Sigma I_i}{\Sigma I_i d_i^2}\right]$$

$$R_i = \frac{PI_i}{\Sigma I_i}\left[1 + \frac{\Sigma I_i}{\Sigma I_i d_i^2}\ e\ d_i\right] \quad (1)$$

Courbon's Method

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$$R_i = \frac{PI_i}{\Sigma I_i}\left[1 + \frac{\Sigma I_i}{\Sigma I_i d_i^2}\ e\ d_i\right]$$
- where

  P= total live load

  I_i= moment of inertia of longitudinal girder

  e= ecentricty of the live load (or c.g. of loads in case of multiple loads

  d_i= distance of girder i from the axis of the bridge

Thank you

Reinforced Concrete Road Bridges

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Kharagpur

Lecture-19

Overview

1. RCC T Beam Bridge
2. Courbon's method of load distribution

RCC T Beam Bridge

Problem statement

Problem : 1 Design a RCC T Beam bridge for the following parameters :

- Center to center span: 20.000 m
- Width of carriage way : 7500.0 mm
- Width of the foot path : 1500.0 mm on either side
- Width of crash barrier : 450.0 mm on either side
- Wearing coat: 100 mm
- Loading :
  (i) IRC Class A
  (ii) IRC Class 70R(Tracked)
  (iii) IRC Class 70R(Wheel)
- Materials : Concrete : M30, Steel : Fe500

Schematic deck cross-section

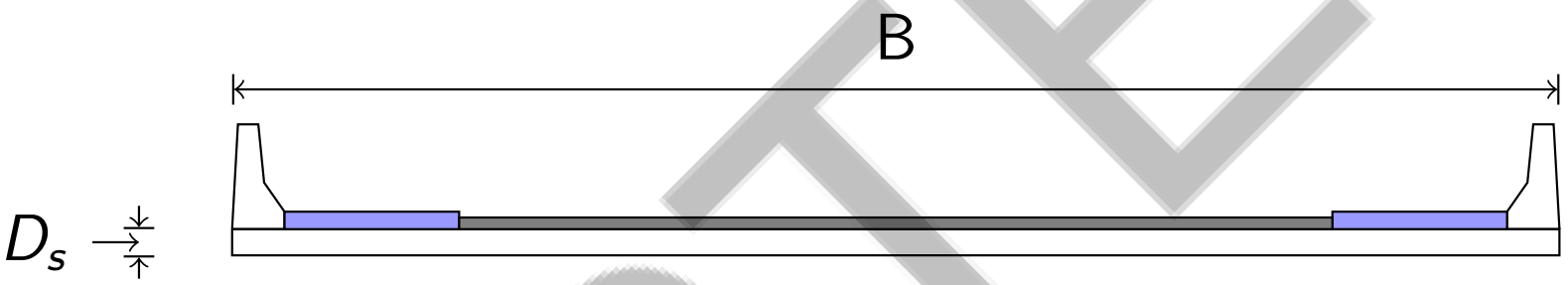

Figure 1: RCC T Beam : Deck C/S - schematic

Schematic deck cross-section

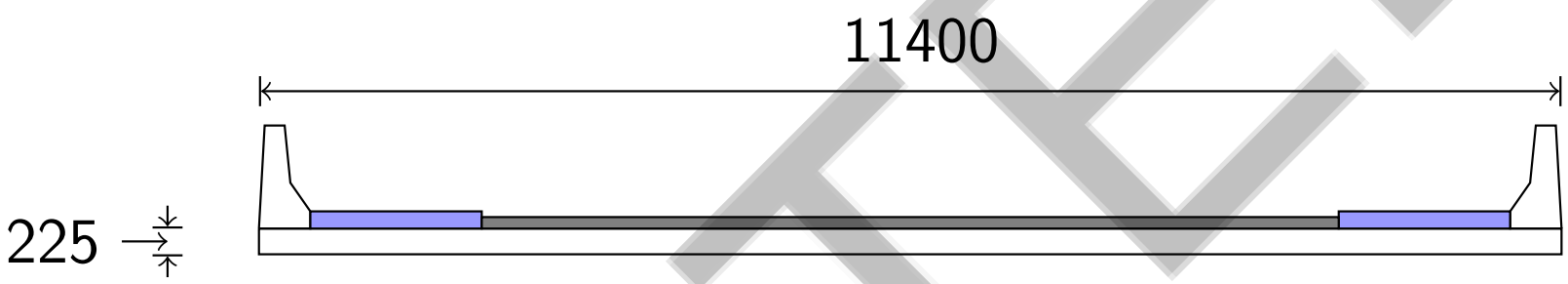

Figure 2: RCC T Beam : Deck C/S - schematic

Width of deck,B= $450.0 + 1500.0 + 7500.0 + 1500.0 + 450.0 = 11400.0\ mm$

RCC T Beam Bridge - 4 girders

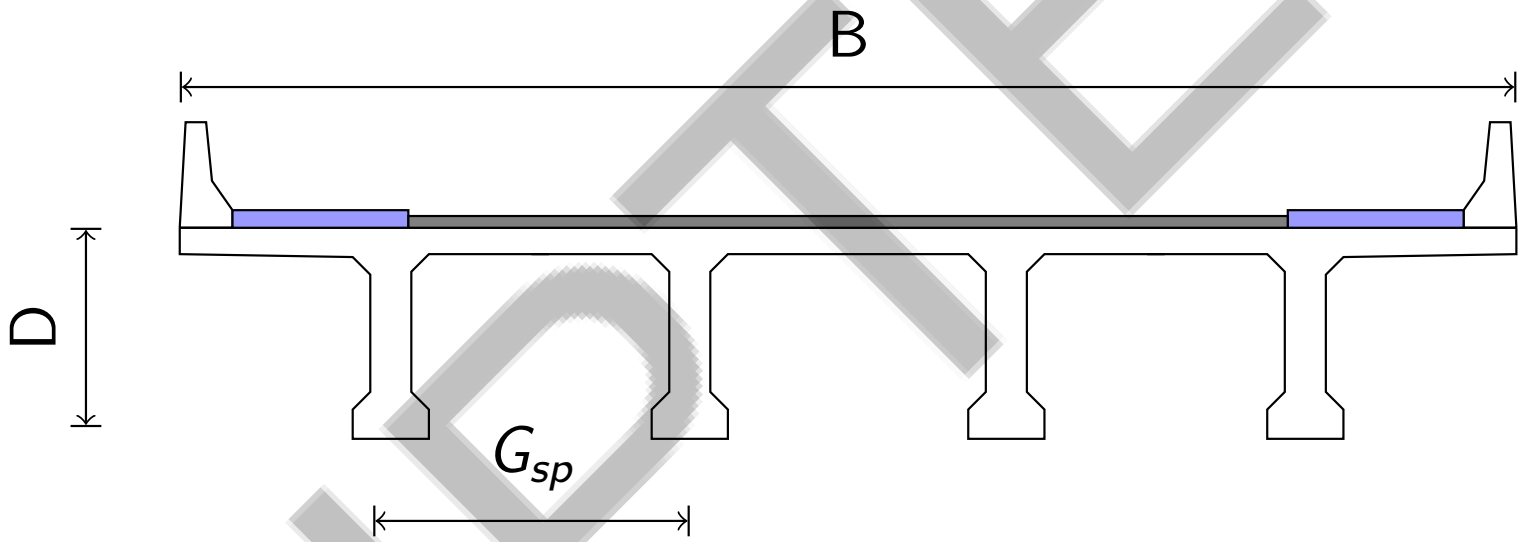

Figure 3: RCC T Beam : Span C/S

RCC T Beam Bridge - 4 girders

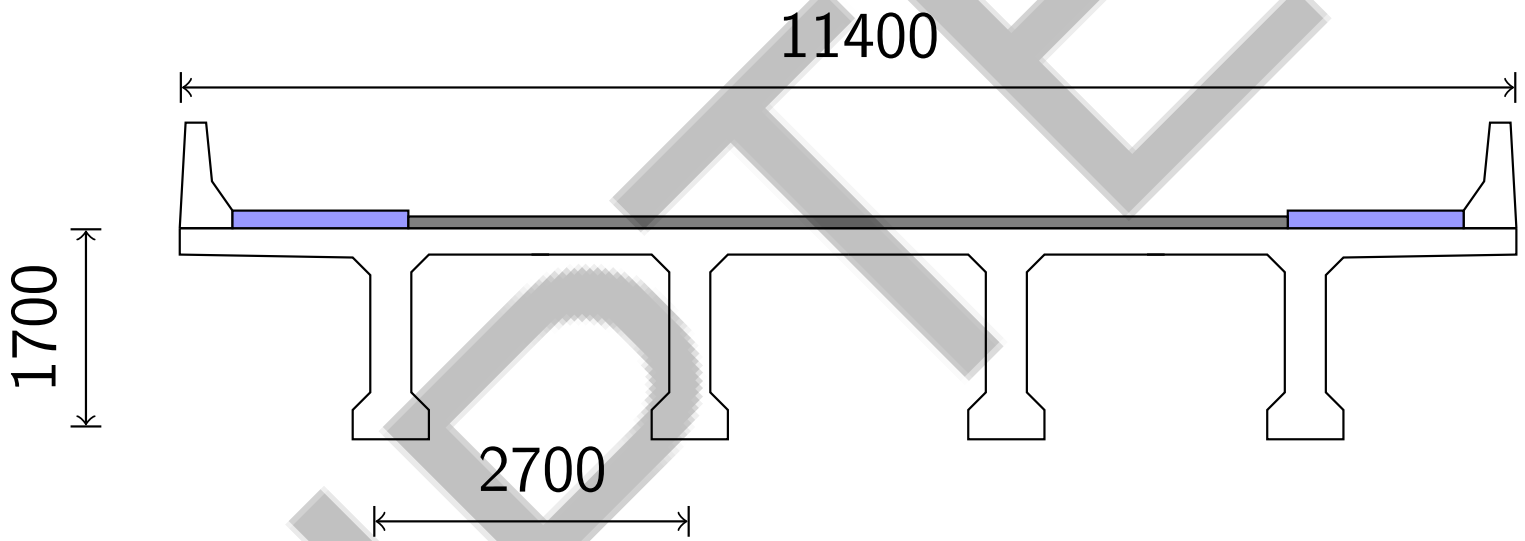

Figure 4: RCC T Beam : Span C/S

RCC T Beam Bridge - 4 girders

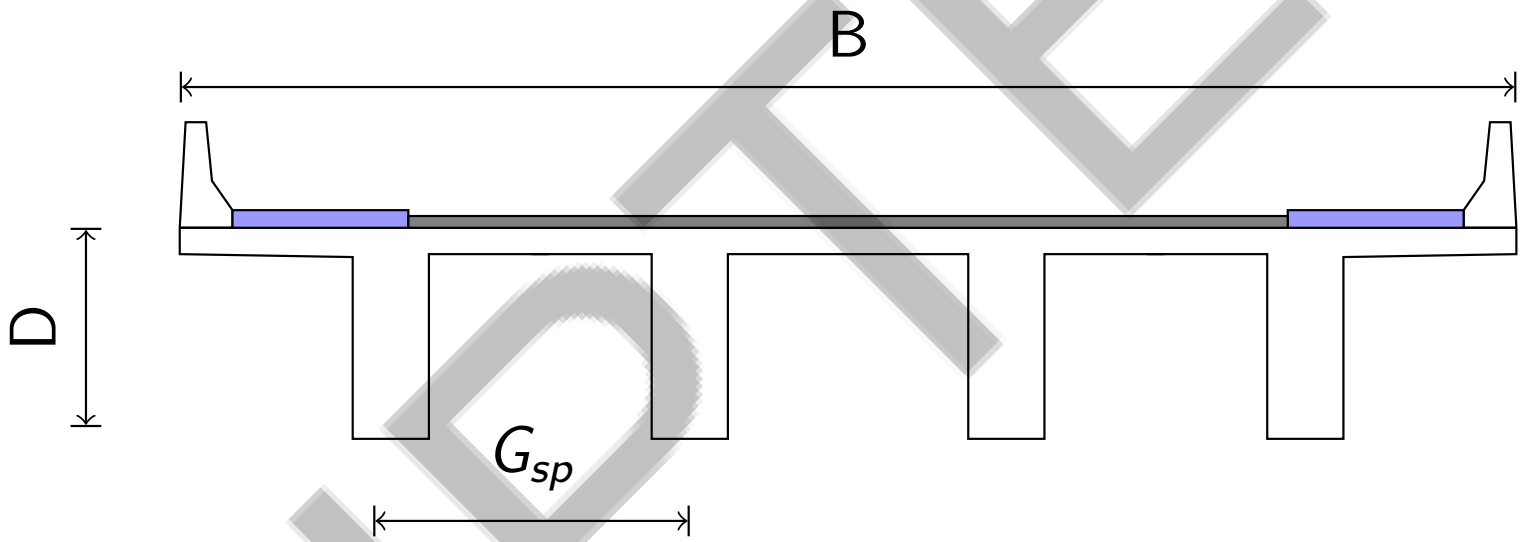

Figure 5: RCC T Beam : Support C/S

RCC T Beam Bridge - 4 girders

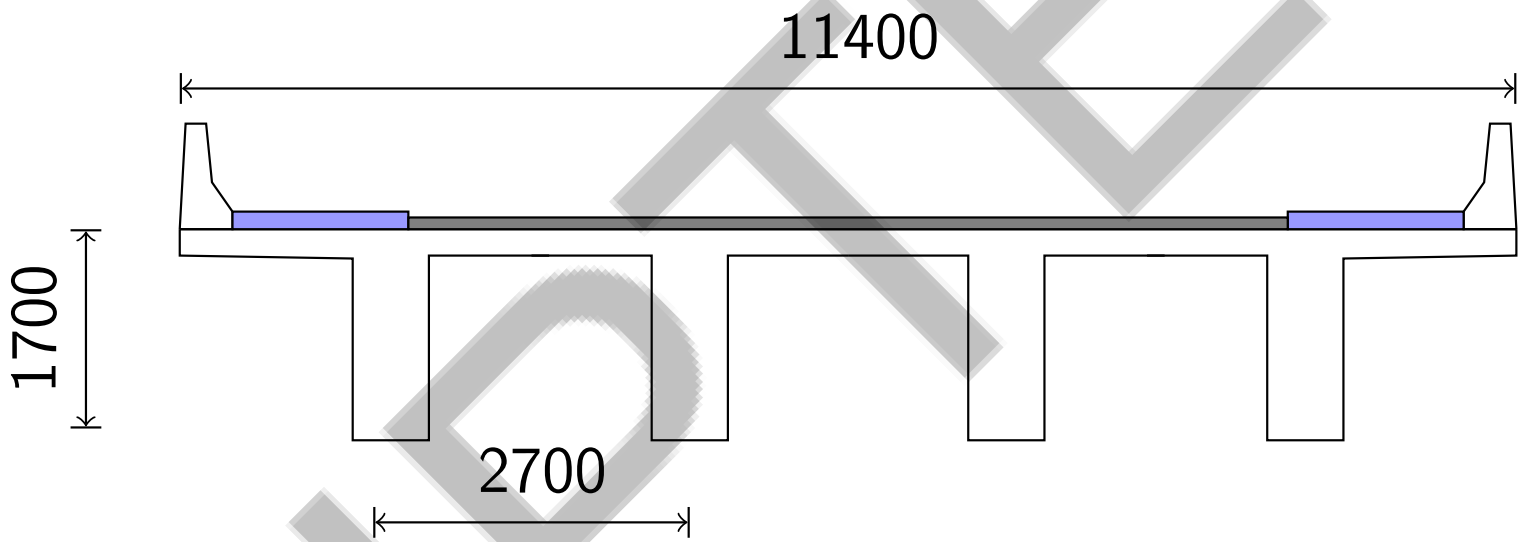

Figure 6: RCC T Beam : Support C/S

RCC T Beam Bridge - 4 girders

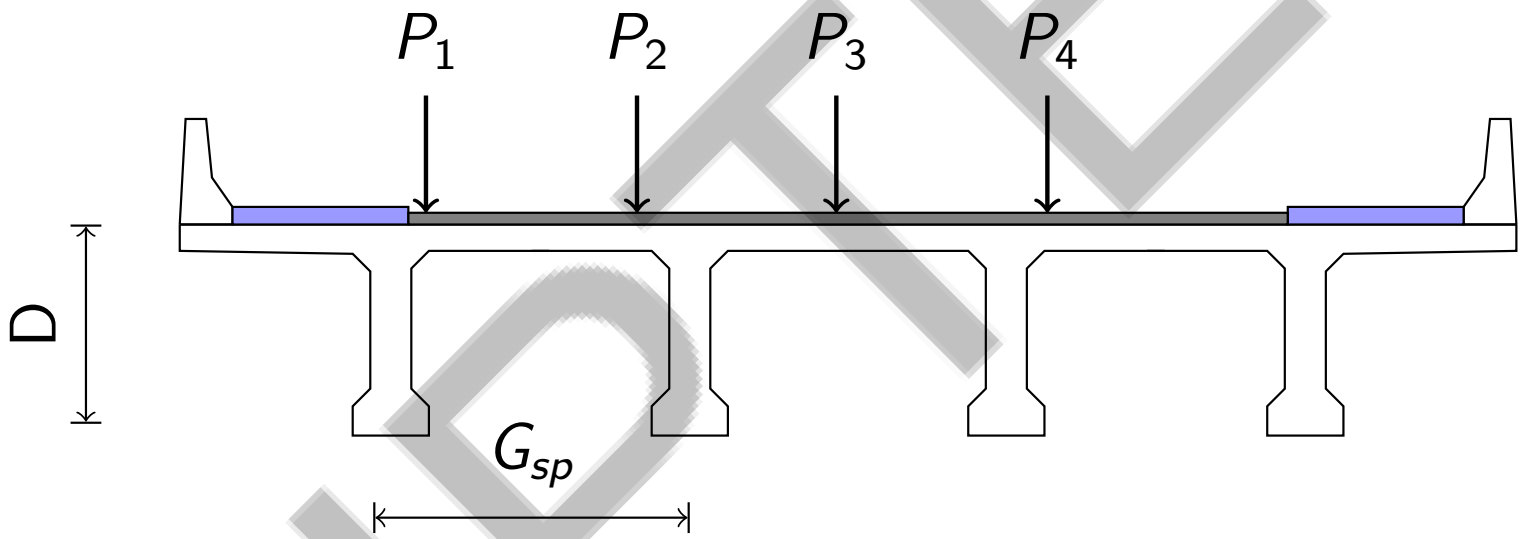

Figure 7: RCC T Beam : Span C/S

RCC T Beam Bridge - 4 girders

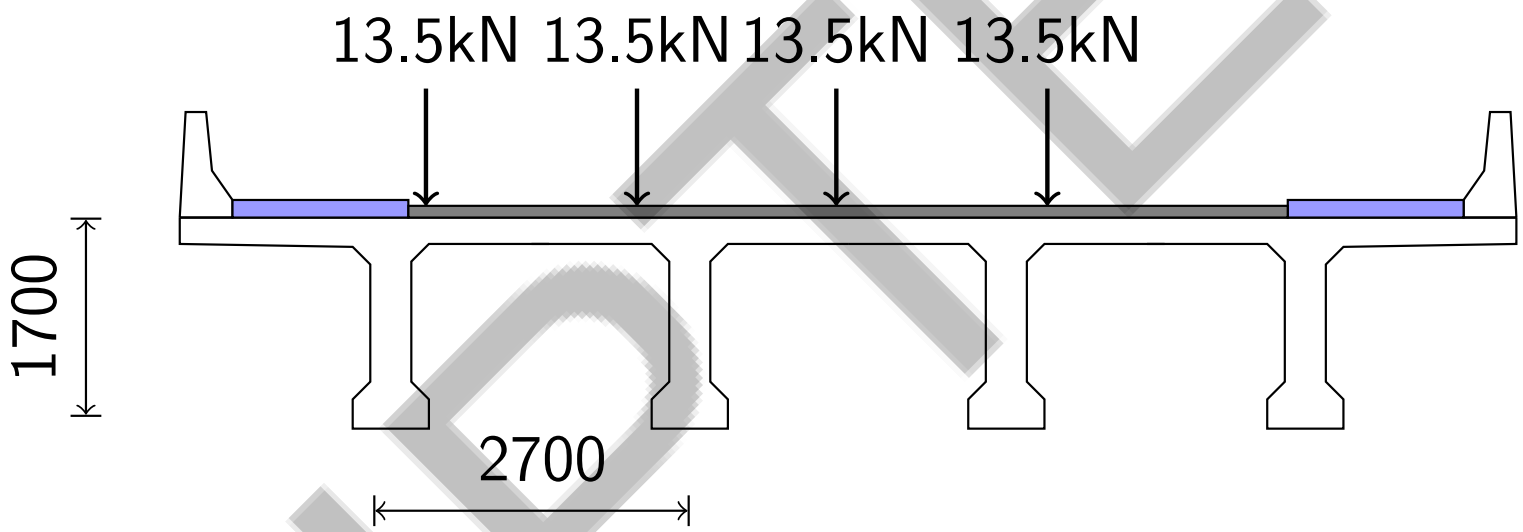

Figure 8: RCC T Beam : Span C/S

RCC T Beam Bridge - 4 girders

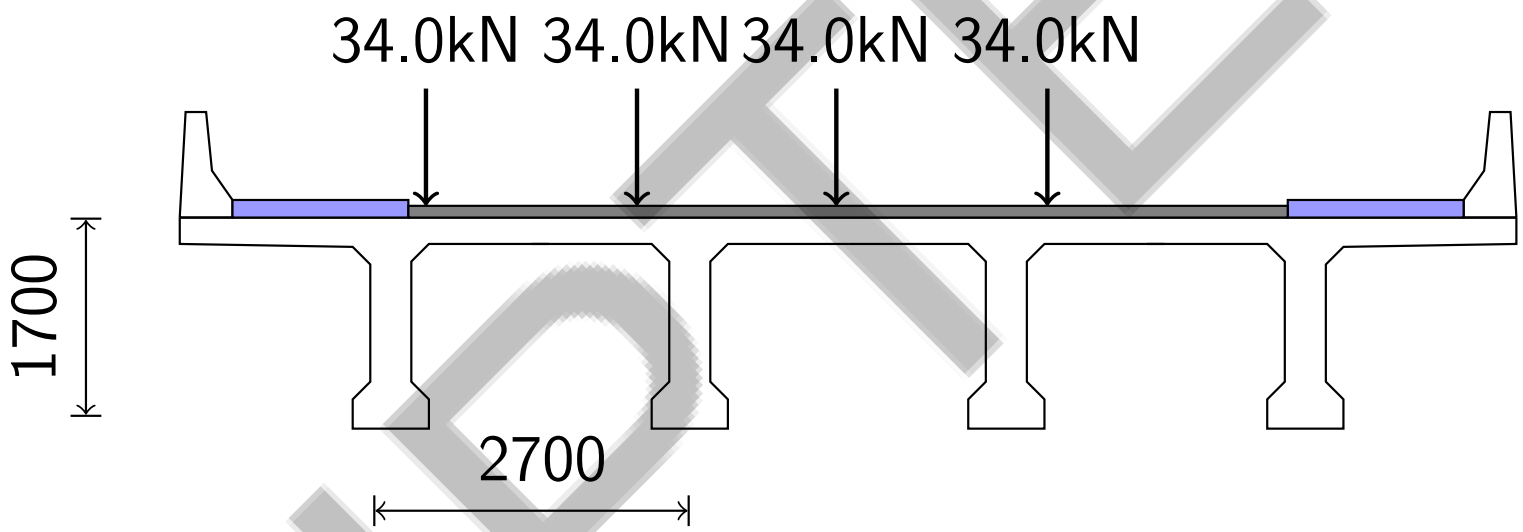

Figure 9: RCC T Beam : Span C/S

RCC T Beam Bridge - 4 girders

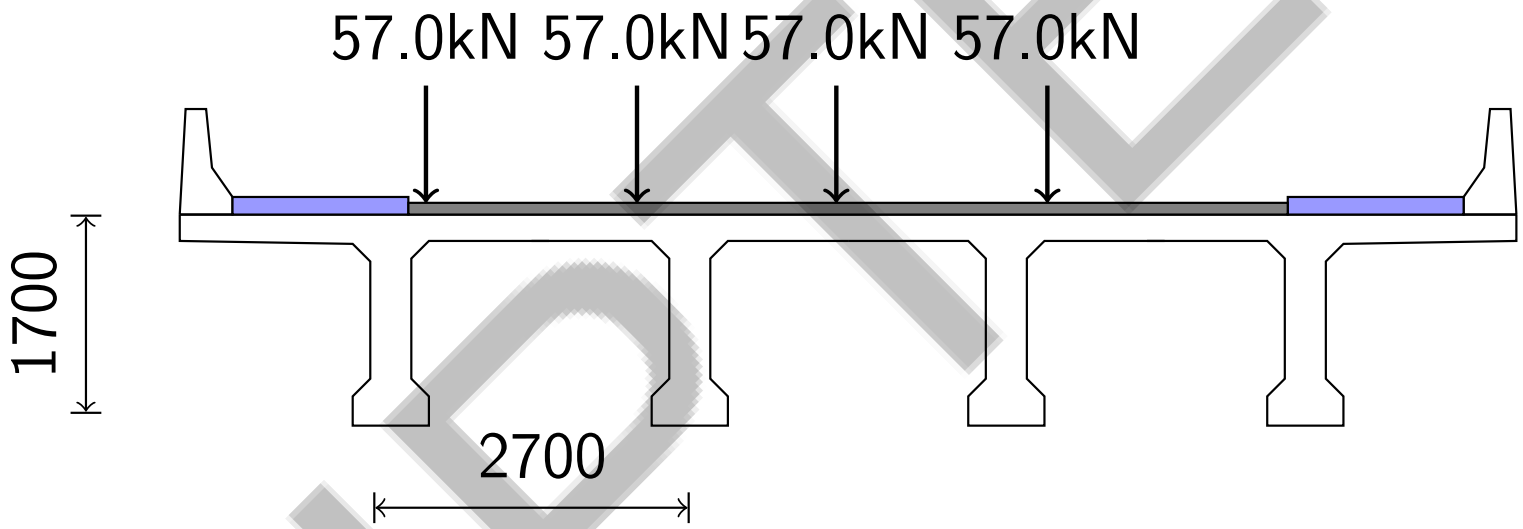

Figure 10: RCC T Beam : Span C/S

RCC T Beam Bridge - 4 girders

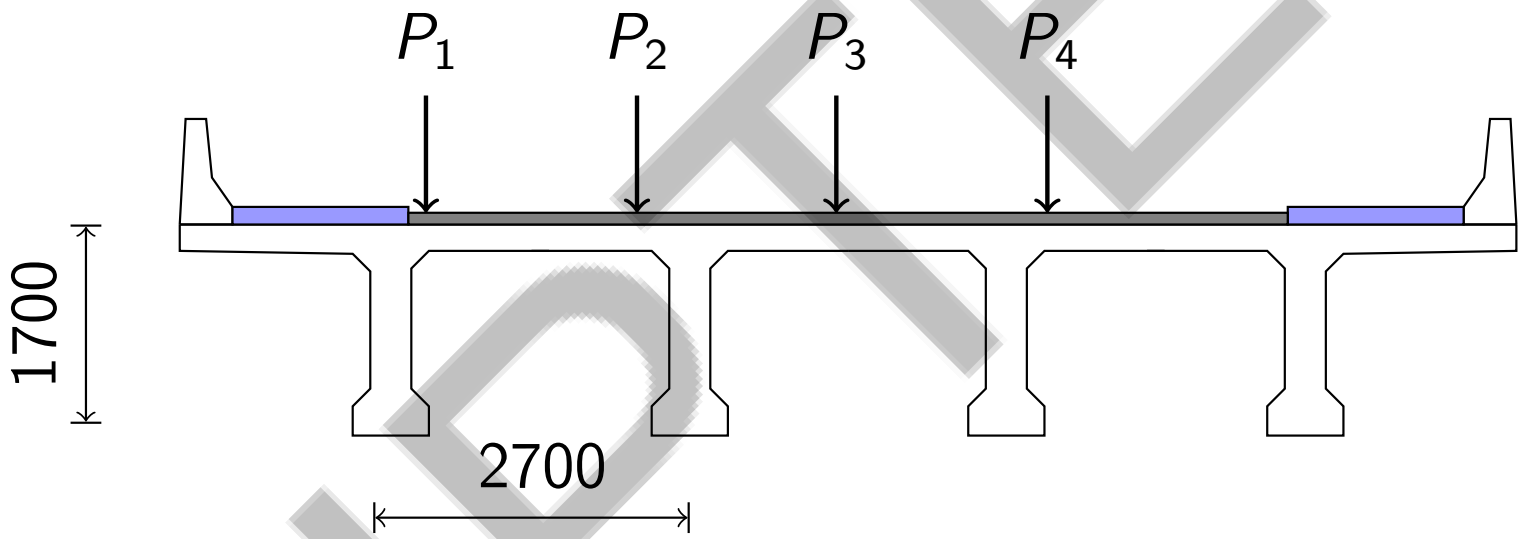

Figure 11: RCC T Beam : Span C/S

Courbon's method of load distribution

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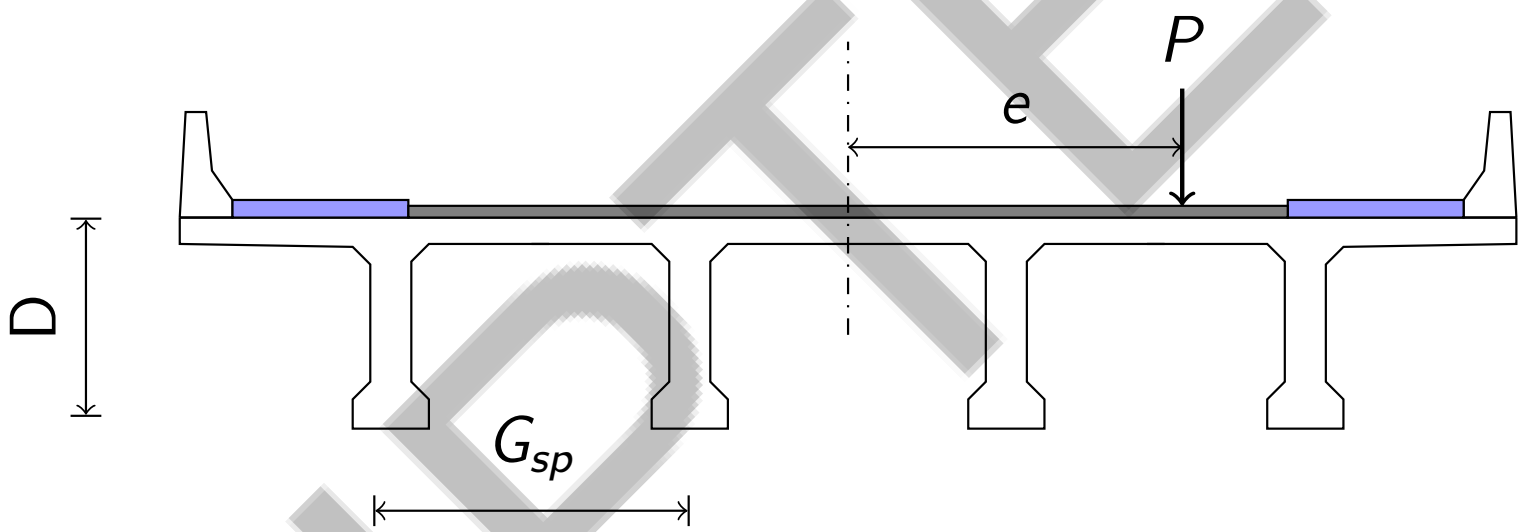

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Thank you

Reinforced Concrete Road Bridges

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Lecture-20

Summary and Closure

Reinforced concrete road bridges

- General introduction to Bridge Engineering is given

Reinforced concrete road bridges

- IRC loading and general features of design are discussed

Reinforced concrete road bridges

- Basic principles of design codes are discussed

Reinforced concrete road bridges

- Working stress method and limit state method of design are discussed

Reinforced concrete road bridges

- Various aspects of design of slab bridges are discussed

Reinforced concrete road bridges

- Various aspects of design of RCC T beam bridges are discussed

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Thank you