BIRLA INSTITUTE OF TECHNOLOGY & SCIENCE, PILANI
DEPARTMENT OF CIVIL ENGINEERING
FIRST SEMESTER 2023-24
CE G616: BRIDGE ENGINEERING
MID-SEM EXAMINATION
PART-A (CLOSE BOOK)

Duration: 30 Minutes **Max. Marks: 15**

Q1. For a slab culvert of effective span 5.0 m, determine the maximum *Live Load Moment* produced in the slab due to IRC Class 70R *wheeled* vehicle considering the vehicle axel loads *as concentrated loads* acting the at the mid-point of axel and moving on the slab idealized as 1-D structure.

[10]

Q2. For the T-beam bridge shown in Figure on sheet attached, assuming the wheel loads of IRC *Class 70R Tracked* vehicular loading as Concentrated loads acting at the centroid of wheels, determine the maximum Load transferred to the exterior longitudinal girder using the Courbon's method. Treating this load uniformly distributed over the contact length, determine the maximum moment in exterior girder.

[5]

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PART-B (OPEN BOOK)

Duration: 60 Minutes **Max. Marks: 30**

Q2. In a 12 m long and 9 m wide T-beam bridge, the spacing of longitudinal as well as transverse girders is 3.0 as seen in Fig. showing the Plan and a Section along the transverse direction. For this bridge,

a. Determine the maximum moments produced in an *internal slab panel* due to IRC Class 70R *Bogie loading* (total weight 400 kN) as shown in figure (in the sheet attached).

b. Determine the maximum moment produced in a *cantilever slab panel* of bridge due to IRC *Class-A* loading.

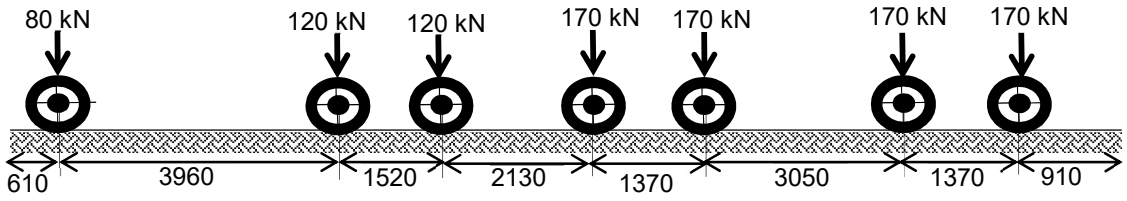
[10+10]

Q3. For the T-beam bridge shown in Figure, where the longitudinal as well as transverse girders are provided at 3.0 m c/c spacing and the as shown in figure. Assuming the wheel loads of IRC Class 70R Tracked vehicular loading as a *SINGLE* concentrated load of 700 kN acting at centroid of vehicle, determine the maximum bending moment in exterior longitudinal girder Hendry-Jaeger Method. The Hendry-Jaeger's parameter 'A' and 'F' are defined as

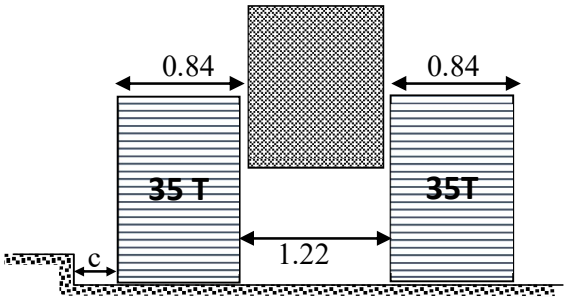
$$A = \frac{12}{\pi^4}\left(\frac{L}{h}\right)^3 . \frac{n\,EI_T}{EI} \quad \text{and} \quad F = \frac{\pi^2}{2n}.\left(\frac{h}{L}\right)C\left(\frac{GJ}{EI_T}\right); \quad where \quad C = \frac{EI_{outer}}{EI_{\text{int}\,ernal}}$$

[10]

Details IRC Class 70R and Class-A Loading

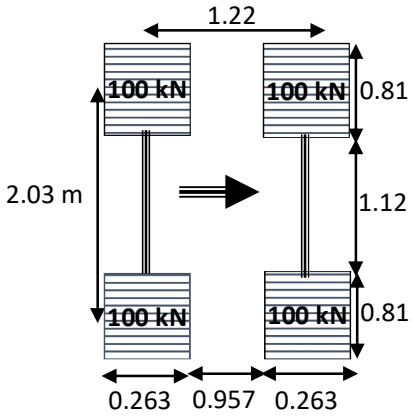


IRC Class-70R Wheeled Vehicle

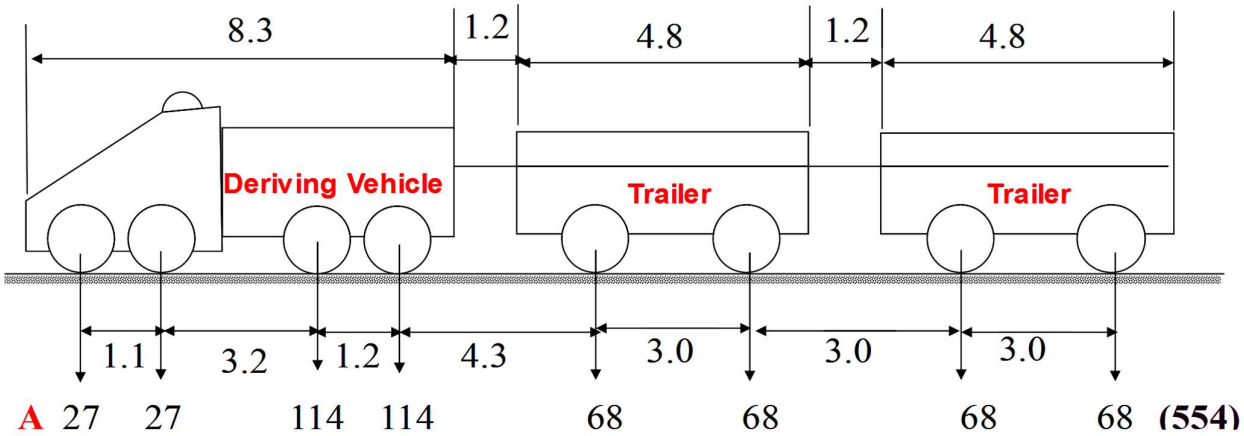


IRC Class-70R Tracked Vehicle

Wheel contact length along the span = 4.57 m
For 2-lane bridge (carriageway width<9.6 m) c = 1.2 m

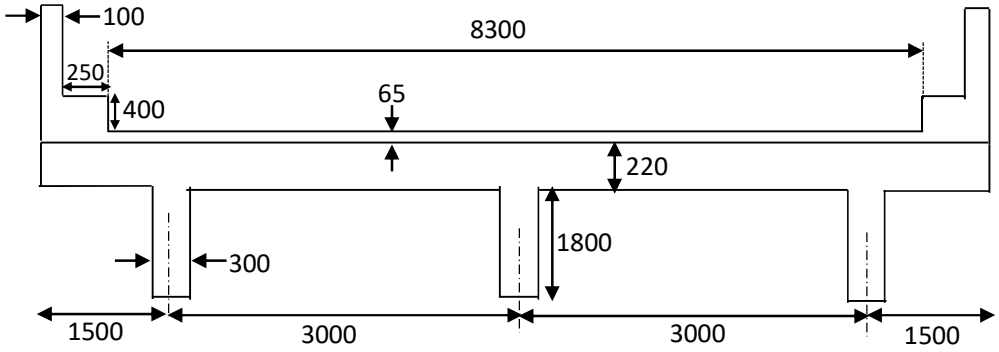


Contact dimensions of IRC Class-70R Bogie Loading



IRC Class-A Loading

Details of T-beam Bridge



Section at X-X