University Of Technology
Building and Construction Eng. Dept.
Final Exam – First Attempt – 2010/2011

Subject : Structural Design
Branch : Structural Eng

Class: 4th
Time : 3 Hours
Date : 7/ 6 /2011

Notes: 1) Answer only four questions
2) Open books and notes

Q1) By using subframe analysis method and alternate pattern loading find the maximum moment, end reactions for beams A & B in the precast concrete frame shown in Fig.1. Also find the maximum end moments for the columns C, D & E. Assume column C having fixed support and the beam column connections are pinned. Beam section is 300x600 mm and column is circular having 350 mm diameter. The distance from the edge of the column to the center of the beam end reaction is 100 mm. D.L.=45 kN/m and L.L.=35 kN/m.

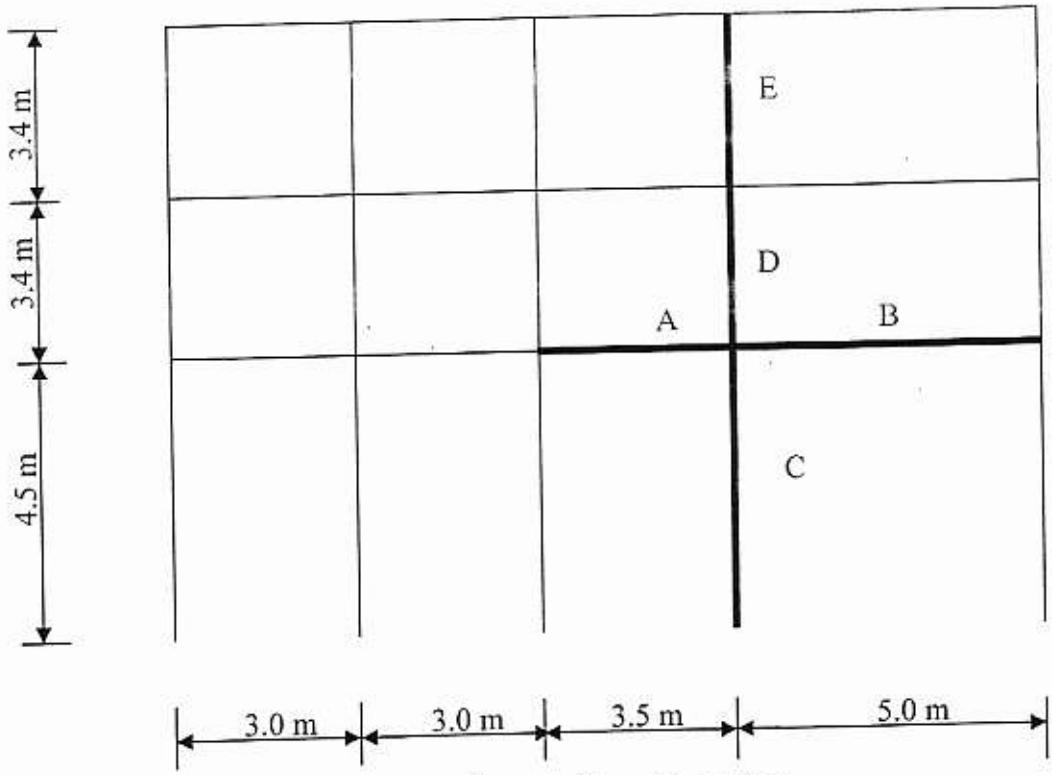

Fig.1 Precast frame Question One

Q2) By using LRFD method find the longitudinal main reinforcement perpendicular to traffic direction for the deck slab **(shown in fig.2)** for one of interior spans, the slab having total width 12.8m supported on five I girders of flange width 300mm as shown below. Assume slab thickness is 200 mm and wearing surface is made of asphalt of 70 mm thick having density of 23kN/m^3. Live load is HS15 according to AASHTO, concrete f_c'=21 mPa, f_y=410 mPa.

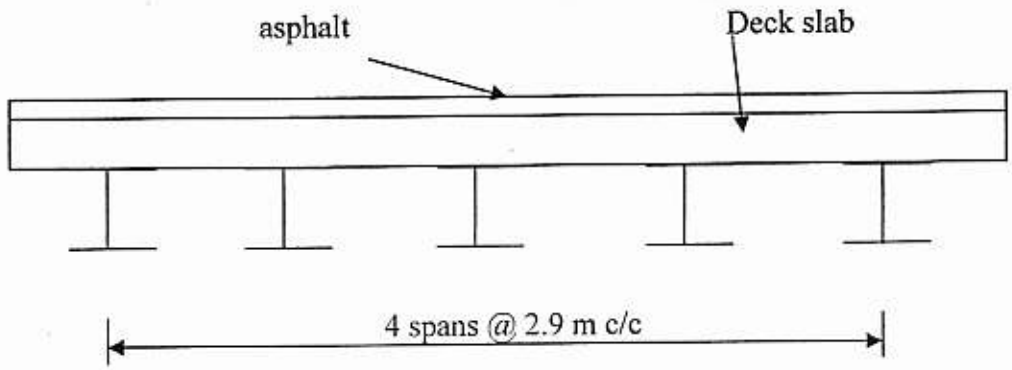

Fig.2 Deck slab Question two

Q3) Find the longitudinal main reinforcement parallel to traffic direction for the 12 inch thick deck slab having length 26.25 ft and width 32.8 ft, simply supported on concrete beams of width 13.8 inch. Assume wearing surface is made of asphalt of 2 inch thick of density 143 Ib/ft^3 while concrete density is 150 Ib/ft^3. Live load is HS15 according to AASHTO, concrete f_c'=5000 psi, f_y=60 ksi, E_c =57000$\sqrt{f_c'}$ psi, E_s=29,000,000 psi and use working stress design method.

Q4) A reinforced concrete circular water tank **(Fig.3)** having inside diameter 8.15 m, inside height 3.15 m wall thickness 200 mm, base slab thickness is350 mm which extending from exterior face of wall by 600 mm, shrinkage coefficient is 0.0003, f_c'=20 mPa, f_y=410 mPa, E_s=200,000 mPa and E_c =4700$\sqrt{f_c'}$

1. Determine the required wall reinforcement for maximum circular tension and flexure (positive or negative) considering that wall is fixed base and free top and the tank is under loading of water to its full height (leak test).
2. Check if the tank can be float or not when it is empty, if doesn't float find the factor of safety against floating and if floats what would you suggest to prevent it from floating.

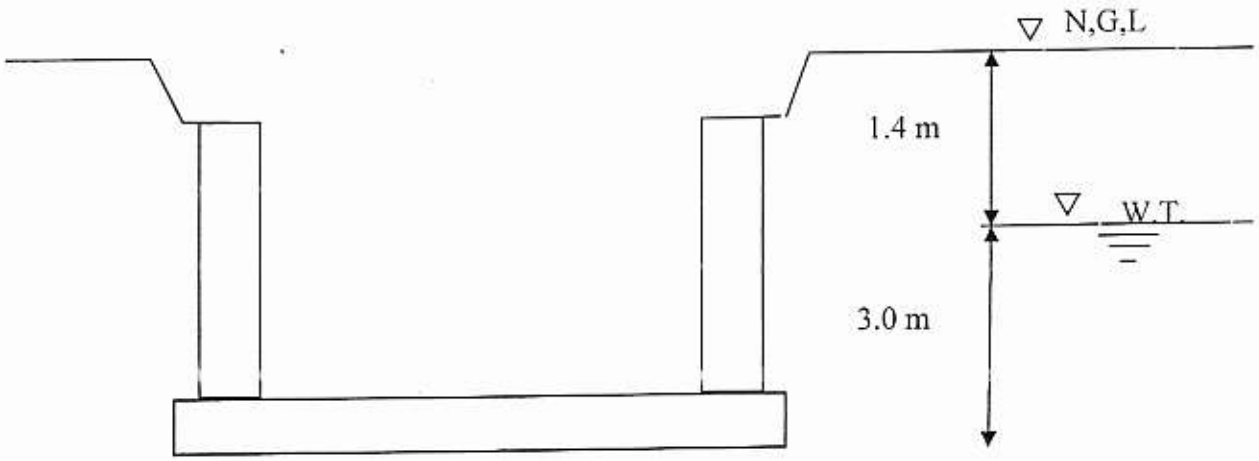

Fig.3 Tank of Question four

Q5) A rectangular concrete tank of two cells **(shown in fig.4)** having interior dimensions a=4m, b=8m and c=6m. Assume the condition that the tank has no cover and the base is hinged. Use f_c'= 27.5 mPa, f_y=400 mPa. Assuming wall thickness is 350 mm find:

1) Flexural reinforcement for the absolute maximum (from both horizantal and vertical) moment in short outer wall at edge of intersection between interior wall and exterior wall.
2) Required reinforcement for the BS 8007, assuming that crack width must not be more than 0.15 mm and bar spacing must not be less than 90mm.

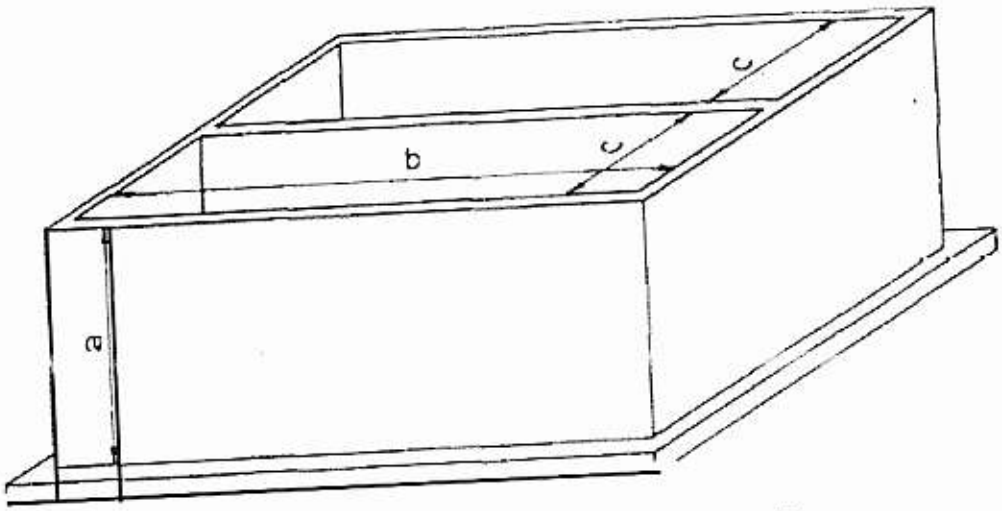

Fig.4 Tank of Question five