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Answers to assignment question.

Question 1a)

 Flexural strength which is associated with materials, is the bending strength (maximum) that can be applied to a material before it yields or fails. It is also known as modulus of rupture. It occurs transversely in a material.

Question 1b)

Section: 450 x 450

Ult axial load: 4000kn

Pile diameter: 500mm

Spacing: 1350 centre – centre

Fcu: 30N/mm2

Fy: 410N/mm2

Depth : 1100mm

Solu:

Edge distance: (500/2) + 150 = 400mm

Effective depth: h – cover – Ø = 1100 – 25 – 500 = 575mm

Span l: ½ x 1350 = 675mm

Critical s: 1/5 Ø = 1/5 x 500 = 100mm

Av = (1350-450)/2 = 450 – 100 = 350mm

a' = 250 – 100 = 150mm

Design for reinforcement:

As = (NL)/(4xD x V x 0.37 x Fyk) = (4000x103x675)/4x1050x0.87x410 = 1802.23mm2

Total area = 2As = 2 x1807.23 = 3604.47mm2

Provide Y25 at 250 c/c

Shear check:

 V = P/2 = 4000/2 = 2000KN

Vcd = V. (av)/(2d) = (2000 x 350)/(2 x 1050) = 333.33KN

Vrd . C = 0.12k (100PFck )1/2 ≥ (0.035 x 1.441.5 x 300.5) = 0.37 ≥ 0.005 (o.k)

Vrd .bd = (0.37 x 2225k x 1050)/(1000x1000) = 0.86 > 0.37

Question 2a)

Ø: 45°

Supports : 1820kg/m3

30 – 410N/mm3

Assume H= 5

Ka = (1-sin 45) / (1+ sin45) = 0.17

Pa = Ka x P x g x H = 0.17 x 1520 x 10 x 5 x 10-3

Load due to surcharge:

Ps = KaSL = 0.17 X 12 = 2.04KN/m2

Horizontal forces Hk = ½ x 15.47 x 5 = 38.675 KN

Horizontal forces due to surcharge H = 2.04 x 5 = 10.2

Vertical load

Hw = ½ x (a+b)h = ½ x (0.3 + 0.4) x 4.4 x 24 = 36.96 KN

Hc = ½ x (2.4 + 2.5) x 4.4 x 1820 x 10 x 103 = 196.196

Hb = APconc = 3.8 x 0.6 x 24 = 54.7KN

VL = Dsl = 2.4 X 12 =28.8KN

Overturning moment

Mo = (ϒf x Hk x H/3) + (ϒ x A x Hs x H/2) = (1.1 x 38.675 x (5/2)) + (1.5 x 10.2 x (5/2)) = 109.154KNm

Restraint moment

Mr = [(Hw (c + b/2)) + (Hb x B/2) + (Hc (d + b – a))] ϒf = [(36.96 (1.2)) + (54.7 x 1.9) + (196.196 (2.4 – 0.3))] x 0.9 = 526.23KNm

Question 2bi)

The base of bored pile is widened to increase its bearing capacity. This is done by under reaming the shaft at the base i.e. using an expanding cutting tool to cut conical shaped base which can be up to three times the diameter of the pile.

Question 2bii)

 The reinforcement are used as well as the design to increase its resistance to bending forces and compression forces during its transporting, boring (hammering or screwing), and load bearing stages.

Question 3b)

 The likely place to situate a bridge in Afe Babalola University is the road leading to the teaching hospital from the rout at the new/ fresher’s boy’s hostel. The reason being because, there is a mini bridge at that spot which is shallow and can be affected by natural disasters such as flooding. Also, this rout is meant to be a quick emergency rout to the hospital but the depression and the presence of a gate at that location and reduce the arrival time.

Question 4a:

The Ha loading system is a uniformly distributed loading system for small vehicles with the conventional permissible minimal weight while the Hb loading system is an abnormal loading system for loads which are indivisible loads permissible for exceptional industrial loads such as high and heavy machinery vehicles, generators, transformers, etc.

Question 4b)

Mathematical expression for active earth pressure:

Ka = (1 – sin Ø) / (1 + sin Ø) = tan2 (45° - Ø/2)

Mathematical expression for passive earth pressure:

Kp = (1 + sin Ø) / (1 - sin Ø) = tan2 (45° + Ø/2)