THE UNIVERSITY OF ZAMBIA

SCHOOL OF AGRICULTURAL SCIENCES

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TEST 1.

QUESTION ONE

a) natural building materials;
wood and soil.

Manmade building materials;
steel and concrete

(b) Original cost
- Maintenance cost
- Ease of cleaning
- Durability of the structure.

(c.) poor handling / poor seasoning;
- checks and splits.

natural defects

Brittle heart and knots.

Advantages

(f) It is readily available
- It is resistant to fire.

Disadvantages

- It has very high shrinkage
- It has low resistance to water penetration.

QUESTION TWO

a) - cement water ratio.
- cement aggregate ratio.

b) Data

15m long
10m wide
Slab 8cm thick $= \left(8cm \times \frac{1m}{100cm}\right) = 0.08m$

nominal mix = 1:2:4
Bulk density of sand - 1400kg/m3
Bulk density of stones - 1600kg/m3
volume of concrete 2/3 of sum of individual volumes
∴ decrease in volume $= \frac{2}{3} \times 100\% = 66.66\%$, $100\% - 66.66\%$
decrease in volume = 33.3%

efficiency = 95%

i.) Maximum size of the course aggregate (stones) in mm.

$8cm \times \frac{10mm}{1cm} = 80mm$

$= 80mm \times \frac{1}{4}$

$= \underline{20mm}$

Total volume;
$= 15m \times 10m \times 0.08m$
$= 12m^3$

Number of bags;

Assuming 33.3% decrease in volume when mixed and 5% was waste since our concrete mix was 95% efficient

$= 12m^3 + 12m^3(33.3\% + 5\%)$

$= 12m^3 + 4.596$

$= \underline{16.6m^3}$

bags of cement; $\frac{(16.6m^3 \times 1)}{6}$

$= \underline{2.77m^3}$

$2.77m^3 \times \frac{1000L}{m^3} = 2770L$

1 (50kg) bag $= 37L$

$x = 2,770L$

No. of bags $= \frac{2,770L}{37L}$

$= 74.864$

$= \underline{75 \text{ bags}}$

Tonnes of stones;

$= \frac{16.6m^3 \times 4}{6}$

$$\frac{66.4}{6}$$

$= \underline{11.1m^3}$

Convert bulk density to tonnes

$$= \frac{1600kg/m^3}{1000}$$

$= 1.6$ tonnes$/m^3$

volume $= \dfrac{16.6m^3 \times 4}{6}$

$= \underline{11.1m^3}$

Mass = Density x volume

$= 11.1m^3 \times 1.6$ tonnes$/m^3$

$=$ 17.70 tonnes

(iv) Tonnes of sand;

$$= \frac{16.6m^3 \times 2}{6}$$

$= \underline{5.53\ m^3}$

convert bulk density to tonnes

$= \dfrac{1400kg/m^3}{1000} = 1.4$ tonnes$/m^3$

Weight = volume x Density

$= 5.53 m^3 \times 1.4 \text{ tonnes}/m^3$

= **7.75 tonnes**

QUESTION 3

Two categories of Loads
- Dead loads
- Live loads.

Examples:

Dead loads - Footings, Foundations, walls, Floors

Live loads - Animals, The action of wind on an elevation.

point load = Length x base x UDL

$$UDL = \frac{\text{point load}}{\text{length} \times \text{base}}$$

$$= \frac{2000 \text{ KN}}{10 \times 12.05}$$

$= 16.597 \text{ KN}/m^2$

Total load supported by A

$A = 2.013 m \times 10 m \times 16.597 \text{ KN}/m^2$

$= 334.015 \text{ KN}$

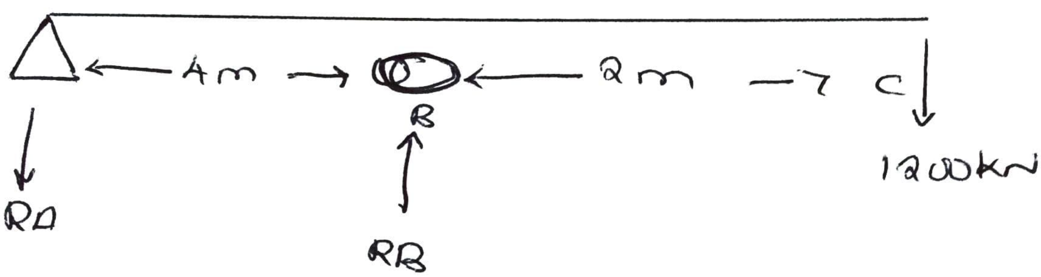
The uniform distributed Load acting on A

$$= \frac{334.015 \text{ KN}}{10 m} = 33.4015 \text{ KN}/m^2$$

~~cont~~

QUESTION 4

conditions;
- sum of all external forces acting on the body is zero
- sum of all external torques from all external forces is zero
  rotational (equilibrium) $\Sigma M_o = 0$
- net force should be zero
  $\Sigma F_x = 0 \quad \Sigma F_y = 0$



i) $\Sigma M_o = 0, \quad \Sigma F_y = 0, \quad \Sigma F_x = 0$

Taking moments at A

$\Sigma MO_A = 0$

$= -R_B(4) + 1200(6)$

$= -4RB + 7200$

$\frac{4RB}{4} = \frac{7200}{4}$

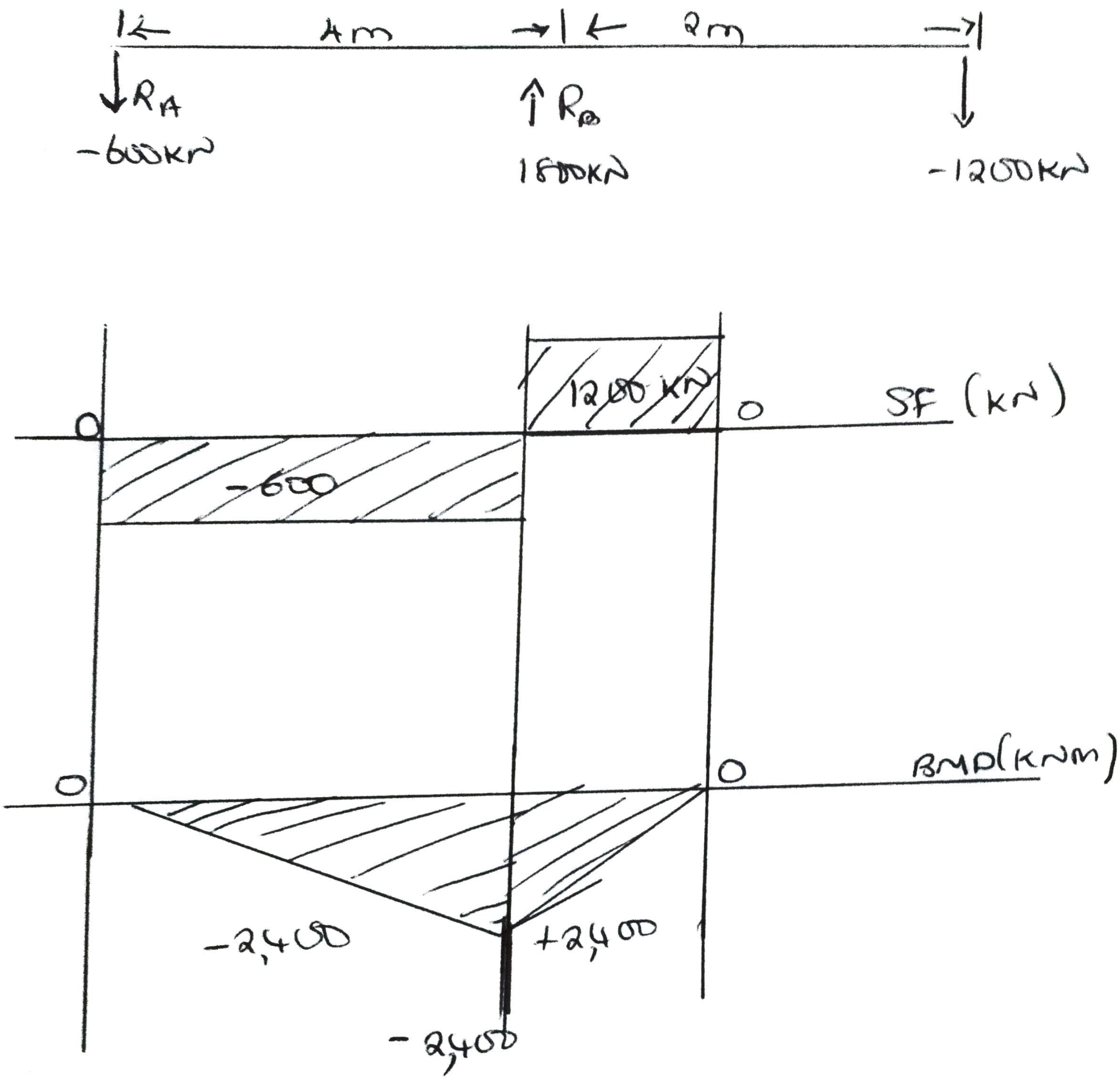
$R_B = 1800\ KN$

$\Sigma F_y = 0$

$= R_A + R_B - 1200\ KN$

$= R_A + 1800 - 1200KN$

$= R_A + 600KN \quad \therefore \ R_A = -600KN$



1200 kN at RB

-2400 kNm at RB