Bangladesh Bank

Post: Assistant Director (Civil)

Date: 2018

Total Marks-200

BANGLADESH BANK - AD

DESIGN | 2019 | INTEGRITY

Q.01 |

Interval	0	100	200	300	400
Area	800	900	1000	800	900

Find Volume?

Solution :

By Trapizoidal $V = \frac{d}{2}\{A_1 + A_n + 2(\text{Others})\}$

$= \frac{100}{2}\{800 + 900 + 2(1000 + 900 + 800)\}$

$= 355 \times 10^3 \ m^3$

Q.02 | Length of chain was 20m and measured length found 200m, Chain length found 10cm long. Find True length of measured distance.

Design Integrity
All about Civil Engineering

Solution :

$l = l' \times \frac{L'}{L}$

$= 200 \times \frac{20.1}{20}$

$= 201 \ m$

Ans:

Given

$L = 20 \ m$

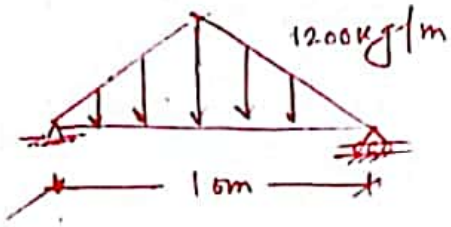
$L' = 20 + 0.1$

$= 20.1 \ m$

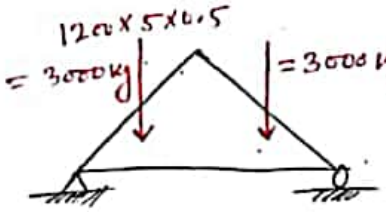
$l' = 200 \ m$

$l = ?$

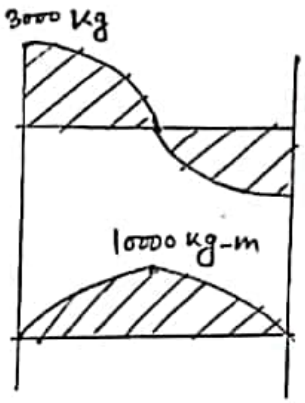
Q.03 | Draw SFD, BMD,



Solution:



$\uparrow R_A = 3000\ kg$ $\quad R_B = 3000\ kg$



Moment at mid

$= 3000 \times 5 - 3000 \times \frac{5}{3}$

$= 10,000\ kg\text{-}m$

G-4 | Design a cantiliven slab of overchanging length of 5', Depth of end support 12" and width 12", f'_c = 4ksi, f_y = 60ksi

Solution : Slab thickness = $\frac{L}{10} = \frac{5\times12}{10} = 6''$

Self weight = $\frac{6}{12}\times150 = 75$ psf

Now, Moment = $\frac{wl^2}{2} = (1.4\times75\times5^2)/2 = 1.312$ k-ft

Again, $M_u = \phi A_s f_y (d - a/2)$ Here $a = \frac{A_s f_y}{0.85 f'_c b}$

$\Rightarrow 1.312\times12 = 0.9\times A_s\times60\left(6 - \frac{1.47A_s}{2}\right)$ $= \frac{A_s\times60}{0.85\times4\times12}$

$\therefore A_s = 0.048$ in^2/ft $= 1.47 A_s$

Now, A_s (minimum) = $\rho_{min} \times bd = 0.0033\times12\times5$

$= 0.196$ in^2 (Taken)

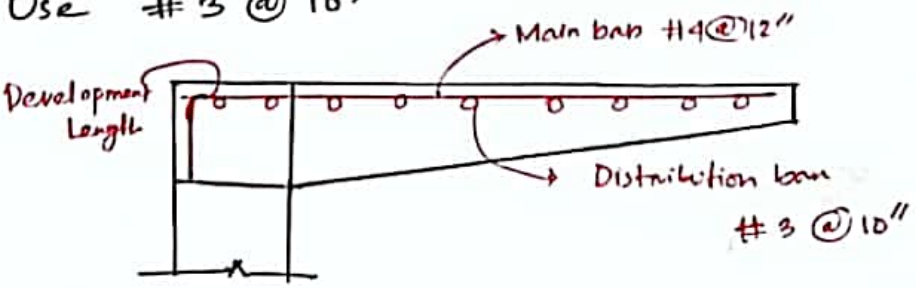
Spacing = $\frac{A\times12}{A_s} = \frac{0.2\times12}{0.196} = 12''$ (OK)

So, Use #4 @ 12" Spacing main bars

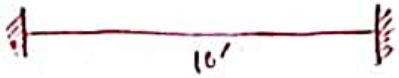
And, Transverse direction – Shrinkage and Temparature bar

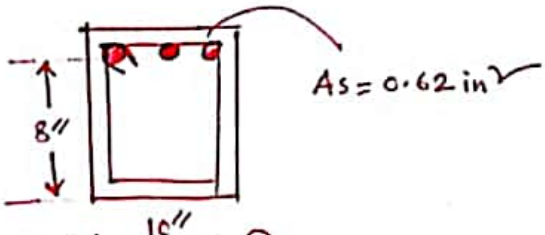
$A_s = 0.0018\,bd = 0.0018\times12\times6 = 0.1296$ in^2/ft

So, Use #3 @ 10"



Q.5





Find the maximum Live Load beam could carry?

Solution:

$$DL = \left(\frac{10\times10}{144}\times10\times150\right) = 1041.66\ \# = 1.04\ K$$

$$\text{Total Load} = (1.4\times1.04 + 1.7\times LL)$$

$$= 1.45 + 1.7\ LL$$

Now, $M = \frac{w l^2}{12}$

$$= (1.45 + 1.7\ LL)\times 10^2/12$$

$$= \frac{25}{3}\times(1.45 + 1.7\ LL)$$

Again, $M_u = \phi A_s f_y (d - a/2)$

$$= 0.9\times0.62\times60\times\left(8 - \frac{1.09}{2}\right)$$

$$= 249.5\ K\text{-inch}$$

$$a = \frac{A_s f_y}{0.85 f'_c b}$$

$$= \frac{0.62\times60}{0.85\times4\times10}$$

$$= 1.09$$

So, $\frac{25}{3}\times(1.45 + 1.7\ L) = 249.5$

$$\therefore LL = 16.75\ K$$

Ans:

Q.6] Define development length / $V_u = 30K$, if no web reinforcement provided. Find minimum Beam Section.

Solution:

For, No web reinforcement $V_u = \frac{\phi V_c}{2}$

So, $\frac{\phi V_c}{2} = \phi \sqrt{f_c'} \times bd$

$= 0.75 \times \sqrt{4000} \times bd$

$\Rightarrow 47.43\ bd = 30K \times 1000$ (pound)

$\Rightarrow bd = 632.45$

$\Rightarrow b^2 = 632.45$ (Assumed $b = d$)

$\therefore b = 25.14''$

$\therefore$ Beam Size = $25'' \times 26''$ Ans.

Q.07| Velocity of a vehicle 50kmph, Radius of curvature is 100m, Find super-elevation, when frictional coaffiient 0.15

Solution:

$$\text{Superelavation} = e = \frac{v^2}{127R} - w$$

$$= \frac{(50)^2}{127 \times 100} - 0.15$$

$$= 0.0468 < 0.06 \approx 6\%$$

(OK)

Ans: 0.0468

Q.08| Specific gravity 2.7, water content 8% Find

i) Porosity ii) Degree of saturation when void ratio e = 0.47

Solution:

Given
G = 2.7
w = 0.08
n = ?
S = ?
e = 0.47

i) $n = \frac{e}{1+e} = \frac{0.47}{1+0.47} = 0.32$

ii) $S = \frac{w \times G}{e} = 0.08 \times 2.7 / 0.47$

$= 0.45$

$= 45\%$

Ans

Q.9| Poisons ratio $\nu = 0.25$, $E = 30 \times 10^6$, Find the modulas of Rigidity

Solution:

Given

$\nu = 0.25$

$E = 30 \times 10^6$

$G = ?$

$$G = \frac{E}{2(1+\nu)}$$

$$= \frac{30 \times 10^6}{2(1+0.25)}$$

$$= 12 \times 10^6 \text{ PSI}$$

— Ans

Q.10| BOD Sample 5mg diluted in 300 mL of bottle when $DO_{(initial)} = 7.4$ mg/L, $DO_{(Final)} = 4.4$ mg/L Find

i) Standard BOD

ii) Final or ultimate BOD. If $K = 0.1 \text{ day}^{-1}$

Solution:

i) $BOD_5 = (D_{oi} - D_{OF}) / DF$

$= 7.4 - 4.4 / (5/300)$

$= 180$ mg/L

ii) $BOD_5 = BOD_{ult}(1 - e^{-kt})$

$\Rightarrow 180 = BOD_{ult} \times (1 - e^{-0.1 \times 5})$

$\therefore BOD_{ult} = 457.46$ mg/L

Ans

Q.11 1cm Sand / $Q = 300\ m^3/s$ / Design channel by Lacey's theory.

Solution:

$$f_s = 1.76\sqrt{d}$$
$$= 1.76 \times \sqrt{1 \times 10}$$
$$= 4.19$$

$$S = \frac{f^{5/3}}{3340 \times Q^{1/6}}$$
$$= \frac{4.19^{5/3}}{3340 \times (300)^{1/6}}$$
$$= 1.26 \times 10^{-3}$$

$$R = 0.47 \times \left(\frac{Q}{f}\right)^{1/3}$$
$$= 0.47 \times \left(\frac{300}{4.19}\right)^{1/3}$$
$$= 1.95\ m$$

$$P = 4.75\sqrt{Q}$$
$$= 4.75\sqrt{300}$$
$$= 82.27\ m$$

$$A = PR$$
$$= 82.27 \times 1.95$$
$$= 160.42$$

Assuming slope $H:V = 0.5:1$

$S = 0.5$

$$P = 82.27 = b + 2\sqrt{1+S^2} \times h$$
$$\Rightarrow 82.27 = b + 2 \times \sqrt{1+0.5^2} \times h \quad \text{---(i)}$$

Again,
$$A = (b + Sh) \times h$$
$$\Rightarrow 160.42 = (b + 0.5h) \times h \quad \text{---(ii)}$$

(i)/(ii)

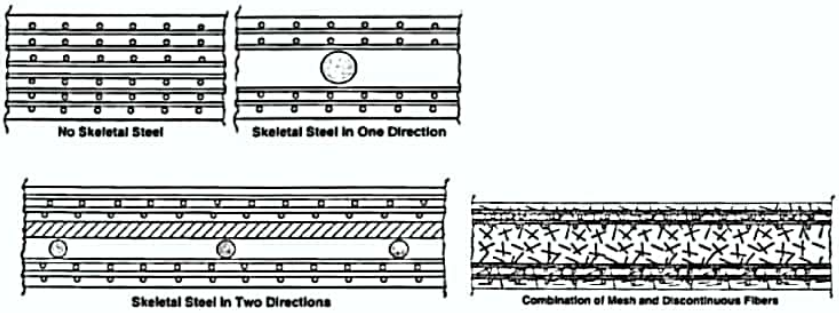
$h = 45.35\ m$

$b = 0.81\ m$

Ans

12. Draw ferrocement Section and describe C 1st class brick

Ferrocement Section:



1st Class brick properties:

- All bricks should be of first class of standard specifications.
- Bricks should be made of good earth completely burnt.
- Bricks should be of deep cherry red or copper color.
- Bricks should be regular in shape.
- Edges of bricks should be sharp.
- On being struck, bricks should emit clear ringing sound.
- Bricks should be free from cracks, chips, flaws and lumps of any kind.
- Bricks should not absorb water more than one sixth of its weight after one hour of immersing in water.
- Bricks should have a minimum crushing strength of 105 kg per square meter (1500 lbs per square inch).

Q13

Materials	Weight	Sp.G
Cement	267 kg	2.65
Water	190 kg	1.0
Sand (SSD)	779 kg	2.4
CA	1150 kg	3.0

Air void 3% / Find weight of concrete.

CEMENT

Density = $G\gamma_w = 2.65 \times 1000 = 2650\ kg/m^3$

Volume = $\frac{267}{2650} = 0.1007\ m^3$ $\left(V = \frac{m}{d}\right)$

WATER

Density = $1000\ kg/m^3$ $V = \frac{190}{1000} = 0.19\ m^3$

SAND

Density = $2.4 \times 1000 = 2400\ kg/m^3$

Volume = $\frac{779}{2400} = 0.32\ m^3$

CA

Density = $3 \times 1000 = 3000\ kg/m^3$

$V = \frac{1150}{3000} = 0.38\ m^3$

Total volume = $(0.1007 + 0.19 + 0.32 + 0.38) \times 1.03$

$= 1.02\ m^3$

Weight = $\left(1.02 \times \frac{W}{U.W}\right) = (1.02 \times 2400)$

$= 2880\ kg$

Ans: 2880 kg

14. Define Duty, delta. Derive the relationship between them.

Duty:

The term duty means the area of land that can be irrigated with unit volume of irrigation water. Duty represents the irrigating capacity of a unit. It is the relation the between the area of a crop irrigated and the quantity of irrigation water required during the entire period of the growth of that crop. For example, if 3 cumecs of water supply is required for a crop sown in an area of 5100 hectares, the duty of irrigation water will be 5100/3 = 1700 hectares/cumecs, and the discharge of 3 cumecs will be required throughout the base period.

Delta:

It is the total depth of the water required by a crop during the entire period the crop is in the field and is denoted by the symbol Δ. For example, if a crop requires about 12 watering at an interval of 10 days, and a water depth of 10 cm. If the area under the crop is A hectares, the total quantity will be 1.20 X A = 1.2 A hectare-metres in a period of 120 days.

Relation between Duty and Delta

D= duty in hectares/cumec

Δ= total depth of water supplied in metres

B= base period in days

i. If we take a field of area D hectares, water supplied to the field corresponding to the water depth Δ metres will be = Δ x D hectares-metres = D x Δ x1044 cubic-metres. .... (1)

ii. Again for the same field of D hectares, one cumec of water is required to flow during the entire base period.

Hence, water supplied to this field. = (1) x (B x 24 x 60 x 60) cubic-metres .... (2)

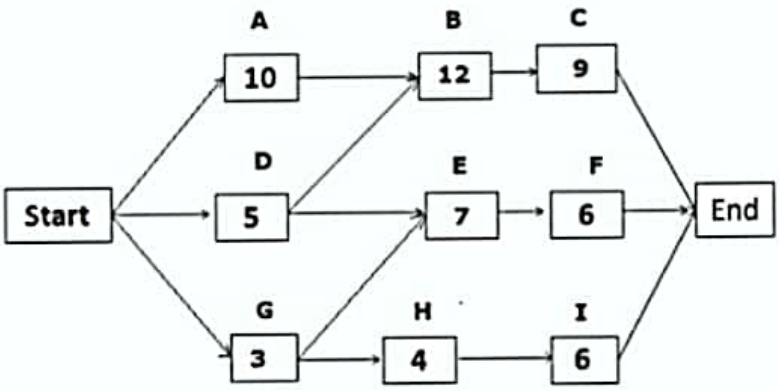
Equating Equations (1) and (2), we get

D x Δ x 1044 = B x 24 x 60 x 60

Δ = B×24×60×60D×104=8.64 B/D metres.

Δ=8.64 B/D metres

15. Based on the below network diagram, identify the total paths, critical path, and float for each path.



The above network diagram has five paths. The paths and their duration are as follows:

1. **Start -> A -> B -> C -> End**, Duration: 31 days. 2. **Start -> D -> E -> F -> End**, Duration: 18 days. 3. **Start -> D -> B -> d -> End**, Duration: 26 days. 4. **Start -> G -> H -> I -> End**, Duration: 13 days. 5. **Start -> G -> E -> F -> End**, Duration: 16 days.

Since the duration of the first path is the longest, it is the critical path. The float on the critical path is zero.

16. Explain about PIEV theory, & What are the criteria used in traffic signal?

PIEV theory

PIEV mens

P= Perception I=Intellection E=Emotion V=Violation

1) Perception time:

It's the time required for the sensations received by the eyes or ears of the driver to be transmitted to the brain through the nervous system & spinal cord or it is the time required to perceive an object or situation.

2) Intellection time :

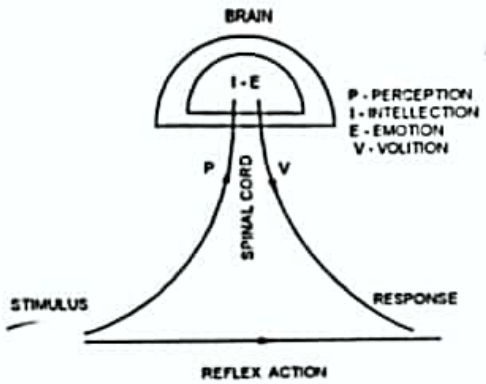
It's the time require for the driver to understand the situation it is also the time required for comparing the different thoughts.

3) Emotion time:

It's the time elapsed during emotional sensational and other mental disturbance such as fear, anger or any other emotional feeling superstition etc

4) Volitiontime:

It's the time taken by the driver for the final action such as brake application.



Criteria should considered in traffic signal;

The traffic engineer should consider the following things

1) Average number of vehicles and pedestrians using it
2) Analyzes crash statistics
3) Studies speed data
4) Examines road conditions
5) The physical layout of the intersection.
6) Delays experienced during peak hours
7) Average vehicle speeds
8) Roadside developments

17.What is green building technology?

A 'green' building is a building that, in its design, construction or operation, reduces or eliminates negative impacts, and can create positive impacts, on our climate and natural environment. Green buildings preserve precious natural resources and improve our quality of life.

There are a number of features which can make a building 'green'. These include:

- Efficient use of energy, water and other resources
- Use of renewable energy, such as solar energy
- Pollution and waste reduction measures, and the enabling of re-use and recycling
- Good indoor environmental air quality

- Use of materials that are non-toxic, ethical and sustainable
- Consideration of the environment in design, construction and operation
- Consideration of the quality of life of occupants in design, construction and operation
- A design that enables adaptation to a changing environment

Any building can be a green building, whether it's a home, an office, a school, a hospital, a community centre, or any other type of structure, provided it includes features listed above.

However, it is worth noting that not all green buildings are – and need to be - the same. Different countries and regions have a variety of characteristics such as distinctive climatic conditions, unique cultures and traditions, diverse building types and ages, or wide-ranging environmental, economic and social priorities – all of which shape their approach to green building.

18. Define internet intranet extranet

1. Internet :

The network formed by the co-operative interconnection of millions of computers, linked together is called Internet. Internet comprises of :

2. Intranet :

It is an internal private network built within an organization using Internet and World Wide Web standards and products that allows employees of an organization to gain access to corporate information.

3. Extranet :

It is the type of network that allows users from outside to access the Intranet of an organization.