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IQRA NATIONAL

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Q NO# 01:-

Part (a) :- principle of prestressing:-

- Some important conclusions can be drawn from previous simple examples:
- prestressing can control or even eliminate concrete tensile stress for specified loads.
- Eccentric prestress is usually much more efficient than concentric prestress.
- variable eccentricity is usually preferable to constant eccentricity, from the viewpoints of both stress control or deflection control.

Advantages of prestressing:-

- prestressing results in the overall improvement in performance of structure concrete used for ordinary load or spans.
- prestressing extends the range of application far beyond the limits for ordinary reinforced concrete, leading not only to much longer spans with economical member cross sections than previously through possible, but permitting innovative new

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Structural forms to be employed.

Part (B) :-

Methods of prestressing:

- Although many methods have been used to produce the desired state of precompression in concrete members, all pre-stressed concrete members can be placed in one of two categories.
- pre-Tensioned,
- post-Tensioned.

Pre-tensioning :-

- the Strands are tensioned over the casting bed at full length of the time, after which a number of individual members are cast along the stressed tendon.
- When the jacking force is released, the pre-stress force is transferred to each member by bond, ay the Stands are cut free b/w members.

• post-Tensioning :-

- ~~When the tendon~~ usually hollow conduits containing

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Containing the unstressed tendons are placed in the beam forms, to the desired profile, before pouring the Concrete.

- the Conduit is wired to auxiliary Beam reinforcement (unstressed Stirrups) to prevent accidental displacement, as the Concrete is poured.

- when it has gained Sufficient Strength, the Concrete beam itself is used to provide the reaction for the Stressing Jack.

Part (c):-

Bridge:- Bridge is a Structure having an opening not less than 6000 mm forms part of a highway or over, or under which the highway passes.

Example:
⇒ Ayub Bridge in Sukkur.

⇒ Kanchey Bridge Gilgit.

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Culvert :-

Structure ~~6000~~ having Span less then 6000 mm generally is called Culvert : they are generally used for water Conveying through barrier.

E.g = i) Hayatabad phase 7 Colvert.

part (D) :-

there are two types of loads Considered an design of bridge.

- **permanent loads:-**
- Self weight of ginders & deck, wearing Surface, Curbs & parapets & railing, utilities & luminaries & pressures from earth retainments.

- **Transient loads:-**
- Gravity (Live) load due to vehicular, railway & pedestrian traffic.
- the automobile is one of the most bridges; it is the truck

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it is the truck that Causes the Critical load effects.

- Lateral loads due to water, wind, earthquake & ship collisions etc.

part (e):-

(SMRF):-

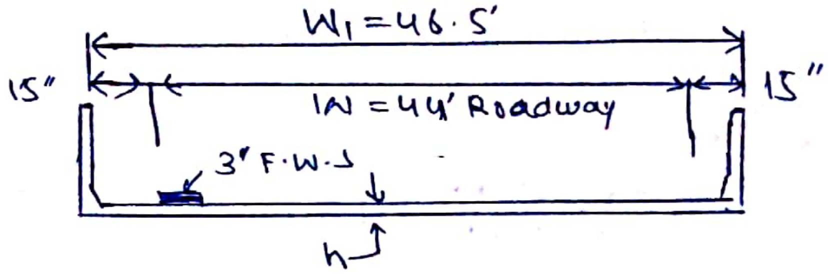
SMRF Stand for Special moment ~~frame~~ resisting frame. A moment resisting frame specially detailed to provided dectile behaviour & comply with the requirements gives in IS-4326 or IS-13920.

~~OMRF~~

OMRF:-

OMRF Stand ordinary moment resisting frame. A moment resisting frame not meeting Special detailing requirments for ductile behaviour.

Q NO#02 :-



Sol:.

Step # 01 :-

Sizes:-

- Length of Bridge (S) = 35 ft c/c.
- Clear roadway width (W) = 44 ft
- For a Curb width of 15", total width of bridge $(w_1) = 44 + (2 \times 15/12) = 46.5$ ft.

- Minimum thickness of Bridge

$h_{min} = 1.2(s+10)/30 = 1.2(35+10)/30 = 1.8 \text{ ft} \times 12$

$= 21.6'' \approx 22''$.

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Step # 02

Loads :

- Slab load (W_{DC}) = $h \gamma_{conc}$

$= (22/12) \times 0.15 = 0.275$ ksf.

- wearing Surface load (W_{DC}) = $h \gamma_{wearing\ surface}$

$= (3 \div 12) \times 0.14 = 0.035$ ksf.

Step # 03 :-

- Dead load moment :-

Slab moment (M_{DC}) = $W_{DC} S^2 \div 8$.

$= 0.275 \times (35^2) \div 8 = 42$ ft - Kip/ft

- wearing Surface moment (M_{DW})

$= W_{DW} S^2 / 8$

$= 0.035 \times 35^2 \div 8 = 5.3$ ft - Kip/ft.

- Live load moment :-

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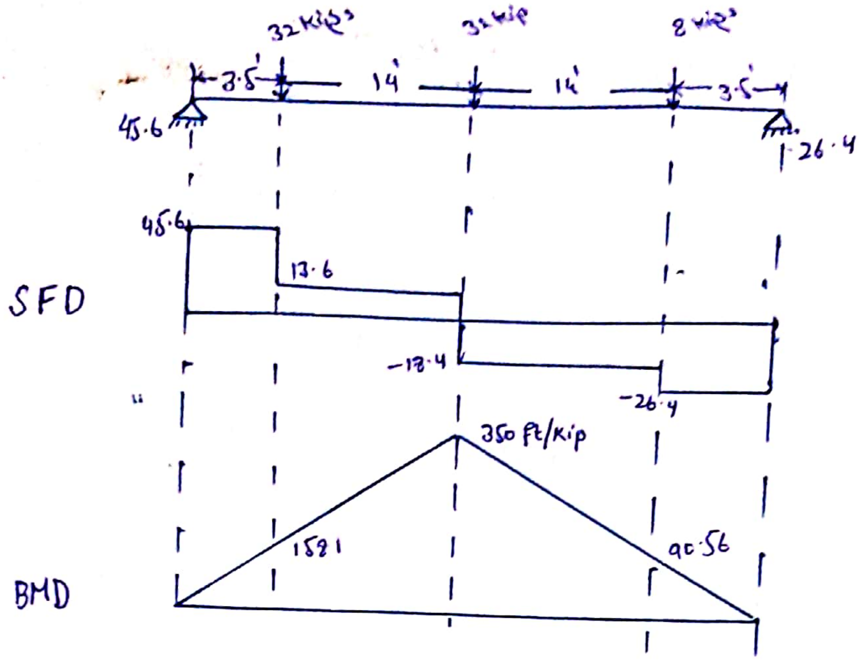
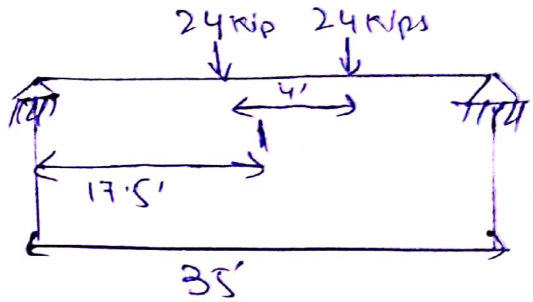


- Truck Load moment

$M_{truck} = 350$ ft/kip

- Tandem moment:

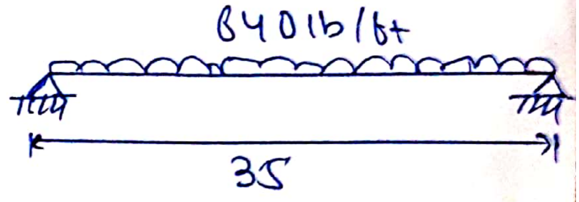
$M_{tandem} = 372$ ft/kip.



- Lane Moment:-

$M_{lane} = 0.64 \times 35^2 \div 8$

$= 98$ ft/kips.



- Live load Moments:-
  - $M_{tandem} > M_{truck}$ therefore we will use M_{tandem}

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- M_{LL+IM} (including impact) = $1.33\, M_{tandem} + M_{lane}$

$= 1.33 \times 372 + 98 = 593$ ft-kip.

- To convert $M_{LL \cdot IM}$ to moment/ft, divide M_{LL+IM} "E" design lane width.

- Design lane width "E".
- For single lane loaded:
- $E\,(\text{inches}) = 10.0 + 5.0 \sqrt{(L_1 W_1)}$

L_1 = Modified span length = Minimum of (S = 35 ft) or 60 ft = 35 ft

W_1 = Modified edge to edge width = minimum of (W_1 = 46.5 ft) or 30 ft = 30 ft.

- therefore, $E = 10.00 + 5.0 \sqrt{(35 \times 30.00)}$
$= 172$ in $= 14.3$ ft

- Design lane width "E".
- For multilane loaded.
- $E\,(\text{inches}) = 84 - 1.44 \sqrt{(L_1 W_1)} \leq W_1 / N_L$

W_1 = minimum of (W_1 = 46.5 ft) or 60 ft
= 46.5 ft.

N_L = No. of design lanes = INT(W/12)
(44/12) = 3

- $E = 84 + 1.44\sqrt{(35 \times 46.5)} \leq 46.5 \div 3$
  $= 142$ inch or 11.84 ft ≤ 15.5.
- therefore, $E = 11.84$ ft (least of all).
- Moment (per foot).
- M_{LL+IM} per foot $= 593 \div 11.84 = 50$ ft-kip/ft

Now,
- $M_u = 1.05\,[1.25 M_{DC} + 1.5 M_{DW} + 1.75 M_{LL+IM}$ (per foot)]
- $M_u = 1.05\,(1.25 \times 42 + 1.5 \times 5.33 + 1.75 \times 50)$.
- $M_u = 155.3$ ft-kip/ft $= 1863.6$ in-kip/ft

Step No # 04.:

Design:-(a)

- Moment (M_u) $= 155.3$ ft-kip/ft $= 1863.6$ in-kip/ft
- Effective depth of bridge slab (d) =
  h - cover - 1/2 x Dia of bar used.
- using # 8 bar, effective depth is bottom Cover for slab is taken equal to 1".
- $d = 22 - 1 - 1/2 \times 1 = 20.5$ inch.
- $A_{s\,min} = 0.0018 \times 12 \times 22 = 0.47\ in^2$.
- $A_s = M_u / \{\phi f_y (d - a/2)\}$.
- After trials $A_s = 1.80\ in^2$, (#8 4 inches c/c)

Design (B)

- Distribution reinforcement (bottom transverse reinforcement [A S .14.4.1].
- $A_{transverse} = (100/\sqrt{S}$ or 50 %) of As

$$100/\sqrt{35} = 16.9\ \% < 50\ \%$$

- therefore, A transverse = 0.169 × 1.80
  = 0.304 in².

- A_{stmin} (shrinkage) = 0.0018 Ag
  = 0.0018 × 12 × 22 = 0.47 in²
  (# 5 @ 8 inch c/c)

- maximum Spacing for temperature steel reinforcement in one way slab according to ACI 7.7.6.2.1 is minimum of
- $5h_f = 5 \times 22 = 110"$.
- 18".
- therefore # 5 @ 8 inches c/c is ok.

- Shrinkage & temp reinforcement in top face of slab (long & transverse both). For grade 60 steel

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- Finally usually #5 @ 8 inch c/c.
- Final Recommendation.
- Main Steel (Bottom = #8 @ 4" c/c.
- Transverse bottom reinforcement = #5 @ 8" c/c throughout.
- Top Steel (long & Transverse) = #5 @ 8" c/c.

Step # 05

Drafting:-