Submitted To ⇒ Engr Fawad Khan.

Submitted By ⇒ Abdullah Aziz.

I.D ⇒ 7671.

Section ⇒ Senior.

Paper ⇒ PRCD II.

Exam ⇒ Summer (Mid).

Date ⇒ 25-August-2020.

IQRA NATIONAL UNIVERSITY,

QNO# 01;
part (a):

Capacity & demand on Structures:

Capacity:

The overall ability of a Structure to Carry an imposed demand.
Beam will resist the applied load upto to its Capacity & will fail when demand exceeds Capacity.

- Failure:
- occurs when Capacity is less than demand.
- To avoid failure, Capacity to demand ratio should be kept greater than one, or at least equal to one.
- It is, however, intuitive to

P.T.O

one.

- It is, however, intuitive to have some margin of safety i.e to have capacity to demand ratio more than.

- Demand:-
- Demand on a structure refers to all external actions
- Gravity, wind, earthquake, snow are external actions.
- these actions when act on the structure will induce internal disturbance(s) in the structure in the form of stresses (such as compression, tension, bending, shear & torsion) the internal stresses are also called load effects. It is called demand.

part (B):- Basic Design methods:

Step 01: Size:- Sizes of all structural

P.T.O

by non Structural element are decided.

Step NO# 02

Loads :- Loads on Structures are determined based on accumptional characteristics by functionality (refer Appendix C at the end of this Lecture

Step # 03 -

Analysis :- Effect of loads are calculated on all structural elements

Step # 04,

Design :- Structural elements are designed for the respective load effects following the code provisions

• Size ; gives the minimam one way slab thickness.

P.T.O

Loads:

Service loads shall be in accordance with the general building code of which this code forms a part, with such live load reductions as the permitted in the general building code.

- One way slab usually designed for gravity loading.
- Analysis :-

the ACI addresses provisions for the analysis & design of concrete members.

- According to ACI as an alternate to frame analysis, ACI approximate moments shall be permitted for design of one-way slabs with certain restrictions.

Design:

- capacity demand.
- Capacity or design strength = strength reduction factor (ϕ) x Nominal strength
- Bar spacing (in inches) = $A_b / A_s \times 12$
  (A_b = Area of bar in in^2, A_s design steel in in^2/ft).

Q NO# 01:

Part (c):- the effect of Strength reduction factor on flexural Strength:-

In the design of flexural Strength, the Strength reduction factor decreases from Tension- controlled Sections to Compression- controlled sections to increase Safety with decreasing ductility it is called the effect of strength reduction factor on flexural strength.

Q NO# 02:

problems:-

Design Slab & beam of a 90 x 60 Hall. the height of hall is 15 ft. Concrete Compressive Strength f'c = 3 ksi & steel yield strength is 40 ksi. Take 2-inch mud layer & 2-inch tile layer above slab. Take LL = 40 psf. Also design column & footing for the said problems & at the end of each structural member design draw proper sketch:-

Data:

Slab & Beam of a 90'x60' Hall.

→ Height of hall = 15 ft.

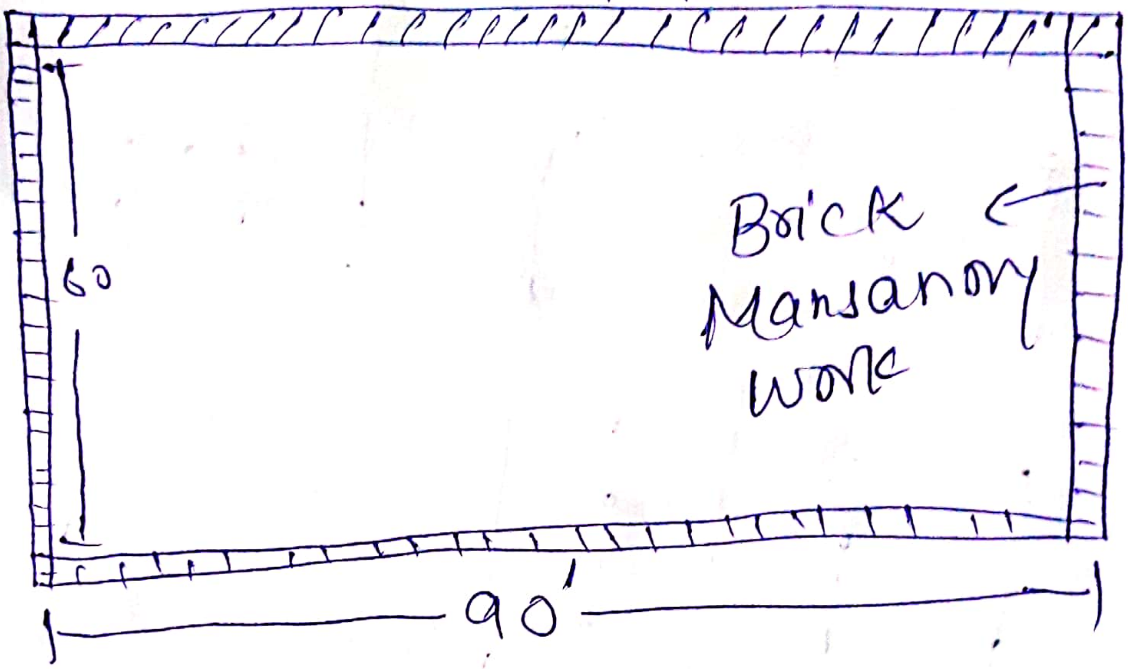
→ Compressive Strength (f'c) = 3 ksi

→ mud layer = 2 inchs.

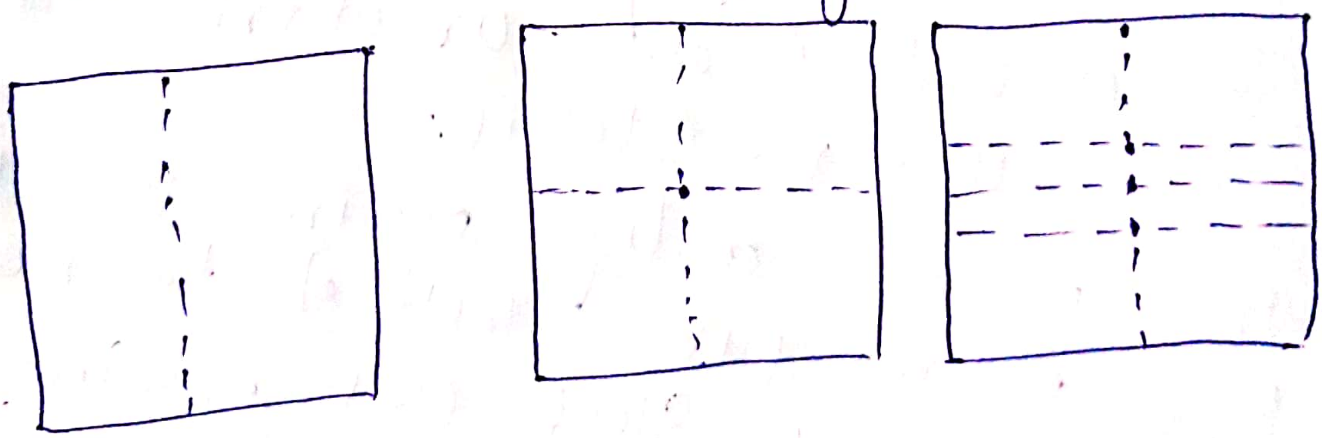
→ tiles above slab = 2 inches

→ Take LL = 40 psf

A) design column or footing from the Said problems at the end of Structural member design. Draw a proper sketch.



Structural Configuration

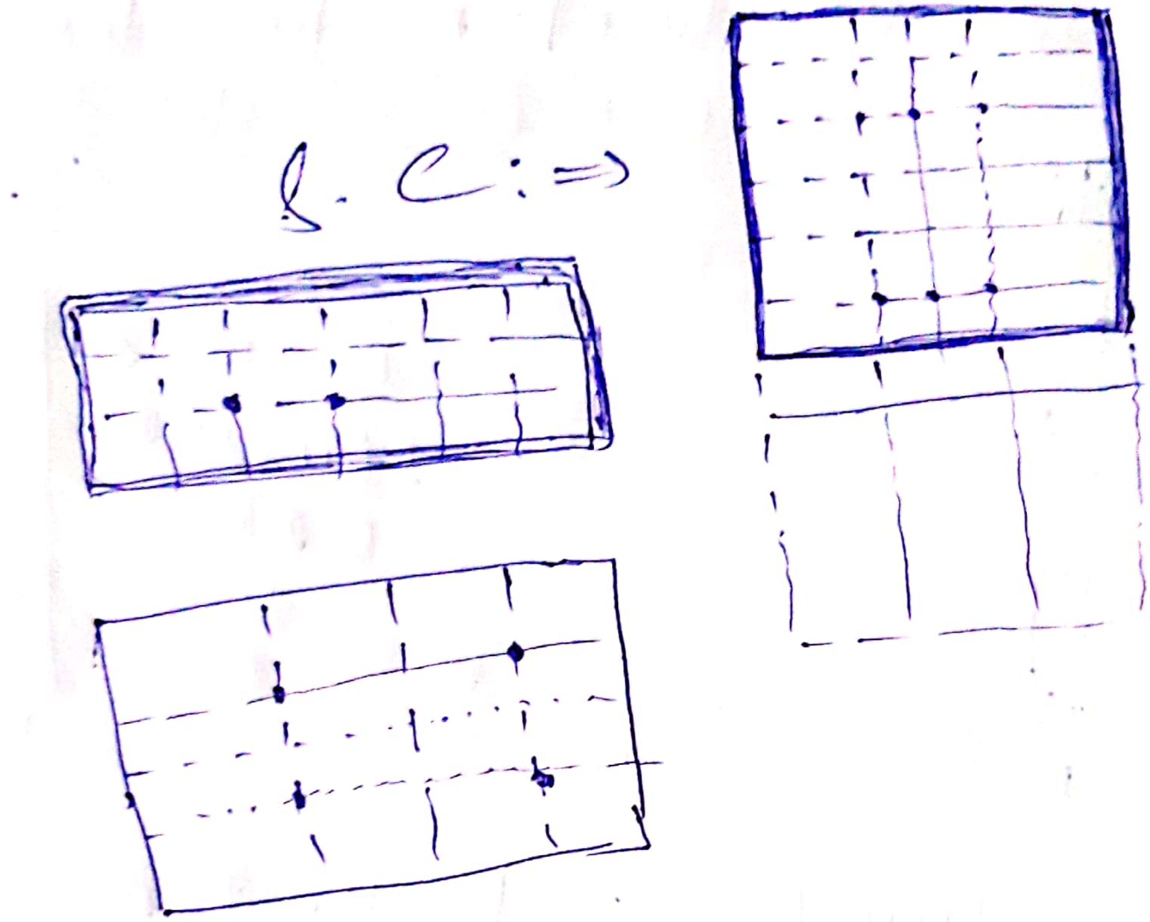


Assume St- Conf. Take Frme to reach to a resonable - arragment of beams. girders

P.T.O

of columns it depend on experience Several alternative are possible.

E. C :=>



Structural Configuration Selected for this problems :-

this is not only option or the best option just selected to make a one way slab design. Case.

Slab design

Step # 01 Table

P.T.O

Minimum thickness.				
	Simply Supported	one end continuous	Both end continuous	Cantilever
Member	Members not supporting attach to partitions or other construction likely damaged by large deflection.			
Slide one way slabs	$l/20$	$l/24$	$l/28$	$l/10$
Beams or ribbed one way slabs	$l/16$	$l/18.5$	$l/21$	$l/8$

$h = l/24 \times (0.4 + fy/100000) = 3.8"$.

$h = l/28 \times (0.4 + fy/100000) = 3"$.

Take $(h) = 6"$.

* (Minimum by ACI for End span).

$[L = l_n = 9.5')$

* (Minimum by ACI for interior span)

$[l = l_n = 9.5']$

⇒ Effective depth $(d) = h_f = 0.75 - (3/8)/2 = 5"$ for

$l_0 = l_n$; for interior supports such as becam by Columns with $l_n \leq 10'_c$

Step # 02

(Loads)

Table :- Dead loads.

Material	Thickness	γ (KCF)	Load Thickness (KSf)
Slab	6 in	0.15	6/12 x 0.15 = 0.075
Mud	2	0.08	2/12 x 0.08 = 0.013
Tile	2	0.12	
		Total	0.108 ksf

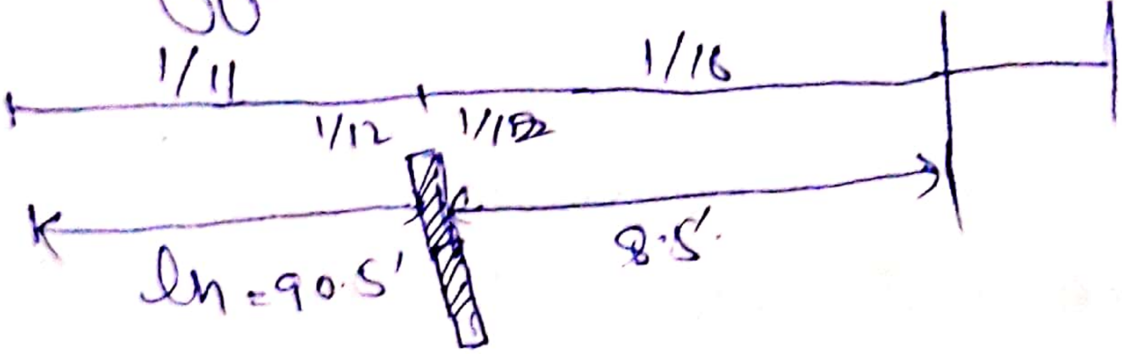
factored load (wu) = 1.2 D.L + 1.6 L = 1.2

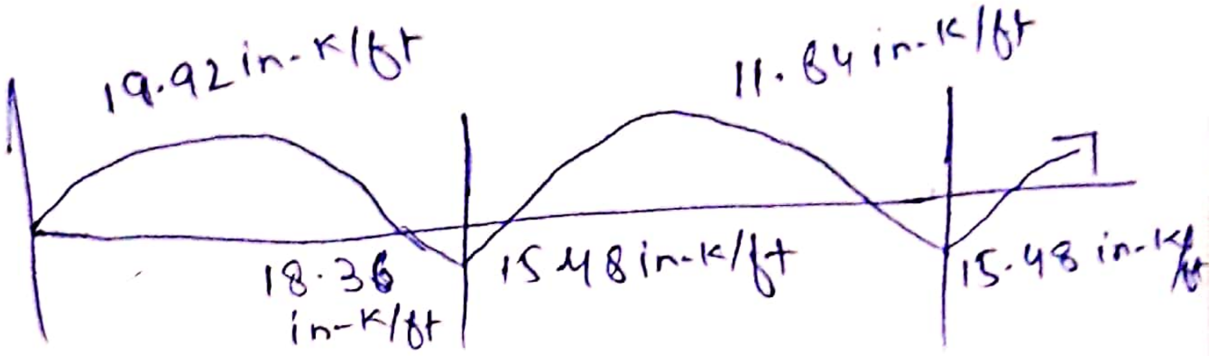
1.2 x 0.108 x 1.6 x 0.04.

0.1296 + 0.064.

=) 0.1936 ksf

M = Coefficient × wn × ln².



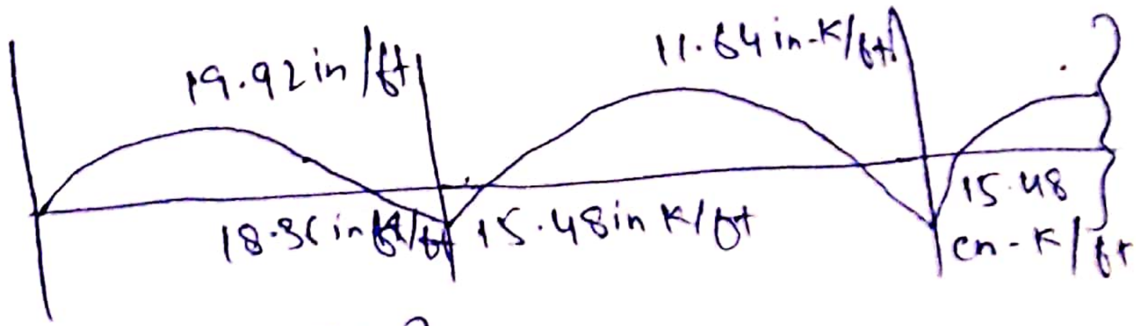


φMn Calculated from Asmin is > all moments Calculated in step No # 03.

there fore As = As min.

= 0.144 in²/ft (#3) @ 9.166" c/c

this will work for both positive & negative steel as Asmin governs.



* Main Reinforcement S.D :⇒

Maximum

Spacing for main steel reinforcement in one way slab according to ACI.

7.6.5 is maximum of 3hf = 3×6 = 18"

= 18"

Finaly use # 3 @ 9" c/c.

Shrinkage Steel S.D ⇒

Ast = 0.002bhf Ast = 0.002 × 12 × 6

= 0.144 in²/ft

Shrinkage reinforcement is same as main reinforcement because

Ast = Asmin = 0.144 in².

Maximum spacing for temp steel reinforcement in one way slab according to ACI 7.12.2.2

is maximum of

5hf = 5×6 = 30" OR 18"

P.T.O

therefore 9" Spacing is ok :-

Steep # 05 S.D ⇒ Drafting:

(Main) reinforcemnt # 3 @ 9" c/c (positive / Negative)

Shrinkage reinforcemnt = # 3 @ 9" c/c

Supporting bars = # 3 @ 18" c/c

the End slab design

Beam design :

S # 01 Size #

Minimum thickness hmin = l/16

l = clear Span (ln) + depth (Beam) ≤ c/c Distance b/w Supports

let depth = 5'.

ln + depth of Beam = 60' + 5' = 65'

c/c distance B/w Beam Support

= 60 + 2 × (9 × 12) = 61.5'.

therefore l = 61.5'.

P.T.O

Depth (h) = (161.5 ft) x (0.4 + fy)(100000) x 12
= 36.9" (minimum by ACI 9.5.2.2)

Step #02 load:

load on beam will be equal to factored load on beam from slab factored self weight of beam slab.

factored load on slab.
a = 0.214 ksf.

- load on beam from slab
= 0.214 ksf x 10 = 2.14 k/ft

factored self load of beam slab
= 1.2 x (54 x 18/144) x 0.015 = 1.215 k/ft

Total load on beam = 2.14 + 1.215
⇒ 3.355 k/ft

Scanned with CamScanner