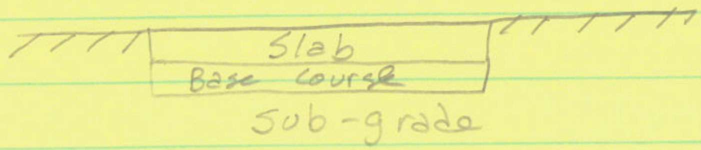
Nov 29, 2010

Slab on Grade
- Types
- Design Methods
- Drying Shrinkage
- Temp. Charges
- Joints
- Distributed Loads
- Point Loads
- Vehicular Loading

Wed Exam 3
3-5 pm

→ Slab on Grade

Concrete slab supported by soil



Examples:

Roads
Airfields
warehouse
} High Quality Required

floors
Patio
walkways
driveways

→ RC Slab on Grade Design Goals

- Limited or <u>no</u> cracking
- Durable surface
- Flat surface, no bumps

→ Design Loads

- temp & drying shrinkage
- distributed loads
  - uniform
  - variable
- point Loads
  - wheel
  - rack & post
  - column

→ Types of Slab

A - Concrete only

B - concrete w/ T&S steel

C - shrinkage compensating concrete

D - post-tensioned concrete

E - lightly reinforced (bars or PT tendons)

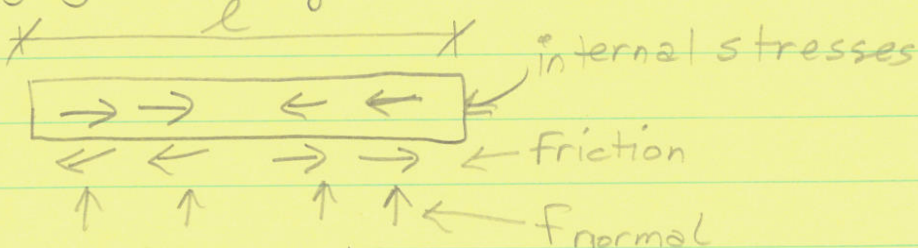
F - structurally reinforced slab (1 or 2 layers of bars or WWF)

→ Design Methods

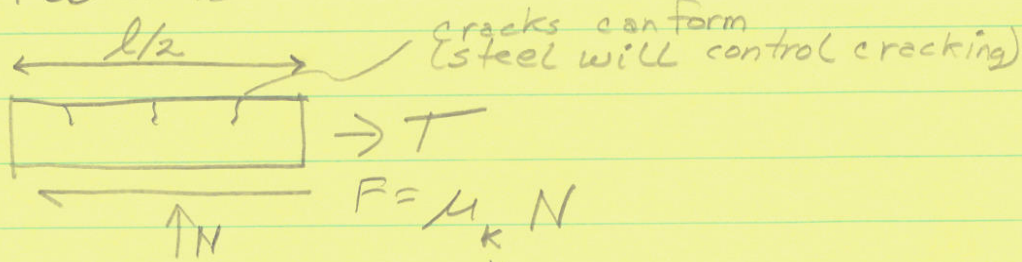
ENCE435 Method ✱ → - Portland Cement Association (PCA) Most common

- Wire Reinforcing Institute (WRI)
- U.S. Army Corps of Engineers (COE)
- Post-Tensioning Institute (PTI)
- ACI Committee 223 (ACI 223)

→ Drying Shrinkage in Slabs



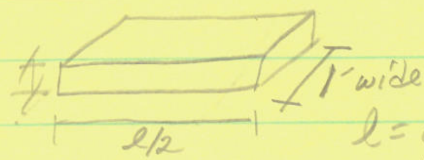
FBD of 1/2 slab



$F = \mu_k N$

$\mu_k \equiv$ friction w/ base

→ Subgrade Drag Equation



$N = w_c t (l/2)(1')$

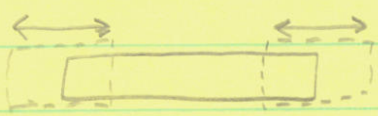
$T = F = \mu_k w_c t (l/2)(1')$

$T = A_s f_{s\,allowed} \rightarrow \approx 0.67 f_y$ * for Temp & shrinkage

$$A_s = \frac{\mu_k w_c t \, l(1')}{2 f_{s\,allowable}}$$ (for 1ft wide strip)

→ Temperature in Slabs

for 1ft wide strip.



$$A_s = \frac{f_r \, 12''(t)}{2 f_{s\,allowed} - T \alpha E_s}$$

$f_r = 0.4(0.25\sqrt{f'_c})$

t = thickness

$f_{s\,allowed} = 0.67 f_y$

$T = \Delta T$ in °F

α = coefficient of thermal expansion (in/in /°F)

$E_s = 29 \times 10^{-6}$ psi

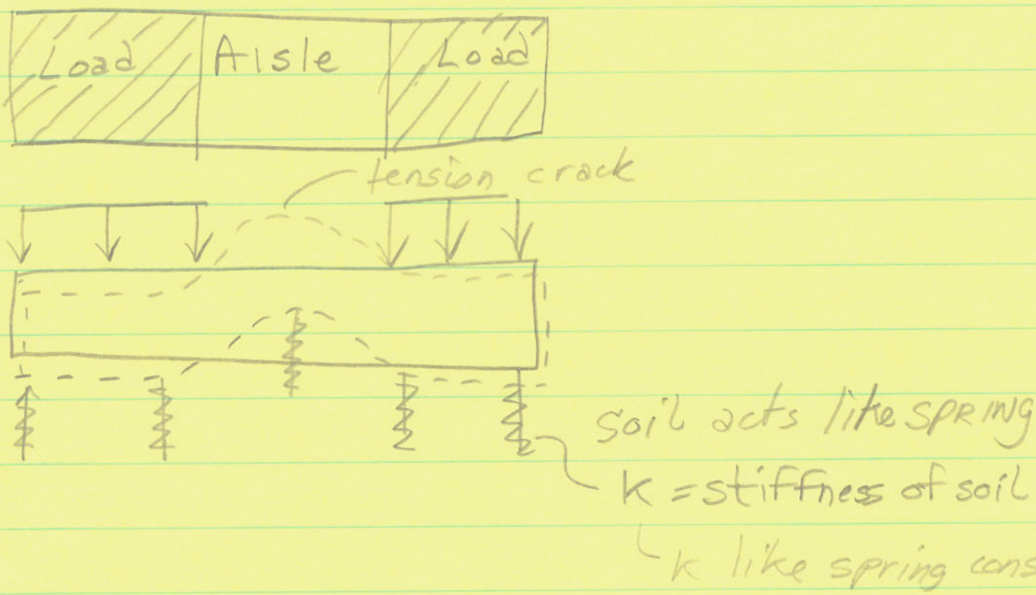
Exam Question

→ Joints in Slab

- Purpose
  - accomodate movement
  - prevent cracking
  - constructability
- Types
  - Isolation - seperate slab from non-moving structure
  - Construction - stopping points or limits of screed
  - Contraction - planned cracked locations
  - Exponsion - allow for temp effect

→ Distributed Loads

Example Warehouse



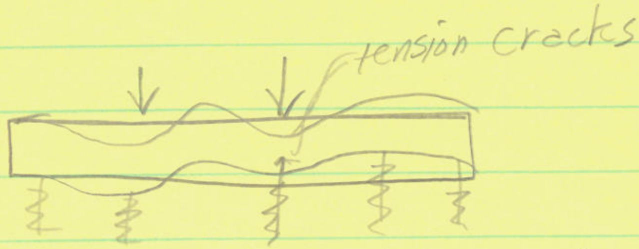
→ Distributed Loads

Selection of design table depends on layout

Fixed "predictable" [Table A.33] Aisles — in handout pg 16 → Variable "unpredictable" [A.32] Random

* Assumes a FS of 2.0

→ Point Loads



ex post or vehicle load

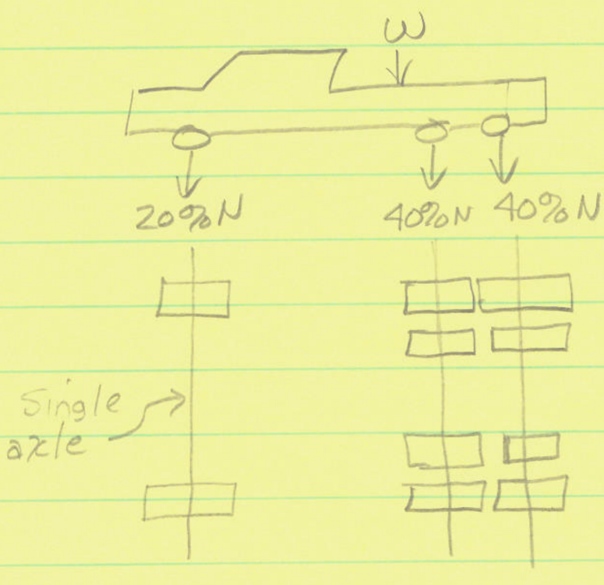
Rack & Post Loading

Use tables based on Subgrade k } A.17 k = 50 pci pg 13
A.18 k = 100 pci pg 14
A.19 k = 200 pci pg 15

*Interpolation allowed

→ To use the tables you need
- spacing of posts x & Y
- size of baseplate
- Subgrade k value (Fig A.2 pg 7)

→ Vehicle loading



→ Single wheel axle load

Use Figure A.7 (pg 11)

To use A.7 you need:

- subgrade value K
- stress per 1000 lb axle load

$$= \frac{f_{allowed}\ psi}{axle\ load\ (kips)}$$

- wheel spacing (in)
- effective contact area (in^2)

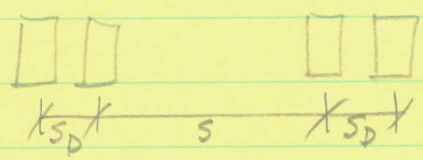
$$= \frac{tire\ load\ (lbs)}{tire\ pressure\ (psi)}$$

→ Dual wheel axle Load

- Use Fig A.9

To use A.9 you need:

- dual wheel spacing, S_D



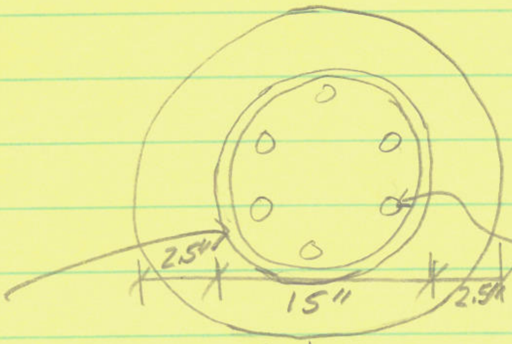
- effective contact area
- slab thickness from single axle

<u>results</u>

equivelant load factor, F

- multiply F x dualwheel axle load
- redesign as single axle

3pm Not 4:30 12-1-2010



Column

$e_x = 10''$

$f'_c = 4$ ksi

$f_y = 60$ ksi

6 - #10

$A_s = 7.62 in^2$

$A_g = \pi r^2 = 314 in^2$

$\gamma = \frac{\text{inside}}{\text{outside}} = \frac{15}{20} = 0.75$

short answer

column problem

footing

Use the interaction curves to determine the P_n value for the short column which has bending about 1 axis.

serviceabili

prestressed

anything

NO

$\frac{e}{h} = \frac{10}{20} = 0.5$

$\rho = \frac{A_s}{A_g} = \frac{7.62}{314} = 0.0243$

plot a straight line so $R = k\frac{e}{h}$, through origin

$k_n = \frac{P_n}{f'_c A_g}$ $R_n = \frac{P_n e}{f'_c A_g h}$

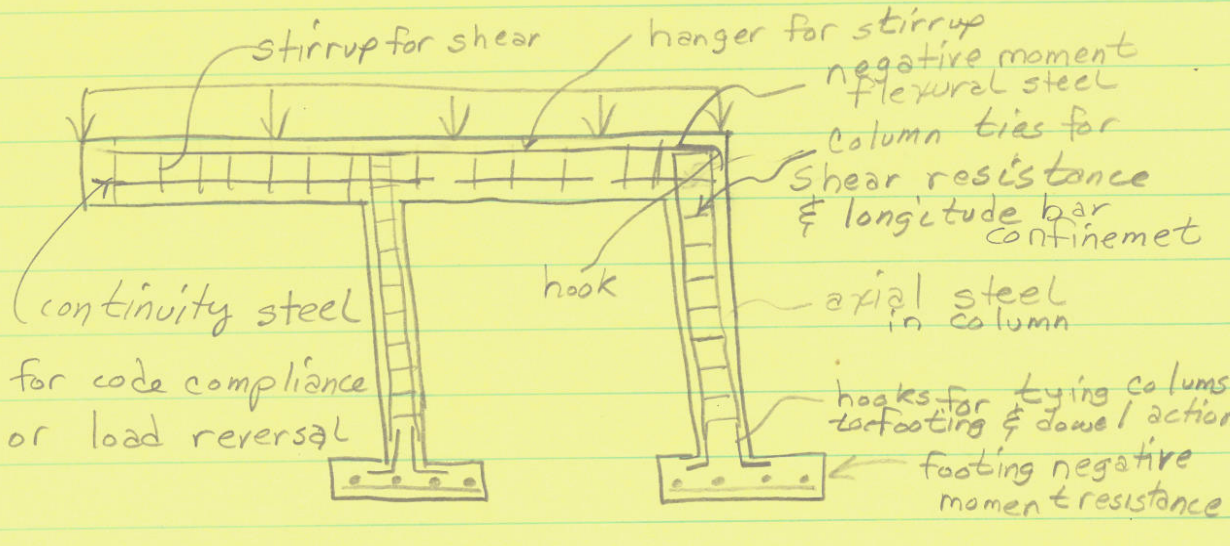
$R_n = (0.16)(0.5) = 0.3$

↑

k_n

USE Chart

$P_n = k_N f'_c A_g = (0.31)(4)(314) = 3944k$


stirrup for shear
hanger for stirrup
negative moment flexural steel
column ties for shear resistance & longitude bar confinemet
hook
continuity steel
for code compliance or load reversal
axial steel in column
hooks for tying colums to footing & dowel action
footing negative moment resistance