Reinforced Concrete Design 1

ENCE335

Project : Phase 3

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Section 1

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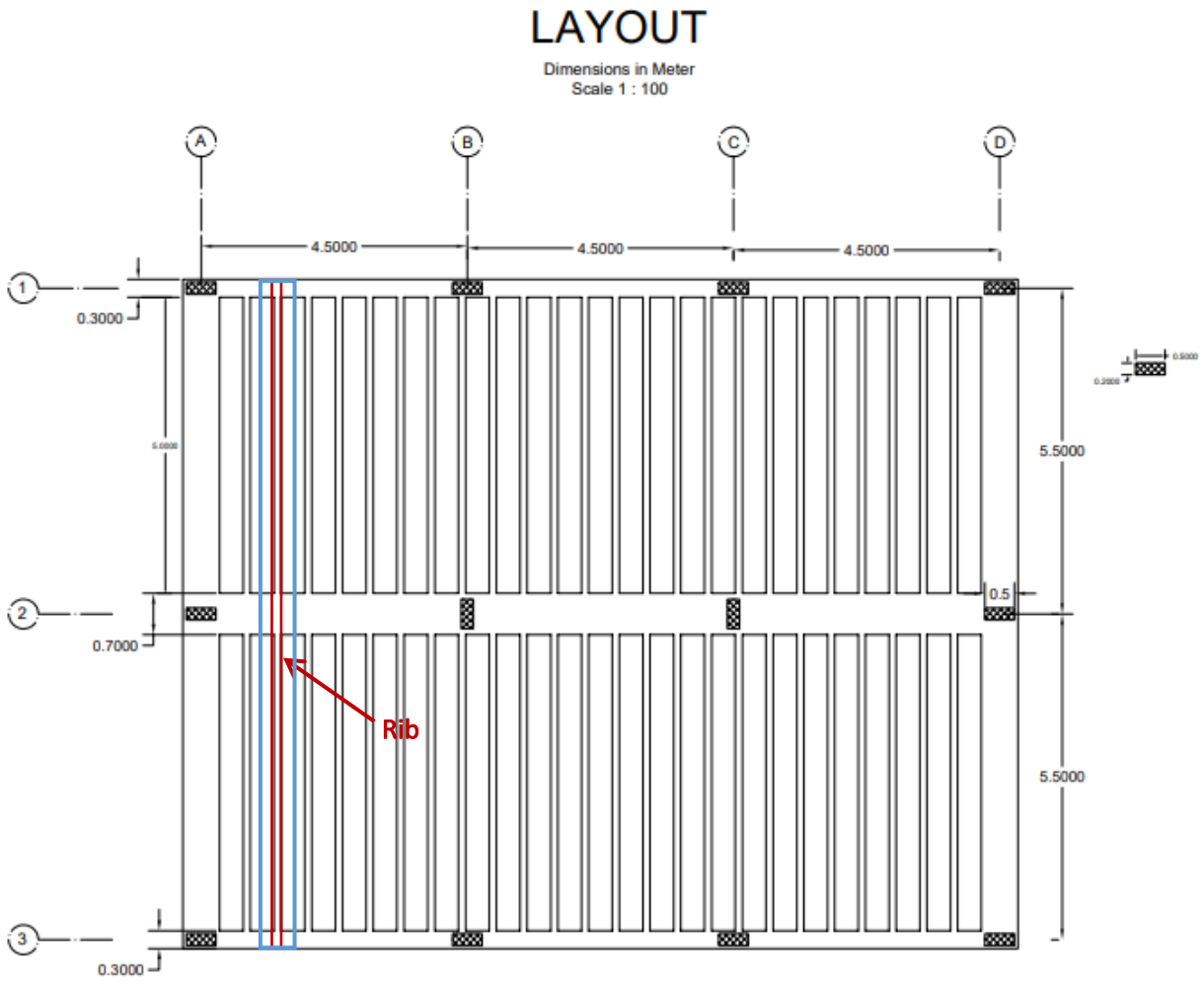
Total Dead Load = S.W + SI + Partitions = 9.3 KN/m2

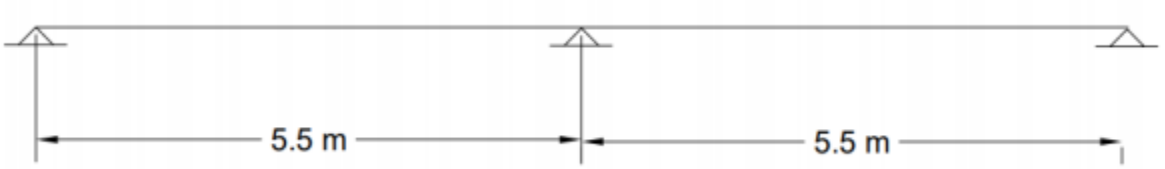
Live Load = 1.9 KN/m2

Ultimate Uniformly Load = 1.2*(DL)+1.6*(LL) = 14.2 KN/m2

Load per rib = ultimate load * tributary width = 14.2 * 0.52 =7.384 KN/m

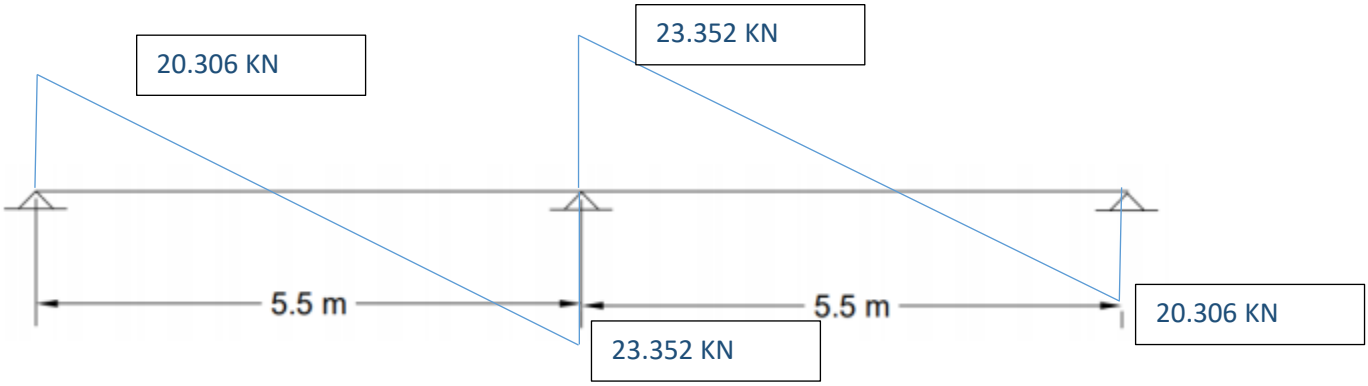


Structural system for a strip of slab (rib):

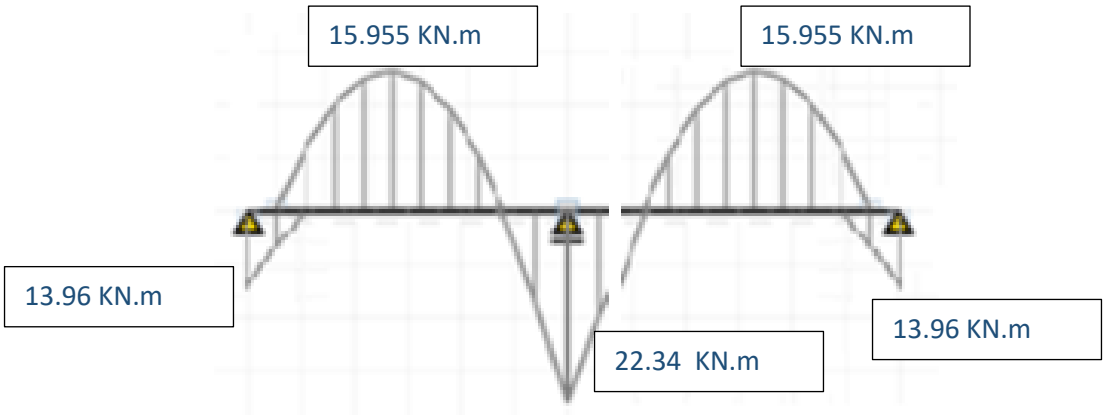


Shear Diagram :

Using ACI coefficients (applied ACI code requirements) :

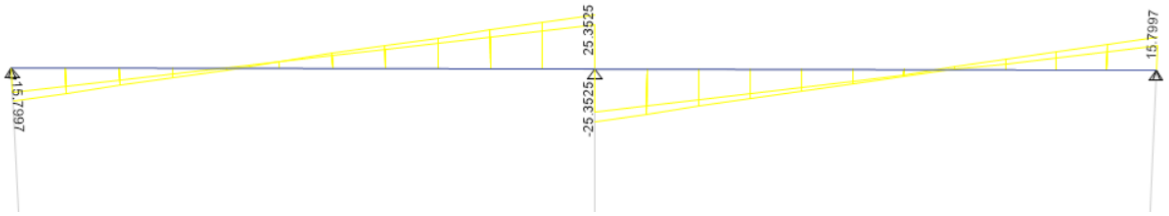


Moment Diagram :

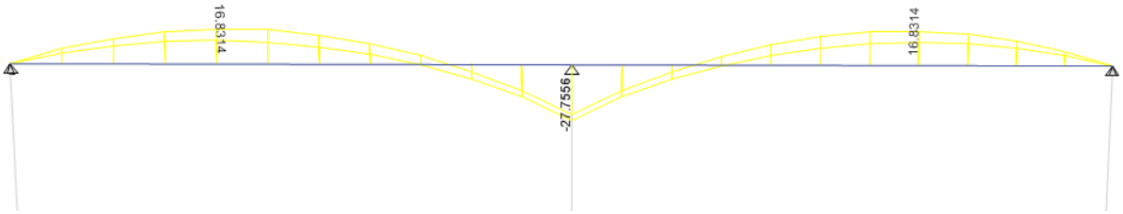


Analyze the slab structure using ETABS :

Shear :



Bending Moment:



Rib section (B=120 mm , H = 300 mm)

Shear design for slab(rib):

yield strength of steel used **fy** = 420 MPa

Compressive strength of concrete **fc'** = 28 MPa

Cover = 20mm

Diameter of stirrup = 10 mm

B_{rib} = 120 mm

Assume diameter of main reinforcement = 13mm

D=300-20-10-(13/2) = 263.5 mm

$\Phi Vc = (1.1)*0.75*0.17*(fc')^{1/2} *b*d$

ΦVc = 0.75*0.17*(28)^0.5 *120*264*1.1=23.47 KN

ΦVc > Vu=23.352 KN -->> no need for shear reinforcement.

Flexural design for slab (rib):

yield strength of steel used **fy** = 420 MPa

Compressive strength of concrete **fc'** = 28 MPa

Stirruphanger =10mm

B_{rib} = 120 mm , d= 263.5 mm

From table A.4:

ρ 0.005	ρ0.004(max)	ρ(min)	β1
0.0181	0.0206	0.0033	0.85

M=13.96 KN.m :

Assume:

*One layer.

*Cover=20mm.

*d bar=13mm.

*dagg=19mm.

*d=300-20-10-13/2=263.5mm.

* Φ = 0.9

*Smin = 25.33 mm

Note: positive moment has a bottom reinforcement, and negative moment has a top reinforcement.

$R = M_u/\Phi bd^2$ = 1.86 MPa

From table A.5a : ρ = 0.004625 > ρ_{min} → As = ρbd = 146.25 mm^2 **> As min**.

From table A.2 : 2 Φ13 → As = 258 mm^2 → ρ =0.00816

ρ > ρ min=0.0033 , ρ < $\rho_{0.005}$ = 0.0181 → Φ = 0.9

check width : S = 120- 2*(20+10) – 2(13) = 34mm > Smin

From table A.5a : ρ =0.00816 → R= 3.1776 MPa

➔ ΦMn = Φ Rbd^2 = 23.83 KN.m >>Mu=13.96 KN.m

➔ ΦMn = 23.83 KN.m > Mmax = 22.34 KN.m

2Φ13 is a suitable reinforcement to the moment 22.34 KN.m and

15.955 KN.m

because ΦMn > Mu .

Shrinkage and temperature reinforcement

(minimum reinforcement in top slab) :

$A_{s,min}$ = 0.0018 *B*H = 0.0018*(1000)*(60) = **108 mm^2/m**

→ Area Φ10= 71mm^2

# of bars = As/A bar= 108 / 71 = 1.52 bar/m

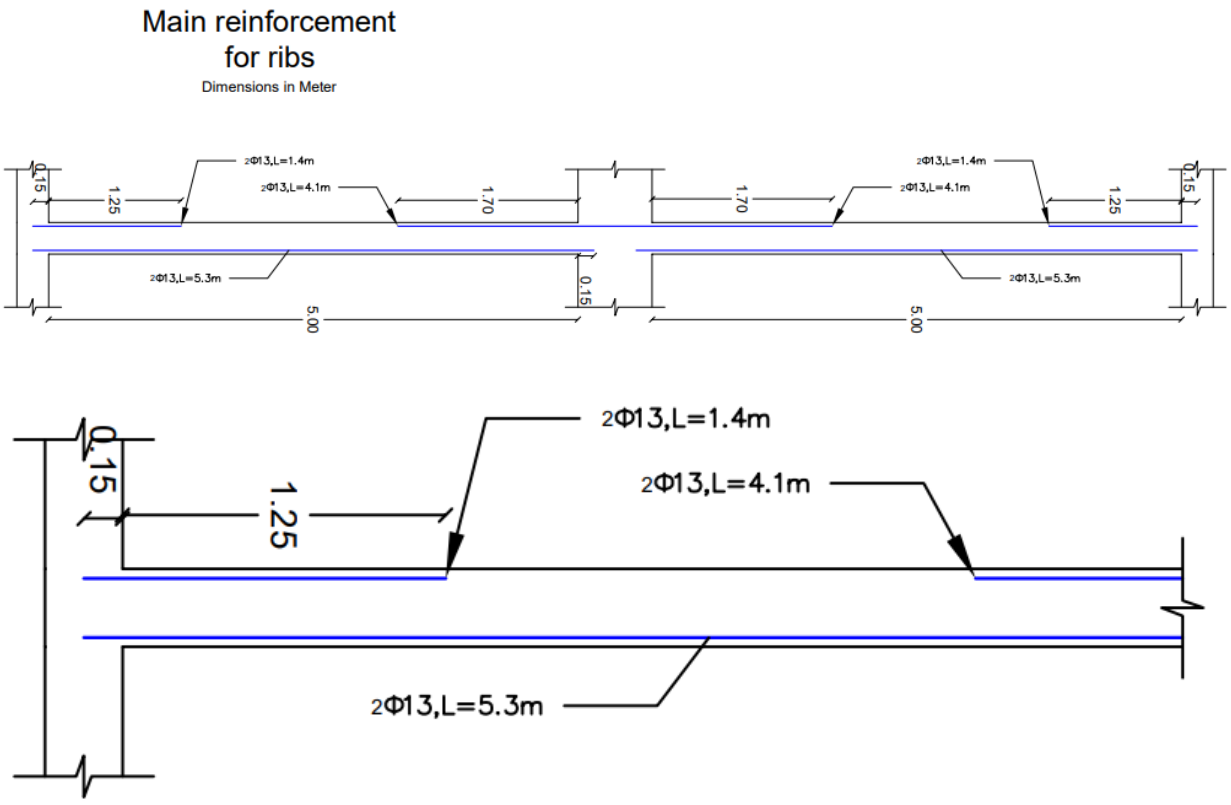
Spacing between bars = 1000 mm /1.52 = **657.402mm**

~ Φ10@520mm (in ribs direction)

~ Φ10@200mm (other direction)

Detailing for Slab ,

Plan view and cross sections :



Plan View Reinforcement :