

## Design Roof

แบบ

ใช้ Cpac Monier ขนาด 33 x 42 ซม @ 0.32 ม. (4.4 Kg/แผ่น)

ระยะห่างจันทัน = 1.00 ม

$$DL = 4.4 / 0.32 = 17 \text{ Kg/m}$$

$$LL = 30 \text{ Kg/m}$$

$$w = 17 + 30 = 47 \text{ Kg/m}$$

$$M = \frac{1}{8} w l^2$$
$$= \frac{1}{8} (47)(1)^2 = 6 \text{ Kg-m}$$

Use : L 25x25x3 มม. (1.12 Kg/m)

$$f_b = \frac{M}{Z}$$

$$= \frac{(6)(100)}{0.448}$$

$$= 1340 \text{ Kg/Cm}^2 < F_b = 0.6 f_y = 1440 \text{ Kg/Cm}^2$$

$$= \frac{5 w L^3}{384 EI}$$

$$= \frac{5 (47)(100)^3}{384 (2 \times 10^6)(1.26)}$$

$$= 0.24 \text{ Cm} < L = \frac{0.27 \text{ Cm}}{360}$$

### งานพื้น

$$\text{Span} = 3 \text{ m}$$

$$\text{DL เหล็ก} = 5 \text{ Kg/m}$$

$$\text{DL กระเบื้อง} = 4.4 * 11 = 50 \text{ Kg/m}^2$$

$$\text{LL} = 30 \text{ Kg/m}^2$$

$$\begin{aligned} w &= (50 + 30)(1) + 5 \\ &= 85 \text{ Kg/m} \end{aligned}$$

$$\begin{aligned} M &= \frac{1}{8} w L^2 \\ &= \frac{1}{8} (85)(3)^2 \\ &= 95 \text{ Kg-m} \end{aligned}$$

$$\text{Use : } 100 \times 50 \times 20 \times 2.3 \text{ mm.}$$

$$f_b = \frac{M}{Z}$$

$$= \frac{(95)(100)}{16.1} = 590 \text{ Kg/cm}^2 < F_b = 0.6 f_y = 1440 \text{ Kg/cm}^2$$

$$= \frac{5 w L^3}{384 EI}$$

$$= \frac{5 (85 \times 3) (300)^3}{384 (2 \times 10^6) (80.7)}$$

$$= 0.16 \text{ cm} < \frac{L}{360} = 0.83 \text{ cm}$$

อกไก่ ตะเฒ่า อะเล ชื้อ ตั้ง

$$\text{Area for Loading} = 3.00 \times 3.00 \text{ m.}$$

$$\text{DL กระเบื้อง} = 4.4 \times 11 = 50 \text{ Kg/m}^2$$

$$\text{LL} = 30 \text{ Kg/m}^2$$

$$\text{DL โครงเหล็ก} = 10 \text{ Kg/m}$$

$$w = (50 + 30)(3.00) + 10$$

$$= 250 \text{ Kg/m}$$

$$M = \frac{1}{8} wL^2$$

$$= \frac{1}{8} (250)(3.50)^2$$

$$= 383 \text{ Kg-m}$$

$$\text{Use : } 2 \square 150 \times 50 \times 20 \times 2.3 \text{ mm}$$

$$f_b = \frac{M}{Z}$$

$$= \frac{(3.83)(100)}{2 (28)}$$

$$= 683 \text{ Kg/cm}^2 < F_b = 0.6 f_y = 1440 \text{ Kg/cm}^2$$

$$\Delta = \frac{5}{384} \frac{wL^3}{EI}$$

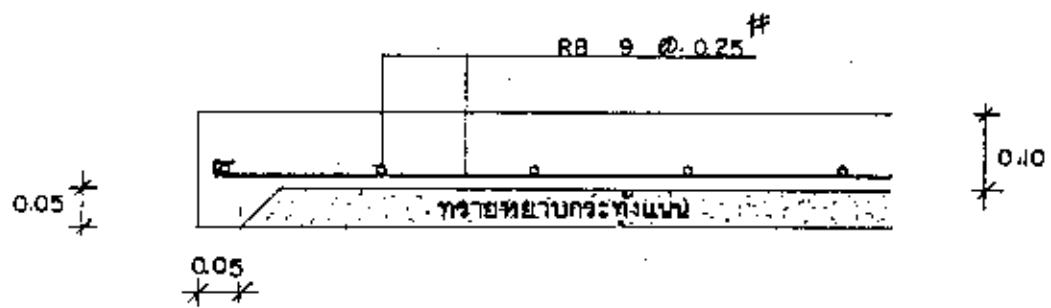
$$= \frac{5(250 \times 3.5)(350)^3}{384 (2 \times 10^6)(2 \times 210)}$$

$$= 0.67 \text{ Cm} < L = 0.97 \text{ Cm}$$

360

# Design Slab

Slab on Ground

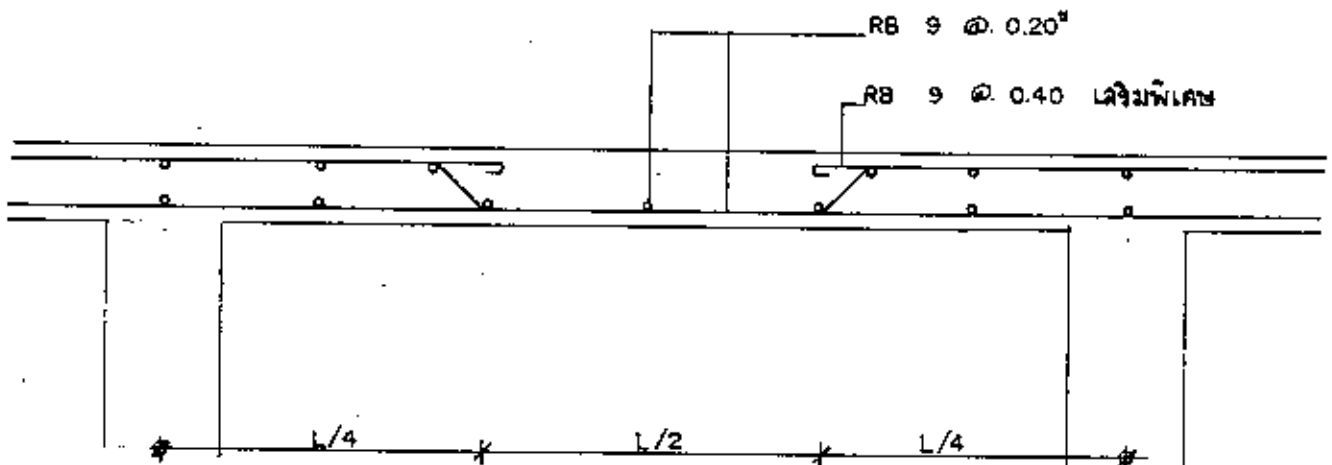


SO

# Slab On Beam

$$\begin{aligned}
 \text{Depth} &= 0.10 \text{ m} \\
 w &= 390 \text{ Kg/m}^2 \\
 c &= 0.050 \\
 M &= c w s^2 \\
 &= (0.050)(390)(3.00)^2 \\
 &= 175 \text{ Kg-m} < M_r \\
 A_s &= \frac{M}{f_s j d} \\
 &= \frac{(175)(100)}{(1200)(0.876)(8)} \\
 &= 2.08 \text{ Cm}^2
 \end{aligned}$$

Use RB 9 mm @ 0.20\*



(SI)

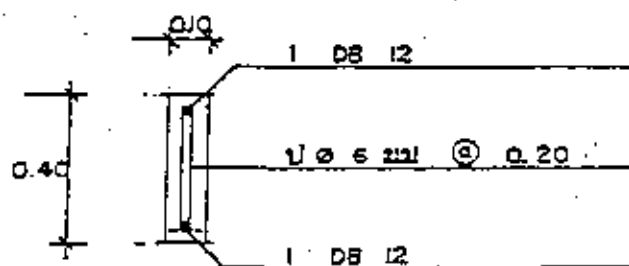
SECTION = 10 x 40 Cm  
 SPAN = 3.00 m  
 W = 564 Kg/m

M =  $\frac{1}{11} W L^2$   
 = 462 Kg-m < Mr

As =  $\frac{M \times 100}{(fs)(j)(d)}$   
 = 1.03 Cm<sup>2</sup>

V =  $W L/2$   
 = 846 Kg < Vc  
 V1 = \_\_\_\_\_ Kg

USE ; 1 DB 12 mm  
 ; 1  $\phi$  6 mm @ 0.20 m  
 ; \_\_\_\_\_



BEAM NO. B0'

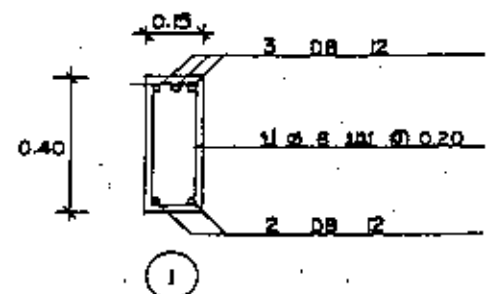
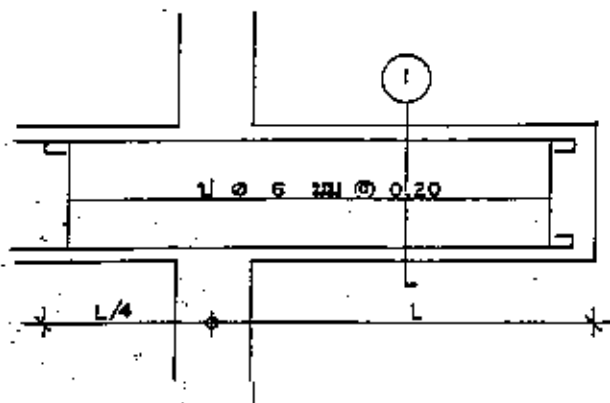
CODE NO. C1

SECTION = 15 X 40 Cm  
 SPAN = 1.00 m  
 w = 720 Kg/m  
 P = 527 Kg  
 M =  $\frac{1}{2} WL^2 + PL$   
 = 892 Kg-m < Mr

As = M\*100  
 (f<sub>s</sub>)(j)(d)  
 = 2.00 Cm<sup>2</sup>

V = WL + P  
 = 1257 Kg < V<sub>c</sub>  
 V' =          Kg

USE ; 2 DB 12 (A<sub>s</sub> = 2.26 cm<sup>2</sup>)  
 ; 1 Ø 6 MM @ 0.20  
 ;         



BEAM NO. B1

CODE NO. S1

SECTION = 15 X 40 Cm

SPAN = 2.50 m

W = 1.764 Kg/m

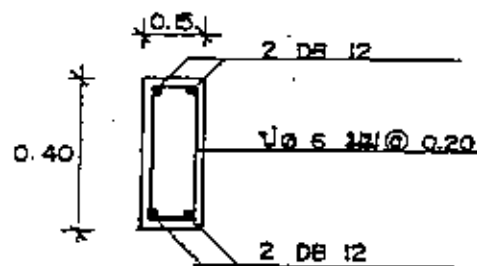
M =  $\frac{1}{11} W L^2$   
 = 1002 Kg-m < Mr

As =  $\frac{M \times 100}{(fs)(j)(d)}$   
 = 2.24 Cm<sup>2</sup>

V =  $W L/2$   
 = 2205 Kg > Vc

V' = 320 Kg

USE ; 2 DB 12 (As = 2.26 cm<sup>2</sup>)  
 ; U  $\phi$  6 mm @ 0.20  
 ;





BEAM NO. B1'

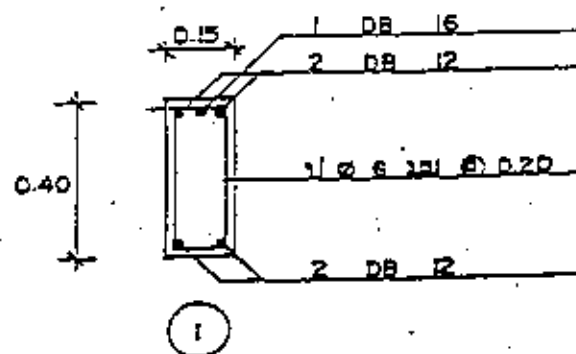
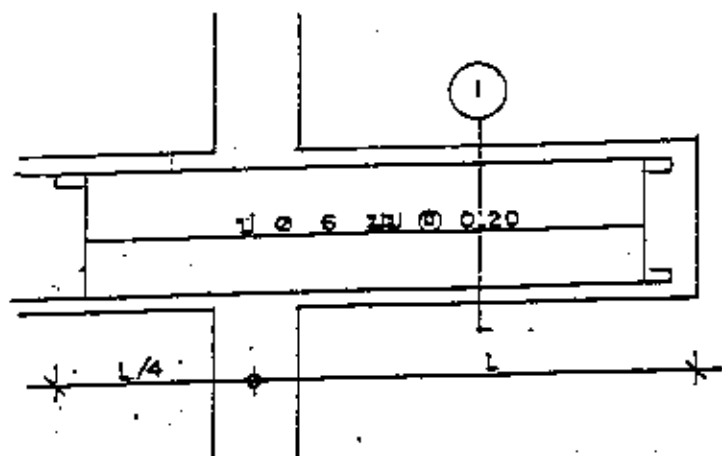
CODE NO. C3

SECTION = 15 X 40 Cm  
 SPAN = 1.00 m  
 w = 1218 Kg/m  
 P = 1222 Kg  
 M =  $\frac{1}{2} WL^2 + PL$   
 = 1831 Kg-m < Mr

As =  $\frac{M \times 100}{(fs)(j)(d)}$   
 = 4.10 Cm<sup>2</sup>

V = WL + P  
 = 2440 Kg > Vc  
 V' = 555 Kg

USE ; 2 DB 12 + 1 DB 16 (As = 4.27 cm<sup>2</sup>)  
 ; 1  $\phi$  6 mm @ 0.20  
 ; \_\_\_\_\_



BEAM NO. B<sub>2</sub>

CODE NO. S2

SECTION = 15 X 40 Cm

SPAN = 3.50 m

w = 1360 Kg/m

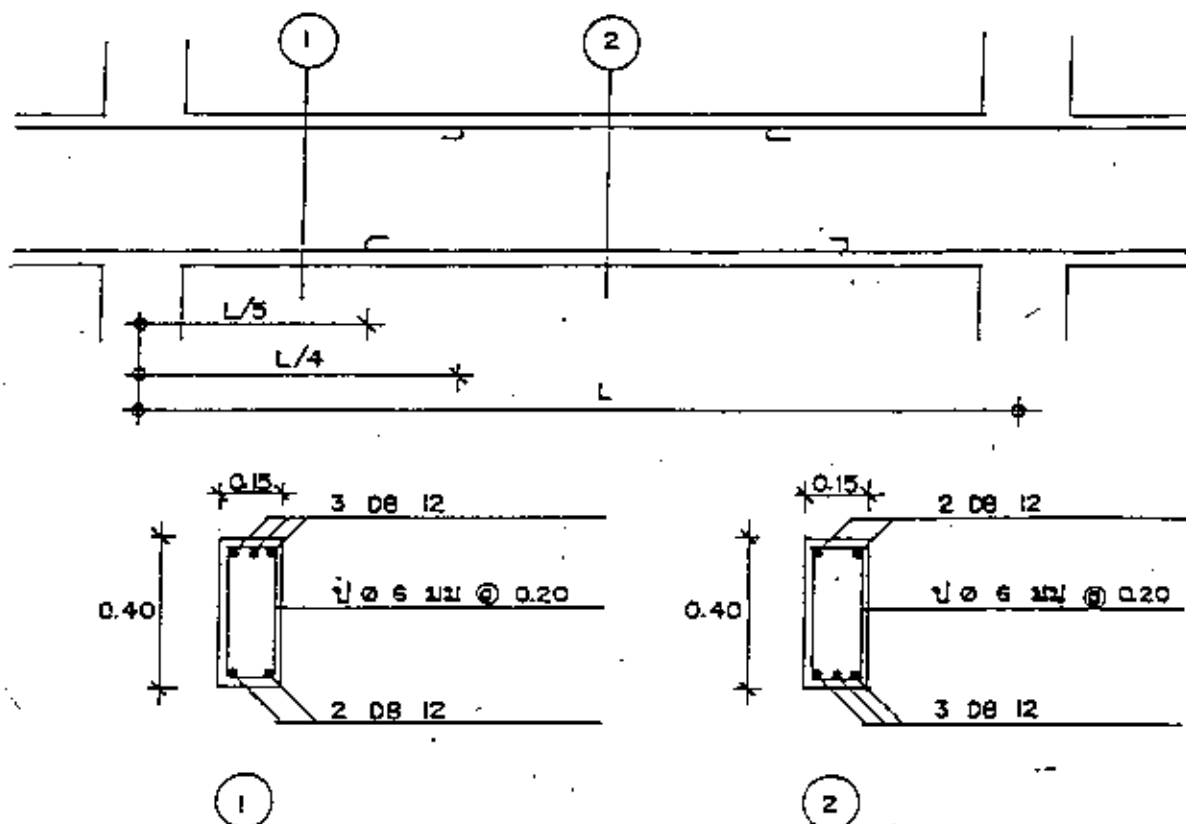
M =  $\frac{1}{11} w L^2$   
= 1515 Kg-m < Mr

As =  $\frac{M \times 100}{(f_s)(j)(d)}$   
= 3.39 Cm<sup>2</sup>

V =  $w L/2$   
= 2380 Kg > Vc

V' = 495 Kg

USE ; 3 DB 12 (As = 3.39 cm<sup>2</sup>)  
; U Ø 6 MM @ 0.20  
;



BEAM NO. B<sub>3</sub>

CODE NO. S3

SECTION = 15 X 40 Cm

SPAN = 3.00 m

w = 2232 Kg/m

M =  $\frac{1}{11} w L^2$

= 1826 Kg-m < Mr

As = M\*100

(fs)(j)(d)

= 4.08 Cm<sup>2</sup>

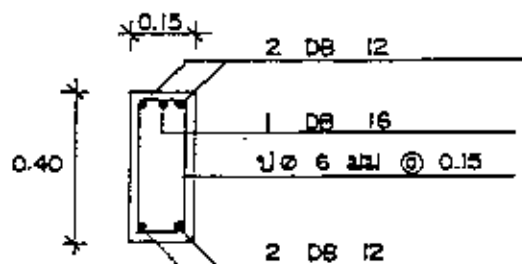
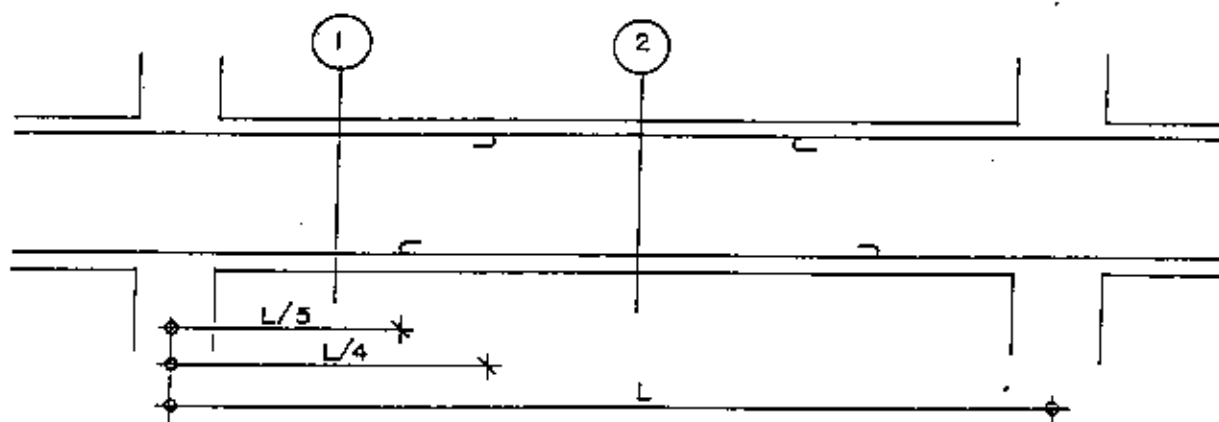
V =  $w L/2$

= 3348 Kg > Vc

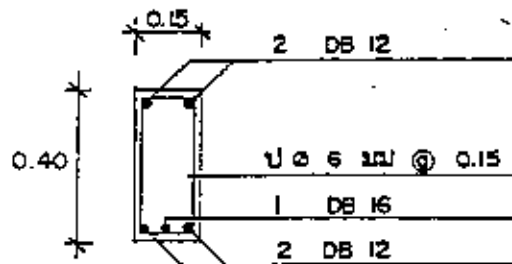
V' = 1463 Kg

USE ; 2 DB 12 + 1 DB 16 (As = 4.27 cm<sup>2</sup>)

;U  $\phi$  6 mm @ 0.15



1



2

$$\text{SECTION} = \underline{15 \times 40} \text{ Cm}$$

$$\text{SPAN} = \underline{3.50} \text{ m}$$

$$W = \underline{2232} \text{ Kg/m}$$

$$M = \frac{1}{11} W L^2$$

$$= \underline{2485} \text{ Kg-m} > M_r$$

$$A_{st} = \frac{M_r \cdot 100}{(f_s)(j)(d)} + \frac{(M - M_r) \cdot 100}{f_s (d - d')}$$

$$= \underline{5.56} \text{ Cm}^2$$

$$A_{sc} = \frac{1/2 (M - M_r) \cdot 100}{f_s (d - d')} \left( \frac{1 - k}{K - d'/j} \right)$$

$$= \underline{1.92} \text{ Cm}^2$$

$$V = W L/2$$

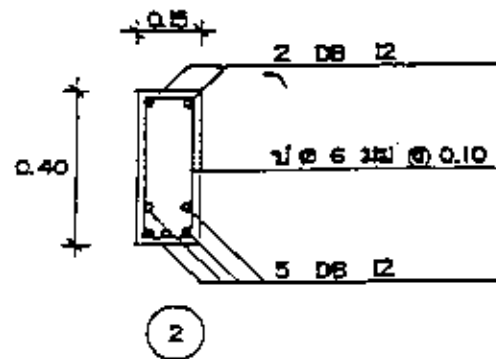
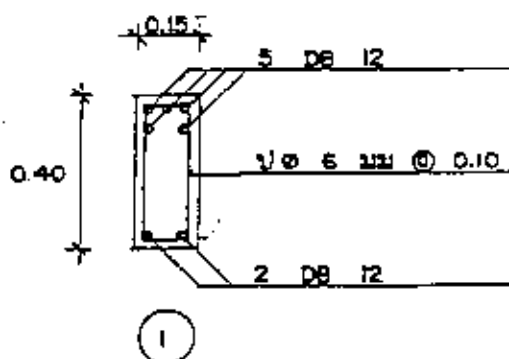
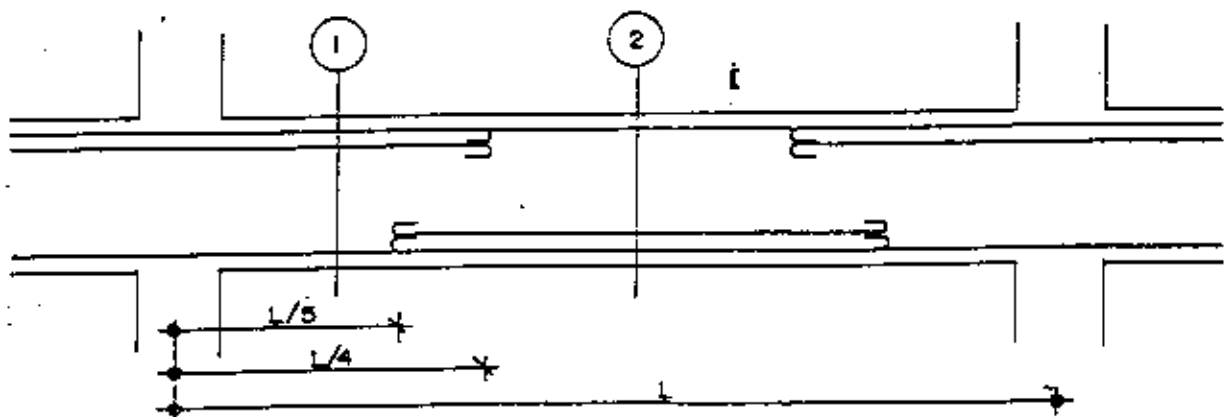
$$= \underline{3906} \text{ Kg} > V_c$$

$$V_1 = \underline{2021} \text{ Kg}$$

USE ;  $A_{st} : 5 \text{ DB } 12 \text{ (} A_s = 5.65 \text{ cm}^2 \text{)}$

;  $A_{sc} : 2 \text{ DB } 12 \text{ (} A_s = 2.26 \text{ cm}^2 \text{)}$

;  $V \phi 6 \text{ mm @ } 0.10$



SECTION = 15 X 40 CmSPAN = 4.00 mW = 2232 Kg/m

$$M = \frac{1}{11} W L^2$$

$$= \underline{3247} \text{ Kg-m} > M_r$$

$$A_{st} = \frac{M_r \cdot 100}{(f_s)(j)(d)} + \frac{(M - M_r) \cdot 100}{f_s (d - d')}$$

$$= \underline{7.25} \text{ Cm}^2$$

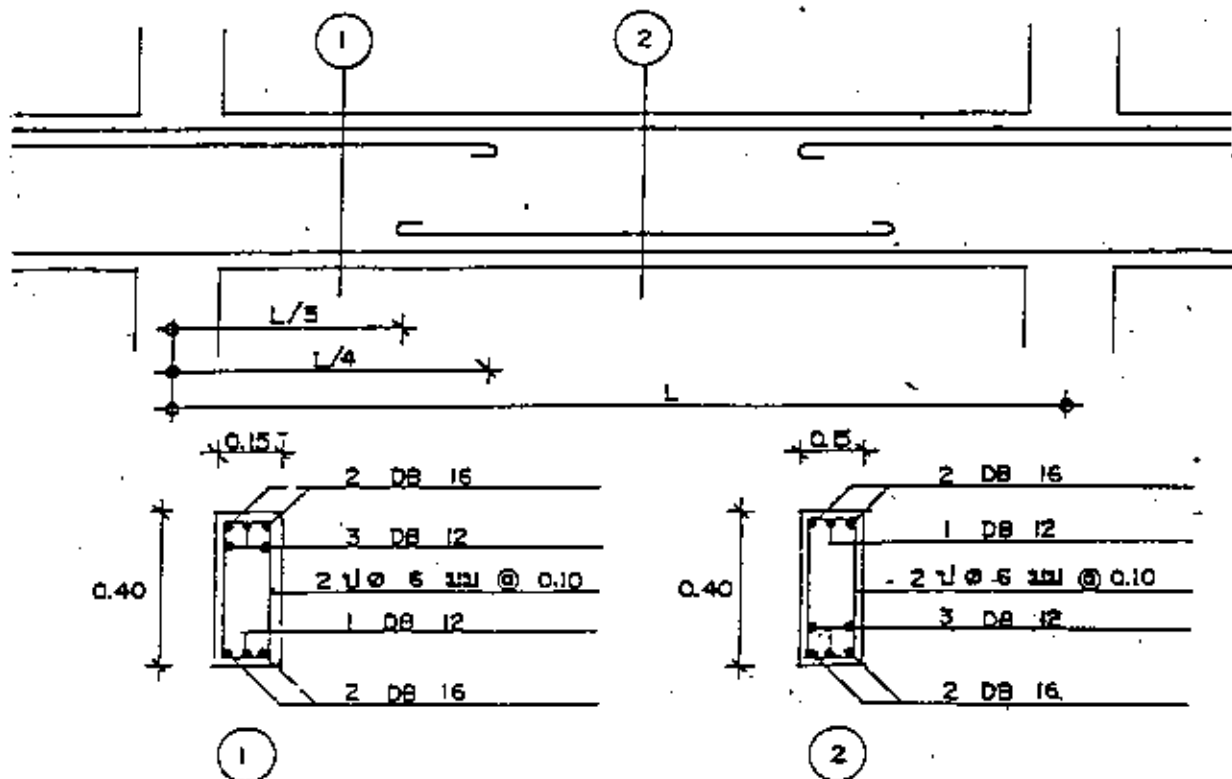
$$A_{sc} = \frac{1}{2} \frac{(M - M_r) \cdot 100}{f_s (d - d') \left( \frac{1 - k}{K - d'/d} \right)}$$

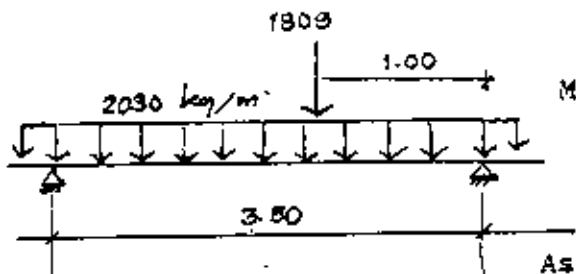
$$= \underline{4.40} \text{ Cm}^2$$

$$V = W L / 2$$

$$= \underline{4464} \text{ Kg} > V_c$$

$$V_1 = \underline{2579} \text{ Kg}$$

USE ; Ast : 2 DB 12 + 2 DB 16 (As = 7.41 cm<sup>2</sup>); Asc : 4 DB 12 (As = 4.52 cm<sup>2</sup>); 2 U 6 mm @ 0.10

SECTION = 15 x 40 CmSPAN = 3.50 mW = 2,030 Kg/m

$$M = 4.079 \text{ Kg-m} > M_r = 1895 \text{ Kg-m}$$

$$A_{st} = \frac{M_r \cdot 100}{(f_s)(j)(d)} + \frac{(M - M_r) \cdot 100}{f_s (d - d')}$$

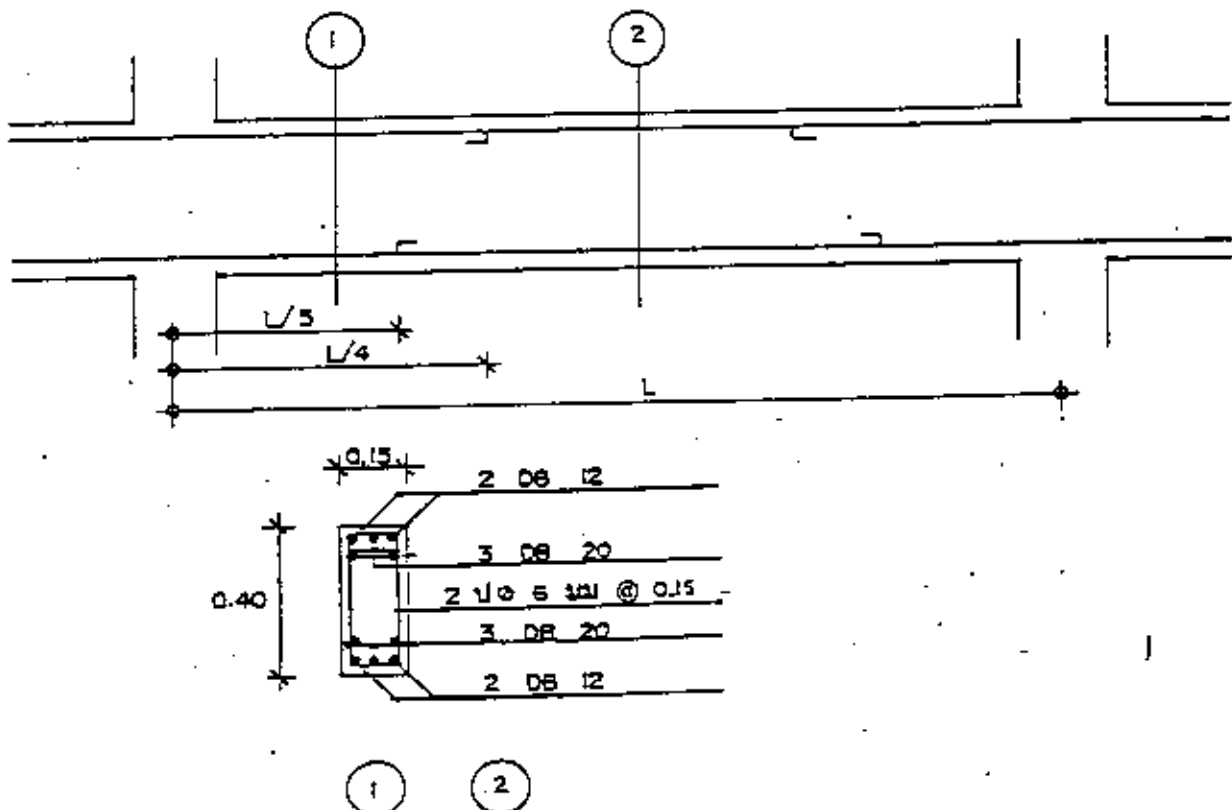
$$= 9.20 \text{ Cm}^2$$

$$A_{sc} = \frac{1/2 (M - M_r) \cdot 100}{f_s (d - d')} \left( \frac{1 - k}{k - d'/d} \right)$$

$$= 9.26 \text{ Cm}^2$$

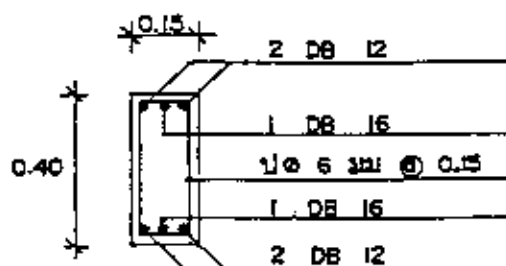
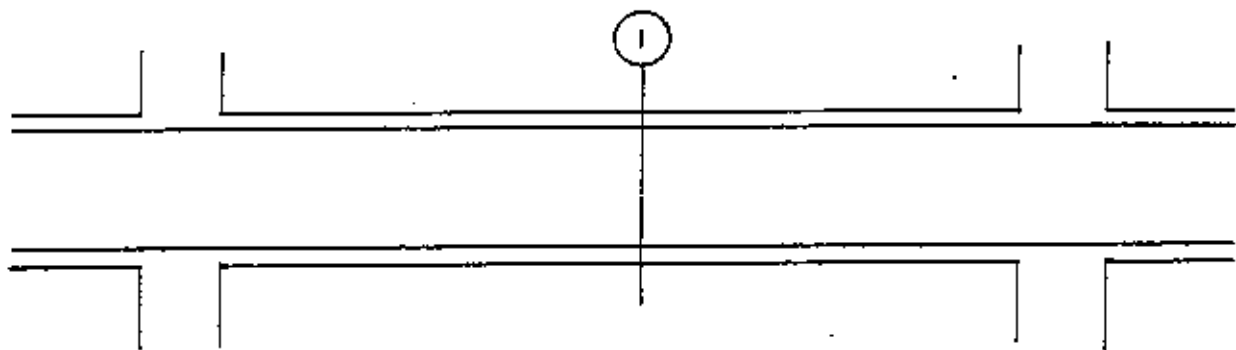
$$V = 4845 \text{ Kg} > V_c$$

$$V_i = 2960 \text{ Kg}$$

USE ; A<sub>st</sub> : 2 DB 12 + 3 DB 20; A<sub>sc</sub> : 2 DB 12 + 3 DB 20; 2 U 6 321 @ 0.15 m. resist shear 3200 kg

BEAM NO. B7CODE NO. S3SECTION = 15 X 40 CmSPAN = 3.00 mw = 2232 Kg/mM =  $\frac{1}{11} w L^2$ = 1826 Kg-m < MrAs =  $\frac{M \times 100}{(f_s)(j)(d)}$ = 4.08 Cm<sup>2</sup>V =  $w L/2$ = 3348 Kg > VcV' = 1463 KgUSE ; 2 DB 12 + 1 DB 16 (As = 4.27 cm<sup>2</sup>); 1  $\phi$  6 mm @ 0.15

;



1

C<sub>1</sub>

Design Column

Max Load = 11,500 Kg

Choose: Section 15 x 15 Cm

$P_g = 2\%$

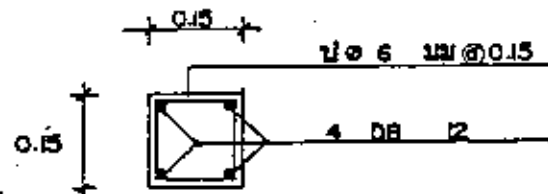
$A_s = P_g A_g$

$= (0.02)(15 \times 15)$

$= 4.5 \text{ cm}^2$

Use 4 DB 12

U 6 mm @ 0.15



C<sub>1</sub>



# Design Column

Max Load = 15,000 Kg

Choose: Section 15 x 15 Cm

$$P_g = \underline{3.5\%}$$

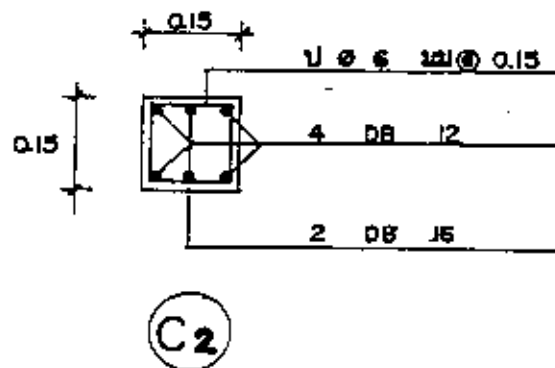
$$A_s = P_g A_g$$

$$= (0.035) (15 \times 15)$$

$$= \underline{7.9 \text{ Cm}^2}$$

Use 4 DB 12 + 2 DB 16

U 6 mm @ 0.15



C<sub>3</sub>

Max Load = 17,000 Kg

Choose Section 20 x 20 Cm

$P_g = 1.13 \%$

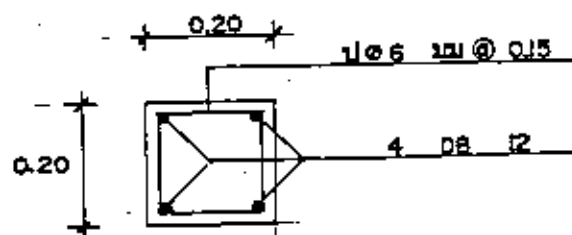
$A_s = P_g A_g$

$= 0.0113 (20 \times 20)$

$= 4.52 \text{ Cm}^2$

Use 4 DB 12

U 6 mm @ 0.15



C<sub>3</sub>

Design Column

Max Load = 20000 Kg

Choose: Section 20x20 Cm

$P_g = 2.13\%$

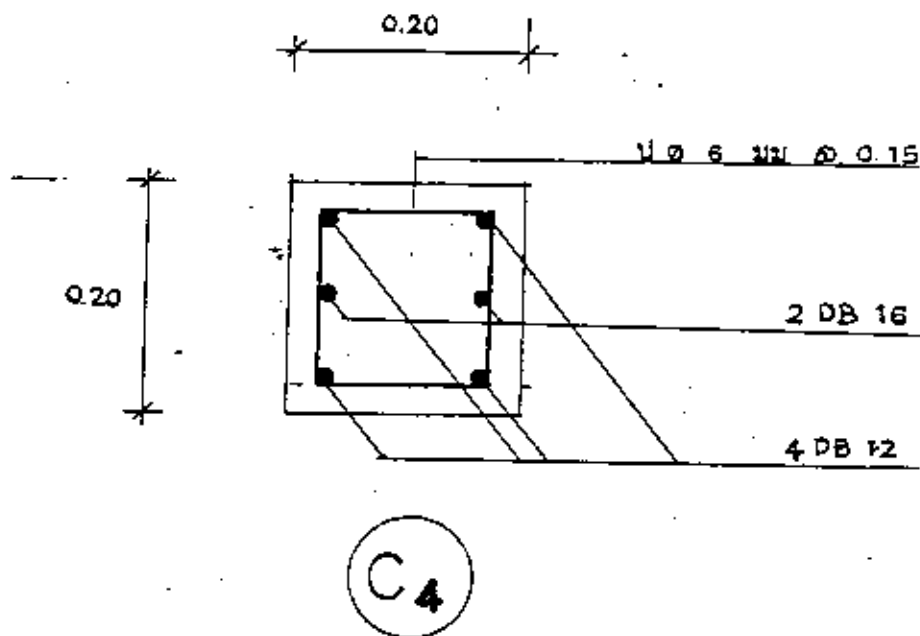
$A_s = P_g A_g$

$= (0.021)(20 \times 20)$

$= 8.40 \text{ Cm}^2$

Use 4 DB 12 + 2 DB 16

U 6 mm @ 0.15



COLUMN NUMBER C 5

DESIGNED AS A CIRCULAR TIED COLUMN AND CONCENTRIC LOAD

COLUMN LOAD 1100 KG.

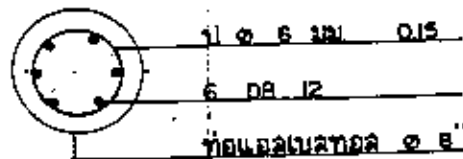
SIZE OF COLUMN 20 CM. DIAMETER

VERTICAL BARS 6 DB 12 MM

BINDERS RB 6 MM. AT SPACING 15 CM.

ALLOWABLE LOAD =  $0.85(0.25 \times 175 \times 314 + 0.4 \times 2800 \times 6.78)$

= 18137 KG. > COLUMN LOAD



Section

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I 18\*18\*10.00 m.

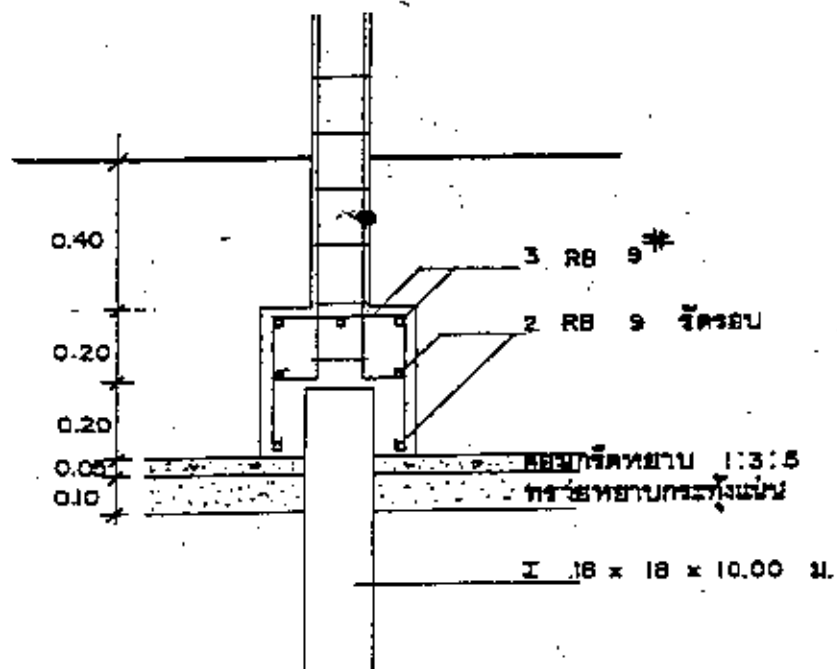
8,000 Kg.

40\*40=40 Cm.

$\approx 0.0025 \text{ bt}$

$$= 2 \text{ cm}^2$$

Use 3 RB 9\*



Fi

### Design Footing

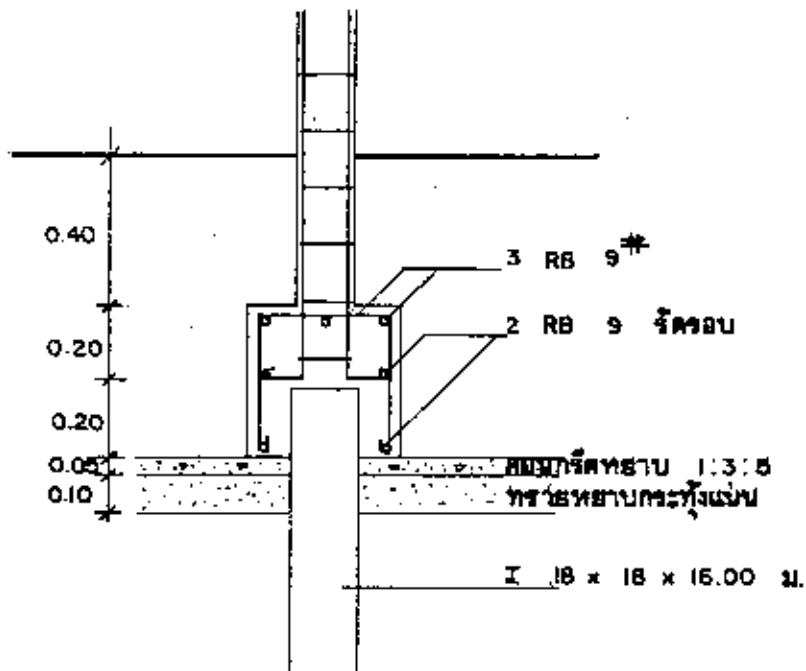
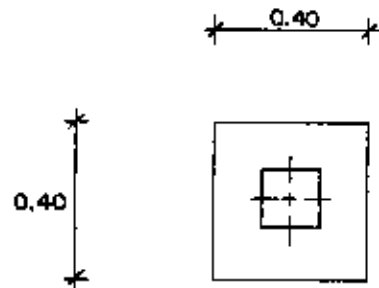
Choose I 18\*18\*16.00 m.

Max Allow Load = 12,000 Kg.

Use : ฐานรากขนาด 40\*40\*40 Cm.

$$\begin{aligned} A_s &= 0.0025 \text{ bt} \\ &= (0.0025)(40)(20) \\ &= 2 \text{ Cm}^2 \end{aligned}$$

Use 3 RB 9\*



F2

$$\text{Weight From Column} = 20,000 \text{ Kg}$$

Choose I 18\*18\*16.00 m จำนวน 2 ต้น

$$\text{Max Allow Load} = 24,000 \text{ Kg}$$

$$V \text{ รับ นน. ต้นละ } 10,000 \text{ Kg}$$

$$M = (10,000) (0.60 - 0.15) = 2250 \text{ Kg-m}$$

$$\begin{aligned} d &= \sqrt{\frac{M}{R_b}} \\ &= \sqrt{\frac{(2250)(100)}{(10.26)(40)}} \\ &= 23 \text{ Cm} \end{aligned}$$

เลือกใช้ฐานราก หน้า 40 Cm d = 35 Cm

#### พิจารณาแรงเฉือน

ระยะ 0.35 m จากขอบเสา เป็น Critical Section

$$\text{Center เข็มห่าง} = 0.35 - 0.225$$

$$= 0.125$$

$$P' = \frac{P (X+15)}{30}$$

$$= \frac{10,000 (-12.5 + 15)}{30} = 828 \text{ Kg}$$

$$V = \frac{828}{(40)(40)}$$

$$= 0.50 \text{ Kg/Cm}^2 < 0.29 \sqrt{f_c'} = 3.84 \text{ Kg/Cm}^2$$

พิจารณาที่ระยะ d/2 จากขอบเสา

$$d/2 = 17.5 \text{ จากขอบเสา}$$

$$\text{เสาเข็มห่างจาก Critical Section} = 0.05 \text{ Cm}$$

$$P' = P (X + 15)$$

$$30$$

$$\left( \frac{10,000}{30} \right) (5+15)$$

$$= 6,667 \text{ Kg}$$

$$\text{ทางค้ำนก้างของฐานราก Critical Section ยาว} = 15+35 = 50 \text{ Kg}$$

$$V = P' = 6667 \text{ Kg}$$

$$v = \frac{V}{bd}$$

$$= \frac{6667}{(40)(35)} = 4.76 \text{ Kg/Cm}^2 = < 0.53 \sqrt{f_c'} = 7.01 \text{ 4Cm}$$

$$A_s = \frac{M}{f_s j d}$$

$$= \frac{(2250) (100)}{(1400) (0.887) (35)} = 5.17 \text{ Cm}^2$$

Use 5 DB 12

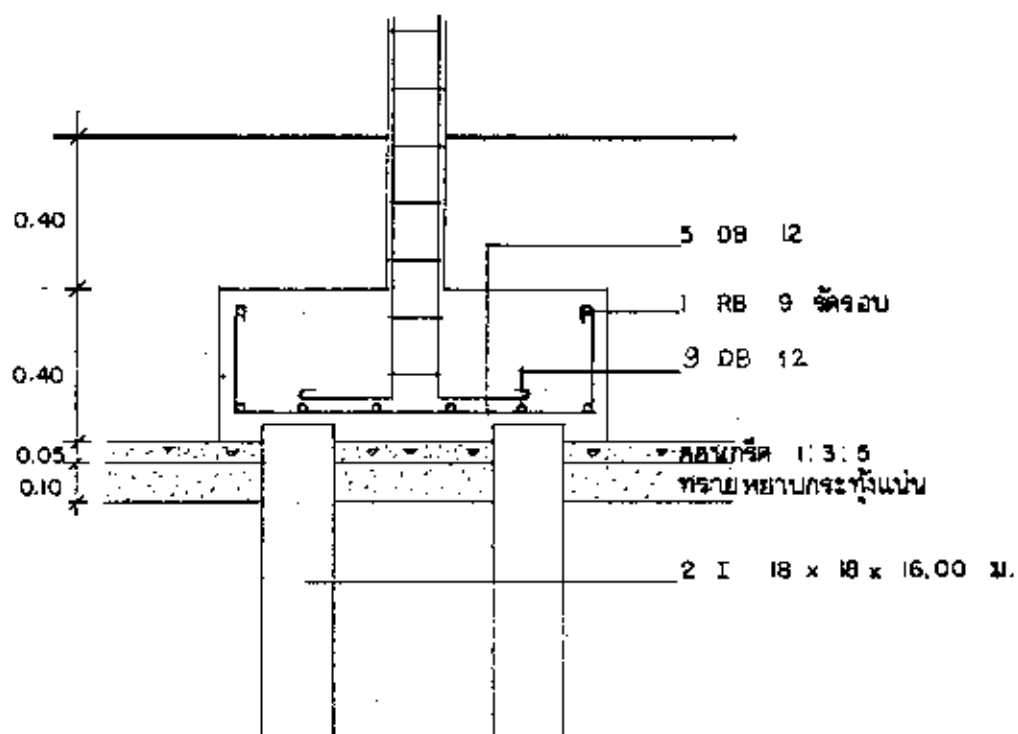
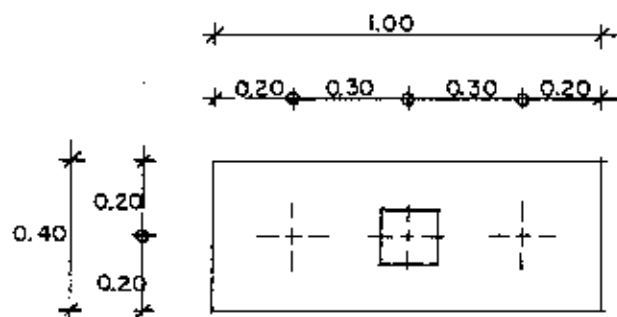
$$\text{เหล็กเสริมกันร้าว} = 0.0025 \text{ bt}$$

$$= 0.0025 (100)(40)$$

$$= 10 \text{ Cm}^2$$

Use 9 DB 12





F3