Diseño de Losas

Nivel -1

 $e \coloneqq 17 \ cm$

 $s_{max} \coloneqq 1.6 \cdot e = 27.2 \ cm$

 $rec \coloneqq 2$ **cm**

 $d \coloneqq e - rec = 150 \ \mathbf{mm}$

0.- Datos iniciales

Sobrecarga:

$$SC_h = 200 \frac{kgf}{m^2}$$

$$SC_{AcE} = 400 \frac{kgf}{m^2}$$

$$SC_B \coloneqq 300 \ \frac{\textit{kgf}}{\textit{m}^2}$$

$$SC_A \coloneqq 500 \ \frac{\textit{kgf}}{\textit{m}^2}$$

$$SC_T \coloneqq 100 \frac{\textit{kgf}}{\textit{m}^2}$$

$$SC \coloneqq SC_A$$

$$SC = 500 \frac{kgf}{m^2}$$

Peso Propio

$$PP_{Tab} = 100 \frac{kgf}{m^2}$$

$$e_{yeso} \coloneqq 25$$
 cm

$$PP_y := e_{yeso} \cdot 10 \frac{kgf}{m^2 \cdot cm} = 250 \frac{kgf}{m^2}$$

$$e_{SL} \coloneqq 5$$
 cm

$$PP_{sl}\!\coloneqq\!e_{SL}\!\cdot\!20\;\frac{\textit{kgf}}{\textit{m}^2\cdot\textit{cm}}\!=\!100\;\frac{\textit{kgf}}{\textit{m}^2}$$

$$PP_{adic} \coloneqq PP_{Tab} + PP_y + PP_{sl}$$

$$PP_{adic} = 450 \frac{kgf}{m^2}$$

· Sobrecarga:

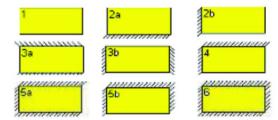
Habitacional: 200 kgf/m^2

Áreas Comunes y Escaleras: 400 kgf/m^2

Balcones: 300 kgf/m^2 Autos: 500 kgf/m^2 Techo: 100 kgf/m^2

Peso Propio

Tabiques: 60 - 120 kgf/m^2 Yeso: 10 $kgf/m^2 \, {
m x cm}$ Sobrelosa: 20 $kgf/m^2 \, {
m x cm}$



1.- Tipo de Hormigón

$$f'c \coloneqq 350 \ MPa$$

$$\gamma_h = 2.5 \frac{tonnef}{m^3}$$

Hormigón H35

$$fy = 420 \, MPa$$

Acero A63-42H

$$Lx = 5 \, \mathbf{m}$$

$$Ly = 5.33 \, \mathbf{m}$$

$$e \coloneqq 17$$
 cm

$$e \coloneqq 17 \ cm$$
 $\varepsilon \coloneqq \frac{Ly}{Lx} = 1.066$

$$\varepsilon \coloneqq r.upp\left(\varepsilon\right) = 1.1$$

3.- Parámetros

$$k := 0.55 \qquad \lambda := 35$$

$$e_{min} := \frac{k \cdot Lx}{\lambda} + rec = 9.86 \text{ cm} \qquad e_{min} := r.up (e_{min}) = 10 \text{ cm}$$

$$mx := 50.7 \qquad my := 61.2 \qquad \Delta x := 1.05$$

$$mex := 18.8 \qquad mey := 20.3$$

$$cm^{2}$$

$$e_{min} \coloneqq r.up\left(e_{min}\right) = 10 \ \textbf{cm}$$

$$mx \coloneqq 50.7$$
$$mex \coloneqq 18.8$$

$$my \coloneqq 61.2$$
$$mey \coloneqq 20.3$$

$$\Delta x = 1.05$$

$$\Delta y = 1.05$$

$$AS_{min} := e \cdot 0.18\% = 3.06 \frac{cm^2}{m}$$

Armadura mínima =>
$$\Phi 8@16$$

4.- Cargas

$$PP_{losa} := \gamma_h \cdot e = 0.43 \frac{tonnef}{m^2}$$

$$PP_t := PP_{losa} + PP_{adic} = 0.88 \frac{tonnef}{m^2}$$

$$PP_t = PP_{losa} + PP_{adic} = 0.88 \frac{tonney}{m^2}$$

$$q_u = 1.2 \cdot PP_t + 1.6 \ SC$$
 $q_u = 1.85 \ \frac{\textbf{tonnef}}{\textbf{m}^2}$

$$Ku \coloneqq q_u \cdot \left(Lx \cdot Ly \right) = 49.3 \ \frac{\textbf{tonnef} \cdot \textbf{m}}{\textbf{m}}$$

$$\alpha \coloneqq \frac{SC}{2 \cdot q_u} = 0.14$$

5.- Momento últimos

$$Mx0101 \coloneqq \frac{Ku}{mx} \cdot (1 + \alpha \cdot \Delta x) \cdot k$$

$$As := \frac{Mx0101}{0.9 \cdot (0.9 \cdot d) \cdot fy} = 1.17 \frac{cm^2}{m}$$

$$Mx0101 = 0.61 \frac{tonnef \cdot m}{m}$$

Momento positivo último en lado corto

$$a \coloneqq \frac{As \cdot fy}{0.85 \cdot f'c \cdot 1 \ m} = 0.17 \ \frac{mm}{m}$$

$$As = 1.06 \frac{cm^2}{m} < As_{min} => Armadura mínima => 48@16$$

$$My0101 \coloneqq \frac{Ku}{my} \boldsymbol{\cdot} \left(1 + \alpha \boldsymbol{\cdot} \Delta y \right) \boldsymbol{\cdot} k$$

$$As := \frac{My0101}{0.9 \cdot (0.9 \cdot d) \cdot fy} = 0.97 \frac{cm^2}{m}$$

$$My0101 = 0.51 \frac{tonnef \cdot m}{m}$$

$$a \coloneqq \frac{As \cdot fy}{0.85 \cdot f'c \cdot 1 \ \boldsymbol{m}} = 0.14 \ \frac{\boldsymbol{m}\boldsymbol{m}}{\boldsymbol{m}}$$

$$My0101 \coloneqq \frac{Ku}{my} \cdot \left(1 + \alpha \cdot \Delta y\right) \cdot k \qquad My0101 = 0.51 \quad \frac{\textbf{tonnef} \cdot \textbf{m}}{\textbf{m}} \qquad \text{Momento positivo último en lado largo}$$

$$As \coloneqq \frac{My0101}{0.9 \cdot \left(0.9 \cdot d\right) \cdot fy} = 0.97 \quad \frac{\textbf{cm}^2}{\textbf{m}} \qquad a \coloneqq \frac{As \cdot fy}{0.85 \cdot f'c \cdot 1 \cdot \textbf{m}} = 0.14 \quad \frac{\textbf{mm}}{\textbf{m}} \qquad As \coloneqq \frac{My0101}{0.9 \cdot \left(d - \frac{a \cdot 1 \cdot \textbf{m}}{2}\right) \cdot fy}$$

$$As = 0.88 \frac{cm^2}{m}$$
 < As_{min} => Armadura mínima => $\frac{\Phi 8@16}{m}$

$$Mex0101 := \frac{Ku}{mex} \cdot (1 + \alpha \cdot \Delta x) \cdot k$$

$$As := \frac{Mex0101}{0.0 \cdot (0.0 \cdot d) \cdot f_{st}} = 3.17 \frac{cm^2}{m}$$

$$Mex0101 = 1.65 \frac{tonnef \cdot m}{m}$$

$$a \coloneqq \frac{As \cdot fy}{0.85 \cdot f'c \cdot 1 \ m} = 0.45 \ \frac{mm}{m}$$

$$a \coloneqq \frac{As \cdot fy}{0.85 \cdot f'c \cdot 1 \ m} = 0.45 \ \frac{mm}{m}$$

$$\begin{aligned} Mex 0101 &\coloneqq \frac{Ku}{mex} \cdot \left(1 + \alpha \cdot \Delta x\right) \cdot k & Mex 0101 &= 1.65 \frac{tonnef \cdot m}{m} & \text{Momento negativo último en} \\ As &\coloneqq \frac{Mex 0101}{0.9 \cdot \left(0.9 \cdot d\right) \cdot fy} &= 3.17 \frac{cm^2}{m} & a &\coloneqq \frac{As \cdot fy}{0.85 \cdot f'c \cdot 1} &= 0.45 \frac{mm}{m} & As &\coloneqq \frac{Mex 0101}{0.9 \cdot \left(d - \frac{a \cdot 1}{2}\right) \cdot fy} \end{aligned}$$

$$As = 2.85 \frac{cm^2}{m} > As_{min} = > \frac{\phi 10@15}{}$$

$$\phi 10@15$$

$$Mey0101 := \frac{Ku}{mey} \cdot (1 + \alpha \cdot \Delta y) \cdot k$$

$$s := \frac{Mey0101}{0.9 \cdot (0.9 \cdot d) \cdot f_{2}} = 2.93 \frac{cm^{2}}{m}$$

$$\begin{array}{ccc}
 & m \\
 & As \cdot fy \\
 & & mn \\
\end{array}$$

$$a \coloneqq \frac{As \cdot fy}{0.85 \cdot f'c \cdot 1 \ m} = 0.41 \ \frac{mm}{m}$$

$$Mey0101 \coloneqq \frac{Ku}{mey} \cdot \left(1 + \alpha \cdot \Delta y\right) \cdot k \qquad Mey0101 = 1.53 \frac{tonnef \cdot m}{m} \qquad \text{Momento negativo último en}$$

$$As \coloneqq \frac{Mey0101}{0.9 \cdot \left(0.9 \cdot d\right) \cdot fy} = 2.93 \frac{cm^2}{m} \qquad a \coloneqq \frac{As \cdot fy}{0.85 \cdot f'c \cdot 1} = 0.41 \frac{mm}{m} \qquad As \coloneqq \frac{Mey0101}{0.9 \cdot \left(d - \frac{a \cdot 1}{2}\right) \cdot fy}$$

$$As = 2.64 \frac{cm^2}{m} > As_{min} = > \frac{\phi 10@16}{\phi 10@16}$$

$$\phi 10@$$

LOSA 0102

Caso: 6

2.- Dimensiones de Losa (Lx, Ly, e)

$$Lx = 5 \, \mathbf{m}$$

$$Ly = 7.2 \, \boldsymbol{m}$$

$$e \coloneqq 17$$
 cm

$$e \coloneqq 17 \text{ cm}$$
 $\varepsilon \coloneqq \frac{Ly}{Lx} = 1.44$

$$\varepsilon \coloneqq r.upp(\varepsilon) = 1.5$$

3.- Parámetros

$$e_{min}\coloneqq r.up\left(e_{min}\right)=11$$
 cm

$$mx \coloneqq 44.4$$

 $mex \coloneqq 19.8$

$$my = 140.5$$

 $mey = 26.2$

$$\Delta x \coloneqq 1.31$$
$$\Delta y \coloneqq 1.31$$

$$AS_{min} := e \cdot 0.18\% = 3.06 \frac{cm^2}{m}$$

Armadura mínima => $\Phi 8@16$

4.- Cargas

$$PP_{losa} := \gamma_h \cdot e = 0.43 \frac{\textbf{tonnef}}{\textbf{m}^2}$$

$$PP_t \coloneqq PP_{losa} + PP_{adic} = 0.88 \ \frac{\textbf{tonnej}}{\textbf{m}^2}$$

$$q_u = 1.2 \cdot PP_t + 1.6 \ SC$$
 $q_u = 1.85 \ \frac{\textbf{tonnef}}{\textbf{m}^2}$

$$Ku := q_u \cdot (Lx \cdot Ly) = 66.6 \frac{\textbf{tonnef} \cdot \textbf{m}}{\textbf{m}}$$

$$\alpha \coloneqq \frac{SC}{2 \cdot q_u} = 0.14$$

5.- Momento últimos

$$Mx0102 \coloneqq \frac{Ku}{mx} \cdot (1 + \alpha \cdot \Delta x) \cdot k$$

$$5.- \ \, \text{Momento ultimos} \\ Mx0102 \coloneqq \frac{Ku}{mx} \cdot \left(1 + \alpha \cdot \Delta x\right) \cdot k \qquad \qquad Mx0102 = 1.02 \ \frac{\textbf{tonnef} \cdot \textbf{m}}{\textbf{m}} \qquad \text{Momento positivo ultimo en la solution} \\ As \coloneqq \frac{Mx0102}{0.9 \cdot \left(0.9 \cdot d\right) \cdot fy} = 1.97 \ \frac{\textbf{cm}^2}{\textbf{m}} \qquad \qquad a \coloneqq \frac{As \cdot fy}{0.85 \cdot f'c \cdot 1} = 0.28 \ \frac{\textbf{mm}}{\textbf{m}} \qquad As \coloneqq \frac{Mx0102}{0.9 \cdot \left(d - \frac{a \cdot 1}{2}\right) \cdot fy} \\ \frac{2}{0.9 \cdot \left(d - \frac{a \cdot 1}{2}\right) \cdot fy} = \frac{1.97 \cdot \frac{d^2}{m^2}}{m^2} \qquad \qquad As \coloneqq \frac{Mx0102}{0.85 \cdot f'c \cdot 1} = 0.28 \ \frac{d^2}{m^2} = 0.28 \$$

$$Mx0102 = 1.02 \frac{tonnef \cdot m}{m}$$

$$a := \frac{As \cdot fy}{0.85 \cdot f'c \cdot 1} = 0.28 \frac{mm}{m}$$

Momento positivo último en lado corto

$$As := \frac{Mx0102}{0.9 \cdot \left(d - \frac{a \cdot 1}{2} \frac{m}{2}\right) \cdot fy}$$

$$As = 1.77 \frac{cm^2}{m} < As_{min} => Armadura mínima => \frac{\Phi 8@16}{m}$$

$$My0102 \coloneqq \frac{Ku}{my} \boldsymbol{\cdot} \left(1 + \alpha \boldsymbol{\cdot} \Delta y \right) \boldsymbol{\cdot} k$$

$$As := \frac{My0102}{0.9 \cdot (0.9 \cdot d) \cdot fy} = 0.62 \frac{cm^2}{m}$$

$$My0102 = 0.32 \frac{tonnef \cdot m}{m}$$

$$a := \frac{As \cdot fy}{0.85 \cdot f'c \cdot 1 m} = 0.09 \frac{mm}{m}$$

Momento positivo último en lado largo

$$My0102 := \frac{Ku}{my} \cdot \left(1 + \alpha \cdot \Delta y\right) \cdot k \qquad My0102 = 0.32 \frac{tonnef \cdot m}{m} \qquad \text{Momento positivo último en la final positivo último en la fin$$

$$As = 0.56 \frac{cm^2}{m}$$
 < As_{min} => Armadura mínima => $\frac{\Phi 8@16}{m}$

$$Mex0102 \coloneqq \frac{Ku}{mex} \cdot \left(1 + \alpha \cdot \Delta x\right) \cdot k$$

$$As := \frac{Mex0102}{0.9 \cdot (0.9 \cdot d) \cdot fy} = 4.41 \frac{cm^2}{m}$$

$$Mex0102 = 2.3 \frac{tonnef \cdot m}{m}$$

$$a \coloneqq \frac{As \cdot fy}{0.85 \cdot f'c \cdot 1 \ m} = 0.62 \ \frac{mm}{m}$$

Momento negativo último en lado corto

$$\begin{aligned} Mex 0102 \coloneqq & \frac{Ku}{mex} \cdot \left(1 + \alpha \cdot \Delta x\right) \cdot k & Mex 0102 = 2.3 \, \frac{tonnef \cdot m}{m} & \text{Momento negativo último en} \\ As \coloneqq & \frac{Mex 0102}{0.9 \cdot \left(0.9 \cdot d\right) \cdot fy} = 4.41 \, \frac{\mathbf{cm}^2}{m} & a \coloneqq \frac{As \cdot fy}{0.85 \cdot f'c \cdot 1 \, m} = 0.62 \, \frac{mm}{m} & As \coloneqq \frac{Mex 0102}{0.9 \cdot \left(d - \frac{a \cdot 1 \, m}{2}\right) \cdot fy} \end{aligned}$$

$$As = 3.98 \frac{cm^2}{m} > As_{min} = > \frac{\phi 10@11}{}$$

$$Mey0102 \coloneqq \frac{Ku}{mey} \cdot (1 + \alpha \cdot \Delta y) \cdot k$$

$$As := \frac{Mey0102}{0.9 \cdot (0.9 \cdot d) \cdot fy} = 3.33 \frac{cm^2}{m}$$

 $As = 3.01 \frac{cm^2}{m} > As_{min} = > \frac{\phi 10@14}{\phi 10@14}$

$$Mey0102 = 1.74 \frac{tonnef \cdot m}{m}$$

$$a \coloneqq \frac{As \cdot fy}{0.85 \cdot f'c \cdot 1 \ m} = 0.47 \ \frac{mm}{m}$$

$$Mey0102 \coloneqq \frac{Ku}{mey} \cdot \left(1 + \alpha \cdot \Delta y\right) \cdot k \qquad Mey0102 = 1.74 \quad \frac{tonnef \cdot m}{m} \qquad \text{Momento negativo último en}$$

$$As \coloneqq \frac{Mey0102}{0.9 \cdot \left(0.9 \cdot d\right) \cdot fy} = 3.33 \quad \frac{cm^2}{m} \qquad a \coloneqq \frac{As \cdot fy}{0.85 \cdot f'c \cdot 1} = 0.47 \quad \frac{mm}{m} \qquad As \coloneqq \frac{Mey0102}{0.9 \cdot \left(d - \frac{a \cdot 1}{2}\right) \cdot fy}$$

LOSA 0103

Caso: 6

2.- Dimensiones de Losa (Lx, Ly, e)

$$Lx = 5 \, \boldsymbol{m}$$

$$Ly = 7.2 \, \mathbf{m}$$

$$e \coloneqq 17 \ cm$$

$$e \coloneqq 17 \ cm$$
 $\varepsilon \coloneqq \frac{Ly}{Lx} = 1.44$

$$\varepsilon \coloneqq r.upp\left(\varepsilon\right) = 1.5$$

3.- Parámetros

$$k = 0.58$$
 $\lambda = 35$

$$e := \frac{k \cdot Lx}{k \cdot Lx} + rec = 10.29 \text{ cm}$$

29 **cm**
$$e_{min} \coloneqq r.up\left(e_{min}\right) = 11$$
 cm

$$mx \coloneqq 44.4$$
$$mex \coloneqq 19.8$$

$$my = 140.5$$

$$\Delta x = 1.31$$

$$AS_{min} := e \cdot 0.18\% = 3.06 \frac{cm^2}{m}$$

Armadura mínima => $\Phi 8@16$

4.- Cargas

$$PP_{losa} := \gamma_h \cdot e = 0.43 \frac{tonnef}{m^2}$$

$$q_u\!\coloneqq\!1.2 \boldsymbol{\cdot} PP_t \!+\! 1.6 \ SC$$

$$q_u = 1.2 \cdot PP_t + 1.6 \ SC$$
 $q_u = 1.85 \frac{tonnef}{m^2}$

$$Ku \coloneqq q_u \boldsymbol{\cdot} \left(Lx \boldsymbol{\cdot} Ly \right) = 66.6 \ \frac{\textbf{tonnef} \boldsymbol{\cdot} \textbf{m}}{\textbf{m}}$$

$$\alpha \coloneqq \frac{SC}{2 \cdot q_u} = 0.14$$

5.- Momento últimos

$$Mx0103 \coloneqq \frac{Ku}{mx} \cdot \left(1 + \alpha \cdot \Delta x\right) \cdot k$$

$$Mx0103 = 1.02 \frac{tonnef \cdot m}{m}$$

$$a \coloneqq \frac{As \cdot fy}{0.85 \cdot f'c \cdot 1 \ m} = 0.28 \ \frac{mm}{m}$$

Momento positivo último en lado corto

$$As \coloneqq \frac{Mx0103}{0.9 \cdot \left(d - \frac{a \cdot 1 \ m}{2}\right) \cdot fy}$$

$$As = 1.77 \frac{cm^2}{m} < A$$

$$As = 1.77 \frac{cm^2}{m}$$
 < As_{min} => Armadura mínima => Φ 8@16

$$My0103 \coloneqq \frac{Ku}{my} \cdot (1 + \alpha \cdot \Delta y) \cdot k$$

$$My0103 \coloneqq \frac{Ku}{my} \cdot \left(1 + \alpha \cdot \Delta y\right) \cdot k \qquad My0103 = 0.32 \frac{\textbf{tonnef} \cdot \textbf{m}}{\textbf{m}} \qquad \text{Momento positivo último en la superscription}$$

$$As \coloneqq \frac{My0103}{0.9 \cdot \left(0.9 \cdot d\right) \cdot fy} = 0.62 \frac{\textbf{cm}^2}{\textbf{m}} \qquad a \coloneqq \frac{As \cdot fy}{0.85 \cdot f'c \cdot 1 \ \textbf{m}} = 0.09 \frac{\textbf{mm}}{\textbf{m}} \qquad As \coloneqq \frac{My0103}{0.9 \cdot \left(d - \frac{a \cdot 1 \ \textbf{m}}{2}\right) \cdot fy}$$

$$My0103 = 0.32 \frac{tonnef \cdot m}{m}$$

$$a \coloneqq \frac{As \cdot fy}{0.85 \cdot f'c \cdot 1 \ m} = 0.09 \ \frac{mm}{m}$$

Momento positivo último en lado largo

$$As := \frac{My0103}{0.9 \cdot \left(d - \frac{a \cdot 1}{2} \frac{m}{2}\right) \cdot fy}$$

$$As = 0.56 \frac{cm^2}{m}$$
 < As_{min} => Armadura mínima => $\Phi 8@16$

$$Mex0103 := \frac{Ku}{mex} \cdot (1 + \alpha \cdot \Delta x) \cdot k$$

$$As := \frac{Mex0103}{0.9 \cdot (0.9 \cdot d) \cdot fy} = 4.41 \frac{cm^2}{m}$$

$$Mex0103 = 2.3 \frac{tonnef \cdot m}{m}$$

$$a \coloneqq \frac{As \cdot fy}{0.85 \cdot f'c \cdot 1 \ m} = 0.62 \ \frac{mm}{m}$$

Momento negativo último en lado corto

$$\begin{aligned} Mex 0103 &\coloneqq \frac{Ku}{mex} \cdot \left(1 + \alpha \cdot \Delta x\right) \cdot k & Mex 0103 &= 2.3 \ \frac{tonnef \cdot m}{m} & \text{Momento negativo último en} \\ As &\coloneqq \frac{Mex 0103}{0.9 \cdot \left(0.9 \cdot d\right) \cdot fy} = 4.41 \ \frac{cm^2}{m} & a &\coloneqq \frac{As \cdot fy}{0.85 \cdot f'c \cdot 1} = 0.62 \ \frac{mm}{m} & As &\coloneqq \frac{Mex 0103}{0.9 \cdot \left(d - \frac{a \cdot 1}{2}\right) \cdot fy} \end{aligned}$$

$$As = 3.98 \frac{cm^2}{m} > As_{min} = > \frac{\phi 10@11}{\phi 10@11}$$

$$\phi 10@1$$

$$Mey0103 \coloneqq \frac{Ku}{mey} \cdot (1 + \alpha \cdot \Delta y) \cdot k$$

$$As := \frac{Mey0103}{0.9 \cdot (0.9 \cdot d) \cdot fy} = 3.33 \frac{cm^2}{m}$$

$$Mey0103 = 1.74 \frac{\textbf{tonnef} \cdot \textbf{m}}{\textbf{m}}$$

$$a := \frac{As \cdot fy}{0.85 \cdot f'c \cdot 1 \ m} = 0.47 \ \frac{mm}{m}$$

$$Mey0103 := \frac{Ku}{mey} \cdot \left(1 + \alpha \cdot \Delta y\right) \cdot k \qquad Mey0103 = 1.74 \frac{tonnef \cdot m}{m} \qquad \text{Momento negativo último en}$$

$$As := \frac{Mey0103}{0.9 \cdot \left(0.9 \cdot d\right) \cdot fy} = 3.33 \frac{cm^2}{m} \qquad a := \frac{As \cdot fy}{0.85 \cdot f'c \cdot 1 \ m} = 0.47 \frac{mm}{m} \qquad As := \frac{Mey0103}{0.9 \cdot \left(d - \frac{a \cdot 1 \ m}{2}\right) \cdot fy}$$

$$As = 3.01 \frac{cm^2}{m} > As_{min} = > \frac{\phi 10@15}{}$$

$$Lx = 5 \, \boldsymbol{m}$$

$$Ly := 7.89 \ m$$

$$e \coloneqq 17$$
 cm

$$e := 17 \text{ cm}$$
 $\varepsilon := \frac{Ly}{Lx} = 1.578$ $\varepsilon := r.upp(\varepsilon) = 1.6$

$$\varepsilon \coloneqq r.upp\left(\varepsilon\right) = 1.6$$

3.- Parámetros

$$e_{min} \coloneqq r.up\left(e_{min}\right) = 17$$
 cm

$$mx \coloneqq 46.1$$

$$mex \coloneqq 20.5$$

$$my = 163$$

$$\Delta x = 1.39$$
 $\Delta u = 1.39$

$$AS_{min} = e \cdot 0.18\% = 3.06 \frac{cm^2}{m}$$

Armadura mínima => $\Phi 8@16$

4.- Cargas

$$PP_{losa} := \gamma_h \cdot e = 0.43 \frac{tonnef}{m^2}$$

$$PP_t \coloneqq PP_{losa} + PP_{adic} = 0.88 \frac{\textbf{tonnef}}{\textbf{m}^2}$$

$$q_u = 1.2 \cdot PP_t + 1.6 \ SC$$
 $q_u = 1.85 \frac{tonnef}{contact}$

$$q_u = 1.85 \frac{tonnef}{m^2}$$

$$Ku \coloneqq q_u \cdot \left(Lx \cdot Ly \right) = 72.98 \ \frac{\textbf{tonnef} \cdot \textbf{m}}{\textbf{m}}$$

$$\alpha \coloneqq \frac{SC}{2 \cdot q_u} = 0.14$$

$$Mx0104 \coloneqq \frac{Ku}{mx} \cdot (1 + \alpha \cdot \Delta x) \cdot k$$

$$As := \frac{Mx0104}{0.9 \cdot (0.9 \cdot d) \cdot fy} = 3.61 \frac{cm^2}{m}$$

$$Mx0104 = 1.88 \frac{tonnef \cdot m}{m}$$

$$a \coloneqq \frac{As \cdot fy}{0.85 \cdot f'c \cdot 1 \ m} = 0.51 \ \frac{mn}{m}$$

$$5.- \ \, \text{Momento últimos} \\ Mx0104 \coloneqq \frac{Ku}{mx} \cdot \left(1 + \alpha \cdot \Delta x\right) \cdot k \\ As \coloneqq \frac{Mx0104}{0.9 \cdot \left(0.9 \cdot d\right) \cdot fy} = 3.61 \, \frac{cm^2}{m}$$
 $Mx0104 = 1.88 \, \frac{tonnef \cdot m}{m}$ Momento positivo último en la $\frac{As \cdot fy}{0.85 \cdot f'c \cdot 1} = 0.51 \, \frac{mm}{m}$ $As \coloneqq \frac{Mx0104}{0.9 \cdot \left(d - \frac{a \cdot 1}{2}\right) \cdot fy}$

$$As = 3.26 \frac{cm^2}{m} > As_{min} \Rightarrow \Phi = \Phi = \Phi = \Phi = \Phi$$

$$My0104 := \frac{Ku}{my} \cdot (1 + \alpha \cdot \Delta y) \cdot k$$

$$My0104 \qquad cm$$

$$My0104 := \frac{Ku}{my} \cdot \left(1 + \alpha \cdot \Delta y\right) \cdot k \qquad My0104 = 0.53 \frac{tonnef \cdot m}{m} \qquad \text{Momento positivo último en la final positivo último en la fin$$

$$My0104 = 0.53 \frac{tonnef \cdot m}{m}$$

$$a \coloneqq \frac{As \cdot fy}{0.85 \cdot f'c \cdot 1 \ m} = 0.14 \ \frac{mm}{m}$$

Momento positivo último en lado largo
$$Mv0104$$

$$As := \frac{My0104}{0.9 \cdot \left(d - \frac{a \cdot 1 \ m}{2}\right) \cdot fy}$$

$$As = 0.92 \frac{cm^2}{m} < As_{min} => Armadura mínima => \Phi 8@16$$

Armadura mínima =>
$$\Phi 8@16$$

$$Mex0104 := \frac{Ku}{mex} \cdot (1 + \alpha \cdot \Delta x) \cdot k$$

$$As := \frac{Mex0104}{0.9 \cdot (0.9 \cdot d) \cdot fy} = 8.13 \frac{cm^2}{m}$$

$$Mex0104 = 4.23 \frac{tonnef \cdot m}{m}$$

$$a \coloneqq \frac{As \cdot fy}{0.85 \cdot f'c \cdot 1 \ m} = 1.15 \ \frac{mm}{m}$$

$$\begin{aligned} Mex 0104 &\coloneqq \frac{Ku}{mex} \cdot \left(1 + \alpha \cdot \Delta x\right) \cdot k & Mex 0104 &= 4.23 \ \frac{tonnef \cdot m}{m} & \text{Momento negativo último en} \\ As &\coloneqq \frac{Mex 0104}{0.9 \cdot \left(0.9 \cdot d\right) \cdot fy} = 8.13 \ \frac{cm^2}{m} & a &\coloneqq \frac{As \cdot fy}{0.85 \cdot f'c \cdot 1 \ m} = 1.15 \ \frac{mm}{m} & As &\coloneqq \frac{Mex 0104}{0.9 \cdot \left(d - \frac{a \cdot 1 \ m}{2}\right) \cdot fy} \end{aligned}$$

$$As = 7.34 \frac{cm^2}{m} > As_{min} = > \frac{\phi 10@10}{}$$

$$Mey0104 \coloneqq \frac{Ku}{mey} \cdot \left(1 + \alpha \cdot \Delta y\right) \cdot k$$

$$As := \frac{Mey0104}{0.9 \cdot (0.9 \cdot d) \cdot fy} = 5.97 \frac{cm^2}{m}$$

$$m$$

$$a := \frac{As \cdot fy}{} = 0.84$$

$$a \coloneqq \frac{As \cdot fy}{0.85 \cdot f'c \cdot 1 \ m} = 0.84 \ \frac{mm}{m}$$

$$As = 5.39 \frac{cm^2}{m} > As_{min} = > \frac{\phi 10@14}{\phi 10@14}$$

$$\phi 10@14$$

$$Lx \coloneqq 4.45 \ \boldsymbol{m}$$

$$Ly = 5 \, \mathbf{m}$$

$$e \coloneqq 17$$
 cm

$$e := 17 \text{ cm}$$
 $\varepsilon := \frac{Ly}{Lx} = 1.124$ $\varepsilon := r.upp(\varepsilon) = 1.2$

$$\varepsilon \coloneqq r.upp(\varepsilon) = 1.2$$

3.- Parámetros

9.12 CM
$$e_{min}$$

$$mx := 47.2$$
 $my := 78$
 $mex := 18.6$ $mey := 2$

$$\Delta x \coloneqq 1.1$$
$$\Delta y \coloneqq 1.1$$

$$AS_{min} := e \cdot 0.18\% = 3.06 \frac{cm^2}{m}$$

Armadura mínima => Ф8@16

4.- Cargas

$$PP_{losa} := \gamma_h \cdot e = 0.43 \frac{tonnef}{m^2}$$

$$PP_t \coloneqq PP_{losa} + PP_{adic} = 0.88 \ \frac{\textbf{tonnef}}{\textbf{m}^2}$$

$$q_u = 1.2 \cdot PP_t + 1.6 \ SC$$
 $q_u = 1.85 \ \frac{\textbf{tonnef}}{\cdots}$

$$q_u = 1.85 \frac{tonnef}{m^2}$$

$$Ku \coloneqq q_u \cdot (Lx \cdot Ly) = 41.16 \frac{\textbf{tonnef} \cdot \textbf{m}}{\textbf{m}}$$

$$\alpha \coloneqq \frac{SC}{2 \cdot q_u} = 0.14$$

5.- Momento últimos

$$Mx0105 \coloneqq \frac{Ku}{mx} \cdot \left(1 + \alpha \cdot \Delta x\right) \cdot k \qquad \qquad Mx0105 = 0.56 \; \frac{\textit{tonnef} \cdot \textit{m}}{\textit{m}}$$

lado corto
$$As \coloneqq \frac{Mx0105}{0.9 \cdot (0.9 \cdot d) \cdot fy} = 1.08 \frac{\mathbf{cm}^2}{\mathbf{m}} \qquad \qquad a \coloneqq \frac{As \cdot fy}{0.85 \cdot f'c \cdot 1 \ \mathbf{m}} = 0.15 \frac{\mathbf{mm}}{\mathbf{m}} \qquad As \coloneqq \frac{Mx0105}{0.9 \cdot \left(d - \frac{a \cdot 1 \ \mathbf{m}}{2}\right) \cdot fy}$$

$$Mx0105 = 0.56 \frac{tonnef \cdot m}{m}$$

Momento positivo último en

$$a := \frac{As \cdot fy}{0.85 \cdot f'c \cdot 1 m} = 0.15 \frac{mm}{m}$$

$$As = 0.97 \frac{cm^2}{m}$$
 < As_{min} => Armadura mínima => $\frac{\Phi 8@16}{m}$

$$My0105 \coloneqq \frac{Ku}{my} \cdot (1 + \alpha \cdot \Delta y) \cdot k$$

$$My0105 \qquad cm$$

$$My0105 := \frac{Ku}{my} \cdot \left(1 + \alpha \cdot \Delta y\right) \cdot k \qquad My0105 = 0.34 \frac{tonnef \cdot m}{m} \qquad \text{Momento positivo último en la final positivo último en la fin$$

$$My0105 = 0.34 \frac{tonnef \cdot m}{m}$$

$$a := \frac{As \cdot fy}{0.85 \cdot f'c \cdot 1 \ m} = 0.09 \ \frac{mm}{m}$$

$$As \coloneqq \frac{My0105}{0.9 \cdot \left(d - \frac{a \cdot 1 \ m}{2}\right) \cdot fy}$$

$$As = 0.58 \frac{cm^2}{m}$$
 < As_{min} => Armadura mínima => $\Phi 8@16$

$$Mex0105 := \frac{Ku}{mex} \cdot (1 + \alpha \cdot \Delta x) \cdot k$$

$$As := \frac{Mex0105}{0.9 \cdot (0.9 \cdot d) \cdot fy} = 2.74 \frac{cm^2}{m}$$

$$Mex0105 = 1.42 \frac{tonnef \cdot m}{m}$$

$$a \coloneqq \frac{As \cdot fy}{0.85 \cdot f'c \cdot 1 \ m} = 0.39 \ \frac{mm}{m}$$

$$Mex0105 \coloneqq \frac{Ku}{mex} \cdot \left(1 + \alpha \cdot \Delta x\right) \cdot k \qquad Mex0105 = 1.42 \frac{tonnef \cdot m}{m} \qquad \text{Momento negativo último en}$$

$$As \coloneqq \frac{Mex0105}{0.9 \cdot \left(0.9 \cdot d\right) \cdot fy} = 2.74 \frac{cm^2}{m} \qquad a \coloneqq \frac{As \cdot fy}{0.85 \cdot f'c \cdot 1 \ m} = 0.39 \frac{mm}{m} \qquad As \coloneqq \frac{Mex0105}{0.9 \cdot \left(d - \frac{a \cdot 1 \ m}{2}\right) \cdot fy}$$

$$As = 2.47 \frac{cm^2}{m} > As_{min} \Rightarrow \frac{\phi 8@11}{}$$

$$Mey0105 \coloneqq \frac{Ku}{mey} \cdot (1 + \alpha \cdot \Delta y) \cdot k$$

$$As := \frac{Mey0105}{0.9 \cdot (0.9 \cdot d) \cdot fy} = 2.37 \frac{cm^2}{m}$$

$$As = 2.13 \frac{cm^2}{m} > As_{min} => \frac{\phi 8@13}{}$$

$$Mey0105 = 1.23 \frac{\textbf{tonnef} \cdot \textbf{m}}{\textbf{m}}$$

$$As \cdot fy \qquad \qquad \textbf{mn}$$

$$a \coloneqq \frac{As \cdot fy}{0.85 \cdot f'c \cdot 1 \ m} = 0.33 \ \frac{mm}{m}$$

$$Lx = 3.6 \ \boldsymbol{m}$$

$$Ly = 5 \, \mathbf{m}$$

$$e \coloneqq 17$$
 cm

$$e := 17 \text{ cm}$$
 $\varepsilon := \frac{Ly}{L_x} = 1.389$ $\varepsilon := r.upp(\varepsilon) = 1.4$

$$\varepsilon \coloneqq r.upp\left(\varepsilon\right) = 1.4$$

3.- Parámetros

$$e_{min} \coloneqq r.up\left(e_{min}\right) = 8$$
 cm

$$mx \coloneqq 44.6$$

$$mex \coloneqq 19.2$$

$$my \coloneqq 116.6$$
 $mey \coloneqq 24.5$

$$\Delta x = 1.24$$

$$AS_{min} := e \cdot 0.18\% = 3.06 \frac{cm^2}{m}$$

Armadura mínima => Ф8@16

4.- Cargas

$$PP_{losa} := \gamma_h \cdot e = 0.43 \frac{tonnef}{m^2}$$

$$PP_t := PP_{losa} + PP_{adic} = 0.88 \frac{tonnej}{m^2}$$

$$q_u \coloneqq 1.2 \bullet PP_t + 1.6 \ SC$$

$$q_u \coloneqq 1.2 \cdot PP_t + 1.6 \ SC \qquad q_u = 1.85 \ \frac{\textit{tonnef}}{\textit{m}^2}$$

$$Ku := q_u \cdot (Lx \cdot Ly) = 33.3 \frac{tonnef \cdot m}{m} \quad \alpha := \frac{SC}{2 \cdot q_u} = 0.14$$

5.- Momento últimos

$$Mx0106 \coloneqq \frac{Ku}{mx} \cdot (1 + \alpha \cdot \Delta x) \cdot k$$

$$As := \frac{Mx0106}{0.9 \cdot (0.9 \cdot d) \cdot fy} = 0.95 \frac{cm^2}{m}$$

$$Mx0106 = 0.5 \frac{tonnef \cdot m}{m}$$

$$a \coloneqq \frac{As \cdot fy}{0.85 \cdot f'c \cdot 1 \ m} = 0.13 \ \frac{mm}{m}$$

$$Mx0106 \coloneqq \frac{Ku}{mx} \cdot \left(1 + \alpha \cdot \Delta x\right) \cdot k \qquad Mx0106 = 0.5 \frac{tonnef \cdot m}{m} \qquad \text{Momento positivo último en la final positivo último en la final$$

$$As = 0.86 \frac{cm^2}{m}$$
 < As_{min} => Armadura mínima => $\Phi 8@16$

$$My0106 := \frac{Ku}{my} \cdot (1 + \alpha \cdot \Delta y) \cdot k$$

$$My0106 := \frac{Ku}{my} \cdot \left(1 + \alpha \cdot \Delta y\right) \cdot k \qquad My0106 = 0.19 \frac{tonnef \cdot m}{m} \qquad \text{Momento positivo último en la final support of the property o$$

$$My0106 = 0.19 \frac{tonnef \cdot m}{m}$$

$$a := \frac{As \cdot fy}{0.85 \cdot f'c \cdot 1 \ m} = 0.05 \ \frac{mm}{m}$$

$$As := \frac{My0106}{0.9 \cdot \left(d - \frac{a \cdot 1}{2} \frac{m}{2}\right) \cdot fy}$$

$$As = 0.33 \frac{cm^2}{m}$$
 < As_{min} => Armadura mínima => $\Phi 8@16$

$$Mex0106 := \frac{Ku}{mex} \cdot (1 + \alpha \cdot \Delta x) \cdot k$$

$$As := \frac{Mex0106}{0.9 \cdot (0.9 \cdot d) \cdot fy} = 2.22 \frac{cm^2}{m}$$

$$Mex0106 = 1.15 \frac{tonnef \cdot m}{m}$$

$$a \coloneqq \frac{As \cdot fy}{0.85 \cdot f'c \cdot 1 \ m} = 0.31 \ \frac{mm}{m}$$

$$\begin{aligned} Mex 0106 &\coloneqq \frac{Ku}{mex} \cdot \left(1 + \alpha \cdot \Delta x\right) \cdot k & Mex 0106 &= 1.15 \ \frac{tonnef \cdot m}{m} & \text{Momento negativo último en} \\ As &\coloneqq \frac{Mex 0106}{0.9 \cdot \left(0.9 \cdot d\right) \cdot fy} = 2.22 \ \frac{cm^2}{m} & a &\coloneqq \frac{As \cdot fy}{0.85 \cdot f'c \cdot 1 \ m} = 0.31 \ \frac{mm}{m} & As &\coloneqq \frac{Mex 0106}{0.9 \cdot \left(d - \frac{a \cdot 1 \ m}{2}\right) \cdot fy} \end{aligned}$$

$$As = 2 \frac{cm^2}{m} > As_{min} \Rightarrow \frac{\phi 8@14}{}$$

$$\phi 8@14$$

$$Mey0106 := \frac{Ku}{mey} \cdot (1 + \alpha \cdot \Delta y) \cdot k$$

$$As := \frac{Mey0106}{0.9 \cdot (0.9 \cdot d) \cdot fy} = 1.74 \frac{cm^2}{m}$$

$$As = 1.57 \frac{cm^2}{m} > As_{min} = > \frac{\phi 8@18}{}$$

$$Mey0106 = 0.9 \frac{tonnef \cdot m}{m}$$

$$a \coloneqq \frac{As \cdot fy}{0.85 \cdot f'c \cdot 1 \ m} = 0.25 \ \frac{mm}{m}$$

$$Lx \coloneqq 5.33 \ \boldsymbol{m}$$

$$Ly := 5.54 \ m$$

$$e \coloneqq 17 \ cm$$

$$e := 17 \text{ cm}$$
 $\varepsilon := \frac{Ly}{Lx} = 1.039$ $\varepsilon := r.upp(\varepsilon) = 1.1$

$$\varepsilon \coloneqq r.upp(\varepsilon) = 1.1$$

3.- Parámetros

$$k := 0.55$$
 $\lambda := 35$

$$e := \frac{k \cdot Lx}{10.38} + rec = 10.38 \text{ cm}$$

$$ec = 10.38$$
 cm $e_{min} :=$

$$7 my := 66.3$$
$$mey := 20.3$$

$$my = 66.3$$
$$mey = 20.3$$

$$\Delta x = 1.05$$

$$\Delta y = 1.05$$

$$AS_{min} := e \cdot 0.18\% = 3.06 \frac{cm^2}{m}$$

Armadura mínima => $\Phi 8@16$

4.- Cargas

$$PP_{losa} := \gamma_h \cdot e = 0.43 \frac{tonnef}{m^2}$$

$$k \coloneqq 0.55 \qquad \lambda \coloneqq 35$$

$$e_{min} \coloneqq \frac{k \cdot Lx}{\lambda} + rec = 10.38 \text{ cm} \qquad e_{min} \coloneqq r.up\left(e_{min}\right) = 11 \text{ cm}$$

$$mx \coloneqq 50.7 \qquad my \coloneqq 66.3 \qquad \Delta x \coloneqq 1.05 \qquad PP_{losa} \vDash \gamma_h \cdot e = 0.43 \frac{tonnef}{m^2}$$

$$PP_{losa} \coloneqq \gamma_h \cdot e = 0.43 \frac{tonnef}{m^2}$$

$$PP_{losa} \vDash PP_{losa} + PP_{adic} = 0.88 \frac{tonnef}{m^2}$$

$$q_u = 1.2 \cdot PP_t + 1.6 \ SC$$
 $q_u = 1.85 \ \frac{tonnef}{constant}$

$$q_u = 1.85 \frac{tonnef}{m^2}$$

$$Ku := q_u \cdot (Lx \cdot Ly) = 54.63 \frac{tonnef \cdot m}{m}$$

$$\alpha \coloneqq \frac{SC}{2 \cdot q_u} = 0.14$$

5.- Momento últimos

$$Mx0107 \coloneqq \frac{Ku}{mx} \cdot (1 + \alpha \cdot \Delta x) \cdot k$$

$$Mx0107 = 0.68 \frac{tonnef \cdot r}{m}$$

Momento positivo último en lado corto

$$As := \frac{Mx0107}{0.9 \cdot (0.9 \cdot d) \cdot fu} = 1.3 \frac{cm^2}{m}$$

$$a := \frac{As \cdot fy}{0.85 \cdot f'c \cdot 1 \ m} = 0.18 \ \frac{mm}{m}$$

$$Mx0107 := \frac{Ku}{mx} \cdot (1 + \alpha \cdot \Delta x) \cdot k$$

$$Mx0107 = 0.68 \frac{tonnef \cdot m}{m}$$

$$As := \frac{Mx0107}{0.9 \cdot (0.9 \cdot d) \cdot fy} = 1.3 \frac{cm^2}{m}$$

$$a := \frac{As \cdot fy}{0.85 \cdot f'c \cdot 1 \ m} = 0.18 \frac{mm}{m}$$

$$As := \frac{Mx0107}{0.9 \cdot \left(d - \frac{a \cdot 1}{2}\right) \cdot fy}$$

$$As = 1.17 \frac{cm^2}{m}$$

 $\langle As_{min} \rangle = Armadura minima = \frac{48@16}{}$

$$My0107 \coloneqq \frac{Ku}{my} \cdot (1 + \alpha \cdot \Delta y) \cdot k$$

$$As := \frac{My0107}{0.9 \cdot (0.9 \cdot d) \cdot fy} = 0.99 \frac{cm^2}{m}$$

$$My0107 = 0.52 \frac{tonnef \cdot m}{m}$$

$$a := \frac{As \cdot fy}{0.85 \cdot f'c \cdot 1 \ m} = 0.14 \ \frac{mm}{m}$$

Momento positivo último en lado largo

$$My0107 := \frac{Ku}{my} \cdot \left(1 + \alpha \cdot \Delta y\right) \cdot k \qquad My0107 = 0.52 \frac{tonnef \cdot m}{m} \qquad \text{Momento positivo último en la final positivo formula in the positivo$$

$$As = 0.9 \frac{cm^2}{m}$$
 < As_{min} => Armadura mínima => $\Phi 8@16$

$$Mex0107 := \frac{Ku}{mex} \cdot (1 + \alpha \cdot \Delta x) \cdot k$$

$$As := \frac{Mex0107}{0.9 \cdot (0.9 \cdot d) \cdot fy} = 3.51 \frac{cm^{2}}{m}$$

$$Mex0107 = 1.82 \frac{tonnef \cdot m}{m}$$

$$a \coloneqq \frac{As \cdot fy}{0.85 \cdot f'c \cdot 1 \ m} = 0.5 \ \frac{mm}{m}$$

Momento negativo último en lado corto

$$\begin{aligned} Mex 0107 &\coloneqq \frac{Ku}{mex} \cdot \left(1 + \alpha \cdot \Delta x\right) \cdot k & Mex 0107 &= 1.82 \ \frac{tonnef \cdot m}{m} & \text{Momento negativo último en} \\ As &\coloneqq \frac{Mex 0107}{0.9 \cdot \left(0.9 \cdot d\right) \cdot fy} &= 3.51 \ \frac{cm^2}{m} & a &\coloneqq \frac{As \cdot fy}{0.85 \cdot f'c \cdot 1 \ m} &= 0.5 \ \frac{mm}{m} & As &\coloneqq \frac{Mex 0107}{0.9 \cdot \left(d - \frac{a \cdot 1 \ m}{2}\right) \cdot fy} \end{aligned}$$

$$As = 3.16 \frac{cm^2}{m} > As_{min} = > \frac{\phi 10@13}{}$$

$$Mey0107 \coloneqq \frac{Ku}{mey} \cdot (1 + \alpha \cdot \Delta y) \cdot k$$

$$As := \frac{Mey0107}{0.9 \cdot (0.9 \cdot d) \cdot fu} = 3.25 \frac{cm^2}{m}$$

$$Mey0107 = 1.69 \frac{tonnef \cdot m}{m}$$

$$a \coloneqq \frac{As \cdot fy}{0.85 \cdot f'c \cdot 1 \ m} = 0.46 \ \frac{mm}{m}$$

$$As = 2.93 \frac{cm^2}{m} > As_{min} = > \frac{\phi 10@14}{\phi 10@14}$$

$$Lx \coloneqq 5.54 \ \boldsymbol{m}$$

$$Ly := 7.2 \, \boldsymbol{m}$$

$$e := 17$$
 cn

$$e := 17 \text{ cm}$$
 $\varepsilon := \frac{Ly}{Lx} = 1.3$ $\varepsilon := r.upp(\varepsilon) = 1.3$

$$\varepsilon \coloneqq r.upp(\varepsilon) = 1.3$$

3.- Parámetros

$$e_{min}\coloneqq r.up\left(e_{min}\right)=11$$
 cm

$$my = 95.6$$

 $mey = 22.9$

$$\Delta x = 1.17$$

$$AS_{min} := e \cdot 0.18\% = 3.06 \frac{cm^2}{m}$$

Armadura mínima => Ф8@16

4.- Cargas

$$PP_{losa} := \gamma_h \cdot e = 0.43 \frac{tonnef}{m^2}$$

$$PP_t \coloneqq PP_{losa} + PP_{adic} = 0.88 \frac{tonnef}{m^2}$$

$$q_u := 1.2 \cdot PP_t + 1.6 \ SC$$
 $q_u = 1.85 \ \frac{tonnef}{c}$

$$q_u = 1.85 \frac{tonnef}{m^2}$$

$$Ku := q_u \cdot (Lx \cdot Ly) = 73.79 \frac{\textbf{tonnef} \cdot \textbf{m}}{\textbf{m}}$$

$$\alpha \coloneqq \frac{SC}{2 \cdot q_u} = 0.14$$

5.- Momento últimos

$$Mx0108 := \frac{Ku}{mx} \cdot (1 + \alpha \cdot \Delta x) \cdot k$$

$$Mx0108 = 1.06 \frac{tonnef \cdot m}{m}$$

$$a \coloneqq \frac{As \cdot fy}{0.85 \cdot f'c \cdot 1 \ m} = 0.29 \ \frac{mn}{m}$$

$$As := \frac{Mx0108}{0.9 \cdot \left(d - \frac{a \cdot 1 \ m}{2}\right) \cdot fy}$$

$$As = 1.83 \frac{cm^2}{m}$$
 < As_{min} => Armadura mínima => $\Phi 8@16$

$$My0108 := \frac{Ku}{my} \cdot (1 + \alpha \cdot \Delta y) \cdot k$$

$$My0108 := \frac{Ku}{my} \cdot \left(1 + \alpha \cdot \Delta y\right) \cdot k \qquad My0108 = 0.5 \frac{tonnef \cdot m}{m} \qquad \text{Momento positivo último en la solution of the solution}$$

$$As := \frac{My0108}{0.9 \cdot \left(0.9 \cdot d\right) \cdot fy} = 0.96 \frac{cm^2}{m} \qquad a := \frac{As \cdot fy}{0.85 \cdot f'c \cdot 1} = 0.14 \frac{mm}{m} \qquad As := \frac{My0108}{0.9 \cdot \left(d - \frac{a \cdot 1}{2}\right) \cdot fy}$$

$$My0108 = 0.5 \frac{tonnef \cdot m}{m}$$

$$a := \frac{As \cdot fy}{0.85 \cdot f'c \cdot 1 \ m} = 0.14 \ \frac{mm}{m}$$

$$As \coloneqq \frac{My0108}{0.9 \cdot \left(d - \frac{a \cdot 1}{2} \frac{\mathbf{m}}{2}\right) \cdot fy}$$

$$As = 0.87 \frac{cm^2}{m} < As_{min} \Rightarrow Armadura mínima = 48@16$$

$$<$$
 As_{min}

$$Mex0108 := \frac{Ku}{mex} \cdot (1 + \alpha \cdot \Delta x) \cdot k$$

$$As \coloneqq \frac{Mex0108}{0.9 \cdot (0.9 \cdot d) \cdot fy} = 4.89 \frac{cm^2}{m}$$

$$Mex0108 = 2.55 \frac{tonnef \cdot m}{m}$$

$$a \coloneqq \frac{As \cdot fy}{0.85 \cdot f'c \cdot 1 \ m} = 0.69 \ \frac{mm}{m}$$

$$\begin{aligned} Mex 0108 &\coloneqq \frac{Ku}{mex} \cdot \left(1 + \alpha \cdot \Delta x\right) \cdot k & Mex 0108 &= 2.55 \ \frac{tonnef \cdot m}{m} & \text{Momento negativo último en} \\ As &\coloneqq \frac{Mex 0108}{0.9 \cdot \left(0.9 \cdot d\right) \cdot fy} = 4.89 \ \frac{cm^2}{m} & a &\coloneqq \frac{As \cdot fy}{0.85 \cdot f'c \cdot 1 \ m} = 0.69 \ \frac{mm}{m} & As &\coloneqq \frac{Mex 0108}{0.9 \cdot \left(d - \frac{a \cdot 1 \ m}{2}\right) \cdot fy} \end{aligned}$$

$$As = 4.41 \frac{cm^2}{m} > As_{min} \Rightarrow \phi = 10011$$

$$Mey0108 \coloneqq \frac{Ku}{mey} \cdot (1 + \alpha \cdot \Delta y) \cdot k$$

$$As := \frac{Mey0108}{0.9 \cdot (0.9 \cdot d) \cdot fy} = 4.02 \frac{cm^2}{m}$$

$$As = 3.62 \frac{cm^2}{m} > As_{min} = > \frac{\phi 8@13}{}$$

$$a \coloneqq \frac{As \cdot fy}{0.85 \cdot f'c \cdot 1 \ m} = 0.57 \ \frac{mm}{m}$$

$$\begin{aligned} Mey 0108 &\coloneqq \frac{Ku}{mey} \cdot \left(1 + \alpha \cdot \Delta y\right) \cdot k & Mey 0108 &= 2.09 \ \frac{tonnef \cdot m}{m} & \text{Momento negativo último en} \\ As &\coloneqq \frac{Mey 0108}{0.9 \cdot \left(0.9 \cdot d\right) \cdot fy} = 4.02 \ \frac{cm^2}{m} & a &\coloneqq \frac{As \cdot fy}{0.85 \cdot f'c \cdot 1} = 0.57 \ \frac{mm}{m} & As &\coloneqq \frac{Mey 0108}{0.9 \cdot \left(d - \frac{a \cdot 1}{2}\right) \cdot fy} \end{aligned}$$

$$Lx \coloneqq 5.54 \ \boldsymbol{m}$$

$$Ly = 7.2 \, \mathbf{m}$$

$$e := 17 \ cn$$

$$\varepsilon \coloneqq \frac{Ly}{Lx} = 1.3$$

$$e := 17 \text{ cm}$$
 $\varepsilon := \frac{Ly}{L_x} = 1.3$ $\varepsilon := r.upp(\varepsilon) = 1.3$

3.- Parámetros

$$e_{min}\coloneqq r.up\left(e_{min}\right)=11$$
 cm

$$my = 95.6$$

 $mey = 22.9$

$$\Delta x = 1.17$$

$$AS_{min} := e \cdot 0.18\% = 3.06 \frac{cm^2}{m}$$

Armadura mínima => Ф8@16

4.- Cargas

$$PP_{losa} := \gamma_h \cdot e = 0.43 \frac{tonnef}{m^2}$$

$$PP_t \coloneqq PP_{losa} + PP_{adic} = 0.88 \frac{tonnef}{m^2}$$

$$q_u = 1.2 \cdot PP_t + 1.6 \ SC$$
 $q_u = 1.85 \ \frac{tonnef}{m^2}$

$$Ku := q_u \cdot (Lx \cdot Ly) = 73.79 \frac{\textbf{tonnef} \cdot \textbf{m}}{\textbf{m}}$$

$$\alpha \coloneqq \frac{SC}{2 \cdot q_u} = 0.14$$

5.- Momento últimos

$$Mx0109 \coloneqq \frac{Ku}{mx} \cdot (1 + \alpha \cdot \Delta x) \cdot k$$

$$Mx0109 = 1.06 \frac{tonnef \cdot m}{m}$$

$$a \coloneqq \frac{As \cdot fy}{0.85 \cdot f'c \cdot 1 \ m} = 0.29 \ \frac{mn}{m}$$

$$\frac{y}{1 m} = 0.29 \frac{mm}{m} \qquad As := \frac{1}{0.9}$$

$$As = 1.83 \frac{cm^2}{m} < As_{min} \Rightarrow Armadura mínima = 48@16$$

$$As := \frac{}{0.9 \cdot \left(d - \frac{a \cdot 1 \ m}{2}\right) \cdot fy}$$

$$My0109 := \frac{Ku}{my} \cdot (1 + \alpha \cdot \Delta y) \cdot k$$

$$My0109 := \frac{Ku}{my} \cdot \left(1 + \alpha \cdot \Delta y\right) \cdot k \qquad My0109 = 0.5 \frac{tonnef \cdot m}{m} \qquad \text{Momento positivo último en la solution of the solution}$$

$$As := \frac{My0109}{0.9 \cdot \left(0.9 \cdot d\right) \cdot fy} = 0.96 \frac{cm^2}{m} \qquad a := \frac{As \cdot fy}{0.85 \cdot f'c \cdot 1} = 0.14 \frac{mm}{m} \qquad As := \frac{My0109}{0.9 \cdot \left(d - \frac{a \cdot 1}{2}\right) \cdot fy}$$

$$My0109 = 0.5 \frac{tonnef \cdot m}{m}$$

$$a \coloneqq \frac{As \cdot fy}{0.85 \cdot f'c \cdot 1 \ m} = 0.14 \ \frac{mm}{m}$$

Momento positivo último en lado largo

$$As \coloneqq \frac{My0109}{0.9 \cdot \left(d - \frac{a \cdot 1}{2} \frac{\mathbf{m}}{2}\right) \cdot fy}$$

$$As = 0.87 \frac{cm^2}{m} < As_{min} => Armadura mínima => \frac{\Phi 8@16}{m}$$

$$<$$
 As_{min}

$$Mex0109 := \frac{Ku}{mex} \cdot (1 + \alpha \cdot \Delta x) \cdot k$$

$$As := \frac{Mex0109}{0.9 \cdot (0.9 \cdot d) \cdot fy} = 4.89 \frac{cm^2}{m}$$

$$Mex0109 = 2.55 \frac{tonnef \cdot m}{m}$$

$$a \coloneqq \frac{As \cdot fy}{0.85 \cdot f'c \cdot 1 \ m} = 0.69 \ \frac{mm}{m}$$

Momento negativo último en lado corto

$$\begin{aligned} Mex 0109 &\coloneqq \frac{Ku}{mex} \cdot \left(1 + \alpha \cdot \Delta x\right) \cdot k & Mex 0109 &= 2.55 \ \frac{tonnef \cdot m}{m} & \text{Momento negativo último en} \\ As &\coloneqq \frac{Mex 0109}{0.9 \cdot \left(0.9 \cdot d\right) \cdot fy} = 4.89 \ \frac{cm^2}{m} & a &\coloneqq \frac{As \cdot fy}{0.85 \cdot f'c \cdot 1 \ m} = 0.69 \ \frac{mm}{m} & As &\coloneqq \frac{Mex 0109}{0.9 \cdot \left(d - \frac{a \cdot 1 \ m}{2}\right) \cdot fy} \end{aligned}$$

$$As = 4.41 \frac{cm^2}{m} > As_{min} \Rightarrow \phi = 10011$$

$$As_{min} =>$$

$$Mey0109 := \frac{Ku}{mey} \cdot (1 + \alpha \cdot \Delta y) \cdot k$$

$$As := \frac{Mey0109}{0.9 \cdot (0.9 \cdot d) \cdot fy} = 4.02 \frac{cm^2}{m}$$

$$As = 3.62 \frac{cm^2}{m} > As_{min} => \frac{\phi 8@13}{}$$

 $\begin{aligned} Mey 0109 &\coloneqq \frac{Ku}{mey} \cdot \left(1 + \alpha \cdot \Delta y\right) \cdot k & Mey 0109 &= 2.09 \ \frac{tonnef \cdot m}{m} & \text{Momento negativo último en} \\ As &\coloneqq \frac{Mey 0109}{0.9 \cdot \left(0.9 \cdot d\right) \cdot fy} = 4.02 \ \frac{cm^2}{m} & a &\coloneqq \frac{As \cdot fy}{0.85 \cdot f'c \cdot 1} = 0.57 \ \frac{mm}{m} & As &\coloneqq \frac{Mey 0109}{0.9 \cdot \left(d - \frac{a \cdot 1}{2}\right) \cdot fy} \end{aligned}$ Momento negativo último en lado largo

$$a \coloneqq \frac{As \cdot fy}{0.85 \cdot f'c \cdot 1 \ m} = 0.57 \ \frac{mm}{m}$$

$$As := \frac{Mey0109}{0.0 \left(\frac{1}{4} \cdot \frac{a \cdot 1}{m} \right) f_{12}}$$

$$Lx \coloneqq 5.54 \ \boldsymbol{m}$$

$$Lu := 12.34 \, n$$

$$e \coloneqq 17$$
 cm

$$Ly := 12.34 \ m$$
 $e := 17 \ cm$ $\varepsilon := \frac{Ly}{Lx} = 2.227$ $\varepsilon := r.upp(\varepsilon) = 3.3$

$$\varepsilon \coloneqq r.upp(\varepsilon) = 3.3$$

 $PP_{losa} := \gamma_h \cdot e = 0.43 \frac{tonnef}{m^2}$

4.- Cargas

 $\alpha = \frac{SC}{2 \cdot a} = 0.14$

3.- Parámetros

$$\begin{array}{ll} \boldsymbol{k} \coloneqq 0.58 & \lambda \coloneqq 35 \\ e_{min} \coloneqq \frac{\boldsymbol{k} \cdot Lx}{\lambda} + rec = 11.18 \ \boldsymbol{cm} & e_{min} \coloneqq r.up \ (e_{min}) = 12 \ \boldsymbol{cm} \end{array}$$

$$e_{min} \coloneqq r.up\left(e_{min}\right) = 12$$
 cm

$$mx := \frac{q_u \cdot Ly^2}{17 \cdot tonnef} = 16.57$$

$$my \coloneqq 0 \quad \Delta x \coloneqq 0$$

$$mx := \frac{q_u \cdot Ly^2}{17 \cdot tonnef} = 16.57$$

$$my := 0 \quad \Delta x := 0$$

$$mex := \frac{q_u \cdot Ly^2}{12 \cdot tonnef} = 23.48$$

$$mey := \frac{q_u \cdot Ly^2}{17.5 \cdot tonnef} = 16.1 \quad \Delta y := 0$$

$$\Delta S = -2.018\% = 3.06 \quad cm^2$$

$$mey := \frac{q_u \cdot Ly^2}{17.5 \cdot tonnef} = 16.1$$
 $\Delta y := 0$

$PP_t := PP_{losa} + PP_{adic} = 0.88 \frac{tonnef}{2}$ $q_u \coloneqq 1.2 \cdot PP_t + 1.6 \ SC \qquad q_u = 1.85 \ \frac{\textit{tonnef}}{\textit{m}^2}$ $Ku := q_u \cdot (Lx \cdot Ly) = 126.47 \frac{\textbf{tonnef} \cdot \textbf{m}}{\textbf{m}}$

$$AS_{min} \coloneqq e \cdot 0.18\% = 3.06 \frac{cm^2}{m}$$

Armadura mínima => $\Phi 8@16$

5.- Momento últimos

$$Mx0110 \coloneqq \frac{Ku}{mx} \cdot \left(1 + \alpha \cdot \Delta x\right) \cdot k \qquad Mx0110 = 4.43 \frac{tonnef \cdot m}{m} \qquad \text{Momento positivo último en la secondarian of the secondarian of th$$

$$Mx0110 = 4.43 \ \frac{\textbf{tonnef} \cdot \textbf{m}}{\textbf{m}}$$

$$As := \frac{Mx0110}{0.9 \cdot (0.9 \cdot d) \cdot fy} = 8.51 \cdot \frac{cm^2}{m}$$

$$a \coloneqq \frac{As \cdot fy}{0.85 \cdot f'c \cdot 1 \ m} = 1.2 \ \frac{mm}{m}$$

$$As := \frac{Mx0110}{0.9 \cdot \left(d - \frac{a \cdot 1 \ m}{2}\right) \cdot fy}$$

$$As = 7.69 \frac{cm^2}{m} > As_{min} = > \Phi 10@10$$

$$My0110 := \frac{Ku}{my} \cdot (1 + \alpha \cdot \Delta y) \cdot k$$

$$\boxed{My0110} = ? \frac{tonnef \cdot}{m}$$

$$My0110 := \frac{Ku}{my} \cdot \left(1 + \alpha \cdot \Delta y\right) \cdot k$$

$$As := \frac{My0110}{0.9 \cdot \left(0.9 \cdot d\right) \cdot fy} = ? \frac{cm^2}{m}$$

$$a := \frac{As \cdot fy}{0.85 \cdot f'c \cdot 1 \ m} = ? \frac{mm}{m}$$

$$As := \frac{My0110}{0.9 \cdot \left(d - \frac{a \cdot 1}{2}\right) \cdot fy}$$

$$a := \frac{As \cdot fy}{0.85 \cdot f'c \cdot 1 \ m} = ? \frac{mm}{m}$$

$$As := \frac{\boxed{My0110}}{0.9 \cdot \left(d - \frac{a \cdot 1 \ m}{2}\right) \cdot fy}$$

$$As = ? \frac{cm^2}{m}$$

$$As = ? \frac{cm^2}{m}$$
 < $As_{min} = > Armadura mínima = > $\Phi 8@16$$

$$Mex0110 := \frac{Ku}{mex} \cdot (1 + \alpha \cdot \Delta x) \cdot k$$

$$Mex0110 = 3.12 \frac{tonnef \cdot m}{m}$$

$$As := \frac{Mex0110}{0.9 \cdot (0.9 \cdot d) \cdot fy} = 6 \frac{cm^2}{m}$$

$$a := \frac{As \cdot fy}{0.85 \cdot f'c \cdot 1 \ m} = 0.85 \ \frac{mm}{m}$$

$$Mex0110 \coloneqq \frac{Ku}{mex} \cdot \left(1 + \alpha \cdot \Delta x\right) \cdot k \qquad Mex0110 = 3.12 \frac{tonnef \cdot m}{m} \qquad \text{Momento negativo } 0 = 3.12 \frac{tonnef \cdot m}{m} \qquad As \coloneqq \frac{Mex0110}{0.9 \cdot \left(0.9 \cdot d\right) \cdot fy} = 6 \frac{cm^2}{m} \qquad a \coloneqq \frac{As \cdot fy}{0.85 \cdot f'c \cdot 1 \cdot m} = 0.85 \frac{mm}{m} \qquad As \coloneqq \frac{Mex0110}{0.9 \cdot \left(d - \frac{a \cdot 1 \cdot m}{2}\right) \cdot fy}$$

$$As = 5.42 \frac{cm^2}{m} > As_{min} = > \frac{\phi 10@15}{}$$

$$\phi 10@15$$

$$Mey0110 \coloneqq \frac{Ku}{mey} \cdot \left(1 + \alpha \cdot \Delta y\right) \cdot k$$

$$Mey0110 = 4.56 \frac{tonnef \cdot m}{m}$$

$$Mey0110 := \frac{Ku}{mey} \cdot \left(1 + \alpha \cdot \Delta y\right) \cdot k \qquad Mey0110 = 4.56 \frac{tonnef \cdot m}{m} \qquad \text{Momento negativo último en}$$

$$As := \frac{Mey0110}{0.9 \cdot \left(0.9 \cdot d\right) \cdot fy} = 8.76 \frac{cm^2}{m} \qquad a := \frac{As \cdot fy}{0.85 \cdot f'c \cdot 1} = 1.24 \frac{mm}{m} \qquad As := \frac{Mey0110}{0.9 \cdot \left(d - \frac{a \cdot 1}{2}\right) \cdot fy}$$

$$a \coloneqq \frac{As \cdot fy}{0.85 \cdot f'c \cdot 1 \ m} = 1.24 \ \frac{mm}{m}$$

$$As := \frac{Mey0110}{0.9 \cdot \left(d - \frac{a \cdot 1 \ m}{2}\right) \cdot fy}$$

$$As = 7.91 \frac{cm^2}{m} > As_{min} = > \frac{\phi 10@10}{}$$

$$Lx = 3.6 \, \mathbf{m}$$

$$Ly = 5.54 \ \boldsymbol{m}$$

$$e \coloneqq 17$$
 cm

$$e \coloneqq 17 \text{ cm}$$
 $\varepsilon \coloneqq \frac{Ly}{Lx} = 1.539$

$$\varepsilon \coloneqq r.upp(\varepsilon) = 1.6$$

3.- Parámetros

$$\begin{array}{lll} \textbf{\textit{k}} \coloneqq 0.58 & \lambda \coloneqq 35 \\ e_{min} \coloneqq \frac{\textbf{\textit{k}} \cdot Lx}{\lambda} + rec = 7.97 \ \textbf{\textit{cm}} & e_{min} \coloneqq r.up \ (e_{min}) = 8 \ \textbf{\textit{cm}} \\ mx \coloneqq 46.1 & my \coloneqq 163 & \Delta x \coloneqq 1.39 \\ mex \coloneqq 20.5 & mey \coloneqq 27.9 & \Delta y \coloneqq 1.39 \end{array}$$

$$e_{min} \coloneqq r.up\left(e_{min}\right) = 8$$
 cm

$$mx \coloneqq 46.1$$
$$mex \coloneqq 20.5$$

$$my \coloneqq 163$$

$$\Delta x = 1.39$$

$$AS_{min} \coloneqq e \cdot 0.18\% = 3.06 \frac{cm^2}{m}$$

Armadura mínima => $\Phi 8@16$

4.- Cargas

$$PP_{losa} := \gamma_h \cdot e = 0.43 \frac{\textit{tonnef}}{\textit{m}^2}$$

$$PP_t \coloneqq PP_{losa} + PP_{adic} = 0.88 \frac{tonnef}{m^2}$$

$$q_u \coloneqq 1.2 \cdot PP_t + 1.6 \ SC$$

$$q_u \coloneqq 1.2 \cdot PP_t + 1.6 \ SC \qquad q_u = 1.85 \ \frac{\textit{tonnef}}{\textit{m}^2}$$

$$Ku \coloneqq q_u \boldsymbol{\cdot} \left(Lx \boldsymbol{\cdot} Ly \right) = 36.9 \ \frac{\boldsymbol{tonnef \cdot m}}{\boldsymbol{m}}$$

$$\alpha \coloneqq \frac{SC}{2 \cdot q_u} = 0.14$$

5.- Momento últimos

$$Mx0111 := \frac{Ku}{mx} \cdot (1 + \alpha \cdot \Delta x) \cdot k$$

$$Mx0111 = 0.55 \frac{tonnef \cdot m}{m}$$

$$a \coloneqq \frac{As \cdot fy}{0.85 \cdot f'c \cdot 1 \ m} = 0.15 \ \frac{mm}{m}$$

Momento positivo último en lado corto

$$As \coloneqq \frac{Mx0111}{0.9 \cdot \left(d - \frac{a \cdot 1}{2} \frac{\textbf{m}}{2}\right) \cdot fy}$$

$$As = 0.95 \frac{cm^2}{m}$$
 < As_{min} => Armadura mínima => $\Phi 8@16$

$$My0111 := \frac{Ku}{my} \cdot (1 + \alpha \cdot \Delta y) \cdot k$$

$$My0111 = 0.16 \frac{tonnef \cdot m}{m}$$

$$As := \frac{My0111}{0.9 \cdot (0.9 \cdot d) \cdot fy} = 0.3 \frac{cm^2}{m}$$

$$a \coloneqq \frac{As \cdot fy}{0.85 \cdot f'c \cdot 1 \ m} = 0.04 \ \frac{mn}{m}$$

$$My0111 := \frac{Ku}{my} \cdot \left(1 + \alpha \cdot \Delta y\right) \cdot k \qquad My0111 = 0.16 \ \frac{\textbf{tonnef} \cdot \textbf{m}}{\textbf{m}} \qquad \text{Momento positivo último en lado largo}$$

$$As := \frac{My0111}{0.9 \cdot \left(0.9 \cdot d\right) \cdot fy} = 0.3 \ \frac{\textbf{cm}^2}{\textbf{m}} \quad a := \frac{As \cdot fy}{0.85 \cdot f'c \cdot 1 \ \textbf{m}} = 0.04 \ \frac{\textbf{mm}}{\textbf{m}} \qquad As := \frac{My0111}{0.9 \cdot \left(d - \frac{a \cdot 1 \ \textbf{m}}{2}\right) \cdot fy}$$

$$As = 0.27 \frac{cm^2}{m} < As_{min} =$$
 Armadura mínima = $\frac{\Phi 8@16}{m}$

$$<$$
 As_{min}

$$Mex0111 := \frac{Ku}{mex} \cdot (1 + \alpha \cdot \Delta x) \cdot k$$

$$Mex0111 = 1.24 \frac{tonnef \cdot m}{m}$$

$$As := \frac{Mex0111}{0.9 \cdot (0.9 \cdot d) \cdot fy} = 2.38 \frac{cm^2}{m}$$

$$a \coloneqq \frac{As \cdot fy}{0.85 \cdot f'c \cdot 1 \ m} = 0.34 \ \frac{mm}{m}$$

$$Mex0111 := \frac{Ku}{mex} \cdot (1 + \alpha \cdot \Delta x) \cdot k \qquad Mex0111 = 1.24 \frac{tonnef \cdot m}{m} \qquad \text{Momento negativo último en}$$

$$As := \frac{Mex0111}{0.9 \cdot (0.9 \cdot d) \cdot fy} = 2.38 \frac{cm^2}{m} \qquad a := \frac{As \cdot fy}{0.85 \cdot f'c \cdot 1} = 0.34 \frac{mm}{m} \qquad As := \frac{Mex0111}{0.9 \cdot \left(d - \frac{a \cdot 1}{2}\right) \cdot fy}$$

$$As = 2.15 \frac{cm^2}{m}$$
 < As_{min} => Armadura mínima => $\frac{\Phi 8@16}{m}$

$$Mey0111 \coloneqq \frac{Ku}{mey} \cdot \left(1 + \alpha \cdot \Delta y\right) \cdot k$$

$$Mey0111 = 0.91 \frac{tonnef \cdot m}{m}$$

$$As := \frac{Mey0111}{0.9 \cdot (0.9 \cdot d) \cdot fy} = 1.75 \frac{cm^2}{m}$$

$$a := \frac{As \cdot fy}{0.85 \cdot f'c \cdot 1 \cdot m} = 0.25 \cdot \frac{mm}{m}$$

$$Mey0111 := \frac{Ku}{mey} \cdot \left(1 + \alpha \cdot \Delta y\right) \cdot k \qquad Mey0111 = 0.91 \frac{tonnef \cdot m}{m} \qquad \text{Momento negativo último en}$$

$$As := \frac{Mey0111}{0.9 \cdot \left(0.9 \cdot d\right) \cdot fy} = 1.75 \frac{cm^2}{m} \qquad a := \frac{As \cdot fy}{0.85 \cdot f'c \cdot 1} = 0.25 \frac{mm}{m} \qquad As := \frac{Mey0111}{0.9 \cdot \left(d - \frac{a \cdot 1}{2}\right) \cdot fy}$$

$$As = 1.58 \frac{cm^2}{m}$$

$$As = 1.58 \frac{cm^2}{m}$$
 < As_{min} => Armadura mínima => $\Phi 8@16$

$$Lx \coloneqq 6.05 \ \boldsymbol{m}$$

$$Ly = 9.34 \ m$$

$$e \coloneqq 17$$
 cm

$$e \coloneqq 17 \ cm$$
 $\varepsilon \coloneqq \frac{Ly}{Lx} = 1.544$

$$\varepsilon \coloneqq r.upp(\varepsilon) = 1.6$$

3.- Parámetros

$$k := 0.58 \qquad \lambda := 35$$

$$e_{min} := \frac{k \cdot Lx}{\lambda} + rec = 12.03 \text{ cm} \qquad e_{min} := r.up(e_{min}) = 13 \text{ cm}$$

$$e_{min}\coloneqq r.up\left(e_{min}\right)=13$$
 cm

$$mx := 46.1$$
 $my := 163$ $\Delta x := 1.39$ $mex := 20.5$ $mey := 27.9$ $\Delta y := 1.39$

$$my = 163$$
 $mey = 27$

$$\Delta x \coloneqq 1.39$$
$$\Delta y \coloneqq 1.39$$

$$AS_{min} \coloneqq e \cdot 0.18\% = 3.06 \frac{cm^2}{m}$$

Armadura mínima => $\Phi 8@16$

4.- Cargas

$$PP_{losa} := \gamma_h \cdot e = 0.43 \frac{tonnef}{m^2}$$

$$PP_t \coloneqq PP_{losa} + PP_{adic} = 0.88 \frac{\textbf{tonnef}}{\textbf{m}^2}$$

$$q_u \coloneqq 1.2 \cdot PP_t + 1.6 \ SC$$

$$q_u \coloneqq 1.2 \cdot PP_t + 1.6 \ SC$$
 $q_u = 1.85 \ \frac{\textbf{tonnef}}{\textbf{m}^2}$

$$Ku \coloneqq q_u \boldsymbol{\cdot} \left(Lx \boldsymbol{\cdot} Ly \right) = 104.54 \ \frac{\boldsymbol{tonnef \cdot m}}{\boldsymbol{m}}$$

$$\alpha \coloneqq \frac{SC}{2 \cdot q_u} = 0.14$$

5.- Momento últimos

$$Mx0112 \coloneqq \frac{Ku}{mx} \cdot \left(1 + \alpha \cdot \Delta x\right) \cdot k$$

$$a := \frac{As \cdot fy}{} = 0.42 \frac{mm}{}$$

$$As := \frac{Mx0112}{0.9 \cdot (0.9 \cdot d) \cdot fy} = 3 \frac{cm^2}{m}$$

$$a \coloneqq \frac{As \cdot fy}{0.85 \cdot f'c \cdot 1 \ m} = 0.42 \ \frac{mm}{m}$$

$$Mx0112 \coloneqq \frac{Ku}{mx} \cdot \left(1 + \alpha \cdot \Delta x\right) \cdot k \qquad Mx0112 = 1.56 \frac{tonnef \cdot m}{m} \qquad \text{Momento positivo úl}$$

$$As \coloneqq \frac{Mx0112}{0.9 \cdot \left(0.9 \cdot d\right) \cdot fy} = 3 \frac{cm^2}{m} \qquad a \coloneqq \frac{As \cdot fy}{0.85 \cdot f'c \cdot 1 \ m} = 0.42 \frac{mm}{m} \qquad As \coloneqq \frac{Mx0112}{0.9 \cdot \left(d - \frac{a \cdot 1 \ m}{2}\right) \cdot fy}$$

$$As = 2.71 \frac{cm^2}{m} < As_{min} =$$
 Armadura mínima = $\frac{\Phi 8@16}{m}$

$$My0112 \coloneqq \frac{Ku}{my} \boldsymbol{\cdot} \left(1 + \alpha \boldsymbol{\cdot} \Delta y\right) \boldsymbol{\cdot} k$$

$$My0112 := \frac{Ku}{my} \cdot \left(1 + \alpha \cdot \Delta y\right) \cdot k \qquad My0112 = 0.44 \frac{tonnef \cdot m}{m} \qquad \text{Momento positivo último en la final positivo formula in the positivo formula is a set of the positive formula in the positive formula in the positive formula is a set of the positive formula in the positive formula is a set of the positive formula in the positive formula is a set of the positive formula in the positive formula is a set of the positive formula in the positive formula is a set of the positive formula in the positive formula is a set of the positive formula in the positive formula is a set of the positive formula in the positive formula is a set of the positive formula in the positive formula is a set of the positive formula in the positive formula is a set of the positive formula in the$$

$$My0112 = 0.44 \frac{tonnef \cdot m}{m}$$

$$a := \frac{As \cdot fy}{0.85 \cdot f' \cdot 1.1} = 0.12 \frac{mm}{m}$$

Momento positivo último en lado largo

$$As := \frac{My0112}{0.9 \cdot \left(d - \frac{a \cdot 1 \ m}{2}\right) \cdot fy}$$

$$As = 0.76 \frac{cm^2}{m} < As_{min} \Rightarrow Armadura mínima \Rightarrow 48@16$$

$$<$$
 As_{min} =

$$Mex0112 := \frac{Ku}{mex} \cdot (1 + \alpha \cdot \Delta x) \cdot k$$

$$As := \frac{Mex0112}{0.9 \cdot (0.9 \cdot d) \cdot fu} = 6.75 \frac{cm^2}{m}$$

$$Mex0112 = 3.51 \frac{tonnef \cdot m}{m}$$

$$a \coloneqq \frac{As \cdot fy}{0.85 \cdot f'c \cdot 1 \ m} = 0.95 \ \frac{mm}{m}$$

Momento negativo último en lado corto

$$\begin{aligned} Mex 0112 &\coloneqq \frac{Ku}{mex} \cdot \left(1 + \alpha \cdot \Delta x\right) \cdot k & \qquad Mex 0112 &= 3.51 \ \frac{tonnef \cdot m}{m} & \qquad \text{Momento negativo último en} \\ As &\coloneqq \frac{Mex 0112}{0.9 \cdot \left(0.9 \cdot d\right) \cdot fy} &= 6.75 \ \frac{cm^2}{m} & \qquad a &\coloneqq \frac{As \cdot fy}{0.85 \cdot f'c \cdot 1 \ m} &= 0.95 \ \frac{mm}{m} & \qquad As &\coloneqq \frac{Mex 0112}{0.9 \cdot \left(d - \frac{a \cdot 1 \ m}{2}\right) \cdot fy} \end{aligned}$$

$$Mey0112 := \frac{Ku}{mey} \cdot (1 + \alpha \cdot \Delta y) \cdot k$$

$$As := \frac{Mey0112}{0.9 \cdot (0.9 \cdot d) \cdot fy} = 4.96 \frac{cm^2}{m}$$

 $As = 4.48 \frac{cm^2}{m} > As_{min} => \Phi 8@10$

$$Mey0112 = 2.58 \frac{\textbf{tonnef} \cdot \textbf{m}}{\textbf{m}}$$

$$a := \frac{As \cdot fy}{0.85 \cdot f'c \cdot 1 \ m} = 0.7 \ \frac{mm}{m}$$

$$Mey0112 := \frac{Ku}{mey} \cdot \left(1 + \alpha \cdot \Delta y\right) \cdot k \qquad Mey0112 = 2.58 \frac{tonnef \cdot m}{m} \qquad \text{Momento negativo último en}$$

$$As := \frac{Mey0112}{0.9 \cdot \left(0.9 \cdot d\right) \cdot fy} = 4.96 \frac{cm^2}{m} \qquad a := \frac{As \cdot fy}{0.85 \cdot f'c \cdot 1 \ m} = 0.7 \frac{mm}{m} \qquad As := \frac{Mey0112}{0.9 \cdot \left(d - \frac{a \cdot 1 \ m}{2}\right) \cdot fy}$$

$$Lx \coloneqq 4.65 \ \boldsymbol{m}$$

$$Ly = 5.6 \, \mathbf{m}$$

$$e \coloneqq 17$$
 cm

$$e \coloneqq 17 \ cm$$
 $\varepsilon \coloneqq \frac{Ly}{Lx} = 1.204$

$$\varepsilon \coloneqq r.upp(\varepsilon) = 1.3$$

3.- Parámetros

$$k := 0.56 \qquad \lambda := 35$$

$$e_{min} := \frac{k \cdot Lx}{\lambda} + rec = 9.44 \text{ cm} \qquad e_{min} := r.up \left(e_{min}\right) = 10 \text{ cm}$$

$$e_{min} \coloneqq r.up\left(e_{min}\right) = 10$$
 cm

$$mx := 45.2$$
 $my := 95.6$ $\Delta x := 1.17$ $mex := 18.8$ $mey := 22.9$ $\Delta y := 1.17$

$$my \coloneqq 95.6$$

$$mey \coloneqq 22.9$$

$$\Delta x \coloneqq 1.17$$

$$\Delta u \coloneqq 1.17$$

$$AS_{min} \coloneqq e \cdot 0.18\% = 3.06 \frac{cm^2}{m}$$

Armadura mínima => $\Phi 8@16$

4.- Cargas

$$PP_{losa} := \gamma_h \cdot e = 0.43 \frac{tonnef}{m^2}$$

$$PP_t \coloneqq PP_{losa} + PP_{adic} = 0.88 \frac{tonnef}{m^2}$$

$$q_u \coloneqq 1.2 \cdot PP_t + 1.6 \ SC$$

$$q_u \coloneqq 1.2 \cdot PP_t + 1.6 \ SC \qquad q_u = 1.85 \ \frac{\textit{tonnef}}{\textit{m}^2}$$

$$Ku \coloneqq q_u \cdot \left(Lx \cdot Ly \right) = 48.17 \ \frac{\textbf{tonnef} \cdot \textbf{m}}{\textbf{m}}$$

$$\alpha \coloneqq \frac{SC}{2 \cdot q_u} = 0.14$$

$$Mx0113 := \frac{Ku}{mx} \cdot (1 + \alpha \cdot \Delta x) \cdot k \qquad Mx0113 = 0.69 \frac{tonnef \cdot m}{m} \qquad \text{Momento positivo último en la section of the se$$

$$Mx0113 = 0.69 \frac{tonnef \cdot m}{m}$$

$$As := \frac{Mx0113}{0.9 \cdot (0.9 \cdot d) \cdot fy} = 1.33 \frac{cm^2}{m}$$

$$a \coloneqq \frac{As \cdot fy}{0.85 \cdot f'c \cdot 1 \ m} = 0.19 \ \frac{mm}{m}$$

$$As := \frac{Mx0113}{0.9 \cdot \left(d - \frac{a \cdot 1 \ m}{2}\right) \cdot fy}$$

$$As = 1.2 \frac{cm^2}{m}$$
 $< As_{min} = >$ Armadura mínima = $> \frac{\Phi 8@16}{}$

$$My0113 \coloneqq \frac{Ku}{my} \cdot \left(1 + \alpha \cdot \Delta y\right) \cdot k$$

$$My0113 := \frac{Ku}{my} \cdot \left(1 + \alpha \cdot \Delta y\right) \cdot k \qquad My0113 = 0.33 \frac{tonnef \cdot m}{m} \qquad \text{Momento positivo último en la solution of the solution of the$$

$$My0113 = 0.33 \frac{tonnef \cdot m}{m}$$

$$a \coloneqq \frac{As \cdot fy}{0.85 \cdot f'c \cdot 1 \ m} = 0.09 \ \frac{mm}{m}$$

$$\frac{\text{d}s \cdot fy}{\cdot f'c \cdot 1 \ m} = 0.09 \ \frac{mm}{m}$$

$$As = 0.57 \frac{cm^2}{m}$$
 < As_{min} => Armadura mínima => $\Phi 8@16$

$$<$$
 As_{min}

$$Mex0113 \coloneqq \frac{Ku}{mex} \cdot \left(1 + \alpha \cdot \Delta x\right) \cdot k \qquad \qquad Mex0113 = 1.66 \frac{\textit{tonnef} \cdot \textit{m}}{\textit{m}}$$

$$As := \frac{Mex0113}{0.0 \cdot (0.0 \cdot d) \cdot f_{tt}} = 3.19 \frac{cm^2}{m}$$

$$Mex0113 = 1.66 \frac{tonnef \cdot m}{m}$$

$$a \coloneqq \frac{As \cdot fy}{0.85 \cdot f'c \cdot 1 \ m} = 0.45 \ \frac{mm}{m}$$

$$Mex0113 := \frac{1.66}{mex} \cdot (1 + \alpha \cdot \Delta x) \cdot k$$

$$As := \frac{Mex0113}{0.9 \cdot (0.9 \cdot d) \cdot fy} = 3.19 \frac{cm^2}{m}$$

$$As := \frac{As \cdot fy}{0.85 \cdot f'c \cdot 1 \ m} = 0.45 \frac{mm}{m}$$

$$As := \frac{Mex0113}{0.9 \cdot \left(d - \frac{a \cdot 1 \ m}{2}\right) \cdot fy}$$

$$As = 2.88 \frac{cm^2}{m} < As_{min} => Armadura mínima => \frac{\Phi 8@16}{m}$$

$$Mey0113 \coloneqq \frac{Ku}{mey} \cdot \left(1 + \alpha \cdot \Delta y\right) \cdot k$$

$$As := \frac{Mey0113}{0.9 \cdot (0.9 \cdot d) \cdot fu} = 2.62 \frac{cm^2}{m}$$

$$Mey0113 = 1.36 \frac{tonnef \cdot m}{m}$$

$$a \coloneqq \frac{As \cdot fy}{0.85 \cdot f'c \cdot 1 \ m} = 0.37 \ \frac{mm}{m}$$

$$Mey0113 \coloneqq \frac{Ku}{mey} \cdot \left(1 + \alpha \cdot \Delta y\right) \cdot k \qquad Mey0113 = 1.36 \frac{tonnef \cdot m}{m} \qquad \text{Momento negativo último en}$$

$$As \coloneqq \frac{Mey0113}{0.9 \cdot \left(0.9 \cdot d\right) \cdot fy} = 2.62 \frac{cm^2}{m} \qquad a \coloneqq \frac{As \cdot fy}{0.85 \cdot f'c \cdot 1} = 0.37 \frac{mm}{m} \qquad As \coloneqq \frac{Mey0113}{0.9 \cdot \left(d - \frac{a \cdot 1}{2}\right) \cdot fy}$$

$$As = 2.36 \frac{cm^2}{m}$$

$$As = 2.36 \frac{cm^2}{m}$$
 < As_{min} => Armadura mínima => $\Phi 8@16$

$$Lx \coloneqq 4.65 \ \boldsymbol{m}$$

$$Ly = 5.6 \, \mathbf{m}$$

$$e \coloneqq 17$$
 cm

$$e \coloneqq 17 \ cm$$
 $\varepsilon \coloneqq \frac{Ly}{Lx} = 1.204$

$$\varepsilon \coloneqq r.upp(\varepsilon) = 1.3$$

3.- Parámetros

$$\begin{array}{ll} \pmb{k \coloneqq 0.56} & \lambda \coloneqq 35 \\ e_{min} \coloneqq \frac{\pmb{k \cdot L}x}{\lambda} + rec = 9.44 \ \pmb{cm} & e_{min} \coloneqq r.up \left(e_{min}\right) = 10 \ \pmb{cm} \end{array}$$

$$e_{min} \coloneqq r.up\left(e_{min}\right) = 10$$
 cm

$$mx := 45.2$$
 $my := 95.6$ $\Delta x := 1.17$ $mex := 18.8$ $mey := 22.9$ $\Delta y := 1.17$

$$my = 95.6$$

 $mey = 22.9$

$$\Delta x \coloneqq 1.17$$

$$\Delta u \coloneqq 1.17$$

$$AS_{min} \coloneqq e \cdot 0.18\% = 3.06 \frac{cm^2}{m}$$

Armadura mínima => $\Phi 8@16$

4.- Cargas

$$PP_{losa} := \gamma_h \cdot e = 0.43 \frac{\textit{tonnef}}{\textit{m}^2}$$

$$PP_t \coloneqq PP_{losa} + PP_{adic} = 0.88 \frac{\textbf{tonnef}}{\textbf{m}^2}$$

$$q_u \coloneqq 1.2 \cdot PP_t + 1.6 \ SC$$

$$q_u \coloneqq 1.2 \cdot PP_t + 1.6 \ SC \qquad q_u = 1.85 \ \frac{\textit{tonnef}}{\textit{m}^2}$$

$$Ku \coloneqq q_u \boldsymbol{\cdot} \left(Lx \boldsymbol{\cdot} Ly \right) = 48.17 \ \frac{\boldsymbol{tonnef \cdot m}}{\boldsymbol{m}}$$

$$\alpha \coloneqq \frac{SC}{2 \cdot q_u} = 0.14$$

$$Mx0114 := \frac{Ku}{mx} \cdot (1 + \alpha \cdot \Delta x) \cdot k$$

$$Mx0114 \qquad cm^{2}$$

$$Mx0114 = 0.69 \frac{tonnef \cdot m}{m}$$

$$Mx0114 := \frac{Ku}{mx} \cdot \left(1 + \alpha \cdot \Delta x\right) \cdot k \qquad Mx0114 = 0.69 \frac{tonnef \cdot m}{m} \qquad \text{Momento positivo último en la secondarian of the secondarian of t$$

$$a \coloneqq \frac{As \cdot fy}{0.85 \cdot f'c \cdot 1 \ m} = 0.19 \ \frac{mm}{m}$$

$$As := \frac{Mx0114}{0.9 \cdot \left(d - \frac{a \cdot 1 \ m}{2}\right) \cdot fy}$$

$$As = 1.2 \frac{cm^2}{m}$$
 $As_{min} = Armadura mínima = $\Phi 8@16$$

Armadura mínima =>
$$\Phi 8@16$$

$$My0114 := \frac{Ku}{my} \cdot (1 + \alpha \cdot \Delta y) \cdot k$$

$$My0114 = 0.33 \frac{tonnef \cdot m}{m}$$

$$My0114 := \frac{Ku}{my} \cdot \left(1 + \alpha \cdot \Delta y\right) \cdot k \qquad My0114 = 0.33 \frac{tonnef \cdot m}{m} \qquad \text{Momento positivo último en la substitution of the substitution of$$

$$a \coloneqq \frac{As \cdot fy}{0.85 \cdot f'c \cdot 1 \ m} = 0.09 \ \frac{mm}{m}$$

$$As := \frac{My0114}{0.9 \cdot \left(d - \frac{a \cdot 1 \ m}{2}\right) \cdot fy}$$

$$As = 0.57 \frac{cm^2}{m}$$
 < As_{min} => Armadura mínima => $\frac{\Phi 8@16}{m}$

$$<$$
 As_{min}

$$Mex0114 := \frac{Ku}{mex} \cdot (1 + \alpha \cdot \Delta x) \cdot k$$

$$Mex0114 = 1.66 \frac{tonnef \cdot m}{m}$$

$$As := \frac{Mex0114}{0.9 \cdot (0.9 \cdot d) \cdot fy} = 3.19 \frac{cm^2}{m}$$

$$a := \frac{As \cdot fy}{0.85 \cdot f'c \cdot 1 \ m} = 0.45 \ \frac{mm}{m}$$

$$Mex0114 \coloneqq \frac{Ku}{mex} \cdot \left(1 + \alpha \cdot \Delta x\right) \cdot k \qquad Mex0114 = 1.66 \frac{tonnef \cdot m}{m} \qquad \text{Momento negativo último en}$$

$$As \coloneqq \frac{Mex0114}{0.9 \cdot \left(0.9 \cdot d\right) \cdot fy} = 3.19 \frac{cm^2}{m} \qquad a \coloneqq \frac{As \cdot fy}{0.85 \cdot f'c \cdot 1} = 0.45 \frac{mm}{m} \qquad As \coloneqq \frac{Mex0114}{0.9 \cdot \left(d - \frac{a \cdot 1}{2}\right) \cdot fy}$$

$$As = 2.88 \frac{cm^2}{m}$$
 < As_{min} => Armadura mínima => $\frac{\Phi 8@16}{m}$

$$Mey0114 \coloneqq \frac{Ku}{mey} \cdot \left(1 + \alpha \cdot \Delta y\right) \cdot k$$

$$Mey0114 = 1.36 \frac{tonnef \cdot n}{m}$$

$$As := \frac{Mey0114}{0.9 \cdot (0.9 \cdot d) \cdot fu} = 2.62 \frac{cr}{2}$$

$$a \coloneqq \frac{As \cdot fy}{0.85 \cdot f'c \cdot 1 \ m} = 0.37 \ \frac{mm}{m}$$

$$As = 2.36 \frac{cm^2}{m}$$

$$As = 2.36 \frac{cm^2}{m}$$
 < As_{min} => Armadura mínima => $\Phi 8@16$

$$Mey0114 := \frac{Ku}{mey} \cdot \left(1 + \alpha \cdot \Delta y\right) \cdot k \qquad Mey0114 = 1.36 \frac{tonnef \cdot m}{m} \qquad \text{Momento negativo último en}$$

$$As := \frac{Mey0114}{0.9 \cdot \left(0.9 \cdot d\right) \cdot fy} = 2.62 \frac{cm^2}{m} \qquad a := \frac{As \cdot fy}{0.85 \cdot f'c \cdot 1} = 0.37 \frac{mm}{m} \qquad As := \frac{Mey0114}{0.9 \cdot \left(d - \frac{a \cdot 1}{2}\right) \cdot fy}$$

$$Lx \coloneqq 6.05 \ \boldsymbol{m}$$

$$Ly = 9.49 \ m$$

$$e \coloneqq 17$$
 cm

$$e \coloneqq 17 \text{ cm}$$
 $\varepsilon \coloneqq \frac{Ly}{Lx} = 1.569$

$$\varepsilon \coloneqq r.upp(\varepsilon) = 1.6$$

3.- Parámetros

$$k \coloneqq 0.58 \qquad \lambda \coloneqq 35$$

$$k \cdot Lx$$

$$e_{min} \coloneqq \frac{k \cdot Lx}{\lambda} + rec = 12.03 \text{ cm}$$
 $e_{min} \coloneqq r.up\left(e_{min}\right) = 13 \text{ cm}$

$$mx := 46.1$$
 $my := 163$ $\Delta x := 1.39$ $mex := 20.5$ $mey := 27.9$ $\Delta y := 1.39$

$$AS_{min} \coloneqq e \cdot 0.18\% = 3.06 \frac{cm^2}{m}$$

Armadura mínima => $\Phi 8@16$

4.- Cargas

$$PP_{losa} := \gamma_h \cdot e = 0.43 \frac{tonnef}{m^2}$$

$$PP_t = PP_{losa} + PP_{adic} = 0.88 \frac{tonnef}{m^2}$$

$$q_u \coloneqq 1.2 \cdot PP_t + 1.6 \ SC$$

$$q_u \coloneqq 1.2 \cdot PP_t + 1.6 \ SC$$
 $q_u = 1.85 \ \frac{\textbf{tonnef}}{\textbf{m}^2}$

$$Ku := q_u \cdot (Lx \cdot Ly) = 106.22 \frac{\textbf{tonnef} \cdot \textbf{m}}{\textbf{m}}$$

Momento positivo último en lado corto

Momento positivo último en lado largo

$$\alpha \coloneqq \frac{SC}{2 \cdot q_u} = 0.14$$

5.- Momento últimos

$$Mx0115 \coloneqq \frac{Ku}{mx} \boldsymbol{\cdot} \left(1 + \alpha \boldsymbol{\cdot} \Delta x \right) \boldsymbol{\cdot} k$$

$$Mx0115 := \frac{Ku}{mx} \cdot (1 + \alpha \cdot \Delta x) \cdot k \qquad Mx0115 = 1.59 \frac{tonnef \cdot m}{m} \qquad \text{Momento positivo último en la secondarian of the secondarian of the$$

$$Mx0115 = 1.59 \frac{tonnef \cdot m}{m}$$

$$a \coloneqq \frac{As \cdot fy}{0.85 \cdot f'c \cdot 1 \ m} = 0.43 \ \frac{mm}{m}$$

$$a \coloneqq \frac{As \cdot fy}{0.85 \cdot f'c \cdot 1 \ m} = 0.43 \ \frac{mm}{m}$$

$$As = 2.75 \frac{cm^2}{m}$$
 < As_{min} => Armadura mínima => $\Phi 8@16$

$$My0115 \coloneqq \frac{Ku}{my} \cdot (1 + \alpha \cdot \Delta y) \cdot k$$

$$My0115 := \frac{Ku}{my} \cdot \left(1 + \alpha \cdot \Delta y\right) \cdot k \qquad My0115 = 0.45 \frac{tonnef \cdot m}{m} \qquad \text{Momento positivo último en la solution of the solution of the$$

$$My0115 = 0.45 \frac{tonnef \cdot m}{m}$$

$$a \coloneqq \frac{As \cdot fy}{0.85 \cdot f'c \cdot 1 \ m} = 0.12 \ \frac{mm}{m}$$

$$As = 0.78 \frac{cm^2}{m}$$
 < As_{min} => Armadura mínima => $\Phi 8@16$

$$Mex0115 := \frac{Ku}{mex} \cdot (1 + \alpha \cdot \Delta x) \cdot k$$

$$As := \frac{Mex0115}{(1 - c)^{2}} = 6.86 \frac{cm^{2}}{(1 - c)^{2}}$$

$$(0.9 \cdot a) \cdot jy$$

 $As = 4.55 \frac{cm^2}{m} > As_{min} = > \frac{\Phi 8@11}{m}$

$$Mex0115 = 3.57 \frac{tonnef \cdot m}{m}$$

$$a \coloneqq \frac{As \cdot fy}{0.85 \cdot f'c \cdot 1 \ m} = 0.97 \ \frac{mm}{m}$$

$$\begin{aligned} Mex 0115 &\coloneqq \frac{Ku}{mex} \cdot \left(1 + \alpha \cdot \Delta x\right) \cdot k & \qquad Mex 0115 &= 3.57 \ \frac{tonnef \cdot m}{m} & \qquad \text{Momento negativo último en} \\ As &\coloneqq \frac{Mex 0115}{0.9 \cdot \left(0.9 \cdot d\right) \cdot fy} &= 6.86 \ \frac{cm^2}{m} & \qquad a &\coloneqq \frac{As \cdot fy}{0.85 \cdot f'c \cdot 1} = 0.97 \ \frac{mm}{m} & \qquad As &\coloneqq \frac{Mex 0115}{0.9 \cdot \left(d - \frac{a \cdot 1}{2}\right) \cdot fy} \end{aligned}$$

$$As = 6.19 \frac{cm^2}{m} > As_{min} = > \frac{\Phi 10@12}{}$$

$$Mey0115 \coloneqq \frac{Ku}{mey} \cdot (1 + \alpha \cdot \Delta y) \cdot k$$

$$As := \frac{Mey0115}{0.9 \cdot (0.9 \cdot d) \cdot fy} = 5.04 \frac{cm^2}{m}$$

$$Mey0115 = 2.62 \frac{tonnef \cdot m}{m}$$

$$a \coloneqq \frac{As \cdot fy}{0.85 \cdot f'c \cdot 1 \ m} = 0.71 \ \frac{mm}{m}$$

$$Mey0115 \coloneqq \frac{Ku}{mey} \cdot \left(1 + \alpha \cdot \Delta y\right) \cdot k \qquad Mey0115 = 2.62 \frac{tonnef \cdot m}{m} \qquad \text{Momento negativo último en}$$

$$As \coloneqq \frac{Mey0115}{0.9 \cdot \left(0.9 \cdot d\right) \cdot fy} = 5.04 \frac{cm^2}{m} \qquad a \coloneqq \frac{As \cdot fy}{0.85 \cdot f'c \cdot 1 \ m} = 0.71 \frac{mm}{m} \qquad As \coloneqq \frac{Mey0115}{0.9 \cdot \left(d - \frac{a \cdot 1 \ m}{2}\right) \cdot fy}$$

$$Lx \coloneqq 4.45 \ \boldsymbol{m}$$

$$Ly = 10.5 \, \boldsymbol{m}$$

$$e \coloneqq 17$$
 cm

$$e \coloneqq 17 \text{ cm}$$
 $\varepsilon \coloneqq \frac{Ly}{Lx} = 2.36$

$$\varepsilon \coloneqq r.upp(\varepsilon) = 3.4$$

3.- Parámetros

$$k = 0.58$$
 $\lambda = 35$

$$e_{min} := \frac{k \cdot Lx}{\lambda} + rec = 9.37 \text{ cm}$$
 $e_{min} := r.up\left(e_{min}\right) = 10 \text{ cm}$

$$e_{min} \coloneqq r.up\left(e_{min}\right) = 10$$
 cm

$$mx \coloneqq \frac{q_u \cdot Ly^2}{17 \cdot tonnef} = 12$$

$$my = 0$$
 $\Delta x = 0$

$$mex \coloneqq \frac{q_u \cdot Ly^2}{12 \cdot tonnef} = 17$$

$$mx := \frac{q_u \cdot Ly^2}{17 \cdot tonnef} = 12 \qquad my := 0 \quad \Delta x := 0$$

$$mex := \frac{q_u \cdot Ly^2}{12 \cdot tonnef} = 17 \qquad mey := \frac{q_u \cdot Ly^2}{17.5 \cdot tonnef} = 11.66$$

$$\Delta y = 0$$

$$AS_{min} := e \cdot 0.18\% = 3.06 \frac{cm^2}{m}$$

Armadura mínima => ₱8@16

4.- Cargas

$$PP_{losa} := \gamma_h \cdot e = 0.43 \frac{tonnef}{m^2}$$

$$PP_t \coloneqq PP_{losa} + PP_{adic} = 0.88 \frac{tonnef}{m^2}$$

$$q_u \coloneqq 1.2 \cdot PP_t + 1.6 \ SC$$

$$q_u \coloneqq 1.2 \cdot PP_t + 1.6 \ SC$$
 $q_u = 1.85 \ \frac{\textbf{tonnef}}{\textbf{m}^2}$

$$Ku := q_u \cdot (Lx \cdot Ly) = 86.44 \frac{\textbf{tonnef} \cdot \textbf{m}}{\textbf{m}}$$

$$\alpha \coloneqq \frac{SC}{2 \cdot q_n} = 0.14$$

5.- Momento últimos

$$Mx0116 := \frac{Ku}{mx} \cdot (1 + \alpha \cdot \Delta x) \cdot k$$

$$Mx0116 = 4.18 \frac{tonnef \cdot m}{m}$$

$$a \coloneqq \frac{As \cdot fy}{0.85 \cdot f'c \cdot 1 \ m} = 1.13 \ \frac{mm}{m}$$

Momento positivo último en lado corto

$$As := \frac{Mx0116}{0.9 \cdot \left(d - \frac{a \cdot 1 \ m}{2}\right) \cdot fy}$$

$$My0116 := \frac{Ku}{my} \cdot (1 + \alpha \cdot \Delta y) \cdot k$$

$$As := \frac{My0116}{0.9 \cdot (0.9 \cdot d) \cdot fy} = ? \frac{cm^2}{m}$$

$$My0116 = ? \frac{tonnef \cdot m}{m}$$

$$As := \frac{\boxed{My0116}}{0.9 \cdot (0.9 \cdot d) \cdot fy} = ? \frac{cm^2}{m}$$

$$a := \frac{As \cdot fy}{0.85 \cdot f'c \cdot 1 \ m} = ? \frac{mm}{m}$$

$$My0116 := \frac{Ku}{my} \cdot \left(1 + \alpha \cdot \Delta y\right) \cdot k$$

$$As := \frac{My0116}{0.9 \cdot \left(0.9 \cdot d\right) \cdot fy} = ? \frac{cm^2}{m}$$

$$a := \frac{As \cdot fy}{0.85 \cdot f'c \cdot 1 \ m} = ? \frac{mm}{m}$$

$$As := \frac{My0116}{0.9 \cdot \left(d - \frac{a \cdot 1}{2}\right) \cdot fy}$$

$$As = ? \frac{cm^2}{m}$$
 $< As_{min} =>$ Armadura mínima $=> \frac{\Phi 8@16}{m}$

$$Mex0116 \coloneqq \frac{Ku}{mex} \cdot \left(1 + \alpha \cdot \Delta x\right) \cdot k \qquad \qquad Mex0116 = 2.95 \frac{\textit{tonnef} \cdot \textit{m}}{\textit{m}}$$

$$As \coloneqq \frac{Mex0116}{0.9 \cdot \left(0.9 \cdot d\right) \cdot fy} = 5.67 \cdot \frac{\mathbf{cm}^2}{\mathbf{m}} \qquad \qquad a \coloneqq \frac{As \cdot fy}{0.85 \cdot f'c \cdot 1 \cdot \mathbf{m}} = 0.8 \cdot \frac{\mathbf{mm}}{\mathbf{m}} \qquad As \coloneqq \frac{Mex0116}{0.9 \cdot \left(d - \frac{a \cdot 1 \cdot \mathbf{m}}{2}\right) \cdot fy}$$

$$Mex0116 = 2.95 \frac{tonnef \cdot m}{m}$$

$$a \coloneqq \frac{As \cdot fy}{0.85 \cdot f'c \cdot 1 \ m} = 0.8 \ \frac{mm}{m}$$

Momento negativo último en lado corto

$$As \coloneqq \frac{Mex0116}{0.9 \cdot \left(d - \frac{a \cdot 1}{2} \frac{m}{2}\right) \cdot fy}$$

$$Iev0116 := \frac{Ku}{\cdot (1 + \alpha \cdot \Delta u) \cdot k}$$

$$Mey0116 \coloneqq \frac{Ku}{mey} \cdot \left(1 + \alpha \cdot \Delta y\right) \cdot k \qquad Mey0116 = 4.3 \frac{tonnef \cdot m}{m} \qquad \text{Momento negativo último en}$$

$$As \coloneqq \frac{Mey0116}{0.9 \cdot \left(0.9 \cdot d\right) \cdot fy} = 8.27 \frac{cm^2}{m} \qquad a \coloneqq \frac{As \cdot fy}{0.85 \cdot f'c \cdot 1} = 1.17 \frac{mm}{m} \qquad As \coloneqq \frac{Mey0116}{0.9 \cdot \left(d - \frac{a \cdot 1}{2}\right) \cdot fy}$$

$$Mey0116 = 4.3 \frac{tonnef \cdot m}{}$$

$$a \coloneqq \frac{As \cdot fy}{0.85 \cdot f'c \cdot 1 \ m} = 1.17 \ \frac{mm}{m}$$

$$As := \frac{Mey0116}{0.9 \cdot \left(d - \frac{a \cdot 1 \ m}{2}\right) \cdot fy}$$

$$As = 7.47 \frac{cm^2}{m} > As_{min} \Rightarrow \Phi 10@10$$

$$Lx = 3.06 \ \boldsymbol{m}$$

$$Ly = 10.5 \, \boldsymbol{m}$$

$$e \coloneqq 17$$
 cm

$$e \coloneqq 17 \text{ cm}$$
 $\varepsilon \coloneqq \frac{Ly}{Lx} = 3.431$

$$\varepsilon \coloneqq r.upp(\varepsilon) = 5.5$$

3.- Parámetros

$$k = 0.58$$
 $\lambda = 35$

$$e_{min} := \frac{k \cdot Lx}{\lambda} + rec = 7.07 \text{ cm}$$
 $e_{min} := r.up(e_{min}) = 8 \text{ cm}$

$$e_{min} \coloneqq r.up\left(e_{min}\right) = 8$$
 cm

$$mx := \frac{q_u \cdot Ly^2}{17 \cdot tonnef} = 12$$

$$my = 0$$
 $\Delta x = 0$

$$mex \coloneqq \frac{q_u \cdot Ly^2}{12 \cdot tonnef} = 17$$

$$mx \coloneqq \frac{q_u \cdot Ly^2}{17 \cdot tonnef} = 12 \qquad my \coloneqq 0 \quad \Delta x \coloneqq 0$$

$$mex \coloneqq \frac{q_u \cdot Ly^2}{12 \cdot tonnef} = 17 \qquad mey \coloneqq \frac{q_u \cdot Ly^2}{17.5 \cdot tonnef} = 11.66$$

$$\Delta y \coloneqq 0$$

$$AS_{min} := e \cdot 0.18\% = 3.06 \frac{cm^2}{m}$$

Armadura mínima => ₱8@16

4.- Cargas

$$PP_{losa} := \gamma_h \cdot e = 0.43 \frac{tonnef}{m^2}$$

$$PP_t = PP_{losa} + PP_{adic} = 0.88 \frac{tonnef}{m^2}$$

$$q_u \coloneqq 1.2 \cdot PP_t + 1.6 \ SC$$

$$q_u = 1.2 \cdot PP_t + 1.6 \ SC$$
 $q_u = 1.85 \ \frac{tonnef}{m^2}$

$$Ku := q_u \cdot (Lx \cdot Ly) = 59.44 \frac{\textbf{tonnef} \cdot \textbf{m}}{\textbf{m}}$$

$$\alpha \coloneqq \frac{SC}{2 \cdot q_u} = 0.14$$

5.- Momento últimos

$$Mx0117 := \frac{Ku}{mx} \cdot (1 + \alpha \cdot \Delta x) \cdot b$$

$$Mx0117 = 2.87 \frac{tonnef \cdot m}{m}$$

$$a \coloneqq \frac{As \cdot fy}{0.85 \cdot f'c \cdot 1 \ m} = 0.78 \ \frac{mm}{m}$$

$$As \coloneqq \frac{Mx0117}{0.9 \cdot \left(d - \frac{a \cdot 1 \ m}{2}\right) \cdot fy}$$

$$As = 4.98 \frac{cm^2}{m} > As_{min} \Rightarrow \boxed{\Phi 8@10}$$

$$My0117 := \frac{Ku}{my} \cdot (1 + \alpha \cdot \Delta y) \cdot k$$

$$My0117 \coloneqq \frac{Ku}{my} \cdot \left(1 + \alpha \cdot \Delta y\right) \cdot k$$

$$As \coloneqq \frac{My0117}{0.9 \cdot \left(0.9 \cdot d\right) \cdot fy} = ? \frac{cm^2}{m}$$

$$a \coloneqq \frac{As \cdot fy}{0.85 \cdot f'c \cdot 1 \ m} = ? \frac{mm}{m}$$

$$As \coloneqq \frac{My0117}{0.9 \cdot \left(d - \frac{a \cdot 1}{2}\right) \cdot fy}$$

$$My0117 = ? \frac{tonnef \cdot m}{m}$$

$$\frac{1}{m}$$
 Momento

$$As := \underbrace{My0117}$$

$$\boxed{As} = ? \frac{cm^2}{m} \qquad \quad \text{Armadura minima} => \frac{\Phi 8@16}{m}$$

$$Mex0117 := \frac{Ku}{mex} \cdot (1 + \alpha \cdot \Delta x) \cdot k$$

$$Mex0117 = 2.03 \frac{tonnef \cdot n}{m}$$

$$As := \frac{Mex0117}{0.9 \cdot (0.9 \cdot d) \cdot fy} = 3.9 \frac{cm^2}{m}$$

$$a := \frac{As \cdot fy}{0.85 \cdot f'c \cdot 1 \ m} = 0.55 \ \frac{mm}{m}$$

$$As = 3.51 \frac{cm^2}{m} > As_{min} \Rightarrow \Phi = \Phi = \Phi = \Phi$$

$$\Phi 8@14$$

$$Mey0117 := \frac{Ku}{mey} \cdot (1 + \alpha \cdot \Delta y) \cdot k$$

$$0117 \coloneqq \frac{1}{mey} \cdot (1 + \alpha \cdot \Delta y) \cdot k$$

$$M_{\alpha \cdot \alpha} = 0117$$

$$Mey0117 = 2.96 \frac{tonnef \cdot m}{m}$$

$$As := \frac{Mey0117}{0.9 \cdot (0.9 \cdot d) \cdot fy} = 5.68 \frac{cm^2}{m}$$

$$a \coloneqq \frac{As \cdot fy}{0.85 \cdot f'c \cdot 1 \ m} = 0.8 \ \frac{mm}{m}$$

$$Mey0117 \coloneqq \frac{Ku}{mey} \cdot \left(1 + \alpha \cdot \Delta y\right) \cdot k \qquad Mey0117 = 2.96 \frac{tonnef \cdot m}{m} \qquad \text{Momento negativo último en}$$

$$As \coloneqq \frac{Mey0117}{0.9 \cdot \left(0.9 \cdot d\right) \cdot fy} = 5.68 \frac{cm^2}{m} \qquad a \coloneqq \frac{As \cdot fy}{0.85 \cdot f'c \cdot 1 \ m} = 0.8 \frac{mm}{m} \qquad As \coloneqq \frac{Mey0117}{0.9 \cdot \left(d - \frac{a \cdot 1 \ m}{2}\right) \cdot fy}$$

$$As = 5.13 \frac{cm^2}{m} > As_{min} = > \frac{\Phi 10@15}{}$$

$$Lx \coloneqq 7.16 \ \boldsymbol{m}$$

$$Lu := 11.34 \ m$$

$$e \coloneqq 17$$
 cm

$$Ly := 11.34 \; m$$
 $e := 17 \; cm$ $\varepsilon := \frac{Ly}{Lx} = 1.584$

$$\varepsilon \coloneqq r.upp(\varepsilon) = 1.6$$

3.- Parámetros

$$k \coloneqq 0.58$$
 $\lambda \coloneqq 35$

$$e := \frac{k \cdot Lx}{k \cdot Lx} + rec = 13.87 \text{ cm}$$

$$e_{min} \coloneqq \frac{k \cdot Lx}{\lambda} + rec = 13.87 \text{ cm}$$
 $e_{min} \coloneqq r.up\left(e_{min}\right) = 14 \text{ cm}$

$$mx := 46.1$$
 $my := 163$ $\Delta x := 1.39$ $mex := 20.5$ $mey := 27.9$ $\Delta y := 1.39$

$$my \coloneqq 163$$

$$mey \coloneqq 27.9$$

$$\Delta x \coloneqq 1.39$$

$$\Delta u \coloneqq 1.39$$

$$AS_{min} \coloneqq e \cdot 0.18\% = 3.06 \frac{cm^2}{m}$$

Armadura mínima => $\Phi 8@16$

4.- Cargas

$$PP_{losa} := \gamma_h \cdot e = 0.43 \frac{tonnef}{m^2}$$

$$PP_t \coloneqq PP_{losa} + PP_{adic} = 0.88 \frac{tonnef}{m^2}$$

$$q_u \coloneqq 1.2 \cdot PP_t + 1.6 \ SC$$

$$q_u \coloneqq 1.2 \cdot PP_t + 1.6 \ SC$$
 $q_u = 1.85 \ \frac{\textbf{tonnef}}{\textbf{m}^2}$

$$Ku \coloneqq q_u \cdot \left(Lx \cdot Ly \right) = 150.21 \ \frac{\textbf{tonnef} \cdot \textbf{m}}{\textbf{m}}$$

$$\alpha \coloneqq \frac{SC}{2 \cdot q_u} = 0.14$$

5.- Momento últimos

$$Mx0118 \coloneqq \frac{Ku}{mx} \cdot \left(1 + \alpha \cdot \Delta x\right) \cdot k$$

$$Mx0118 \coloneqq \frac{Ku}{mx} \cdot \left(1 + \alpha \cdot \Delta x\right) \cdot k \qquad Mx0118 = 2.24 \frac{tonnef \cdot m}{m} \qquad \text{Momento positivo último en la section of the s$$

$$Mx0118 = 2.24 \frac{tonnef \cdot m}{m}$$

$$a \coloneqq \frac{As \cdot fy}{0.85 \cdot f'c \cdot 1 \ m} = 0.61 \ \frac{mm}{m}$$

Momento positivo último en lado corto

$$As := \frac{Mx0118}{0.9 \cdot \left(d - \frac{a \cdot 1 \ m}{2}\right) \cdot fy}$$

$$As = 3.89 \frac{cm^2}{m} > As_{min} = > \frac{\Phi 10@20}{}$$

$$\Phi10@20$$

$$My0118 \coloneqq \frac{Ku}{my} \cdot (1 + \alpha \cdot \Delta y) \cdot k$$

$$My0118 := \frac{Ku}{my} \cdot \left(1 + \alpha \cdot \Delta y\right) \cdot k \qquad My0118 = 0.63 \frac{tonnef \cdot m}{m} \qquad \text{Momento positivo último en la final positivo formula}$$

$$As := \frac{My0118}{0.9 \cdot \left(0.9 \cdot d\right) \cdot fy} = 1.22 \frac{cm^2}{m} \qquad a := \frac{As \cdot fy}{0.85 \cdot f'c \cdot 1 \ m} = 0.17 \frac{mm}{m} \qquad As := \frac{My0118}{0.9 \cdot \left(d - \frac{a \cdot 1 \ m}{2}\right) \cdot fy}$$

$$My0118 = 0.63 \frac{tonnef \cdot m}{m}$$

$$a \coloneqq \frac{As \cdot fy}{0.85 \cdot f'c \cdot 1 \ m} = 0.17 \ \frac{mm}{m}$$

Momento positivo último en lado largo

$$As \coloneqq \frac{My0118}{0.9 \cdot \left(d - \frac{a \cdot 1}{2} \frac{m}{2}\right) \cdot fy}$$

$$As = 1.1 \frac{cm^2}{m}$$
 $\langle As_{min} \rangle$ => Armadura mínima => $\Phi 8@16$

$$<$$
 As_{min}

$$Mex0118 := \frac{Ku}{mex} \cdot (1 + \alpha \cdot \Delta x) \cdot b$$

$$Mex0118 = 5.05 \frac{tonnef \cdot m}{m}$$

$$As := \frac{Mex0118}{0.9 \cdot (0.9 \cdot d) \cdot fy} = 9.7 \frac{cm^2}{m}$$

$$a \coloneqq \frac{As \cdot fy}{0.85 \cdot f'c \cdot 1 \ m} = 1.37 \ \frac{mm}{m}$$

$$\begin{aligned} & \textit{Mex} 0118 \coloneqq \frac{\textit{Ku}}{\textit{mex}} \cdot \left(1 + \alpha \cdot \Delta x\right) \cdot k & \textit{Mex} 0118 = 5.05 \ \frac{\textit{tonnef} \cdot \textit{m}}{\textit{m}} & \textit{Momento negativo último en lado corto} \\ & \textit{As} \coloneqq \frac{\textit{Mex} 0118}{0.9 \cdot \left(0.9 \cdot d\right) \cdot fy} = 9.7 \ \frac{\textit{cm}^2}{\textit{m}} & \textit{a} \coloneqq \frac{\textit{As} \cdot fy}{0.85 \cdot f'c \cdot 1 \ \textit{m}} = 1.37 \ \frac{\textit{mm}}{\textit{m}} & \textit{As} \coloneqq \frac{\textit{Mex} 0118}{0.9 \cdot \left(d - \frac{a \cdot 1 \ \textit{m}}{2}\right) \cdot fy} \end{aligned}$$

$$As = 8.77 \frac{cm^2}{m} > As_{min} =$$
 $\Phi 12@12$

$$\Phi 12@1$$

$$Mey0118 \coloneqq \frac{Ku}{mey} \cdot \left(1 + \alpha \cdot \Delta y\right) \cdot k$$

$$\frac{\partial}{\partial y} \cdot (1 + \alpha \cdot \Delta y) \cdot k$$

$$Mey0118 = 3.71 \frac{\textbf{tonnef} \cdot \textbf{m}}{\textbf{m}}$$

$$Mey0118 \coloneqq \frac{Ku}{mey} \cdot \left(1 + \alpha \cdot \Delta y\right) \cdot k \qquad Mey0118 = 3.71 \quad \frac{tonnef \cdot m}{m} \qquad \text{Momento negativo último en}$$

$$As \coloneqq \frac{Mey0118}{0.9 \cdot \left(0.9 \cdot d\right) \cdot fy} = 7.13 \quad \frac{cm^2}{m} \qquad a \coloneqq \frac{As \cdot fy}{0.85 \cdot f'c \cdot 1} = 1.01 \quad \frac{mm}{m} \qquad As \coloneqq \frac{Mey0118}{0.9 \cdot \left(d - \frac{a \cdot 1}{2}\right) \cdot fy}$$

$$a \coloneqq \frac{As \cdot fy}{0.85 \cdot f'c \cdot 1 \ m} = 1.01 \ \frac{mm}{m}$$

$$As := \frac{Mey0118}{0.9 \cdot \left(d - \frac{a \cdot 1 \ m}{2}\right) \cdot fy}$$

$$As = 6.44 \frac{cm^2}{m} > As_{min} \Rightarrow \boxed{\Phi 10@12}$$

$$Lx \coloneqq 1.4 \ \boldsymbol{m}$$

$$Ly = 11.2 \ m$$

$$e \coloneqq 17$$
 cm

$$e \coloneqq 17 \ cm$$
 $\varepsilon \coloneqq \frac{Ly}{Lx} = 8$

$$\varepsilon \coloneqq r.upp(\varepsilon) = 15.1$$

4.- Cargas

3.- Parámetros

$$\begin{aligned} & \boldsymbol{k} \coloneqq 0.58 & \lambda \coloneqq 35 \\ & e_{min} \coloneqq \frac{\boldsymbol{k} \cdot Lx}{\lambda} + rec = 4.32 \ \boldsymbol{cm} & e_{min} \coloneqq r.up \ (e_{min}) = 5 \ \boldsymbol{cm} \end{aligned}$$

$$e_{min} \coloneqq r.up\left(e_{min}\right) = 5$$
 cm

$$mx \coloneqq \frac{q_u \cdot Ly^2}{17 \cdot tonnef} = 13.65$$

$$my \coloneqq 0$$
 $\Delta x \coloneqq 0$

$$mex \coloneqq \frac{q_u \cdot Ly^2}{12 \cdot tonnef} = 19.34$$

$$mey := \frac{q_u \cdot Ly^2}{17.5 \cdot tonnef} = 13.26$$
 $\Delta y :=$

$q_u \coloneqq 1.2 \cdot PP_t + 1.6 \ SC \qquad q_u = 1.85 \ \frac{\textit{tonnef}}{\textit{m}^2}$

 $PP_{losa} := \gamma_h \cdot e = 0.43 \frac{tonnef}{m^2}$

$PP_t = PP_{losa} + PP_{adic} = 0.88 \frac{tonnef}{2}$

$$mx := \frac{q_u \cdot Ly^2}{17 \cdot tonnef} = 13.65$$

$$my := 0 \quad \Delta x := 0$$

$$mex := \frac{q_u \cdot Ly^2}{12 \cdot tonnef} = 19.34$$

$$mey := \frac{q_u \cdot Ly^2}{17.5 \cdot tonnef} = 13.26$$

$$AS_{min} := e \cdot 0.18\% = 3.06 \frac{cm^2}{m}$$

$$mey = \frac{q_u - 2g}{17.5 \cdot tonnef} = 13.26 \qquad \Delta y = 0$$

$$Ku := q_u \cdot (Lx \cdot Ly) = 29.01 \frac{\textbf{tonnef} \cdot \textbf{m}}{\textbf{m}}$$
$$\alpha := \frac{SC}{2 \cdot a} = 0.14$$

Armadura mínima => ₱8@16

$$Mx0119 := \frac{Ku}{mx} \cdot (1 + \alpha \cdot \Delta x) \cdot k$$

$$4x0119 = 1.23 \frac{\textbf{tonnef} \cdot \textbf{m}}{\textbf{m}}$$

$$a \coloneqq \frac{As \cdot fy}{0.85 \cdot f'c \cdot 1 \ m} = 0.33 \ \frac{mm}{m}$$

$$As := \frac{Mx0119}{0.9 \cdot \left(d - \frac{a \cdot 1 \ m}{2}\right) \cdot fy}$$

$$As = 2.13 \frac{cm^2}{m} < As_{min} => Armadura mínima => \frac{\Phi 8@16}{m}$$

Armadura mínima =>
$$\Phi 8@16$$

$$My0119 := \frac{Ku}{|my|} \cdot (1 + \alpha \cdot \Delta y) \cdot k$$

$$\underbrace{My0119}_{m} = ? \frac{totnef}{m}$$

$$As := \frac{My0119}{0.9 \cdot (0.9 \cdot d) \cdot fy} = ? \frac{cm^2}{m}$$

$$a := \frac{As \cdot fy}{0.85 \cdot f'c \cdot 1 \ m} = ? \frac{mm}{m}$$

$$My0119 \coloneqq \frac{Ku}{my} \cdot \left(1 + \alpha \cdot \Delta y\right) \cdot k$$

$$As \coloneqq \frac{My0119}{0.9 \cdot \left(0.9 \cdot d\right) \cdot fy} = ? \frac{cm^2}{m}$$

$$a \coloneqq \frac{As \cdot fy}{0.85 \cdot f'c \cdot 1 \ m} = ? \frac{mm}{m}$$

$$As \coloneqq \frac{My0119}{0.9 \cdot \left(d - \frac{a \cdot 1}{2}\right) \cdot fy}$$

$$\boxed{As} = ? \frac{cm^2}{m} \qquad \quad \text{Armadura minima} => \frac{\Phi 8@16}{m}$$

$$Mex0119 \coloneqq \frac{Ku}{mex} \cdot \left(1 + \alpha \cdot \Delta x\right) \cdot k \qquad \qquad Mex0119 = 0.87 \; \frac{\textit{tonnef} \cdot \textit{m}}{\textit{m}}$$

$$Mex0119 = 0.87 \frac{tonnef \cdot m}{m}$$

$$As \coloneqq \frac{Mex0119}{0.9 \cdot \left(0.9 \cdot d\right) \cdot fy} = 1.67 \frac{\mathbf{cm}^2}{\mathbf{m}} \qquad \qquad a \coloneqq \frac{As \cdot fy}{0.85 \cdot f'c \cdot 1 \ \mathbf{m}} = 0.24 \frac{\mathbf{mm}}{\mathbf{m}} \qquad As \coloneqq \frac{Mex0119}{0.9 \cdot \left(d - \frac{a \cdot 1 \ \mathbf{m}}{2}\right) \cdot fy}$$

$$a \coloneqq \frac{As \cdot fy}{0.85 \cdot f'c \cdot 1 \ m} = 0.24 \ \frac{mm}{m}$$

$$As := \frac{Mex0119}{0.9 \cdot \left(d - \frac{a \cdot 1}{2} \frac{m}{2}\right) \cdot fy}$$

$$As = 1.51 \frac{cm^2}{m}$$
 < As_{min} => Armadura mínima => $\Phi 8@16$

$$Mey0119 \coloneqq \frac{Ku}{mey} \cdot (1 + \alpha \cdot \Delta y) \cdot k$$

$$Mey0119 = 1.27 \frac{tonnef \cdot m}{m}$$

$$As := \frac{Mey0119}{0.9 \cdot (0.9 \cdot d) \cdot fy} = 2.44 \frac{cm^2}{m}$$

$$a \coloneqq \frac{As \cdot fy}{0.85 \cdot f'c \cdot 1 \ m} = 0.34 \ \frac{mm}{m}$$

$$Mey0119 \coloneqq \frac{Ku}{mey} \cdot \left(1 + \alpha \cdot \Delta y\right) \cdot k \qquad Mey0119 = 1.27 \quad \frac{tonnef \cdot m}{m} \qquad \text{Momento negativo último en}$$

$$As \coloneqq \frac{Mey0119}{0.9 \cdot \left(0.9 \cdot d\right) \cdot fy} = 2.44 \quad \frac{cm^2}{m} \qquad a \coloneqq \frac{As \cdot fy}{0.85 \cdot f'c \cdot 1} = 0.34 \quad \frac{mm}{m} \qquad As \coloneqq \frac{Mey0119}{0.9 \cdot \left(d - \frac{a \cdot 1}{2}\right) \cdot fy}$$

$$As = 2.2 \frac{cm^2}{m}$$

$$As = 2.2 \frac{cm^2}{m}$$
 < As_{min} => Armadura mínima => $\Phi 8@16$

$$Lx \coloneqq 2.1 \; \boldsymbol{m}$$

$$Ly := 4.04 \ m$$

$$e := 17 \, cm$$

$$e \coloneqq 17 \text{ cm}$$
 $\varepsilon \coloneqq \frac{Ly}{Lx} = 1.924$

$$\varepsilon \coloneqq r.upp(\varepsilon) = 2$$

3.- Parámetros

$$k = 0.75 \qquad \lambda = 35$$

$$k \cdot Lx$$

$$e_{min} \coloneqq \frac{k \cdot Lx}{\lambda} + rec = 6.5 \ \textbf{cm}$$
 $e_{min} \coloneqq r.up\left(e_{min}\right) = 7 \ \textbf{cm}$

$$mx := 37.5$$
 $my := 202$ $\Delta x := 0.68$ $mex := 17.6$ $\Delta y := 0.46$

$$my = 202$$

$$\Delta x = 0.68$$

$$AS_{min} \coloneqq e \cdot 0.18\% = 3.06 \frac{cm^2}{m}$$

Armadura mínima => Ф8@16

4.- Cargas

$$PP_{losa} := \gamma_h \cdot e = 0.43 \frac{tonnef}{m^2}$$

$$PP_t = PP_{losa} + PP_{adic} = 0.88 \frac{tonnef}{m^2}$$

$$q_u \coloneqq 1.2 \cdot PP_t + 1.6 \ SC$$

$$q_u \coloneqq 1.2 \cdot PP_t + 1.6 \ SC \qquad q_u = 1.85 \ \frac{\textit{tonnef}}{\textit{m}^2}$$

$$Ku \coloneqq q_u \boldsymbol{\cdot} \left(Lx \boldsymbol{\cdot} Ly \right) = 15.7 \ \frac{\boldsymbol{tonnef \cdot m}}{\boldsymbol{m}}$$

$$\alpha \coloneqq \frac{SC}{2 \cdot q_u} = 0.14$$

5.- Momento últimos

$$Mx0120 := \frac{Ku}{mx} \cdot (1 + \alpha \cdot \Delta x) \cdot k$$

$$\frac{S.\text{- Momento ultimos}}{Mx0120 := \frac{Ku}{mx} \cdot \left(1 + \alpha \cdot \Delta x\right) \cdot k} \qquad \qquad \frac{Mx0120 = 0.34 \ \frac{tonnef \cdot m}{m}}{m} \qquad \text{Momento positivo último en la solution of the solution$$

$$Mx0120 = 0.34 \frac{tonnef \cdot m}{m}$$

$$a \coloneqq \frac{As \cdot fy}{0.85 \cdot f'c \cdot 1 \ m} = 0.09 \ \frac{mm}{m}$$

Momento positivo último en lado corto

$$As \coloneqq \frac{Mx0120}{0.9 \cdot \left(d - \frac{a \cdot 1}{2} \frac{m}{2}\right) \cdot fy}$$

$$As = 0.59 \frac{cm^2}{m}$$
 < As_{min} => Armadura mínima => $\Phi 8@16$

$$My0120 \coloneqq \frac{Ku}{my} \cdot (1 + \alpha \cdot \Delta y) \cdot k$$

$$My0120 := \frac{Ku}{my} \cdot \left(1 + \alpha \cdot \Delta y\right) \cdot k \qquad My0120 = 0.06 \frac{\textbf{tonnef} \cdot \textbf{m}}{\textbf{m}} \qquad \text{Momento positivo último en la substitution of the substi$$

$$My0120 = 0.06 \frac{tonnef \cdot m}{m}$$

$$a := \frac{As \cdot fy}{0.85 \cdot f'c \cdot 1 \ m} = 0.02 \ \frac{mm}{m}$$

Momento positivo último en lado largo

$$As := \frac{My0120}{0.9 \cdot \left(d - \frac{a \cdot 1}{2} \frac{m}{2}\right) \cdot fy}$$

$$As = 0.11 \frac{cm^2}{m}$$
 < As_{min} => Armadura mínima => $\Phi 8@16$

$$<$$
 As_{min}

$$Mex0120 := \frac{Ku}{mex} \cdot (1 + \alpha \cdot \Delta x) \cdot k$$

$$Mex0120 = 0.73 \frac{tonnef \cdot m}{m}$$

$$As := \frac{Mex0120}{0.9 \cdot (0.9 \cdot d) \cdot fy} = 1.4 \frac{cm^2}{m}$$

$$a \coloneqq \frac{As \cdot fy}{0.85 \cdot f'c \cdot 1 \ m} = 0.2 \ \frac{mm}{m}$$

$$\begin{split} \mathit{Mex} 0120 \coloneqq & \frac{\mathit{Ku}}{\mathit{mex}} \cdot \left(1 + \alpha \cdot \Delta x\right) \cdot k & \mathit{Mex} 0120 = 0.73 \ \frac{\mathit{tonnef} \cdot \mathit{m}}{\mathit{m}} & \mathsf{Momento negativo \ \'ultimo \ en \ lado \ corto} \\ \mathit{As} \coloneqq & \frac{\mathit{Mex} 0120}{0.9 \cdot \left(0.9 \cdot d\right) \cdot \mathit{fy}} = 1.4 \ \frac{\mathit{cm}^2}{\mathit{m}} & \mathit{a} \coloneqq \frac{\mathit{As} \cdot \mathit{fy}}{0.85 \cdot \mathit{f'c} \cdot 1 \ \mathit{m}} = 0.2 \ \frac{\mathit{mm}}{\mathit{m}} & \mathit{As} \coloneqq \frac{\mathit{Mex} 0120}{0.9 \cdot \left(d - \frac{a \cdot 1 \ \mathit{m}}{2}\right) \cdot \mathit{fy}} \end{split}$$

$$As = 1.26 \frac{cm^2}{m}$$

 $As = 1.26 \frac{cm^2}{m}$ < As_{min} => Armadura mínima => $\Phi 8@16$

$$Mey0120 \coloneqq \frac{Ku}{mey} \cdot \left(1 + \alpha \cdot \Delta y\right) \cdot k$$

$$Mey0120 = 0.51 \frac{tonnef}{m}$$

$$As := \frac{Mey0120}{0.9 \cdot (0.9 \cdot d) \cdot fy} = 0.98 \frac{cm^2}{m}$$

$$a := \frac{As \cdot fy}{0.85 \cdot f'c \cdot 1 m} = 0.14 \frac{mm}{m}$$

$$Mey0120 := \frac{Ku}{mey} \cdot \left(1 + \alpha \cdot \Delta y\right) \cdot k \qquad Mey0120 = 0.51 \quad \frac{tonnef \cdot m}{m} \qquad \text{Momento negativo último en}$$

$$As := \frac{Mey0120}{0.9 \cdot \left(0.9 \cdot d\right) \cdot fy} = 0.98 \quad \frac{cm^2}{m} \qquad a := \frac{As \cdot fy}{0.85 \cdot f'c \cdot 1} = 0.14 \quad \frac{mm}{m} \qquad As := \frac{Mey0120}{0.9 \cdot \left(d - \frac{a \cdot 1}{2}\right) \cdot fy}$$

$$As = 0.88 \frac{cm^2}{m}$$

$$As = 0.88 \frac{cm^2}{m}$$
 < As_{min} => Armadura mínima => Φ 8@16

$$Lx \coloneqq 2.9 \ \boldsymbol{m}$$

$$Ly = 6.36 \ m$$

$$e \coloneqq 17$$
 cm

$$e \coloneqq 17 \text{ cm}$$
 $\varepsilon \coloneqq \frac{Ly}{Lx} = 2.193$

$$\varepsilon \coloneqq r.upp(\varepsilon) = 3.2$$

3.- Parámetros

$$k \coloneqq 0.58 \qquad \qquad \lambda \coloneqq 35$$

$$e_{min} \coloneqq \frac{k \cdot Lx}{\lambda} + rec = 6.81 \text{ cm}$$
 $e_{min} \coloneqq r.up(e_{min}) = 7 \text{ cm}$

$$mx \coloneqq \frac{q_u \cdot Ly^2}{17 \cdot tonnef} = 4.4 \qquad my \coloneqq 0 \quad \Delta x \coloneqq 0$$

$$mex \coloneqq \frac{q_u \cdot Ly^2}{12 \cdot tonnef} = 6.24 \qquad mey \coloneqq \frac{q_u \cdot Ly^2}{17.5 \cdot tonnef} = 4.28$$

$$AS_{min} \coloneqq e \cdot 0.18\% = 3.06 \frac{cm^2}{m}$$

$$mex \coloneqq \frac{q_u \cdot Ly^2}{12 \cdot tonnef} = 6.24 \qquad meg$$

$$mey \coloneqq \frac{q_u \cdot Ly^2}{17.5 \cdot tonnef} = 4.28$$

$$\Delta y = 0$$

$$AS_{min} \coloneqq e \cdot 0.18\% = 3.06 \frac{cm^2}{m}$$

Armadura mínima => ₱8@16

4.- Cargas

$$PP_{losa} := \gamma_h \cdot e = 0.43 \frac{tonnef}{m^2}$$

$$PP_t \coloneqq PP_{losa} + PP_{adic} = 0.88 \frac{tonnef}{m^2}$$

$$q_u \coloneqq 1.2 \cdot PP_t + 1.6 \ SC$$
 $q_u = 1.85 \ \frac{\textbf{tonnef}}{\textbf{m}^2}$

$$q_u = 1.85 \frac{tonnef}{m^2}$$

$$Ku := q_u \cdot (Lx \cdot Ly) = 34.12 \frac{\textbf{tonnef} \cdot \textbf{m}}{\textbf{m}}$$

$$\alpha \coloneqq \frac{SC}{2 \cdot q_u} = 0.14$$

5.- Momento últimos

$$Mx0121 := \frac{Ku}{mx} \cdot (1 + \alpha \cdot \Delta x) \cdot k$$

$$Mx0121 := \frac{Ku}{mx} \cdot (1 + \alpha \cdot \Delta x) \cdot k \qquad Mx0121 = 4.5 \frac{tonnef \cdot m}{m} \qquad \text{Momento positivo último en la final positivo último en la final$$

$$Mx0121 = 4.5 \frac{tonnef \cdot m}{m}$$

$$a := \frac{As \cdot fy}{0.85 \cdot f'c \cdot 1 \ m} = 1.22 \ \frac{mm}{m}$$

$$As := \frac{Mx0121}{0.9 \cdot \left(d - \frac{a \cdot 1}{2} \frac{m}{2}\right) \cdot fy}$$

$$My0121 := \frac{Ku}{my} \cdot (1 + \alpha \cdot \Delta y) \cdot k$$

$$As := \frac{My0121}{0.9 \cdot (0.9 \cdot d) \cdot fy} = ? \frac{cm^2}{m}$$

$$My0121 = ? \frac{tonnef \cdot m}{m}$$

$$\frac{10121}{m} = ? \frac{1}{m}$$

$$My0121 := \frac{Ku}{my} \cdot \left(1 + \alpha \cdot \Delta y\right) \cdot k$$

$$As := \frac{My0121}{0.9 \cdot \left(0.9 \cdot d\right) \cdot fy} = ? \frac{cm^2}{m}$$

$$a := \frac{As \cdot fy}{0.85 \cdot f'c \cdot 1 \ m} = ? \frac{mm}{m}$$

$$As := \frac{My0121}{0.9 \cdot \left(d - \frac{a \cdot 1 \ m}{2}\right) \cdot fy}$$

$$As = ? \frac{cm^2}{m}$$

 $\boxed{As} = ? \frac{cm^2}{m} \qquad <As_{min} \Rightarrow \text{Armadura mínima} \Rightarrow \boxed{\Phi 8@16}$

$$Mex0121 \coloneqq \frac{Ku}{mex} \cdot (1 + \alpha \cdot \Delta x) \cdot k$$

$$Mex0121 = 3.17 \frac{tonnef \cdot n}{m}$$

$$As := \frac{Mex0121}{0.9 \cdot (0.9 \cdot d) \cdot fy} = 6.1 \frac{cm^2}{m}$$

$$a := \frac{As \cdot fy}{0.85 \cdot f'c \cdot 1 \ m} = 0.86 \ \frac{mm}{m}$$

$$Mex0121 \coloneqq \frac{Ku}{mex} \cdot \left(1 + \alpha \cdot \Delta x\right) \cdot k \qquad Mex0121 = 3.17 \frac{tonnef \cdot m}{m} \qquad \text{Momento negative of } \frac{1}{m} = \frac{Mex0121}{0.9 \cdot \left(0.9 \cdot d\right) \cdot fy} = 6.1 \frac{cm^2}{m} \quad a \coloneqq \frac{As \cdot fy}{0.85 \cdot f'c \cdot 1 \cdot m} = 0.86 \frac{mm}{m} \quad As \coloneqq \frac{Mex0121}{0.9 \cdot \left(d - \frac{a \cdot 1 \cdot m}{2}\right) \cdot fy} = 0.86 \frac{mm}{m} \quad As \coloneqq \frac{Mex0121}{0.9 \cdot \left(d - \frac{a \cdot 1 \cdot m}{2}\right) \cdot fy} = 0.86 \frac{mm}{m} \quad As \coloneqq \frac{Mex0121}{0.9 \cdot \left(d - \frac{a \cdot 1 \cdot m}{2}\right) \cdot fy} = 0.86 \frac{mm}{m} \quad As \coloneqq \frac{Mex0121}{0.9 \cdot \left(d - \frac{a \cdot 1 \cdot m}{2}\right) \cdot fy} = 0.86 \frac{mm}{m} \quad As \coloneqq \frac{Mex0121}{0.9 \cdot \left(d - \frac{a \cdot 1 \cdot m}{2}\right) \cdot fy} = 0.86 \frac{mm}{m} \quad As \coloneqq \frac{Mex0121}{0.9 \cdot \left(d - \frac{a \cdot 1 \cdot m}{2}\right) \cdot fy} = 0.86 \frac{mm}{m} \quad As \coloneqq \frac{Mex0121}{0.9 \cdot \left(d - \frac{a \cdot 1 \cdot m}{2}\right) \cdot fy} = 0.86 \frac{mm}{m} \quad As \coloneqq \frac{Mex0121}{0.9 \cdot \left(d - \frac{a \cdot 1 \cdot m}{2}\right) \cdot fy} = 0.86 \frac{mm}{m} \quad As \coloneqq \frac{Mex0121}{0.9 \cdot \left(d - \frac{a \cdot 1 \cdot m}{2}\right) \cdot fy} = 0.86 \frac{mm}{m} \quad As \coloneqq \frac{Mex0121}{0.9 \cdot \left(d - \frac{a \cdot 1 \cdot m}{2}\right) \cdot fy} = 0.86 \frac{mm}{m} \quad As \coloneqq \frac{Mex0121}{0.9 \cdot \left(d - \frac{a \cdot 1 \cdot m}{2}\right) \cdot fy} = 0.86 \frac{mm}{m} \quad As \coloneqq \frac{Mex0121}{0.9 \cdot \left(d - \frac{a \cdot 1 \cdot m}{2}\right) \cdot fy} = 0.86 \frac{mm}{m} \quad As \coloneqq \frac{Mex0121}{0.9 \cdot \left(d - \frac{a \cdot 1 \cdot m}{2}\right) \cdot fy} = 0.86 \frac{mm}{m} \quad As \coloneqq \frac{Mex0121}{0.9 \cdot \left(d - \frac{a \cdot 1 \cdot m}{2}\right) \cdot fy} = 0.86 \frac{mm}{m} \quad As \coloneqq \frac{Mex0121}{0.9 \cdot \left(d - \frac{a \cdot 1 \cdot m}{2}\right) \cdot fy} = 0.86 \frac{mm}{m} \quad As \coloneqq \frac{Mex0121}{0.9 \cdot \left(d - \frac{a \cdot 1 \cdot m}{2}\right) \cdot fy} = 0.86 \frac{mm}{m} \quad As \coloneqq \frac{Mex0121}{0.9 \cdot \left(d - \frac{a \cdot 1 \cdot m}{2}\right) \cdot fy} = 0.86 \frac{mm}{m} \quad As \coloneqq \frac{Mex0121}{0.9 \cdot \left(d - \frac{a \cdot 1 \cdot m}{2}\right) \cdot fy} = 0.86 \frac{mm}{m} \quad As \coloneqq \frac{Mex0121}{0.9 \cdot \left(d - \frac{a \cdot 1 \cdot m}{2}\right) \cdot fy} = 0.86 \frac{mm}{m} \quad As \coloneqq \frac{Mex0121}{0.9 \cdot \left(d - \frac{a \cdot 1 \cdot m}{2}\right) \cdot fy} = 0.86 \frac{mm}{m} \quad As \coloneqq \frac{Mex0121}{0.9 \cdot \left(d - \frac{a \cdot 1 \cdot m}{2}\right) \cdot fy} = 0.86 \frac{mm}{m} \quad As \coloneqq \frac{Mex0121}{0.9 \cdot \left(d - \frac{a \cdot 1 \cdot m}{2}\right) \cdot fy} = 0.86 \frac{mm}{m} \quad As \coloneqq \frac{Mex0121}{0.9 \cdot \left(d - \frac{a \cdot 1 \cdot m}{2}\right) \cdot fy} = 0.86 \frac{mm}{m} \quad As \coloneqq \frac{Mex0121}{0.9 \cdot \left(d - \frac{a \cdot 1 \cdot m}{2}\right) \cdot fy} = 0.86 \frac{mm}{m} \quad As \coloneqq \frac{Mex0121}{0.9 \cdot \left(d - \frac{a \cdot 1 \cdot m}{2}\right) \cdot fy} = 0.86 \frac{mm}{m} \quad As \coloneqq \frac{Mex0121}{0.9 \cdot \left(d - \frac{a \cdot 1 \cdot m}{2}\right) \cdot fy} = 0.86 \frac{mm}{m} \quad As \coloneqq$$

$$Mey0121 := \frac{Ku}{mey} \cdot (1 + \alpha \cdot \Delta y) \cdot k$$

$$y0121 \coloneqq \frac{\Lambda u}{mey} \cdot (1 + \alpha \cdot \Delta y) \cdot k$$

$$Mey0121 = 4.63 \frac{totnef \cdot m}{m}$$

$$As := \frac{Mey0121}{0.9 \cdot (0.9 \cdot d) \cdot fy} = 8.89 \frac{cm^2}{m}$$

$$a \coloneqq \frac{As \cdot fy}{0.85 \cdot f'c \cdot 1 \ m} = 1.26 \ \frac{mn}{m}$$

$$Mey0121 \coloneqq \frac{Ku}{mey} \cdot \left(1 + \alpha \cdot \Delta y\right) \cdot k \qquad Mey0121 = 4.63 \frac{tonnef \cdot m}{m} \qquad \text{Momento negativo último en}$$

$$As \coloneqq \frac{Mey0121}{0.9 \cdot \left(0.9 \cdot d\right) \cdot fy} = 8.89 \frac{cm^2}{m} \qquad a \coloneqq \frac{As \cdot fy}{0.85 \cdot f'c \cdot 1} = 1.26 \frac{mm}{m} \qquad As \coloneqq \frac{Mey0121}{0.9 \cdot \left(d - \frac{a \cdot 1}{2}\right) \cdot fy}$$

$$Lx \coloneqq 4.25 \ \boldsymbol{m}$$

$$Ly = 6.36 \ m$$

$$e \coloneqq 17$$
 cm

$$e \coloneqq 17 \text{ cm}$$
 $\varepsilon \coloneqq \frac{Ly}{Lx} = 1.496$

$$\varepsilon \coloneqq r.upp(\varepsilon) = 1.5$$

3.- Parámetros

$$\begin{array}{l} \pmb{k \coloneqq 0.58} & \lambda \coloneqq 35 \\ e_{min} \coloneqq \frac{\pmb{k \cdot Lx}}{\lambda} + rec = 9.04 \ \textit{cm} & e_{min} \coloneqq r.up \left(e_{min}\right) = 10 \ \textit{cm} \end{array}$$

$$e_{min} \coloneqq r.up\left(e_{min}\right) = 10$$
 cm

$$mx := 44.4$$
 $my := 140.5$ $\Delta x := 1.31$ $mex := 19.8$ $mey := 26.2$ $\Delta y := 1.31$

$$my = 140.5$$

$$\Delta x \coloneqq 1.31$$
$$\Delta y \coloneqq 1.31$$

$$AS_{min} \coloneqq e \cdot 0.18\% = 3.06 \frac{cm^2}{m}$$

Armadura mínima => $\Phi 8@16$

4.- Cargas

$$PP_{losa} := \gamma_h \cdot e = 0.43 \frac{\textbf{tonnef}}{\textbf{m}^2}$$

$$PP_t \coloneqq PP_{losa} + PP_{adic} = 0.88 \frac{\textbf{tonnef}}{\textbf{m}^2}$$

$$q_u \coloneqq 1.2 \cdot PP_t + 1.6 \ SC$$

$$q_u \coloneqq 1.2 \cdot PP_t + 1.6 \ SC \qquad q_u = 1.85 \ \frac{\textit{tonnef}}{\textit{m}^2}$$

$$Ku \coloneqq q_u \cdot (Lx \cdot Ly) = 50.01 \frac{\textbf{tonnef} \cdot \textbf{m}}{\textbf{m}}$$

$$\alpha \coloneqq \frac{SC}{2 \cdot q_u} = 0.14$$

5.- Momento últimos

$$Mx0122 := \frac{Ku}{mx} \cdot (1 + \alpha \cdot \Delta x) \cdot k$$

$$\frac{cond}{(2cd) \cdot fu} = 1.48 \frac{cm^2}{m}$$

$$Mx0122 = 0.77 \frac{tonnef \cdot m}{m}$$

$$a := \frac{As \cdot fy}{0.85 \cdot f'c \cdot 1 \ m} = 0.21 \ \frac{mm}{m}$$

$$As = 1.33 \frac{cm^2}{m} < As_{min} = Armadura mínima = \frac{\Phi 8@16}{m}$$

$$My0122 \coloneqq \frac{Ku}{my} \cdot (1 + \alpha \cdot \Delta y) \cdot k$$

$$My0122 := \frac{Ku}{my} \cdot \left(1 + \alpha \cdot \Delta y\right) \cdot k \qquad My0122 = 0.24 \frac{tonnef \cdot m}{m} \qquad \text{Momento positivo último en la final positivo último en la fin$$

$$My0122 = 0.24 \frac{\textbf{tonnef} \cdot \textbf{m}}{\textbf{m}}$$

$$a \coloneqq \frac{As \cdot fy}{0.85 \cdot f'c \cdot 1 \ m} = 0.07 \ \frac{mm}{m}$$

$$As := \frac{My0122}{0.9 \cdot \left(d - \frac{a \cdot 1 \ m}{2}\right) \cdot fy}$$

$$As = 0.42 \frac{cm^2}{m} < As_{min} => Armadura mínima => \frac{\Phi 8@16}{m}$$

Armadura mínima =>
$$\Phi 8@16$$

$$Mex0122 := \frac{Ku}{mex} \cdot (1 + \alpha \cdot \Delta x) \cdot k$$

$$As := \frac{Mex0122}{0.9 \cdot (0.9 \cdot d) \cdot fu} = 3.31 \frac{cm^2}{m}$$

$$Mex0122 = 1.72 \frac{tonnef \cdot m}{m}$$

$$a \coloneqq \frac{As \cdot fy}{0.85 \cdot f'c \cdot 1 \ m} = 0.47 \ \frac{mm}{m}$$

$$\begin{aligned} Mex 0122 \coloneqq & \frac{Ku}{mex} \cdot \left(1 + \alpha \cdot \Delta x\right) \cdot k & Mex 0122 = 1.72 & \frac{tonnef \cdot m}{m} & \text{Momento negativo último en} \\ As \coloneqq & \frac{Mex 0122}{0.9 \cdot \left(0.9 \cdot d\right) \cdot fy} = 3.31 & \frac{cm^2}{m} & a \coloneqq & \frac{As \cdot fy}{0.85 \cdot f'c \cdot 1} & = 0.47 & \frac{mm}{m} & As \coloneqq & \frac{Mex 0122}{0.9 \cdot \left(d - \frac{a \cdot 1}{2}\right) \cdot fy} \end{aligned}$$

$$As = 2.99 \frac{cm^2}{m} < As_{min} => Armadura mínima => \frac{\Phi 8@16}{m}$$

$$Mey0122 \coloneqq \frac{Ku}{mey} \cdot \left(1 + \alpha \cdot \Delta y\right) \cdot k \qquad \qquad Mey0122 = 1.3 \frac{\textbf{tonnef} \cdot \textbf{m}}{\textbf{m}}$$

$$Mey0122 = 1.3 \frac{tonnef \cdot m}{m}$$

Momento negativo último en lado largo

$$As := \frac{Mey0122}{0.9 \cdot (0.9 \cdot d) \cdot fu} = 2.5 \frac{cm^2}{m}$$

$$a := \frac{As \cdot fy}{0.85 \cdot f'c \cdot 1 m} = 0.35 \frac{mm}{m}$$

$$As \coloneqq \frac{Mey0122}{0.9 \cdot \left(0.9 \cdot d\right) \cdot fy} = 2.5 \frac{cm^2}{m} \quad a \coloneqq \frac{As \cdot fy}{0.85 \cdot f'c \cdot 1 \ m} = 0.35 \frac{mm}{m} \qquad As \coloneqq \frac{Mey0122}{0.9 \cdot \left(d - \frac{a \cdot 1 \ m}{2}\right) \cdot fy}$$

$$As = 2.26 \frac{cm^2}{m}$$

 $As = 2.26 \frac{cm^2}{m}$ < As_{min} => Armadura mínima => $\Phi 8@16$

$$Lx = 6.49 \ m$$

$$Ly := 7.16 \ m$$

$$e \coloneqq 17$$
 cm

$$e \coloneqq 17 \ cm$$
 $\varepsilon \coloneqq \frac{Ly}{Lx} = 1.103$

$$\varepsilon \coloneqq r.upp(\varepsilon) = 1.2$$

3.- Parámetros

$$k = 0.56 \qquad \lambda = 35$$

$$k \cdot Lx$$

$$e_{min} \coloneqq \frac{k \cdot Lx}{\lambda} + rec = 12.38 \text{ cm}$$
 $e_{min} \coloneqq r.up\left(e_{min}\right) = 13 \text{ cm}$

$$my = 78.9$$

$$e_{min} = r.up(e_{min}) = 13$$

$$mx := 47.2$$
 $my := 78.9$ $\Delta x := 1.1$ $mex := 18.6$ $mey := 21.5$ $\Delta y := 1.1$

$$AS_{min} \coloneqq e \cdot 0.18\% = 3.06 \frac{cm^2}{m}$$

Armadura mínima => $\Phi 8@16$

4.- Cargas

$$PP_{losa} := \gamma_h \cdot e = 0.43 \frac{tonnef}{m^2}$$

$$PP_t = PP_{losa} + PP_{adic} = 0.88 \frac{tonnef}{m^2}$$

$$q_u = 1.2 \cdot PP_t + 1.6 \ SC$$
 $q_u = 1.85 \ \frac{tonnef}{constant}$

$$q_u = 1.85 \frac{tonnef}{m^2}$$

$$Ku := q_u \cdot (Lx \cdot Ly) = 85.97 \frac{\textbf{tonnef} \cdot \textbf{m}}{\textbf{m}}$$

$$\alpha \coloneqq \frac{SC}{2 \cdot q_u} = 0.14$$

5.- Momento últimos

$$Mx0123 \coloneqq \frac{Ku}{mx} \boldsymbol{\cdot} \left(1 + \alpha \boldsymbol{\cdot} \Delta x\right) \boldsymbol{\cdot} k$$

$$Mx0123 \coloneqq \frac{Ku}{mx} \cdot \left(1 + \alpha \cdot \Delta x\right) \cdot k \qquad Mx0123 = 1.17 \frac{tonnef \cdot m}{m} \qquad \text{Momento positivo último en la section of the property of the p$$

$$Mx0123 = 1.17 \frac{tonnef \cdot m}{m}$$

$$a := \frac{As \cdot fy}{0.85 \cdot f'c \cdot 1 \ m} = 0.32 \ \frac{mm}{m}$$

$$a = \frac{1}{0.85 \cdot f'c \cdot 1} = \frac{1}{m} = 0.32 = \frac{1}{m}$$

$$As = 2.03 \frac{cm^2}{m}$$
 < As_{min} => Armadura mínima => $\Phi 8@16$

Armadura mínima =>
$$\Phi 8@16$$

$$My0123 := \frac{Ku}{my} \cdot \left(1 + \alpha \cdot \Delta y\right) \cdot k \qquad My0123 = 0.7 \frac{tonnef \cdot m}{m} \qquad \text{Momento positivo último en la solution of the solution}$$

$$As := \frac{My0123}{0.9 \cdot \left(0.9 \cdot d\right) \cdot fy} = 1.35 \frac{cm^2}{m} \qquad a := \frac{As \cdot fy}{0.85 \cdot f'c \cdot 1 \ m} = 0.19 \frac{mm}{m} \qquad As := \frac{My0123}{0.9 \cdot \left(d - \frac{a \cdot 1 \ m}{2}\right) \cdot fy}$$

$$My0123 = 0.7 \frac{\textbf{tonnef} \cdot \textbf{m}}{\textbf{m}}$$

$$a \coloneqq \frac{As \cdot fy}{0.85 \cdot f'c \cdot 1 \ m} = 0.19 \ \frac{mm}{m}$$

$$As := \frac{My0123}{0.9 \cdot \left(d - \frac{a \cdot 1 \ m}{2}\right) \cdot fy}$$

$$As = 1.21 \frac{cm^2}{m} < As_{min} \Rightarrow Armadura mínima = 48@16$$

Armadura mínima =>
$$\Phi 8@16$$

$$Mex0123 := \frac{Ku}{mex} \cdot (1 + \alpha \cdot \Delta x) \cdot k$$

$$As := \frac{Mex0123}{0.9 \cdot (0.9 \cdot d) \cdot fy} = 5.71 \frac{cm^2}{m}$$

$$Mex0123 = 2.97 \frac{tonnef \cdot m}{m}$$

$$a \coloneqq \frac{As \cdot fy}{0.85 \cdot f'c \cdot 1 \ m} = 0.81 \ \frac{mm}{m}$$

$$Mex0123 \coloneqq \frac{Ku}{mex} \cdot \left(1 + \alpha \cdot \Delta x\right) \cdot k \qquad Mex0123 = 2.97 \quad \frac{tonnef \cdot m}{m} \qquad \text{Momento negativo último en}$$

$$As \coloneqq \frac{Mex0123}{0.9 \cdot \left(0.9 \cdot d\right) \cdot fy} = 5.71 \quad \frac{cm^2}{m} \qquad a \coloneqq \frac{As \cdot fy}{0.85 \cdot f'c \cdot 1} = 0.81 \quad \frac{mm}{m} \qquad As \coloneqq \frac{Mex0123}{0.9 \cdot \left(d - \frac{a \cdot 1}{2}\right) \cdot fy}$$

$$As = 5.16 \frac{cm^2}{m} > As_{min} = > \frac{\Phi 10@15}{}$$

$$Mey0123 := \frac{Ku}{mey} \cdot (1 + \alpha \cdot \Delta y) \cdot k$$

$$Mey0123 \coloneqq \frac{Ku}{mey} \cdot \left(1 + \alpha \cdot \Delta y\right) \cdot k \qquad Mey0123 = 2.57 \cdot \frac{tonnef \cdot m}{m} \qquad \text{Momento negativo último en}$$

$$As \coloneqq \frac{Mey0123}{0.9 \cdot \left(0.9 \cdot d\right) \cdot fy} = 4.94 \cdot \frac{cm^2}{m} \qquad a \coloneqq \frac{As \cdot fy}{0.85 \cdot f'c \cdot 1} = 0.7 \cdot \frac{mm}{m} \qquad As \coloneqq \frac{Mey0123}{0.9 \cdot \left(d - \frac{a \cdot 1}{2}\right) \cdot fy}$$

 $As = 4.46 \frac{cm^2}{m} > As_{min} => \Phi 8@11$

$$Mey0123 = 2.57 \frac{tonnef \cdot m}{}$$

$$a := \frac{As \cdot fy}{0.85 \cdot f'c \cdot 1 m} = 0.7 \frac{mm}{m}$$

$$As := \frac{Mey0123}{0.9 \cdot \left(d - \frac{a \cdot 1 \ m}{2}\right) \cdot fy}$$

$$Lx \coloneqq 8.24 \ \boldsymbol{m}$$

$$Lu := 18.54 \text{ m}$$

$$e \coloneqq 17$$
 cm

$$Ly := 18.54 \; \boldsymbol{m}$$
 $e := 17 \; \boldsymbol{cm}$ $\varepsilon := \frac{Ly}{Lx} = 2.25$

$$\varepsilon \coloneqq r.upp(\varepsilon) = 3.3$$

 $PP_{losa} := \gamma_h \cdot e = 0.43 \frac{tonnef}{m^2}$

4.- Cargas

3.- Parámetros

$$k \coloneqq 0.58 \qquad \lambda \coloneqq 35$$

$$k \cdot Lx$$

$$e_{min} := \frac{k \cdot Lx}{\lambda} + rec = 15.65 \ cm$$
 $e_{min} := r.up\left(e_{min}\right) = 16 \ cm$

$$mx \coloneqq \frac{q_u \cdot Ly^2}{17 \cdot tonnef} = 37.41$$

$$my \coloneqq 0$$
 $\Delta x \coloneqq 0$

$$mx := \frac{q_u \cdot Ly^2}{17 \cdot tonnef} = 37.41$$

$$my := 0 \quad \Delta x := 0$$

$$mex := \frac{q_u \cdot Ly^2}{12 \cdot tonnef} = 52.99$$

$$mey := \frac{q_u \cdot Ly^2}{17.5 \cdot tonnef} = 36.34$$

$$mey \coloneqq \frac{q_u \cdot Ly^2}{17.5 \cdot tonnef} = 36.34$$
 $\Delta y \coloneqq 0$

$$\begin{split} &PP_t \coloneqq PP_{losa} + PP_{adic} = 0.88 \; \frac{\textit{tonnef}}{\textit{m}^2} \\ &q_u \coloneqq 1.2 \cdot PP_t + 1.6 \; SC \qquad q_u = 1.85 \; \frac{\textit{tonnef}}{\textit{m}^2} \end{split}$$

$$mex := \frac{12 \cdot tonnef}{12 \cdot tonnef} = 52.99$$

$$AS_{min} := e \cdot 0.18\% = 3.06 \frac{cm^2}{m}$$

$$mey := \frac{q_u \cdot Ly}{17.5 \cdot tonnef} = 36.34 \qquad \Delta y := 0$$

$$Ku := q_u \cdot (Lx \cdot Ly) = 282.62 \frac{tonnef \cdot m}{m}$$

$$\alpha := \frac{SC}{2 \cdot a} = 0.14$$

$$Mx0124 := \frac{Ku}{mx} \cdot (1 + \alpha \cdot \Delta x) \cdot k$$

$$Mx0124 = 4.38 \frac{tonnef \cdot m}{m}$$

$$a := \frac{As \cdot fy}{0.85 \cdot f'c \cdot 1 \ m} = 1.19 \frac{mm}{m}$$

$$As \coloneqq \frac{Mx0124}{0.9 \cdot \left(d - \frac{a \cdot 1}{2} \frac{m}{2}\right) \cdot fy}$$

$$\Phi10@10$$

$$My0124 := \frac{Ku}{my} \cdot (1 + \alpha \cdot \Delta y) \cdot k$$

$$My0124 = ? \frac{tonnef \cdot r}{m}$$

$$As := \frac{My0124}{0.9 \cdot (0.9 \cdot d) \cdot fy} = ? \frac{cm^2}{m}$$

$$a := \frac{As \cdot fy}{0.85 \cdot f'c \cdot 1 \ m} = ? \frac{mm}{m}$$

$$My0124 := \frac{Ku}{my} \cdot \left(1 + \alpha \cdot \Delta y\right) \cdot k$$

$$As := \frac{My0124}{0.9 \cdot \left(0.9 \cdot d\right) \cdot fy} = ? \frac{cm^2}{m}$$

$$a := \frac{As \cdot fy}{0.85 \cdot f'c \cdot 1 \ m} = ? \frac{mm}{m}$$

$$As := \frac{My0124}{0.9 \cdot \left(d - \frac{a \cdot 1 \ m}{2}\right) \cdot fy}$$

$$\boxed{As} = ? \frac{cm^2}{m} \qquad \quad \text{Armadura minima} => \frac{\Phi 8@16}{m}$$

Armadura mínima =>
$$\frac{d8@16}{}$$

$$Mex0124 \coloneqq \frac{Ku}{mex} \cdot \left(1 + \alpha \cdot \Delta x\right) \cdot k \qquad \qquad Mex0124 = 3.09 \; \frac{\textit{tonnef} \cdot \textit{m}}{\textit{m}}$$

$$Mex0124 = 3.09 \frac{tonnef \cdot n}{m}$$

$$As \coloneqq \frac{Mex0124}{0.9 \cdot \left(0.9 \cdot d\right) \cdot fy} = 5.94 \frac{cm^2}{m} \qquad a \coloneqq \frac{As \cdot fy}{0.85 \cdot f'c \cdot 1 \ m} = 0.84 \frac{mm}{m} \qquad As \coloneqq \frac{Mex0124}{0.9 \cdot \left(d - \frac{a \cdot 1 \ m}{2}\right) \cdot fy}$$

$$a \coloneqq \frac{As \cdot fy}{0.85 \cdot f'c \cdot 1 \ m} = 0.84 \ \frac{mm}{m}$$

$$As := \frac{Mex0124}{0.9 \cdot \left(d - \frac{a \cdot 1}{2} \frac{m}{2}\right) \cdot fy}$$

$$\Phi 10@14$$

$$Mey0124 := \frac{Ku}{\text{Mey0124}} \cdot (1 + \alpha \cdot \Delta y) \cdot k$$

$$Mey0124 = 4.51 \frac{tonnef \cdot m}{m}$$

$$Mey0124 \coloneqq \frac{Ku}{mey} \cdot \left(1 + \alpha \cdot \Delta y\right) \cdot k \qquad Mey0124 = 4.51 \quad \frac{tonnef \cdot m}{m} \qquad \text{Momento negativo último en}$$

$$As \coloneqq \frac{Mey0124}{0.9 \cdot \left(0.9 \cdot d\right) \cdot fy} = 8.67 \quad \frac{cm^2}{m} \qquad a \coloneqq \frac{As \cdot fy}{0.85 \cdot f'c \cdot 1} = 1.22 \quad \frac{mm}{m} \qquad As \coloneqq \frac{Mey0124}{0.9 \cdot \left(d - \frac{a \cdot 1}{2}\right) \cdot fy}$$

$$a := \frac{As \cdot fy}{0.85 \cdot f'c \cdot 1 \ m} = 1.22 \frac{mm}{m}$$

$$As := \frac{Mey0124}{0.9 \cdot \left(d - \frac{a \cdot 1 \ m}{2}\right) \cdot fy}$$

$$As = 7.83 \frac{cm^2}{m} > As_{min} \Rightarrow \Phi = \Phi = \Phi = \Phi$$

$$\Phi 8@11$$

$$Lx = 5 \, \mathbf{m}$$

$$Ly := 8.24 \ m$$

$$e \coloneqq 17$$
 cm

$$e \coloneqq 17 \ cm$$
 $\varepsilon \coloneqq \frac{Ly}{Lx} = 1.648$

$$\varepsilon \coloneqq r.upp(\varepsilon) = 1.7$$

3.- Parámetros

$$\begin{aligned} & \boldsymbol{k} \coloneqq 0.58 & \lambda \coloneqq 35 \\ & e_{min} \coloneqq \frac{\boldsymbol{k} \cdot Lx}{\lambda} + rec = 10.29 \ \boldsymbol{cm} & e_{min} \coloneqq r.up \left(e_{min}\right) = 11 \ \boldsymbol{cm} \end{aligned}$$

$$e_{min} \coloneqq r.up\left(e_{min}\right) = 11$$
 cm

$$mx := 46.1$$
 $my := 163$ $\Delta x := 1.39$ $mex := 20.5$ $mey := 27.9$ $\Delta y := 1.39$

$$my = 163$$
 $mey = 27$

$$\Delta x \coloneqq 1.39$$

$$\Delta u \coloneqq 1.39$$

$$AS_{min} \coloneqq e \cdot 0.18\% = 3.06 \frac{cm^2}{m}$$

Armadura mínima => $\Phi 8@16$

4.- Cargas

$$PP_{losa} := \gamma_h \cdot e = 0.43 \frac{tonnef}{m^2}$$

$$PP_t \coloneqq PP_{losa} + PP_{adic} = 0.88 \frac{\textbf{tonnef}}{\textbf{m}^2}$$

$$q_u \coloneqq 1.2 \cdot PP_t + 1.6 \ SC$$

$$q_u \coloneqq 1.2 \cdot PP_t + 1.6 \ SC$$
 $q_u = 1.85 \ \frac{\textbf{tonnef}}{\textbf{m}^2}$

$$Ku := q_u \cdot (Lx \cdot Ly) = 76.22 \frac{\textbf{tonnef} \cdot \textbf{m}}{\textbf{m}}$$

$$\alpha \coloneqq \frac{SC}{2 \cdot q_u} = 0.14$$

$$Mx0125 \coloneqq \frac{Ku}{mx} \cdot (1 + \alpha \cdot \Delta x) \cdot k$$

$$a := \frac{As \cdot fy}{} = 0.31 \frac{mm}{}$$

$$Mx0125 \coloneqq \frac{Ku}{mx} \cdot \left(1 + \alpha \cdot \Delta x\right) \cdot k \qquad Mx0125 = 1.14 \frac{tonnef \cdot m}{m} \qquad \text{Momento positivo último en la section of the property of the p$$

$$a \coloneqq \frac{As \cdot fy}{0.85 \cdot f'c \cdot 1 \ m} = 0.31 \ \frac{mm}{m}$$

$$As := \frac{Mx0125}{0.9 \cdot \left(d - \frac{a \cdot 1 \ m}{2}\right) \cdot fy}$$

$$As = 1.97 \frac{cm^2}{m}$$
 < As_{min} => Armadura mínima => $\Phi 8@16$

Armadura mínima =>
$$\Phi 8@16$$

$$My0125 \coloneqq \frac{Ku}{my} \cdot (1 + \alpha \cdot \Delta y) \cdot k$$

$$My0125 = 0.32 \frac{tonnef \cdot m}{m}$$

$$My0125 := \frac{Ku}{my} \cdot \left(1 + \alpha \cdot \Delta y\right) \cdot k \qquad My0125 = 0.32 \frac{tonnef \cdot m}{m} \qquad \text{Momento positivo último en la solution of the solution}$$

$$As := \frac{My0125}{0.9 \cdot \left(0.9 \cdot d\right) \cdot fy} = 0.62 \frac{cm^2}{m} \qquad a := \frac{As \cdot fy}{0.85 \cdot f'c \cdot 1 \ m} = 0.09 \frac{mm}{m} \qquad As := \frac{My0125}{0.9 \cdot \left(d - \frac{a \cdot 1 \ m}{2}\right) \cdot fy}$$

$$a := \frac{As \cdot fy}{0.85 \cdot f' \cdot 1.1m} = 0.09 \frac{mm}{m}$$

$$As := \frac{My0125}{0.9 \cdot \left(d - \frac{a \cdot 1 \ m}{2}\right) \cdot fy}$$

$$As = 0.56 \frac{cm^2}{m}$$
 < As_{min} => Armadura mínima => $\frac{\Phi 8@16}{m}$

$$Mex0125 \coloneqq \frac{Ku}{mex} \cdot \left(1 + \alpha \cdot \Delta x\right) \cdot k \qquad \qquad Mex0125 = 2.56 \frac{\textit{tonnef} \cdot \textit{m}}{\textit{m}}$$

$$Mex0125 = 2.56 \frac{tonnef \cdot m}{m}$$

$$As \coloneqq \frac{Mex0125 \coloneqq \frac{1}{mex} \cdot (1 + \alpha \cdot \Delta x) \cdot k}{0.9 \cdot (0.9 \cdot d) \cdot fy} = 4.92 \frac{cm^2}{m}$$

$$As \coloneqq \frac{As \cdot fy}{0.85 \cdot f'c \cdot 1 \ m} = 0.69 \frac{mm}{m}$$

$$As \coloneqq \frac{Mex0125}{0.9 \cdot \left(d - \frac{a \cdot 1}{2}\right) \cdot fy}$$

$$As \coloneqq \frac{Mex0125}{0.9 \cdot \left(d - \frac{a \cdot 1}{2}\right) \cdot fy}$$

$$a \coloneqq \frac{As \cdot fy}{0.85 \cdot f'c \cdot 1 \ m} = 0.69 \ \frac{mm}{m}$$

$$As := \frac{Mex0125}{0.9 \cdot \left(d - \frac{a \cdot 1 \ m}{2}\right) \cdot fy}$$

$$As = 4.44 \frac{cm^2}{m} > As_{min} \Rightarrow \Phi = \Phi = \Phi = \Phi$$

$$Mey0125 \coloneqq \frac{Ku}{mey} \cdot \left(1 + \alpha \cdot \Delta y\right) \cdot k \qquad Mey0125 = 1.88 \frac{tonnef \cdot m}{m} \qquad \text{Momento negativo último en}$$

$$As \coloneqq \frac{Mey0125}{0.9 \cdot \left(0.9 \cdot d\right) \cdot fy} = 3.62 \frac{cm^2}{m} \qquad a \coloneqq \frac{As \cdot fy}{0.85 \cdot f'c \cdot 1} = 0.51 \frac{mm}{m} \qquad As \coloneqq \frac{Mey0125}{0.9 \cdot \left(d - \frac{a \cdot 1}{2}\right) \cdot fy}$$

$$As := \frac{Mey0125}{0.9 \cdot (0.9 \cdot d) \cdot fy} = 3.62 \frac{cm^2}{m}$$

$$a \coloneqq \frac{As \cdot fy}{0.85 \cdot f'c \cdot 1 \ m} = 0.51 \ \frac{mm}{m}$$

$$As := \frac{Mey0125}{0.9 \cdot \left(d - \frac{a \cdot 1 \ m}{2}\right) \cdot fy}$$

$$As = 3.26 \frac{cm^2}{m} > As_{min} = > \frac{\Phi 8@15}{}$$

$$Lx \coloneqq 5.52 \ \boldsymbol{m}$$

$$Ly := 8.24 \ m$$

$$e \coloneqq 17$$
 cm

$$e \coloneqq 17 \text{ cm}$$
 $\varepsilon \coloneqq \frac{Ly}{Lx} = 1.493$

$$\varepsilon \coloneqq r.upp(\varepsilon) = 1.5$$

3.- Parámetros

$$k \coloneqq 0.58$$
 $\lambda \coloneqq 35$ $e_{min} \coloneqq \frac{k \cdot Lx}{\lambda} + rec = 11.15 \text{ cm}$ $e_{min} \coloneqq r.up\left(e_{min}\right) = 12 \text{ cm}$

$$e_{min} \coloneqq r.up\left(e_{min}\right) = 12$$
 cm

$$mx := 44.4$$
 $my := 140.5$ $\Delta x := 1.31$ $mex := 19.8$ $mey := 26.2$ $\Delta y := 1.31$

$$my = 140.5$$

$$\Delta x \coloneqq 1.33$$

$$\Delta u \coloneqq 1.33$$

$$AS_{min} \coloneqq e \cdot 0.18\% = 3.06 \frac{cm^2}{m}$$

Armadura mínima => $\Phi 8@16$

4.- Cargas

$$PP_{losa} := \gamma_h \cdot e = 0.43 \frac{tonnef}{m^2}$$

$$PP_t \coloneqq PP_{losa} + PP_{adic} = 0.88 \frac{tonnef}{m^2}$$

$$q_u \coloneqq 1.2 \cdot PP_t + 1.6 \ SC$$

$$q_u \coloneqq 1.2 \cdot PP_t + 1.6 \ SC \qquad q_u = 1.85 \ \frac{\textit{tonnef}}{\textit{m}^2}$$

$$Ku \coloneqq q_u \boldsymbol{\cdot} \left(Lx \boldsymbol{\cdot} Ly \right) = 84.15 \ \frac{\boldsymbol{tonnef \cdot m}}{\boldsymbol{m}}$$

$$\alpha \coloneqq \frac{SC}{2 \cdot q_u} = 0.14$$

$$Mx0126 := \frac{Ku}{mx} \cdot (1 + \alpha \cdot \Delta x) \cdot k$$

$$Mx0126 = 1.29 \frac{totnef \cdot m}{m}$$

$$Mx0126 \coloneqq \frac{Ku}{mx} \cdot \left(1 + \alpha \cdot \Delta x\right) \cdot k \qquad Mx0126 = 1.29 \frac{tonnef \cdot m}{m} \qquad \text{Momento positivo último en la secondarian of the secondarian of th$$

$$a \coloneqq \frac{As \cdot fy}{0.85 \cdot f'c \cdot 1 \ m} = 0.35 \ \frac{mm}{m}$$

$$As := \frac{Mx0126}{0.9 \cdot \left(d - \frac{a \cdot 1 \ m}{2}\right) \cdot fy}$$

$$As = 2.24 \frac{cm^2}{m}$$
 < As_{min} => Armadura mínima => $\Phi 8@16$

Armadura mínima =>
$$\Phi 8@16$$

$$My0126 \coloneqq \frac{Ku}{my} \cdot \left(1 + \alpha \cdot \Delta y\right) \cdot k$$

$$My0126 = 0.41 \frac{tonnef \cdot m}{m}$$

$$My0126 := \frac{Ku}{my} \cdot \left(1 + \alpha \cdot \Delta y\right) \cdot k \qquad My0126 = 0.41 \frac{tonnef \cdot m}{m} \qquad \text{Momento positivo último en la final positivo último en la fin$$

$$a \coloneqq \frac{As \cdot fy}{0.85 \cdot f'c \cdot 1 \ m} = 0.11 \ \frac{mm}{m}$$

$$4s := \frac{My0126}{0.9 \cdot \left(d - \frac{a \cdot 1 \ \mathbf{m}}{2}\right) \cdot fy}$$

$$As = 0.71 \frac{cm^2}{m}$$
 < As_{min} => Armadura mínima => $\Phi 8@16$

$$Mex0126 := \frac{Ku}{mex} \cdot (1 + \alpha \cdot \Delta x) \cdot k$$

$$Mex0126 = 2.9 \frac{tonnef \cdot m}{}$$

$$a \coloneqq \frac{As \cdot fy}{0.85 \cdot f'c \cdot 1 \ m} = 0.79 \ \frac{mm}{m}$$

$$As := \frac{Mex0126}{0.9 \cdot \left(d - \frac{a \cdot 1 \ m}{2}\right) \cdot fy}$$

$$\Phi 8@10$$

$$Mey0126 \coloneqq \frac{Ku}{mey} \cdot \left(1 + \alpha \cdot \Delta y\right) \cdot k$$

$$Mey0126 = 2.19 \frac{tonnef \cdot m}{m}$$

$$Mey0126 \coloneqq \frac{Ku}{mey} \cdot \left(1 + \alpha \cdot \Delta y\right) \cdot k \qquad Mey0126 = 2.19 \frac{tonnef \cdot m}{m} \qquad \text{Momento negativo último en}$$

$$As \coloneqq \frac{Mey0126}{0.9 \cdot \left(0.9 \cdot d\right) \cdot fy} = 4.21 \frac{cm^2}{m} \qquad a \coloneqq \frac{As \cdot fy}{0.85 \cdot f'c \cdot 1} = 0.59 \frac{mm}{m} \qquad As \coloneqq \frac{Mey0126}{0.9 \cdot \left(d - \frac{a \cdot 1}{2}\right) \cdot fy}$$

$$a \coloneqq \frac{As \cdot fy}{0.85 \cdot f'c \cdot 1 \ m} = 0.59 \ \frac{mm}{m}$$

$$As := \frac{Mey0126}{0.9 \cdot \left(d - \frac{a \cdot 1 \ m}{2}\right) \cdot fy}$$

$$Lx := 7.09 \ m$$

$$Ly = 10.15 \ m$$

$$e \coloneqq 17 \ cm$$

$$e \coloneqq 17 \text{ cm}$$
 $\varepsilon \coloneqq \frac{Ly}{Lx} = 1.432$

$$\varepsilon \coloneqq r.upp(\varepsilon) = 1.5$$

3.- Parámetros

$$\begin{aligned} & \boldsymbol{k} \coloneqq 0.58 & \lambda \coloneqq 35 \\ & e_{min} \coloneqq \frac{\boldsymbol{k} \cdot Lx}{\lambda} + rec = 13.75 \ \boldsymbol{cm} & e_{min} \coloneqq r.up \left(e_{min}\right) = 14 \ \boldsymbol{cm} \end{aligned}$$

$$cm$$
 $e_{min} \coloneqq r.up\left(e_{min}\right) = 14$ cm

$$mx := 44.4$$
 $my := 140.5$ $\Delta x := 1.31$ $mex := 19.8$ $mey := 26.2$ $\Delta y := 1.31$

$$my := 140.5$$

 $mey := 26.2$

$$\Delta x = 1.31$$
 $\Delta u = 1.31$

$$AS_{min} \coloneqq e \cdot 0.18\% = 3.06 \frac{cm^2}{m}$$

Armadura mínima => $\Phi 8@16$

4.- Cargas

$$PP_{losa} := \gamma_h \cdot e = 0.43 \frac{tonnef}{m^2}$$

$$PP_t = PP_{losa} + PP_{adic} = 0.88 \frac{tonnef}{m^2}$$

$$q_u \coloneqq 1.2 \cdot PP_t + 1.6 \ SC$$

$$q_u \coloneqq 1.2 \cdot PP_t + 1.6 \ SC$$
 $q_u = 1.85 \ \frac{\textbf{tonnef}}{\textbf{m}^2}$

$$Ku := q_u \cdot (Lx \cdot Ly) = 133.13 \frac{\textbf{tonnef} \cdot \textbf{m}}{\textbf{m}}$$

$$\alpha \coloneqq \frac{SC}{2 \cdot q_u} = 0.14$$

5.- Momento últimos

$$Mx0127 := \frac{Ku}{mx} \cdot (1 + \alpha \cdot \Delta x) \cdot k$$

$$Mx0127 \coloneqq \frac{Ku}{mx} \cdot \left(1 + \alpha \cdot \Delta x\right) \cdot k \qquad Mx0127 = 2.05 \frac{tonnef \cdot m}{m} \qquad \text{Momento positivo último en la section of the s$$

$$Mx0127 = 2.05 \frac{tonnef \cdot m}{m}$$

$$a \coloneqq \frac{As \cdot fy}{0.85 \cdot f'c \cdot 1 \ m} = 0.56 \ \frac{mm}{m}$$

$$As := \frac{Mx0127}{0.9 \cdot \left(d - \frac{a \cdot 1 \ m}{2}\right) \cdot f_3}$$

$$As = 3.55 \frac{cm^2}{m} > As_{min} \Rightarrow \Phi = \Phi = \Phi = \Phi$$

$$My0127 \coloneqq \frac{Ku}{my} \cdot (1 + \alpha \cdot \Delta y) \cdot k$$

$$My0127 \qquad cm$$

$$My0127 := \frac{Ku}{my} \cdot \left(1 + \alpha \cdot \Delta y\right) \cdot k \qquad My0127 = 0.65 \frac{tonnef \cdot m}{m} \qquad \text{Momento positivo último en la solution}$$

$$As := \frac{My0127}{0.9 \cdot \left(0.9 \cdot d\right) \cdot fy} = 1.24 \frac{cm^2}{m} \qquad a := \frac{As \cdot fy}{0.85 \cdot f'c \cdot 1 \ m} = 0.18 \frac{mm}{m} \qquad As := \frac{My0127}{0.9 \cdot \left(d - \frac{a \cdot 1 \ m}{2}\right) \cdot fy}$$

$$My0127 = 0.65 \frac{tonnef \cdot m}{m}$$

$$a \coloneqq \frac{As \cdot fy}{0.85 \cdot f'c \cdot 1 \ m} = 0.18 \ \frac{mm}{m}$$

$$As := \frac{My0127}{0.9 \cdot \left(d - \frac{a \cdot 1 \ m}{2}\right) \cdot fy}$$

$$As = 1.12 \frac{cm^2}{m} < As_{min} => Armadura mínima => \frac{\Phi 8@16}{m}$$

$$Mex0127 := \frac{Ku}{mex} \cdot (1 + \alpha \cdot \Delta x) \cdot k$$

$$\begin{aligned} Mex 0127 &\coloneqq \frac{Ku}{mex} \cdot \left(1 + \alpha \cdot \Delta x\right) \cdot k & \qquad Mex 0127 &= 4.59 \ \frac{tonnef \cdot m}{m} & \qquad \text{Momento negativo último en} \\ As &\coloneqq \frac{Mex 0127}{0.9 \cdot \left(0.9 \cdot d\right) \cdot fy} &= 8.82 \ \frac{cm^2}{m} & \qquad a &\coloneqq \frac{As \cdot fy}{0.85 \cdot f'c \cdot 1} = 1.25 \ \frac{mm}{m} & \qquad As &\coloneqq \frac{Mex 0127}{0.9 \cdot \left(d - \frac{a \cdot 1}{2}\right) \cdot fy} \end{aligned}$$

$$Mex0127 = 4.59 \frac{tonnef \cdot m}{m}$$

$$a \coloneqq \frac{As \cdot fy}{0.85 \cdot f'c \cdot 1 \ m} = 1.25 \ \frac{mm}{m}$$

$$As := \frac{Mex0127}{0.9 \cdot \left(d - \frac{a \cdot 1 \ m}{2}\right) \cdot fy}$$

$$As = 7.97 \frac{cm^2}{m} > As_{min} = > \frac{\Phi 12@14}{}$$

 $As = 6.02 \frac{cm^2}{m} > As_{min} = > \frac{\Phi 10@13}{}$

$$Mey0127 := \frac{Ku}{mey} \cdot \left(1 + \alpha \cdot \Delta y\right) \cdot k \qquad Mey0127 = 3.47 \frac{tonnef \cdot m}{m} \qquad \text{Momento negativo último en}$$

$$As := \frac{Mey0127}{0.9 \cdot \left(0.9 \cdot d\right) \cdot fy} = 6.67 \frac{cm^2}{m} \qquad a := \frac{As \cdot fy}{0.85 \cdot f'c \cdot 1 \ m} = 0.94 \frac{mm}{m} \qquad As := \frac{Mey0127}{0.9 \cdot \left(d - \frac{a \cdot 1 \ m}{2}\right) \cdot fy}$$

$$As := \frac{Mey0127}{0.9 \cdot (0.9 \cdot d) \cdot fy} = 6.67 \frac{cm^2}{m}$$

$$a := \frac{As \cdot fy}{0.85 \cdot f'a \cdot 1 \cdot m} = 0.94 \cdot \frac{mn}{m}$$

$$As := \frac{Mey0127}{0.9 \cdot \left(d - \frac{a \cdot 1 \ m}{2}\right) \cdot fy}$$

$$Lx = 3.06 \ \boldsymbol{m}$$

$$Lu = 10.15 \, n$$

$$e \coloneqq 17$$
 cm

$$Ly \coloneqq 10.15 \ \mathbf{m}$$
 $e \coloneqq 17 \ \mathbf{cm}$ $\varepsilon \coloneqq \frac{Ly}{Lx} = 3.317$

$$\varepsilon \coloneqq r.upp(\varepsilon) = 5.4$$

3.- Parámetros

$$\begin{array}{ll} \pmb{k \coloneqq 0.58} & \lambda \coloneqq 35 \\ e_{min} \coloneqq \frac{\pmb{k \cdot Lx}}{\lambda} + rec = 7.07 \ \textit{cm} & e_{min} \coloneqq r.up \ (e_{min}) = 8 \ \textit{cm} \end{array}$$

$$e_{min} \coloneqq r.up\left(e_{min}\right) = 8$$
 cm

$$mx \coloneqq \frac{q_u \cdot Ly^2}{17 \cdot tonnef} = 11.21$$

$$my \coloneqq 0 \quad \Delta x \coloneqq 0$$

$$mex \coloneqq \frac{q_u \cdot Ly^2}{12 \cdot tonnef} = 15.88$$

$$mey \coloneqq \frac{q_u \cdot Ly^2}{17.5 \cdot tonnef} = 10.89$$

$$my \coloneqq 0$$
 $\Delta x \coloneqq 0$

$$mex \coloneqq \frac{q_u \cdot Ly^2}{12 \cdot tonnef} = 15.88$$

$$mey \coloneqq \frac{q_u \cdot Ly^2}{17.5 \cdot tonnef} = 10.89$$

$$\Delta y := 0$$
 $AS_{min} := e \cdot 0.18\% = 3.06 \frac{cm^2}{m}$

Armadura mínima => $\Phi 8@16$

4.- Cargas

$$PP_{losa} := \gamma_h \cdot e = 0.43 \frac{tonnef}{m^2}$$

$$PP_t \coloneqq PP_{losa} + PP_{adic} = 0.88 \ \frac{\textbf{tonnef}}{\textbf{m}^2}$$

$$q_u \coloneqq 1.2 \cdot PP_t + 1.6 \ SC$$

$$q_u \coloneqq 1.2 \cdot PP_t + 1.6 \ SC$$
 $q_u = 1.85 \ \frac{\textbf{tonnef}}{\textbf{m}^2}$

$$Ku := q_u \cdot (Lx \cdot Ly) = 57.46 \frac{\textbf{tonnef} \cdot \textbf{m}}{\textbf{m}}$$

$$\alpha \coloneqq \frac{SC}{2 \cdot q_u} = 0.14$$

$$Mx0128 := \frac{Ku}{mx} \cdot (1 + \alpha \cdot \Delta x) \cdot k$$

$$71 \frac{cm^2}{}$$

$$Mx0128 = 2.97 \frac{\textbf{tonnef} \cdot \textbf{m}}{}$$

$$a \coloneqq \frac{As \cdot fy}{0.85 \cdot f'c \cdot 1 \ m} = 0.81 \ \frac{mm}{m}$$

$$As := \frac{Mx0128}{0.9 \cdot \left(d - \frac{a \cdot 1 \ m}{2}\right) \cdot fy}$$

$$\Phi 10@15$$

$$My0128 := \frac{Ku}{my} \cdot (1 + \alpha \cdot \Delta y) \cdot k$$

$$My0128 \coloneqq \frac{Ku}{my} \cdot \left(1 + \alpha \cdot \Delta y\right) \cdot k \qquad \underbrace{My0128} = ? \frac{tonnef \cdot m}{m} \qquad \text{Momento positivo último en lado largo}$$

$$As \coloneqq \frac{My0128}{0.9 \cdot \left(0.9 \cdot d\right) \cdot fy} = ? \frac{cm^2}{m} \qquad a \coloneqq \frac{As \cdot fy}{0.85 \cdot f'c \cdot 1 \ m} = ? \frac{mm}{m} \qquad As \coloneqq \frac{My0128}{0.9 \cdot \left(d - \frac{a \cdot 1 \ m}{2}\right) \cdot fy}$$

$$As := \frac{\boxed{My0128}}{0.9 \cdot (0.9 \cdot d) \cdot fy} = ? \frac{cm^2}{m}$$

$$a := \frac{\mathbf{As} \cdot fy}{0.85 \cdot f'c \cdot 1 \ \mathbf{m}} = ? \ \frac{\mathbf{mm}}{\mathbf{m}}$$

$$As := \frac{My0128}{0.9 \cdot \left(d - \frac{a \cdot 1 \ m}{2}\right) \cdot fy}$$

$$\boxed{As} = ? \frac{cm^2}{m} \qquad \quad \text{Armadura minima} => \frac{\Phi 8@16}{m}$$

$$<$$
 As_{min} =>

$$Mex0128 := \frac{Ku}{mex} \cdot (1 + \alpha \cdot \Delta x) \cdot k \qquad Mex0128 = 2.1 \frac{tonnef \cdot m}{m}$$

$$Mex0128 = 2.1 \frac{tonnef \cdot n}{m}$$

$$As := \frac{Mex0128}{0.9 \cdot (0.9 \cdot d) \cdot fy} = 4.03 \frac{cm^2}{m} \qquad a := \frac{As \cdot fy}{0.85 \cdot f'c \cdot 1 \ m} = 0.57 \frac{mm}{m} \qquad As := \frac{Mex0128}{0.9 \cdot \left(d - \frac{a \cdot 1 \ m}{2}\right) \cdot fy}$$

$$a := \frac{As \cdot fy}{0.85 \cdot f' \cdot a \cdot 1 \cdot m} = 0.57 \cdot \frac{mm}{m}$$

$$As := \frac{Mex0128}{0.9 \cdot \left(d - \frac{a \cdot 1}{2} \frac{m}{2}\right) \cdot fy}$$

$$As = 3.64 \frac{cm^2}{m} > As_{min} \Rightarrow \qquad \Phi = 8013$$

$$Mey0128 := \frac{Ku}{mey} \cdot (1 + \alpha \cdot \Delta y) \cdot k$$

$$Mey0128 = 3.06 \frac{tonnef \cdot m}{m}$$

$$Mey0128 \coloneqq \frac{Ku}{mey} \cdot \left(1 + \alpha \cdot \Delta y\right) \cdot k \qquad Mey0128 = 3.06 \frac{tonnef \cdot m}{m} \qquad \text{Momento negativo último en}$$

$$As \coloneqq \frac{Mey0128}{0.9 \cdot \left(0.9 \cdot d\right) \cdot fy} = 5.88 \frac{cm^2}{m} \qquad a \coloneqq \frac{As \cdot fy}{0.85 \cdot f'c \cdot 1} = 0.83 \frac{mm}{m} \qquad As \coloneqq \frac{Mey0128}{0.9 \cdot \left(d - \frac{a \cdot 1}{2}\right) \cdot fy}$$

$$a \coloneqq \frac{As \cdot fy}{0.85 \cdot f'c \cdot 1 \ m} = 0.83 \ \frac{mm}{m}$$

$$As := \frac{Mey0128}{0.9 \cdot \left(d - \frac{a \cdot 1 \ m}{2}\right) \cdot fy}$$

$$\Phi 10@14$$

$$Lx \coloneqq 2.32 \ \boldsymbol{m}$$

$$Ly \coloneqq 4.3 \ \boldsymbol{m}$$

$$e \coloneqq 17$$
 cm

$$e \coloneqq 17 \text{ cm}$$
 $\varepsilon \coloneqq \frac{Ly}{Lx} = 1.853$

$$\varepsilon \coloneqq r.upp(\varepsilon) = 1.9$$

3.- Parámetros

$$\begin{aligned} & \boldsymbol{k} \coloneqq 0.58 & \lambda \coloneqq 35 \\ & e_{min} \coloneqq \frac{\boldsymbol{k} \cdot Lx}{\lambda} + rec = 5.84 \ \boldsymbol{cm} & e_{min} \coloneqq r.up \ (e_{min}) = 6 \ \boldsymbol{cm} \end{aligned}$$

$$e_{min} \coloneqq r.up\left(e_{min}\right) = 6$$
 cm

$$mx \coloneqq 48.8$$
$$mex \coloneqq 22$$

$$my \coloneqq 190$$

$$mey \coloneqq 31.4$$

$$\Delta x = 1.39$$

$$\Delta u = 1.39$$

$$mx := 48.8$$
 $my := 190$ $\Delta x := 1.39$ $mex := 22$ $mey := 31.4$ $\Delta y := 1.39$ $AS_{min} := e \cdot 0.18\% = 3.06 \frac{cm^2}{m}$

Armadura mínima => $\Phi 8@16$

4.- Cargas

$$PP_{losa} := \gamma_h \cdot e = 0.43 \frac{tonnef}{m^2}$$

$$PP_t \coloneqq PP_{losa} + PP_{adic} = 0.88 \frac{\textbf{tonnef}}{\textbf{m}^2}$$

$$q_u \coloneqq 1.2 \cdot PP_t + 1.6 \ SC$$

$$q_u \coloneqq 1.2 \cdot PP_t + 1.6 \ SC \qquad q_u = 1.85 \ \frac{\textit{tonnef}}{\textit{m}^2}$$

$$Ku \coloneqq q_u \boldsymbol{\cdot} \left(Lx \boldsymbol{\cdot} Ly \right) = 18.46 \ \frac{\boldsymbol{tonnef \cdot m}}{\boldsymbol{m}}$$

$$\alpha \coloneqq \frac{SC}{2 \cdot q_u} = 0.14$$

5.- Momento últimos

$$Mx0129 \coloneqq \frac{Ku}{mx} \cdot (1 + \alpha \cdot \Delta x) \cdot k$$

$$Mx0129 = 0.26 \frac{tonnef \cdot m}{m}$$

Momento positivo último en lado corto

$$As := \frac{Mx0129}{0.9 \cdot (0.9 \cdot d) \cdot fy} = 0.5 \frac{cm^2}{m}$$

$$a \coloneqq \frac{As \cdot fy}{0.85 \cdot f'c \cdot 1 \ m} = 0.07 \ \frac{mm}{m}$$

$$As = 0.45 \frac{cm^2}{m}$$
 < As_{min} => Armadura mínima => $\Phi 8@16$

$$My0129 \coloneqq \frac{Ku}{my} \cdot \left(1 + \alpha \cdot \Delta y\right) \cdot k$$

$$My0129 = 0.07 \frac{tonnef \cdot m}{m}$$

$$My0129 := \frac{Ku}{my} \cdot \left(1 + \alpha \cdot \Delta y\right) \cdot k \qquad My0129 = 0.07 \frac{tonnef \cdot m}{m} \qquad \text{Momento positivo último en la substitution of the substitution of$$

$$a := \frac{As \cdot fy}{0.85 \cdot f'c \cdot 1 \ m} = 0.18 \ \frac{mm}{m}$$

$$As := \frac{My0129}{0.9 \cdot \left(d - \frac{a \cdot 1 \ m}{2}\right) \cdot fy}$$

$$As = 0.12 \frac{cm^2}{m} < As_{min} => Armadura mínima => \frac{\Phi 8@16}{m}$$

$$Mex0129 := \frac{Ku}{mex} \cdot (1 + \alpha \cdot \Delta x) \cdot k$$

$$Mex0129 = 0.58 \frac{tonnef \cdot m}{m}$$

$$As := \frac{Mex0129}{0.9 \cdot (0.9 \cdot d) \cdot fy} = 1.11 \frac{cm^2}{m}$$

$$a := \frac{As \cdot fy}{0.85 \cdot f'c \cdot 1 \ m} = 0.16 \ \frac{mm}{m}$$

$$Mex0129 \coloneqq \frac{Ku}{mex} \cdot \left(1 + \alpha \cdot \Delta x\right) \cdot k \qquad Mex0129 = 0.58 \cdot \frac{tonnef \cdot m}{m} \qquad \text{Momento negativo último en}$$

$$As \coloneqq \frac{Mex0129}{0.9 \cdot \left(0.9 \cdot d\right) \cdot fy} = 1.11 \cdot \frac{cm^2}{m} \qquad a \coloneqq \frac{As \cdot fy}{0.85 \cdot f'c \cdot 1} = 0.16 \cdot \frac{mm}{m} \qquad As \coloneqq \frac{Mex0129}{0.9 \cdot \left(d - \frac{a \cdot 1}{2}\right) \cdot fy}$$

$$As = 1 \frac{cm^2}{m}$$

 $As = 1 \frac{cm^2}{m}$ < As_{min} => Armadura mínima => $\Phi 8@16$

$$Mey0129 \coloneqq \frac{Ku}{mey} \cdot (1 + \alpha \cdot \Delta y) \cdot k$$

$$Mey0129 = 0.4 \frac{tonnef \cdot m}{}$$

$$As := \frac{Mey0129}{0.9 \cdot (0.9 \cdot d) \cdot fy} = 0.78 \frac{cm^2}{m}$$

$$a \coloneqq \frac{As \cdot fy}{0.85 \cdot f'c \cdot 1 \ m} = 0.11 \ \frac{mm}{m}$$

$$Mey0129 \coloneqq \frac{Ku}{mey} \cdot \left(1 + \alpha \cdot \Delta y\right) \cdot k \qquad Mey0129 = 0.4 \quad \frac{tonnef \cdot m}{m} \qquad \text{Momento negativo último en}$$

$$As \coloneqq \frac{Mey0129}{0.9 \cdot \left(0.9 \cdot d\right) \cdot fy} = 0.78 \quad \frac{cm^2}{m} \qquad a \coloneqq \frac{As \cdot fy}{0.85 \cdot f'c \cdot 1} = 0.11 \quad \frac{mm}{m} \qquad As \coloneqq \frac{Mey0129}{0.9 \cdot \left(d - \frac{a \cdot 1}{2}\right) \cdot fy}$$

$$As = 0.7 \frac{cm^2}{m}$$

 $As = 0.7 \frac{cm^2}{m}$ < As_{min} => Armadura mínima => $\Phi 8@16$