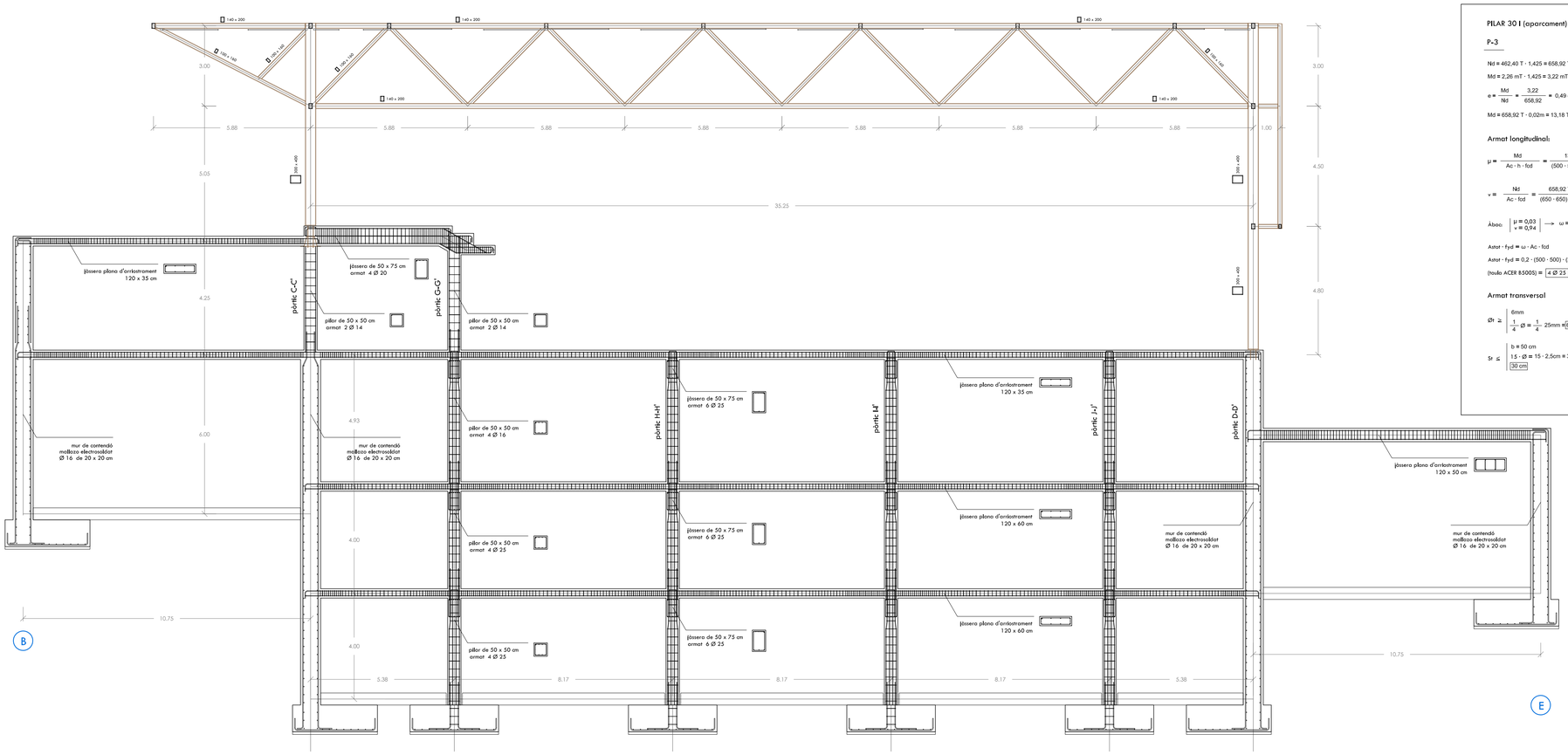


PILAR 30 I (aparcament)

P-3

Nd = 462,40 T · 1,425 = 658,92 T

Md = 2,26 mT · 1,425 = 3,22 mT

$e = \frac{Md}{Nd} = \frac{3,22}{658,92} = 0,49\ cm < 2cm$

Md = 658,92 T · 0,02m = 13,18 Tm

Armat longitudinal:

$\mu = \frac{Md}{Ac \cdot h \cdot fcd} = \frac{13,18\ mT \cdot 10^7}{(500 \cdot 500) \cdot 500 \cdot (25/1,5)} = 0,06$

$\nu = \frac{Nd}{Ac \cdot fcd} = \frac{658,92\ T \cdot 10^7}{(650 \cdot 650) \cdot (25/1,5)} = 0,94$

Àbac $\left| \begin{array}{l} \mu = 0,03 \\ \nu = 0,94 \end{array} \right. \longrightarrow \omega = 0,2$

Astot · fyd = ω · Ac · fcd

Astot · fyd = 0,2 · (500 · 500) · (25/1,5) = 833 KN

(taula ACER B500S) = $\boxed{4\ Ø\ 25}$ (833,70 KN)

Armat transversal

$Ø_t \geq \left| \begin{array}{l} 6mm \\ \frac{1}{4} \cdot Ø = \frac{1}{4} \cdot 25mm = \boxed{6,25mm} \end{array} \right.$

$S_t \leq \left| \begin{array}{l} b = 50\ cm \\ 15 \cdot Ø = 15 \cdot 2,5cm = 37,5cm \\ \boxed{30\ cm} \end{array} \right.$

P-2

Nd = 294,61 T · 1,425 = 419,82 T

Md = 2,26 mT · 1,425 = 3,22 mT

$e = \frac{Md}{Nd} = \frac{3,22}{419,82} = 0,76\ cm < 2cm$

Md = 419,82 T · 0,02m = 8,40 Tm

Armat longitudinal

$\mu = \frac{Md}{Ac \cdot h \cdot fcd} = \frac{8'40\ mT \cdot 10^7}{(500 \cdot 500) \cdot 500 \cdot (25/1,5)} = 0,04$

$\nu = \frac{Nd}{Ac \cdot fcd} = \frac{419,82\ T \cdot 10^7}{(500 \cdot 500) \cdot (25/1,5)} = 1,01$

Àbac $\left| \begin{array}{l} \mu = 0,04 \\ \nu = 1,02 \end{array} \right. \longrightarrow \omega = 0,2$

Astot · fyd = ω · Ac · fcd

Astot · fyd = 0,2 · (500 · 500) · (25/1,5) = 833 KN

(taula ACER B500S) = $\boxed{4\ Ø\ 25}$ (833,70 KN)

Armat transversal

$Ø_t \geq \left| \begin{array}{l} 6mm \\ \frac{1}{4} \cdot Ø = \frac{1}{4} \cdot 25mm = \boxed{6,25mm} \end{array} \right.$

$S_t \leq \left| \begin{array}{l} b = 50\ cm \\ 15 \cdot Ø = 15 \cdot 2,5cm = 37,5cm \\ \boxed{30\ cm} \end{array} \right.$

P-1

Nd = 128,06 T · 1,425 = 182,49 T

Md = 1,73 mT · 1,425 = 2,47 mT

$e = \frac{Md}{Nd} = \frac{2,47}{182,49} = 1,35\ cm < 2cm$

Md = 182,49 T · 0,02m = 3,65 Tm

Armat longitudinal

$\mu = \frac{Md}{Ac \cdot h \cdot fcd} = \frac{3'65\ mT \cdot 10^7}{(500 \cdot 500) \cdot 500 \cdot (25/1,5)} = 0,02$

$\nu = \frac{Nd}{Ac \cdot fcd} = \frac{182,49\ T \cdot 10^7}{(500 \cdot 500) \cdot (25/1,5)} = 0,44$

Àbac $\left| \begin{array}{l} \mu = 0,02 \\ \nu = 0,44 \end{array} \right. \longrightarrow \omega = 0$

Cuantía mínima:

$\rho \geq 0,028 \qquad As = 0,0028 \cdot 50 \cdot 50 = 7\ cm$

As · fyd = 700 · (500 / 1,15) = 304'3 KN

As · fyd ≥ 0,04

Ac fcd = 0,04 · 500 · 500 · (25/1,5) = 166,67 KN (≤ 304,3 KN)

304,3 KN ⟶ $\boxed{4\ Ø\ 16}$ (349,67 KN)

Armat transversal

$Ø_t \geq \left| \begin{array}{l} \boxed{6mm} \\ \frac{1}{4} \cdot Ø = \frac{1}{4} \cdot 16mm = 4mm \end{array} \right.$

$S_t \leq \left| \begin{array}{l} b = 50\ cm \\ 15 \cdot Ø = 15 \cdot 1,6cm = \boxed{24cm} \\ 30\ cm \end{array} \right.$

PB

Nd = 71,15 T · 1,425 = 101,39 T

Md = 7,77 mT · 1,425 = 11,07 mT

$e = \frac{Md}{Nd} = \frac{11,07}{101,39} = 10,9\ cm > 2cm$

Md = 101,39 T · 0,11m = 11,15 Tm

Armat longitudinal

$\mu = \frac{Md}{Ac \cdot h \cdot fcd} = \frac{11,15\ mT \cdot 10^7}{(500 \cdot 500) \cdot 500 \cdot (25/1,5)} = 0,05$

$\nu = \frac{Nd}{Ac \cdot fcd} = \frac{101,39\ T \cdot 10^7}{(500 \cdot 500) \cdot (25/1,5)} = 0,24$

Àbac $\left| \begin{array}{l} \mu = 0,05 \\ \nu = 0,24 \end{array} \right. \longrightarrow \omega = 0$

Cuantía mínima:

$\rho \geq 0,028 \qquad As = 0,0028 \cdot 50 \cdot 50 = 7\ cm$

As · fyd = 700 · (500 / 1,15) = 304'3 KN

As · fyd ≥ 0,04

Ac fcd = 0,04 · 500 · 500 · (25/1,5) = 166,67 KN (≤ 304,3 KN)

304,3 KN ⟶ $\boxed{4\ Ø\ 16}$ (349,67 KN)

Armat transversal

$Ø_t \geq \left| \begin{array}{l} \boxed{6mm} \\ \frac{1}{4} \cdot Ø = \frac{1}{4} \cdot 16mm = 4mm \end{array} \right.$

$S_t \leq \left| \begin{array}{l} b = 50\ cm \\ 15 \cdot Ø = 15 \cdot 1,6cm = \boxed{24cm} \\ 30\ cm \end{array} \right.$

ENCAVALLADA (pòrtic 24)

Cordó inferior

Perfil tubular rectangular: 140 x 200mm, e=20mm

- Barra a tracció més desfavorable:

$\sigma = \frac{Nd}{A} = \frac{132,27\ T \cdot 1,425}{120\ cm^2} = 1,71\ T/cm^2 < 2,6\ T/cm^2$

Cordó superior

Perfil tubular rectangular: 140 x 200mm, e=20mm

- Barra a compressió més desfavorable:

$\sigma = \frac{Nd}{X \cdot A} = \frac{136,67\ T \cdot 1,425}{0,70 \cdot 120\ cm^2} = 2,31\ T/cm^2 < 2,6\ T/cm^2$

Diagonals

Perfil tubular rectangular: 100 x 160mm, e=15mm

- Barra a tracció més desfavorable:

$\sigma = \frac{Nd}{A} = \frac{62,05\ T \cdot 1,425}{68\ cm^2} = 1,35\ T/cm^2 < 2,6\ T/cm^2$

- Barra a compressió més desfavorable:

$\sigma = \frac{Nd}{X \cdot A} = \frac{70,70\ T \cdot 1,425}{0,72 \cdot 68\ cm^2} = 2,05\ T/cm^2 < 2,6\ T/cm^2$

Pilars

Perfil tubular rectangular: 300 x 400mm, e=20mm

Lk = Lreal = 450 cm

E = 2100000 Kg /cm²

I = 6'650 cm⁴

Ncr = $(\pi/Lk)^2 \cdot E \cdot I$ = 6309,9T

A = 264 cm²

fyd = 3227,27 Kg/cm²

$\lambda y = \sqrt{(A \cdot fyd)/Ncr} = 0,52$

(taula 6.3 del CTE_DB_SE_A)

X = 0,90

$\sigma = \frac{Nd}{X \cdot A} = \frac{84,90\ T \cdot 1,425}{0,90 \cdot 264\ cm^2} = 0,81\ T/cm^2 < 2,6\ T/cm^2$

PILAR 24C (grada)

Pòrtic principal (C)

Nd = 143,10 T · 1,425 = 203,92 T

Md = 0,65 mT · 1,425 = 0,93 mT

$e = \frac{Md}{Nd} = \frac{0,93}{203,92} = 0,45\ cm < 2cm$

Md = 203,92 T · 0,02 m = 4,08 mT

Pòrtic secundari (24)

Nd = 203,92 T

Md = 9,87 mT · 1,425 = 14,07 mT

$e = \frac{Md}{Nd} = \frac{14,07}{203,92} = 0,07\ m > 2cm$

Md = 203,92 T · 0,07 = 14,27 mT

Armat longitudinal

$\mu_0 = \frac{Mad}{Ac \cdot hx \cdot fcd} = \frac{4,08\ mT \cdot 10^7}{(500 \cdot 500) \cdot 500 \cdot (25/1,5)} = 0,02$

$\mu_b = \frac{Mbd}{Ac \cdot hy \cdot fcd} = \frac{14,27\ mT \cdot 10^7}{(500 \cdot 500) \cdot 500 \cdot (25/1,5)} = 0,07$

$\nu = \frac{Nd}{Ac \cdot fcd} = \frac{203,92\ T \cdot 10^7}{(500 \cdot 500) \cdot (25/1,5)} = 0,49$

Àbac $\left| \begin{array}{l} \nu = 0,4 \longrightarrow \omega = 0 \\ \nu = 0,8 \longrightarrow \omega = 0 \end{array} \right| \quad \nu = 0,49 \longrightarrow \omega = 0$

Cuantía mínima:

$\rho \geq 0,028 \qquad As = 0,0028 \cdot 50 \cdot 50 = 7\ cm$

As · fyd = 700 · (500 / 1,15) = 304'3 KN

As · fyd ≥ 0,04

Ac fcd = 0,04 · 500 · 500 · (20/1,5) = 166,67 KN (≤ 304,3 KN)

As · fyd = 304,3 KN / 4 = 76,08 KN

76,08 KN ⟶ $\boxed{2\ Ø\ 14}$ (133,86 KN)

Armat transversal

$Ø_t \geq \left| \begin{array}{l} \boxed{6mm} \\ \frac{1}{4} \cdot Ø = \frac{1}{4} \cdot 14mm = 3mm \end{array} \right.$

$S_t \leq \left| \begin{array}{l} b = 50\ cm \\ 15 \cdot Ø = 15 \cdot 1,4cm = \boxed{21cm} \\ 30\ cm \end{array} \right.$

JÀSSERA GRADA (pòrtic 24)

Secció esquerra:

Secció: 50 x 75 cm (d = 70 cm)

M = 20,39 Tm

$\mu = \frac{Md}{b \cdot d^2 \cdot fcd} = \frac{20,39\ mT \cdot 1,425 \cdot 10^7}{500 \cdot 700^2 \cdot (25/1,5)} = 0,07 \longrightarrow \omega = 0,09$

$\omega = \frac{As\ fyd}{b \cdot d \cdot fcd} \qquad As\ fyd = 0,09 \cdot 500 \cdot 700 \cdot (25/1,5) = 525\ KN$

(taula ACER B500S) = $\boxed{4\ Ø\ 20}$ (546,37 KN)

Cuantía mínima:

$\rho \geq 0,028 \qquad As = 0,0028 \cdot 50 \cdot 75 = 10,5\ cm$

As · fyd = 1050 · (500 / 1,15) = 456,52 KN

As · fyd ≥ 0,04

Ac fcd = 0,04 · 500 · 750 · (25 / 1,5) = 250 KN (≤ 456,52 KN)

456,52 KN ⟶ 4 Ø 20 (546,37 KN)

Secció central

Secció: 50 x 75 cm (d = 70 cm)

M = 16,40 Tm

$\mu = \frac{Md}{b \cdot d^2 \cdot fcd} = \frac{16,40\ mT \cdot 1,425 \cdot 10^7}{500 \cdot 700^2 \cdot (25/1,5)} = 0,06 \longrightarrow \omega = 0,07$

$\omega = \frac{As\ fyd}{b \cdot d \cdot fcd} \qquad As\ fyd = 0,07 \cdot 500 \cdot 700 \cdot (25/1,5) = 408,33\ KN$

(taula ACER B500S) = 3 Ø 20 (409,77 KN)

Cuantía mínima:

456,52 KN ⟶ $\boxed{4\ Ø\ 20}$ (546,37 KN)

Secció dreta

Secció: 50 x 75 cm (d = 70 cm)

M = 17,84 Tm

$\mu = \frac{Md}{b \cdot d^2 \cdot fcd} = \frac{17,84\ mT \cdot 1,425 \cdot 10^7}{500 \cdot 700^2 \cdot (25/1,5)} = 0,06 \longrightarrow \omega = 0,07$

$\omega = \frac{As\ fyd}{b \cdot d \cdot fcd} = \qquad As\ fyd = 0,07 \cdot 500 \cdot 700 \cdot (25/1,5) = 408,33\ KN$

(taula ACER B500S) = 3 Ø 20 (409,77 KN)

Cuantía mínima:

456,52 KN ⟶ $\boxed{4\ Ø\ 20}$ (546,37 KN)

JÀSSERA APARCAMENT (pòrtic I)

Seccions esquerra i dreta

Secció: 50 x 80 cm (d = 75 cm)

M = 57,10 Tm

$\mu = \frac{Md}{b \cdot d^2 \cdot fcd} = \frac{57,10\ mT \cdot 1,425 \cdot 10^7}{500 \cdot 750^2 \cdot (25/1,5)} = 0,18 \longrightarrow \omega = 0,20$

$\omega = \frac{As\ fyd}{b \cdot d \cdot fcd} \qquad As\ fyd = 0,20 \cdot 500 \cdot 750 \cdot (25/1,5) = 1250\ KN$

(taula ACER B500S) = $\boxed{6\ Ø\ 25}$ (1280,54 KN)

Cuantía mínima:

$\rho \geq 0,028 \qquad As = 0,0028 \cdot 50 \cdot 80 = 11,20\ cm$

As · fyd = 1120 · (500 / 1,15) = 486,96 KN

As · fyd ≥ 0,04

Ac fcd = 0,04 · 500 · 800 · (25/1,5) = 250 KN (≤ 486,96 KN)

486,96 KN ⟶ 4 Ø 20 (546,37 KN)

Secció central

Secció: 50 x 80 cm (d = 75 cm)

M = 27,90 Tm

$\mu = \frac{Md}{b \cdot d^2 \cdot fcd} = \frac{27,90\ mT \cdot 1,425 \cdot 10^7}{500 \cdot 750^2 \cdot (25/1,5)} = 0,08 \longrightarrow \omega = 0,09$

$\omega = \frac{As\ fyd}{b \cdot d \cdot fcd} \qquad As\ fyd = 0,09 \cdot 500 \cdot 750 \cdot (25/1,5) = 562,5\ KN$

(taula ACER B500S) = $\boxed{3\ Ø\ 25}$ (1280,54 KN)

Cuantía mínima:

$\rho \geq 0,028 \qquad As = 0,0028 \cdot 50 \cdot 80 = 11,20\ cm$

As · fyd = 1120 · (500 / 1,15) = 486,96 KN

As · fyd ≥ 0,04

Ac fcd = 0,04 · 500 · 800 · (25/1,5) = 250 KN (≤ 486,96 KN)

486,96 KN ⟶ 4 Ø 20 (546,37 KN)

PÒRTIC 24

- **Màxim desplaçament vertical: fletxa vertical** (δ_v)

$\delta v < \frac{L\ (cm)}{250} = \frac{3525\ cm}{250} = 14,10\ cm$

$\delta v = 5,75\ cm < 14,10\ cm$

- **Màxim desplaçament horitzontal: vent** (δ_h)

$\delta h < \frac{L\ (cm)}{500} = \frac{1200\ cm}{500} = 2,40\ cm$

$\delta h = 2,25\ cm < 2,40\ cm$

PÒRTIC C

- **Màxim desplaçament vertical: fletxa vertical** (δ_v)

$\delta v < \frac{L\ (cm)}{750} = \frac{600\ cm}{750} = 0,80\ cm$

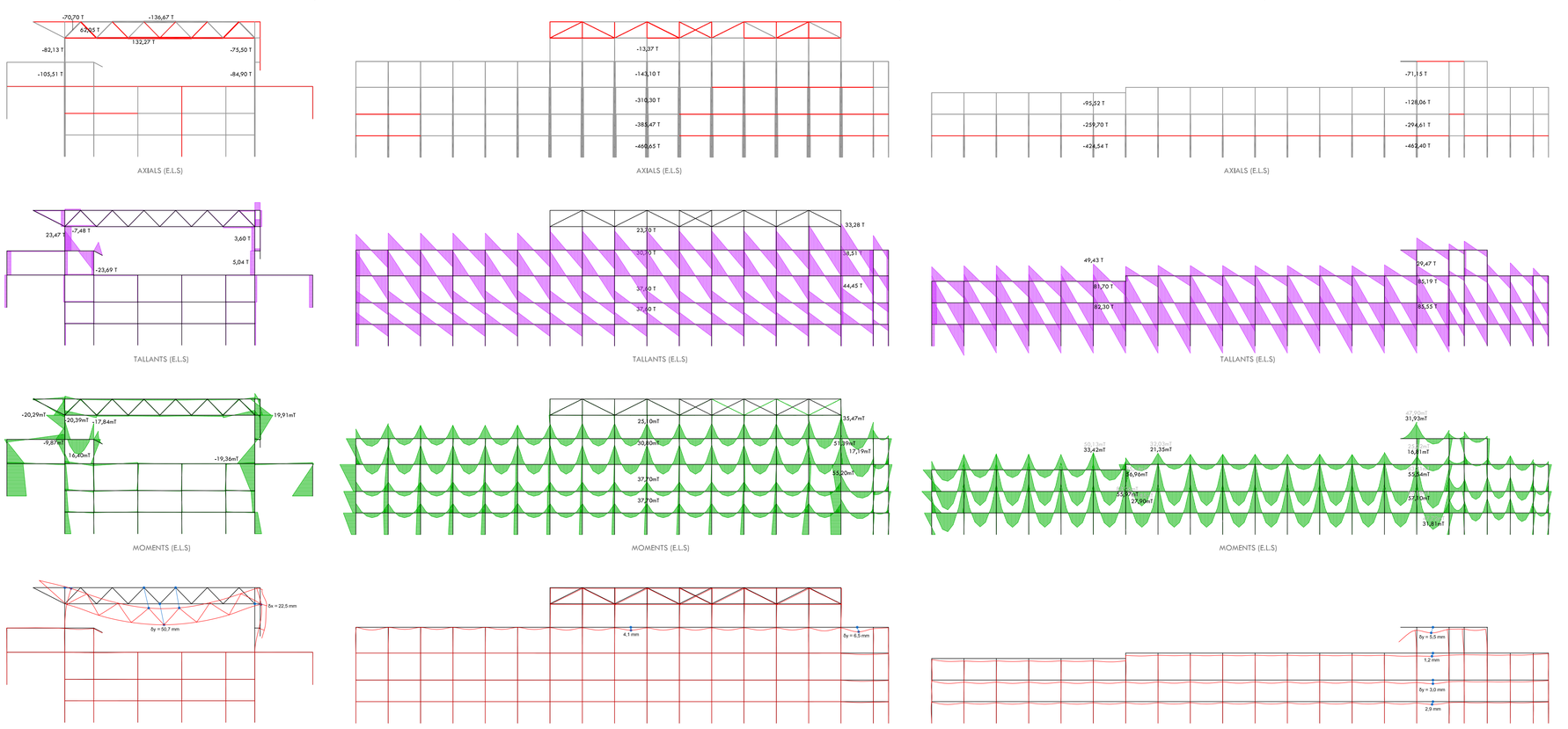
$\delta v = 0,65\ cm < 0,80\ cm$

PÒRTIC I

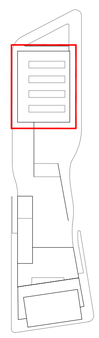
- **Màxim desplaçament vertical: fletxa vertical** (δ_v)

$\delta v < \frac{L\ (cm)}{750} = \frac{600\ cm}{750} = 0,80\ cm$

$\delta v = 0,55\ cm < 0,80\ cm$



PÒRTIC 24

PÒRTIC C

PÒRTIC I