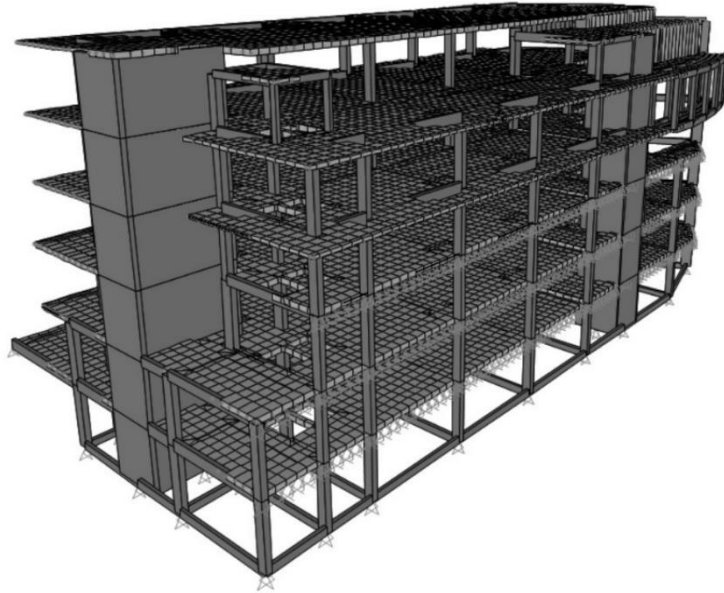




INSTITUTO SUPERIOR DE ENGENHARIA DE LISBOA

Área Departamental de Engenharia Civil



**Projeto de Estruturas e Fundações de um Edifício de
Escritórios com Grandes Vãos**

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ANEXOS

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1 DADOS GERAIS DE CÁLCULO

- Betão

Betão	f_{ck} [Mpa]	f_{cd} [Mpa]	$f_{ck,cube}$ [Mpa]	f_{cm} [Mpa]	f_{ctm} [Mpa]	$f_{ctk,0,05}$ [Mpa]	E_{cm} [Gpa]	ϵ_{cu2} [%]
C30/37	30,00	20,00	37,00	38,00	2,90	2,00	33,00	3,50
C25/30	25,00	16,67	30,00	33,00	2,60	1,80	31,00	3,50

Betão para Lajes, Vigas, Paredes e Pilares

Classe de Resistência à Compressão	C30/37
Classe de Exposição Ambiental	XC3 (P)
Classe de Teor de Cloretos	CL 0.40
Dimensão Máxima do Agregado	25 mm
Classe de Consistência	S3

Betão para as Fundações e Muros de Suporte

Classe de Resistência à Compressão	C30/37
Classe de Exposição Ambiental	XC2 (P)
Classe de Teor de Cloretos	CL 0.40
Dimensão Máxima do Agregado	25 mm
Classe de Consistência	S3

Betão para Regularização das Fundações

Classe de Resistência à Compressão	C12/15
Classe de Exposição Ambiental	X0 (P)
Classe de Teor de Cloretos	CL 1.0
Dimensão Máxima do Agregado	25 mm
Classe de Consistência	S3

- Aço para betão armado

f_{yk} [Mpa]	f_{yd} [Mpa]	E_s [Gpa]	$\epsilon_{sy,d}$ [%]
500,00	435,00	200,00	2,18

- Restantes cargas permanentes

Revestimentos e Divisórias:

- Laje do piso: enchimento, revestimento, tetos e paredes interiores: 2,50 KN/m²;
- Consolas: enchimento e revestimento: 1,50 KN/m²;
- Coberturas com revestimento em gravilha: 2,50 KN/m²;

Paredes Exteriores:

- Alvenaria de tijolo dupla com 0,27 m de espessura: 9,00 KN/m;
- Alvenaria de tijolo simples, com 0,15 m de espessura: 7,00 KN/m;
- Janelas/vãos exteriores em vidro: 1,50 KN/m;

- Ações variáveis

Piso 1, Piso 2, Piso 3, Piso 4 e Piso 5:

- Acessos e circulações: 4,00 KN/m²;
- Zona de escritórios: 3,00 KN/m².

Piso 6/Cobertura:

- Terraço não acessível: 1,00 KN/m².

Paredes periféricas:

- Sobrecarga no tardo do aterro: 3,00 KN/m².

2 CÁLCULO DOS CENTROS DE RIGIDEZ E MASSA DOS PISOS

2.1 Piso 1

Elem. Est	a (m)	b (m)	l (m)	V (m ³)	m _i (ton)	x (m)	m _i ·x _i	y (m)	m _i ·y _i
Vb1.1	0.75	0.25	7.35	1.38	3.45	1.73	5.96	21.07	72.59
	0.75	0.25	3.88	0.73	1.82	4.18	7.60	16.41	29.85
	0.75	0.25	6.50	1.22	3.05	6.88	20.96	11.28	34.37
	0.75	0.25	9.80	1.84	4.59	10.65	48.92	4.12	18.93
Vb1.2	0.75	0.25	7.40	1.39	3.47	54.77	189.98	22.78	79.02
	0.75	0.25	2.45	0.46	1.15	54.77	62.90	17.85	20.50
	0.75	0.25	4.50	0.84	2.11	54.77	115.53	10.88	22.95
	0.75	0.25	8.63	1.62	4.05	54.77	221.56	4.31	17.44

Laje 1	39.50	26.47	0.36	376.40	941.01	34.92	32860.02	13.24	12458.95	
	4.46	3.20	0.36	5.14	12.84	16.92	217.33	24.23	311.23	escada e1
	0.55	2.20	0.36	0.44	1.09	18.93	20.61	20.13	21.92	abertura
	0.80	7.17	0.36	2.06	5.16	23.69	122.30	22.96	118.53	abertura
	1.58	2.35	0.36	1.34	3.34	47.84	159.87	22.58	75.46	abertura
	1.69	2.35	0.36	1.43	3.57	49.78	177.93	22.58	80.71	abertura
	4.46	3.20	0.36	5.14	12.84	52.34	672.30	14.88	191.13	escada e2
			A (m²)	V (m³)	m_i (ton)	x (m)	m_i·x_i	y (m)	m_i·y_i	
			9.38		2.63	21.09	55.40	22.97	60.32	1
			30.07		8.42	27.99	235.67	22.80	191.96	2
			39.68		11.11	35.17	390.76	22.79	253.19	3
			36.28		10.16	42.88	435.54	22.80	231.63	4
			12.19		3.41	52.92	180.57	22.82	77.86	5
			60.14		16.84	19.09	321.53	12.27	206.63	6
		60.14		16.84	27.17	457.53	13.95	234.82	7	
		60.14		16.84	35.17	592.24	13.95	234.82	8	
		60.14		16.84	43.17	726.95	13.95	234.82	9	
		14.73		4.12	50.89	209.92	10.64	43.87	10	
		49.92		13.98	19.11	267.17	4.31	60.17	11	
		49.92		13.98	27.17	379.76	4.31	60.17	12	
		49.92		13.98	35.17	491.57	4.31	60.17	13	
		49.92		13.98	43.17	603.39	4.31	60.17	14	
		42.96		12.03	50.72	610.17	4.16	50.09	15	

Laje 2			241.90	87.08	217.71	9.82	2137.76	16.35	3559.12	
			31.26		8.75	5.04	44.14	22.86	200.02	1
			28.25		7.91	11.01	87.05	22.82	180.48	2
			11.98		3.36	6.55	21.99	16.16	54.22	3
			54.16		15.17	11.47	173.92	13.69	207.58	4
			22.93		6.42	12.99	83.36	5.02	32.25	5

$$\frac{\Sigma m_i}{926.79} \qquad \frac{\Sigma m_i \cdot x_i}{27932.23} \qquad \frac{\Sigma m_i \cdot y_i}{12779.48}$$

$$\frac{\Sigma m_i \cdot x_i / \Sigma m_i}{30.14} \qquad \frac{\Sigma m_i \cdot y_i / \Sigma m_i}{13.79}$$

Coordenadas SAP

$$81.96 \qquad 49.73$$

Centro de Rigidez

Elem. Est	b (m)	h (m)	l (m)	V (m ³)	m _i (ton)	I _x (m ⁴)	I _y (m ⁴)	x (m)	y (m)	x _i ·I _{xi}	y _i ·I _{yi}
P1	0.25	0.95	2.14	0.51	1.27	0.0142	0.0049	0.00	24.36	0.00	0.12
P2	0.40	0.60	2.14	0.51	1.28	0.0072	0.0032	8.17	26.47	0.06	0.08
P3	0.40	0.60	2.14	0.51	1.28	0.0072	0.0032	23.17	26.47	0.17	0.08
P4	0.40	0.60	2.14	0.51	1.28	0.0072	0.0032	31.17	26.47	0.22	0.08
P5	0.40	0.60	2.14	0.51	1.28	0.0072	0.0032	39.17	26.47	0.28	0.08
P6	0.40	0.60	2.14	0.51	1.28	0.0072	0.0032	47.17	26.47	0.34	0.08
P7	0.40	0.60	2.14	0.51	1.28	0.0072	0.0032	50.73	26.47	0.37	0.08
P8	0.40	0.60	2.14	0.51	1.28	0.0072	0.0032	54.67	26.47	0.39	0.08
P9	0.25	0.80	2.14	0.43	1.07	0.0085	0.0032	3.43	17.85	0.03	0.06
P10	0.40	0.80	2.14	0.68	1.71	0.0171	0.0043	8.17	19.17	0.14	0.08
P11	0.40	0.80	2.14	0.68	1.71	0.0171	0.0043	15.17	19.17	0.26	0.08
P12	0.80	0.40	2.14	0.68	1.71	0.0043	0.0171	23.17	18.98	0.10	0.32
P13	0.40	0.80	2.14	0.68	1.71	0.0171	0.0043	31.17	19.17	0.53	0.08
P14	0.40	0.80	2.14	0.68	1.71	0.0171	0.0043	39.17	19.17	0.67	0.08
P15	0.40	0.80	2.14	0.68	1.71	0.0171	0.0043	47.17	19.17	0.81	0.08
P16	0.40	0.80	2.14	0.68	1.71	0.0171	0.0043	50.73	19.17	0.87	0.08
P17	0.40	0.80	2.14	0.68	1.71	0.0171	0.0043	54.67	19.17	0.93	0.08
P18	0.25	0.95	2.14	0.51	1.27	0.0142	0.0049	8.26	8.66	0.12	0.04
P19	0.40	1.00	2.14	0.86	2.14	0.0333	0.0053	15.17	8.73	0.51	0.05
P20	0.40	1.00	2.14	0.86	2.14	0.0333	0.0053	23.17	8.73	0.77	0.05
P21	0.40	1.00	2.14	0.86	2.14	0.0333	0.0053	31.17	8.73	1.04	0.05
P22	0.40	1.00	2.14	0.86	2.14	0.0333	0.0053	39.17	8.73	1.31	0.05
P23	0.40	1.00	2.14	0.86	2.14	0.0333	0.0053	47.17	8.73	1.57	0.05
P24	0.40	0.80	2.14	0.68	1.71	0.0171	0.0043	52.49	8.73	0.90	0.04
P25	0.40	0.80	2.14	0.68	1.71	0.0171	0.0043	54.67	8.73	0.93	0.04
Pa1	0.30	3.75	2.14	2.41	6.02	1.3184	0.0084	15.17	24.90	20.00	0.21
Pa2	0.30	3.75	2.14	2.41	6.02	1.3184	0.0084	18.67	24.90	24.61	0.21
Pa12	3.80	0.30	2.14	2.44	6.10	0.0086	1.3718	16.92	26.62	0.14	36.52
Pa4	0.25	2.00	2.14	1.07	2.68	0.1305	0.0388	5.23	14.41	0.68	0.56
N1	6.50	0.30	2.14	4.17	10.43	0.0146	6.8656	51.61	16.63	0.75	114.15
N12	0.30	3.80	2.14	2.44	6.10	1.3718	0.0086	54.72	14.88	75.07	0.13
N2	6.50	0.30	2.14	4.17	10.43	0.0146	6.8656	51.61	13.13	0.75	90.12

<u>Σ I_x</u>	<u>Σ I_y</u>	<u>Σ x_i·I_{xi}</u>	<u>Σ y_i·I_{yi}</u>
4.59	15.28	135.32	243.91

M_{tot} = 1014.99 ton

<u>Σ x_i·I_{xi} / Σ I_x</u>	<u>Σ y_i·I_{yi} / Σ I_y</u>
29.49	15.96

M_{SAP} = 946.87

e_x =	0.65
e_y =	2.17

Coordenadas SAP
81.31 51.90

2.2 Piso 2

Centro de Massa

Elem. Est	a (m)	b (m)	l (m)	V (m ³)	m _i (ton)	x (m)	m _i .x _i	y (m)	m _i .y _i
-----------	-------	-------	-------	---------------------	----------------------	-------	--------------------------------	-------	--------------------------------

Vb2.1	0.60	0.25	7.35	1.10	2.76	1.73	4.77	21.07	58.07
	0.60	0.25	3.88	0.58	1.46	4.18	6.08	16.41	23.88
	0.60	0.25	6.50	0.98	2.44	6.88	16.77	11.28	27.50
Vb2.2	0.60	0.25	7.40	1.11	2.78	54.77	151.99	22.78	63.21
	0.60	0.25	2.45	0.37	0.92	54.77	50.32	17.85	16.40
	0.60	0.25	4.50	0.68	1.69	54.77	92.42	10.88	18.36

Laje 1	39.50	21.45	0.36	305.02	762.55	34.92	26628.16	15.75	12010.12		
	4.46	3.20	0.36	5.14	12.84	16.92	217.33	24.23	311.23	escada e1	
	0.55	2.20	0.36	0.44	1.09	18.93	20.61	20.13	21.92	abertura	
	0.80	7.17	0.36	2.06	5.16	23.69	122.30	22.96	118.53	abertura	
	1.58	2.35	0.36	1.34	3.34	47.84	159.87	22.58	75.46	abertura	
	1.69	2.35	0.36	1.43	3.57	49.78	177.93	22.58	80.71	abertura	
	4.46	3.20	0.36	5.14	12.84	52.34	672.30	14.88	191.13	escada e2	
				A (m²)	V (m³)	m_i (ton)	x (m)	m_i.x_i	y (m)	m_i.y_i	
				9.38		2.63	21.09	55.40	22.97	60.32	1
				30.07		8.42	27.99	235.67	22.80	191.96	2
				39.68		11.11	35.17	390.76	22.79	253.19	3
				36.28		10.16	42.88	435.54	22.80	231.63	4
				12.19		3.41	52.92	180.57	22.82	77.86	5
				60.14		16.84	19.09	321.53	12.27	206.63	6
				60.14		16.84	27.17	457.53	13.95	234.82	7
				60.14		16.84	35.17	592.24	13.95	234.82	8
				60.14		16.84	43.17	726.95	13.95	234.82	9
			14.73		4.12	50.89	209.92	10.64	43.87	10	
			15.81		4.43	19.11	84.60	6.77	29.95	11	
			15.81		4.43	27.17	120.25	6.77	29.95	12	
			15.81		4.43	35.17	155.66	6.77	29.95	13	
			15.81		4.43	43.17	191.07	6.77	29.95	14	
			12.28		3.44	50.48	173.59	6.66	22.90	15	

Laje 2			226.14	81.41	203.53	9.57	1947.37	17.31	3523.85	
			31.26		8.75	5.04	44.14	22.86	200.02	1
			28.25		7.91	11.01	87.05	22.82	180.48	2
			11.98		3.36	6.55	21.99	16.16	54.22	3
			54.16		15.17	11.47	173.92	13.69	207.58	4
		11.59		3.24	12.51	40.60	6.68	21.67	5	

Σm_i	$\Sigma m_i \cdot x_i$	$\Sigma m_i \cdot y_i$
772.47	22828.55	12365.82

$\Sigma m_i \cdot x_i / \Sigma m_i$	$\Sigma m_i \cdot y_i / \Sigma m_i$
29.55	16.01

Coordenadas SAP
81.38 51.95

Centro de Rigidez

Elem. Est	b (m)	h (m)	l (m)	V (m ³)	m _i (ton)	I _x (m ⁴)	I _y (m ⁴)	x (m)	y (m)	x _i ·I _{xi}	y _i ·I _{yi}
P1	0.25	0.95	2.14	0.51	1.27	0.0142	0.0049	0.00	24.36	0.00	0.12
P2	0.40	0.60	2.14	0.51	1.28	0.0072	0.0032	8.17	26.47	0.06	0.08
P3	0.40	0.60	2.14	0.51	1.28	0.0072	0.0032	23.17	26.47	0.17	0.08
P4	0.40	0.60	2.14	0.51	1.28	0.0072	0.0032	31.17	26.47	0.22	0.08
P5	0.40	0.60	2.14	0.51	1.28	0.0072	0.0032	39.17	26.47	0.28	0.08
P6	0.40	0.60	2.14	0.51	1.28	0.0072	0.0032	47.17	26.47	0.34	0.08
P7	0.40	0.60	2.14	0.51	1.28	0.0072	0.0032	50.73	26.47	0.37	0.08
P8	0.40	0.60	2.14	0.51	1.28	0.0072	0.0032	54.67	26.47	0.39	0.08
P9	0.25	0.80	2.14	0.43	1.07	0.0085	0.0032	3.43	17.85	0.03	0.06
P10	0.40	0.80	2.14	0.68	1.71	0.0171	0.0043	8.17	19.17	0.14	0.08
P11	0.40	0.80	2.14	0.68	1.71	0.0171	0.0043	15.17	19.17	0.26	0.08
P12	0.80	0.40	2.14	0.68	1.71	0.0043	0.0171	23.17	18.98	0.10	0.32
P13	0.40	0.80	2.14	0.68	1.71	0.0171	0.0043	31.17	19.17	0.53	0.08
P14	0.40	0.80	2.14	0.68	1.71	0.0171	0.0043	39.17	19.17	0.67	0.08
P15	0.40	0.80	2.14	0.68	1.71	0.0171	0.0043	47.17	19.17	0.81	0.08
P16	0.40	0.80	2.14	0.68	1.71	0.0171	0.0043	50.73	19.17	0.87	0.08
P17	0.40	0.80	2.14	0.68	1.71	0.0171	0.0043	54.67	19.17	0.93	0.08
P18	0.25	0.95	2.14	0.51	1.27	0.0142	0.0049	8.26	8.66	0.12	0.04
P19	0.40	1.00	2.14	0.86	2.14	0.0333	0.0053	15.17	8.73	0.51	0.05
P20	0.40	1.00	2.14	0.86	2.14	0.0333	0.0053	23.17	8.73	0.77	0.05
P21	0.40	1.00	2.14	0.86	2.14	0.0333	0.0053	31.17	8.73	1.04	0.05
P22	0.40	1.00	2.14	0.86	2.14	0.0333	0.0053	39.17	8.73	1.31	0.05
P23	0.40	1.00	2.14	0.86	2.14	0.0333	0.0053	47.17	8.73	1.57	0.05
P24	0.40	0.80	2.14	0.68	1.71	0.0171	0.0043	52.49	8.73	0.90	0.04
P25	0.40	0.80	2.14	0.68	1.71	0.0171	0.0043	54.67	8.73	0.93	0.04
Pa1	0.30	3.75	2.14	2.41	6.02	1.3184	0.0084	15.17	24.90	20.00	0.21
Pa2	0.30	3.75	2.14	2.41	6.02	1.3184	0.0084	18.67	24.90	24.61	0.21
Pa12	3.80	0.30	2.14	2.44	6.10	0.0086	1.3718	16.92	26.62	0.14	36.52
Pa4	0.25	2.00	2.14	1.07	2.68	0.1305	0.0388	5.23	14.41	0.68	0.56
N1	6.50	0.30	2.14	4.17	10.43	0.0146	6.8656	51.61	16.63	0.75	114.15
N12	0.30	3.80	2.14	2.44	6.10	1.3718	0.0086	54.72	14.88	75.07	0.13
N2	6.50	0.30	2.14	4.17	10.43	0.0146	6.8656	51.61	13.13	0.75	90.12

ΣI_x	ΣI_y	$\Sigma x_i \cdot I_{xi}$	$\Sigma y_i \cdot I_{yi}$
4.59	15.28	135.32	243.91

M_{tot} = 860.66 ton
ΔM_{1,2} = 15.20 %

$\Sigma x_i \cdot I_{xi} / \Sigma I_x$	$\Sigma y_i \cdot I_{yi} / \Sigma I_y$
29.49	15.96

M_{SAP} = 782.27

e_x = 0.06
e_y = 0.05

Coordenadas SAP
81.31 51.90

2.3 Piso 3

Centro de Massa

Elem. Est	a (m)	b (m)	l (m)	V (m ³)	m _i (ton)	x (m)	m _i .x _i	y (m)	m _i .y _i
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Vb3.1	0.60	0.25	7.35	1.10	2.76	1.73	4.77	21.07	58.07
	0.60	0.25	3.88	0.58	1.46	4.18	6.08	16.41	23.88
	0.60	0.25	6.50	0.98	2.44	6.88	16.77	11.28	27.50
Vb3.2	0.60	0.25	7.40	1.11	2.78	54.77	151.99	22.78	63.21

Laje 1	A=	809.70	0.36	291.49	728.73	34.11	24855.36	15.47	11273.44		
	4.46	3.20	0.36	5.14	12.84	16.92	217.33	24.23	311.23	escada e1	
	0.55	2.20	0.36	0.44	1.09	18.93	20.61	20.13	21.92	abertura	
	0.80	7.17	0.36	2.06	5.16	23.69	122.30	22.96	118.53	abertura	
	1.58	2.35	0.36	1.34	3.34	47.84	159.87	22.58	75.46	abertura	
	1.69	2.35	0.36	1.43	3.57	49.78	177.93	22.58	80.71	abertura	
	4.46	3.20	0.36	5.14	12.84	52.34	672.30	14.88	191.13	escada e2	
				A (m²)	V (m³)	m_i (ton)	x (m)	m_i.x_i	y (m)	m_i.y_i	
				9.38		2.63	21.09	55.40	22.97	60.32	1
				30.07		8.42	27.99	235.67	22.80	191.96	2
				39.68		11.11	35.17	390.76	22.79	253.19	3
				36.28		10.16	42.88	435.54	22.80	231.63	4
				60.14		16.84	19.09	321.53	12.27	206.63	6
				60.14		16.84	27.17	457.53	13.95	234.82	7
			60.14		16.84	35.17	592.24	13.95	234.82	8	
			60.14		16.84	43.17	726.95	13.95	234.82	9	
			14.73		4.12	50.89	209.92	10.64	43.87	10	
			15.81		4.43	19.11	84.60	6.77	29.95	11	
			15.81		4.43	27.17	120.25	6.77	29.95	12	
			15.81		4.43	35.17	155.66	6.77	29.95	13	
			15.81		4.43	43.17	191.07	6.77	29.95	14	
			12.28		3.44	50.48	173.59	6.66	22.90	15	

Laje 2			226.14	81.41	203.53	9.57	1947.37	17.31	3523.85	
			28.25		7.91	11.01	87.05	22.82	180.48	2
			8.85		2.48	6.76	16.77	15.52	38.47	3
			54.16		15.17	11.47	173.92	13.69	207.58	4
			11.59		3.24	12.51	40.60	6.68	21.67	5
			29.88		8.37	52.34	437.91	14.88	124.50	abertura

Σm_i	$\Sigma m_i \cdot x_i$	$\Sigma m_i \cdot y_i$
740.72	20705.03	11763.51

$\Sigma m_i \cdot x_i / \Sigma m_i$	$\Sigma m_i \cdot y_i / \Sigma m_i$
27.95	15.88

Coordenadas SAP

79.78	51.83
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Centro de Rigidez

Elem. Est	b (m)	h (m)	l (m)	V (m ³)	m _i (ton)	I _x (m ⁴)	I _y (m ⁴)	x (m)	y (m)	x _i ·I _{xi}	y _i ·I _{yi}
P1	0.25	0.95	2.14	0.51	1.27	0.0142	0.0049	0.00	24.36	0.00	0.12
P2	0.40	0.60	2.14	0.51	1.28	0.0072	0.0032	8.17	26.47	0.06	0.08
P3	0.40	0.60	2.14	0.51	1.28	0.0072	0.0032	23.17	26.47	0.17	0.08
P4	0.40	0.60	2.14	0.51	1.28	0.0072	0.0032	31.17	26.47	0.22	0.08
P5	0.40	0.60	2.14	0.51	1.28	0.0072	0.0032	39.17	26.47	0.28	0.08
P6	0.40	0.60	2.14	0.51	1.28	0.0072	0.0032	47.17	26.47	0.34	0.08
P7	0.40	0.60	2.14	0.51	1.28	0.0072	0.0032	50.73	26.47	0.37	0.08
P8	0.40	0.60	2.14	0.51	1.28	0.0072	0.0032	54.67	26.47	0.39	0.08
P9	0.25	0.60	2.14	0.32	0.80	0.0037	0.0016	3.47	17.76	0.01	0.03
P10	0.40	0.80	2.14	0.68	1.71	0.0171	0.0043	8.17	19.17	0.14	0.08
P11	0.40	0.60	2.14	0.51	1.28	0.0072	0.0032	15.17	19.17	0.11	0.06
P12	0.80	0.40	2.14	0.68	1.71	0.0043	0.0171	23.17	18.98	0.10	0.32
P13	0.40	0.60	2.14	0.51	1.28	0.0072	0.0032	31.17	19.17	0.22	0.06
P14	0.40	0.60	2.14	0.51	1.28	0.0072	0.0032	39.17	19.17	0.28	0.06
P15	0.40	0.60	2.14	0.51	1.28	0.0072	0.0032	47.17	19.17	0.34	0.06
P16	0.40	0.60	2.14	0.51	1.28	0.0072	0.0032	50.73	19.17	0.37	0.06
P17	0.40	0.80	2.14	0.68	1.71	0.0171	0.0043	54.67	19.17	0.93	0.08
P18	0.25	0.95	2.14	0.51	1.27	0.0142	0.0049	8.26	8.66	0.12	0.04
P19	0.40	0.80	2.14	0.68	1.71	0.0171	0.0043	15.17	8.73	0.26	0.04
P20	0.40	0.80	2.14	0.68	1.71	0.0171	0.0043	23.17	8.73	0.40	0.04
P21	0.40	0.80	2.14	0.68	1.71	0.0171	0.0043	31.17	8.73	0.53	0.04
P22	0.40	0.80	2.14	0.68	1.71	0.0171	0.0043	39.17	8.73	0.67	0.04
P23	0.40	0.80	2.14	0.68	1.71	0.0171	0.0043	47.17	8.73	0.81	0.04
P24	0.40	0.60	2.14	0.51	1.28	0.0072	0.0032	52.49	8.73	0.38	0.03
P25	0.40	0.80	2.14	0.68	1.71	0.0171	0.0043	54.67	8.73	0.93	0.04
Pa1	0.30	3.75	2.14	2.41	6.02	1.3184	0.0084	15.17	24.90	20.00	0.21
Pa2	0.30	3.75	2.14	2.41	6.02	1.3184	0.0084	18.67	24.90	24.61	0.21
Pa12	3.80	0.30	2.14	2.44	6.10	0.0086	1.3718	16.92	26.62	0.14	36.52
Pa4	0.25	2.00	2.14	1.07	2.68	0.1305	0.0388	5.23	14.41	0.68	0.56
N1	6.50	0.30	2.14	4.17	10.43	0.0146	6.8656	51.61	16.63	0.75	114.15
N12	0.30	3.80	2.14	2.44	6.10	1.3718	0.0086	54.72	14.88	75.07	0.13
N2	6.50	0.30	2.14	4.17	10.43	0.0146	6.8656	51.61	13.13	0.75	90.12

ΣI_x	ΣI_y	$\Sigma x_i \cdot I_{xi}$	$\Sigma y_i \cdot I_{yi}$
4.44	15.27	130.44	243.72

M_{tot} = 823.94 ton
ΔM_{2,3} = 4.27 %

$\Sigma x_i \cdot I_{xi} / \Sigma I_x$	$\Sigma y_i \cdot I_{yi} / \Sigma I_y$
29.36	15.96

M_{SAP} = 724.47

e_x = 1.40
e_y = 0.08

Coordenadas SAP
81.18 51.90

2.4 Piso 4

Centro de Massa										
Elem. Est	a (m)	b (m)	l (m)	V (m ³)	m _i (ton)	x (m)	m _i .x _i	y (m)	m _i .y _i	
Vb4.1	0.60	0.25	7.35	1.10	2.76	1.73	4.77	21.07	58.07	
	0.60	0.25	3.88	0.58	1.46	4.18	6.08	16.41	23.88	
	0.60	0.25	6.50	0.98	2.44	6.88	16.77	11.28	27.50	
Vb4.2	0.60	0.25	7.40	1.11	2.78	54.77	151.99	22.78	63.21	
Vb4.3	0.40	0.25	4.60	0.46	1.15	52.57	60.45	10.90	12.54	
Vb4.4	0.70	0.25	6.91	1.21	3.02	11.71	35.42	8.35	25.26	
	0.70	0.25	8.00	1.40	3.50	19.16	67.05	8.35	29.23	
	0.70	0.25	8.00	1.40	3.50	27.16	95.05	8.35	29.23	
	0.70	0.25	8.00	1.40	3.50	35.17	123.10	8.35	29.23	
	0.70	0.25	8.00	1.40	3.50	43.17	151.10	8.35	29.23	
Vb4.5	0.70	0.25	5.32	0.93	2.33	49.83	116.03	8.35	19.44	
	0.70	0.25	4.50	0.79	1.97	20.90	41.14	26.65	52.47	
	0.70	0.25	8.00	3.70	9.26	21.17	196.08	26.65	246.83	
	0.70	0.25	8.00	6.15	15.39	35.17	541.17	26.65	410.06	
	0.70	0.25	8.00	7.55	18.89	43.17	815.36	26.65	503.33	
	0.70	0.25	3.56	8.57	21.42	48.95	1048.40	26.65	570.74	
Laje 1	A=	874.00	0.36	314.64	786.60	34.39	27051.69	17.32	13626.06	
	4.46	3.20	0.36	5.14	12.84	16.92	217.33	24.23	311.23	escada e1
	0.55	2.20	0.36	0.44	1.09	18.93	20.61	20.13	21.92	abertura
	0.80	7.17	0.36	2.06	5.16	23.69	122.30	22.96	118.53	abertura
	1.58	2.35	0.36	1.34	3.34	47.84	159.87	22.58	75.46	abertura
	1.69	2.35	0.36	1.43	3.57	49.78	177.93	22.58	80.71	abertura
	4.46	3.20	0.36	5.14	12.84	52.34	672.30	14.88	191.13	escada e2
			A (m ²)	V (m ³)	m _i (ton)	x (m)	m _i .x _i	y (m)	m _i .y _i	
			9.38		2.63	21.09	55.40	22.97	60.32	1
			30.07		8.42	27.99	235.67	22.80	191.96	2
			39.68		11.11	35.17	390.76	22.79	253.19	3
			36.28		10.16	42.88	435.54	22.80	231.63	4
		60.14		16.84	19.09	321.53	12.27	206.63	6	
		60.14		16.84	27.17	457.53	13.95	234.82	7	
		60.14		16.84	35.17	592.24	13.95	234.82	8	
		60.14		16.84	43.17	726.95	13.95	234.82	9	
		9.67		2.71	49.84	134.92	10.65	28.82	10	
Laje 2			253.28	91.18	227.95	9.24	2107.20	18.72	4268.04	
			8.85		2.48	6.76	16.77	15.52	38.47	3
			49.06		13.74	11.48	157.72	13.28	182.44	4
			101.03		28.29	8.46	239.21	22.64	640.36	abertura
Barras e Montante	0.30	0.50	2.08	0.31	0.78	-0.84	-0.66	26.24	20.46	
	0.30	0.50	2.08	0.31	0.78	2.15	1.68	27.21	21.22	
	0.30	0.50	2.08	0.31	0.78	5.25	4.10	27.93	21.78	
	0.30	0.50	2.08	0.31	0.78	8.41	6.56	28.41	22.16	
	0.30	0.50	2.08	0.31	0.78	11.59	9.04	28.65	22.35	
	0.30	0.50	2.08	0.31	0.78	14.77	11.52	28.68	22.37	V
	0.30	0.50	2.08	0.31	0.78	2.57	2.00	25.56	19.93	
	0.30	0.50	2.08	0.31	0.78	5.57	4.34	26.24	20.47	
	0.30	0.50	2.08	0.31	0.78	8.62	6.72	26.69	20.82	
	0.30	0.50	2.08	0.31	0.78	11.69	9.12	26.90	20.98	
	0.30	0.50	2.08	0.31	0.78	14.77	11.52	16.95	13.22	
	0.30	0.50	3.19	0.48	1.20	0.64	0.77	26.75	31.98	
	0.30	0.50	3.19	0.48	1.20	3.70	4.42	27.58	32.97	
	0.30	0.50	3.19	0.48	1.20	6.83	8.17	28.18	33.69	
0.30	0.50	3.19	0.48	1.20	10.00	11.95	28.54	34.12		

0.30	0.50	3.19	0.48	1.20	13.18	15.76	28.67	34.28
0.30	0.50	3.19	0.48	1.20	1.06	1.27	25.10	30.01
0.30	0.50	3.19	0.48	1.20	4.07	4.86	25.91	30.97
0.30	0.50	3.19	0.48	1.20	7.09	8.48	26.48	31.65
0.30	0.50	3.19	0.48	1.20	10.15	12.14	26.81	32.05
0.30	0.50	3.19	0.48	1.20	13.23	15.82	26.93	32.20

H

Σm_i	$\Sigma m_i \cdot x_i$	$\Sigma m_i \cdot y_i$
946.19	27643.83	17236.78
	$\Sigma m_i \cdot x_i / \Sigma m_i$	$\Sigma m_i \cdot y_i / \Sigma m_i$
	29.22	18.22

Coordenadas SAP
81.04 54.16

Centro de Rigidez

Elem. Est	b (m)	h (m)	l (m)	V (m ³)	m _i (ton)	I _x (m ⁴)	I _y (m ⁴)	x (m)	y (m)	x _i ·I _{xi}	y _i ·I _{yi}
P1	0.25	0.95	2.14	0.51	1.27	0.0142	0.0049	0.00	24.36	0.00	0.12
P2	0.40	0.60	2.14	0.51	1.28	0.0072	0.0032	8.17	26.47	0.06	0.08
P3	0.40	0.60	2.14	0.51	1.28	0.0072	0.0032	23.17	26.47	0.17	0.08
P4	0.40	0.60	2.14	0.51	1.28	0.0072	0.0032	31.17	26.47	0.22	0.08
P5	0.40	0.60	2.14	0.51	1.28	0.0072	0.0032	39.17	26.47	0.28	0.08
P6	0.40	0.60	2.14	0.51	1.28	0.0072	0.0032	47.17	26.47	0.34	0.08
P7	0.40	0.60	2.14	0.51	1.28	0.0072	0.0032	50.73	26.47	0.37	0.08
P9	0.25	0.60	2.14	0.32	0.80	0.0037	0.0016	3.47	17.76	0.01	0.03
P10	0.40	0.80	2.14	0.68	1.71	0.0171	0.0043	8.17	19.17	0.14	0.08
P11	0.40	0.60	2.14	0.51	1.28	0.0072	0.0032	15.17	19.17	0.11	0.06
P12	0.80	0.40	2.14	0.68	1.71	0.0043	0.0171	23.17	18.98	0.10	0.32
P13	0.40	0.60	2.14	0.51	1.28	0.0072	0.0032	31.17	19.17	0.22	0.06
P14	0.40	0.60	2.14	0.51	1.28	0.0072	0.0032	39.17	19.17	0.28	0.06
P15	0.40	0.60	2.14	0.51	1.28	0.0072	0.0032	47.17	19.17	0.34	0.06
P16	0.40	0.60	2.14	0.51	1.28	0.0072	0.0032	50.73	19.17	0.37	0.06
P18	0.25	0.95	2.14	0.51	1.27	0.0142	0.0049	8.26	8.66	0.12	0.04
P19	0.40	0.80	2.14	0.68	1.71	0.0171	0.0043	15.17	8.73	0.26	0.04
P20	0.40	0.80	2.14	0.68	1.71	0.0171	0.0043	23.17	8.73	0.40	0.04
P21	0.40	0.80	2.14	0.68	1.71	0.0171	0.0043	31.17	8.73	0.53	0.04
P22	0.40	0.80	2.14	0.68	1.71	0.0171	0.0043	39.17	8.73	0.67	0.04
P23	0.40	0.80	2.14	0.68	1.71	0.0171	0.0043	47.17	8.73	0.81	0.04
P24	0.40	0.60	2.14	0.51	1.28	0.0072	0.0032	52.49	8.73	0.38	0.03
Pa1	0.30	3.75	2.14	2.41	6.02	1.3184	0.0084	15.17	24.90	20.00	0.21
Pa2	0.30	3.75	2.14	2.41	6.02	1.3184	0.0084	18.67	24.90	24.61	0.21
Pa12	3.80	0.30	2.14	2.44	6.10	0.0086	1.3718	16.92	26.62	0.14	36.52
Pa4	0.25	2.00	2.14	1.07	2.68	0.1305	0.0388	5.23	14.41	0.68	0.56
N1	6.50	0.30	2.14	4.17	10.43	0.0146	6.8656	51.61	16.63	0.75	114.15
N12	0.30	3.80	2.14	2.44	6.10	1.3718	0.0086	54.72	14.88	75.07	0.13
N2	6.50	0.30	2.14	4.17	10.43	0.0146	6.8656	51.61	13.13	0.75	90.12

ΣI_x	ΣI_y	$\Sigma x_i \cdot I_{xi}$	$\Sigma y_i \cdot I_{yi}$
4.40	15.26	128.18	243.52

$\Sigma x_i \cdot I_{xi} / \Sigma I_x$	$\Sigma y_i \cdot I_{yi} / \Sigma I_y$
29.12	15.96

M_{tot} = 1024.71 ton
ΔM_{3,4} = 24.37 %

M_{SAP} = 701.21

e_x = 0.10
e_y = 2.26

Coordenadas SAP
80.94 51.90

PROJETO DE ESTRUTURAS E FUNDAÇÕES DE UM EDIFÍCIO DE ESCRITÓRIOS COM GRANDES VÃOS

2.5 Piso 5

Centro de Massa										
Elem. Est	a (m)	b (m)	l (m)	V (m ³)	m _i (ton)	x (m)	m _i .x _i	y (m)	m _i .y _i	
Vb5.1	0.60	0.25	7.35	1.10	2.76	1.73	4.77	21.07	58.07	
	0.60	0.25	3.88	0.58	1.46	4.18	6.08	16.41	23.88	
	0.60	0.25	6.50	0.98	2.44	6.88	16.77	11.28	27.50	
Vb5.2	0.60	0.25	7.40	1.11	2.78	54.77	151.99	22.78	63.21	
Vb5.3	0.40	0.25	4.60	0.46	1.15	52.57	60.45	10.90	12.54	
Vb5.4	0.70	0.25	6.91	1.21	3.02	11.71	35.42	8.35	25.26	
	0.70	0.25	8.00	1.40	3.50	19.16	67.05	8.35	29.23	
	0.70	0.25	8.00	1.40	3.50	27.16	95.05	8.35	29.23	
	0.70	0.25	8.00	1.40	3.50	35.17	123.10	8.35	29.23	
	0.70	0.25	8.00	1.40	3.50	43.17	151.10	8.35	29.23	
Vb5.5	0.70	0.25	5.32	0.93	2.33	49.83	116.03	8.35	19.44	
	0.70	0.25	4.50	0.79	1.97	20.90	41.14	26.65	52.47	
	0.70	0.25	8.00	3.70	9.26	21.17	196.08	26.65	246.83	
	0.70	0.25	8.00	6.15	15.39	35.17	541.17	26.65	410.06	
	0.70	0.25	8.00	7.55	18.89	43.17	815.36	26.65	503.33	
	0.70	0.25	3.56	8.57	21.42	48.95	1048.40	26.65	570.74	
Laje 1	A=	874.00	0.36	314.64	786.60	34.39	27051.69	17.32	13626.06	
	4.46	3.20	0.36	5.14	12.84	16.92	217.33	24.23	311.23	
	0.55	2.20	0.36	0.44	1.09	18.93	20.61	20.13	21.92	
	0.80	7.17	0.36	2.06	5.16	23.69	122.30	22.96	118.53	
	1.58	2.35	0.36	1.34	3.34	47.84	159.87	22.58	75.46	
	1.69	2.35	0.36	1.43	3.57	49.78	177.93	22.58	80.71	
	4.46	3.20	0.36	5.14	12.84	52.34	672.30	14.88	191.13	
				A (m ²)	V (m ³)	m _i (ton)	x (m)	m _i .x _i	y (m)	m _i .y _i
				9.38		2.63	21.09	55.40	22.97	60.32
			30.07		8.42	27.99	235.67	22.80	191.96	
			39.68		11.11	35.17	390.76	22.79	253.19	
			36.28		10.16	42.88	435.54	22.80	231.63	
			60.14		16.84	19.09	321.53	12.27	206.63	
			60.14		16.84	27.17	457.53	13.95	234.82	
			60.14		16.84	35.17	592.24	13.95	234.82	
			60.14		16.84	43.17	726.95	13.95	234.82	
			9.67		2.71	49.84	134.92	10.65	28.82	
Laje 2			253.28	91.18	227.95	9.24	2107.20	18.72	4268.04	
			8.85		2.48	6.76	16.77	15.52	38.47	
			49.06		13.74	11.48	157.72	13.28	182.44	
			66.66		18.67	8.33	155.53	21.38	399.08	
Barras e Montante	0.30	0.50	2.08	0.31	0.78	-0.84	-0.66	26.24	20.46	
	0.30	0.50	2.08	0.31	0.78	2.15	1.68	27.21	21.22	
	0.30	0.50	2.08	0.31	0.78	5.25	4.10	27.93	21.78	
	0.30	0.50	2.08	0.31	0.78	8.41	6.56	28.41	22.16	
	0.30	0.50	2.08	0.31	0.78	11.59	9.04	28.65	22.35	
	0.30	0.50	2.08	0.31	0.78	14.77	11.52	28.68	22.37	
	0.30	0.50	2.08	0.31	0.78	2.57	2.00	25.56	19.93	
	0.30	0.50	2.08	0.31	0.78	5.57	4.34	26.24	20.47	
	0.30	0.50	2.08	0.31	0.78	8.62	6.72	26.69	20.82	
	0.30	0.50	2.08	0.31	0.78	11.69	9.12	26.90	20.98	
	0.30	0.50	2.08	0.31	0.78	14.77	11.52	26.95	21.22	
	0.30	0.50	3.19	0.48	1.20	0.64	0.77	26.75	31.98	
	0.30	0.50	3.19	0.48	1.20	3.70	4.42	27.58	32.97	
	0.30	0.50	3.19	0.48	1.20	6.83	8.17	28.18	33.69	
	0.30	0.50	3.19	0.48	1.20	10.00	11.95	28.54	34.12	
	0.30	0.50	3.19	0.48	1.20	13.18	15.76	28.67	34.28	
0.30	0.50	3.19	0.48	1.20	1.06	1.27	25.10	30.01		
0.30	0.50	3.19	0.48	1.20	4.07	4.86	25.91	30.97		
0.30	0.50	3.19	0.48	1.20	7.09	8.48	26.48	31.65		

escada e1
abertura
abertura
abertura
escada e2

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abertura

V
H

0.30	0.50	3.19	0.48	1.20	10.15	12.14	26.81	32.05
0.30	0.50	3.19	0.48	1.20	13.23	15.82	26.93	32.20

$$\frac{\Sigma m_i}{955.82} \quad \frac{\Sigma m_i \cdot x_i}{27727.51} \quad \frac{\Sigma m_i \cdot y_i}{17478.06}$$

$$\frac{\Sigma m_i \cdot x_i / \Sigma m_i}{29.01} \quad \frac{\Sigma m_i \cdot y_i / \Sigma m_i}{18.29}$$

Coordenadas SAP

80.83 54.23

Centro de Rigidez

Elem. Est	b (m)	h (m)	l (m)	V (m ³)	m _i (ton)	I _x (m ⁴)	I _y (m ⁴)	x (m)	y (m)	x _i ·I _{xi}	y _i ·I _{yi}
P1	0.25	0.95	2.14	0.51	1.27	0.0142	0.0049	0.00	24.36	0.00	0.12
P3	0.40	0.60	2.14	0.51	1.28	0.0072	0.0032	23.17	26.47	0.17	0.08
P4	0.40	0.60	2.14	0.51	1.28	0.0072	0.0032	31.17	26.47	0.22	0.08
P5	0.40	0.60	2.14	0.51	1.28	0.0072	0.0032	39.17	26.47	0.28	0.08
P6	0.40	0.60	2.14	0.51	1.28	0.0072	0.0032	47.17	26.47	0.34	0.08
P7	0.40	0.60	2.14	0.51	1.28	0.0072	0.0032	50.73	26.47	0.37	0.08
P9	0.25	0.60	2.14	0.32	0.80	0.0037	0.0016	3.47	17.76	0.01	0.03
P11	0.40	0.60	2.14	0.51	1.28	0.0072	0.0032	15.17	19.17	0.11	0.06
P12	0.80	0.40	2.14	0.68	1.71	0.0043	0.0171	23.17	18.98	0.10	0.32
P13	0.40	0.60	2.14	0.51	1.28	0.0072	0.0032	31.17	19.17	0.22	0.06
P14	0.40	0.60	2.14	0.51	1.28	0.0072	0.0032	39.17	19.17	0.28	0.06
P15	0.40	0.60	2.14	0.51	1.28	0.0072	0.0032	47.17	19.17	0.34	0.06
P16	0.40	0.60	2.14	0.51	1.28	0.0072	0.0032	50.73	19.17	0.37	0.06
P18	0.25	0.95	2.14	0.51	1.27	0.0142	0.0049	8.26	8.66	0.12	0.04
P19	0.40	0.80	2.14	0.68	1.71	0.0171	0.0043	15.17	8.73	0.26	0.04
P20	0.40	0.80	2.14	0.68	1.71	0.0171	0.0043	23.17	8.73	0.40	0.04
P21	0.40	0.80	2.14	0.68	1.71	0.0171	0.0043	31.17	8.73	0.53	0.04
P22	0.40	0.80	2.14	0.68	1.71	0.0171	0.0043	39.17	8.73	0.67	0.04
P23	0.40	0.80	2.14	0.68	1.71	0.0171	0.0043	47.17	8.73	0.81	0.04
P24	0.40	0.60	2.14	0.51	1.28	0.0072	0.0032	52.49	8.73	0.38	0.03
Pa1	0.30	3.75	2.14	2.41	6.02	1.3184	0.0084	15.17	24.90	20.00	0.21
Pa2	0.30	3.75	2.14	2.41	6.02	1.3184	0.0084	18.67	24.90	24.61	0.21
Pa12	3.80	0.30	2.14	2.44	6.10	0.0086	1.3718	16.92	26.62	0.14	36.52
Pa4	0.25	2.00	2.14	1.07	2.68	0.1305	0.0388	5.23	14.41	0.68	0.56
N1	6.50	0.30	2.14	4.17	10.43	0.0146	6.8656	51.61	16.63	0.75	114.15
N12	0.30	3.80	2.14	2.44	6.10	1.3718	0.0086	54.72	14.88	75.07	0.13
N2	6.50	0.30	2.14	4.17	10.43	0.0146	6.8656	51.61	13.13	0.75	90.12

$$\frac{\Sigma I_x}{4.38} \quad \frac{\Sigma I_y}{15.25} \quad \frac{\Sigma x_i \cdot I_{xi}}{127.98} \quad \frac{\Sigma y_i \cdot I_{yi}}{243.35}$$

$M_{tot} = 1031.33 \text{ ton}$

$\Delta M_{4,5} = 0.65 \%$

$M_{SAP} = 717.65$

$$\frac{\Sigma x_i \cdot I_{xi} / \Sigma I_x}{29.24} \quad \frac{\Sigma y_i \cdot I_{yi} / \Sigma I_y}{15.96}$$

$e_x = 0.23$

$e_y = 2.33$

Coordenadas SAP

81.06 51.90

2.6 Cobertura

Centro de Massa

Elem. Est	a (m)	b (m)	l (m)	V (m ³)	m _i (ton)	x (m)	m _i .x _i	y (m)	m _i .y _i
Vb6.1	0.60	0.25	3.88	0.58	1.46	4.18	6.08	16.41	23.88
	0.60	0.25	6.50	0.98	2.44	6.88	16.77	11.28	27.50
Vb6.2	0.70	0.25	6.91	1.21	3.02	11.71	35.42	8.35	25.26
	0.70	0.25	8.00	1.40	3.50	19.16	67.05	8.35	29.23
	0.70	0.25	8.00	1.40	3.50	27.16	95.05	8.35	29.23
	0.70	0.25	8.00	1.40	3.50	35.17	123.10	8.35	29.23
	0.70	0.25	8.00	1.40	3.50	43.17	151.10	8.35	29.23
	0.70	0.25	5.32	0.93	2.33	49.83	116.03	8.35	19.44
Vb6.3	0.40	0.25	4.60	0.46	1.15	52.57	60.45	10.90	12.54
Vb6.4	0.4	0.25	5.13	0.51	1.28	50.81	65.16	21.56	27.66
Vb6.5	0.4	0.25	5.13	0.51	1.28	47.10	60.40	21.56	27.66
Vb6.6	0.6	0.25	7.75	1.16	2.91	23.17	67.34	22.78	66.19
Vb6.8	0.4	0.25	8.00	0.80	2.00	19.07	38.14	18.90	37.80
Vb6.9	0.4	0.25	4.35	0.44	1.09	20.93	22.76	26.65	28.98
Vb6.10	0.4	0.25	3.55	0.36	0.89	48.95	43.45	18.90	16.77
Vb6.11	0.4	0.25	3.55	0.36	0.89	48.95	43.45	24.03	21.33

Laje 1	A=	706.02	0.36	254.17	635.42	29.50	18743.13	13.47	8558.49
			A (m ²)	V (m ³)	m _i (ton)	x (m)	m _i .x _i	y (m)	m _i .y _i
			60.14		16.84	19.09	321.53	12.27	206.63
			60.14		16.84	27.17	457.53	13.95	234.82
			60.14		16.84	35.17	592.24	13.95	234.82
			60.14		16.84	43.17	726.95	13.95	234.82
			9.67		2.71	49.84	134.92	10.65	28.82
			17.90		5.01	6.76	33.91	15.52	77.80
		62.69		17.55	11.48	201.52	13.28	233.11	

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Laje 2	A=	10.6635	0.36	3.84	9.60	48.95	469.80	21.47	206.01
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Laje 3	A=	120.9052	0.36	43.53	108.81	15.15	1648.02	22.72	2472.07
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Σm_i	$\Sigma m_i \cdot x_i$	$\Sigma m_i \cdot y_i$
695.93	19404.08	10437.66
	$\Sigma m_i \cdot x_i / \Sigma m_i$	$\Sigma m_i \cdot y_i / \Sigma m_i$
	27.88	15.00

Coordenadas SAP
79.71 50.94

Centro de Rigidez

Elem. Est	b (m)	h (m)	l (m)	V (m ³)	m _i (ton)	I _x (m ⁴)	I _y (m ⁴)	x (m)	y (m)	x _i .I _{xi}	y _i .I _{yi}
P1	0.25	0.95	2.14	0.51	1.27	0.0142	0.0049	0.00	24.36	0.00	0.12
P3	0.40	0.60	2.14	0.51	1.28	0.0072	0.0032	23.17	26.47	0.17	0.08
P9	0.25	0.60	2.14	0.32	0.80	0.0037	0.0016	3.47	17.76	0.01	0.03
P11	0.40	0.60	2.14	0.51	1.28	0.0072	0.0032	15.17	19.17	0.11	0.06
P12	0.80	0.40	2.14	0.68	1.71	0.0043	0.0171	23.17	18.98	0.10	0.32
P13	0.40	0.60	2.14	0.51	1.28	0.0072	0.0032	31.17	19.17	0.22	0.06
P14	0.40	0.60	2.14	0.51	1.28	0.0072	0.0032	39.17	19.17	0.28	0.06
P15	0.40	0.60	2.14	0.51	1.28	0.0072	0.0032	47.17	19.17	0.34	0.06

P18	0.25	0.95	2.14	0.51	1.27	0.0142	0.0049	8.26	8.66	0.12	0.04
P19	0.40	0.80	2.14	0.68	1.71	0.0171	0.0043	15.17	8.73	0.26	0.04
P20	0.40	0.80	2.14	0.68	1.71	0.0171	0.0043	23.17	8.73	0.40	0.04
P21	0.40	0.80	2.14	0.68	1.71	0.0171	0.0043	31.17	8.73	0.53	0.04
P22	0.40	0.80	2.14	0.68	1.71	0.0171	0.0043	39.17	8.73	0.67	0.04
P23	0.40	0.80	2.14	0.68	1.71	0.0171	0.0043	47.17	8.73	0.81	0.04
P24	0.40	0.60	2.14	0.51	1.28	0.0072	0.0032	52.49	8.73	0.38	0.03
Pa1	0.30	3.75	2.14	2.41	6.02	1.3184	0.0084	15.17	24.90	20.00	0.21
Pa2	0.30	3.75	2.14	2.41	6.02	1.3184	0.0084	18.67	24.90	24.61	0.21
Pa12	3.80	0.30	2.14	2.44	6.10	0.0086	1.3718	16.92	26.62	0.14	36.52
Pa4	0.25	2.00	2.14	1.07	2.68	0.1305	0.0388	5.23	14.41	0.68	0.56
N1	6.50	0.30	2.14	4.17	10.43	0.0146	6.8656	51.61	16.63	0.75	114.15
N12	0.30	3.80	2.14	2.44	6.10	1.3718	0.0086	54.72	14.88	75.07	0.13
N2	6.50	0.30	2.14	4.17	10.43	0.0146	6.8656	51.61	13.13	0.75	90.12

ΣI_x	ΣI_y	$\Sigma x_i \cdot I_{xi}$	$\Sigma y_i \cdot I_{yi}$
4.34	15.24	126.41	242.95

$M_{tot} = 762.47$ ton
 $\Delta M_{s,cob} = 26.07$ %

$\frac{\Sigma x_i \cdot I_{xi}}{\Sigma I_x}$	$\frac{\Sigma y_i \cdot I_{yi}}{\Sigma I_y}$
29.11	15.95

$M_{SAP} = 596.93$

$e_x = 1.23$
 $e_y = 0.95$

Coordenadas SAP
80.94 51.89

2.7 Comparação excentricidades

	CM_x	CM_y	CR_x	CR_y	e_x	e_y
Piso1	30.14	13.79	29.49	15.96	0.65	-2.17
Piso2	29.55	16.01	29.49	15.96	0.06	0.05
Piso3	27.95	15.88	29.36	15.96	-1.40	-0.08
Piso4	29.22	18.22	29.12	15.96	0.10	2.26
Piso5	29.01	18.29	29.24	15.96	-0.23	2.33
Cob	27.88	15.00	29.11	15.95	-1.23	-0.95

3 REGULARIDADE EM PLANTA

3.1 Esbelteza dos pisos

$$\lambda = \frac{l_{max}}{l_{min}} < 4,0 \tag{3.1}$$

Em que:

l_{max} Maior dimensão em planta do edifício;
 l_{min} Menor dimensão em planta do edifício.

	l_{max} [m]	l_{min} [m]	λ
Piso 1	55,23	26,99	2,05
Piso 2	55,23	21,85	2,53
Piso 3	55,23	21,85	2,53
Piso 4	56,02	22,77	2,46
Piso 5	56,02	22,77	2,46
Cobertura	52,8	14,71	3,59

3.2 Excentricidades e raios de torção e giração

$$e_{x0} \leq 0,30 \cdot r_x \tag{3.2}$$

$$r_x \geq l_s \tag{3.3}$$

Em que:

e_{x0} Distancia entre o centro de rigidez e o centro de gravidade, medida segundo a direção x , perpendicular à direção de cálculo considerada;

$r_x = \sqrt{\frac{k_\theta}{k_y}}$ Raiz quadrada da relação entre a rigidez de torção e a rigidez lateral na direção y (“raio de torção”);

l_s Raio de giração da massa do piso em planta, igual a $\sqrt{\frac{I_x + I_y}{A}}$, sendo A a área em planta do edifício e I_x e I_y as inércias em torno de x e y .

3.2.1 MODELO GLOBAL

3.2.1.1 Piso 1

<u>Planta</u>	<u>CM</u>	<u>CR</u>
$I_x = 73966.46 \text{ m}^4$	$x_{CM} = 30.14$	$x_{CR} = 29.49$
$I_y = 268326.19 \text{ m}^4$	$y_{CM} = 13.79$	$y_{CR} = 15.96$

$$A = 1298.23 \text{ m}^2$$

$$I_s = 16.24 \text{ m} \quad \text{Não Regular em x}$$

$$e_{0x} = 0.65 < 0.3 \cdot r_x = 57.517 \quad \text{Regular em y}$$

$$e_{0y} = 2.17 < 0.3 \cdot r_y = 3.827 \quad \text{Regular em x}$$

Pelo SAP com diafragmas

$$d_x = 8.85E-07 \quad d_y = 2.00E-04 \quad \Theta_z = 5.44E-09$$

$$k_x = 1.13E+09 \quad k_y = 5000000 \quad k_\Theta = 1.84E+11$$

$$r_x = 191.7236 \quad r_y = 12.75647$$

3.2.1.2 Piso 2

Planta

$$I_x = 40392.85 \text{ m}^4$$

$$I_y = 231892.59 \text{ m}^4$$

$$A = 1077.68 \text{ m}^2$$

$$I_s = 15.89528 \text{ m}$$

CM

$$x_{CM} = 29.55$$

$$y_{CM} = 16.01$$

CR

$$x_{CR} = 29.49$$

$$y_{CR} = 15.96$$

$$e_{0x} = 0.06 < 0.3 \cdot r_x = 15.160 \quad \text{Regular em y}$$

$$e_{0y} = 0.05 < 0.3 \cdot r_y = 2.962 \quad \text{Regular em x}$$

Pelo SAP com diafragmas

$$d_x = 1.91E-05 \quad d_y = 5.00E-04 \quad \Theta_z = 1.96E-07$$

$$k_x = 52383447 \quad k_y = 2000000 \quad k_\Theta = 5.11E+09$$

$$r_x = 50.53342 \quad r_y = 9.87408$$

3.2.1.3 Piso 3

Planta

$$I_x = 38089.99 \text{ m}^4$$

$$I_y = 210006.13 \text{ m}^4$$

$$A = 1036.81 \text{ m}^2$$

$$I_s = 15.46893 \text{ m}$$

CM

$$x_{CM} = 27.95$$

$$y_{CM} = 15.88$$

CR

$$x_{CR} = 29.36$$

$$y_{CR} = 15.96$$

$$e_{0x} = 1.40 < 0.3 \cdot r_x = 14.74096 \quad \text{Regular em y}$$

$$e_{0y} = 0.08 < 0.3 \cdot r_y = 2.918223 \quad \text{Regular em x}$$

Pelo SAP com diafragmas

$$k_x = 23196474 \quad k_y = 909090.9 \quad k_\theta = 2.19E+09$$

$$r_x = 49.13653 \quad r_y = 9.727408$$

3.2.1.4 Piso 4

<u>Planta</u>		<u>CM</u>	<u>CR</u>
$I_x = 47531.42 \text{ m}^4$		$x_{CM} = 29.14$	$x_{CR} = 29.12$
$I_y = 236837.82 \text{ m}^4$		$y_{CM} = 18.25$	$y_{CR} = 15.96$
$A = 1127.28 \text{ m}^2$			
$I_s = 15.88274 \text{ m}$		Não Regular em x	
$e_{0x} = 0.02$	<	$0.3*r_x = 11.33893$	<u>Regular em y</u>
$e_{0y} = 2.29$	<	$0.3*r_y = 3.499271$	<u>Regular em x</u>

Pelo SAP com diafragmas

$$d_x = 2.00E-04 \quad d_y = 2.10E-03 \quad \theta_z = 1.47E-06$$

$$k_x = 5000000 \quad k_y = 476190.5 \quad k_\theta = 6.8E+08$$

$$r_x = 37.79645 \quad r_y = 11.66424$$

3.2.1.5 Piso 5

<u>Planta</u>		<u>CM</u>	<u>CR</u>
$I_x = 47531.42 \text{ m}^4$		$x_{CM} = 28.93$	$x_{CR} = 29.24$
$I_y = 236837.82 \text{ m}^4$		$y_{CM} = 18.32$	$y_{CR} = 15.96$
$A = 1127.28 \text{ m}^2$			
$I_s = 15.88274 \text{ m}$		Não Regular em x	
$e_{0x} = 0.30$	<	$0.3*r_x = 9.733285$	<u>Regular em y</u>
$e_{0y} = 2.36$	<	$0.3*r_y = 4.029963$	<u>Regular em x</u>

Pelo SAP com diafragmas

$$d_x = 6.00E-04 \quad d_y = 3.50E-03 \quad \theta_z = 3.33E-06$$

$$k_x = 1666667 \quad k_y = 285714.3 \quad k_\theta = 3.01E+08$$

$$r_x = 32.44428 \quad r_y = 13.43321$$

3.2.1.6 Cobertura

<u>Planta</u>		<u>CM</u>	<u>CR</u>
$I_x = 12227.65 \text{ m}^4$		$x_{CM} = 27.88$	$x_{CR} = 29.11$
$I_y = 139016.16 \text{ m}^4$		$y_{CM} = 15.00$	$y_{CR} = 15.95$
$A = 706.02 \text{ m}^2$			

$$I_s = 14.63629 \text{ m}$$

Não é regular em x

$$e_{0x} = 1.23 < 0.3 * r_x = 9.009279 \quad \text{Regular em y}$$

$$e_{0y} = 0.95 < 0.3 * r_y = 3.989376 \quad \text{Regular em x}$$

Pelo SAP com diafragmas

$$d_x = 1.00E-03 \quad d_y = 5.10E-03 \quad \Theta_z = 5.66E-06$$

$$k_x = 1000000 \quad k_y = 196078.4 \quad k_\theta = 1.77E+08$$

$$r_x = 30.03093 \quad r_y = 13.29792$$

3.2.2 MODELO PARCIAL

3.2.2.1 Piso 1

Planta

$$I_x = 73966.46 \text{ m}^4$$

$$I_y = 268326.19 \text{ m}^4$$

$$A = 1298.23 \text{ m}^2$$

$$I_s = 16.24 \text{ m}$$

CM

$$x_{CM} = 30.14$$

$$y_{CM} = 13.79$$

CR

$$x_{CR} = 29.49$$

$$y_{CR} = 15.96$$

$$e_{0x} = 0.65 < 0.3 * r_x = 57.491 \quad \text{Regular em y}$$

$$e_{0y} = 2.17 < 0.3 * r_y = 3.826 \quad \text{Regular em x}$$

Pelo SAP com diafragmas

$$d_x = 8.86E-07 \quad d_y = 2.00E-04 \quad \Theta_z = 5.45E-09$$

$$k_x = 1.13E+09 \quad k_y = 5000000 \quad k_\theta = 1.84E+11$$

$$r_x = 191.6356 \quad r_y = 12.75349$$

3.2.2.2 Piso 2

Planta

$$I_x = 40392.85 \text{ m}^4$$

$$I_y = 231892.59 \text{ m}^4$$

$$A = 1077.68 \text{ m}^2$$

$$I_s = 15.89528 \text{ m}$$

CM

$$x_{CM} = 29.55$$

$$y_{CM} = 16.01$$

CR

$$x_{CR} = 29.49$$

$$y_{CR} = 15.96$$

$$e_{0x} = 0.06 < 0.3 * r_x = 16.298 \quad \text{Regular em y}$$

$$e_{0y} = 0.05 < 0.3 * r_y = 2.958 \quad \text{Regular em x}$$

Pelo SAP com diafragmas

$$\begin{array}{llll}
 d_x = & 1.98E-05 & d_y = & 6.00E-04 & \Theta_z = & 2.03E-07 \\
 k_x = & 50581689 & k_y = & 1666667 & k_\Theta = & 4.92E+09 \\
 \\
 r_x = & 54.3259 & r_y = & 9.861311 & &
 \end{array}$$

3.2.2.3 Piso 3

<u>Planta</u>		<u>CM</u>	<u>CR</u>
$I_x = 38089.99 \text{ m}^4$		$x_{CM} = 27.95$	$x_{CR} = 29.36$
$I_y = 210006.13 \text{ m}^4$		$y_{CM} = 15.88$	$y_{CR} = 15.96$
$A = 1036.81 \text{ m}^2$			
$I_s = 15.46893 \text{ m}$		<u>Não Regular em x</u>	
$e_{0x} = 1.40$	<	$0.3*r_x = 15.75092$	<u>Regular em y</u>
$e_{0y} = 0.08$	<	$0.3*r_y = 2.917112$	<u>Regular em x</u>

Pelo SAP com diafragmas

$$\begin{array}{llll}
 d_x = & 4.46E-05 & d_y = & 1.30E-03 & \Theta_z = & 4.72E-07 \\
 k_x = & 22426553 & k_y = & 769230.8 & k_\Theta = & 2.12E+09 \\
 \\
 r_x = & 52.50308 & r_y = & 9.723706 & &
 \end{array}$$

3.2.2.4 Piso 4

<u>Planta</u>		<u>CM</u>	<u>CR</u>
$I_x = 47531.42 \text{ m}^4$		$x_{CM} = 29.14$	$x_{CR} = 29.12$
$I_y = 236837.82 \text{ m}^4$		$y_{CM} = 18.25$	$y_{CR} = 15.96$
$A = 1127.28 \text{ m}^2$			
$I_s = 15.88274 \text{ m}$		<u>Não Regular em x</u>	
$e_{0x} = 0.02$	<	$0.3*r_x = 11.74816$	<u>Regular em y</u>
$e_{0y} = 2.29$	<	$0.3*r_y = 3.391401$	<u>Regular em x</u>

Pelo SAP com diafragmas

$$\begin{array}{llll}
 d_x = & 2.00E-04 & d_y = & 2.40E-03 & \Theta_z = & 1.57E-06 \\
 k_x = & 5000000 & k_y = & 416666.7 & k_\Theta = & 6.39E+08 \\
 \\
 r_x = & 39.16052 & r_y = & 11.30467 & &
 \end{array}$$

3.2.2.5 Piso 5

<u>Planta</u>		<u>CM</u>	<u>CR</u>
$I_x = 47531.42 \text{ m}^4$		$x_{CM} = 28.93$	$x_{CR} = 29.24$
$I_y = 236837.82 \text{ m}^4$		$y_{CM} = 18.32$	$y_{CR} = 15.96$
$A = 1127.28 \text{ m}^2$			
$I_s = 15.88274 \text{ m}$		Não Regular em x	
$e_{0x} = 0.30$	<	$0.3 * r_x = 10.36103$	<u>Regular em y</u>
$e_{0y} = 2.36$	<	$0.3 * r_y = 3.870297$	<u>Regular em x</u>

Pelo SAP com diafragmas

$d_x = 6.00E-04$	$d_y = 4.30E-03$	$\Theta_z = 3.61E-06$
$k_x = 1666667$	$k_y = 232558.1$	$k_\Theta = 2.77E+08$
$r_x = 34.53676$	$r_y = 12.90099$	

3.2.2.6 Cobertura

<u>Planta</u>		<u>CM</u>	<u>CR</u>
$I_x = 12227.65 \text{ m}^4$		$x_{CM} = 27.88$	$x_{CR} = 29.11$
$I_y = 139016.16 \text{ m}^4$		$y_{CM} = 15.00$	$y_{CR} = 15.95$
$A = 706.02 \text{ m}^2$			
$I_s = 14.63629 \text{ m}$		Não é regular em x	
$e_{0x} = 1.23$	<	$0.3 * r_x = 9.618485$	<u>Regular em y</u>
$e_{0y} = 0.95$	<	$0.3 * r_y = 4.164926$	<u>Regular em x</u>

Pelo SAP com diafragmas

$d_x = 1.20E-03$	$d_y = 6.40E-03$	$\Theta_z = 6.23E-06$
$k_x = 833333.3$	$k_y = 156250$	$k_\Theta = 1.61E+08$
$r_x = 32.06162$	$r_y = 13.88309$	

3.2.3 COMPARAÇÃO DOS RAIOS DE GIRAÇÃO DOS DOIS MODELOS

<u>Piso</u>	<u>$r_{x,Global}$</u>	<u>$r_{x,Parcial}$</u>		<u>Piso</u>	<u>$r_{y,Global}$</u>	<u>$r_{y,Parcial}$</u>	
1	191.724	191.636	>	1	12.7565	12.7535	>
2	50.521	54.326	<	2	9.8716	9.8613	>
3	49.120	52.503	<	3	9.7276	9.7237	>
4	37.771	39.161	<	4	11.6563	11.3047	>
5	32.425	34.537	<	5	13.4251	12.9010	>
Cob	30.004	32.062	<	Cob	13.2862	13.8831	<

4 REGULARIDADE EM ALTURA

4.1 Variações de massa e rigidez dos pisos

Piso	Massa SAP2000 [Ton]	K_x [KN/m]	K_y [KN/m]
1	946,87	$1,13 \times 10^9$	$5,00 \times 10^6$
2	782,27	$5,23 \times 10^7$	$2,00 \times 10^6$
3	724,47	$2,32 \times 10^7$	$9,09 \times 10^5$
4	701,21	$5,00 \times 10^6$	$4,76 \times 10^5$
5	717,65	$1,67 \times 10^6$	$2,86 \times 10^5$
Cobertura	596,93	$1,00 \times 10^6$	$1,96 \times 10^5$

4.2 Recuos em planta

Piso	Dim. em planta x [m]	Dim. em planta y [m]	Verificação dos recuos							
			<30% em x		<30% em y		<10% em x		<10% em y	
1	55,23	26,99	-	-	-	-	-	-	-	-
2	55,23	21,85	0%	Verifica	19%	Verifica	0%	Verifica	19%	Não Verifica
3	51,30	21,85	7%	Verifica	19%	Verifica	7%	Verifica	0%	Verifica
4	53,27	22,77	4%	Verifica	16%	Verifica	-4%	Verifica	-4%	Verifica
5	53,27	22,77	4%	Verifica	16%	Verifica	0%	Verifica	0%	Verifica
Cobertura	52,80	14,71	4%	Verifica	45%	Não Verifica	1%	Verifica	35%	Não Verifica

5 CÁLCULO DA AÇÃO SÍSMICA

5.1 Definição dos parâmetros de cálculo

1- Localização: Lisboa

2- Zonamento Sísmico:

	Sismo Tipo 1	Sismo Tipo 2
Zona	1.30	2.30
a_{gR} (m/s ²)	1.50	1.70

Quadro NA.I

3- Classe De Importância: II Quadro 4.3

4- Coeficiente de Importância:

	Sismo Tipo 1	Sismo Tipo 2
γ_{II}	1.00	1.00

Quadro NA.II Logo $a_g = a_{gr}$

5- Efeito do Terreno: Tipo B Quadro 3.1

Depósitos de areia muito compacta, de seixo (cascalho) ou de argila muito rija, com uma espessura de, pelo menos, várias dezenas de metros, caracterizados por um aumento gradual das propriedades mecânicas com a profundidade

Acção Sísmica Tipo 1				
Tipo	$S_{máx}$	$T_B(S)$	$T_C(S)$	$T_D(S)$
B	1.35	0.10	0.60	2.00

Quadro NA-3.2

Acção Sísmica Tipo 2				
Tipo	$S_{máx}$	$T_B(S)$	$T_C(S)$	$T_D(S)$
B	1.35	0.10	0.25	2.00

Quadro NA-3.3

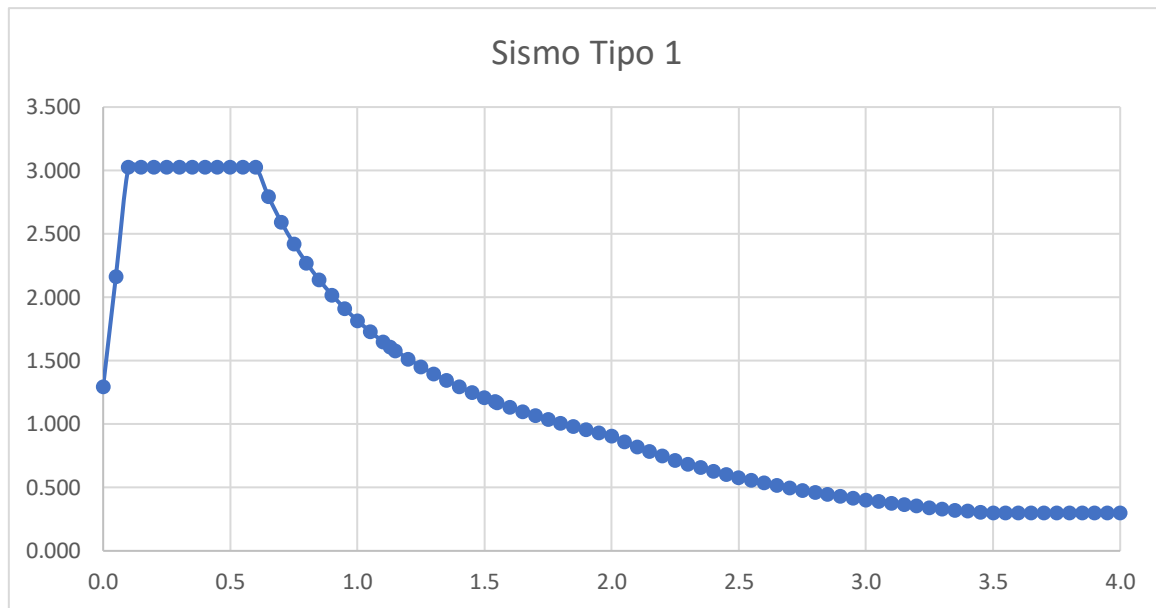
6- Determinação de S em função de a_g

$a_g \leq 1 \text{ m/s}^2 \quad S = S_{\max}$ $1 \text{ m/s}^2 < a_g < 4 \text{ m/s}^2 \quad S = S_{\max} - \frac{S_{\max} - 1}{3} (a_g - 1)$ $a_g \geq 4 \text{ m/s}^2 \quad S = 1,0$
--

	Sismo Tipo 1	Sismo Tipo 2
S	1.29	1.27
Justificação	$1 < a_g < 4$	$1 < a_g < 4$

5.2 Espectro de cálculo da ação sísmica tipo 1

T	S _{dl} (T)
0.0	1.298
0.05	2.163
0.1	3.027
0.15	3.027
0.2	3.027
0.25	3.027
0.3	3.027
0.35	3.027
0.4	3.027
0.45	3.027
0.5	3.027
0.55	3.027
0.6	3.027
0.65	2.794
0.7	2.595
0.75	2.422
0.8	2.271
0.85	2.137
0.9	2.018
0.95	1.912
1	1.816
1.05	1.730
1.1	1.651
1.129	1.609
1.15	1.579
1.2	1.514
1.25	1.453
1.3	1.397
1.35	1.345
1.4	1.297
1.45	1.253
1.5	1.211
1.541	1.179
1.55	1.172
1.6	1.135
1.65	1.101
1.7	1.068
1.75	1.038
1.8	1.009
1.85	0.982
1.9	0.956
1.95	0.931
2	0.908
2.05	0.864
2.1	0.824
2.15	0.786
2.2	0.751
2.25	0.718
2.3	0.687
2.35	0.658
2.4	0.631
2.45	0.605
2.5	0.581
2.55	0.559
2.6	0.537
2.65	0.517
2.7	0.498
2.75	0.480
2.8	0.463
2.85	0.447
2.9	0.432
2.95	0.417
3	0.404
3.05	0.391
3.1	0.378
3.15	0.366
3.2	0.355
3.25	0.344
3.3	0.334
3.35	0.324
3.4	0.314
3.45	0.305
3.5	0.300
3.55	0.300
3.6	0.300
3.65	0.300
3.7	0.300
3.75	0.300
3.8	0.300
3.85	0.300
3.9	0.300
3.95	0.300
4	0.300



Acção Sísmica Tipo 1				
Tipo	S _{máx}	T _B (S)	T _C (S)	T _D (S)
B	1.35	0.10	0.60	2.00

Ductilidade Média

Sismo Tipo 1		q	
Zona	1.30	1.60	
a _g	1.50		

Torção Acidental		
T	f	S
0.2213	4.51875	3.027
0.70015	1.42827	2.594

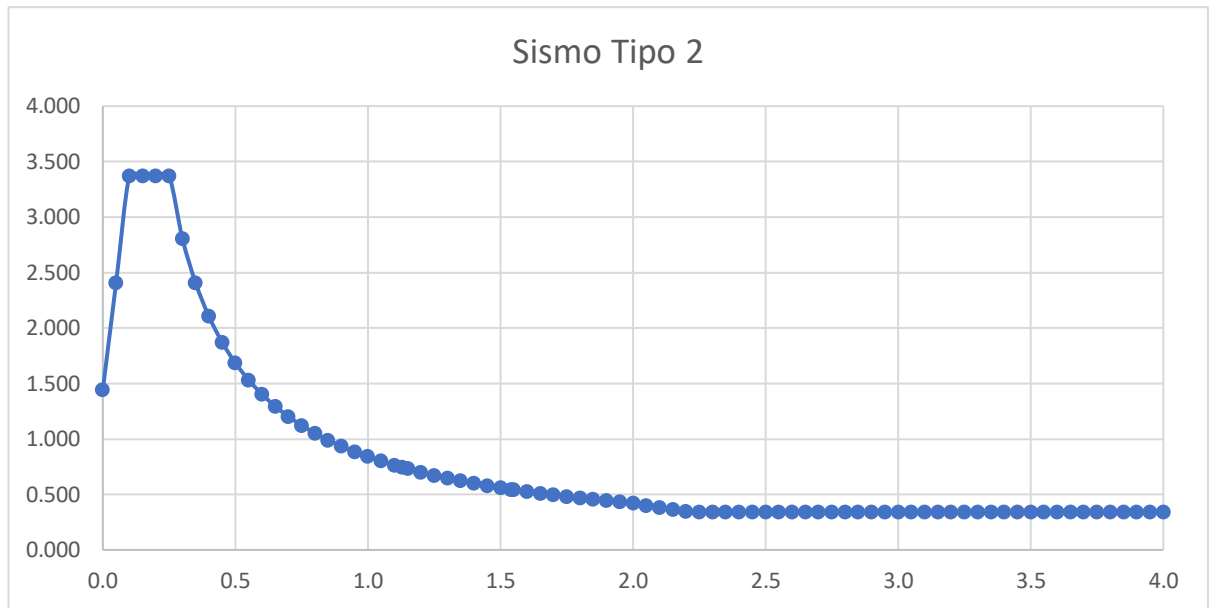
Trans. X (Modal 3)
Trans. Y (Modal 1)

Sismo Tipo 1		Sismo Tipo 1	
γ _c	1.00	S	1.29

$$\begin{aligned}
 0 \leq T \leq T_B: & \quad S_d(T) = a_g \cdot S \cdot \left[\frac{2}{3} + \frac{T}{T_B} \cdot \left(\frac{2.5}{q} - \frac{2}{3} \right) \right] \\
 T_B \leq T \leq T_C: & \quad S_d(T) = a_g \cdot S \cdot \frac{2.5}{q} \\
 T_C \leq T \leq T_D: & \quad S_d(T) = \begin{cases} a_g \cdot S \cdot \frac{2.5}{q} \left[\frac{T_C}{T} \right] \\ \geq \beta \cdot a_g \end{cases} \\
 T_D \leq T \leq 4s: & \quad S_d(T) = \begin{cases} a_g \cdot S \cdot \frac{2.5}{q} \left[\frac{T_C \cdot T_D}{T^2} \right] \\ \geq \beta \cdot a_g \end{cases}
 \end{aligned}$$

5.3 Espectro de cálculo da ação sísmica tipo 2

T	S ₀₂ (T)
0.0	1.445
0.05	2.407
0.1	3.369
0.15	3.369
0.2	3.369
0.25	3.369
0.3	2.808
0.35	2.406
0.4	2.106
0.45	1.872
0.5	1.685
0.55	1.531
0.6	1.404
0.65	1.296
0.7	1.203
0.75	1.123
0.8	1.053
0.85	0.991
0.9	0.936
0.95	0.887
1	0.842
1.05	0.802
1.1	0.766
1.129	0.746
1.15	0.732
1.2	0.702
1.25	0.674
1.3	0.648
1.35	0.624
1.4	0.602
1.45	0.581
1.5	0.562
1.541	0.547
1.55	0.543
1.6	0.526
1.65	0.510
1.7	0.495
1.75	0.481
1.8	0.468
1.85	0.455
1.9	0.443
1.95	0.432
2	0.421
2.05	0.401
2.1	0.382
2.15	0.364
2.2	0.348
2.25	0.340
2.3	0.340
2.35	0.340
2.4	0.340
2.45	0.340
2.5	0.340
2.55	0.340
2.6	0.340
2.65	0.340
2.7	0.340
2.75	0.340
2.8	0.340
2.85	0.340
2.9	0.340
2.95	0.340
3	0.340
3.05	0.340
3.1	0.340
3.15	0.340
3.2	0.340
3.25	0.340
3.3	0.340
3.35	0.340
3.4	0.340
3.45	0.340
3.5	0.340
3.55	0.340
3.6	0.340
3.65	0.340
3.7	0.340
3.75	0.340
3.8	0.340
3.85	0.340
3.9	0.340
3.95	0.340
4	0.340



Acção Sísmica Tipo 2				
Tipo	S _{máx}	T _B (S)	T _C (S)	T _D (S)
B	1.35	0.10	0.25	2.00

Ductilidade Média

Sismo Tipo 2		q	
Zona	2.30		1.6
a _g	1.70		

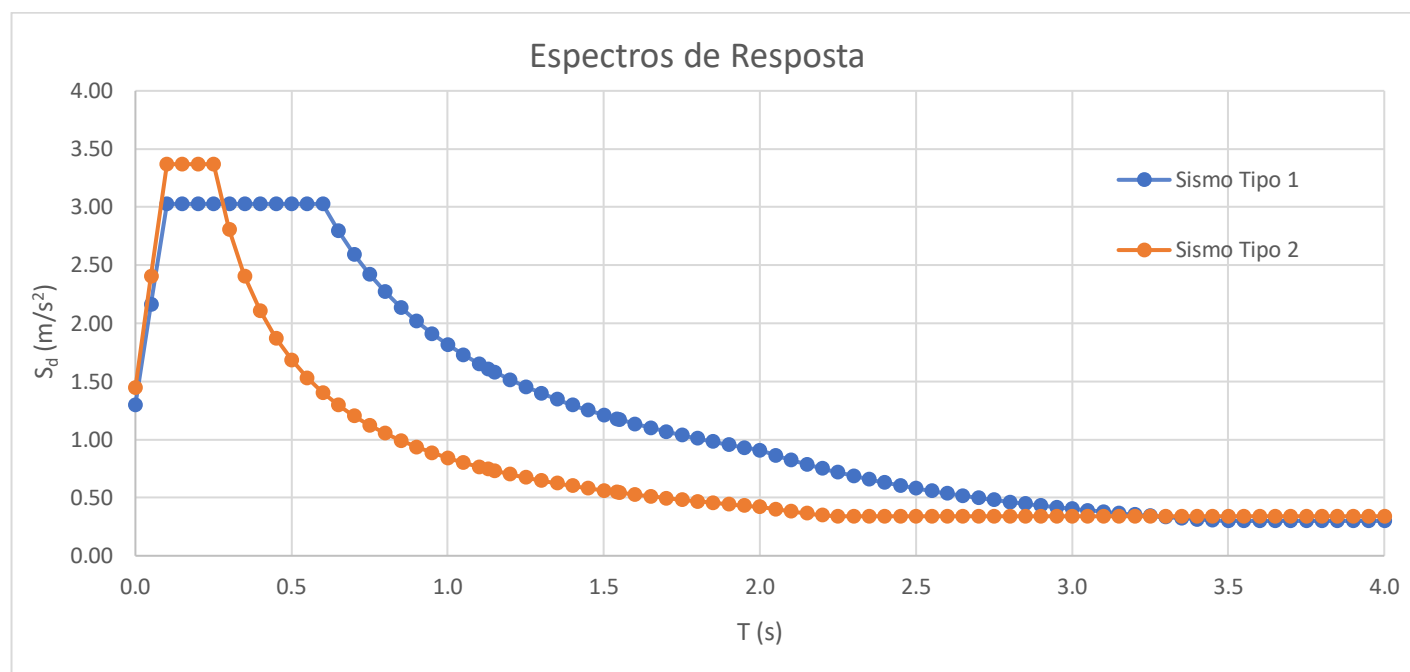
Torção Acidental		
T	f	S
0.2213	4.51875	3.369
0.70015	1.42827	1.203

Trans. X (Modal 3)
Trans. Y (Modal 1)

Sismo Tipo 2		Sismo Tipo 2	
γ _c	1.00	S	1.27

$$\begin{aligned}
 0 \leq T \leq T_B: & \quad S_d(T) = a_g \cdot S \cdot \left[\frac{2}{3} + \frac{T}{T_B} \cdot \left(\frac{2.5}{q} - \frac{2}{3} \right) \right] \\
 T_B \leq T \leq T_C: & \quad S_d(T) = a_g \cdot S \cdot \frac{2.5}{q} \\
 T_C \leq T \leq T_D: & \quad S_d(T) = a_g \cdot S \cdot \frac{2.5}{q} \left[\frac{T_C}{T} \right] \\
 & \quad \geq \beta \cdot a_g \\
 T_D \leq T \leq 4s: & \quad S_d(T) = a_g \cdot S \cdot \frac{2.5}{q} \left[\frac{T_C \cdot T_D}{T^2} \right] \\
 & \quad \geq \beta \cdot a_g
 \end{aligned}$$

5.4 Espectro de cálculo da ação sísmica tipo 1 e 2



6 CONTRIBUIÇÃO DO SISTEMA SECUNDÁRIO PARA A RIGIDEZ LATERAL DA ESTRUTURA

$$\frac{d_{e2}}{d_{e1}} < 1,15 \quad (6.1)$$

Em que:

- d_2 Deslocamento do modelo parcial;
 d_{e1} Deslocamento do modelo global.

Sismo Tipo 1							
Direção X				Direção Y			
Em x				Em y			
Piso	d_{e2} [mm]	d_{e1} [mm]	d_{e2}/d_{e1}	Piso	d_{e2} [mm]	d_{e1} [mm]	d_{e2}/d_{e1}
1	0.003	0.003	0.984	1	5.000	5.000	1.000
2	0.400	0.400	1.000	2	12.300	12.000	1.025
3	1.100	1.100	1.000	3	22.300	21.100	1.057
4	2.900	2.700	1.074	4	34.200	31.800	1.075
5	4.800	4.500	1.067	5	46.600	42.600	1.094
Cob	6.400	6.000	1.067	Cob	55.900	50.400	1.109

Sismo Tipo 2							
Direção X				Direção Y			
Em x				Em y			
Piso	d_{e2} [mm]	d_{e1} [mm]	d_{e2}/d_{e1}	Piso	d_{e2} [mm]	d_{e1} [mm]	d_{e2}/d_{e1}
1	0.002	0.002	0.994	1	2.800	2.700	1.037
2	0.300	0.300	1.000	2	6.500	6.300	1.032
3	0.800	0.800	1.000	3	11.400	10.900	1.046
4	2.300	2.200	1.045	4	17.400	16.200	1.074
5	4.200	4.200	1.000	5	23.600	21.700	1.088
Cob	5.800	5.700	1.018	Cob	28.500	25.800	1.105

7 ANÁLISE MODAL

	T (s)	f (Hz)	U _x (%)	U _y (%)	U _z (%)	ΣU _x	ΣU _y	ΣU _z
1	0.700148	1.4283	0.0014	<u>0.6847</u>	0.00025	0.0014	0.6847	0.00025
2	0.355914	2.8097	<u>0.13443</u>	0.01218	0.00018	0.13583	0.69688	0.00043
3	0.221296	4.5188	<u>0.28792</u>	0.00041	0.00063	0.42375	0.69729	0.00106
4	0.197843	5.0545	0.00035	<u>0.19912</u>	0.00059	0.42411	0.89641	0.00165
5	0.177541	5.6325	7.66E-06	0.00039	<u>0.28701</u>	0.42411	0.8968	0.28866
6	0.169854	5.8874	5.41E-06	0.00209	0.01771	0.42412	0.8989	0.30636
7	0.167851	5.9577	0.0001	0.00039	9.06E-05	0.42422	0.89929	0.30645
8	0.164505	6.0788	0.00321	0.00675	0.00848	0.42743	0.90604	0.31494
9	0.160129	6.2450	3.68E-06	3.17E-06	0.00012	0.42743	0.90604	0.31505
10	0.154621	6.4674	5.64E-05	0.00018	0.00085	0.42749	0.90622	0.3159
11	0.153779	6.5028	0.00016	6.89E-05	0.00517	0.42765	0.90629	0.32106
12	0.15273	6.5475	0.00025	7.13E-05	0.01111	0.4279	0.90636	0.33217
13	0.150545	6.6425	0.0003	4.04E-05	0.00186	0.4282	0.9064	0.33404
14	0.144593	6.9160	4.32E-06	2.00E-06	0.00044	0.4282	0.9064	0.33448
15	0.140045	7.1406	1.83E-06	0.00021	4.95E-05	0.4282	0.90661	0.33453
16	0.138279	7.2318	0.00048	4.64E-05	0.00878	0.42869	0.90666	0.34331
17	0.137493	7.2731	3.17E-05	3.76E-05	0.00365	0.42872	0.9067	0.34696
18	0.136588	7.3213	0.00025	0.00017	<u>0.07549</u>	0.42897	0.90686	0.42245
19	0.132739	7.5336	0.00014	0.00011	2.00E-05	0.42911	0.90697	0.42247
20	0.130602	7.6569	1.47E-05	5.41E-07	3.13E-05	0.42913	0.90697	0.4225
21	0.129698	7.7102	0.00029	2.88E-05	0.01196	0.42942	0.907	0.43446
22	0.127693	7.8313	4.28E-05	8.10E-06	0.01325	0.42946	0.907	0.44771
23	0.127153	7.8645	0.0001	4.45E-06	1.80E-07	0.42956	0.90701	0.44771
24	0.126877	7.8816	0.00011	5.13E-06	0.02539	0.42967	0.90701	0.4731
25	0.12228	8.1780	2.31E-05	1.14E-05	0.00099	0.42969	0.90703	0.47409
26	0.120651	8.2884	0.00021	0.00019	0.00031	0.4299	0.90722	0.47441
27	0.120255	8.3157	6.47E-05	3.18E-05	0.03558	0.42997	0.90725	0.50999
28	0.118303	8.4529	1.13E-05	4.62E-06	0.01875	0.42998	0.90725	0.52874
29	0.117881	8.4831	0.00012	5.04E-05	0.01792	0.4301	0.9073	0.54666
30	0.117469	8.5129	3.51E-06	8.72E-06	0.02644	0.4301	0.90731	0.57311
31	0.115655	8.6464	2.87E-08	6.98E-06	0.0024	0.4301	0.90732	0.57551
32	0.115374	8.6675	0.00012	3.07E-06	0.00573	0.43023	0.90732	0.58123
33	0.114706	8.7179	1.44E-05	1.20E-05	0.00087	0.43024	0.90733	0.58211
34	0.11462	8.7245	0.00032	9.61E-06	5.72E-05	0.43056	0.90734	0.58216
35	0.112412	8.8958	9.86E-05	2.85E-05	0.00058	0.43066	0.90737	0.58274
36	0.11194	8.9334	0.00021	4.36E-06	0.002	0.43087	0.90738	0.58474
37	0.111157	8.9963	0.00062	0.00012	0.00903	0.43148	0.90749	0.59376
38	0.110809	9.0245	0.00011	1.37E-05	0.00923	0.43159	0.90751	0.60299
39	0.109666	9.1186	1.63E-06	1.41E-05	0.00936	0.43159	0.90752	0.61235
40	0.109466	9.1353	0.00037	0.00023	9.93E-05	0.43197	0.90775	0.61245
41	0.108945	9.1789	1.63E-06	2.11E-05	0.00095	0.43197	0.90778	0.6134
42	0.107968	9.2620	3.26E-05	1.26E-05	0.00054	0.432	0.90779	0.61394
43	0.107406	9.3105	7.75E-06	7.35E-05	0.00185	0.43201	0.90786	0.61579
44	0.107198	9.3285	0.00012	1.41E-05	0.00151	0.43213	0.90788	0.6173

45	0.106877	9.3566	0.00159	4.09E-05	2.96E-05	0.43372	0.90792	0.61733
46	0.10659	9.3817	1.18E-05	0.0001	0.00095	0.43373	0.90802	0.61828
47	0.105933	9.4399	3.45E-05	3.64E-05	0.0003	0.43376	0.90806	0.61858
48	0.105486	9.4799	0.00021	0.00102	0.00028	0.43397	0.90907	0.61886
49	0.104924	9.5307	0.00033	6.04E-05	0.00013	0.4343	0.90913	0.619
50	0.103348	9.6760	0.00153	0.00307	0.00028	0.43583	0.9122	0.61928
51	0.103	9.7087	0.00024	0.00078	4.57E-05	0.43607	0.91298	0.61932
52	0.101945	9.8092	0.00059	0.00143	8.62E-07	0.43665	0.91441	0.61932
53	0.101614	9.8412	0.00051	0.00012	0.00796	0.43717	0.91453	0.62728
54	0.101132	9.8881	0.00139	0.00618	0.00018	0.43856	0.92071	0.62746
55	0.100904	9.9104	0.00297	0.0045	3.00E-05	0.44152	0.92521	0.62749
56	0.099907	10.0093	0.00044	5.50E-05	0.00131	0.44196	0.92527	0.62881
57	0.099812	10.0188	0.00762	0.01322	3.14E-05	0.44958	0.93848	0.62884
58	0.098795	10.1220	1.54E-05	0.00061	0.00047	0.4496	0.9391	0.62931
59	0.09846	10.1564	0.00051	0.00393	1.47E-05	0.45011	0.94303	0.62932
60	0.098207	10.1826	0.0009	0.0002	0.00253	0.451	0.94323	0.63185
61	0.09735	10.2722	0.00032	0.00073	0.00042	0.45133	0.94396	0.63228
62	0.096942	10.3154	0.00039	2.56E-05	0.00193	0.45171	0.94399	0.63421
63	0.096517	10.3609	3.04E-08	0.00033	0.00178	0.45171	0.94432	0.63599
64	0.095256	10.4980	0.00044	0.00071	0.00139	0.45215	0.94503	0.63738
65	0.094592	10.5717	0.00083	0.00115	0.00399	0.45299	0.94618	0.64137
66	0.094071	10.6303	0.00065	0.00032	0.00295	0.45364	0.9465	0.64432
67	0.093746	10.6671	0.00444	0.00026	0.00572	0.45808	0.94675	0.65004
68	0.093341	10.7134	5.27E-05	3.69E-05	0.0008	0.45813	0.94679	0.65084
69	0.092701	10.7874	0.02358	0.01161	0.00143	0.48172	0.9584	0.65226
70	0.092371	10.8259	0.00297	0.00291	0.00015	0.48468	0.96131	0.65241
71	0.09181	10.8921	6.64E-05	0.00064	0.00074	0.48475	0.96194	0.65315
72	0.091652	10.9108	0.0011	0.00044	0.00086	0.48584	0.96238	0.65401
73	0.09098	10.9914	5.17E-05	0.00013	2.65E-06	0.4859	0.96251	0.65401
74	0.090419	11.0596	1.72E-06	0.00013	0.00087	0.4859	0.96264	0.65488
75	0.089863	11.1281	4.45E-06	0.00014	0.0009	0.4859	0.96278	0.65578
76	0.089697	11.1486	9.52E-05	6.71E-05	0.00045	0.486	0.96285	0.65623
77	0.089438	11.1809	7.37E-06	1.26E-06	0.00167	0.48601	0.96285	0.6579
78	0.088881	11.2510	4.75E-06	2.45E-05	7.63E-05	0.48601	0.96287	0.65798
79	0.088262	11.3299	2.02E-06	1.59E-05	0.00705	0.48601	0.96289	0.66503
80	0.088124	11.3476	1.37E-06	9.22E-05	2.62E-05	0.48601	0.96298	0.66505
81	0.087314	11.4529	0.00057	0.00015	0.00168	0.48658	0.96313	0.66673
82	0.086757	11.5264	1.55E-05	4.74E-05	9.64E-06	0.4866	0.96318	0.66674
83	0.086693	11.5350	8.91E-05	2.94E-07	0.00143	0.48669	0.96318	0.66818
84	0.086051	11.6210	0.00097	2.15E-05	0.00208	0.48766	0.9632	0.67026
85	0.086004	11.6274	3.38E-06	4.96E-05	0.00113	0.48766	0.96325	0.67139
86	0.085459	11.7015	0.00012	2.45E-05	5.79E-05	0.48778	0.96328	0.67145
87	0.084807	11.7915	0.0001	2.34E-05	0.00224	0.48788	0.9633	0.67369
88	0.083277	12.0081	0.00039	1.10E-06	0.00054	0.48827	0.9633	0.67422
89	0.083041	12.0422	0.00069	2.04E-05	0.00027	0.48896	0.96332	0.67449
90	0.082655	12.0985	0.0003	1.26E-07	0.02627	0.48926	0.96332	0.70077

8 TORÇÃO ACIDENTAL

$$M_{ai} = e_{ai} \cdot F_i \quad (8.1)$$

Em que:

M_{ai} Momento torsor de eixo vertical aplicado no piso i ;
 F_i Força horizontal atuando no piso i .

$$e_{ai} = \pm 0,05 \cdot L_i \quad (8.2)$$

Em que:

e_{ai} Excentricidade accidental da massa do piso i em relação à sua localização nominal, aplicada na mesma direção em todos os pisos;
 L_i Dimensão do piso na direção perpendicular à direção da ação sísmica.

$$F_i = F_b \cdot \frac{z_i \cdot m_i}{\sum z_j \cdot m_j} \quad (8.3)$$

Em que:

F_b Força de corte sísmica na base;
 m_i e m_j Massas dos pisos;
 z_i e z_j Alturas das massas m_i e m_j acima do nível de aplicação da ação sísmica.

$$F_b = S_d(T_1) \cdot m \cdot \lambda \quad (8.4)$$

Em que:

$S_d(T_1)$ Ordenada do espectro de cálculo para o período T_1 ;
 T_1 Período de vibração fundamental do edifício para o movimento lateral na direção considerada;
 m Massa total do edifício, acima da fundação ou acima do nível superior de uma cave rígida;
 λ Fator de correção, cujo valor é igual a: $\lambda = 0,85$ se $T_1 \leq 2 \cdot T_C$ e o edifício tiver mais de dois pisos, ou $\lambda = 1,0$ nos outros casos.

1. Excentricidade Acidental

Piso	1	2	3	4	5	Cob
e_{xi} (m)	2.76	2.76	2.57	2.66	2.66	2.64
e_{yi} (m)	1.35	1.09	1.09	1.14	1.14	0.74

2. Força de Corte Basal em Cada Direção

Sismo 1:	2. T_c =	1.2
	$T_1(x)$ =	0.2213
	$T_1(y)$ =	0.70015
	S_{dx} =	3.0273
	S_{dy} =	2.5943
	λ =	0.85

$$F_{bx1} = 14217.01$$

$$F_{by1} = 12183.4$$

Sismo 2:	$2.T_c=$	0.5
	$T_1(x)=$	0.2213
	$T_1(y)=$	0.70015
	$S_{dx}=$	3.36901
	$S_{dy}=$	1.20296
	$\lambda_x=$	0.85
	$\lambda_y=$	1

$$F_{bx2} = 15821.548$$

$$F_{by2} = 6646.2849$$

3. Força Sísmica Equivalente Por Piso (em cada direção) forças de inércia

Piso	z_i	m_i	$z_i \cdot m_i$	Sismo 1		Sismo 2	
				F_{ix}	F_{iy}	F_{ix}	F_{iy}
1	4.30	1014.99	4364.44	769.43	659.37	856.27	359.70
2	8.50	860.66	7315.64	1289.71	1105.23	1435.27	602.92
3	12.70	823.94	10464.01	1844.75	1580.88	2052.95	862.40
4	16.90	1028.13	17375.37	3063.19	2625.03	3408.90	1432.01
5	21.10	1034.76	21833.36	3849.11	3298.53	4283.52	1799.41
Cob	25.30	762.47	19290.48	3400.82	2914.36	3784.63	1589.84
	$\Sigma =$	5524.94	80643.30				

4. Momento Torçor (por piso e por direção)

Piso	Sismo 1		Sismo 2		Máx (Sismo 1)	Máx (Sismo 2)
	M_{aix}	M_{aiy}	M_{aix}	M_{aiy}		
1	1038.73	1820.85	1155.96	993.31	1820.85	1155.96
2	1409.01	3052.09	1568.03	1664.98	3052.09	1664.98
3	2015.39	4054.95	2242.85	2212.06	4054.95	2242.85
4	3487.44	6989.14	3881.04	3812.72	6989.14	3881.04
5	4382.22	8782.34	4876.79	4790.94	8782.34	4876.79
Cob	2499.60	7693.91	2781.71	4197.18	7693.91	4197.18

9 CONSIDERAÇÃO DOS EFEITOS DE 2º ORDEM

$$\theta = \frac{P_{tot} \cdot d_r}{V_{tot} \cdot h} \leq 0,10 \quad (9.1)$$

Em que:

θ	Coefficiente de sensibilidade ao deslocamento relativo entre pisos;
P_{tot}	Carga gravítica total devida a todos os pisos acima do piso considerado, incluindo este, na situação de projeto sísmica;
V_{tot}	Força de corte sísmica total no piso considerado.

9.1 Massas e forças de corte por piso

$F_{bx,AS1} =$	14217.01	KN	$F_{bx,AS2} =$	15821.55	KN
$F_{by,AS1} =$	12183.40	KN	$F_{by,AS2} =$	6646.28	KN

Pios	Massa (ton) SAP2000	Sismo 1		Sismo 2	
		$F_{ix,1}$ (KN)	$F_{iy,2}$ (KN)	$F_{ix,2}$ (KN)	$F_{iy,2}$ (KN)
1	946.87	769.43	659.37	856.27	359.70
2	782.27	1289.71	1105.23	1435.27	602.92
3	724.47	1844.75	1580.88	2052.95	862.40
4	701.21	3063.19	2625.03	3408.90	1432.01
5	717.65	3849.11	3298.53	4283.52	1799.41
Cob	596.93	3400.82	2914.36	3784.63	1589.84
	4469.40				

9.2 Verificação modelo global

Piso	Sismo 1							
	P_{tot} [KN]	$V_{tot,x}$ [KN]	$V_{tot,y}$ [KN]	$d_{r,x}$ [mm]	$d_{r,y}$ [mm]	h [m]	Θ_x	Θ_y
1	51896.38	14217.01	12183.40	0.005	8.00	4.30	0.000004	0.00792
2	40880.37	13447.58	11524.03	0.635	11.20	8.50	0.000227	0.00467
3	31570.84	12157.87	10418.80	1.120	14.56	12.70	0.000229	0.00347
4	22984.54	10313.12	8837.92	2.560	17.12	16.90	0.000338	0.00263
5	14424.31	7249.93	6212.89	2.880	17.28	21.10	0.000272	0.00190
Cob	5853.85	3400.82	2914.36	2.400	12.48	25.30	0.000163	0.00099

Sismo 2								
Piso	P _{tot} [KN]	V _{tot,x} [KN]	V _{tot,y} [KN]	d _{r,x}	d _{r,y}	h	Θ _x	Θ _y
1	51896.38	15821.55	6646.28	0.003	4.320	4.30	0.000002	0.00784
2	40880.37	14965.28	6286.59	0.477	5.760	8.50	0.000153	0.00441
3	31570.84	13530.01	5683.66	0.800	7.360	12.70	0.000147	0.00322
4	22984.54	11477.06	4821.26	2.240	8.480	16.90	0.000265	0.00239
5	14424.31	8068.16	3389.26	3.200	8.800	21.10	0.000271	0.00177
Cob	5853.85	3784.63	1589.84	2.400	6.560	25.30	0.000147	0.00095

9.3 Verificação modelo parcial

Sismo 1								
Piso	P _{tot} [KN]	V _{tot,x} [KN]	V _{tot,y} [KN]	d _{r,x} [mm]	d _{r,y} [mm]	h [m]	Θ _x	Θ _y
1	51896.38	14217.01	12731.86	0.005	8.00	4.30	0.000004	0.00758
2	40880.37	13447.58	12042.81	0.635	11.68	8.50	0.000227	0.00466
3	31570.84	12157.87	10887.83	1.120	16.00	12.70	0.000229	0.00365
4	22984.54	10313.12	9235.78	2.880	19.04	16.90	0.000380	0.00280
5	14424.31	7249.93	6492.58	3.040	19.84	21.10	0.000287	0.00209
Cob	5853.85	3400.82	3045.56	2.560	14.88	25.30	0.000174	0.00113

Sismo 2								
Piso	P _{tot} [KN]	V _{tot,x} [KN]	V _{tot,y} [KN]	d _{r,x} [mm]	d _{r,y} [mm]	h [m]	Θ _x	Θ _y
1	51896.38	18613.59	6945.48	0.003	4.480	4.30	0.000002	0.00778
2	40880.37	17606.21	6569.59	0.477	5.920	8.50	0.000130	0.00433
3	31570.84	15917.66	5939.52	0.800	7.840	12.70	0.000125	0.00328
4	22984.54	13502.43	5038.30	2.400	9.600	16.90	0.000242	0.00259
5	14424.31	9491.95	3541.83	3.040	9.920	21.10	0.000219	0.00191
Cob	5853.85	4452.51	1661.41	2.560	7.840	25.30	0.000133	0.00109

10 ASPECTOS GERAIS DE DIMENSIONAMENTO

10.1 Recobrimento das armaduras

Elemento	Recobrimento [mm]
Laje, Pilares, Paredes e Vigas	35
Fundações e Muros de contenção	50
Regularização das Fundações	50

10.2 Distância mínima entre varões

$$d = \text{máx}\{k_1 \cdot \emptyset; d_g + k_2; 20 \text{ mm}\} \quad (10.1)$$

Em que:

k_1	Igual a 1 mm;
\emptyset	Diâmetro do varão;
d_g	Dimensão máxima do agregado;
k_2	Igual a 5 mm.

Como a máxima dimensão do agregado é de 25 mm o espaçamento mínimo entre varões é de 30 mm, exceto na utilização de varões de 32 mm. Nesse caso o espaçamento mínimo será igual ao diâmetro do varão.

10.3 Diâmetro mínimo de dobragem dos varões

$$\emptyset_{m,min.} = \begin{cases} 4\emptyset, & \text{se } \emptyset \leq 16 \text{ mm} \\ 7\emptyset, & \text{se } \emptyset > 16 \text{ mm} \end{cases} \quad (10.2)$$

Em que:

$\emptyset_{m,min.}$	Diâmetro mínimo do mandril.
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\emptyset [mm]	$\emptyset_{m,min.}$ [mm]
6	24
8	32
10	40
12	48
16	64
20	140
25	175
32	224

10.4 Comprimento de amarração dos varões

$$l_{bd} = \alpha_1 \cdot \alpha_2 \cdot \alpha_3 \cdot \alpha_4 \cdot \alpha_5 \cdot l_{b,rqd} \geq l_{b,min} \quad (10.3)$$

Em que:

l_{bd}	Comprimento de amarração de cálculo;
$l_{b,min}$	Comprimento de amarração mínimo;
$\alpha_1, \alpha_2, \alpha_3, \alpha_4, \alpha_5$	Coefficientes que têm em consideração a forma, o recobrimento e a cintagem das armaduras;
$l_{b,rqd} = \frac{\emptyset}{4} \cdot \frac{\sigma_{sd}}{f_{bd}}$	Comprimento de amarração de referência;
σ_{sd}	Valor de cálculo da tensão na seção do varão a partir da qual é medido o comprimento de amarração;
$f_{bd} = 2,25 \cdot \eta_1 \cdot \eta_2 \cdot f_{ctd}$	Valor de cálculo da tensão de rotura de aderência;
η_1	Igual a 1 para condições de “boa” aderência, e igual a 0,7 para os outros casos;
η_2	Igual a 1 para $\emptyset \leq 32 \text{ mm}$ e $\frac{132-\emptyset}{100}$ para $\emptyset > 32 \text{ mm}$;
$f_{ctd} = \frac{\alpha_{ct} \cdot f_{ctk,0,05}}{\gamma_c}$	Valor de cálculo da tensão de rotura do betão à tração;
α_{ct}	Coefficiente que tem em conta os efeitos de longo prazo na resistência à tração e os efeitos desfavoráveis resultantes do modo como a carga é aplicada. Igual a 1;
$f_{ctk,0,05}$	Valor característico da tensão de rotura do betão à tração;
γ_c	Coefficiente parcial de segurança relativo ao betão.

$$l_{b,min} \geq \begin{cases} \max\{0,3 \cdot l_{b,rqd}; 10\emptyset; 100 \text{ mm}\}, & \text{para varões tracionados} \\ \max\{0,6 \cdot l_{b,rqd}; 10\emptyset; 100 \text{ mm}\}, & \text{para varões comprimidos} \end{cases} \quad (10.4)$$

\emptyset [mm]	$l_{b,rqd}$ [m]	$l_{b,min,t}$ [m]	$l_{b,min,c}$ [m]	l_{bd} [m]
12	0,62	0,19	0,11	0,62
16	0,83	0,25	0,15	0,83
20	1,04	0,31	0,19	1,04
25	1,29	0,39	0,23	1,29
32	1,66	0,50	0,30	1,66

Notas:

1. Para efeitos de cálculo adotou-se para os coeficientes $\alpha_1, \alpha_2, \alpha_3, \alpha_4, \alpha_5$, valor unitário, uma vez que l_{bd} é aproximadamente igual a $l_{b,rqd}$.
2. Admitiu-se que $\sigma_{sd} = f_{yd}$.

10.5 Comprimento de sobreposição de armaduras

$$l_0 = \alpha_1 \cdot \alpha_2 \cdot \alpha_3 \cdot \alpha_5 \cdot \alpha_6 \cdot l_{b,rqd} \geq l_{0,min} \quad (10.5)$$

Em que:

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l_0	Comprimento de sobreposição de cálculo;
$l_{0,min}$	Comprimento de sobreposição mínimo;
$\alpha_1, \alpha_2, \alpha_3, \alpha_5, \alpha_6$	Coefficientes que têm em consideração a forma, o recobrimento, a cintagem das armaduras e percentagem de varões sobrepostos.

$$l_{0,min} \geq \max\{0,3 \cdot \alpha_6 \cdot l_{b,rqd}; 15\emptyset; 200 \text{ mm}\} \quad (10.6)$$

\emptyset [mm]	$l_{0,min}$ [m]	l_0 [m]
12	0,28	0,93
16	0,37	1,24
20	0,47	1,55
25	0,58	1,94
32	0,75	2,49

Notas:

1. Para efeitos de cálculo adotou-se para os coeficientes $\alpha_1, \alpha_2, \alpha_3, \alpha_4, \alpha_5$, valor unitário.
2. Para o coeficiente α_6 adotou-se um valor igual a 1,5 de forma conservativa, assumindo que a percentagem de varões sobrepostos em relação à área total da seção transversal é superior a 50 %.

11 DIMENSIONAMENTO

11.1 Lajes

11.1.1 ARMADURAS MÁXIMAS E MÍNIMAS

$$A_{S,min} = 0,26 \cdot \frac{f_{ctm}}{f_{yk}} \cdot b_t \cdot d \quad (11.1)$$

$$A_{S,máx} = 0,04 \cdot A_c \quad (11.2)$$

Em que:

$A_{S,min}$	Área de armadura mínima;
$A_{S,máx}$	Área de armadura máxima;
f_{ctm}	Valor médio da tensão de rotura do betão à tração simples;
f_{yk}	Valor característico da tensão de cedência à tração do aço;
b_t	Largura média da zona tracionada;
d	Altura útil da seção transversal [mm].

Laje	Espessura [m]	d [m]	$A_{S,min}$ [cm ² /m]	$A_{S,máx}$ [cm ² /m]
Aligeirada	0,36	0,33	4,97	144,00
Consolas e Passadiço	0,20	0,17	2,56	80,00

11.1.2 ESPAÇAMENTO MÁXIMO ARMADURAS DE FLEXÃO

- Para as armaduras principais:

$$S_{max,slabs} = 3 \cdot h \leq 400 \text{ mm} \quad (11.3)$$

- Para as armaduras de distribuição:

$$S_{max,slabs} = 3,5 \cdot h \leq 400 \text{ mm} \quad (11.4)$$

Em que:

h	Altura da laje em mm.
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Notas:

1. Como $h = 360$ mm o espaçamento máximo é igual a 400 mm.

11.1.3 ESFORÇO TRANSVERSO

- Resistência ao corte:

$$V_{Rd,c} = \left[C_{Rd,c} \cdot k \cdot (100 \cdot \rho_l \cdot f_{ck})^{\frac{1}{3}} + k_1 \cdot \sigma_{cp} \right] \cdot b_w \cdot d \quad (11.5)$$

Com um mínimo de (Eq.(11.6):

$$V_{Rd,c} = (v_{min} + k_1 \cdot \sigma_{cp}) \cdot b_w \cdot d \quad (11.6)$$

Em que:

$$f_{ck} \quad \text{Em MPa;}$$

$$C_{Rd,c} = \frac{0.18}{\gamma_c} \quad \text{Adimensional;}$$

$$k_1 = 1 + \sqrt{\frac{200}{d}} \leq 2,0 \quad \text{Com d em mm;}$$

$$\rho_l = \frac{A_{sl}}{b_w \cdot d}$$

$$A_{sl} \quad \text{Área de armadura de tração;}$$

$$b_w \quad \text{Menor largura da seção transversal na área tracionada [mm];}$$

$$d \quad \text{Altura útil da seção transversal [mm];}$$

$$\sigma_{cp} = \frac{N_{Ed}}{A_c} < 0,2 \cdot f_{cd} \quad \text{Tensão de compressão no betão [MPa];}$$

$$N_{Ed} \quad \text{Esforço normal na secção devido às ações aplicadas ou ao pré-esforço [N];}$$

$$A_c \quad \text{Área da seção transversal de betão [mm}^2\text{];}$$

$$v_{min} = 0,035 \cdot k^{\frac{3}{2}} \cdot f_{ck}^{\frac{1}{2}} \quad \text{Em [N].}$$

$$V_{Rd,c}$$

e [m]	d [m]	b _w [m]	k	f _{ck} [MPa]	V _{Rd,min} [KN/m]	A _{sl} [cm ² /m]	ρ _l	V _{Rd,c} [KN/m]
0,36	0,33	1,00	1,78	30,00	150,05	5,27	0,002	118,73
0,20	0,17	1,00	2,00	30,00	92,18	5,27	0,003	85,80

Notas:

1. Nestes cálculos adotou-se uma armadura de distribuição de Ø10//0,15 (5,27 cm²/m), de acordo com a Eq(11.1);
2. Nas zonas aligeiradas (e = 0,36 m) a resistência ao corte é reduzida em 50% devido ao sistema de aligeiramento, de acordo com o manual do fabricante;
3. Nas zonas aligeiradas onde ultrapassava um esforço de corte igual a 75,0 KN/m preconizou-se zona maciça.

11.1.4 FLEXÃO

- Determinação dos momentos atuantes:
 - Armaduras Inferiores:

$$M_{Ed,xx}^+ = M_{Ed,xx}^+ + |M_{Ed,xy}| \quad (11.7)$$

$$M_{Ed,yy}^+ = M_{Ed,yy}^+ + |M_{Ed,xy}| \quad (11.8)$$

- Armaduras Superiores:

$$M_{Ed,xx}^- = M_{Ed,xx}^- - |M_{Ed,xy}| \quad (11.9)$$

$$M_{Ed,yy}^- = M_{Ed,yy}^- - |M_{Ed,xy}| \quad (11.10)$$

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- Armaduras de flexão

$$\mu = \frac{M_{Ed}}{b \cdot d \cdot f_{cd}} \quad (11.11)$$

$$\omega = \mu \cdot (1 + \mu) \quad (11.12)$$

$$A_s = \frac{\omega \cdot b \cdot d \cdot f_{cd}}{f_{yd}} \quad (11.13)$$

Em que:

M_{Ed}	Valor de cálculo do momento atuante;
f_{cd}	Valor de cálculo da tensão de rotura do betão à compressão;
b	Largura da seção transversal;
d	Altura útil da seção transversal [mm];
μ	Momento fletor reduzido;
ω	Percentagem mecânica de armadura;
f_{yd}	Valor de cálculo da tensão de cedência à tração do aço.

Notas:

1. Adotou-se uma armadura mínima de distribuição inferior de $\emptyset 12//0,15$ ($7,53 \text{ cm}^2/\text{m}$), face aos momentos registados, mantendo uma distribuição uniforme de armaduras;
2. Adotou-se uma armadura de distribuição superior em malhasol AQ50 ($1,96 \text{ cm}^2/\text{m}$).

11.1.4.1 Piso 1

- Segundo x

Alinhamento	Pilar	$M_{Ed,xx}$ (KN.m)	$M_{Ed,xy}$ (KN.m)	M_{Ed} (KN.m)	μ	ω	A_{sd} (cm^2/m)	Armadura Adotada	A_s (cm^2/m)	x [m]	$M_{Rd,x}$ [KN.m/m]	
Armadura Superior Segundo x	A'	P2	-35.84	-1.57	-37.41	0.01717	0.01747	2.650	$\emptyset 10//0.15$	5.27	0.02	74.11
		P3	-27.92	-2.24	-30.16	0.01385	0.01404	2.130	$\emptyset 10//0.15$	5.27	0.02	74.11
		P4	-60.37	-0.62	-60.99	0.02800	0.02879	4.368	$\emptyset 10//0.15$	5.27	0.02	74.11
		P5	-60.15	5.32	-65.47	0.03006	0.03096	4.698	$\emptyset 10//0.15$	5.27	0.02	74.11
		P6	-0.40	-8.17	-8.56	0.00393	0.00395	0.599	$\emptyset 10//0.15$	5.27	0.02	74.11
		P7	-53.53	-15.30	-68.82	0.03160	0.03260	4.946	$\emptyset 10//0.15$	5.27	0.02	74.11
		P8	-3.03	-30.55	-33.58	0.01542	0.01566	2.375	$\emptyset 10//0.15$	5.27	0.02	74.11
		B'	P10	-203.76	20.31	-224.07	0.10288	0.11346	17.215	$\emptyset 20//0.15$	20.93	0.07
	P11		-204.39	5.83	-210.22	0.09652	0.10583	16.057	$\emptyset 20//0.15$	20.93	0.07	276.07
	P12		-231.58	-3.93	-235.50	0.10813	0.11982	18.179	$\emptyset 20//0.15$	20.93	0.07	276.07
	P13		-321.62	1.30	-322.92	0.14826	0.17025	25.831	$\emptyset 25//0.15$	32.73	0.10	410.22
	P14		-301.24	-4.25	-305.48	0.14026	0.15993	24.265	$\emptyset 25//0.15$	32.73	0.10	410.22
	P15		-151.80	-15.97	-167.77	0.07703	0.08296	12.587	$\emptyset 16//0.15$	13.40	0.04	182.36
	P16		-53.35	5.47	-58.81	0.02700	0.02773	4.207	$\emptyset 10//0.15$	5.27	0.02	74.11
	P17		-35.21	21.79	-57.00	0.02617	0.02686	4.075	$\emptyset 10//0.15$	5.27	0.02	74.11
	C'	P18	-124.93	5.65	-130.58	0.05995	0.06355	9.642	$\emptyset 16//0.15$	13.40	0.04	182.36
		P19	-330.53	0.90	-331.43	0.15217	0.17532	26.601	$\emptyset 25//0.15$	32.73	0.10	410.22
		P20	-367.87	-0.94	-368.80	0.16933	0.19800	30.042	$\emptyset 25//0.15$	32.73	0.10	410.22
		P21	-368.69	0.21	-368.90	0.16937	0.19806	30.051	$\emptyset 25//0.15$	32.73	0.10	410.22
		P22	-356.16	5.03	-361.19	0.16583	0.19333	29.333	$\emptyset 25//0.15$	32.73	0.10	410.22
		P23	-245.79	11.75	-257.54	0.11824	0.13223	20.062	$\emptyset 20//0.15$	20.93	0.07	276.07
		P24	-80.83	-10.61	-91.44	0.04198	0.04374	6.637	$\emptyset 12//0.15$	7.33	0.02	102.23
		P25	-58.65	-14.72	-73.37	0.03369	0.03482	5.283	$\emptyset 12//0.15$	7.33	0.02	102.23
	1	P1	-74.15	70.19	-144.34	0.06627	0.07066	10.721	$\emptyset 16//0.15$	13.40	0.04	182.36
		P9	-49.80	-8.07	-57.87	0.02657	0.02728	4.138	$\emptyset 10//0.15$	5.27	0.02	74.11
Pa5		-46.07	-6.52	-52.59	0.02415	0.02473	3.752	$\emptyset 10//0.15$	5.27	0.02	74.11	

Alinhamento	Vão	$M_{Ed,xx}$	$M_{Ed,xy}$	M_{Ed}	μ	ω	A_{sd}	Armadura	A_s	x [m]	$M_{Rd,x}$	
		(KN.m)	(KN.m)	(KN.m)			(cm ² /m)	Adotada	(cm ² /m)			
Armadura Inferior Segundo x	A'	P1/P2	0.00	0.00	0.00	0.00000	0.00000	0.000			0.00	0.00
		P2/P3	0.00	0.00	0.00	0.00000	0.00000	0.000			0.00	0.00
		P3/P4	0.00	0.00	0.00	0.00000	0.00000	0.000			0.00	0.00
		P4/P5	0.00	0.00	0.00	0.00000	0.00000	0.000			0.00	0.00
		P5/P6	0.00	0.00	0.00	0.00000	0.00000	0.000			0.00	0.00
		P6/P7	0.00	0.00	0.00	0.00000	0.00000	0.000			0.00	0.00
		P7/P8	0.00	0.00	0.00	0.00000	0.00000	0.000			0.00	0.00
	B'	.../P10	32.46	16.65	49.11	0.02255	0.02306	3.498	$A_{s,dist}$	7.53	0.02	104.94
		P10/P11	55.54	14.63	70.17	0.03222	0.03326	5.046	$A_{s,dist}$	7.53	0.02	104.94
		P11/P12	67.36	3.91	71.27	0.03272	0.03379	5.127	$A_{s,dist}$	7.53	0.02	104.94
		P12/P13	78.01	0.68	78.69	0.03613	0.03743	5.680	$A_{s,dist}$	7.53	0.02	104.94
		P13/P14	66.49	-1.06	67.55	0.03101	0.03198	4.852	$A_{s,dist}$	7.53	0.02	104.94
		P14/P15	73.63	-13.11	86.74	0.03983	0.04141	6.283	$A_{s,dist}$	7.53	0.02	104.94
		P15/P16	-16.39	1.82	-14.57	0.00669	0.00673	1.022	$A_{s,dist}$	7.53	0.02	104.94
	C'	P16/P17	19.46	3.53	22.99	0.01056	0.01067	1.618	$A_{s,dist}$	7.53	0.02	104.94
		P18/P19	81.88	2.87	84.75	0.03891	0.040426	6.134	$A_{s,dist}$	7.53	0.02	104.94
		P19/P20	77.39	-0.60	77.99	0.03581	0.03709	5.627	$A_{s,dist}$	7.53	0.02	104.94
		P20/P21	74.56	0.80	75.36	0.03460	0.035798	5.431	$A_{s,dist}$	7.53	0.02	104.94
		P21/P22	75.22	1.40	76.62	0.03518	0.036417	5.525	$A_{s,dist}$	7.53	0.02	104.94
		P22/P23	79.72	11.38	91.10	0.04183	0.043577	6.612	$A_{s,dist}$	7.53	0.02	104.94
		P23/P24	31.02	-8.26	39.28	0.01803	0.01836	2.786	$A_{s,dist}$	7.53	0.02	104.94
	1	P24/P25	20.33	-12.24	32.57	0.01495	0.015178	2.303	$A_{s,dist}$	7.53	0.02	104.94
		P1/P9	0.00	0.00	0.00	0.00000	0.00000	0.000			0.00	0.00
		P9/Pa5	0.00	0.00	0.00	0.00000	0.00000	0.000			0.00	0.00
			Pa5/P18	0.00	0.00	0.00	0.00000	0.00000	0.000		0.00	0.00

• Segundo y

Alinhamento	Pilar	$M_{Ed,yy}$	$M_{Ed,xy}$	M_{Ed}	μ	ω	A_{sd}	Armadura	A_s	x [m]	$M_{Rd,y}$	
		(KN.m)	(KN.m)	(KN.m)			(cm ² /m)	Adotada	(cm ² /m)			
Armadura Superior Segundo Y	1	P1	-1.52	23.34	-24.86	0.01141	0.01154	1.752	$\emptyset 10//0.15$	5.27	0.02	74.11
		P9	-32.04	-2.41	-34.45	0.01582	0.01607	2.438	$\emptyset 10//0.15$	5.27	0.02	74.11
		Pa5	-12.38	1.75	-14.125	0.00649	0.00653	0.990	$\emptyset 10//0.15$	5.27	0.02	74.11
		P18	-77.91	29.345	-107.25	0.04924	0.05167	7.839	$\emptyset 16//0.15$	13.40	0.04	182.36
	2	P2	-79.55	-5.02	-84.57	0.03883	0.04034	6.120	$\emptyset 12//0.15$	7.53	0.02	104.94
		P10	-173.78	21.44	-195.215	0.08963	0.09766	14.818	$\emptyset 20//0.15$	20.93	0.07	276.07
	3	P18	0.00	0	0	0.00000	0.00000	0.000			0.00	0.00
		P11	-182.33	9.715	-192.045	0.08817	0.09595	14.558	$\emptyset 20//0.15$	20.93	0.07	276.07
	4	P19	-253.30	-0.18	-253.48	0.11638	0.12993	19.713	$\emptyset 20//0.15$	20.93	0.07	276.07
		P3	-43.35	1.48	-44.83	0.02058	0.02101	3.187	$\emptyset 10//0.15$	5.27	0.02	74.11
		P12	-283.28	67.125	-350.405	0.16088	0.18677	28.337	$\emptyset 25//0.15$	32.73	0.10	410.22
		P20	-255.34	0.48	-255.815	0.11745	0.13125	19.914	$\emptyset 20//0.15$	20.93	0.07	276.07
	5	P4	-115.52	-3.11	-118.63	0.05447	0.05743	8.714	$\emptyset 16//0.15$	13.40	0.04	182.36
		P13	-228.12	-0.01	-228.13	0.10474	0.11571	17.557	$\emptyset 20//0.15$	20.93	0.07	276.07
		P21	-242.96	1.155	-244.11	0.11208	0.12464	18.911	$\emptyset 20//0.15$	20.93	0.07	276.07
	6	P5	-105.72	1.55	-107.27	0.04925	0.05168	7.841	$\emptyset 16//0.15$	13.40	0.04	182.36
		P14	-217.25	-5.105	-222.35	0.10209	0.11251	17.071	$\emptyset 20//0.15$	20.93	0.07	276.07
		P22	-242.55	5.23	-247.775	0.11376	0.12670	19.224	$\emptyset 20//0.15$	20.93	0.07	276.07
	7	P6	-93.77	-10.75	-104.52	0.04799	0.05029	7.630	$\emptyset 16//0.15$	13.40	0.04	182.36
		P15	-95.84	-18.165	-114	0.05234	0.05508	8.357	$\emptyset 16//0.15$	13.40	0.04	182.36
		P23	-149.33	10.325	-159.655	0.07330	0.07868	11.937	$\emptyset 16//0.15$	13.40	0.04	182.36
	8	P7	-71.62	-8.67	-80.29	0.03686	0.03822	5.799	$\emptyset 12//0.15$	7.53	0.02	104.94
		P16	-56.88	1.505	-58.38	0.02680	0.02752	4.176	$\emptyset 10//0.15$	5.27	0.02	74.11
	9	P24	-87.32	-9.95	-97.265	0.04466	0.04665	7.078	$\emptyset 12//0.15$	7.33	0.02	102.23
	10	P8	-33.17	-25.77	-58.94	0.02706	0.02779	4.217	$\emptyset 10//0.15$	5.27	0.02	74.11
P17		-39.28	17.325	-56.605	0.02599	0.02666	4.046	$\emptyset 10//0.15$	5.27	0.02	74.11	
		P25	-91.11	-11.55	-102.655	0.04713	0.04935	7.488	$\emptyset 12//0.15$	7.53	0.02	104.94

	Alinhamento	Vão	$M_{Ed,yy}$	$M_{Ed,xy}$	M_{Ed}	μ	ω	A_{sd}	Armadura	A_s	x [m]	$M_{Rd,y}$ [KN.m/m]	
			(KN.m)	(KN.m)	(KN.m)			(cm ² /m)	Adotada	(cm ² /m)			
Armadura Inferior Segundo Y	1	P1/P9	0.00	0.00	0.00	0.00000	0.00000	0.000			0.00	0.00	
		P9/Pa5	0.00	0.00	0.00	0.00000	0.00000	0.000			0.00	0.00	
		Pa5/P18	0.00	0.00	0.00	0.00000	0.00000	0.000			0.00	0.00	
		P18/...	0.00	0.00	0.00	0.00000	0.00000	0.000			0.00	0.00	
	2	P2/P10	60.08	2.02	62.10	0.02851	0.02933	4.449	$A_{s,dist}$	7.53	0.02	104.94	
		P10/P18	51.14	14.45	65.59	0.03011	0.03102	4.707	$A_{s,dist}$	7.53	0.02	104.94	
	3	P11/P19	99.43	-2.25	101.68	0.04669	0.04886	7.414	$A_{s,dist}$	7.53	0.02	104.94	
		P19/...	104.57	-6.80	111.37	0.05113	0.05375	8.155	$\emptyset 10//0.15$	12.80	0.04	174.63	
	4	P3/P12	22.49	-4.75	27.24	0.01251	0.01266	1.921	$A_{s,dist}$	7.53	0.02	104.94	
		P12/P20	107.59	-2.42	110.01	0.05051	0.05306	8.051	$\emptyset 10//0.15$	12.80	0.04	174.63	
		P20/...	116.05	0.47	116.52	0.05350	0.05636	8.551	$\emptyset 10//0.15$	12.80	0.04	174.63	
	5	P4/P13	66.20	-1.96	68.16	0.03129	0.03227	4.897	$A_{s,dist}$	7.53	0.02	104.94	
		P13/P21	101.49	1.27	102.76	0.04718	0.04941	7.496	$A_{s,dist}$	7.53	0.02	104.94	
		P21/...	116.56	-0.14	116.70	0.05358	0.05645	8.565	$\emptyset 10//0.15$	12.80	0.04	174.63	
	6	P5/P14	68.01	-0.25	68.26	0.03134	0.03232	4.904	$A_{s,dist}$	7.53	0.02	104.94	
		P14/P22	93.28	-0.30	93.58	0.04297	0.04481	6.799	$A_{s,dist}$	7.53	0.02	104.94	
		P22/...	121.49	-0.71	122.20	0.05611	0.05925	8.990	$\emptyset 10//0.15$	12.80	0.04	174.63	
	7	P6/P15	0.00	0.00	0.00	0.00000	0.00000	0.000			0.00	0.00	
		P15/P23	27.55	-1.43	28.98	0.01331	0.01348	2.046	$A_{s,dist}$	7.53	0.02	104.94	
		P23/...	122.50	6.45	128.95	0.05921	0.06271	9.515	$\emptyset 10//0.15$	12.80	0.04	174.63	
	8	P7/P16	0.00	0.00	0.00	0.00000	0.00000	0.000			0.00	0.00	
	9	Nu/P24	0.00	0.00	0.00	0.00000	0.00000	0.000			0.00	0.00	
	10	P8/P17	41.24	-3.33	44.57	0.02046	0.02088	3.168	$A_{s,dist}$	7.53	0.02	104.94	
		Nu/P25	0.00	0.00	0.00	0.00000	0.00000	0.000			0.00	0.00	
			P25/...	84.65	6.28	90.93	0.04175	0.04349	6.599	$A_{s,dist}$	7.53	0.02	104.94

11.1.4.2 Piso 2

- Segundo x

	Alinhamento	Pilar	$M_{Ed,xx}$	$M_{Ed,xy}$	M_{Ed}	μ	ω	A_{sd}	Armadura	A_s	x [m]	$M_{Rd,x}$ [KN.m/m]
			(KN.m)	(KN.m)	(KN.m)			(cm ² /m)	Adotada	(cm ² /m)		
Armadura Superior Segundo x	A'	P2	-39.01	-1.40	-40.41	0.01855	0.01890	2.867	$\emptyset 10//0.15$	5.27	0.02	74.11
		P3	-25.91	-2.35	-28.26	0.01298	0.01314	1.994	$\emptyset 10//0.15$	5.27	0.02	74.11
		P4	-72.93	1.97	-74.90	0.03439	0.03557	5.397	$\emptyset 12//0.15$	7.53	0.02	104.94
		P5	-72.10	4.27	-76.37	0.03506	0.03629	5.507	$\emptyset 12//0.15$	7.53	0.02	104.94
		P6	-56.75	-9.88	-66.63	0.03059	0.03153	4.783	$\emptyset 10//0.15$	5.27	0.02	74.11
		P7	-57.66	-15.31	-72.97	0.03350	0.03463	5.254	$\emptyset 10//0.15$	5.27	0.02	74.11
		P8	-0.68	-28.39	-29.07	0.01335	0.01353	2.052	$\emptyset 10//0.15$	5.27	0.02	74.11
		B'	P10	-208.04	-30.06	-238.09	0.10932	0.12127	18.399	$\emptyset 20//0.15$	20.93	0.07
	P11		-196.64	-31.53	-228.17	0.10476	0.11574	17.560	$\emptyset 20//0.15$	20.93	0.07	276.07
	P12		-206.43	-4.34	-210.77	0.09677	0.10613	16.103	$\emptyset 20//0.15$	20.93	0.07	276.07
	P13		-304.10	1.74	-305.84	0.14042	0.16014	24.297	$\emptyset 25//0.15$	32.73	0.10	410.22
	P14		-278.05	-5.60	-283.65	0.13023	0.14719	22.333	$\emptyset 25//0.15$	32.73	0.10	410.22
	P15		-136.76	-20.90	-157.66	0.07239	0.07763	11.778	$\emptyset 16//0.15$	13.40	0.04	182.36
	P16		-77.38	9.01	-86.39	0.03966	0.04124	6.256	$\emptyset 12//0.15$	7.53	0.02	104.94
	P17		-52.10	22.94	-75.04	0.03445	0.03564	5.408	$\emptyset 12//0.15$	7.53	0.02	104.94
	C'		P18	-157.86	28.08	-185.94	0.08537	0.09266	14.059	$\emptyset 20//0.15$	20.93	0.07
		P19	-283.24	-3.80	-287.03	0.13179	0.14915	22.630	$\emptyset 25//0.15$	32.73	0.10	410.22
		P20	-303.86	-4.55	-308.41	0.14160	0.16165	24.526	$\emptyset 25//0.15$	32.73	0.10	410.22
		P21	-308.54	-0.21	-308.75	0.14176	0.16185	24.557	$\emptyset 25//0.15$	32.73	0.10	410.22
		P22	-301.63	8.52	-310.15	0.14240	0.16268	24.682	$\emptyset 25//0.15$	32.73	0.10	410.22
		P23	-207.93	13.95	-221.88	0.10187	0.11225	17.031	$\emptyset 20//0.15$	20.93	0.07	276.07
		P24	-66.01	-10.27	-76.28	0.03502	0.03625	5.500	$\emptyset 12//0.15$	7.53	0.02	104.94
		P25	-79.75	-35.65	-115.40	0.05298	0.05579	8.465	$\emptyset 16//0.15$	13.40	0.04	182.36
	1	P1	-107.05	111.01	-218.06	0.10012	0.11014	16.711	$\emptyset 20//0.15$	20.93	0.07	276.07
		P9	-48.77	-12.46	-61.23	0.02811	0.02890	4.385	$\emptyset 10//0.15$	5.27	0.02	74.11
Pa5		-61.39	-8.68	-70.07	0.03217	0.03321	5.038	$\emptyset 10//0.15$	5.27	0.02	74.11	

Alinhamento	Vão	$M_{Ed,xx}$	$M_{Ed,xy}$	M_{Ed}	μ	ω	A_{sd}	Armadura	A_s	x [m]	$M_{Rd,x}$	
		(KN.m)	(KN.m)	(KN.m)			(cm ² /m)	Adotada	(cm ² /m)			
Armadura Inferior Segundo x	A'	P1/P2	0.00	0.00	0.00	0.00000	0.00000	0.000			0.00	0.00
		P2/P3	0.00	0.00	0.00	0.00000	0.00000	0.000			0.00	0.00
		P3/P4	0.00	0.00	0.00	0.00000	0.00000	0.000			0.00	0.00
		P4/P5	0.00	0.00	0.00	0.00000	0.00000	0.000			0.00	0.00
		P5/P6	0.00	0.00	0.00	0.00000	0.00000	0.000			0.00	0.00
		P6/P7	0.00	0.00	0.00	0.00000	0.00000	0.000			0.00	0.00
		P7/P8	0.00	0.00	0.00	0.00000	0.00000	0.000			0.00	0.00
	.../P10	0.00	0.00	0.00	0.00000	0.00000	0.000			0.00	0.00	
	B'	P10/P11	54.64	17.22	71.86	0.03299	0.03408	5.171	$A_{s,dist}$	7.53	0.02	104.94
		P11/P12	62.81	2.23	65.04	0.02986	0.03075	4.666	$A_{s,dist}$	7.53	0.02	104.94
		P12/P13	78.73	1.03	79.76	0.03662	0.03796	5.760	$A_{s,dist}$	7.53	0.02	104.94
		P13/P14	68.67	-1.53	70.20	0.03223	0.03327	5.048	$A_{s,dist}$	7.53	0.02	104.94
		P14/P15	74.17	-15.93	90.10	0.04137	0.04308	6.536	$A_{s,dist}$	7.53	0.02	104.94
		P15/P16	-25.68	3.03	-22.65	0.01040	0.01051	1.594	$A_{s,dist}$	7.53	0.02	104.94
		P16/P17	18.21	9.08	27.29	0.01253	0.01269	1.925	$A_{s,dist}$	7.53	0.02	104.94
	C'	P18/P19	77.14	-0.05	77.19	0.03544	0.03670	5.568	$A_{s,dist}$	7.53	0.02	104.94
		P19/P20	64.72	-4.18	68.90	0.03163	0.03264	4.952	$A_{s,dist}$	7.53	0.02	104.94
		P20/P21	61.34	0.36	61.70	0.02833	0.02913	4.420	$A_{s,dist}$	7.53	0.02	104.94
		P21/P22	63.06	3.23	66.29	0.03044	0.03136	4.758	$A_{s,dist}$	7.53	0.02	104.94
		P22/P23	66.49	15.56	82.05	0.03767	0.03909	5.931	$A_{s,dist}$	7.53	0.02	104.94
		P23/P24	21.92	-6.24	28.16	0.01293	0.01310	1.987	$A_{s,dist}$	7.53	0.02	104.94
		P24/P25	35.75	-22.62	58.37	0.02680	0.02752	4.175	$A_{s,dist}$	7.53	0.02	104.94
	1	P1/P9	0.00	0.00	0.00	0.00000	0.00000	0.000			0.00	0.00
		Pa5/Pa5	0.00	0.00	0.00	0.00000	0.00000	0.000			0.00	0.00
		Pa5/P18	0.00	0.00	0.00	0.00000	0.00000	0.000			0.00	0.00

• Segundo y

Alinhamento	Pilar	$M_{Ed,yy}$	$M_{Ed,xy}$	M_{Ed}	μ	ω	A_{sd}	Armadura	A_s	x [m]	$M_{Rd,y}$
		(KN.m)	(KN.m)	(KN.m)			(cm ² /m)	Adotada	(cm ² /m)		
1	P1	-31.38	28.55	-59.93	0.02752	0.02827	4.290	$\emptyset 10//0.15$	5.27	0.02	74.11
	P9	-41.58	-1.30	-42.88	0.01969	0.02008	3.046	$\emptyset 10//0.15$	5.27	0.02	74.11
	Pa5	-24.51	1.78	-26.29	0.01207	0.01221	1.853	$\emptyset 10//0.15$	5.27	0.02	74.11
	P18	-79.24	50.82	-130.06	0.05972	0.06328	9.601	$\emptyset 16//0.15$	13.40	0.04	182.36
2	P2	-98.27	-4.15	-102.42	0.04702	0.04924	7.470	$\emptyset 12//0.15$	7.53	0.02	104.94
	P10	-175.15	21.29	-196.44	0.09019	0.09833	14.919	$\emptyset 20//0.15$	20.93	0.07	276.07
3	P18	0.00	0.00	0.00	0.00000	0.00000	0.000			0.00	0.00
	P11	-156.96	4.85	-161.80	0.07429	0.07981	12.109	$\emptyset 16//0.15$	13.40	0.04	182.36
4	P19	-241.36	-6.06	-247.42	0.11360	0.12650	19.194	$\emptyset 20//0.15$	20.93	0.07	276.07
	P3	-56.52	4.45	-60.97	0.02799	0.02878	4.366	$\emptyset 10//0.15$	5.27	0.02	74.11
5	P12	-261.22	66.37	-327.59	0.15041	0.17303	26.253	$\emptyset 25//0.15$	32.73	0.10	410.22
	P20	-224.59	-1.58	-226.17	0.10384	0.11463	17.392	$\emptyset 20//0.15$	20.93	0.07	276.07
6	P4	-140.46	-1.62	-142.08	0.06523	0.06949	10.543	$\emptyset 16//0.15$	13.40	0.04	182.36
	P13	-211.73	0.05	-211.77	0.09723	0.10669	16.187	$\emptyset 20//0.15$	20.93	0.07	276.07
7	P21	-221.02	1.92	-222.94	0.10236	0.11283	17.120	$\emptyset 20//0.15$	20.93	0.07	276.07
	P5	-139.35	0.37	-139.72	0.06415	0.06827	10.358	$\emptyset 16//0.15$	13.40	0.04	182.36
8	P14	-200.30	-6.50	-206.80	0.09495	0.10396	15.774	$\emptyset 20//0.15$	20.93	0.07	276.07
	P22	-225.98	9.76	-235.73	0.10823	0.11995	18.199	$\emptyset 20//0.15$	20.93	0.07	276.07
9	P6	-101.75	-12.73	-114.48	0.05256	0.05532	8.394	$\emptyset 16//0.15$	13.40	0.04	182.36
	P15	-81.12	-23.73	-104.85	0.04814	0.05046	7.655	$\emptyset 16//0.15$	13.40	0.04	182.36
10	P23	-150.60	12.82	-163.42	0.07503	0.08066	12.238	$\emptyset 16//0.15$	13.40	0.04	182.36
	P7	-79.13	-8.30	-87.43	0.04014	0.04175	6.335	$\emptyset 12//0.15$	7.53	0.02	104.94
11	P16	-48.17	2.80	-50.97	0.02340	0.02395	3.633	$\emptyset 10//0.15$	5.27	0.02	74.11
	P24	-92.13	-8.87	-101.00	0.04637	0.04852	7.362	$\emptyset 12//0.15$	7.53	0.02	104.94
12	P8	-38.55	-23.40	-61.95	0.02844	0.02925	4.438	$\emptyset 10//0.15$	5.27	0.02	74.11
	P17	-50.22	17.57	-67.79	0.03112	0.03209	4.869	$\emptyset 10//0.15$	5.27	0.02	74.11
13	P25	-130.41	-22.73	-153.14	0.07031	0.07526	11.418	$\emptyset 16//0.15$	13.40	0.04	182.36

PROJETO DE ESTRUTURAS E FUNDAÇÕES DE UM EDIFÍCIO DE ESCRITÓRIOS COM GRANDES VÃOS

	Alinhamento	Vão	$M_{Ed,yy}$	$M_{Ed,xy}$	M_{Ed}	μ	ω	A_{sd}	Armadura	A_s	x [m]	$M_{Rd,y}$
			(KN.m)	(KN.m)	(KN.m)			(cm ² /m)	Adotada	(cm ² /m)		
Armadura Inferior Segundo Y	1	P1/P9	0.00	0.00	0.00	0.00000	0.00000	0.000			0.00	0.00
		P9/Pa5	0.00	0.00	0.00	0.00000	0.00000	0.000			0.00	0.00
		Pa5/P18	0.00	0.00	0.00	0.00000	0.00000	0.000			0.00	0.00
		P18/...	0.00	0.00	0.00	0.00000	0.00000	0.000			0.00	0.00
	2	P2/P10	6.65	2.56	9.21	0.00423	0.00425	0.644	$A_{s,dist}$	7.53	0.02	104.94
		P10/P18	48.75	18.84	67.59	0.03103	0.03200	4.855	$A_{s,dist}$	7.53	0.02	104.94
	3	P11/P19	102.44	-2.88	105.32	0.04836	0.05069	7.692	$\emptyset 10//0.15$	12.80	0.04	174.63
		P19/...	0.00	0.00	0.00	0.00000	0.00000	0.000			0.00	0.00
	4	P3/P12	15.85	-0.70	16.55	0.00760	0.00766	1.162	$A_{s,dist}$	7.53	0.02	104.94
		P12/P20	113.11	-2.75	115.86	0.05320	0.05603	8.500	$\emptyset 10//0.15$	12.80	0.04	174.63
		P20/...	0.00	0.00	0.00	0.00000	0.00000	0.000			0.00	0.00
	5	P4/P13	69.50	-1.18	70.68	0.03245	0.03350	5.084	$A_{s,dist}$	7.53	0.02	104.94
		P13/P21	107.14	0.86	108.00	0.04959	0.05205	7.897	$\emptyset 10//0.15$	12.80	0.04	174.63
		P21/...	0.00	0.00	0.00	0.00000	0.00000	0.000			0.00	0.00
	6	P5/P14	71.34	-1.78	73.12	0.03357	0.03470	5.265	$A_{s,dist}$	7.53	0.02	104.94
		P14/P22	95.75	-0.20	95.95	0.04405	0.04599	6.979	$A_{s,dist}$	7.53	0.02	104.94
		P22/...	0.00	0.00	0.00	0.00000	0.00000	0.000			0.00	0.00
	7	P6/P15	0.00	0.00	0.00	0.00000	0.00000	0.000			0.00	0.00
		P15/P23	23.81	2.61	26.42	0.01213	0.01228	1.863	$A_{s,dist}$	7.53	0.02	104.94
		P23/...	0.00	0.00	0.00	0.00000	0.00000	0.000			0.00	0.00
	8	P7/P16	0.00	0.00	0.00	0.00000	0.00000	0.000			0.00	0.00
	9	Nu/P24	0.00	0.00	0.00	0.00000	0.00000	0.000			0.00	0.00
	10	P8/P17	55.62	-5.13	60.75	0.02789	0.02867	4.350	$A_{s,dist}$	7.53	0.02	104.94
		Nu/P25	0.00	0.00	0.00	0.00000	0.00000	0.000			0.00	0.00
			P25/...	0.00	0.00	0.00	0.00000	0.00000	0.000		0.00	0.00

11.1.4.3 Piso 3

- Segundo x

	Alinhamento	Pilar	$M_{Ed,xx}$	$M_{Ed,xy}$	M_{Ed}	μ	ω	A_{sd}	Armadura	A_s	x [m]	$M_{Rd,x}$
			(KN.m)	(KN.m)	(KN.m)			(cm ² /m)	Adotada	(cm ² /m)		
Armadura Superior Segundo x	A'	P2	-32.85	-2.09	-34.94	0.01604	0.01630	2.473	$\emptyset 10//0.15$	5.27	0.02	74.11
		P3	-56.47	-1.18	-57.65	0.02647	0.02717	4.122	$\emptyset 10//0.15$	5.27	0.02	74.11
		P4	-81.07	1.88	-82.95	0.03808	0.03953	5.998	$\emptyset 12//0.15$	7.53	0.02	104.94
		P5	-79.90	3.72	-83.62	0.03839	0.03986	6.048	$\emptyset 12//0.15$	7.53	0.02	104.94
		P6	-55.81	-16.48	-72.29	0.03319	0.03429	5.203	$\emptyset 10//0.15$	5.27	0.02	74.11
		P7	10.44	-54.58	-44.14	0.02027	0.02068	3.137	$\emptyset 10//0.15$	5.27	0.02	74.11
		P8	0.00	0.00	0.00	0.00000	0.00000	0.000			0.00	0.00
		B'	P10	-128.19	-4.59	-132.77	0.06096	0.06468	9.813	$\emptyset 16//0.15$	13.40	0.04
	P11		-191.28	-36.59	-227.87	0.10462	0.11557	17.535	$\emptyset 20//0.15$	20.93	0.07	276.07
	P12		-221.82	1.02	-222.84	0.10231	0.11278	17.111	$\emptyset 20//0.15$	20.93	0.07	276.07
	P13		-308.43	1.00	-309.43	0.14207	0.16225	24.618	$\emptyset 25//0.15$	32.73	0.10	410.22
	P14		-272.96	-7.84	-280.80	0.12892	0.14554	22.083	$\emptyset 25//0.15$	32.73	0.10	410.22
	P15		-131.27	-22.92	-154.18	0.07079	0.07580	11.501	$\emptyset 16//0.15$	13.40	0.04	182.36
	P16		-22.49	48.06	-70.55	0.03239	0.03344	5.074	$\emptyset 10//0.15$	5.27	0.02	74.11
	P17		0.00	0.00	0.00	0.00000	0.00000	0.000			0.00	0.00
	C'	P18	-166.49	-13.76	-180.25	0.08276	0.08961	13.596	$\emptyset 20//0.15$	20.93	0.07	276.07
		P19	-256.30	-3.28	-259.58	0.11918	0.13339	20.238	$\emptyset 20//0.15$	20.93	0.07	276.07
		P20	-256.21	-8.93	-265.14	0.12173	0.13655	20.718	$\emptyset 20//0.15$	20.93	0.07	276.07
		P21	-273.22	-0.74	-273.96	0.12579	0.14161	21.485	$\emptyset 25//0.15$	32.73	0.10	410.22
		P22	-262.42	10.27	-272.69	0.12520	0.14087	21.374	$\emptyset 25//0.15$	32.73	0.10	410.22
		P23	-155.27	17.49	-172.76	0.07932	0.08561	12.989	$\emptyset 16//0.15$	13.40	0.04	182.36
		P24	-95.09	2.09	-97.18	0.04462	0.04661	7.071	$\emptyset 12//0.15$	7.53	0.02	104.94
		P25	0.00	0.00	0.00	0.00000	0.00000	0.000			0.00	0.00
	1	P1	-103.54	67.39	-170.93	0.07848	0.08464	12.842	$\emptyset 16//0.15$	13.40	0.04	182.36
		P9	-47.64	-9.26	-56.90	0.02612	0.02681	4.067	$\emptyset 10//0.15$	5.27	0.02	74.11
Pa5		-84.74	-14.46	-99.20	0.04555	0.04762	7.225	$\emptyset 12//0.15$	7.53	0.02	104.94	

Alinhamento	Vão	$M_{Ed,xx}$	$M_{Ed,xy}$	M_{Ed}	μ	ω	A_{sd}	Armadura	A_s	x [m]	$M_{Rd,x}$	
		(KN.m)	(KN.m)	(KN.m)			(cm ² /m)	Adotada	(cm ² /m)			
Armadura Inferior Segundo x	A'	P1/P2	0.00	0.00	0.00	0.00000	0.00000	0.000			0.00	0.00
		P2/P3	0.00	0.00	0.00	0.00000	0.00000	0.000			0.00	0.00
		P3/P4	0.00	0.00	0.00	0.00000	0.00000	0.000			0.00	0.00
		P4/P5	0.00	0.00	0.00	0.00000	0.00000	0.000			0.00	0.00
		P5/P6	0.00	0.00	0.00	0.00000	0.00000	0.000			0.00	0.00
		P6/P7	0.00	0.00	0.00	0.00000	0.00000	0.000			0.00	0.00
		P7/P8	0.00	0.00	0.00	0.00000	0.00000	0.000			0.00	0.00
	B'	.../P10	-18.77	41.53	22.76	0.01045	0.01056	1.602	$A_{s,dist}$	7.53	0.02	104.94
		P10/P11	66.85	21.71	88.56	0.04066	0.04231	6.420	$A_{s,dist}$	7.53	0.02	104.94
		P11/P12	60.86	1.59	62.45	0.02867	0.02950	4.475	$A_{s,dist}$	7.53	0.02	104.94
		P12/P13	80.46	0.31	80.77	0.03708	0.03846	5.835	$A_{s,dist}$	7.53	0.02	104.94
		P13/P14	71.14	-2.01	73.15	0.03359	0.03471	5.267	$A_{s,dist}$	7.53	0.02	104.94
		P14/P15	75.95	-19.15	95.10	0.04366	0.04557	6.914	$A_{s,dist}$	7.53	0.02	104.94
		P15/P16	0.00	0.00	0.00	0.00000	0.00000	0.000			0.00	0.00
	C'	P16/P17	0.00	0.00	0.00	0.00000	0.00000	0.000			0.00	0.00
		P18/P19	71.42	-6.27	77.69	0.03567	0.03694	5.605	$A_{s,dist}$	7.53	0.02	104.94
		P19/P20	59.47	-5.67	65.14	0.02991	0.03080	4.674	$A_{s,dist}$	7.53	0.02	104.94
		P20/P21	55.24	0.11	55.35	0.02541	0.02606	3.954	$A_{s,dist}$	7.53	0.02	104.94
		P21/P22	58.09	4.05	62.14	0.02853	0.02934	4.452	$A_{s,dist}$	7.53	0.02	104.94
		P22/P23	60.02	19.51	79.53	0.03652	0.03785	5.743	$A_{s,dist}$	7.53	0.02	104.94
		P23/P24	6.16	-0.91	7.07	0.00325	0.00326	0.494	$A_{s,dist}$	7.53	0.02	104.94
	1	P24/P25	0.00	0.00	0.00	0.00000	0.00000	0.000			0.00	0.00
		P1/P9	0.00	0.00	0.00	0.00000	0.0000	0.000			0.00	0.00
		Pa5/P18	0.00	0.00	0.00	0.00000	0.0000	0.000			0.00	0.00

• Segundo y

Alinhamento	Pilar	$M_{Ed,yy}$	$M_{Ed,xy}$	M_{Ed}	μ	ω	A_{sd}	Armadura	A_s	x [m]	$M_{Rd,y}$	
		(KN.m)	(KN.m)	(KN.m)			(cm ² /m)	Adotada	(cm ² /m)			
Armadura Superior Segundo Y	1	P1	-1.93	29.36	-31.29	0.01437	0.01457	2.211	$\emptyset 10//0.15$	5.27	0.02	74.11
		P9	4.66	-3.82	0.84	0.00039	0.00039	0.059	$\emptyset 10//0.15$	5.27	0.02	74.11
		Pa5	-31.54	0.99	-32.53	0.01493	0.01516	2.300	$\emptyset 10//0.15$	5.27	0.02	74.11
		P18	-41.82	56.64	-98.46	0.04520	0.04725	7.169	$\emptyset 12//0.15$	7.53	0.02	104.94
	2	P2	-89.32	-7.83	-97.15	0.04461	0.04659	7.070	$\emptyset 12//0.15$	7.53	0.02	104.94
		P10	-198.55	2.91	-201.45	0.09249	0.10105	15.331	$\emptyset 20//0.15$	20.93	0.07	276.07
		P18	0.00	0.00	0.00	0.00000	0.00000	0.000			0.00	0.00
	3	P11	-185.49	-13.27	-198.75	0.09125	0.09958	15.109	$\emptyset 20//0.15$	20.93	0.07	276.07
		P19	-225.34	-9.51	-234.85	0.10783	0.11945	18.124	$\emptyset 20//0.15$	20.93	0.07	276.07
	4	P3	-67.64	5.02	-72.66	0.03336	0.03447	5.231	$\emptyset 10//0.15$	5.27	0.02	74.11
		P12	-298.81	66.26	-365.07	0.16761	0.19571	29.694	$\emptyset 25//0.15$	32.73	0.10	410.22
		P20	-218.38	-2.59	-220.97	0.10146	0.11175	16.955	$\emptyset 20//0.15$	20.93	0.07	276.07
	5	P4	-151.19	-2.34	-153.53	0.07049	0.07546	11.449	$\emptyset 16//0.15$	13.40	0.04	182.36
		P13	-288.39	-0.18	-288.57	0.13249	0.15005	22.766	$\emptyset 25//0.15$	32.73	0.10	410.22
		P21	-214.99	2.46	-217.45	0.09984	0.10980	16.660	$\emptyset 20//0.15$	20.93	0.07	276.07
	6	P5	-144.65	-1.16	-145.81	0.06695	0.07143	10.837	$\emptyset 16//0.15$	13.40	0.04	182.36
		P14	-258.23	-9.20	-267.43	0.12278	0.13786	20.917	$\emptyset 20//0.15$	20.93	0.07	276.07
		P22	-217.44	12.20	-229.63	0.10543	0.11655	17.683	$\emptyset 20//0.15$	20.93	0.07	276.07
	7	P6	-95.66	-19.63	-115.29	0.05293	0.05574	8.456	$\emptyset 16//0.15$	13.40	0.04	182.36
		P15	-68.47	-27.64	-96.11	0.04413	0.04607	6.990	$\emptyset 12//0.15$	7.53	0.02	104.94
		P23	-107.68	18.18	-125.86	0.05779	0.06113	9.274	$\emptyset 16//0.15$	13.40	0.04	182.36
	8	P7	-65.95	-36.05	-102.00	0.04683	0.04903	7.438	$\emptyset 12//0.15$	7.53	0.02	104.94
		P16	-141.37	36.12	-177.49	0.08149	0.08813	13.372	$\emptyset 16//0.15$	13.40	0.04	182.36
	9	P24	-79.80	1.96	-81.76	0.03754	0.03895	5.909	$\emptyset 12//0.15$	7.53	0.02	104.94
		P8	0.00	0.00	0.00	0.00000	0.00000	0.000			0.00	0.00
10	P17	0.00	0.00	0.00	0.00000	0.00000	0.000			0.00	0.00	
	P25	0.00	0.00	0.00	0.00000	0.00000	0.000			0.00	0.00	

	Alinhamento	Vão	$M_{Ed,yy}$	$M_{Ed,xy}$	M_{Ed}	μ	ω	A_{sd}	Armadura Adotada	A_s	x [m]	$M_{Rd,y}$ [KN.m/m]	
			(KN.m)	(KN.m)	(KN.m)			(cm ² /m)		(cm ² /m)			
Armadura Inferior Segundo Y	1	P1/P9	0.00	0.00	0.00	0.00000	0.00000	0.000			0.00	0.00	
		P9/Pa5	0.00	0.00	0.00	0.00000	0.00000	0.000			0.00	0.00	
		Pa5/P18	0.00	0.00	0.00	0.00000	0.00000	0.000			0.00	0.00	
			P18/...	0.00	0.00	0.00	0.00000	0.00000	0.000			0.00	0.00
	2	P2/P10	172.09	25.98	198.07	0.09094	0.09921	15.053	Ø12//0.15	15.06	0.05	203.56	
		P10/P18	54.08	18.46	72.54	0.03331	0.03442	5.222	$A_{s,dist}$	7.53	0.02	104.94	
	3	P11/P19	113.62	-1.75	115.37	0.05297	0.05578	8.463	Ø10//0.15	12.80	0.04	174.63	
		P19/...	0.00	0.00	0.00	0.00000	0.00000	0.000			0.00	0.00	
	4	P3/P12	9.71	1.56	11.27	0.00517	0.00520	0.789	$A_{s,dist}$	7.53	0.02	104.94	
		P12/P20	126.53	-3.24	129.77	0.05958	0.06313	9.579	Ø10//0.15	12.80	0.04	174.63	
		P20/...	0.00	0.00	0.00	0.00000	0.00000	0.000			0.00	0.00	
	5	P4/P13	69.26	-0.98	70.24	0.03225	0.03329	5.051	$A_{s,dist}$	7.53	0.02	104.94	
		P13/P21	120.40	0.76	121.16	0.05563	0.05872	8.910	Ø10//0.15	12.80	0.04	174.63	
		P21/...	0.00	0.00	0.00	0.00000	0.00000	0.000			0.00	0.00	
	6	P5/P14	71.75	-2.95	74.70	0.03430	0.03547	5.382	$A_{s,dist}$	7.53	0.02	104.94	
		P14/P22	106.08	0.09	106.17	0.04875	0.05112	7.757	Ø10//0.15	12.80	0.04	174.63	
		P22/...	0.00	0.00	0.00	0.00000	0.00000	0.000			0.00	0.00	
	7	P6/P15	0.00	0.00	0.00	0.00000	0.00000	0.000			0.00	0.00	
		P15/P23	19.57	1.10	20.67	0.00949	0.00958	1.454	$A_{s,dist}$	7.53	0.02	104.94	
		P23/...	0.00	0.00	0.00	0.00000	0.00000	0.000			0.00	0.00	
	8	P7/P16	0.00	0.00	0.00	0.00000	0.00000	0.000			0.00	0.00	
	9	Nu/P24	3.70	0.92	4.62	0.00212	0.00213	0.323	$A_{s,dist}$	7.53	0.02	104.94	
	10	P8/P17	0.00	0.00	0.00	0.00000	0.00000	0.000			0.00	0.00	
		Nu/P25	0.00	0.00	0.00	0.00000	0.00000	0.000			0.00	0.00	
		P25/...	0.00	0.00	0.00	0.00000	0.00000	0.000			0.00	0.00	

11.1.4.4 Piso 4

- Segundo x

	Alinhamento	Pilar	$M_{Ed,xx}$	$M_{Ed,xy}$	M_{Ed}	μ	ω	A_{sd}	Armadura Adotada	A_s	x [m]	$M_{Rd,x}$ [KN.m/m]
			(KN.m)	(KN.m)	(KN.m)			(cm ² /m)		(cm ² /m)		
Armadura Superior Segundo x	A'	P2	0.00	0.00	0.00	0.00000	0.00000	0.000			0.00	0.00
		P3	-64.61	-5.14	-69.75	0.03202	0.03305	5.015	Ø10//0.15	5.27	0.02	74.11
		P4	-114.13	1.44	-115.57	0.05306	0.05588	8.478	Ø16//0.15	13.40	0.04	182.36
		P5	-112.84	-0.65	-113.49	0.05211	0.05482	8.318	Ø16//0.15	13.40	0.04	182.36
		P6	-71.58	-5.29	-76.87	0.03529	0.03654	5.544	Ø12//0.15	7.53	0.02	104.94
		P7	-57.69	-9.11	-66.80	0.03067	0.03161	4.796	Ø10//0.15	5.27	0.02	74.11
		P8	0.00	0.00	0.00	0.00000	0.00000	0.000			0.00	0.00
		P10	0.00	0.00	0.00	0.00000	0.00000	0.000			0.00	0.00
	B'	P11	-284.08	-108.52	-392.60	0.18025	0.21275	32.279	Ø25//0.15	32.73	0.10	410.22
		P12	-272.67	19.07	-291.74	0.13395	0.15189	23.046	Ø25//0.15	32.73	0.10	410.22
		P13	-301.10	1.93	-303.03	0.13913	0.15849	24.047	Ø25//0.15	32.73	0.10	410.22
		P14	-264.16	-9.84	-274.00	0.12580	0.14163	21.488	Ø25//0.15	32.73	0.10	410.22
		P15	-110.71	-24.00	-134.71	0.06185	0.06568	9.965	Ø16//0.15	13.40	0.04	182.36
		P16	-66.78	18.60	-85.38	0.03920	0.04074	6.181	Ø12//0.15	7.53	0.02	104.94
		P17	0.00	0.00	0.00	0.00000	0.00000	0.000			0.00	0.00
	C'	P18	-41.19	-43.09	-84.28	0.03870	0.04019	6.098	Ø12//0.15	7.53	0.02	104.94
		P19	-148.98	-0.63	-149.61	0.06869	0.07341	11.138	Ø16//0.15	13.40	0.04	182.36
		P20	-149.41	-6.01	-155.42	0.07136	0.07645	11.599	Ø16//0.15	13.40	0.04	182.36
		P21	-149.17	-1.16	-150.33	0.06902	0.07378	11.195	Ø16//0.15	13.40	0.04	182.36
		P22	-137.52	8.53	-146.05	0.06705	0.07155	10.856	Ø16//0.15	13.40	0.04	182.36
		P23	-74.63	16.94	-91.56	0.04204	0.04381	6.646	Ø12//0.15	7.53	0.02	104.94
		P24	-41.45	1.43	-42.87	0.01968	0.02007	3.045	Ø10//0.15	5.27	0.02	74.11
		P25	0.00	0.00	0.00	0.00000	0.00000	0.000			0.00	0.00
	1	P1	0.00	0.00	0.00	0.00000	0.00000	0.000			0.00	0.00
		P9	-190.71	-54.97	-245.68	0.11280	0.12552	19.045	Ø20//0.15	20.93	0.07	276.07
	Pa5	-137.51	-48.14	-185.65	0.08524	0.09250	14.035	Ø20//0.15	20.93	0.07	276.07	

Alinhamento	Vão	$M_{Ed,xx}$	$M_{Ed,xy}$	M_{Ed}	μ	ω	A_{sd}	Armadura	A_s	x [m]	$M_{Rd,x}$ [KN.m/m]	
		(KN.m)	(KN.m)	(KN.m)			(cm ² /m)	Adotada	(cm ² /m)			
Armadura Inferior Segundo x	P1/P2	0.00	0.00	0.00	0.00000	0.00000	0.000			0.00	0.00	
	P2/P3	0.00	0.00	0.00	0.00000	0.00000	0.000			0.00	0.00	
	P3/P4	34.27	1.23	35.50	0.01630	0.01657	2.513	$A_{s,dist}$	7.53	0.02	104.94	
	P4/P5	26.24	-0.25	26.49	0.01216	0.01231	1.868	$A_{s,dist}$	7.53	0.02	104.94	
	P5/P6	34.15	-4.25	38.40	0.01763	0.01794	2.722	$A_{s,dist}$	7.53	0.02	104.94	
	P6/P7	-15.04	-3.73	-11.31	0.00519	0.00522	0.792	$A_{s,dist}$	7.53	0.02	104.94	
	P7/P8	0.00	0.00	0.00	0.00000	0.00000	0.000			0.00	0.00	
	.../P10	0.00	0.00	0.00	0.00000	0.00000	0.000			0.00	0.00	
	.../P11	140.82	56.94	197.76	0.09080	0.09904	15.027	$\emptyset 12//0.15$	15.06	0.05	203.56	
	P11/P12	52.80	-1.78	54.58	0.02506	0.02569	3.897	$A_{s,dist}$	7.53	0.02	104.94	
	P12/P13	81.83	-0.23	82.06	0.03768	0.03910	5.932	$A_{s,dist}$	7.53	0.02	104.94	
	P13/P14	71.89	-2.63	74.52	0.03421	0.03539	5.369	$A_{s,dist}$	7.53	0.02	104.94	
	P14/P15	77.17	-22.57	99.74	0.04579	0.04789	7.266	$A_{s,dist}$	7.53	0.02	104.94	
	P15/P16	0.00	0.00	0.00	0.00000	0.00000	0.000			0.00	0.00	
	P16/P17	0.00	0.00	0.00	0.00000	0.00000	0.000			0.00	0.00	
	P18/P19	47.71	-6.74	54.45	0.02500	0.02563	3.888	$A_{s,dist}$	7.53	0.02	104.94	
	P19/P20	33.03	-1.55	34.58	0.01588	0.01613	2.447	$A_{s,dist}$	7.53	0.02	104.94	
	P20/P21	32.61	0.10	32.71	0.01502	0.01524	2.313	$A_{s,dist}$	7.53	0.02	104.94	
	P21/P22	35.33	2.84	38.17	0.01753	0.01783	2.706	$A_{s,dist}$	7.53	0.02	104.94	
	P22/P23	34.45	16.69	51.14	0.02348	0.02403	3.646	$A_{s,dist}$	7.53	0.02	104.94	
	P23/P24	3.15	-1.01	4.16	0.00191	0.00191	0.290	$A_{s,dist}$	7.53	0.02	104.94	
	P24/P25	0.00	0.00	0.00	0.00000	0.00000	0.000			0.00	0.00	
	1	P1/P9	0.00	0.00	0.00	0.00000	0.00000	0.000			0.00	0.00
		P9/Pa5	0.00	0.00	0.00	0.00000	0.00000	0.000			0.00	0.00
		Pa5/P18	0.00	0.00	0.00	0.00000	0.00000	0.000			0.00	0.00

nas zonas com 20 cm de espessura, apenas na zona da viga vierendeel verificam-se momentos significativos

Passadiço	$M_x +$	0.00	0.00	0.00	0.00000	0.00000	0.000				
	$M_x -$	0.00	0.00	0.00	0.00000	0.00000	0.000			7.53	

• Segundo y

Alinhamento	Pilar	$M_{Ed,yy}$	$M_{Ed,xy}$	M_{Ed}	μ	ω	A_{sd}	Armadura	A_s	x [m]	$M_{Rd,y}$ [KN.m/m]
		(KN.m)	(KN.m)	(KN.m)			(cm ² /m)	Adotada	(cm ² /m)		
1	P1	0.00	0.00	0.00	0.00000	0.00000	0.000			0.00	0.00
	P9	-26.42	-40.22	-66.63	0.03059	0.03153	4.784	$\emptyset 10//0.15$	5.27	0.02	74.11
	Pa5	-93.04	-52.67	-145.71	0.06690	0.07137	10.829	$\emptyset 16//0.15$	13.40	0.04	182.36
	P18	-29.87	-15.75	-45.62	0.02094	0.02138	3.244	$\emptyset 10//0.15$	5.27	0.02	74.11
2	P2	0.00	0.00	0.00	0.00000	0.00000	0.000			0.00	0.00
	P10	0.00	0.00	0.00	0.00000	0.00000	0.000			0.00	0.00
3	P11	-302.78	-89.86	-392.63	0.18027	0.21277	32.282	$\emptyset 25//0.15$	32.73	0.10	410.22
	P19	-221.14	-5.27	-226.41	0.10395	0.11476	17.411	$\emptyset 20//0.15$	20.93	0.07	276.07
4	P3	-49.90	-6.62	-56.52	0.02595	0.02662	4.039	$\emptyset 10//0.15$	5.27	0.02	74.11
	P12	-307.30	76.33	-383.63	0.17614	0.20716	31.431	$\emptyset 25//0.15$	32.73	0.10	410.22
	P20	-234.12	-1.56	-235.68	0.10821	0.11992	18.194	$\emptyset 20//0.15$	20.93	0.07	276.07
5	P4	-166.73	0.77	-167.49	0.07690	0.08281	12.565	$\emptyset 16//0.15$	13.40	0.04	182.36
	P13	-281.69	1.10	-282.79	0.12984	0.14669	22.257	$\emptyset 25//0.15$	32.73	0.10	410.22
6	P21	-229.80	0.25	-230.04	0.10562	0.11678	17.718	$\emptyset 20//0.15$	20.93	0.07	276.07
	P5	-166.62	-1.14	-167.76	0.07702	0.08296	12.587	$\emptyset 16//0.15$	13.40	0.04	182.36
	P14	-251.86	-11.49	-263.34	0.12091	0.13553	20.563	$\emptyset 20//0.15$	20.93	0.07	276.07
7	P22	-206.77	10.07	-216.84	0.09956	0.10947	16.609	$\emptyset 20//0.15$	20.93	0.07	276.07
	P6	-107.96	-6.50	-114.46	0.05255	0.05531	8.392	$\emptyset 16//0.15$	13.40	0.04	182.36
	P15	-68.18	-27.47	-95.64	0.04391	0.04584	6.955	$\emptyset 12//0.15$	7.53	0.02	104.94
8	P23	-51.35	19.17	-70.52	0.03238	0.03342	5.071	$\emptyset 10//0.15$	5.27	0.02	74.11
	P7	-69.45	-3.37	-72.82	0.03343	0.03455	5.242	$\emptyset 10//0.15$	5.27	0.02	74.11
9	P16	-105.16	10.12	-115.28	0.05293	0.05573	8.456	$\emptyset 16//0.15$	13.40	0.04	182.36
	P24	-31.24	0.62	-31.85	0.01462	0.01484	2.251	$\emptyset 10//0.15$	5.27	0.02	74.11
10	P8	0.00	0.00	0.00	0.00000	0.00000	0.000			0.00	0.00
	P17	0.00	0.00	0.00	0.00000	0.00000	0.000			0.00	0.00
	P25	0.00	0.00	0.00	0.00000	0.00000	0.000			0.00	0.00

		Alinhamento	Vão	M _{Ed,yy} (KN.m)	M _{Ed,xy} (KN.m)	M _{Ed} (KN.m)	μ	ω	A _{sd} (cm ² /m)	Armadura Adotada	A _s (cm ² /m)	x [m]	M _{Rd,y} [KN.m/m]
Armadura Inferior Segundo Y	1		P1/P9	0.00	0.00	0.00	0.00000	0.00000	0.000			0.00	0.00
			P9/Pa5	0.00	0.00	0.00	0.00000	0.00000	0.000			0.00	0.00
			Pa5/P18	0.00	0.00	0.00	0.00000	0.00000	0.000			0.00	0.00
			P18/...	0.00	0.00	0.00	0.00000	0.00000	0.000			0.00	0.00
	2		P2/P10	0.00	0.00	0.00	0.00000	0.00000	0.000			0.00	0.00
			P10/P18	0.00	0.00	0.00	0.00000	0.00000	0.000			0.00	0.00
	3		P11/P19	134.35	12.41	146.76	0.06738	0.07192	10.913	Ø10//0.15	12.80	0.04	174.63
			P19/...	0.00	0.00	0.00	0.00000	0.00000	0.000			0.00	0.00
	4		P3/P12	0.00	0.00	0.00	0.00000	0.00000	0.000			0.00	0.00
			P12/P20	139.29	-3.80	143.09	0.06570	0.07001	10.623	Ø10//0.15	12.80	0.04	174.63
			P20/...	0.00	0.00	0.00	0.00000	0.00000	0.000			0.00	0.00
	5		P4/P13	55.07	1.32	56.39	0.02589	0.02656	4.030	A _{s,dist}	7.53	0.02	104.94
			P13/P21	133.11	0.53	133.64	0.06136	0.06512	9.881	Ø10//0.15	12.80	0.04	174.63
			P21/...	0.00	0.00	0.00	0.00000	0.00000	0.000			0.00	0.00
	6		P5/P14	59.02	-5.44	64.46	0.02960	0.03047	4.623	A _{s,dist}	7.53	0.02	104.94
			P14/P22	116.27	-0.08	116.35	0.05342	0.05627	8.538	Ø10//0.15	12.80	0.04	174.63
			P22/...	0.00	0.00	0.00	0.00000	0.00000	0.000			0.00	0.00
	7		P6/P15	0.00	0.00	0.00	0.00000	0.00000	0.000			0.00	0.00
			P15/P23	17.89	1.38	19.27	0.00885	0.00893	1.354	A _{s,dist}	7.53	0.02	104.94
			P23/...	0.00	0.00	0.00	0.00000	0.00000	0.000			0.00	0.00
	8		P7/P16	0.00	0.00	0.00	0.00000	0.00000	0.000			0.00	0.00
	9		Nu/P24	7.42	-0.50	7.92	0.00364	0.00365	0.554	A _{s,dist}	7.53	0.02	104.94
	10		P8/P17	0.00	0.00	0.00	0.00000	0.00000	0.000			0.00	0.00
			Nu/P25	0.00	0.00	0.00	0.00000	0.00000	0.000			0.00	0.00
			P25/...	0.00	0.00	0.00	0.00000	0.00000	0.000			0.00	0.00
	Passadiço		My +	32.37	-15.74	48.11	0.08324	0.09016	7.047	Ø12//0.15	7.53		
			My -	-30.36	19.46	-49.82	0.08619	0.09362	7.318	Ø12//0.15	7.53		

11.1.4.5 Piso 5

- Segundo x

		Alinhamento	Pilar	M _{Ed,xx} (KN.m)	M _{Ed,xy} (KN.m)	M _{Ed} (KN.m)	μ	ω	A _{sd} (cm ² /m)	Armadura Adotada	A _s (cm ² /m)	x [m]	M _{Rd,x} [KN.m/m]
Armadura Superior Segundo x	A'		P2	0.00	0.00	0.00	0.00000	0.00000	0.000			0.00	0.00
			P3	-67.64	-5.30	-72.94	0.03349	0.03461	5.251	Ø10//0.15	5.27	0.02	74.11
			P4	-113.39	1.58	-114.97	0.05278	0.05557	8.431	Ø16//0.15	13.40	0.04	182.36
			P5	-111.51	-1.06	-112.56	0.05168	0.05435	8.246	Ø16//0.15	13.40	0.04	182.36
			P6	-82.57	-1.17	-83.74	0.03845	0.03993	6.058	Ø12//0.15	7.53	0.02	104.94
			P7	-50.72	-14.34	-65.06	0.02987	0.03076	4.668	Ø10//0.15	5.27	0.02	74.11
			P8	0.00	0.00	0.00	0.00000	0.00000	0.000			0.00	0.00
			P10	0.00	0.00	0.00	0.00000	0.00000	0.000			0.00	0.00
	B'		P11	-127.58	-171.08	-298.66	0.13712	0.15593	23.658	Ø25//0.15	32.73	0.10	410.22
			P12	-257.30	-1.45	-258.74	0.11880	0.13291	20.166	Ø20//0.15	20.93	0.07	276.07
			P13	-323.69	2.33	-326.01	0.14968	0.17209	26.110	Ø25//0.15	32.73	0.10	410.22
			P14	-287.80	-11.28	-299.08	0.13732	0.15618	23.696	Ø25//0.15	32.73	0.10	410.22
			P15	-152.38	-26.39	-178.77	0.08208	0.08881	13.475	Ø16//0.15	13.40	0.04	182.36
			P16	-79.47	49.78	-129.25	0.05934	0.06286	9.538	Ø16//0.15	13.40	0.04	182.36
			P17	0.00	0.00	0.00	0.00000	0.00000	0.000			0.00	0.00
	C'		P18	-43.80	-42.24	-86.04	0.03950	0.04106	6.231	Ø12//0.15	7.53	0.02	104.94
			P19	-150.25	-0.59	-150.84	0.06926	0.07405	11.236	Ø16//0.15	13.40	0.04	182.36
			P20	-149.96	-5.39	-155.34	0.07132	0.07641	11.593	Ø16//0.15	13.40	0.04	182.36
			P21	-148.54	-1.75	-150.28	0.06900	0.07376	11.191	Ø16//0.15	13.40	0.04	182.36
			P22	-137.17	8.23	-145.39	0.06675	0.07121	10.804	Ø16//0.15	13.40	0.04	182.36
			P23	-74.31	17.99	-92.29	0.04237	0.04417	6.702	Ø12//0.15	7.53	0.02	104.94
			P24	-41.76	1.01	-42.77	0.01964	0.02002	3.038	Ø10//0.15	5.27	0.02	74.11
			P25	0.00	0.00	0.00	0.00000	0.00000	0.000			0.00	0.00
	1		P1	-52.47	-23.94	-76.41	0.03508	0.03631	5.510	Ø12//0.15	7.53	0.02	104.94
			Pa5	-206.40	-58.22	-264.62	0.12150	0.13626	20.674	Ø20//0.15	20.93	0.07	276.07
		Pa5	-146.05	-49.50	-195.55	0.08978	0.09785	14.846	Ø20//0.15	20.93	0.07	276.07	

Alinhamento	Vão	$M_{Ed,xx}$	$M_{Ed,xy}$	M_{Ed}	μ	ω	A_{sd}	Armadura	A_s	x [m]	$M_{Rd,x}$ [KN.m/m]	
		(KN.m)	(KN.m)	(KN.m)			(cm ² /m)	Adotada	(cm ² /m)			
A'	P1/P2	0.00	0.00	0.00	0.00000	0.00000	0.000			0.00	0.00	
	P2/P3	0.00	0.00	0.00	0.00000	0.00000	0.000			0.00	0.00	
	P3/P4	36.25	1.55	37.80	0.01736	0.01766	2.679	$A_{s,dist}$	7.53	0.02	104.94	
	P4/P5	26.37	-0.32	26.69	0.01225	0.01240	1.882	$A_{s,dist}$	7.53	0.02	104.94	
	P5/P6	35.47	-2.76	38.23	0.01755	0.01786	2.710	$A_{s,dist}$	7.53	0.02	104.94	
	P6/P7	0.00	0.00	0.00	0.00000	0.00000	0.000			0.00	0.00	
	P7/P8	0.00	0.00	0.00	0.00000	0.00000	0.000			0.00	0.00	
	.../P10	0.00	0.00	0.00	0.00000	0.00000	0.000			0.00	0.00	
	.../P11	140.06	56.15	196.21	0.09009	0.09820	14.900	$\emptyset 12//0.15$	15.06	0.05	203.56	
	P11/P12	47.82	-2.88	50.70	0.02328	0.02382	3.614	$A_{s,dist}$	7.53	0.02	104.94	
B'	P12/P13	88.93	0.13	89.06	0.04089	0.04256	6.458	$A_{s,dist}$	7.53	0.02	104.94	
	P13/P14	77.35	-2.66	80.01	0.03674	0.03809	5.778	$A_{s,dist}$	7.53	0.02	104.94	
	P14/P15	83.37	-19.52	102.89	0.04724	0.04947	7.506	$A_{s,dist}$	7.53	0.02	104.94	
	P15/P16	0.00	0.00	0.00	0.00000	0.00000	0.000			0.00	0.00	
	P16/P17	0.00	0.00	0.00	0.00000	0.00000	0.000			0.00	0.00	
	P18/P19	46.43	-6.35	52.78	0.02423	0.02482	3.766	$A_{s,dist}$	7.53	0.02	104.94	
	P19/P20	32.91	-1.40	34.31	0.01575	0.01600	2.428	$A_{s,dist}$	7.53	0.02	104.94	
	P20/P21	31.86	0.40	32.26	0.01481	0.01503	2.281	$A_{s,dist}$	7.53	0.02	104.94	
C'	P21/P22	34.31	2.92	37.23	0.01709	0.01739	2.638	$A_{s,dist}$	7.53	0.02	104.94	
	P22/P23	34.24	16.33	50.57	0.02322	0.02376	3.605	$A_{s,dist}$	7.53	0.02	104.94	
	P23/P24	2.81	-1.14	3.95	0.00181	0.00182	0.276			0.00	0.00	
	P24/P25	0.00	0.00	0.00	0.00000	0.00000	0.000			0.00	0.00	
	1	P1/P9	0.00	0.00	0.00	0.00000	0.00000	0.000			0.00	0.00
	Pa5/P18	0.00	0.00	0.00	0.00000	0.00000	0.000			0.00	0.00	

nas zonas com 20 cm de espessura, apenas na zona da viga vierendeel verificam-se momentos significativos

Passadiço	$M_x +$	-	-	-	-	-	-	-	-	-
	$M_x -$	-52.39	8.78	-61.17	0.10582	0.11702	9.146	$\emptyset 10//0.15$	7.53	

• Segundo y

Alinhamento	Pilar	$M_{Ed,yy}$	$M_{Ed,xy}$	M_{Ed}	μ	ω	A_{sd}	Armadura	A_s	x [m]	$M_{Rd,y}$ [KN.m/m]
		(KN.m)	(KN.m)	(KN.m)			(cm ² /m)	Adotada	(cm ² /m)		
1	P1	-70.60	-20.98	-91.58	0.04205	0.04381	6.648	$\emptyset 12//0.15$	7.53	0.02	104.94
	P9	-29.12	-43.49	-72.60	0.03333	0.03444	5.226	$\emptyset 10//0.15$	5.27	0.02	74.11
	Pa5	-91.92	-52.31	-144.23	0.06622	0.07060	10.712	$\emptyset 16//0.15$	13.40	0.04	182.36
	P18	-29.90	-2.00	-31.90	0.01465	0.01486	2.255	$\emptyset 10//0.15$	5.27	0.02	74.11
2	P2	0.00	0.00	0.00	0.00000	0.00000	0.000			0.00	0.00
	P10	0.00	0.00	0.00	0.00000	0.00000	0.000			0.00	0.00
	P18	0.00	0.00	0.00	0.00000	0.00000	0.000			0.00	0.00
3	P11	-293.96	-89.58	-383.54	0.17610	0.20710	31.423	$\emptyset 25//0.15$	32.73	0.10	410.22
	P19	-221.53	-4.89	-226.42	0.10396	0.11476	17.413	$\emptyset 20//0.15$	20.93	0.07	276.07
4	P3	-47.46	-7.17	-54.62	0.02508	0.02571	3.900	$\emptyset 10//0.15$	5.27	0.02	74.11
	P12	-311.64	74.99	-386.63	0.17751	0.20902	31.714	$\emptyset 25//0.15$	32.73	0.10	410.22
	P20	-238.71	-1.45	-240.16	0.11026	0.12242	18.574	$\emptyset 20//0.15$	20.93	0.07	276.07
5	P4	-150.95	1.06	-152.00	0.06979	0.07466	11.328	$\emptyset 16//0.15$	13.40	0.04	182.36
	P13	-295.78	1.39	-297.17	0.13644	0.15506	23.526	$\emptyset 25//0.15$	32.73	0.10	410.22
	P21	-240.31	0.08	-240.39	0.11037	0.12255	18.594	$\emptyset 20//0.15$	20.93	0.07	276.07
6	P5	-147.95	-1.47	-149.42	0.06860	0.07331	11.123	$\emptyset 16//0.15$	13.40	0.04	182.36
	P14	-261.54	-12.47	-274.00	0.12580	0.14163	21.489	$\emptyset 25//0.15$	32.73	0.10	410.22
	P22	-209.26	10.23	-219.49	0.10077	0.11093	16.831	$\emptyset 20//0.15$	20.93	0.07	276.07
7	P6	-115.57	-1.85	-117.42	0.05391	0.05682	8.620	$\emptyset 16//0.15$	13.40	0.04	182.36
	P15	-87.87	-29.37	-117.24	0.05383	0.05672	8.606	$\emptyset 16//0.15$	13.40	0.04	182.36
	P23	-47.17	19.82	-66.99	0.03076	0.03170	4.810	$\emptyset 10//0.15$	5.27	0.02	74.11
8	P7	-78.73	-9.65	-88.38	0.04058	0.04223	6.407	$\emptyset 12//0.15$	7.53	0.02	104.94
	P16	-175.85	41.22	-217.07	0.09966	0.10960	16.629	$\emptyset 20//0.15$	20.93	0.07	276.07
9	P24	-24.31	0.55	-24.86	0.01141	0.01154	1.751	$\emptyset 10//0.15$	5.27	0.02	74.11
10	P8	0.00	0.00	0.00	0.00000	0.00000	0.000			0.00	0.00
	P17	0.00	0.00	0.00	0.00000	0.00000	0.000			0.00	0.00
	P25	0.00	0.00	0.00	0.00000	0.00000	0.000			0.00	0.00

		Alinhamento	Vão	M _{Ed,yy} (KN.m)	M _{Ed,xy} (KN.m)	M _{Ed} (KN.m)	μ	ω	A _{sd} (cm ² /m)	Armadura Adotada	A _s (cm ² /m)	x [m]	M _{Rd,y} [KN.m/m]
Armadura Inferior Segundo Y	1		P1/P9	0.00	0.00	0.00	0.00000	0.00000	0.000			0.00	0.00
			P9/Pa5	0.00	0.00	0.00	0.00000	0.00000	0.000			0.00	0.00
			Pa5/P18	0.00	0.00	0.00	0.00000	0.00000	0.000			0.00	0.00
			P18/...	0.00	0.00	0.00	0.00000	0.00000	0.000			0.00	0.00
	2		P2/P10	0.00	0.00	0.00	0.00000	0.00000	0.000			0.00	0.00
			P10/P18	0.00	0.00	0.00	0.00000	0.00000	0.000			0.00	0.00
	3		P11/P19	134.57	12.90	147.47	0.06771	0.07229	10.969	∅10//0.15	12.80	0.04	174.63
			P19/...	0.00	0.00	0.00	0.00000	0.00000	0.000			0.00	0.00
	4		P3/P12	0.00	0.00	0.00	0.00000	0.00000	0.000			0.00	0.00
			P12/P20	138.80	-4.55	143.35	0.06582	0.07015	10.643	∅10//150	12.80	0.04	174.63
			P20/...	0.00	0.00	0.00	0.00000	0.00000	0.000			0.00	0.00
	5		P4/P13	69.37	1.67	71.04	0.03262	0.03368	5.110	A _{s,dist}	7.53	0.02	104.94
			P13/P21	130.96	0.42	131.38	0.06032	0.06396	9.704	∅10//0.15	12.80	0.04	174.63
			P21/...	0.00	0.00	0.00	0.00000	0.00000	0.000			0.00	0.00
	6		P5/P14	73.55	-6.35	79.90	0.03669	0.03803	5.770	A _{s,dist}	7.53	0.02	104.94
			P14/P22	112.99	0.30	113.29	0.05202	0.05472	8.303	∅10//0.15	12.80	0.04	174.63
			P22/...	0.00	0.00	0.00	0.00000	0.00000	0.000			0.00	0.00
	7		P6/P15	0.00	0.00	0.00	0.00000	0.00000	0.000			0.00	0.00
			P15/P23	15.82	2.29	18.11	0.00831	0.00838	1.272	A _{s,dist}	7.53	0.02	104.94
			P23/...	0.00	0.00	0.00	0.00000	0.00000	0.000			0.00	0.00
	8		P7/P16	0.00	0.00	0.00	0.00000	0.00000	0.000			0.00	0.00
	9		Nu/P24	6.89	-0.13	7.02	0.00322	0.00323	0.491			0.00	0.00
	10		P8/P17	0.00	0.00	0.00	0.00000	0.00000	0.000			0.00	0.00
			Nu/P25	0.00	0.00	0.00	0.00000	0.00000	0.000			0.00	0.00
			P25/...	0.00	0.00	0.00	0.00000	0.00000	0.000			0.00	0.00

Passadiço	My +	0.00	0.00	0.00	0.00000	0.00000	0.000					
	My -	-61.49	0.41	-61.90	0.10709	0.11856	9.267	∅10//0.15	7.53			

11.1.4.6 Cobertura

- Segundo x

		Alinhamento	Pilar	M _{Ed,xx} (KN.m)	M _{Ed,xy} (KN.m)	M _{Ed} (KN.m)	μ	ω	A _{sd} (cm ² /m)	Armadura Adotada	A _s (cm ² /m)	x [m]	M _{Rd,x} [KN.m/m]
Armadura Superior Segundo x	A'		P2	0.00	0.00	0.00	0.00000	0.00000	0.000			0.00	0.00
			P3	0.00	0.00	0.00	0.00000	0.00000	0.000			0.00	0.00
			P4	0.00	0.00	0.00	0.00000	0.00000	0.000			0.00	0.00
			P5	0.00	0.00	0.00	0.00000	0.00000	0.000			0.00	0.00
			P6	0.00	0.00	0.00	0.00000	0.00000	0.000			0.00	0.00
			P7	0.00	0.00	0.00	0.00000	0.00000	0.000			0.00	0.00
			P8	0.00	0.00	0.00	0.00000	0.00000	0.000			0.00	0.00
			P10	0.00	0.00	0.00	0.00000	0.00000	0.000			0.00	0.00
	B'		P11	-62.32	-22.81	-85.13	0.03908	0.04061	6.162	∅12//0.15	7.53	0.02	104.94
			P12	-151.70	3.69	-155.39	0.07134	0.07643	11.597	∅16//0.15	13.40	0.04	182.36
			P13	-171.19	-0.82	-172.01	0.07897	0.08521	12.929	∅16//0.15	13.40	0.04	182.36
			P14	-153.24	-13.82	-167.05	0.07670	0.08258	12.530	∅16//0.15	13.40	0.04	182.36
			P15	-44.77	-18.17	-62.94	0.02890	0.02973	4.511	∅10//0.15	5.27	0.02	74.11
			P16	0.00	0.00	0.00	0.00000	0.00000	0.000			0.00	0.00
			P17	0.00	0.00	0.00	0.00000	0.00000	0.000			0.00	0.00
	C'		P18	-43.91	-4.89	-48.80	0.02241	0.02291	3.476	∅10//0.15	5.27	0.02	74.11
			P19	-119.20	-2.89	-122.09	0.05605	0.05920	8.981	∅16//0.15	13.40	0.04	182.36
			P20	-133.72	-6.06	-139.77	0.06417	0.06829	10.362	∅16//0.15	13.40	0.04	182.36
			P21	-132.46	-1.58	-134.04	0.06154	0.06533	9.912	∅16//0.15	13.40	0.04	182.36
			P22	-119.38	8.43	-127.81	0.05868	0.06213	9.426	∅16//0.15	13.40	0.04	182.36
			P23	-69.42	12.34	-81.76	0.03754	0.03895	5.909	∅12//0.15	7.53	0.02	104.94
			P24	-45.62	1.81	-47.43	0.02177	0.02225	3.376	∅10//0.15	5.27	0.02	74.11
	1		P1	0.00	0.00	0.00	0.00000	0.00000	0.000			0.00	0.00
			P9	-77.59	-1.38	-78.97	0.03626	0.03757	5.701	∅12//0.15	7.53	0.02	104.94
			Pa5	-61.66	-14.03	-75.69	0.03475	0.03596	5.456	∅12//0.15	7.53	0.02	104.94

	Alinhamento	Vão	$M_{Ed,xx}$	$M_{Ed,xy}$	M_{Ed}	μ	ω	A_{sd}	Armadura	A_s	x [m]	$M_{Rd,x}$
			(KN.m)	(KN.m)	(KN.m)			(cm ² /m)	Adotada	(cm ² /m)		
Armadura Inferior Segundo x	A'	P1/P2	0.00	0.00	0.00	0.00000	0.00000	0.000			0.00	0.00
		P2/P3	0.00	0.00	0.00	0.00000	0.00000	0.000			0.00	0.00
		P3/P4	0.00	0.00	0.00	0.00000	0.00000	0.000			0.00	0.00
		P4/P5	0.00	0.00	0.00	0.00000	0.00000	0.000			0.00	0.00
		P5/P6	0.00	0.00	0.00	0.00000	0.00000	0.000			0.00	0.00
		P6/P7	0.00	0.00	0.00	0.00000	0.00000	0.000			0.00	0.00
		P7/P8	0.00	0.00	0.00	0.00000	0.00000	0.000			0.00	0.00
	B'	.../P10	0.00	0.00	0.00	0.00000	0.00000	0.000			0.00	0.00
		P10/P11	0.00	0.00	0.00	0.00000	0.00000	0.000			0.00	0.00
		P11/P12	-7.70	6.33	-1.37	0.00063	0.00063	0.095	$A_{s,dist}$	7.53	0.02	104.94
		P12/P13	56.84	0.96	57.80	0.02654	0.02724	4.133	$A_{s,dist}$	7.53	0.02	104.94
		P13/P14	63.03	-5.92	68.95	0.03166	0.03266	4.955	$A_{s,dist}$	7.53	0.02	104.94
		P14/P15	58.43	-26.54	84.97	0.03901	0.04053	6.150	$A_{s,dist}$	7.53	0.02	104.94
		P15/P16	0.00	0.00	0.00	0.00000	0.00000	0.000			0.00	0.00
		P16/P17	0.00	0.00	0.00	0.00000	0.00000	0.000			0.00	0.00
		P18/P19	64.82	-6.94	71.76	0.03295	0.03403	5.164	$A_{s,dist}$	7.53	0.02	104.94
		P19/P20	29.22	-3.14	32.36	0.01486	0.01508	2.288	$A_{s,dist}$	7.53	0.02	104.94
	P20/P21	28.96	-1.67	30.63	0.01406	0.01426	2.164	$A_{s,dist}$	7.53	0.02	104.94	
	C'	P21/P22	32.05	3.44	35.49	0.01629	0.01656	2.513	$A_{s,dist}$	7.53	0.02	104.94
		P22/P23	29.46	16.17	45.63	0.02095	0.02139	3.245	$A_{s,dist}$	7.53	0.02	104.94
		P23/P24	0.81	-0.72	1.53	0.00070	0.00070	0.107	$A_{s,dist}$	7.53	0.02	104.94
		P24/P25	0.00	0.00	0.00	0.00000	0.00000	0.000			0.00	0.00
		1	P1/P9	0.00	0.00	0.00	0.00000	0.00000	0.000			0.00
	P9/Pa5	0.00	0.00	0.00	0.00000	0.00000	0.000			0.00	0.00	
	Pa5/P18	0.00	0.00	0.00	0.00000	0.00000	0.000			0.00	0.00	

- Segundo y

	Alinhamento	Pilar	$M_{Ed,yy}$	$M_{Ed,xy}$	M_{Ed}	μ	ω	A_{sd}	Armadura	A_s	x [m]	$M_{Rd,y}$
			(KN.m)	(KN.m)	(KN.m)			(cm ² /m)	Adotada	(cm ² /m)		
Armadura Superior Segundo y	1	P1	0.00	0.00	0.00	0.00000	0.00000	0.000			0.00	0.00
		P9	-70.84	12.50	-83.34	0.03826	0.03973	6.028	$\emptyset 12//0.15$	7.53	0.02	104.94
		Pa5	-45.69	-3.57	-49.26	0.02261	0.02313	3.509	$\emptyset 10//0.15$	5.27	0.02	74.11
	P18	-42.43	2.41	-44.84	0.02059	0.02101	3.188	$\emptyset 10//0.15$	5.27	0.02	74.11	
	2	P2	0.00	0.00	0.00	0.00000	0.00000	0.000			0.00	0.00
		P10	0.00	0.00	0.00	0.00000	0.00000	0.000			0.00	0.00
	3	P18	0.00	0.00	0.00	0.00000	0.00000	0.000			0.00	0.00
		P11	-93.15	-11.38	-104.53	0.04799	0.05029	7.631	$\emptyset 16//0.15$	13.40	0.04	182.36
	P19	-151.27	-5.51	-156.78	0.07198	0.07716	11.707	$\emptyset 16//0.15$	13.40	0.04	182.36	
	4	P3	0.00	0.00	0.00	0.00000	0.00000	0.000			0.00	0.00
		P12	-143.70	2.67	-146.37	0.06720	0.07172	10.881	$\emptyset 16//0.15$	13.40	0.04	182.36
	P20	-167.07	-3.54	-170.61	0.07833	0.08447	12.816	$\emptyset 16//0.15$	13.40	0.04	182.36	
	5	P4	0.00	0.00	0.00	0.00000	0.00000	0.000			0.00	0.00
		P13	-143.02	-1.20	-144.22	0.06621	0.07060	10.712	$\emptyset 16//0.15$	13.40	0.04	182.36
	P21	-182.65	-0.33	-182.97	0.08401	0.09107	13.817	$\emptyset 16//0.15$	13.40	0.04	182.36	
	6	P5	0.00	0.00	0.00	0.00000	0.00000	0.000			0.00	0.00
		P14	-133.96	-15.15	-149.11	0.06846	0.07315	11.098	$\emptyset 16//0.15$	13.40	0.04	182.36
	P22	-158.41	10.42	-168.83	0.07751	0.08352	12.672	$\emptyset 16//0.15$	13.40	0.04	182.36	
	7	P6	0.00	0.00	0.00	0.00000	0.00000	0.000			0.00	0.00
		P15	2.54	-20.30	-17.76	0.00815	0.00822	1.247	$\emptyset 10//0.15$	5.27	0.02	74.11
	P23	-36.03	13.20	-49.23	0.02260	0.02311	3.507	$\emptyset 10//0.15$	5.27	0.02	74.11	
	8	P7	0.00	0.00	0.00	0.00000	0.00000	0.000			0.00	0.00
		P16	0.00	0.00	0.00	0.00000	0.00000	0.000			0.00	0.00
	9	P24	-32.12	1.21	-33.32	0.01530	0.01553	2.357	$\emptyset 10//0.15$	5.27	0.02	74.11
		P8	0.00	0.00	0.00	0.00000	0.00000	0.000			0.00	0.00
	10	P17	0.00	0.00	0.00	0.00000	0.00000	0.000			0.00	0.00
		P25	0.00	0.00	0.00	0.00000	0.00000	0.000			0.00	0.00

	Alinhamento	Vão	$M_{Ed,yy}$	$M_{Ed,xy}$	M_{Ed}	μ	ω	A_{sd}	Armadura	A_s	x [m]	$M_{Rd,y}$ [KN.m/m]
			(KN.m)	(KN.m)	(KN.m)			(cm ² /m)	Adotada	(cm ² /m)		
Armadura Inferior Segundo Y	1	P1/P9	0.00	0.00	0.00	0.00000	0.00000	0.000			0.00	0.00
		P9/Pa5	0.00	0.00	0.00	0.00000	0.00000	0.000			0.00	0.00
		Pa5/P18	0.00	0.00	0.00	0.00000	0.00000	0.000			0.00	0.00
		P18/...	0.00	0.00	0.00	0.00000	0.00000	0.000			0.00	0.00
	2	P2/P10	0.00	0.00	0.00	0.00000	0.00000	0.000			0.00	0.00
		.../P18	0.00	0.00	0.00	0.00000	0.00000	0.000			0.00	0.00
	3	P11/P19	94.15	3.81	97.96	0.04498	0.04700	7.131	$A_{s,dist}$	7.53	0.02	104.94
		P19/...	0.00	0.00	0.00	0.00000	0.00000	0.000			0.00	0.00
	4	P3/P12	0.00	0.00	0.00	0.00000	0.00000	0.000			0.00	0.00
		P12/P20	108.65	-6.16	114.81	0.05271	0.05549	8.420	Ø10//0.15	12.80	0.04	174.63
		P20/...	0.00	0.00	0.00	0.00000	0.00000	0.000			0.00	0.00
	5	P4/P13	0.00	0.00	0.00	0.00000	0.00000	0.000			0.00	0.00
		P13/P21	112.87	-1.36	114.23	0.05245	0.05520	8.375	Ø10//0.15	12.80	0.04	174.63
		P21/...	0.00	0.00	0.00	0.00000	0.00000	0.000			0.00	0.00
	6	P5/P14	0.00	0.00	0.00	0.00000	0.00000	0.000			0.00	0.00
		P14/P22	92.67	1.65	94.32	0.04331	0.04518	6.855	$A_{s,dist}$	7.53	0.02	104.94
		P22/...	0.00	0.00	0.00	0.00000	0.00000	0.000			0.00	0.00
	7	P6/P15	0.00	0.00	0.00	0.00000	0.00000	0.000			0.00	0.00
		P15/P23	3.27	7.72	10.99	0.00505	0.00507	0.769			0.00	0.00
		P23/...	0.00	0.00	0.00	0.00000	0.00000	0.000			0.00	0.00
8	P7/P16	0.00	0.00	0.00	0.00000	0.00000	0.000			0.00	0.00	
9	Nu/P24	2.05	0.83	2.88	0.00132	0.00132	0.201			0.00	0.00	
	P8/P17	0.00	0.00	0.00	0.00000	0.00000	0.000			0.00	0.00	
10	Nu/P25	0.00	0.00	0.00	0.00000	0.00000	0.000			0.00	0.00	
	P25/...	0.00	0.00	0.00	0.00000	0.00000	0.000			0.00	0.00	

11.1.5 PUNÇAMENTO

O cálculo da resistência da laje ao punçamento foi descrito na integra no documento escrito, no capítulo 6.2.5.

11.2 Escadas

O cálculo do dimensionamento das armaduras das escadas foi descrito na integra no documento escrito, no capítulo 6.3.

11.3 Vigas

- Armaduras máximas e mínimas (Eq.(11.1 e Eq.(11.2)

b_w [m]	h_w [m]	d_w [m]	f_{ctm}	f_{yk} [Mpa]	$A_{s,min}$ [cm ²]	$A_{s,max}$ [cm ²]
0,25	0,40	0,37	2,90	500,00	1,39	40,00
0,25	0,60	0,57	2,90	500,00	2,15	60,00
0,25	0,70	0,67	2,90	500,00	2,53	70,00
0,25	0,75	0,72	2,90	500,00	2,71	75,00
0,25	1,34	1,31	2,90	500,00	4,94	134,00
0,25	3,02	2,99	2,90	500,00	11,27	302,00

- Diâmetros máximos recomendados

Viga	Pilar	h_c [m]	$d_{bl,max}$ [mm]
Vb1	P1	0,95	51
	P9	0,80	43
	Pa4	2,00	108
	P18	0,95	51
Vb2	P8	0,60	32
	P17 e P25	0,80	43
Vb6	P3 a P7	0,40	22

- Factor de ductilidade em curvatura

$$\begin{cases} \mu_\varphi = 2 \times q_0 - 1 & \text{se } T_1 \geq T_C \\ \mu_\varphi = 1 + 2 \times (q_0 - 1) \times \frac{T_C}{T_1} & \text{se } T_1 < T_C \end{cases} \quad (11.14)$$

Em que:

T_1 Período fundamental da estrutura para movimentos horizontais no plano de flexão associado à curvatura em causa;
 T_C Período máximo da zona de aceleração constante no espectro de resposta.

T_1	T_c (AS1)	T_c (AS2)	q_0	μ_φ
1,428	0,60	0,25	1,60	2,20

11.3.1 FLEXÃO

O dimensionamento à flexão das vigas foi feito retirando o valor das armaduras do programa de cálculo. Foi feito posteriormente o cálculo dos momentos resistentes dado por:

$$M_{Rd} = A_s \times f_{yd} \times (d_w - 0,4 \times x) \quad (11.15)$$

$$x = \frac{A_s \times f_{yd}}{0,8 \times b_w \times f_{cd}} \quad (11.16)$$

Em que:

A_s Área de armadura longitudinal de tração;
 d_w Distância entre o centro de gravidade da armadura e fibra mais comprimida;
 x Posição da linha neutra;
 b_w Largura da seção transversal.

No caso das vigas primárias, foi tido em consideração a contribuição das armaduras da laje, sendo o momento resistente neste caso dado por:

$$M_{Rd} = (A_{s,sup,laje} + A_{s,sup,viga}) \times f_{yd} \times z_1 + A_{s,inf,laje} \times f_{yd} \times z_2 \quad (11.17)$$

Em que:

$A_{s,sup,laje}$ Área de armadura superior da laje;

$A_{s,inf.,laje}$	Área de armadura inferior da laje;
$A_{s,sup.,viga}$	Área de armadura longitudinal de tração;
$z_1 = 0,90 \times (h_w - rec)$	Distâncias dos centros de gravidade das armaduras e fibra mais comprimida.
$z_2 = 0,90 \times (h_w - (e_{laje} + rec))$	

Sendo que, para as vigas primárias foi feita a verificação das taxas de armadura, que segundo o EC8 são dadas por:

$$\rho \geq \rho_{min} = 0,5 \times \frac{f_{ctm}}{f_{yk}} \quad (11.18)$$

$$\rho = \frac{A_{s,tração}}{A_c} \quad (11.19)$$

Em que:

A_c Área da seção transversal da viga.

&

$$\rho \leq \rho_{max} = \rho' + \frac{0.0018}{\mu_\phi \times \varepsilon_{sy,d}} \times \frac{f_{cd}}{f_{yd}} \quad (11.20)$$

Em que:

μ_ϕ Fator de ductilidade em curvatura;
 $\varepsilon_{sy,d}$ Extensão de cedência do aço;
 ρ' Taxa de armadura na zona comprimida.

Para as restantes vigas foi feita apenas a verificação das armaduras máximas e mínimas, dadas pelas Eq.(11.1 e Eq(11.2 do presente documento.

11.3.1.1 Viga Vb.1

Viga	Secção	Face	Combinação	M _{ed} [KN]	A _{S,viga} [cm ²]	A _{S,viga,adt} [cm ²]	b _w [m]	h _w [m]	b _{ef} [m]	A _{S,inf,laje} [cm ²]	A _{S,sup,laje} [cm ²]	z1 [m]	z2 [m]	M _{Rd} ⁻ [KN.m]	M _{Rd} ⁺ [KN.m]	A _{S,total,sup} [cm ²]	A _{S,total,inf} [cm ²]	ρ'	ρ	ρ _{min}	ρ _{max}	ρ' > 0,5.ρ
Vb1.1	1	Sup	Sismo 1-	268.68	13.07	3Ø25	14.73	0.250	0.250	1.883	0.490	0.648	0.324	455.553	-	17.103	-	0.0050	0.0091	0.0029	0.022	Verifica
		Inf	Sismo 1-	134.34	6.25	3Ø20	9.42	0.250	0.250	1.883	0.490	0.648	0.324	-	265.531	-	9.420	-				
	2 (vão)	Sup	Fund	-141.89	5.21	2Ø25	9.82	0.250	0.250	1.883	0.490	0.648	0.324	317.150	-	12.193	-	0.0033	0.0065	0.0029	0.021	Verifica
		Inf	Fund	70.94	5.21	2Ø20	6.28	0.250	0.250	1.883	0.490	0.648	0.324	-	177.021	-	6.280	-				
	3	Sup	Sismo 1-	-270.92	9.16	2Ø25	9.82	0.250	0.250	1.883	0.490	0.648	0.324	317.150	-	12.193	-	0.0050	0.0065	0.0029	0.022	Verifica
		Inf	Sismo 1+	280.6	9.51	3Ø20	9.42	0.250	0.250	1.883	0.490	0.648	0.324	-	265.531	-	9.420	-				
	4 (vão)	Sup	Sismo 1+	-347.67	11.97	3Ø25	14.73	0.250	0.250	1.883	0.490	0.648	0.324	455.553	-	17.103	-	0.0066	0.0091	0.0029	0.024	Verifica
		Inf	Sismo 1-	270.15	9.13	2Ø20+3Ø16	12.31	0.250	0.250	1.883	0.490	0.648	0.324	-	346.994	-	12.310	-				
	5	Sup	Sismo 1+	-372.45	13.60	3Ø25	14.73	0.250	0.250	1.883	0.490	0.648	0.324	455.553	-	17.103	-	0.0066	0.0091	0.0029	0.024	Verifica
		Inf	Sismo 1+	289.62	10.60	2Ø20+3Ø16	12.31	0.250	0.250	1.883	0.490	0.648	0.324	-	346.994	-	12.310	-				
	6 (vão)	Sup	Sismo 1-	-159.81	5.27	2Ø25	9.82	0.250	0.250	1.883	0.490	0.648	0.324	317.150	-	12.193	-	0.0033	0.0065	0.0029	0.021	Verifica
		Inf	Sismo 1+	187.1	6.21	2Ø20	6.28	0.250	0.250	1.883	0.490	0.648	0.324	-	177.021	-	6.280	-				
	7	Sup	Sismo 1+	-396.34	13.81	3Ø25	14.73	0.250	0.250	1.883	0.490	0.648	0.324	455.553	-	17.103	-	0.0050	0.0091	0.0029	0.022	Verifica
		Inf	Sismo 1-	182.96	6.07	3Ø20	9.42	0.250	0.250	1.883	0.490	0.648	0.324	-	265.531	-	9.420	-				
	8 (vão)	Sup	Sismo 1+	-133.64	5.21	2Ø25	9.82	0.250	0.250	1.883	0.490	0.648	0.324	317.150	-	12.193	-	0.0044	0.0065	0.0029	0.022	Verifica
		Inf	Fund	245.7	8.26	2Ø20+1Ø16	8.29	0.250	0.250	1.883	0.490	0.648	0.324	-	233.679	-	8.290	-				
	9	Sup	0	0	0.00	2Ø25	9.82	0.250	0.250	1.883	0.490	0.648	0.324	317.150	-	12.193	-	0.0044	0.0065	0.0029	0.022	Verifica
		Inf	Fund	218.58	7.31	2Ø20+1Ø16	8.29	0.250	0.250	1.883	0.490	0.648	0.324	-	233.679	-	8.290	-				

Viga	Secção	Face	Combinação	M _{ed} [KN]	A _{S,viga} [cm ²]	A _{S,viga,adt} [cm ²]	b _w [m]	h _w [m]	b _{ef} [m]	A _{S,inf,laje} [cm ²]	A _{S,sup,laje} [cm ²]	z1 [m]	z2 [m]	M _{Rd} ⁻ [KN.m]	M _{Rd} ⁺ [KN.m]	A _{S,total,sup} [cm ²]	A _{S,total,inf} [cm ²]	ρ'	ρ	ρ _{min}	ρ _{max}	ρ' > 0,5.ρ
Vb2.1	1	Sup	Sismo 1-	-267.51	11.99	2Ø25+1Ø20	12.96	0.250	0.600	1.883	0.490	0.513	0.189	315.620	-	15.333	-	0.0063	0.0102	0.0029	0.024	Verifica
		Inf	Sismo 1-	103.45	9.03	3Ø20	9.42	0.250	0.600	1.883	0.490	0.513	0.189	-	210.212	-	9.420	-				
	2 (vão)	Sup	Sismo 1+	-74.02	4.13	2Ø25	9.82	0.250	0.600	1.883	0.490	0.513	0.189	245.550	-	12.193	-	0.0042	0.0081	0.0029	0.021	Verifica
		Inf	Fund	109.32	4.57	2Ø20	6.28	0.250	0.600	1.883	0.490	0.513	0.189	-	140.141	-	6.280	-				
	3	Sup	Sismo 1+	-315.94	14.31	3Ø25	14.73	0.250	0.600	1.883	0.490	0.513	0.189	355.119	-	17.103	-	0.0063	0.0114	0.0029	0.024	Verifica
		Inf	Sismo 1+	221.69	9.90	3Ø20	9.42	0.250	0.600	1.883	0.490	0.513	0.189	-	210.212	-	9.420	-				
	4 (vão)	Sup	Sismo 1+	-298.45	13.42	3Ø25	14.73	0.250	0.600	1.883	0.490	0.513	0.189	355.119	-	17.103	-	0.0082	0.0114	0.0029	0.026	Verifica
		Inf	Sismo 1-	230.49	10.08	2Ø20+3Ø16	12.31	0.250	0.600	1.883	0.490	0.513	0.189	-	274.704	-	12.310	-				
	5	Sup	Sismo 1+	-305.02	13.70	3Ø25	14.73	0.250	0.600	1.883	0.490	0.513	0.189	355.119	-	17.103	-	0.0082	0.0114	0.0029	0.026	Verifica
		Inf	Sismo 1+	275.4	12.30	2Ø20+3Ø16	12.31	0.250	0.600	1.883	0.490	0.513	0.189	-	274.704	-	12.310	-				
	6 (vão)	Sup	Sismo 1-	-131.87	5.56	2Ø25	9.82	0.250	0.600	1.883	0.490	0.513	0.189	245.550	-	12.193	-	0.0042	0.0081	0.0029	0.021	Verifica
		Inf	Sismo 1+	148.62	6.30	2Ø20	6.28	0.250	0.600	1.883	0.490	0.513	0.189	-	140.141	-	6.280	-				
	7	Sup	Sismo 1+	-298.98	13.40	3Ø25	14.73	0.250	0.600	1.883	0.490	0.513	0.189	355.119	-	17.103	-	0.0082	0.0114	0.0029	0.026	Verifica
		Inf	Sismo 1-	225.29	10.10	2Ø20+3Ø16	12.31	0.250	0.600	1.883	0.490	0.513	0.189	-	274.704	-	12.310	-				

Viga	Secção	Face	Combinação	M _{ed} [KN]	A _{S,viga} [cm ²]	A _{S,viga,adt} [cm ²]	b _w [m]	h _w [m]	b _{ef} [m]	A _{S,inf,laje} [cm ²]	A _{S,sup,laje} [cm ²]	z1 [m]	z2 [m]	M _{Rd} ⁻ [KN.m]	M _{Rd} ⁺ [KN.m]	A _{S,total,sup} [cm ²]	A _{S,total,inf} [cm ²]	ρ'	ρ	ρ _{min}	ρ _{max}	ρ' > 0,5.ρ	
Vb3.1	1	Sup	Sismo 1-	-260.85	11.69	2Ø25+1Ø20	12.96	0.250	0.600	0.250	1.883	0.490	0.513	0.189	315.620	-	15.333	-	0.0063	0.0102	0.0029	0.024	Verifica
		Inf	Sismo 1+	163.57	7.33	3Ø20	9.42	0.250	0.600	0.250	1.883	0.490	0.513	0.189	-	210.212	-	9.420	-	0.0063	0.0081	0.0029	0.024
	2 (vão)	Sup	Sismo 1-	-106.4	4.44	2Ø25	9.82	0.250	0.600	0.250	1.883	0.490	0.513	0.189	245.550	-	12.193	-	0.0063	0.0081	0.0029	0.024	Verifica
		Inf	Sismo 1+	150.15	6.37	2Ø20	9.42	0.250	0.600	0.250	1.883	0.490	0.513	0.189	-	210.212	-	9.420	-	0.0063	0.0081	0.0029	0.024
	3	Sup	Sismo 1+	-247.42	10.89	2Ø25+1Ø20	12.96	0.250	0.600	0.250	1.883	0.490	0.513	0.189	315.620	-	15.333	-	0.0082	0.0102	0.0029	0.026	Verifica
		Inf	Sismo 1+	254.887	11.42	2Ø20+3Ø16	12.31	0.250	0.600	0.250	1.883	0.490	0.513	0.189	-	274.704	-	12.310	-	0.0082	0.0102	0.0029	0.026
	4 (vão)	Sup	Sismo 1+	-386.79	18.11	2Ø25+3Ø20	19.24	0.250	0.600	0.250	1.883	0.490	0.513	0.189	455.762	-	21.613	-	0.0105	0.0144	0.0029	0.028	Verifica
		Inf	Sismo 1-	306.1	13.81	5Ø20	15.70	0.250	0.600	0.250	1.883	0.490	0.513	0.189	-	350.353	-	15.700	-	0.0105	0.0144	0.0029	0.028
	5	Sup	Sismo 1+	-421.71	18.90	2Ø25+3Ø20	19.24	0.250	0.600	0.250	1.883	0.490	0.513	0.189	455.762	-	21.613	-	0.0105	0.0144	0.0029	0.028	Verifica
		Inf	Sismo 1+	344.7	15.42	5Ø20	15.70	0.250	0.600	0.250	1.883	0.490	0.513	0.189	-	350.353	-	15.700	-	0.0105	0.0144	0.0029	0.028
	6 (vão)	Sup	Sismo 1-	-282.61	12.62	2Ø25+1Ø20	12.96	0.250	0.600	0.250	1.883	0.490	0.513	0.189	315.620	-	15.333	-	0.0082	0.0102	0.0029	0.026	Verifica
		Inf	Sismo 1+	255.24	11.27	2Ø20+3Ø16	12.31	0.250	0.600	0.250	1.883	0.490	0.513	0.189	-	274.704	-	12.310	-	0.0082	0.0102	0.0029	0.026
	7	Sup	Sismo 1+	-397.488	17.81	2Ø25+3Ø20	19.24	0.250	0.600	0.250	1.883	0.490	0.513	0.189	455.762	-	21.613	-	0.0105	0.0144	0.0029	0.028	Verifica
		Inf	Sismo 1-	315.661	14.15	5Ø20	15.70	0.250	0.600	0.250	1.883	0.490	0.513	0.189	-	350.353	-	15.700	-	0.0105	0.0144	0.0029	0.028

Viga	Secção	Face	Combinação	M _{ed} [KN]	A _{S,viga} [cm ²]	A _{S,viga,adt} [cm ²]	b _w [m]	h _w [m]	b _{ef} [m]	A _{S,inf,laje} [cm ²]	A _{S,sup,laje} [cm ²]	z1 [m]	z2 [m]	M _{Rd} ⁻ [KN.m]	M _{Rd} ⁺ [KN.m]	A _{S,total,sup} [cm ²]	A _{S,total,inf} [cm ²]	ρ'	ρ	ρ _{min}	ρ _{max}	ρ' > 0,5.ρ	
Vb4.1	1	Sup	Sismo 1-	-322.64	14.43	3Ø25	14.73	0.250	0.600	0.250	1.883	0.490	0.513	0.189	355.119	-	17.103	-	0.0086	0.0114	0.0029	0.026	Verifica
		Inf	Sismo 1+	227.25	10.18	2Ø25+1Ø20	12.96	0.250	0.600	0.250	1.883	0.490	0.513	0.189	-	289.209	-	12.960	-	0.0086	0.0114	0.0029	0.026
	2 (vão)	Sup	Sismo 1-	-168.13	7.18	2Ø25	9.82	0.250	0.600	0.250	1.883	0.490	0.513	0.189	245.550	-	12.193	-	0.0065	0.0081	0.0029	0.024	Verifica
		Inf	Sismo 1+	168.26	7.18	2Ø25	9.82	0.250	0.600	0.250	1.883	0.490	0.513	0.189	-	219.138	-	9.820	-	0.0065	0.0081	0.0029	0.024
	3	Sup	Sismo 1+	-225.48	9.84	2Ø25+1Ø20	12.96	0.250	0.600	0.250	1.883	0.490	0.513	0.189	315.620	-	15.333	-	0.0086	0.0102	0.0029	0.026	Verifica
		Inf	Sismo 1+	232.03	10.40	2Ø25+1Ø20	12.96	0.250	0.600	0.250	1.883	0.490	0.513	0.189	-	289.209	-	12.960	-	0.0086	0.0102	0.0029	0.026
	4 (vão)	Sup	Sismo 1+	-448.84	21.71	5Ø25	24.55	0.250	0.600	0.250	1.883	0.490	0.513	0.189	574.257	-	26.923	-	0.0128	0.0179	0.0029	0.030	Verifica
		Inf	Sismo 1-	369.38	17.15	2Ø25+3Ø20	19.24	0.250	0.600	0.250	1.883	0.490	0.513	0.189	-	429.350	-	19.240	-	0.0128	0.0179	0.0029	0.030
	5	Sup	Sismo 1-	-491.58	21.96	5Ø25	24.55	0.250	0.600	0.250	1.883	0.490	0.513	0.189	574.257	-	26.923	-	0.0128	0.0179	0.0029	0.030	Verifica
		Inf	Sismo 1+	406.91	18.19	2Ø25+3Ø20	19.24	0.250	0.600	0.250	1.883	0.490	0.513	0.189	-	429.350	-	19.240	-	0.0128	0.0179	0.0029	0.030
	6 (vão)	Sup	Sismo 1-	-352.28	16.22	2Ø25+3Ø20	19.24	0.250	0.600	0.250	1.883	0.490	0.513	0.189	455.762	-	21.613	-	0.0098	0.0144	0.0029	0.027	Verifica
		Inf	Sismo 1+	301.12	13.55	3Ø25	14.73	0.250	0.600	0.250	1.883	0.490	0.513	0.189	-	328.707	-	14.730	-	0.0098	0.0144	0.0029	0.027
	7	Sup	Sismo 1+	-480.72	21.51	5Ø25	24.55	0.250	0.600	0.250	1.883	0.490	0.513	0.189	574.257	-	26.923	-	0.0128	0.0179	0.0029	0.030	Verifica
		Inf	Sismo 1-	392.23	17.58	2Ø25+3Ø20	19.24	0.250	0.600	0.250	1.883	0.490	0.513	0.189	-	429.350	-	19.240	-	0.0128	0.0179	0.0029	0.030

Viga	Secção	Face	Combinação	M _{ed} [KN]	A _{S,viga} [cm ²]	A _{S,viga,adt} [cm ²]	b _w [m]	h _w [m]	b _{ef} [m]	A _{S,inf,laje} [cm ²]	A _{S,sup,laje} [cm ²]	z1 [m]	z2 [m]	M _{Rd} ⁻ [KN.m]	M _{Rd} ⁺ [KN.m]	A _{S,total,sup} [cm ²]	A _{S,total,inf} [cm ²]	ρ'	ρ	ρ _{min}	ρ _{max}	ρ' > 0,5.ρ	
Vb5.1	1	Sup	Sismo 1-	-375.3	16.82	2Ø25+3Ø20	19.24	0.250	0.600	0.250	1.883	0.490	0.513	0.189	455.762	-	21.613	-	0.0105	0.0144	0.0029	0.028	Verifica
		Inf	Sismo 1+	340.69	15.27	5Ø20	15.70	0.250	0.600	0.250	1.883	0.490	0.513	0.189	-	350.353	-	15.700	-	0.0105	0.0144	0.0029	0.028
	2 (vão)	Sup	Sismo 1-	-203.44	8.80	2Ø25	9.82	0.250	0.600	0.250	1.883	0.490	0.513	0.189	245.550	-	12.193	-	0.0082	0.0081	0.0029	0.026	Verifica
		Inf	Sismo 1+	239.22	10.49	2Ø20+3Ø16	12.31	0.250	0.600	0.250	1.883	0.490	0.513	0.189	-	274.704	-	12.310	-	0.0082	0.0102	0.0029	0.026
	3	Sup	Sismo 1+	-283.4	12.66	2Ø25+1Ø20	12.96	0.250	0.600	0.250	1.883	0.490	0.513	0.189	315.620	-	15.333	-	0.0082	0.0102	0.0029	0.026	Verifica
		Inf	Sismo 1-	242.7	10.66	2Ø20+3Ø16	12.31	0.250	0.600	0.250	1.883	0.490	0.513	0.189	-	274.704	-	12.310	-	0.0105	0.0144	0.0029	0.028
	4 (vão)	Sup	Sismo 1+	-378.75	17.66	2Ø25+3Ø20	19.24	0.250	0.600	0.250	1.883	0.490	0.513	0.189	455.762	-	21.613	-	0.0105	0.0144	0.0029	0.028	Verifica
		Inf	Sismo 1-	301.82	13.59	5Ø20	15.70	0.250	0.600	0.250	1.883	0.490	0.513	0.189	-	350.353	-	15.700	-	0.0105	0.0144	0.0029	0.028
	5	Sup	Sismo 1-	-427.31	19.13	2Ø25+3Ø20	19.24	0.250	0.600	0.250	1.883	0.490	0.513	0.189	455.762	-	21.613	-	0.0105	0.0144	0.0029	0.028	Verifica
		Inf	Sismo 1-	328.67	14.70	5Ø20	15.70	0.250	0.600	0.250	1.883	0.490	0.513	0.189	-	350.353	-	15.700	-	0.0105	0.0144	0.0029	0.028
	6 (vão)	Sup	Sismo 1-	-307.35	13.87	3Ø25	14.73	0.250	0.600	0.250	1.883	0.490	0.513	0.189	355.119	-	17.103	-	0.0082	0.0114	0.0029	0.026	Verifica
		Inf	Sismo 1+	241.85	10.62	2Ø20+3Ø16	12.31	0.250	0.600	0.250	1.883	0.490	0.513	0.189	-	274.704	-	12.310	-	0.0105	0.0144	0.0029	0.028
	7	Sup	Sismo 1+	-408.66	18.28	2Ø25+3Ø20	19.24	0.250	0.600	0.250	1.883	0.490	0.513	0.189	455.762	-	21.613	-	0.0105	0.0144	0.0029	0.028	Verifica
		Inf	Sismo 1-	334.79	15.00	5Ø20	15.70	0.250	0.600	0.250	1.883	0.490	0.513	0.189	-	350.353	-	15.700	-	0.0105	0.0144	0.0029	0.028

Viga	Secção	Face	Combinação	M _{ed} [KN]	A _{S,viga} [cm ²]	A _{S,viga,adt} [cm ²]	b _w [m]	h _w [m]	b _{ef} [m]	A _{S,inf,laje} [cm ²]	A _{S,sup,laje} [cm ²]	z1 [m]	z2 [m]	M _{Rd} ⁻ [KN.m]	M _{Rd} ⁺ [KN.m]	A _{S,total,sup} [cm ²]	A _{S,total,inf} [cm ²]	ρ'	ρ	ρ _{min}	ρ _{max}	ρ' > 0,5.ρ	
Vb6.1	1	Sup	Sismo 1-	-301.06	13.55	3Ø25	14.73	0.250	0.600	0.250	1.883	0.490	0.513	0.189	355.119	-	17.103	-	0.0063	0.0114	0.0029	0.024	Verifica
		Inf	Sismo 1+	178.52	7.65	3Ø20	9.42	0.250	0.600	0.250	1.883	0.490	0.513	0.189	-	210.212	-	9.420	-	0.0063	0.0081	0.0029	0.024
	2 (vão)	Sup	Sismo 1-	-175.12	7.50	2Ø25	9.82	0.250	0.600	0.250	1.883	0.490	0.513	0.189	245.550	-	12.193	-	0.0063	0.0081	0.0029	0.024	Verifica
		Inf	Sismo 1+	330.69	9.16	3Ø20	9.42	0.250	0.600	0.250	1.883	0.490	0.513	0.189	-	210.212	-	9.420	-	0.0042	0.0144	0.0029	0.021
	3	Sup	Sismo 1+	-365.58	16.31	2Ø25+3Ø20	19.24	0.250	0.600	0.250	1.883	0.490	0.513	0.189	455.762	-	21.613	-	0.0063	0.0114	0.0029	0.024	Verifica
		Inf	Sismo 1+	147.77	6.26	2Ø20	6.28	0.250	0.600	0.250	1.883	0.490	0.513	0.189	-	140.141	-	6.280	-	0.0063	0.0114	0.0029	0.024
	4 (vão)	Sup	Sismo 1+	-226.93	9.78	3Ø25	14.73	0.250	0.600	0.250	1.883	0.490	0.513	0.189	355.119	-	17.103	-	0.0063	0.0114	0.0029	0.024	Verifica
		Inf	Sismo 1-	136.91	5.78	3Ø20	9.42	0.250	0.600	0.250	1.883	0.490	0.513	0.189	-	210.212	-	9.420	-	0.0063	0.0114	0.0029	0.024
	5	Sup	Sismo 1-	-317.53	14.39	3Ø25	14.73	0.250	0.600	0.250	1.883	0.490	0.513	0.189	355.119	-	17.103	-	0.0063	0.0114	0.0029	0.024	Verifica
		Inf	Sismo 1+	199.67	8.62	3Ø20	9.42	0.250	0.600	0.250	1.883	0.490	0.513	0.189	-	210.212	-	9.420	-	0.0042	0.0081	0.0029	0.021
	6 (vão)	Sup	Sismo 1-	-207.96	9.01	2Ø25	9.82	0.250	0.600	0.250	1.883	0.490	0.513	0.189	245.550	-	12.193	-	0.0063	0.0114	0.0029	0.024	Verifica
		Inf	Sismo 1+	148	6.27	2Ø20	6.28	0.250	0.600	0.250	1.883	0.490	0.513	0.189	-	140.141	-	6.280	-	0.0063	0.0102	0.0029	0.024
	7	Sup	Sismo 1+	-275.9	12.28	2Ø25+1Ø20	12.96	0.250	0.600	0.250	1.883	0.490	0.513	0.189	315.620	-	15.333	-	0.0063	0.0102	0.0029	0.024	Verifica
		Inf	Sismo 1-	207.62	9.00	3Ø20	9.42	0.250	0.600	0.250	1.883	0.490	0.513	0.189	-	210.212	-	9.420	-	0.0063	0.0102	0.0029	0.024

Notas:

1. No piso 6, na seção 3, existe uma mudança de altura na viga, tendo-se dividido a armadura superior por 2 níveis??

11.3.1.2 Viga Vb.2

Viga	Secção	Face	Combinação	M _{ed} [KN]	A _{S,viga} [cm ²]	A _{S,viga,adt} [cm ²]	b _w [m]	h _w [m]	b _{ef} [m]	A _{S,inf,laje} [cm ²]	A _{S,sup,laje} [cm ²]	z1 [m]	z2 [m]	M _{Rd} ⁻ [KN.m]	M _{Rd} ⁺ [KN.m]	A _{S,total,sup} [cm ²]	A _{S,total,inf} [cm ²]	ρ'	ρ	ρ _{min}	ρ _{max}	ρ' > 0,5.ρ	
Vb1.2	1	Sup	Sismo 1+	-256.88	8.66	3Ø20	9.42	0.250	0.750	0.400	3.012	0.784	0.648	0.324	330.081	-	13.216	-	0.0044	0.0070	0.0029	0.022	Verifica
		Inf	Sismo 1-	130.81	5.21	2Ø20+1Ø16	8.29	0.250	0.750	0.400	3.012	0.784	0.648	0.324	-	233.679	-	8.290	-				
	2 (vão)	Sup	Sismo 1+	-145.97	5.21	2Ø20	6.28	0.250	0.750	0.400	3.012	0.784	0.648	0.324	241.571	-	10.076	-	0.0033	0.0054	0.0029	0.021	Verifica
		Inf	Sismo 1-	122.16	5.21	2Ø20	6.28	0.250	0.750	0.400	3.012	0.784	0.648	0.324	-	177.021	-	6.280	-				
	3	Sup	Sismo 1+	-415.82	14.56	5Ø20	15.70	0.250	0.750	0.400	3.012	0.784	0.648	0.324	507.102	-	19.496	-	0.0084	0.0104	0.0029	0.026	Verifica
		Inf	Sismo 1-	443.35	15.64	5Ø20	15.70	0.250	0.750	0.400	3.012	0.784	0.648	0.324	-	442.552	-	15.700	-				
	4 (vão)	Sup	Sismo 1+	-218.22	7.29	5Ø20	15.70	0.250	0.750	0.400	3.012	0.784	0.648	0.324	507.102	-	19.496	-	0.0072	0.0104	0.0029	0.024	Verifica
		Inf	Sismo 1-	218.18	7.29	3Ø20+2Ø16	13.44	0.250	0.750	0.400	3.012	0.784	0.648	0.324	-	378.847	-	13.440	-				
	5	Sup	Sismo 1+	-444.55	15.69	5Ø20	15.70	0.250	0.750	0.400	3.012	0.784	0.648	0.324	507.102	-	19.496	-	0.0072	0.0104	0.0029	0.024	Verifica
		Inf	Sismo 1+	376.29	13.05	3Ø20+2Ø16	13.44	0.250	0.750	0.400	3.012	0.784	0.648	0.324	-	378.847	-	13.440	-				
	6 (vão)	Sup	Sismo 1-	-179.82	5.96	2Ø20	6.28	0.250	0.750	0.400	3.012	0.784	0.648	0.324	241.571	-	10.076	-	0.0033	0.0054	0.0029	0.021	Verifica
		Inf	Sismo 1+	76.99	5.21	2Ø20	6.28	0.250	0.750	0.400	3.012	0.784	0.648	0.324	-	177.021	-	6.280	-				
	7	Sup	Sismo 1+	-438.44	15.45	5Ø20	15.70	0.250	0.750	0.400	3.012	0.784	0.648	0.324	507.102	-	19.496	-	0.0066	0.0104	0.0029	0.024	Verifica
		Inf	Sismo 1+	240.5	8.08	2Ø20+3Ø16	12.31	0.250	0.750	0.400	3.012	0.784	0.648	0.324	-	346.994	-	12.310	-				
	8 (vão)	Sup	Sismo 1+	92.28	5.21	2Ø20	6.28	0.250	0.750	0.400	3.012	0.784	0.648	0.324	241.571	-	10.076	-	0.0044	0.0054	0.0029	0.022	Verifica
		Inf	Fund	226.21	7.57	2Ø20+1Ø16	8.29	0.250	0.750	0.400	3.012	0.784	0.648	0.324	-	233.679	-	8.290	-				
	9	Sup	0	0	0.00	2Ø20	6.28	0.250	0.750	0.400	3.012	0.784	0.648	0.324	241.571	-	10.076	-	0.0033	0.0054	0.0029	0.021	Verifica
		Inf	Fund	189.01	6.28	2Ø20	6.28	0.250	0.750	0.400	3.012	0.784	0.648	0.324	-	177.021	-	6.280	-				
Vb2.2	1	Sup	Sismo 1+	-155.93	6.63	2Ø25	9.82	0.250	0.600	0.400	3.012	0.784	0.513	0.189	261.397	-	13.616	-	0.0055	0.0091	0.0029	0.023	Verifica
		Inf	Sismo 1+	77.96	4.13	2Ø20+1Ø16	8.29	0.250	0.600	0.400	3.012	0.784	0.513	0.189	-	184.995	-	8.290	-				
	2 (vão)	Sup	-	0	4.13	2Ø25	9.82	0.250	0.600	0.400	3.012	0.784	0.513	0.189	261.397	-	13.616	-	0.0055	0.0091	0.0029	0.023	Verifica
		Inf	Fund	88.97	4.13	2Ø20+1Ø16	8.29	0.250	0.600	0.400	3.012	0.784	0.513	0.189	-	184.995	-	8.290	-				
	3	Sup	Sismo 1+	-297.71	13.38	3Ø25	14.73	0.250	0.600	0.400	3.012	0.784	0.513	0.189	370.966	-	18.526	-	0.0105	0.0124	0.0029	0.028	Verifica
		Inf	Sismo 1-	300.9	13.54	5Ø20	15.70	0.250	0.600	0.400	3.012	0.784	0.513	0.189	-	350.353	-	15.700	-				
	4 (vão)	Sup	Sismo 1-	-193.02	8.32	2Ø25+3Ø20	19.24	0.250	0.600	0.400	3.012	0.784	0.513	0.189	471.609	-	23.036	-	0.0105	0.0154	0.0029	0.028	Verifica
		Inf	Sismo 1+	157.5	6.70	5Ø20	15.70	0.250	0.600	0.400	3.012	0.784	0.513	0.189	-	350.353	-	15.700	-				
	5	Sup	Sismo 1-	-362.61	16.78	2Ø25+3Ø20	19.24	0.250	0.600	0.400	3.012	0.784	0.513	0.189	471.609	-	23.036	-	0.0105	0.0154	0.0029	0.028	Verifica
		Inf	Sismo 1+	317.34	14.38	5Ø20	15.70	0.250	0.600	0.400	3.012	0.784	0.513	0.189	-	350.353	-	15.700	-				
	6 (vão)	Sup	Sismo 1-	-109.89	4.60	2Ø25	9.82	0.250	0.600	0.400	3.012	0.784	0.513	0.189	261.397	-	13.616	-	0.0055	0.0091	0.0029	0.023	Verifica
		Inf	Sismo 1-	124.8	5.25	2Ø20+1Ø16	8.29	0.250	0.600	0.400	3.012	0.784	0.513	0.189	-	184.995	-	8.290	-				
	7	Sup	Sismo 1-	-284.06	12.69	2Ø25+1Ø20	12.96	0.250	0.600	0.400	3.012	0.784	0.513	0.189	331.467	-	16.756	-	0.0063	0.0112	0.0029	0.024	Verifica
		Inf	Sismo 1+	212.69	9.23	3Ø20	9.42	0.250	0.600	0.400	3.012	0.784	0.513	0.189	-	210.212	-	9.420	-				

11.3.1.3 Viga Vb.3

Viga	Secção	Face	Combinação	M _{ed} [KN]	A _{S,viga} [cm ²]	A _{S,viga,adt} [cm ²]	b _w [m]	h _w [m]	x [m]	M _{Rd} ⁻ [KN.m]	M _{Rd} ⁺ [KN.m]	A _{S,min} [cm ²]	A _{S,max} [cm ²]	
Vb3.3	1	Sup	Sismo 1+	-349.1	16.05	2Ø25+3Ø20	19.24	0.250	0.600	0.209	407.009	-	2.15	60.00
		Inf	Sismo 1+	174.55	7.47	2Ø20+1Ø16	8.29	0.250	0.600	0.090	-	192.546		
	2 (vão)	Sup	-	0	4.13	2Ø25	9.82	0.250	0.600	0.107	225.239	-		
		Inf	Sismo 1-	124.1	5.22	2Ø20	6.28	0.250	0.600	0.068	-	148.250		
	3	Sup	Sismo 1-	-426.7	20.39	3Ø25+2Ø20	21.01	0.250	0.600	0.228	437.415	-		
		Inf	Sismo 1-	213.35	9.26	3Ø20	9.42	0.250	0.600	0.102	-	216.778		

Viga	Secção	Face	Combinação	M _{ed} [KN]	A _{S,viga} [cm ²]	A _{S,viga,adt} [cm ²]	b _w [m]	h _w [m]	x [m]	M _{Rd} ⁻ [KN.m]	M _{Rd} ⁺ [KN.m]	A _{S,min} [cm ²]	A _{S,max} [cm ²]	
Vb4.3	1	Sup	Sismo 1+	-390.03	18.29	2Ø25+3Ø20	19.24	0.250	0.600	0.209	407.009	-	2.15	60.00
		Inf	Sismo 1+	195.01	8.41	3Ø20	9.42	0.250	0.600	0.102	-	216.778		
	2 (vão)	Sup	-	0	4.13	2Ø25	9.82	0.250	0.600	0.107	225.239	-		
		Inf	Sismo 1-	137.22	5.79	2Ø20	6.28	0.250	0.600	0.068	-	148.250		
	3	Sup	Sismo 1-	-424.11	20.24	3Ø25+2Ø20	21.01	0.250	0.600	0.228	437.415	-		
		Inf	Sismo 1-	212.05	9.20	3Ø20	9.42	0.250	0.600	0.102	-	216.778		

Viga	Secção	Face	Combinação	M _{ed} [KN]	A _{S,viga} [cm ²]	A _{S,viga,adt} [cm ²]	b _w [m]	h _w [m]	x [m]	M _{Rd} ⁻ [KN.m]	M _{Rd} ⁺ [KN.m]	A _{S,min} [cm ²]	A _{S,max} [cm ²]	
Vb5.3	1	Sup	Sismo 1+	-295.96	13.29	3Ø25	14.73	0.250	0.600	0.160	324.174	-	2.15	60.00
		Inf	Sismo 1+	147.98	6.27	2Ø20	6.28	0.250	0.600	0.068	-	148.250		
	2 (vão)	Sup	-	0	4.13	2Ø25	9.82	0.250	0.600	0.107	225.239	-		
		Inf	Fund	163.43	6.97	2Ø20+1Ø16	8.29	0.250	0.600	0.090	-	192.546		
	3	Sup	Sismo 1-	-345.83	15.88	2Ø25+3Ø20	19.24	0.250	0.600	0.209	407.009	-		
		Inf	Sismo 1-	172.91	7.40	2Ø20+1Ø16	8.29	0.250	0.600	0.090	-	192.546		

11.3.1.4 Viga Vb.4

Viga	Secção	Face	Combinação	M _{ed} [KN]	A _{S,viga} [cm ²]	A _{S,viga,adt} [cm ²]	b _w [m]	h _w [m]	x [m]	M _{Rd} ⁻ [KN.m]	M _{Rd} ⁺ [KN.m]	A _{S,min} [cm ²]	A _{S,max} [cm ²]	
Vb4.4	1	Sup	Sismo 1+	-109.77	7.48	2Ø20+1Ø16	8.29	0.250	0.400	0.090	120.423	-	1.39	40.00
		Inf	Sismo 1-	86.76	5.79	2Ø20	6.28	0.250	0.400	0.068	-	93.614		
	2 (vão)	Sup	Sismo 1+	-56.92	3.70	2Ø20	6.28	0.250	0.400	0.068	93.614	-		
		Inf	Sismo 1-	57.16	3.72	2Ø20	6.28	0.250	0.400	0.068	-	93.614		
	3	Sup	Sismo 1-	-198.28	14.95	5Ø20	15.70	0.250	0.400	0.171	206.049	-		
		Inf	Sismo 1+	196.24	14.76	5Ø20	15.70	0.250	0.400	0.171	-	206.049		

Viga	Secção	Face	Combinação	M _{ed} [KN]	A _{S,viga} [cm ²]	A _{S,viga,adt} [cm ²]	b _w [m]	h _w [m]	x [m]	M _{Rd} ⁻ [KN.m]	M _{Rd} ⁺ [KN.m]	A _{S,min} [cm ²]	A _{S,max} [cm ²]	
Vb5.4	1	Sup	Sismo 1+	-99.08	6.68	2Ø20+1Ø16	8.29	0.250	0.400	0.090	120.423	-	1.39	40.00
		Inf	Sismo 1-	71.31	4.69	2Ø20	6.28	0.250	0.400	0.068	-	93.614		
	2 (vão)	Sup	Sismo 1+	-51.25	3.32	2Ø20	6.28	0.250	0.400	0.068	93.614	-		
		Inf	Sismo 1-	48.86	3.15	2Ø20	6.28	0.250	0.400	0.068	-	93.614		
	3	Sup	Sismo 1-	-168.58	12.24	2Ø20+3Ø16	13.31	0.250	0.400	0.145	180.702	-		
		Inf	Sismo 1+	175.94	12.89	2Ø20+3Ø16	12.31	0.250	0.400	0.134	-	169.455		

Viga	Secção	Face	Combinação	M _{ed} [KN]	A _{S,viga} [cm ²]	A _{S,viga,adt} [cm ²]	b _w [m]	h _w [m]	x [m]	M _{Rd} ⁻ [KN.m]	M _{Rd} ⁺ [KN.m]	A _{S,min} [cm ²]	A _{S,max} [cm ²]	
Vb6.4	1	Sup	Sismo 1+	-69.88	4.59	2Ø16+1Ø12	5.15	0.250	0.400	0.056	77.871	-	1.39	40.00
		Inf	Sismo 1+	34.94	2.68	2Ø16	4.02	0.250	0.400	0.044	-	61.644		
	2 (vão)	Sup	Sismo 1+	-14.84	2.68	2Ø16	4.02	0.250	0.400	0.044	61.644	-		
		Inf	Sismo 1+	14.56	2.68	2Ø16	4.02	0.250	0.400	0.044	-	61.644		
	3	Sup	Sismo 1-	-98.29	6.63	2Ø16+3Ø12	7.41	0.250	0.400	0.081	108.874	-		
		Inf	Sismo 1+	101.73	6.88	2Ø16+3Ø12	7.41	0.250	0.400	0.081	-	108.874		

11.3.1.5 Viga Vb.5

Viga	Secção	Face	Combinação	M _{ed} [KN]	A _{S,viga} [cm ²]	A _{S,viga,adt} [cm ²]	b _w [m]	h _w [m]	x [m]	M _{Rd} ⁻ [KN.m]	M _{Rd} ⁺ [KN.m]	A _{S,min} [cm ²]	A _{S,max} [cm ²]	
Vb4.5	1	Sup	Sismo 1-	-177.21	6.35	2Ø16+3Ø12	7.41	0.250	0.700	0.081	205.574	-	2.53	70.00
		Inf	Sismo 1-	88.6	4.85	2Ø16+1Ø12	5.15	0.250	0.700	0.056	-	145.078		
	2 (vão)	Sup	-	0	0.00	2Ø16	4.02	0.250	0.700	0.044	114.105	-		
		Inf	Fund	205.73	7.42	3Ø16+2Ø12	8.29	0.250	0.700	0.090	-	228.608		
	3	Sup	Sismo 1-	-254.04	9.28	5Ø16	10.05	0.250	0.700	0.109	273.795	-		
		Inf	Sismo 1-	127.02	4.85	2Ø16+1Ø12	5.15	0.250	0.700	0.056	-	145.078		
	4 (vão)	Sup	-	0	0.00	2Ø16	4.02	0.250	0.700	0.044	114.105	-		
		Inf	Fund	154.39	5.50	3Ø16	6.03	0.250	0.700	0.066	-	168.864		
	5	Sup	Sismo 1-	-250.33	9.14	5Ø16	10.05	0.250	0.700	0.109	273.795	-		
		Inf	Sismo 1-	125.16	4.85	2Ø16+1Ø12	5.15	0.250	0.700	0.056	-	145.078		
	6 (vão)	Sup	-	0	0.00	2Ø16	4.02	0.250	0.700	0.044	114.105	-		
		Inf	Fund	149.77	5.33	3Ø16	6.03	0.250	0.700	0.066	-	168.864		
	7	Sup	Sismo 1-	-247.43	9.02	5Ø16	10.05	0.250	0.700	0.109	273.795	-		
		Inf	Sismo 1-	123.71	4.85	2Ø16+1Ø12	5.15	0.250	0.700	0.056	-	145.078		
	8 (vão)	Sup	-	0	0.00	2Ø16	4.02	0.250	0.700	0.044	114.105	-		
		Inf	Fund	160.98	5.74	3Ø16	6.03	0.250	0.700	0.066	-	168.864		
	9	Sup	Sismo 1-	-225.35	8.17	3Ø16+2Ø12	8.29	0.250	0.700	0.090	228.608	-		
		Inf	Sismo 1-	88.6	4.85	2Ø16+1Ø12	5.15	0.250	0.700	0.056	-	145.078		
	10 (vão)	Sup	-	0	0.00	2Ø16	4.02	0.250	0.700	0.044	114.105	-		
		Inf	Fund	157.97	5.63	3Ø16	6.03	0.250	0.700	0.066	-	168.864		
	11	Sup	Fund	-235.68	8.57	5Ø16	10.05	0.250	0.700	0.109	273.795	-		
		Inf	Fund	117.84	4.85	2Ø16+1Ø12	5.15	0.250	0.700	0.056	-	145.078		
	12 (vão)	Sup	Fund	-10.06	4.85	2Ø16+1Ø12	5.15	0.250	0.700	0.056	145.078	-		
		Inf	Fund	45.2	4.85	2Ø16+1Ø12	5.15	0.250	0.700	0.056	-	145.078		
13	Sup	Fund	-38.03	4.85	2Ø16+1Ø12	5.15	0.250	0.700	0.056	145.078	-			
	Inf	Fund	19.01	4.85	2Ø16+1Ø12	5.15	0.250	0.700	0.056	-	145.078			

Viga	Secção	Face	Combinação	M _{ed} [KN]	A _{S,viga} [cm ²]	A _{S,viga,adt} [cm ²]	b _w [m]	h _w [m]	x [m]	M _{Rd} ⁻ [KN.m]	M _{Rd} ⁺ [KN.m]	A _{S,min} [cm ²]	A _{S,max} [cm ²]	
Vb5.5	1	Sup	Sismo 1-	-186.73	6.70	2Ø16+3Ø12	7.41	0.250	0.700	0.081	205.574	-	2.53	70.00
		Inf	Sismo 1-	93.36	4.85	2Ø16+1Ø12	5.15	0.250	0.700	0.056	-	145.078		
	2 (vão)	Sup	-	0	0.00	2Ø16	4.02	0.250	0.700	0.044	114.105	-		
		Inf	Fund	205.16	7.40	3Ø16+2Ø12	8.29	0.250	0.700	0.090	-	228.608		
	3	Sup	Fund	-251.12	9.17	5Ø16	10.05	0.250	0.700	0.109	273.795	-		
		Inf	Fund	125.61	4.85	2Ø16+1Ø12	5.15	0.250	0.700	0.056	-	145.078		
	4 (vão)	Sup	-	0	0.00	2Ø16	4.02	0.250	0.700	0.044	114.105	-		
		Inf	Fund	156.18	5.56	3Ø16	6.03	0.250	0.700	0.066	-	168.864		
	5	Sup	Sismo 1-	-246.01	8.97	5Ø16	10.05	0.250	0.700	0.109	273.795	-		
		Inf	Sismo 1-	123	4.85	2Ø16+1Ø12	5.15	0.250	0.700	0.056	-	145.078		
	6 (vão)	Sup	-	0	0.00	2Ø16	4.02	0.250	0.700	0.044	114.105	-		
		Inf	Fund	149.14	5.30	3Ø16	6.03	0.250	0.700	0.066	-	168.864		
	7	Sup	Sismo 1-	-240.02	8.85	5Ø16	10.05	0.250	0.700	0.109	273.795	-		
		Inf	Sismo 1-	121.51	4.85	2Ø16+1Ø12	5.15	0.250	0.700	0.056	-	145.078		
	8 (vão)	Sup	-	0	0.00	2Ø16	4.02	0.250	0.700	0.044	114.105	-		
		Inf	Fund	161.42	5.76	3Ø16	6.03	0.250	0.700	0.066	-	168.864		
	9	Sup	Sismo 1-	-216.85	7.84	3Ø16+2Ø12	8.29	0.250	0.700	0.090	228.608	-		
		Inf	Sismo 1-	108.42	4.85	2Ø16+1Ø12	5.15	0.250	0.700	0.056	-	145.078		
	10 (vão)	Sup	-	0	0.00	2Ø16	4.02	0.250	0.700	0.044	114.105	-		
		Inf	Fund	157.52	5.61	3Ø16	6.03	0.250	0.700	0.066	-	168.864		
	11	Sup	Fund	-242.63	8.84	5Ø16	10.05	0.250	0.700	0.109	273.795	-		
		Inf	Fund	121.91	4.85	2Ø16+1Ø12	5.15	0.250	0.700	0.056	-	145.078		
	12 (vão)	Sup	Sismo 1-	-61.19	4.85	2Ø16+1Ø12	5.15	0.250	0.700	0.056	145.078	-		
		Inf	Sismo 1-	35.54	4.85	2Ø16+1Ø12	5.15	0.250	0.700	0.056	-	145.078		
13	Sup	Fund	-41.88	4.85	2Ø16+1Ø12	5.15	0.250	0.700	0.056	145.078	-			
	Inf	Fund	20.94	4.85	2Ø16+1Ø12	5.15	0.250	0.700	0.056	-	145.078			

Viga	Secção	Face	Combinação	M _{ed} [KN]	A _{S,viga} [cm ²]	A _{S,viga,adt} [cm ²]	b _w [m]	h _w [m]	x [m]	M _{Rd} ⁻ [KN.m]	M _{Rd} ⁺ [KN.m]	A _{S,min} [cm ²]	A _{S,max} [cm ²]	
Vb6.5	1	Sup	Sismo 1-	-60.72	4.85	2Ø16+3Ø12	7.41	0.250	0.700	0.081	205.574	-	2.53	70.00
		Inf	Sismo 1-	30.36	4.85	2Ø16+1Ø12	5.15	0.250	0.700	0.056	-	145.078		
	2 (vão)	Sup	-	0.00	0.00	2Ø16	4.02	0.250	0.700	0.044	114.105	-		
		Inf	Fund	185.14	6.64	3Ø16+2Ø12	8.29	0.250	0.700	0.090	-	228.608		
	3	Sup	Fund	-214.00	7.74	5Ø16	10.05	0.250	0.700	0.109	273.795	-		
		Inf	Fund	107.00	4.85	2Ø16+1Ø12	5.15	0.250	0.700	0.056	-	145.078		
	4 (vão)	Sup	-	0.00	0.00	2Ø16	4.02	0.250	0.700	0.044	114.105	-		
		Inf	Fund	126.76	4.85	3Ø16	6.03	0.250	0.700	0.066	-	168.864		
	5	Sup	Fund	-232.60	8.45	5Ø16	10.05	0.250	0.700	0.109	273.795	-		
		Inf	Sismo 1-	116.30	4.85	2Ø16+1Ø12	5.15	0.250	0.700	0.056	-	145.078		
	6 (vão)	Sup	-	0.00	0.00	2Ø16	4.02	0.250	0.700	0.044	114.105	-		
		Inf	Fund	123.57	4.85	3Ø16	6.03	0.250	0.700	0.066	-	168.864		
	7	Sup	Fund	-229.01	8.31	5Ø16	10.05	0.250	0.700	0.109	273.795	-		
		Inf	Fund	114.50	4.85	2Ø16+1Ø12	5.15	0.250	0.700	0.056	-	145.078		
	8 (vão)	Sup	-	0.00	0.00	2Ø16	4.02	0.250	0.700	0.044	114.105	-		
		Inf	Fund	138.11	4.99	3Ø16	6.03	0.250	0.700	0.066	-	168.864		
	9	Sup	Fund	-202.52	7.30	3Ø16+2Ø12	8.29	0.250	0.700	0.090	228.608	-		
		Inf	Fund	101.26	4.85	2Ø16+1Ø12	5.15	0.250	0.700	0.056	-	145.078		
	10 (vão)	Sup	-	0.00	0.00	2Ø16	4.02	0.250	0.700	0.044	114.105	-		
		Inf	Fund	126.88	4.85	3Ø16	6.03	0.250	0.700	0.066	-	168.864		
	11	Sup	Sismo 1+	-207.68	7.49	5Ø16	10.05	0.250	0.700	0.109	273.795	-		
		Inf	Sismo 1+	103.84	4.85	2Ø16+1Ø12	5.15	0.250	0.700	0.056	-	145.078		
	12 (vão)	Sup	Sismo 1-	-8.36	4.85	2Ø16+1Ø12	5.15	0.250	0.700	0.056	145.078	-		
		Inf	Sismo 1-	19.72	4.85	2Ø16+1Ø12	5.15	0.250	0.700	0.056	-	145.078		
13	Sup	Fund	-35.26	4.85	2Ø16+1Ø12	5.15	0.250	0.700	0.056	145.078	-			
	Inf	Fund	17.63	4.85	2Ø16+1Ø12	5.15	0.250	0.700	0.056	-	145.078			

11.3.1.6 Viga Vb.6

Viga	Secção	Face	Combinação	M _{ed} [KN]	A _{S,viga} [cm ²]	A _{S,viga,adt} [cm ²]	b _w [m]	h _w [m]	b _{ef} [m]	A _{S,inf,laje} [cm ²]	A _{S,sup,laje} [cm ²]	z1 [m]	z2 [m]	M _{Rd} ⁻ [KN.m]	M _{Rd} ⁺ [KN.m]	A _{S,total,sup} [cm ²]	A _{S,total,inf} [cm ²]	ρ'	ρ	ρ _{min}	ρ _{max}	ρ' > 0,5.ρ	
Vb4.6	1	Sup	Sismo 1+	-170.64	6.10	2Ø16+3Ø12	7.41	0.250	0.700	0.600	4.518	1.176	0.603	0.279	280.048	-	13.104	-	0.0042	0.0075	0.0029	0.022	Verifica
		Inf	Sismo 1+	85.32	4.85	2Ø16+3Ø12	7.41	0.250	0.700	0.600	4.518	1.176	0.603	0.279	-	194.368	-	7.410	0.0034	0.0062	0.0029	0.021	Verifica
	2 (vão)	Sup	Sismo 1+	-19.88	4.85	2Ø16+1Ø12	5.15	0.250	0.700	0.600	4.518	1.176	0.603	0.279	220.767	-	10.844	-	0.0034	0.0062	0.0029	0.021	Verifica
		Inf	Sismo 1+	28.46	4.85	3Ø16	6.03	0.250	0.700	0.600	4.518	1.176	0.603	0.279	-	158.170	-	6.030	0.0034	0.0062	0.0029	0.021	Verifica
	3	Sup	Fund	-238.11	8.66	5Ø16	10.05	0.250	0.700	0.600	4.518	1.176	0.603	0.279	349.296	-	15.744	-	0.0047	0.0090	0.0029	0.022	Verifica
		Inf	Fund	115.93	4.85	3Ø16+2Ø12	8.29	0.250	0.700	0.600	4.518	1.176	0.603	0.279	-	217.451	-	8.290	0.0047	0.0090	0.0029	0.022	Verifica
	4 (vão)	Sup	-	0	0.00	2Ø16	4.02	0.250	0.700	0.600	4.518	1.176	0.603	0.279	191.126	-	9.714	-	0.0034	0.0056	0.0029	0.021	Verifica
		Inf	Fund	156.36	5.57	3Ø16	6.03	0.250	0.700	0.600	4.518	1.176	0.603	0.279	-	158.170	-	6.030	0.0034	0.0056	0.0029	0.021	Verifica
	5	Sup	Fund	-215.45	7.79	3Ø16+2Ø12	8.29	0.250	0.700	0.600	4.518	1.176	0.603	0.279	303.131	-	13.984	-	0.0042	0.0080	0.0029	0.022	Verifica
		Inf	Fund	107.72	4.85	2Ø16+3Ø12	7.41	0.250	0.700	0.600	4.518	1.176	0.603	0.279	-	194.368	-	7.410	0.0042	0.0080	0.0029	0.022	Verifica
	6 (vão)	Sup	-	0	0.00	2Ø16	4.02	0.250	0.700	0.600	4.518	1.176	0.603	0.279	191.126	-	9.714	-	0.0029	0.0056	0.0029	0.020	Verifica
Inf		Fund	118.35	4.85	2Ø16+1Ø12	5.15	0.250	0.700	0.600	4.518	1.176	0.603	0.279	-	135.087	-	5.150	0.0029	0.0056	0.0029	0.020	Verifica	
7	Sup	Fund	-229.76	8.34	5Ø16	10.05	0.250	0.700	0.600	4.518	1.176	0.603	0.279	349.296	-	15.744	-	0.0047	0.0090	0.0029	0.022	Verifica	
	Inf	Fund	114.88	4.85	3Ø16+2Ø12	8.29	0.250	0.700	0.600	4.518	1.176	0.603	0.279	-	217.451	-	8.290	0.0047	0.0090	0.0029	0.022	Verifica	
8 (vão)	Sup	-	0	0.00	2Ø16	4.02	0.250	0.700	0.600	4.518	1.176	0.603	0.279	191.126	-	9.714	-	0.0034	0.0056	0.0029	0.021	Verifica	
	Inf	Fund	152.53	5.43	3Ø16	6.03	0.250	0.700	0.600	4.518	1.176	0.603	0.279	-	158.170	-	6.030	0.0034	0.0056	0.0029	0.021	Verifica	
9	Sup	Fund	-163.35	5.83	2Ø16+3Ø12	7.41	0.250	0.700	0.600	4.518	1.176	0.603	0.279	280.048	-	13.104	-	0.0042	0.0075	0.0029	0.022	Verifica	
	Inf	Fund	81.67	4.85	2Ø16+3Ø12	7.41	0.250	0.700	0.600	4.518	1.176	0.603	0.279	-	194.368	-	7.410	0.0042	0.0075	0.0029	0.022	Verifica	
10 (vão)	Sup	Sismo 1+	-38.81	4.85	2Ø16+1Ø12	5.15	0.250	0.700	0.600	4.518	1.176	0.603	0.279	220.767	-	10.844	-	0.0034	0.0062	0.0029	0.021	Verifica	
	Inf	Fund	32.54	4.85	3Ø16	6.03	0.250	0.700	0.600	4.518	1.176	0.603	0.279	-	158.170	-	6.030	0.0034	0.0062	0.0029	0.021	Verifica	
11	Sup	Fund	-101.79	4.85	2Ø16+1Ø12	5.15	0.250	0.700	0.600	4.518	1.176	0.603	0.279	220.767	-	10.844	-	0.0034	0.0062	0.0029	0.021	Verifica	
	Inf	Fund	50.89	4.85	3Ø16	6.03	0.250	0.700	0.600	4.518	1.176	0.603	0.279	-	158.170	-	6.030	0.0034	0.0062	0.0029	0.021	Verifica	

Viga	Secção	Face	Combinação	M _{ed} [KN]	A _{S,viga} [cm ²]	A _{S,viga,adt} [cm ²]	b _w [m]	h _w [m]	b _{ef} [m]	A _{S,inf,laje} [cm ²]	A _{S,sup,laje} [cm ²]	z1 [m]	z2 [m]	M _{Rd} ⁻ [KN.m]	M _{Rd} ⁺ [KN.m]	A _{S,total,sup} [cm ²]	A _{S,total,inf} [cm ²]	ρ'	ρ	ρ _{min}	ρ _{max}	ρ' > 0,5·ρ	
Vb5.6	1	Sup	Sismo 1+	-184.37	6.61	2Ø16+3Ø12	7.41	0.250	0.700	0.600	4.518	1.176	0.603	0.279	280.048	-	13.104	-	0.0042	0.0075	0.0029	0.022	Verifica
		Inf	Sismo 1+	92.18	4.85	2Ø16+3Ø12	7.41	0.250	0.700	0.600	4.518	1.176	0.603	0.279	-	194.368	-	7.410	-	0.0042	0.0075	0.0029	0.022
	2 (vão)	Sup	Sismo 1-	-31.01	4.85	2Ø16+1Ø12	5.15	0.250	0.700	0.600	4.518	1.176	0.603	0.279	220.767	-	10.844	-	0.0034	0.0062	0.0029	0.021	Verifica
		Inf	Sismo 1-	23.85	4.85	3Ø16	6.03	0.250	0.700	0.600	4.518	1.176	0.603	0.279	-	158.170	-	6.030	-	0.0034	0.0062	0.0029	0.021
	3	Sup	Fund	-235.8	8.57	5Ø16	10.05	0.250	0.700	0.600	4.518	1.176	0.603	0.279	349.296	-	15.744	-	0.0047	0.0090	0.0029	0.022	Verifica
		Inf	Sismo 1-	83.85	4.85	3Ø16+2Ø12	8.29	0.250	0.700	0.600	4.518	1.176	0.603	0.279	-	217.451	-	8.290	-	0.0047	0.0090	0.0029	0.022
	4 (vão)	Sup	-	0	0.00	2Ø16	4.02	0.250	0.700	0.600	4.518	1.176	0.603	0.279	191.126	-	9.714	-	0.0034	0.0056	0.0029	0.021	Verifica
		Inf	Fund	166.33	5.94	3Ø16	6.03	0.250	0.700	0.600	4.518	1.176	0.603	0.279	-	158.170	-	6.030	-	0.0034	0.0056	0.0029	0.021
	5	Sup	Fund	-228.3	8.28	3Ø16+2Ø12	8.29	0.250	0.700	0.600	4.518	1.176	0.603	0.279	303.131	-	13.984	-	0.0042	0.0080	0.0029	0.022	Verifica
		Inf	Fund	114.15	4.85	2Ø16+3Ø12	7.41	0.250	0.700	0.600	4.518	1.176	0.603	0.279	-	194.368	-	7.410	-	0.0042	0.0080	0.0029	0.022
	6 (vão)	Sup	-	0	0.00	2Ø16	4.02	0.250	0.700	0.600	4.518	1.176	0.603	0.279	191.126	-	9.714	-	0.0029	0.0056	0.0029	0.020	Verifica
Inf		Fund	120.71	4.85	2Ø16+1Ø12	5.15	0.250	0.700	0.600	4.518	1.176	0.603	0.279	-	135.087	-	5.150	-	0.0029	0.0056	0.0029	0.020	Verifica
7	Sup	Fund	-232.09	8.43	5Ø16	10.05	0.250	0.700	0.600	4.518	1.176	0.603	0.279	349.296	-	15.744	-	0.0047	0.0090	0.0029	0.022	Verifica	
	Inf	Fund	116.04	4.85	3Ø16+2Ø12	8.29	0.250	0.700	0.600	4.518	1.176	0.603	0.279	-	217.451	-	8.290	-	0.0047	0.0090	0.0029	0.022	Verifica
8 (vão)	Sup	-	0	0.00	2Ø16	4.02	0.250	0.700	0.600	4.518	1.176	0.603	0.279	191.126	-	9.714	-	0.0034	0.0056	0.0029	0.021	Verifica	
	Inf	Fund	157.7	5.62	3Ø16	6.03	0.250	0.700	0.600	4.518	1.176	0.603	0.279	-	158.170	-	6.030	-	0.0034	0.0056	0.0029	0.021	Verifica
9	Sup	Fund	-171.97	6.15	2Ø16+3Ø12	7.41	0.250	0.700	0.600	4.518	1.176	0.603	0.279	280.048	-	13.104	-	0.0042	0.0075	0.0029	0.022	Verifica	
	Inf	Fund	85.98	4.85	2Ø16+3Ø12	7.41	0.250	0.700	0.600	4.518	1.176	0.603	0.279	-	194.368	-	7.410	-	0.0042	0.0075	0.0029	0.022	Verifica
10 (vão)	Sup	Sismo 1+	-18.83	4.85	2Ø16+1Ø12	5.15	0.250	0.700	0.600	4.518	1.176	0.603	0.279	220.767	-	10.844	-	0.0034	0.0062	0.0029	0.021	Verifica	
	Inf	Fund	38.13	4.85	3Ø16	6.03	0.250	0.700	0.600	4.518	1.176	0.603	0.279	-	158.170	-	6.030	-	0.0034	0.0062	0.0029	0.021	Verifica
11	Sup	Fund	-15.85	4.85	2Ø16+1Ø12	5.15	0.250	0.700	0.600	4.518	1.176	0.603	0.279	220.767	-	10.844	-	0.0034	0.0062	0.0029	0.021	Verifica	
	Inf	Fund	7.92	4.85	3Ø16	6.03	0.250	0.700	0.600	4.518	1.176	0.603	0.279	-	158.170	-	6.030	-	0.0034	0.0062	0.0029	0.021	Verifica

Viga	Secção	Face	Combinação	M _{ed} [KN]	A _{S,viga} [cm ²]	A _{S,viga,adt} [cm ²]	b _w [m]	h _w [m]	b _{ef} [m]	A _{S,inf,laje} [cm ²]	A _{S,sup,laje} [cm ²]	z1 [m]	z2 [m]	M _{Rd} ⁻ [KN.m]	M _{Rd} ⁺ [KN.m]	A _{S,total,sup} [cm ²]	A _{S,total,inf} [cm ²]	ρ'	ρ	ρ _{min}	ρ _{max}	ρ' > 0,5·ρ	
Vb6.6	1	Sup	Sismo 1+	-42.45	2.73	2Ø16	4.02	0.250	0.400	0.400	3.012	0.784	0.333	0.009	70.768	-	7.816	-	0.0040	0.0078	0.0029	0.021	Verifica
		Inf	Sismo 1+	21.22	2.68	2Ø16	4.02	0.250	0.400	0.400	3.012	0.784	0.333	0.009	-	58.232	-	4.020	-	0.0040	0.0078	0.0029	0.021
	2 (vão)	Sup	Sismo 1+	-3.89	2.68	2Ø16	4.02	0.250	0.400	0.400	3.012	0.784	0.333	0.009	70.768	-	7.816	-	0.0040	0.0078	0.0029	0.021	Verifica
		Inf	Sismo 1+	10.93	2.68	2Ø16	4.02	0.250	0.400	0.400	3.012	0.784	0.333	0.009	-	58.232	-	4.020	-	0.0040	0.0078	0.0029	0.021
	3	Sup	Sismo 1+	-5.78	2.68	2Ø16	4.02	0.250	0.400	0.400	3.012	0.784	0.333	0.009	70.768	-	7.816	-	0.0040	0.0078	0.0029	0.021	Verifica
		Inf	Sismo 1+	12.05	2.68	2Ø16	4.02	0.250	0.400	0.400	3.012	0.784	0.333	0.009	-	58.232	-	4.020	-	0.0040	0.0078	0.0029	0.021

11.3.1.7 *Viga da cobertura*

Viga	Secção	Face	Combinação	M _{ed} [KN]	A _{S,viga} [cm ²]	A _{S,viga,adt} [cm ²]	b _w [m]	h _w [m]	x [m]	M _{Rd} ⁻ [KN.m]	M _{Rd} ⁺ [KN.m]	A _{S,min} [cm ²]	A _{S,max} [cm ²]	
Vb6.8	1	Sup	Sismo 1+	24.79	2.68	2Ø16	4.02	0.250	0.400	0.044	61.644	-	1.39	40.00
		Inf	Sismo 1+	16.14	2.68	2Ø16	4.02	0.250	0.400	0.044	-	61.644		
	2 (vão)	Sup	-	0	0.00	2Ø16	4.02	0.250	0.400	0.044	61.644	-		
		Inf	Fund	18.72	2.68	2Ø16	4.02	0.250	0.400	0.044	-	61.644		
	3	Sup	Sismo 1+	-19.13	2.68	2Ø16	4.02	0.250	0.400	0.044	61.644	-		
		Inf	Sismo1+	18.69	2.68	2Ø16	4.02	0.250	0.400	0.044	-	61.644		

Viga	Secção	Face	Combinação	M _{ed} [KN]	A _{S,viga} [cm ²]	A _{S,viga,adt} [cm ²]	b _w [m]	h _w [m]	x [m]	M _{Rd} ⁻ [KN.m]	M _{Rd} ⁺ [KN.m]	A _{S,min} [cm ²]	A _{S,max} [cm ²]	
Vb6.9	1	Sup	Sismo 1-	-32.64	2.68	2Ø16	4.02	0.250	0.400	0.044	61.644	-	1.39	40.00
		Inf	Sismo 1-	27.52	2.68	2Ø16	4.02	0.250	0.400	0.044	-	61.644		
	2 (vão)	Sup	Sismo 1-	-10.53	2.68	2Ø16	4.02	0.250	0.400	0.044	61.644	-		
		Inf	Fund	12.58	2.68	2Ø16	4.02	0.250	0.400	0.044	-	61.644		
	3	Sup	Fund	-46.38	2.99	2Ø16	4.02	0.250	0.400	0.044	61.644	-		
		Inf	Fund	23.19	2.68	2Ø16	4.02	0.250	0.400	0.044	-	61.644		

Viga	Secção	Face	Combinação	M _{ed} [KN]	A _{S,viga} [cm ²]	A _{S,viga,adt} [cm ²]	b _w [m]	h _w [m]	x [m]	M _{Rd} ⁻ [KN.m]	M _{Rd} ⁺ [KN.m]	A _{S,min} [cm ²]	A _{S,max} [cm ²]	
Vb6.10	1	Sup	Sismo 1-	-140.03	9.08	5Ø16	10.05	0.250	0.400	0.109	142.643	-	1.39	40.00
		Inf	Sismo 1-	73.8	4.87	2Ø16+1Ø12	5.15	0.250	0.400	0.056	-	77.871		
	2 (vão)	Sup	Sismo 1-	-4.6	2.76	2Ø16	4.02	0.250	0.400	0.044	61.644	-		
		Inf	Fund	15.58	2.68	2Ø16	4.02	0.250	0.400	0.044	-	61.644		
	3	Sup	Sismo 1+	-81.41	5.40	3Ø16	6.03	0.250	0.400	0.066	90.172	-		
		Inf	Sismo 1+	66.06	4.86	2Ø16+1Ø12	5.15	0.250	0.400	0.056	-	77.871		

Viga	Secção	Face	Combinação	M _{ed} [KN]	A _{S,viga} [cm ²]	A _{S,viga,adt} [cm ²]	b _w [m]	h _w [m]	x [m]	M _{Rd} ⁻ [KN.m]	M _{Rd} ⁺ [KN.m]	A _{S,min} [cm ²]	A _{S,max} [cm ²]	
Vb6.11	1	Sup	Sismo 1+	-66.94	4.39	5Ø16	10.05	0.250	0.400	0.109	142.643	-	1.39	40.00
		Inf	Sismo 1+	37.1	2.74	2Ø16+1Ø12	5.15	0.250	0.400	0.056	-	77.871		
	2 (vão)	Sup	Sismo 1+	-8.65	2.68	2Ø16	4.02	0.250	0.400	0.044	61.644	-		
		Inf	Fund	16.49	2.68	2Ø16	4.02	0.250	0.400	0.044	-	61.644		
	3	Sup	Sismo 1-	-98.72	6.66	3Ø16	6.03	0.250	0.400	0.066	90.172	-		
		Inf	Sismo 1-	49.36	3.19	2Ø16+1Ø12	5.15	0.250	0.400	0.056	-	77.871		

Viga	Secção	Face	Combinação	M _{ed} [KN]	A _{S,viga} [cm ²]	A _{S,viga,adt} [cm ²]	b _w [m]	h _w [m]	x [m]	M _{Rd} ⁻ [KN.m]	M _{Rd} ⁺ [KN.m]	A _{S,min} [cm ²]	A _{S,max} [cm ²]	
Vb6.12	1	Sup	Sismo 1+	-23.12	7.02	2Ø16+3Ø12	7.41	0.250	1.340	0.081	411.869	-	4.94	134.00
		Inf	Sismo 1+	2.69	7.02	2Ø16+3Ø12	7.41	0.250	1.340	0.081	-	411.869		
	2 (vão)	Sup	Sismo 1+	-4.05	7.02	2Ø16+3Ø12	7.41	0.250	1.340	0.081	411.869	-		
		Inf	Sismo 1-	10.14	7.02	2Ø16+3Ø12	7.41	0.250	1.340	0.081	-	411.869		
	3	Sup	Sismo 1-	-14.28	7.02	2Ø16+3Ø12	7.41	0.250	1.340	0.081	411.869	-		
		Inf	Sismo 1-	3.06	7.02	2Ø16+3Ø12	7.41	0.250	1.340	0.081	-	411.869		

Viga	Secção	Face	Combinação	M _{ed} [KN]	A _{S,viga} [cm ²]	A _{S,viga,adt} [cm ²]	b _w [m]	h _w [m]	x [m]	M _{Rd} ⁻ [KN.m]	M _{Rd} ⁺ [KN.m]	A _{S,min} [cm ²]	A _{S,max} [cm ²]	
Vb6.13	1	Sup	Sismo 1-	-104.56	4.36	2Ø16+1Ø12	5.15	0.250	0.600	0.056	122.676	-	2.15	60.00
		Inf	Sismo 1-	52.28	4.13	2Ø16+1Ø12	5.15	0.250	0.600	0.056	-	122.676		
	2 (vão)	Sup	Sismo 1-	-32.62	4.13	2Ø16+1Ø12	5.15	0.250	0.600	0.056	122.676	-		
		Inf	Sismo 1+	103.3	4.31	2Ø16+1Ø12	5.15	0.250	0.600	0.056	-	122.676		
	3	Sup	Sismo 1+	-106.46	4.45	2Ø16+1Ø12	5.15	0.250	0.600	0.056	122.676	-		
		Inf	Sismo 1+	81.45	4.13	2Ø16+1Ø12	5.15	0.250	0.600	0.056	-	122.676		

11.3.2 ESFORÇO TRANSVERSO

Para as vigas secundárias, o valor da resistência ao esforço transversal é dado pelo menor dos valores obtidos através das seguintes expressões:

$$V_{Rd,s} = \frac{A_{sw}}{S} \times z \times f_{yd} \times \cot \theta \quad (11.21)$$

$$V_{Rd,max} = \frac{\alpha_{cw} \times b_w \times z \times v \times f_{cd}}{\cot \theta + \tan \theta} \quad (11.22)$$

Em que:

$z = 0,9 \times d_w$	Braço interno entre as resultantes de tensões axiais de flexão e tração;
θ	Angulo entre o eixo da peça e a direção das bielas comprimidas (45°);
α_{cw}	Igual a 1,00 para elementos não pré-esforçados;
$v = 0,60 \times \left(1 - \frac{f_{ck}}{250}\right)$	Coefficiente de redução da resistência do betão fendilhado por esforço transversal;

No caso das vigas primárias, foi utilizado o método pela capacidade real, prescrito no EC8, calculando as armaduras para o esforço transversal mobilizado, através dos momentos resistentes das vigas:

$$V_{Ed,mob} = \frac{M_{Rb,2} + M_{Rb,1}}{l_{cl}} \pm V_{g+\psi_2 \times q} \quad (11.23)$$

Em que:

l_{cl}	Comprimento livre da viga;
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As armaduras mínimas, segundo o EC2 são dadas por:

$$\rho_{w,min} = \frac{0,08 \times \sqrt{f_{ck}}}{f_{yk}} \quad (11.24)$$

$$\rho_w = \frac{A_{sw}}{S \times b_w \times \sin \alpha} \quad (11.25)$$

Em que:

$\rho_{w,min}$	Taxa de armadura mínima de esforço transversal;
ρ_w	Taxa de armadura de esforço transversal;
A_{sw}	Área de armadura de esforço transversal;
α	Ângulo formado entre as armaduras verticais e o eixo longitudinal ($\alpha = 90^\circ$);
S	Espaçamento das armaduras verticais medido ao longo do eixo longitudinal do elemento;

f_{ck} [MPa]	f_{yk} [MPa]	$\rho_{w,min}$	α [°]	b_w [m]	$A_{sw,min}$ [cm ² /m]
30	500	0,0009	90	0,25	2,19

O espaçamento máximo longitudinal é dado por:

$$S_{l,max} = 0,75 \times d_w \times (1 + \cot \alpha) \quad (11.26)$$

$$S_{t,max} = 0,75 \times d_w \leq 600 \text{ mm} \quad (11.27)$$

d_w [m]	$S_{l,max} = S_{tmax}$ [m]
0,37	0,28
0,57	0,43
0,67	0,50
0,72	0,54
1,31	0,60
2,99	0,60

E o espaçamento máximo para as vigas primárias é dado por:

$$S = \min \left\{ \frac{h_w}{4}; 24 \times d_{bw}; 225 \text{ mm}; 8 \times d_{bL} \right\} \quad (11.28)$$

Em que:

h_w	Altura da viga;
d_{bw}	Diâmetro dos estribos;
d_{bL}	Diâmetro dos varões longitudinais;

Viga	h_w [m]	d_{bw} [mm]	d_{bl} [mm]	$S_{max,EC8}$ [m]
Vb1	0,75	8,00	16,00	0,13
	0,60	8,00	16,00	0,13
Vb2	0,75	8,00	16,00	0,13
	0,60	8,00	16,00	0,13
Vb6	0,70	8,00	12,00	0,10
	0,40	8,00	12,00	0,10

11.3.2.1 Viga Vb.1

Viga	Troço	l_{cl} [m]	Secção	Face	M_{Rd}^- [KN.m]	M_{Rd}^+ [KN.m]	$V_{q,p}$ [KN]	$V_{Ed,mob}$ [KN]	V_{Ed} [KN]	$V_{Rd,max}$ [KN]	(A_s/S) [cm ² /m]
Vb1.1	1	6.483	1	Sup	455.55	-	34.11	145.33	145.33	1717.2	5.16
				Inf	-	265.53		-123.99			
	3	Sup	317.15	-	8.60	275.85	298.77	10.60			
		Inf	-	265.53		-298.77					
	2	2.4851	3	Sup	317.15	-	23.09	166.79	183.03	6.49	
				Inf	-	346.99		-183.03			
	5	Sup	455.55	-	67.70	137.08	137.08	4.86			
		Inf	-	346.99		-126.35					
	3	5.0179	7	Sup	455.55	-	20.74	146.25	146.25	6.55	
				Inf	-	265.53		-146.25			
	4	9.9348	7	Sup	455.55	-	20.74	146.25	146.25	6.55	
				Inf	-	265.53		-146.25			
9	9.9348	9	Sup	317.15	-	20.74	146.25	146.25	6.55		
			Inf	-	233.68		-146.25				

Viga	Troço	Zona Crítica					Zona Corrente					
		l_{cr} [m]	V_{Ed} [KN]	$(A_s/S)_{Ramo}$ [cm ² /m]	$S_{max,EC8}$ [m]	$A_{s,adot}$ [cm ² /m]	V_{Ed} [KN]	$(A_s/S)_{Ramo}$ [cm ² /m]	$S_{max,EC2}$ [m]	$A_{s,adot}$ [cm ² /m]		
Vb1.1	1	0.75	145.33	2.58	0.13	ø8//0.10	5.00	111.71	1.98	0.500	ø8//0.20	2.50
	2	0.75	298.77	5.30	0.13	ø10//0,10	7.90	118.43	2.10	0.500	ø10//0,20	3.95
	3	0.75	183.03	3.25	0.13	ø8//0.10	5.00	128.32	2.28	0.500	ø8//0.20	2.50
	4	0.75	137.08	2.43	0.13	ø8//0.10	5.00	116.38	2.06	0.500	ø8//0.20	2.50

Viga	Troço	l_{cl} [m]	Secção	Face	M_{Rd}^- [KN.m]	M_{Rd}^+ [KN.m]	$V_{q,p}$ [KN]	$V_{Ed,mob}$ [KN]	V_{Ed} [KN]	$V_{Rd,max}$ [KN]	(A_s/S) [cm ² /m]
Vb2.1	1	6.483	1	Sup	315.62	-	31.07	112.18	118.27	1359.45	5.30
				Inf	-	210.21		-118.27			
	3	Sup	355.12	-	7.44	260.88	260.88	11.69			
		Inf	-	210.21		-234.93					
	2	2.4851	3	Sup	355.12	-	20.74	146.25	146.25	6.55	
				Inf	-	274.70		-146.25			
	5	2.4851	5	Sup	355.12	-	20.74	146.25	146.25	6.55	
				Inf	-	274.70		-146.25			
	3	5.0179	7	Sup	355.12	-	20.74	146.25	146.25	6.55	
				Inf	-	274.70		-146.25			

Viga	Troço	Zona Crítica					Zona Corrente					
		l_{cr} [m]	V_{Ed} [KN]	$(A_s/S)_{Ramo}$ [cm ² /m]	$S_{max,EC8}$ [m]	$A_{s,adot}$ [cm ² /m]	V_{Ed} [KN]	$(A_s/S)_{Ramo}$ [cm ² /m]	$S_{max,EC2}$ [m]	$A_{s,adot}$ [cm ² /m]		
Vb2.1	1	0.60	118.27	2.65	0.13	ø8//0.10	5.00	96.38	2.16	0.430	ø8//0.20	2.50
	2	0.60	260.88	5.85	0.13	ø10//0,10	7.90	134.91	3.02	0.430	ø10//0,20	3.95
	3	0.60	146.25	3.28	0.13	ø8//0.10	5.00	111.28	2.49	0.430	ø8//0.20	2.50

Viga	Troço	l_{cl} [m]	Secção	Face	M_{Rd}^- [KN.m]	M_{Rd}^+ [KN.m]	$V_{q,p}$ [KN]	$V_{Ed,mob}$ [KN]	V_{Ed} [KN]	$V_{Rd,max}$ [KN]	(A_s/S) [cm ² /m]
Vb3.1	1	6.483	1	Sup	315.62	-	31.07	122.13	122.13	1359.45	5.47
				Inf	-	210.21					
			3	Sup	315.62	-		-112.18			
	2	2.4851	3	Sup	315.62	-	7.44	275.43	301.38	1359.45	13.51
				Inf	-	274.70					
			5	Sup	455.76	-		-301.38			
	3	5.0179	5	Sup	455.76	-	20.74	181.39	181.39	1359.45	8.13
				Inf	-	350.35					
			7	Sup	455.76	-		-181.39			
				Inf	-	350.35					

Viga	Troço	Zona Crítica					Zona Corrente					
		l_{cr} [m]	V_{Ed} [KN]	$(A_s/S)_{Ramo}$ [cm ² /m]	$S_{max,EC8}$ [m]	$A_{s,adot}$ [cm ² /m]	V_{Ed} [KN]	$(A_s/S)_{Ramo}$ [cm ² /m]	$S_{max,EC2}$ [m]	$A_{s,adot}$ [cm ² /m]		
Vb3.1	1	0.60	122.13	2.74	0.13	Ø8//0.10	5.00	99.52	2.23	0.430	Ø8//0.20	2.50
	2	0.60	301.38	6.75	0.13	Ø10//0,10	7.90	155.85	3.49	0.430	Ø10//0,20	3.95
	3	0.60	181.39	4.06	0.13	Ø8//0.10	5.00	138.01	3.09	0.430	Ø8//0.15	3.33

Viga	Troço	l_{cl} [m]	Secção	Face	M_{Rd}^- [KN.m]	M_{Rd}^+ [KN.m]	$V_{q,p}$ [KN]	$V_{Ed,mob}$ [KN]	V_{Ed} [KN]	$V_{Rd,max}$ [KN]	(A_s/S) [cm ² /m]
Vb4.1	1	6.483	1	Sup	355.12	-	31.07	130.46	130.46	1359.45	5.85
				Inf	-	289.21					
			3	Sup	315.62	-		-124.36			
	2	2.4851	3	Sup	315.62	-	7.44	307.21	354.90	1359.45	15.90
				Inf	-	289.21					
			5	Sup	574.26	-		-354.90			
	3	5.0179	5	Sup	574.26	-	20.74	220.74	220.74	1359.45	9.89
				Inf	-	429.35					
			7	Sup	574.26	-		-220.74			
				Inf	-	429.35					

Viga	Troço	Zona Crítica				Zona Corrente						
		l_{cr} [m]	V_{Ed} [KN]	$(A_s/S)_{Ramo}$ [cm ² /m]	$S_{max,EC8}$ [m]	$A_{s,adot}$ [cm ² /m]	V_{Ed} [KN]	$(A_s/S)_{Ramo}$ [cm ² /m]	$S_{max,EC2}$ [m]	$A_{s,adot}$ [cm ² /m]		
Vb4.1	1	0.60	130.46	2.92	0.13	Ø8//0.10	5.00	106.31	2.38	0.430	Ø8//0.20	2.50
	2	0.60	354.90	7.95	0.13	Ø10//0,075	10.53	183.52	4.11	0.430	Ø10//0,15	5.27
	3	0.60	220.74	4.95	0.13	Ø8//0.10	5.00	167.95	3.76	0.430	Ø8//0.125	4.00

Viga	Troço	l_{cl} [m]	Secção	Face	M_{Rd}^- [KN.m]	M_{Rd}^+ [KN.m]	$V_{q,p}$ [KN]	$V_{Ed,mob}$ [KN]	V_{Ed} [KN]	$V_{Rd,max}$ [KN]	(A_s/S) [cm ² /m]
Vb5.1	1	6.483	1	Sup	455.76	-	31.07	143.74	143.74	1359.45	6.44
				Inf	-	350.35					
			3	Sup	315.62	-		-133.79			
	2	2.4851	3	Sup	315.62	-	7.44	275.43	301.38	1359.45	13.51
				Inf	-	274.70					
			5	Sup	455.76	-		-301.38			
	3	5.0179	5	Sup	455.76	-	20.74	181.39	181.39	1359.45	8.13
				Inf	-	350.35					
			7	Sup	455.76	-		-181.39			
				Inf	-	350.35					

Viga	Troço	Zona Crítica				Zona Corrente						
		l_{cr} [m]	V_{Ed} [KN]	$(A_s/S)_{Ramo}$ [cm ² /m]	$S_{max,EC8}$ [m]	$A_{s,adot}$ [cm ² /m]	V_{Ed} [KN]	$(A_s/S)_{Ramo}$ [cm ² /m]	$S_{max,EC2}$ [m]	$A_{s,adot}$ [cm ² /m]		
Vb5.1	1	0.60	143.74	3.22	0.13	Ø8//0.10	5.00	117.14	2.62	0.430	Ø8//0.15	3.33
	2	0.60	301.38	6.75	0.13	Ø10//0,10	7.90	155.85	3.49	0.430	Ø10//0,20	3.95
	3	0.60	181.39	4.06	0.13	Ø8//0.10	5.00	138.01	3.09	0.430	Ø8//0.15	3.33

Viga	Troço	l_{cl} [m]	Secção	Face	M_{Rd}^- [KN.m]	M_{Rd}^+ [KN.m]	$V_{q,p}$ [KN]	$V_{Ed,mob}$ [KN]	V_{Ed} [KN]	$V_{Rd,max}$ [KN]	(A_s/S) [cm ² /m]
Vb6.1	1	6.483	1	Sup	355.12	-	31.07	107.46	133.79	1359.45	6.00
				Inf	-	210.21					
			3	Sup	455.76	-		-133.79			
	2	2.4851	3	Sup	455.76	-	7.44	275.43	275.43	1359.45	12.34
				Inf	-	140.14					
			5	Sup	355.12	-		-206.73			
			Inf	-	210.21						
	3	5.0179	5	Sup	355.12	-	20.74	133.40	133.40	1359.45	5.98
				Inf	-	210.21					
			7	Sup	315.62	-		-125.53			
			Inf	-	210.21						

Viga	Troço	l_{cr} [m]	Zona Crítica				Zona Corrente					
			V_{Ed} [KN]	$(A_s/S)_{Ramo}$ [cm ² /m]	$S_{max,EC8}$ [m]	$A_{s,adot}$ [cm ² /m]	V_{Ed} [KN]	$(A_s/S)_{Ramo}$ [cm ² /m]	$S_{max,EC2}$ [m]	$A_{s,adot}$ [cm ² /m]		
Vb6.1	1	0.60	133.79	3.00	0.13	∅8//0.10	5.00	109.03	2.44	0.430	∅8//0.20	2.50
	2	0.60	275.43	6.17	0.13	∅10//0,10	7.90	142.43	3.19	0.430	∅10//0,20	3.95
	3	0.60	133.40	2.99	0.13	∅8//0.10	5.00	101.50	2.27	0.430	∅8//0.20	2.50

11.3.2.2 Viga Vb.2

Viga	Troço	l_{cl} [m]	Secção	Face	M_{Rd}^- [KN.m]	M_{Rd}^+ [KN.m]	$V_{q,p}$ [KN]	$V_{Ed,mob}$ [KN]	V_{Ed} [KN]	$V_{Rd,max}$ [KN]	(A_s/S) [cm ² /m]
Vb1.2	1	6.6	1	Sup	330.08	-	35.07	152.14	152.14	1717.2	2.699
				Inf	-	233.68					
			3	Sup	507.10	-		-147.31			
	2	2	3	Sup	507.10	-	6.49	449.46	481.31	1717.2	8.538
				Inf	-	442.55					
			5	Sup	507.10	-		-481.31			
			Inf	-	378.85						
	3	3.95	5	Sup	507.10	-	16.28	232.51	240.57	1717.2	4.267
				Inf	-	378.85					
			7	Sup	507.10	-		-240.57			
			Inf	-	346.99						
	4	8.35	7	Sup	507.10	-	50.95	132.88	132.88	1717.2	2.357
Inf				-	346.99						
9			Sup	241.57	-	-121.43					
Inf	-	177.02									

Viga	Troço	l_{cr} [m]	Zona Crítica				Zona Corrente					
			V_{Ed} [KN]	$(A_s/S)_{Ramo}$ [cm ² /m]	$S_{max,EC8}$ [m]	$A_{s,adot}$ [cm ² /m]	V_{Ed} [KN]	$(A_s/S)_{Ramo}$ [cm ² /m]	$S_{max,EC2}$ [m]	$A_{s,adot}$ [cm ² /m]		
Vb1.2	1	0.75	152.14	1.35	0.13	∅8//0.10	5.00	117.56	2.09	0.500	∅8//0.20	2.50
	2	0.75	481.31	4.27	0.13	∅8//0,10	5.00	120.33	2.13	0.500	∅8//0,20	2.50
	3	0.75	240.57	2.13	0.13	∅8//0.10	5.00	149.21	2.65	0.500	∅8//0.15	3.33
	4	0.75	132.88	1.18	0.13	∅8//0.10	5.00	109.01	1.93	0.500	∅8//0.20	2.50

Viga	Troço	l_d [m]	Secção	Face	M_{Rd}^- [KN.m]	M_{Rd}^+ [KN.m]	$V_{q,p}$ [KN]	$V_{Ed,mob}$ [KN]	V_{Ed} [KN]	$V_{Rd,max}$ [KN]	(A_s/S) [cm ² /m]						
Vb2.2	1	6.6	1	Sup	261.40	-	31.98	124.67	124.67	1359.45	2.793						
				Inf	-	185.00											
			3	Sup	370.97	-											
				Inf	-	350.35											
			2	2	3	Sup						370.97	-	5.55	366.21	416.53	9.333
						Inf						-	350.35				
	3	3.95	5	Sup	471.61	-	14.43	-416.53	187.04	187.04	4.191						
				Inf	-	350.35											
				7	Sup	331.47						-					
					Inf	-						210.21					

Viga	Troço	Zona Crítica					Zona Corrente					
		l_{cr} [m]	V_{Ed} [KN]	$(A_s/S)_{Ramo}$ [cm ² /m]	$S_{max,EC8}$ [m]	$A_{s,adot}$ [cm ² /m]	V_{Ed} [KN]	$(A_s/S)_{Ramo}$ [cm ² /m]	$S_{max,EC2}$ [m]	$A_{s,adot}$ [cm ² /m]		
Vb2.2	1	0.60	124.67	1.40	0.13	Ø8//0.10	5.00	102.00	2.29	0.430	Ø8//0.20	2.50
	2	0.60	416.53	4.67	0.13	Ø8//0,10	5.00	166.61	3.73	0.430	Ø8//0,125	4.00
	3	0.60	187.04	2.10	0.13	Ø8//0.10	5.00	130.22	2.92	0.430	Ø8//0.15	3.33

11.3.2.3 Viga Vb.3

Viga	Combinação	V_{Ed} [KN]	b_w [m]	h_w [m]	$V_{Rd,max}$ [KN]	$(A_s/S)_{Ramo}$ [cm ² /m]	$A_{s,adot}$ [cm ² /m]	
Vb3.3	Sismo 1-	217.27	0.25	0.60	1359.45	4.87	Ø10//0.150	5.27
Vb4.3	Sismo 1-	267.07	0.25	0.60	1359.45	5.98	Ø10//0.125	6.32
Vb5.3	Sismo 1-	267.87	0.25	0.60	1359.45	6.00	Ø10//0.125	6.32

11.3.2.4 Viga Vb.4

Viga	Combinação	V_{Ed} [KN]	b_w [m]	h_w [m]	$V_{Rd,max}$ [KN]	$(A_s/S)_{Ramo}$ [cm ² /m]	$A_{s,adot}$ [cm ² /m]	
Vb4.4	Sismo 1-	172.47	0.25	0.40	882.45	5.95	Ø10//0.125	6.32
Vb5.4	Sismo 1+	154.58	0.25	0.40	882.45	5.34	Ø10//0.125	6.32
Vb6.4	Sismo 1+	93.28	0.25	0.40	882.45	3.22	Ø10//0.200	3.95

11.3.2.5 Viga Vb.5

Viga	Tramo	Combinação	V_{Ed} [KN]	b_w [m]	h_w [m]	$V_{Rd,max}$ [KN]	$(A_s/S)_{Ramo}$ [cm ² /m]	$A_{s,adot}$ [cm ² /m]
Vb4.5	1	Sismo 1-	137.14	0.25	0.70	1597.95	2.61	Ø8//0.15 3.33
	2	Sismo 1+	140.37	0.25	0.70	1597.95	2.68	Ø8//0.15 3.33
	3	Sismo 1-	143.07	0.25	0.70	1597.95	2.73	Ø8//0.15 3.33
	4	Sismo 1-	144.65	0.25	0.70	1597.95	2.76	Ø8//0.15 3.33
	5	Sismo 1+	168.57	0.25	0.70	1597.95	3.21	Ø8//0.15 3.33
	6	Sismo 1-	92.52	0.25	0.70	1597.95	1.76	Ø8//0.20 2.50
Vb5.5	1	Sismo 1-	138.18	0.25	0.70	1597.95	2.63	Ø8//0.15 3.33
	2	Sismo 1+	140.04	0.25	0.70	1597.95	2.67	Ø8//0.15 3.33
	3	Sismo 1-	142.82	0.25	0.70	1597.95	2.72	Ø8//0.15 3.33
	4	Sismo 1-	144.19	0.25	0.70	1597.95	2.75	Ø8//0.15 3.33
	5	Sismo 1+	163.96	0.25	0.70	1597.95	3.13	Ø8//0.15 3.33
	6	Sismo 1-	90.48	0.25	0.70	1597.95	1.72	Ø8//0.20 2.50
Vb6.5	1	Sismo 1+	135.99	0.25	0.70	1597.95	2.59	Ø8//0.15 3.33
	2	Sismo 1+	133.03	0.25	0.70	1597.95	2.54	Ø8//0.15 3.33
	3	Sismo 1-	139.79	0.25	0.70	1597.95	2.66	Ø8//0.15 3.33
	4	Sismo 1-	143.43	0.25	0.70	1597.95	2.73	Ø8//0.15 3.33
	5	Sismo +	143.70	0.25	0.70	1597.95	2.74	Ø8//0.15 3.33
	6	Sismo 1-	93.16	0.25	0.70	1597.95	1.78	Ø8//0.20 2.50

11.3.2.6 Viga Vb.6

Viga	Troço	l_{cl} [m]	Secção	Face	M_{Rd}^- [KN.m]	M_{Rd}^+ [KN.m]	$V_{q,p}$ [KN]	$V_{Ed,mob}$ [KN]	V_{Ed} [KN]	$V_{Rd,max}$ [KN]	$(A_s/S)_{Ramo}$ [cm ² /m]	
Vb4.6 & Vb5.6	1	4.15	1	Sup	280.05	-	16.83	136.71	147.83		5.636	
				Inf	-	194.37		-147.83				
				3	Sup	349.30	-	42.62	114.15	114.15		4.352
					Inf	-	217.45		-111.11			
	2	7.60		3	Sup	349.30	-	42.62	114.15	114.15	1597.95	4.352
					Inf	-	217.45		-114.15			
				5	Sup	303.13	-	42.62	114.15	114.15		4.352
					Inf	-	194.37		-108.08			
	3	7.60		5	Sup	303.13	-	42.62	111.11	114.15	1597.95	4.352
					Inf	-	194.37		-114.15			
				7	Sup	349.30	-	42.62	114.15	114.15		4.352
					Inf	-	217.45		-108.08			
4	7.60		7	Sup	349.30	-	42.62	114.15	114.15		4.352	
				Inf	-	217.45		-108.08				
			9	Sup	280.05	-	11.41	150.08	150.08		5.722	
				Inf	-	194.37		-142.78				
5	3.16		9	Sup	280.05	-	11.41	150.08	150.08		5.722	
				Inf	-	194.37		-142.78				
			11	Sup	220.77	-	11.41	150.08	150.08		5.722	
				Inf	-	158.17		-142.78				

Viga	Troço	l_{cl} [m]	Secção	Face	M_{Rd}^- [KN.m]	M_{Rd}^+ [KN.m]	$V_{q,p}$ [KN]	$V_{Ed,mob}$ [KN]	V_{Ed} [KN]	$V_{Rd,max}$ [KN]	(A_s/S) [cm ² /m]					
Vb6.6	1	4.15	1	Sup	70.77	-	12.94	44.02	44.02	882.45	3.039					
				Inf	-	58.23		-44.02								
				3	Sup	70.77		-				12.94	44.02	44.02	882.45	3.039
					Inf	-		58.23					-44.02			

Viga	Troço	Zona Crítica					Zona Corrente				
		l_{cr} [m]	V_{Ed} [KN]	$(A_s/S)_{Ramo}$ [cm ² /m]	$S_{max,EC8}$ [m]	$A_{s,adot}$ [cm ² /m]	V_{Ed} [KN]	$(A_s/S)_{Ramo}$ [cm ² /m]	$S_{max,EC2}$ [m]	$A_{s,adot}$ [cm ² /m]	
Vb4.6 & Vb5.6	1	0.70	147.83	2.82	0.10	Ø8//0.10 5.00	97.96	1.87	0.500	Ø8//0.20 2.50	
	2	0.70	114.15	2.18	0.10	Ø8//0.10 5.00	93.12	1.78	0.500	Ø8//0.20 2.50	
	3	0.70	114.15	2.18	0.10	Ø8//0.10 5.00	93.12	1.78	0.500	Ø8//0.20 2.50	
	4	0.70	114.15	2.18	0.10	Ø8//0.10 5.00	93.12	1.78	0.500	Ø8//0.20 2.50	
	5	0.70	150.08	2.86	0.10	Ø8//0.10 5.00	83.59	1.59	0.500	Ø8//0.20 2.50	

Viga	Troço	Zona Crítica					Zona Corrente				
		l_{cr} [m]	V_{Ed} [KN]	$(A_s/S)_{Ramo}$ [cm ² /m]	$S_{max,EC8}$ [m]	$A_{s,adot}$ [cm ² /m]	V_{Ed} [KN]	$(A_s/S)_{Ramo}$ [cm ² /m]	$S_{max,EC2}$ [m]	$A_{s,adot}$ [cm ² /m]	
Vb6.6	1	0.40	44.02	1.52	0.10	Ø8//0.10 5,00	35.54	1.23	0.280	Ø8//0.20 2,500	

11.3.2.7 Viga da cobertura

Vigas Cobertura	Combinação	V_{Ed} [KN]	b_w [m]	h_w [m]	V_{Rd,max} [KN]	(A_s/S)_{Ramo} [cm²/m]	A_{S,adot} [cm²/m]	
Vb6.8	Sismo 1-	41.29	0.25	0.40	882.45	1.43	Ø8//0.20	2.50
Vb6.9	Sismo 1+	49.69	0.25	0.40	882.45	1.72	Ø8//0.20	2.50
Vb6.10	Sismo 1-	90.65	0.25	0.40	882.45	3.13	Ø8//0.15	3.33
Vb6.11	Sismo 1-	65.89	0.25	0.40	882.45	2.27	Ø8//0.15	3.33
Vb6.12	Sismo 1+	73.56	0.25	1.34	3124.35	0.72	Ø8//0.20	2.50
Vb6.13	Sismo 1+	90.61	0.25	0.60	1359.45	2.03	Ø8//0.20	2.50

11.4 Pilares primários

11.4.1 VERIFICAÇÃO DO ESFORÇO AXIAL REDUZIDO

Piso	Pilar	Dimensões		$N_{Ed,max}$ [KN]	v_d	Verificação
		x	y			
-1	1	0.25	0.70	-17.23	0.00	OK
	2	0.40	0.60	-17.41	0.00	OK
	3	0.40	0.60	-17.41	0.00	OK
	4	0.40	0.60	-17.41	0.00	OK
	5	0.40	0.60	-17.41	0.00	OK
	6	0.40	0.60	-17.41	0.00	OK
	7	0.40	0.60	-17.41	0.00	OK
	8	0.40	0.60	-17.41	0.00	OK
	9	0.25	0.70	-1794.90	0.51	OK
	17	0.40	0.80	-1231.01	0.19	OK
	18	0.25	0.90	-2717.48	0.60	OK
	25	0.40	0.80	-904.60	0.14	OK
1	1	0.25	0.70	-16.83	0.00	OK
	2	0.40	0.60	-17.01	0.00	OK
	3	0.40	0.60	-17.01	0.00	OK
	4	0.40	0.60	-17.01	0.00	OK
	5	0.40	0.60	-17.01	0.00	OK
	6	0.40	0.60	-17.01	0.00	OK
	7	0.40	0.60	-17.01	0.00	OK
	8	0.40	0.60	-17.01	0.00	OK
	9	0.25	0.70	-1501.11	0.43	OK
	17	0.40	0.80	-623.39	0.10	OK
	18	0.25	0.90	-2234.34	0.50	OK
	25	0.40	0.80	-421.66	0.07	OK
2	1	0.25	0.70	-16.83	0.00	OK
	2	0.40	0.60	-17.01	0.00	OK
	3	0.40	0.60	-17.01	0.00	OK
	4	0.40	0.60	-17.01	0.00	OK
	5	0.40	0.60	-17.01	0.00	OK
	6	0.40	0.60	-17.01	0.00	OK
	7	0.40	0.60	-17.01	0.00	OK
	9	0.25	0.70	-1179.79	0.34	OK
	18	0.25	0.90	-1791.59	0.40	OK
	3	1	0.25	0.70	-1955.96	0.56
3		0.40	0.60	-1076.02	0.22	OK
4		0.40	0.60	-1473.76	0.31	OK
5		0.40	0.60	-1516.88	0.32	OK
6		0.40	0.60	-1167.36	0.24	OK
7		0.40	0.60	-791.04	0.16	OK
9		0.25	0.60	-882.32	0.29	OK
18		0.25	0.70	-1307.65	0.37	OK
4	1	0.25	0.70	-1696.84	0.48	OK
	3	0.40	0.60	-623.00	0.13	OK
	4	0.40	0.60	-739.94	0.15	OK
	5	0.40	0.60	-756.90	0.16	OK
	6	0.40	0.60	-632.42	0.13	OK
	7	0.40	0.60	-370.62	0.08	OK
	9	0.25	0.60	-580.85	0.19	OK
	18	0.25	0.70	-810.60	0.23	OK
5	1	0.25	0.70	-495.27	0.14	OK
	3	0.25	0.40	-135.59	0.07	OK
	9	0.25	0.60	-585.24	0.20	OK
	18	0.25	0.70	-356.14	0.10	OK

11.4.2 DIMENSIONAMENTO

Pilar	Dimensões		Piso	N _{Ed,max} [KN]	N _{min} [KN]	M _x [KN.m]	M _{x,min} [KN.m]	V _y [KN]	M _y [KN.m]	M _{y,min} [KN.m]	V _x [KN]	A _{sx} [cm ²]		A _{sy} [cm ²]		EF
	x	y														
1	0.25	0.70	-1	-17.23	17.23	-118.05	81.87	45.68	-17.45	9.71	-6.30	5Ø20	15.70	4Ø20+2Ø16	16.58	23.40%
	0.25	0.70	1	-16.83	16.83	309.67	-189.33	117.88	-12.70	10.44	-5.27	5Ø20	15.70	4Ø20+2Ø16	16.58	53.30%
	0.25	0.70	2	-16.83	16.83	288.77	-183.31	105.29	-23.69	23.38	-10.77	5Ø20	15.70	4Ø20+2Ø16	16.58	52.00%
	0.25	0.70	3	-1955.96	-211.42	301.84	-234.01	97.76	72.07	-55.90	-30.11	5Ø20	15.70	4Ø20+2Ø16	16.58	63.00%
	0.25	0.70	4	-1696.84	-72.70	-407.40	238.63	132.49	-88.95	83.28	-41.00	5Ø20	15.70	4Ø20+2Ø16	16.58	80.10%
	0.25	0.70	5	-495.27	100.50	-420.56	308.07	248.29	-21.45	-5.41	-7.66	5Ø20	15.70	4Ø20+2Ø16	16.58	67.40%
2	0.40	0.60	-1	-17.41	17.41	52.81	-52.01	23.03	6.72	-2.94	2.25	3Ø16	6.03	2Ø16+2Ø12	6.28	26.80%
	0.40	0.60	1	-17.01	17.01	104.80	-59.67	37.12	-0.49	0.24	-0.17	3Ø16	6.03	2Ø16+2Ø12	6.28	52.40%
	0.40	0.60	2	-17.01	17.01	-148.41	97.35	72.69	-0.03	0.01	-0.10	3Ø16	6.03	2Ø16+2Ø12	6.28	74.20%
3	0.40	0.60	-1	-17.41	17.41	36.61	-31.23	11.54	-5.65	-4.17	-1.92	3Ø20	9.42	2Ø20+2Ø16	10.30	11.90%
	0.40	0.60	1	-17.01	17.01	44.41	-30.54	12.32	0.28	-0.23	0.11	3Ø20	9.42	2Ø20+2Ø16	10.30	14.00%
	0.40	0.60	2	-17.01	17.01	53.18	-35.94	17.18	-6.85	4.46	2.37	3Ø20	9.42	2Ø20+2Ø16	10.30	17.20%
	0.40	0.60	3	-1076.02	-572.18	61.39	-43.35	22.48	89.69	-76.47	-39.56	3Ø20	9.42	2Ø20+2Ø16	10.30	31.50%
	0.40	0.60	4	-623.00	-337.97	49.80	46.93	-22.81	127.08	-116.89	-58.09	3Ø20	9.42	2Ø20+2Ø16	10.30	46.70%
	0.25	0.40	5	-135.59	-84.12	-106.69	50.43	50.68	-20.21	17.58	-12.19	3Ø20	9.42	2Ø20+1Ø16	8.29	62.50%
4	0.40	0.60	-1	-17.41	17.41	-66.91	48.77	26.54	1.14	0.83	0.38	3Ø20	9.42	2Ø20+2Ø16	10.30	21.20%
	0.40	0.60	1	-17.01	17.01	136.16	-107.14	57.40	0.92	-0.79	0.25	3Ø20	9.42	2Ø20+2Ø16	10.30	43.00%
	0.40	0.60	2	-17.01	17.01	161.83	-139.69	71.46	-10.44	9.93	3.54	3Ø20	9.42	2Ø20+2Ø16	10.30	51.60%
	0.40	0.60	3	-1473.76	-909.62	176.66	-147.25	76.86	-53.01	50.31	24.23	3Ø20	9.42	2Ø20+2Ø16	10.30	38.60%
	0.40	0.60	4	-739.94	-462.36	-289.07	211.73	119.19	-61.41	57.53	28.32	3Ø20	9.42	2Ø20+2Ø16	10.30	68.30%
5	0.40	0.60	-1	-17.41	17.41	-69.24	49.06	27.25	-1.71	-1.24	-0.57	3Ø20	9.42	2Ø20+2Ø16	10.30	21.90%
	0.40	0.60	1	-17.01	17.01	131.92	-108.64	55.61	0.93	-0.79	-0.30	3Ø20	9.42	2Ø20+2Ø16	10.30	41.70%
	0.40	0.60	2	-17.01	17.01	160.63	-138.96	70.24	-11.44	9.12	3.88	3Ø20	9.42	2Ø20+2Ø16	10.30	51.30%
	0.40	0.60	3	-1516.88	-940.07	179.99	-150.98	78.56	59.90	-58.15	-28.11	3Ø20	9.42	2Ø20+2Ø16	10.30	40.30%
6	0.40	0.60	4	-756.90	-472.34	-285.87	204.45	116.69	76.00	-71.00	-35.00	3Ø20	9.42	2Ø20+2Ø16	10.30	69.70%
	0.40	0.60	-1	-17.41	17.41	-68.35	51.62	27.58	9.73	7.18	3.22	4Ø20	15.70	2Ø20+2Ø16	12.31	20.00%
	0.40	0.60	1	-17.01	17.01	117.67	-97.96	48.29	1.04	-0.94	-0.47	4Ø20	15.70	2Ø20+2Ø16	12.31	34.10%
	0.40	0.60	2	-17.01	17.01	143.37	-121.58	61.01	11.88	-9.30	-4.02	4Ø20	15.70	2Ø20+2Ø16	12.31	41.70%
	0.40	0.60	3	-1167.36	-608.76	160.02	-120.96	66.58	-75.09	60.34	32.25	4Ø20	15.70	2Ø20+2Ø16	12.31	40.00%
	0.40	0.60	4	-632.42	-323.57	-276.89	174.79	107.48	-93.57	91.91	44.16	4Ø20	15.70	2Ø20+2Ø16	12.31	67.90%

7	0.40	0.60	-1	-17.41	17.41	-81.83	65.90	34.13	-3.44	-2.51	-1.20	4Ø20	15.70	2Ø20+2Ø16	12.31	21.20%
	0.40	0.60	1	-17.01	17.01	128.30	-101.01	53.39	0.91	-0.45	-0.32	4Ø20	15.70	2Ø20+2Ø16	12.31	33.00%
	0.40	0.60	2	-17.01	17.01	162.27	-145.03	71.54	-14.39	8.95	4.94	4Ø20	15.70	2Ø20+2Ø16	12.31	42.30%
	0.40	0.60	3	-791.04	-461.66	210.91	-185.80	94.20	59.87	-56.01	-27.59	4Ø20	15.70	2Ø20+2Ø16	12.31	45.40%
	0.40	0.60	4	-370.62	-206.80	-363.15	254.16	146.96	-66.05	63.75	-30.90	4Ø20	15.70	2Ø20+2Ø16	12.31	82.00%
8	0.40	0.60	-1	-17.41	17.41	-110.00	84.83	45.25	4.89	3.41	1.68	4Ø20	12.56	2Ø20+2Ø16	10.30	28.40%
	0.40	0.60	1	-17.01	17.01	-198.23	195.37	93.68	-3.17	2.24	1.29	4Ø20	12.56	2Ø20+2Ø16	10.30	51.00%
9	0.25	0.70	-1	-1794.90	131.48	211.41	-174.91	-89.81	17.99	-13.00	-7.20	5Ø25	24.55	4Ø25+2Ø20	25.92	24.90%
	0.25	0.70	1	-1501.11	133.27	-396.69	316.09	-169.62	-33.19	32.40	-15.62	5Ø25	24.55	4Ø25+2Ø20	25.92	45.80%
	0.25	0.70	2	-1179.79	127.84	-454.89	435.49	-211.96	-32.58	22.48	-13.10	5Ø25	24.55	4Ø25+2Ø20	25.92	50.90%
	0.25	0.60	3	-882.32	-106.77	330.45	-312.17	-152.99	68.67	-35.34	-24.07	5Ø25	24.55	4Ø25+2Ø20	25.92	58.40%
	0.25	0.60	4	-580.85	-194.10	-369.15	360.38	-173.69	-103.13	101.58	-48.74	5Ø25	24.55	4Ø25+2Ø20	25.92	75.10%
17	0.25	0.60	5	-585.24	-142.70	428.51	-403.67	-268.42	-83.68	42.29	-35.82	5Ø25	24.55	4Ø25+2Ø20	25.92	74.50%
	0.40	0.80	-1	-1231.01	630.71	306.38	-231.05	-124.97	-21.76	10.76	7.41	4Ø25	19.64	2Ø25+3Ø20	19.24	26.80%
18	0.40	0.80	1	-623.39	339.34	714.97	-655.6767	-326.23	-61.39	46.67	25.73	4Ø25	19.64	2Ø25+3Ø20	19.24	70.00%
	0.25	0.90	-1	-2717.48	-523.33	-181.35	105.46	-61.38	55.82	-37.12	-21.62	5Ø25	24.55	4Ø25+3Ø20	29.06	27.70%
	0.25	0.90	1	-2234.34	-274.40	397.98	-297.83	144.16	-78.13	77.97	-37.17	5Ø25	24.55	4Ø25+3Ø20	29.06	44.40%
	0.25	0.90	2	-1791.59	-136.30	-321.30	275.98	-127.62	-80.29	-80.15	-38.20	5Ø25	24.55	4Ø25+3Ø20	29.06	40.60%
	0.25	0.70	3	-1307.65	-70.77	-458.97	398.10	-197.57	96.72	-90.28	-44.53	5Ø25	24.55	4Ø25+2Ø20	25.92	70.40%
25	0.25	0.70	4	-810.60	-110.90	498.79	-450.55	-225.85	105.52	-104.98	-50.14	5Ø25	24.55	4Ø25+2Ø20	25.92	77.20%
	0.25	0.70	5	-356.14	-100.21	433.04	-335.46	-155.97	109.28	-107.51	-51.62	5Ø25	24.55	4Ø25+2Ø20	25.92	75.00%
	0.40	0.80	-1	-904.60	-152.65	-236.67	131.49	74.98	-15.10	4.99	4.67	5Ø20	15.70	2Ø20+3Ø16	12.31	25.90%
	0.40	0.80	1	-421.66	-40.41	490.44	-470.13	228.70	-69.97	51.38	28.66	5Ø20	15.70	2Ø20+3Ø16	12.31	64.30%

11.4.3 VERIFICAÇÃO À FLEXÃO DESVIADA

$$\left(\frac{M_{Ed,x}}{M_{Rd,x}}\right)^a + \left(\frac{M_{Ed,y}}{M_{Rd,y}}\right)^a \leq 1,0 \quad (11.29)$$

Em que:

a Exponente, que para seções circulares e elípticas é igual a 2,0, para seções retangulares:

N_{Ed}/N_{Rd}	0,1	0,7	1,0
a	1,0	1,5	2,0

O cálculo do momento resistente foi obtido simplificada através da seguinte expressão:

$$x = \frac{N_{Ed} + (A_{s1} - A_{s2}) \times f_{yd}}{0,8 \times b \times f_{cd}} \quad (11.30)$$

$$M_{Rd} = \left[A_{s1} \cdot \left(d - \frac{h}{2} \right) + A_{s2} \cdot \left(\frac{h}{2} - d_1 \right) \right] \cdot f_{yd} + 0,8 \cdot x \cdot b \cdot f_{cd} \cdot \left(\frac{h}{2} - 0,4 \cdot x \right) \quad (11.31)$$

Em que:

N_{Ed} Esforço axial de cálculo;

M_{Rd} Momento resistente na direção considerada;

Piso	Pilar	Dimensões		N _{max} [KN]	M _{Ed,x} [KN.m]	M _{Ed,y} [KN.m]	A _{sx} [cm ²]	A _{sy} [cm ²]	x _x [m]	M _{Rd,x} [KN.m]	x _y [m]	M _{Rd,y} [KN.m]	EC8	EC2		
		x	y													
-1	1	0.25	0.70	-17.23	-118.05	-17.45	5Ø20	15.70	4Ø20+2Ø16	16.58	0.004	443.088	0.002	139.177	OK	OK
	2	0.40	0.60	-17.41	52.81	6.72	3Ø16	6.03	2Ø16+2Ø12	6.28	0.003	146.849	0.002	96.351	OK	OK
	3	0.40	0.60	-17.41	36.61	-5.65	3Ø20	9.42	2Ø20+2Ø16	10.30	0.003	226.480	0.002	155.806	OK	OK
	4	0.40	0.60	-17.41	-66.91	1.14	3Ø20	9.42	2Ø20+2Ø16	10.30	0.003	226.480	0.002	155.806	OK	OK
	5	0.40	0.60	-17.41	-69.24	-1.71	3Ø20	9.42	2Ø20+2Ø16	10.30	0.003	226.480	0.002	155.806	OK	OK
	6	0.40	0.60	-17.41	-68.35	9.73	4Ø20	15.70	2Ø20+2Ø16	12.31	0.003	373.997	0.002	185.534	OK	OK
	7	0.40	0.60	-17.41	-81.83	-3.44	4Ø20	15.70	2Ø20+2Ø16	12.31	0.003	373.997	0.002	185.534	OK	OK
	8	0.40	0.60	-17.41	-110.00	4.89	4Ø20	12.56	2Ø20+2Ø16	10.30	0.003	300.238	0.002	155.806	OK	OK
	9	0.25	0.70	-1794.90	211.41	17.99	5Ø25	24.55	4Ø25+2Ø20	25.92	0.449	989.520	0.160	323.532	OK	OK
	17	0.40	0.80	-1231.01	306.38	-21.76	4Ø25	19.64	2Ø25+3Ø20	19.24	0.192	1029.904	0.096	483.406	OK	OK
	18	0.25	0.90	-2717.48	-181.35	55.82	5Ø25	24.55	4Ø25+3Ø20	29.06	0.679	1381.453	0.189	374.735	OK	OK
25	0.40	0.80	-904.60	-236.67	-15.10	5Ø20	15.70	2Ø20+3Ø16	12.31	0.141	816.079	0.071	337.413	OK	OK	
1	1	0.25	0.70	-16.83	309.67	-12.70	5Ø20	15.70	4Ø20+2Ø16	16.58	0.004	442.950	0.002	139.127	OK	OK
	2	0.40	0.60	-17.01	104.80	-0.49	3Ø16	6.03	2Ø16+2Ø12	6.28	0.003	146.730	0.002	96.271	FAIL	OK
	3	0.40	0.60	-17.01	44.41	0.28	3Ø20	9.42	2Ø20+2Ø16	10.30	0.003	226.361	0.002	155.727	OK	OK
	4	0.40	0.60	-17.01	136.16	0.92	3Ø20	9.42	2Ø20+2Ø16	10.30	0.003	226.361	0.002	155.727	OK	OK
	5	0.40	0.60	-17.01	131.92	0.93	3Ø20	9.42	2Ø20+2Ø16	10.30	0.003	226.361	0.002	155.727	OK	OK
	6	0.40	0.60	-17.01	117.67	1.04	4Ø20	15.70	2Ø20+2Ø16	12.31	0.003	373.878	0.002	185.455	OK	OK
	7	0.40	0.60	-17.01	128.30	0.91	4Ø20	15.70	2Ø20+2Ø16	12.31	0.003	373.878	0.002	185.455	OK	OK
	8	0.40	0.60	-17.01	-198.23	-3.17	4Ø20	12.56	2Ø20+2Ø16	10.30	0.003	300.119	0.002	155.727	OK	OK
	9	0.25	0.70	-1501.11	-396.69	-33.19	5Ø25	24.55	4Ø25+2Ø20	25.92	0.375	983.527	0.134	321.391	OK	OK
	17	0.40	0.80	-623.39	714.97	-61.39	4Ø25	19.64	2Ø25+3Ø20	19.24	0.097	857.279	0.049	397.093	FAIL	OK
	18	0.25	0.90	-2234.34	397.98	-78.13	5Ø25	24.55	4Ø25+3Ø20	29.06	0.559	1403.282	0.155	380.799	OK	OK
25	0.40	0.80	-421.66	490.44	-69.97	5Ø20	15.70	2Ø20+3Ø16	12.31	0.066	662.935	0.033	260.841	FAIL	OK	
2	1	0.25	0.70	-16.83	288.77	-23.69	5Ø20	15.70	4Ø20+2Ø16	16.58	0.004	442.950	0.002	139.127	OK	OK
	2	0.40	0.60	-17.01	-148.41	-0.03	3Ø16	6.03	2Ø16+2Ø12	6.28	0.003	146.730	0.002	96.271	FAIL	OK
	3	0.40	0.60	-17.01	53.18	-6.85	3Ø20	9.42	2Ø20+2Ø16	10.30	0.003	226.361	0.002	155.727	OK	OK
	4	0.40	0.60	-17.01	161.83	-10.44	3Ø20	9.42	2Ø20+2Ø16	10.30	0.003	226.361	0.002	155.727	FAIL	OK
	5	0.40	0.60	-17.01	160.63	-11.44	3Ø20	9.42	2Ø20+2Ø16	10.30	0.003	226.361	0.002	155.727	FAIL	OK
	6	0.40	0.60	-17.01	143.37	11.88	4Ø20	15.70	2Ø20+2Ø16	12.31	0.003	373.878	0.002	185.455	OK	OK
	7	0.40	0.60	-17.01	162.27	-14.39	4Ø20	15.70	2Ø20+2Ø16	12.31	0.003	373.878	0.002	185.455	OK	OK
	9	0.25	0.70	-1179.79	-454.89	-32.58	5Ø25	24.55	4Ø25+2Ø20	25.92	0.295	957.208	0.105	311.992	OK	OK
	18	0.25	0.90	-1791.59	-321.30	-80.29	5Ø25	24.55	4Ø25+3Ø20	29.06	0.448	1382.293	0.124	374.969	OK	OK
	3	1	0.25	0.70	-1955.96	301.84	72.07	5Ø20	15.70	4Ø20+2Ø16	16.58	0.489	739.096	0.175	244.894	OK
3		0.40	0.60	-1076.02	61.39	89.69	3Ø20	9.42	2Ø20+2Ø16	10.30	0.168	471.718	0.112	319.299	OK	OK
4		0.40	0.60	-1473.76	176.66	-53.01	3Ø20	9.42	2Ø20+2Ø16	10.30	0.230	527.656	0.154	356.590	OK	OK
5		0.40	0.60	-1516.88	179.99	59.90	3Ø20	9.42	2Ø20+2Ø16	10.30	0.237	532.532	0.158	359.841	OK	OK
6		0.40	0.60	-1167.36	160.02	-75.09	4Ø20	15.70	2Ø20+2Ø16	12.31	0.182	633.830	0.122	358.757	OK	OK
7		0.40	0.60	-791.04	210.91	59.87	4Ø20	15.70	2Ø20+2Ø16	12.31	0.124	566.996	0.082	314.200	OK	OK
9		0.25	0.60	-882.32	330.45	68.67	5Ø25	24.55	4Ø25+2Ø20	25.92	0.221	763.527	0.092	292.082	OK	OK
18		0.25	0.70	-1307.65	-458.97	96.72	5Ø25	24.55	4Ø25+3Ø20	25.92	0.327	970.155	0.117	316.615	OK	OK

4	1	0.25	0.70	-1696.84	-407.40	-88.95	5Ø20	15.70	4Ø20+2Ø16	16.58	0.424	743.055	0.152	246.308	OK	OK
	3	0.40	0.60	-623.00	49.80	127.08	3Ø20	9.42	2Ø20+2Ø16	10.30	0.097	383.918	0.065	260.765	OK	OK
	4	0.40	0.60	-739.94	-289.07	-61.41	3Ø20	9.42	2Ø20+2Ø16	10.30	0.116	409.038	0.077	277.512	FAIL	OK
	5	0.40	0.60	-756.90	-285.87	76.00	3Ø20	9.42	2Ø20+2Ø16	10.30	0.118	412.540	0.079	279.846	OK	OK
	6	0.40	0.60	-632.42	-276.89	-93.57	4Ø20	15.70	2Ø20+2Ø16	12.31	0.099	533.522	0.066	291.884	OK	OK
	7	0.40	0.60	-370.62	-363.15	-66.05	4Ø20	15.70	2Ø20+2Ø16	12.31	0.058	471.394	0.039	250.466	FAIL	OK
	9	0.25	0.60	-580.85	-369.15	-103.13	5Ø25	24.55	4Ø25+2Ø20	25.92	0.145	717.196	0.061	272.777	OK	OK
	18	0.25	0.70	-810.60	498.79	105.52	5Ø25	24.55	4Ø25+2Ø20	25.92	0.203	901.475	0.072	292.087	OK	OK
5	1	0.25	0.70	-495.27	-420.56	-21.45	5Ø20	15.70	4Ø20+2Ø16	16.58	0.124	585.903	0.044	190.182	FAIL	OK
	3	0.25	0.40	-135.59	-106.69	-20.21	3Ø20	9.42	2Ø20+1Ø16	8.29	0.034	164.601	0.021	84.317	OK	OK
	9	0.25	0.60	-585.24	428.51	-83.68	5Ø25	24.55	4Ø25+2Ø20	25.92	0.146	718.001	0.061	273.113	OK	OK
	18	0.25	0.70	-356.14	433.04	109.28	5Ø25	24.55	4Ø25+2Ø20	25.92	0.089	795.437	0.032	254.216	OK	OK

11.4.4 ESFORÇO TRANSVERSO MOBILIZADO

$$V_{Ed,mob} = \gamma_{Rd} \cdot \frac{M_{RC,2} + M_{RC,1}}{l_{cl}} \quad (11.32)$$

Em que:

γ_{Rd} Igual a 1,1;
 l_{cl} Comprimento livre do pilar;

Piso	Pilar	Dimensões		l_{cl} [m]	$M_{Rd,x}$ [KN.m]	$V_{Edx,mob}$ [KN]	$V_{Edx,Sap}$ [KN]	$M_{Rd,y}$ [KN.m]	$V_{Edy,mob}$ [KN]	$V_{Edy,Sap}$ [KN]
		x	y							
-1	1	0.25	0.70	0.00	443.09	#DIV/0!	-6.30	139.18	#DIV/0!	45.68
	2	0.40	0.60	0.00	146.85	#DIV/0!	2.25	96.35	#DIV/0!	23.03
	3	0.40	0.60	0.00	226.48	#DIV/0!	-1.92	155.81	#DIV/0!	11.54
	4	0.40	0.60	0.00	226.48	#DIV/0!	0.38	155.81	#DIV/0!	26.54
	5	0.40	0.60	0.00	226.48	#DIV/0!	-0.57	155.81	#DIV/0!	27.25
	6	0.40	0.60	0.00	374.00	#DIV/0!	3.22	185.53	#DIV/0!	27.58
	7	0.40	0.60	0.00	374.00	#DIV/0!	-1.20	185.53	#DIV/0!	34.13
	8	0.40	0.60	0.00	300.24	#DIV/0!	1.68	155.81	#DIV/0!	45.25
	9	0.25	0.70	2.61	989.52	834.08	-7.20	323.53	270.23	-89.81
	17	0.40	0.80	2.61	1029.90	868.12	7.41	483.41	407.47	-124.97
18	0.25	0.90	2.61	1381.45	1164.44	-21.62	374.74	315.87	-61.38	
25	0.40	0.80	2.61	816.08	687.88	4.67	337.41	284.41	74.98	
1	1	0.25	0.70	0.00	442.95	#DIV/0!	-5.27	139.13	#DIV/0!	117.88
	2	0.40	0.60	0.00	146.73	#DIV/0!	-0.17	96.27	#DIV/0!	37.12
	3	0.40	0.60	0.00	226.36	#DIV/0!	0.11	155.73	#DIV/0!	12.32
	4	0.40	0.60	0.00	226.36	#DIV/0!	0.25	155.73	#DIV/0!	57.40
	5	0.40	0.60	0.00	226.36	#DIV/0!	-0.30	155.73	#DIV/0!	55.61
	6	0.40	0.60	0.00	373.88	#DIV/0!	-0.47	185.45	#DIV/0!	48.29
	7	0.40	0.60	0.00	373.88	#DIV/0!	-0.32	185.45	#DIV/0!	53.39
	8	0.40	0.60	0.00	300.12	#DIV/0!	1.29	155.73	#DIV/0!	93.68
	9	0.25	0.70	3.56	983.53	607.80	-15.62	321.39	198.61	-169.62
	17	0.40	0.80	3.56	857.28	529.78	25.73	397.09	245.39	-326.23
18	0.25	0.90	3.56	1403.28	867.20	-37.17	380.80	235.33	144.16	
25	0.40	0.80	3.56	662.93	409.68	28.66	260.84	161.19	228.70	
2	1	0.25	0.70	0.00	442.95	#DIV/0!	-10.77	139.13	#DIV/0!	105.29
	2	0.40	0.60	0.00	146.73	#DIV/0!	-0.10	96.27	#DIV/0!	72.69
	3	0.40	0.60	0.00	226.36	#DIV/0!	2.37	155.73	#DIV/0!	17.18
	4	0.40	0.60	0.00	226.36	#DIV/0!	3.54	155.73	#DIV/0!	71.46
	5	0.40	0.60	0.00	226.36	#DIV/0!	3.88	155.73	#DIV/0!	70.24
	6	0.40	0.60	0.00	373.88	#DIV/0!	-4.02	185.45	#DIV/0!	61.01
	7	0.40	0.60	0.00	373.88	#DIV/0!	4.94	185.45	#DIV/0!	71.54
	9	0.25	0.70	3.56	957.21	591.53	-13.10	311.99	192.80	-211.96
	18	0.25	0.90	3.56	1382.29	854.23	-38.20	374.97	231.72	-127.62
3	1	0.25	0.70	3.46	739.10	469.95	-30.11	244.89	155.71	97.76
	3	0.40	0.60	3.46	471.72	299.94	-39.56	319.30	203.02	22.48
	4	0.40	0.60	3.46	527.66	335.50	24.23	356.59	226.73	76.86
	5	0.40	0.60	3.46	532.53	338.60	-28.11	359.84	228.80	78.56
	6	0.40	0.60	3.46	633.83	403.01	32.25	358.76	228.11	66.58
	7	0.40	0.60	3.46	567.00	360.52	-27.59	314.20	199.78	94.20
	9	0.25	0.60	3.56	763.53	471.84	-24.07	292.08	180.50	-152.99
	18	0.25	0.70	3.56	970.15	599.53	-44.53	316.62	195.66	-197.57
4	1	0.25	0.70	3.46	743.06	472.46	-41.00	246.31	156.61	132.49
	3	0.40	0.60	3.46	383.92	244.11	-58.09	260.76	165.80	-22.81
	4	0.40	0.60	3.46	409.04	260.08	28.32	277.51	176.45	119.19
	5	0.40	0.60	3.46	412.54	262.31	-35.00	279.85	177.94	116.69
	6	0.40	0.60	3.46	533.52	339.23	44.16	291.88	185.59	107.48
	7	0.40	0.60	3.46	471.39	299.73	-30.90	250.47	159.26	146.96
	9	0.25	0.60	3.56	717.20	443.21	-48.74	272.78	168.57	-173.69
	18	0.25	0.70	3.56	901.47	557.09	-50.14	292.09	180.50	-225.85
5	1	0.25	0.70	2.82	585.90	457.09	-7.66	190.18	148.37	248.29
	3	0.25	0.40	2.82	164.60	128.41	-12.19	84.32	65.78	50.68
	9	0.25	0.60	3.56	718.00	443.71	-35.82	273.11	168.78	-268.42
	18	0.25	0.70	3.56	795.44	491.56	-51.62	254.22	157.10	-155.97

11.4.4.1 Armaduras na zona crítica

Piso	Pilar	Dimensões		l _d [m]	l _d /h _c	l _{tr} [m]	d _{bl,min} [m]	S _{d,max} EC2 [m]	S _{d,max} EC8 [m]	V _{Ed,x} [KN]	z _y [m]	V _{Rd,max,x} [KN]	V _{Ed,x} <V _{Rd,max,x}	A _{sw,x} /s [cm ² /m]	A _{sw,x} /s Adotado [cm ² /m]	V _{Rd,s,x} [KN]	V _{Ed,x} <V _{Rd,s,x}	V _{Ed,y} [KN]	z _x [m]	V _{Rd,max,y} [KN]	V _{Ed,y} <V _{Rd,max,y}	A _{sw,y} /s [cm ² /m]	A _{sw,y} /s Adotado [cm ² /m]	V _{Rd,s,y} [KN]	V _{Ed,y} <V _{Rd,s,y}		
		x	y																								
-1	1	0.25	0.70	0.00	0.00	0.00	0.02	0.25	0.10	-6.30	0.60	795.96	OK	-0.24	Ø10//0.10	31.60	828.88	OK	45.68	0.20	731.81	OK	5.30	Ø10//0.10	31.60	272.17	OK
	2	0.40	0.60	0.00	0.00	0.00	0.01	0.24	0.10	2.25	0.51	1083.46	OK	0.10	Ø8//0.10	20.00	446.31	OK	23.03	0.33	1054.94	OK	1.59	Ø8//0.10	20.00	289.71	OK
	3	0.40	0.60	0.00	0.00	0.00	0.02	0.40	0.16	-1.92	0.51	1083.46	OK	-0.09	Ø8//0.10	25.00	557.89	OK	11.54	0.33	1054.94	OK	0.80	Ø8//0.10	25.00	362.14	OK
	4	0.40	0.60	0.00	0.00	0.00	0.02	0.40	0.16	0.38	0.51	1083.46	OK	0.02	Ø8//0.10	25.00	557.89	OK	26.54	0.33	1054.94	OK	1.83	Ø8//0.10	25.00	362.14	OK
	5	0.40	0.60	0.00	0.00	0.00	0.02	0.40	0.16	-0.57	0.51	1083.46	OK	-0.03	Ø8//0.10	25.00	557.89	OK	27.25	0.33	1054.94	OK	1.88	Ø8//0.10	25.00	362.14	OK
	6	0.40	0.60	0.00	0.00	0.00	0.02	0.40	0.16	3.22	0.51	1083.46	OK	0.14	Ø10//0.15	21.08	470.41	OK	27.58	0.33	1054.94	OK	1.90	Ø10//0.15	21.08	305.35	OK
	7	0.40	0.60	0.00	0.00	0.00	0.02	0.40	0.16	-1.20	0.51	1083.46	OK	-0.05	Ø10//0.15	21.08	470.41	OK	34.13	0.33	1054.94	OK	2.36	Ø10//0.15	21.08	305.35	OK
	8	0.40	0.60	0.00	0.00	0.00	0.01	0.24	0.10	1.68	0.51	1083.46	OK	0.08	Ø8//0.10	20.00	446.31	OK	45.25	0.33	1054.94	OK	3.12	Ø8//0.10	20.00	289.71	OK
	9	0.25	0.70	2.61	3.73	0.70	0.02	0.25	0.10	834.08	0.60	795.96	NO	30.34	Ø10//0.10	31.60	828.88	OK	270.23	0.20	731.81	OK	31.37	Ø10//0.10	31.60	272.17	OK
	17	0.40	0.80	2.61	3.26	0.80	0.02	0.40	0.16	868.12	0.69	1463.62	OK	28.80	Ø10//0.10	31.60	952.60	OK	407.47	0.33	1406.59	OK	28.13	Ø10//0.10	31.60	457.74	OK
18	0.25	0.90	2.61	2.90	2.61	0.03	0.25	0.10	1164.44	0.78	1033.56	NO	30.34	Ø12//0.10	45.20	1539.53	OK	315.87	0.20	940.90	OK	36.67	Ø12//0.10	45.20	389.31	OK	
25	0.40	0.80	2.61	3.26	0.80	0.02	0.32	0.13	687.88	0.69	1463.62	OK	22.82	Ø10//0.10+Ø8//0.10	25.80	777.75	OK	284.41	0.33	1406.59	OK	19.63	Ø10//0.10+Ø8//0.10	25.80	373.73	OK	
1	1	0.25	0.70	0.00	0.00	0.00	0.02	0.25	0.10	-5.27	0.60	795.96	OK	-0.20	Ø10//0.10	31.60	828.88	OK	117.88	0.20	731.81	OK	13.69	Ø10//0.10	31.60	272.17	OK
	2	0.40	0.60	0.00	0.00	0.00	0.01	0.24	0.10	-0.17	0.51	1083.46	OK	-0.01	Ø8//0.10	20.00	446.31	OK	37.12	0.33	1054.94	OK	2.56	Ø8//0.10	20.00	289.71	OK
	3	0.40	0.60	0.00	0.00	0.00	0.02	0.40	0.16	0.11	0.51	1083.46	OK	0.00	Ø8//0.10	25.00	557.89	OK	12.32	0.33	1054.94	OK	0.85	Ø8//0.10	25.00	362.14	OK
	4	0.40	0.60	0.00	0.00	0.00	0.02	0.40	0.16	0.25	0.51	1083.46	OK	0.01	Ø8//0.10	25.00	557.89	OK	57.40	0.33	1054.94	OK	3.96	Ø8//0.10	25.00	362.14	OK
	5	0.40	0.60	0.00	0.00	0.00	0.02	0.40	0.16	-0.30	0.51	1083.46	OK	-0.01	Ø8//0.10	25.00	557.89	OK	55.61	0.33	1054.94	OK	3.84	Ø8//0.10	25.00	362.14	OK
	6	0.40	0.60	0.00	0.00	0.00	0.02	0.40	0.16	-0.47	0.51	1083.46	OK	-0.02	Ø10//0.15	21.08	470.41	OK	48.29	0.33	1054.94	OK	3.33	Ø10//0.15	21.08	305.35	OK
	7	0.40	0.60	0.00	0.00	0.00	0.02	0.40	0.16	-0.32	0.51	1083.46	OK	-0.01	Ø10//0.15	21.08	470.41	OK	53.39	0.33	1054.94	OK	3.69	Ø10//0.15	21.08	305.35	OK
	8	0.40	0.60	0.00	0.00	0.00	0.01	0.24	0.10	1.29	0.51	1083.46	OK	0.06	Ø8//0.10	20.00	446.31	OK	93.68	0.33	1054.94	OK	6.47	Ø8//0.10	20.00	289.71	OK
	9	0.25	0.70	3.56	5.09	0.70	0.02	0.25	0.10	607.80	0.60	795.96	OK	23.17	Ø10//0.10	31.60	828.88	OK	198.61	0.20	731.81	OK	23.06	Ø10//0.10	31.60	272.17	OK
	17	0.40	0.80	3.56	4.45	0.80	0.02	0.40	0.16	529.78	0.69	1463.62	OK	17.57	Ø10//0.10	31.60	952.60	OK	326.23	0.33	1406.59	OK	22.52	Ø10//0.10	31.60	457.74	OK
18	0.25	0.90	3.56	3.96	0.90	0.03	0.25	0.10	867.20	0.78	1033.56	OK	25.46	Ø10//0.10	31.60	1076.31	OK	235.33	0.20	940.90	OK	27.32	Ø10//0.10	31.60	272.17	OK	
25	0.40	0.80	3.56	4.45	0.80	0.02	0.32	0.13	409.68	0.69	1463.62	OK	13.59	Ø10//0.10+Ø8//0.10	25.80	777.75	OK	228.70	0.33	1406.59	OK	15.79	Ø10//0.10+Ø8//0.10	25.80	373.73	OK	
2	1	0.25	0.70	0.00	0.00	0.00	0.02	0.25	0.10	-10.77	0.60	795.96	OK	-0.41	Ø10//0.10	31.60	828.88	OK	105.29	0.20	731.81	OK	12.22	Ø10//0.10	31.60	272.17	OK
	2	0.40	0.60	0.00	0.00	0.00	0.01	0.24	0.10	-0.10	0.51	1083.46	OK	0.00	Ø8//0.10	20.00	446.31	OK	72.69	0.33	1054.94	OK	5.02	Ø8//0.10	20.00	289.71	OK
	3	0.40	0.60	0.00	0.00	0.00	0.02	0.40	0.16	2.37	0.51	1083.46	OK	0.11	Ø8//0.10	25.00	557.89	OK	17.18	0.33	1054.94	OK	1.19	Ø8//0.10	25.00	362.14	OK
	4	0.40	0.60	0.00	0.00	0.00	0.02	0.40	0.16	3.54	0.51	1083.46	OK	0.16	Ø8//0.10	25.00	557.89	OK	71.46	0.33	1054.94	OK	4.93	Ø8//0.10	25.00	362.14	OK
	5	0.40	0.60	0.00	0.00	0.00	0.02	0.40	0.16	3.88	0.51	1083.46	OK	0.17	Ø8//0.10	25.00	557.89	OK	70.24	0.33	1054.94	OK	4.85	Ø8//0.10	25.00	362.14	OK
	6	0.40	0.60	0.00	0.00	0.00	0.02	0.40	0.16	-4.02	0.51	1083.46	OK	-0.18	Ø10//0.15	21.08	470.41	OK	61.01	0.33	1054.94	OK	4.21	Ø10//0.15	21.08	305.35	OK
	7	0.40	0.60	0.00	0.00	0.00	0.02	0.40	0.16	4.94	0.51	1083.46	OK	0.22	Ø10//0.15	21.08	470.41	OK	71.54	0.33	1054.94	OK	4.94	Ø10//0.15	21.08	305.35	OK
	9	0.25	0.70	3.56	5.09	0.70	0.02	0.25	0.10	591.53	0.60	795.96	OK	22.55	Ø10//0.10	31.60	828.88	OK	211.96	0.20	731.81	OK	24.61	Ø10//0.10	31.60	272.17	OK
	18	0.25	0.90	3.56	3.96	0.90	0.03	0.25	0.10	854.23	0.78	1033.56	OK	25.08	Ø10//0.10	31.60	1076.31	OK	231.72	0.20	940.90	OK	26.90	Ø10//0.10	31.60	272.17	OK
	3	1	0.25	0.70	3.46	4.94	0.70	0.02	0.25	0.10	469.95	0.60	795.96	OK	17.92	Ø10//0.10	31.60	828.88	OK	155.71	0.20	731.81	OK	18.08	Ø10//0.10	31.60	272.17
3		0.40	0.60	3.46	5.77	0.60	0.02	0.40	0.16	299.94	0.51	1083.46	OK	13.44	Ø8//0.10	25.00	557.89	OK	203.02	0.33	1054.94	OK	14.02	Ø8//0.10	25.00	362.14	OK
4		0.40	0.60	3.46	5.77	0.60	0.02	0.40	0.16	335.50	0.51	1083.46	OK	15.03	Ø8//0.10	25.00	557.89	OK	226.73	0.33	1054.94	OK	15.65	Ø8//0.10	25.00	362.14	OK
5		0.40	0.60	3.46	5.77	0.60	0.02	0.40	0.16	338.60	0.51	1083.46	OK	15.17	Ø8//0.10	25.00	557.89	OK	228.80	0.33	1054.94	OK	15.80	Ø8//0.10	25.00	362.14	OK
6		0.40	0.60	3.46	5.77	0.60	0.02	0.40	0.16	403.01	0.51	1083.46	OK	18.06	Ø10//0.15	21.08	470.41	OK	228.11	0.33	1054.94	OK	15.75	Ø10//0.15	21.08	305.35	OK
7		0.40	0.60	3.46	5.77	0.60	0.02	0.40	0.16	360.52	0.51	1083.46	OK	16.16	Ø10//0.15	21.08	470.41	OK	199.78	0.33	1054.94	OK	13.79	Ø10//0.15	21.08	305.35	OK
9		0.25	0.60	3.56	5.93	0.60	0.02	0.25	0.10	471.84	0.51	677.16	OK	21.14	Ø10//0.10	31.60	705.17	OK	180.50	0.20	627.26	OK	20.96	Ø10//0.10	31.60	272.17	OK
18		0.25	0.70	3.56	5.09	0.70	0.03	0.25	0.10	599.53	0.60	795.96	OK	22.86	Ø10//0.10	31.60	828.88	OK	197.57	0.20	731.81	OK	22.94	Ø10//0.10	31.60	272.17	OK
4	1	0.25	0.70	3.46	4.94	0.70	0.02	0.25	0.10	472.46	0.60	795.96	OK	18.01	Ø10//0.10	31.60	828.88	OK	156.61	0.20	731.81	OK	18.18	Ø10//0.10	31.60	272.17	OK
	3	0.40	0.60	3.46	5.77	0.60	0.02	0.40	0.16	244.11	0.51	1083.46	OK	10.94	Ø8//0.10	25.00	557.89	OK	165.80	0.33	1054.94	OK	11.45	Ø8//0.10	25.00	362.14	OK
	4	0.40	0.60	3.46	5.77	0.60	0.02	0.40	0.16	260.08	0.51	1083.46	OK	11.65	Ø8//0.10	25.00	557.89	OK	176.45	0.33	1054.94	OK	12.18	Ø8//0.10	25.00	362.14	OK
	5	0.40	0.60	3.46	5.77	0.60	0.02	0.40	0.16	262.31	0.51	1083.46	OK	11.75	Ø8//0.10	25.00	557.89	OK	177.94	0.33	1054.94	OK	12.28	Ø8//0.10	25.00	362.14	OK
	6	0.40	0.60	3.46	5.77	0.60	0.02	0.40	0.16	339.23	0.51	1083.46	OK	15.20	Ø1												

11.4.4.2 Verificação dos critérios para ductilidade local

Piso	Pilar	Dimensões				Varoes x	Varoes y	bi,x [m]	bi,y [m]	s [m]	Σbi2	α _m	α _s	α	A _{sw,s} /s Adotado [cm ² /m]	Cintas,x				A _{sw,s} /s Adotado [cm ² /m]	Cintas,y				Taxa Mecânica Volumétrica			2º termo	Verificação		
		x	y	b ₀ [m]	h ₀ [m]											Ext _x	Ø [cm2]	Int _x (b _{1x})	Ø [cm2]		Ext _y	Ø [cm2]	Int _y (b _{1y})	Ø [cm2]	V _{hdblo} [m ³]	V _{clntas} [m ³]	V _{wed}				
-1	1	0.25	0.70	0.19	0.64	3.00	4.00	0.095	0.213	0.100	0.155	0.788	0.679	0.54	Ø10//0.10	31.60	2.00	Ø10 0.79	4.00	Ø10 0.79	Ø10//0.10	31.60	2.00	Ø10 0.79	2.00	Ø10 0.79	0.012	0.00019	0.349	-0.034	OK
	2	0.40	0.60	0.34	0.54	3.00	4.00	0.170	0.180	0.100	0.155	0.859	0.774	0.67	Ø8//0.10	20.00	2.00	Ø8 0.50	4.00	Ø8 0.50	Ø8//0.10	20.00	2.00	Ø8 0.50	2.00	Ø8 0.50	0.018	0.00014	0.166	-0.034	OK
	3	0.40	0.60	0.34	0.54	3.00	4.00	0.170	0.180	0.100	0.155	0.859	0.774	0.67	Ø8//0.10	25.00	2.00	Ø8 0.50	4.00	Ø8 0.50	Ø8//0.10	25.00	2.00	Ø8 0.50	2.00	Ø8 0.50	0.018	0.00014	0.166	-0.034	OK
	4	0.40	0.60	0.34	0.54	3.00	4.00	0.170	0.180	0.100	0.155	0.859	0.774	0.67	Ø8//0.10	25.00	2.00	Ø8 0.50	4.00	Ø8 0.50	Ø8//0.10	25.00	2.00	Ø8 0.50	2.00	Ø8 0.50	0.018	0.00014	0.166	-0.034	OK
	5	0.40	0.60	0.34	0.54	3.00	4.00	0.170	0.180	0.100	0.155	0.859	0.774	0.67	Ø8//0.10	25.00	2.00	Ø8 0.50	4.00	Ø8 0.50	Ø8//0.10	25.00	2.00	Ø8 0.50	2.00	Ø8 0.50	0.018	0.00014	0.166	-0.034	OK
	6	0.40	0.60	0.34	0.54	4.00	4.00	0.113	0.180	0.150	0.136	0.877	0.671	0.59	Ø10//0.15	21.08	2.00	Ø10 0.79	6.00	Ø10 0.79	Ø10//0.15	21.08	2.00	Ø10 0.79	2.00	Ø10 0.79	0.028	0.00022	0.175	-0.034	OK
	7	0.40	0.60	0.34	0.54	4.00	4.00	0.113	0.180	0.150	0.136	0.877	0.671	0.59	Ø10//0.15	21.08	2.00	Ø10 0.79	6.00	Ø10 0.79	Ø10//0.15	21.08	2.00	Ø10 0.79	2.00	Ø10 0.79	0.028	0.00022	0.175	-0.034	OK
	8	0.40	0.60	0.34	0.54	4.00	4.00	0.113	0.180	0.100	0.136	0.877	0.774	0.68	Ø8//0.10	20.00	2.00	Ø8 0.50	6.00	Ø8 0.50	Ø8//0.10	20.00	2.00	Ø8 0.50	2.00	Ø8 0.50	0.018	0.00014	0.166	-0.034	OK
	9	0.25	0.70	0.19	0.64	3.00	4.00	0.095	0.213	0.100	0.155	0.788	0.679	0.54	Ø10//0.10	31.60	2.00	Ø10 0.79	4.00	Ø10 0.79	Ø10//0.10	31.60	2.00	Ø10 0.79	2.00	Ø10 0.79	0.012	0.00019	0.349	0.062	OK
	17	0.40	0.80	0.34	0.74	4.00	5.00	0.113	0.185	0.125	0.175	0.884	0.747	0.66	Ø10//0.10	31.60	2.00	Ø10 0.79	9.00	Ø10 0.79	Ø10//0.10	31.60	2.00	Ø10 0.79	4.00	Ø10 0.79	0.031	0.00031	0.214	-0.003	OK
18	0.25	0.90	0.19	0.84	3.00	5.00	0.095	0.210	0.100	0.194	0.797	0.693	0.55	Ø12//0.10	45.20	2.00	Ø12 1.13	6.00	Ø12 1.13	Ø12//0.10	45.20	2.00	Ø12 1.13	4.00	Ø12 1.13	0.016	0.00039	0.534	0.079	OK	
25	0.40	0.80	0.34	0.74	5.00	5.00	0.085	0.185	0.100	0.166	0.890	0.795	0.71	Ø10//0.10+Ø8//0.10	25.80	2.00	Ø10 0.79	12.00	Ø8 0.50	Ø10//0.10+Ø8//0.10	25.80	2.00	Ø10 0.79	4.00	Ø8 0.50	0.025	0.00026	0.224	-0.011	OK	
1	1	0.25	0.70	0.19	0.64	3.00	4.00	0.095	0.213	0.100	0.155	0.788	0.679	0.54	Ø10//0.10	31.60	2.00	Ø10 0.79	4.00	Ø10 0.79	Ø10//0.10	31.60	2.00	Ø10 0.79	2.00	Ø10 0.79	0.012	0.00019	0.349	-0.034	OK
	2	0.40	0.60	0.34	0.54	3.00	4.00	0.170	0.180	0.100	0.155	0.859	0.774	0.67	Ø8//0.10	20.00	2.00	Ø8 0.50	4.00	Ø8 0.50	Ø8//0.10	20.00	2.00	Ø8 0.50	2.00	Ø8 0.50	0.018	0.00014	0.166	-0.034	OK
	3	0.40	0.60	0.34	0.54	3.00	4.00	0.170	0.180	0.100	0.155	0.859	0.774	0.67	Ø8//0.10	25.00	2.00	Ø8 0.50	4.00	Ø8 0.50	Ø8//0.10	25.00	2.00	Ø8 0.50	2.00	Ø8 0.50	0.018	0.00014	0.166	-0.034	OK
	4	0.40	0.60	0.34	0.54	3.00	4.00	0.170	0.180	0.100	0.155	0.859	0.774	0.67	Ø8//0.10	25.00	2.00	Ø8 0.50	4.00	Ø8 0.50	Ø8//0.10	25.00	2.00	Ø8 0.50	2.00	Ø8 0.50	0.018	0.00014	0.166	-0.034	OK
	5	0.40	0.60	0.34	0.54	3.00	4.00	0.170	0.180	0.100	0.155	0.859	0.774	0.67	Ø8//0.10	25.00	2.00	Ø8 0.50	4.00	Ø8 0.50	Ø8//0.10	25.00	2.00	Ø8 0.50	2.00	Ø8 0.50	0.018	0.00014	0.166	-0.034	OK
	6	0.40	0.60	0.34	0.54	4.00	4.00	0.113	0.180	0.150	0.136	0.877	0.671	0.59	Ø10//0.15	21.08	2.00	Ø10 0.79	6.00	Ø10 0.79	Ø10//0.15	21.08	2.00	Ø10 0.79	2.00	Ø10 0.79	0.028	0.00022	0.175	-0.034	OK
	7	0.40	0.60	0.34	0.54	4.00	4.00	0.113	0.180	0.150	0.136	0.877	0.671	0.59	Ø10//0.15	21.08	2.00	Ø10 0.79	6.00	Ø10 0.79	Ø10//0.15	21.08	2.00	Ø10 0.79	2.00	Ø10 0.79	0.028	0.00022	0.175	-0.034	OK
	8	0.40	0.60	0.34	0.54	4.00	4.00	0.113	0.180	0.100	0.136	0.877	0.774	0.68	Ø8//0.10	20.00	2.00	Ø8 0.50	6.00	Ø8 0.50	Ø8//0.10	20.00	2.00	Ø8 0.50	2.00	Ø8 0.50	0.018	0.00014	0.166	-0.034	OK
	9	0.25	0.70	0.19	0.64	3.00	4.00	0.095	0.213	0.100	0.155	0.788	0.679	0.54	Ø10//0.10	31.60	2.00	Ø10 0.79	4.00	Ø10 0.79	Ø10//0.10	31.60	2.00	Ø10 0.79	2.00	Ø10 0.79	0.012	0.00019	0.349	0.046	OK
	17	0.40	0.80	0.34	0.74	4.00	5.00	0.113	0.185	0.125	0.175	0.884	0.747	0.66	Ø10//0.10	31.60	2.00	Ø10 0.79	9.00	Ø10 0.79	Ø10//0.10	31.60	2.00	Ø10 0.79	4.00	Ø10 0.79	0.031	0.00031	0.214	-0.019	OK
18	0.25	0.90	0.19	0.84	3.00	5.00	0.095	0.210	0.100	0.194	0.797	0.693	0.55	Ø10//0.10	31.60	2.00	Ø10 0.79	6.00	Ø10 0.79	Ø10//0.10	31.60	2.00	Ø10 0.79	4.00	Ø10 0.79	0.016	0.00027	0.374	0.059	OK	
25	0.40	0.80	0.34	0.74	5.00	5.00	0.085	0.185	0.100	0.166	0.890	0.795	0.71	Ø10//0.10+Ø8//0.10	25.80	2.00	Ø10 0.79	12.00	Ø8 0.50	Ø10//0.10+Ø8//0.10	25.80	2.00	Ø10 0.79	4.00	Ø8 0.50	0.025	0.00026	0.224	-0.024	OK	
2	1	0.25	0.70	0.19	0.64	3.00	4.00	0.095	0.213	0.100	0.155	0.788	0.679	0.54	Ø10//0.10	31.60	2.00	Ø10 0.79	4.00	Ø10 0.79	Ø10//0.10	31.60	2.00	Ø10 0.79	2.00	Ø10 0.79	0.012	0.00019	0.349	-0.034	OK
	2	0.40	0.60	0.34	0.54	3.00	4.00	0.170	0.180	0.100	0.155	0.859	0.774	0.67	Ø8//0.10	20.00	2.00	Ø8 0.50	4.00	Ø8 0.50	Ø8//0.10	20.00	2.00	Ø8 0.50	2.00	Ø8 0.50	0.018	0.00014	0.166	-0.034	OK
	3	0.40	0.60	0.34	0.54	3.00	4.00	0.170	0.180	0.100	0.155	0.859	0.774	0.67	Ø8//0.10	25.00	2.00	Ø8 0.50	4.00	Ø8 0.50	Ø8//0.10	25.00	2.00	Ø8 0.50	2.00	Ø8 0.50	0.018	0.00014	0.166	-0.034	OK
	4	0.40	0.60	0.34	0.54	3.00	4.00	0.170	0.180	0.100	0.155	0.859	0.774	0.67	Ø8//0.10	25.00	2.00	Ø8 0.50	4.00	Ø8 0.50	Ø8//0.10	25.00	2.00	Ø8 0.50	2.00	Ø8 0.50	0.018	0.00014	0.166	-0.034	OK
	5	0.40	0.60	0.34	0.54	3.00	4.00	0.170	0.180	0.100	0.155	0.859	0.774	0.67	Ø8//0.10	25.00	2.00	Ø8 0.50	4.00	Ø8 0.50	Ø8//0.10	25.00	2.00	Ø8 0.50	2.00	Ø8 0.50	0.018	0.00014	0.166	-0.034	OK
	6	0.40	0.60	0.34	0.54	4.00	4.00	0.113	0.180	0.150	0.136	0.877	0.671	0.59	Ø10//0.15	21.08	2.00	Ø10 0.79	6.00	Ø10 0.79	Ø10//0.15	21.08	2.00	Ø10 0.79	2.00	Ø10 0.79	0.028	0.00022	0.175	-0.034	OK
	7	0.40	0.60	0.34	0.54	4.00	4.00	0.113	0.180	0.150	0.136	0.877	0.671	0.59	Ø10//0.15	21.08	2.00	Ø10 0.79	6.00	Ø10 0.79	Ø10//0.15	21.08	2.00	Ø10 0.79	2.00	Ø10 0.79	0.028	0.00022	0.175	-0.034	OK
	9	0.25	0.70	0.19	0.64	3.00	4.00	0.095	0.213	0.100	0.155	0.788	0.679	0.54	Ø10//0.10	31.60	2.00	Ø10 0.79	4.00	Ø10 0.79	Ø10//0.10	31.60	2.00	Ø10 0.79	2.00	Ø10 0.79	0.012	0.00019	0.349	0.029	OK
	18	0.25	0.90	0.19	0.84	3.00	5.00	0.095	0.210	0.100	0.194	0.797	0.693	0.55	Ø10//0.10	31.60	2.00	Ø10 0.79	6.00	Ø10 0.79	Ø10//0.10	31.60	2.00	Ø10 0.79	4.00	Ø10 0.79	0.016	0.00027	0.374	0.040	OK
	3	1	0.25	0.70	0.19	0.64	3.00	4.00	0.095	0.213	0.100	0.155	0.788	0.679	0.54	Ø10//0.10	31.60	2.00	Ø10 0.79	4.00	Ø10 0.79	Ø10//0.10	31.60	2.00	Ø10 0.79						

11.4.4.3 Armaduras zona corrente

Piso	Pilar	Dimensões		l _{cl} [m]	l _{cr} [m]	S _{d,max} EC2 [m]	Crítico V _{Ed,x} [KN]	Corrente V _{Ed,y} [KN]	z _y [m]	V _{Rd,max,x} [KN]	V _{Ed,x} <V _{Rd,max,x}	A _{sw,x} /s [cm ² /m]	A _{sw,x} /s Adotado [cm ² /m]	V _{Rd,s,x} [KN]	V _{Ed,x} <V _{Rd,s,x}	Crítico V _{Ed,y} [KN]	Corrente V _{Ed,y} [KN]	z _x [m]	V _{Rd,max,y} [KN]	V _{Ed,y} <V _{Rd,max,y}	A _{sw,y} /s [cm ² /m]	A _{sw,y} /s Adotado [cm ² /m]	V _{Rd,s,y} [KN]	V _{Ed,y} <V _{Rd,s,y}			
		x	y																								
-1	1	0.25	0.70	0.00	0.00	0.250	-6.30	#DIV/0!	0.60	795.96	#DIV/0!	#DIV/0!	Ø10//0.20	15.80	414.44	#DIV/0!	45.68	#DIV/0!	0.20	731.81	#DIV/0!	#DIV/0!	Ø10//0.20	15.80	136.09	#DIV/0!	
	2	0.40	0.60	0.00	0.00	0.240	2.25	#DIV/0!	0.51	1083.46	#DIV/0!	#DIV/0!	Ø8//0.20	10.00	223.16	#DIV/0!	23.03	#DIV/0!	0.33	1054.94	#DIV/0!	#DIV/0!	Ø8//0.20	10.00	144.86	#DIV/0!	
	3	0.40	0.60	0.00	0.00	0.400	-1.92	#DIV/0!	0.51	1083.46	#DIV/0!	#DIV/0!	Ø8//0.15	13.32	297.24	#DIV/0!	11.54	#DIV/0!	0.33	1054.94	#DIV/0!	#DIV/0!	Ø8//0.15	13.32	192.95	#DIV/0!	
	4	0.40	0.60	0.00	0.00	0.400	0.38	#DIV/0!	0.51	1083.46	#DIV/0!	#DIV/0!	Ø8//0.15	13.32	297.24	#DIV/0!	26.54	#DIV/0!	0.33	1054.94	#DIV/0!	#DIV/0!	Ø8//0.15	13.32	192.95	#DIV/0!	
	5	0.40	0.60	0.00	0.00	0.400	-0.57	#DIV/0!	0.51	1083.46	#DIV/0!	#DIV/0!	Ø8//0.15	13.32	297.24	#DIV/0!	27.25	#DIV/0!	0.33	1054.94	#DIV/0!	#DIV/0!	Ø8//0.15	13.32	192.95	#DIV/0!	
	6	0.40	0.60	0.00	0.00	0.400	3.22	#DIV/0!	0.51	1083.46	#DIV/0!	#DIV/0!	Ø10//0.25	12.64	282.07	#DIV/0!	27.58	#DIV/0!	0.33	1054.94	#DIV/0!	#DIV/0!	Ø10//0.25	12.64	183.10	#DIV/0!	
	7	0.40	0.60	0.00	0.00	0.400	-1.20	#DIV/0!	0.51	1083.46	#DIV/0!	#DIV/0!	Ø10//0.25	12.64	282.07	#DIV/0!	34.13	#DIV/0!	0.33	1054.94	#DIV/0!	#DIV/0!	Ø10//0.25	12.64	183.10	#DIV/0!	
	8	0.40	0.60	0.00	0.00	0.240	1.68	#DIV/0!	0.51	1083.46	#DIV/0!	#DIV/0!	Ø8//0.20	10.00	223.16	#DIV/0!	45.25	#DIV/0!	0.33	1054.94	#DIV/0!	#DIV/0!	Ø8//0.20	10.00	144.86	#DIV/0!	
	9	0.25	0.70	2.61	0.70	0.250	795.96	369.01	0.60	795.96	OK	14.07	Ø10//0.20	15.80	414.44	OK	270.23	125.28	0.20	731.81	OK	14.55	Ø10//0.20	15.80	136.09	OK	
	17	0.40	0.80	2.61	0.80	0.400	868.12	335.94	0.69	1463.62	OK	11.14	Ø10//0.25	12.64	381.04	OK	407.47	157.68	0.33	1406.59	OK	10.89	Ø10//0.25	12.64	183.10	OK	
	18	0.25	0.90	2.61	2.61	0.250	1033.56	-1033.56	0.78	1033.56	OK	-30.34	Ø12//0.10	45.20	1539.53	OK	315.87	-315.87	0.20	940.90	OK	-36.67	Ø12//0.10	45.20	389.31	OK	
	25	0.40	0.80	2.61	0.80	0.320	687.88	266.19	0.69	1463.62	OK	8.83	Ø10//0.25+Ø8//0.25	10.32	311.10	OK	284.41	110.06	0.33	1406.59	OK	7.60	Ø10//0.25+Ø8//0.25	10.32	149.49	OK	
	1	1	0.25	0.70	0.00	0.00	0.250	-5.27	#DIV/0!	0.60	795.96	#DIV/0!	#DIV/0!	Ø10//0.20	15.80	414.44	#DIV/0!	117.88	#DIV/0!	0.20	731.81	#DIV/0!	#DIV/0!	Ø10//0.20	15.80	136.09	#DIV/0!
		2	0.40	0.60	0.00	0.00	0.240	-0.17	#DIV/0!	0.51	1083.46	#DIV/0!	#DIV/0!	Ø8//0.20	10.00	223.16	#DIV/0!	37.12	#DIV/0!	0.33	1054.94	#DIV/0!	#DIV/0!	Ø8//0.20	10.00	144.86	#DIV/0!
		3	0.40	0.60	0.00	0.00	0.400	0.11	#DIV/0!	0.51	1083.46	#DIV/0!	#DIV/0!	Ø8//0.15	13.32	297.24	#DIV/0!	12.32	#DIV/0!	0.33	1054.94	#DIV/0!	#DIV/0!	Ø8//0.15	13.32	192.95	#DIV/0!
		4	0.40	0.60	0.00	0.00	0.400	0.25	#DIV/0!	0.51	1083.46	#DIV/0!	#DIV/0!	Ø8//0.15	13.32	297.24	#DIV/0!	57.40	#DIV/0!	0.33	1054.94	#DIV/0!	#DIV/0!	Ø8//0.15	13.32	192.95	#DIV/0!
		5	0.40	0.60	0.00	0.00	0.400	-0.30	#DIV/0!	0.51	1083.46	#DIV/0!	#DIV/0!	Ø8//0.15	13.32	297.24	#DIV/0!	55.61	#DIV/0!	0.33	1054.94	#DIV/0!	#DIV/0!	Ø8//0.15	13.32	192.95	#DIV/0!
		6	0.40	0.60	0.00	0.00	0.400	-0.47	#DIV/0!	0.51	1083.46	#DIV/0!	#DIV/0!	Ø10//0.25	12.64	282.07	#DIV/0!	48.29	#DIV/0!	0.33	1054.94	#DIV/0!	#DIV/0!	Ø10//0.25	12.64	183.10	#DIV/0!
7		0.40	0.60	0.00	0.00	0.400	-0.32	#DIV/0!	0.51	1083.46	#DIV/0!	#DIV/0!	Ø10//0.25	12.64	282.07	#DIV/0!	53.39	#DIV/0!	0.33	1054.94	#DIV/0!	#DIV/0!	Ø10//0.25	12.64	183.10	#DIV/0!	
8		0.40	0.60	0.00	0.00	0.240	1.29	#DIV/0!	0.51	1083.46	#DIV/0!	#DIV/0!	Ø8//0.20	10.00	223.16	#DIV/0!	93.68	#DIV/0!	0.33	1054.94	#DIV/0!	#DIV/0!	Ø8//0.20	10.00	144.86	#DIV/0!	
9		0.25	0.70	3.56	0.70	0.250	607.80	368.78	0.60	795.96	OK	14.06	Ø10//0.20	15.80	414.44	OK	198.61	120.51	0.20	731.81	OK	13.99	Ø10//0.20	15.80	136.09	OK	
17		0.40	0.80	3.56	0.80	0.400	529.78	291.68	0.69	1463.62	OK	9.68	Ø10//0.25	12.64	381.04	OK	326.23	179.61	0.33	1406.59	OK	12.40	Ø10//0.25	12.64	183.10	OK	
18		0.25	0.90	3.56	0.90	0.250	867.20	428.73	0.78	1033.56	OK	12.59	Ø10//0.20	15.80	538.16	OK	235.33	116.34	0.20	940.90	OK	13.51	Ø10//0.20	15.80	136.09	OK	
25		0.40	0.80	3.56	0.80	0.320	409.68	225.55	0.69	1463.62	OK	7.48	Ø10//0.25+Ø8//0.25	10.32	311.10	OK	228.70	125.91	0.33	1406.59	OK	8.69	Ø10//0.25+Ø8//0.25	10.32	149.49	OK	
2		1	0.25	0.70	0.00	0.00	0.250	-10.77	#DIV/0!	0.60	795.96	#DIV/0!	#DIV/0!	Ø10//0.20	15.80	414.44	#DIV/0!	105.29	#DIV/0!	0.20	731.81	#DIV/0!	#DIV/0!	Ø10//0.20	15.80	136.09	#DIV/0!
		2	0.40	0.60	0.00	0.00	0.240	-0.10	#DIV/0!	0.51	1083.46	#DIV/0!	#DIV/0!	Ø8//0.20	10.00	223.16	#DIV/0!	72.69	#DIV/0!	0.33	1054.94	#DIV/0!	#DIV/0!	Ø8//0.20	10.00	144.86	#DIV/0!
		3	0.40	0.60	0.00	0.00	0.400	2.37	#DIV/0!	0.51	1083.46	#DIV/0!	#DIV/0!	Ø8//0.15	13.32	297.24	#DIV/0!	17.18	#DIV/0!	0.33	1054.94	#DIV/0!	#DIV/0!	Ø8//0.15	13.32	192.95	#DIV/0!
		4	0.40	0.60	0.00	0.00	0.400	3.54	#DIV/0!	0.51	1083.46	#DIV/0!	#DIV/0!	Ø8//0.15	13.32	297.24	#DIV/0!	71.46	#DIV/0!	0.33	1054.94	#DIV/0!	#DIV/0!	Ø8//0.15	13.32	192.95	#DIV/0!
		5	0.40	0.60	0.00	0.00	0.400	3.88	#DIV/0!	0.51	1083.46	#DIV/0!	#DIV/0!	Ø8//0.15	13.32	297.24	#DIV/0!	70.24	#DIV/0!	0.33	1054.94	#DIV/0!	#DIV/0!	Ø8//0.15	13.32	192.95	#DIV/0!
		6	0.40	0.60	0.00	0.00	0.400	-4.02	#DIV/0!	0.51	1083.46	#DIV/0!	#DIV/0!	Ø10//0.25	12.64	282.07	#DIV/0!	61.01	#DIV/0!	0.33	1054.94	#DIV/0!	#DIV/0!	Ø10//0.25	12.64	183.10	#DIV/0!
	7	0.40	0.60	0.00	0.00	0.400	4.94	#DIV/0!	0.51	1083.46	#DIV/0!	#DIV/0!	Ø10//0.25	12.64	282.07	#DIV/0!	71.54	#DIV/0!	0.33	1054.94	#DIV/0!	#DIV/0!	Ø10//0.25	12.64	183.10	#DIV/0!	
	9	0.25	0.70	3.56	0.70	0.250	591.53	358.91	0.60	795.96	OK	13.68	Ø10//0.20	15.80	414.44	OK	211.96	128.60	0.20	731.81	OK	14.93	Ø10//0.20	15.80	136.09	OK	
	18	0.25	0.90	3.56	0.90	0.250	854.23	422.31	0.78	1033.56	OK	12.40	Ø10//0.20	15.80	538.16	OK	231.72	114.56	0.20	940.90	OK	13.30	Ø10//0.20	15.80	136.09	OK	
	3	1	0.25	0.70	3.46	0.70	0.250	469.95	279.79	0.60	795.96	OK	10.67	Ø10//0.20	15.80	414.44	OK	155.71	92.71	0.20	731.81	OK	10.76	Ø10//0.20	15.80	136.09	OK
		3	0.40	0.60	3.46	0.60	0.400	299.94	195.91	0.51	1083.46	OK	8.78	Ø8//0.15	13.32	297.24	OK	203.02	132.61	0.33	1054.94	OK	9.15	Ø8//0.15	13.32	192.95	OK
		4	0.40	0.60	3.46	0.60	0.400	335.50	219.14	0.51	1083.46	OK	9.82	Ø8//0.15	13.32	297.24	OK	226.73	148.10	0.33	1054.94	OK	10.22	Ø8//0.15	13.32	192.95	OK
		5	0.40	0.60	3.46	0.60	0.400	338.60	221.17	0.51	1083.46	OK	9.91	Ø8//0.15	13.32	297.24	OK	228.80	149.45	0.33	1054.94	OK	10.32	Ø8//0.15	13.32	192.95	OK
		6	0.40	0.60	3.46	0.60	0.400	403.01	263.24	0.51	1083.46	OK	11.80	Ø10//0.25	12.64	282.07	OK	228.11	149.00	0.33	1054.94	OK	10.29	Ø10//0.25	12.64	183.10	OK
		7	0.40	0.60	3.46	0.60	0.400	360.52	235.48	0.51	1083.46	OK	10.55	Ø10//0.25	12.64	282.07	OK	199.78	130.49	0.33	1054.94	OK	9.01	Ø10//0.25	12.64	183.10	OK
		9	0.25	0.60	3.56	0.60	0.250	471.84	312.79	0.51	677.16	OK	14.02	Ø10//0.15	21.08	470.41	OK	180.50	119.66	0.20	627.26	OK	13.89	Ø10//0.15	21.08	181.56	OK
		18	0.25	0.70	3.56	0.70	0.250	599.53	363.76	0.60	795.96	OK	13.87	Ø10//0.15	21.08	552.94	OK	197.57	119.87	0.20	731.81	OK	13.92	Ø10//0.15	21.08	181.56	OK
		4	1	0.25	0.70	3.46	0.70	0.250	472.46	281.29	0.60	795.96	OK	10.72	Ø10//0.20	15.80	414.44	OK	156.61	93.24	0.20	731.81	OK	10.83	Ø10//0.20	15.80	136.09
3			0.40	0.60	3.46	0.60	0.400	244.11	159.45	0.51	1083.46	OK	7.15	Ø8//0.15	13.32	297.24	OK	165.80	108.30	0.33	1054.94	OK	7.48	Ø8//0.15	13.32	192.95	OK
4			0.40	0.60	3.46	0.60	0.400	260.08	169.88	0.51	1083.46	OK	7.61	Ø8//0.15	13.32	297.24	OK	176.45	115.26	0.33	1054.94	OK	7.96	Ø8//0.15	13.32	192.95	OK
5			0.40	0.60	3.46	0.60	0.400	262.31	171.33	0.51	1083.46	OK	7.68	Ø8//0.15	13.32	297.24	OK	177.94	116.22	0.33	1054.94	OK	8.02	Ø8//0.15	13.32	192.95	OK
6			0.40	0.60	3.46	0.60	0.400	339.23	221.58	0.51	1083.46	OK	9.93	Ø10//0.25	12.64	282.07	OK	185.59	121.22	0.33	1054.94	OK	8.37	Ø10//0.25	12.64	183.10	OK
7			0.40	0.60	3.46	0.60	0.400	299.73	195.78																		

11.5 Pilares secundários

11.5.1 VERIFICAÇÃO AO ESFORÇO AXIAL REDUZIDO

Piso	Pilar	Dimensões		N _{Ed,max} [KN]	v _d	Verificação
		x	y			
-1	10	0.40	0.80	-2968.72	0.46	OK
	11	0.40	0.80	-8358.02	1.31	FAIL
	12	0.80	0.40	-7761.26	1.21	FAIL
	13	0.40	0.80	-7759.84	1.21	FAIL
	14	0.40	0.80	-7439.54	1.16	FAIL
	15	0.40	0.80	-4174.30	0.65	FAIL
	16	0.40	0.80	-2807.68	0.44	OK
	19	0.40	1.00	-8164.25	1.02	FAIL
	20	0.40	1.00	-7774.99	0.97	FAIL
	21	0.40	1.00	-7795.87	0.97	FAIL
	22	0.40	1.00	-7774.69	0.97	FAIL
	23	0.40	1.00	-6522.29	0.82	FAIL
24	0.40	0.80	-4403.10	0.69	FAIL	
1	10	0.40	0.80	-2968.72	0.46	OK
	11	0.40	0.80	-6556.56	1.02	FAIL
	12	0.80	0.40	-6458.21	1.01	FAIL
	13	0.40	0.80	-6382.77	1.00	FAIL
	14	0.40	0.80	-6122.30	0.96	FAIL
	15	0.40	0.80	-3335.63	0.52	OK
	16	0.40	0.80	-1831.28	0.29	OK
	19	0.40	1.00	-6536.88	0.82	FAIL
	20	0.40	1.00	-6120.23	0.77	FAIL
	21	0.40	1.00	-6139.09	0.77	FAIL
	22	0.40	1.00	-6116.10	0.76	FAIL
	23	0.40	1.00	-5155.23	0.64	OK
24	0.40	0.80	-3604.78	0.56	OK	
2	10	0.40	0.80	-841.36	0.13	OK
	11	0.40	0.80	-4986.55	0.78	FAIL
	12	0.80	0.40	-5223.74	0.82	FAIL
	13	0.40	0.80	-5051.50	0.79	FAIL
	14	0.40	0.80	-4847.49	0.76	FAIL
	15	0.40	0.80	-2642.80	0.41	OK
	16	0.40	0.80	-892.60	0.14	OK
	19	0.40	1.00	-4993.95	0.62	OK
	20	0.40	1.00	-4645.64	0.58	OK
	21	0.40	1.00	-4668.01	0.58	OK
	22	0.40	1.00	-4645.59	0.58	OK
	23	0.40	1.00	-3827.64	0.48	OK
24	0.40	0.80	-2878.28	0.45	OK	
3	11	0.40	0.60	-3432.69	0.72	FAIL
	12	0.80	0.40	-3986.49	0.62	OK
	13	0.40	0.60	-3709.42	0.77	FAIL
	14	0.40	0.60	-3564.16	0.74	FAIL
	15	0.40	0.60	-1878.04	0.39	OK
	16	0.40	0.60	-722.42	0.15	OK
	19	0.40	0.80	-3574.76	0.56	OK
	20	0.40	0.80	-3290.01	0.51	OK
	21	0.40	0.80	-3322.96	0.52	OK
	22	0.40	0.80	-3292.40	0.51	OK
	23	0.40	0.80	-2671.78	0.42	OK
	24	0.40	0.60	-1800.70	0.38	OK
4	11	0.40	0.60	-2299.38	0.48	OK
	12	0.80	0.40	-2689.75	0.42	OK
	13	0.40	0.60	-2363.88	0.49	OK
	14	0.40	0.60	-2295.69	0.48	OK
	15	0.40	0.60	-1199.13	0.25	OK
	16	0.40	0.60	-441.48	0.09	OK
	19	0.40	0.80	-2344.14	0.37	OK
	20	0.40	0.80	-2172.27	0.34	OK
	21	0.40	0.80	-2203.12	0.34	OK
	22	0.40	0.80	-2182.68	0.34	OK
	23	0.40	0.80	-1691.61	0.26	OK
	24	0.40	0.60	-1104.01	0.23	OK
5	11	0.40	0.60	-1222.48	0.25	OK
	12	0.80	0.40	-1358.56	0.21	OK
	13	0.40	0.60	-941.28	0.20	OK
	14	0.40	0.60	-932.93	0.19	OK
	15	0.40	0.60	-364.24	0.08	OK
	16	0.40	0.60	-171.10	0.04	OK
	19	0.40	0.80	-1122.50	0.18	OK
	20	0.40	0.80	-1053.14	0.16	OK
	21	0.40	0.80	-1095.79	0.17	OK
	22	0.40	0.80	-1085.17	0.17	OK
	23	0.40	0.80	-760.52	0.12	OK
	24	0.40	0.60	-484.25	0.10	OK
26	0.30	0.50	-133.78	0.04	OK	
27	0.30	0.50	-132.47	0.04	OK	

11.5.2 DIMENSIONAMENTO

Pilar	Dimensões		Piso	N _{Ed,max} [KN]	N _{min} [KN]	M _x [KN.m]	M _{x,min} [KN.m]	V _y [KN]	M _y [KN.m]	M _{y,min} [KN.m]	V _x [KN]	A _{sx} [cm ²]		A _{sy} [cm ²]		EF
	x	y														
10	0.40	0.80	-1	-2968.72	-2791.23	-470.91	465.95	198.45	73.26	-60.94	-31.15	5Ø25	24.55	2Ø25+4Ø20	22.38	39.30%
	0.40	0.80	1	-1913.03	-1781.58	-386.03	362.72	-173.17	-74.91	70.99	-34.62	5Ø25	24.55	2Ø25+4Ø20	22.38	34.90%
	0.40	0.80	2	-841.36	-773.95	-672.05	561.65	277.68	198.45	-147.46	-86.11	5Ø25	24.55	2Ø25+4Ø20	22.38	76.50%
11	0.40	0.80	-1	-8358.02	-2988.78	-786.24	557.38	236.46	32.34	-16.86	-9.20	6Ø25	29.46	25+2Ø20 (8de:	25.92	95.60%
	0.40	0.80	1	-6556.56	-2722.27	928.69	-768.43	403.01	-55.23	51.60	-25.38	6Ø25	29.46	4Ø25+2Ø20	25.92	75.10%
	0.40	0.80	2	-4986.55	-2482.68	-898.24	749.55	391.34	-67.57	66.11	-31.69	6Ø25	29.46	4Ø25+2Ø20	25.92	60.20%
	0.40	0.60	3	-3432.69	-2265.23	-602.73	556.80	275.73	106.67	-99.62	-48.59	6Ø25	29.46	25+1Ø20 (7de:	22.78	62.00%
	0.40	0.60	4	-2299.38	-1535.23	580.46	-551.85	269.49	-131.34	129.79	-62.17	6Ø25	29.46	4Ø25+1Ø20	22.78	57.10%
	0.40	0.60	5	-1222.48	-813.24	-709.71	668.84	427.19	147.23	-107.96	-79.28	6Ø25	29.46	4Ø25+1Ø20	22.78	67.90%
12	0.80	0.40	-1	-7761.26	-5517.46	-357.92	302.55	153.58	-79.64	68.21	19.87	8Ø25	39.28	3Ø25	14.73	96.80%
	0.80	0.40	1	-6458.21	-4573.50	-365.87	353.07	171.09	169.96	-167.46	-72.91	8Ø25	39.28	3Ø25	14.73	71.90%
	0.80	0.40	2	-5223.74	-3632.09	-377.28	371.81	178.26	193.53	-168.77	-80.27	8Ø25	39.28	3Ø25	14.73	61.90%
	0.80	0.40	3	-3986.49	-2704.41	-417.22	405.37	195.79	-296.78	228.68	-123.41	7Ø25	34.37	2Ø25+1Ø20	12.98	69.70%
	0.80	0.40	4	-2689.75	-1801.49	384.90	-373.63	180.56	-195.68	170.31	-83.22	7Ø25	34.37	2Ø25+1Ø20	12.98	56.30%
	0.80	0.40	5	-1358.56	-831.00	-476.77	457.38	296.84	317.65	-261.96	-362.62	7Ø25	34.37	2Ø25+1Ø20	12.98	75.30%
13	0.40	0.80	-1	-7759.84	-7557.97	-551.57	472.68	219.38	-12.56	3.36	3.66	5Ø25	24.55	2Ø25+4Ø20	22.38	97.40%
	0.40	0.80	1	-6382.77	-6218.78	-444.21	375.93	192.55	37.22	-29.86	15.95	5Ø25	24.55	2Ø25+4Ø20	22.38	48.80%
	0.40	0.80	2	-5051.50	-4899.61	-554.92	498.62	248.93	-48.69	46.57	22.52	5Ø25	24.55	2Ø25+4Ø20	22.38	48.00%
	0.40	0.60	3	-3709.42	-3574.63	-414.03	347.25	180.85	-85.48	79.79	-38.84	4Ø25	19.64	2Ø25+2Ø20	16.1	69.60%
	0.40	0.60	4	-2363.88	-2278.26	-412.50	410.41	195.88	89.69	-87.85	-42.27	4Ø25	19.64	2Ø25+2Ø20	16.1	59.80%
	0.40	0.60	5	-941.28	-857.04	-516.00	333.64	202.26	85.45	-68.49	-36.64	4Ø25	19.64	2Ø25+2Ø20	16.1	74.40%
14	0.40	0.80	-1	-7439.54	-6891.14	-562.24	502.81	221.62	-8.76	2.65	2.64	5Ø25	24.55	2Ø25+4Ø20	22.38	84.80%
	0.40	0.80	1	-6122.30	-5598.97	-403.97	350.92	177.13	40.14	-38.65	18.73	5Ø25	24.55	2Ø25+4Ø20	22.38	42.30%
	0.40	0.80	2	-4847.49	-4380.05	-516.79	484.67	237.08	-69.70	64.23	31.76	5Ø25	24.55	2Ø25+4Ø20	22.38	45.60%
	0.40	0.60	3	-3564.16	-3183.58	-404.22	350.54	179.16	105.07	-102.81	49.48	4Ø25	19.64	2Ø25+2Ø20	16.1	69.80%
	0.40	0.60	4	-2295.69	-2022.85	398.67	389.86	187.70	-113.65	109.94	53.23	4Ø25	19.64	2Ø25+2Ø20	16.1	61.70%
	0.40	0.60	5	-932.93	-774.66	-444.47	298.96	176.95	-112.98	95.84	49.71	4Ø25	19.64	2Ø25+2Ø20	16.1	69.40%

14	0.40	0.80	2	-4847.49	-4380.05	-516.79	484.67	237.08	-69.70	64.23	31.76	5Ø25	24.55	2Ø25+4Ø20	22.38	45.60%
	0.40	0.60	3	-3564.16	-3183.58	-404.22	350.54	179.16	105.07	-102.81	49.48	4Ø25	19.64	2Ø25+2Ø20	16.1	69.80%
	0.40	0.60	4	-2295.69	-2022.85	398.67	389.86	187.70	-113.65	109.94	53.23	4Ø25	19.64	2Ø25+2Ø20	16.1	61.70%
	0.40	0.60	5	-932.93	-774.66	-444.47	298.96	176.95	-112.98	95.84	49.71	4Ø25	19.64	2Ø25+2Ø20	16.1	69.40%
15	0.40	0.80	-1	-4174.30	-1820.01	613.10	-515.90	-234.71	-78.93	-38.56	24.79	5Ø25	24.55	2Ø25+3Ø20	19.24	51.80%
	0.40	0.80	1	-3335.63	-1306.96	-414.28	413.53	-192.46	136.35	-132.90	64.07	5Ø25	24.55	2Ø25+3Ø20	19.24	42.30%
	0.40	0.80	2	-2642.80	-845.33	590.75	-575.51	-276.01	-169.44	153.23	76.63	5Ø25	24.55	2Ø25+3Ø20	19.24	56.10%
	0.40	0.60	3	-1878.04	-574.10	441.85	-440.43	202.95	-178.50	176.04	84.41	5Ø25	24.55	2Ø25+3Ø20	19.24	65.30%
	0.40	0.60	4	-1199.13	-474.10	488.18	-440.20	-221.00	186.83	-186.20	88.81	5Ø25	24.55	2Ø25+3Ø20	19.24	71.40%
	0.40	0.60	5	-364.24	-126.37	-353.36	289.00	-205.58	181.16	-137.81	107.80	5Ø25	24.55	2Ø25+3Ø20	19.24	62.30%
16	0.40	0.80	-1	-2807.68	-251.47	729.75	-552.06	-236.52	14.92	-10.62	-4.68	6Ø25	29.46	4Ø25+2Ø20	25.92	46.20%
	0.40	0.80	1	-1831.28	-502.70	-714.36	693.76	-333.32	-19.75	17.89	8.20	6Ø25	29.46	4Ø25+2Ø20	25.92	47.00%
	0.40	0.80	2	-892.60	-791.77	-753.61	599.66	-320.29	-72.42	48.80	27.76	6Ø25	29.46	4Ø25+2Ø20	25.92	58.30%
	0.40	0.60	3	-722.42	-626.65	481.77	-418.88	-213.37	66.60	-65.78	-31.09	6Ø25	29.46	4Ø25+2Ø20	25.92	54.40%
	0.40	0.60	4	-441.48	-370.70	674.78	-568.51	-295.95	81.59	-80.91	-38.67	6Ø25	29.46	4Ø25+2Ø20	25.92	78.50%
	0.40	0.60	5	-171.10	-91.36	189.81	-170.06	-111.70	-82.68	67.62	47.58	3Ø25	14.73	2Ø25+2Ø20	16.10	48.70%
19	0.40	1.00	-1	-8164.25	-69527.48	635.43	-520.74	-203.28	27.81	-13.41	-9.22	4Ø25	19.64	2Ø25+3Ø20	19.24	72.00%
	0.40	1.00	1	-6536.88	-5421.28	-525.57	445.30	-220.26	-111.49	89.97	-47.92	4Ø25	19.64	2Ø25+3Ø20	19.24	47.40%
	0.40	1.00	2	-4993.95	-4113.87	598.70	-500.67	-252.15	142.99	132.38	-65.50	4Ø25	19.64	2Ø25+3Ø20	19.24	47.50%
	0.40	0.80	3	-3574.76	-2936.99	562.99	-537.04	-257.31	201.16	-192.36	-93.68	4Ø25	19.64	2Ø25+3Ø20	19.24	65.40%
	0.40	0.80	4	-2344.14	-1949.57	737.35	-585.92	-314.49	230.34	-226.86	-108.86	4Ø25	19.64	2Ø25+3Ø20	19.24	78.50%
	0.40	0.80	5	-1122.50	-960.93	651.99	-342.78	-235.09	185.39	-183.33	-99.22	4Ø25	19.64	2Ø25+3Ø20	19.24	71.90%
20	0.40	1.00	-1	-7774.99	-7193.00	555.62	-473.87	-177.27	-23.67	22.16	6.87	4Ø25	19.64	2Ø25+3Ø20	19.24	54.90%
	0.40	1.00	1	-6120.23	-5560.31	373.90	-359.48	163.51	80.03	-77.57	32.91	4Ø25	19.64	2Ø25+3Ø20	19.24	31.90%
	0.40	1.00	2	-4645.64	-4228.12	542.34	-458.22	-228.59	104.21	-103.08	46.60	4Ø25	19.64	2Ø25+3Ø20	19.24	39.30%
	0.40	0.80	3	-3290.01	-3013.65	476.94	-433.81	-212.69	169.72	-156.38	-77.63	4Ø25	19.64	2Ø25+3Ø20	19.24	54.40%
	0.40	0.80	4	-2172.27	-2009.44	603.84	-472.87	-255.56	196.86	-196.55	-93.67	4Ø25	19.64	2Ø25+3Ø20	19.24	65.30%
	0.40	0.80	5	-1053.14	-998.26	623.32	-319.78	-214.65	169.56	-158.79	-79.32	4Ø25	19.64	2Ø25+3Ø20	19.24	68.30%
21	0.40	1.00	-1	-7795.87	-7079.17	580.28	-511.97	-188.22	22.64	-22.55	-6.56	4Ø25	19.64	2Ø25+3Ø20	19.24	57.60%
	0.40	1.00	1	-6139.09	-5498.74	351.58	-299.67	-142.93	-80.57	77.73	-32.80	4Ø25	19.64	2Ø25+3Ø20	19.24	30.70%
	0.40	1.00	2	-4668.01	-4209.19	539.31	-465.47	-228.72	-108.74	98.90	-47.60	4Ø25	19.64	2Ø25+3Ø20	19.24	39.60%
	0.40	0.80	3	-3322.96	-3030.47	477.16	-423.27	-210.71	176.15	-162.63	-80.65	4Ø25	19.64	2Ø25+3Ø20	19.24	55.30%
	0.40	0.80	4	-2203.12	-2026.49	542.91	-440.44	-233.22	204.91	-203.87	-97.33	4Ø25	19.64	2Ø25+3Ø20	19.24	62.20%
	0.40	0.80	5	-1095.79	-1014.34	661.88	-324.06	-231.16	168.95	-168.36	-84.12	4Ø25	19.64	2Ø25+3Ø20	19.24	70.70%
22	0.40	1.00	-1	-7774.69	-6798.09	618.71	-576.59	-197.29	-21.95	17.85	6.51	4Ø25	19.64	2Ø25+3Ø20	19.24	60.90%
	0.40	1.00	1	-6116.10	-5222.03	300.96	-294.65	-125.99	89.25	-81.13	37.79	4Ø25	19.64	2Ø25+3Ø20	19.24	29.00%
	0.40	1.00	2	-4645.59	-3936.98	500.32	-471.82	-220.57	119.36	-108.98	54.31	4Ø25	19.64	2Ø25+3Ø20	19.24	38.80%
	0.40	0.80	3	-3292.40	-2787.51	467.69	-448.08	-213.78	-182.82	169.26	82.15	4Ø25	19.64	2Ø25+3Ø20	19.24	55.50%
	0.40	0.80	4	-2182.68	-1848.12	514.95	-408.54	-218.78	-204.56	201.57	96.70	4Ø25	19.64	2Ø25+3Ø20	19.24	60.50%
	0.40	0.80	5	-1085.17	-912.27	616.40	-312.92	-217.23	-197.25	177.19	89.15	4Ø25	19.64	2Ø25+3Ø20	19.24	71.00%

23	0.40	1.00	-1	-6522.29	-2776.33	-870.27	621.49	-197.56	-73.87	25.32	23.07	4Ø25	19.64	2Ø25+3Ø20	19.24	66.90%
	0.40	1.00	1	-5155.23	-1834.80	474.87	-457.64	202.85	145.97	-122.87	63.96	4Ø25	19.64	2Ø25+3Ø20	19.24	42.40%
	0.40	1.00	2	-3827.64	-1205.97	582.37	-539.39	258.41	180.29	-173.90	84.24	4Ø25	19.64	2Ø25+3Ø20	19.24	48.50%
	0.40	0.80	3	-2671.78	-802.72	459.31	-440.95	-191.89	-245.83	218.37	110.48	4Ø25	19.64	2Ø25+3Ø20	19.64	63.20%
	0.40	0.80	4	-1691.61	-603.28	439.18	-358.63	-175.62	-269.79	268.44	128.15	4Ø25	19.64	2Ø25+3Ø20	19.64	66.70%
	0.40	0.80	5	-760.52	-363.70	348.75	-330.03	-119.93	-255.71	240.30	118.08	4Ø25	19.64	2Ø25+3Ø20	19.64	64.50%
24	0.40	0.80	-1	-4403.10	-669.06	-542.10	455.97	126.74	-44.81	20.11	15.10	5Ø20	15.7	2Ø20+3Ø16	12.31	57.10%
	0.40	0.80	1	-3604.78	-406.96	527.59	-484.00	237.34	109.93	-103.21	50.49	5Ø20	15.7	2Ø20+3Ø16	12.31	58.60%
	0.40	0.80	2	-2878.28	-268.36	-641.00	608.24	295.54	109.89	-83.76	45.38	5Ø20	15.7	2Ø20+3Ø16	12.31	65.20%
	0.40	0.60	3	-1800.70	-226.37	421.24	-384.41	191.03	-104.04	91.02	-45.85	4Ø20	12.56	2Ø20+2Ø16	10.3	77.90%
	0.40	0.60	4	-1104.01	-239.53	-365.91	360.41	163.61	-105.75	104.62	50.08	4Ø20	12.56	2Ø20+2Ø16	10.3	74.40%
	0.40	0.60	5	-484.25	-205.09	-290.62	256.88	145.00	-86.38	79.92	40.34	4Ø20	12.56	2Ø20+2Ø16	10.3	68.20%
26	0.30	0.50	5	-133.78	6.99	217.05	-162.92	123.60	55.10	-52.57	-34.73	3Ø25	14.73	2Ø25+1Ø20	12.96	69.86%
27	0.30	0.50	5	-132.47	10.28	194.91	-130.61	105.00	-51.11	43.52	-30.52	3Ø25	14.73	2Ø25+1Ø20	12.96	62.80%

11.5.3 VERIFICAÇÃO À FLEXÃO DESVIADA

Piso	Pilar	Dimensões		N _{max} [KN]	M _{Ed,x} [KN.m]	M _{Ed,y} [KN.m]	A _{sx} [cm ²]	A _{sy} [cm ²]	x _x [m]	M _{Rd,x} [KN.m]	x _y [m]	M _{Rd,y} [KN.m]	EC2		
		x	y												
-1	10	0.40	0.80	-2968.72	-470.91	73.26	5Ø25	24.55	2Ø25+4Ø20	22.38	0.464	1426.921	0.232	649.329	OK
	11	0.40	0.80	-8358.02	-786.24	32.34	6Ø25	29.46	25+2Ø20 (8de	25.92	0.800	1357.917	0.400	588.157	OK
	12	0.80	0.40	-7761.26	-357.92	-79.64	8Ø25	39.28	3Ø25	14.73	0.400	785.751	0.800	883.759	OK
	13	0.40	0.80	-7759.84	-551.57	-12.56	5Ø25	24.55	2Ø25+4Ø20	22.38	0.800	1199.865	0.400	535.800	OK
	14	0.40	0.80	-7439.54	-562.24	-8.76	5Ø25	24.55	2Ø25+4Ø20	22.38	0.800	1199.865	0.400	535.800	OK
	15	0.40	0.80	-4174.30	613.10	-78.93	5Ø25	24.55	2Ø25+3Ø20	19.24	0.652	1370.935	0.326	574.895	OK
	16	0.40	0.80	-2807.68	729.75	14.92	6Ø25	29.46	4Ø25+2Ø20	25.92	0.439	1578.698	0.219	698.547	OK
	19	0.40	1.00	-8164.25	635.43	27.81	4Ø25	19.64	2Ø25+3Ø20	19.24	1.000	1443.080	0.400	540.560	OK
	20	0.40	1.00	-7774.99	555.62	-23.67	4Ø25	19.64	2Ø25+3Ø20	19.24	1.000	1443.080	0.400	540.560	OK
	21	0.40	1.00	-7795.87	580.28	22.64	4Ø25	19.64	2Ø25+3Ø20	19.24	1.000	1443.080	0.400	540.560	OK
	22	0.40	1.00	-7774.69	618.71	-21.95	4Ø25	19.64	2Ø25+3Ø20	19.24	1.000	1443.080	0.400	540.560	OK
	23	0.40	1.00	-6522.29	-870.27	-73.87	4Ø25	19.64	2Ø25+3Ø20	19.24	1.000	1443.080	0.400	540.560	OK
24	0.40	0.80	-4403.10	-542.10	-44.81	5Ø20	15.70	2Ø20+3Ø16	12.31	0.688	1054.918	0.344	456.832	OK	
1	10	0.40	0.80	-1913.03	-386.03	-74.91	5Ø25	24.55	2Ø25+4Ø20	22.38	0.299	1326.746	0.149	599.241	OK
	11	0.40	0.80	-6556.56	928.69	-55.23	6Ø25	29.46	4Ø25+2Ø20	25.92	0.800	1357.917	0.400	588.157	OK
	12	0.80	0.40	-6458.21	-365.87	169.96	8Ø25	39.28	3Ø25	14.73	0.400	785.751	0.800	883.759	OK
	13	0.40	0.80	-6382.77	-444.21	37.22	5Ø25	24.55	2Ø25+4Ø20	22.38	0.800	1199.865	0.400	535.800	OK
	14	0.40	0.80	-6122.30	-403.97	40.14	5Ø25	24.55	2Ø25+4Ø20	22.38	0.800	1199.865	0.400	535.800	OK
	15	0.40	0.80	-3335.63	-414.28	136.35	5Ø25	24.55	2Ø25+3Ø20	19.24	0.521	1429.115	0.261	603.985	OK
	16	0.40	0.80	-1831.28	-714.36	-19.75	6Ø25	29.46	4Ø25+2Ø20	25.92	0.286	1471.229	0.143	644.813	OK
	19	0.40	1.00	-6536.88	-525.57	-111.49	4Ø25	19.64	2Ø25+3Ø20	19.24	1.000	1443.080	0.400	540.560	OK
	20	0.40	1.00	-6120.23	373.90	80.03	4Ø25	19.64	2Ø25+3Ø20	19.24	0.956	1522.119	0.383	572.176	OK
	21	0.40	1.00	-6139.09	351.58	-80.57	4Ø25	19.64	2Ø25+3Ø20	19.24	0.959	1517.097	0.384	570.166	OK
	22	0.40	1.00	-6116.10	300.96	89.25	4Ø25	19.64	2Ø25+3Ø20	19.24	0.956	1523.213	0.382	572.613	OK
	23	0.40	1.00	-5155.23	474.87	145.97	4Ø25	19.64	2Ø25+3Ø20	19.24	0.806	1719.669	0.322	651.195	OK
24	0.40	0.80	-3604.78	527.59	109.93	5Ø20	15.70	2Ø20+3Ø16	12.31	0.563	1135.142	0.282	496.945	OK	

2	10	0.40	0.80	-841.36	-672.05	198.45	5Ø25	24.55	2Ø25+4Ø20	22.38	0.131	1082.566	0.066	477.151	OK
	11	0.40	0.80	-4986.55	-898.24	-67.57	6Ø25	29.46	4Ø25+2Ø20	25.92	0.779	1388.832	0.390	603.614	OK
	12	0.80	0.40	-5223.74	-377.28	193.53	8Ø25	39.28	3Ø25	14.73	0.400	785.751	0.800	883.759	OK
	13	0.40	0.80	-5051.50	-554.92	-48.69	5Ø25	24.55	2Ø25+4Ø20	22.38	0.789	1216.012	0.395	543.874	OK
	14	0.40	0.80	-4847.49	-516.79	-69.70	5Ø25	24.55	2Ø25+4Ø20	22.38	0.757	1260.626	0.379	566.181	OK
	15	0.40	0.80	-2642.80	590.75	-169.44	5Ø25	24.55	2Ø25+3Ø20	19.24	0.413	1410.860	0.206	594.857	OK
	16	0.40	0.80	-892.60	-753.61	-72.42	6Ø25	29.46	4Ø25+2Ø20	25.92	0.139	1255.562	0.070	536.979	OK
	19	0.40	1.00	-4993.95	598.70	142.99	4Ø25	19.64	2Ø25+3Ø20	19.24	0.780	1741.334	0.312	659.861	OK
	20	0.40	1.00	-4645.64	542.34	104.21	4Ø25	19.64	2Ø25+3Ø20	19.24	0.726	1777.027	0.290	674.138	OK
	21	0.40	1.00	-4668.01	539.31	-108.74	4Ø25	19.64	2Ø25+3Ø20	19.24	0.729	1775.190	0.292	673.404	OK
	22	0.40	1.00	-4645.59	500.32	119.36	4Ø25	19.64	2Ø25+3Ø20	19.24	0.726	1777.030	0.290	674.140	OK
	23	0.40	1.00	-3827.64	582.37	180.29	4Ø25	19.64	2Ø25+3Ø20	19.24	0.598	1801.223	0.239	683.817	OK
24	0.40	0.80	-2878.28	-641.00	109.89	5Ø20	15.70	2Ø20+3Ø16	12.31	0.450	1138.914	0.225	498.830	OK	
3	11	0.40	0.60	-3432.69	-602.73	106.67	6Ø25	29.46	2Ø25+1Ø20 (7de	22.78	0.536	985.362	0.358	532.481	OK
	12	0.80	0.40	-3986.49	-417.22	-296.78	7Ø25	34.37	2Ø25+1Ø20	12.98	0.311	809.002	0.623	1019.166	OK
	13	0.40	0.60	-3709.42	-414.03	-85.48	4Ø25	19.64	2Ø25+2Ø20	16.10	0.580	714.183	0.386	406.678	OK
	14	0.40	0.60	-3564.16	-404.22	105.07	4Ø25	19.64	2Ø25+2Ø20	16.10	0.557	736.640	0.371	421.650	OK
	15	0.40	0.60	-1878.04	441.85	-178.50	5Ø25	24.55	2Ø25+3Ø20	19.24	0.293	919.652	0.196	513.208	OK
	16	0.40	0.60	-722.42	481.77	66.60	6Ø25	29.46	4Ø25+2Ø20	25.92	0.113	876.122	0.075	506.095	OK
	19	0.40	0.80	-3574.76	562.99	201.16	4Ø25	19.64	2Ø25+3Ø20	19.24	0.559	1263.434	0.279	600.171	OK
	20	0.40	0.80	-3290.01	476.94	169.72	4Ø25	19.64	2Ø25+3Ø20	19.24	0.514	1271.705	0.257	604.306	OK
	21	0.40	0.80	-3322.96	477.16	176.15	4Ø25	19.64	2Ø25+3Ø20	19.24	0.519	1271.267	0.260	604.087	OK
	22	0.40	0.80	-3292.40	467.69	-182.82	4Ø25	19.64	2Ø25+3Ø20	19.24	0.514	1271.678	0.257	604.293	OK
	23	0.40	0.80	-2671.78	459.31	-245.83	4Ø25	19.64	2Ø25+3Ø20	19.64	0.417	1254.773	0.209	601.756	OK
	24	0.40	0.60	-1800.70	421.24	-104.04	4Ø20	12.56	2Ø20+2Ø16	10.30	0.281	632.587	0.188	377.372	OK
4	11	0.40	0.60	-2299.38	580.46	-131.34	6Ø25	29.46	4Ø25+1Ø20	22.78	0.359	1051.383	0.240	576.494	OK
	12	0.80	0.40	-2689.75	384.90	-195.68	7Ø25	34.37	2Ø25+1Ø20	12.98	0.210	820.196	0.420	1041.554	OK
	13	0.40	0.60	-2363.88	-412.50	89.69	4Ø25	19.64	2Ø25+2Ø20	16.10	0.369	821.262	0.246	478.065	OK
	14	0.40	0.60	-2295.69	398.67	-113.65	4Ø25	19.64	2Ø25+2Ø20	16.10	0.359	820.664	0.239	477.666	OK
	15	0.40	0.60	-1199.13	488.18	186.83	5Ø25	24.55	2Ø25+3Ø20	19.24	0.187	846.550	0.125	464.473	OK
	16	0.40	0.60	-441.48	674.78	81.59	6Ø25	29.46	4Ø25+2Ø20	25.92	0.069	812.277	0.046	463.531	OK
	19	0.40	0.80	-2344.14	737.35	230.34	4Ø25	19.64	2Ø25+3Ø20	19.24	0.366	1226.430	0.183	581.669	OK
	20	0.40	0.80	-2172.27	603.84	196.86	4Ø25	19.64	2Ø25+3Ø20	19.24	0.339	1206.197	0.170	571.552	OK
	21	0.40	0.80	-2203.12	542.91	204.91	4Ø25	19.64	2Ø25+3Ø20	19.24	0.344	1210.101	0.172	573.504	OK
	22	0.40	0.80	-2182.68	514.95	-204.56	4Ø25	19.64	2Ø25+3Ø20	19.24	0.341	1207.527	0.171	572.218	OK
	23	0.40	0.80	-1691.61	439.18	-269.79	4Ø25	19.64	2Ø25+3Ø20	19.64	0.264	1130.009	0.132	539.374	OK
	24	0.40	0.60	-1104.01	-365.91	-105.75	4Ø20	12.56	2Ø20+2Ø16	10.30	0.173	550.060	0.115	322.354	OK

5	11	0.40	0.60	-1222.48	-709.71	147.23	6Ø25	29.46	4Ø25+1Ø20	22.78	0.191	965.355	0.127	519.143	OK
	12	0.80	0.40	-1358.56	-476.77	317.65	7Ø25	34.37	2Ø25+1Ø20	12.98	0.106	722.367	0.212	845.895	OK
	13	0.40	0.60	-941.28	-516.00	85.45	4Ø25	19.64	2Ø25+2Ø20	16.10	0.147	688.351	0.098	389.457	OK
	14	0.40	0.60	-932.93	-444.47	-112.98	4Ø25	19.64	2Ø25+2Ø20	16.10	0.146	686.825	0.097	388.440	OK
	15	0.40	0.60	-364.24	-353.36	181.16	5Ø25	24.55	2Ø25+3Ø20	19.24	0.057	677.659	0.038	351.879	OK
	16	0.40	0.60	-171.10	189.81	-82.68	3Ø25	14.73	2Ø25+2Ø20	16.10	0.027	395.509	0.018	271.120	OK
	19	0.40	0.80	-1122.50	651.99	185.39	4Ø25	19.64	2Ø25+3Ø20	19.24	0.175	1002.461	0.088	469.684	OK
	20	0.40	0.80	-1053.14	623.32	169.56	4Ø25	19.64	2Ø25+3Ø20	19.24	0.165	984.149	0.082	460.528	OK
	21	0.40	0.80	-1095.79	661.88	168.95	4Ø25	19.64	2Ø25+3Ø20	19.24	0.171	995.479	0.086	466.193	OK
	22	0.40	0.80	-1085.17	616.40	-197.25	4Ø25	19.64	2Ø25+3Ø20	19.24	0.170	992.680	0.085	464.794	OK
	23	0.40	0.80	-760.52	348.75	-255.71	4Ø25	19.64	2Ø25+3Ø20	19.64	0.119	900.270	0.059	424.505	OK
	24	0.40	0.60	-484.25	-290.62	-86.38	4Ø20	12.56	2Ø20+2Ø16	10.30	0.076	425.653	0.050	239.416	OK
	26	0.30	0.50	-133.78	217.05	55.10	3Ø25	14.73	2Ø25+1Ø20	12.96	0.028	313.886	0.017	154.474	OK
	27	0.30	0.50	-132.47	194.91	-51.11	3Ø25	14.73	2Ø25+1Ø20	12.96	0.028	313.586	0.017	154.295	OK

11.5.4 ESFORÇO TRANSVERSO

Dado pela Eq.(11.21 e Eq.(11.22

11.5.4.1 Armaduras na zona crítica

Piso	Pilar	Dimensões		l_{cr} [m]	$d_{bl,min}$ [m]	$S_{cl,max}$ EC2 [m]	$S_{cl,max,cr}$ EC2 [m]	V_{Edx} [KN]	Z_x [m]	$V_{Rd,max,x}$ [KN]	$V_{Ed,x} < V_{Rd,max,x}$	$A_{sw,x}/s$ [cm ² /m]	$A_{sw,x}/s$ Adotado [cm ² /m]	$V_{Rd,s,x}$ [KN]	$V_{Ed,x} < V_{Rd,s,x}$	$V_{Ed,y}$ [KN]	Z_y [m]	$V_{Rd,max,y}$ [KN]	$V_{Ed,y} < V_{Rd,max,y}$	$A_{sw,y}/s$ [cm ² /m]	$A_{sw,y}/s$ Adotado [cm ² /m]	$V_{Rd,s,y}$ [KN]	$V_{Ed,y} < V_{Rd,s,y}$		
		x	y																						
-1	10	0.40	0.80	0.80	0.020	0.40	0.24	-31.15	0.33	1406.59	OK	2.15	Ø8//0.20	15.00	217.28	OK	198.45	0.69	1463.62	OK	6.58	Ø8//0.20	15.00	452.18	OK
	11	0.40	0.80	0.80	0.020	0.40	0.24	-9.20	0.33	1406.59	OK	0.64	Ø8//0.15	13.32	192.95	OK	236.46	0.69	1463.62	OK	7.84	Ø8//0.15	13.32	401.54	OK
	12	0.80	0.40	0.80	0.025	0.40	0.24	19.87	0.69	1463.62	OK	0.66	Ø8//0.20	15.00	452.18	OK	153.58	0.33	1406.59	OK	10.60	Ø8//0.20	15.00	217.28	OK
	13	0.40	0.80	0.80	0.020	0.40	0.24	3.66	0.33	1406.59	OK	0.25	Ø8//0.20	15.00	217.28	OK	219.38	0.69	1463.62	OK	7.28	Ø8//0.20	15.00	452.18	OK
	14	0.40	0.80	0.80	0.020	0.40	0.24	2.64	0.33	1406.59	OK	0.18	Ø8//0.20	15.00	217.28	OK	221.62	0.69	1463.62	OK	7.35	Ø8//0.20	15.00	452.18	OK
	15	0.40	0.80	0.80	0.020	0.40	0.24	24.79	0.33	1406.59	OK	1.71	Ø8//0.20	10.00	144.86	OK	-234.71	0.69	1463.62	OK	7.79	Ø8//0.20	10.00	301.46	OK
	16	0.40	0.80	0.80	0.020	0.40	0.24	-4.68	0.33	1406.59	OK	0.32	Ø8//0.15	13.32	192.95	OK	-236.52	0.69	1463.62	OK	7.85	Ø8//0.15	13.32	401.54	OK
	19	0.40	1.00	1.00	0.020	0.40	0.24	-9.22	0.33	1758.24	OK	0.64	Ø8//0.20	10.00	144.86	OK	-203.28	0.87	1843.78	OK	5.35	Ø8//0.20	10.00	379.76	OK
	20	0.40	1.00	1.00	0.020	0.40	0.24	6.87	0.33	1758.24	OK	0.47	Ø8//0.20	10.00	144.86	OK	-177.27	0.87	1843.78	OK	4.67	Ø8//0.20	10.00	379.76	OK
	21	0.40	1.00	1.00	0.020	0.40	0.24	-6.56	0.33	1758.24	OK	0.45	Ø8//0.20	10.00	144.86	OK	-188.22	0.87	1843.78	OK	4.96	Ø8//0.20	10.00	379.76	OK
	22	0.40	1.00	1.00	0.020	0.40	0.24	6.51	0.33	1758.24	OK	0.45	Ø8//0.20	10.00	144.86	OK	-197.29	0.87	1843.78	OK	5.20	Ø8//0.20	10.00	379.76	OK
	23	0.40	1.00	1.00	0.020	0.40	0.24	23.07	0.33	1758.24	OK	1.59	Ø8//0.20	10.00	144.86	OK	-197.56	0.87	1843.78	OK	5.20	Ø8//0.20	10.00	379.76	OK
24	0.40	0.80	0.80	0.016	0.32	0.19	15.10	0.33	1406.59	OK	1.04	Ø8//0.15	13.32	192.95	OK	126.74	0.69	1463.62	OK	4.20	Ø8//0.15	13.32	401.54	OK	
1	10	0.40	0.80	0.80	0.020	0.40	0.24	-34.62	0.33	1406.59	OK	2.39	Ø8//0.20	15.00	217.28	OK	-173.17	0.69	1463.62	OK	5.74	Ø8//0.20	15.00	452.18	OK
	11	0.40	0.80	0.80	0.020	0.40	0.24	-25.38	0.33	1406.59	OK	1.75	Ø8//0.15	13.32	192.95	OK	399.81	0.69	1463.62	OK	13.26	Ø8//0.15	13.32	401.54	OK
	12	0.80	0.40	0.80	0.025	0.40	0.24	-72.91	0.69	1463.62	OK	2.42	Ø8//0.20	15.00	452.18	OK	171.09	0.33	1406.59	OK	11.81	Ø8//0.20	15.00	217.28	OK
	13	0.40	0.80	0.80	0.020	0.40	0.24	15.95	0.33	1406.59	OK	1.10	Ø8//0.20	15.00	217.28	OK	192.55	0.69	1463.62	OK	6.39	Ø8//0.20	15.00	452.18	OK
	14	0.40	0.80	0.80	0.020	0.40	0.24	18.73	0.33	1406.59	OK	1.29	Ø8//0.20	15.00	217.28	OK	177.13	0.69	1463.62	OK	5.88	Ø8//0.20	15.00	452.18	OK
	15	0.40	0.80	0.80	0.020	0.40	0.24	64.07	0.33	1406.59	OK	4.42	Ø8//0.20	10.00	144.86	OK	-192.46	0.69	1463.62	OK	6.38	Ø8//0.20	10.00	301.46	OK
	16	0.40	0.80	0.80	0.020	0.40	0.24	8.20	0.33	1406.59	OK	0.57	Ø8//0.15	13.32	192.95	OK	-333.32	0.69	1463.62	OK	11.06	Ø8//0.15	13.32	401.54	OK
	19	0.40	1.00	1.00	0.020	0.40	0.24	-47.92	0.33	1758.24	OK	3.31	Ø8//0.20	10.00	144.86	OK	-220.26	0.87	1843.78	OK	5.80	Ø8//0.20	10.00	379.76	OK
	20	0.40	1.00	1.00	0.020	0.40	0.24	32.91	0.33	1758.24	OK	2.27	Ø8//0.20	10.00	144.86	OK	163.51	0.87	1843.78	OK	4.31	Ø8//0.20	10.00	379.76	OK
	21	0.40	1.00	1.00	0.020	0.40	0.24	-32.80	0.33	1758.24	OK	2.26	Ø8//0.20	10.00	144.86	OK	-142.93	0.87	1843.78	OK	3.76	Ø8//0.20	10.00	379.76	OK
	22	0.40	1.00	1.00	0.020	0.40	0.24	37.79	0.33	1758.24	OK	2.61	Ø8//0.20	10.00	144.86	OK	-125.99	0.87	1843.78	OK	3.32	Ø8//0.20	10.00	379.76	OK
	23	0.40	1.00	1.00	0.020	0.40	0.24	63.96	0.33	1758.24	OK	4.42	Ø8//0.20	10.00	144.86	OK	202.85	0.87	1843.78	OK	5.34	Ø8//0.20	10.00	379.76	OK
24	0.40	0.80	0.80	0.016	0.32	0.19	50.49	0.33	1406.59	OK	3.49	Ø8//0.15	13.32	192.95	OK	237.34	0.69	1463.62	OK	7.87	Ø8//0.15	13.32	401.54	OK	
2	10	0.40	0.80	0.80	0.020	0.40	0.24	-86.11	0.33	1406.59	OK	5.94	Ø8//0.20	15.00	217.28	OK	277.68	0.69	1463.62	OK	9.21	Ø8//0.20	15.00	452.18	OK
	11	0.40	0.80	0.80	0.020	0.40	0.24	-31.69	0.33	1406.59	OK	2.19	Ø8//0.15	13.32	192.95	OK	391.34	0.69	1463.62	OK	12.98	Ø8//0.15	13.32	401.54	OK
	12	0.80	0.40	0.80	0.025	0.40	0.24	-80.27	0.69	1463.62	OK	2.66	Ø8//0.20	15.00	452.18	OK	178.26	0.33	1406.59	OK	12.31	Ø8//0.20	15.00	217.28	OK
	13	0.40	0.80	0.80	0.020	0.40	0.24	22.52	0.33	1406.59	OK	1.55	Ø8//0.20	15.00	217.28	OK	248.93	0.69	1463.62	OK	8.26	Ø8//0.20	15.00	452.18	OK
	14	0.40	0.80	0.80	0.020	0.40	0.24	31.76	0.33	1406.59	OK	2.19	Ø8//0.20	15.00	217.28	OK	237.08	0.69	1463.62	OK	7.86	Ø8//0.20	15.00	452.18	OK
	15	0.40	0.80	0.80	0.020	0.40	0.24	76.63	0.33	1406.59	OK	5.29	Ø8//0.20	10.00	144.86	OK	-276.01	0.69	1463.62	OK	9.16	Ø8//0.20	10.00	301.46	OK
	16	0.40	0.80	0.80	0.020	0.40	0.24	27.76	0.33	1406.59	OK	1.92	Ø8//0.15	13.32	192.95	OK	-320.29	0.69	1463.62	OK	10.62	Ø8//0.15	13.32	401.54	OK
	19	0.40	1.00	1.00	0.020	0.40	0.24	-65.50	0.33	1758.24	OK	4.52	Ø8//0.20	10.00	144.86	OK	-252.15	0.87	1843.78	OK	6.64	Ø8//0.20	10.00	379.76	OK
	20	0.40	1.00	1.00	0.020	0.40	0.24	46.60	0.33	1758.24	OK	3.22	Ø8//0.20	10.00	144.86	OK	-228.59	0.87	1843.78	OK	6.02	Ø8//0.20	10.00	379.76	OK
	21	0.40	1.00	1.00	0.020	0.40	0.24	-47.60	0.33	1758.24	OK	3.29	Ø8//0.20	10.00	144.86	OK	-228.72	0.87	1843.78	OK	6.02	Ø8//0.20	10.00	379.76	OK
	22	0.40	1.00	1.00	0.020	0.40	0.24	54.31	0.33	1758.24	OK	3.75	Ø8//0.20	10.00	144.86	OK	-220.57	0.87	1843.78	OK	5.81	Ø8//0.20	10.00	379.76	OK
	23	0.40	1.00	1.00	0.020	0.40	0.24	84.24	0.33	1758.24	OK	5.82	Ø8//0.20	10.00	144.86	OK	258.41	0.87	1843.78	OK	6.80	Ø8//0.20	10.00	379.76	OK
24	0.40	0.80	0.80	0.016	0.32	0.19	45.38	0.33	1406.59	OK	3.13	Ø8//0.15	13.32	192.95	OK	295.54	0.69	1463.62	OK	9.80	Ø8//0.15	13.32	401.54	OK	

3	11	0.40	0.60	0.60	0.020	0.40	0.24	-48.59	0.33	1054.94	OK	3.35	Ø8//0.075	13.34	193.24	OK	275.73	0.51	1083.46	OK	12.36	Ø8//0.075	13.34	297.69	OK
	12	0.80	0.40	0.80	0.020	0.40	0.24	-123.41	0.69	1463.62	OK	4.09	Ø8//0.15	19.98	602.31	OK	195.79	0.33	1406.59	OK	13.52	Ø8//0.15	19.98	289.42	OK
	13	0.40	0.60	0.60	0.020	0.40	0.24	-38.84	0.33	1054.94	OK	2.68	Ø8//0.20	10.00	144.86	OK	180.85	0.51	1083.46	OK	8.10	Ø8//0.20	10.00	223.16	OK
	14	0.40	0.60	0.60	0.020	0.40	0.24	49.48	0.33	1054.94	OK	3.42	Ø8//0.20	10.00	144.86	OK	179.16	0.51	1083.46	OK	8.03	Ø8//0.20	10.00	223.16	OK
	15	0.40	0.60	0.60	0.020	0.40	0.24	84.41	0.33	1054.94	OK	5.83	Ø8//0.20	10.00	144.86	OK	202.95	0.51	1083.46	OK	9.09	Ø8//0.20	10.00	223.16	OK
	16	0.40	0.60	0.60	0.020	0.40	0.24	-31.09	0.33	1054.94	OK	2.15	Ø8//0.15	13.32	192.95	OK	-213.37	0.51	1083.46	OK	9.56	Ø8//0.15	13.32	297.24	OK
	19	0.40	0.80	0.80	0.020	0.40	0.24	-93.68	0.33	1406.59	OK	6.47	Ø8//0.15	13.32	192.95	OK	-257.31	0.69	1463.62	OK	8.54	Ø8//0.15	13.32	401.54	OK
	20	0.40	0.80	0.80	0.020	0.40	0.24	-77.63	0.33	1406.59	OK	5.36	Ø8//0.15	13.32	192.95	OK	-212.69	0.69	1463.62	OK	7.06	Ø8//0.15	13.32	401.54	OK
	21	0.40	0.80	0.80	0.020	0.40	0.24	-80.65	0.33	1406.59	OK	5.57	Ø8//0.15	13.32	192.95	OK	-210.71	0.69	1463.62	OK	6.99	Ø8//0.15	13.32	401.54	OK
	22	0.40	0.80	0.80	0.020	0.40	0.24	82.15	0.33	1406.59	OK	5.67	Ø8//0.15	13.32	192.95	OK	-213.78	0.69	1463.62	OK	7.09	Ø8//0.15	13.32	401.54	OK
23	0.40	0.80	0.80	0.020	0.40	0.24	110.48	0.33	1406.59	OK	7.63	Ø8//0.15	13.32	192.95	OK	-191.89	0.69	1463.62	OK	6.37	Ø8//0.15	13.32	401.54	OK	
24	0.40	0.60	0.60	0.016	0.32	0.19	-45.85	0.33	1054.94	OK	3.17	Ø8//0.15	13.32	192.95	OK	191.03	0.51	1083.46	OK	8.56	Ø8//0.15	13.32	297.24	OK	
4	11	0.40	0.60	0.60	0.020	0.40	0.24	-62.17	0.33	1054.94	OK	4.29	Ø8//0.075	13.34	193.24	OK	269.49	0.51	1083.46	OK	12.08	Ø8//0.075	13.34	297.69	OK
	12	0.80	0.40	0.80	0.020	0.40	0.24	-83.22	0.69	1463.62	OK	2.76	Ø8//0.15	19.98	602.31	OK	180.56	0.33	1406.59	OK	12.47	Ø8//0.15	19.98	289.42	OK
	13	0.40	0.60	0.60	0.020	0.40	0.24	-42.27	0.33	1054.94	OK	2.92	Ø8//0.20	10.00	144.86	OK	195.88	0.51	1083.46	OK	8.78	Ø8//0.20	10.00	223.16	OK
	14	0.40	0.60	0.60	0.020	0.40	0.24	53.23	0.33	1054.94	OK	3.67	Ø8//0.20	10.00	144.86	OK	187.70	0.51	1083.46	OK	8.41	Ø8//0.20	10.00	223.16	OK
	15	0.40	0.60	0.60	0.020	0.40	0.24	88.81	0.33	1054.94	OK	6.13	Ø8//0.20	10.00	144.86	OK	-216.20	0.51	1083.46	OK	9.69	Ø8//0.20	10.00	223.16	OK
	16	0.40	0.60	0.60	0.020	0.40	0.24	-38.67	0.33	1054.94	OK	2.67	Ø8//0.15	13.32	192.95	OK	-295.95	0.51	1083.46	OK	13.26	Ø8//0.15	13.32	297.24	OK
	19	0.40	0.80	0.80	0.020	0.40	0.24	-108.86	0.33	1406.59	OK	7.51	Ø8//0.15	13.32	192.95	OK	-314.49	0.69	1463.62	OK	10.43	Ø8//0.15	13.32	401.54	OK
	20	0.40	0.80	0.80	0.020	0.40	0.24	-93.67	0.33	1406.59	OK	6.47	Ø8//0.15	13.32	192.95	OK	-255.56	0.69	1463.62	OK	8.48	Ø8//0.15	13.32	401.54	OK
	21	0.40	0.80	0.80	0.020	0.40	0.24	-97.33	0.33	1406.59	OK	6.72	Ø8//0.15	13.32	192.95	OK	-233.22	0.69	1463.62	OK	7.74	Ø8//0.15	13.32	401.54	OK
	22	0.40	0.80	0.80	0.020	0.40	0.24	96.70	0.33	1406.59	OK	6.68	Ø8//0.15	13.32	192.95	OK	-218.78	0.69	1463.62	OK	7.26	Ø8//0.15	13.32	401.54	OK
23	0.40	0.80	0.80	0.020	0.40	0.24	128.15	0.33	1406.59	OK	8.85	Ø8//0.15	13.32	192.95	OK	-175.62	0.69	1463.62	OK	5.83	Ø8//0.15	13.32	401.54	OK	
24	0.40	0.60	0.60	0.016	0.32	0.19	50.08	0.33	1054.94	OK	3.46	Ø8//0.15	13.32	192.95	OK	163.61	0.51	1083.46	OK	7.33	Ø8//0.15	13.32	297.24	OK	
5	11	0.40	0.60	0.60	0.020	0.40	0.24	-79.28	0.33	1054.94	OK	5.47	Ø8//0.075	13.34	193.24	OK	283.19	0.51	1083.46	OK	12.69	Ø8//0.075	13.34	297.69	OK
	12	0.80	0.40	0.80	0.020	0.40	0.24	-362.62	0.69	1463.62	OK	12.03	Ø8//0.15	19.98	602.31	OK	264.84	0.33	1406.59	OK	18.28	Ø8//0.15	19.98	289.42	OK
	13	0.40	0.60	0.60	0.020	0.40	0.24	-36.64	0.33	1054.94	OK	2.53	Ø8//0.20	10.00	144.86	OK	202.26	0.51	1083.46	OK	9.06	Ø8//0.20	10.00	223.16	OK
	14	0.40	0.60	0.60	0.020	0.40	0.24	49.71	0.33	1054.94	OK	3.43	Ø8//0.20	10.00	144.86	OK	176.95	0.51	1083.46	OK	7.93	Ø8//0.20	10.00	223.16	OK
	15	0.40	0.60	0.60	0.020	0.40	0.24	107.80	0.33	1054.94	OK	7.44	Ø8//0.20	10.00	144.86	OK	-205.58	0.51	1083.46	OK	9.21	Ø8//0.20	10.00	223.16	OK
	16	0.40	0.60	0.60	0.020	0.40	0.24	47.58	0.33	1054.94	OK	3.28	Ø8//0.20	10.00	144.86	OK	-111.70	0.51	1083.46	OK	5.01	Ø8//0.20	10.00	223.16	OK
	19	0.40	0.80	0.80	0.020	0.40	0.24	-99.22	0.33	1406.59	OK	6.85	Ø8//0.15	13.32	192.95	OK	-235.09	0.69	1463.62	OK	7.80	Ø8//0.15	13.32	401.54	OK
	20	0.40	0.80	0.80	0.020	0.40	0.24	-79.32	0.33	1406.59	OK	5.48	Ø8//0.15	13.32	192.95	OK	-214.65	0.69	1463.62	OK	7.12	Ø8//0.15	13.32	401.54	OK
	21	0.40	0.80	0.80	0.020	0.40	0.24	-84.12	0.33	1406.59	OK	5.81	Ø8//0.15	13.32	192.95	OK	-231.16	0.69	1463.62	OK	7.67	Ø8//0.15	13.32	401.54	OK
	22	0.40	0.80	0.80	0.020	0.40	0.24	89.15	0.33	1406.59	OK	6.15	Ø8//0.15	13.32	192.95	OK	-217.23	0.69	1463.62	OK	7.21	Ø8//0.15	13.32	401.54	OK
23	0.40	0.80	0.80	0.020	0.40	0.24	118.08	0.33	1406.59	OK	8.15	Ø8//0.15	13.32	192.95	OK	-119.93	0.69	1463.62	OK	3.98	Ø8//0.15	13.32	401.54	OK	
24	0.40	0.60	0.60	0.016	0.32	0.19	40.34	0.33	1054.94	OK	2.78	Ø8//0.15	13.32	192.95	OK	145.00	0.51	1083.46	OK	6.50	Ø8//0.15	13.32	297.24	OK	
26	0.30	0.50	0.50	0.020	0.30	0.18	-34.73	0.24	641.52	OK	3.29	Ø8//0.15	6.66	70.40	OK	122.00	0.42	670.03	OK	6.63	Ø8//0.15	6.66	122.55	OK	
27	0.30	0.50	0.50	0.020	0.30	0.18	-30.52	0.24	641.52	OK	2.89	Ø8//0.15	6.66	70.40	OK	105.00	0.42	670.03	OK	5.71	Ø8//0.15	6.66	122.55	OK	

11.5.4.2 Armaduras zona corrente

Piso	Pilar	Dimensões		l _d [m]	l _{cr} [m]	d _{el,min} [m]	S _{el,max} EC2 [m]	Crítico		Corrente		Z _c [m]	V _{Rd,max,x} [KN]	V _{Ed,x} <V _{Rd,max,x}	A _{sw,x} /s [cm ² /m]	A _{sw,y} /s Adotado [cm ² /m]	V _{Rd,s,x} [KN]	V _{Ed,x} <V _{Rd,s,x}	Crítico		Corrente		Z _y [m]	V _{Rd,max,y} [KN]	V _{Ed,y} <V _{Rd,max,y}	A _{sw,y} /s [cm ² /m]	A _{sw,y} /s Adotado [cm ² /m]	V _{Rd,s,y} [KN]	V _{Ed,y} <V _{Rd,s,y}
		x	y					V _{Ed,x} [KN]	V _{Ed,y} [KN]	V _{Ed,y} [KN]	V _{Ed,x} [KN]																		
-1	10	0.40	0.80	3.00	0.80	0.020	0.40	-31.15	-14.54	0.33	1406.59	OK	1.00	Ø8//0.30	10.02	145.14	OK	198.45	92.61	0.69	1463.62	OK	3.07	Ø8//0.30	10.02	302.06	OK		
	11	0.40	0.80	3.00	0.80	0.020	0.40	-9.20	-4.29	0.33	1406.59	OK	0.30	Ø8//0.25	8.00	115.88	OK	236.46	110.35	0.69	1463.62	OK	3.66	Ø8//0.25	8.00	241.16	OK		
	12	0.80	0.40	3.00	0.80	0.025	0.40	19.87	9.27	0.69	1463.62	OK	0.31	Ø8//0.30	10.02	302.06	OK	153.58	71.67	0.33	1406.59	OK	4.95	Ø8//0.30	10.02	145.14	OK		
	13	0.40	0.80	3.00	0.80	0.020	0.40	3.66	1.71	0.33	1406.59	OK	0.12	Ø8//0.30	10.02	145.14	OK	219.38	102.38	0.69	1463.62	OK	3.40	Ø8//0.30	10.02	302.06	OK		
	14	0.40	0.80	3.00	0.80	0.020	0.40	2.64	1.23	0.33	1406.59	OK	0.09	Ø8//0.30	10.02	145.14	OK	221.62	103.42	0.69	1463.62	OK	3.43	Ø8//0.30	10.02	302.06	OK		
	15	0.40	0.80	3.00	0.80	0.020	0.40	24.79	11.57	0.33	1406.59	OK	0.80	Ø8//0.30	6.68	96.76	OK	-234.71	-109.53	0.69	1463.62	OK	3.63	Ø8//0.30	6.68	201.37	OK		
	16	0.40	0.80	3.00	0.80	0.020	0.40	-4.68	-2.18	0.33	1406.59	OK	0.15	Ø8//0.30	6.68	96.76	OK	-236.52	-110.38	0.69	1463.62	OK	3.66	Ø8//0.30	6.68	201.37	OK		
	19	0.40	1.00	3.00	1.00	0.020	0.40	-9.22	-3.07	0.33	1758.24	OK	0.21	Ø8//0.30	6.68	96.76	OK	-203.28	-67.76	0.87	1843.78	OK	1.78	Ø8//0.30	6.68	253.68	OK		
	20	0.40	1.00	3.00	1.00	0.020	0.40	6.87	2.29	0.33	1758.24	OK	0.16	Ø8//0.30	6.68	96.76	OK	-177.27	-59.09	0.87	1843.78	OK	1.56	Ø8//0.30	6.68	253.68	OK		
	21	0.40	1.00	3.00	1.00	0.020	0.40	-6.56	-2.19	0.33	1758.24	OK	0.15	Ø8//0.30	6.68	96.76	OK	-188.22	-62.74	0.87	1843.78	OK	1.65	Ø8//0.30	6.68	253.68	OK		
	22	0.40	1.00	3.00	1.00	0.020	0.40	6.51	2.17	0.33	1758.24	OK	0.15	Ø8//0.30	6.68	96.76	OK	-197.29	-65.76	0.87	1843.78	OK	1.73	Ø8//0.30	6.68	253.68	OK		
	23	0.40	1.00	3.00	1.00	0.020	0.40	23.07	7.69	0.33	1758.24	OK	0.53	Ø8//0.30	6.68	96.76	OK	-197.56	-65.85	0.87	1843.78	OK	1.73	Ø8//0.30	6.68	253.68	OK		
24	0.40	0.80	3.00	0.80	0.016	0.32	15.10	7.05	0.33	1406.59	OK	0.49	Ø8//0.30	6.68	96.76	OK	126.74	59.15	0.69	1463.62	OK	1.96	Ø8//0.30	6.68	201.37	OK			
1	10	0.40	0.80	3.80	0.80	0.020	0.40	-34.62	-20.05	0.33	1406.59	OK	1.38	Ø8//0.30	10.02	145.14	OK	-173.17	-100.26	0.69	1463.62	OK	3.33	Ø8//0.30	10.02	302.06	OK		
	11	0.40	0.80	3.80	0.80	0.020	0.40	-25.38	-14.69	0.33	1406.59	OK	1.01	Ø8//0.25	8.00	115.88	OK	399.81	231.47	0.69	1463.62	OK	7.68	Ø8//0.25	8.00	241.16	OK		
	12	0.80	0.40	3.80	0.80	0.025	0.40	-72.91	-42.21	0.69	1463.62	OK	1.40	Ø8//0.30	10.02	302.06	OK	171.09	99.05	0.33	1406.59	OK	6.84	Ø8//0.30	10.02	145.14	OK		
	13	0.40	0.80	3.80	0.80	0.020	0.40	15.95	9.23	0.33	1406.59	OK	0.64	Ø8//0.30	10.02	145.14	OK	192.55	111.48	0.69	1463.62	OK	3.70	Ø8//0.30	10.02	302.06	OK		
	14	0.40	0.80	3.80	0.80	0.020	0.40	18.73	10.84	0.33	1406.59	OK	0.75	Ø8//0.30	10.02	145.14	OK	177.13	102.55	0.69	1463.62	OK	3.40	Ø8//0.30	10.02	302.06	OK		
	15	0.40	0.80	3.80	0.80	0.020	0.40	64.07	37.09	0.33	1406.59	OK	2.56	Ø8//0.30	6.68	96.76	OK	-192.46	-111.43	0.69	1463.62	OK	3.70	Ø8//0.30	6.68	201.37	OK		
	16	0.40	0.80	3.80	0.80	0.020	0.40	8.20	4.75	0.33	1406.59	OK	0.33	Ø8//0.30	6.68	96.76	OK	-333.32	-192.98	0.69	1463.62	OK	6.40	Ø8//0.30	6.68	201.37	OK		
	19	0.40	1.00	3.80	1.00	0.020	0.40	-47.92	-22.70	0.33	1758.24	OK	1.57	Ø8//0.30	6.68	96.76	OK	-220.26	-104.33	0.87	1843.78	OK	2.75	Ø8//0.30	6.68	253.68	OK		
	20	0.40	1.00	3.80	1.00	0.020	0.40	32.91	15.59	0.33	1758.24	OK	1.08	Ø8//0.30	6.68	96.76	OK	163.51	77.45	0.87	1843.78	OK	2.04	Ø8//0.30	6.68	253.68	OK		
	21	0.40	1.00	3.80	1.00	0.020	0.40	-32.80	-15.54	0.33	1758.24	OK	1.07	Ø8//0.30	6.68	96.76	OK	-142.93	-67.71	0.87	1843.78	OK	1.78	Ø8//0.30	6.68	253.68	OK		
	22	0.40	1.00	3.80	1.00	0.020	0.40	37.79	17.90	0.33	1758.24	OK	1.24	Ø8//0.30	6.68	96.76	OK	-125.99	-59.68	0.87	1843.78	OK	1.57	Ø8//0.30	6.68	253.68	OK		
	23	0.40	1.00	3.80	1.00	0.020	0.40	63.96	30.30	0.33	1758.24	OK	2.09	Ø8//0.30	6.68	96.76	OK	202.85	96.09	0.87	1843.78	OK	2.53	Ø8//0.30	6.68	253.68	OK		
24	0.40	0.80	3.80	0.80	0.016	0.32	50.49	29.23	0.33	1406.59	OK	2.02	Ø8//0.30	6.68	96.76	OK	237.34	137.41	0.69	1463.62	OK	4.56	Ø8//0.30	6.68	201.37	OK			
2	10	0.40	0.80	3.80	0.80	0.020	0.40	-86.11	-49.85	0.33	1406.59	OK	3.44	Ø8//0.30	10.02	145.14	OK	277.68	160.76	0.69	1463.62	OK	5.33	Ø8//0.30	10.02	302.06	OK		
	11	0.40	0.80	3.80	0.80	0.020	0.40	-31.69	-18.34	0.33	1406.59	OK	1.27	Ø8//0.25	8.00	115.88	OK	391.34	226.57	0.69	1463.62	OK	7.52	Ø8//0.25	8.00	241.16	OK		
	12	0.80	0.40	3.80	0.80	0.025	0.40	-80.27	-46.47	0.69	1463.62	OK	1.54	Ø8//0.30	10.02	302.06	OK	178.26	103.20	0.33	1406.59	OK	7.12	Ø8//0.30	10.02	145.14	OK		
	13	0.40	0.80	3.80	0.80	0.020	0.40	22.52	13.04	0.33	1406.59	OK	0.90	Ø8//0.30	10.02	145.14	OK	248.93	144.12	0.69	1463.62	OK	4.78	Ø8//0.30	10.02	302.06	OK		
	14	0.40	0.80	3.80	0.80	0.020	0.40	31.76	18.39	0.33	1406.59	OK	1.27	Ø8//0.30	10.02	145.14	OK	237.08	137.26	0.69	1463.62	OK	4.55	Ø8//0.30	10.02	302.06	OK		
	15	0.40	0.80	3.80	0.80	0.020	0.40	76.63	44.36	0.33	1406.59	OK	3.06	Ø8//0.30	6.68	96.76	OK	-276.01	-159.79	0.69	1463.62	OK	5.30	Ø8//0.30	6.68	201.37	OK		
	16	0.40	0.80	3.80	0.80	0.020	0.40	27.76	16.07	0.33	1406.59	OK	1.11	Ø8//0.30	6.68	96.76	OK	-320.29	-185.43	0.69	1463.62	OK	6.15	Ø8//0.30	6.68	201.37	OK		
	19	0.40	1.00	3.80	1.00	0.020	0.40	-65.50	-31.03	0.33	1758.24	OK	2.14	Ø8//0.30	6.68	96.76	OK	-252.15	-119.44	0.87	1843.78	OK	3.15	Ø8//0.30	6.68	253.68	OK		
	20	0.40	1.00	3.80	1.00	0.020	0.40	46.60	22.07	0.33	1758.24	OK	1.52	Ø8//0.30	6.68	96.76	OK	-228.59	-108.28	0.87	1843.78	OK	2.85	Ø8//0.30	6.68	253.68	OK		
	21	0.40	1.00	3.80	1.00	0.020	0.40	-47.60	-22.55	0.33	1758.24	OK	1.56	Ø8//0.30	6.68	96.76	OK	-228.72	-108.34	0.87	1843.78	OK	2.85	Ø8//0.30	6.68	253.68	OK		
	22	0.40	1.00	3.80	1.00	0.020	0.40	54.31	25.72	0.33	1758.24	OK	1.78	Ø8//0.30	6.68	96.76	OK	-220.57	-104.48	0.87	1843.78	OK	2.75	Ø8//0.30	6.68	253.68	OK		
	23	0.40	1.00	3.80	1.00	0.020	0.40	84.24	39.91	0.33	1758.24	OK	2.75	Ø8//0.30	6.68	96.76	OK	258.41	122.40	0.87	1843.78	OK	3.22	Ø8//0.30	6.68	253.68	OK		
24	0.40	0.80	3.80	0.80	0.016	0.32	45.38	26.27	0.33	1406.59	OK	1.81	Ø8//0.30	6.68	96.76	OK	295.54	171.10	0.69	1463.62	OK	5.68	Ø8//0.30	6.68	201.37	OK			
3	11	0.40	0.60	3.80	0.60	0.020	0.40	-48.59	-33.24	0.33	1054.94	OK	2.29	Ø8//0.10	10.00	144.86	OK	275.73	188.66	0.51	1083.46	OK	8.45	Ø8//0.10	10.00	223.16	OK		
	12	0.80	0.40	3.80	0.80	0.020	0.40	-123.41	-71.45	0.69	1463.62	OK	2.37	Ø8//0.30	10.02	302.06	OK	195.79	113.35	0.33	1406.59	OK	7.83	Ø8//0.30	10.02	145.14	OK		
	13	0.40	0.60	3.80	0.60	0.020	0.40	-38.84	-26.57	0.33	1054.94	OK	1.83	Ø8//0.30	6.68	96.76	OK	180.85	123.74	0.51	1083.46	OK	5.54	Ø8//0.30	6.68	149.07	OK		
	14	0.40	0.60	3.80	0.60	0.020	0.40	49.48	33.86	0.33	1054.94	OK	2.34	Ø8//0.30	6.68	96.76	OK	179.16	122.58	0.51	1083.46	OK	5.49	Ø8//0.30	6.68	149.07	OK		
	15	0.40	0.60	3.80	0.60	0.020	0.40	84.41	57.75	0.33	1054.94	OK	3.99	Ø8//0.30	6.68	96.76	OK	202.95	138.86	0.51	1083.46	OK	6.22	Ø8//0.30	6.68	149.07	OK		
	16	0.40	0.60	3.56	0.60	0.020	0.40	-31.09	-20.61	0.33	1054.94	OK	1.42	Ø8//0.20	10.00	144.86	OK	-213.37	-141.45	0.51	1083.46	OK	6.34	Ø8//0.20	10.00	223.16	OK		
	19	0.40	0.80	3.46	0.80	0.020	0.40	-93.68	-50.36	0.33	1406.59	OK</																	

4	11	0.40	0.60	3.80	0.60	0.020	0.40	-62.17	-42.53	0.33	1054.94	OK	2.94	Ø8//0.10	10.00	144.86	OK	269.49	184.39	0.51	1083.46	OK	8.26	Ø8//0.10	10.00	223.16	OK
	12	0.80	0.40	3.80	0.80	0.020	0.40	-83.22	-48.18	0.69	1463.62	OK	1.60	Ø8//0.30	10.02	302.06	OK	180.56	104.54	0.33	1406.59	OK	7.22	Ø8//0.30	10.02	145.14	OK
	13	0.40	0.60	3.80	0.60	0.020	0.40	-42.27	-28.92	0.33	1054.94	OK	2.00	Ø8//0.30	6.68	96.76	OK	195.88	134.02	0.51	1083.46	OK	6.01	Ø8//0.30	6.68	149.07	OK
	14	0.40	0.60	3.80	0.60	0.020	0.40	53.23	36.42	0.33	1054.94	OK	2.51	Ø8//0.30	6.68	96.76	OK	187.70	128.42	0.51	1083.46	OK	5.75	Ø8//0.30	6.68	149.07	OK
	15	0.40	0.60	3.80	0.60	0.020	0.40	88.81	60.76	0.33	1054.94	OK	4.19	Ø8//0.30	6.68	96.76	OK	-216.20	-147.92	0.51	1083.46	OK	6.63	Ø8//0.30	6.68	149.07	OK
	16	0.40	0.60	3.56	0.60	0.020	0.40	-38.67	-25.64	0.33	1054.94	OK	1.77	Ø8//0.20	10.00	144.86	OK	-295.95	-196.19	0.51	1083.46	OK	8.79	Ø8//0.20	10.00	223.16	OK
	19	0.40	0.80	3.46	0.80	0.020	0.40	-108.86	-58.52	0.33	1406.59	OK	4.04	Ø8//0.30	6.68	96.76	OK	-314.49	-169.06	0.69	1463.62	OK	5.61	Ø8//0.30	6.68	201.37	OK
	20	0.40	0.80	3.46	0.80	0.020	0.40	-93.67	-50.35	0.33	1406.59	OK	3.48	Ø8//0.30	6.68	96.76	OK	-255.56	-137.38	0.69	1463.62	OK	4.56	Ø8//0.30	6.68	201.37	OK
	21	0.40	0.80	3.46	0.80	0.020	0.40	-97.33	-52.32	0.33	1406.59	OK	3.61	Ø8//0.30	6.68	96.76	OK	-233.22	-125.37	0.69	1463.62	OK	4.16	Ø8//0.30	6.68	201.37	OK
	22	0.40	0.80	3.46	0.80	0.020	0.40	96.70	51.98	0.33	1406.59	OK	3.59	Ø8//0.30	6.68	96.76	OK	-218.78	-117.61	0.69	1463.62	OK	3.90	Ø8//0.30	6.68	201.37	OK
	23	0.40	0.80	3.46	0.80	0.020	0.40	128.15	68.89	0.33	1406.59	OK	4.76	Ø8//0.30	6.68	96.76	OK	-175.62	-94.41	0.69	1463.62	OK	3.13	Ø8//0.30	6.68	201.37	OK
	24	0.40	0.60	3.46	0.60	0.016	0.32	50.08	32.71	0.33	1054.94	OK	2.26	Ø8//0.30	6.68	96.76	OK	163.61	106.87	0.51	1083.46	OK	4.79	Ø8//0.30	6.68	149.07	OK
5	11	0.40	0.60	2.86	0.60	0.020	0.40	-79.28	-46.01	0.33	1054.94	OK	3.18	Ø8//0.10	10.00	144.86	OK	283.19	164.37	0.51	1083.46	OK	7.37	Ø8//0.10	10.00	223.16	OK
	12	0.80	0.40	2.86	0.80	0.020	0.40	-362.62	-159.76	0.69	1463.62	OK	5.30	Ø8//0.30	10.02	302.06	OK	264.84	116.68	0.33	1406.59	OK	8.05	Ø8//0.30	10.02	145.14	OK
	13	0.40	0.60	3.80	0.60	0.020	0.40	-36.64	-25.07	0.33	1054.94	OK	1.73	Ø8//0.30	6.68	96.76	OK	202.26	138.39	0.51	1083.46	OK	6.20	Ø8//0.30	6.68	149.07	OK
	14	0.40	0.60	3.80	0.60	0.020	0.40	49.71	34.01	0.33	1054.94	OK	2.35	Ø8//0.30	6.68	96.76	OK	176.95	121.07	0.51	1083.46	OK	5.43	Ø8//0.30	6.68	149.07	OK
	15	0.40	0.60	2.62	0.60	0.020	0.40	107.80	58.43	0.33	1054.94	OK	4.03	Ø8//0.30	6.68	96.76	OK	-205.58	-111.42	0.51	1083.46	OK	4.99	Ø8//0.30	6.68	149.07	OK
	16	0.40	0.60	2.62	0.60	0.020	0.40	47.58	25.79	0.33	1054.94	OK	1.78	Ø8//0.30	6.68	96.76	OK	-111.70	-60.54	0.51	1083.46	OK	2.71	Ø8//0.30	6.68	149.07	OK
	19	0.40	0.80	3.46	0.80	0.020	0.40	-99.22	-53.34	0.33	1406.59	OK	3.68	Ø8//0.30	6.68	96.76	OK	-235.09	-126.38	0.69	1463.62	OK	4.19	Ø8//0.30	6.68	201.37	OK
	20	0.40	0.80	3.46	0.80	0.020	0.40	-79.32	-42.64	0.33	1406.59	OK	2.94	Ø8//0.30	6.68	96.76	OK	-214.65	-115.39	0.69	1463.62	OK	3.83	Ø8//0.30	6.68	201.37	OK
	21	0.40	0.80	3.46	0.80	0.020	0.40	-84.12	-45.22	0.33	1406.59	OK	3.12	Ø8//0.30	6.68	96.76	OK	-231.16	-124.26	0.69	1463.62	OK	4.12	Ø8//0.30	6.68	201.37	OK
	22	0.40	0.80	3.46	0.80	0.020	0.40	89.15	47.93	0.33	1406.59	OK	3.31	Ø8//0.30	6.68	96.76	OK	-217.23	-116.78	0.69	1463.62	OK	3.87	Ø8//0.30	6.68	201.37	OK
	23	0.40	0.80	3.46	0.80	0.020	0.40	118.08	63.48	0.33	1406.59	OK	4.38	Ø8//0.30	6.68	96.76	OK	-119.93	-64.47	0.69	1463.62	OK	2.14	Ø8//0.30	6.68	201.37	OK
	24	0.40	0.60	3.46	0.60	0.016	0.32	40.34	26.35	0.33	1054.94	OK	1.82	Ø8//0.30	6.68	96.76	OK	145.00	94.71	0.51	1083.46	OK	4.24	Ø8//0.30	6.68	149.07	OK
26	0.30	0.50	2.62	0.50	0.020	0.30	-34.73	-21.47	0.24	641.52	OK	2.03	Ø8//0.25	5.00	52.85	OK	122.00	75.44	0.42	670.03	OK	4.10	Ø8//0.25	5.00	92.00	OK	
27	0.30	0.50	2.62	0.50	0.020	0.30	-30.52	-18.87	0.24	641.52	OK	1.79	Ø8//0.25	5.00	52.85	OK	105.00	64.92	0.42	670.03	OK	3.53	Ø8//0.25	5.00	92.00	OK	

11.6 Paredes e núcleos de escadas

11.6.1 DETERMINAÇÃO DO COMPRIMENTO DOS PILARES FICTÍCIOS

Segundo o EC8, a espessura (b_w) das paredes não deve ser inferior a 200 mm e maior que:

$$b_w \geq b_{w0} = \max\{0,15; h_s/20\} \quad (11.33)$$

Em que:

h_s Altura livre entre pisos.

De acordo com o EC8 o valor máximo e mínimo do comprimento dos pilares fictícios (l_c) é determinado pelas seguintes expressões:

$$\begin{cases} l_{c,min} = \max\{0,15 \cdot l_w; 1,5 \cdot b_w\}, \text{ se } l_c \leq l_{c,max} \text{ então } b_w > h_s/15 \\ l_{c,max} = \max\{2,0 \cdot b_w; 0,2 \cdot l_w\}, \text{ se } l_c > l_{c,max} \text{ então } b_w > h_s/10 \end{cases} \quad (11.34)$$

Elemento	Piso	l_k [m]	l_y [m]	l_w [m]	b_w [m]	h_w [m]	h_s [m]	$b_w > b_{w0}$	Pilar Fictício		$b_w > h_s/15$	$l_{c,adot.}$ [m]
									l_{min} [m]	l_{max} [m]		
Pa4	-1	0.25	2.00	2.00	0.25	3.86	3.00	OK	0.40	0.50	OK	0.45
	1 ao 5	0.25	2.00	2.00	0.25	4.16	3.80	OK	0.40	0.50	OK	
Pa1 e Pa2	-1	0.30	3.75	3.75	0.30	3.86	3.00	OK	0.60	0.80	OK	0.70
	1 ao 4	0.30	3.75	3.75	0.30	4.16	3.80	OK	0.60	0.80	OK	
	5	0.30	3.75	3.75	0.30	3.02	2.82	OK	0.60	0.80	OK	
Pa3	-1	3.80	0.30	3.80	0.30	3.86	3.00	OK	0.60	0.80	OK	0.75
	1 ao 4	3.80	0.30	3.80	0.30	4.16	3.80	OK	0.60	0.80	OK	
	5	3.80	0.30	3.80	0.30	3.02	2.82	OK	0.60	0.80	OK	
Nu1 e Nu2	-1	6.50	0.30	6.50	0.30	3.86	3.00	OK	1.00	1.30	OK	1.00
	1 ao 5	6.50	0.30	6.50	0.30	4.16	3.80	OK	1.00	1.30	OK	
	-1	0.30	3.80	3.80	0.30	3.86	3.00	OK	0.60	0.80	OK	
Nu3	1 ao 5	0.30	3.80	3.80	0.30	4.16	3.80	OK	0.60	0.80	OK	0.70

11.6.2 ESFORÇOS E DIMENSIONAMENTO DAS ARMADURAS VERTICAIS

O cálculo destes elementos é feito recorrendo ao método dos pilares fictícios, onde a força de tração e armadura necessária é dada por:

$$F_t = \frac{M_{Ed}}{z} \pm \frac{N_{Ed}}{2} \quad (11.35)$$

$$A_{S,v} = \frac{F_t}{f_{syd}} \quad (11.36)$$

Em que:

F_t Força de tração na armadura;

$A_{S,v}$ Armadura vertical do pilar fictício.

Sendo a armadura vertical por metro de parede, adotada para a alma, obtida através da armadura mínima exigida pelo EC2:

$$A_{sv,min}/m = 0,002 \times b_w = 5,00 \text{ cm}^2/m \quad (11.37)$$

- Esforços

Elemento	Piso	N_{Ed} [KN]	v_d	M_{Ed} [KN.m]	V_{Ed} [KN]
Pa4	4	-676.76	0.07	2182.41	731.10
Pa1	3	-1682.41	0.07	5692.52	1366.45
Pa2	3	-2317.66	0.10	4923.21	1356.63
Pa3	3	-4860.42	0.21	-13065.41	2101.33
Nu1	1	-2945.70	0.08	-13273.01	1808.88
Nu2	3	-3503.47	0.09	-14491.77	2732.59
Nu3	3	-1380.82	0.06	-7972.33	-1876.56

- Dimensionamento

Elemento	N_{Ed} [KN]	M_{Ed} [KN.m]	z [m]	f_t [KN]	$A_{sv,d}$ [cm ²]	b_w [m]	$A_{sv,alma}$ [cm ² /m]
Pa4	-676.76	2182.41	1.55	-1069.63	24.59	0.25	5.00
Pa1	-1682.41	5692.52	3.05	1025.20	23.57	0.30	6.00
Pa2	-2317.66	4923.21	3.05	2239.78	51.49		
Pa3	-4860.42	-13065.41	3.10				
Nu1	-2945.70	-13273.01	5.35	1008.09	23.17	0.30	6.00
Nu2	-3503.47	-14491.77	5.35	2838.32	65.25		
Nu3	-1380.82	-7972.33	3.10				

- Armaduras Adotadas

Elemento	$A_{sv,adot}$ [cm ²]	$A_{seção}$ [m ²]	$\rho_v < 0,04$	$A_{sv,alma}$ [cm ²]		
Pa4	8Ø20	25.120	0.113	0.022 ok	Ø12//0.30	3.77
Pa1 e Pa2	8Ø20	25.120	0.210	0.012 ok	Ø12/0.30	3.77
Nó Pa	17Ø20	53.380	0.345	0.015 ok		
Nu1 e Nu2	8Ø20	25.120	0.300	0.008 ok	Ø12/0.30	3.77
Nó Nu	21Ø20	65.940	0.420	0.016 ok		

11.6.3 ESFORÇOS E DIMENSIONAMENTO DAS ARMADURAS HORIZONTAIS

De acordo com as expressões (11.31 e Eq.(11.32):

Elemento	Piso	V_{Ed} [KN]	$1,5xV_{Ed}$ [KN]	d [m]	z [m]	A_{sh}/s [cm ² /m]	$(A_{sh}/s)/Ramo_{adot.}$ [cm ² /m]	$(A_{sh}/s)_{min}$ [cm ² /m]	$V_{Rd,s}$ [KN]	$V_{Rd,max}$ [KN]				
Pa4	4	731.10	1096.65	1.94	1.75	14.44	$\emptyset 10//0,10$	7.90	5.00	OK	1200.03	OK	2304.72	OK
Pa1 e Pa2	3	1366.45	2049.68	3.69	3.32	14.19	$\emptyset 12//0,10$	11.30	5.00	OK	3264.88	OK	5260.46	OK
Pa3	2	2101.33	3152.00	3.74	3.37	21.50	$\emptyset 12//0,10$	11.30	5.00	OK	3313.05	OK	5338.08	OK
Nu1 e Nu2	2	2856.16	4284.24	6.44	5.80	16.99	$\emptyset 12//0,10$	11.30	5.00	OK	5698.05	OK	9180.86	OK
Nu3	1	2207.46	3311.19	3.74	3.37	22.59	$\emptyset 12//0,10$	11.30	5.00	OK	3313.05	OK	5338.08	OK

11.6.3.1 Verificação dos critérios de ductilidade local

Elemento	b_c [m]	b_0 [m]	w_v	α_m	α_s	α	w_{wd}	v_d	2º termo	$\alpha \cdot w_{wd}$		
Pa4	0.25	0.19	0.07206	0.60954	0.64239	0.39156	0.41739	0.070	-0.0081	0.1634	OK	
Pa1 e Pa2	0.30	0.24	0.03426	0.57963	0.72982	0.423026	0.29823	0.103	-0.0103	0.1262	OK	
Nó	Pa1/Pa2	0.30	0.24	0.03426	0.34028	0.72982	0.248343	0.22373	0.103	-0.0103	0.0556	OK
	Pa3	0.30	0.24	0.03309	0.30254	0.72982	0.2208	0.21789	0.213	0.0093	0.0481	OK
Nó	Nu1 e Nu2	0.30	0.24	0.03785	0.40381	0.74956	0.30268	0.26353	0.076	-0.0146	0.0798	OK
	Nu1/Nu2	0.30	0.24	0.03785	0.5953	0.74956	0.446213	0.13746	0.08983	-0.0120	0.0613	OK
	Nu3	0.30	0.24	0.03453	0.34028	0.72982	0.248343	0.22373	0.06056	-0.0179	0.0556	OK

- Verificação do comprimento da zona comprimida

Elemento	l_w [m]	l_c [m]	$\epsilon_{cu2,c}$	χ_u	Ext. das compressões		
Pa4	2.00	0.45	0.0198	0.3738	0.3079	OK	
Pa1 e Pa2	3.75	0.70	0.0161	0.6439	0.5040	OK	
Nó	Pa1/Pa2	3.75	0.70	0.0091	0.6435	0.3948	OK
	Pa3	3.80	0.80	0.0083	1.1698	0.6772	OK
Nó	Nu1 e Nu2	6.5	1.00	0.0115	0.9212	0.6403	OK
	Nu1/Nu2	6.5	1.00	0.0096	1.0374	0.6605	OK
	Nu3	3.8	0.70	0.0091	0.4517	0.2771	OK

11.7 Fundações

- Características do solo:

σ_{adm} [KN/m ²]	γ [KN/m ³]	k_0	k_a	k_p	ϕ' [°]
500,00	21,00	0,30	0,17	5,83	45,00

11.7.1 SAPATAS

11.7.1.1 Pré-dimensionamento

$$A_{\text{sapata}} \geq \frac{N_{Ed} \cdot \gamma}{\sigma_{adm}} \quad (11.38)$$

Em que:

A_{sapata}	Área da sapata [m ²];
N_{Ed}	Esforço normal condicionante [KN];
γ	Coefficiente de majoração, $\gamma = 1,25$ para sapatas com excentricidades e $\gamma = 1,10$ para sapatas sem excentricidades;

A altura das sapatas de pilares e para se obter um comportamento rígido, foi obtida através de:

$$H > \begin{cases} \frac{a - a_0}{4} \\ \frac{b - b_0}{4} \end{cases} \quad (11.39)$$

Em que:

a	Dimensão em x da sapata [m];
a_0	Dimensão em x do pilar [m];
b	Dimensão em y da sapata [m];
b_0	Dimensão em y do pilar [m]

Enquanto para a sapata dos muros utilizou-se:

$$a - E \leq H \quad (11.40)$$

Em que:

a	Largura da sapata;
E	Espessura do muro;
H	Altura da sapata.

Elemento	Dim. Pilare		Combinação	N _{Ed} [KN]	A _{sapata} [m ²]	L [m]	Prop. Sapatas				H = c _{max} /4 [m]	H _{adot} [m]	PP _{Sapata} [KN]	σ _{solo} [KN/m ²]
	x [m]	y [m]					Desig.	x [m]	y [m]	Área [m ²]				
P9	0.25	0.70	Fund	-1267.53	2.79	1.67	S1	1.80	1.80	3.24	0.39	0.60	48.60	406.21
P10	0.40	0.80	Fund	-2932.83	6.45	2.54	S2	2.50	2.70	6.75	0.53	0.60	101.25	449.49
P11	0.40	0.80	Fund	-5605.87	12.33	3.51	S3	3.40	3.60	12.24	0.75	0.90	275.40	480.50
P12	0.80	0.40	Fund	-6664.95	14.66	3.83	S4	3.70	3.90	14.43	0.88	0.90	324.68	484.38
P13	0.40	0.80	Fund	-7391.52	16.26	4.03	S6	3.90	4.10	15.99	0.88	0.90	359.78	484.76
P14	0.40	0.80	Fund	-7271.35	16.00	4.00	S6	3.90	4.10	15.99	0.88	0.90	359.78	477.24
P15	0.40	0.80	Fund	-2941.04	6.47	2.54	S2	2.50	2.70	6.75	0.53	0.60	101.25	450.71
P16	0.40	0.80	Fund	-1433.58	3.15	1.78	S1	1.80	1.80	3.24	0.35	0.60	48.60	457.46
P17	0.40	0.80	Sismo	-2476.18	2.72	1.65	S1	1.80	1.80	3.24	0.35	0.60	48.60	779.25
Pa4	0.25	2.00	Fund	-3337.94	7.34	2.71	S8	2.00	3.50	7.00	0.44	0.60	105.00	491.85
P18	0.25	0.90	Fund	-2520.84	5.55	2.35	S2	2.50	2.70	6.75	0.56	0.60	101.25	388.46
P19	0.40	1.00	Fund	-7363.45	16.20	4.02	S6	3.90	4.10	15.99	0.88	0.90	359.78	483.00
P20	0.40	1.00	Fund	-7287.02	16.03	4.00	S6	3.90	4.10	15.99	0.88	0.90	359.78	478.22
P21	0.40	1.00	Fund	-7238.62	15.92	3.99	S6	3.90	4.10	15.99	0.88	0.90	359.78	475.20
P22	0.40	1.00	Fund	-7088.16	15.59	3.95	S6	3.90	4.10	15.99	0.88	0.90	359.78	465.79
P23	0.40	1.00	Fund	-4334.75	9.54	3.09	S9	3.00	3.20	9.60	0.65	0.90	216.00	474.04
P24	0.40	0.80	Fund	-2358.99	5.19	2.28	S10	2.30	2.30	5.29	0.48	0.60	79.35	460.93
P25	0.40	0.80	Fund	-855.20	1.88	1.37	S10	1.40	1.40	1.96	0.25	0.60	29.40	451.33

Elemento	Dimensões		Combinação	N _{Ed} [KN]	N _{ed,tot} [KN]	A _{sapata} [m ²]	L [m]	Prop. Sapatas				H _{adot} [m]	PP _{Sapata} [KN]	σ _{solo} [KN/m ²]
	x [m]	y [m]						Desig.	x [m]	y [m]	Área [m ²]			
Pa1	0.30	3.75	Sismo	-7090.86				S5	4.35	4.35	18.92	0.60	283.84	805.40
Pa2	0.30	3.75	Sismo	-7804.16	-14956.28	18.70	4.32							
Pa3	3.80	0.30	Sismo	-61.26										

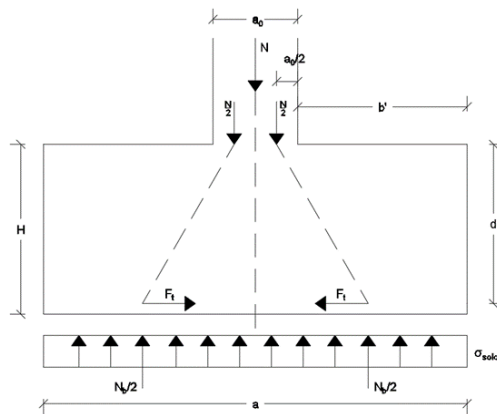
Elemento	Dimensões		Combinação	N _{Ed} [KN]	N _{ed,tot} [KN]	A _{sapata} [m ²]	L [m]	Prop. Sapatas				H _{adot} [m]	PP _{Sapata} [KN]	σ _{solo} [KN/m ²]
	x [m]	y [m]						Desig.	x [m]	y [m]	Área [m ²]			
Nu1	6.50	0.30	Sismo	-5020.17				S7	6.90	4.20	28.98	0.60	434.70	563.72
Nu2	6.50	0.30	Sismo	-7749.77	-15901.96	19.88	4.46							
Nu3	0.30	3.80	Sismo	-3132.02										

Elemento	Dimensões		Combinação	N _{Ed} [KN]	N _{ed,tot} [KN]	A _{sapata} [m ²]	L [m]	Prop. Sapatas				H _{adot} [m]	PP _{Sapata} [KN]	σ _{solo} [KN/m ²]
	x [m]	y [m]						Desig.	x [m]	y [m]	Área [m ²]			
P24	0.40	0.80	Fund	-2358.99	-3214.19	8.04	2.83	S10	4.00	2.10	8.40	0.60	126.00	397.64
P25	0.40	0.80	Fund	-855.20										

Muro	e [m]	h _{sap,adot} [m]	N _{sd} [KN/m]	A _{sapata} [m ²]	a _{sap,adot} [m]	PP _{sapata} [KN/m]	σ _{solo} [KN/m ²]
M1	0.60	0.60	209.71	0.52	1.20	30.00	199.76
M2	0.25	0.60	65.66	0.16	0.90	22.50	97.96

11.7.1.2 Armaduras das sapatas centradas, núcleos e muros

- Sapatas Centradas:



$$A_{s,x} = \frac{N_b \cdot \gamma \cdot (a - a_0)}{8 \cdot d \cdot f_{syd} \cdot b} \quad (11.41)$$

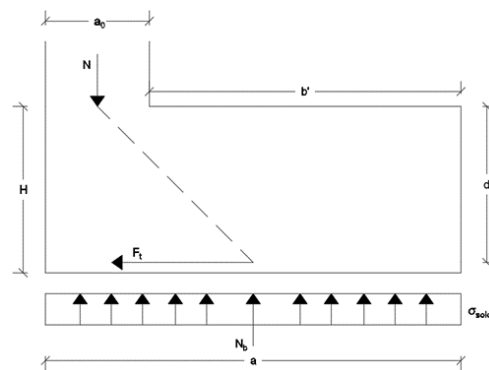
$$A_{s,y} = \frac{N_b \cdot \gamma \cdot (b - b_0)}{8 \cdot d \cdot f_{syd} \cdot a} \quad (11.42)$$

Em que:

- N_b Esforço Axial na base da sapata [KN];
- A_{sx} Armadura necessária na direção x [cm²/m];
- A_{sy} Armadura necessária na direção y [cm²/m];

- Sapata dos núcleos recorrendo às Eq.(11.11, Eq.(11.12 e Eq.(11.13).

- Sapatas dos Muros:



$$F_t = \frac{N_b \cdot \gamma_F \cdot \left(\frac{a - a_0}{2}\right)}{d} \quad (11.43)$$

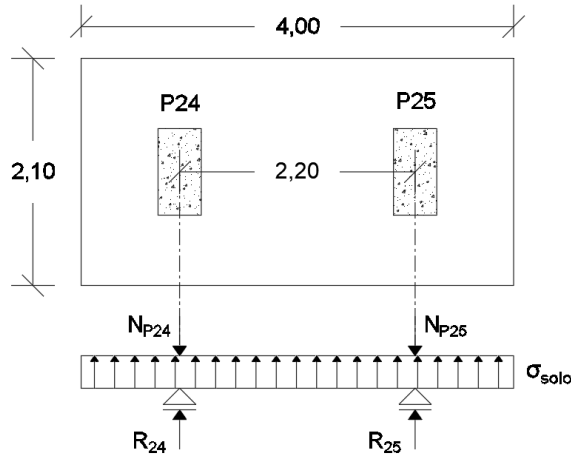
$$A_{s/m} = \frac{F_t}{f_{syd} \cdot b} \quad (11.44)$$

Elemento	Dim. Pilare		Combinação	N _{Ed} [KN]	Sapata	Dim. Sapata			PP _{Sapata} [KN]	N _b [KN]	Armaduras Segundo X				Armaduras Segundo Y			
	x [m]	y [m]				x [m]	y [m]	H [m]			F _{ts,d} [KN]	A _s [cm ² /m]	A _{s,adot} [cm ² /m]	F _{ts,d} [KN]	A _s [cm ² /m]	A _{s,adot} [cm ² /m]		
P9	0.25	0.80	Fund	-1267.53	S1	1.80	1.80	0.60	48.60	-1316.13	708.33	9.05	Ø16//0.20+Ø12//0.20	15.70	456.99	5.84	Ø16//0.20+Ø12//0.20	15.70
P10	0.40	0.80	Fund	-2932.83	S2	2.50	2.70	0.60	101.25	-3034.08	2212.35	18.84	Ø20//0.15	20.93	2001.65	18.41	Ø20//0.15	20.93
P11	0.50	1.00	Fund	-5605.87	S3	3.40	3.60	0.90	275.40	-5881.27	3948.07	25.21	Ø20//0.20+Ø16//0.20	25.75	3539.65	23.93	Ø20//0.20+Ø16//0.20	25.75
P12	0.50	1.00	Fund	-6664.95	S4	3.70	3.90	0.90	324.68	-6989.63	5177.50	30.52	Ø16//0.10+Ø12//0.10	31.40	4692.11	29.15	Ø16//0.10+Ø12//0.10	31.40
P13	0.50	1.00	Fund	-7391.52	S6	3.90	4.10	0.90	359.78	-7751.30	6100.56	34.21	Ø20//0.15+Ø16//0.15	34.33	5562.27	32.79	Ø20//0.15+Ø16//0.15	34.33
P14	0.50	1.00	Fund	-7271.35	S6	3.90	4.10	0.90	359.78	-7631.13	6005.98	33.68	Ø20//0.15+Ø16//0.15	34.33	5476.04	32.28	Ø20//0.15+Ø16//0.15	34.33
P15	0.40	0.80	Fund	-2941.04	S2	2.50	2.70	0.60	101.25	-3042.29	2218.34	18.89	Ø20//0.15	20.93	2007.07	18.46	Ø20//0.15	20.93
P16	0.40	0.80	Fund	-1433.58	S1	1.80	1.80	0.60	48.60	-1482.18	720.50	9.20	Ø16//0.20+Ø12//0.20	15.70	514.65	6.57	Ø16//0.20+Ø12//0.20	15.70
P17	0.40	0.60	Sismo	-2476.18	S1	1.80	1.80	0.60	48.60	-2524.78	1227.32	15.67	Ø16//0.20+Ø12//0.20	15.70	1051.99	13.44	Ø16//0.20+Ø12//0.20	15.70
Pa4	0.25	2.00	Fund	-3337.94	S8	2.20	3.30	0.60	108.90	-3446.84	2333.80	16.26	Ø20//0.15	20.93	1555.87	16.26	Ø20//0.15	20.93
P18	0.25	0.95	Fund	-2520.84	S2	2.50	2.70	0.60	101.25	-2622.09	2048.51	17.44	Ø20//0.15	20.93	1593.28	14.65	Ø20//0.15	20.93
P19	0.50	1.00	Fund	-7363.45	S6	3.90	4.10	0.90	359.78	-7723.23	6078.46	34.08	Ø20//0.15+Ø16//0.15	34.33	5542.13	32.67	Ø20//0.15+Ø16//0.15	34.33
P20	0.50	1.00	Fund	-7287.02	S6	3.90	4.10	0.90	359.78	-7646.80	6018.31	33.74	Ø20//0.15+Ø16//0.15	34.33	5487.28	32.34	Ø20//0.15+Ø16//0.15	34.33
P21	0.50	1.00	Fund	-7238.62	S6	3.90	4.10	0.90	359.78	-7598.40	5980.22	33.53	Ø20//0.15+Ø16//0.15	34.33	5452.55	32.14	Ø20//0.15+Ø16//0.15	34.33
P22	0.50	1.00	Fund	-7088.16	S6	3.90	4.10	0.90	359.78	-7447.94	5861.80	32.87	Ø20//0.15+Ø16//0.15	34.33	5344.58	31.50	Ø20//0.15+Ø16//0.15	34.33
P23	0.50	1.00	Fund	-4334.75	S9	3.00	3.20	0.90	216.00	-4550.75	2633.54	18.92	Ø20//0.15	20.93	2317.51	17.76	Ø20//0.15	20.93

Sapatas Núcleos	d [m]	M _{Ed,x} [KN.m]	μ	ω	A _{S,x} [cm ² /m]	A _{S,x,adot} [cm ² /m]	M _{Ed,y} [KN.m]	μ	ω	A _{S,y} [cm ² /m]	A _{S,y,adot} [cm ² /m]		
S5	0.55	453.95	0.0750	0.0807	20.40	Ø20//0.15	20.93	274.30	0.0453	0.0474	11.98	Ø20//0.15	20.93
S7	0.55	197.39	0.0326	0.0337	8.52	Ø16//0.20+Ø12//0.20	15.70	315.40	0.0521	0.0549	13.87	Ø16//0.20+Ø12//0.20	15.70

Muro	PP _{Sapata} [KN/m]	N _b [KN/m]	γ	a ₀ [m]	a [m]	d [m]	F _{ts,d} [KN]	A _s [cm ² /m]	A _{s,adot} [cm ² /m]	
M1	30.00	239.71	1.50	0.60	1.20	0.55	196.13	4.51	Ø12//0.20	5.65
M2	22.50	88.16	1.50	0.25	0.90	0.55	78.14	1.80	Ø12//0.20	5.65

11.7.1.3 Armaduras da sapata dos pilares P24 e P25



- Para a direção x:

$$A_s = \frac{M_{Ed} \cdot \gamma}{0,9 \cdot d \cdot f_{syd}} \quad (11.45)$$

Em que:

- M_{Ed} Momento fletor condicionante na base do pilar [KN.m];
- A_s Armadura necessária na direção em análise [cm²/m];

h_{sapata} [m]	σ_{solo} [KN/m ²]	$N_{Ed,P25}$ [KN]	R_{25} [KN]	R_{24} [KN]	M_{Ed} [KN.m]	F_{td} [KN]	A_{sx} [cm ² /m]	$A_{sx, adot}$ [cm ² /m]
0.60	397.64	855.20	59.92	1564.71	166.09	512.62	11.78	Ø16//0.25+Ø12//0.25 12.56

- Para a direção y de acordo com a expressão Eq.(11.42):

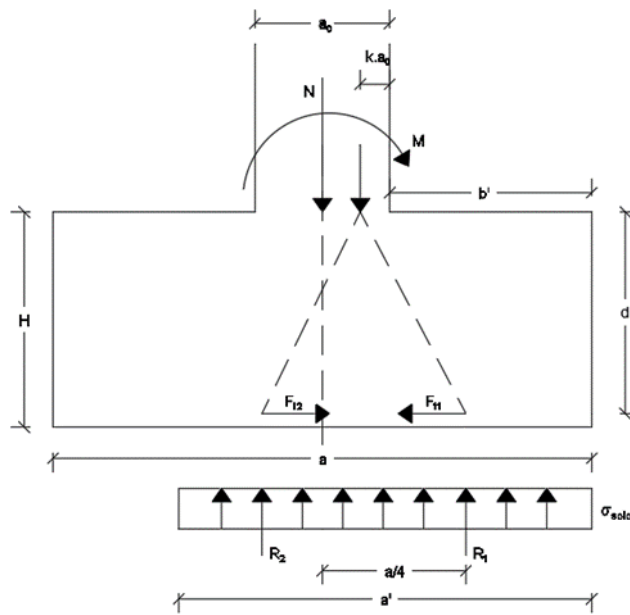
$N_{Ed,tot}$ [KN]	d [m]	a [m]	b [m]	b_0 [m]	F_{td} [KN]	A_{sy} [cm ² /m]	$A_{sy, adot}$ [cm ² /m]
3214.19	0.54	4.00	2.10	0.80	1450.85	8.34	Ø16//0.25+Ø12//0.25 12.56

11.7.1.4 Armaduras da sapata da parede Pa4

Tendo em conta que a sapata da parede Pa4 não se encontra travada em uma das direções, para a direção y, obtiveram-se as armaduras necessárias recorrendo à Eq.(11.42):

N_{Ed} [KN]	d [m]	a [m]	b [m]	b_0 [m]	F_{td} [KN]	A_{sy} [cm ² /m]	$A_{sy, adot}$ [cm ² /m]
3337.94	0.55	2.00	3.50	2.00	1706.90	19.62	Ø16//0.10 20.10

Já para a direção x, tendo em conta as excentricidades provocadas nessa direção, obtiveram-se as armaduras de acordo com:



$$e = M_b / N_b \quad (11.46)$$

$$R_1 = \frac{a}{2} \cdot \sigma_{solo} \quad (11.47)$$

$$F_{t1} = \frac{R_1 \cdot \left(\frac{a}{4} - a_0 \cdot (0,5 - k) \right)}{d} \quad (11.48)$$

$$A_{s/m} = \frac{R \cdot \gamma_F}{f_{syd} \cdot a'} \quad (11.49)$$

Em que:

- e Excentricidade, se $e \leq a/4$ existe compressão nos dois lados da sapata;
- R Reações verticais no solo;
- γ_F Fator de majoração, igual a 1,5;
- Obtido em função de e/a_0 :

k

e/a_0	0.00	0.25	0.50	1.00	1.50
k	0.25	0.20	0.15	0.10	0.05

Tendo-se obtido os seguintes resultados:

N_{Ed} [KN]	M_{Ed} [KN.m]	V_{Ed} [KN]	e_x [[m]	a' [m]	b [m]	σ_{solo} [KN/m ²]	R_1 [KN]	a_0 [m]	e_x/a_0	k
3337.94	65.40	-15.48	0.02	1.98	3.50	491.85	1721.48	0.25	0.08	0.23

F_{t1} [KN]	R_2 [KN]	F_{t2} [KN]	A_{sx} [cm ² /m]	$A_{sx, adot}$ [cm ² /m]
1356.84	1687.75	1708.32	16.83	Ø16//0.10 20.10

11.7.2 VIGAS DE FUNDAÇÃO

11.7.2.1 Flexão

O dimensionamento foi feito, retirando as armaduras diretamente do programam de cálculo, e fazendo as seguintes verificações:

- Largura mínima ($b_{w,min}$) igual a 0,25 m e altura mínima ($h_{w,min}$) de 0,40 m ou 0,50 se o edifício tiver mais de três pisos;
- Ao longo de todo o comprimento das vigas, uma taxa de armadura longitudinal mínima de $\rho_{b,min} = 0,4\%$, nas faces superior e inferior.

Viga	Secção	Face	$A_{s,viga}$ [cm ²]	$A_{s,viga,adt}$ [cm ²]	b_w [m]	h_w [m]	ρ'	ρ	ρ_{min}	ρ_{max}	$\rho' > 0,5 \cdot \rho$	
VF.01	1	Sup.	7.634	2Ø20+2Ø16	10.30	0.25	0.50	0.0075	0.0082	0.0029	0.0248	Verifica
		Inf.	6.874	3Ø20	9.42	0.25	0.50					
	2	Sup.	3.265	2Ø20	6.28	0.25	0.50	0.0050	0.0050	0.0029	0.0223	Verifica
		Inf.	3.925	2Ø20	6.28	0.25	0.50					
	3	Sup.	8.09	2Ø20+2Ø16	10.30	0.25	0.50	0.0075	0.0082	0.0029	0.0248	Verifica
		Inf.	5.425	3Ø20	9.42	0.25	0.50					
	4	Sup.	7.37	2Ø20+2Ø16	10.30	0.25	0.50	0.0075	0.0082	0.0029	0.0248	Verifica
		Inf.	6.46	3Ø20	9.42	0.25	0.50					
	5	Sup.	9.48	2Ø20+2Ø16	10.30	0.25	0.50	0.0075	0.0082	0.0029	0.0248	Verifica
		Inf.	9.16	3Ø20	9.42	0.25	0.50					
	6	Sup.	3.19	2Ø20	6.28	0.25	0.50	0.0050	0.0050	0.0029	0.0223	Verifica
		Inf.	3.79	2Ø20	6.28	0.25	0.50					
	7	Sup.	10.11	2Ø20+2Ø16	10.30	0.25	0.50	0.0075	0.0082	0.0029	0.0248	Verifica
		Inf.	8.2	3Ø20	9.42	0.25	0.50					
	8	Sup.		2Ø20	6.28	0.25	0.50	0.0050	0.0050	0.0029	0.0223	Verifica
		Inf.		2Ø20	6.28	0.25	0.50					
	9	Sup.		2Ø20+2Ø16	10.30	0.25	0.50	0.0075	0.0082	0.0029	0.0248	Verifica
		Inf.		3Ø20	9.42	0.25	0.50					
VF.02	1	Sup.	8.13	2Ø20+2Ø16	10.30	0.25	0.50	0.0075	0.0082	0.0029	0.0248	Verifica
		Inf.	7.44	3Ø20	9.42	0.25	0.50					
	2	Sup.	3.89	2Ø20	6.28	0.25	0.50	0.0050	0.0050	0.0029	0.0223	Verifica
		Inf.	3.74	2Ø20	6.28	0.25	0.50					
	3	Sup.	9.69	2Ø20+2Ø16	10.30	0.25	0.50	0.0075	0.0082	0.0029	0.0248	Verifica
		Inf.	6.95	3Ø20	9.42	0.25	0.50					
VF.03	1	Sup.	8.08	3Ø20	9.42	0.25	0.50	0.0048	0.0075	0.0029	0.0221	Verifica
		Inf.	5.42	3Ø16	6.03	0.25	0.50					
	2	Sup.	3.19	2Ø20	6.28	0.25	0.50	0.0032	0.0050	0.0029	0.0205	Verifica
		Inf.	3.31	2Ø16	4.02	0.25	0.50					
	3	Sup.	8.74	3Ø20	9.42	0.25	0.50	0.0048	0.0075	0.0029	0.0221	Verifica
		Inf.	4.54	3Ø16	6.03	0.25	0.50					
	4	Sup.		2Ø20	6.28	0.25	0.50	0.0032	0.0050	0.0029	0.0205	Verifica
		Inf.		2Ø16	4.02	0.25	0.50					
	5	Sup.		3Ø20	9.42	0.25	0.50	0.0048	0.0075	0.0029	0.0221	Verifica
		Inf.		3Ø16	6.03	0.25	0.50					
VF.04	1	Sup.	6.99	3Ø20	9.42	0.25	0.50	0.0075	0.0075	0.0029	0.0248	Verifica
		Inf.	6.32	3Ø20	9.42	0.25	0.50					
	2	Sup.	3.19	2Ø20	6.28	0.25	0.50	0.0050	0.0050	0.0029	0.0223	Verifica
		Inf.	3.57	2Ø20	6.28	0.25	0.50					
	3	Sup.	7.08	3Ø20	9.42	0.25	0.50	0.0075	0.0075	0.0029	0.0248	Verifica
		Inf.	4.82	3Ø20	9.42	0.25	0.50					
	4	Sup.	3.19	2Ø20	6.28	0.25	0.50	0.0050	0.0050	0.0029	0.0223	Verifica
		Inf.	3.19	2Ø20	6.28	0.25	0.50					
	5	Sup.	7.51	3Ø20	9.42	0.25	0.50	0.0075	0.0075	0.0029	0.0248	Verifica
		Inf.	3.61	3Ø20	9.42	0.25	0.50					
	6	Sup.		2Ø20	6.28	0.25	0.50	0.0050	0.0050	0.0029	0.0223	Verifica
		Inf.		2Ø20	6.28	0.25	0.50					
	7	Sup.		3Ø20	9.42	0.25	0.50	0.0075	0.0075	0.0029	0.0248	Verifica
		Inf.		3Ø20	9.42	0.25	0.50					

VF.05	1	Sup.	8.22	3Ø20	9.42	0.25	0.50	0.0075	0.0075	0.0029	0.0248	Verifica
		Inf.	7.43	3Ø20	9.42	0.25	0.50					
	2	Sup.	3.7	2Ø20	6.28	0.25	0.50	0.0050	0.0050	0.0029	0.0223	Verifica
		Inf.	3.77	2Ø20	6.28	0.25	0.50					
	3	Sup.	9.39	3Ø20	9.42	0.25	0.50	0.0075	0.0075	0.0029	0.0248	Verifica
		Inf.	6.65	3Ø20	9.42	0.25	0.50					
	4	Sup.	3.19	2Ø20	6.28	0.25	0.50	0.0050	0.0050	0.0029	0.0223	Verifica
		Inf.	3.19	2Ø20	6.28	0.25	0.50					
	5	Sup.	8.31	3Ø20	9.42	0.25	0.50	0.0075	0.0075	0.0029	0.0248	Verifica
		Inf.	4.18	3Ø20	9.42	0.25	0.50					
	6	Sup.		2Ø20	6.28	0.25	0.50	0.0050	0.0050	0.0029	0.0223	Verifica
		Inf.		2Ø20	6.28	0.25	0.50					
	7	Sup.		3Ø20	9.42	0.25	0.50	0.0075	0.0075	0.0029	0.0248	Verifica
		Inf.		3Ø20	9.42	0.25	0.50					
VF.06	1	Sup.	8.27	3Ø20	9.42	0.25	0.50	0.0075	0.0075	0.0029	0.0248	Verifica
		Inf.	7.49	3Ø20	9.42	0.25	0.50					
	2	Sup.	3.73	2Ø20	6.28	0.25	0.50	0.0050	0.0050	0.0029	0.0223	Verifica
		Inf.	3.79	2Ø20	6.28	0.25	0.50					
	3	Sup.	9.48	3Ø20	9.42	0.25	0.50	0.0075	0.0075	0.0029	0.0248	Verifica
		Inf.	6.69	3Ø20	9.42	0.25	0.50					
	4	Sup.	3.19	2Ø20	6.28	0.25	0.50	0.0050	0.0050	0.0029	0.0223	Verifica
		Inf.	3.19	2Ø20	6.28	0.25	0.50					
	5	Sup.	8.36	3Ø20	9.42	0.25	0.50	0.0075	0.0075	0.0029	0.0248	Verifica
		Inf.	4.23	3Ø20	9.42	0.25	0.50					
	6	Sup.		2Ø20	6.28	0.25	0.50	0.0050	0.0050	0.0029	0.0223	Verifica
		Inf.		2Ø20	6.28	0.25	0.50					
	7	Sup.		3Ø20	9.42	0.25	0.50	0.0075	0.0075	0.0029	0.0248	Verifica
		Inf.		3Ø20	9.42	0.25	0.50					
VF.07	1	Sup.	8.22	3Ø20	9.42	0.25	0.50	0.0075	0.0075	0.0029	0.0248	Verifica
		Inf.	7.59	3Ø20	9.42	0.25	0.50					
	2	Sup.	3.85	2Ø20	6.28	0.25	0.50	0.0050	0.0050	0.0029	0.0223	Verifica
		Inf.	3.81	2Ø20	6.28	0.25	0.50					
	3	Sup.	9.69	3Ø20	9.42	0.25	0.50	0.0075	0.0075	0.0029	0.0248	Verifica
		Inf.	6.61	3Ø20	9.42	0.25	0.50					
	4	Sup.	3.19	2Ø20	6.28	0.25	0.50	0.0050	0.0050	0.0029	0.0223	Verifica
		Inf.	3.19	2Ø20	6.28	0.25	0.50					
	5	Sup.	8.43	3Ø20	9.42	0.25	0.50	0.0075	0.0075	0.0029	0.0248	Verifica
		Inf.	4.31	3Ø20	9.42	0.25	0.50					
	6	Sup.		2Ø20	6.28	0.25	0.50	0.0050	0.0050	0.0029	0.0223	Verifica
		Inf.		2Ø20	6.28	0.25	0.50					
	7	Sup.		3Ø20	9.42	0.25	0.50	0.0075	0.0075	0.0029	0.0248	Verifica
		Inf.		3Ø20	9.42	0.25	0.50					
VF.08	1	Sup.	8.71	2Ø20+2Ø16	10.30	0.25	0.50	0.0075	0.0082	0.0029	0.0248	Verifica
		Inf.	8.02	3Ø20	9.42	0.25	0.50					
	2	Sup.	4.29	2Ø20	6.28	0.25	0.50	0.0050	0.0050	0.0029	0.0223	Verifica
		Inf.	3.99	2Ø20	6.28	0.25	0.50					
	3	Sup.	10.01	2Ø20+2Ø16	10.30	0.25	0.50	0.0075	0.0082	0.0029	0.0248	Verifica
		Inf.	7.52	3Ø20	9.42	0.25	0.50					
VF.9	1	Sup.		2Ø20+2Ø16	10.30	0.25	0.50	0.0075	0.0082	0.0029	0.0248	Verifica
		Inf.		3Ø20	9.42	0.25	0.50					
	2	Sup.		2Ø20	6.28	0.25	0.50	0.0050	0.0050	0.0029	0.0223	Verifica
		Inf.		2Ø20	6.28	0.25	0.50					
	3	Sup.		2Ø20+2Ø16	10.30	0.25	0.50	0.0075	0.0082	0.0029	0.0248	Verifica
		Inf.		3Ø20	9.42	0.25	0.50					
VF.10	1	Sup.	9.55	2Ø20+2Ø16	10.30	0.25	0.50	0.0075	0.0082	0.0029	0.0248	Verifica
		Inf.	9.13	3Ø20	9.42	0.25	0.50					
	2	Sup.	5.07	2Ø20	6.28	0.25	0.50	0.0050	0.0050	0.0029	0.0223	Verifica
		Inf.	4.65	2Ø20	6.28	0.25	0.50					
	3	Sup.	10.23	2Ø20+2Ø16	10.30	0.25	0.50	0.0075	0.0082	0.0029	0.0248	Verifica
		Inf.	8.81	3Ø20	9.42	0.25	0.50					

VF.11	1	Sup.	3.19	3Ø16	6.03	0.25	0.50	0.0048	0.0048	0.0029	0.0221	Verifica
		Inf.	3.19	3Ø16	6.03	0.25	0.50					
	2	Sup.	3.19	3Ø16	6.03	0.25	0.50	0.0048	0.0048	0.0029	0.0221	Verifica
		Inf.	3.19	3Ø16	6.03	0.25	0.50					
	3	Sup.	3.19	3Ø16	6.03	0.25	0.50	0.0048	0.0048	0.0029	0.0221	Verifica
		Inf.	3.19	3Ø16	6.03	0.25	0.50					
	4	Sup.	3.19	3Ø16	6.03	0.25	0.50	0.0048	0.0048	0.0029	0.0221	Verifica
		Inf.	3.19	3Ø16	6.03	0.25	0.50					
	5	Sup.	3.19	3Ø16	6.03	0.25	0.50	0.0048	0.0048	0.0029	0.0221	Verifica
		Inf.	3.19	3Ø16	6.03	0.25	0.50					
	6	Sup.	0	3Ø16	6.03	0.25	0.50	0.0048	0.0048	0.0029	0.0221	Verifica
		Inf.	3.19	3Ø16	6.03	0.25	0.50					
	7	Sup.	3.19	3Ø16	6.03	0.25	0.50	0.0048	0.0048	0.0029	0.0221	Verifica
		Inf.	3.19	3Ø16	6.03	0.25	0.50					
	8	Sup.	0	3Ø16	6.03	0.25	0.50	0.0048	0.0048	0.0029	0.0221	Verifica
		Inf.	3.19	3Ø16	6.03	0.25	0.50					
	9	Sup.	3.19	3Ø16	6.03	0.25	0.50	0.0048	0.0048	0.0029	0.0221	Verifica
Inf.		3.19	3Ø16	6.03	0.25	0.50						
10	Sup.	0	3Ø16	6.03	0.25	0.50	0.0048	0.0048	0.0029	0.0221	Verifica	
	Inf.	3.19	3Ø16	6.03	0.25	0.50						
11	Sup.	0	3Ø16	6.03	0.25	0.50	0.0048	0.0048	0.0029	0.0221	Verifica	
	Inf.	3.19	3Ø16	6.03	0.25	0.50						
12	Sup.	0	3Ø16	6.03	0.25	0.50	0.0048	0.0048	0.0029	0.0221	Verifica	
	Inf.	3.19	3Ø16	6.03	0.25	0.50						
13	Sup.	3.19	3Ø16	6.03	0.25	0.50	0.0048	0.0048	0.0029	0.0221	Verifica	
	Inf.	3.19	3Ø16	6.03	0.25	0.50						
14	Sup.	3.19	3Ø16	6.03	0.25	0.50	0.0048	0.0048	0.0029	0.0221	Verifica	
	Inf.	3.19	3Ø16	6.03	0.25	0.50						
15	Sup.	3.19	3Ø16	6.03	0.25	0.50	0.0048	0.0048	0.0029	0.0221	Verifica	
	Inf.	3.19	3Ø16	6.03	0.25	0.50						
16	Sup.	0	3Ø16	6.03	0.25	0.50	0.0048	0.0048	0.0029	0.0221	Verifica	
	Inf.	3.19	3Ø16	6.03	0.25	0.50						
17	Sup.	3.19	3Ø16	6.03	0.25	0.50	0.0048	0.0048	0.0029	0.0221	Verifica	
	Inf.	3.19	3Ø16	6.03	0.25	0.50						
VF.12	1	Sup.	3.19	3Ø16	6.03	0.25	0.50	0.0048	0.0048	0.0029	0.0221	Verifica
		Inf.	3.19	3Ø16	6.03	0.25	0.50					
	2	Sup.	3.19	3Ø16	6.03	0.25	0.50	0.0048	0.0048	0.0029	0.0221	Verifica
		Inf.	3.19	3Ø16	6.03	0.25	0.50					
	3	Sup.	3.19	3Ø16	6.03	0.25	0.50	0.0048	0.0048	0.0029	0.0221	Verifica
		Inf.	3.19	3Ø16	6.03	0.25	0.50					
	4	Sup.	0	3Ø16	6.03	0.25	0.50	0.0048	0.0048	0.0029	0.0221	Verifica
		Inf.	3.19	3Ø16	6.03	0.25	0.50					
	5	Sup.	3.19	3Ø16	6.03	0.25	0.50	0.0048	0.0048	0.0029	0.0221	Verifica
		Inf.	3.19	3Ø16	6.03	0.25	0.50					
	6	Sup.	0	3Ø16	6.03	0.25	0.50	0.0048	0.0048	0.0029	0.0221	Verifica
		Inf.	3.19	3Ø16	6.03	0.25	0.50					
	7	Sup.	3.19	3Ø16	6.03	0.25	0.50	0.0048	0.0048	0.0029	0.0221	Verifica
		Inf.	3.19	3Ø16	6.03	0.25	0.50					
	8	Sup.	0	3Ø16	6.03	0.25	0.50	0.0048	0.0048	0.0029	0.0221	Verifica
		Inf.	3.19	3Ø16	6.03	0.25	0.50					
	9	Sup.	3.19	3Ø16	6.03	0.25	0.50	0.0048	0.0048	0.0029	0.0221	Verifica
		Inf.	3.19	3Ø16	6.03	0.25	0.50					
	10	Sup.	0	3Ø16	6.03	0.25	0.50	0.0048	0.0048	0.0029	0.0221	Verifica
		Inf.	3.19	3Ø16	6.03	0.25	0.50					
	11	Sup.	3.19	3Ø16	6.03	0.25	0.50	0.0048	0.0048	0.0029	0.0221	Verifica
		Inf.	3.19	3Ø16	6.03	0.25	0.50					
	12	Sup.	0	3Ø16	6.03	0.25	0.50	0.0048	0.0048	0.0029	0.0221	Verifica
		Inf.	3.19	3Ø16	6.03	0.25	0.50					
	13	Sup.	3.19	3Ø16	6.03	0.25	0.50	0.0048	0.0048	0.0029	0.0221	Verifica
		Inf.	3.19	3Ø16	6.03	0.25	0.50					

11.7.2.2 Esforço Transverso

Obteve-se um valor máximo de esforço transverso para a VF.01 de 126 KN/m, tendo-se adotado uma armadura de Ø8//0,15, recorrendo à Eq.(11.21, em todas as vigas.

11.8 Muros

11.8.1 IMPULSOS NOS MUROS

- Características do solo:

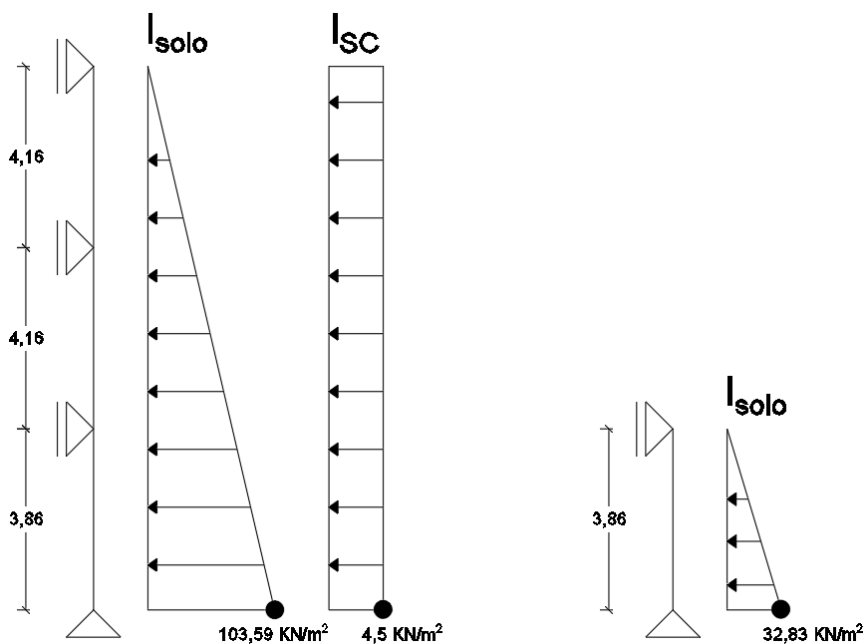
σ_{adm} [KN/m ²]	γ [KN/m ³]	k_0	k_a	k_p	ϕ' [°]
500,00	21,00	0,30	0,17	5,83	45,00

$$I_{Terras} = \gamma_{solo} \cdot h \cdot k_0 \cdot \gamma_G \quad (11.50)$$

$$I_{SC} = SC \cdot k_0 \cdot \gamma_Q \quad (11.51)$$

Em que:

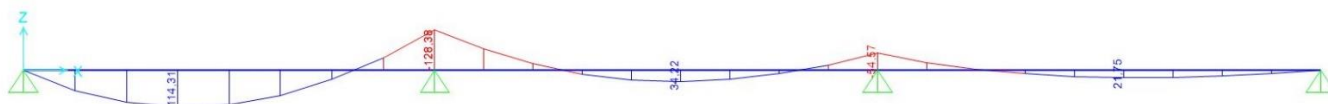
I_{Terras}	Impulso provocado pelo terreno;
γ_{solo}	Peso volúmico do solo;
h	Altura da camada;
k_0	Coefficiente de impulso em repouso;
γ_G	Coefficiente parcial de segurança para ações permanentes, igual a 1,35;
SC	Sobrecarga, neste caso igual a 10 KN/m ² ;
γ_Q	Coefficiente parcial de segurança para ações variáveis, igual a 1,5.



11.8.2 MOMENTOS FLETORES E ESFORÇO TRANSVERSO

Com recurso ao programa automático de cálculo obtiveram-se os seguintes diagramas de momentos fletor:

- Muro M1



- Muro M2

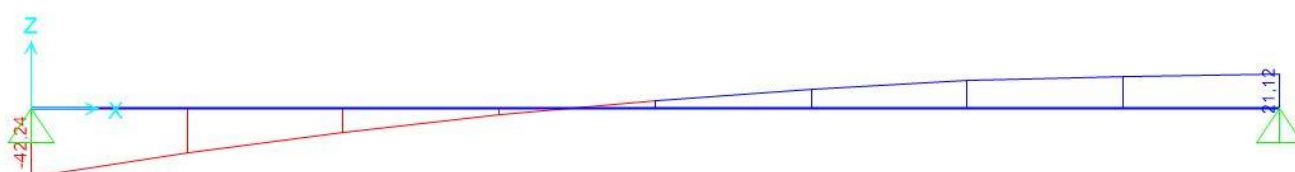


Com recurso ao programa automático de cálculo obtiveram-se os seguintes diagramas de esforço transverso:

- Muro M1



- Muro M2



11.8.2.1 Dimensionamento das armaduras

- Flexão

O dimensionamento das armaduras de flexão foi feito como nas lajes, de acordo com as Eq.(11.11, Eq.(11.12 e Eq.(11.13. Tendo-se obtido a seguinte pormenorização de armaduras.

Muro	e [m]	d [m]	M_{Ed} (KN.m)	μ	ω	A_s (cm ² /m)	$A_{s,adot}$ (cm ² /m)	x [m]	M_{Rd} [KN.m/m]	
M1	0.60	0.55	-128.38	0.02122	0.02167	5.480	Ø12//0.20	5.65	0.018	133.40
	0.30	0.25	-54.57	0.04366	0.04556	5.237	Ø12//0.20	5.65	0.018	59.67
M2	0.25	0.20	31.05	0.03881	0.04032	3.707	Ø12//0.20	5.65	0.018	47.38

- Esforço Transverso

A necessidade de armaduras específicas de esforço transverso foi feito como nas lajes, de acordo com as Eq.(11.5 e Eq.(11.6. Tendo-se obtido a seguinte pormenorização de armaduras:

PROJETO DE ESTRUTURAS E FUNDAÇÕES DE UM EDIFÍCIO DE ESCRITÓRIOS COM GRANDES VÃOS

Muro	e [m]	d [m]	V_{Ed} [KN]	k	As [cm²/m]	ρ_l	V_{Rd,c} [KN]	V_{Rd,min} [KN]
M1	0.6	0.55	199.63	1.60	5.65	0.00103	125.971	213.994
	0.3	0.25	89.74	1.89	5.65	0.00226	193.619	124.964
M2	0.25	0.2	31.05	2.00	5.65	0.00283	220.193	108.444

11.9 Barras e montantes

Estes cálculos encontram-se na integra descritos no documento escrito.

12 ESTADOS LIMITE DE UTILIZAÇÃO

12.1 Fendilhação

Estes cálculos encontram-se na íntegra descritos no documento escrito.

12.2 Deformação

Os cálculos dos momentos de inércia em seção não fendilhada e fendilhada, foram obtidos recorrendo às seguintes expressões de cálculo e tabela (que relaciona esses valores em função da relação, altura útil/altura da seção):

- Coeficiente de fluência: $\varphi = 2,50$
- Módulo de elasticidade do betão: $E_{cm} = 33 \text{ GPa}$
- Módulo de elasticidade efetivo: $E_{c,eff} = 1,05 \cdot \frac{E_{cm}}{(1+\varphi)} = 9,9 \text{ GPa}$
- Coeficiente de homogeneização: $\alpha = \frac{E_s}{E_{c,eff}} = \frac{200}{9,9} = 20,202$
- Taxa de armadura de tração: $\rho = \frac{A_{s,inf}}{b \cdot d} = \frac{(5,27+7,53) \cdot 10^{-4}}{1,00 \cdot 0,33} = 0,00388$

$$\left\{ \begin{array}{l} \alpha \cdot \rho = 20,202 \cdot 0,00388 = 0,07839 \\ \beta = \frac{A_{s,sup}}{A_{s,inf}} = \frac{1,96}{5,27 + 7,53} = 0,15313 \\ \frac{d}{h} = \frac{0,33}{0,36} \cong 0,9 \end{array} \right.$$

d/h= 0.90										
β	0.00		0.25		0.50		0.75		1.00	
$\alpha\rho$	I_I/I_C	I_{II}/I_C	I_I/I_C	I_{II}/I_C	I_I/I_C	I_{II}/I_C	I_I/I_C	I_{II}/I_C	I_I/I_C	I_{II}/I_C
0.00	1.00	0.00	1.00	0.00	1.00	0.00	1.00	0.00	1.00	0.00
0.02	1.04	0.13	1.05	0.13	1.06	0.14	1.07	0.14	1.08	0.14
0.05	1.09	0.29	1.12	0.29	1.14	0.30	1.17	0.30	1.19	0.30
0.10	1.17	0.49	1.23	0.51	1.28	0.52	1.33	0.53	1.38	0.54
0.15	1.25	0.66	1.34	0.69	1.42	0.71	1.50	0.73	1.58	0.75
0.20	1.32	0.79	1.45	0.84	1.56	0.89	1.67	0.93	1.77	0.96
0.25	1.38	0.91	1.55	0.99	1.70	1.05	1.83	1.11	1.96	1.16
0.30	1.44	1.01	1.65	1.12	1.83	1.21	2.00	1.28	2.15	1.35
0.35	1.50	1.10	1.75	1.24	1.97	1.36	2.17	1.46	2.34	1.54
0.40	1.55	1.19	1.85	1.36	2.10	1.50	2.33	1.62	2.54	1.72
0.45	1.60	1.26	1.94	1.47	2.24	1.65	2.50	1.79	2.73	1.91
0.50	1.64	1.33	2.03	1.58	2.37	1.78	2.66	1.95	2.92	2.09

- Interpolação I_I/I_C

- $\alpha \cdot \rho$

$$a = 1,09 + \frac{1,17 - 1,09}{0,10 - 0,05} \cdot (0,07838 - 0,05) = 1,1354, \text{ para } \beta = 0,0$$

$$a = 1,12 + \frac{1,23 - 1,12}{0,10 - 0,05} \cdot (0,07838 - 0,05) = 1,1824, \text{ para } \beta = 0,25$$

- β

$$I_I/I_C = 1,1354 + \frac{1,1824 - 1,1354}{0,25 - 0,00} \cdot (0,15313 - 0,0) = 1,1642$$

- Interpolação I_{II}/I_C

- $\alpha \cdot \rho$

$$a = 0,29 + \frac{0,49 - 0,29}{0,10 - 0,05} \cdot (0,07838 - 0,05) = 0,40352, \text{ para } \beta = 0,0$$

$$a = 0,29 + \frac{0,51 - 0,29}{0,10 - 0,05} \cdot (0,07838 - 0,05) = 0,41487, \text{ para } \beta = 0,25$$

- β

$$I_{II}/I_C = 0,40352 + \frac{0,41487 - 0,40352}{0,25 - 0,00} \cdot (0,15313 - 0,0) = 0,41047$$

12.3 Limitação de danos

Estes cálculos encontram-se na integra descritos no documento escrito.

