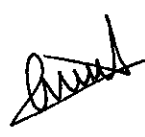
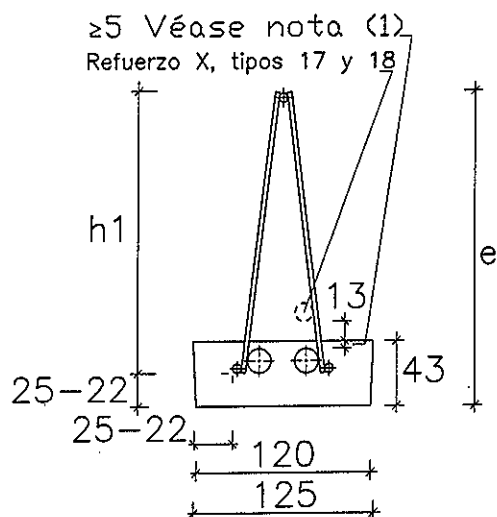


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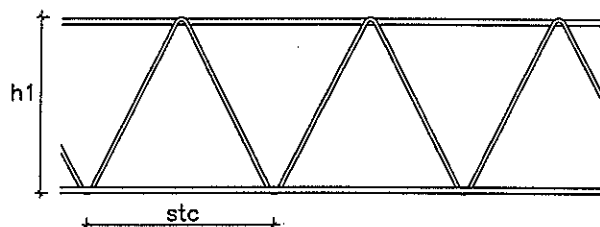
Braña Rica, s/n.
15840 SANTA COMBA (A Coruña)

TECNICO AUTOR DE LA MEMORIA : Jordi Amat

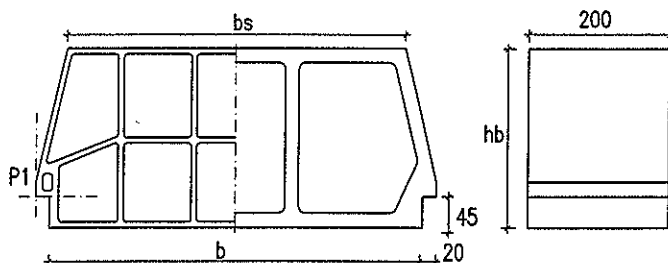
Hoja n° 1 de 24

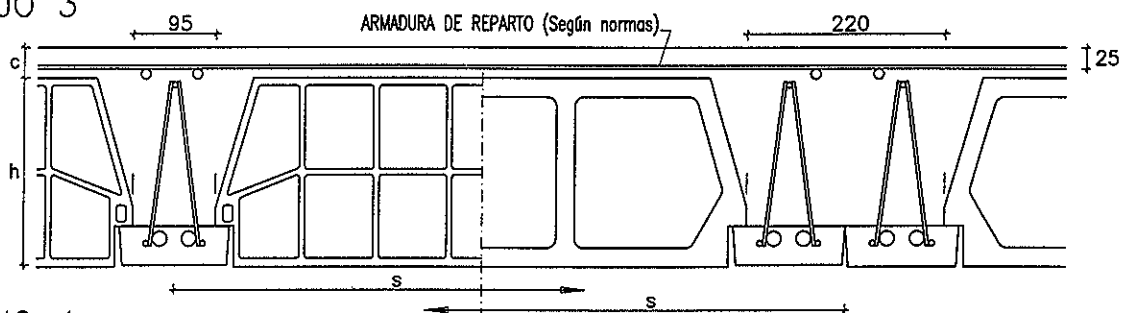
DIBUJO 1
VA.18
Cotas en mm



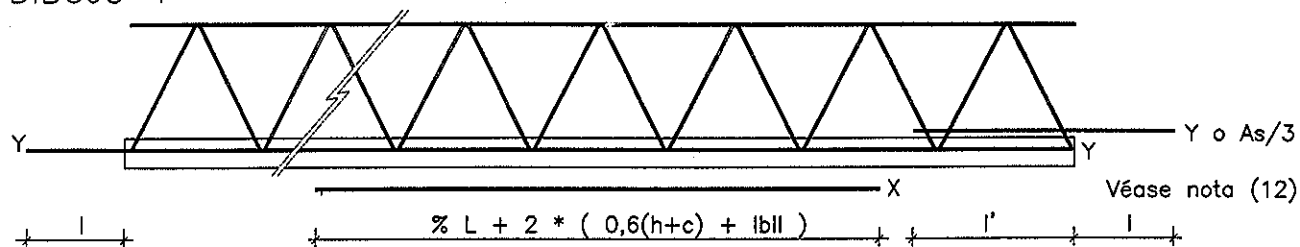
DIBUJO 2



DIBUJO 3



DIBUJO 4



FICHA DE CARACTERISTICAS TECNICAS, SEGUN EHE-08 Y
EN 1991-1, DEL FORJADO DE VIGUETAS ARMADAS

FORJADOS SANTA COMBA, S.L.

Braña Rica, s/n.
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TECNICO AUTOR DE LA MEMORIA : Jordi Amat

Hoja nº 2 de 24

1.- VIGUETA, CELOSIA, MOMENTO FLECTOR ULTIMO Y ARMADURA BASE (Véase dibujo 1)

VIGUETA			CELOSIA				MOM. FLECTOR ULTIMO		ARMADURA BASE
Nombre	e mm	Peso KN/m	Tipo ϕ sup. mm	h1 mm	n ϕ celosia mm	Paso stc mm	Sobre sop. mKN	En vano mKN	n ϕ inferior mm
VA.14	162	0.13	1 6	140	2 ϕ 4	200	1.73	1.17	2 ϕ 6
VA.18	202	0.13	2 6	180	2 ϕ 4	200	2.22	1.50	
VA.24	262	0.13	3 6	240	2 ϕ 4	200	2.95	1.99	
VA.28	302	0.13	4 6	280	2 ϕ 4	200	3.44	2.32	

2.- BLOQUES ALIGERANTES (Véase dibujo 2)

Código	Cotas y coordenadas en mm						PESO (N/ud)		
	hb	b	bs	P.1	P.2	P.3	Cerámico	Hormigón	Poliest.
B15* 65	152	515	480	0; 20	25; 45	31;102	66	135	1
B20* 65	202	515	480	0; 20	25; 45	35;152	74	153	2
B22* 65	222	515	480	0; 20	25; 45	37;173	77	160	2
B25* 65	252	515	480	0; 20	25; 45		82	171	2
B30* 65	302	515	480	0; 20	25; 45		91	188	3

3.- FORJADOS (Véase dibujo 3)

TIPO DE FORJADO (h + c) * s [/D]	VIGUETAS	ARMADURA BASE	BLOQUE	PESO (KN/m2)		
				Cerámico	Hormigón	Poliest.
(15+ 4)* 65.	VA.14	2 ϕ 6	B15* 65	2.20	2.73	
(15+ 4)* 77. D	2xVA.14	2 ϕ 6	B15* 65	2.59	3.04	
(15+ 5)* 65.	VA.14	2 ϕ 6	B15* 65	2.43	2.97	1.94
(15+ 5)* 77. D	2xVA.14	2 ϕ 6	B15* 65	2.82	3.27	2.40
(20+ 4)* 65.	VA.14 ; VA.18	2 ϕ 6	B20* 65	2.56	3.16	
(20+ 4)* 77. D	2xVA.14 ; VA.18	2 ϕ 6	B20* 65	3.09	3.60	
(20+ 5)* 65.	VA.14 ; VA.18	2 ϕ 6	B20* 65	2.79	3.40	2.24
(20+ 5)* 77. D	2xVA.14 ; VA.18	2 ϕ 6	B20* 65	3.32	3.83	2.85
(22+ 4)* 65.	VA.14 ; VA.18	2 ϕ 6	B22* 65	2.71	3.33	
(22+ 4)* 77. D	2xVA.14 ; VA.18	2 ϕ 6	B22* 65	3.29	3.82	
(22+ 5)* 65.	VA.14 ; VA.18	2 ϕ 6	B22* 65	2.94	3.58	2.36
(22+ 5)* 77. D	2xVA.14 ; VA.18	2 ϕ 6	B22* 65	3.53	4.07	3.04
(25+ 4)* 65.	VA.18 ; VA.24	2 ϕ 6	B25* 65	2.92	3.60	
(25+ 4)* 77. D	2xVA.18 ; VA.24	2 ϕ 6	B25* 65	3.58	4.15	
(25+ 5)* 65.	VA.18 ; VA.24	2 ϕ 6	B25* 65	3.16	3.83	2.54
(25+ 5)* 77. D	2xVA.18 ; VA.24	2 ϕ 6	B25* 65	3.81	4.39	3.29
(30+ 4)* 65.	VA.24 ; VA.28	2 ϕ 6	B30* 65	3.27	4.02	
(30+ 4)* 77. D	2xVA.24 ; VA.28	2 ϕ 6	B30* 65	4.07	4.70	
(30+ 5)* 65.	VA.24 ; VA.28	2 ϕ 6	B30* 65	3.52	4.26	2.83
(30+ 5)* 77. D	2xVA.24 ; VA.28	2 ϕ 6	B30* 65	4.30	4.94	3.74

FICHA DE CARACTERISTICAS TECNICAS, SEGUN EHE-08 Y
EN 1991-1, DEL FORJADO DE VIGUETAS ARMADAS

FORJADOS SANTA COMBA, S.L.

Braña Rica, s/n.
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TECNICO AUTOR DE LA MEMORIA : Jordi Amat

Hoja n° 3 de 24



4.- MATERIALES

(2) CONTROL

HORMIGON DE LA VIGUETA : HA-25.0/P/14/IIa ,	fck = 25.0 N/mm2	Gamma.c = 1.50
HORMIGON IN SITU : HA-25.0/B/16/IIa ,	fck = 25.0 N/mm2	Gamma.c = 1.50 Normal
ACERO BASE : B-500	, fyk = 500 N/mm2	Gamma.s = 1.15
ACERO REFUERZO INFERIOR: B-500S	, fyk = 500 N/mm2	Gamma.s = 1.15
ACERO REFUERZO SUPERIOR: B-400S	, fyk = 400 N/mm2	Gamma.s = 1.15 Normal
ACERO REFUERZO SUPERIOR: B-500S	, fyk = 500 N/mm2	Gamma.s = 1.15 Normal
ACERO CELOSIAS : B-500	, fyk = 500 N/mm2	Gamma.s = 1.15

5.- ARMADO DE LA VIGUETA (Véase dibujo 4)

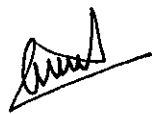
REFUERZO INFERIOR (3)

Y + X	0φ 0	1φ 6	1φ 8	1φ10	1φ 8+1φ 8	1φ12	1φ10+1φ 8
X - %L					1φ 8 - 57		1φ 8 - 52
Y + X	1φ10+1φ10	1φ12+1φ 8	1φ12+1φ10	1φ16	1φ12+1φ12	1φ16+1φ 8	1φ16+1φ10
X - %L	1φ10 - 61	1φ 8 - 48	1φ10 - 56		1φ12 - 63	1φ 8 - 40	1φ10 - 48
Y + X	1φ16+1φ12	1φ16+1φ16	2φ16+1φ12	2φ16+1φ16			
X - %L	1φ12 - 55	1φ16 - 66	1φ12 - 44	1φ16 - 55			

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TECNICO AUTOR DE LA MEMORIA : Jordi Amat



Hoja n° 4 de 24

6.- NOTAS

- (1) Se reduce el recubrimiento superior, temporal, a ≥ 5 mm, según 4.1.3.3 EC-2 Parte 1-3, UNE ENV 1992-1-3, respecto al indicado en 37.2.4.1.e) EHE-08, acciéndose al párrafo b) del artículo 3.º de la EHE-08.
- (2) Los materiales colocados en obra se controlarán (recepción y ejecución) según los cap. 16 y 17 de la EHE-08, con el nivel indicado y bajo la dirección de la dirección facultativa. En los forjados con losa superior de 50 mm tipo (h+5)*s el árido del hormigón de la obra podrá ser de tamaño máximo, $D \leq 20$ mm.
- (3) L = luz de cálculo. A la longitud (en % de L) de la armadura X se le sumará 2 veces $0,6 \cdot H$ más el anclaje correspondiente al diámetro. H es el canto total del forjado. El corte está calculado para vanos aislados y cargas repartidas.
- (4) En caso que una baja cuantía de acero del elemento produzca un momento último, M_u , menor que 1,3 veces el de fisuración, M_f , no se colocará en vanos, solo en voladizos. Para voladizos en ambiente IIb o IIIa, el elemento se fabricará con recubrimientos, nominal+margen, de 30 mm, hormigón con relación a/c $\leq 0,55$ ó 0,5, respectivamente, y con 300 kg/m³ de cemento según Tablas 37.2.4.1 EHE-08.
- (5) Los momentos flectores y los esfuerzos cortantes producidos por las cargas mayoradas con el coef. Γ_{red} serán menores que los valores últimos M_u y V_u .
- (6) Momento de fisuración por compresión según 49.2.1 EHE-08. Sin embargo, EC-2 Parte 1-1 sólo prescribe este ELS para Clases de exposición ambiental equivalentes a III y IV.
- (7) W_k es la abertura característica de la fisura según 49.2.4 EHE-08, debida a un momento solicitante $M_u/1,4$. La abertura que provocan las acciones (combinación cuasipermanentes) es proporcional a los momentos hasta un mínimo de 0,4 W_k . Según 5.1.1.2 EHE-08, los límites de W_k son: $\leq 0,4$ mm en Clase de exp. ambiental I, $\leq 0,3$ en Clase IIa y IIb, $\leq 0,2$ en Clase IIIb, IV, F y Qa y 0,1 en Clase IIIc Qb y Qc. Para ambientes más agresivos que el indicado, el recubrimiento se completará con revestimientos que cumplan 37.2.4.1 EHE-08 y el hormigón cumplirá la tabla 37.3.2.a. En caso de recubrimiento de la armadura superior de 30 mm se reducirá M_u en 5,5/d y $E_{\text{f, fis}} = 10/d$ (d = canto útil en mm).
- (8) Los valores indicados se han calculado según 50.2.2.2 EHE-08, pero homogeneizados. Para estimar las deformaciones se aplicará este mismo artículo y el siguiente de la EHE-98, limitándose las flechas según CTE DB-SE 4.3.3.1 o los Comentarios de EHE-08 apart. 50.1.
A 28 días. Para otra edad se multiplicarán por los factores:

Edad	7 días	14 días	21 días	3 meses	6 meses	1 año	>5 años
Rigidez total	0,78	0,90	0,96	1,08	1,11	1,13	1,16
Momento fisuración	0,93	0,97	0,99	1,03	1,05	1,06	1,07
- (9) Refuerzo inferior mínimo por vigueta para alcanzar el momento último negativo en sección tipo.
- (10) La relación x/d es la profundidad de la fibra neutra respecto al canto útil. A considerar cuando el análisis se haya efectuado según 19.2.3 y 21.º EHE-98.
- (11) Los valores del esfuerzo cortante último V_{cu} , corresponden a la colaboración del hormigón y V_u a la suma de $V_{cu} + V_{su} \leq V_{ul}$. V_{su} es la colaboración de la armadura transversal de cortante. Calculados según 44.2.3 EHE-08.
- (12) El esfuerzo cortante V_{su} , corresponde a la colaboración de la armadura transversal de cortante. V_u , suma de $V_{cu} + V_{su}$, puede quedar limitado por $V_{cu, \text{lim}}$ con b, lim a la altura de la celosía menos 20 mm; a menudo, con doble celosía, si no se alcanza $3/4 \cdot d$, este límite predomina. En caso de variaciones en la anchura de b, lim , el valor de $V_{cu, \text{lim}}$ a tomar es directamente proporcional. Véase 44.2.1 EHE-08, articulado, figuras y comentarios. Cuando b, lim queda en la altura $1/4 \cdot d$ superior (con tolerancia de 2 mm) en la ficha técnica consta el interese. V_{ul} es generalmente superior (véase la memoria del proyecto).
- (13) En el dibujo 1 y 1' corresponden a las longitudes l_1 , l'_1 , l_2 y l'_2 que se deducen del Anejo 12 apart. 7.1 EHE-08 y pueden organizarse en prolongación recta o inclinada, con un ángulo igual o menor a 30º. La distancia l' de solapo óptima no es menor que la necesaria para cubrir dos soldaduras.

FICHA DE CARACTERISTICAS TECNICAS, SEGUN EHE-08 Y
EN 1991-1, DEL FORJADO DE VIGUETAS ARMADAS

FORJADOS SANTA COMBA, S.L.

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TECNICO AUTOR DE LA MEMORIA : Jordi Amat

Hoja n° 5 de 24

FLEXION POSITIVA (por m)

TIPO DE FORJADO (h+c)	TIPO DE VIGUETA	REFUERZO INFERIOR VIGUETA	MOMENTO ULTIMO Mu	Rel. x/d	ESFUERZO CORTANTE Vcu Vu = Vcu+Vsu 1*Cel 2*Cel	Wk	CLASE POR RECUBRIM.	MOMENTO DE FISURACION MF	RIGIDEZ TOTAL FISURADA E-ib E-if	MOMENTO SERVICIO FIS. COMP.
* s	(4)	Y + X	m·kN/m(5)	(10)	kN/m (11)	mm (7)		m·kN/m (8)	(8) m ² ·MN/m	m·kN/m(6)
(15+ 4)	VA.14	1 0φ 0	6.3	.02	17.0 33.5 50.0	.08	IIa	5.2	5.79 0.44	16.0
* 65.		2 1φ 6	9.4	.02	17.0 33.5 50.0	.12	IIa	5.3	5.89 0.64	19.7
		3 1φ 8	11.8	.03	17.0 33.5 49.9	.15	IIa	5.4	5.96 0.78	22.0
		4 1φ10	14.8	.04	16.9 33.3 49.7	.17	IIa	5.5	6.05 0.96	24.5
		5 1φ 8+1φ 8	17.2	.04	17.0 33.4 49.8	.16	IIa	5.5	6.13 1.11	26.5
		6 1φ12	18.4	.05	16.8 33.1 49.4	.19	IIa	5.6	6.16 1.17	27.0
		7 1φ10+1φ 8	20.2	.05	16.9 33.3 49.7	.17	IIa	5.6	6.22 1.27	28.4
		8 1φ10+1φ10	23.1	.06	16.9 33.2 49.6	.17	IIa	5.7	6.30 1.44	30.2
		9 1φ12+1φ 8	23.7	.06	16.9 33.2 49.5	.19	IIa	5.8	6.32 1.47	30.5
		10 1φ12+1φ10	26.6	.07	16.8 33.1 49.4	.19	IIa	5.9	6.41 1.63	32.1
		11 1φ16	27.3	.07	16.6 32.7 48.9	.22	IIa	5.9	6.41 1.65	32.1
		12 1φ12+1φ12	30.1	.08	17.0 33.3 49.5	.18	IIa	6.0	6.51 1.82	33.9
		13 1φ16+1φ 8	32.5	.08	17.4 33.5 49.7	.21	IIa	6.0	6.57 1.93	34.8
		14 1φ16+1φ10	35.4	.09	17.4 33.5 49.7	.21	IIa	6.1	6.66 2.09	36.1
		15 1φ16+1φ12	38.8	.10	17.4 33.5 49.6	.21	IIa	6.3	6.75 2.26	37.6
		16 1φ16+1φ16	47.2	.12	17.3 33.4 49.4	.21	IIa	6.5	6.99 2.69	40.8
		17 2φ16+1φ12	58.0	.15	17.3 33.4 49.5	.20	IIa	6.9	7.31 3.24	44.7
		18 2φ16+1φ16	65.9	.18	17.3 33.3 49.3	.20	IIa	7.2	7.53 3.61	47.0

FLEXION NEGATIVA (por m)

REFUERZO SUPERIOR POR NERVIO	B400 MOMENTO ULTIMO-ABERTURA FISURA Sección tipo Mu Ref. Rel. inf. x/d	Sección maciza Mu Rel. x/d	B500 MOMENTO ULTIMO-ABERTURA FISURA Sección tipo Mu Ref. Rel. inf. x/d	Sección maciza Mu Rel. x/d	ESF.CORTANTE ULTIMO Vcu Vu 1*cel	MOMENTO FISUR. MF	RIGIDEZ TOTAL FIS. E-ib E-if
	m·kN/m (5)	vig. (9) (10) (7)	m·kN/m (5)	(10) (7)	kN/m (11)	m·kN/m (8)	m ² ·MN/m (8)
1φ10	4.9	.10 .08	0.0 .00 .00	6.1 .13 .10	0.0 .00 .00	16.5 32.5	11.1 5.6 0.69
2φ 8	6.3	.13 .07	0.0 .00 .00	10.3 .17 .09	0.0 .00 .00	16.6 32.6	11.2 5.6 0.78
1φ12	6.9	.15 .08	0.0 .00 .00	11.3 .19 .11	0.0 .00 .00	16.4 32.4	11.2 5.6 0.82
1φ 8+1φ10	10.5	.17 .07	0.0 .00 .00	12.9 .21 .09	0.0 .00 .00	16.6 32.6	11.2 5.6 0.90
2φ10	12.5	.21 .07	0.0 .00 .00	15.3 .26 .12	0.0 .00 .00	16.5 32.5	11.2 5.6 1.01
1φ10+1φ12	14.9	.25 .09	0.0 .00 .00	18.1 .32 .15	20.3 .06 .20	16.5 32.5	11.3 5.6 1.14
2φ12	17.2	.30 .11	0.0 .00 .00	20.6 .39 .16	23.7 .07 .21	16.4 32.4	11.3 5.6 1.25
1φ10+1φ16	20.3	.38 .15	23.3 .07 .20	24.0 .50 .20	28.9 .09 .28	16.6 32.6	11.4 5.6 1.40
1φ12+1φ16	22.2	.45 .15	26.0 .08 .21	26.0 .57 .20	32.3 .10 .28	17.0 33.0	11.4 5.7 1.51
2φ16	26.4	.59 .16	32.9 .10 .21	34.1 1φ12 .53 .21	40.7 .13 .27	16.9 32.9	11.5 5.7 1.74
4φ12	29.0	.65 .14	37.3 .12 .19	39.9 1φ16 .44 .18	46.1 .15 .24	17.1 33.1	11.6 5.7 1.91
2φ16+1φ12	34.9	1φ12 .55 .17	41.7 .13 .22	43.1 1φ16 .57 .21	51.5 .17 .28	17.0 32.9	11.6 5.7 2.02
3φ16	38.5	1φ12 .67 .17	48.2 .16 .22	53.0 2φ16 .35 .21	59.3 .20 .27	16.9 32.9	11.7 5.7 2.20
4φ16	55.9	2φ16 .43 .17	62.9 .21 .21	61.6 2φ16 .71 .21	76.9 .26 .26	16.9 32.9	11.9 5.7 2.58

ESFUERZO CORTANTE Vsu (12) (kN/m) VA.14 (simple celosía) : 16
(kN/m) VA.14 (doble celosía) : 32
b,lím (mm) : 650 Vcu,lím (kN/m) (VA.14) : 111

FICHA DE CARACTERISTICAS TECNICAS, SEGUN EHE-08 Y
EN 1991-1, DEL FORJADO DE VIGUETAS ARMADAS

FORJADOS SANTA COMBA, S.L.

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TECNICO AUTOR DE LA MEMORIA : Jordi Amat

Hoja n° 6 de 24

FLEXION POSITIVA (por m)

TIPO DE FORJADO (h+c) * s	TIPO DE VIGUETA (4)	REFUERZO INFERIOR VIGUETA Y + X	MOMENTO ULTIMO Mu m·kN/m(5)	Rel. x/d (10)	ESFUERZO CORTANTE Vcu Vu = Vcu+Vsu 1*Cel 2*Cel kN/m (11)	Wk	CLASE POR RECUBRIM.	MOMENTO DE FISURACION MF m·kN/m (8)	RIGIDEZ TOTAL FISURADA E·Ib E·If (8) m ² ·MN/m	MOMENTO SERVICIO FIS. COMP. m·kN/m(6)
(15+ 4) * 77. D	VA.14	1 0φ 0	10.6	.03	33.3 61.2 89.0	.11	IIa	8.1	8.22 0.72	20.6
		2 1φ 6	15.8	.04	33.3 61.2 89.0	.16	IIa	8.3	8.34 1.03	25.3
		3 1φ 8	19.7	.05	33.2 61.0 88.8	.20	IIa	8.4	8.43 1.25	28.1
		4 1φ10	24.7	.06	33.1 60.7 88.4	.22	IIa	8.6	8.55 1.53	31.1
		5 1φ 8+1φ 8	28.7	.07	33.2 60.9 88.7	.19	IIa	8.7	8.66 1.76	33.5
		6 1φ12	30.6	.08	32.9 60.4 87.9	.23	IIa	8.7	8.69 1.85	34.2
		7 1φ10+1φ 8	33.5	.08	33.1 60.8 88.4	.20	IIa	8.8	8.76 2.02	35.9
		8 1φ10+1φ10	38.3	.10	33.0 60.6 88.2	.20	IIa	9.0	8.88 2.27	38.1
		9 1φ12+1φ 8	39.3	.10	33.0 60.5 88.1	.22	IIa	9.0	8.90 2.32	38.4
		10 1φ12+1φ10	44.0	.11	32.9 60.4 87.9	.21	IIa	9.2	9.01 2.57	40.4
		11 1φ16	45.0	.12	32.5 59.7 86.9	.26	IIa	9.2	9.00 2.58	40.2
		12 1φ12+1φ12	49.6	.13	32.9 60.3 87.7	.21	IIa	9.4	9.14 2.85	42.5
		13 1φ16+1φ 8	53.3	.14	32.6 59.9 87.2	.25	IIa	9.5	9.21 3.02	43.5
		14 1φ16+1φ10	57.9	.15	33.4 60.6 87.9	.24	IIa	9.6	9.31 3.25	45.1
		15 1φ16+1φ12	63.2	.17	34.0 61.2 88.4	.24	IIa	9.8	9.43 3.51	46.8
		16 1φ16+1φ16	76.2	.21	33.8 60.9 88.0	.23	IIa	10.2	9.73 4.12	50.3
		17 2φ16+1φ12	92.7	.26	33.9 61.0 88.2	.22	IIa	10.8	10.13 4.91	54.4
		18 2φ16+1φ16	103.5	.36	33.8 60.8 87.9	.22	IIa	11.2	10.39 5.44	56.7

FLEXION NEGATIVA (por m)

REFUERZO SUPERIOR POR NERVIO	B400 MOMENTO ULTIMO-ABERTURA FISURA								B500 MOMENTO ULTIMO-ABERTURA FISURA								ESF.CORTANTE ULTIMO		MOMENTO FISUR. Mf	RIGIDEZ	
	Sección tipo				Sección maciza				Sección tipo				Sección maciza				Vcu Vu 1*cel. kN/m (11)	m2·MN/m (8)			
	Mu	Ref.	Rel.	Wk	Mu	Rel.	Wk	Mu	Ref.	Rel.	Wk	Mu	Rel.	Wk	m·kN/m (5)	(9)				(10)	(7)
	inf.	x/d		x/d	inf.	x/d		inf.	x/d		x/d										
	m·kN/m	vig.	mm	m·kN/m	mm	m·kN/m	vig.	mm	m·kN/m	mm	m·kN/m	mm									
	(5)	(9)	(10)	(7)	(5)	(10)	(7)	(5)	(9)	(10)	(7)	(5)	(10)	(7)							
1φ10	0.0	.00	.00		0.0	.00	.00	0.0	.00	.00		0.0	.00	.00	32.3	59.3	13.0	8.0	0.77		
2φ 8	0.0	.00	.00		0.0	.00	.00	0.0	.00	.00		0.0	.00	.00	32.5	59.5	13.1	8.0	0.87		
1φ12	0.0	.00	.00		0.0	.00	.00	0.0	.00	.00		0.0	.00	.00	32.1	59.1	13.1	8.0	0.91		
1φ 8+1φ10	0.0	.00	.00		0.0	.00	.00	8.5	.11	.11		0.0	.00	.00	32.4	59.4	13.1	8.0	0.99		
2φ10	0.0	.00	.00		0.0	.00	.00	13.7	.13	.10		0.0	.00	.00	32.3	59.3	13.2	8.0	1.10		
1φ10+1φ12	13.3	.13	.09		0.0	.00	.00	16.4	.16	.12		0.0	.00	.00	32.2	59.2	13.2	8.0	1.23		
2φ12	15.5	.15	.08		0.0	.00	.00	19.1	.19	.15		20.1	.06	.15	32.1	59.1	13.3	8.0	1.34		
1φ10+1φ16	18.7	.19	.13		19.8	.06	.14	23.0	.23	.20		24.6	.08	.23	31.9	58.9	13.3	8.1	1.51		
1φ12+1φ16	20.8	.21	.14		22.1	.07	.16	25.4	.26	.21		27.5	.09	.24	31.9	58.9	13.4	8.1	1.62		
2φ16	25.8	.27	.16		27.9	.09	.18	31.2	.34	.22		34.6	.11	.25	31.7	58.7	13.5	8.1	1.88		
4φ12	29.0	.30	.14		31.7	.10	.18	34.9	.38	.19		39.3	.12	.24	32.1	59.1	13.6	8.1	2.07		
2φ16+1φ12	32.0	.35	.17		35.5	.11	.21	38.2	.44	.22		43.9	.14	.28	31.8	58.8	13.6	8.1	2.21		
3φ16	36.2	.41	.17		41.1	.13	.21	42.7	.52	.22		50.8	.17	.27	31.7	58.7	13.7	8.2	2.42		
4φ16	44.9	.56	.17		53.8	.18	.21	57.7	1φ12	.50	.22	66.1	.22	.26	33.0	60.0	14.0	8.2	2.90		

ESFUERZO CORTANTE Vsu (12) (kN/m) VA.14 (simple celosía) : 27
(kN/m) VA.14 (doble celosía) : 54
b, lím (mm) : 895 Vcu, lím (kN/m) (VA.14) : 129

FICHA DE CARACTERISTICAS TECNICAS, SEGUN EHE-08 Y
EN 1991-1, DEL FORJADO DE VIGUETAS ARMADAS

FORJADOS SANTA COMBA, S.L.

Braña Rica, s/n.
15840 SANTA COMBA (A Coruña)

TECNICO AUTOR DE LA MEMORIA : Jordi Amat

Hoja nº 7 de 24



FLEXION POSITIVA (por m)

TIPO DE FORJADO (h+c) * s	TIPO DE VIGUETA (4)	REFUERZO INFERIOR VIGUETA Y + X	MOMENTO ULTIMO Mu m·kN/m(5)	Rel. x/d (10)	ESFUERZO CORTANTE Vcu Vu = Vcu+Vsu 1*Cel 2*Cel kN/m (11)	Wk mm (7)	CLASE POR RECUBRIM.	MOMENTO DE FISURACION Mf m·kN/m (8)	RIGIDEZ TOTAL FISURADA E·Ib E·If (8) m2·MN/m	MOMENTO SERVICIO FIS. COMP. m·kN/m(6)
(15+ 5) * 65.	VA.14	1 0φ 0	6.7	.01	18.1 35.6 53.1	.08	IIa	5.7	6.79 0.50	17.5
		2 1φ 6	10.0	.02	18.1 35.6 53.1	.12	IIa	5.8	6.91 0.73	21.5
		3 1φ 8	12.5	.03	18.0 35.5 52.9	.15	IIa	5.9	7.00 0.88	24.1
		4 1φ10	15.7	.03	18.0 35.3 52.7	.17	IIa	6.0	7.10 1.09	26.8
		5 1φ 8+1φ 8	18.3	.04	18.0 35.4 52.9	.16	IIa	6.1	7.20 1.25	28.9
		6 1φ12	19.5	.04	17.9 35.2 52.5	.19	IIa	6.1	7.23 1.32	29.6
		7 1φ10+1φ 8	21.4	.05	18.0 35.4 52.7	.17	IIa	6.2	7.29 1.44	31.1
		8 1φ10+1φ10	24.6	.05	17.9 35.3 52.6	.17	IIa	6.3	7.40 1.64	33.1
		9 1φ12+1φ 8	25.2	.06	17.9 35.2 52.5	.19	IIa	6.3	7.42 1.67	33.4
		10 1φ12+1φ10	28.3	.06	17.9 35.2 52.5	.19	IIa	6.5	7.52 1.85	35.2
		11 1φ16	29.0	.07	17.7 34.8 51.9	.22	IIa	6.5	7.52 1.87	35.2
		12 1φ12+1φ12	32.1	.07	17.8 35.1 52.3	.18	IIa	6.6	7.64 2.07	37.2
		13 1φ16+1φ 8	34.6	.08	18.1 35.3 52.4	.22	IIa	6.7	7.71 2.20	38.2
		14 1φ16+1φ10	37.6	.09	18.5 35.6 52.8	.21	IIa	6.8	7.81 2.37	39.7
		15 1φ16+1φ12	41.3	.09	18.5 35.6 52.7	.21	IIa	6.9	7.93 2.58	41.3
		16 1φ16+1φ16	50.3	.12	18.4 35.4 52.5	.21	IIa	7.2	8.21 3.06	44.9
		17 2φ16+1φ12	61.9	.15	18.4 35.5 52.6	.20	IIa	7.6	8.59 3.69	49.2
		18 2φ16+1φ16	70.4	.17	18.4 35.4 52.4	.20	IIa	7.9	8.85 4.12	51.8

FLEXION NEGATIVA (por m)

REFUERZO SUPERIOR POR NERVIO	B400 MOMENTO ULTIMO-ABERTURA FISURA						B500 MOMENTO ULTIMO-ABERTURA FISURA						ESF.CORTANTE		MOMENTO	RIGIDEZ				
	Sección tipo						Sección maciza						ULTIMO		FISUR.	TOTAL FIS.				
	Mu	Ref.	Rel.	Wk			Mu	Rel.	Wk			Mu	Rel.	Wk	Mf	E·Ib	E·If			
	inf. x/d						x/d						x/d			1*cel.				
	m·kN/m	vig.		mm			m·kN/m			mm			m·kN/m		mm	kN/m	m·kN/m	m2·MN/m		
	(5)	(9)	(10)	(7)			(5)	(10)	(7)			(5)	(10)	(7)		(11)	(8)	(8)		
1φ10	5.2	.10	.08		0.0	.00	.00	6.5	.12	.10		0.0	.00	.00		17.6	34.6	12.6	6.6	0.77
2φ 8	6.7	.12	.07		0.0	.00	.00	8.2	.16	.09		0.0	.00	.00		17.7	34.7	12.7	6.6	0.90
1φ12	7.4	.14	.09		0.0	.00	.00	12.1	.18	.11		0.0	.00	.00		17.5	34.5	12.7	6.6	0.94
1φ 8+1φ10	8.4	.16	.07		0.0	.00	.00	13.7	.20	.09		0.0	.00	.00		17.6	34.6	12.7	6.6	1.03
2φ10	13.4	.20	.07		0.0	.00	.00	16.4	.24	.11		0.0	.00	.00		17.6	34.6	12.7	6.6	1.16
1φ10+1φ12	16.0	.24	.08		0.0	.00	.00	19.4	.30	.15		0.0	.00	.00		17.5	34.5	12.8	6.6	1.30
2φ12	18.4	.28	.11		0.0	.00	.00	22.2	.36	.16		25.3	.07	.21		17.5	34.5	12.8	6.6	1.43
1φ10+1φ16	21.8	.36	.14		24.8	.07	.20	25.9	.47	.20		30.8	.08	.28		17.3	34.3	12.9	6.6	1.62
1φ12+1φ16	24.0	.42	.15		27.8	.08	.21	28.2	.54	.20		34.5	.10	.28		18.0	35.0	12.9	6.6	1.74
2φ16	28.6	.55	.16		35.1	.10	.21	36.8	1φ12	.50	.21	43.4	.12	.27		18.0	35.0	13.0	6.7	2.00
4φ12	31.4	.61	.14		39.7	.11	.19	40.5	1φ12	.57	.18	49.1	.14	.25		18.2	35.2	13.1	6.7	2.20
2φ16+1φ12	37.7	1φ12	.52	.16	44.5	.13	.23	46.6	1φ16	.54	.21	55.0	.16	.29		18.0	35.0	13.2	6.7	2.33
3φ16	41.8	1φ12	.63	.16	51.5	.15	.22	57.1	2φ16	.33	.21	63.4	.18	.28		18.0	35.0	13.3	6.7	2.54
4φ16	60.3	2φ16	.41	.17	67.3	.20	.21	68.1	2φ16	.67	.21	82.3	.25	.26		18.0	35.0	13.5	6.7	2.99

ESFUERZO CORTANTE Vsu (12) (kN/m) VA.14 (simple celosía) : 17
(kN/m) VA.14 (doble celosía) : 34
b,lím (mm) : 650 Vcu,lím (kN/m) (VA.14) : 118.1

FICHA DE CARACTERISTICAS TECNICAS, SEGUN EHE-08 Y
EN 1991-1, DEL FORJADO DE VIGUETAS ARMADAS

FORJADOS SANTA COMBA, S.L.

Braña Rica, s/n.
15840 SANTA COMBA (A Coruña)

TECNICO AUTOR DE LA MEMORIA : Jordi Amat

Hoja n° 8 de 24

FLEXION POSITIVA (por m)

TIPO DE FORJADO (h+c) * s	TIPO DE VIGUETA (4)	REFUERZO INFERIOR VIGUETA Y + X	MOMENTO ULTIMO Mu m·kN/m(5)	Rel. x/d (10)	ESFUERZO CORTANTE Vcu Vu = Vcu+Vsu 1*Cel 2*Cel kN/m (11)	Wk	CLASE POR RECUBRIM.	MOMENTO DE FISURACION Mf m·kN/m (8)	RIGIDEZ TOTAL FISURADA E·Ib E·If (8) m ² ·MN/m	MOMENTO SERVICIO FIS. COMP. m·kN/m(6)
(15+ 5) * 77. D	VA.14	1 0φ 0	11.2	.02	35.4 64.9 94.4	.10	IIa	9.0	9.70 0.80	22.5
		2 1φ 6	16.8	.04	35.4 64.9 94.4	.16	IIa	9.2	9.84 1.17	27.6
		3 1φ 8	20.9	.05	35.3 64.7 94.2	.20	IIa	9.3	9.95 1.42	30.7
		4 1φ10	26.2	.06	35.1 64.5 93.8	.22	IIa	9.5	10.09 1.74	34.1
		5 1φ 8+1φ 8	30.5	.07	35.2 64.6 94.1	.19	IIa	9.6	10.21 2.00	36.7
		6 1φ12	32.5	.07	35.0 64.1 93.3	.24	IIa	9.7	10.25 2.10	37.5
		7 1φ10+1φ 8	35.6	.08	35.1 64.5 93.8	.21	IIa	9.8	10.34 2.29	39.4
		8 1φ10+1φ10	40.7	.09	35.1 64.3 93.6	.20	IIa	9.9	10.48 2.59	41.8
		9 1φ12+1φ 8	41.8	.09	35.0 64.2 93.5	.22	IIa	10.0	10.50 2.64	42.2
		10 1φ12+1φ10	46.8	.11	35.0 64.1 93.3	.22	IIa	10.1	10.63 2.92	44.3
		11 1φ16	48.0	.11	34.6 63.4 92.3	.26	IIa	10.1	10.63 2.94	44.2
		12 1φ12+1φ12	52.9	.12	34.9 64.0 93.1	.21	IIa	10.3	10.78 3.25	46.6
		13 1φ16+1φ 8	56.9	.13	34.7 63.6 92.6	.25	IIa	10.5	10.87 3.44	47.9
		14 1φ16+1φ10	61.7	.14	34.7 63.7 92.6	.24	IIa	10.6	11.00 3.70	49.6
		15 1φ16+1φ12	67.5	.16	35.9 64.8 93.7	.24	IIa	10.8	11.15 4.00	51.5
		16 1φ16+1φ16	81.5	.20	35.9 64.7 93.5	.23	IIa	11.3	11.50 4.71	55.6
		17 2φ16+1φ12	99.2	.25	36.0 64.8 93.6	.22	IIa	11.9	11.98 5.63	60.6
		18 2φ16+1φ16	111.7	.28	35.9 64.6 93.4	.22	IIa	12.4	12.30 6.25	63.5

FLEXION NEGATIVA (por m)

REFUERZO SUPERIOR POR NERVIO	B400 MOMENTO ULTIMO-ABERTURA FISURA Sección tipo Mu Ref. Rel. Wk inf. x/d m·kN/m vig. mm (5) (9) (10) (7)	Sección maciza Mu Rel. Wk x/d m·kN/m mm (5) (10) (7)	B500 MOMENTO ULTIMO-ABERTURA FISURA Sección tipo Mu Ref. Rel. Wk inf. x/d m·kN/m vig. mm (5) (9) (10) (7)	Sección maciza Mu Ref. Rel. Wk x/d m·kN/m mm (5) (10) (7)	ESF.CORTANTE ULTIMO Vcu Vu 1*cel. kN/m (11)	MOMENTO FISUR. Mf m·kN/m (8)	RIGIDEZ TOTAL FIS. E·Ib E·If m ² ·MN/m (8)
1φ10	0.0 .00 .00	0.0 .00 .00	0.0 .00 .00	0.0 .00 .00	34.3 63.0	14.9	9.4 0.87
2φ 8	0.0 .00 .00	0.0 .00 .00	0.0 .00 .00	0.0 .00 .00	34.5 63.2	14.9	9.4 0.98
1φ12	0.0 .00 .00	0.0 .00 .00	0.0 .00 .00	0.0 .00 .00	34.1 62.8	15.0	9.4 1.03
1φ 8+1φ10	0.0 .00 .00	0.0 .00 .00	0.0 .00 .00	0.0 .00 .00	34.4 63.1	15.0	9.5 1.11
2φ10	0.0 .00 .00	0.0 .00 .00	14.6 .12 .10	0.0 .00 .00	34.3 63.0	15.0	9.5 1.24
1φ10+1φ12	14.2 .12 .09	0.0 .00 .00	17.5 .15 .11	0.0 .00 .00	34.2 62.9	15.1	9.5 1.38
2φ12	16.5 .14 .08	0.0 .00 .00	20.4 .18 .14	0.0 .00 .00	34.1 62.8	15.1	9.5 1.52
1φ10+1φ16	20.0 .18 .12	0.0 .00 .00	24.5 .22 .19	26.2 .07 .23	33.9 62.6	15.2	9.5 1.72
1φ12+1φ16	22.3 .20 .13	23.5 .06 .16	27.2 .25 .20	29.3 .08 .24	33.9 62.6	15.2	9.5 1.84
2φ16	27.7 .26 .15	29.8 .08 .18	33.5 .32 .21	36.9 .10 .25	33.7 62.4	15.4	9.6 2.15
4φ12	31.1 .28 .14	33.8 .09 .18	37.5 .36 .18	41.9 .12 .24	34.1 62.8	15.5	9.6 2.36
2φ16+1φ12	34.4 .33 .16	37.9 .11 .21	41.1 .42 .22	46.9 .13 .28	33.8 62.5	15.5	9.6 2.53
3φ16	39.0 .39 .17	43.9 .12 .21	46.2 .49 .22	54.2 .16 .28	33.7 62.4	15.6	9.6 2.77
4φ16	48.6 .53 .17	57.5 .17 .21	62.4 1φ12 .47 .22	70.7 .21 .27	35.2 63.8	15.9	9.7 3.33

ESFUERZO CORTANTE Vsu (12) (kN/m) VA.14 (simple celosía) : 28.7
(kN/m) VA.14 (doble celosía) : 57.4
b,lím (mm) : 895 Vcu,lím (kN/m) (VA.14) : 137.3

FICHA DE CARACTERISTICAS TECNICAS, SEGUN EHE-08 Y
EN 1991-1, DEL FORJADO DE VIGUETAS ARMADAS

FORJADOS SANTA COMBA, S.L.

Braña Rica, s/n.
15840 SANTA COMBA (A Coruña)

TECNICO AUTOR DE LA MEMORIA : Jordi Amat

Hoja nº 9 de 24

FLEXION POSITIVA (por m)

TIPO DE FORJADO (h+c) * s	TIPO DE VIGUETA (4)	REFUERZO INFERIOR VIGUETA Y + X	MOMENTO ULTIMO Mu m·kN/m(5)	Rel. x/d (10)	ESFUERZO CORTANTE Vcu Vu = Vcu+Vsu 1*Cel 2*Cel kN/m (11)	Wk CLASE POR RECUBRIM. mm (7)	MOMENTO DE FISURACION Mf m·kN/m (8)	RIGIDEZ TOTAL FISURADA E·Ib E·If (8) m ² ·MN/m	MOMENTO SERVICIO FIS.COMP. m·kN/m(6)		
(20+ 4) * 65.	VA.14	1	0φ 0	8.2	.01	21.6 43.1 64.6	.08	IIa	8.3	11.48 0.78	24.2
	VA.18	2	1φ 6	12.3	.02	21.6 43.1 64.6	.11	IIa	8.4	11.65 1.13	29.7
		3	1φ 8	15.4	.02	21.6 43.0 64.5	.15	IIa	8.5	11.76 1.38	33.2
		4	1φ10	19.4	.03	21.6 42.9 64.3	.17	IIa	8.7	11.92 1.70	37.0
		5	1φ 8+1φ 8	22.5	.03	21.6 43.0 64.4	.16	IIa	8.8	12.05 1.95	40.0
		6	1φ12	24.2	.04	21.5 42.8 64.1	.19	IIa	8.8	12.10 2.06	41.0
		7	1φ10+1φ 8	26.5	.04	21.6 42.9 64.3	.17	IIa	8.9	12.21 2.25	43.0
		8	1φ10+1φ10	30.4	.05	21.5 42.9 64.2	.17	IIa	9.1	12.35 2.55	45.8
		9	1φ12+1φ 8	31.2	.05	21.5 42.8 64.1	.19	IIa	9.1	12.38 2.61	46.3
		10	1φ12+1φ10	35.1	.05	21.5 42.8 64.1	.19	IIa	9.2	12.53 2.89	48.8
		11	1φ16	36.0	.05	21.4 42.5 63.6	.22	IIa	9.2	12.54 2.93	49.0
		12	1φ12+1φ12	39.8	.06	21.5 42.7 64.0	.19	IIa	9.4	12.71 3.24	51.6
		13	1φ16+1φ 8	43.0	.07	21.4 42.6 63.7	.22	IIa	9.5	12.81 3.45	53.2
		14	1φ16+1φ10	46.8	.07	21.4 42.5 63.7	.22	IIa	9.6	12.96 3.73	55.3
		15	1φ16+1φ12	51.4	.08	21.9 43.0 64.1	.22	IIa	9.8	13.13 4.05	57.6
		16	1φ16+1φ16	62.8	.10	22.4 43.4 64.5	.21	IIa	10.2	13.55 4.82	62.6
		17	2φ16+1φ12	77.4	.12	22.4 43.5 64.6	.21	IIa	10.8	14.11 5.82	68.3
		18	2φ16+1φ16	88.3	.14	22.4 43.4 64.4	.20	IIa	11.2	14.50 6.53	71.7

FLEXION NEGATIVA (por m)

REFUERZO SUPERIOR POR NERVIO	B400 MOMENTO ULTIMO-ABERTURA FISURA							B500 MOMENTO ULTIMO-ABERTURA FISURA							ESF.CORTANTE		MOMENTO	RIGIDEZ		
	Sección tipo							Sección maciza							ULTIMO		FISUR.	TOTAL FIS.		
	Mu	Ref.	Rel.	Wk	Mu	Rel.	Wk	Mu	Ref.	Rel.	Wk	Mu	Rel.	Wk	Vcu	Vu	Mf	E·Ib	E·If	
	inf. x/d				x/d			inf. x/d				x/d			1*cel.					
	m·kN/m	vig.		mm	m·kN/m		mm	m·kN/m	vig.		mm	m·kN/m		mm	kN/m		m·kN/m	m2·MN/m		
(5)	(9)	(10)	(7)	(5)	(10)	(7)	(5)	(9)	(10)	(7)	(5)	(10)	(7)	(11)		(8)		(8)		
1φ10	0.0	.00	.00		0.0	.00	.00	8.1	.10	.11		0.0	.00	.00	21.3	42.3	16.8	11.2	1.11	
2φ 8	8.3	.10	.08		0.0	.00	.00	10.3	.13	.09		0.0	.00	.00	21.4	42.4	16.8	11.2	1.30	
1φ12	9.2	.11	.09		0.0	.00	.00	11.4	.14	.11		0.0	.00	.00	21.2	42.2	16.8	11.2	1.38	
1φ 8+1φ10	10.5	.13	.08		0.0	.00	.00	17.2	.16	.10		0.0	.00	.00	21.3	42.3	16.9	11.2	1.53	
2φ10	16.8	.16	.07		0.0	.00	.00	20.6	.20	.10		0.0	.00	.00	21.3	42.3	17.0	11.3	1.74	
1φ10+1φ12	20.1	.19	.08		0.0	.00	.00	24.6	.24	.14		0.0	.00	.00	21.3	42.3	17.0	11.3	1.98	
2φ12	23.3	.23	.10		0.0	.00	.00	28.4	.30	.16		0.0	.00	.00	21.2	42.2	17.1	11.3	2.21	
1φ10+1φ16	28.0	.29	.14		0.0	.00	.00	33.6	.38	.20		38.4	.07	.29	21.2	42.2	17.2	11.3	2.52	
1φ12+1φ16	30.8	.34	.15		34.6	.06	.20	36.7	.44	.21		43.0	.08	.29	21.2	42.2	17.3	11.3	2.72	
2φ16	37.3	.45	.16		43.8	.08	.21	43.9	.54	.21		54.3	.10	.28	22.1	43.1	17.5	11.4	3.18	
4φ12	41.3	.49	.14		49.6	.09	.20	48.2	.59	.18		61.4	.11	.26	22.3	43.3	17.6	11.4	3.51	
2φ16+1φ12	44.9	.55	.16		55.7	.10	.23	57.5	1φ12	.54	.21	69.0	.13	.30	22.1	43.1	17.7	11.5	3.75	
3φ16	49.9	.63	.16		64.6	.12	.23	67.7	1φ16	.54	.22	79.8	.15	.29	22.1	43.1	17.9	11.5	4.10	
4φ16	71.0	1φ16	.59	.17	84.7	.16	.22	91.6	2φ16	.54	.21	104.2	.20	.27	22.1	43.1	18.3	11.6	4.86	

ESFUERZO CORTANTE Vsu (12) (kN/m) VA.14 (simple celosía) : 21 VA.18 (simple celosía) : 20.5
(kN/m) VA.14 (doble celosía) : 42 VA.18 (doble celosía) : 40.9
b,lím (mm) : 146 Vcu,lím (kN/m) (VA.14) : 32.5
650 (VA.18) : 144.5

FICHA DE CARACTERISTICAS TECNICAS, SEGUN EHE-08 Y
EN 1991-1, DEL FORJADO DE VIGUETAS ARMADAS

FORJADOS SANTA COMBA, S.L.

Braña Rica, s/n.
15840 SANTA COMBA (A Coruña)

TECNICO AUTOR DE LA MEMORIA : Jordi Amat

Hoja nº 10 de 24

FLEXION POSITIVA (por m)

TIPO DE FORJADO (h+c) * s	TIPO DE VIGUETA (4)	REFUERZO INFERIOR VIGUETA Y + X	MOMENTO ULTIMO Mu m·kN/m(5)	Rel. x/d (10)	ESFUERZO CORTANTE Vcu Vu = Vcu+Vsu 1*Cel 2*Cel kN/m (11)	Wk	CLASE POR RECUBRIM.	MOMENTO DE FISURACION Mf m·kN/m (8)	RIGIDEZ TOTAL FISURADA E·Ib E·If (8) m ² ·MN/m	MOMENTO SERVICIO FIS. COMP. m·kN/m(6)
(20+ 4) * 77. D	VA.14	1 0φ 0	13.8	.02	42.3 78.6 114.8	.10	IIa	12.8	16.11 1.27	31.1
	VA.18	2 1φ 6	20.6	.03	42.3 78.6 114.8	.16	IIa	13.1	16.33 1.82	38.1
		3 1φ 8	25.9	.04	42.2 78.4 114.6	.20	IIa	13.2	16.49 2.23	42.5
		4 1φ10	32.4	.05	42.1 78.2 114.3	.23	IIa	13.5	16.70 2.73	47.2
		5 1φ 8+1φ 8	37.7	.06	42.2 78.4 114.5	.19	IIa	13.6	16.86 3.13	50.8
		6 1φ12	40.3	.06	42.0 78.0 113.9	.25	IIa	13.7	16.93 3.29	52.1
		7 1φ10+1φ 8	44.1	.07	42.1 78.2 114.3	.22	IIa	13.9	17.06 3.60	54.6
		8 1φ10+1φ10	50.5	.08	42.1 78.1 114.2	.21	IIa	14.1	17.25 4.05	58.0
		9 1φ12+1φ 8	51.9	.08	42.1 78.0 114.0	.23	IIa	14.1	17.29 4.14	58.6
		10 1φ12+1φ10	58.2	.09	42.0 78.0 113.9	.23	IIa	14.3	17.49 4.59	61.6
		11 1φ16	59.8	.09	41.8 77.4 113.0	.27	IIa	14.3	17.49 4.65	61.7
		12 1φ12+1φ12	65.8	.10	42.0 77.9 113.7	.22	IIa	14.6	17.72 5.11	64.9
		13 1φ16+1φ 8	71.0	.11	41.9 77.6 113.3	.26	IIa	14.7	17.85 5.43	66.6
		14 1φ16+1φ10	77.1	.12	41.9 77.5 113.2	.25	IIa	15.0	18.04 5.84	68.9
		15 1φ16+1φ12	84.5	.13	41.8 77.5 113.2	.25	IIa	15.2	18.25 6.32	71.4
		16 1φ16+1φ16	102.6	.16	43.6 79.2 114.7	.24	IIa	15.8	18.78 7.47	76.6
		17 2φ16+1φ12	125.5	.21	43.8 79.4 115.0	.23	IIa	16.7	19.50 8.93	82.5
		18 2φ16+1φ16	141.6	.28	43.7 79.2 114.8	.22	IIa	17.3	19.99 9.93	85.9

FLEXION NEGATIVA (por m)

REFUERZO SUPERIOR POR NERVIO	B400 MOMENTO ULTIMO-ABERTURA FISURA Sección tipo Mu Ref. Rel. Wk inf. x/d m·kN/m vig. mm (5) (9) (10) (7)	B500 MOMENTO ULTIMO-ABERTURA FISURA Sección maciza Mu Ref. Rel. Wk inf. x/d m·kN/m mm (5) (9) (10) (7)	ESF. CORTANTE ULTIMO Vcu Vu 1*cel kN/m (11)	MOMENTO FISUR. Mf m·kN/m (8)	RIGIDEZ TOTAL FIS. E·Ib E·If m ² ·MN/m (8)
1φ10	0.0 .00 .00	0.0 .00 .00	0.0 .00 .00	41.7 77.1	19.7 15.8 1.17
2φ 8	0.0 .00 .00	0.0 .00 .00	0.0 .00 .00	41.8 77.2	19.8 15.8 1.35
1φ12	0.0 .00 .00	0.0 .00 .00	0.0 .00 .00	41.5 77.0	19.8 15.8 1.43
1φ 8+1φ10	0.0 .00 .00	0.0 .00 .00	0.0 .00 .00	41.7 77.1	19.8 15.8 1.57
2φ10	0.0 .00 .00	0.0 .00 .00	0.0 .00 .00	41.7 77.1	19.9 15.8 1.77
1φ10+1φ12	0.0 .00 .00	0.0 .00 .00	21.9 .12 .12	41.6 77.0	20.0 15.9 2.01
2φ12	20.7 .11 .09	0.0 .00 .00	25.6 .14 .13	41.5 77.0	20.0 15.9 2.25
1φ10+1φ16	25.1 .14 .11	0.0 .00 .00	31.0 .18 .19	41.4 76.8	20.2 15.9 2.58
1φ12+1φ16	28.0 .16 .13	0.0 .00 .00	34.4 .20 .21	41.4 76.8	20.2 16.0 2.79
2φ16	35.0 .21 .16	37.2 .07 .17	42.8 .26 .22	41.3 76.7	20.4 16.0 3.29
4φ12	39.4 .23 .14	42.1 .07 .17	48.0 .29 .19	41.5 77.0	20.6 16.1 3.65
2φ16+1φ12	43.9 .26 .17	47.4 .09 .22	53.0 .34 .22	41.3 76.8	20.7 16.2 3.94
3φ16	50.1 .31 .17	55.0 .10 .22	60.1 .40 .22	41.3 76.7	20.9 16.2 4.37
4φ16	63.3 .43 .17	72.3 .13 .22	74.7 .53 .22	41.5 76.9	21.3 16.4 5.32

ESFUERZO CORTANTE Vsu (12) (kN/m) VA.14 (simple celosía) : 35.4 VA.18 (simple celosía) : 34.5
(kN/m) VA.14 (doble celosía) : 70.9 VA.18 (doble celosía) : 69.1
b, lím (mm) : 396 Vcu, lím (kN/m) (VA.14) : 74.3
895 (VA.18) : 168

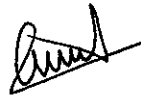
FICHA DE CARACTERISTICAS TECNICAS, SEGUN EHE-08 Y
EN 1991-1, DEL FORJADO DE VIGUETAS ARMADAS

FORJADOS SANTA COMBA, S.L.

Braña Rica, s/n.
15840 SANTA COMBA (A Coruña)

TECNICO AUTOR DE LA MEMORIA : Jordi Amat

Hoja n° 11 de 24



FLEXION POSITIVA (por m)

TIPO DE FORJADO (h+c)	TIPO DE VIGUETA	REFUERZO INFERIOR VIGUETA	MOMENTO ULTIMO Mu	Rel. x/d	ESFUERZO CORTANTE Vcu Vu = Vcu+Vsu 1*Cel 2*Cel	Wk	CLASE POR RECUBRIM.	MOMENTO DE FISURACION MF	RIGIDEZ TOTAL FISURADA E·Ib E·If	MOMENTO SERVICIO FIS. COMP.				
* s	(4)	Y + X	m·kN/m(5)	(10)	kN/m (11)	mm (7)		m·kN/m (8)	(8) m2·MN/m	m·kN/m(6)				
(20+ 5)	VA.14	1	0φ 0	8.6	.01	22.3	44.7	67.2	.08	IIa	9.0	13.21	0.87	26.0
* 65.	VA.18	2	1φ 6	12.9	.02	22.3	44.7	67.2	.10	IIa	9.2	13.39	1.25	32.0
		3	1φ 8	16.1	.02	22.2	44.7	67.1	.14	IIa	9.3	13.53	1.53	35.7
		4	1φ10	20.3	.03	22.2	44.6	66.9	.17	IIa	9.4	13.71	1.87	39.8
		5	1φ 8+1φ 8	23.6	.03	22.2	44.6	67.1	.16	IIa	9.6	13.85	2.16	43.0
		6	1φ12	25.3	.03	22.1	44.4	66.7	.19	IIa	9.6	13.91	2.27	44.1
		7	1φ10+1φ 8	27.7	.04	22.2	44.6	66.9	.17	IIa	9.7	14.03	2.49	46.3
		8	1φ10+1φ10	31.8	.04	22.2	44.5	66.9	.17	IIa	9.9	14.20	2.81	49.3
		9	1φ12+1φ 8	32.7	.04	22.1	44.5	66.8	.19	IIa	9.9	14.24	2.87	49.8
		10	1φ12+1φ10	36.8	.05	22.1	44.4	66.7	.19	IIa	10.0	14.40	3.20	52.5
		11	1φ16	37.8	.05	22.0	44.1	66.2	.22	IIa	10.0	14.42	3.25	52.7
		12	1φ12+1φ12	41.7	.06	22.1	44.4	66.6	.19	IIa	10.2	14.61	3.57	55.5
		13	1φ16+1φ 8	45.1	.06	22.0	44.2	66.3	.22	IIa	10.3	14.74	3.81	57.3
		14	1φ16+1φ10	49.1	.07	22.0	44.2	66.3	.22	IIa	10.5	14.90	4.12	59.5
		15	1φ16+1φ12	53.9	.08	22.3	44.4	66.5	.22	IIa	10.6	15.10	4.47	62.0
		16	1φ16+1φ16	65.9	.09	23.2	45.2	67.3	.21	IIa	11.1	15.58	5.33	67.5
		17	2φ16+1φ12	81.3	.12	23.2	45.3	67.4	.21	IIa	11.7	16.23	6.45	74.2
		18	2φ16+1φ16	92.8	.13	23.2	45.2	67.2	.21	IIa	12.1	16.68	7.24	78.4

FLEXION NEGATIVA (por m)

REFUERZO SUPERIOR POR NERVIO	B400 MOMENTO ULTIMO-ABERTURA FISURA						B500 MOMENTO ULTIMO-ABERTURA FISURA						ESF.CORTANTE		MOMENTO FISUR. Mf	RIGIDEZ			
	Sección tipo				Sección maciza		Sección tipo				Sección maciza		ULTIMO Vcu Vu 1*cel. kN/m (11)	m2-MN/m (8)					
	Mu	Ref.	Rel.	Wk	Mu	Rel.	Mu	Ref.	Rel.	Wk	Mu	Rel.				Wk			
	inf.	x/d			x/d		inf.	x/d			x/d								
	m·kN/m	vig.	mm		m·kN/m	mm	m·kN/m	vig.	mm		m·kN/m	(10)				mm			
(5)	(9)	(10)	(7)	(5)	(10)	(7)	(5)	(9)	(10)	(7)	(5)	(10)	(7)		(8)	(8)			
1φ10	0.0	.00	.00		0.0	.00	.00	8.5	.09	.11		0.0	.00	.00	22.0	43.9	19.0	12.9	1.25
2φ 8	8.7	.10	.08		0.0	.00	.00	10.8	.12	.09		0.0	.00	.00	22.0	44.0	19.1	12.9	1.47
1φ12	9.7	.11	.09		0.0	.00	.00	12.0	.14	.12		0.0	.00	.00	21.9	43.9	19.1	12.9	1.56
1φ 8+1φ10	11.0	.12	.08		0.0	.00	.00	18.1	.15	.10		0.0	.00	.00	22.0	44.0	19.2	12.9	1.72
2φ10	13.3	.15	.08		0.0	.00	.00	21.7	.19	.09		0.0	.00	.00	22.0	43.9	19.2	12.9	1.94
1φ10+1φ12	21.2	.19	.08		0.0	.00	.00	25.9	.23	.13		0.0	.00	.00	21.9	43.9	19.3	13.0	2.22
2φ12	24.6	.22	.09		0.0	.00	.00	30.0	.28	.15		0.0	.00	.00	21.9	43.9	19.4	13.0	2.46
1φ10+1φ16	29.5	.28	.13		0.0	.00	.00	35.5	.37	.20		40.3	.07	.29	21.8	43.8	19.5	13.0	2.81
1φ12+1φ16	32.5	.32	.14		36.3	.06	.20	38.9	.42	.20		45.1	.07	.29	21.8	43.8	19.6	13.0	3.04
2φ16	39.5	.43	.15		46.0	.08	.21	46.6	.52	.21		57.1	.09	.28	22.7	44.7	19.7	13.1	3.56
4φ12	43.7	.47	.14		52.0	.08	.20	51.3	.56	.18		64.5	.11	.26	23.1	45.0	19.9	13.1	3.92
2φ16+1φ12	47.7	.53	.16		58.5	.10	.24	61.0	1φ12	.52	.21	72.5	.12	.31	22.9	44.9	20.0	13.2	4.18
3φ16	53.2	.60	.16		67.9	.11	.23	67.7	1φ12	.61	.21	83.9	.14	.29	22.9	44.9	20.2	13.2	4.58
4φ16	70.8	1φ12	.65	.17	89.1	.15	.22	97.0	2φ16	.52	.21	109.7	.19	.27	22.9	44.9	20.6	13.3	5.44

ESFUERZO CORTANTE Vsu (12) (kN/m) VA.14 (simple celosía) : 22 VA.18 (simple celosía) : 21.4
(kN/m) VA.14 (doble celosía) : 44 VA.18 (doble celosía) : 42.9
b, lfm (mm) : 146 Vcu, lfm (kN/m) (VA.14) : 33.4
650 (VA.18) : 148.9

FICHA DE CARACTERISTICAS TECNICAS, SEGUN EHE-08 Y
EN 1991-1, DEL FORJADO DE VIGUETAS ARMADAS

FORJADOS SANTA COMBA, S.L.

Braña Rica, s/n.
15840 SANTA COMBA (A Coruña)

TECNICO AUTOR DE LA MEMORIA : Jordi Amat

Hoja n° 12 de 24

FLEXION POSITIVA (por m)

TIPO DE FORJADO (h+c) * s	TIPO DE VIGUETA (4)	REFUERZO INFERIOR VIGUETA Y + X	MOMENTO ULTIMO Mu m·kN/m(5)	Rel. x/d (10)	ESFUERZO CORTANTE Vcu Vu = Vcu+Vsu 1*Cel 2*Cel kN/m (11)	Wk CLASE POR RECUBRIM. (7)	MOMENTO DE FISURACION Mf m·kN/m (8)	RIGIDEZ TOTAL FISURADA E·Ib E·If (8) m ² ·MN/m	MOMENTO SERVICIO FIS. COMP. m·kN/m(6)
(20+ 5) * 77. D	VA.14	1 0φ 0	14.5	.02	43.5 81.5 119.5	.10 I Ia	14.0	18.59 1.41	33.5
	VA.18	2 1φ 6	21.6	.03	43.5 81.5 119.5	.15 I Ia	14.3	18.83 2.02	41.0
		3 1φ 8	27.1	.04	43.5 81.4 119.2	.20 I Ia	14.5	19.02 2.46	45.7
		4 1φ10	34.0	.05	43.4 81.1 118.9	.23 I Ia	14.7	19.25 3.01	50.8
		5 1φ 8+1φ 8	39.5	.05	43.4 81.3 119.2	.19 I Ia	14.9	19.45 3.45	54.7
		6 1φ12	42.3	.06	43.3 80.9 118.5	.25 I Ia	15.0	19.53 3.65	56.1
		7 1φ10+1φ 8	46.3	.06	43.4 81.2 118.9	.22 I Ia	15.1	19.68 3.97	58.7
		8 1φ10+1φ10	53.0	.07	43.3 81.1 118.8	.21 I Ia	15.3	19.90 4.48	62.4
		9 1φ12+1φ 8	54.4	.08	43.3 81.0 118.6	.23 I Ia	15.4	19.95 4.58	63.1
		10 1φ12+1φ10	61.1	.09	43.3 80.9 118.5	.23 I Ia	15.6	20.17 5.07	66.4
		11 1φ16	62.7	.09	43.0 80.3 117.7	.27 I Ia	15.6	20.19 5.14	66.5
		12 1φ12+1φ12	69.1	.10	43.2 80.8 118.3	.22 I Ia	15.9	20.43 5.65	70.0
		13 1φ16+1φ 8	74.5	.11	43.1 80.5 117.9	.26 I Ia	16.0	20.59 6.01	72.0
		14 1φ16+1φ10	81.0	.12	43.1 80.5 117.9	.26 I Ia	16.3	20.80 6.47	74.7
		15 1φ16+1φ12	88.8	.13	43.1 80.4 117.8	.25 I Ia	16.5	21.07 7.01	77.7
		16 1φ16+1φ16	107.8	.16	44.5 81.7 118.9	.24 I Ia	17.2	21.68 8.29	84.0
		17 2φ16+1φ12	132.0	.20	45.4 82.6 119.9	.23 I Ia	18.1	22.51 9.94	91.3
		18 2φ16+1φ16	149.7	.23	45.3 82.5 119.7	.22 I Ia	18.8	23.09 11.08	95.5

FLEXION NEGATIVA (por m)

REFUERZO SUPERIOR POR NERVIOS	B400 MOMENTO ULTIMO-ABERTURA FISURA Sección tipo Mu Ref. Rel. Wk inf. x/d m·kN/m vig. mm (5) (9) (10) (7)	B500 MOMENTO ULTIMO-ABERTURA FISURA Sección maciza Mu Ref. Rel. Wk inf. x/d m·kN/m mm (5) (9) (10) (7)	ESF.CORTANTE ULTIMO Vcu Vu 1*cel kN/m (11)	MOMENTO FISUR. Mf m·kN/m (8)	RIGIDEZ TOTAL FIS. E·Ib E·If m ² ·MN/m (8)
1φ10	0.0 .00 .00	0.0 .00 .00	0.0 .00 .00	42.9 80.0	22.3 18.2 1.30
2φ 8	0.0 .00 .00	0.0 .00 .00	0.0 .00 .00	43.0 80.1	22.4 18.2 1.51
1φ12	0.0 .00 .00	0.0 .00 .00	0.0 .00 .00	42.8 79.9	22.4 18.2 1.60
1φ 8+1φ10	0.0 .00 .00	0.0 .00 .00	0.0 .00 .00	43.0 80.1	22.4 18.2 1.75
2φ10	0.0 .00 .00	0.0 .00 .00	0.0 .00 .00	42.9 80.0	22.5 18.3 1.97
1φ10+1φ12	0.0 .00 .00	0.0 .00 .00	23.0 .12 .12	42.8 80.0	22.6 18.3 2.25
2φ12	16.3 .11 .09	0.0 .00 .00	26.9 .14 .11	42.8 79.9	22.7 18.3 2.50
1φ10+1φ16	26.4 .14 .10	0.0 .00 .00	32.6 .17 .18	42.6 79.8	22.8 18.4 2.86
1φ12+1φ16	29.5 .15 .12	0.0 .00 .00	36.2 .19 .20	42.6 79.7	22.9 18.4 3.11
2φ16	36.9 .20 .15	39.0 .06 .17	45.2 .25 .21	42.5 79.6	23.1 18.5 3.67
4φ12	41.5 .22 .13	44.2 .07 .17	50.6 .28 .19	42.8 79.9	23.2 18.6 4.06
2φ16+1φ12	46.2 .25 .16	49.7 .08 .22	56.0 .32 .22	42.6 79.7	23.3 18.6 4.38
3φ16	52.9 .30 .17	57.7 .10 .22	63.6 .38 .22	42.5 79.6	23.5 18.7 4.87
4φ16	67.0 .41 .17	76.0 .13 .22	79.3 .50 .22	42.5 79.6	24.0 18.9 5.93

ESFUERZO CORTANTE Vsu (12) (kN/m) VA.14 (simple celosía) : 37.1 VA.18 (simple celosía) : 36.2
(kN/m) VA.14 (doble celosía) : 74.2 VA.18 (doble celosía) : 72.4
b, lím (mm) : 396 Vcu, lím (kN/m) (VA.14) : 76.6
895 (VA.18) : 173

FICHA DE CARACTERISTICAS TECNICAS, SEGUN EHE-08 Y
EN 1991-1, DEL FORJADO DE VIGUETAS ARMADAS

FORJADOS SANTA COMBA, S.L.

Braña Rica, s/n.
15840 SANTA COMBA (A Coruña)

TECNICO AUTOR DE LA MEMORIA : Jordi Amat

Hoja n° 13 de 24

FLEXION POSITIVA (por m)

TIPO DE FORJADO (h+c) * s	TIPO DE VIGUETA (4)	REFUERZO INFERIOR VIGUETA Y + X	MOMENTO ULTIMO Mu m·kN/m(5)	Rel. x/d (10)	ESFUERZO CORTANTE Vcu Vu = Vcu+Vsu 1*Cel 2*Cel kN/m (11)	Wk mm (7)	CLASE POR RECUBRIM.	MOMENTO DE FISURACION Mf m·kN/m (8)	RIGIDEZ TOTAL FISURADA E·Ib E·If (8) m ² ·MN/m	MOMENTO SERVICIO FIS.COMP. m·kN/m(6)
(22+ 4) * 65.	VA.14	1 0φ 0	9.0	.01	22.9 46.4 69.9	.09	IIa	9.7	14.50 0.96	28.0
	VA.18	2 1φ 6	13.5	.02	22.9 46.4 69.9	.10	IIa	9.9	14.70 1.37	34.3
		3 1φ 8	16.9	.02	22.9 46.3 69.7	.14	IIa	10.0	14.83 1.68	38.3
		4 1φ10	21.2	.03	22.8 46.2 69.6	.17	IIa	10.2	15.02 2.06	42.7
		5 1φ 8+1φ 8	24.7	.03	22.9 46.3 69.7	.15	IIa	10.3	15.18 2.36	46.0
		6 1φ12	26.5	.03	22.8 46.0 69.3	.19	IIa	10.4	15.24 2.50	47.3
		7 1φ10+1φ 8	29.0	.04	22.8 46.2 69.6	.17	IIa	10.5	15.35 2.74	49.6
		8 1φ10+1φ10	33.3	.04	22.8 46.1 69.5	.17	IIa	10.6	15.53 3.09	52.8
		9 1φ12+1φ 8	34.2	.04	22.8 46.1 69.4	.19	IIa	10.6	15.57 3.16	53.4
		10 1φ12+1φ10	38.5	.05	22.8 46.0 69.3	.19	IIa	10.8	15.75 3.51	56.3
		11 1φ16	39.5	.05	22.6 45.7 68.8	.23	IIa	10.8	15.76 3.57	56.5
		12 1φ12+1φ12	43.6	.06	22.7 46.0 69.2	.19	IIa	11.0	15.95 3.92	59.5
		13 1φ16+1φ 8	47.2	.06	22.7 45.8 69.0	.22	IIa	11.1	16.09 4.19	61.4
		14 1φ16+1φ10	51.3	.07	22.7 45.8 69.0	.22	IIa	11.2	16.25 4.52	63.8
		15 1φ16+1φ12	56.4	.07	22.7 45.8 69.0	.22	IIa	11.4	16.46 4.92	66.5
		16 1φ16+1φ16	69.0	.09	24.0 47.0 70.1	.21	IIa	11.9	16.96 5.87	72.2
		17 2φ16+1φ12	85.2	.11	24.0 47.1 70.2	.21	IIa	12.5	17.63 7.09	78.6
		18 2φ16+1φ16	97.3	.13	24.0 47.0 70.0	.21	IIa	12.9	18.11 7.95	82.4

FLEXION NEGATIVA (por m)

REFUERZO SUPERIOR POR NERVIO	B400 MOMENTO ULTIMO-ABERTURA FISURA Sección tipo Mu Ref. Rel. Wk inf. x/d m·kN/m vig. mm (5) (9) (10) (7)	B500 MOMENTO ULTIMO-ABERTURA FISURA Sección maciza Mu Ref. Rel. Wk inf. x/d m·kN/m mm (5) (10) (7)	B500 MOMENTO ULTIMO-ABERTURA FISURA Sección tipo Mu Ref. Rel. Wk inf. x/d m·kN/m vig. mm (5) (9) (10) (7)	B500 MOMENTO ULTIMO-ABERTURA FISURA Sección maciza Mu Ref. Rel. Wk inf. x/d m·kN/m mm (5) (10) (7)	ESF.CORTANTE ULTIMO Vcu Vu 1*cel. kN/m (11)	MOMENTO FISUR. Mf m·kN/m (8)	RIGIDEZ TOTAL FIS. E·Ib E·If m ² ·MN/m (8)
1φ10	0.0 .00 .00	0.0 .00 .00	8.9 .09 .12	0.0 .00 .00	22.6 45.6	19.2	14.2 1.31
2φ 8	9.1 .09 .08	0.0 .00 .00	11.3 .12 .09	0.0 .00 .00	22.6 45.6	19.3	14.2 1.56
1φ12	10.1 .10 .10	0.0 .00 .00	12.5 .13 .12	0.0 .00 .00	22.5 45.5	19.3	14.2 1.66
1φ 8+1φ10	11.5 .12 .08	0.0 .00 .00	19.0 .15 .10	0.0 .00 .00	22.6 45.6	19.4	14.2 1.83
2φ10	13.9 .14 .08	0.0 .00 .00	22.8 .18 .09	0.0 .00 .00	22.6 45.6	19.5	14.3 2.10
1φ10+1φ12	22.2 .18 .08	0.0 .00 .00	27.2 .22 .14	0.0 .00 .00	22.5 45.5	19.6	14.3 2.39
2φ12	25.8 .21 .10	0.0 .00 .00	31.5 .27 .16	0.0 .00 .00	22.5 45.5	19.7	14.3 2.68
1φ10+1φ16	31.0 .27 .14	0.0 .00 .00	37.4 .35 .20	42.2 .06 .29	22.4 45.4	19.8	14.4 3.07
1φ12+1φ16	34.2 .31 .15	0.0 .00 .00	41.0 .40 .21	47.3 .07 .29	22.4 45.4	19.9	14.4 3.32
2φ16	41.7 .41 .16	48.2 .07 .21	49.4 .49 .21	59.8 .09 .29	23.1 46.1	20.1	14.4 3.90
4φ12	46.2 .45 .14	54.5 .08 .20	54.4 .54 .18	67.6 .10 .26	23.9 46.8	20.3	14.5 4.28
2φ16+1φ12	50.5 .51 .16	61.3 .09 .24	59.0 .60 .21	76.0 .12 .31	23.7 46.7	20.4	14.5 4.59
3φ16	56.5 .57 .16	71.2 .11 .23	71.8 1φ12 .58 .21	88.0 .14 .30	23.7 46.7	20.6	14.6 5.05
4φ16	75.2 1φ12 .62 .17	93.5 .14 .22	102.5 2φ16 .50 .22	115.1 .18 .28	23.7 46.7	21.1	14.8 6.02

ESFUERZO CORTANTE Vsu (12) (kN/m) VA.14 (simple celosía) : 23 VA.18 (simple celosía) : 22.4
(kN/m) VA.14 (doble celosía) : 46 VA.18 (doble celosía) : 44.8
b,lím (mm) : 140 Vcu,lím (kN/m) (VA.14) : 33
156 (VA.18) : 36.8

FICHA DE CARACTERISTICAS TECNICAS, SEGUN EHE-08 Y
EN 1991-1, DEL FORJADO DE VIGUETAS ARMADAS

FORJADOS SANTA COMBA, S.L.

Braña Rica, s/n.
15840 SANTA COMBA (A Coruña)

TECNICO AUTOR DE LA MEMORIA : Jordi Amat

Hoja n° 14 de 24

FLEXION POSITIVA (por m)

TIPO DE FORJADO (h+c)	TIPO DE VIGUETA	REFUERZO INFERIOR VIGUETA	MOMENTO ULTIMO Mu	Rel. x/d	ESFUERZO CORTANTE Vcu Vu = Vcu+Vsu	Wk	CLASE POR RECUBRIM.	MOMENTO DE FISURACION Mf	RIGIDEZ TOTAL FISURADA E-It E-If	MOMENTO SERVICIO FIS. COMP.
* s	(4)	Y + X	m·kN/m(5)	(10)	1*Cel 2*Cel kN/m (11)	mm (7)		m·kN/m (8)	(8) m2·MN/m	m·kN/m(6)
(22+ 4)	VA.14	1 0φ 0	15.1	.02	44.7 84.4 124.0	.10	IIa	15.0	20.27 1.56	36.0
* 77. D	VA.18	2 1φ 6	22.6	.03	44.7 84.4 124.0	.15	IIa	15.3	20.54 2.23	44.0
		3 1φ 8	28.3	.04	44.7 84.3 123.8	.20	IIa	15.5	20.74 2.72	49.0
		4 1φ10	35.5	.04	44.6 84.1 123.5	.23	IIa	15.7	20.97 3.31	54.5
		5 1φ 8+1φ 8	41.3	.05	44.7 84.2 123.8	.20	IIa	15.9	21.18 3.79	58.6
		6 1φ12	44.2	.06	44.5 83.8 123.1	.25	IIa	16.0	21.25 4.01	60.2
		7 1φ10+1φ 8	48.4	.06	44.6 84.1 123.5	.22	IIa	16.2	21.41 4.36	63.0
		8 1φ10+1φ10	55.5	.07	44.6 84.0 123.4	.21	IIa	16.4	21.65 4.92	66.9
		9 1φ12+1φ 8	57.0	.07	44.5 83.9 123.2	.24	IIa	16.4	21.70 5.04	67.6
		10 1φ12+1φ10	63.9	.08	44.5 83.8 123.1	.23	IIa	16.7	21.93 5.58	71.1
		11 1φ16	65.7	.09	44.3 83.3 122.3	.28	IIa	16.7	21.94 5.66	71.3
		12 1φ12+1φ12	72.3	.09	44.5 83.7 123.0	.22	IIa	17.0	22.21 6.21	74.8
		13 1φ16+1φ 8	78.1	.10	44.3 83.4 122.5	.26	IIa	17.1	22.37 6.61	76.8
		14 1φ16+1φ10	84.9	.11	44.3 83.4 122.5	.26	IIa	17.4	22.60 7.12	79.4
		15 1φ16+1φ12	93.0	.12	44.3 83.3 122.4	.25	IIa	17.7	22.86 7.72	82.2
		16 1φ16+1φ16	113.1	.15	45.3 84.2 123.2	.24	IIa	18.4	23.50 9.12	88.1
		17 2φ16+1φ12	138.6	.19	46.9 85.9 124.8	.23	IIa	19.3	24.36 10.90	94.8
		18 2φ16+1φ16	156.9	.26	46.9 85.7 124.6	.23	IIa	20.0	24.97 12.14	98.7

FLEXION NEGATIVA (por m)

REFUERZO SUPERIOR POR NERVIO	B400 MOMENTO ULTIMO-ABERTURA FISURA	B500 MOMENTO ULTIMO-ABERTURA FISURA	ESF.CORTANTE ULTIMO	MOMENTO FISUR.	RIGIDEZ TOTAL FIS.
	Sección tipo	Sección maciza	Sección tipo	Sección maciza	
	Mu Ref. Rel. Wk	Mu Ref. Rel. Wk	Mu Ref. Rel. Wk	Mu Ref. Rel. Wk	
	inf. x/d	inf. x/d	inf. x/d	inf. x/d	
	m·kN/m vig. mm	m·kN/m mm	m·kN/m vig. mm	m·kN/m mm	
	(5) (9) (10) (7)	(5) (10) (7)	(5) (9) (10) (7)	(5) (10) (7)	
1φ10	0.0 .00 .00	0.0 .00 .00	0.0 .00 .00	44.1 83.0	22.6 19.9 1.36
2φ 8	0.0 .00 .00	0.0 .00 .00	0.0 .00 .00	44.3 83.1	22.7 19.9 1.59
1φ12	0.0 .00 .00	0.0 .00 .00	0.0 .00 .00	44.0 82.8	22.7 19.9 1.69
1φ 8+1φ10	0.0 .00 .00	0.0 .00 .00	0.0 .00 .00	44.2 83.0	22.8 19.9 1.85
2φ10	0.0 .00 .00	0.0 .00 .00	0.0 .00 .00	44.1 83.0	22.9 20.0 2.11
1φ10+1φ12	0.0 .00 .00	0.0 .00 .00	24.1 .11 .12	44.1 82.9	23.0 20.0 2.40
2φ12	0.0 .00 .00	0.0 .00 .00	28.2 .13 .12	44.0 82.8	23.1 20.0 2.69
1φ10+1φ16	27.7 .13 .10	0.0 .00 .00	34.2 .16 .19	43.9 82.7	23.2 20.1 3.10
1φ12+1φ16	30.9 .15 .12	0.0 .00 .00	38.0 .18 .20	43.9 82.7	23.3 20.1 3.36
2φ16	38.7 .19 .15	40.9 .06 .16	47.5 .23 .22	43.8 82.6	23.5 20.2 3.99
4φ12	43.5 .21 .14	46.2 .07 .17	53.2 .27 .19	44.0 82.8	23.7 20.3 4.42
2φ16+1φ12	48.6 .24 .17	52.1 .08 .21	59.0 .31 .22	43.8 82.6	23.8 20.4 4.79
3φ16	55.7 .29 .17	60.5 .09 .22	67.1 .37 .22	43.8 82.6	24.0 20.5 5.33
4φ16	70.7 .39 .17	79.7 .12 .22	83.9 .48 .22	43.8 82.6	24.6 20.7 6.53

ESFUERZO CORTANTE Vsu (12) (kN/m) VA.14 (simple celosía) : 38.8 VA.18 (simple celosía) : 37.8
(kN/m) VA.14 (doble celosía) : 77.6 VA.18 (doble celosía) : 75.7
b,lím (mm) : 390 Vcu,lím (kN/m) (VA.14) : 77.6
406 (VA.18) : 80.8

FICHA DE CARACTERISTICAS TECNICAS, SEGUN EHE-08 Y
EN 1991-1, DEL FORJADO DE VIGUETAS ARMADAS

FORJADOS SANTA COMBA, S.L.

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15840 SANTA COMBA (A Coruña)

TECNICO AUTOR DE LA MEMORIA : Jordi Amat

Hoja n° 15 de 24

FLEXION POSITIVA (por m)

TIPO DE FORJADO (h+c) * s	TIPO DE VIGUETA (4)	REFUERZO INFERIOR VIGUETA Y + X	MOMENTO ULTIMO Mu m·kN/m(5)	Rel. x/d (10)	ESFUERZO CORTANTE Vcu Vu = Vcu+Vsu 1*Cel 2*Cel kN/m (11)	Wk	CLASE POR RECUBRIM.	MOMENTO DE FISURACION Mf m·kN/m (8)	RIGIDEZ TOTAL FISURADA E·Ib E·If (8) m ² ·MN/m	MOMENTO SERVICIO FIS. COMP. m·kN/m(6)
(22+ 5) * 65.	VA.14	1 0φ 0	0.0	.00	23.5 48.0 72.5	.00	IIa	10.6	16.58 1.06	0.0
	VA.18	2 1φ 6	14.0	.02	23.5 48.0 72.5	.09	IIa	10.7	16.80 1.50	36.7
		3 1φ 8	17.6	.02	23.5 47.9 72.4	.14	IIa	10.9	16.97 1.84	41.0
		4 1φ10	22.1	.03	23.4 47.8 72.2	.17	IIa	11.0	17.18 2.25	45.7
		5 1φ 8+1φ 8	25.8	.03	23.5 47.9 72.3	.15	IIa	11.2	17.35 2.59	49.2
		6 1φ12	27.6	.03	23.4 47.7 72.0	.19	IIa	11.2	17.42 2.75	50.6
		7 1φ10+1φ 8	30.3	.04	23.4 47.8 72.2	.17	IIa	11.3	17.56 2.99	53.0
		8 1φ10+1φ10	34.7	.04	23.4 47.8 72.1	.17	IIa	11.5	17.75 3.38	56.5
		9 1φ12+1φ 8	35.7	.04	23.4 47.7 72.0	.19	IIa	11.5	17.79 3.46	57.1
		10 1φ12+1φ10	40.1	.05	23.4 47.7 72.0	.19	IIa	11.7	18.00 3.84	60.2
		11 1φ16	41.3	.05	23.3 47.4 71.5	.23	IIa	11.7	18.02 3.91	60.5
		12 1φ12+1φ12	45.5	.05	23.4 47.6 71.9	.19	IIa	11.9	18.24 4.29	63.7
		13 1φ16+1φ 8	49.2	.06	23.3 47.4 71.6	.22	IIa	12.0	18.39 4.59	65.7
		14 1φ16+1φ10	53.6	.06	23.3 47.4 71.6	.22	IIa	12.2	18.59 4.96	68.3
		15 1φ16+1φ12	58.9	.07	23.3 47.4 71.5	.22	IIa	12.4	18.82 5.39	71.2
		16 1φ16+1φ16	72.1	.09	24.8 48.8 72.9	.21	IIa	12.8	19.39 6.43	77.6
		17 2φ16+1φ12	89.1	.11	24.8 48.9 72.9	.21	IIa	13.5	20.17 7.78	85.3
		18 2φ16+1φ16	101.8	.12	24.8 48.8 72.8	.21	IIa	14.0	20.71 8.75	90.0

FLEXION NEGATIVA (por m)

REFUERZO SUPERIOR POR NERVIO	B400 MOMENTO ULTIMO-ABERTURA FISURA Sección tipo Mu Ref. Rel. Wk inf. x/d m·kN/m vig. mm (5) (9) (10) (7)	B500 MOMENTO ULTIMO-ABERTURA FISURA Sección maciza Mu Ref. Rel. Wk inf. x/d m·kN/m vig. mm (5) (10) (7)	B500 MOMENTO ULTIMO-ABERTURA FISURA Sección maciza Mu Ref. Rel. Wk inf. x/d m·kN/m vig. mm (5) (9) (10) (7)	ESF. CORTANTE ULTIMO Vcu Vu 1*cel. kN/m (11)	MOMENTO FISUR. Mf m·kN/m (8)	RIGIDEZ TOTAL FIS. E·Ib E·If m ² ·MN/m (8)
1φ10	0.0 .00 .00	0.0 .00 .00	9.3 .09 .12	0.0 .00 .00	23.2 47.2	21.8 16.2 1.48
2φ 8	0.0 .00 .00	0.0 .00 .00	11.8 .11 .09	0.0 .00 .00	23.3 47.3	21.9 16.2 1.74
1φ12	10.6 .10 .10	0.0 .00 .00	13.1 .13 .12	0.0 .00 .00	23.1 47.1	21.9 16.2 1.85
1φ 8+1φ10	12.1 .11 .08	0.0 .00 .00	14.9 .14 .10	0.0 .00 .00	23.2 47.2	22.0 16.3 2.04
2φ10	14.5 .14 .08	0.0 .00 .00	23.9 .17 .10	0.0 .00 .00	23.2 47.2	22.0 16.3 2.32
1φ10+1φ12	23.2 .17 .08	0.0 .00 .00	28.5 .21 .12	0.0 .00 .00	23.2 47.2	22.1 16.3 2.66
2φ12	27.0 .20 .08	0.0 .00 .00	33.0 .26 .15	0.0 .00 .00	23.1 47.1	22.2 16.4 2.97
1φ10+1φ16	32.5 .26 .13	0.0 .00 .00	39.3 .34 .19	44.1 .06 .28	23.1 47.1	22.4 16.4 3.40
1φ12+1φ16	36.0 .30 .14	0.0 .00 .00	43.2 .38 .20	49.4 .07 .29	23.1 47.0	22.5 16.4 3.68
2φ16	43.9 .39 .15	50.4 .07 .21	52.1 .47 .21	62.5 .09 .29	23.6 47.6	22.7 16.5 4.32
4φ12	48.7 .43 .14	56.9 .08 .20	57.5 .52 .18	70.7 .10 .26	24.6 48.6	22.9 16.6 4.74
2φ16+1φ12	53.3 .48 .16	64.1 .09 .24	62.5 .58 .21	79.5 .11 .31	24.5 48.5	23.0 16.6 5.09
3φ16	59.7 .55 .16	74.5 .10 .23	75.9 1φ12 .56 .21	92.1 .13 .30	24.5 48.5	23.2 16.7 5.60
4φ16	79.5 1φ12 .60 .17	97.9 .14 .22	108.0 2φ16 .48 .22	120.6 .17 .28	24.5 48.5	23.8 16.8 6.67

ESFUERZO CORTANTE Vsu (12) (kN/m) VA.14 (simple celosía) : 24 VA.18 (simple celosía) : 23.4
(kN/m) VA.14 (doble celosía) : 48 VA.18 (doble celosía) : 46.8
b, lím (mm) : 140 Vcu, lím (kN/m) (VA.14) : 33.9
156 (VA.18) : 37.8

FICHA DE CARACTERISTICAS TECNICAS, SEGUN EHE-08 Y
EN 1991-1, DEL FORJADO DE VIGUETAS ARMADAS

FORJADOS SANTA COMBA, S.L.

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TECNICO AUTOR DE LA MEMORIA : Jordi Amat

Hoja n° 16 de 24

FLEXION POSITIVA (por m)

TIPO DE FORJADO (h+c)	TIPO DE VIGUETA	REFUERZO INFERIOR VIGUETA	MOMENTO ULTIMO Mu	Rel. x/d	ESFUERZO CORTANTE Vcu	Vu = Vcu+Vsu	Wk	CLASE POR RECUBRIM.	MOMENTO DE FISURACION Mf	RIGIDEZ TOTAL FISURADA	MOMENTO SERVICIO
* s	(4)	Y + X	m·kN/m(5)	(10)	1*Cel 2*Cel	kN/m (11)	mm (7)		m·kN/m (8)	E·Ib E·If (8) m ² ·MN/m	m·kN/m(6)
(22+ 5)	VA.14	1 0φ 0	15.8	.02	46.0	87.3 128.6	.10	IIa	16.3	23.24 1.72	38.6
* 77. D	VA.18	2 1φ 6	23.6	.03	46.0	87.3 128.6	.14	IIa	16.6	23.53 2.44	47.1
		3 1φ 8	29.5	.03	45.9	87.2 128.4	.19	IIa	16.8	23.75 2.97	52.5
		4 1φ10	37.1	.04	45.8	87.0 128.1	.23	IIa	17.1	24.03 3.63	58.3
		5 1φ 8+1φ 8	43.1	.05	45.9	87.1 128.3	.20	IIa	17.3	24.26 4.16	62.7
		6 1φ12	46.2	.05	45.7	86.7 127.7	.25	IIa	17.4	24.35 4.39	64.4
		7 1φ10+1φ 8	50.5	.06	45.8	87.0 128.1	.22	IIa	17.5	24.53 4.78	67.4
		8 1φ10+1φ10	57.9	.07	45.8	86.9 128.0	.21	IIa	17.8	24.80 5.39	71.6
		9 1φ12+1φ 8	59.5	.07	45.7	86.8 127.8	.24	IIa	17.8	24.85 5.52	72.4
		10 1φ12+1φ10	66.8	.08	45.7	86.7 127.7	.23	IIa	18.1	25.12 6.11	76.2
		11 1φ16	68.7	.08	45.5	86.2 126.9	.28	IIa	18.1	25.14 6.21	76.5
		12 1φ12+1φ12	75.6	.09	45.7	86.6 127.5	.23	IIa	18.4	25.43 6.81	80.4
		13 1φ16+1φ 8	81.6	.10	45.5	86.3 127.1	.27	IIa	18.6	25.63 7.25	82.8
		14 1φ16+1φ10	88.7	.11	45.5	86.3 127.1	.26	IIa	18.8	25.88 7.81	85.9
		15 1φ16+1φ12	97.3	.12	45.5	86.2 127.0	.25	IIa	19.1	26.19 8.47	89.3
		16 1φ16+1φ16	118.4	.15	46.2	86.8 127.4	.24	IIa	19.9	26.93 10.04	96.5
		17 2φ16+1φ12	145.2	.18	48.5	89.1 129.8	.23	IIa	20.9	27.92 12.04	104.6
		18 2φ16+1φ16	164.9	.21	48.4	89.0 129.5	.23	IIa	21.6	28.62 13.43	109.4

FLEXION NEGATIVA (por m)

REFUERZO SUPERIOR POR NERVIO	B400 MOMENTO ULTIMO-ABERTURA FISURA	Sección tipo	Sección maciza	B500 MOMENTO ULTIMO-ABERTURA FISURA	Sección tipo	Sección maciza	ESF.CORTANTE ULTIMO	MOMENTO FISUR.	RIGIDEZ TOTAL FIS.
	Mu Ref. Rel. Wk	Sección tipo	Sección maciza	Mu Ref. Rel. Wk	Sección tipo	Sección maciza	Vcu Vu	Mf	E·Ib E·If
	m·kN/m vig. inf. x/d	mm	m·kN/m x/d	mm	m·kN/m vig. inf. x/d	mm	kN/m 1*cel	m·kN/m	m ² ·MN/m
	(5) (9) (10) (7)		(5) (10) (7)		(5) (9) (10) (7)		(11)	(8)	(8)
1φ10	0.0 .00 .00		0.0 .00 .00		0.0 .00 .00		45.4 85.9	25.6	22.8 1.51
2φ 8	0.0 .00 .00		0.0 .00 .00		0.0 .00 .00		45.5 86.0	25.6	22.8 1.76
1φ12	0.0 .00 .00		0.0 .00 .00		0.0 .00 .00		45.2 85.7	25.7	22.8 1.87
1φ 8+1φ10	0.0 .00 .00		0.0 .00 .00		0.0 .00 .00		45.4 85.9	25.7	22.8 2.05
2φ10	0.0 .00 .00		0.0 .00 .00		0.0 .00 .00		45.4 85.9	25.8	22.9 2.33
1φ10+1φ12	0.0 .00 .00		0.0 .00 .00		19.0 .11 .12		45.3 85.8	25.9	22.9 2.66
2φ12	0.0 .00 .00		0.0 .00 .00		29.5 .13 .11		45.2 85.7	26.0	23.0 2.97
1φ10+1φ16	29.0 .12 .10		0.0 .00 .00		35.8 .16 .17		45.1 85.6	26.1	23.0 3.42
1φ12+1φ16	32.3 .14 .11		0.0 .00 .00		39.9 .18 .19		45.1 85.6	26.2	23.1 3.72
2φ16	40.6 .18 .14		42.7 .06 .16		49.8 .22 .21	53.1 .07 .25	45.0 85.5	26.5	23.2 4.41
4φ12	45.6 .20 .13		48.3 .07 .17		55.8 .25 .19	60.0 .08 .24	45.2 85.7	26.7	23.3 4.88
2φ16+1φ12	51.0 .23 .16		54.4 .07 .21		62.0 .30 .22	67.6 .09 .30	45.0 85.5	26.8	23.3 5.28
3φ16	58.5 .28 .17		63.3 .09 .22		70.6 .35 .22	78.4 .11 .29	45.0 85.5	27.0	23.4 5.89
4φ16	74.5 .37 .17		83.4 .12 .22		88.5 .46 .22	103.0 .15 .29	45.0 85.5	27.6	23.6 7.22

ESFUERZO CORTANTE Vsu (12) (kN/m) VA.14 (simple celosía) : 40.5 VA.18 (simple celosía) : 39.5
(kN/m) VA.14 (doble celosía) : 81 VA.18 (doble celosía) : 79
b,lím (mm) : 390 Vcu,lím (kN/m) (VA.14) : 79.8
406 (VA.18) : 83

FICHA DE CARACTERISTICAS TECNICAS, SEGUN EHE-08 Y
EN 1991-1, DEL FORJADO DE VIGUETAS ARMADAS

FORJADOS SANTA COMBA, S.L.

Braña Rica, s/n.
15840 SANTA COMBA (A Coruña)

TECNICO AUTOR DE LA MEMORIA : Jordi Amat

Hoja n° 17 de 24

FLEXION POSITIVA (por m)

TIPO DE FORJADO (h+c) * s	TIPO DE VIGUETA (4)	REFUERZO INFERIOR VIGUETA Y + X	MOMENTO ULTIMO Mu m·kN/m(5)	Rel. x/d (10)	ESFUERZO CORTANTE Vcu Vu = Vcu+Vsu 1*Cel 2*Cel kN/m (11)	Wk mm (7)	CLASE POR RECUBRIM.	MOMENTO DE FISURACION Mf m·kN/m (8)	RIGIDEZ TOTAL FISURADA E·Ib E·If (8) m ² ·MN/m	MOMENTO SERVICIO FIS. COMP. m·kN/m(6)
(25+ 4) * 65.	VA.18	1 0φ 0	0.0	.00	24.7 50.5 76.4	.00	IIa	12.1	19.89 1.20	0.0
	VA.24	2 1φ 6	15.2	.01	24.7 50.5 76.4	.08	IIa	12.3	20.14 1.73	41.1
		3 1φ 8	19.0	.02	24.7 50.5 76.2	.13	IIa	12.5	20.32 2.12	46.1
		4 1φ10	24.0	.02	24.7 50.4 76.1	.17	IIa	12.6	20.55 2.62	51.5
		5 1φ 8+1φ 8	27.9	.03	24.7 50.5 76.2	.15	IIa	12.8	20.75 3.01	55.5
		6 1φ12	29.9	.03	24.6 50.2 75.9	.19	IIa	12.8	20.82 3.20	57.1
		7 1φ10+1φ 8	32.8	.03	24.7 50.4 76.1	.18	IIa	13.0	20.97 3.49	59.8
		8 1φ10+1φ10	37.6	.04	24.6 50.3 76.0	.18	IIa	13.1	21.20 3.95	63.8
		9 1φ12+1φ 8	38.7	.04	24.6 50.3 75.9	.19	IIa	13.2	21.25 4.05	64.5
		10 1φ12+1φ10	43.5	.04	24.6 50.2 75.9	.19	IIa	13.3	21.46 4.50	68.1
		11 1φ16	44.8	.05	24.5 49.9 75.4	.23	IIa	13.4	21.49 4.59	68.5
		12 1φ12+1φ12	49.4	.05	24.6 50.2 75.8	.19	IIa	13.6	21.74 5.05	72.1
		13 1φ16+1φ 8	53.4	.05	24.5 50.0 75.5	.22	IIa	13.7	21.90 5.39	74.4
		14 1φ16+1φ10	58.2	.06	24.5 50.0 75.5	.22	IIa	13.9	22.12 5.83	77.3
		15 1φ16+1φ12	64.0	.07	24.5 50.0 75.4	.22	IIa	14.1	22.38 6.35	80.5
		16 1φ16+1φ16	78.3	.08	25.7 51.0 76.4	.21	IIa	14.6	23.02 7.60	87.2
		17 2φ16+1φ12	96.9	.10	26.3 51.8 77.2	.21	IIa	15.3	23.86 9.20	94.7
		18 2φ16+1φ16	110.8	.12	26.3 51.7 77.1	.21	IIa	15.8	24.47 10.33	99.1

FLEXION NEGATIVA (por m)

REFUERZO SUPERIOR POR NERVIO	B400 MOMENTO ULTIMO-ABERTURA FISURA Sección tipo Mu Ref. Rel. Wk inf. x/d m·kN/m vig. mm (5) (9) (10) (7)	Sección maciza Mu Rel. Wk x/d m·kN/m mm (5) (10) (7)	B500 MOMENTO ULTIMO-ABERTURA FISURA Sección tipo Mu Ref. Rel. Wk inf. x/d m·kN/m vig. mm (5) (9) (10) (7)	Sección maciza Mu Ref. Rel. Wk x/d m·kN/m mm (5) (10) (7)	ESF.CORTANTE ULTIMO Vcu Vu 1*cel. kN/m (11)	MOMENTO FISUR. Mf m·kN/m (8)	RIGIDEZ TOTAL FIS. E·Ib E·If m ² ·MN/m (8)
1φ10	0.0 .00 .00	0.0 .00 .00	0.0 .00 .00	0.0 .00 .00	24.4 49.8	23.1	19.5 1.76
2φ 8	0.0 .00 .00	0.0 .00 .00	12.9 .10 .09	0.0 .00 .00	24.5 49.8	23.2	19.5 2.08
1φ12	11.5 .09 .10	0.0 .00 .00	14.3 .12 .12	0.0 .00 .00	24.4 49.7	23.3	19.6 2.22
1φ 8+1φ10	13.1 .10 .08	0.0 .00 .00	16.2 .13 .10	0.0 .00 .00	24.5 49.8	23.3	19.6 2.43
2φ10	15.8 .13 .08	0.0 .00 .00	26.0 .16 .10	0.0 .00 .00	24.4 49.8	23.4	19.6 2.78
1φ10+1φ12	25.3 .16 .08	0.0 .00 .00	31.1 .20 .13	0.0 .00 .00	24.4 49.7	23.5	19.7 3.18
2φ12	29.5 .19 .09	0.0 .00 .00	36.1 .24 .15	0.0 .00 .00	24.4 49.7	23.7	19.7 3.55
1φ10+1φ16	35.6 .24 .14	0.0 .00 .00	43.2 .31 .20	0.0 .00 .00	24.3 49.6	23.8	19.8 4.08
1φ12+1φ16	39.4 .27 .15	0.0 .00 .00	47.5 .35 .21	53.7 .06 .29	24.3 49.6	23.9	19.8 4.42
2φ16	48.3 .36 .16	54.7 .06 .21	57.6 .44 .21	68.0 .08 .29	24.4 49.7	24.2	19.9 5.18
4φ12	53.6 .40 .14	61.9 .07 .20	63.6 .48 .18	76.8 .09 .27	25.5 50.8	24.5	20.0 5.69
2φ16+1φ12	59.0 .45 .16	69.7 .08 .24	69.5 .53 .21	86.5 .10 .32	26.1 51.4	24.6	20.1 6.12
3φ16	66.3 .51 .17	81.0 .10 .24	77.4 .61 .21	100.3 .12 .31	26.0 51.4	24.9	20.2 6.75
4φ16	81.1 .64 .17	106.6 .13 .22	107.9 1φ16 .61 .22	131.5 .16 .29	26.0 51.4	25.5	20.4 8.07

ESFUERZO CORTANTE Vsu (12) (kN/m) VA.18 (simple celosía) : 25.3 VA.24 (simple celosía) : 24.4
(kN/m) VA.18 (doble celosía) : 50.7 VA.24 (doble celosía) : 48.7
b, lím (mm) : 148 Vcu, lím (kN/m) (VA.18) : 37.8
650 (VA.24) : 165.9

FICHA DE CARACTERISTICAS TECNICAS, SEGUN EHE-08 Y
EN 1991-1, DEL FORJADO DE VIGUETAS ARMADAS

FORJADOS SANTA COMBA, S.L.

Braña Rica, s/n.
15840 SANTA COMBA (A Coruña)

TECNICO AUTOR DE LA MEMORIA : Jordi Amat

Hoja n° 18 de 24

FLEXION POSITIVA (por m)

TIPO DE FORJADO (h+c)	TIPO DE VIGUETA	REFUERZO INFERIOR VIGUETA	MOMENTO ULTIMO Mu	Rel. x/d	ESFUERZO CORTANTE Vcu Vu = Vcu+Vsu 1*Cel 2*Cel	Wk	CLASE POR RECUBRIM.	MOMENTO DE FISURACION MF	RIGIDEZ TOTAL FISURADA E-1b E-1f	MOMENTO SERVICIO FIS. COMP.
* s	(4)	Y + X	m·kN/m(5)	(10)	kN/m (11)	mm (7)		m·kN/m (8)	(8) m2·MN/m	m·kN/m(6)
(25+ 4)	VA.18	1 0φ 0	17.1	.02	48.4 91.9 135.5	.11	IIa	18.6	27.70 1.95	43.1
* 77. D	VA.24	2 1φ 6	25.5	.03	48.4 91.9 135.5	.14	IIa	18.9	28.02 2.80	53.0
		3 1φ 8	32.0	.03	48.3 91.8 135.3	.19	IIa	19.1	28.26 3.44	59.2
		4 1φ10	40.2	.04	48.2 91.6 135.0	.23	IIa	19.4	28.58 4.23	65.9
		5 1φ 8+1φ 8	46.7	.05	48.3 91.8 135.2	.20	IIa	19.6	28.83 4.85	70.9
		6 1φ12	50.1	.05	48.1 91.4 134.6	.26	IIa	19.7	28.94 5.14	72.9
		7 1φ10+1φ 8	54.8	.06	48.2 91.6 135.0	.22	IIa	19.9	29.14 5.60	76.3
		8 1φ10+1φ10	62.8	.06	48.2 91.5 134.9	.22	IIa	20.2	29.43 6.32	81.0
		9 1φ12+1φ 8	64.5	.07	48.1 91.4 134.7	.24	IIa	20.2	29.49 6.47	81.9
		10 1φ12+1φ10	72.5	.07	48.1 91.4 134.6	.24	IIa	20.5	29.79 7.19	86.0
		11 1φ16	74.6	.08	47.9 90.8 133.8	.28	IIa	20.5	29.81 7.30	86.3
		12 1φ12+1φ12	82.1	.08	48.1 91.3 134.5	.23	IIa	20.8	30.14 8.02	90.4
		13 1φ16+1φ 8	88.7	.09	48.0 91.0 134.0	.27	IIa	21.0	30.36 8.55	92.8
		14 1φ16+1φ10	96.4	.10	47.9 91.0 134.0	.27	IIa	21.3	30.65 9.22	95.9
		15 1φ16+1φ12	105.8	.11	47.9 90.9 133.9	.26	IIa	21.6	30.99 10.00	99.2
		16 1φ16+1φ16	128.9	.14	47.8 90.7 133.6	.25	IIa	22.5	31.81 11.85	106.3
		17 2φ16+1φ12	158.3	.17	51.4 94.4 137.3	.24	IIa	23.5	32.92 14.21	114.2
		18 2φ16+1φ16	179.6	.23	51.4 94.3 137.1	.23	IIa	24.4	33.71 15.83	118.9

FLEXION NEGATIVA (por m)

REFUERZO SUPERIOR POR NERVIO	B400 MOMENTO ULTIMO Mu	Sección tipo Ref. Rel. inf. x/d	Wk	ABERTURA FISURA Sección maciza Rel. x/d	B500 MOMENTO ULTIMO Mu	Sección tipo Ref. Rel. inf. x/d	Wk	ABERTURA FISURA Sección maciza Rel. x/d	ESF.CORTANTE ULTIMO Vcu Vu	MOMENTO FISUR. MF	RIGIDEZ TOTAL FIS. E-1b E-1f
	m·kN/m (5)	vig. (9)	mm (10)	mm (7)	m·kN/m (5)	vig. (9)	mm (10)	mm (7)	kN/m (11)	m·kN/m (8)	m2·MN/m (8)
1φ10	0.0	.00	.00	0.0 .00 .00	0.0	.00	.00	0.0 .00 .00	47.8 90.5	27.3	27.2 1.85
2φ 8	0.0	.00	.00	0.0 .00 .00	0.0	.00	.00	0.0 .00 .00	47.9 90.6	27.4	27.2 2.14
1φ12	0.0	.00	.00	0.0 .00 .00	0.0	.00	.00	0.0 .00 .00	47.6 90.4	27.4	27.2 2.27
1φ 8+1φ10	0.0	.00	.00	0.0 .00 .00	0.0	.00	.00	0.0 .00 .00	47.8 90.6	27.5	27.3 2.49
2φ10	0.0	.00	.00	0.0 .00 .00	0.0	.00	.00	0.0 .00 .00	47.8 90.5	27.6	27.3 2.82
1φ10+1φ12	0.0	.00	.00	0.0 .00 .00	20.6	.10	.12	0.0 .00 .00	47.7 90.5	27.7	27.4 3.22
2φ12	0.0	.00	.00	0.0 .00 .00	32.1	.12	.12	0.0 .00 .00	47.6 90.4	27.8	27.5 3.59
1φ10+1φ16	31.5	.11	.10	0.0 .00 .00	39.0	.14	.18	0.0 .00 .00	47.5 90.3	28.0	27.5 4.13
1φ12+1φ16	35.2	.13	.11	0.0 .00 .00	43.5	.16	.20	0.0 .00 .00	47.5 90.3	28.1	27.6 4.48
2φ16	44.3	.17	.15	0.0 .00 .00	54.4	.21	.22	57.7 .07 .24	47.4 90.2	28.4	27.7 5.32
4φ12	49.8	.19	.14	52.5 .06 .16	61.0	.23	.19	65.2 .08 .24	47.6 90.4	28.6	27.9 5.87
2φ16+1φ12	55.7	.21	.17	59.2 .07 .21	68.0	.27	.23	73.5 .09 .30	47.5 90.2	28.8	28.0 6.37
3φ16	64.0	.25	.17	68.8 .08 .22	77.5	.32	.23	85.4 .10 .30	47.4 90.2	29.0	28.1 7.11
4φ16	81.9	.35	.17	90.7 .11 .22	97.8	.43	.22	112.2 .13 .29	47.4 90.2	29.7	28.4 8.68

ESFUERZO CORTANTE Vsu (12) (kN/m) VA.18 (simple celosía) : 42.8 VA.24 (simple celosía) : 41.1
(kN/m) VA.18 (doble celosía) : 85.5 VA.24 (doble celosía) : 82.3
b,lím (mm) : 398 Vcu,lím (kN/m) (VA.18) : 85.8
895 (VA.24) : 192.8

FICHA DE CARACTERISTICAS TECNICAS, SEGUN EHE-08 Y
EN 1991-1, DEL FORJADO DE VIGUETAS ARMADAS

FORJADOS SANTA COMBA, S.L.

Braña Rica, s/n.
15840 SANTA COMBA (A Coruña)

TECNICO AUTOR DE LA MEMORIA : Jordi Amat

Hoja n° 19 de 24



FLEXION POSITIVA (por m)

TIPO DE FORJADO (h+c) * s	TIPO DE VIGUETA (4)	REFUERZO INFERIOR VIGUETA Y + X	MOMENTO ULTIMO Mu m·kN/m(5)	Rel. x/d (10)	ESFUERZO CORTANTE Vcu Vu = Vcu+Vsu 1*Cel 2*Cel kN/m (11)	Wk mm (7)	CLASE POR RECUBRIM.	MOMENTO DE FISURACION Mf m·kN/m (8)	RIGIDEZ TOTAL FISURADA E·Ib E·If (8) m ² ·MN/m	MOMENTO SERVICIO FIS. COMP. m·kN/m(6)
(25+ 5) * 65.	VA.18 VA.24	1 0φ 0 2 1φ 6 3 1φ 8 4 1φ10 5 1φ 8+1φ 8 6 1φ12 7 1φ10+1φ 8 8 1φ10+1φ10 9 1φ12+1φ 8 10 1φ12+1φ10 11 1φ16 12 1φ12+1φ12 13 1φ16+1φ 8 14 1φ16+1φ10 15 1φ16+1φ12 16 1φ16+1φ16 17 2φ16+1φ12 18 2φ16+1φ16	0.0 15.8 19.8 24.9 29.0 31.1 34.0 39.1 40.2 45.2 46.6 51.3 55.5 60.5 66.5 81.5 100.8 115.3	.00 .01 .02 .02 .03 .03 .03 .04 .04 .04 .04 .05 .05 .06 .06 .08 .10 .11	25.3 52.1 78.9 25.3 52.1 78.9 25.3 52.1 78.8 25.3 52.0 78.6 25.3 52.0 78.8 25.2 51.8 78.4 25.3 52.0 78.6 25.3 51.9 78.5 25.2 51.9 78.5 25.2 51.8 78.4 25.1 51.5 77.9 25.2 51.8 78.3 25.1 51.6 78.0 25.1 51.6 78.0 25.1 51.6 78.0 26.1 52.5 78.8 27.1 53.5 79.9 27.1 53.4 79.8	.00 .08 .13 .17 .15 .19 .17 .17 .19 .19 .23 .19 .22 .22 .22 .22 .21 .21	IIa IIa IIa IIa IIa IIa IIa IIa IIa IIa IIa IIa IIa IIa IIa IIa IIa IIa	13.1 13.3 13.4 13.6 13.8 13.9 14.0 14.2 14.2 14.4 14.4 14.6 14.7 14.9 15.2 15.7 16.5 17.0	22.60 1.29 22.87 1.87 23.08 2.30 23.34 2.83 23.56 3.26 23.65 3.46 23.81 3.77 24.07 4.28 24.12 4.38 24.37 4.88 24.40 4.97 24.68 5.46 24.86 5.85 25.12 6.32 25.41 6.88 26.14 8.25 27.10 9.99 27.79 11.25	0.0 43.6 48.8 54.6 58.8 60.5 63.4 67.6 68.4 72.3 72.7 76.5 79.0 82.1 85.6 93.5 102.7 108.3

FLEXION NEGATIVA (por m)

REFUERZO SUPERIOR POR NERVIO	B400 MOMENTO ULTIMO-ABERTURA FISURA Sección tipo Mu Ref. Rel. Wk inf. x/d m·kN/m vig. mm (5) (9) (10) (7)	Sección maciza Mu Rel. Wk x/d m·kN/m mm (5) (10) (7)	B500 MOMENTO ULTIMO-ABERTURA FISURA Sección tipo Mu Ref. Rel. Wk inf. x/d m·kN/m vig. mm (5) (9) (10) (7)	Sección maciza Mu Rel. Wk x/d m·kN/m mm (5) (10) (7)	ESF.CORTANTE ULTIMO Vcu Vu 1*cel. kN/m (11)	MOMENTO FISUR. Mf m·kN/m (8)	RIGIDEZ TOTAL FIS. E·Ib E·If m ² ·MN/m (8)
1φ10 2φ 8 1φ12 1φ 8+1φ10 2φ10 1φ10+1φ12 2φ12 1φ10+1φ16 1φ12+1φ16 2φ16 4φ12 2φ16+1φ12 3φ16 4φ16	0.0 .00 .00 0.0 .00 .00 0.0 .00 .00 13.7 .10 .09 16.5 .12 .08 19.8 .15 .08 30.7 .18 .08 37.1 .23 .12 41.1 .26 .14 50.5 .35 .15 56.1 .39 .13 61.8 .43 .16 69.6 .49 .16 85.5 .62 .17	0.0 .00 .00 0.0 .00 .00 0.0 .00 .00 0.0 .00 .00 0.0 .00 .00 0.0 .00 .00 0.0 .00 .00 0.0 .00 .00 0.0 .00 .00 56.9 .06 .21 64.3 .07 .20 72.5 .08 .24 84.3 .09 .24 111.0 .12 .23	0.0 .00 .00 13.4 .10 .09 14.9 .11 .13 16.9 .13 .11 27.0 .15 .10 32.5 .19 .11 37.7 .23 .14 45.1 .30 .19 49.6 .34 .20 60.3 .42 .21 66.7 .46 .18 73.0 .51 .21 81.5 .59 .21 113.4 1φ16 .59 .21	0.0 .00 .00 0.0 .00 .00 0.0 .00 .00 0.0 .00 .00 0.0 .00 .00 0.0 .00 .00 0.0 .00 .00 0.0 .00 .00 0.0 .00 .00 70.7 .08 .29 79.9 .09 .27 90.0 .10 .32 104.4 .12 .31 137.0 .15 .29	25.0 51.3 25.1 51.4 25.0 51.3 25.1 51.4 25.0 51.3 25.0 51.3 25.0 51.3 24.9 51.2 24.9 51.2 24.9 51.2 25.9 52.2 26.9 53.2 26.8 53.1 26.8 53.1	26.2 26.3 26.3 26.4 26.5 26.6 26.8 26.9 27.0 27.3 27.6 27.7 28.0 28.7	22.2 1.95 22.2 2.29 22.2 2.44 22.2 2.68 22.3 3.05 22.3 3.48 22.4 3.89 22.4 4.47 22.5 4.84 22.6 5.67 22.7 6.22 22.7 6.69 22.8 7.38 23.1 8.83

ESFUERZO CORTANTE Vsu (12) (kN/m) VA.18 (simple celosía) : 26.3 VA.24 (simple celosía) : 25.3
(kN/m) VA.18 (doble celosía) : 52.6 VA.24 (doble celosía) : 50.6
b, lím (mm) : 148 Vcu, lím (kN/m) (VA.18) : 38.7
650 (VA.24) : 170.1

FICHA DE CARACTERISTICAS TECNICAS, SEGUN EHE-08 Y
EN 1991-1, DEL FORJADO DE VIGUETAS ARMADAS

FORJADOS SANTA COMBA, S.L.

Braña Rica, s/n.
15840 SANTA COMBA (A Coruña)

TECNICO AUTOR DE LA MEMORIA : Jordi Amat

Hoja n° 20 de 24

FLEXION POSITIVA (por m)

TIPO DE FORJADO (h+c)	TIPO DE VIGUETA	REFUERZO INFERIOR VIGUETA	MOMENTO ULTIMO Mu	Rel. x/d	ESFUERZO CORTANTE Vcu	Vu = Vcu+Vsu	Wk	CLASE POR RECUBRIM.	MOMENTO DE FISURACION MF	RIGIDEZ TOTAL FISURADA E-If	MOMENTO SERVICIO FIS. COMP.
* s	(4)	Y + X	m·kN/m(5)	(10)	kN/m (11)	1*Cel 2*Cel	mm (7)		m·kN/m (8)	(8) m2·MN/m	m·kN/m(6)
(25+ 5)	VA.18	1 0φ 0	0.0	.00	49.5	94.8 140.0	.00	IIa	20.1	31.48 2.12	0.0
* 77. D	VA.24	2 1φ 6	26.5	.02	49.5	94.8 140.0	.13	IIa	20.4	31.84 3.05	56.2
		3 1φ 8	33.2	.03	49.5	94.6 139.8	.19	IIa	20.6	32.12 3.73	62.8
		4 1φ10	41.7	.04	49.4	94.4 139.5	.23	IIa	20.9	32.47 4.58	69.9
		5 1φ 8+1φ 8	48.5	.05	49.5	94.6 139.7	.20	IIa	21.2	32.75 5.25	75.2
		6 1φ12	52.0	.05	49.3	94.2 139.1	.26	IIa	21.3	32.88 5.57	77.3
		7 1φ10+1φ 8	56.9	.05	49.4	94.5 139.5	.22	IIa	21.5	33.10 6.07	80.9
		8 1φ10+1φ10	65.3	.06	49.4	94.4 139.3	.22	IIa	21.8	33.44 6.85	86.1
		9 1φ12+1φ 8	67.0	.06	49.3	94.3 139.2	.24	IIa	21.8	33.51 7.02	87.1
		10 1φ12+1φ10	75.3	.07	49.3	94.2 139.1	.24	IIa	22.1	33.84 7.78	91.7
		11 1φ16	77.5	.07	49.1	93.7 138.3	.29	IIa	22.2	33.88 7.93	92.2
		12 1φ12+1φ12	85.3	.08	49.3	94.1 138.9	.23	IIa	22.5	34.25 8.70	96.8
		13 1φ16+1φ 8	92.2	.09	49.1	93.8 138.5	.27	IIa	22.7	34.49 9.28	99.8
		14 1φ16+1φ10	100.3	.10	49.1	93.8 138.5	.27	IIa	23.0	34.81 10.01	103.5
		15 1φ16+1φ12	110.0	.11	49.1	93.7 138.4	.26	IIa	23.3	35.21 10.86	107.6
		16 1φ16+1φ16	134.1	.13	49.0	93.5 138.0	.25	IIa	24.2	36.15 12.92	116.1
		17 2φ16+1φ12	164.9	.16	52.3	96.8 141.4	.24	IIa	25.4	37.41 15.52	125.7
		18 2φ16+1φ16	187.6	.19	52.9	97.4 141.9	.23	IIa	26.2	38.30 17.34	131.4

FLEXION NEGATIVA (por m)

REFUERZO SUPERIOR POR NERVIO	B400 MOMENTO ULTIMO-ABERTURA FISURA						B500 MOMENTO ULTIMO-ABERTURA FISURA						ESF.CORTANTE		MOMENTO FISUR. Mf	RIGIDEZ			
	Sección tipo						Sección maciza						ULTIMO			TOTAL FIS.			
	Mu	Ref.	Rel.	Wk	Mu	Rel.	Wk	Mu	Ref.	Rel.	Wk	Mu	Rel.	Wk		Vcu	Vu	E- Ib	E- If
	inf.	x/d			x/d			inf.	x/d			x/d				1*cel.			
	m·kN/m	vig.		mm	m·kN/m	vig.	mm	m·kN/m	vig.	mm	m·kN/m	vig.	mm	m·kN/m			m2·MN/m		
	(5)	(9)	(10)	(7)	(5)	(10)	(7)	(5)	(9)	(10)	(7)	(5)	(10)	(7)	(11)		(8)	(8)	
1φ10	0.0	.00	.00		0.0	.00	.00	0.0	.00	.00		0.0	.00	.00	49.0	93.4	30.7	30.9	2.04
2φ 8	0.0	.00	.00		0.0	.00	.00	0.0	.00	.00		0.0	.00	.00	49.1	93.5	30.8	30.9	2.35
1φ12	0.0	.00	.00		0.0	.00	.00	0.0	.00	.00		0.0	.00	.00	48.8	93.2	30.8	31.0	2.49
1φ 8+1φ10	0.0	.00	.00		0.0	.00	.00	0.0	.00	.00		0.0	.00	.00	49.0	93.4	30.9	31.0	2.73
2φ10	0.0	.00	.00		0.0	.00	.00	0.0	.00	.00		0.0	.00	.00	49.0	93.4	31.0	31.0	3.09
1φ10+1φ12	0.0	.00	.00		0.0	.00	.00	0.0	.00	.00		0.0	.00	.00	48.9	93.3	31.1	31.1	3.51
2φ12	0.0	.00	.00		0.0	.00	.00	33.4	.11	.12		0.0	.00	.00	48.8	93.2	31.2	31.2	3.92
1φ10+1φ16	32.8	.11	.11		0.0	.00	.00	40.6	.14	.16		0.0	.00	.00	48.7	93.1	31.4	31.3	4.51
1φ12+1φ16	36.7	.12	.10		0.0	.00	.00	45.3	.16	.18		0.0	.00	.00	48.7	93.1	31.5	31.3	4.89
2φ16	46.1	.16	.14		0.0	.00	.00	56.7	.20	.21		60.0	.06	.24	48.6	93.0	31.8	31.5	5.80
4φ12	51.8	.18	.13		54.5	.06	.16	63.6	.23	.18		67.8	.07	.24	48.8	93.2	32.0	31.6	6.41
2φ16+1φ12	58.0	.20	.16		61.5	.07	.21	70.9	.26	.22		76.5	.08	.30	48.6	93.1	32.2	31.7	6.95
3φ16	66.8	.24	.17		71.6	.08	.22	81.0	.31	.22		88.8	.10	.30	48.6	93.0	32.5	31.8	7.75
4φ16	85.6	.33	.17		94.4	.10	.22	102.5	.41	.22		116.8	.13	.29	48.6	93.0	33.2	32.2	9.47

ESFUERZO CORTANTE Vsu (12) (kN/m) VA.18 (simple celosía) : 44.4 VA.24 (simple celosía) : 42.7
(kN/m) VA.18 (doble celosía) : 88.8 VA.24 (doble celosía) : 85.4
b,lím (mm) : 398 Vcu,lím (kN/m) (VA.18) : 87.9
895 (VA.24) : 197.7

FICHA DE CARACTERISTICAS TECNICAS, SEGUN EHE-08 Y
EN 1991-1, DEL FORJADO DE VIGUETAS ARMADAS

FORJADOS SANTA COMBA, S.L.

Braña Rica, s/n.
15840 SANTA COMBA (A Coruña)

TECNICO AUTOR DE LA MEMORIA : Jordi Amat

Hoja n° 21 de 24



FLEXION POSITIVA (por m)

TIPO DE FORJADO (h+c)	TIPO DE VIGUETA	REFUERZO INFERIOR VIGUETA Y + X	MOMENTO ULTIMO Mu	Rel. x/d	ESFUERZO CORTANTE Vcu	Vu = Vcu+Vsu	Wk	CLASE POR RECUBRIM.	MOMENTO DE FISURACION Mf	RIGIDEZ TOTAL FISURADA E-It E-If	MOMENTO SERVICIO FIS.COMP.
* s	(4)		m·kN/m(5)	(10)	kN/m (11)		mm (7)		m·kN/m (8)	(8) m2·MN/m	m·kN/m(6)
(30+ 4)	VA.24	1 0φ 0	0.0	.00	27.7	57.2	86.7	.00	IIa	16.7	31.46 1.67 0.0
* 65.	VA.28	2 1φ 6	18.1	.01	27.7	57.2	86.7	.08	IIa	16.9	31.79 2.43 53.8
		3 1φ 8	22.7	.02	27.7	57.2	86.6	.11	IIa	17.1	32.05 3.00 60.3
		4 1φ10	28.6	.02	27.7	57.1	86.5	.16	IIa	17.3	32.37 3.72 67.5
		5 1φ 8+1φ 8	33.2	.02	27.7	57.1	86.6	.15	IIa	17.5	32.64 4.28 72.8
		6 1φ12	35.7	.03	27.6	56.9	86.3	.19	IIa	17.5	32.75 4.56 75.0
		7 1φ10+1φ 8	39.1	.03	27.7	57.1	86.5	.17	IIa	17.7	32.95 4.98 78.6
		8 1φ10+1φ10	44.9	.03	27.6	57.0	86.4	.18	IIa	17.9	33.26 5.66 83.8
		9 1φ12+1φ 8	46.2	.03	27.6	57.0	86.3	.19	IIa	17.9	33.33 5.79 84.8
		10 1φ12+1φ10	52.0	.04	27.6	56.9	86.3	.19	IIa	18.1	33.64 6.46 89.6
		11 1φ16	53.6	.04	27.5	56.6	85.8	.23	IIa	18.2	33.69 6.60 90.3
		12 1φ12+1φ12	59.0	.04	27.6	56.9	86.2	.19	IIa	18.4	34.01 7.25 94.9
		13 1φ16+1φ 8	63.9	.05	27.5	56.7	85.9	.23	IIa	18.6	34.25 7.77 97.9
		14 1φ16+1φ10	69.6	.05	27.5	56.7	85.9	.23	IIa	18.8	34.56 8.41 101.5
		15 1φ16+1φ12	76.6	.06	27.5	56.7	85.9	.22	IIa	19.0	34.92 9.17 105.5
		16 1φ16+1φ16	93.9	.07	27.7	56.8	85.9	.22	IIa	19.7	35.82 11.01 114.0
		17 2φ16+1φ12	116.3	.09	29.8	59.0	88.1	.21	IIa	20.5	37.01 13.34 123.2
		18 2φ16+1φ16	133.2	.10	30.1	59.2	88.3	.21	IIa	21.2	37.87 15.02 128.7

FLEXION NEGATIVA (por m)

REFUERZO SUPERIOR POR NERVIO	B400 MOMENTO ULTIMO-ABERTURA FISURA Sección tipo Mu Ref. Rel. Wk inf. x/d	Sección maciza Mu Rel. Wk x/d	B500 MOMENTO ULTIMO-ABERTURA FISURA Sección tipo Mu Ref. Rel. Wk inf. x/d	Sección maciza Mu Rel. Wk x/d	ESF.CORTANTE ULTIMO Vcu Vu	MOMENTO FISUR. Mf	RIGIDEZ TOTAL FIS. E-It E-If
	m·kN/m vig. mm	m·kN/m mm	m·kN/m vig. mm	m·kN/m mm	kN/m 1*cel.	m·kN/m	m2·MN/m
	(5) (9) (10) (7)	(5) (10) (7)	(5) (9) (10) (7)	(5) (10) (7)	(11)	(8)	(8)
1φ10	0.0 .00 .00	0.0 .00 .00	0.0 .00 .00	0.0 .00 .00	27.4 56.5	30.2	31.0 2.65
2φ 8	0.0 .00 .00	0.0 .00 .00	15.4 .09 .09	0.0 .00 .00	27.5 56.5	30.3	31.0 3.10
1φ12	0.0 .00 .00	0.0 .00 .00	17.2 .10 .13	0.0 .00 .00	27.4 56.4	30.3	31.1 3.30
1φ 8+1φ10	0.0 .00 .00	0.0 .00 .00	19.5 .11 .11	0.0 .00 .00	27.5 56.5	30.4	31.1 3.63
2φ10	19.0 .11 .08	0.0 .00 .00	31.3 .13 .10	0.0 .00 .00	27.4 56.5	30.6	31.2 4.14
1φ10+1φ12	23.0 .13 .09	0.0 .00 .00	37.7 .16 .12	0.0 .00 .00	27.4 56.4	30.7	31.3 4.74
2φ12	35.6 .16 .08	0.0 .00 .00	43.8 .20 .15	0.0 .00 .00	27.4 56.4	30.9	31.3 5.29
1φ10+1φ16	43.2 .20 .13	0.0 .00 .00	52.7 .26 .20	0.0 .00 .00	27.3 56.3	31.1	31.4 6.08
1φ12+1φ16	47.9 .23 .14	0.0 .00 .00	58.2 .30 .21	0.0 .00 .00	27.3 56.3	31.3	31.5 6.58
2φ16	59.3 .30 .16	0.0 .00 .00	71.3 .37 .22	81.7 .07 .29	27.3 56.3	31.7	31.7 7.75
4φ12	66.0 .34 .14	74.2 .06 .20	79.1 .40 .19	92.2 .07 .28	27.5 56.6	32.0	31.9 8.51
2φ16+1φ12	73.0 .37 .17	83.7 .07 .25	87.0 .45 .22	104.0 .09 .33	28.7 57.7	32.2	32.0 9.19
3φ16	82.7 .43 .17	97.4 .08 .24	97.9 .51 .22	120.8 .10 .32	29.9 58.9	32.6	32.1 10.17
4φ16	102.9 .54 .17	128.5 .11 .23	128.9 1φ12 .57 .22	158.9 .13 .30	29.9 58.9	33.5	32.5 12.25

ESFUERZO CORTANTE Vsu (12) (kN/m) VA.24 (simple celosía) : 29 VA.28 (simple celosía) : 28.4
(kN/m) VA.24 (doble celosía) : 58.1 VA.28 (doble celosía) : 56.8
b,lím (mm) : 175 Vcu,lím (kN/m) (VA.24) : 50.2
650 (VA.28) : 186.5

FICHA DE CARACTERISTICAS TECNICAS, SEGUN EHE-08 Y
EN 1991-1, DEL FORJADO DE VIGUETAS ARMADAS

FORJADOS SANTA COMBA, S.L.

Braña Rica, s/n.
15840 SANTA COMBA (A Coruña)

TECNICO AUTOR DE LA MEMORIA : Jordi Amat

Hoja n° 22 de 24

FLEXION POSITIVA (por m)

TIPO DE FORJADO (h+c) * s	TIPO DE VIGUETA (4)	REFUERZO INFERIOR VIGUETA Y + X	MOMENTO ULTIMO Mu m·kN/m(5)	Rel. x/d (10)	ESFUERZO CORTANTE Vcu Vu = Vcu+Vsu 1*Cel 2*Cel kN/m (11)	Wk mm (7)	CLASE POR RECUBRIM.	MOMENTO DE FISURACION MF m·kN/m (8)	RIGIDEZ TOTAL FISURADA E·Ib E·If (8) m ² ·MN/m	MOMENTO SERVICIO FIS. COMP. m·kN/m(6)
(30+ 4) * 77. D	VA.24	1 0φ 0	0.0	.00	54.2 104.0 153.8	.00	IIa	25.4	43.60 2.74	0.0
	VA.28	2 1φ 6	30.4	.02	54.2 104.0 153.8	.10	IIa	25.7	44.06 3.97	69.6
		3 1φ 8	38.1	.03	54.1 103.9 153.6	.18	IIa	26.0	44.40 4.89	77.8
		4 1φ10	47.9	.03	54.1 103.7 153.3	.23	IIa	26.3	44.83 6.03	86.8
		5 1φ 8+1φ 8	55.7	.04	54.1 103.8 153.6	.20	IIa	26.6	45.20 6.94	93.4
		6 1φ12	59.8	.04	54.0 103.5 153.0	.26	IIa	26.7	45.35 7.37	96.1
		7 1φ10+1φ 8	65.4	.05	54.1 103.7 153.4	.23	IIa	26.9	45.62 8.03	100.4
		8 1φ10+1φ10	75.1	.05	54.0 103.6 153.2	.23	IIa	27.3	46.05 9.10	106.4
		9 1φ12+1φ 8	77.1	.06	54.0 103.5 153.1	.25	IIa	27.3	46.13 9.31	107.6
		10 1φ12+1φ10	86.7	.06	54.0 103.5 153.0	.25	IIa	27.7	46.55 10.35	112.8
		11 1φ16	89.4	.07	53.7 103.0 152.2	.30	IIa	27.7	46.61 10.57	113.4
		12 1φ12+1φ12	98.3	.07	53.9 103.4 152.8	.24	IIa	28.1	47.05 11.58	118.4
		13 1φ16+1φ 8	106.4	.08	53.8 103.1 152.4	.28	IIa	28.3	47.36 12.38	121.6
		14 1φ16+1φ10	115.7	.09	53.8 103.1 152.4	.28	IIa	28.7	47.77 13.36	125.5
		15 1φ16+1φ12	127.0	.09	53.8 103.0 152.3	.27	IIa	29.1	48.26 14.51	129.8
		16 1φ16+1φ16	155.2	.12	53.7 102.8 152.0	.26	IIa	30.1	49.46 17.27	138.8
		17 2φ16+1φ12	191.1	.14	55.5 104.7 153.9	.24	IIa	31.4	51.04 20.74	148.9
		18 2φ16+1φ16	217.5	.20	58.2 107.3 156.4	.24	IIa	32.4	52.17 23.17	155.0

FLEXION NEGATIVA (por m)

REFUERZO SUPERIOR POR NERVIO	B400 MOMENTO ULTIMO-ABERTURA FISURA Mu Ref. Rel. Wk m·kN/m vig. inf. x/d (5) (9) (10) (7)	Sección tipo Sección maciza Mu Ref. Rel. Wk m·kN/m x/d (5) (10) (7)	B500 MOMENTO ULTIMO-ABERTURA FISURA Mu Ref. Rel. Wk m·kN/m vig. inf. x/d (5) (9) (10) (7)	Sección tipo Sección maciza Mu Ref. Rel. Wk m·kN/m x/d (5) (10) (7)	ESF.CORTANTE ULTIMO Vcu Vu kN/m 1*cel. (11)	MOMENTO FISUR. MF m·kN/m (8)	RIGIDEZ TOTAL FIS. E·Ib E·If m ² ·MN/m (8)
1φ10	0.0 .00 .00	0.0 .00 .00	0.0 .00 .00	0.0 .00 .00	53.6 102.7	35.9	42.9 2.82
2φ 8	0.0 .00 .00	0.0 .00 .00	0.0 .00 .00	0.0 .00 .00	53.7 102.8	36.0	43.0 3.25
1φ12	0.0 .00 .00	0.0 .00 .00	0.0 .00 .00	0.0 .00 .00	53.5 102.5	36.1	43.0 3.44
1φ 8+1φ10	0.0 .00 .00	0.0 .00 .00	0.0 .00 .00	0.0 .00 .00	53.7 102.7	36.2	43.1 3.75
2φ10	0.0 .00 .00	0.0 .00 .00	0.0 .00 .00	0.0 .00 .00	53.6 102.7	36.3	43.2 4.24
1φ10+1φ12	0.0 .00 .00	0.0 .00 .00	0.0 .00 .00	0.0 .00 .00	53.5 102.6	36.4	43.3 4.81
2φ12	0.0 .00 .00	0.0 .00 .00	38.5 .10 .12	0.0 .00 .00	53.5 102.5	36.6	43.4 5.37
1φ10+1φ16	0.0 .00 .00	0.0 .00 .00	47.0 .12 .17	0.0 .00 .00	53.4 102.4	36.8	43.5 6.18
1φ12+1φ16	42.4 .11 .11	0.0 .00 .00	52.5 .14 .19	0.0 .00 .00	53.4 102.4	36.9	43.6 6.71
2φ16	53.5 .14 .14	0.0 .00 .00	65.9 .17 .22	69.2 .06 .22	53.3 102.3	37.3	43.9 7.96
4φ12	60.1 .16 .13	0.0 .00 .00	74.0 .20 .19	78.2 .06 .24	53.5 102.5	37.6	44.0 8.77
2φ16+1φ12	67.5 .18 .16	71.0 .06 .20	82.8 .23 .23	88.3 .07 .30	53.3 102.4	37.8	44.2 9.54
3φ16	77.9 .21 .17	82.7 .07 .21	95.0 .27 .23	102.7 .08 .30	53.3 102.3	38.2	44.4 10.63
4φ16	100.4 .29 .18	109.2 .09 .23	121.0 .36 .23	135.3 .11 .30	53.3 102.3	39.0	45.0 13.02

ESFUERZO CORTANTE Vsu (12) (kN/m) VA.24 (simple celosía) : 49 VA.28 (simple celosía) : 47.9
(kN/m) VA.24 (doble celosía) : 98.1 VA.28 (doble celosía) : 95.9
b,l_{fm} (mm) : 425 Vcu,l_{fm} (kN/m) (VA.24) : 102.9
895 (VA.28) : 216.7

FICHA DE CARACTERISTICAS TECNICAS, SEGUN EHE-08 Y
EN 1991-1, DEL FORJADO DE VIGUETAS ARMADAS

FORJADOS SANTA COMBA, S.L.

Braña Rica, s/n.
15840 SANTA COMBA (A Coruña)

TECNICO AUTOR DE LA MEMORIA : Jordi Amat

Hoja n° 23 de 24

FLEXION POSITIVA (por m)

TIPO DE FORJADO (h+c) * s	TIPO DE VIGUETA (4)	REFUERZO INFERIOR VIGUETA Y + X	MOMENTO ULTIMO Mu m·kN/m(5)	Rel. x/d (10)	ESFUERZO CORTANTE Vcu Vu = Vcu+Vsu 1*Cel 2*Cel kN/m (11)	Wk mm (7)	CLASE POR RECUBRIM.	MOMENTO DE FISURACION Mf m·kN/m (8)	RIGIDEZ TOTAL FISURADA E·Ib E·If (8) m2·MN/m	MOMENTO SERVICIO FIS.COMP. m·kN/m(6)
(30+ 5) * 65.	VA.24	1 0φ 0	0.0	.00	28.3 58.8 89.2	.00	IIa	17.9	35.43 1.78	0.0
	VA.28	2 1φ 6	18.6	.01	28.3 58.8 89.2	.08	IIa	18.1	35.80 2.60	56.5
		3 1φ 8	23.4	.02	28.3 58.7 89.1	.11	IIa	18.3	36.09 3.21	63.3
		4 1φ10	29.5	.02	28.2 58.6 88.9	.16	IIa	18.5	36.44 3.97	70.9
		5 1φ 8+1φ 8	34.3	.02	28.3 58.7 89.0	.15	IIa	18.7	36.74 4.58	76.4
		6 1φ12	36.9	.02	28.2 58.5 88.7	.19	IIa	18.8	36.87 4.87	78.8
		7 1φ10+1φ 8	40.3	.03	28.2 58.6 88.9	.17	IIa	19.0	37.09 5.32	82.5
		8 1φ10+1φ10	46.4	.03	28.2 58.5 88.8	.17	IIa	19.2	37.44 6.04	88.0
		9 1φ12+1φ 8	47.6	.03	28.2 58.5 88.8	.19	IIa	19.2	37.51 6.20	89.1
		10 1φ12+1φ10	53.6	.04	28.2 58.5 88.7	.19	IIa	19.4	37.86 6.90	94.1
		11 1φ16	55.3	.04	28.1 58.2 88.2	.23	IIa	19.5	37.92 7.06	94.9
		12 1φ12+1φ12	60.9	.04	28.2 58.4 88.6	.19	IIa	19.7	38.27 7.75	99.7
		13 1φ16+1φ 8	66.0	.04	28.1 58.2 88.4	.23	IIa	19.9	38.55 8.31	103.1
		14 1φ16+1φ10	71.9	.05	28.1 58.2 88.4	.23	IIa	20.1	38.89 9.00	107.3
		15 1φ16+1φ12	79.1	.05	28.1 58.2 88.3	.22	IIa	20.4	39.30 9.81	112.0
		16 1φ16+1φ16	97.1	.07	28.1 58.1 88.2	.22	IIa	21.1	40.31 11.79	122.3
		17 2φ16+1φ12	120.2	.08	30.3 60.3 90.4	.21	IIa	22.0	41.65 14.32	133.7
		18 2φ16+1φ16	137.7	.10	30.9 60.9 90.9	.21	IIa	22.6	42.62 16.16	140.7

FLEXION NEGATIVA (por m)

REFUERZO SUPERIOR POR NERVIO	B400 MOMENTO ULTIMO-ABERTURA FISURA Sección tipo Mu Ref. Rel. Wk inf. x/d m·kN/m vig. mm (5) (9) (10) (7)	B500 MOMENTO ULTIMO-ABERTURA FISURA Sección maciza Mu Ref. Rel. Wk inf. x/d m·kN/m vig. mm (5) (9) (10) (7)	ESF.CORTANTE ULTIMO Vcu Vu 1*cel. kN/m (11)	MOMENTO FISUR. Mf m·kN/m (8)	RIGIDEZ TOTAL FIS. E·Ib E·If m2·MN/m (8)
1φ10	0.0 .00 .00	0.0 .00 .00	0.0 .00 .00	28.0 58.0	34.1 34.9 2.88
2φ 8	0.0 .00 .00	0.0 .00 .00	15.9 .08 .09	28.1 58.0	34.3 34.9 3.37
1φ12	0.0 .00 .00	0.0 .00 .00	17.8 .09 .14	28.0 57.9	34.3 35.0 3.60
1φ 8+1φ10	0.0 .00 .00	0.0 .00 .00	20.2 .11 .11	28.0 58.0	34.4 35.0 3.94
2φ10	19.7 .10 .08	0.0 .00 .00	24.4 .13 .10	28.0 58.0	34.5 35.1 4.48
1φ10+1φ12	23.7 .13 .09	0.0 .00 .00	39.0 .16 .11	28.0 58.0	34.7 35.1 5.12
2φ12	36.9 .15 .08	0.0 .00 .00	45.4 .19 .13	28.0 57.9	34.9 35.2 5.73
1φ10+1φ16	44.7 .19 .11	0.0 .00 .00	54.6 .25 .19	27.9 57.9	35.1 35.3 6.56
1φ12+1φ16	49.6 .22 .13	0.0 .00 .00	60.4 .29 .20	27.9 57.9	35.2 35.4 7.10
2φ16	61.5 .29 .15	0.0 .00 .00	74.1 .36 .21	27.8 57.8	35.6 35.6 8.36
4φ12	68.4 .33 .13	76.6 .06 .20	82.2 .39 .18	28.0 57.9	35.9 35.7 9.18
2φ16+1φ12	75.8 .36 .16	86.5 .07 .25	90.5 .43 .21	29.1 59.1	36.2 35.8 9.91
3φ16	86.0 .41 .16	100.7 .08 .24	102.0 .50 .22	30.6 60.6	36.5 36.0 10.97
4φ16	107.3 .52 .17	132.8 .10 .23	134.4 1φ12 .56 .22	30.6 60.6	37.5 36.4 13.22

ESFUERZO CORTANTE Vsu (12) (kN/m) VA.24 (simple celosía) : 30 VA.28 (simple celosía) : 29.3
(kN/m) VA.24 (doble celosía) : 60 VA.28 (doble celosía) : 58.6
b,lím (mm) : 175 Vcu,lím (kN/m) (VA.24) : 51.3
650 (VA.28) : 190.5

FICHA DE CARACTERISTICAS TECNICAS, SEGUN EHE-08 Y
EN 1991-1, DEL FORJADO DE VIGUETAS ARMADAS

FORJADOS SANTA COMBA, S.L.

Braña Rica, s/n.
15840 SANTA COMBA (A Coruña)

TECNICO AUTOR DE LA MEMORIA : Jordi Amat

Hoja n° 24 de 24

FLEXION POSITIVA (por m)

TIPO DE FORJADO (h+c) * s	TIPO DE VIGUETA (4)	REFUERZO INFERIOR VIGUETA Y + X	MOMENTO ULTIMO Mu m·kN/m(5)	Rel. x/d (10)	ESFUERZO CORTANTE Vcu Vu = Vcu+Vsu 1*Cel 2*Cel kN/m (11)	Wk CLASE POR RECUBRIM. mm (7)	MOMENTO DE FISURACION MF m·kN/m (8)	RIGIDEZ TOTAL FISURADA E·Ib E·If (8) m ² ·MN/m	MOMENTO SERVICIO FIS. COMP. m·kN/m(6)
(30+ 5) * 77. D	VA.24	1 0φ 0	0.0	.00	55.3 106.7 158.2	.00	27.2	49.01 2.92	0.0
	VA.28	2 1φ 6	31.4	.02	55.3 106.7 158.2	.10	27.6	49.51 4.25	73.1
		3 1φ 8	39.3	.03	55.3 106.6 158.0	.17	27.9	49.90 5.23	81.7
		4 1φ10	49.5	.03	55.2 106.4 157.7	.23	28.2	50.38 6.45	91.2
		5 1φ 8+1φ 8	57.5	.04	55.3 106.6 157.9	.20	28.5	50.77 7.42	98.2
		6 1φ12	61.8	.04	55.1 106.2 157.3	.26	28.7	50.95 7.88	101.1
		7 1φ10+1φ 8	67.5	.05	55.2 106.4 157.7	.23	28.9	51.25 8.59	105.7
		8 1φ10+1φ10	77.5	.05	55.2 106.3 157.5	.23	29.2	51.73 9.74	112.6
		9 1φ12+1φ 8	79.7	.05	55.1 106.3 157.4	.25	29.3	51.82 9.97	113.9
		10 1φ12+1φ10	89.6	.06	55.1 106.2 157.3	.25	29.7	52.29 11.09	120.0
		11 1φ16	92.3	.06	54.9 105.7 156.5	.30	29.7	52.35 11.31	120.9
		12 1φ12+1φ12	101.5	.07	55.1 106.1 157.1	.24	30.1	52.85 12.40	126.7
		13 1φ16+1φ 8	109.9	.08	54.9 105.8 156.7	.29	30.4	53.21 13.27	130.6
		14 1φ16+1φ10	119.6	.08	54.9 105.8 156.7	.28	30.7	53.67 14.33	135.2
		15 1φ16+1φ12	131.3	.09	54.9 105.8 156.6	.27	31.1	54.22 15.58	140.4
		16 1φ16+1φ16	160.5	.11	54.8 105.5 156.3	.26	32.2	55.55 18.59	151.2
		17 2φ16+1φ12	197.7	.14	56.3 107.1 157.9	.25	33.6	57.31 22.38	163.2
		18 2φ16+1φ16	225.4	.16	59.1 109.7 160.4	.24	34.6	58.59 25.07	170.5

FLEXION NEGATIVA (por m)

REFUERZO SUPERIOR POR NERVIO	B400 MOMENTO ULTIMO-ABERTURA FISURA Sección tipo Mu Ref. Rel. Wk inf. x/d m·kN/m vig. mm (5) (9) (10) (7)	B500 MOMENTO ULTIMO-ABERTURA FISURA Sección maciza Mu Ref. Rel. Wk inf. x/d m·kN/m vig. mm (5) (10) (7)	B500 MOMENTO ULTIMO-ABERTURA FISURA Sección tipo Mu Ref. Rel. Wk inf. x/d m·kN/m vig. mm (5) (9) (10) (7)	B500 MOMENTO ULTIMO-ABERTURA FISURA Sección maciza Mu Ref. Rel. Wk inf. x/d m·kN/m vig. mm (5) (10) (7)	ESF.CORTANTE ULTIMO Vcu Vu 1*cel. kN/m (11)	MOMENTO FISUR. MF m·kN/m (8)	RIGIDEZ TOTAL FIS. E·Ib E·If m ² ·MN/m (8)
1φ10	0.0 .00 .00	0.0 .00 .00	0.0 .00 .00	0.0 .00 .00	54.8 105.4	40.2	48.2 3.06
2φ 8	0.0 .00 .00	0.0 .00 .00	0.0 .00 .00	0.0 .00 .00	54.9 105.5	40.3	48.3 3.51
1φ12	0.0 .00 .00	0.0 .00 .00	0.0 .00 .00	0.0 .00 .00	54.6 105.3	40.3	48.3 3.72
1φ 8+1φ10	0.0 .00 .00	0.0 .00 .00	0.0 .00 .00	0.0 .00 .00	54.8 105.4	40.4	48.4 4.05
2φ10	0.0 .00 .00	0.0 .00 .00	0.0 .00 .00	0.0 .00 .00	54.8 105.4	40.5	48.5 4.57
1φ10+1φ12	0.0 .00 .00	0.0 .00 .00	0.0 .00 .00	0.0 .00 .00	54.7 105.3	40.7	48.6 5.19
2φ12	0.0 .00 .00	0.0 .00 .00	0.0 .00 .00	0.0 .00 .00	54.6 105.3	40.8	48.7 5.78
1φ10+1φ16	0.0 .00 .00	0.0 .00 .00	48.6 .12 .14	0.0 .00 .00	54.5 105.1	41.0	48.8 6.66
1φ12+1φ16	43.9 .10 .11	0.0 .00 .00	54.3 .13 .17	0.0 .00 .00	54.5 105.1	41.2	48.9 7.22
2φ16	55.3 .13 .13	0.0 .00 .00	68.2 .17 .21	0.0 .00 .00	54.4 105.0	41.6	49.2 8.56
4φ12	62.2 .15 .12	0.0 .00 .00	76.6 .19 .18	80.8 .06 .24	54.6 105.3	41.9	49.4 9.43
2φ16+1φ12	69.9 .17 .16	73.4 .06 .20	85.7 .22 .22	91.2 .07 .30	54.5 105.1	42.1	49.5 10.25
3φ16	80.6 .21 .17	85.4 .07 .21	98.5 .26 .23	106.1 .08 .30	54.4 105.0	42.5	49.8 11.43
4φ16	104.1 .28 .17	112.9 .09 .23	125.7 .35 .23	139.9 .11 .30	54.4 105.0	43.3	50.3 14.01

ESFUERZO CORTANTE Vsu (12) (kN/m) VA.24 (simple celosía) : 50.6 VA.28 (simple celosía) : 49.5
(kN/m) VA.24 (doble celosía) : 101.2 VA.28 (doble celosía) : 98.9
b,lím (mm) : 425 Vcu,lím (kN/m) (VA.24) : 105.1 (VA.28) : 221.4
895