THE JOURNEY OF THE UNHEARD VOICES

// a home for women in Madrid

TECHNICAL INFORMATION.

The Independent Group 2023
Alexandra Diephuis de Bustamante

Research mentor | Mark Pimlott
Design mentor | Daniel Rosbottom
Building technology mentor | Koen Mulder

INDEX//

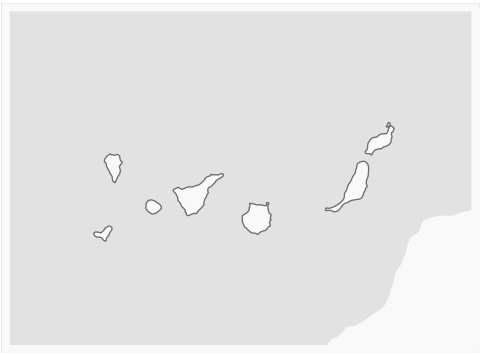
KM.0

-

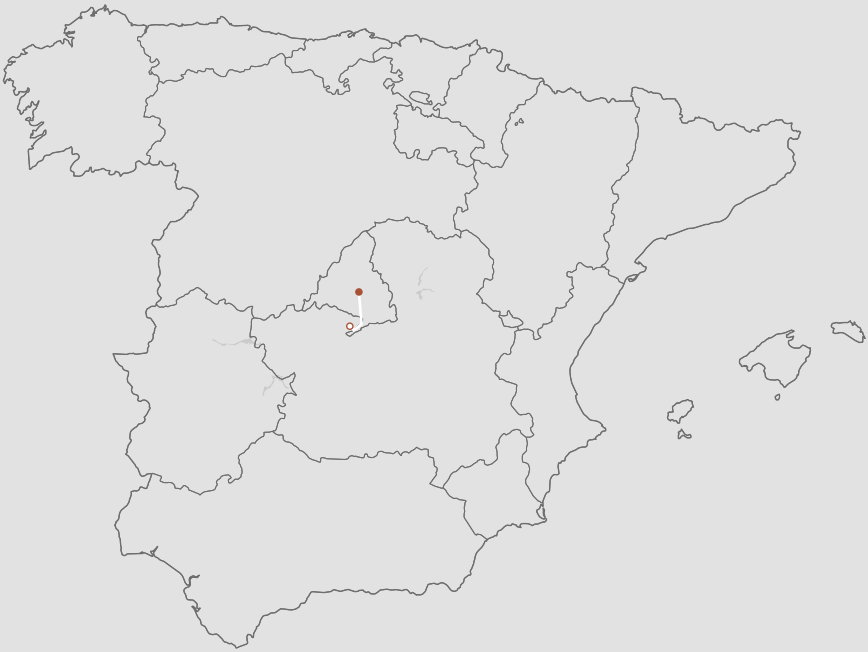
origin of the construction materials

KM.0

The main sustanability approach of the project is to use local materials, reducing logistics, costs, and supportig local manufacters.

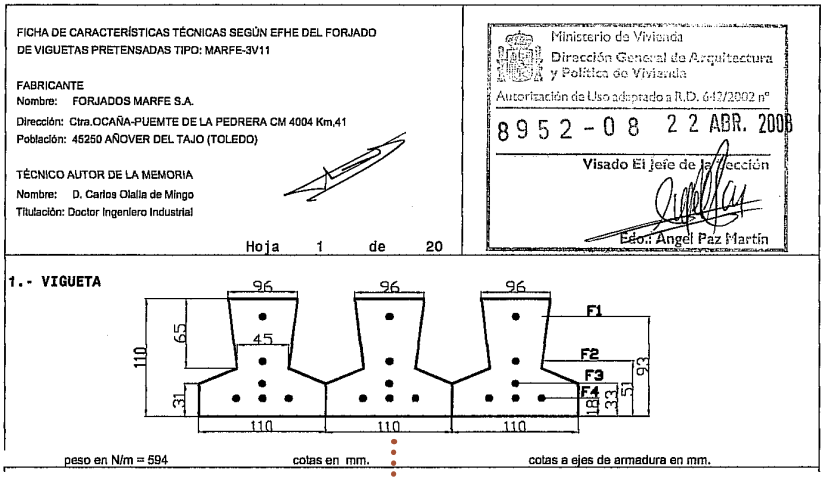



1
2
3
4
SPAIN



1 **Forjados Marfe S.A.**

Polinya, Barcelona - 613km



v5 profile - measurements

Forjados Marfe S.A. | Vigueta de hormigón prensado & bovedilla de hormigón

Prestressed Concrete Joist (Simple – T) & Concrete vault for prestressed Slab
Produced in Añover de Tajo, Toledo.

Forjados Marfe was founded in 1971. They specalized in prefabricated concrete.

type | V5
length | 4.5-7m
weight | 20kg Pressed concrete joist

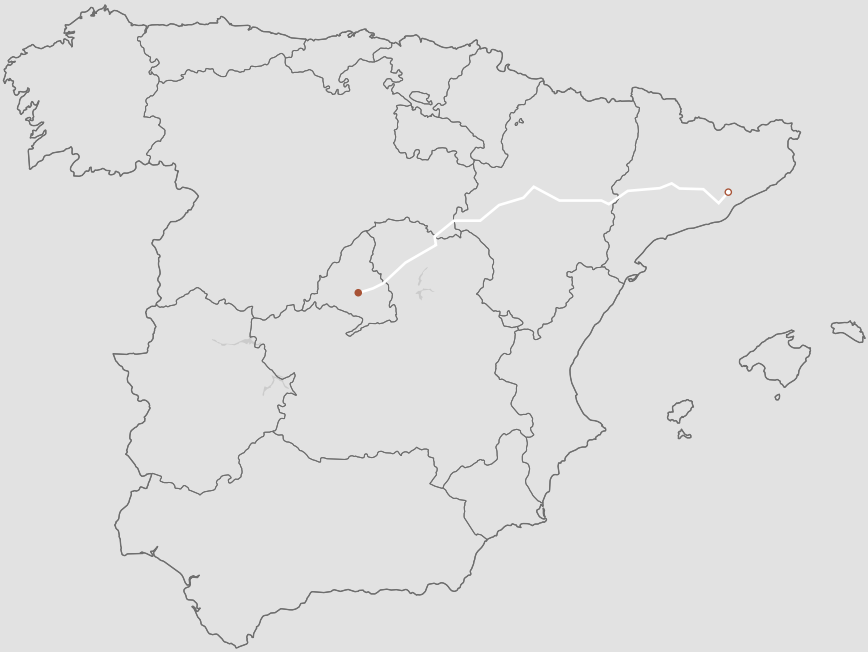
dimensions | 60x20x22cm
span | 70cm
weight | 16.73kg Concrete vault

Vigueta de Hormigón Pretensada (Simple – T)

TIPO	LONGITUD (m)	PESO (kg/m)
V1	1.00m a 3.30m	20 Kg
V3	3.40m a 4.40m	20 Kg
V5	4.50m a 7.00m	20 Kg
V6 especial	5.00m a 7.00m	20 Kg

Bovedilla de Hormigón para Forjado Pretensado

TIPO	EJES	PESO	UND/PALET
60x20x15	70 cm	13.39 Kg	70
60x20x17	70 cm	13.78 Kg	60
60x20x20	70 cm	16.55 Kg	50
60x20x22	70 cm	16.73 Kg	50
60x20x25	70 cm	16.54 Kg	40
60x20x27	70 cm	18.44 Kg	40
60x20x30	70 cm	20.30 Kg	40



2 LaComa

Balaguer,Lleida - 485km

WALL CONSTRUCTION FOR THE EXTERIOR FACADE

1. Support (hollow brick)
2. Isovit e-cork bonding mortar
3. Thermal Aglocork panel
4. Isovit mechanical fixing
5. Isovit e-cork regularization mortar
6. Isovit rede 160 reinforcing mesh
7. Reabilita Cal AC finish mortar (lime mortar)
8. Isocit AD 25 + Isovit REV SP silicate paint

Barnacork | Aglocork Térmico

Expanded cork chipboard
Produced in Polinya, Barcelona.

It is a family owned bussiness, created in 1954 by Eugenio Palet. Today, they are leading the cork industry in Spain, and the use of recycled cork for constuction materials.

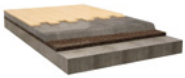
pannel dimensions | 1000x500mm
density | 110kg/m3
thermal conductivity | 0.04W/m.K

Principales sistemas de aplicación

Cubiertas



Suelos




Paredes exteriores



Paredes interiores

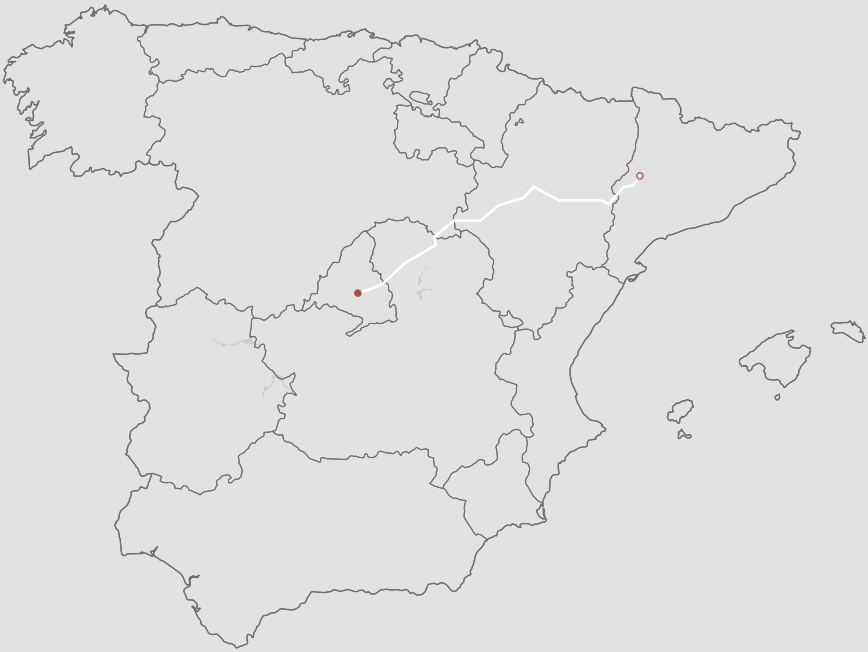
Techos

CARACTERIZACIÓN TÉCNICA Rendimiento declarado: ICB - EN 13170 - L2 - W2 - T2 - CS(10)100 - TR50 - WS - MU20 - CC(0,8/0,4/10)5 - AFr35

Características esenciales	**Propiedad**	**Especificación técnica armonizada** EN 13170: 2012
Reacción al fuego, características de la Euroclase	Reacción al fuego	Euroclase E´
Resistencia termica	Resistencia termica	Ver tabla A
	Conductividad térmica	0,040 W / m.K
	Espesor, d_L	T1 - T2 (d> 50 mm)
Permeabilidad al agua	Absorción de agua	WS
Vapor de agua	Transmisión de vapor de agua	MU20
Fuerza compresión	Fuerza compresión al 10% de deformación	CS (10) 100
Durabilidad de la reacción al fuego contra el calor, la intemperie, el envejecimiento / degradación	Características de durabilidad	Satisfactorio
Durabilidad de la resistencia térmica contra el calor, la intemperie, el envejecimiento / la degradación	Resistencia térmica y conductividad térmica	Satisfactorio
	Características de durabilidad	Satisfactorio
Resistencia a la tracción / flexión	Resistencia a la tracción perpendicular a las caras	TR50
Durabilidad de la resistencia a la compresión contra el envejecimiento / degradación	Fluencia compresiva	CC (0,8 / 0,4 / 10) 5

Tabla A Resistencia Térmica (R) de acuerdo con EN 13170: 2012 + A1: 2015

Espesor, d_L [mm]	20	25	30	35	40	45	50	55	60	65	70	75	80	85	90	95
Resistencia térmica [m². K / W]	0,50	0,60	0,75	0,85	1,00	1,10	1,25	1,35	1,50	1,60	1,75	1,85	2,00	2,10	2,25	2,35
Espesor, d_L [mm]	100	110	120	130	140	150	160	170	180	190	200	210	220	230	240	250
Resistencia térmica [m². K / W]	2,50	2,75	3,00	3,25	3,50	3,75	4,00	4,25	4,50	4,75	5,00	5,25	5,50	5,75	6,00	6,25



3 LaComa

Balaguer,Lleida - 485km

LaComa | Bovedilla curva cara vista, lisa roja

Ceramic vault for a 'block and beam' construction, smooth red type
Produced in Balaguer, Lleida.

~~*It is a family owned bussiness, created in 1954 by Eugenio Palet. Today, they are leading the cork industry in Spain, and the use of recycled cork for constuction materials.*~~

dimenions | 58.8x22x14cm
span | 70cm
weight | 8kg

bovedilla lisa roja

bovedilla raspada roja

bovedilla raspada caña

bovedilla rasilla lisa

bovedilla rasilla raspada

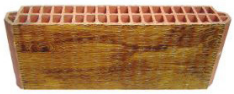
bovedilla rasilla rayada

bovedilla bailén lisa roja

bovedilla bailén raspada roja

bovedilla bailén raspada caña

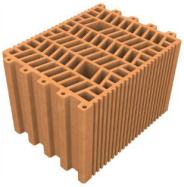
bovedilla madera



bovedilla madra plana

Características

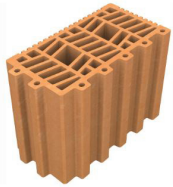
	Bovedilla Curva	Bovedilla Curva BAILÉN	Bovedilla Plana
Sistema de evaluación	4	4	4
Medidas (cm)	58,8 x 22 x 14	60,5 x 22 x 22	56 x 22 x 9
Unidades/palet	90	50	130
Unidades/m²	7,5	7,5	8,1
Masa mínima	8 kgs	11 kgs	7 kgs
Resistencia normalizada	25	25	25
Reacción al fuego	A1	A1	A1
Hidrofugado	Sí	Sí	Sí
Resistencia a la flexión	≥ 100 kg	≥ 100 kg	≥ 100 kg
Resistencia al punzonamiento	≥ 150 kg	≥ 150 kg	≥ 150 kg



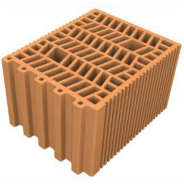
Bloque base de 24

Media vertical de 24

Media horizontal de 24



Esquina de 24



Terminación de 24

Zuncho de 24 a 33

LaComa | Termoarcilla de 24

Thermo-clay blocks for the exterior facade
Produced in Balaguer, Lleida.

dimensions | 300x232x190mm
weight | 10.4kg
density | 1615-1785kg/m^3
thermal conductivity | 0.198W/mK

CERAMICA LA COMA S.A.

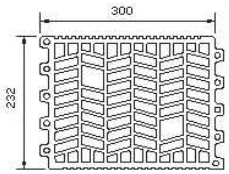
FICHA TÉCNICA DE PRODUCTO
PIEZA P PARA FÁBRICAS A REVESTIR

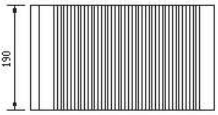
CE

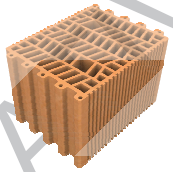
06

Última revisión: 07/03/2019

DESIGNACIÓN DEL MODELO :	Pieza P de arcilla cocida aligerada (G3) Cat I R-12,5 de 300 x 232 x 190
NOMBRE COMERCIAL :	Termoarcilla de 24
Nº CERTIFICADO CONFORMIDAD CE	0099/CPR/A73/0029
REF. DECLARACIÓN PRESTACIONES	DP-010
NORMA DEL PRODUCTO	EN 771-1:2011+A1:2015
USO PREVISTO	Elemento de exteriores/interiores con exigencias acústicas, térmicas y de fuego, para fábricas estructurales sustentantes. Junta corriente de mortero. No destinado a ser expuesto.







Cotas en mm

CARACTERISTICAS TECNICAS DE LA PIEZA

Característica			Unidades	Método de comprobación	Valores garantizados
Aspecto y estructura	Exfoliación / laminación		[Uds.]	Visual sobre 6 piezas	Ninguna
	Piezas fisuradas				≤ 2 piezas fisuradas
	Piezas desconchadas	Entre 5 y 10 mm		UNE 67039 EX	≤ 1 pieza desconchada
		Mayor de 10 mm			Ninguna
Tolerancias dimensionales	Valor medio	Largo (l)	[mm]	UNE-EN 772-16	± 7
		Ancho (a)			± 6
		Grueso (h)			± 6
	Recorrido	Largo (l)			± 10
		Ancho (a)			± 9
		Grueso (h)			± 8
Espesor de pared	Pared exterior no vista		[mm]	UNE-EN 772-16	≥ 6
	Pared interior				≥ 3
Espesor combinado de tabiquillos			[%]	UNE-EN 772-16	≥ 20
Paralelismo de las caras (Ortogonalidad)			[%]	UNE-EN 772-16	≤ 2
Desnivel	Entre cantos		[mm]	IT-06 (Ensayo interno)	≤ 5
	Entre tablas				≤ 4
Encaje	Separación mínima machihembrados extremos		[mm]	IT-06 (Ensayo interno)	≤ 2
	Separación máxima machihembrados interiores				≤ 5
Planeidad de las caras	Diagonales	l > 300 mm	[mm]	UNE-EN 772-20	≤ 4
		300≥ l ≥ 250 mm			≤ 4
		l ≤ 250 mm			≤ 4
Porcentaje de huecos			[%]	UNE-EN 772-3	48 - 54
Volumen del mayor hueco			[%]	UNE-EN 772-3/9/16	≤ 12,5
Absorción en piezas barrera anticapilaridad			[%]	UNE-EN 772-7	---"No dejar expuesto"
Succión			[Kg/(m^2xmin)]	UNE-EN 772-11	≤ 4,5
Resistencia normalizada característica			[N/mm^2]	UNE-EN 772-1	≥ 12,5
Densidad		Absoluta	[Kg/m^3]	UNE-EN 772-13	1615 - 1785
		Aparente			790 - 870
Masa			[g]	Anexo D RP 34.14 AENOR	≥ 10.400
Durabilidad (Resistencia a la helada)			---	UNE 67028 EX	F_0 "No dejar expuesto"
Propiedades térmicas		λ_{pieza}	[W/m x k]	λ_{pieza} : 0,198 W/mk	Ensayo anexo
		R_{muro}	[m^2 x k/W]		Ensayo anexo
Permeabilidad al vapor de agua - μ			---	Catálogo CTE	10
Contenido en sales solubles activas			---	UNE-EN 772-5	S_0
Expansión por humedad			[mm/m]	UNE 67036	≤ 0,6
Reacción al fuego		% materia orgánica ≤ 1%	---	UNE-EN 13501-1	A1
Adherencia			[N/mm^2]	Anexo C UNE-EN 998-2	0,15
Piezas especiales					SI
Observaciones:					

Ceràmica La Coma, S.A. - Carretera de Menàrguens s/n 25600 - Balaguer (Lleida - España) - Tel. 973445104 - Fax 973447080 - www.lacoma.com

LaComa | Termoarcilla de 14

Thermo-clay blocks for the interior facade
Produced in Balaguer, Lleida.

dimensions | 300x142x190mm
weight | 6.4kg
density | 1615-1785kg/m^3
thermal conductivity | 0.2W/mK

CERAMICA LA COMA S.A.

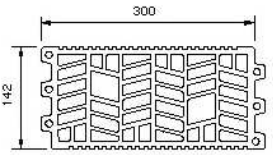
FICHA TÉCNICA DE PRODUCTO
PIEZA P PARA FÁBRICAS A REVESTIR

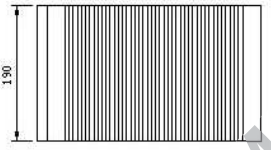
CE

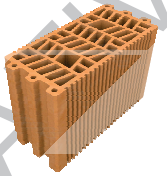
06

Última revisión: 07/03/2019

DESIGNACIÓN DEL MODELO :	Pieza P de arcilla cocida aligerada (G3) Cat I R-12,5 de 300 x 142 x 190
NOMBRE COMERCIAL :	Termoarcilla de 14
Nº CERTIFICADO CONFORMIDAD CE	0099/CPR/A73/0029
REF. DECLARACIÓN PRESTACIONES	DP-008
NORMA DEL PRODUCTO	EN 771-1:2011+A1:2015
USO PREVISTO	Elemento de exteriores/interiores con exigencias acústicas, térmicas y de fuego, para fábricas estructurales sustentantes. Junta corriente de mortero. No destinado a ser expuesto.







Cotas en mm

ARACTERISTICAS TECNICAS DE LA PIEZA

Característica			Unidades	Método de comprobación	Valores garantizados
Aspecto y estructura	Exfoliación / laminación		[Uds.]	Visual sobre 6 piezas	Ninguna
	Piezas fisuradas				≤ 2 piezas fisuradas
	Piezas desconchadas	Entre 5 y 10 mm		UNE 67039 EX	≤ 1 pieza desconchada
		Mayor de 10 mm			Ninguna
Tolerancias dimensionales	Valor medio	Largo (l)	[mm]	UNE-EN 772-16	± 7
		Ancho (a)			± 5
		Grueso (h)			± 6
	Recorrido	Largo (l)			± 10
		Ancho (a)			± 7
		Grueso (h)			± 8
Espesor de pared	Pared exterior no vista		[mm]	UNE-EN 772-16	≥ 6
	Pared interior				≥ 3
Espesor combinado de tabiquillos			[%]	UNE-EN 772-16	≥ 20
Paralelismo de las caras (Ortogonalidad)			[%]	UNE-EN 772-16	≤ 2
Desnivel	Entre cantos		[mm]	IT-06 (Ensayo interno)	≤ 5
	Entre tablas				≤ 4
Encaje	Separación mínima machihembrados extremos		[mm]	IT-06 (Ensayo interno)	≤ 2
	Separación máxima machihembrados interiores				≤ 5
Planeidad de las caras	Diagonales	l > 300 mm	[mm]	UNE-EN 772-20	≤ 4
		300≥ l ≥ 250 mm			≤ 4
		l ≤ 250 mm			≤ 4
Porcentaje de huecos			[%]	UNE-EN 772-3	48 - 53
Volumen del mayor hueco			[%]	UNE-EN 772-3/9/16	≤ 12,5
Absorción en piezas barrera anticapilaridad			[%]	UNE-EN 772-7	---"No dejar expuesto"
Succión			[Kg/(m²xmin)]	UNE-EN 772-11	≤ 4,5
Resistencia normalizada característica			[N/mm²]	UNE-EN 772-1	≥ 12,5
Densidad		Absoluta	[Kg/m³]	UNE-EN 772-13	1615 - 1785
		Aparente			810 - 890
Masa			[g]	Anexo D RP 34.14 AENOR	≥ 6.400
Durabilidad (Resistencia a la helada)			---	UNE 67028 EX	F_0 "No dejar expuesto"
Propiedades térmicas		λ_{pieza}	[W/m x k]	λ_{pieza} : 0,200 W/mk	Ensayo anexo
		R_{muro}	[m² x k/W]		Ensayo anexo
Permeabilidad al vapor de agua - μ			---	Catálogo CTE	10
Contenido en sales solubles activas			---	UNE-EN 772-5	S_0
Expansión por humedad			[mm/m]	UNE 67036	≤ 0,6
Reacción al fuego		% materia orgánica ≤ 1%	---	UNE-EN 13501-1	A1
Adherencia			[N/mm²]	Anexo C UNE-EN 998-2	0,15
Piezas especiales					SI
Observaciones:					

Ceràmica La Coma, S.A. - Carretera de Menàrguens s/n 25600 - Balaguer (Lleida - España) - Tel. 973445104 - Fax 973447080 - www.lacoma.com

LaComa | Tochana de 7

Hollow brick for the interior walls
Produced in Balaguer, Lleida.

dimensions | 70x160x330mm
weight | 2.9kg
density | 1530-1870kg/m^3
thermal conductivity | 0.32W/mK

CERAMICA LA COMA S.A.

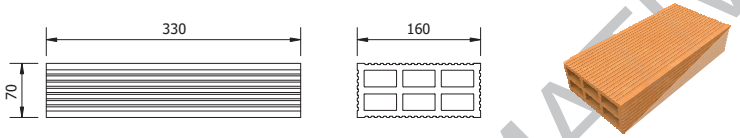
FICHA TÉCNICA DE PRODUCTO
PIEZA P PARA FÁBRICAS A REVESTIR

CE

12

Última revisión: 07/03/2019

DESIGNACIÓN DEL MODELO :	Pieza P de arcilla cocida hueca (G4) Cat I R-3 de 330 x 160 x 70
NOMBRE COMERCIAL :	Tochana de 7 (7x16x33)
Nº CERTIFICADO CONFORMIDAD CE	Sistema 4
REF. DECLARACIÓN PRESTACIONES	DP-050
NORMA DEL PRODUCTO	EN 771-1:2011+A1:2015
USO PREVISTO	Elemento de exteriores/interiores con exigencias acústicas, térmicas y de fuego, para fábricas estructurales sustentadas. No destinado a ser expuesto.

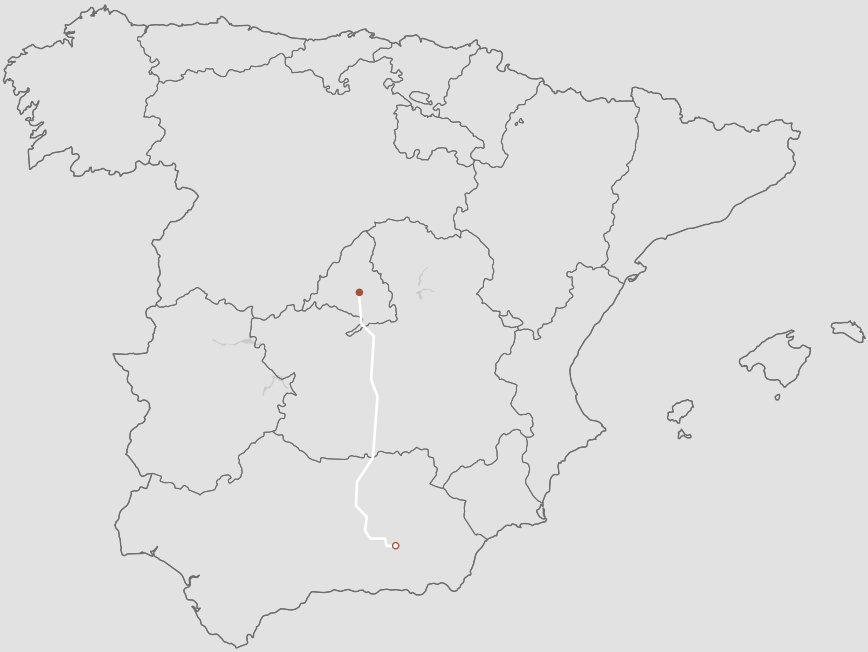


Cotas en mm

CARACTERISTICAS TECNICAS DE LA PIEZA

Característica			Unidades	Método de comprobación	Valores garantizados
Aspecto y estructura	Exfoliación / laminación		[Uds.]	Visual sobre 6 piezas	Ninguna
	Piezas fisuradas				≤ 2 piezas fisuradas
	Piezas desconchadas	Entre 7 y 15 mm		UNE 67039 EX	≤ 1 pieza desconchada
		Mayor de 15 mm			Ninguna
Tolerancias dimensionales	Valor medio	Largo (l)	[mm]	UNE-EN 772-16	± 7
		Ancho (a)			± 5
		Grueso (h)			± 3
	Recorrido	Largo (l)			± 11
		Ancho (a)			± 8
		Grueso (h)			± 5
Espesor de pared	Pared exterior no vista		[mm]	UNE-EN 772-16	≥ 6
	Pared interior				≥ 5
Espesor combinado de tabiquillos			[%]	UNE-EN 772-16	≥ 20
Paralelismo de las caras (Ortogonalidad)			[%]	UNE-EN 772-16	---
Desnivel	Entre cantos		[mm]	IT-06 (Ensayo interno)	---
	Entre tablas				---
Encaje	Separación mínima machihembrados extremos		[mm]	IT-06 (Ensayo interno)	---
	Separación máxima machihembrados interiores				---
Planeidad de las caras	Diagonales	l > 300 mm	[mm]	UNE-EN 772-20	≤ 4
		300≥ l ≥ 250 mm			≤ 4
		l ≤ 250 mm			≤ 4
Porcentaje de huecos			[%]	UNE-EN 772-3	50 ± 10%
Volumen del mayor hueco			[%]	UNE-EN 772-3/9/16	≤ 12,5
Absorción en piezas barrera anticapilaridad			[%]	UNE-EN 772-7	---"No dejar expuesto"
Succión			[Kg/(m²·min)]	UNE-EN 772-11	≤ 4,5
Resistencia normalizada característica			[N/mm²]	UNE-EN 772-1	≥ 3
Densidad		Absoluta	[Kg/m³]	UNE-EN 772-13	1530 - 1870
		Aparente			720 - 880
Masa			[g]	Anexo D RP 34.14 AENOR	≥ 2900
Durabilidad (Resistencia a la helada)			---	UNE 67028 EX	F_0"No dejar expuesto"
Propiedades térmicas		λ_{pieza}	[W/m x k]	λ_{pieza} : 0,32 W/mk	0.32
		R_{muro}	[m² x k/W]		0.16
Permeabilidad al vapor de agua - μ			---	Catálogo CTE	10
Contenido en sales solubles activas			---	UNE-EN 772-5	S_0
Expansión por humedad			[mm/m]	UNE 67036	≤ 0,6
Reacción al fuego		% materia orgánica ≤ 1%	---	UNE-EN 13501-1	A1
Adherencia			[N/mm²]	Anexo C UNE-EN 998-2	0,15
Piezas especiales					No
Observaciones:					

Ceràmica La Coma, S.A. - Carretera de Menàrguens s/n 25600 - Balaguer (Lleida - España) - Tel. 973445104 - Fax 973447080 - www.lacoma.com



4 Cannabric

Guadix, Granada - 445km

Cannabric | Cannahabitat para hormigón vertido de cáñamo

Hempcrete
Produced in Guadix, Granada

For the poured-in hempcrete, a combination of hemp aggregate mixed with a binder composed of hydraulic lime and aerated lime is needed. It has to be mixed on site and can be projected with a hemp concrete spraying machine. 80% of the total water needed for the mixure should be added to the concrete mixer with the lime. Once mixed, the hemp aggregate should be poured in slowly. Lastly the remaining 20% of the water should be added.

weight hemp bag | 20kg
weight lime mixure bag | 20kg
acoustic insulation | 37-45dB
thermal conductivity hemp | 0.048W/mK

Ficha técnica
CANNAHABITAT

3. CARACTERÍSTICAS DEL PRODUCTO

CARACTERÍSTICAS	VALOR	NORMA
Masa volúmica	110 kg/m^3	
Conductibilidad térmica cañamiza (λ)	0,48	EN 12667
Granulometría representativa	Ø6,30 mm/2,5 %; Ø3,15 mm /32 %; Ø2 mm/ 39 %; Ø1 mm/24 %; Ø0,50 mm /2 %	EN 12086
Índice de fibra y polvo	<2 %	
Índice de humedad	<15 %	
PH en suspensión al 10%	7,2	
Calor específico	2.109 J/gK *	
Poder calorífico inferior	3715 cal/g	
Poder calorífico superior	4055 cal/g	
Poder absorbente (agua)	210-250%	NF V19-002
Capacidad de retención de agua	415%	ensayo de Westinghouse
Poder absorbente de los elementos minerales	24 meq/ 100g en bruto	

** determinado por CANNATEKTUM*

4. COMPOSICION

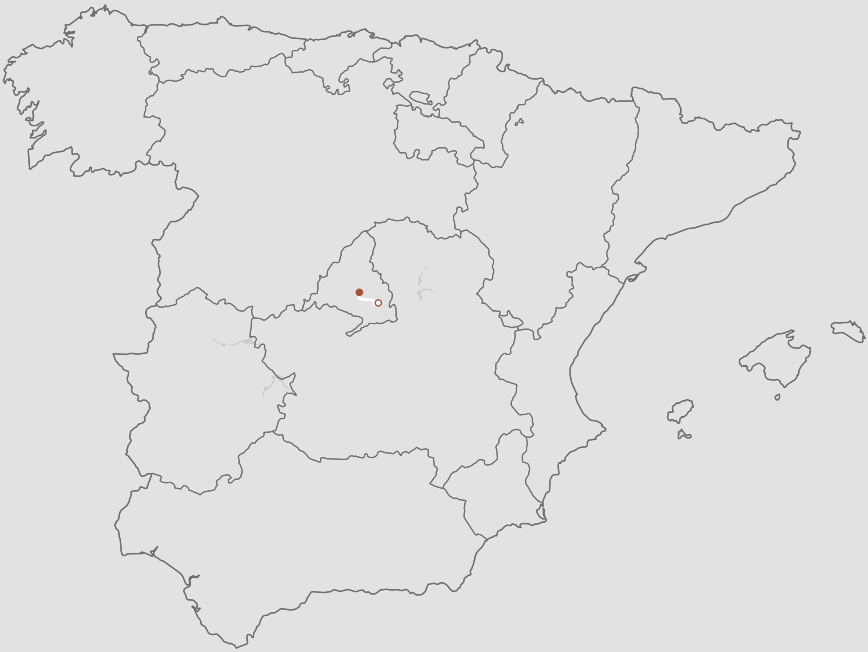
Celulosa bruta: 45-55%
Lignina: 15-25%
Hemicelulosa: 15-20%

El cáñamo es un producto natural cuyas características pueden variar ligeramente en función de diversos factores, especialmente en el caso de desfavorables condiciones de almacenamiento (humedad, etc.)

5. ENVASADO

Kg / Saco	20
Sacos / Palet	21
Kg / Palet	420
Palets / Trailer	33

CANNATEKTUM habitat and materials science, S.L.
hemp building
vernacular architecture
troglodyte housing
info@cannabric.com
www.cannabric.com
natural and historical construction products
cannabric manufacture



6 **Hijos de Cesáreo Guerra**

Campo Real, Madrid - 40km

Hijos de Cesáreo Guerra |Baldosas artesanales de barro

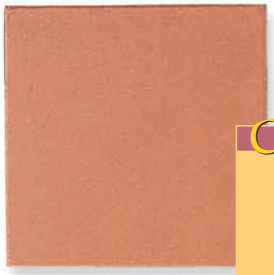
Terracotta tiles
Produced in Campo Real, Madrid

sizes
10x20x2cm
8x27x2cm
20x20x2cm
17x26x2cm

Rectangulares y Cuadrados

Rectangulares

17 x 26 x 2
14 x 27 x 2
10 x 20 x 2
25 x 7 x 2



Cuadradas

40 x 40 x 3
27 x 27 x 2,5
20 x 20 x 2
14 x 14 x 2
10 x 10 x 1,5

Peldaños y Rodapiés

Modelos	Me
Peldaño	27 x
Rodapié con bisel	10 x 8 x

CALCULATIONS

-

dimensions of the construction

ACOUSTIC INSULATION

Dividing wall between apartments

Composition | 12.5mm gypsum wallboard, 70mm hollow brick, 35mm cork panel, 70mm hollow brick and 12.5mm gypsum wallboard.

Floor between apartments

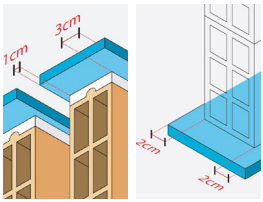
Composition | 25mm wood finish, 50mm dryfloor heating insulation, 50mm cork insulation, 100mm poured-in hemprete, 220mm hollow concrete block and 12.5mm gypsum finish.

Mass Law For Oblique Incidence

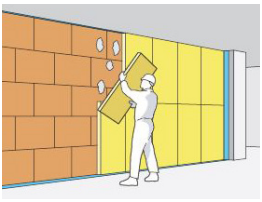
$$R = 20\log\left(\frac{2\pi * f * m * cos\theta}{2 * p * c}\right) + 20\log\left(\frac{2\pi * f * m * cos\theta}{2 * p * c}\right) + 20\log\left(\frac{2.2\pi * f * d * cos\theta}{c}\right)$$

Element	Material	Material Density (kg/m³)	Thickness (m)	Frequency (Hz)				
				125	250	500	1000	2000
Interior wall	Gypsum plate	668	0.013	17.95	23.97	29.99	36.02	42.04
	Hollow brick	1700	0.700	61.03	67.05	73.07	79.09	85.11
	Cork	110	0.350	31.23	37.25	43.27	49.29	55.31
	Hollow brick	1700	0.700	61.03	67.05	73.07	79.09	85.11
	Gypsum plate	668	0.013	17.95	23.97	29.99	36.02	42.04
			TOTAL	180.70	210.80	240.90	271.01	301.11

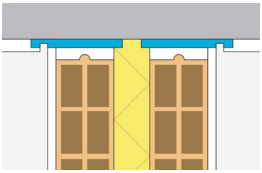
Element	Material	Material Density (kg/m³)	Thickness (m)	Frequency (Hz)				
				125	250	500	1000	2000
Floor	Wood finish	700	0.025	24.38	30.40	36.42	42.44	48.46
	Floor heating	110	0.050	14.33	20.35	26.37	32.39	38.41
	Cork	110	0.050	14.33	20.35	26.37	32.39	38.41
	Hempcrete	415	0.100	31.88	37.90	43.92	49.94	55.96
	Concrete block	642	0.220	42.52	48.54	54.56	60.58	66.60
	Gypsum plate	668	0.013	17.95	23.97	29.99	36.02	42.04
			TOTAL	136.89	173.01	209.13	245.26	281.38



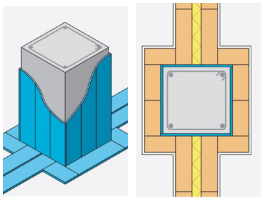
For each brick wall an elastic band has to be placed on the top and bottom, protruding 2cm on each side on the floor, and 1 and 3cm by the ceiling.



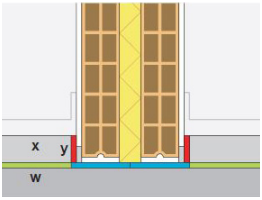
Dividing walls consist of a layer of hollow bricks, insulation (cork) and a second layer of hollow bricks.



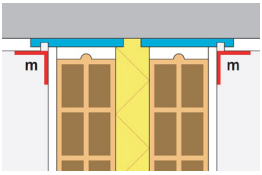
For the wall-ceiling connection, once the plaster has been applied to the wall and ceiling, sticking the trowel against the wall, cut vertically through the plaster until you reach the elastic band.



For acoustic insulation, columns are wrapped with the elastic band.



The elastic band on the bottom of the wall is placed directly on the concrete floor. To avoid discontinuities in the placement of the anti-impact sheet (w) and avoid impact-sound transmission between the floor finish (x) and the wall, perimeter overlapping plastics (y) will be used.



To finish it off, place a strip of paper (m) to cover the joint, and use joint paste over the paper (the paste shouldn't penetrate the cut).

COLUMN SIZE FOR THE NEW CONSTRUCTION

maximum length | 4m

profile dimensions | 225x225mm
number of steel bars | 4
steel bar diameter | 12mm

CHARACTERISTICS			
N	Initial Applied Load	1200	kN
Ned	Load Compensating for Eccentricities	1200	kN
fck	Concrete Compressive Strength	40	MPa
fyk	Steel Yield Stress	500	MPa
γc	Concrete Partial Safety Factor	1.5	
γs	Steel Partial Safety Factor	1.15	
L	Column Length	4	
Le	Pin and Restrained	3.4	
Ac:As	Reinforcement Ratio	2%	
Safety Factor	Columns Loaded by Similar Stiffness Beams or Slabs	1.25	

☐ Use Factored Load

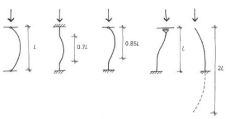


Fig. 2.11 Effective lengths of struts

1. Calculate Axial Loads for Initial Design

fck	Concrete Compressive Strength	40	
γc	Concrete Partial Safety Factor	1.5	
fyk	Steel Yield Stress	500	
γs	Steel Partial Safety Factor	1.15	
Ac	Area of Concrete	1	1 means unknown
As	Area of Steel	0.02	
Ned	Axial Capacity	27.36	*Ac

Therefore Ac = Applied Load / Ned

Ac	Area of Concrete	43855.93	mm²
Side Length	For a Squared Column	209.42	mm

2. Propose a side length larger than the previous result

b	Proposed Side Length	225	mm
Ac	Area of Concrete	50625	mm²
As	**Area of Steel**	**1012.5**	**mm²**

SELECT APPROPRIATE STEEL AREA

Number of Bars	Bar Diameter (mm)		
4	20	1256.64	mm²

3. Design for Eccentricity of 5%

Ned	Load Compensating for Eccentricities	1200	kN
b	Side Length	225	mm
h	Side Length	225	mm
fck	Concrete Compressive Strength	40	MPa
	y-axis of Graph	0.59	
	SELECT VALUE LINE As*fyk / bh*fck	0.11	

4. Re-arrange equation to find As

	Line Value	0.11	
b	Side Length	225	
h	Side Length	225	
fck	Concrete Compressive Strength	40	
fyk	Steel Yield Stress	500	
As	**Area of Steel**	**445.5**	**mm²**

SELECT APPROPRIATE STEEL AREA

Number of Bars	Bar Diameter (mm)		
4	12	452.39	mm²

Area of Steel to Concrete	0.89%	
As min	0.04%	

CORRECT AMOUNT OF STEEL

$$N_{ed} = 0.7\frac{f_{ck}}{\gamma_c}A_c + \frac{f_{yk}}{\gamma_s}A_s$$

Number of bars	Bar diameter (mm)								
	6	8	10	12	16	20	25	32	40
1	28	50	79	113	201	314	491	804	125
2	57	101	157	226	402	628	982	1608	251
3	85	151	236	339	603	942	1473	2413	377
4	113	201	314	452	804	1257	1963	3217	502
5	141	251	393	565	1005	1571	2454	4021	628
6	170	302	471	679	1206	1885	2945	4825	754
7	198	352	550	792	1407	2199	3436	5630	879
8	226	402	628	905	1608	2513	3927	6434	1005
9	254	452	707	1018	1810	2827	4418	7238	1131

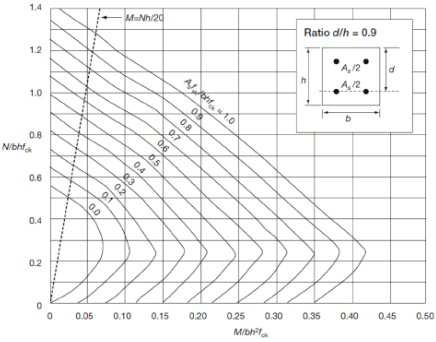
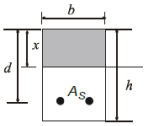


Fig 5.8 Column interaction diagram

Number of bars	Bar diameter (mm)								
	6	8	10	12	16	20	25	32	40
1	2	λpieza : 0,200 W/mk			201	314	491	804	1257
2					402	628	982	1608	2513
3	85	151	236	339	603	942	1473	2413	3770
4	113	201	314	452	804	1257	1963	3217	5027
5	141	251	393	565	1005	1571	2454	4021	6283
6	170	302	471	679	1206	1885	2945	4825	7540
7	198	352	550	792	1407	2199	3436	5630	8796
8	226	402	628	905	1608	2513	3927	6434	10053
9	254	452	707	1018	1810	2827	4418	7238	11310

CONCRETE SECTION			
b	Width	200	mm
h	Height	400	mm
Cover	Concrete around the Steel Link	50	
Link	Link Diametre	10	
Bar	Steel Rod Diametre	15	
d	MANUAL INPUT	440	☐ CHECK FOR MANUAL INPUT
d	Height to Centre of Reinforcement	325	mm
Factor	x = (factor)d	0.5	
x	Distance to Neutral Axis	162.5	mm
γc	Concrete Partial Safety Factor	1.5	
fck	Concrete Compressive Strength	40	MPa
fyk	Steel Yield Stress	500	Mpa
γs	Steel Partial Safety Factor	1.15	
fyd	Steel Design Yield Stress	434.78	Mpa
Φ	Diameter of Steel Bars	20	mm
#	Number of Steel Bars	4	
As	Area of Steel	1256.64	mm²



1. Calculate Ultimate Bending Moment (Mu) for concrete crushing

fck	Concrete Compressive Strength	40	N/mm²
b	Width	200	mm
d	Height to Centre of Reinforcement	325	mm
Mu	**Ultimate Bending Moment**	**141.12**	**kN•m**

$$M_u = \left(0.7\frac{f_{ck}}{\gamma_c} b \frac{d}{2}\right)\left(d - \frac{0.5d}{2}\right)$$

$$= 0.26\frac{f_{ck}}{\gamma_c} bd^2 \approx 0.167 f_{ck} bd^2$$

2. Calculate Ultimate Bending Moment (Mu) by Steel Yielding

As	Area of Steel	1256.64	
fyk	Steel Yield Stress	500	
d	Height to Centre of Reinforcement	325	
x	Distance to Neutral Axis	162.5	
γs	Steel Partial Safety Factor	1.15	
x/d		0.450	☑ Check to use x/d
Mu	**Ultimate Bending Moment**	**137.59**	**kN**

$$M_u = \frac{A_s f_{yk} d\left(1 - \frac{0.5x}{d}\right)}{\gamma_s}$$

3. Calculate x/d

γc	Concrete Partial Safety Factor	1.5	
γs	Steel Partial Safety Factor	1.15	
As	Area of Steel	1256.64	mm²
fyk	Steel Yield Stress	500	MPa
fck	Concrete Compressive Strength	40	MPa
b	Width	200	mm
d	Height to Centre of Reinforcement	325	mm
x/d		0.450	
(1-0.5*x/d)		0.775	

$$\frac{x}{d} = \frac{\gamma_c A_s f_{yk}}{\gamma_s 0.7 f_{ck} bd}$$

4. Compare beam resistance

Mu	Concrete Crushing	141.12 kN
Mu	Steel Yielding	137.59 kN
	Beam Fails @	137.59 kN

GOVERNED BY STEEL YIELDING

BEAM SIZE FOR THE NEW CONSTRUCTION

maximum span | 5.5m

profile dimensions | 200x400mm
number of steel bars | 4
steel bar diameter | 20mm

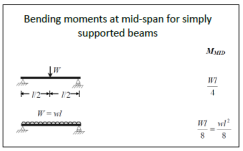
LOAD CALCULATIONS

L	Beam Length	5.5	m
fck	Concrete Compressive Strength	40	MPa
fyk	Steel Yield Stress	500	MPa
$P_{concrete}$	Density of Concrete	2400	kg/m³
Imposed Load	Live Load	11	kN
Other Load	Dead Load	23.14	kN/m
Self Load	Dead Load	1883.52	N/m
Factors	Live Load	1.5	
	Dead Load	1.35	
ULS	Live Load	16.5	kN
	Dead Load	33.78	kN

MAX. APPLIED BENDING MOMENT

Distance	Distance From Support	5.5	m
Mmid	Applied Load @ Beam Centre	90.75	kN
	Distributed Load	127.74	kN
	TOTAL BENDING MOMENT	**218.49**	**kN**

Check if Load is not on centre



Check to use utilization factor

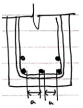
1. Define Utilization Factor

UFc	Utilization Factor (current)	1.59	
UFa	Utilization Factor (aim)	0.95	
Load	Target Load	229.99	kN

2. Calculate Steel Required Maintaining Depth

Mu	Ultimate Bending Moment	229.99	kN
ys	Steel Partial Safety Factor	1.15	
d	Height to Centre of Reinforcement	325	mm
fyk	Steel Yield Stress	500	MPa
(1-0.5*x/d)		0.775	
As	**Area of Steel Required**	**2100.53**	**mm²**
a	Distance between Rods	40	mm

$$A_s = \frac{M_u \gamma_s}{0.75 d f_{yk}}$$



Number of bars	Bar diameter (mm)								
	6	8	10	12	16	20	25	32	40
1	28	50	79	113	201	314	491	804	1257
2	57	101	157	226	402	628	982	1608	2513
3	85	151	236	339	603	942	1473	2413	3770
4	113	201	314	452	804	1257	1963	3217	5027
5	141	251	393	565	1005	1571	2454	4021	6283
6	170	302	471	679	1206	1885	2945	4825	7540
7	198	352	550	792	1407	2199	3436	5630	8796
8	226	402	628	905	1608	2513	3927	6434	10053
9	254	452	707	1018	1810	2827	4418	7238	11310

SELECT APPROPRIATE AREA SAME DEPTH

Number of Bars	Bar Diameter (mm)
2	20

SELECT APPROPRIATE AREA MODIFYING DEPTH

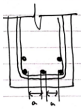
Number of Bars	Bar Diameter (mm)
2	25

3. Calculate by Increasing Beam Depth

Mu	Ultimate Bending Moment	229.99	kN
ys	Steel Partial Safety Factor	1.15	
d	Height to Centre of Reinforcement	325	mm
h2	New Height	500	mm
fyk	Steel Yield Stress	500	MPa
(1-0.5*x/d)		0.775	
As	**Area of Steel Required**	**1606.29**	**mm²**
a	Distance between Rods	30	mm

d=d+(h2-h)

$$A_s = \frac{M_u \gamma_s}{0.75 d f_{yk}}$$



4. Calculating Max. Shear Force

w	Distributed Load	33.78	kN/m
L	Length	5.5	m
W	Point Load	16.5	kN
Vmax	**Max. Shear Force**	**109.40**	**kN**

5. Calculate Maximum Stress the Concrete can Carry

fck	Concrete Compressive Strength	40	MPa
fcd	Concrete Design Strength	26.67	MPa
fc,max	Max. Stress Concrete can Carry	13.44	MPa

$$f_{c,max} = 0.6(1 - f_{ck}/250) f_{cd}$$

6. Calculate Design Shear Resistance

fc,max	Max. Stress Concrete can Carry	13.44	N/mm²
bw	Width	200	mm
d	Height to Centre of Reinforcement	325	mm
cotΘ		1	
tanΘ		1	
VRd,c	**Design Shear Resistance**	**393.12**	**kN**

SATISFACTORY 393.12 > 109.40

7. Design Shear Links

VRd,c	Design Shear Resistance	109.40	kN
S	Stirrup Spacing	500	mm
ys	Steel Partial Safety Factor	1.15	
fyk	Steel Yield Stress	500	MPa
d	Height to Centre of Reinforcement	325	mm
cotΘ		1	
Asw	**Total Area of Shear Links**	**430.12**	**mm²**

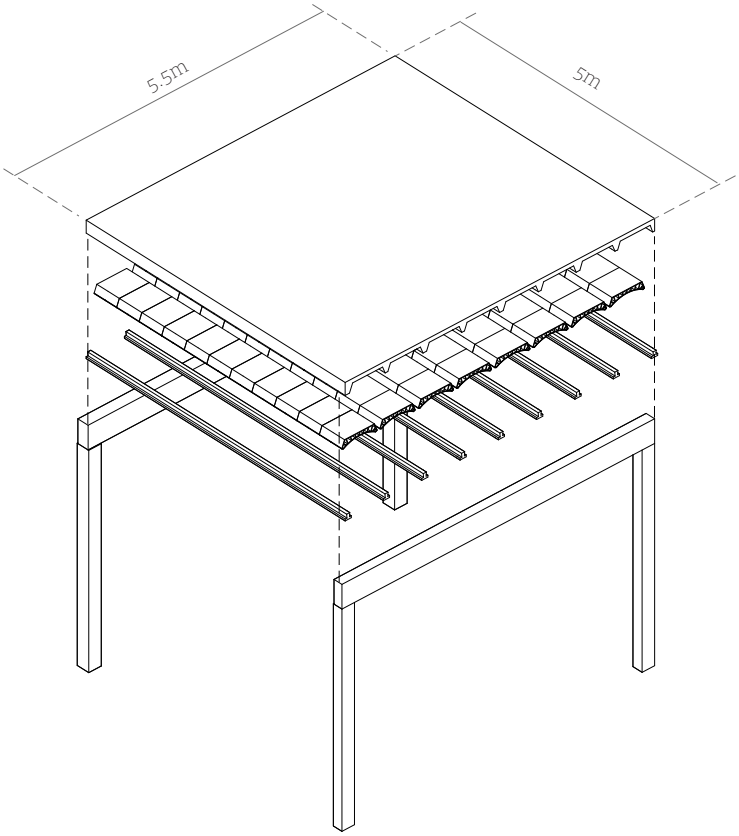
CONSTRUCTION

-

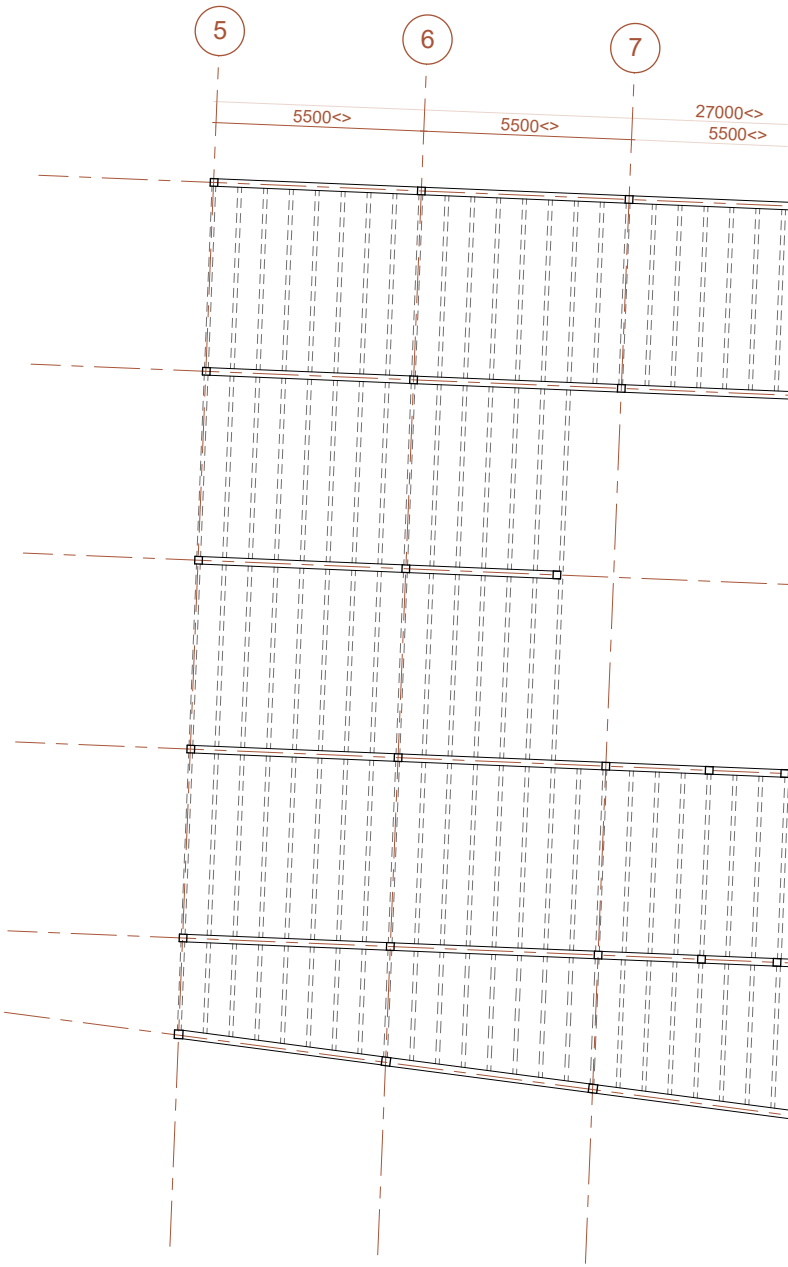
bearing construction

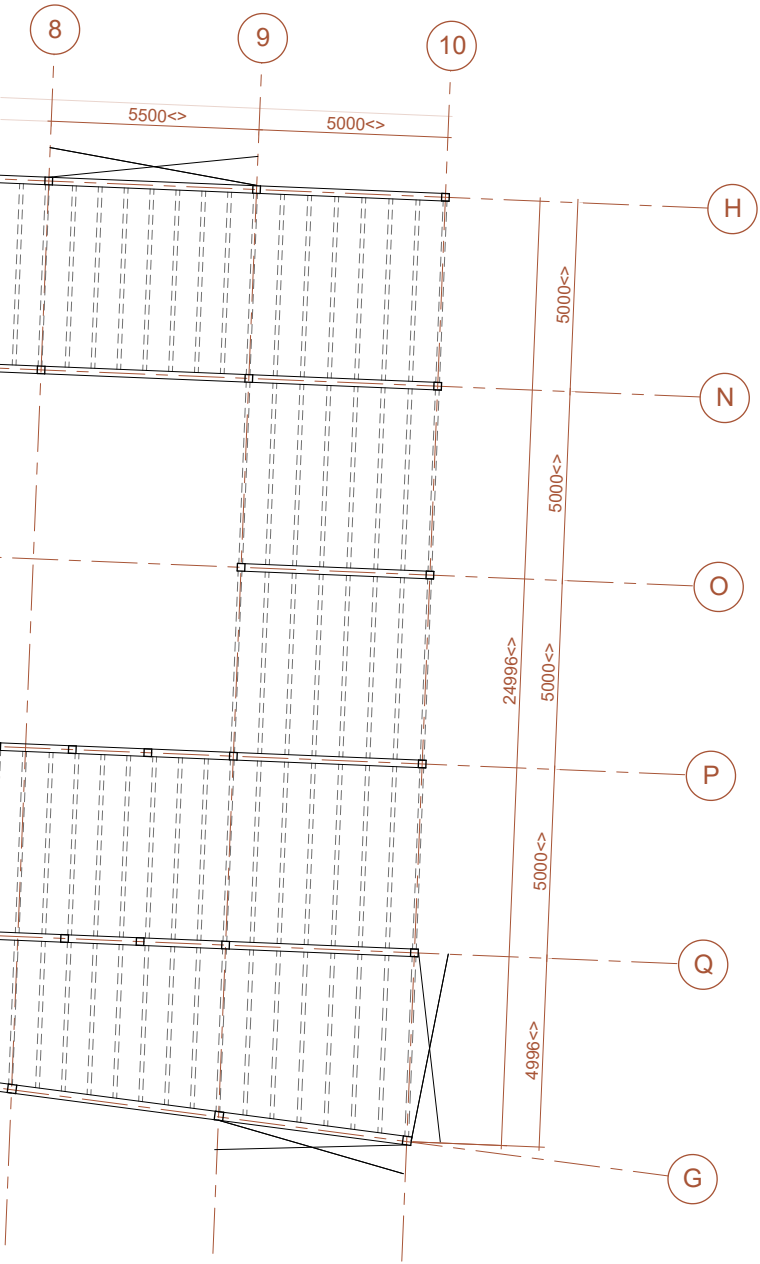
BLOCK AND BEAM CONSTRUCTION

By using this method of building, construction costs can be brought down. No specialized workers and no big cranes are needed. The different elements are smaller , therefore easier to transport.



EXPLODED FRAGMENT | bearing construction


5
6
7
5500<>
5500<>
27000<>
5500<>

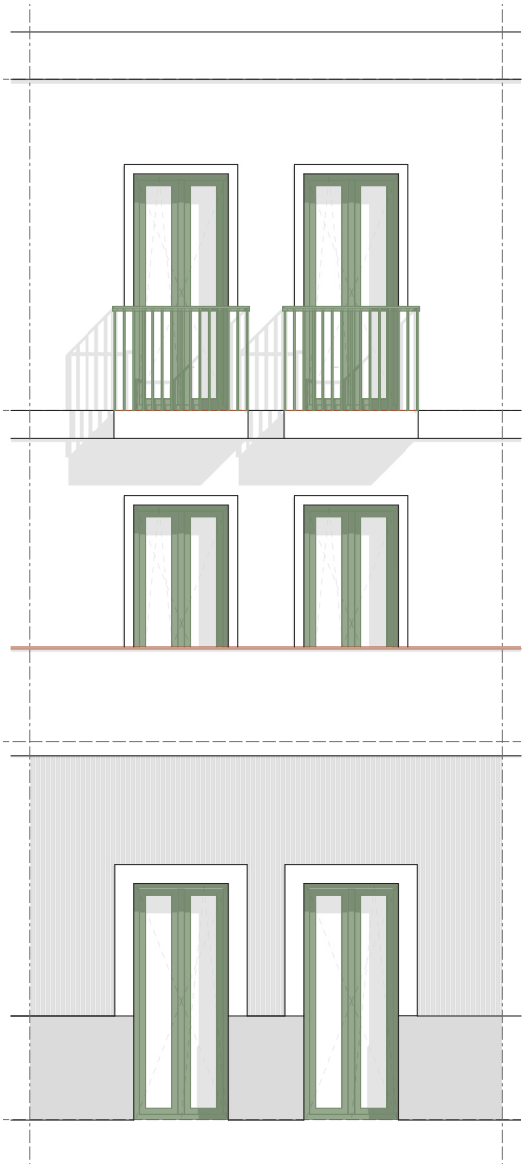

8
9
10
5500<>
5000<>
H
N
O
P
Q
G
5000<>
5000<>
24996<>
5000<>
5000<>
4996<>

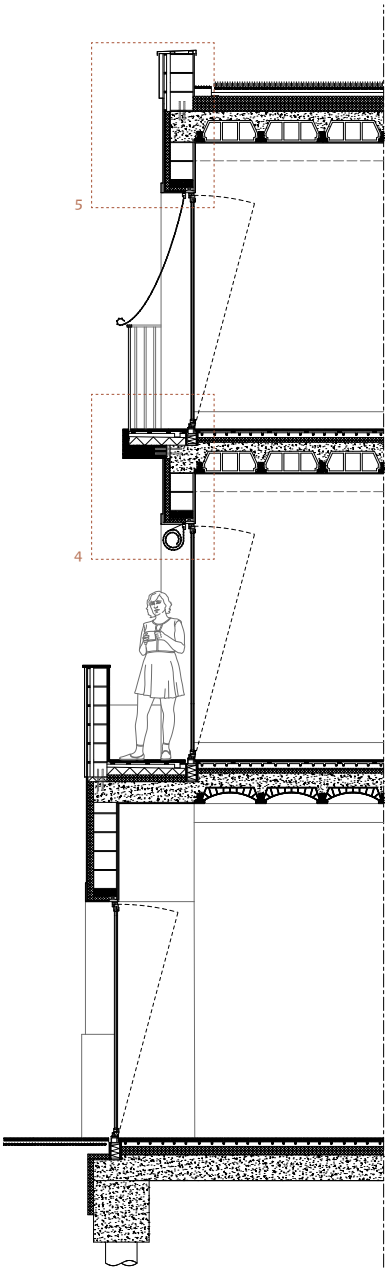
DETAILING

-

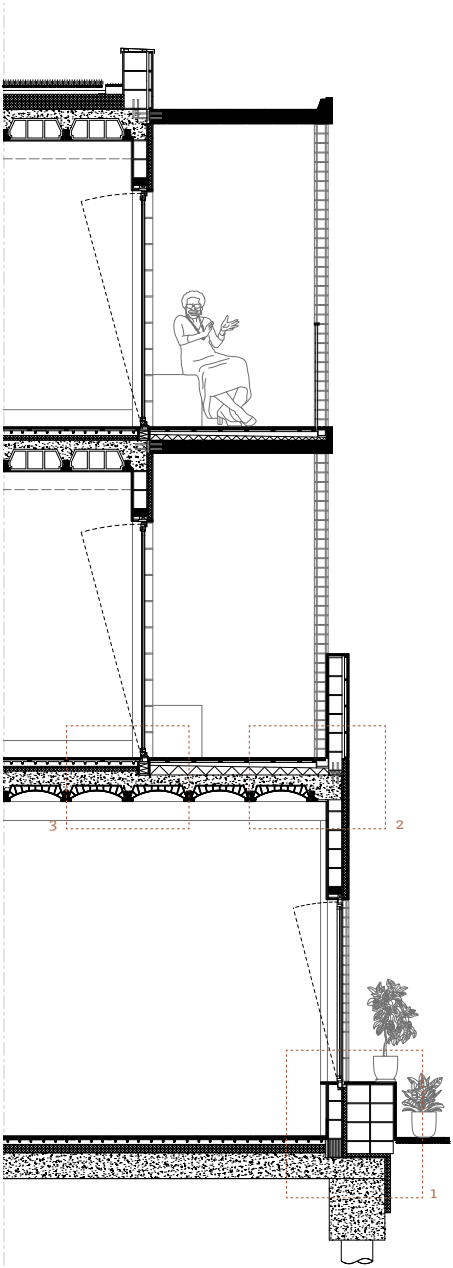
how everything comes together

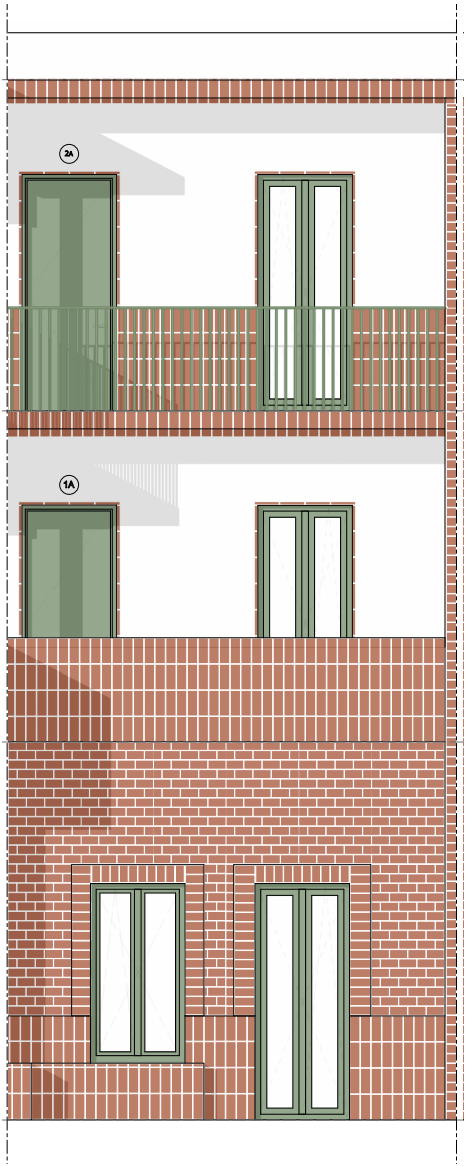
EXTERIOR





INTERIOR



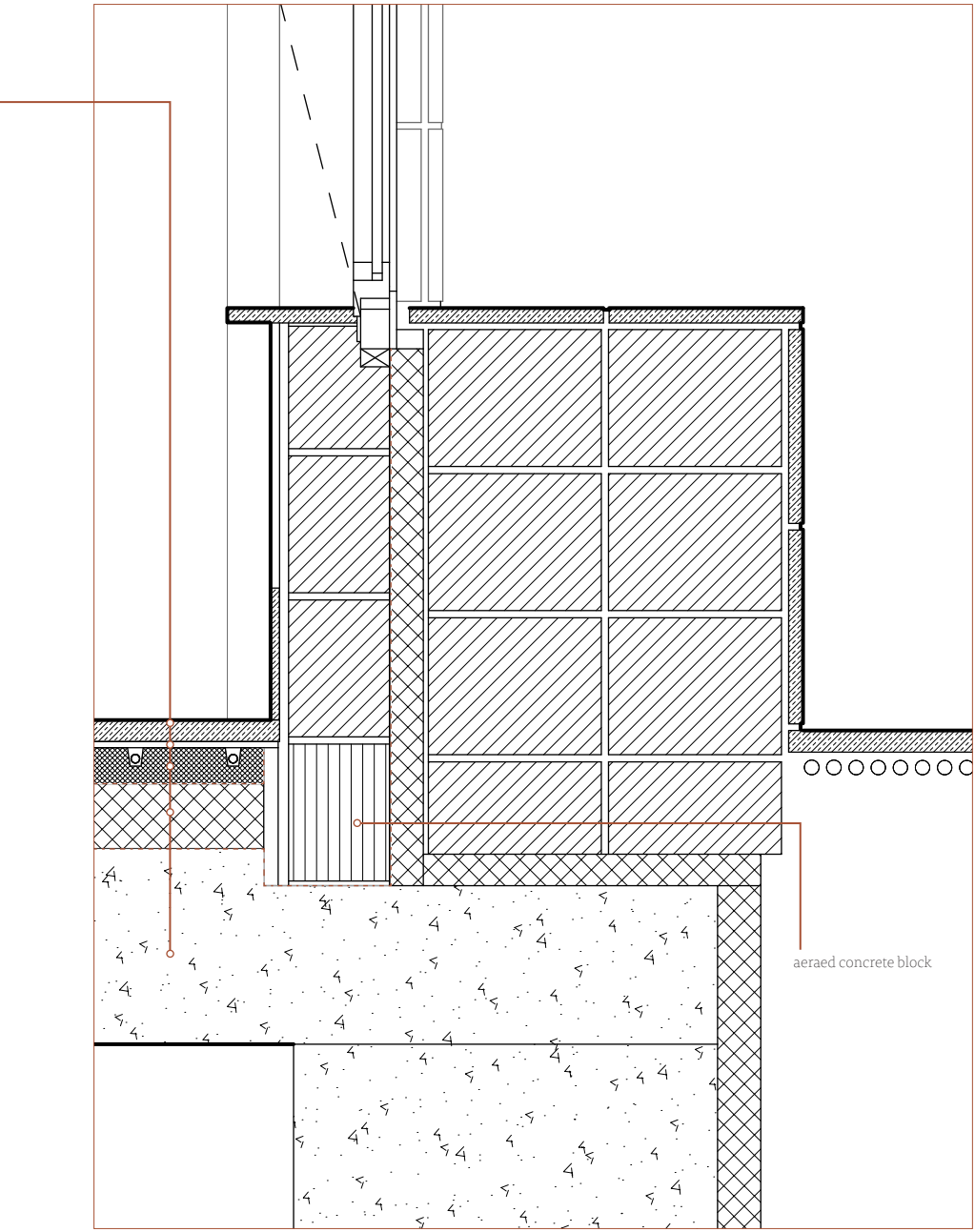


INTERIOR

Terracotta tiles - 260x140x30mm
Cement - 8mm
Dry heating system - 50mm
Vapour resistive membrane
Insulation (expanded cork chipboard) - 90mm
Water air resistive membrane
Cast on site hempcrete - 270mm

EXTERIOR

DETAIL 1 | Ground floor
Re-scaled 1.5


aeraed concrete block

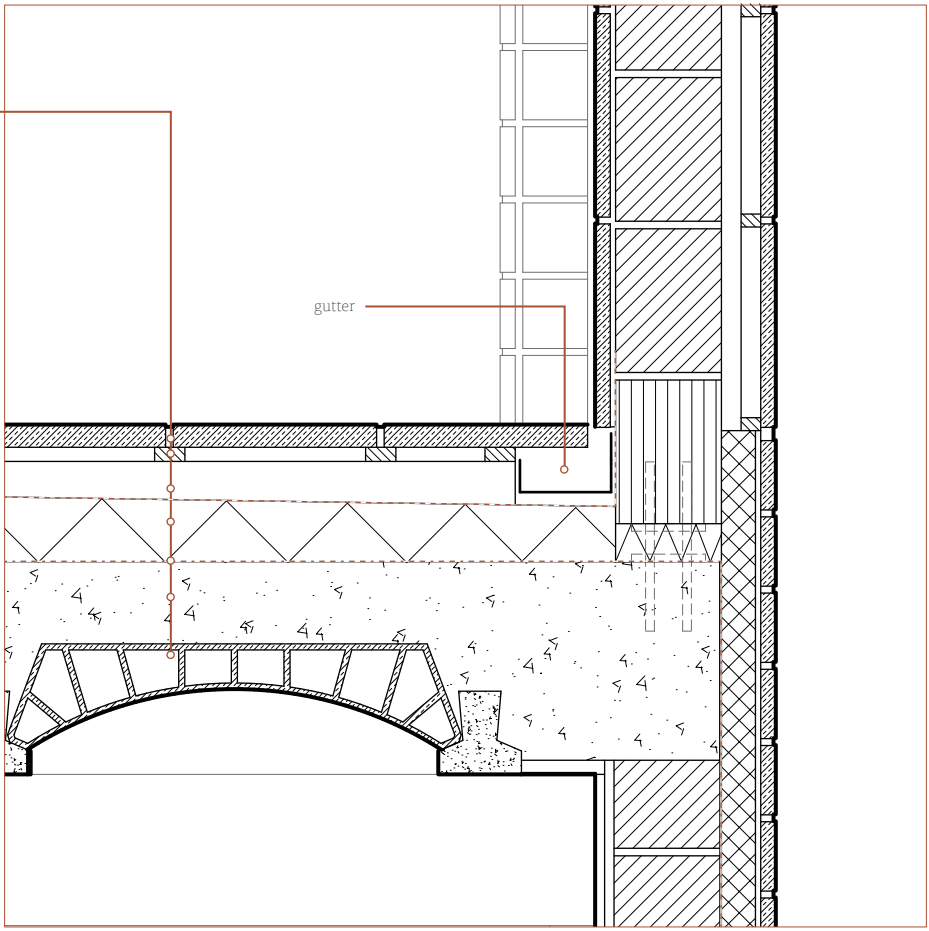
EXTERIOR

Terracotta tiles 200x100x30mm
Support structure 1 - 20mm
Support structure 2 - 30-60mm
Waterproof foil
Insulation (expanded cork chipboard) - 1000x500x100-70mm
Vapour proof foil
Block and beam system consisting of cast on site hempcrete and prefab ceramic vaults (58.8x22x14mm) - 320mm

INTERIOR

DETAIL 2 | Intermediate floor

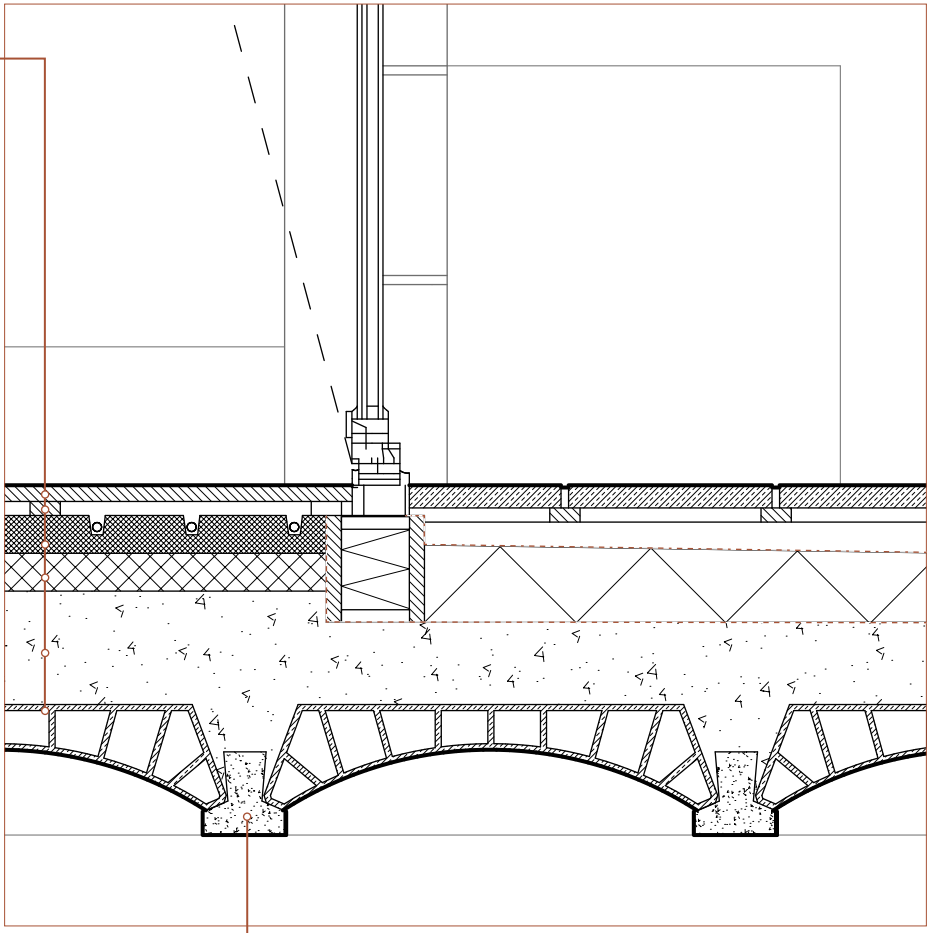
Re-scaled 1.5


gutter

Ash wood floor finish - 2000x140x20mm
Substructure floor - 25mm
Dry floor heating system - 50mm
Insulation (expanded cork chipboard) - 1000x500x50mm
Block and beam system consisting of cast on site hempcrete and prefab ceramic vaults (58.8x22x14mm) - 320mm

DETAIL 3 | Gallery

Re-scaled 1.5

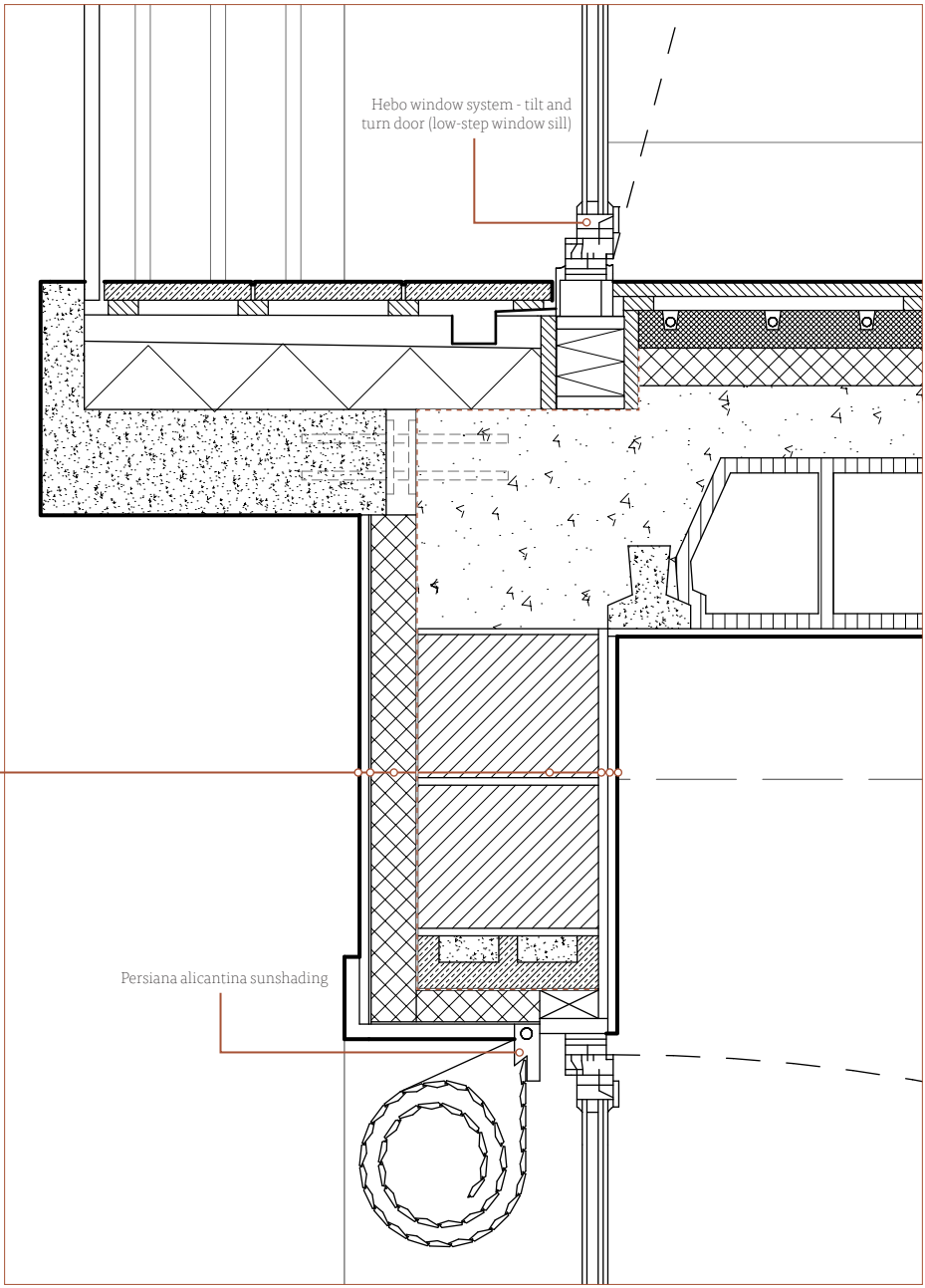

Pressed concrete joist - inverted T profile 110x110mm

EXTERIOR

Silicate paint (Isocit AD25+Isovit REV SP)
Finish lime mortar (Reabilita CAL AC) - 12.5mm
Reinforcing mesh
Regularization mortar - 5mm
Mechanical fixing
Insulation (expanded cork chipboard) - 1000x500x50mm
Bonding mortar (Isovit e-cork) - 5mm
Vapourproof foil
Thermo-clay blocks - 300x232x190mm
Gypsum plate - 12.5mm
Gypsum plate - 12.5mm

INTERIOR

DETAIL 4 | Balcony
Re-scaled 1.5


Hebo window system - tilt and turn door (low-step window sill)
Persiana alicantina sunshading

EXTERIOR

Soil and planting - 30mm
Substrate - 30mm
Drainage layer - 40mm
EPDM foil
Waterproof foil
Insulation (expanded cork chipboard) - 1000x500x160mm
Vapourproof foil
Block and beam system consisting of cast on site hempcrete and prefab concrete hollow block (600x200x20mm) - 320mm
Gypsum plate finish - 12.5mm

INTERIOR

DETAIL 5 | Green roof
Re-scaled 1.5