

RESIDÊNCIA CRIATIVA

MATÉRIA ADENTRO

INOVA ALGARVE 3.0

CCDR ALGARVE

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INOVA ALGARVE 3.0

CCDR ALGARVE
Comissão de Coordenação e Desenvolvimento Regional do Algarve I.P.

RESIDÊNCIA CRIATIVA · MATÉRIA ADENTRO ·

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TURISMO RESPONSÁVEL • RESPONSIBLE TOURISM

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An initiative of the Programme for the Development of New Products Based on Local Materials Inspired by the Mediterranean Diet, promoted by the Algarve Regional Coordination and Development Commission as part of the INOVA ALGARVE 3.0 | ALGARVE 2030 project.



Fig. 1
"Tanta Cana" public event — Fonte da Benémola (Loulé) — 30/05/2026

Introduction

The Programme for the Development of New Products Based on Local Materials Inspired by the Mediterranean Diet (MD) builds on the work carried out by CCDR Algarve, I.P. to safeguard and promote the Mediterranean Diet as a defining element of the cultural identity of communities throughout the Mediterranean basin, particularly in the Algarve. Recognition of the potential of innovation to give local resources new uses, functions and value was the starting point for this new programme, which gave rise to the Matéria Adentro identity. This approach began in 2011 with the TASA project — Ancestral Techniques, Contemporary Solutions.

The project seeks to enhance the value of the region's resources and traditional knowledge and skills by bringing them together with creativity, design and innovation. The aim was to encourage the creation of new products from local materials, enhancing their economic and cultural value through collaborative processes involving artisans, businesses, designers, architects and other participants in the production and creative sectors.

In this way, the programme sought to help diversify and strengthen the regional economy, reinforcing the links between innovation, sustainability, the circular economy and regional identity.

The ability to transform what makes each region distinctive, through innovation and by making the most of its local resources, is an important factor in competitiveness. Dialogue between people with traditional knowledge and skills and professionals from outside their communities is particularly important in this process. Architects, designers, visual artists and other creative professionals can help reinvent materials and techniques, identify new uses and adapt them to contemporary needs and market requirements.

It was in this context that the challenge was set to work with the Algarve's natural and traditional materials, such as cane, rammed earth, oyster shell and the clay used in tile-making workshops, exploring new applications and encouraging the creation of products with greater added value. The process focused on bringing together the knowledge, experience and skills of the various participants to arrive at innovative solutions that businesses in the region could develop and produce.

The initiative thus sought to support the productive use of local resources and encourage projects capable of strengthening and diversifying the regional economic base. Business participation is of strategic importance here, both in turning ideas and prototypes into new products and in encouraging innovation, improving competitiveness and responding to a market increasingly attentive to sustainability, the origin of materials and the principles of the circular economy.

This catalogue presents the results of this work, promoted by CCDR Algarve, I.P. as part of the INOVA ALGARVE 3.0 project — Promotion of Qualified Entrepreneurship in the Algarve Region, co-funded by the ALGARVE 2030 | Portugal 2030 Regional Programme.

Led by NERA — the Algarve Region Business Association, INOVA ALGARVE 3.0 aims to help the region's small and medium-sized enterprises (SMEs) build their capabilities and innovate, strengthening their capacity to pursue innovation and digital transition in line with the EREI Algarve regional strategy.

Alongside CCDR Algarve, I.P., the the INOVA ALGARVE, 3.0 project includes the Algarve Evolution Association, the KIPT — Innovation and Tourism Association, the Algarve Tourism Board (RTA), Tertúlia Algarvia — the Algarve Centre for Knowledge in Culture and Food, and the University of the Algarve.

The aim goes beyond preserving materials, techniques and knowledge: it is to bring them into the present, reinvent them and create the conditions for them to generate new economic opportunities, new products and new ways to showcase the Algarve through the region's most authentic qualities.



Fig. 2
Working session with the residency teams — CCDR Algarve, 28/05/2026



Fig. 3
Telheiro Alberto Rocha

Matéria Adentro thus continues a strand of work that CCDR Algarve, I.P., through its Regional Planning and Development Unit, has pursued since the beginning of this century: enhancing the value of the Algarve's local resources and traditional knowledge and skills by bringing together tradition, creativity and innovation, helping to strengthen regional identity, particularly in sparsely populated areas, and improve the region's competitiveness.

José Apolinário
President of the Algarve Regional Coordination and Development Commission, I.P.

Cristiano Cabrita
Vice President of the Algarve Regional Coordination and Development Commission, I.P.



Fig. 4
Public event — "Santa Catarina's Tile-making Workshops: A Living Heritage" — Parish Council of S. Catarina da F. Bispo — 28/04/2026



Fig. 5
Public event — Culatra Island, 03/06/2026



Creative residencies – Matéria Adentro

How can we encourage the economic use of resources whose underuse creates an environmental liability? How can we enhance the value of traditional techniques while opening up new uses and market applications? The products developed through these creative residencies reflect an active search for answers to these challenges.



Fig. 6
Visit to Telheiro Alberto Rocha

The work focused on four materials and practices with a strong presence and impact in the region. **Cane** is an abundant invasive species that proliferates along waterways, narrowing their channels and increasing the risk of flooding. **Oyster shell** is a waste product of aquaculture that, because it has not been put to economic use, accumulates in the Ria Formosa, adversely affecting the ecosystem. **Rammed earth** faces restrictions in municipal planning approvals for structural construction, limiting its contemporary use. Finally, the **tile--making sector** is seeing a steady decline in its traditional workshops, threatening the survival of an important part of the region's intangible cultural heritage.

These materials and techniques nevertheless offered favourable conditions for innovation: strong links to the region, substantial local availability, a willingness to experiment and opportunities to work with the regional production network.

The work focused primarily on natural building and sustainable architecture — sectors capable of using significant volumes of raw materials, putting circular economy principles into practice and bringing cultural value to the solutions developed. The solutions were required to result in functional prototypes and feasible proofs of concept, without relying on complex industrial processes or lengthy laboratory programmes.

Over five months, through co-creation and collaborative experimentation, teams of designers, architects and production professionals — supported by R&D laboratories — studied materials, tested ideas and designed solutions in a committed joint effort. This less visible work was complemented by four public events for the community, providing opportunities to share ideas, discuss the topics explored and raise awareness of them.



Fig. 7
Visit to an oyster farm on Culatra Island with Sílvia Padinha

The results reflect the project's experimental nature and offer tangible prospects for further work, both in production and commercialisation and in research and development.

Graça Palma — Proactivetur



Fig. 8
Nuno Lúcio (A Engenharia da Taipa) compacting earth using the traditional method

Cane

The history, the project and results





Historical and cultural context – Uses of cane in the Algarve

The human use and processing of plant materials are as old as the need for shelter, housing, and the storage and transport of goods. In the Algarve, giant reed (*Arundo donax L.*), a non-native species introduced to Portugal long ago and abundant along its many waterways, has served a wide range of everyday purposes throughout history. Its local availability, together with its lightness, strength, flexibility and ease of processing, made it a particularly versatile resource, used in domestic life, agriculture and fishing, in the construction of shelters and houses, and in the making of baskets, sound-producing instruments, toys and many other objects. These varied uses reveal a profound understanding of the plant's characteristics, where it grows and how to harvest, prepare and process it. They embody technical and ecological knowledge passed down through generations to meet the community's shared needs.

Cane basketry is one of the Algarve's most characteristic crafts, particularly along the banks of the Guadiana Valley, where extensive stands of giant reed grow. Weaving cane produces a wide variety of baskets, essential to agriculture, fishing, and the storage and transport of produce.

Even today, a substantial number of basket makers remain active in the region, although fewer than in the mid-20th century. Basket making was traditionally a male occupation, learnt from an early age from relatives and neighbours through observation and imitation. Women made the smaller, more finely worked pieces.



Fig. 9
Making a cane mat on a loom



Fig. 10
Baskets made by basket maker José Valente. Ribeira da Gafa (Vila Real de Santo António)
Credit: Catarina Oliveira

The master craftsman knows the materials, the harvesting season and the drying times. Cane grows all year round, but is harvested mainly in winter, usually in January at the new moon, when it is not growing: "Cane cut in January lasts the whole year." After being cut with a knife or billhook, it is cleaned and split into strips of different thicknesses, depending on the piece to be made. The basket maker starts with the base, weaving the strips around the structural stakes, known as "mestras", which cross at the centre of the basket. These are then bent upwards to form the framework of the sides. Some of the stakes are used to form the handle, while the others are bent over and tucked into the weave. The rim and handle or handles are finished with binding. Usually seated on a low chair with a woven bulrush seat, the basket maker uses simple tools: a sickle to cut and strip the cane; a pocketknife or a sharper knife to split it into strips; a piece of canvas or leather to protect the knee when paring the cane; and an iron or wooden spike to adjust the rings.



Fig. 11
Baskets made by basket maker José Valente. Ribeira da Gafa (Vila Real de Santo António)
Credit: Catarina Oliveira

Cane basketry in the Algarve gave rise to a wide variety of containers and objects adapted to the needs of farm work, fishing and domestic life. Large baskets, usually with two handles, were mainly used in agriculture and for transporting and storing produce. In coastal areas, their ability to drain water easily also made them suitable for unloading fish and meeting the needs of the canning industry. Other agricultural baskets included round-handled baskets for picking fresh figs and the "cestos de tabela", made to standard dimensions for transporting oranges from the Algarve to Lisbon. In the north-eastern Algarve, large, tall baskets with fitted lids, known as "condessas", were used to store bread. The "covos" made in the Lower Guadiana area, with the ends of the canes pointing inwards, were fish traps designed to retain the catch. Basketry also included smaller, more finely crafted pieces, such as baskets for lace, given as courtship gifts, and, later, "banestras", used to display and transport dried figs, almonds and other produce. Production of these baskets developed in response to the growth of tourism.

This diversity of uses extended to other traditional activities. In *As Mulheres do Meu País* (published between 1948 and 1950), Maria Lamas records women in Azinhal (Castro Marim), where bobbin lace was particularly important, working on a cushion supported by a cane basket, known as a "cesto dos bilros", made and adapted specifically for this purpose. There are also intriguing records of "covos" used for rearing chicks and of woven muzzles fitted over the snouts of mules. This variety demonstrates the remarkable versatility of cane, made into objects of different shapes, sizes and levels of craftsmanship, closely linked to the economic activities, domestic practices and social relationships of communities in the Algarve.

The use of plant materials, particularly cane, in building in the Algarve is documented as far back as at least the 16th century. In a study of Renaissance religious architecture, Horta Correia (1989) highlights three-aisled buildings with no transept and a single roof of tiles and cane, suggesting a regional building solution. In Tavira, the Visitações da Ordem de Santiago record a cane roof covering at the Church of Santa Maria do Castelo in 1554. Also in Tavira, cane formed part of the construction of the steeply hipped



Fig. 12
Hut with a cane frame and windbreak. Quarteira (Loulé) in OLIVEIRA; GALHANO; PEREIRA (1969) Centro de Estudos de Etnologia.



Fig. 13
Installing cane lathing, 1955. Alte (Loulé).
Credit: Ordem dos Arquitectos

"telhados de tesouro" roofs of noble town houses between the late 15th and 16th centuries. It was used as a roof lining to support the tiles and also provided natural insulation.

In the 18th century, in 1712, Father António Carvalho da Costa, in his *Corografia Portuguesa*, records that Olhão *"has 300 households, living in cane houses roofed with thatch, because they are not permitted to build them in stone and lime"*. The Memórias Paroquiais of 1758 also record more than 300 huts in Olhão, gradually replaced by masonry houses. This shows that cane construction was a significant part of the housing stock of the Algarve's coastal communities.



Fig. 14
Cane lining on the underside of a house roof. Pinheiro, Luz de Tavira (Tavira)
Credit: Catarina Oliveira

In the 20th century, the ethnographic accounts of Ernesto Veiga de Oliveira, Fernando Galhano and Benjamim Pereira documented the survival of these techniques in considerable detail. In *Construções Primitivas em Portugal* (1969), the chapter on huts in the Algarve records their use in Quarteira, Faro, Santa Luzia/Terra Estreita and Torre de Ares. In Quarteira, cane could form part of the frame itself. Canes were also used in "encaniçado", the latticework supporting the roof, as well as in partitions, gates and windbreaks. Several functions can therefore be distinguished: structural framing, cane latticework and tile support, partitions, linings and thermal insulation.

Recent studies of vernacular architecture confirm the continuity of these uses. The publication *Materiais, sistemas e técnicas de construção tradicional* (2008) records the use of cane in various building systems in the Algarve. In the eastern Serra do Caldeirão, cane linings are thought to have been among the earliest roofing solutions, favoured by the abundance of the raw material and the scarcity of timber for battens.

Once cleaned and dried, the canes were laid over the timber frame to form a continuous support beneath the tiles. In the eastern Algarve, the publication records cane linings beneath curved clay roof tiles, as well as systems in which the cane supported a layer of earth or clay before the tiles were laid. Cane was also used in walls. Various forms of traditional framed partition, or "tabique", are described: timber and cane frameworks filled with stone, ceramic fragments and clay; woven cane mats intended to receive render; and simple partitions of whole canes held in a timber frame. This evidence complements earlier descriptions in *Construções Primitivas em Portugal* and in *Arquitectura Popular em Portugal* (1961). Cane was used for roof support, lathing, wall framing and partitioning, as a base for render and in the construction of specific features such as chimneys.

Throughout history, then, cane was more than a material for rudimentary or temporary buildings. It was a plant resource incorporated into a range of building solutions, chosen according to local availability, the scarcity of timber, economy of construction and the comfort and performance required of roofs and walls.



Fig. 15
Cane used in fig harvesting. Picture postcard. Algarve, second half of the 20th century

Cane also has numerous uses in the Algarve's rural activities. It was closely linked to the **traditional cycle of fig harvesting and drying**, playing a part at various stages of the work. In his *Corografia do Reino do Algarve* (1577), Friar João de São José describes the fig harvest and mentions "cambos", long cane poles used by pickers to reach and knock down fruit they could not pick by hand. Cane was also used in the baskets and large carrying baskets for gathering and transporting the fruit, a practice documented by ethnographers until very recently. Once picked, the figs were laid on mats, often made of cane, spread out on the drying ground, or "almeixar", where they were left to dry. The mats were brought in at the end of the day and spread out again in the morning. **Cane mats** are still made today for drying fruit and providing shade. They are woven by hand using a suspended structure commonly known as a stone-weighted or counterweight loom. Friar João de São José's 16th-century description thus finds a particularly striking continuation in traditional practices preserved in the Algarve into the 20th century: cane as a harvesting tool, as the raw material for gathering and transport baskets, and in the mats on which figs were laid out to dry.



Fig. 16
Cane supports in a vegetable garden. Furnazinhas (Castro Marim) Credit: Catarina Oliveira

In vegetable gardens, canes are often erected as supports for tomatoes and legumes. Accounts from the 16th century also mention its use in making fences and vine stakes. In the past, women harvesting cereals wore cane finger guards, known as "dedeiras" or "canudos", to protect their fingers if the sickle slipped. Cane was also used to make blowpipes for reviving the fire.

Throughout history, cane has been a favoured material for making toys and musical instruments. In rural areas, where toys were scarce, children themselves, or their parents and grandparents, used simple tools to turn abundant cane into small pipes, flutes, whistles, scraped percussion instruments, "treco-larecos" (noisemakers), cricket cages, toy guns, carts, kites and other toys.



Fig. 17
Cane musical instruments.
Credit: Catarina Oliveira



Fig. 18
Cane nightingale whistle.
Credit: Catarina Oliveira

Wind and percussion instruments were particularly notable among these sound-producing objects. Many sought to reproduce the sounds of the natural world — birdsong, the calls of cicadas and crickets, or the croaking of frogs — revealing a close relationship between observation of nature and children's creativity. Cane also featured in festive traditions, in the pipes and whistles accompanying processions, and in instruments used by itinerant tradespeople, such as the panpipes of animal gelders and knife grinders.

The historical diversity of cane uses in the Algarve reflects more than the availability of a raw material: it expresses knowledge built through a sustained relationship between plant, place and community.

The Algarve's varied terrain – coast, Barrocal and uplands – shaped the distribution and characteristics of its plant resources and, in turn, the ways in which they were used and processed. Cane, abundant along waterways, became part of many bodies of knowledge and techniques: basketry, mats, toys and sound-producing instruments, agricultural implements, fishing gear, framed partitions, linings and roofing, among many others.

Each use required an understanding of where the plant grew, when and how to harvest it, which canes were best suited to the purpose, and how to prepare, dry and preserve them, adapting their properties to specific needs. The uses of cane over time can thus be understood as the product of a plant-based technology, in which the diversity of the Algarve's landscape comes together with observation, experimentation, the passing on of knowledge and the human ability to turn a locally available plant into material, object, tool, shelter and architecture.

Catarina Oliveira

BIBLIOGRAPHY

CORREIA, José Eduardo Horta (1989) — *A Arquitectura do Algarve como Expressão Privilegiada da Sua Especificidade Cultural*. In O Algarve na Perspectiva da Antropologia Ecológica, p. 135-146. Lisboa: INIC.

DURKEE, Fatima; SUZANO, Astrid (2026) — Um cento de cestos: Uma tecnologia sustentável para o século XXI. Lisboa: Imprensa Nacional — Casa da Moeda; Museu de Arte Popular.

LAMAS, Maria (2002) — As mulheres do meu país. [S.l.]: Editorial Caminho.

ODIANA (2004) — Baixo Guadiana: Caminhos do Património. [S.l.]: Associação Odiana.

OLIVEIRA, Catarina (2012) — *Empreita e cestaria. Entrançados de palma, verga e cana no Algarve*. In TASA, Técnicas Ancestrais, Soluções Atuais, p. 209-217. Faro: CCDR Algarve.

OLIVEIRA, Catarina (2013) — *Empreita e cestaria no Algarve a partir da palma, esparto e cana. Antigos saberes, novos fazeres*. In Idades Entrelaçadas. Formas e memórias das artes de trabalhar fibras vegetais, p. 91-105. Lisboa: IEFP.

OLIVEIRA, Ernesto Veiga; GALHANO, Fernando; PEREIRA, Benjamim (1969) — Construções Primitivas em Portugal. Lisboa: Centro de Estudos de Etnologia.

PIRES MARTINS, Artur; CASTRO, Celestino de; TORRES, Fernando (1961) — Zona 6 — Algarve. In Arquitectura Popular em Portugal. Lisboa: Sindicato Nacional dos Arquitectos.

PROACTIVETUR (coord. e investigação) (2021) — Red Book: Lista Vermelha das Atividades Artesanais Algarvias. Faro: Comissão de Coordenação e Desenvolvimento Regional do Algarve — CCDR Algarve.

RIBEIRO, Vítor (coord.) (2008) — Materiais, sistemas e técnicas de construção tradicional. Contributos para o estudo da arquitectura vernácula da região oriental da serra do Caldeirão. Faro: CCDR Algarve; Porto: Edições Afrontamento.

ROMBA, Sandra (2012/2013) — *Evolução Urbana de Olhão*. In Promontoria, ano 10, n.º 10, p. 55-80.

ROMBA, Sandra (2015) — *Evolução Urbana de Olhão*. Olhão: Editora Sul, Sol, Sal.

SANTOS, Ana Isabel Nascimento (2021) — *Telhados de tesouro da Ribeira de Tavira. Modelos e tipologias de casas nobres entre os séculos XV e XVI*. In Povoações Alcandoradas. Arquitetura e Paisagem. 2.º Congresso Internacional Arquitetura Tradicional no Mediterrâneo Ocidental, p. 123-127.

SÃO JOSÉ, Frei João de (2023) — Corografia do Reino do Algarve (1577). Edição de Rui Manuel Loureiro e Daniela Nunes Pereira. Faro: Direção Regional de Cultura do Algarve.



Fig. 19
Cane harvesting — José Vitorino

Project and results

Giant reed (Arundo donax L.) - once widely used in crafts and building – is a rapidly spreading plant that invades ecosystems, becoming dominant over other species and affecting plant and animal life. It is also an exceptionally valuable resource with some notable characteristics: it is extremely versatile and has a high capacity to capture CO_2.

The experimental work undertaken during this residency aimed to restore this material's status as a valuable building resource while helping to control the species.

After a period of research and discussion with relevant individuals and organisations, we identified possible ways of incorporating cane into new materials for natural building. We set out to develop at least two cohesive and apparently functional products made predominantly from cane. To this end, we produced the following technical samples:

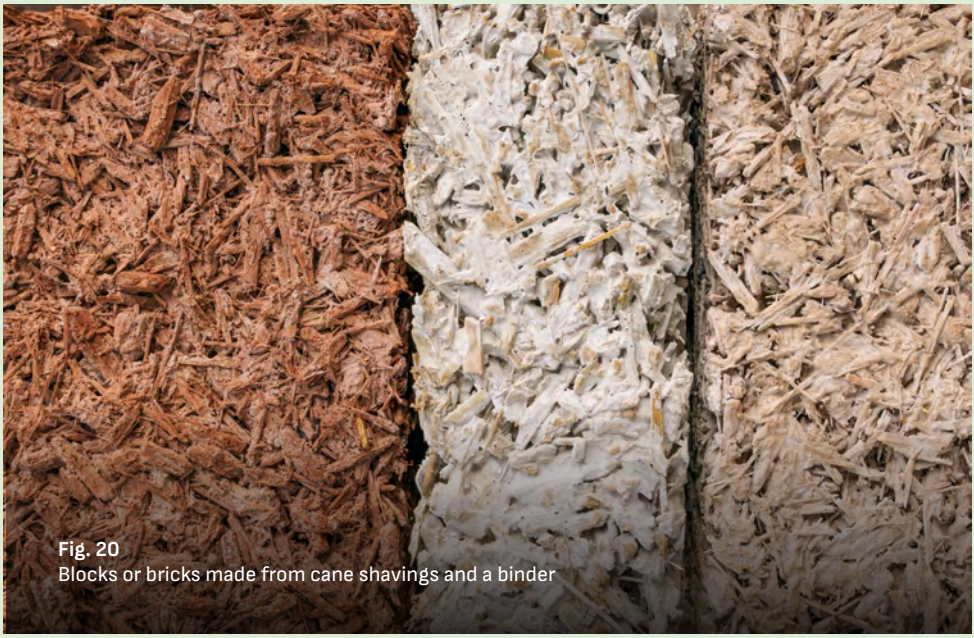


Fig. 20
Blocks or bricks made from cane shavings and a binder

Product category	Formulation/Composition	References
Cane block / brick	Cane and lime	A to A2; B to B3; D1 and D2
Cane block / brick	Cane, lime and clay	B4, B5 and D3
Cane block / brick	Cane and clay	C
Cane block / brick	Cane, clay and lime	C1 to C3
Insulating panel	Cane (mat format)	E1, E2, E3
Renders and mortars	Cane, sand and lime/clay	R1 to R6
Renders and mortars	Cane, crushed oyster shell and lime/clay	R4 to R6



Fig. 21
Shredding process



Fig. 22
Screening the cane shavings

To produce the blocks and renders, we used small quantities (41.5 kg) of dried, shredded and sieved cane, working with simple tools. The mixing process was similar to that used in various small-scale natural building applications. The render and mortar experiments incorporating oyster shell focused on replacing all the natural sand with crushed oyster shell, which had first been sieved to adjust its particle size distribution. The mats were made from whole canes using methods similar to traditional practice, following the guidance in the academic literature[1].

The main obstacle was the time available for the project: cane has a specific harvesting season and needs time to dry and be uniformly shredded, while lime also requires a long drying period.

We therefore knew that it would not be possible to validate all the proofs of concept and technical samples developed through laboratory testing. The empirical results were very satisfactory, but we felt it was important to obtain scientific data for at least one of the cane block formulations. The ITECONS assessment showed that block B5 has good

[1] Ansolin, A. P. (2021). *Caracterização da cana Arundo donax L. e avaliação do seu potencial como material de isolamento térmico em Portugal* [Master's thesis, University of Minho]. RepositóriUM. uminho.pt



Fig. 23
Adding all the components of the block/brick mix



Fig. 24
Mixing the block/brick formulation

physical and thermal performance, approaching that of conventional hemp-based solutions. The material provides slightly less insulation than standard hempcrete, but its higher density gives it greater thermal inertia. This is a promising result at an early stage of development, showing that there is clear scope to optimise the block formulation.

The render trials also produced good empirical results for most of the technical samples developed, indicating scope to incorporate cane into different formulations for bedding and rendering mortars.



Fig. 25
Filling a mould with a cane-based mix/mortar

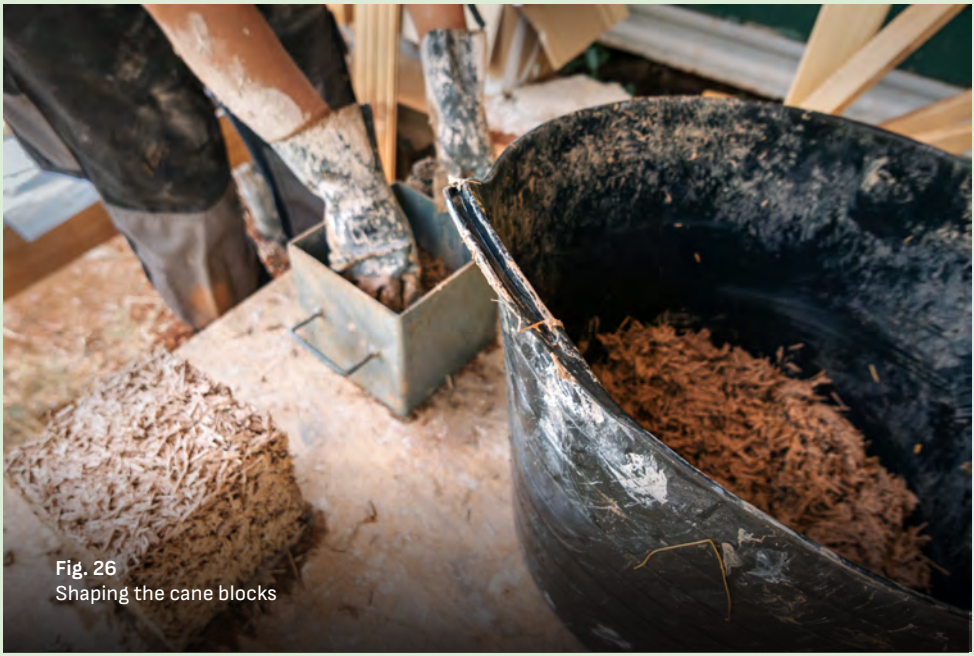


Fig. 26
Shaping the cane blocks

For the insulating panel, our aim was to produce a technical product sample applying the scientific findings of the study we used as a reference. We arrived at several configurations that offer potential solutions for sustainable construction.

Given the abundance of cane as a natural resource and the growth of sustainable and natural building, we believe that cane-based products can and should always be considered as an alternative. They offer an opportunity to promote effective collaboration between the bodies involved in land management and professionals working in this field.

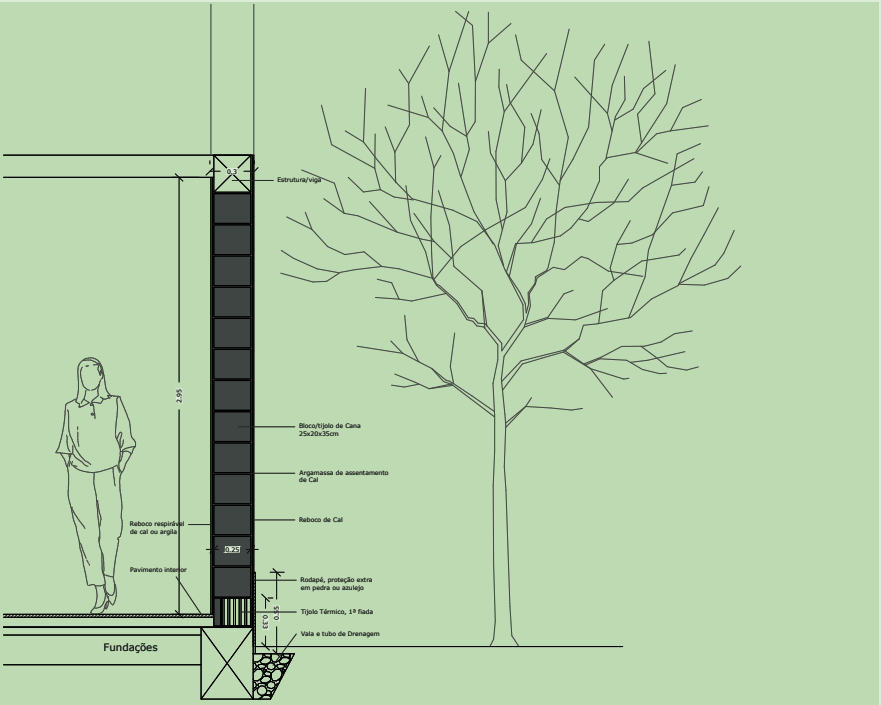
Although further practical experimentation and academic partnerships are needed, the products studied show strong technical and economic viability and, above all, offer a sustainable solution with a significant environmental impact. For example, building 1 m^2 of external wall (30 cm thick) requires 15 cane blocks (35 × 20 × 25 cm). This represents the removal of tens of kilograms of carbon dioxide from the atmosphere.



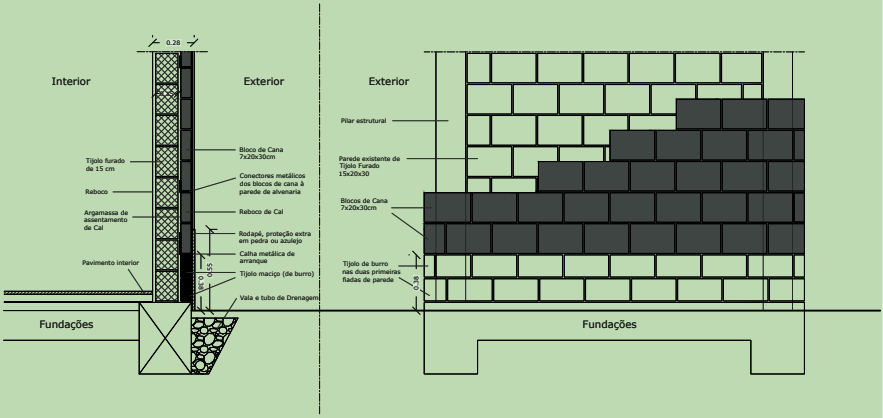
Fig. 27
Testing mortars containing cane fibre



Fig. 28
Moulding blocks



Seção de Paredes Exterior de 30cm preenchida com Blocos de Cana (desenho exemplificativo)



Seção de parede existente em alvenaria convencional com reforço térmico pelo exterior com Blocos de Cana de 7cm espessura. (desenho exemplificativo)

Perspetiva frontal de parede sem reboco. Exemplo de assentamento e revestimento de Blocos de Cana sobre uma parede de alvenaria existente.

Fig. 29
Demonstrating the use of cane blocks/bricks



Fig. 30
Final render samples containing cane fibre and clay (R3)

Sector / market: Natural building and sustainable architecture

Researchers: Cláudia Martins and Susana Carmo Silva

INSULATING CANE RENDERS AND MORTARS (R1 TO R6 SERIES)

Test objective: Assessment of the workability, adhesion and technical feasibility of incorporating cane shavings as a plant-based aggregate (R1 to R6) and partially or wholly replacing natural sand with crushed oyster shell (R4 to R6) in rendering and bedding mortars.

General properties observed: Requires greater care in preparation and application than conventional mortars, but shows good workability and adhesion comparable to traditional formulations. No visible cracking during the initial curing stage.

Sample dimensions / scale: Panel specimens (30 × 15 cm), prismatic specimens (16 × 4 × 4 cm) and application to technical sample E2.

R-series variations (composition and proportions)

Reference	Primary binder	Mineral aggregate
R2	Natural hydraulic lime (NHL 3.5) + hydrated lime	Fine sand + coarse sand
R3	Clay	Fine sand + coarse sand
R4	Natural hydraulic lime (NHL 3.5) / hydrated lime	Crushed oyster shell (sand replacement)
R5	Clay	Crushed oyster shell (sand replacement)

INSULATING CANE MATS (E1 TO E3 SERIES)

Test objective: Development and technical validation of flexible and semi-rigid panels/ mats based on the technical literature (Ansolin, A. P., 2021[1]), exploring different weaving and tying techniques and integration with other building systems (renders and blocks).

Composition and mix proportions: Cane strips/rods *(Arundo donax* L.*)* and tying cord.

Waste material content: ~100% cane (plant-based raw material).

Theoretical reference: [1] Ansolin, A. P. (2021). Caracterização da cana Arundo donax L. e avaliação do seu potencial como material de isolamento térmico em Portugal [Master's thesis, University of Minho]. RepositóriUM.

Series variations (applications, properties and substrates)

Reference	Format / test substrate	Specific properties and applications
E1	Block made from a double roll of cane matting	Requires precision in manufacture/weaving; easy to handle and install on site.
E2	Rolled mat; demonstration using bedding mortar and R4 render	Allows lightweight interior partitions and dividing walls to be built quickly, with the finish applied directly.
E3	Block of interleaved matting; 15 × 15 sample	Requires precision in manufacture and weaving; easy to handle and install on site



Fig. 31
Block made from a double roll of cane matting (E1)



Fig. 32
15 × 15 block of interleaved matting (E3)



Fig. 33
B5 and C cane bricks

INSULATING CANE BLOCKS AND BRICKS (A TO A2, B TO B5, C TO C3 AND D1 TO D3 SERIES)

Test objective: Assessment of the workability, structural integrity and technical feasibility of insulating blocks and bricks made from cane fibre shavings and different binder matrices.

General properties observed: Good mechanical strength and high workability. No visible cracking during the initial curing stage, with most formulations retaining their integrity after drying.

Sample dimensions / scale: Block specimens (15 × 15 × 15 cm) and brick specimens (20 × 10 × 6 cm).

Series a variations (composition and proportions)

Reference	Primary binder	Secondary binder	Key properties
A2	Natural hydraulic lime (NHL 5)	–	Good mechanical strength and sound insulation
B5	Lime	Clay	ITECONS — Thermal insulation and mechanical strength
C	Clay	–	Thermal insulation
D1	Natural hydraulic lime (NHL 3.5) / hydrated lime	–	Low weight and thermal insulation



Fig. 34
Demonstration of laying cane bricks (B5 and C) to form masonry



Fig. 35
Block D1 — Cane shavings, hydrated lime and NHL lime



Fig. 36
Insulating cane renders (from top to bottom)
R5 — Cane, clay and oyster shell
R3 — Cane, clay and sands
R2 — Cane, hydrated lime, NHL lime and sands



Fig. 37
Insulating cane renders

Oyster shell

The history, the project and results





Historical and cultural context – Shells (oysters and other bivalves)

Traditional architecture is the result of a long process of adaptation to locally available resources. For centuries, earth, stone, plant materials and lime formed the material basis of vernacular buildings in the Algarve, creating a built landscape characterised by rammed earth, adobe, masonry, tiled roofs and finishes made with lime.

The Algarve coast, particularly the Ria Formosa lagoon system, is characterised by a longstanding relationship between its communities and marine resources. For centuries, gathering oysters, clams, wedge clams and other bivalves has been an important economic activity and source of food. It has also generated large quantities of shell waste, which is generally discarded or sent for disposal after the shellfish have been eaten.

Although often regarded as waste or a by-product of little economic value, bivalve shells have chemical and mineralogical characteristics similar to those of the raw material traditionally used to produce lime. This composition gives them considerable potential for use in sustainable construction, particularly in lime mortar formulations and earth building systems such as rammed earth and adobe.



Fig. 38
Detail of bivalve shell in a lime-and-sand adobe block from a house dating from 1925. Monte Gordo, Vila Real de Santo António
Credit: José Lima

The region's lime kilns used locally quarried limestone, which was burnt for several days in wood-fired kilns. This process produced quicklime, which was then hydrated by adding water to obtain air lime, widely used in mortars, renders and limewash (Aguiar 2002: 201–206).

Calcium carbonate is the main constituent of the limestone used in traditional lime kilns. When limestone is subjected to high temperatures (around 900 °C), it decomposes to produce calcium oxide (CaO), known as quicklime. Subsequent hydration produces slaked lime, or air lime, used in the preparation of mortars (Santos 208: 181).

Historically, lime was produced by burning locally sourced limestone. However, several coastal regions of the Mediterranean and Atlantic have records of seashells also being used as a raw material for lime production (Ferraz 2019). Although limestone was the predominant raw material for lime production in the Algarve, the chemical principle is exactly the same: calcium carbonate is the main constituent of both limestone and shells. This chemical similarity highlights the potential to put bivalve shells to use as a raw material compatible with traditional processes for producing lime-based binders and calcareous aggregates. They can therefore be considered a contemporary alternative to resources traditionally used in building.



Fig. 39
Lime-and-sand adobe blocks containing bivalve shell, from a house dating from 1925, being prepared for laboratory testing. Monte Gordo, Vila Real de Santo António
Credit: José Lima.

This chemical affinity may have enabled shells to be used in various forms in vernacular architecture. One application involved incorporating crushed shell as an aggregate in earth or lime mortars, serving a similar function to the calcareous aggregates traditionally used in renders and other finishes. Another practice involved finely grinding the shells, which contributed to the workability and stability of mortars, improving their physical and mechanical properties. Finally, through calcination, shells could provide a raw material for producing lime-based binders, using processes identical to those employed in traditional lime kilns.

The advantages may be particularly significant in earth construction. The performance of rammed earth and adobe depends on a balance between mechanical strength, water vapour permeability and the ability to regulate humidity inside buildings (Faria, Lima 2018). Introducing excessively rigid or impermeable materials, such as cements and high-strength hydraulic limes, causes cracking, moisture retention and accelerated deterioration of mortars. By contrast, calcareous materials behave in a way that is more compatible with traditional building systems (Mateus *et al.*, 2005). Incorporating crushed shell or material obtained by calcining shells can help improve certain physical, chemical and mechanical properties, reducing shrinkage and increasing the durability of finishes while retaining the water vapour permeability essential to earth buildings. (Jaquin, Augarde 2011: 37–52)

For experimental applications in earth construction, some studies recommend shell powders with a particle size below 0.5 mm to stabilise the material and ensure compatibility with the mineral composition of the earth used for building. In rendering mortars, shell particles up to 2 mm in size can achieve behaviour similar to that of the fine calcareous aggregates traditionally used. Crushed shell additions of between 5% and 15% of the volume of earth have shown promising results in laboratory tests, although they must always be adapted to the specific characteristics of the soils used (Bi *et al.* 2026).

At a time when construction is seeking solutions with a lower ecological impact, oyster shells and those of other bivalves offer a particularly interesting example of the interplay between tradition and innovation. Just as lime has been integral to the vernacular architecture of the Algarve for centuries, this marine waste can help develop more sustainable mortars and materials. Its value lies not only in its chemical similarity to air lime, but also in the potential to turn local waste into a resource compatible with circular economy principles, the conservation of built heritage and sustainable building practices.

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Alongside the technical, building and heritage benefits, there is an important environmental dimension. Reusing bivalve waste from the Ria Formosa reduces the amount of waste sent for disposal and promotes local networks for making productive use of resources. It also strengthens the connection between the Algarve's natural and built heritage, showing that coastal materials can play an important role in conserving and developing vernacular building techniques for contemporary construction.



Fig. 40
Masonry of sand-and-lime adobe blocks containing bivalve shell in a house dating from 1925. Monte Gordo, Vila Real de Santo António
Credit: José Lima

BIBLIOGRAPHY

AGUIAR, José (2002) — Cor e cidade histórica: Estudos cromáticos e conservação do património. Porto: FAUP.

BELLEI, Poliana; TORRES, Isabel; SOLSTAD, Runar; FLORES-COLEN, Inês (2023) — Potential Use of Oyster Shell Waste in the Composition of Construction Composites: A Review. Buildings, 13(6), 1546.

BI, Sheng; CHAO, Zeyu; FENG, Mingyang; *et al*. (2026) — Calcined oyster shell poder as a lime substitute in earthen building materials. Sci Rep 16, 27723.

FARIA, Paulina; LIMA, José (2018) — Cadernos de construção com terra 3: rebocos de terra. Lisboa: Argumentum.

FERRAZ, Eduardo; GAMELAS, José A.F.; COROADO, João; *et al*. (2019) — Recycling Waste Seashells to Produce Calcitic Lime: Characterization and Wet Slaking Reactivity. Waste Biomass Valor 10.

MATEUS, Luís; VEIGA, Rosário; BRITO, Jorge (2005) — Caracterização dos Revestimentos Tradicionais de Construções em Taipa no Barlavento Algarvio.

SANTOS, Marta (2008) — *A cal*. In AAVV. Materiais, sistemas e técnicas de construção tradicional. Contributos para o estudo da arquitectura vernácula da região oriental da serra do Caldeirão, p. 45-48. Faro: CCDR Algarve.

SANTOS, Marta (2008) — *Argamassas e revestimentos*. In AAVV. Materiais, sistemas e técnicas de construção tradicional. Contributos para o estudo da arquitectura vernácula da região oriental da serra do Caldeirão, p.104-117. Faro: CCDR Algarve.

SANTOS, Marta (2008) — *Fornos de cal*. In AAVV. Materiais, sistemas e técnicas de construção tradicional. Contributos para o estudo da arquitectura vernácula da região oriental da serra do Caldeirão, p.178-183. Faro: CCDR Algarve.

VEIGA, Maria do Rosário; AGUIAR, José; SILVA, António Santos; CARVALHO, Fernanda — Conservação e renovação de revestimentos de paredes de edifícios antigos. Lisboa: aLNEC, 2004.

JAQUIN, Paul; AUGARDE, Charles (2011) - Earth building. History, science and conservation. IHS BRE Press.

VEIGA, Maria do Rosário; AGUIAR, José; SILVA, António Santos; CARVALHO, Fernanda (2004) — Conservação e renovação de revestimentos de paredes de edifícios antigos. Lisboa: LNEC.



Fig. 41
Earth adobe blocks containing bivalve shell, from a house dating from the first half of the 20th century, being prepared for laboratory testing. Hortas, Vila Real de Santo António
Credit: José Lima



Fig. 42
House dating from 1925, with external walls built from sand-and-lime adobe blocks containing bivalve shell. Monte Gordo, Vila Real de Santo António
Credit: José Lima

Project and results

The central challenge of this residency was to demonstrate the viability and range of applications of oyster shell — a waste material generated locally in large volumes — without resorting to highly complex or technology-intensive industrial processes.

Internationally recognised for its high calcium carbonate ($CaCO_3$) content, oyster shell has considerable potential as an alternative raw material in sectors such as ceramics and sustainable construction. Since the value chain for this by-product is not yet firmly established in the region, the work was intended from the outset to focus primarily on demonstration, experimentation and awareness-raising.

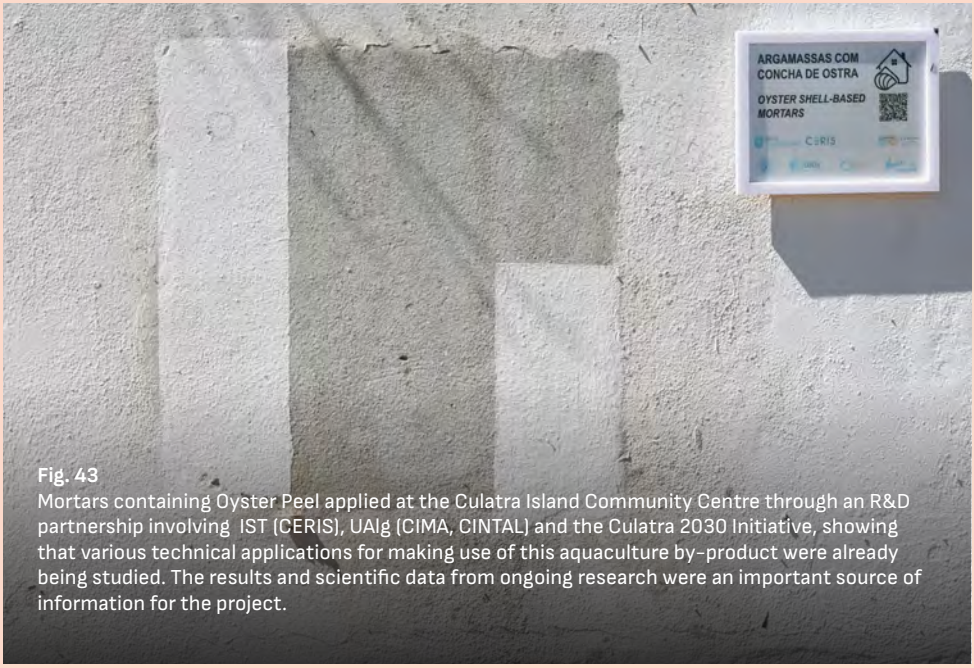


Fig. 43
Mortars containing Oyster Peel applied at the Culatra Island Community Centre through an R&D partnership involving IST (CERIS), UAlg (CIMA, CINTAL) and the Culatra 2030 Initiative, showing that various technical applications for making use of this aquaculture by-product were already being studied. The results and scientific data from ongoing research were an important source of information for the project.

To test the material's applications, two forms of processing were used: crushing the shell into granules and grinding it into a fine powder. André Pacheco (Culatra 2030 Initiative) and Sílvia Padinha (Culatra Island Residents' Association) helped with collecting and crushing the shell. The fine powder was produced in the ISE-UAlg laboratories under the guidance of Professor Miguel Oliveira, where different particle sizes were explored using ball mills and hand sieves.

The laboratory trials revealed significant operational challenges: processing 10 kg of shell to obtain just 1.5 kg of powder with a particle size of 0.25 mm was demanding and time-consuming. The high energy consumption involved in grinding, followed by the manual sieving required, raised questions about the process's sustainability at scale. This finding prompted a change of strategy: restricting the powder to ceramic applications, which require smaller volumes of material, and directing crushed shell towards natural building, where processing is minimal.

In trials with local ceramicists, incorporating oyster shell powder proved particularly effective in high-firing ceramic bodies, such as stoneware. The material produced a beneficial vitrification effect, allowing a reduction in sintering temperature and firing time.



Fig. 44
Formulation trial incorporating 40% raw oyster shell, combined with gloss glaze (30%), feldspar (20%) and kaolin (10%), fired at 1180 °C with ceramicist Leonel Telo (Monchique)



Fig. 45
Study of the behaviour of powdered and crushed shell incorporated into glazes applied to biscuit-fired tiles — Atelier de Azulejaria Aresta Viva

At Atelier Aresta Viva, ceramicist Rui Mascarenhas explored the artistic possibilities in low-fired ceramics. Although the shell offered no structural improvements in this area, promising aesthetic and textural effects were identified.

Physicochemical data shared by Instituto Superior Técnico (Professor Rui Silva and Professor Inês Flores-Colen), resulting from two years of research into this waste material, provided the scientific basis needed to proceed with natural building trials.

A Engenharia da Taipa carried out trials using compacted unfired earth with crushed shell added as a substitute for sand. The company first confirmed that there were no efflorescence problems and found that the material showed good mechanical stabilisation. The resulting formulation, containing ~30% oyster



Fig. 46
Preparing trials of oyster shell glazes applied to biscuit-fired tiles
— Atelier de Azulejaria Aresta Viva

shell, stands out for its capacity to incorporate very large quantities of material. For example, making the modular bench comprising two modules, presented in the rammed-earth chapter, uses approximately 485 kg of shell. The visible mineral fragments also give the result aesthetic value, opening up opportunities to use rammed earth containing oyster shell in other contexts.

In mortars and renders, trials replaced all the sand with crushed shell that had first been sieved into fractions equivalent to coarse and fine sand. Five test formulations (R4 to R8) combined oyster shell aggregate with different binders — natural hydraulic lime (NHL 3.5), hydrated lime and clay — and, in some cases, incorporated cane fibre as structural reinforcement.



In a preliminary assessment, oyster shell showed mechanical behaviour and workability entirely comparable to those of conventional sand.

The empirical results suggest a high level of viability and effective performance for these sustainable mortars.

The trials carried out during this residency demonstrated the technical and aesthetic viability of reusing oyster shell and highlighted its potential for use in large quantities in natural building. It is believed that these and other projects can help encourage the development of local circular economy networks, turning an environmental problem into a sustainable economic resource for the region.



Fig. 47
Crushing machine acquired by AMIC through the "Culatra 2020" initiative to support R&D projects in partnership with Instituto Superior Técnico



Fig. 48
Artistic exploration of the reaction of oyster shell in glazes with a crackle effect — Atelier de Azulejaria Aresta Viva



Fig. 49
Crushed and sieved oyster shell



Fig. 50
Applying a render containing lime, oyster shell and cane fibre during trials of mortar formulations, adhesion, workability and plasticity



Fig. 51
Rammed-earth display block containing oyster shell in the lower section

RAMMED-EARTH DISPLAY BLOCK CONTAINING OYSTER SHELL

Design / production: A Engenharia da Taipa

Recommended use: Interior architectural elements and decorative panels, street furniture

Composition and formulation: Compacted unfired earth incorporating ~30% crushed oyster shell (visible mineral aggregate)

Dimensions (H × W × D): 20 × 10 × 22 cm

Weight: 8 kg

Ordering enquiries:
A Engenharia da Taipa
geral@aengenhariadataipa.pt



Fig. 52
Rammed-earth display block containing oyster shell (uniform fill)

SUSTAINABLE OYSTER SHELL RENDERS (R6 TO R8 SERIES) — PROOF OF CONCEPT

Sector / market: Natural building and sustainable architecture

Researchers: Cláudia Martins and Susana Carmo Silva

Test objective: Assessment of the workability, adhesion and technical feasibility of wholly replacing natural sand with crushed and sieved oyster shell in different binder matrices, with and without plant-based reinforcement.

General properties observed: Excellent adhesion to the substrate and no cracking during the initial curing stage. The R7 and R8 mixes provide a uniform mineral finish, while formulation R6 has a rustic texture due to the plant fibre reinforcement.

Sample dimensions / scale: Panel specimens (30 × 15 cm).

R-series variations (composition and proportions):

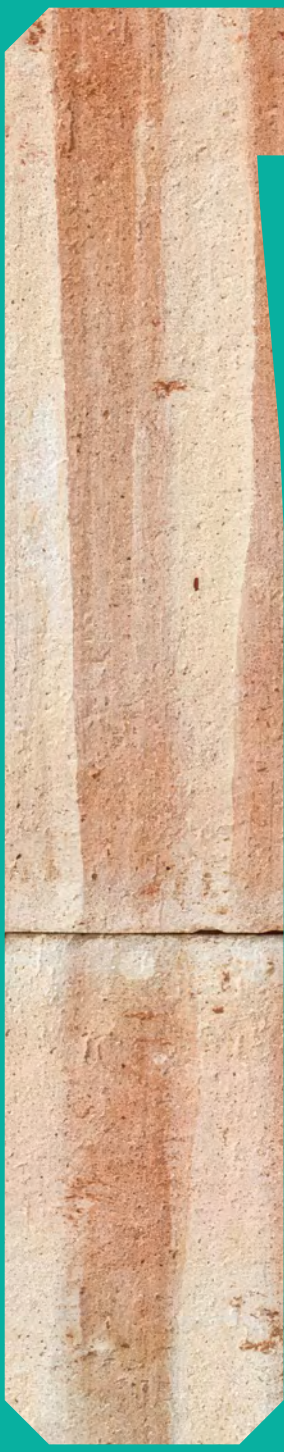
Reference	Primary binder	Mineral aggregate	Waste material content (excluding water)	Mineral aggregate
R6	Clay	Oyster shell + cane shavings	37.5% (oyster shell + cane)	Textured finish (plant-based reinforcement)
R7	Natural hydraulic lime (NHL 3.5) + hydrated lime	Crushed oyster shell	42.4% oyster shell	Uniform mineral finish (lime matrix)
R8	Clay	Crushed oyster shell	42.2% oyster shell	Uniform mineral finish (clay matrix)



Fig. 53
Render containing oyster shell and cane (from bottom to top)
R6 — Oyster shell, cane and clay;
R7 — Oyster shell, hydrated lime and NHL 3.5 hydraulic lime;
R8 — Oyster shell and clay

Tile-making workshops

The history, the project and results





Historical and cultural context – Traditional tile-making workshops

Traditional tile-making workshops embody the close relationship between place, geology and vernacular architecture in the Algarve. More than simply production sites, tile-making workshops transform clay into essential building components: roof tiles, bricks, floor tiles and ceramic pieces used in floors, roofs, walls and finishes. Their importance extends beyond production: these spaces preserve ancestral knowledge, practices and techniques that have shaped the region's built identity (Oliveira, Galhano 1992).

The location of tile-making workshops is directly linked to the presence of clays and clayey soils suitable for producing ceramic pieces. From the Costa Vicentina to the River Guadiana, the availability of clay-rich soils has supported the continuity of this activity. The Silves sandstone belt, with its reddish clays, and the valleys where clays of different colours are extracted provide the mineral raw material that, once prepared, is made into building products (Kopp 1989). Red clay, white clay and other local earths can be combined to achieve the required plasticity, colour and strength. This choice is both technical and sensory: before and during kneading, the artisan assesses the texture, moisture content, fineness and suitability of the clay body by touch.

Work in the tile-making workshop begins with extracting and selecting the clay. The raw material is transported, cleaned of impurities, crushed, mixed with water and kneaded to a uniform consistency. Before moulding, the mixture is left to rest so that moisture is distributed evenly and the clay body develops elasticity and workability. Moulding follows, often using wooden or iron moulds. Each piece is formed by hand, smoothed, cut and carefully removed from the mould.



Fig. 54
Mixture of sand and ash for molding the part

Floor tiles may bear hand marks, incisions or finishes made with fingers or styluses, giving each piece its distinctive character. The curve of roof tiles is formed using a special mould, known as a "galapo", and precisely repeated movements.

The tools used in tile-making workshops are simple but specialised: hoes, shovels, sieves, mixing troughs, workbenches, cutting wires, rulers, moulds, formers, trays, carts, kilns and kiln-stoking tools. Production depends as much on time as on technique. After moulding, the pieces must dry slowly in covered, ventilated areas outdoors. Drying is a critical stage: if it is too rapid, cracks appear; if it is insufficient, the piece may warp or break in the kiln. During drying, the artisan observes the piece's colour, weight, the sound it makes when tapped and any warping to decide when it is ready for firing.

Firing is the stage at which clay is permanently transformed into building ceramics. In traditional production, kilns are fuelled with firewood and other local fuels — pinecone husks and almond shells, rockrose and scrub — requiring control of temperature, duration and heat distribution. Firing continues for

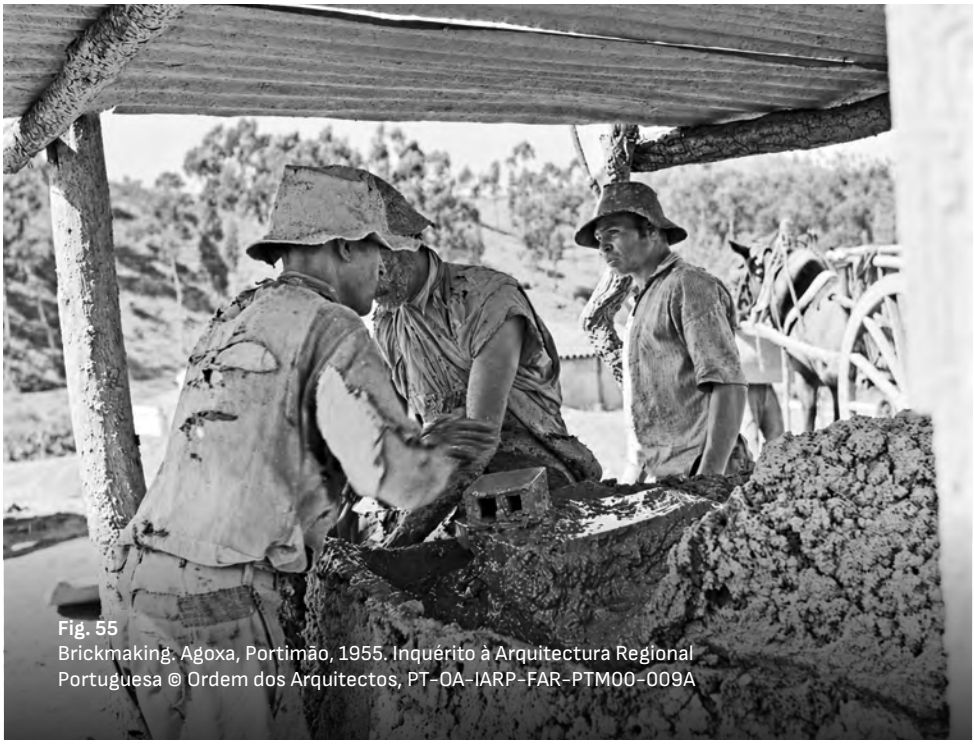


Fig. 55
Brickmaking. Agoxa, Portimão, 1955. Inquérito à Arquitectura Regional Portuguesa © Ordem dos Arquitectos, PT-OA-IARP-FAR-PTM00-009A

many hours without interruption, with constant adjustments by the master tile maker and kiln stokers. Small variations produce differences in strength, colour and texture. Handmade pieces are therefore rarely completely uniform: they have subtle variations in colour, irregularities and marks that reveal their handmade origins and the natural behaviour of the material. Far from being defects, these characteristics are part of their identity (Pires Martins *et al*, 1961).

The kiln consists of a combustion chamber, about two metres below ground level, and a firing chamber, where the pieces are loaded. The two chambers communicate across their full extent, allowing a column of flame to pass freely between them. Firing begins gradually, allowing the entire structure to heat up slowly. This is followed by the stoking stage, when the kiln reaches temperatures of around 1000 °C and operates continuously for 24 hours. This direct flow of flame allows hot air to circulate freely through all the courses of pieces, which have been arranged and stacked beforehand. Depending on the size of the tileworks, these traditional kilns can usually fire around 15,000 pieces per kiln load (Santos 2008:177).



Fig. 56
Brick drying in the sun. Pinhal, Albufeira, 1955. Inquérito à Arquitectura Regional Portuguesa © Ordem dos Arquitectos, PT-OA-IARP-FAR-ABF00-013

The products of tile-making workshops have many applications in the Algarve's vernacular architecture. Clay roof tiles define the landscape of pitched roofs, protecting buildings from the weather and helping to ventilate homes and improve their thermal performance. Solid bricks in a variety of shapes and sizes form walls, arches, vaults, chimneys, ovens and other building elements. Floor tiles and terracotta paving tiles cover indoor and outdoor floors, providing strength and easy maintenance. Together, these materials establish a Mediterranean building language, complemented by limewashed surfaces, the use of schist and earth, and the incorporation of plant materials (Oliveira, Galhano 1992).

The influence of tile-making workshops on the Algarve's architecture goes beyond the availability of materials. It is also evident in the scale of the pieces, the structure of roofs and vaults, the design of eaves, the texture of floors, and the continuity between craft production and the finished building. The master builder understood the possibilities and limitations of the available products: how to lay a roof tile, correct slopes, combine brick with lime mortar, and protect junctions and edges. The tile-making workshop and the building site were part of the same system of knowledge. Local production met immediate building needs and facilitated the repair, replacement and maintenance of buildings.

Safeguarding tile-making workshops is therefore a matter of heritage and culture. When a facility closes, more than a workshop is lost: so too is knowledge of raw materials and extraction sites, the preparation of clay bodies for moulding, production processes, building methods and the making of pieces in their traditional forms. The Algarve's vernacular architecture owes part of its identity to this network of craft production. Valuing and safeguarding tile-making workshops means recognising that the quality of vernacular architecture depends as much on the material processes that make a building possible as on the building itself.

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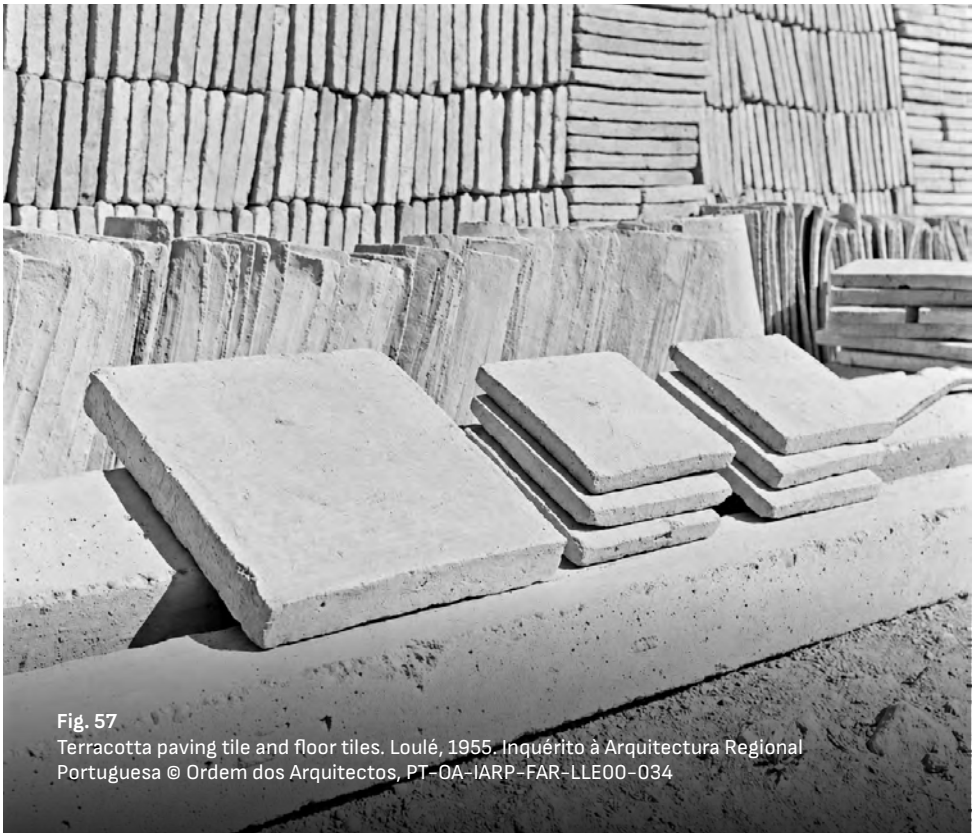


Fig. 57
Terracotta paving tile and floor tiles. Loulé, 1955. Inquérito à Arquitectura Regional Portuguesa © Ordem dos Arquitectos, PT-OA-IARP-FAR-LLE00-034

BIBLIOGRAPHY

PIRES MARTINS, Artur; CASTRO, Celestino de; TORRES, Fernando (1961), "Zona 6 — Algarve", in Arquitectura Popular em Portugal. Lisboa: Sindicato Nacional dos Arquitectos.

OLIVEIRA, Veiga de Oliveira, GALHANO, Fernando (1992) — Arquitectura tradicional portuguesa. Lisboa: Publicações Dom Quixote.

SANTOS, Marta (2008) — *Telheiros*. In AAVV. Materiais, sistemas e técnicas de construção tradicional. Contributos para o estudo da arquitectura vernácula da região oriental da serra do Caldeirão, p.170-177. Faro: CCDR Algarve.

KOPP, Erwin (1989) — Os solos do Algarve e as suas características. Direção Regional de Agricultura do Algarve.

Project and results

The residency explored different aspects and objectives in its work with tile-making workshops. One aim was to explore new designs and applications for traditional tile-making workshops without significantly changing their existing craft production processes. The other was to follow the innovation process at a tileworks whose strategy focuses on diversifying products and markets for handmade ceramics.

The team focused its work on the three traditional tile-making workshops still operating in the Santa Catarina da Fonte do Bispo area: Alberto Rocha, Fernando Faustino and Vidal Brito. It also worked with Heritage Clay Tiles, formerly Roficer, a family-run factory on the outskirts of Tavira, currently expanding and innovating and primarily producing glazed clay pieces.



Fig. 58
Moulding the textured tile



Fig. 59
Painting with white-clay slip

The common starting point for the work with Santa Catarina's traditional tile-making workshops was the 30 × 15 cm tile, one of their most widely produced items.

Two variations were created from the same geometry: in one, a texture of fine lines covers a triangular area of the surface, creating an interplay of relief, light and shade; in the other, the same area is coated with "cré", a white-clay slip that introduces a tonal contrast. The simplicity of the design allows the tiles to be combined and oriented in various ways, creating different compositions and patterns.

The challenge of creating a piece with traditional tile-making workshops for a new architectural application led to a set of shapes that increases the tiles' modularity and therefore the range of possible combinations in surface coverings. It also enables more three-dimensional uses, particularly in openwork vertical screens.



Fig. 60
Openwork brick and forming frame (gavieira)

These elements have proven effective in climates such as the Algarve's: they filter solar radiation while allowing natural ventilation and greater privacy without losing the connection to the outdoors. When in contact with water, they also provide evaporative cooling.

Taking the 20 × 20 cm square tile as the starting shape, it was subdivided into 3 parts: a central circle with a radius of 10 cm and two surrounding elements resulting from this "subtraction". The dimensions of this tile series (2 cm thick) allow countless combinations with pieces already in the catalogue: the 20 × 20 tile itself, as well as the 10 × 10 and 20 × 5. For the three-dimensional piece, the "subtracted" rectangular shape was used: the element remaining after removal of the central circle. Giving it a thickness similar to that of a traditional solid clay brick increases its potential for use in vertical surfaces.

Arranging these pieces in different combinations makes it possible to create dividing screens, floor drainage channels, bench bases and even bottle racks.

Development involved drawing, making moulds, producing prototypes and carrying out successive drying and firing trials. The clay and main production methods used in the tile-making workshops were retained so that the new designs could become part of everyday work without requiring fundamental changes to production.

Experimentation was necessarily slow. Around two weeks can elapse between making a piece, drying it and firing the next kiln load. Each result was therefore important for understanding how the pieces behaved and for adjusting shapes, dimensions, thicknesses and textures in subsequent trials.

One of the main challenges was working with the particular characteristics of clay, the unpredictability inherent in craft production, and the variability of drying and firing. The "art of loading the kiln" is just as decisive, if not more so. The position of pieces in the kiln affects the result: those in the lower sections bear greater loads because of the weight of pieces stacked above them, so more fragile pieces tend to be placed higher up. The final colour also varies according to the temperature reached and exposure to smoke inside the kiln.

Preparing and arranging each kiln load depends heavily on the workers' experience, but there is always an element of uncertainty, itself a characteristic of this craft production method.

The project produced a collection of pieces that expands the possibilities for arranging and using Santa Catarina clay while preserving its identity and traditional manufacturing methods.



Fig. 61
Square tile and circle undergoing testing

Relatively simple changes – new shapes made with moulds, selective surface treatments and different ways of combining the pieces – introduced a more contemporary design language without departing from the existing process. The new designs thus retain a direct connection with the tradition of tile-making workshops while opening up further applications in contemporary architecture and interior design.



Fig. 62
Drying the pieces

The results showed potential for commercial use, in a market where architects and designers seek distinctive ceramic pieces that can give spaces a sense of identity. Here, the connection to the region adds value: references to the local landscape and flora are reinterpreted through a contemporary graphic language rather than used literally.

Two tile designs were developed for Heritage Clay Tiles, responding to its need to enhance product design using the hydraulic press recently installed at the factory. The designs drew inspiration from local natural features, particularly the rockrose flower and the undulating forms of the Serra do Caldeirão.

The first design is a 10 × 10 cm tile with a stylised rockrose petal in low relief. The second is a series of three 15 × 15 tiles that combine to create curved lines inspired by the upland landscape. The pieces have a glazed finish and can be produced in the colours available in the factory's catalogue. One of the main challenges was adapting the moulds to the hydraulic press, requiring several adjustments and trials before suitable prototypes were achieved.



Fig. 63
Presses for the "Esteva" and "Serra" tiles



Fig. 64
Group of demoulded pieces



TEXTURED TILE

Type: Ceramic tile

Design: Alexandra Gonçalves

Production: Santa Catarina tile-making workshops (Alberto Rocha, Vidal Brito)

Recommended use: Floors and walls (outdoors and indoors)

Materials and composition: Santa Catarina clay fired in a traditional kiln

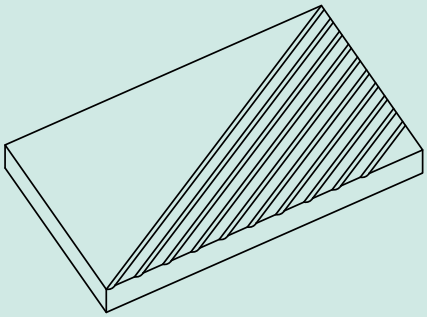
Finish / texture: Natural — textured

Dimensions (L × W × H): 30 × 15 × 1.8 cm

Weight: Approx. 1500 g

Ordering enquiries:
TELHEIRO ALBERTO ROCHA:
geral@albertorocha.pt

TELHEIRO VIDAL BRITO:
mail@vidalbrito.com



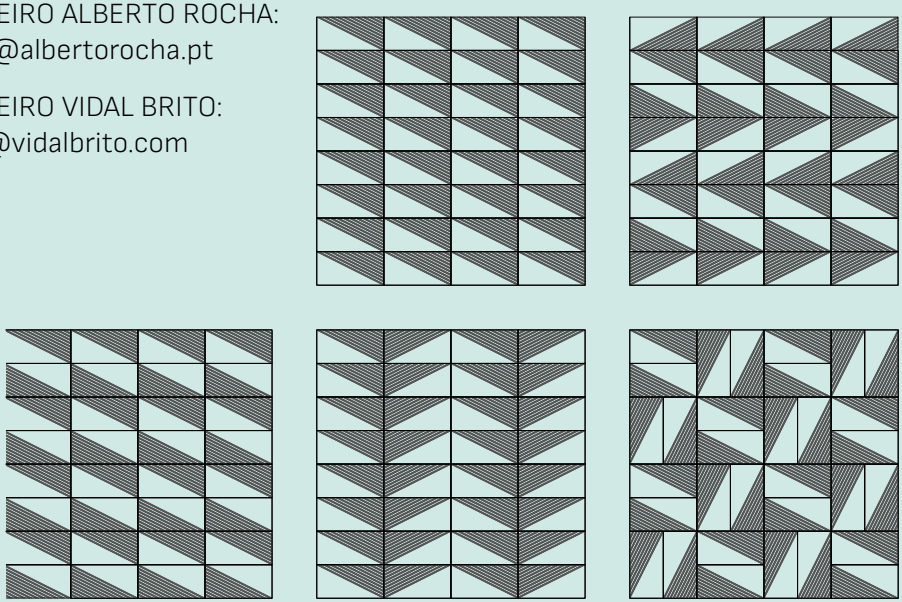


Fig. 65
Textured tile



Fig. 66
Textured tile



Fig. 67
Textured tile

PAINTED TILE

Type: Ceramic tile

Design: Alexandra Gonçalves

Production: Santa Catarina tile-making workshops (Alberto Rocha, Vidal Brito)

Recommended use: Floors and walls (outdoors and indoors)

Materials and composition: Santa Catarina clay fired in a traditionalkiln

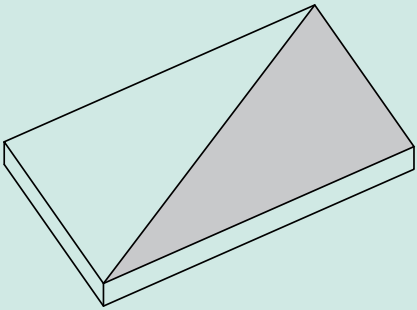
Finish / texture: Natural — painted with white-clay slip

Dimensions (L × W × H): 30 × 15 × 1.8 cm

Weight: Approx. 1500 g

Ordering enquiries:
TELHEIRO ALBERTO ROCHA:
geral@albertorocha.pt

TELHEIRO VIDAL BRITO:
mail@vidalbrito.com



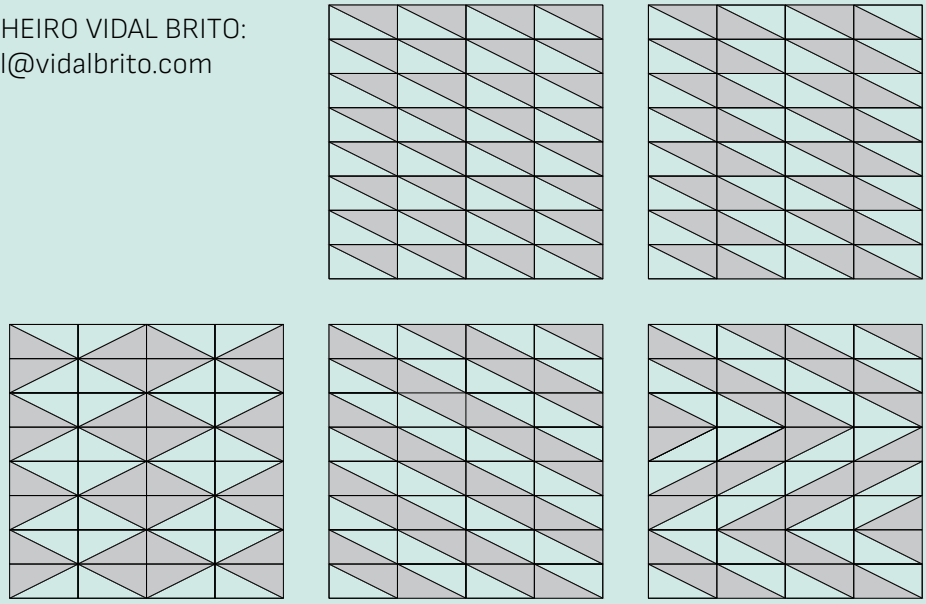


Fig. 68
Painted tile



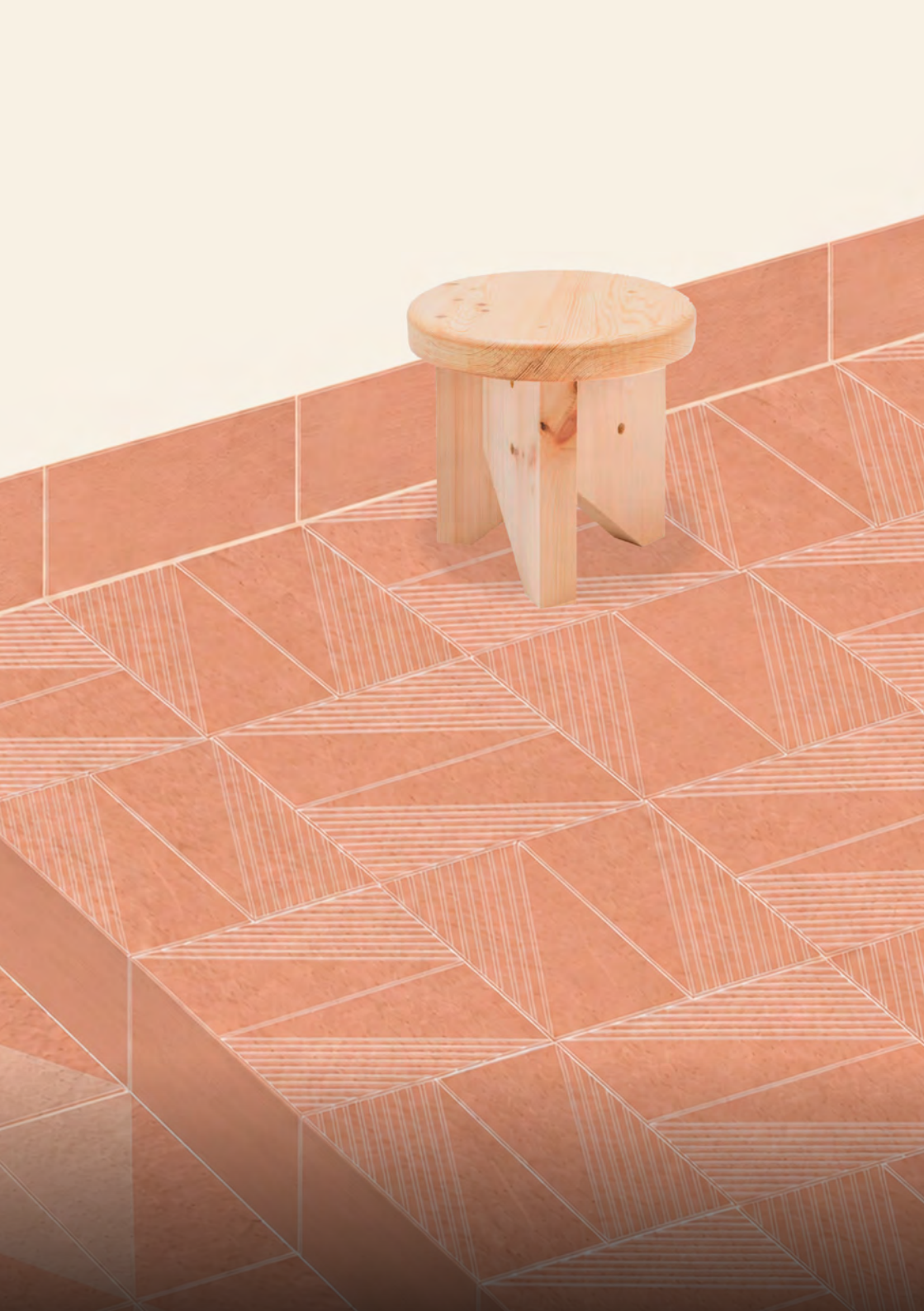
Fig. 69
Painted tile



Fig. 70
Painted tile



Fig. 71
Pattern arrangement of the 30 × 15 tiles



SQUARE TILE AND CIRCLE

Type: Ceramic tile

Design: Perto Arquitetura

Production: Santa Catarina tile-making workshops (Alberto Rocha, Vidal Brito)

Recommended use: Floors and walls (outdoors and indoors)

Materials and composition: Santa Catarina clay fired in a traditional kiln

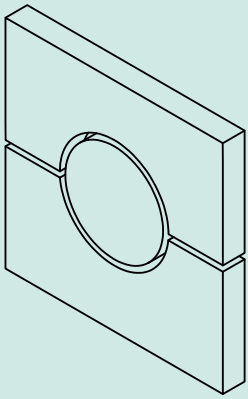
Finish / texture: Natural

Dimensions (L × W × H): 20 × 20 × 2 cm

Weight: Approx. 1250 g

Ordering enquiries:
TELHEIRO ALBERTO ROCHA:
geral@albertorocha.pt

TELHEIRO VIDAL BRITO:
mail@vidalbrito.com



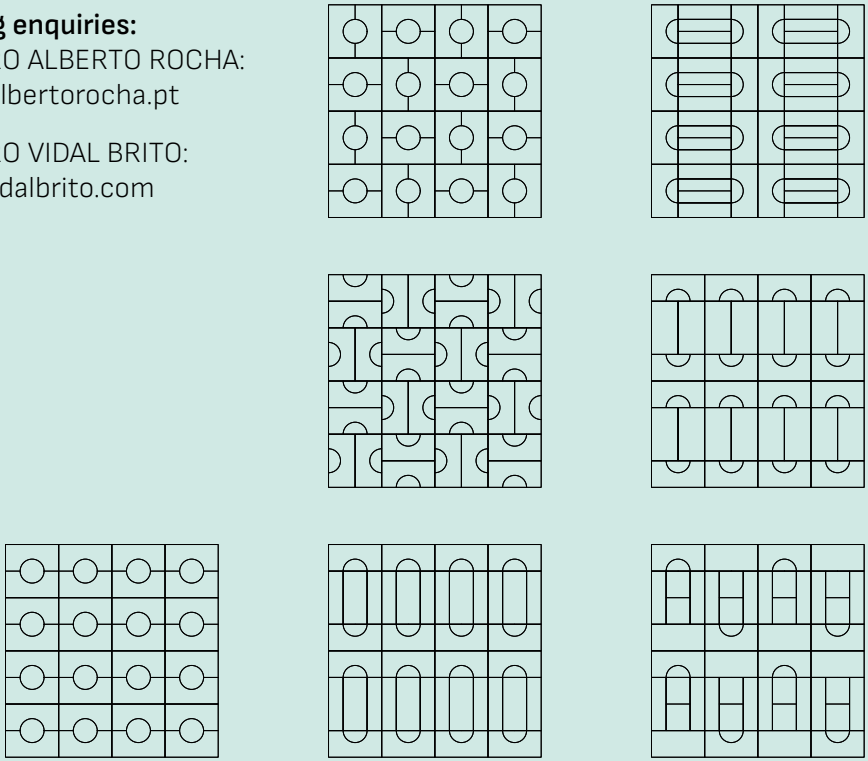


Fig. 72
Square tile and circle



Fig. 73
Square tile and circle and Half-circle openwork brick

HALF-CIRCLE OPENWORK BRICK

Type: Openwork clay brick

Design: Perto Arquitetura

Production: Santa Catarina tile-making workshops (Alberto Rocha, Vidal Brito)

Recommended use: Vertical screens in various arrangements

Materials and composition: Clay from Santa Catarina fired in a traditional kiln

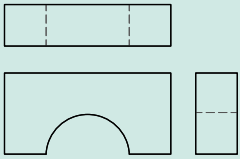
Finish / texture: Natural

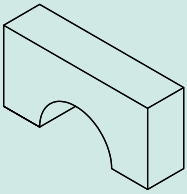
Dimensions (L × W × H): 20 × 10 × 5 cm

Weight: Approx. 1100 g

Ordering enquiries:
TELHEIRO ALBERTO ROCHA:
geral@albertorocha.pt

TELHEIRO VIDAL BRITO:
mail@vidalbrito.com





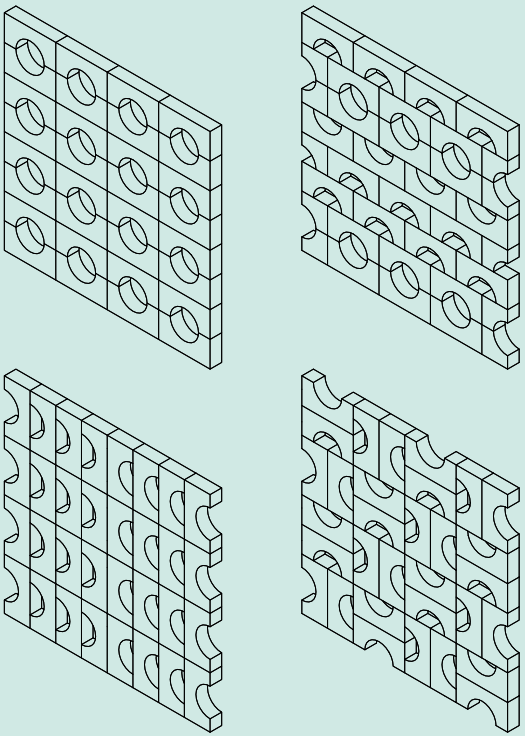


Fig. 74
Tijolo vazado 1/2 círculo



Fig. 75
Square tile and circle

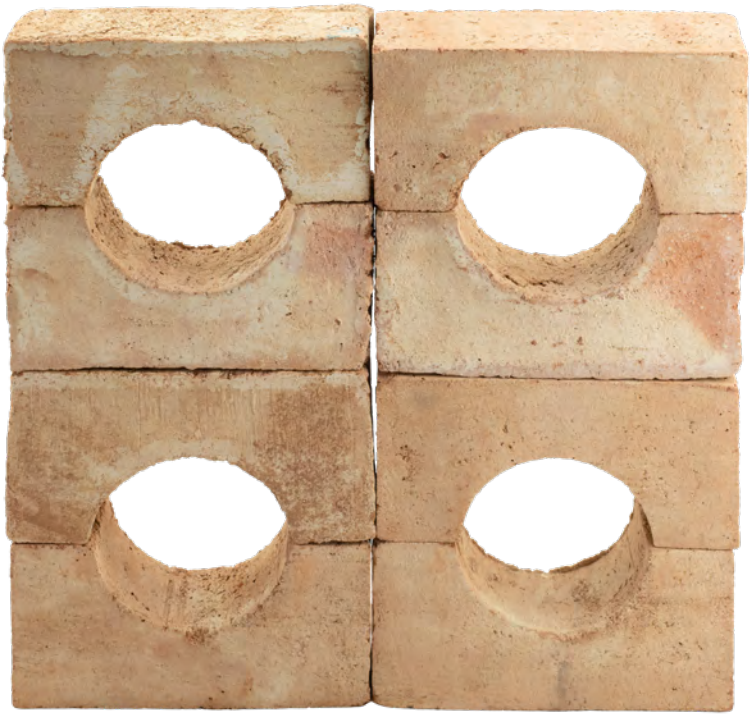


Fig. 76
Half-circle openwork brick (arrangement)



Fig. 77
Pattern arrangement of the square tile and circle and the half-circle openwork brick



ROUNDED OPENWORK BRICK

Type: Openwork clay brick

Design: Perto Arquitetura

Production: Santa Catarina tile-making workshops (Alberto Rocha, Vidal Brito)

Recommended use: Vertical screens in various arrangements

Materials and composition: Clay from Santa Catarina fired in a traditional kiln

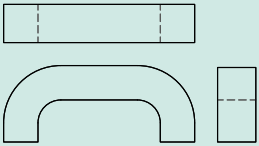
Finish / texture: Natural

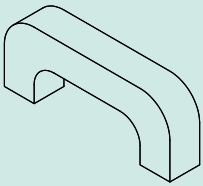
Dimensions (L × W × H): 25 × 10 × 5 cm

Weight: Approx. 1000 g

Ordering enquiries:
TELHEIRO ALBERTO ROCHA:
geral@albertorocha.pt

TELHEIRO VIDAL BRITO:
mail@vidalbrito.com





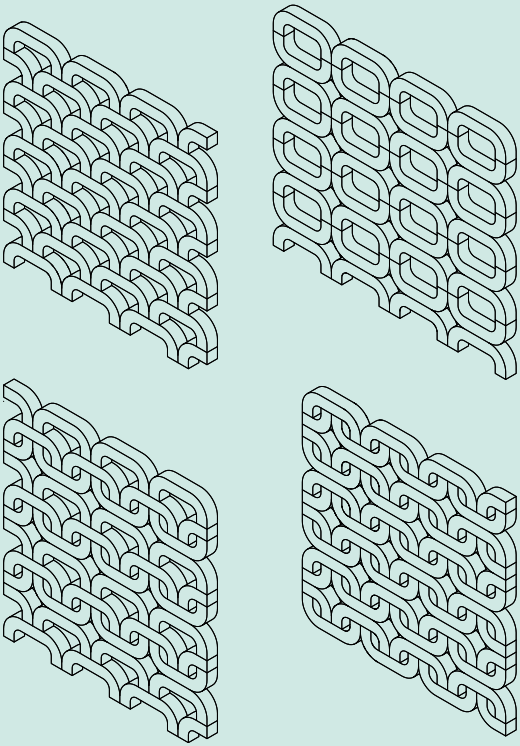


Fig. 78
Rounded openwork brick



Fig. 79
Rounded openwork brick



Fig. 80
Rounded openwork brick (arrangement)

ESTEVA TILE

Type: Ceramic tile

Design: Alexandra Gonçalves

Production: Heritage Clay Tiles (Roficer)

Recommended use: Surface coverings (indoors and outdoors)

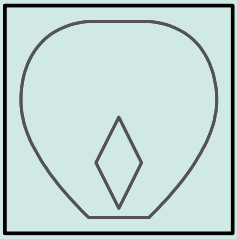
Materials and composition: Blend of local clay and clay from elsewhere in Portugal

Finish / texture: Glazed (catalogue colours)

Dimensions (L × W): 10 × 10 cm

Weight: Approx. 160 g

Ordering enquiries:
HERITAGE CLAY TILES (ROFICER):
comercial@heritagetiles.pt



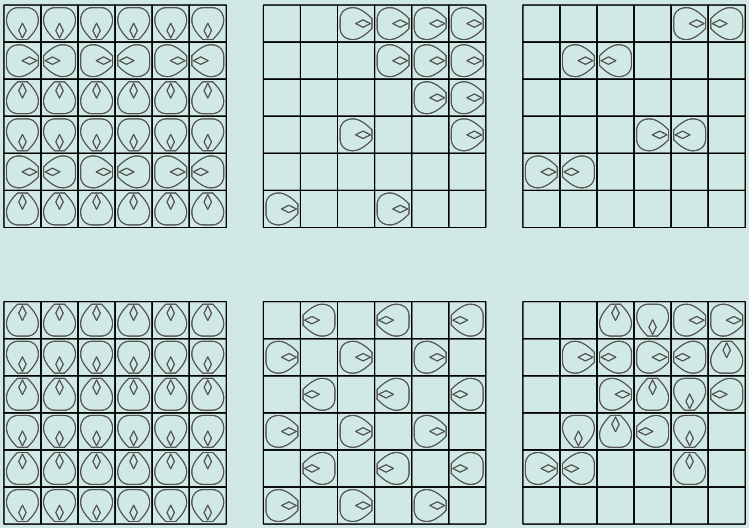


Fig. 81
Esteva tile



Fig. 82
Esteva tile



Fig. 83
Esteva tile

SERRA TILE

Type: Ceramic tile

Design: Alexandra Gonçalves

Production: Heritage Clay Tiles (Roficer)

Recommended use: Surface coverings (indoors and outdoors)

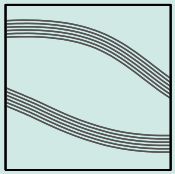
Materials and composition: Blend of local clay and clay from elsewhere in Portugal

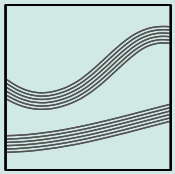
Finish / texture: Glazed (catalogue colours)

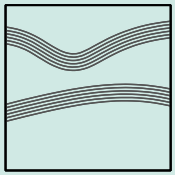
Dimensions (L × W): 15 × 15 cm

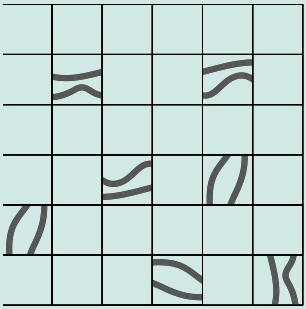
Weight: Approx. 320 g

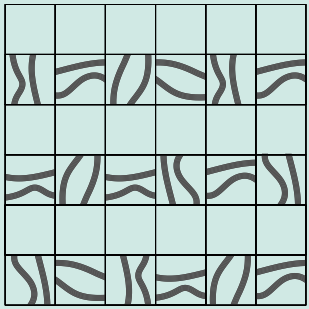
Ordering enquiries:
HERITAGE CLAY TILES (ROFICER):
comercial@heritagetiles.pt











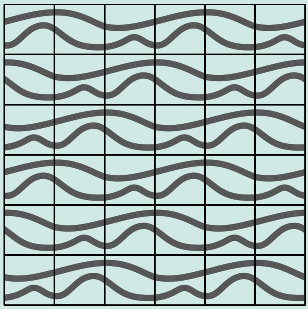


Fig. 84
Serra tile



Fig. 85
Serra tile



Fig. 86
Serra tile

Rammed earth

The history, the project and results





Historical and cultural context – Rammed earth

Rammed earth is a building technique using compacted unfired earth that has a central place in southern Portugal's vernacular architecture. In the Algarve, it forms part of a building culture shaped by adaptation to the Mediterranean climate, economy of means and careful use of locally available resources (Pires Martins et al., 1961). More than simply a way of building walls, rammed earth expresses a profound relationship between material, craft and place. Construction involves a series of practical decisions: selecting the earth, preparing the mix, erecting the formwork panels, compacting in layers, protecting the surfaces and ensuring maintenance over time.

The expertise of master rammed-earth builders was based on a sensory and technical understanding of the raw materials. Before any formal design, the earth was assessed: its colour, texture, damp smell and content of organic matter, grains, small stones, sand, silt and clay. The ideal earth for rammed-earth construction is neither pure clay nor loose sand. It requires a balance between fine particles, which provide cohesion, and coarser material, which reduces shrinkage and increases stability. Earth with too much clay may crack as it dries; earth that is too sandy may lose cohesion (Fernandes, Correia 2005). The master builder therefore adjusted the mix empirically, combining accumulated experience with simple tests by hand: squeezing a damp handful, checking whether it holds its shape, and observing how it breaks, dries and responds to impact (Rocha 2015: 36).



Fig. 87
Detail of rammed earth

Construction almost always began with preparation of the base. The earth wall needed protection from ground moisture, so rammed earth was commonly built on a stone or masonry plinth to protect it from rising damp and rain splash. The formwork panels were then erected. This removable formwork, usually made of timber, consisted of boards, crosspieces, uprights, wedges and clamps. Earth was placed inside the formwork in successive layers, slightly damp and sufficiently plastic to compact, but not waterlogged. Compaction was carried out with hand rammers, using repeated, rhythmic vertical movements that required strength, coordination and experience (Oliveira, Galhano 1992).

The tools were simple, robust and suited to collective work: shovels, hoes, baskets, buckets, mallets, rammers, string lines, plumb lines, levels, squares and the formwork panels themselves. Simplicity did not mean a lack of skill. On the contrary, construction required precise control of thickness, alignment, verticality and corners, the wall junctions and the integration of doors and windows. Openings were vulnerable points because they interrupted the continuity of the wall; they needed compatible lintels, jambs and edge details. Corners and wall tops also required particular attention, as the structure's overall strength and protection from water depended on them.

The working movements were decisive in determining the final quality of the construction. The earth was deposited, spread, levelled and rammed until it became dense. The rammed-earth builder could tell when a layer was sufficiently compacted from the sharp sound of the rammer, the resistance felt through the arms and the appearance of the surface. The wall was built in courses, with each section determined by the dimensions of the formwork panels. Removing the formwork revealed the horizontal traces of the process: different layers of earth, slight colour variations, mineral inclusions and a dense, sometimes irregular texture that reveals the manual nature of construction. This layering is now valued for its beauty, but originated in practical necessity.



Fig. 88
Tamping the earth into the retaining wall **Monte das Pitas, Silves, 1955. Inquérito à Arquitectura Regional Portuguesa © Ordem dos Arquitectos, PT-OA-IARP-FAR-SLV00-007**

Understanding the local context of the raw materials is essential to understanding rammed earth in the Algarve. The Algarve is not a homogeneous region: its coast, Barrocal and uplands have distinct soils, rocks, vegetation and climatic conditions. In the uplands and transitional areas, where earth and rocky soils coexist, rammed earth is often combined with stone plinths, mixed masonry, earth or lime renders and clay-tiled roofs. In coastal areas, rammed earth appears to have been less common, giving way to adobe blocks, which required larger quantities of sand and water to make.

The availability of local materials determined the building solutions. People built with what was close at hand, reducing transport and costs while maintaining continuity between landscape, materials and construction.

Technically, rammed earth is characterised by solid, monolithic walls of considerable thickness — usually 50 to 60 cm — and excellent thermal inertia. The material's ability to store heat and release it slowly helps regulate the temperature inside the house: during the day, the wall absorbs thermal energy; at night, it releases it gradually. In the Algarve's climate, with its hot, dry summers, this property contributes to indoor comfort. Earth also helps regulate ambient humidity, provided the wall remains permeable to water vapour and is not covered with incompatible finishes. Mineral renders made with lime or earth, limewash and eaves therefore play a decisive role in the durability of earth building systems (Faria, Lima 2018).

The main vulnerability of rammed earth is prolonged exposure to water in its various states. A properly constructed earth building can last for centuries, but its durability depends on clear building principles: suitable foundations protected from damp, effective protection against moisture ingress, correctly detailed openings, effective roofs and eaves, compatible finishes and regular maintenance.

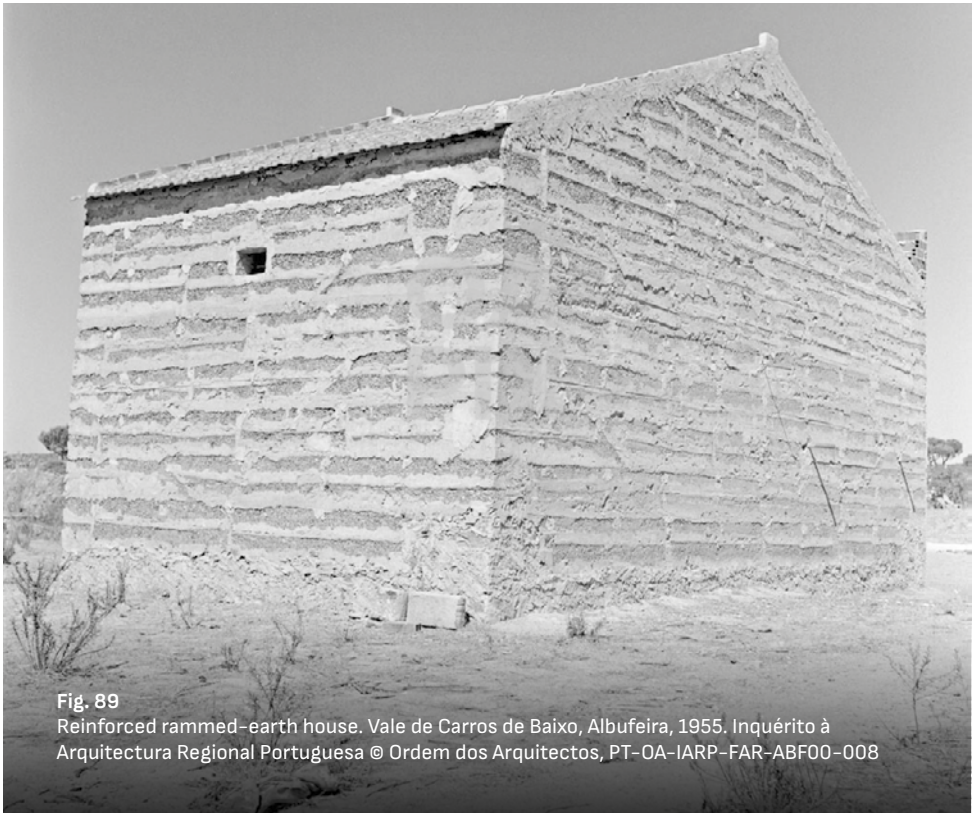


Fig. 89
Reinforced rammed-earth house. Vale de Carros de Baixo, Albufeira, 1955. Inquérito à Arquitectura Regional Portuguesa © Ordem dos Arquitectos, PT-OA-IARP-FAR-ABF00-008

In the Algarve's vernacular architecture, rammed earth brings together architectural solutions that arise naturally from the material's own possibilities. The technique lends itself to continuous, linear wall surfaces of generous thickness. The detailing of openings — including thresholds, jambs and lintels — accommodates the necessary breaks in the walls while ensuring the strength required to support the roofs. Rammed-earth buildings are usually rendered with lime mortar and limewashed for greater durability. When exposed, however, the earth reveals a palette of natural tones that connects the building to the landscape (Pires Martins *et al*, 1961)

The lack of master rammed-earth builders and the interruption of hands-on transmission now make the proper conservation of this heritage more difficult. Rehabilitating a rammed-earth building involves more than repairing cracks or applying a new finish. It requires an understanding of the earth's composition, the nature of the defects, the compatibility of the mortars and the hygrothermal behaviour of the structure as a whole.

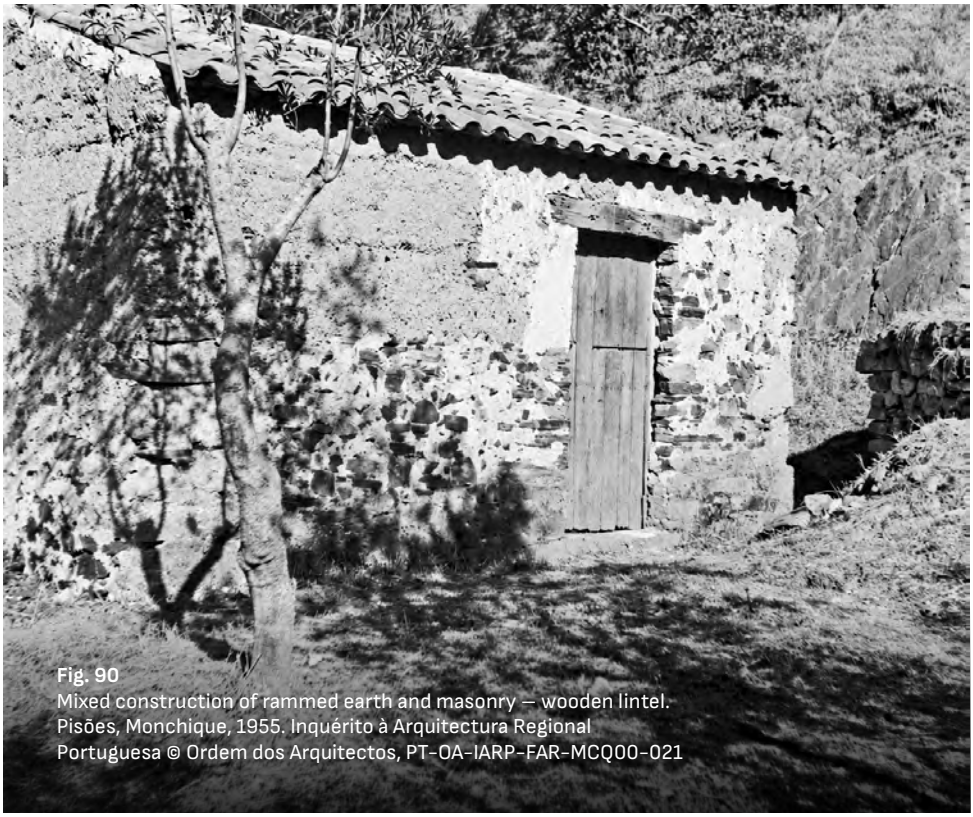


Fig. 90
Mixed construction of rammed earth and masonry — wooden lintel. Pisões, Monchique, 1955. Inquérito à Arquitectura Regional Portuguesa © Ordem dos Arquitectos, PT-OA-IARP-FAR-MCQ00-021

Excessively rigid and impermeable materials, such as cement-based mortars, can worsen defects by preventing moisture from evaporating and accelerating deterioration of the buildings.

Contemporary interventions must therefore combine technical research, respect for traditional solutions and practical workshop training.

Rammed earth is thus a seemingly simple technology, yet one of considerable sophistication in construction. By combining sustainability principles with architectural criteria, its use today promotes ecological construction deeply rooted in the cultural heritage of the region.

Marta Santos

BIBLIOGRAPHY

FARIA, Paulina, LIMA, José (2018) — Cadernos de construção com terra 3: rebocos de terra. Lisboa: Argumentum.

FERNANDES, Maria Lopes Aleixo, CORREIA, Mariana (Coords.) (2005) — Arquitectura de terra em Portugal. Lisboa: Argumentum.

MENDES, Miguel Ferreira Mendes (2023) — Cadernos de construção com terra 4: taipa. Lisboa: Argumentum.

MENDES, Miguel Ferreira Mendes (2023) — Cadernos de construção com terra 4: taipa. Lisboa: Argumentum.

VEIGA, Maria do Rosário; AGUIAR, José; SILVA, António Santos; CARVALHO, Fernanda (2004) — Conservação e renovação de revestimentos de paredes de edifícios antigos. Lisboa: LNEC.

MINKE, Gernot (2010) — Manual de construcción en tierra. Teruel: Ecohabitar S.L.

OLIVEIRA, Veiga de Oliveira, GALHANO, Fernando (1992) — Arquitectura tradicional portuguesa. Lisboa: Publicações Dom Quixote.

PIRES MARTINS, Artur; CASTRO, Celestino de; TORRES, Fernando (1961), "Zona 6 — Algarve", in *Arquitectura Popular em Portugal*. Lisboa: Sindicato Nacional dos Arquitectos.



Fig. 91
Formwork

Project and results

The results of the residency grew out of direct collaboration with the production company A Engenharia da Taipa, combining traditional technical know-how with experimentation and design innovation. The main challenge was to move rammed earth beyond its strictly structural role and develop a contemporary application that could support a modular production system suited to prefabrication, expanding the scale of its use and creating new market opportunities. The work involved creating street furniture using this traditional technique from southern Portugal, highlighting earth as a sustainable material with a low environmental impact and deep connections to the region's building identity.

The choice of application – street furniture for public spaces – provides a practical demonstration of the transformative potential of local resources and traditional techniques when applied to contemporary design.



Fig. 92
First layer of rammed earth on a concrete base

This approach offers a strategic proposal enabling municipalities and public bodies to adopt sustainable solutions with a low carbon impact that enhance the value of raw materials, cultural heritage and local building identity. Earth, an abundant resource that has not undergone industrial processing, thus becomes a driver of urban and regional regeneration.

The relevance and ambition of this proposal also extend beyond the public sector. By freeing rammed earth from its exclusively architectural and structural role through a system suited to prefabrication, a diverse range of opportunities opens up for the private market. These range from the hotel and tourism sector, which seeks outdoor furnishings that blend into the landscape and tell a local story, to corporate, residential and interior design projects seeking sustainable pieces with a strongly tactile, natural character.

Using rammed earth for street furniture brings particular challenges — exposure to outdoor conditions and the weight and size of the elements



Fig. 93
Unfired earth with a particle size distribution suitable for rammed-earth construction

— but also reveals qualities especially suited to this use: robustness, durability and the ability to age naturally, developing a character of its own over time. The starting point is a simple idea: a rammed-earth bench needs good boots and a good hat.

The most exposed areas — the base and upper surface — are protected by a thin layer of pigmented concrete. This extends the piece's durability without concealing the natural character of the earth and creates a subtle contrast between the raw material and the protective mineral finish.



Fig. 94
Mixing unfired earth with water and 5% cement in a standard concrete mixer



Fig. 95
Unfired earth

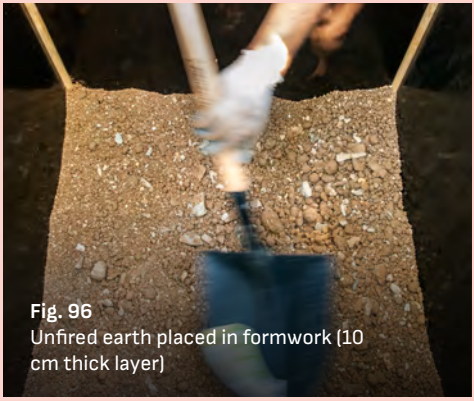


Fig. 96
Unfired earth placed in formwork (10 cm thick layer)



Fig. 97
Modular rammed earth bench in production.

1. MODULAR BENCH — HORIZONTAL EXPANSION

The first design is a modular bench conceived to expand horizontally by repeating the same rammed-earth element. Its length, shape and layout can be adapted to each space by alternating continuous seating modules with modules featuring circular cut-outs. These introduce breaks in the bench and can serve as small planting beds, shaded spots or support areas.

The same family of modules also produces standalone pieces, such as a square element with a circular cut-out that can serve as a planter or freestanding support. The system can therefore extend beyond a linear bench to accommodate different uses: gathering, resting, playing or complementary functions such as bicycle parking.

MODULAR RAMMED-EARTH BENCH

Type: Street furniture

Design: Perto Arquitetura

Production: A Engenharia da Taipa

Materials and composition: 90% compacted, stabilised unfired earth (gravelly soil and sand), with a water-repellent treatment and a concrete base with anchoring points for transport

Dimensions (L × W × H): 86 × 86 × 86 cm

Weight: ~675 kg (solid lower base) | ~400 kg (upper module with cut-out)

Ordering enquiries:
A Engenharia da Taipa
geral@aengenhariadataipa.pt

Fig. 98
Modular rammed-earth bench concept





Fig. 99
Modular rammed-earth bench installed in the Alameda Garden (Faro)



2. SEAT, TABLE AND LAMP — VERTICAL EXPANSION

The second design uses the same module and formwork to explore vertical repetition. A single module serves as a seat. Two stacked modules, with a tabletop added — for example, a wooden top fixed to an internal reinforcing structure — form a taller, narrower table, while a wider module with a larger top creates a second, lower table variant. As the system extends further upwards, it becomes a lamp, with an iron element at the top that caps and protects the piece while incorporating the lighting.

The same construction principle thus serves several functions — a seat, two table variants and a lamp — simply by changing the number, proportions and arrangement of modules. Rammed earth remains the common, structuring material, while wood and iron fulfil the specific roles of tabletop and protective cap.

The two designs share the same language, material and construction process, but explore two different forms of expansion — horizontal in the modular bench and vertical in the seat/table/lamp system — using a single set of formwork. This streamlines production without limiting the range of possible configurations.

SEAT/TABLE/LAMP SYSTEM

Type: Street furniture

Design: Perto Arquitetura

Production: A Engenharia da Taipa

Materials and composition: Seat: Rammed earth, concrete / Table: Rammed earth, concrete, iron, wood or stone / Lamp: Rammed earth, concrete, iron

Dimensions (L × W × H): Seat: 46 × 43 cm / Table: 46 × 73 cm / Lamp: 46 × 190 cm

Weight: approx. Seat: 120 kg / Table: 190 kg / Lamp: 250 kg

Ordering enquiries:
A Engenharia da Taipa
geral@aengenhariadataipa.pt



Fig. 101
Seat/table/lamp system



Fig. 102
Rammed-earth table system



Fig. 103
Rammed-earth table system

Concluding remarks

The experience of this residency and the projects it produced illustrate the many opportunities that local resources offer for innovative approaches addressing market needs, environmental challenges and the need to enhance cultural value.

Innovation was understood here in its most practical and collaborative sense: finding new answers to current problems by drawing on available resources in close cooperation with local stakeholders.

It is striking that some of the problems now driving the search for new applications for the Algarve's local materials did not exist in the recent past. Consider giant reed *(Arundo donax* L.*)*. Only a few decades ago, when rural activity was thriving, basket makers around Castro Marim rented land beside waterways to secure the raw materials for their craft. This example illustrates the balance that historically existed between the ecosystem and human activity. The loss of cane's economic value has turned it into a serious environmental problem: the lack of management and use allows dense growth to choke watercourses, increasing flood risk and biodiversity loss.

The eco-friendly block developed during this residency for wall infill and insulation, whose properties were validated in a test at ITECONS, demonstrates the technical feasibility of producing a stable, cohesive product from a cane composite. This solution meets growing demand in natural building and brings considerable environmental value by sequestering carbon and helping to control an invasive species.

Vernacular architecture, too, has always depended on local resources. Rammed-earth construction, using compacted local earth, gradually fell out of use. Despite renewed interest in sustainable building solutions, its structural use is now constrained by regulatory barriers. The approach tested involved adapting the technique to a new scale and use — street furniture — creating the conditions for prefabrication and opening up new market opportunities for businesses in the region.

Similar concerns about enhancing the value of intangible cultural heritage inspired applied innovation in traditional tile-making workshops. Although this residency's contribution focused on product design, much remains to be done to pass on knowledge and skills and strengthen the sustainability of this activity.

Rammed-earth construction and tile-making retain active production processes using local materials in architecture and sustainable building. Working with businesses in these sectors therefore produced prototypes ready to join their catalogues and be replicated.

For oyster shell and cane, the starting point was different: the aim was to demonstrate the potential to create a genuine value chain. In the case of oyster shell, its incorporation into rammed earth and rendering mortars demonstrated the feasibility of giving economic value to aquaculture waste, opening up prospects for future investment by local producers.

This focus on experimentation and demonstration is essential. Even where the necessary technical and industrial conditions are not yet fully in place, the proofs of concept and samples developed provide a tangible incentive to continue the work until products reach the market.

This residency does not exhaust the possibilities for innovation with these materials or the diversity of Algarve resources that could be put to productive use. Materials such as Churra sheep's wool, Silves sandstone, cork, sea salt and various by-products of the regional economy fully justify future rounds of research and development, opening up new possibilities for the region's materials.

Graça Palma — Proactivetur



Fig. 104
The spread of cane *(Arundo donax* L.*)* in the water channels at Fonte da Benémola illustrates the impact of invasive non-native species on the riparian ecosystem, altering the dynamics of native vegetation cover.



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Comissão de Coordenação e Desenvolvimento Regional do Algarve I.P.

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