



CEB

COMPRESSED EARTH BLOCKS

BIØN II - Follow-up report

By Oficinas do Convento and CRU atelier
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BIØN
Building Impact Zero Network



Erasmus+



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Opposite page

1. Completed structure from 2017. The mortar and wood still drying

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1. Same view from 2020. The wood visibly greyer in tone.

Compressed Earth Blocks (CEB) are built with raw earth, mechanically compressed into a mould. They are more commonly used in masonry walls, arches, vaults and domes. Depending on the composition, shape and dimension of the blocks it can also be used as cladding.

For the NESTS the blocks were used both as load and non-load bearing elements, making up the majority of the construction. Its proximity both to conventional and vernacular construction materials, as well as its flexibility in terms of infrastructure make the CEB an interesting option towards a lower environmental impact of the building industry.

Founded in 1996, Oficinas do Convento is a nonprofit organisation that works with a wide range of artistic, cultural and social projects. Following the transition of the ceramics and earth construction workshops to a different site in Montemor-o-Novo, there was a need to provide extra shelter to artists, architects and designers in residence.

Materials were mainly kilometre zero and produced on site which fomented interesting and much needed discussions on the environmental, economic and social implications of the act of building, the nature and amount of energy used as well as the importance of autonomy today.

The blocks were made through the help of a team of volunteers. The building ends up being a kind of a manifesto on CEB construction technique, with no introduction of any other load bearing material, except for the foundation which is a cyclopean concrete with local stone .

Vaults and domes' origins remain unclear. One common feature throughout different regions and cultures, however, is that, except for religious and/or buildings that hosted powerful institutions, these elements seem to be more common in places where access to timber is limited. In the past 200

years the notions of resource and availability have changed drastically due to industrialization and global mobility, overthrowing basic ideas such as the concept that a raw product should be cheaper than another that exists in the same amount and requires transformation, or that local resources are cheaper than those requiring transportation.

A main goal of the project was to empower participants through what is commonly considered a lost art – building arches and vaults – with a material that is both new and old, technological and analogue.

1. SOCIAL LANDSCAPE AND PLACEMAKING

A space of informal knowledge sharing and experimentation open for volunteers and workshops that perpetuate a place for learning while building for the community.

An informal construction school

After the Design and Build with CEB course was finished the building had just the structural work done. Foundations, walls, arches and vaults were completed in an intense learning process with one month of duration.

The building was continued in an appropriation process of volunteers and self proposed workshops and experiments that were proposed during the upcoming years. The building assumed a central role in the training and experiments of the Earth Lab - OC, acting as a "construction school" under the coordination of Oficinas do Convento team.

Four years on, the two bedrooms have been fully booked despite the work that is still to be completed, especially the carpentry, furniture and heating.

Mainly due to Covid-19 restrictions, the NESTS made up for a great alternative

to the closed dormitory at Oficinas do Convento, allowing many artists to continue their work.

There have been several workshops and training events happening since BION implemented the first workshop to build the CEB structure. Pavement in terracotta workshop, carpentry workshops, sgraffito workshop, as well as several volunteer events to place the roof, to paint the walls. Everything has been self made except for the outside windows and main door.

Volunteers in coordination with Oficinas do Convento have been using the project as a sort of "construction school" in a Learn by Building method. This method has had its pros and cons, namely:

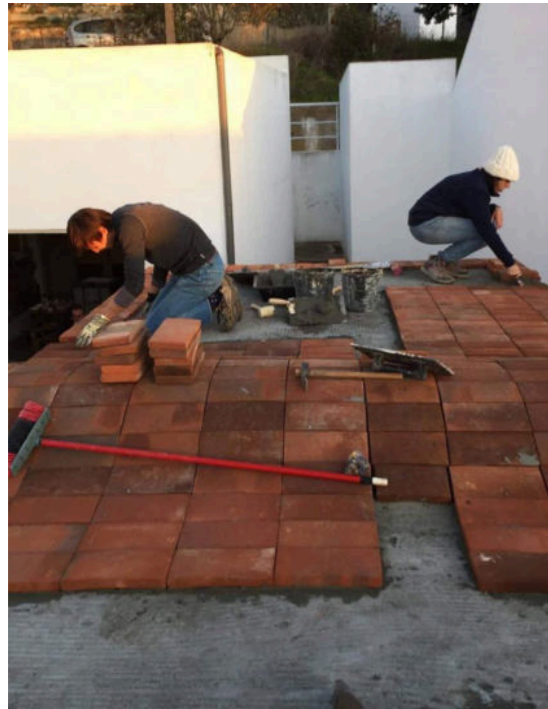
Pros:

- Enhances autonomy and team work collaboration;
- Allows for more experimental and creative techniques;

Cons:

- Errors of design and/or construction;
- Slower;





Along the years several artistic residents of Oficinas do Convento were host for different periods in different seasons inside "Ninhos". The building has been extremely useful during the pandemic since it allows artists to safely stay and work in an otherwise closed infrastructure.

User's feedback

In general the experience of living in Ninhos has been positive especially to the summer users and even considered essential to get deeper in the ceramic work while in residence. The thermal inertia of the walls makes the day when the temperature outside reaches 42°C. The fact that it is still a laboratory of experiments in construction makes it feel unfinished to some users. Finding the source of leakage that is the origin of the high humidity in winter time is crucial for the duration of the building. The need for better furniture and mosquito nets

together with blinders in the windows would make a substantial improvement in comfort. The craft details of different tiles design, of light bricks and of the sgraffito makes a special atmosphere together with the vaulted ceiling.

Cláudia Brito, 57, Portuguese, Lisboa

When did you live in The Nest?

August 2022

Where you alone? Yes

How long did you stay in The Nest?

One week

In general terms, how would you evaluate your experience while living in Ninhos?

Quite good

Did you feel any discomfort while living there?

No

Did you act to improve your living experience? How?

No. No need.

What are the most comfortable aspects while living there?

Insulation. It was very hot outside, while inside the Ninhos the temperature was always quite cool.

To improve the experience of the next users, what are your suggestions?

In terms of construction, none. Maybe some

improvement in terms of the furniture.
Cristina Gallizioli, 31, Italian, Italy

When did you live in The Nest?

I lived there twice

1) end of August till the end of October 2020

2) end of August and beginning of September 2021

Where you alone?

1st time I was alone, the second with my duo

How long did you stay in The Nest?

Two months and a half in total

In general terms, how would you evaluate your experience while living in Ninhos?

It's been a very good experience, I enjoyed a lot staying there

Did you feel any discomfort while living there?

At the end of October '20, after several rainy days, there were some leaks near the windows, but maybe now they are already repaired. Also, a general sensation of humidity in the walls when raining for a few days in autumn. Dogs barking was also quite loud in the night, I had to wear hear plugs.

Did you act to improve your living experience? How?

I added textile blinds on the windows, basic furniture in the space, left there three big pillows I sew.

What about comfort in general? What are the most comfortable aspects while living there?

I liked the contact and proximity with the earth and the floor tiles, I think it added a lot to bond emotionally with the space. The sensation of being surrounded by the vault. It felt like my own little bubble in the middle of the garden, at the same time very connected to lavadores.

To improve the experience of the next users, what are your suggestions?

I think 2 people max each time is enough, better if they know each other. And I wouldn't divide the space in two with walls, that would be too tight. I'd also like a bench just outside ninhos, near the door.

Have you participated in the construction of The Nest? How is your feeling when you come as a user after all the effort?

Yes I participated in the bricks making and workshop. I'm a bit claustrophobic so I wasn't sure about the size of the nests while designing and building. But I was positively surprised as a resident: it's actually a good dimension. And the summer comfort is working very well: in august I could feel fresh inside even in the middle of a 40° day. I liked to sleep there with all the memory of the nice people and group that built it, it made

me think of them.

Ralph Nashawaty, 37, Lebanese, M-o-N

When did you live in The Nest?

On and off since 2020

Where you alone? Yes

How long did you stay in The Nest?

A few weekends

In general terms, how would you evaluate your experience while living in Ninhos?

Very practical for intensive working times at OCT.

Did you feel any discomfort while living there?

It gets humid specially starting November till May. It needs to be heated in advance to dry out the place. Major leak of air from below the main door. It is missing blackout curtains, the natural light in the morning is annoying if you want to sleep more. The walls were losing pieces of plaster and it was falling on me while sleeping.

Did you act to improve your living experience? How?

Yes, added an improvised curtain, added bricks to fill out the gap under the door to avoid cold air from entering, used two mattresses on top of each other to make the bed more comfortable.

What are the most comfortable aspects while living there?

The coolness of the place in summer time

To improve the experience of the next users, what are your suggestions?

Curtains, hooks to hang clothes, a better door, a heater and dehumidifier to control the temperature and relative humidity, a big carpet for the winter, fix the windows leaks (both), add a furniture to organise clothes and other belongings, a more comfortable bed and bedding set, a comfortable 1 or 2 person sofa, fix the inner walls so they don't constantly loose dust and debris, dirtying the floor..

Have you participated in the construction of The Nest? How is your feeling when you come as a user after all the effort?

No, I just varnished the floor with linseed oil. The feeling is that there are misconceptions in the construction and it needs constant maintenance, which is not necessarily being done. It's a nice building, but the water proofing and roof in general is poorly done and will not protect the building. I have a feeling that it won't last long if there's no annual maintenance to the structure, and it's too bad as such a place is very much needed for residents working in OCT.



This page
1 & 2: Two different settings of the same space



Opposite page
1. Young resident playing with the morning sun.

Scenography for local artists

The Nests have been also part of two video works registered by video artists and film makers based on the region. The first was a fake ceramic competition for the annual festival Pre(o)cupada that during the COVID 19 pandemics was transferred to a TV show that was transmitted at national level during 48 hours. The results are still available on-line. The Nests appear as the scenography for the jury to express the private opinions on the work of the participants.



Another work filmed partially there was Nena, from the director Francisco de Campos, part of the work of a local theatre company Ruínas. In this film the space was pictured as the tiny house of one of the main characters. This medium film was exhibited at the local theatres.

Julia Reibel & Family, 35, German, Switzerland

When did you live in The Nest?
4 weeks in June 2022

Where you alone?

We were there in 4. Two adults, two kids, 1 and 4 years old

In general terms, how would you evaluate your experience while living in Ninhos?

We liked it a lot!! Also because I was part of the building team and Louise too.

Did you feel any discomfort while living there?

High humidity inside, Windows which you can't open while its really hot. I think there is a leak in the roof which you could easily find out when you put a temporary metal-board on the roof an see if its getting better.

To improve the experience of the next users, what are your suggestions?

I would suggest mosquito net for the widows. There where a lot.

Also some nice beds with proper mattress

would increase a lot the comfort.some proper furniture. It was a really really hot summer. for other terms would be nice to have a table and some shade outside to have the possibility to hang out a bit. Maybe also place where you can have some water without opening lavadouros or casa do poço.

What are the most comfortable aspects while living There?

The floor, and the bricks and the sgraffito and form and everything is really really beautiful!!!! The kids loved it also a looooot!!

They even didn't want to sleep in the beautiful Tânia house because ninhos is so cosy.

Have you participated in the construction of The Nest?

How is your feeling when you come as a user after all the effort? Im a bit sad about the state. It feels not finished yet but already falling down somehow.



Where the materials came from ?

FROM SITE ¹ 92%

The Compressed Earth Blocks' earth from a farm 1km away, the granite stones and gravels from a quarry 6km away for foundation's and correction of CEB granulometry, the handmade floor and roof tiles produces on site with clay from a farm 3km away.

LOCALLY ² 5%

The masonry mortar's and foundations' sand came from an extraction located 30km away. The windows and doors were made by a local craftsmen with national wood. The cement for the foundation and CEB stabilization came from 80km away. The cork granulate for the insulation plaster, the handmade expanded clay (a side product from a nearby industry) and the reused glass bottles that came from a nearby farm for the vaults light infill.

TRANSPORTED ³ 3%

The mortar's natural hydraulic lime and the plaster's aerial lime was produced nationally in a region 200km away. The roof waterproof membrane and the glass fiber mesh, the rebars for the foundation are from unknown production and might be imported.

¹ Village and surroundings (in a radius of 10km)

² Province (in a radius of 100km)

³ More than 100km far from the site
Percentages of the total volume of materials.



Type of material

EARTH 70%

Local earth mixed with 3% of cement being sun-dried. Local earth used to produce the floor tiles and roof tiles.

AGGREGATES 15%

Stones are the main component of the foundation. Gravels are also in the foundation mortar. Small gravels were added to the CEB mix for physical stabilization. Sand for the mortars and plasters.

BINDERS 7%

Natural Hydraulic Lime for the masonry mortar and some rough plaster. Cement for the CEB chemical stabilization. Aerial lime for finish plaster and sgraffito.

WOOD 5%

Wood was only used for formwork, so it can be reused and as a fuel material to cook the terra-cotta materials. It also the chosen materials for doors and windows.

OTHER 3%

Waterproof membrane, rebars and other metal, glass reused and new, pigment...

Issues with the construction after 5 years in use



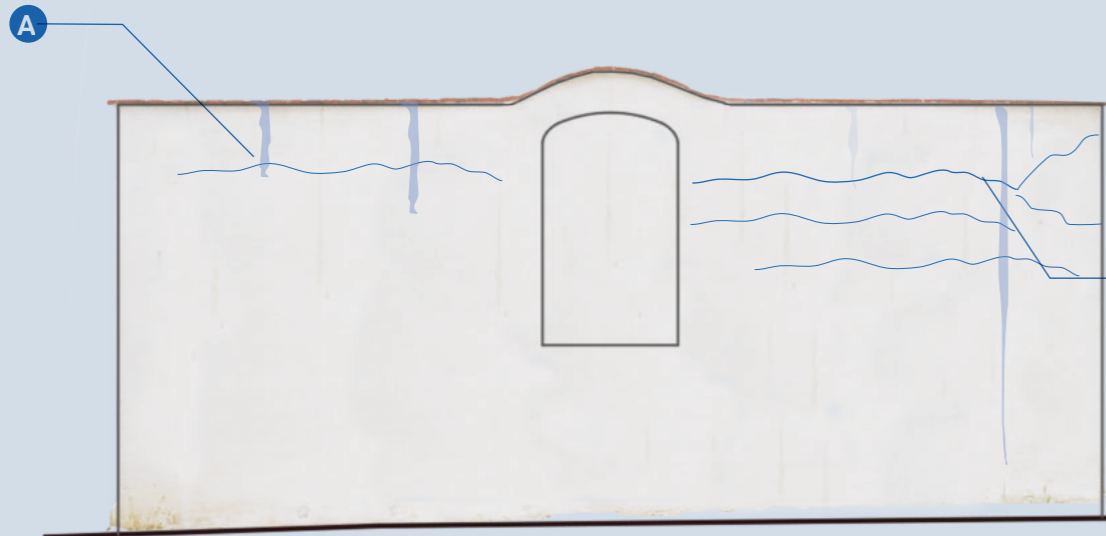
Humidity water marks from the water dripping along the plaster in correspondence of the terracota tiles mortar joints.

Add a metal dripping edge with a gutter.

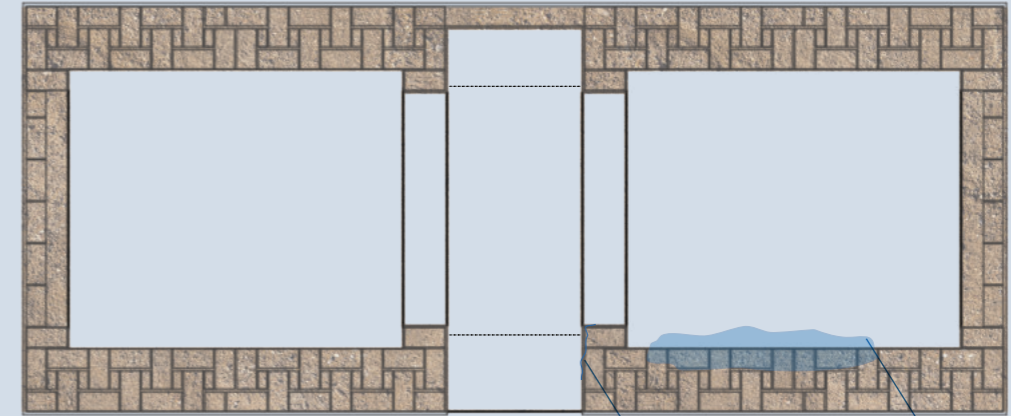
B Main peripheral crack corresponding to the transition between heavy infill and light infill of the vault.
Redo the entire exterior plaster reinforced with strong plaster mesh.

C Cracks that might indicate a foundation movement, in an area where we couldn't reach the mother rock during construction.

Evaluation of the peripheral water drainage and possible consolidation of the foundation.



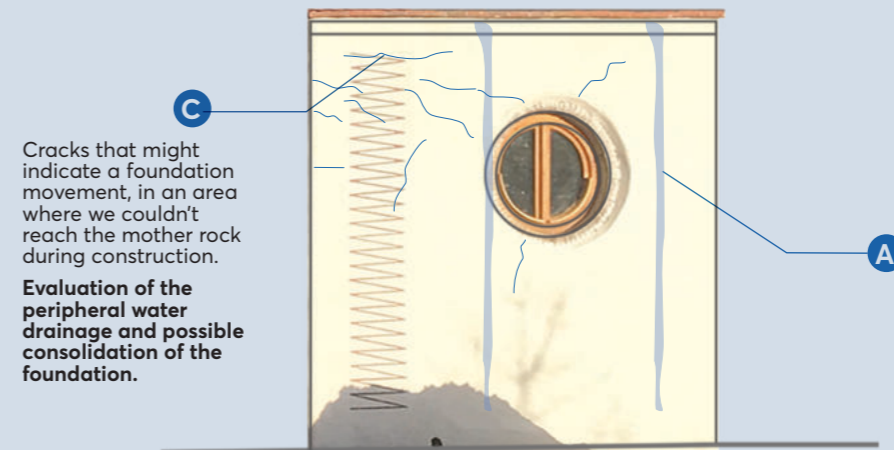
B Main peripheral crack corresponding to the transition between heavy infill and light infill of the vault.
Redo the entire exterior plaster reinforced with strong plaster mesh.



F Cracks in the interior arch plaster. Probably due to the foundation movement. No cracks on the vaults.
Re-plaster with mesh and adopt solution C.

D Humidity marks with some algae and fungi from the water infiltration from the façade. Dust and brick material drop.

Solve the infiltration with solution A. Probably plaster the interior to avoid material dropping from the vault.

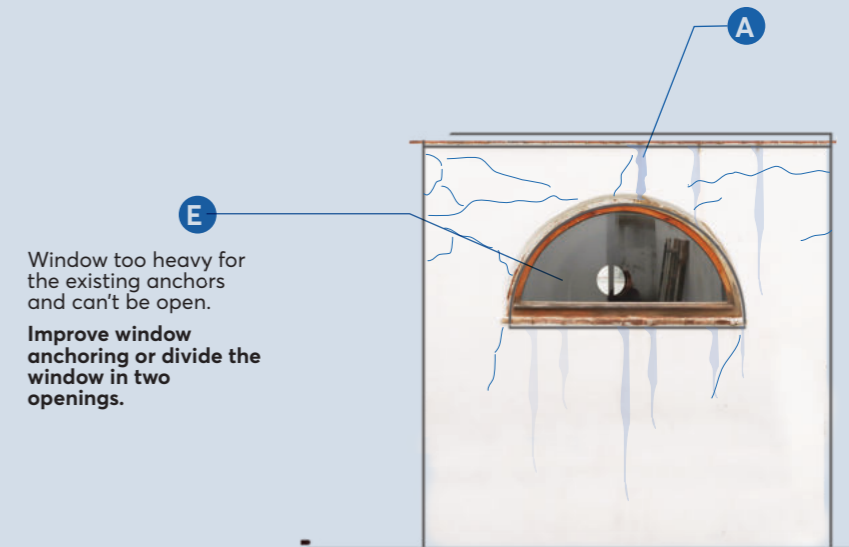


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Add a metal dripping edge with a gutter.



E Window too heavy for the existing anchors and can't be open.
Improve window anchoring or divide the window in two openings.



2. CEB ARCHITECTURE AND THE TECHNICAL EVALUATION

The building is functioning as an accommodation space for artists in residence at the Ceramic Research Center. It is designed to have two bedrooms or a bedroom and a living room and an entrance hall. At the entrance hall a small fireplace to improve interior comfort during the winter is planned.

At the moment the partition walls have not been made, making the space a larger double bedroom and once the interviews raise a question about it, may end up having just a curtain just to divide the space at night.

The space had been hosting mainly couples, families, or single residents, once the small space required some intimacy that can be hard for unknown people to share. The ceramic work space and earth lab are 20 minutes walking from the NGO headquarters where the dorms are located, making the Nests the perfect space for a full work immersion during the artistic residences.

The load bearing walls

The walls are in reasonable shape. No cracks are visible, but, as stated before, the surface or the bricks can be a bit dusty. Lime-wash was applied to prevent this, and depending on how the surface ages it will be decided whether or not an interior render will be needed. If the bigger aggregates remain in the brick, it is only the smaller particles at the surface that are more fragile and eventually the bricks will stabilise; however, it may be that the compression power during production was not enough and that the bricks are too soft to be exposed.

The arches

An arch is a structural element that supports the weight of the roof. The arches had been made also with the same bricks from the walls but with the most resistant ones, the ones that were more compressed. The signs of danger in an arch are cracks, especially when we have three or more that can provoke a collapse. The exterior arches have no apparent cracks. In the interior ones there are thin cracks on the plaster but that doesn't have enough expression to be considered. In general the structure is well preserved and that the forces of the arch are well balanced by the thickness of the walls.

The vaults

The vaults show no signs of cracks and have aged well. The exception is at the weather façade (exposed to southwest) where due to the short roof edge, the water drips from the roof entering in the plaster, causing fungus and higher levels of dusting. The vault has been cleaned and lime washed to help prevent the dusting inside but an intervention at the level of the roof edge must be done to prevent the water from dripping along the wall, entering behind the plaster.

The footing and breathing system

The stone and lime basement where the walls sit has no visible damage. The breathing system with the PVC pipes and grids and the stone and gravel is helping also to the quality of the floor and to avoid problems with capillarity rising, even when no complementary waterproof layer was used to avoid this common issue, like bitumen or other chemical barriers. This proves that the traditional foundation methods with good basement ventilation are sufficient to keep humidity from rising.

The partition walls

In the first self-organised workshop, in 2018, the partition structure was supposed to rely its weight almost entirely on the existing structure through metal connection elements. The bricks, however, started dusting off, making the drilled holes larger and out of shape. It was then decided that the constant use of a door could be too much stress to the arch, especially when the doors were made of solid timber and quite heavy. The construction detail of the partition walls was redesigned towards a self-standing piece that would fit within the frame. Due to Covid-19 pandemic, the execution of those elements was

suspended. After the interviews it is in suspense if a more physical separation should be built or it should be just a separation curtain to give more privacy in case of two contemporary residents.

The windows and doors

These elements were made by a local craftsman. Even after some corrections were made to avoid water from entering the building, they seem to be working better, except for the arched window, which is not sufficiently anchored on the frame. Instructions were already carried out to fix this issue, but for the moment the window must stay closed. With the infiltration at the southwest wall the door suffered with the humidity and the wood moved making the opening and closing very difficult. A plan is set to correct the door when the plaster will be also substituted.

The masonry

The bricks show no sign of structural problems, but they dust off. Compared to other CEB's, it could be that a manual mechanic compressor does not exert the right amount of pressure in order to have a clean and hard surface, and that for exposed bricks and hydraulic compression is required.

In the second BION workshop fired bricks were used for flooring, and later they were also used for roofing and for a wall at the end of the entrance. The wall was made with leftover bricks and other pieces that could not be sold either for aesthetic reasons or minor cracks. Since they varied both in shape and size, it was a good opportunity to develop a pattern, which works fine and creates a sort of panel.

The mortars and plasters

The mortar used for the walls, arches and vaults has aged well. For the exterior walls, a first layer of insulated





Opposite page
1. Curved wall from the interior. The wood is recycled deciduous wood that has been treated.



This page
1. The mortar mix is now a light grey and the wood appears darker in contrast. Especially the oak trunks used.

2. The oak wood has now dried and a gap to the mortar mix appears (B).

mortar, made with lime, cork and sand was applied during winter and left unfinished for several months. The water content of the walls at the time was probably too much for the plaster and several cracks opened up, leaving space for rainwater to leak inside and damage the bricks. Later on the render was corrected and a finishing layer and lime wash was applied, along with the tile roofing that extends 2cm outside the wall. This, however, wasn't enough, and cracks in the same areas have appeared once again. It is planned an intervention to remove the plaster and extend the dripping edge in order to improve the efficiency of the water protection.

The roof

The roof was built in a kind of terrace way to accentuate the shape of the

central vault. It has slopes on each side redirecting the water to the sides of the building. On top of the slope mortar an industrial waterproof membrane made with natural rubber was applied with the reinforcement of glass fibre mesh. On top, a layer of local handmade terracotta tiles was placed with an industrial flexible cement glue. There are no cracks on the roof and the humidity problems don't appear to have a cause on the roof. The dripping edge made by the tiles themselves appear not to be sufficient and to be even worse on the joints making the water drip through the facade and infiltrate on the cracks, provoking their enlargement and consequent acceleration of the humidity problems. A new dripping edge has to be placed, probably in metal to avoid this issue.





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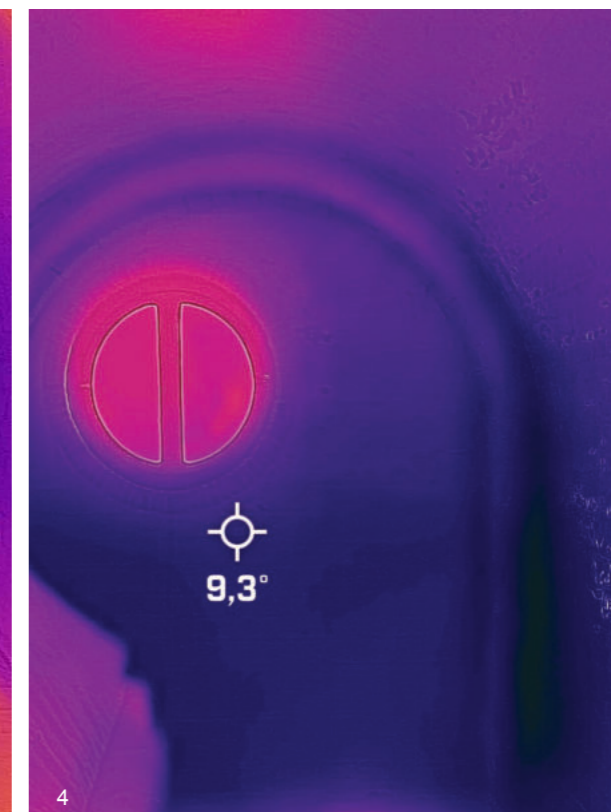
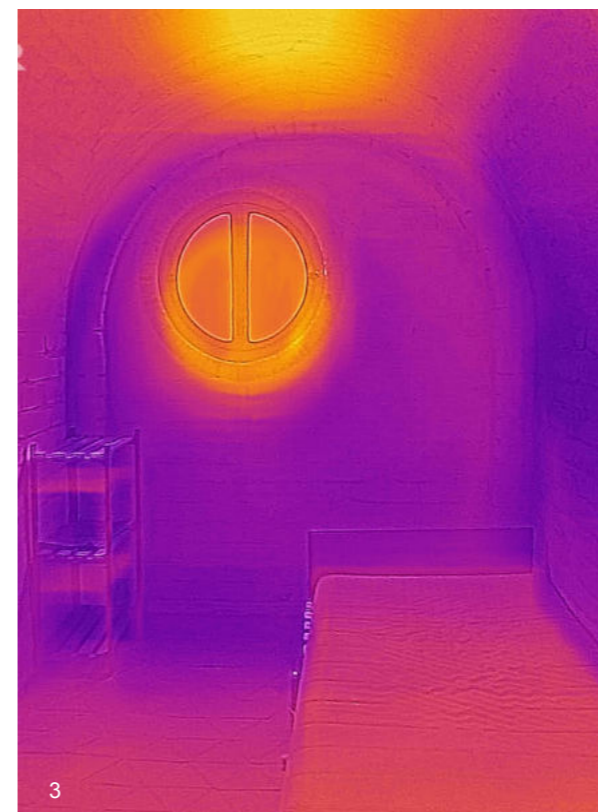
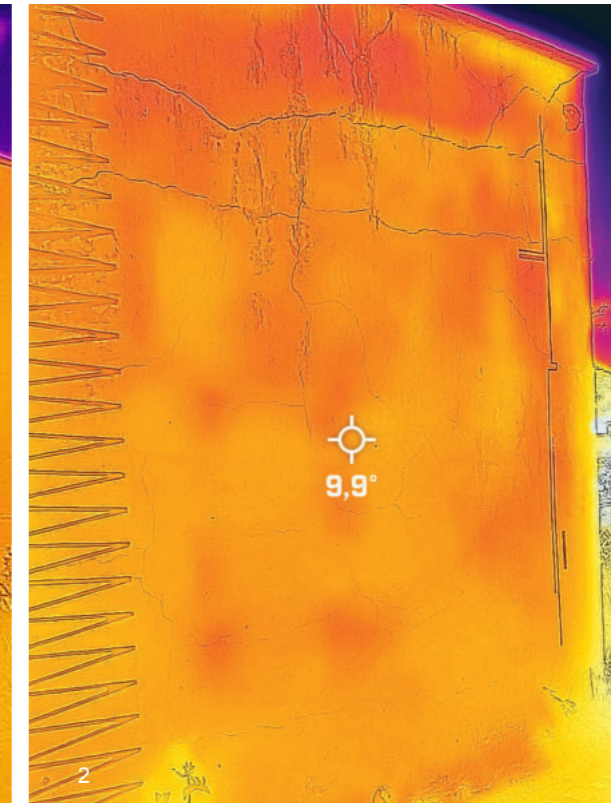
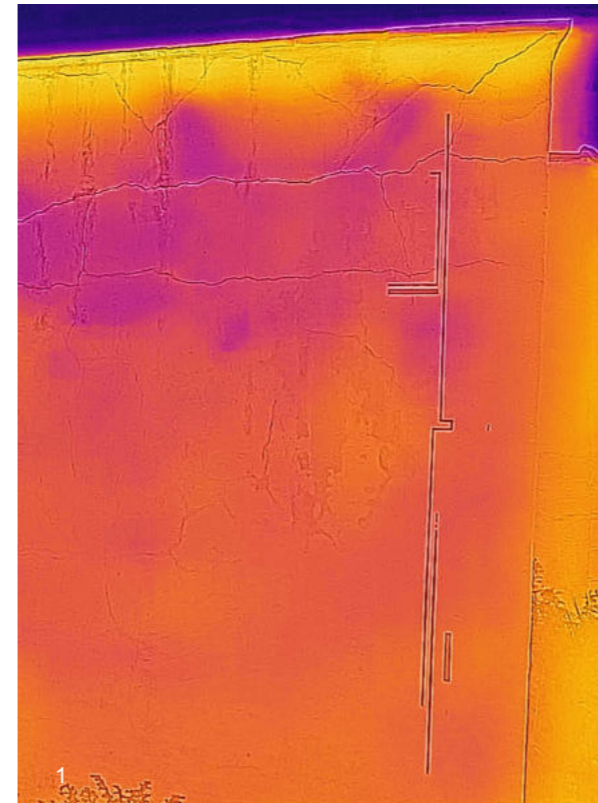
1. General view of the room with some humidity stains in the vault with presence of some green micro-organisms. Presence of some cracks in the arch plaster.

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1. & 2. Humidity due to water drip in the façade. The insufficient roof hanging makes the water drip through the plaster and infills inside the masonry, making it expand and crack further.

3. Inside there is also humidity stains and cracks in the plaster. The wooden frames with national wood had also deform and make the door difficult to open.

4. Inside small efflorescences in the lime paint due to the plaster infiltrations. This provokes some detachments of the lime paint, falling some dust and particles here and there.



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1. & 2. Comparison of two thermal photos taken in April 2022 and December 2022. Illustration of the exterior plaster infiltration, the darker spots are the more humid places, corresponding with the bigger cracks.

3 & 4. Comparison of two thermal photos taken in April 2022 and December 2022. There are colder places in correspondence with the exterior cracks in the plaster confirming the humidity source that

causes problems in the interior. In winter, with no source of heating, that walls became to humid. Interesting so see how the heat accumulates in the upper part of the vault making it feel very

comfortable in summer time. In winter according to the interviews the humidity is quite high making it more uncomfortable.

3. EDUCATIONAL AND NETWORKING APPROACH

"I decided to stay more time in Montemor-o-novo, after the BIØN workshop building with CEB, first because the building site was not over and second because during the workshop we were many people and even if of course there was space for everybody, it has been different to build a vault only the four of us. We also produced all the tiles for the floor. I can say I learned a lot about different kind of natural materials, about wood, about earth/clay in general and I discovered much more about the culture, also, I felt complete integrate in the community."

Participant at the BIØN workshop and volunteer after

For OC and the community the effects of the workshop are being felt until today. Five people that participated started actively volunteering at OC not only to finish the Nest construction but also to organise other training or participate in other activities. Some people move to Montemor-o-novo and start working at the two architectural offices that work with these techniques. Some friends of participants came also to help and one also started working in one of the offices. The network became stronger with ex participants joining the network across all the participant countries.

Regarding the organisation of the workshop itself, a one month duration course is very demanding but also very rewarding once it allows the group to grow exchanging knowledge together. In this workshop especially, once the scope

was mainly the CEB masonry, but also in other courses the building was unfinished. In the case of OC and due to the experimental and continuous educational work that the organisation is doing this was taken as a challenge and allowed volunteers to learn more and propose activities with the CEB structure as a base.

This building was an act of co-creation and co-building. We can count several self proposed activities after the first BIØN workshop. Namely with the ex participants volunteering with some friends together with members of OC also volunteering the following activities were performed: the vaults infill; the building of the 3rd vault and supporting arches; the application of the ceramic tiles in the floor; the application of the waterproof membrane; the application of the roof tiles; the entrance decorative pattern wall; the lime washing of the interior walls; the finishing plaster with sgraffito technique; the workshop of carpentry with local woods for the interior partitions.

The only professional work with local craftsmen was done for the exterior carpentry work and for the exterior rough plaster work. This was a choice due to the need to protect the structure faster.

Time is also an important key issue for collaboration, once it allows the proposals to emerge and the availability



to be implemented. Also flexibility and comprehension regarding mistakes and results.

In the end of the day the appropriation of the process by the community of learners has been the most rewarding achievement for an organisation based in a small interior rural town, making it also possible to welcome the fixation of this new population in the local community. For this to happen one of the biggest challenges in Montemor-o-novo has been the offer of affordable houses for renting. For rural fixation of young professionals a good policy for housing rights has to emerge, once even if there are many empty houses they are not accessible due to several factors since the need to major renovation to the heritage issues.

We learned a lot on earth construction, both theoretically and practically. Moreover ... we had a personal great time, creating some beautiful bonds that will probably last forever. Once our 1-month deadline for building the ninhos (nests) expired, some of us decided to run the last construction phases over time. As much as it was compatible with our schedules, we would try to meet on the weekend to complete the roof and then waterproof it, waterproof the façades, to protect the earthen walls, while decorating them and ultimately lime wash the interior face of the walls. This follow-up of the workshop was a completely spontaneous choice for some of us, each one dedicating their personal spare time to finish the ninhos, a piece halfway between art and construction."

Participant at the BIØN workshop and volunteer after



4. REFLECTIONS

The main insights from the experiment CEB building are based around 4 key aspects:

1. CEB is modular and portable

CEB has a great potential to be appropriated as a regular building masonry but made with a raw material having less CO2 emissions and embodied energy.

2. CEB appropriation and cost

Cost effective, and affordable structure can be completed by communities with little or no previous experience. A community press can be a great investment where the earth is good to build.

3. A sharing platform

Co-creation and Co-building at this never ending building site as an opportunity to exchange knowledge, to practice and to experiment while learning not only building skill but also team management.

4. CEB and Placemaking

Being easily appropriated due to the similarity with other masonry, being made with local excavation material, being a great alternative to the import of inexistent local wood CEB is a great material for placemaking.

1. CEB - a portable rammed earth

Compressed Earth Blocks are a recent technology that appear in an industrialized society, making use of one of the Earth's oldest resources.

CEB mass is 2083,3kg/m³ being very similar to rammed earth. Both are load bearing compressed earth techniques. Compressed Earth Blocks are a sort of portable and modular rammed earth.

This concept opens up a wide range of possibilities for this material, not only for when it is appropriated to use it, but also for when rammed earth is not a viable option:

a) Rehabilitation of a rammed earth ruin. In Portugal it is very common to see ruins with voids on otherwise well preserved rammed earth walls. Since rammed earth is only compressed from above and that vibration from compression may desegregate the old walls, a good alternative is to infill with CEB, taking advantage of its load bearing capacities.

b) Highly urban, compacted building sites. The average compression of earth for load bearing elements is around 40%, meaning that the earth that will be used for rammed earth takes almost 1,5x the size of the built elements. If the working area is scarce, blocks that arrive at the construction site ready to be applied may be the solution.

c) Retrofit of spaces with existing slabs. When remodeling an apartment on the 2nd floor, for example, the height between slabs and their resistance to loads and vibration in many cases makes rammed earth an unfeasible construction method, while CEBs, for their masonry type of construction, can be easily used.

d) In terms of on-site assembly, CEB's are similar to terracotta bricks being very close to most kinds of masonry. This makes the technique easily appropriated by a common builder with no previous experience with earth construction.

2. CEB appropriation and cost

Most of the considerations so far have an industrialized society as a background. When one thinks of different scenarios – whether it is a different culture or a self-build project, for example – the values upon which one makes a decision may change drastically.

In order to make CEB's one needs, at least, a mechanical press, which can be bought or made with some DIY principles. Although adobe bricks need less tools to make, it may happen that the site is poor in clay and/or fibers, rendering that technique unfeasible. Over the course of three weeks the team (five to six people) made about 4500 bricks with a manual press, which equals 300 bricks per day. Only one of the participants had any experience, and there was quite an evolution in time, which could potentially mean that for higher quantities it would've taken relatively less additional time. The possibility of a community investment in a hydraulic press would make the production much more competitive with the price per brick decreasing substantially.

Another quality of this technique is that it is raw, meaning that it can be endlessly reused, as long as the mix hasn't been much stabilized. Additionally, due to earth's hygrometric properties, it creates healthy and comfortable environments indoors. Building with CEBs can thus become an efficient alternative to conventional bricks in two completely different environments: self-construction, where time and/or human labour is abundant, or in highly technological chains of production, where it is the material itself and the lack of transformation required that make it an interesting alternative.

3. A sharing platform

The appropriation of the building site by so many people searching for an opportunity to experiment and practice construction learnings was very spontaneous. Probably due to the character of the NGO that has been open doored for 30 years welcoming citizen participation.

While the self-organized workshops failed to achieve their ultimate goal – finish the building – they did provide the participants a valuable opportunity to learn while actively contributing to the maintenance (to say the least) of the built environment. The fact that the budget was very limited and that construction could only resume during weekends extended the work throughout months, which is tiresome and inefficient. Understanding the pathologies associated with the building technique and test possible solutions to the problems presented informed the network greatly for future applications, and fostered working together, creativity and resilience.

It also made evident the need for young professionals and students as well as for adults searching to experiment new techniques that an open building site school would be a great figure to establish, being open to receive motivated learners that don't find the possibility to experiment these crafts elsewhere.

4. CEB and placemaking

The building aimed at taking a new masonry to its tectonic limits and be used as a load bearing element that discard the need for imported timber, metal or concrete roofing, using instead arches and vaults. Additionally to the mechanical properties of the CEBs', one should not forget that, while arches and vaults are common elements in Portuguese traditional architecture, very few masons know how to build them once the demand is quite low. From that point of view, the workshop was very successful in transmitting valuable knowledge to the participants, and featured as a case study for those visiting Oficinas do Convento.

As stated before due to Covid-19 restrictions the Nests has become a safe space for hosting artists in residence.

The organic development of self-organized workshops to finish the building has worked as a very good opportunity to experiment new methods, materials and techniques, while empowering the participants, creating social bonds as a precious side effect.

And at last but not less relevant, the potential of the technique to use local resources that have little value, like the excavation material, the possibility to implement local chains of production and to be used by regular craftsman in the building site makes it a valid choice to build structures for the community and to empower the community to rely less and less on imported materials.





BIØN – Building Impact Zero Network
A network of partners active in low impact building techniques. Our aim is to share knowledge, practices and experiences, in order to contribute to the built environment and to our communities.

BIØN – Building Impact Zero Network is a group of partners, created in 2015, active in low environmental impact building techniques with positive social impact. Our aim is to share knowledge, practices and experiences, in order to contribute to the built environment and engage our communities.

Our objectives are:

- Improve the access to quality information about low impact building techniques through our platform, and through actively participating in our local communities. We will document our work and provide open access documents through our website and multinational network.
- Increase the skills for construction workers, NEET, migrants, refugees, students, professionals and other adults interested in the topics about low impact building techniques through workshops.
- Increase awareness about low impact techniques on an environmental-, economical-, social- and cultural level.
- Develop strategies to maximise participation and generate inclusive

communities, by the use of architecture as a tool. Improve the connection between formal and informal learning systems, developing or using existing accreditation systems.

- Improve standards of natural and recycled materials use in building, by integrating the building legislation of each country and discuss possibilities with stakeholders, councils and communities.

More info at: www.bi0n.eu

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Erasmus+ is the European Union programme for education, training, youth and sport. It runs for seven years, from 2014 to 2022 with organisations invited to apply for funding each year to undertake creative and worthwhile activities. Erasmus+ aims to modernise education, training and youth work across Europe.

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Building Impact Zero Network



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