

Earth – an essential building material for vernacular architecture in arid and semi-arid climate zones

Earth is an essential building material for vernacular architecture, not only in Europe but also and especially in arid and semi-arid climate zones such as those in Central Asia, the Arabian Peninsula and North Africa.

As a locally-available, simple to use and recyclable building material, earth building has developed in many different regionally-specific ways over the centuries. In many areas where local conditions are not so conducive to so-called modern building methods, earth building continues to be an important way of constructing buildings. Today, in the context of sustainability, holistic approaches to considering and designing buildings is gaining increasing importance. Low primary energy requirement, low environmental pollution and low CO₂ equivalent value are just some of the key advantages of earth building over many conventional building materials, not to mention year-round thermal comfort and near unparalleled recyclability.

This paper shows, using examples from Nepal, Oman, Dubai and North Africa, how earth building in these regions has remained an important part of vernacular building, and the aesthetic qualities this building material has for the design of healthy, comfortable and attractive living environments.

Vernacular architecture

When we consider building materials in terms of their sustainability and in the context of regional building methods, we repeatedly encounter the term “vernacular architecture”. The term vernacular originates from the Latin vernaculus meaning “domestic, native, indigenous” Source: online etymology dictionary). The “Encyclopedia of Vernacular Architecture of the World” [1] defines vernacular architecture as: “...comprising the dwellings and all other buildings of

the people. Related to their environmental contexts and available resources they are customarily owner- or community-built, utilizing traditional technologies. All forms of vernacular architecture are built to meet specific needs, accommodating the values, economies and ways of life of the cultures that produce them.”

Vernacular architecture is therefore not solely about making efficient use of resources but also about ways of building that are accepted by the people, that are integral to their way of life and arise through their participation. These principles have resurfaced in current discourse on holistic and sustainable building practices, in particular with regard to efficiency, consistency and sufficiency, which are fundamental factors influencing the degree of resilience of a building method.

It has also become clear that the ever-broader spectrum of sustainability certification schemes that have arisen over the past decades in western nations – LEED, BREEAM, DGNB, ACTIVE HOUSE, etc. – are at best a way of highlighting flagship sustainable building projects, but are unable to resolve the immediate global challenge of providing affordable and humane housing for the greater majority of the ever-increasing global population.

This has not gone unnoticed, and various dedicated planners and architects have campaigned to raise public debate on this issue:

“The greatest humanitarian challenge we face today is that of providing shelter. Currently one in seven people lives in a slum or refugee camp, and more than three billion people – nearly half the world’s population – do not have access to clean water or adequate sanitation. The physical design of our

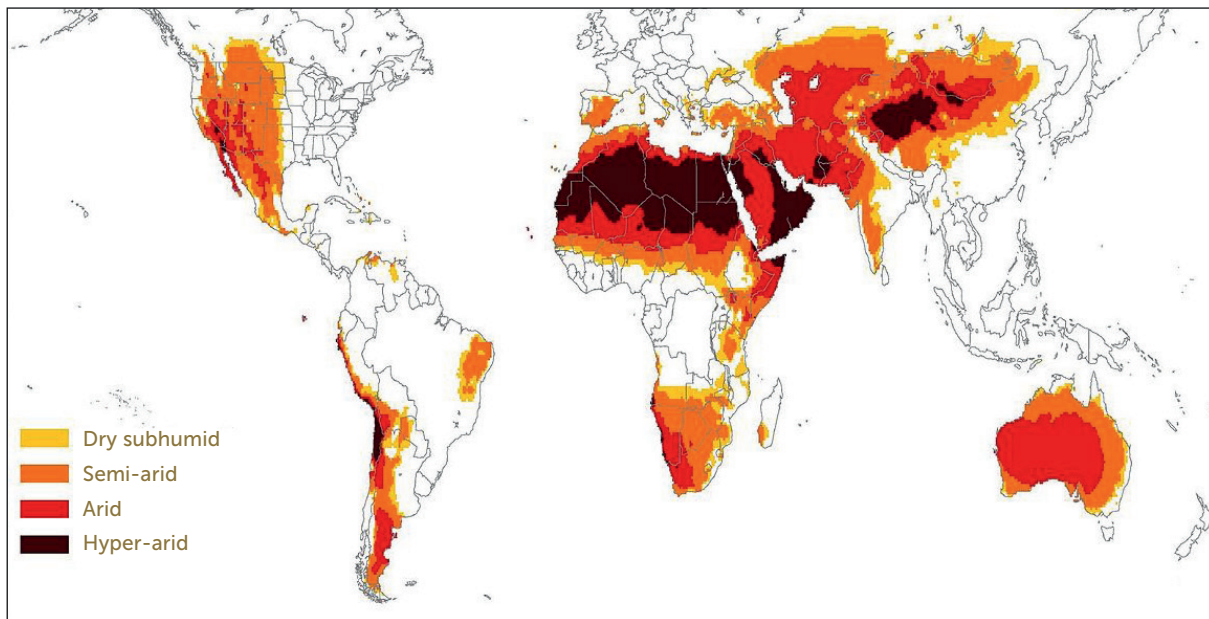


Fig. 1 Arid and semi-arid regions of the world

homes, neighbourhoods, and communities shapes every aspect of our lives. Yet too often architects are desperately needed in the places where they can least be afforded"

(from the introduction to "Design Like You Give A Damn: Architectural Responses To Humanitarian Crises"[2]).

But the traditional role of the architect is shifting from that of a designer to that of an organiser, mediating between the various conflicting aims, regulations and interests of the different parties involved in the building process – and then only if an architect is involved at all. Indeed, in many regions of Asia, Africa and the Middle East, the profession of the architect is largely unknown, despite the fact that traditional building methods go back hundreds and even thousands of years, as Bernard Rudofsky demonstrates in his book *Architecture Without Architects: A Short Introduction to Non-pedigreed Architecture* [3].

To address this global challenge, we therefore need methods that can be adopted by a broad mass of people, methods that are *low-tech* and *high-quality* and can be adapted to meet local conditions – adapted *vernacular building methods* that are compatible with common people.

If we take a look at local, climatically-responsive, resource-efficient building methods in use around the world, it should not surprise us to find that earth fea-

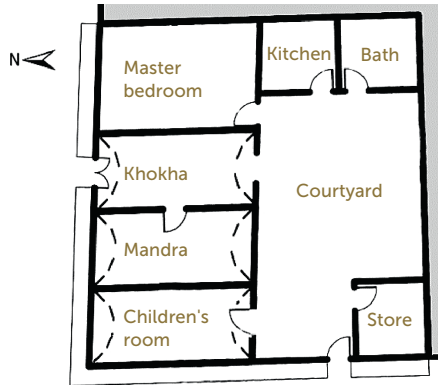
tures prominently in many regions of the world. In this paper, I will concentrate on arid and semi-arid climate zones because earth plays an important role as a natural means of regulating climatic conditions.

The impact of the building design and the materials used on the comfort and performance of the building is best experienced, but in addition to such empirical methods, it can also be assessed through calculations. The following comparison is of two buildings in the arid climate of Egypt was presented at the VER-SUS conference in 2015 [4].

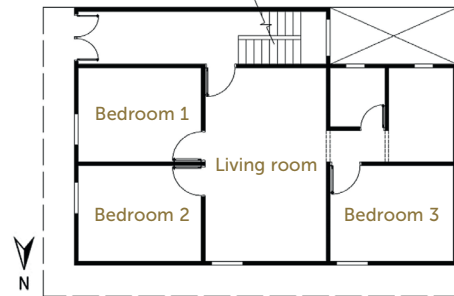
In the first of the two models, the vernacular example (left), the temperature is close to the thermal comfort zone, unlike the second, modern design (right). The vernacular model is therefore well suited to hot, arid climate zones such as that of Aswan in Egypt.

The mean air temperature of approx. 37°C in the rooms of the vernacular example are a product of cool air passing through the rooms from the internal courtyard at night. During the day, the thick earth external and internal walls and small opening keep the cool air within the house.

In the second "modern" house, the walls cannot provide this buffering function because they are much too thin and have large openings. In addition, the precast concrete block masonry walls do not retain heat well and are not vapour permeable, further reducing the comfort level of the interior.



Example: Vernacular architecture



Example: Modern architecture

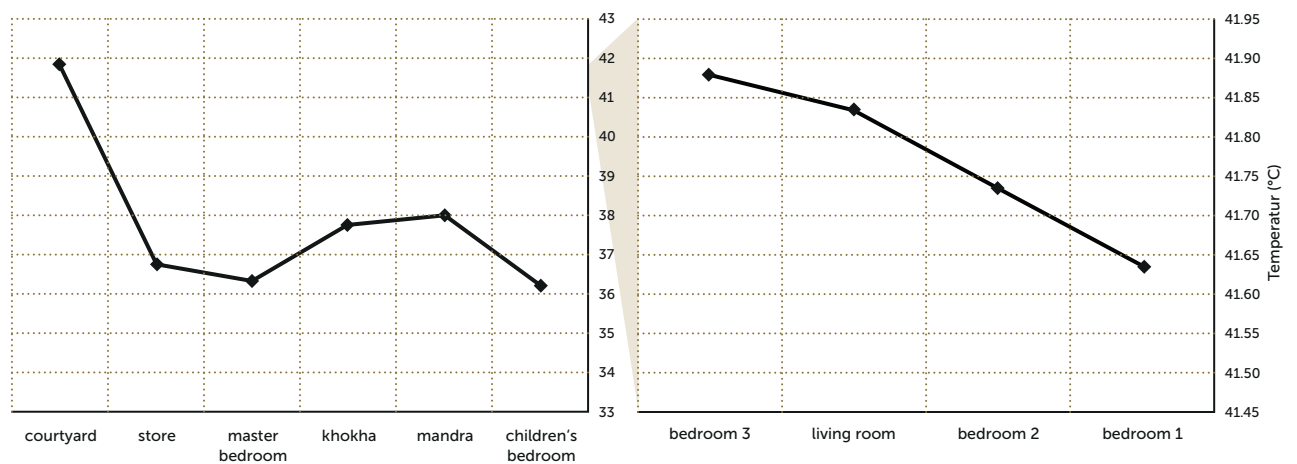
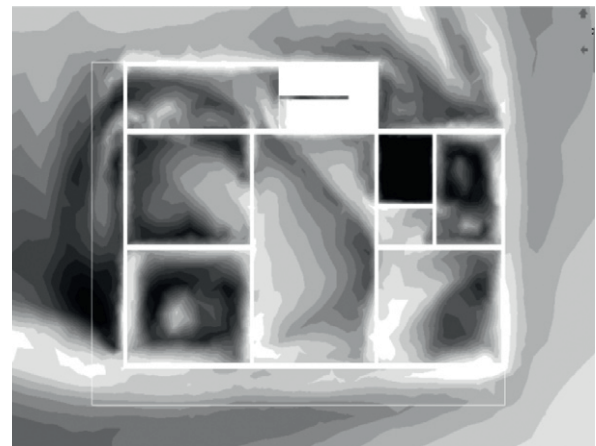
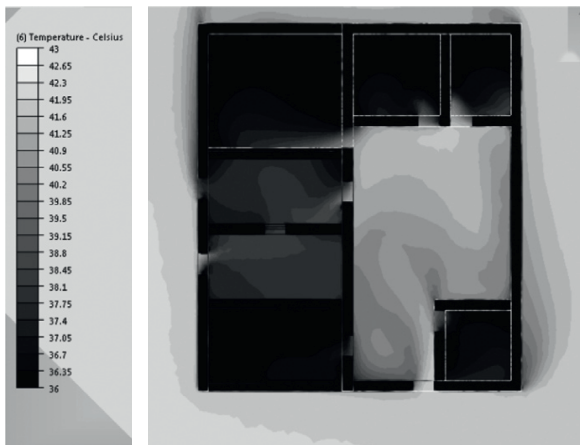


Fig. 2 A comparison of vernacular and modern buildings in the arid climate of Egypt

Vernacular architecture can exhibit good design qualities. The thermal regulating function of earth is therefore prized in climates with extreme diurnal temperature fluctuations, such as in arid and semi-arid climate zones. However, this is just one aspect: it is the aesthetic qualities and design of climate responsive building methods that secures a sense of

regional identity and acceptance among the local population, and ultimately therefore the comfort of interiors in modern buildings made of earth.



Fig. 3 - 10 Typical traditional building methods in the Bardia region of western Nepal featuring a bamboo loadbearing structure with earth daub and clay plaster. 7: Women applying clay daub and plaster to a bamboo construction and lattice work. 8: First coat of plaster applied to the bamboo construction. 9: Tharu Museum, Bardia, western Nepal. In the middle, receptacles made of earth for storing food. 10: Portrayals of animals in the plaster serve as decorative elements but also as a way of personalising the dwelling and the inhabitants relationship to it.



Fig. 11 - 13 Modern adaptation of the Newar Style which can be seen throughout the valleys of the Kathmandu. Model house at Tribhuvan University in Kathmandu made of compressed earth blocks (made with an AURAM earth block press) with an innovative construction method for reinforcing the structure against seismic forces. Project led by Prof. Dr. Sushil B Bajracharya, Associate Professor at the Department of Architecture and Planning, Institute of Engineering (IOE), Tribhuvan University (TU)

Conclusion

The global challenge to provide safe and humane dwellings can only be met by adopting building methods that the majority of the population can apply themselves. Earth, with its thousand-year-old tradition, sustainable characteristics and widespread availability has the potential to play an important role in addressing this challenge.

Reference literature

- [1] Oliver, P.: *Encyclopedia of Vernacular Architecture of the World*, Cambridge University Press, 1997
- [2] Architecture for Humanity: *Design Like You Give A Damn: Architectural Responses To Humanitarian Crises*, Metropolis Books, 2006
- [3] Rudofsky, B.: *Architecture Without Architects: A Short Introduction to Non-pedigreed Architecture*, 1964
- [4] Mileto, Vegas, García Soriano & Cristini (Eds): *Vernacular Architecture: Towards a Sustainable Future*, Taylor & Francis, London, 2015



Abb. 14-18: Bastakiya District in the old town of Dubai. Top left and right: natural shading methods and outdoor seating in the shade of vegetation. 16 (mitte links): Coffeehouse: a better microclimate is achieved through a shaded internal courtyard that utilises the stack effect. 17 (bottom left) Modern adaptation of a traditional shading device 18 (bottom right): Internal courtyard of an artist's house: vegetation, shading and the stack effect are utilised to create a better microclimate.

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Fig. 19-22: Oman. 19-20: Thick earth walls, shading, a sheltered roof terrace with vegetation and water channels create a better microclimate in Misfah Al Abriyeen Oasis. 21-22: Testimonies to the tradition of earth architecture in Nizwa, Oman

Fig. 23: The village of Ait Bouguemez in the High Atlas of Morocco. New buildings made with local, adapted earth building materials and an adapted design aesthetic



Photo: İhsan Deniz Kılıcoglu

