TITLE: OPTIMIZATION OF HYGROTHERMAL PROPERTIES OF EARTHEN BRICKS WALLS OF HOUSING IN BURKINA FASO

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▶ RESEARCH INFORMATION

KEYWORDS
Raw earth, Architecture, thermal comfort, Simulation, thermal inertia, wall optimization

INTRODUCTION / CONTEXT
Ouagadougou, the capital of Burkina Faso, is characterized by two types of architecture. The first ones are formed by constructions made mainly with earth (Fig 1.A). The second ones are formed by “modern” houses (Fig 1.B). The climate is hot and dry. To improve thermal comfort, dwellings must be made with earth materials such as compressed earth blocs or clay bricks due to their high thermal inertia and capacity of earth to regulate moisture has we can see in Fig. 2.B. [2].

QUESTION / GOAL
Many studies focus on building simulation to predict the indoor climate in the Sudano-Sahelian context (M. Kaboré, 2015; E. Ouédraogo, 2015; J.M. Ochoa, 2011; Qin et al., 2010). When these studies concern earth houses, they don’t give the influence of hygrothermal parameters on indoor climate. Based on the adaptive thermal comfort model for indoor climate and local architecture, we establish the influence of each hygrothermal parameters on the indoor climate of different raw-earth wall compositions; we define the limits of modification of these parameters for one and two storey building.

HYPOTHESIS / METHODOLOGY
- Sensitivity analysis of earthen bricks hygrothermal parameters on indoor climate
- Measurement of the basic and improved hygrothermal properties of CEBs and CEBs mixed with byproduct
- Simulation of the wall and indoor climate for representative dwellings with one and two storey

RESULTS
- The specific climatic conditions are analyzed and taken into account in the development of architectural details
- Elaboration of bricks and walls with improved hygrothermal properties

CONCLUSION
Building made with earth in sub-saharan Africa will be improved since conception and production of brick for an adapted architecture which careful about environment.

Fig.1.A: House from mud in Ouagadougou represents 25,6% of dwellings [3]

Fig. 1.B: House in ”zoned area” in Ouagadougou

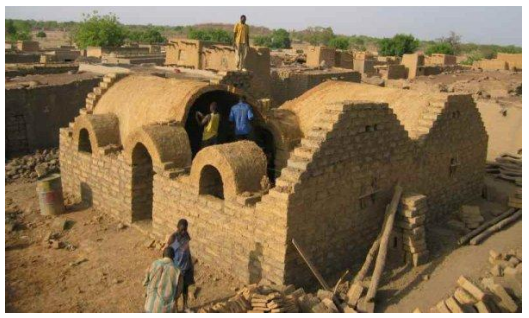
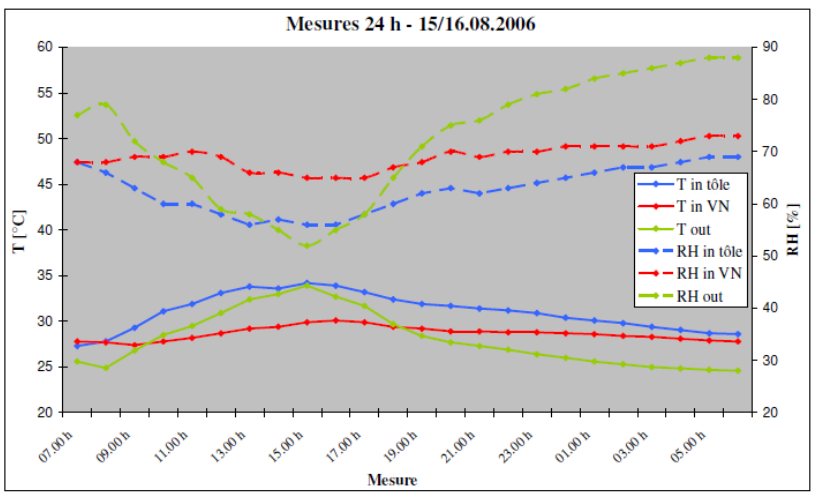


Fig. 1.C: "voûte nubienne" house [4]

	Année	Terre	Pierre	Ciment	Paille	Autr
Burkina Faso	2003	83	0,9	11,4	3,5	1,1
	2005	80,6	0,4	14,6	2,3	2,1
	2007	80,6	0,9	14,9	2,1	1,4
Centre-Nord	2003	90,3	0	3,7	6	0
	2005	83,1	0	3,9	11,2	1,8
	2007	86,9	0,2	6	5	1,9

Fig. 2.A:. Distribution of dwelling according to the nature of the walls [1]



T in VN: indoor temperature of "voûte nubienne" house

Fig. 2.B: Daily evolution of temperature and humidity parameters: modern house vs. "voûte nubienne" house. [2]

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▶ REFERENCES
[1]: INSD. Octobre 2007. Rapport de synthèse :Analyse des résultats du recensement général de la population et de l’habitat.
[2] : Wyss Urs, and Sauret Hugues. “INDICATEURS DE CONFORT DANS LA TECHNIQUE DE LA VOÛTE NUBIENNE,” November 2007.
[3]: Ouattara, Ardjouma, and L. Somé. “La Croissance Urbaine Au Burkina Faso.” Rapport D’analyse Des Données Du Recencement Général de La Population et de L’habitat de, 2006.
[4] https://sustainabledeveloppement.wordpress.com/2012/02/20/la-voute-nubienne-un-toit-durable-pour-tous/