Bioclimatic Materials In Constructions Simulations

Amine Daha Belghiti, Imane Fath Allah, Ghita Yunsi, Salma Kaichouh, Dr. Asmae Khaldoun

Abstract

The aim of this study is to evaluate the different bioclimatic materials that can be used for different house component with a comparison to a default model house on **DesignBuilder** with the goal of getting to the **most optimal materials** for each section of the house with regards to the heat gain and loss through each part individually. This way we can get to the most energy efficient house using **bioclimatic materials**. This was done after a throughout literature review for the available materials and their specifications (mainly **thermal conductivity**, **thickness**, and **R-value**), then a series of **simulations** were made based on the best materials found from the literature review. The simulations include the **heat balance** and the **outside dry-bulb temperature** so that we get a clear idea on the influence of the temperature throughout the year for the region of **Midelt**.

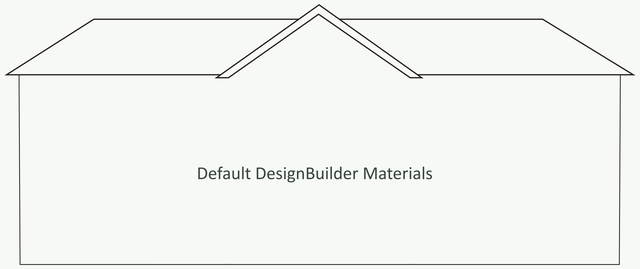
Keywords: *Bioclimatic materials, Energy efficient, Heat balance, Thermal conductivity, R-value*.

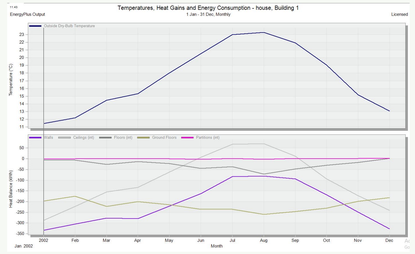
House design on Designbuilder:

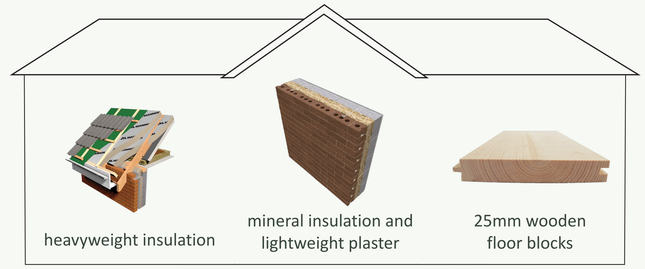
Bioclimatic walls benchmarking:

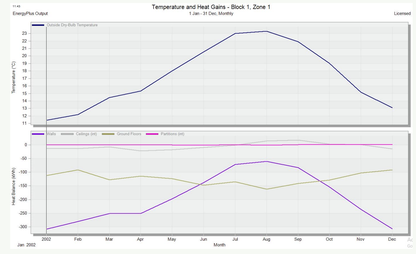
	LENGTH, WIDTH, HEIGHT (MM)	DENSITY (KG/M3)	COMPRESSIVE STRENGTH (KG/CM2)	WATER ABSORPTION (%)	THERMAL CONDUCTIVITY (W/M.K)
FALG BRICKS	230, 100, 70	1600-1750	90-100	10-14%	0.856-2.144
COMPRESSED SOIL EARTH BRICKS	300, 150, 90	1750	20-33	8%	0.520-0.720
RAMMED EARTH BRICKS	295, 140, 90	1500-2000	20-31	12.20%	0.98
LATERITE BRICKS	300,200, 150	1920-2080	52-72	14.58%	0.620-0.697
CLAY BRICKS	190,90,90	1700-1850	30-35	15-25%	0.900-0.940

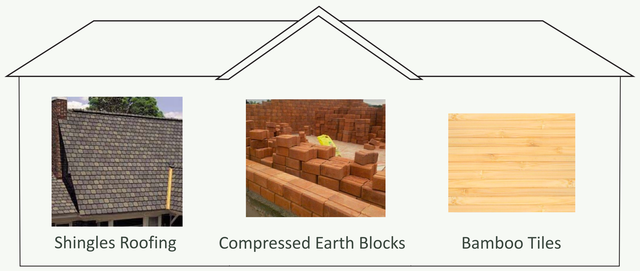
Materials chosen for each simulation and their corresponding results:

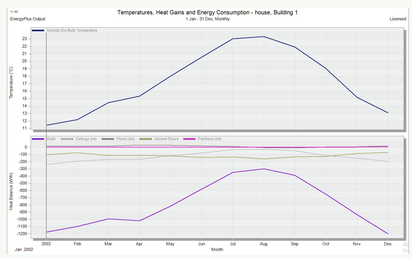


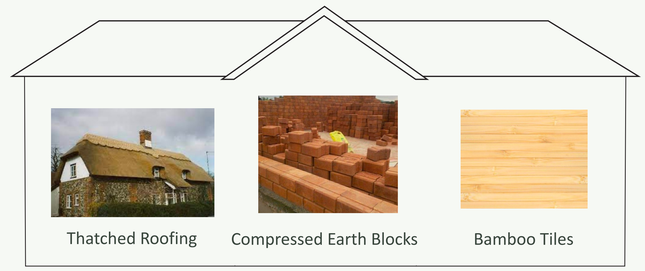


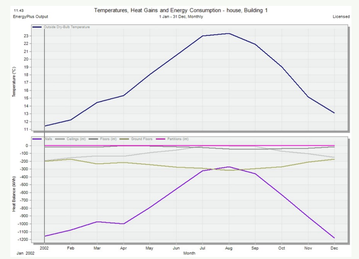












Conclusion

We can notice from the modern house that the graphs of different house partitions throughout the year are diversified in terms of heat balance with some partitions having more **negative heat balance** than what would be advised. This issue gets fixed in the simulation for the bioclimatic houses with an advantage for the house with **shingles roofing** since it had better results for the ceilings. But still, the **insulated house** had much better results with a still negative heat balance for all the partitions in general throughout the year, but the values were much bigger than both the bioclimatic houses. This means that the bioclimatic houses may need some **additional layers of insulation and protection** in order to have more positive results, since the ones we got from these simulations were not the worst and are indeed **really promising** for such materials.