

Adaptive Bricks: Potentials of Evaporative Cooling In Brick Building Envelopes to Enhance Urban Microclimate

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KGK 4 2019

References

- Akbari, H., Pomerantz, M., & Taha, H. (2001). Cool surfaces and shade trees to reduce energy use and improve air quality in urban areas. *Solar Energy*, *70*(3), 295-310. doi: [https://doi.org/10.1016/S0038-092X\(00\)00089-X](https://doi.org/10.1016/S0038-092X(00)00089-X)
- Al-Sanea, S. A., Zedan, M. F., & Al-Hussain, S. N. (2012). Effect of thermal mass on performance of insulated building walls and the concept of energy savings potential. *Applied Energy*, *89*(1), 430-442. doi: <https://doi.org/10.1016/j.apenergy.2011.08.009>
- Al-Sanea, S. A., Zedan, M. F., & Al-Hussain, S. N. (2013). Effect of masonry material and surface absorptivity on critical thermal mass in insulated building walls. *Applied Energy*, *102*, 1063-1070. doi: <https://doi.org/10.1016/j.apenergy.2012.06.016>
- Bonswetch, T., Kobel, D., Gramazio, F., & Kohler, M. (2006). *The informed wall: applying additive digital fabrication techniques on architecture*. Paper presented at the 25th Annual Conference of the Association for Computer-Aided Design in Architecture.
- Cauvin, J. (2000). *The Birth of the Gods and the Origins of Agriculture*: Cambridge University Press.
- Chokhachian, A., Perini, K., Dong, S., & Auer, T. (2017). *How Material Performance of Building Façade Affect Urban Microclimate*. Paper presented at the Powerskin 2017, Munich, Germany.
- Chokhachian, A., Santucci, D., & Auer, T. (2017). A Human-Centered Approach to Enhance Urban Resilience, Implications and Application to Improve Outdoor Comfort in Dense Urban Spaces. *Buildings*, *7*(4), 113.
- Coffman, R., Agnewl, N., Austin, G., & Doehnel, E. (1990). *ADOBE MINERALOGY: Characterization of Adobes from around the world*. Paper presented at the 6th International Conference on the Conservation of Earthen Architecture: Adobe 90.
- Friesem, D. E., Karkanias, P., Tsartsidou, G., & Shahack-Gross, R. (2014). Sedimentary processes involved in mud brick degradation in temperate environments: a micromorphological approach in an ethnoarchaeological context in northern Greece. *Journal of Archaeological Science*, *41*, 556-567. doi: <https://doi.org/10.1016/j.jas.2013.09.017>
- Han, R., Xu, Z., & Qing, Y. (2017). Study of Passive Evaporative Cooling Technique on Water-retaining Roof Brick. *Procedia Engineering*, *180*, 986-992. doi: <https://doi.org/10.1016/j.proeng.2017.04.258>
- He, J., & Liu, K. Q. (2012). Numerical Analysis of Passive Microclimatic-Modifying Effects of a Moist Void-Brick Wall. *Applied Mechanics and Materials*, *193-194*, 1156-1164. doi: 10.4028/www.scientific.net/AMM.193-194.1156
- Howard, L. (1818). *The Climate of London: deduced from Meteorological observations, made at different places in the neighbourhood of the metropolis*: W. Phillips, sold also by J. and A. Arch.

- Jandaghian, Z., & Akbari, H. (2018). The effects of increasing surface reflectivity on heat-related mortality in Greater Montreal Area, Canada. *Urban Climate*, 25, 135-151. doi: <https://doi.org/10.1016/j.uclim.2018.06.002>
- Künzel, H. M. (1994). Verfahren zur ein- und zweidimensionalen Berechnung des gekoppelten Wärme- und Feuchtetransports in Bauteilen mit einfachen Kennwerten. 42.
- Lengsfeld, K., & Holm, A. (2007). Entwicklung und Validierung einer hygrothermischen Raumklima-Simulationssoftware WUFI®-Plus. *Bauphysik*, 29(3), 178-186. doi: [doi:10.1002/bapi.200710025](https://doi.org/10.1002/bapi.200710025)
- Mofidi, F., & Akbari, H. (2017). Personalized energy costs and productivity optimization in offices. *Energy and Buildings*, 143, 173-190. doi: <https://doi.org/10.1016/j.enbuild.2017.03.018>
- Oates, D. (1990). Innovations in mud-brick: Decorative and structural techniques in ancient Mesopotamia. *World Archaeology*, 21(3), 388-406. doi: [10.1080/00438243.1990.9980115](https://doi.org/10.1080/00438243.1990.9980115)
- Rizwan, A. M., Dennis, L. Y. C., & Liu, C. (2008). A review on the generation, determination and mitigation of Urban Heat Island. *Journal of Environmental Sciences*, 20(1), 120-128. doi: [https://doi.org/10.1016/S1001-0742\(08\)60019-4](https://doi.org/10.1016/S1001-0742(08)60019-4)
- Santamouris, M., Papanikolaou, N., Livada, I., Koronakis, I., Georgakis, C., Argiriou, A., & Assimakopoulos, D. N. (2001). On the impact of urban climate on the energy consumption of buildings. *Solar Energy*, 70(3), 201-216. doi: [https://doi.org/10.1016/S0038-092X\(00\)00095-5](https://doi.org/10.1016/S0038-092X(00)00095-5)
- Schmandt-Besserat, D. (2015). The Beginnings of the Use of Clay in Turkey. *Anatolian Studies*, 27, 133-150. doi: [10.2307/3642659](https://doi.org/10.2307/3642659)
- Serena, L. (2012). The Geoarchaeology of Mudbricks in Architecture: A Methodological Study from Çatalhöyük, Turkey. *Geoarchaeology*, 27(2), 140-156. doi: [doi:10.1002/gea.21401](https://doi.org/10.1002/gea.21401)
- Stevanović, M. (1997). The Age of Clay: The Social Dynamics of House Destruction. *Journal of Anthropological Archaeology*, 16(4), 334-395. doi: <https://doi.org/10.1006/jaar.1997.0310>
- TMRGL. (2017). Concrete Block and Brick Manufacturing Market (Product Type - Concrete Block (Hollow, Cellular, and Fully solid), Brick (Clay, Sand lime, and Fly ash clay), and ACC Block - Global Industry Analysis, Size, Share, Growth, Trends, and Forecast 2017 - 2027 (pp. 174): Transparency Market Research.
- Uğurlu, E., & Böke, H. (2009). The use of brick–lime plasters and their relevance to climatic conditions of historic bath buildings. *Construction and Building Materials*, 23(6), 2442-2450. doi: <https://doi.org/10.1016/j.conbuildmat.2008.10.005>
- Wernery, J., Ben-Ishai, A., Binder, B., & Brunner, S. (2017). Aerobrick — An aerogel-filled insulating brick. *Energy Procedia*, 134, 490-498. doi: <https://doi.org/10.1016/j.egypro.2017.09.607>