

Graduation Plan

Master of Science Architecture, Urbanism & Building Sciences



Graduation Plan: All tracks

Submit your Graduation Plan to the Board of Examiners (Examencommissie-BK@tudelft.nl), Mentors and Delegate of the Board of Examiners one week before P2 at the latest.

The graduation plan consists of at least the following data/segments:

Personal information	
Name	Marijn Soeterbroek
Student number	4367626

Studio		
Name / Theme	AR3AE100 Architectural Engineering	
Main mentor	P.M.M. Stoutjesdijk	[Academic field involved]
Second mentor	Dr.ir. M.J. Tenpierik	[Academic field involved]
Argumentation of choice of the studio	This studio allows me the freedom to pursue my personal technical fascinations. This gives me the starting point to design sustainable architecture that helps people thrive!	

Graduation project	
Title of the graduation project	Re-inventing vernacular architecture
Goal	
Locations:	<p>Kerala, India [8°25'33.8"N 77°05'33.3"E]</p> <p>West, Cameroon [5°21'56.3"N 10°25'01.0"E]</p> <p>Amazonas, Venezuela [5°42'21.0"N 62°26'41.8"W]</p>
The posed problem,	The abandonment of vernacular architecture in the rural tropics is causing thermal discomfort in rural dwellings. Vernacular architecture is abandoned due to a lack of skilled workers, incompatibility with modern lifestyles and global construction trends. This leads to increased dependency on air conditioning units and higher embodied energy of construction materials, resulting in a higher energy demand in the global housing sector and

	contributing to rising global temperatures, exacerbating the problem of thermal discomfort in the long term.
research questions and	How and to what extent do bioclimatic strategies in vernacular architecture provide adaptive thermal comfort in a tropical monsoon climate?
design assignment in which these result.	How can a fully biobased rural dwelling for a tropical climate be designed that passively provides thermal comfort, is buildable by local construction workers, and can be adapted to the specific requirements of users/communities from different regions?
Process	
Method description	
<p>Laser cutting prototype models Simulating thermal performance Optimization with thermal performance simulation Parametric modelling for adaptability</p>	

Literature and general practical preference

- Chandel, S., Sharma, V., & Marwah, B. M. (2016). Review of energy efficient features in vernacular architecture for improving indoor thermal comfort conditions. *Renewable and Sustainable Energy Reviews*, 65, 459–477. <https://doi.org/10.1016/j.rser.2016.07.038>
- Dili, A., Naseer, M., & Varghese, T. Z. (2010). Passive environment control system of Kerala vernacular residential architecture for a comfortable indoor environment: A qualitative and quantitative analyses. *Energy and Buildings*, 42(6), 917–927. <https://doi.org/10.1016/j.enbuild.2010.01.002>
- Earth Overshoot Day. (2023, January 13). Earth Overshoot Day. <https://www.overshootday.org>
- Hashemi, A. (2016). Climate Resilient Low-Income Tropical Housing. *Energies*, 9(6), 468. <https://doi.org/10.3390/en9060468>
- Hashemi, A. (2017). Effects of thermal insulation on thermal comfort in low-income tropical housing. *Energy Procedia*, 134, 815–824. <https://doi.org/10.1016/j.egypro.2017.09.535>
- Key World Energy Statistics 2021 – Analysis. (n.d.). IEA. <https://www.iea.org/reports/key-world-energy-statistics-2021>
- Milliken, W., Gardens, R., & La Fayette, R. (1997). The construction of a new Yanomami round-house. *Journal of Ethnobiology*, 17, 215–233. <http://ethnobiology.org/sites/default/files/pdfs/JoE/17-2/MillikenAlbert1997.pdf>
- Nguyen, A. T., & Reiter, S. (2013). Passive designs and strategies for low-cost housing using simulation-based optimization and different thermal comfort criteria. *Journal of Building Performance Simulation*, 7(1), 68–81. <https://doi.org/10.1080/19401493.2013.770067>
- Nguyen, A. T., Truong, N. S. H., Rockwood, D., & Tran Le, A. D. (2019). Studies on sustainable features of vernacular architecture in different regions across the world: A comprehensive synthesis and evaluation. *Frontiers of Architectural Research*, 8(4), 535–548. <https://doi.org/10.1016/j.foar.2019.07.006>
- Nicol, J., & Humphreys, M. (2002). Adaptive thermal comfort and sustainable thermal standards for buildings. *Energy and Buildings*, 34(6), 563–572. [https://doi.org/10.1016/s0378-7788\(02\)00006-3](https://doi.org/10.1016/s0378-7788(02)00006-3)

Oliver, P. (1998). *Encyclopedia Of Vernacular Architecture Of The World*.

Peel, M. C., Finlayson, B. L., & McMahon, T. A. (2007). Updated world map of the Köppen-Geiger climate classification. *Hydrology and Earth System Sciences*, 11(5), 1633–1644. <https://doi.org/10.5194/hess-11-1633-2007>

Rodriguez, C. M., & D'Alessandro, M. (2019). Indoor thermal comfort review: The tropics as the next frontier. *Urban Climate*, 29, 100488. <https://doi.org/10.1016/j.uclim.2019.100488>

Verbeke, S., & Audenaert, A. (2018). Thermal inertia in buildings: A review of impacts across climate and building use. *Renewable and Sustainable Energy Reviews*, 82, 2300–2318. <https://doi.org/10.1016/j.rser.2017.08.083>

Warmte Tabellarium – KLIMAPEDIA. (n.d.). <https://klimapedia.nl/hulpmiddel/warmte-tabellarium/>

Zain, Z. M., Taib, M. N., & Baki, S. M. S. (2007). Hot and humid climate: prospect for thermal comfort in residential building. *Desalination*, 209(1–3), 261–268. <https://doi.org/10.1016/j.desal.2007.04.036>

Reflection

1. What is the relation between your graduation (project) topic, the studio topic (if applicable), your master track (A,U,BT,LA,MBE), and your master programme (MSc AUBS)?

The relation between my graduation topic and the master track is very direct. Because it investigates how the design of the build environment [rural dwelling] can contribute to a sustainable future. In my opinion this should be the core business of the master track.

2. What is the relevance of your graduation work in the larger social, professional and scientific framework.

Relevance larger social framework

Due to urbanization most projects focus on a urban setting. This graduation project however puts emphasis a rural setting, thereby making it relevant in a larger social setting.

Relevance professional framework

This project is relevant within a professional setting because it utilizes parametric design elements. Thus using tools that have professional value.

Relevance scientific framework

The graduation project is strongly connected to scientific research because of the thermal simulation that has been performed.