

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	Adriano de Jesus Valdez Serra
Student number	4994477

Studio		
Name / Theme	AR3B025 Building Technology Graduation Studio	
Main mentor	Regina Bokel	Energy & Climate
Second mentor	Alejandro Prieto	Façade & Products
Argumentation of choice of the studio	Energy & Climate	

Graduation project	
Title of the graduation project	Reducing Cooling Energy Demand of Coastal Hotels in Tropical Climate through Sustainable Façade Renovation Strategies
Goal	
Location:	Dominican Republic
The posed problem, research questions and design assignment in which these results.	High cooling energy demand of coastal hotels under Tropical Climate conditions Is it possible to reduce the cooling energy demand of coastal hotels to 50% of its current consumption by using passive design strategies combined with sustainable materials? Design of 5 façade renovation strategies for a selected guest building block to later compare with its original design state. The energy performance evaluation will be held through hand calculations and energy performance evaluation through the Design Builder software.
The purpose is to create a comparative analysis between the current state of a recently renovated facade of a representative coastal hotel in the Dominican Republic and 5 alternatives of Sustainable Façade Renovation Strategies (combination of passive design and sustainable materials) in order to establish more sustainable guidelines to future renovations in the Dominican Republic construction and as it	

serves under regional climates, can be useful for most countries under tropical climate conditions.

Process

Method description

For the research part, the approach for application in the Dominican Republic will be based on comparative countries with similar climatic conditions. Firstly, because the amount of scientific research and qualitative data is insignificant compared to the existing amount of data such as i.e., South East Asia and other regions that share numerous studies under tropical climate conditions. This background research will be combined with practical architectural and construction knowledge and site visits of the author based on design and construction of coastal hotels in the Dominican Republic and Jamaica (which has a similar climate and construction methods as the Dominican Republic). After the study and analysis of research data, a site selection will be made based on a global representation of the main challenges and conditions of coastal hotels in the Dominican Republic. This includes solar radiation, humidity, precipitation and winds speed. It also has to represent a recently renovated coastal hotel to display the latest techniques and materials used in the Dominican Republic today. On the site of the selected hotel, the closest guest building block to the coastal line and the most vulnerable to the climate conditions will be selected, in order to provide the worst-case scenario for this study.

For the design part, the existing selected building block will be modeled in Revit in order to recreate accurately the existing conditions and serve as the main frame for the design of the sustainable renovation. The first model and its components will be analyzed on the design builder software to evaluate the building's energy performance based on energy flow inward and outward and temperature difference. The input data of average temperature set in the air conditioning by the guests and the average Kw/h of energy consumption will be taken into consideration as well. Afterwards, the sustainable renovation strategies models will be designed and evaluated to be compared at the end with the original and current building of the hotel selected. In this part, a comparative chart with the main aspects of energy performance will be presented to see which strategies met the goal of reducing the cooling energy demand by half (from 40% to 20% of the hotel's total energy consumption). This and additional conclusions will be drawn in order to see the efficiency of these strategies.

Literature and general practical preference

- Passive design studies in countries under tropical climate conditions
- Literature research, encyclopedias and weather stations data for the climate analysis
- The United Nations Environmental Programme roadmap for the Dominican Republic
- Local (Dominican Republic) and international research and literature study about the approach of the Dominican Republic for a more sustainable tourism.
- Thermal comfort studies in countries under tropical climate conditions
- Research of material properties (CES software, technical sheets of market products and research papers with material analysis)
- Personal experience of design and construction (5 years of study in the Dominican Republic and 3 years of work experience on both the Dominican Republic and Jamaica)
- Site visits, data collection and consultation from hotel representatives of the case study coastal hotel selected in Puerto Plata, Dominican Republic (architectural renovation and energy management).

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 relationship is that the main intention of all these topics and programs is to make the world a more sustainable and environmentally friendly space for all organisms living in it through the latest sustainable architectural knowledge. The application of sustainable building technology is essential to shift from old and inefficient design and construction methods towards a more climate and environmentally adaptable design and practices. With this thesis, I'm aiming to help 3rd world countries under harsh tropical climate, that are more vulnerable to climate change, to step up the way they build with better alternatives. Using the coastal hotels of the Dominican Republic as an example, I plan to use the knowledge of climate design, and building technology pillars, such as passive design techniques and sustainable materials, to solve an important energy performance challenge. How much a passive design approach is capable to reduce the cooling energy demand before turning to active design investments? How smart we can design before cheating nature with active technology?. These are personal reflexion questions that I want to solve through passive design and sustainable materials.

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

As humans, we urgently need to step up and look to apply more sustainable measures to today's challenges and inefficient professional practices. Our field of work (design and construction) is responsible for the highest emissions of CO₂ to the atmosphere; therefore, our responsibility is enormous in the global fight against

climate change. Because the Dominican Republic is one of the ten most vulnerable countries to climate change, and coincidentally is the place where I lived and learned to love and appreciate architecture, I decided to apply what I've learned in TU Delft to give back from what I received. The Dominican Republic today uses an inefficient method of renovation in coastal hotels, which represent one of the most important beacons of tourism in the Dominican Republic, which is one of the main pillars of its economy. This inefficient method of renovation of the coastal hotels is placed on display when the studies made by the United Nations Environmental Programme reported that of the total energy consumption of hotels, the cooling energy demand takes up to an average of 40% of that total energy. If this number can be reduced by half (20%) through sustainable façade renovation strategies, the investments in this passive and sustainable technology can serve to avoid the amount of CO₂ produced by inefficient design and also serve to shift the Dominican practice of architecture and construction techniques and materials to more environmentally friendly and energy efficient design and fit into the challenge to adapt to climate change.