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	Thijs Kroft
Student number	5078644

Studio		
Name / Theme	Architectural Engineering	
Main mentor	Mauro Parravicini	Design mentor, architecture
Second mentor	Clara Garcia-Sanchez	Research mentor, Geomatics/Urban Air Flows/CFD
Argumentation of choice of the studio	I chose the architectural engineering studio for its emphasis on technological innovation and the freedom it offers, all while maintaining a structured schedule. Throughout my education, technical requirements have consistently inspired my designs, making the studio's technological focus a perfect fit for my approach. Additionally, the opportunity to select a mentor from outside the studio is invaluable to me, as it allows me to work with an experienced supervisor in the field of aerodynamics—essential for achieving success in this field where I have very limited experience.	

Graduation project	
Title of the graduation project	Wind Driven Design
Goal	
Location:	Netherlands, Rotterdam, Rijnhaven
The posed problem,	Wind behavior around high-rise structures
research questions and	*How can an improved understanding of wind behavior be integrated into high-rise design strategies to enhance pedestrian comfort and safety in Rijnhaven, Rotterdam?*
design assignment in which these result.	Design a high-rise structure in Rijnhaven Rotterdam while taking wind into account for early considerations.
Throughout the world, buildings are becoming taller and the amount of tall buildings is increasing. Tall buildings significantly alter wind patterns, often creating challenges for pedestrian comfort and safety, such as wind tunneling or turbulence at ground level	

This can result in negative impacts on pedestrian comfort around them, and can sometimes even lead to dangerous situations.

Meanwhile, architects have a large knowledge gap on this particular subject, while communication with engineers is often difficult due to a lack of understanding.

This project focusses on helping architects incorporate wind-related effects in the early stages of their design projects while testing the effects of several design strategies on pedestrian comfort.

Process

Method description

A theoretical background of the topic will be formed through a literature review. This literature review will result in several design strategies that will be tested through simulations.

Design strategies take the shape of certain masses that can be inserted in the simulations. The simulations require detailed surroundings (primarily acquired through City4CFD) as well as wind data (acquired through KNMI) The simulations are caried out through CFD (Computational Fluid Dynamics), using OpenFOAM v7.

Results are visualized through paraview as well as pyvista/python.

Literature and general practical preference

Academic Sources on the use of CFD in the built environment, as well as implications on architectural design. For example:

Tax, S. People centred + climate oriented Urbanism. Eindhoven: Eindhoven University of Technology, 2021.

Blocken, B., Janssen, W.D., Van Hooff, T. CFD simulation for pedestrian wind comfort and wind safety in urban areas: General decision framework and case study for the Eindhoven University campus. Elsevier, 2011.

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)?

This topic concerns architecture as well as engineering (hence the studio). It concerns architecture, as it is about design strategies for buildings. These interventions take place in the built environment, hence the master programme. Within this master programme, it is interdisciplinary between architecture and geomatics.

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

There is a large knowledge gap in the architectural field concerning wind behaviour, while the topic is becoming increasingly more relevant. Meanwhile, the primary concern of those who do specialize in wind behaviour is not the impact of different design strategies. Therefore, this topic fills a niche of very few papers that concern themselves both with the architectural design process as well as wind behaviour.