

Graduation Plan

Master of Science Architecture, Urbanism & Building Sciences



Graduation Plan: All tracks

Submit your Graduation Plan to the Board of Examiners (Examcommissie-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	Francisco Munoz
Student number	4621298

Studio		
Name / Theme	Explore Lab / Circularity and robotic fabrication	
Main mentor	Thijs Asselbergs	Architecture
Second mentor	Serdar Asut	Research
Argumentation of choice of the studio	The freedom of the course offered, enabled me to dive deep into the combination of materiality with technology through experimentation in ways other courses didn't.	

Graduation project	
Title of the graduation project	Zwitsal brownfield, a new hub for the city
Goal	
Location:	Apeldoorn, The Netherlands
The posed problem,	With the ambition to stimulate urban growth and revitalize the North part of the city, the large brownfield Zwitsal will undergo a phased transformation in the next 10 years. Many buildings will be demolished to increase the value of the land and new buildings will erect in their place. The concrete and bricks of the demolished buildings will be downcycled for other more basic purposes, dismissing the potential of their properties. New buildings mean new materials, meaning more embodied carbon.
research questions and	How can construction waste, specifically bricks and concrete, be upcycled and integrated in the construction process at a local level through the aid of robotic manufacturing?

<p>design assignment in which these result.</p>	<p>A new approach needs to be proposed in order to push for local circular economies. A series of buildings pertinent to the former factory will be demolished; they will become waste. With the ambition to create a circular economy at a local scale, the goal of the design is to design the transformation of three existing buildings through the upcycling of the demolition waste. The material outcome of the mix between concrete and bricks harvested from the selected donor buildings will be used to create new modular building components through the implementation of robotic fabrication processes found on site, in order to create adaptive and flexible buildings for the future. The design will try to stimulate sustainable lifestyles and cater the needs of the new users of the plot while connecting the district together.</p>
<p><i>[This should be formulated in such a way that the graduation project can answer these questions. The definition of the problem has to be significant to a clearly defined area of research and design.]</i></p>	
<p>Process</p>	
<p>Method description</p>	
<p>Through the research method of experimentation, brick- and concrete-waste from demolitions will be the main materials looked into and the medium with which the manufacturing process will occur is through the use of robotic arms.</p> <p>The material will undergo iterative sampling and analysis, in order to achieve a more comprehensive overview of the potential these two materials can provide when combined. The samples that come out of the experiments, will be tested on the basis of four aspects: compressive strength, elastic modulus porosity and water absorption. Once the optimal composition of the materials has been reached, they will undergo a series of implementation and manufacturing techniques through the use of robotic arms, with the aim to discover a new building process for this “new” building component.</p> <p>Through experimentation, the final material will be put to test through the execution of prototypes carried out through a robotic application. This process will begin during the research phase and will extend to the design phase of the project.</p>	

Literature and general practical preference

The intention of the research is to gain insight to the possibilities of the process in which demolition waste can be upcycled into new modular building components. Since robotic fabrication processes as well as circular waste are two topics that have rarely been practiced in real projects, the information gathered will therefore be used to help understand which robotic applications are most suitable for such a process, what can this "new" material become, how can it be used and how the robotic process provide assistance for the creation of these modular building components.

For this, research will be based on the following points:

- Research papers from universities on robotic fabrications
- Experiments resulting from the implementation of a robotic fabrication application with the waste material.

Reflection

1. The graduation topic of upcycling waste through robotic fabrication is directly linked to ExploreLab in the way the results can effectively be explored through experiments in as far detail as found necessary for the project to run. The project relates to the master track Architecture because of the different scales that are touched from the material, to the architectural expression of the building designs, and from the building processes and strategies to the program of the buildings. The goal of this project aligns to the Master program of Architecture through the work generated at an academic level as well as professional.
2. The project provides a foundation to understand how a new circular approach can be implemented in the development of a large-scale project where many different functions will come in to create a new vibrant hub for the city. It is important to grasp the needs of the new users in order to provide a suitable design solution provided by the (scientific) framework produced by the creation of a new material and the use of a new construction process. A business plan together with a construction process, phased throughout the timeline that the project intends to undergo, will provide insight to how this could become feasible to work in a real setting.