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	Alexandra Fröwis
Student number	5594774

Studio		
Name / Theme	Designing Circular Building Products	
Main mentor	Olga Ioannou	Façade and Product Design: Circular Building Design
Second mentor	David Peck	Climate Design, Critical Materials
Argumentation of choice of the studio	The studio focuses on circularity, which is why I chose it, as I am interested in the implementation of circular strategies within building products and the built environment.	

Graduation project	
Title of the graduation project	The use of critical raw materials in façades and the premise of circularity: identifying dependencies and planning for the future
Goal	
Location:	[-]
The posed problem,	- The building sector is responsible for a big share of global emissions and energy consumption. - The clean energy transition is highly reliant on critical raw materials as they are key components for renewable energy production technologies as well as smart systems (sensors, motors etc.) in buildings. - Façades also contain materials that are rated as critical but the exact amount and placement of these materials is not properly assessed so far. - Strategies to address possible reduction, recycling, etc. of critical raw materials in façades are not properly investigated. - Current policies do not address the implementation and handling of critical materials in the façade sector.
research questions and	Main Q: - How can policies address the implementation of circular strategies regarding critical raw material concern in the facade industry?

	Sub-Qs: - What role do circular raw materials play for the built environment? - How are critical materials related to circularity? - Where can critical raw materials be found in façade systems? - What is the current state of affairs of policies and regulations in critical raw materials in the EU and the Netherlands?
design assignment in which these result.	To develop a framework or strategy to help policy makers with decision making in critical material concerns in building products in order to prevent future material bottlenecks in façade companies.

Process

Method description

Figure 1 shows the framework of the research. The first step of the project is to figure out how much information can be found and therefore how much of the research could be done through literature review. This includes a basic review of the main topics of the research, namely *critical raw materials, circularity* and *facades*, both on their own as well as combined. For the literature review, the search engines Scopus and Google Scholar were used with respective terms. In addition, MOOCs on *critical raw materials, circularity* and *facade* were followed.
To determine what role critical materials play in facades, two curtain wall systems from two different companies are analyzed as case studies. The systems are meant to represent high(est) selling curtain wall systems in the Netherlands without any pre-analysis in terms of materials' criticalities, in order to ensure an unbiased result. Good cooperation with the respective companies is a prerequisite, so that a profound analysis is possible. The analysis then studies the components of the facade systems on a material-level and map the results against the current (2020) CRMs list of the EU. The aim of the research is therefore to visualizes where critical materials are in a facade and to determine the level of criticality per respective facade element.
Regarding the section on policy, an exploratory research is performed to compile a comprehensive overview of existing policies, directives, and regulations in the EU and the Netherlands.
The results of the case studies and the policy investigation is then mapped against each other to visualize whether current policies show an awareness of critical materials concerns within building products in the facade industry. By analysing existing gaps, a decision-making framework or strategy is developed that aims to provide policy makers with recommendation on how to address critical materials concerns in the façade industry.

Literature and general practical preference

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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 overall topic of the thesis is the circular environment and circular strategies related to critical raw materials. Circularity is an important research topic within the architecture faculty and specifically the Building Technology master track, with its focus on sustainability and innovation in the built environment.

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

The available literature on critical materials today mostly discusses the concern in fields related to low carbon, e-mobility or security and defense. There is a gap in research and knowledge for critical materials in the built environment. This thesis will analyze state of the art curtain wall façades systems and their relation to critical materials and evaluate current policies and frameworks in order to show up the gaps. As a result, the thesis aims to work out recommendations on strategies to mitigate critical materials concerns in the built environment.
So scientifically it aims to provide research for this defined gap, professionally the goal is to prevent future material concerns in façade companies and socially the relation of critical materials to the climate crisis and energy transition is discussed.

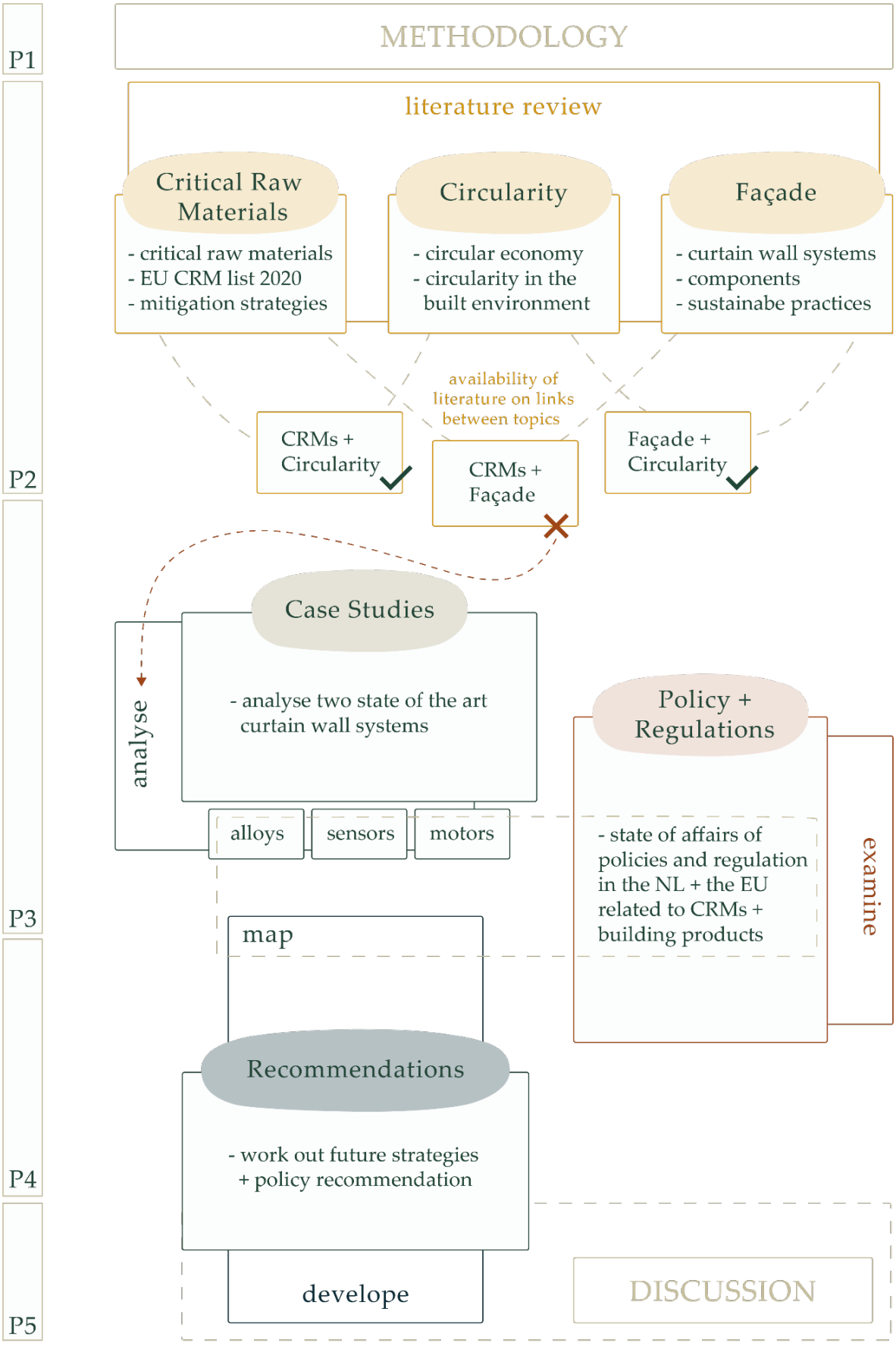

Figure 1: Methodology

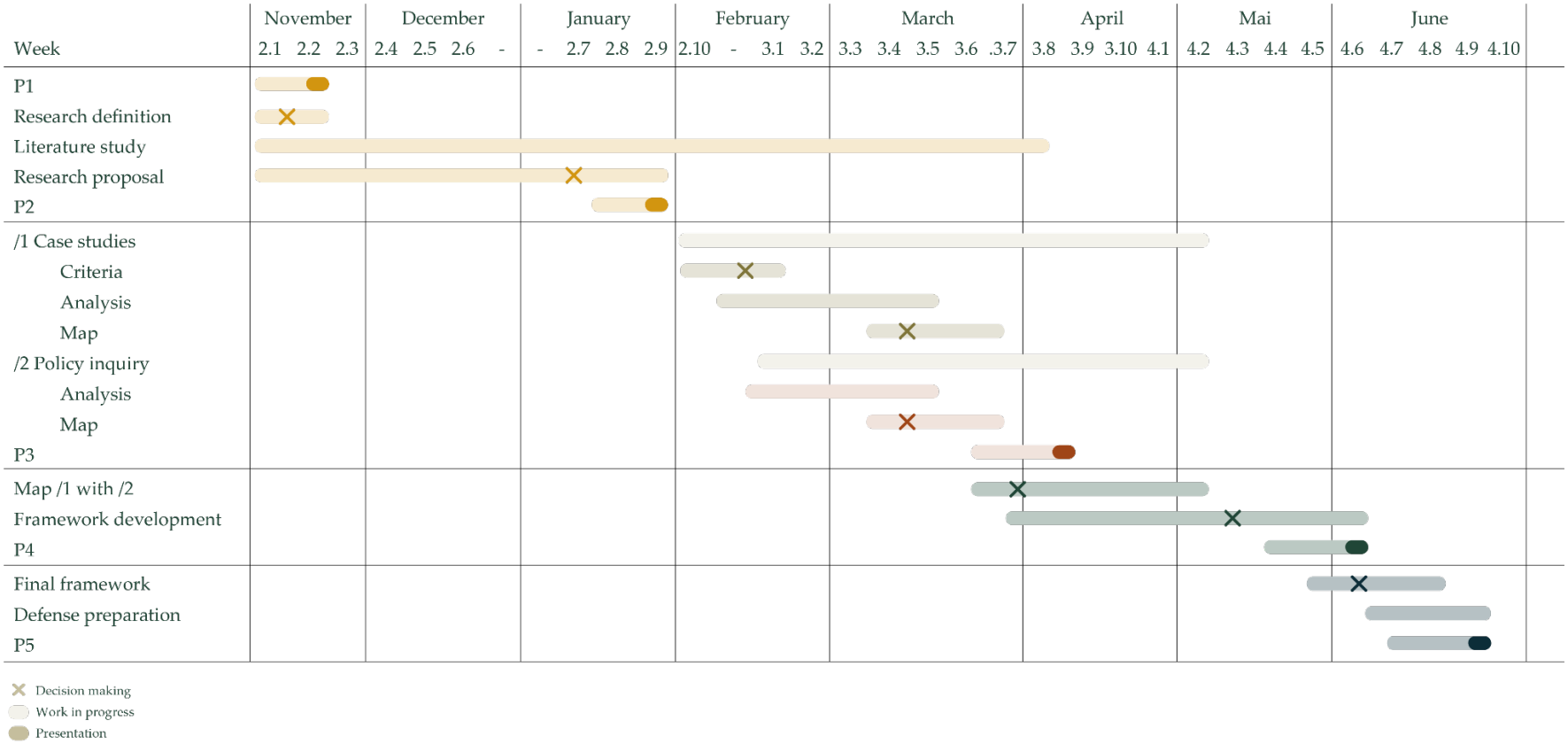

Figure 2: Project plan