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.

Personal information	
Name	Maximilian Friedmann
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Studio		
Name / Theme	aE – Architectural Engineering	
Main mentor	Gilbert Koskamp	Research Mentor
Second mentor	Thomas Offermans	Design/Architectural Mentor
Argumentation of choice of the studio	I chose the Architectural Engineering (aE) studio because of its strong technical focus, which aligns closely with my background and interests. Coming from a pragmatic design and thinking approach, influenced by my German education, I have always been drawn to the technical aspects of architecture. I began my studies at a German *Hochschule*, a university with a strong technical orientation, before transferring to TU Munich. This foundation instilled in me a deep appreciation for precision, efficiency, and problem-solving in architectural design. The freedom offered by the aE studio was another decisive factor in my choice. I value the opportunity to define my own design direction while engaging with technical challenges and innovation. I have been exploring parametric design for some time and had the opportunity to deepen my knowledge during my time at Bjarke Ingels Group, where I worked on major timber projects that utilized parametric workflows. Furthermore, I have a strong connection to timber construction, having worked extensively with it in the past. This experience exposed me to common issues and misconceptions surrounding timber use. The aE studio provides the ideal platform to dive deeper into this topic, critically explore timber tectonics, and contribute meaningful insights into its role in sustainable architecture.	

Graduation project	
Title of the graduation project	Reimagining Timber: Tectonics, Innovation and Locality
Goal	
Location:	Delfshaven, Rotterdam

The posed problem,	Timber is often misused or misunderstood in contemporary construction, reducing it to a substitute for concrete or steel rather than embracing its unique qualities. Over-reliance on systems like cross-laminated timber, for example, prioritizes flat, surface-based applications that neglect timber's natural properties, such as its tensile strength, lightness, and adaptability. This approach not only diminishes timber's architectural expression but also undermines its competitiveness in a market dominated by standardized, industrial materials. Missed opportunities lie in timber's potential to redefine construction practices through its renewability, compatibility with prefabrication, and ability to integrate with digital fabrication and parametric design. In the Netherlands, these challenges are compounded by urban density, regulatory constraints, and the country's reliance on imported timber. Despite its long history with timber construction, the current industry lacks the infrastructure and expertise needed to fully leverage timber's potential. Addressing these systemic gaps is critical for making timber a viable, sustainable, and innovative material in the Dutch context. This thesis explores how timber can be reimagined to align with its inherent logic and material potential. By addressing its misuse and identifying strategies for better integration in the Netherlands, the research aims to position timber as a leading material in modern architectural practice.
research questions and	How can timber's tectonic logic evolve through digital fabrication and parametric design to create a material- and fabrication-driven, context-sensitive architecture in the Dutch context?
design assignment in which these result.	The design assignment focuses on creating a timber-based architectural

	project situated at the waterfront in Delfshaven, Rotterdam. This location, which serves as a bridge between the historical fabric of Delfshaven and the modern developments next to it, provides a unique opportunity to explore the integration of traditional and contemporary architectural principles. The project aims to address one of the most significant challenges in contemporary timber architecture: designing dense urban building blocks that accommodate a variety of typologies, including housing, offices, retail spaces, parking, and public areas. These multifunctional typologies require a coherent design that balances aesthetic, structural, and functional demands while showcasing timber's versatility and potential as a primary construction material. To achieve this, the project will leverage advanced parametric design tools and digital fabrication techniques, enabling optimization of timber's inherent properties. The design will also draw inspiration from Dutch timber construction traditions and fabrication culture, reinterpreting these practices to align with modern sustainability and circularity goals. This assignment seeks to establish a prototype for how timber can be used in dense urban environments, not just as a substitute for steel or concrete but as a material with its own logic and tectonic language. The project aspires to create a human-centered, environmentally responsible design that demonstrates how timber can reconcile tradition with innovation, particularly within the Dutch context. Key challenges include integrating diverse typologies into a cohesive architectural expression ensuring that the design aligns with Rotterdam's urban and cultural identity. The

	resulting project will serve as an example of how timber can redefine urban architecture, bridging historical and modern elements while embracing the technical advancements of digital fabrication and parametric workflows.

Process

Method description

Literature Review

A systematic review of academic texts, industry reports, and relevant architectural frameworks provides the foundation for this study. Key sources include *Bauen mit Holz – Wege in die Zukunft* by Hermann Kaufmann and *Advancing Wood Architecture* by Achim Menges, which offer insights into timber's historical and modern tectonics, digital fabrication, and sustainability. The review focuses on understanding timber's material properties, evolving design methodologies, and its implementation in the Dutch context.

Case Study Analysis

Several architectural projects were analyzed to assess timber's potential and its application in modern tectonics. Studio Precht's Bauernbogen, Herzog & de Meuron's Hauptsitz Christoph Merian Stiftung, Shigeru Ban's Tamedia Building, and the Aussichtsturm der Landesgartenschau by the University of Stuttgart have been the main case studies, which helped form a greater picture of the current developments. On-site visits to selected case studies and under-construction timber projects in Germany and Austria offered additional insight into the materials, fabrication processes, and design decisions involved.

Expert Consultations and Observations

Conversations with timber experts, architects, and craftsmen provided practical perspectives on the challenges and opportunities of using timber in modern construction. A key component of this research was attending the Anatomy of Timber workshop, hosted at TU Delft, which brought together industry professionals, researchers, and students to explore the material's properties and innovative applications in architecture. The workshop offered valuable insights into the integration of digital tools and traditional techniques, highlighting advancements in timber joinery, material optimization, and design workflows.

Additionally, a visit to a timber workshop run by a local craftsman allowed for hands-on observations of the fabrication process, further bridging the gap between traditional craftsmanship and modern fabrication technologies. Observations of both completed and in-progress timber projects helped in understanding material behavior, tectonic language, and the impact of fabrication techniques on design outcomes.

Prototype Modeling

As part of this research, prototype modeling will play a key role in deepening the understanding of fabrication methods and their influence on the design process. By creating physical models, I aim to test and refine fabrication techniques while exploring the structural, material, and aesthetic potential of timber. This iterative

approach will allow for the integration of traditional and digital methods, ensuring that the final design is both innovative and feasible. Modelmaking will also serve as a critical tool to bridge theory and practice, enabling a more tangible exploration of timber tectonics and supporting the development of a project that aligns with sustainable and circular principles.

Parametric Design Research

To explore the impact of parametric design on the project, I will work extensively in a parametric design environment, particularly with Grasshopper. This approach will allow me to embed material properties, structural logic, and environmental factors into computational workflows, ensuring that the design evolves dynamically in response to these parameters. By employing parametric tools, I aim to demonstrate how this methodology can optimize timber use, improve design precision, and enable the creation of innovative architectural forms. This process will not only inform the project's final design but also provide insights into how parametric workflows can enhance sustainability and material efficiency in timber construction.

Literature and general practical preference

My research draws on key theoretical frameworks and practical precedents to explore the potential of timber tectonics through digital fabrication and parametric design. Foundational literature includes *Bauen mit Holz – Wege in die Zukunft* by Hermann Kaufmann and *Advancing Wood Architecture* by Achim Menges, which provide critical insights into timber's tectonic evolution, material properties, and compatibility with modern fabrication techniques. Additionally, Jan Gehl's *Soft City* serves as a guideline for creating dense urban housing with a human-centered approach, emphasizing livability, connectivity, and the integration of architecture into the urban fabric. Gehl's principles will help inform strategies for developing housing that balances density with the well-being of its inhabitants, aligning with the project's goal of creating context-sensitive and sustainable architectural solutions.

The Bauernbogen project by Studio Precht acts as the primary reference for this research. The project exemplifies how architecture can seamlessly bridge tradition and innovation, using parametric tools to reinterpret vernacular forms and materials in a modern context. Its curved timber structure, inspired by agricultural forms, demonstrates how a context-sensitive design can respect local heritage while incorporating cutting-edge techniques. By combining digital fabrication with timber's inherent qualities, the Bauernbogen creates a dynamic and expressive tectonic language that reflects both its material logic and cultural significance. My goal is to achieve a similarly thoughtful and balanced result, one that integrates traditional and modern elements to create an innovative yet contextually grounded architectural project in Delfshaven, Rotterdam.

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

1. Relation studio

The graduation topic, focusing on the evolution of timber tectonics through digital fabrication and parametric design, aligns closely with the goals of the Architectural Engineering (aE) Studio and the MSc Architecture, Urbanism, and Building Sciences (AUBS) programme at TU Delft. The Architectural Engineering track emphasizes sustainable and circular architecture, encouraging innovative technical solutions that integrate material research, digital manufacturing, and ecological design principles. My thesis directly supports this idea by investigating timber's potential to address contemporary architectural challenges, such as urban density, resource scarcity, and environmental impact.

The studio's themes of "Make," "Stock," and "Flow" resonate deeply with my research. Timber's renewability and compatibility with prefabrication processes align with the Make domain, where the focus is on developing systems for reusable materials. My exploration of timber tectonics critically examines how we create and construct by seeking to merge tradition with innovation, informed by a detailed understanding of the processes involved. It highlights the importance of digital tools in bridging traditional craftsmanship with contemporary technology, emphasizing both the technical and cultural dimensions of timber architecture. The Flow domain is addressed through my exploration of timber's role in circular economy frameworks, emphasizing lifecycle design and material reuse.

By addressing challenges like the lack of domestic expertise in timber fabrication and regulatory barriers in the Netherlands, my project demonstrates the practical application of architectural research in solving real-world problems. Through its focus on Delfshaven, Rotterdam, the project provides a localized yet scalable solution, making a meaningful contribution to the future of sustainable urban design.

2. Relevance

My graduation work addresses key societal, professional, and scientific challenges by demonstrating how timber, when integrated with digital fabrication and parametric design, can provide innovative and sustainable solutions for contemporary architecture.

From a societal perspective, the project contributes to the urgent need for carbon-neutral and circular construction methods in dense urban environments like Delfshaven, Rotterdam. By exploring timber's potential to create human-centered, livable spaces, the project aligns with global climate goals and local housing demands while reconnecting communities with natural materials. Additionally, it advocates for the use of renewable resources and circular principles to improve urban resilience and sustainability.

In the professional realm, the project offers a framework for integrating advanced design tools with traditional construction methods, encouraging architects, engineers, and fabricators to collaborate more effectively. The emphasis on parametric workflows and material optimization demonstrates how technical innovations can improve design efficiency and broaden the scope of timber's applications, particularly in urban housing. By bridging tradition and innovation, this work also provides a model for addressing gaps in industry expertise and regulatory standards, particularly in the Dutch context.

On a scientific level, the research contributes to the evolving field of architectural engineering by investigating the role of computational design and robotic fabrication in enhancing timber's architectural and structural potential. It explores how embedding data into design workflows can optimize performance, reduce waste, and create context-sensitive designs. Furthermore, the project seeks to expand the knowledge base on circular construction by examining how bio-based materials and modular systems can align with circular economy principles. This work aims to inspire future research into material-specific design and innovative fabrication techniques that prioritize sustainability.

By connecting these three dimensions, my project demonstrates how architecture can respond to contemporary challenges while advancing both professional practices and scientific understanding.