# 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** | |
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| Name | Yeonghwa Choe |
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| **Studio** | | |
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| Name / Theme | Architectural Engineering Studio / Open Building | |
| Main mentor | Mauro Parravicini | Design |
| Second mentor | Pieter Stoutjesdijk<br>Paddy Tomesen | Research<br>Building Technology |
| Argumentation of choice of the studio | Architectural Engineering Studio deals with various problems faced by contemporary architecture. Based on the principle of Circularity, aE Studio consider in-depth theories and technologies about not only various environmental problems but also the direction architecture should proceed in the increasingly highly capitalized metropolitan city.<br><br>The past 20 years of experience in Seoul, a city that has rapidly become urbanized since modernization period, have made author realize the need for a new city direction through a shift in new architectural thinking. Mass supply-oriented Korea's residential culture led by minority monopoly capital has not only made citizens' lifestyles uniform, but has also caused various environmental or social problems. If Korean apartment-oriented development, already established as a culture, is an inevitable prerequisite for urban development and housing problems, it will also need to think about how to provide a new environment with minimal intervention or how it will be reused in the future.<br><br>In this context, the research and design that Architectural Engineering Studio deliver regarding John Habraken's principles of Open Building, Stewart Brand's principles of Shearing Layers, and Circularity suitable for Korean society, gave author confidence that Korean residential culture will be improved. | |

| **Graduation project** | |
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| Title of the graduation project | Re-living the concrete city |
| **Goal** | |
| Location | Mapo Samsung Apatu, Seoul, South Korea |
| The posed problem | During the modernization period of South Korea, the government radically introduced the concrete high-rise housing system proposed by Modernist architect Le Corbusier in order to solve housing problem. Such a system was an innovative way to provide housing in a short period efficiently and became very popular with the public in that it provides a new and modernized living environment. Such architecture has become a representative residential type in Korea so far under the unique name of "Apatu" and currently accounts for the highest proportion of about 63.5% among various housing types in Korea (National Statistical Office 2021).<br><br>However, the problem is the fact that all the Apatu repeat demolition and reconstruction every 30 years. So, most Apatu in Seoul have already been reconstructed, and some are waiting for re-reconstruction. The main reasons for the reconstruction culture that has become a social phenomenon are as follows.<br><br>Firstly, it is difficult to reuse concrete Apatu made by wet construction. Although maintenance and replacement work are required due to the ageing of the building's installation and structure over time, partial intervention is impossible because every building element is woven into one by wet construction.<br><br>Next, it is difficult to modify the space because the building itself is supported by reinforced concrete bearing wall structure. According to the "Population Census 2021," the average number of household members in the 1970s when Apatu were built in earnest on a large scale was 5.2, while there was more than a double decrease to 2.1 in 2021 (National Statistical Office 2021). However, since all the spaces inside the Apatu are divided into bearing walls, the house cannot be transformed to suit the changes in household members.<br><br>In conclusion, inflexibility caused by Apatu's bearing wall structure and concrete wet construction method was the most crucial reason for not reusing old Apatu. |

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| Research questions | For existing Apatu to become flexible buildings that can be reused in the future again, in-depth research regarding not only existing installation but also new climate installation, which can reduce the complexity of the existing installation system, is needed. Therefore, research on the natural air-conditioning system called The Earth, Wind & Fire Concept (Ben Bronsema, 2013) is the starting point for flexible Apatu. The new installation system will serve as a medium between existing concrete structures and the newly added infill to act like an organism. Also, depending on the position of the new installation, the program layout of future infill can be flexible, so it is possible to create a unique space configuration customized to the users' needs in each housing unit.<br><br>"How could a new installation system including natural air-conditioning (The Earth, Wind and Fire Concept) make existing Korean apartments (Apatu) more flexible?"<br><br>Sub Q1) What installations are basically needed for Apatu?<br><br>Sub Q2) What are the system and essential requirements of The Earth, Wind and Fire Concept (EWF Concept)?<br><br>Sub Q3) How to measure and quantify flexibility?<br><br>Sub Q4) Which layout of the new installation and service shaft maximizes the flexibility of infill customization? |
| Design assignment in which these results. | In order to reuse Mapo Samsung Apatu which is preparing re-reconstruction process at the moment, it is essential to apply Open Building principle considering separation between the Support and Infill (Habraken 1961). Namely, rather than completely demolishing old Apatu, it will be necessary to reuse the concrete structure itself as a vertical land and infrastructure for new vertical housing, replace a new installation system which makes the building more flexible, and plug-in a new fill for the living. And over time, structures, services, and infill will not only be freely changed according to the needs of users, but will also be flexibly replaced according to their life cycle. |

## Process

### Method description

Research on new installation systems that can make existing Apatu more flexible is divided into three parts. The first part is a study of the types and properties of essential installations that Apatu needs to operate. Through technical drawing analysis of Mapo Samsung Apatu selected as a context and another Apatu project constructed by the same company, general requirements such as the overall system and installation dimension will be studied. This research part will be the answer to sub-question 1.

The next step is a study of a new climate installation (The Earth, Wind & Fire Concept) that will reduce the complexity of existing climate installation and increase the flexibility of the building. As an answer to sub-question 2, the principle of the EWF Concept and its requirement will be studied through the literature study of Bronsema (2013), the founder of the concept. And then, through the research by design methodology, several different installation layout options for Mapo Samsung Apatu will be presented, derived from the research in the first and second parts.

The third part is research regarding flexibility. Along with the definition of flexibility, the criteria for measurement of the proposed installation layout option's flexibility are investigated. Through a literature study by Hatipoğlu (2020), appropriate criteria will be selected to compare the flexibility when each installation option is applied to the Apatu. In addition to the literature study, some selected criteria are adjusted to measure the flexibility of Apatu's unique condition, and some criteria suitable for measuring the flexibility of installation are added. This part will present the conclusion of the third sub-question.

Finally, a system that applies different weights for each criterion is studied to produce more accurate results in evaluating the presented options. A more accurate measurement method is selected by comparing the general method proposed by Saaty & Vargas (2012) and the simplified weight approach by Nick van Knaap and Jeroen van Veen. The final score is added for each option through the selected weight method, and the installation option that provides optimal flexibility is finally selected. This process answers sub-question four and will conclude the main thematic research question.

After the installation option is determined through research, the design of the newly added housing module will be carried out. In the process, concerns about the inhabitance where residents can stay during the refurbishment of existing Apatu will be reflected in the housing module. In addition, new mobility system is proposed to solve the problem of a lack of parking space and public facilities that users can use because the ground space is full of parking lots. All design processes will be carried out through plans and section drawings of Urban Scale (1:1000), Building Scale (1:100), and Detail Scale (1:5) and physical or digital models.

**Literature and general practical preference**

The key literature that will be utilized during the entire process is as follows:


1. Bronsema, B. (2013). Earth, Wind & Fire: Natuurlijke Airconditioning. Delft: Eburon. Available from: https://doi.org/10.4233/uuid:d181a9f2-2123-4de1-8856-cd7da74e8268 [accessed 12 January 2023].
2. Schneider, T., & Till, J. (2005). Flexible housing: opportunities and limits. Architectural Research Quarterly, 9(2), Available from: https://doi.org/10.1017/S1359135505000199 [accessed 12 January 2023].
3. Kalfaoğlu Hatipoğlu, H. and Haj İsmail, S. (2020) "HOUSING.FLEXIBILITY: A FRAMEWORK FOR A QUANTITATIVE EVALUATION METHOD DUE TO TURKISH DESIGNERS", ICONARP International Journal of Architecture and Planning, 8(2), pp. 545–566. Available from: 10.15320/ICONARP.2020.126 [accessed 12 January 2023].
4. Habraken, N. J. (2019). Supports: an alternative to mass housing. London: Routledge.
5. Saaty, T., & Vargas, L. (2012). Models, methods, concepts & applications of the analytic hierarchy process (2nd ed.). New York: Springer. Available from: 10.1007/978-1-4614-3597-6 [accessed 12 January 2023].


## 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 gradation topic, which suggests ways to reuse existing Korean apartments, is closely related to the Architectural Engineering Studio's topic (Open Building Principals), which look at the use of buildings from a long-term perspective. In addition, this Open Building principle is linked to the Circularity of the architectural industry ecosystem pursued by the Architecture track, and ultimately, concerns about the future system of Korea's representative residential facilities are consistent with MSc AUBS's direction of approaching architecture from the perspective of urban, technology, and science.

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

Graduation topics that present a new way of living are not simply solutions to one building. This is not only to suggest an improvement direction for one architectural type, but also to form a new social culture to create a better society. In the process of creating flexible architecture, research is conducted to maximize flexibility by analyzing the abstract value of "flexibility" in a scientific way, and more professional and accurate designs are derived by presenting specific technical solutions such as Natural Air Conditioning System and modular housing.