Source book

07.12.2010

Maral Alaei
Fanyi Jin
Tuuli Töniste

Left: Cellular Automata-Our Design Prototype

Pasila Lung

Purification of Air by Vertical Landscape
Students: Maral Alaei, Fanyi Jin, Tuuli Töniste

Performative Patterns of High Density

ARK-E3009 Design of Structures Studio
ARK-E2514 Design of Structures Theory
ARK-E5518 Digital Speculative Urbanism Studio
ARK-E5514 Digital Speculative Urbanism Lecture

Teaching team:
Prof. Toni Kotnik, Prof. Pia Fricker, Prof. Carlos Bañón
Luka Piškorec, Kane Borg

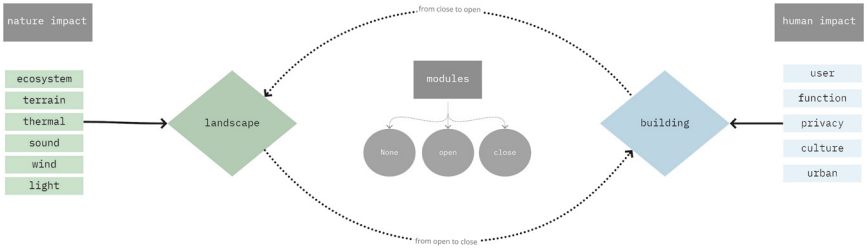
A” DS Aalto University Design of Structures
A! CM Aalto University Computational Methodologies for Landscape Architecture and Urbanism
SUTD SINGAPORE UNIVERSITY OF TECHNOLOGY AND DESIGN
AIRLAB architectural intelligence research lab

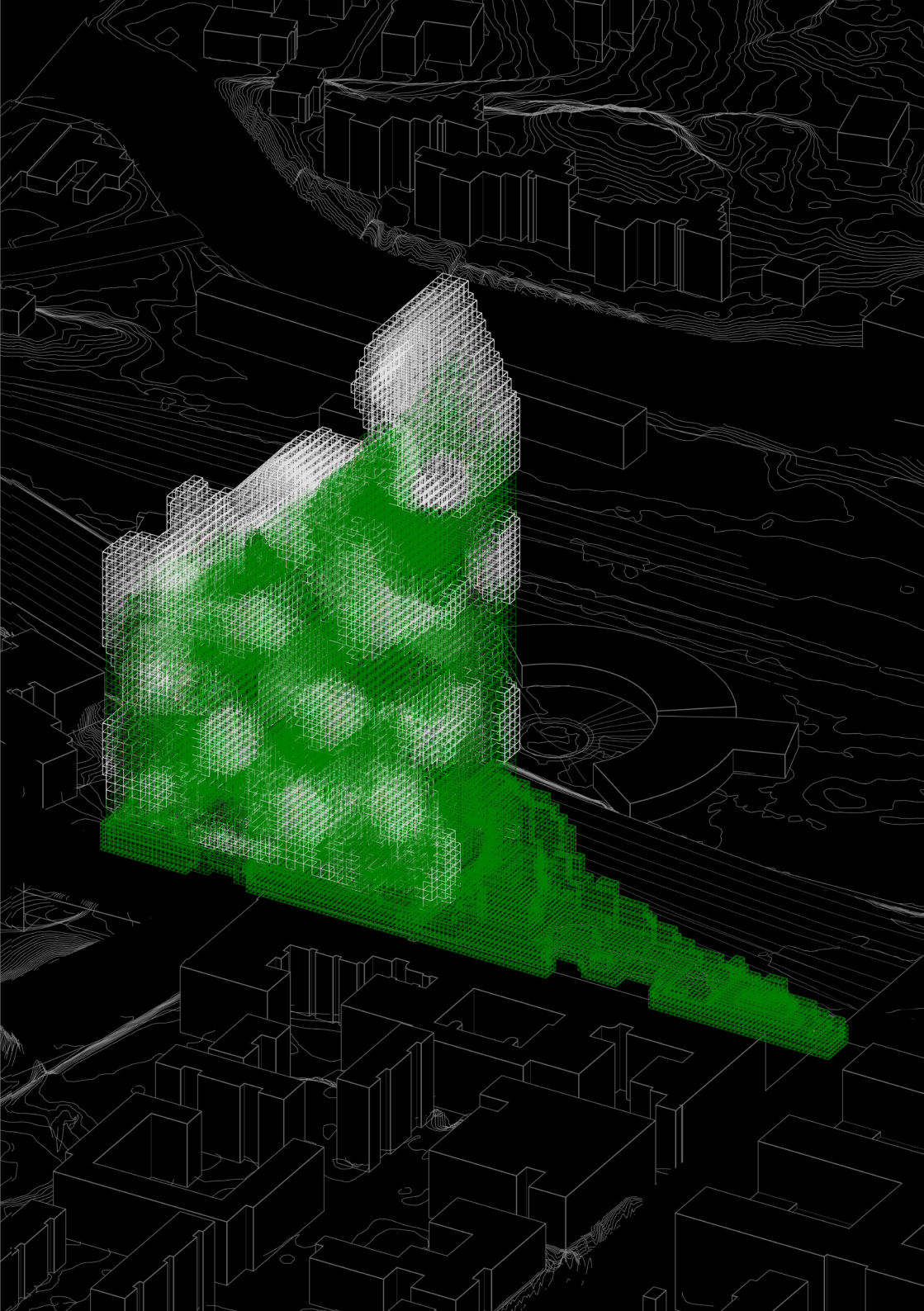
Introduction

In the concrete city centre of Pasila, greenery is needed. The winter months of the cold climate in Helsinki will lie dormant even the scarce of nature. The inner garden of the Pasila high-rise will stay green throughout the seasons, acting as a lung inside of the building and providing natural ventilation for the apartments. The air is flowing into the central landscape of the building through the openings in the building envelope. To ensure the airflow, most of the openings are placed in the predominant wind directions of the area. In the semi-warm centre atrium of the building, the air is purified and humidified by the vast net of plants throughout the atrium. The purified air will move from the building centre to the apartments by buoyancy induced ventilation. The used air is admitted back to the central atrium where the CO2 is absorbed to the plants and the warm air will rise to the top of the higher part of the building centre with the heat difference.

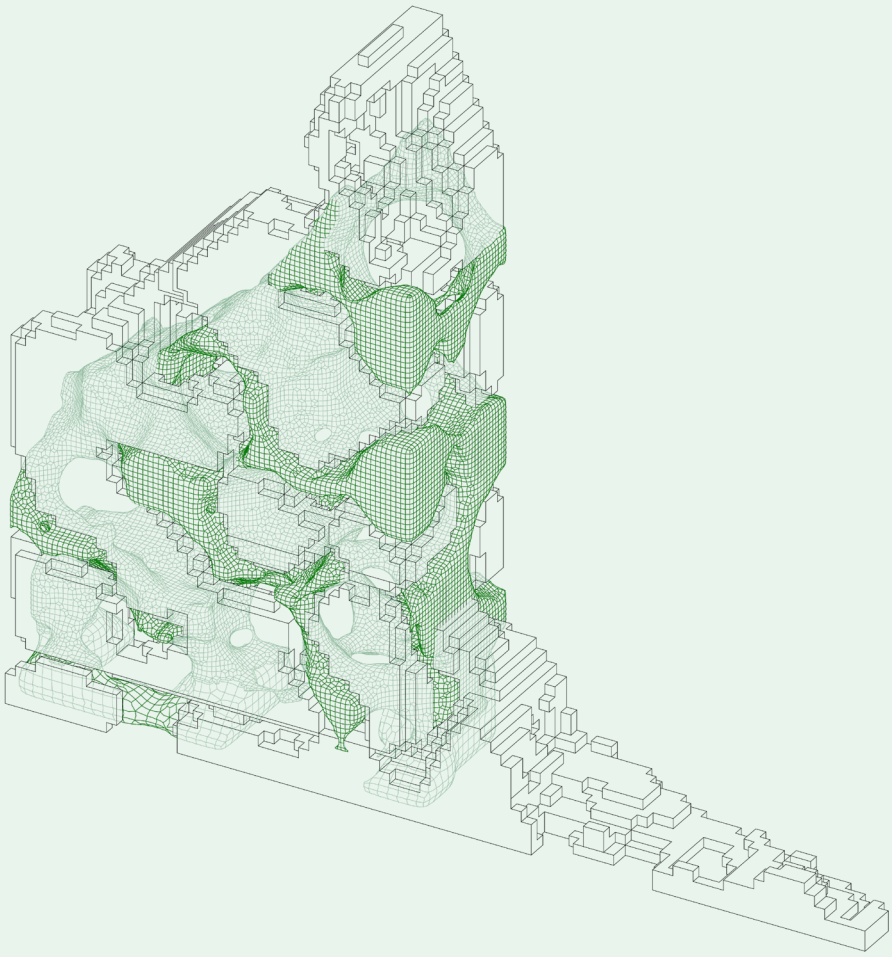
The openings of the building envelope will provide natural lighting to the inner landscape throughout the day from the East, South and West and can be used to cool down the building in the summer. Artificial light is also used for the indoor planting, which also improves the quality of the indoor terraces.

In the middle of the plant nets of the atrium, there are open voids for the floating islands that hold some of the social spaces. The floating islands are connected by a bridge to the horizontal hallways next to the apartments. The two-story apartments provide the possibility to create balconies to the outer side for the view of Helsinki and inner side for the view of the inner landscape and use on the colder seasons. The lower part of the building and the inner landscape among with the floating islands are public and open to everyone. On the ground level, most the natural rock is preserved, adding some commercial spaces and pathways formed by the terrain connecting to the railway station and east side of the building.

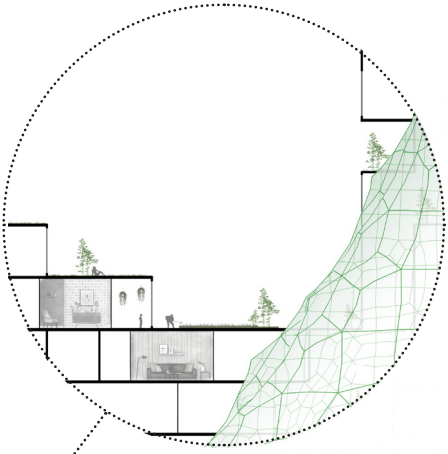




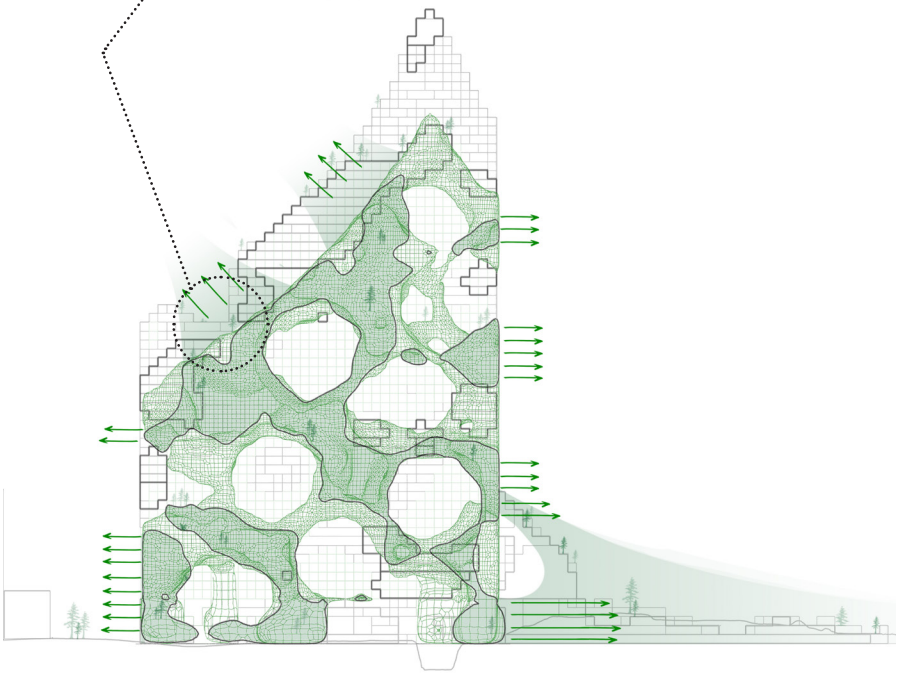
Building Performance



Landscape Spreading In and Out

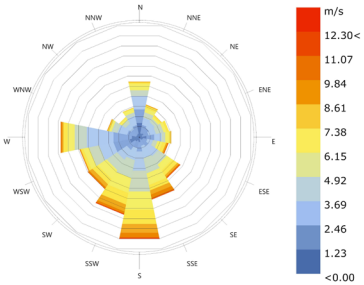


Residents are able to use the inner landscape as a park, the balconies and roofs can be used for outer landscape and farming.

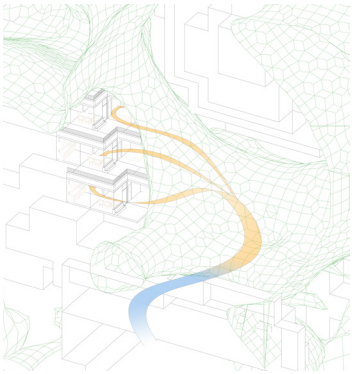


The connection of inner and outer landscape

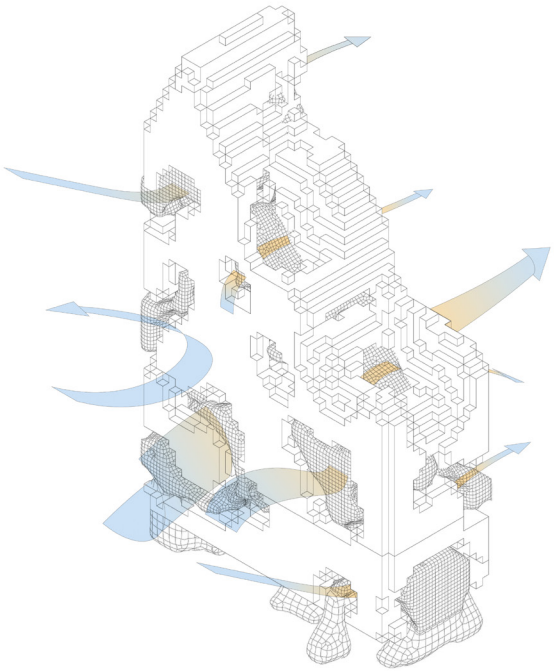
Air Flow and Wind



Wind-Rose
HELSINKI_FIN
1 JAN 1:00 - 31 DEC 24:00
Hourly Data: Wind Speed (m/s)
Calm for 1.20% of the time = 105 hours.
Each closed polyline shows frequency of 1.3%. = 112 hours.



The purified air from the central inner landscape brought to the apartment by one sided bouyancy induced ventilation. The used air is lead back to the central landscape.

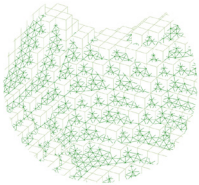


The predominant winds of the site determine the openings to the building to provide airflow. The openings can be used to cool the building in the summer.

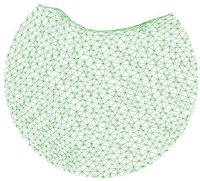
Overall Landscape Function

- Plant nets

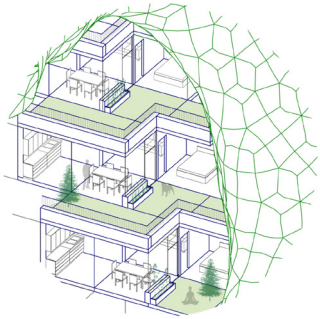
1. Growing Grid (also works as part of the structure)



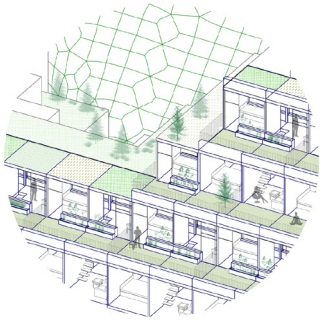
2. Plants start to grow



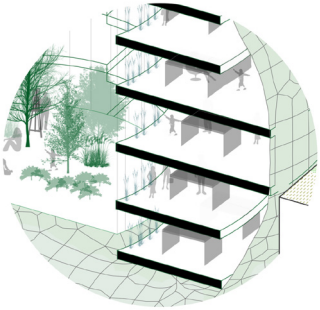
3. Plants smoothing the surface



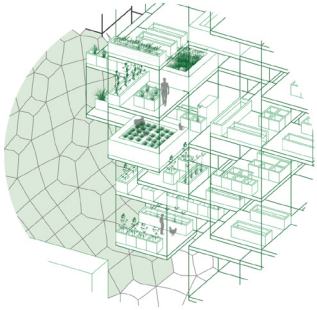
- Inner terraces



- Outer terraces

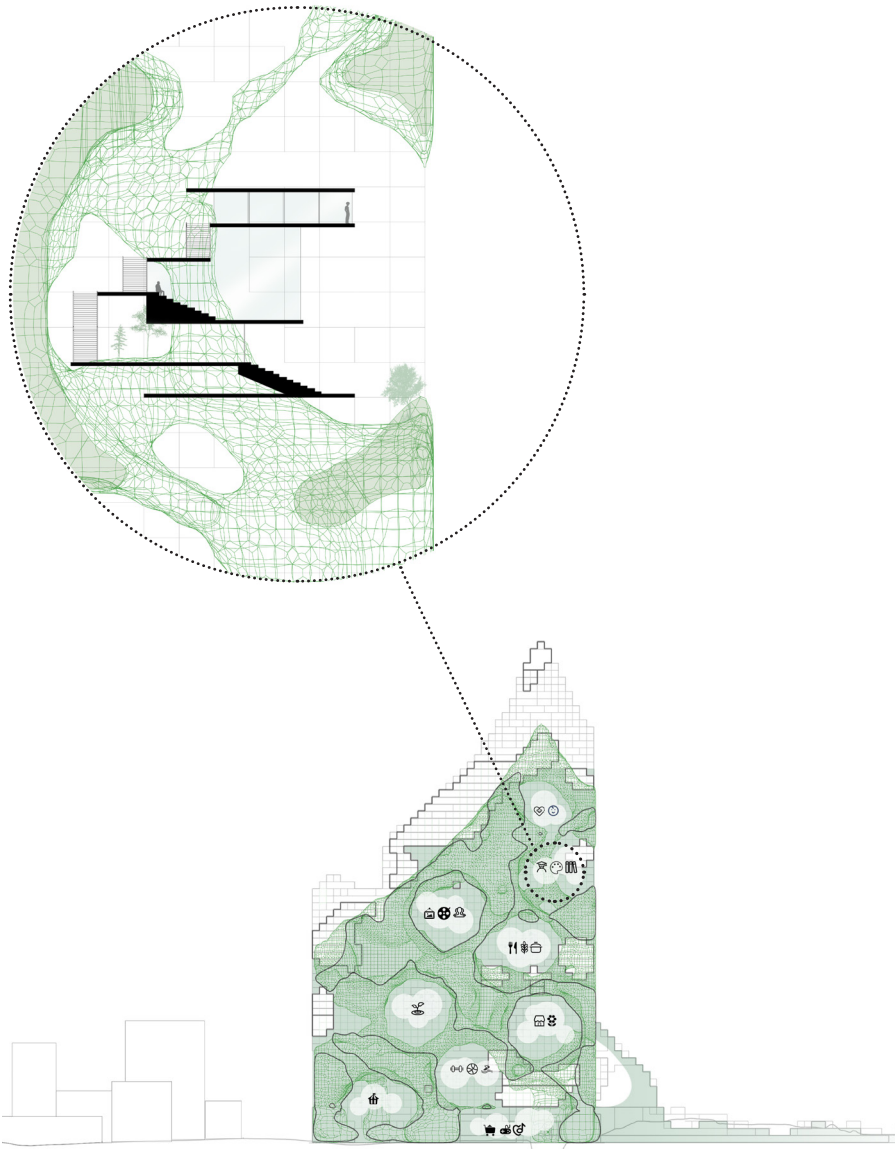


- Inner landscape parks



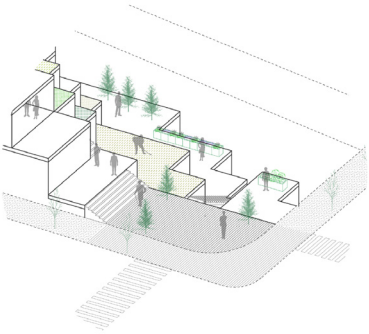
- Farming

Floating Islands

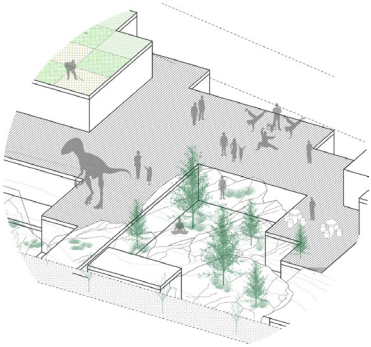


The voids in the inner landscape are used for social spaces, connecting to outer parts of the building with bridges and stairs. These social spaces are public in the lower part of the building and used by the residents in the higher parts of the building.

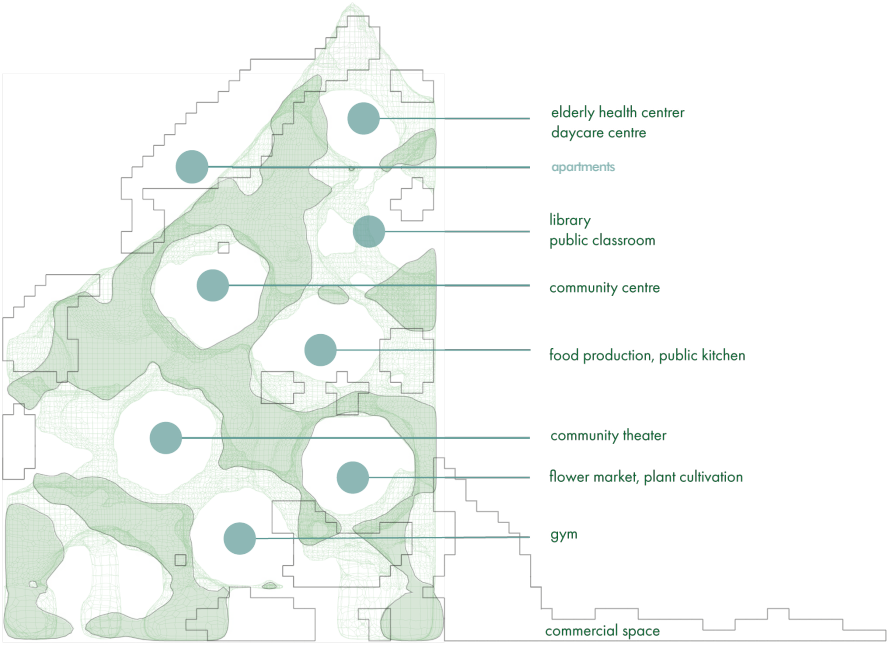
Building Program



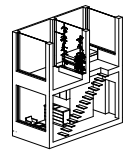
Site entrance

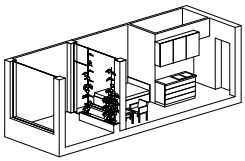


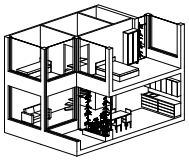
Natural rock preserved in the previous terrain

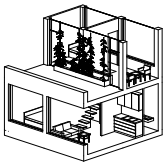


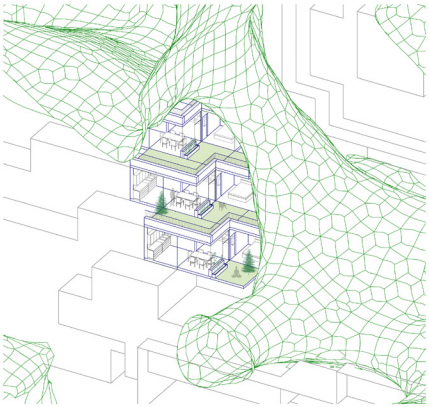
Apartments



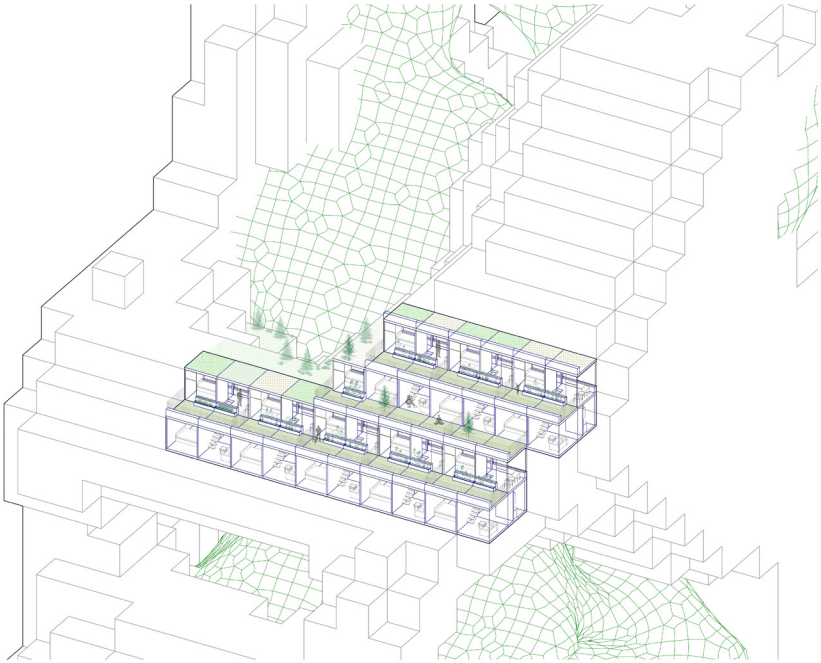






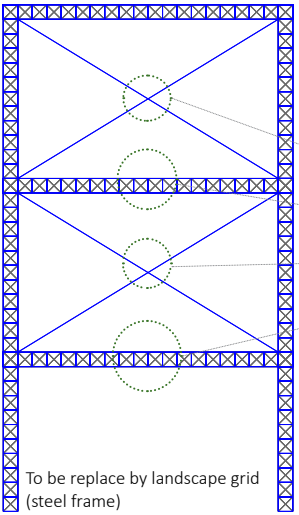


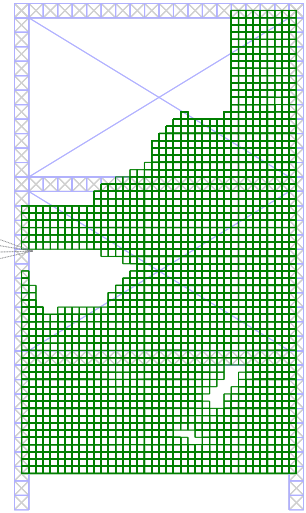
Apartment combination on the West

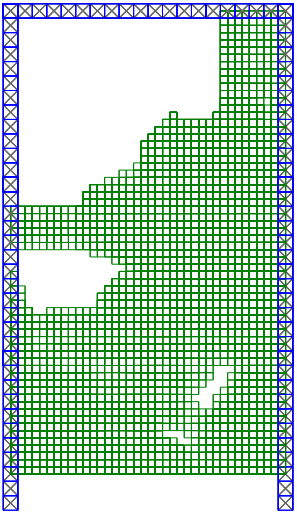


Apartment combination on the South

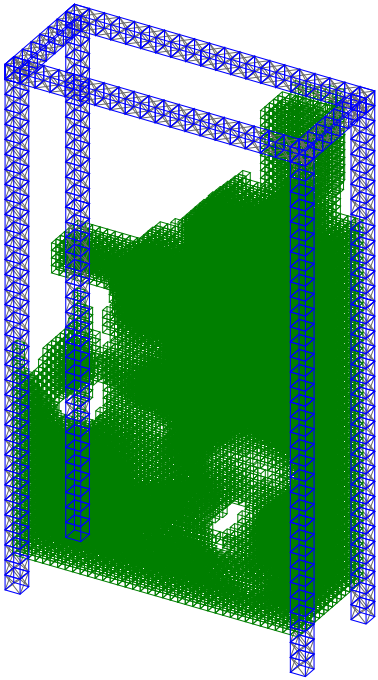
Structure Prototype: Mega-Frame structure system







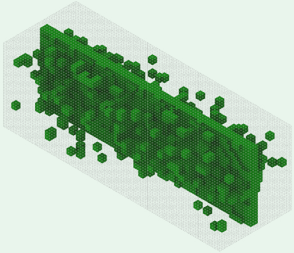
Landscape frame replaced horizontal mega elements

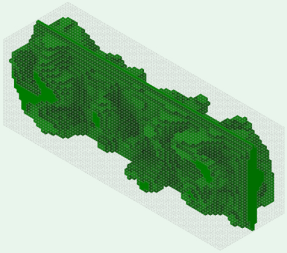


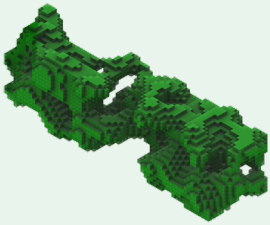
Building Form Generation

2D Form Generation

3D Form Generation



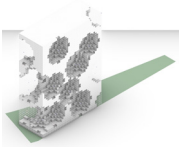




Form Control

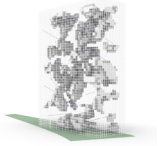
Control Points and Curves Influnced Air Flow Inside of The Building

With Adding Points



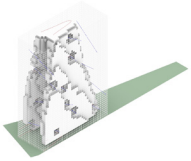
With Removing Points

With Adding Curves

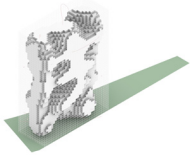


With Removing Curves

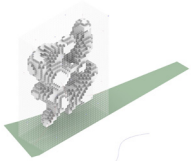
Combination



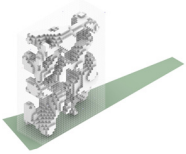
With Adding Curves and Removing Curves



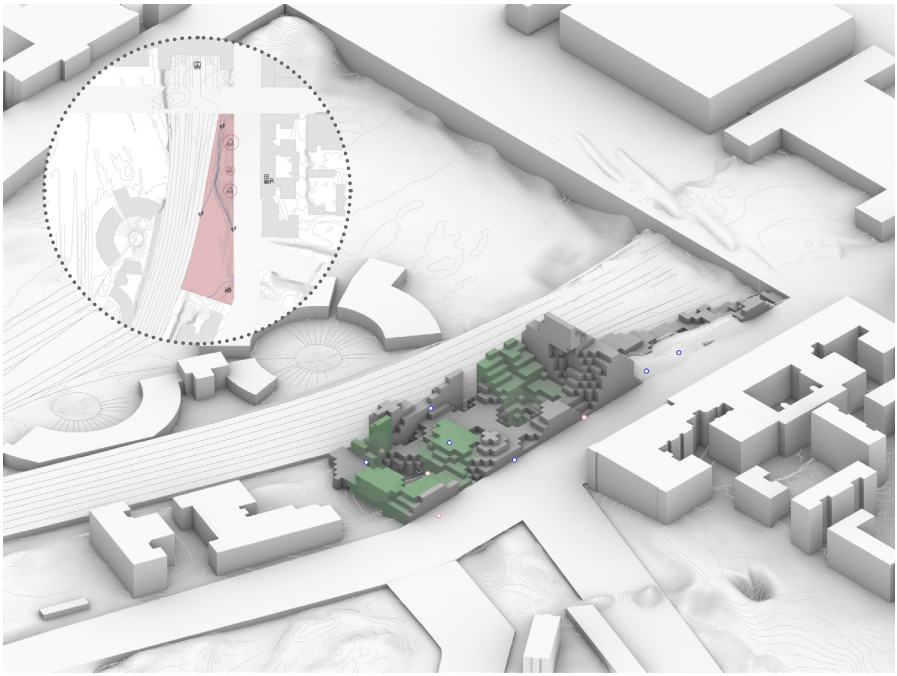
With Adding Points and Adding Curves



With Adding Curves and Removing Points



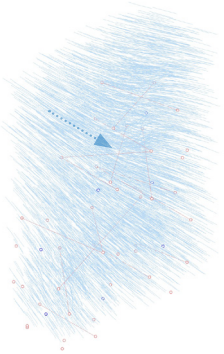
With Adding Points and Removing Points



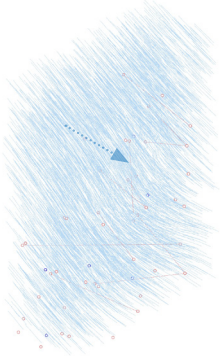
Pathways formed by the terrain and preserved natural rocks

Air Flow Simulation

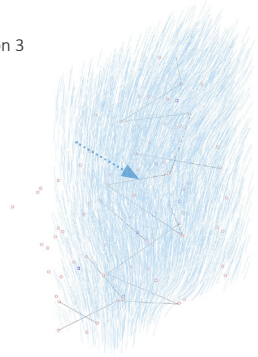
Option 1



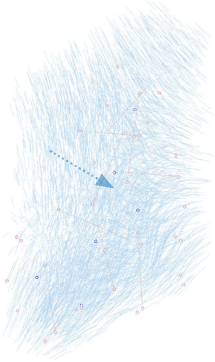
Option 2

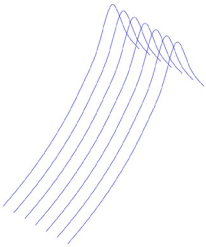


Option 3

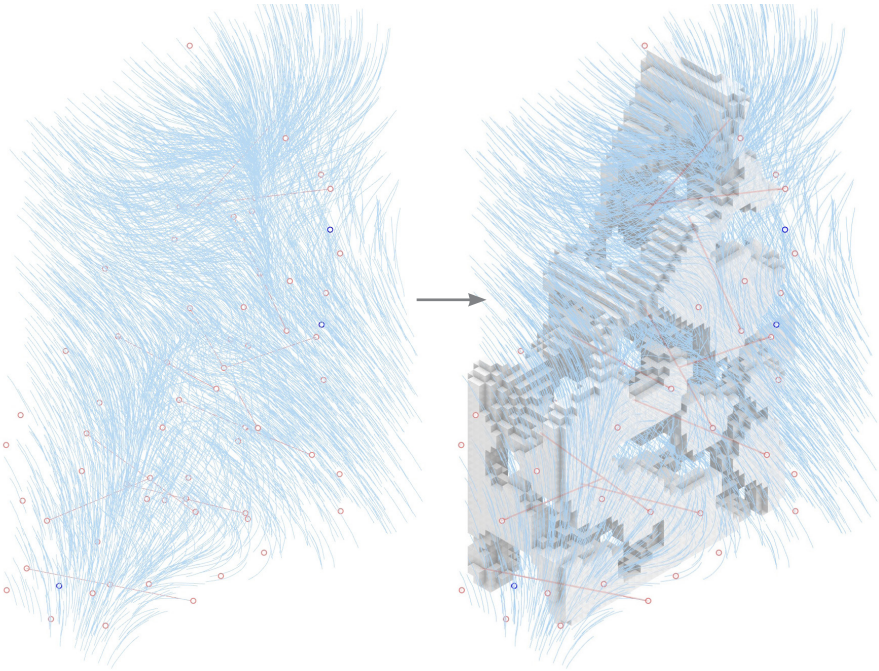


Option 4

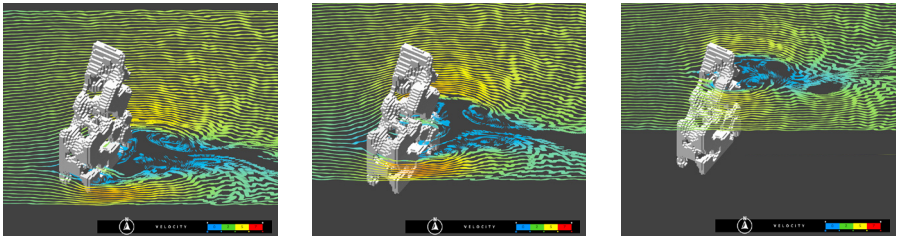




Air flow should spread to diverse directions, it is influenced by control points and curves.



After the wind is brought inside the building, it goes through the inner landscape in diverse directions, guiding the airflow inside the building, improving the air quality.



Wind analysis in different height