SKY VALLAGE FOR URBAN LIFE, HONGKONG

Parametric Base Design for Master Project

2012

Illinois Institute of Technology : College of Architecture

Professor: Ross Wimer Student: Chuan Mei

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SITE ANALYSIS

Hong Kong - Vertical City

According to Emporis, there are 7,650 skyscrapers in Hong Kong, which puts the city at the top of world rankings. It has more buildings higher than 35m (or 100m, or 150m) than any other city. The high density and tall skyline of Hong Kong's urban area is due to a lack of available sprawl space, with the average distance from the harbour front to the steep hills of Hong Kong Island at 1.3 km (0.81 mi), much of it reclaimed land. This lack of space causes demand for dense, high-rise offices and housing. Thirty-six of the world's 100 tallest residential buildings are in Hong Kong. More people in Hong Kong live or work above the 14th floor than anywhere else on Earth, making it the world's most vertical city.

As a result of the lack of space and demand for construction, few older buildings remain, and the city is becoming a centre for modern architecture. The International Commerce Centre (ICC), at 484 m (1,588 ft) high, is the tallest building in Hong Kong and the third tallest in the world, by height to roof measurement. The tallest building prior to the ICC is Two International Finance Centre, at 415 m (1,362 ft) high. Other recognisable skyline features include the HSBC Headquarters Building, the triangular-topped Central Plaza with its pyramid-shaped spire, The Center with its night-time multi-coloured neon light show; A Symphony of Lights and I. M. Pei's Bank of China Tower with its sharp, angular façade. According to the Emporis website, the city skyline has the biggest visual impact of all world cities.[209] Also, Hong Kong's skyline is often regarded to be the best in the world, with the surrounding mountains and Victoria Harbour complementing the skyscrapers. Most of the oldest remaining historic structures, including the Tsim Sha Tsui Clock Tower, the Central Police Station, and the remains of Kowloon Walled City were constructed during the 19th and early 20th centuries.

There are many development plans in place, including the construction of new government buildings, waterfront redevelopment in Central, and a series of projects in West Kowloon. More high-rise development is set to take place on the other side of Victoria Harbour in Kowloon, as the 1998 closure of the nearby Kai Tak Airport lifted strict height restrictions.

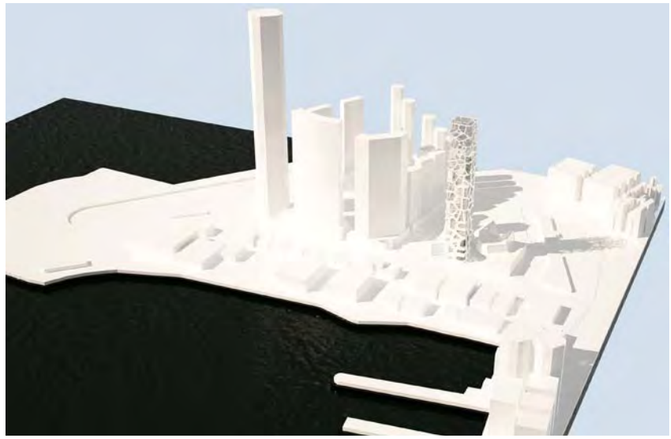
Hong Kong - Diversity City

The territory's population is 7.03 million. In 2009, Hong Kong had a birth rate of 11.7 per 1,000 population and a fertility rate of 1,032 children per 1,000 women. Residents from mainland China do not have the right of abode in Hong Kong, nor are they allowed to enter the territory freely. However, the influx of immigrants from mainland China, approximating 45,000 per year, is a significant contributor to its population growth – a daily quota of 150 Mainland Chinese with family ties in Hong Kong are granted a "one way permit". Life expectancy in Hong Kong is 79.16 years for males and 84.79 years for females as of 2009, making it one of the highest life expectancies in the world.

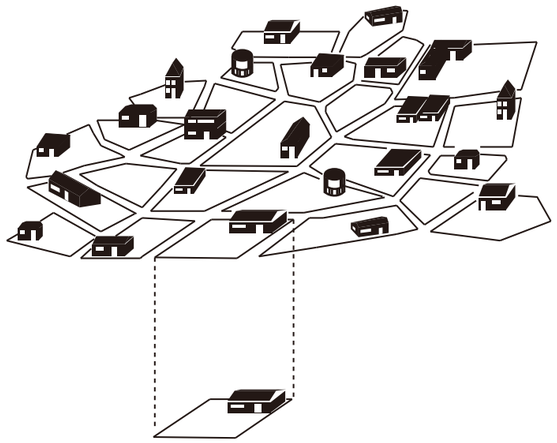
About 95% of the people of Hong Kong are of Chinese descent, the majority of whom are Taishanese, Chiu Chow, other Cantonese people, and Hakka. Hong Kong's Han majority originate mainly from the Guangzhou and Taishan regions in Guangdong province. The remaining 5% of the population is composed of non-ethnic Chinese. There is a South Asian population of Indians, Pakistanis and Nepalese; some Vietnamese refugees have become permanent residents of Hong Kong. There are also Europeans (mostly British), Americans, Canadians, Japanese, and Koreans working in the city's commercial and financial sector.[note 6] In 2008, there were an estimate of 252,500 foreign domestic helpers from Indonesia and the Philippines working in Hong Kong.

Before 2003

After 2010



BIRD-VIEW MASTER PLAN

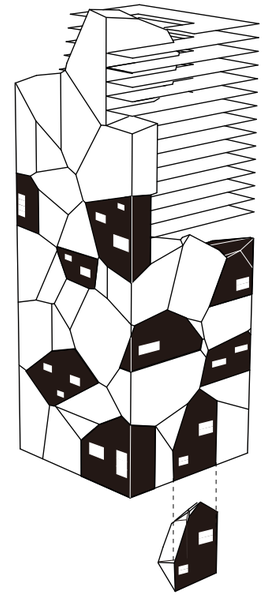


Traditional Village:
High diversity but occupying too much land

Village provides its habitants various types of site for building their houses and gardens. The uniques character of each site shapes and reflects differend life style. However, it occupys too much land resource which should be nature.

Highrise Residence:
Saving land but with low diversity

In developing cities, pursuing speed and profit, the divisions of personal domain are mostly acting on 2D layers. Repititave stacking layers provids effeciencyand capacity, however, personal domains lose the uniqueness they should have.



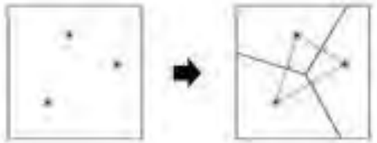
Sky Village:
Saving land and with high diversity of individual living space

Striving to combine the advantages of both traditional village and highrise residence, sky-village applies the 3D plots. It divides the veryical space 3-dimensionally into personal domain to get dense and diversified collective living space

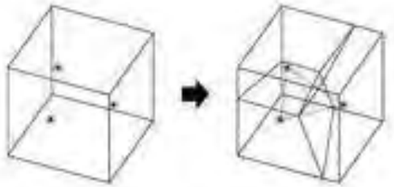
DIVERSITY ***VS*** ***EFFICIENCY*** ***DIVERSITY + EFFICIENCY***

VORONOI STUDY

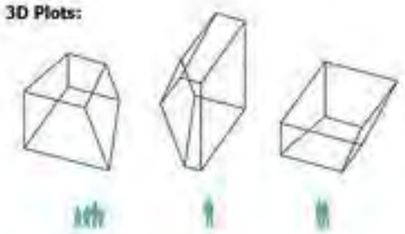
Voronoi Principle:



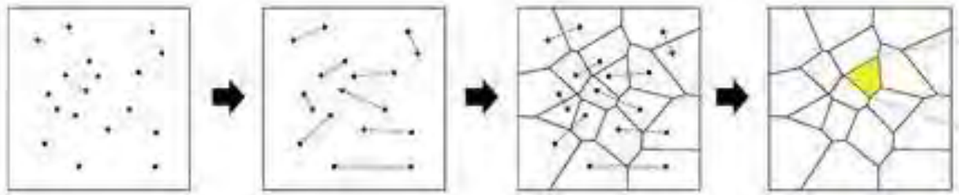
3D Voronoi Principle:



3D Plots:

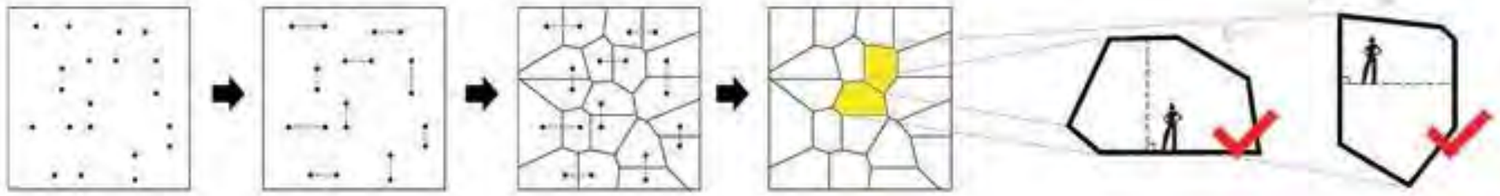


Classic Voronoi division:

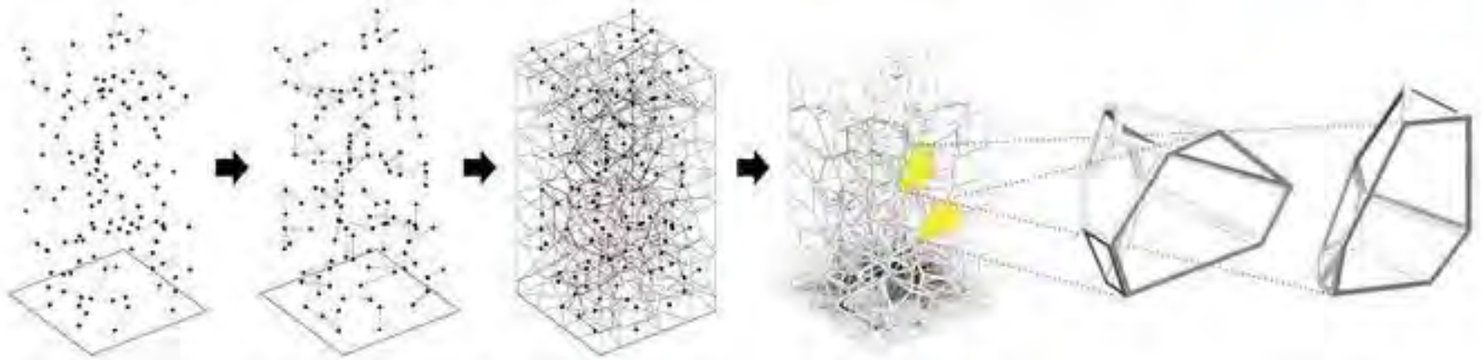


V.S.

Semi-Orthogonal Voronoi division:



3D Semi-Orthogonal Voronoi division:

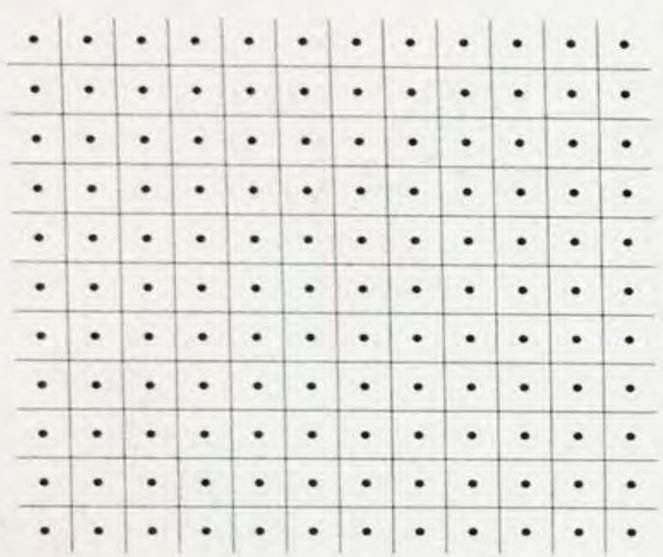


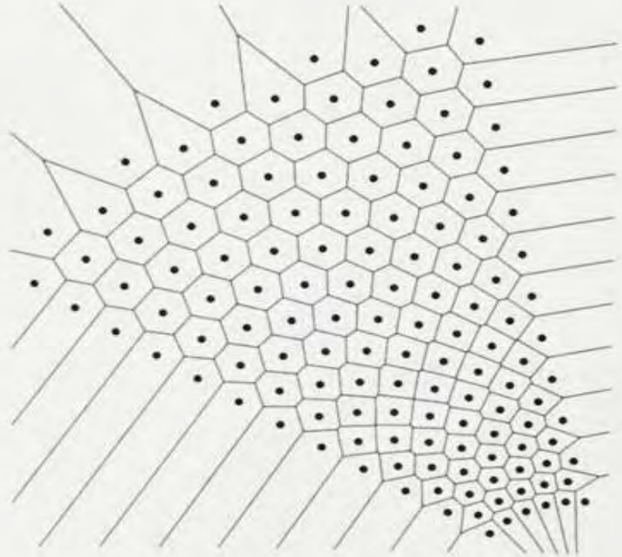
100 random points | adjusted to be orthogonal | generate 3D voronoi | generate structure

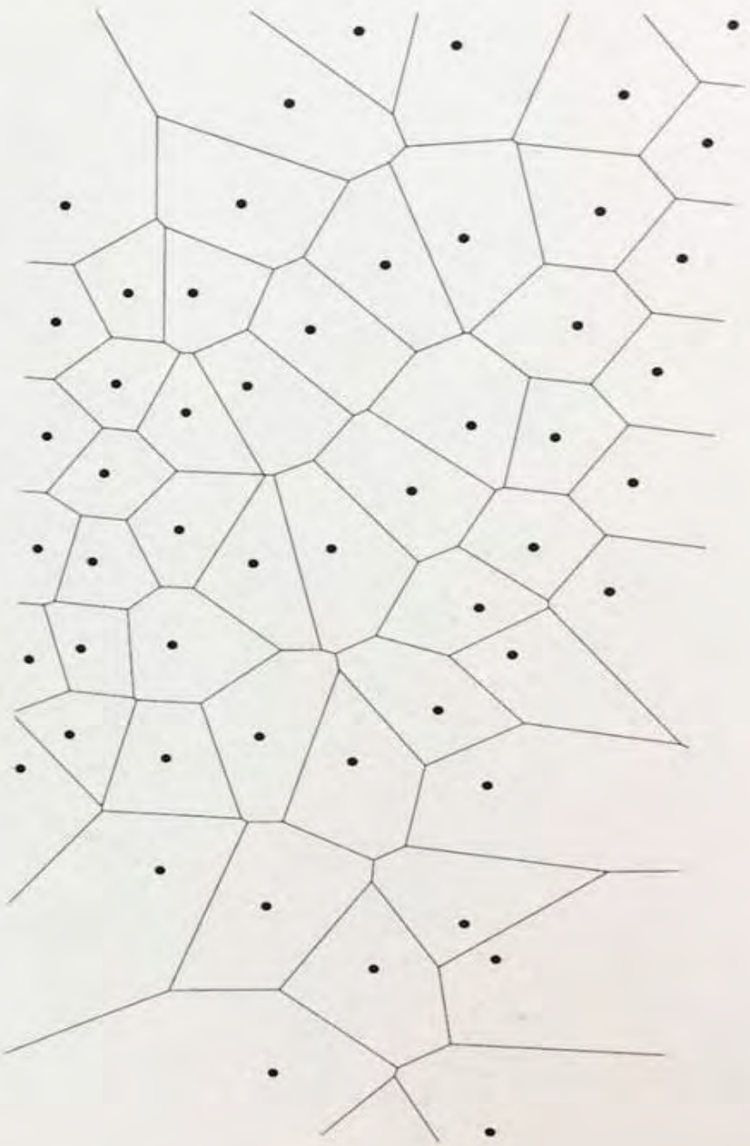
VORONOI STUDY

Experiments: Subdividing Space

Each of these experiments involves the creation of a Voronoi tiling from a point set. They result in cellular patterns where each cell contains all of the space that is closer to its point than to any other point. They form a collection of shapes that can look like squares , honeycombs, crystals, or boulders – the nesting of other orders within a patterned, minimal enclosure system.







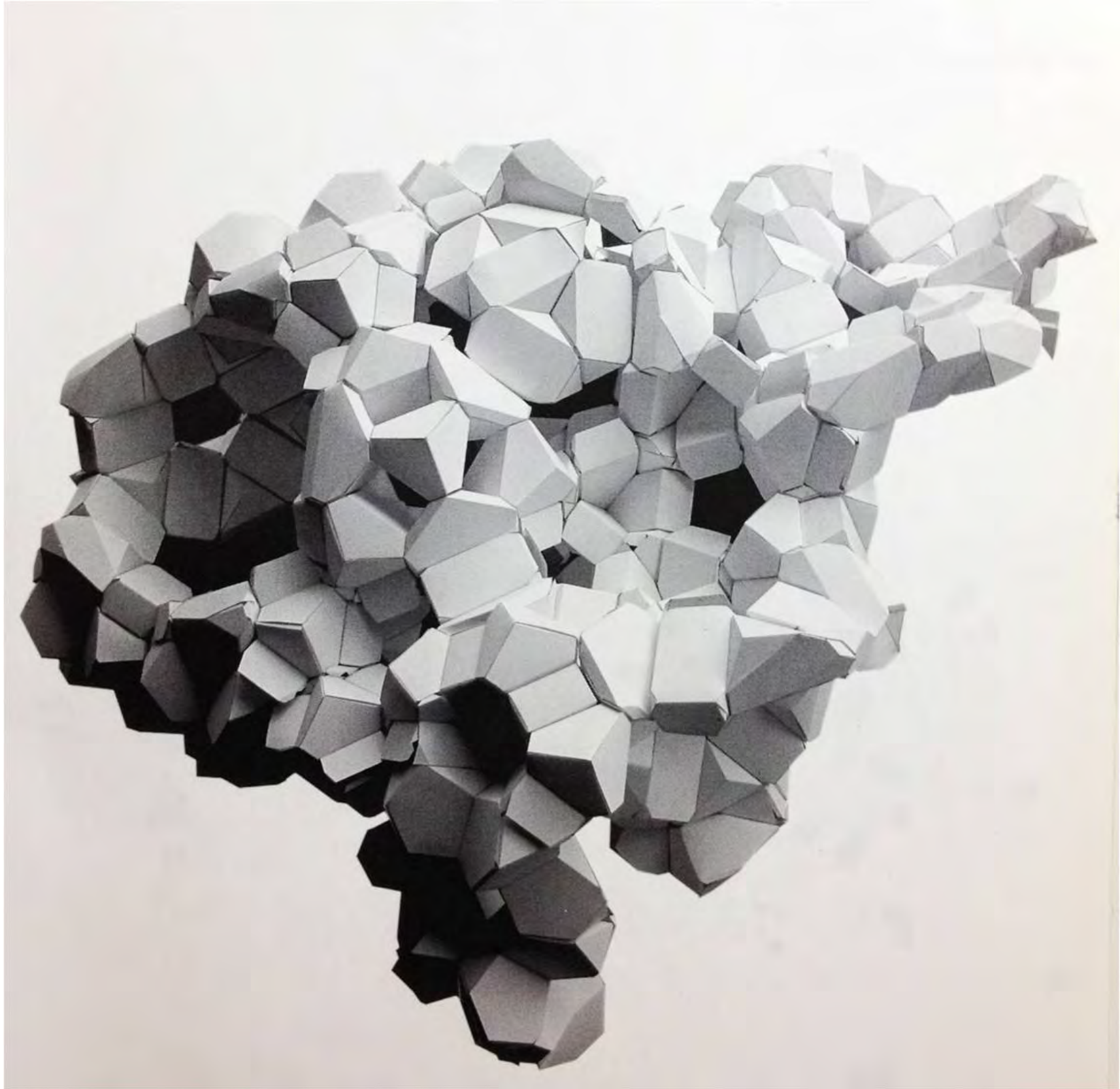
VORONOI STUDY

Grotto

The grotto is an artificial structure or excavation in a garden made to resemble a cave. It is always elaborately artificial , absurdly fake. The grotto found its heyday in Eighteenth-century English gardens, providing a dark and erotic narrative to the landscape garden’s palette..

VORONOI STUDY

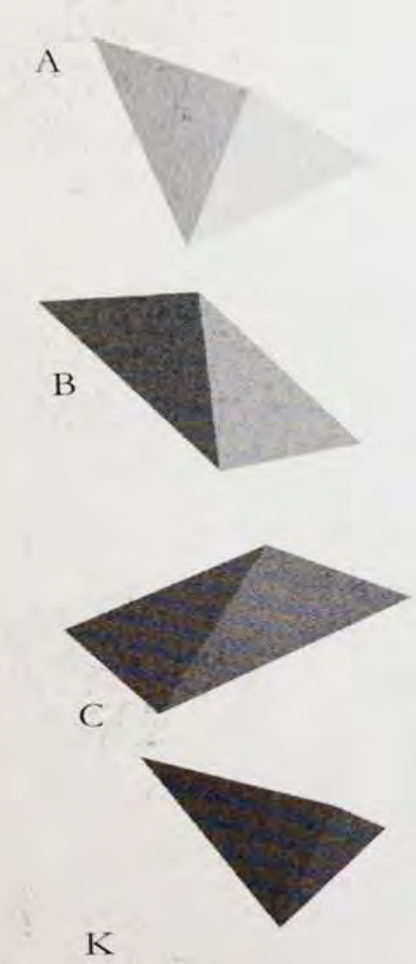
Model of excavated
grotto-folded paper



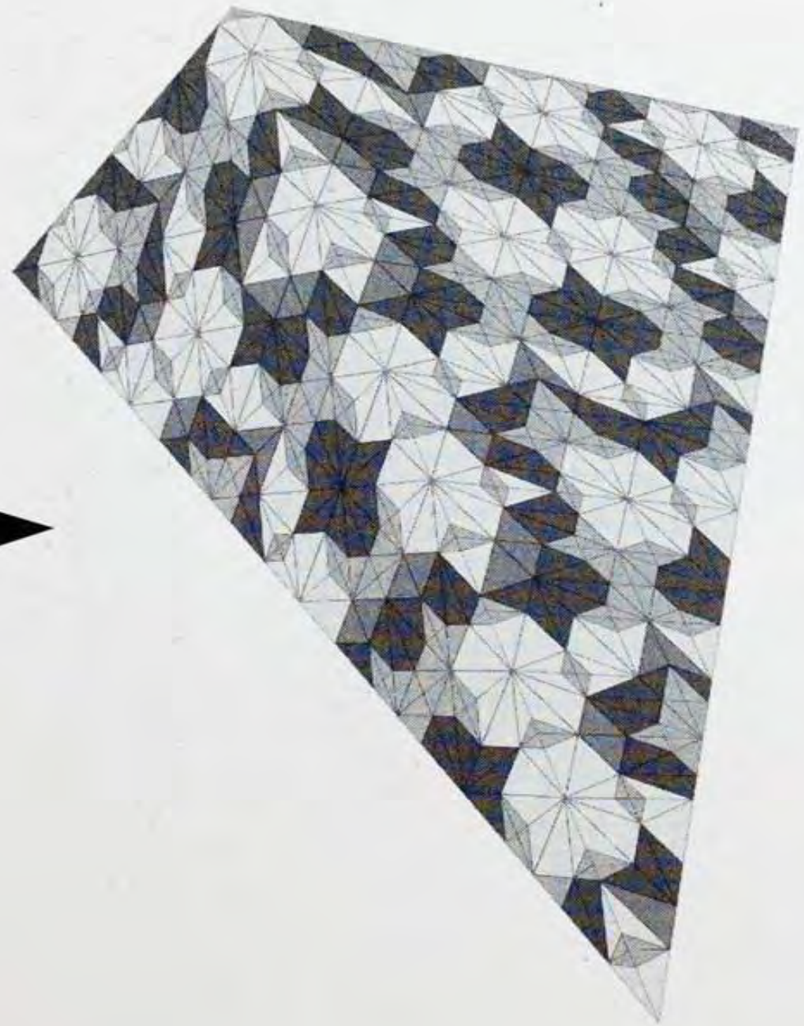
VORONOI STUDY

Modular Boulders

Since the structural unit of a grotto is the boulder, the challenge of the project was to develop a set of modular boulders that combine in a way that defies a conventional Sense of order. The solution uses a combination of algorithms, based on voronoi geometries, that transfer modularity from a Danzer tiling technique (developed at Arup AGU) to a final set of four faceted boulders. These four boulders fit together in a variety of ways. The result is a wildly ordered three-dimensional pattern that never repeats The same way twice.



3D Danzer tiling developed
at Arup AGU

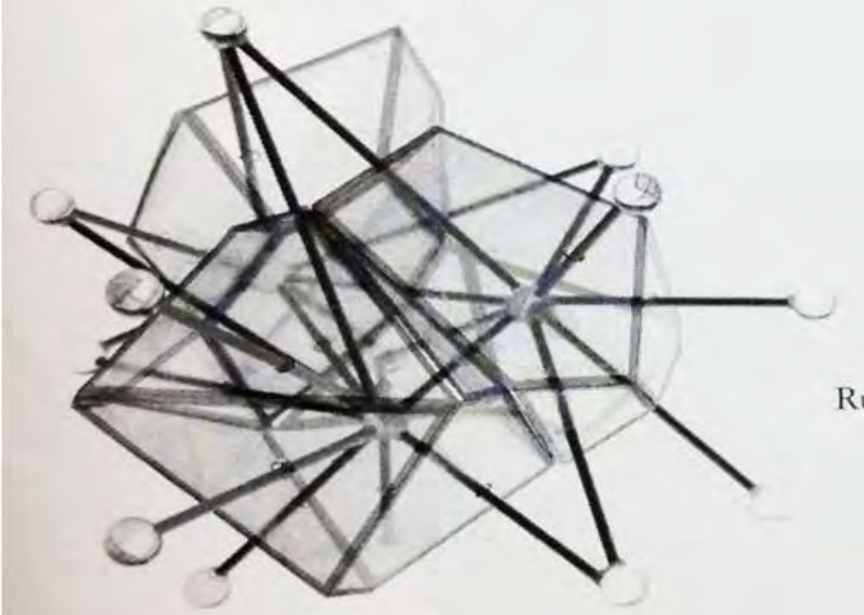


Danzer "K" tile:
seven generations:
11,382 triangles (tetrahedrals)

Conversion to 3,066 points

VORONOI STUDY

The Danzer tiling was carried out to the seventh generation to Produce a tetrahedral packing. But while triangles make great Patterns, a triangles is not a boulder. In order to create boulders (the structural unit of grotto), it was necessary to strip the tetrahedral packing down to its verticies. This revealed a point field from which we could derive a boulder tiling. The result resembled a boulder mess that, on closer inspection, was actually highly structured and composed of only four unit-types- the harmonies and modularity of the Danzer tiling translated.



Run boulder algorithm

Boulder mess made of only
four different modular boulders

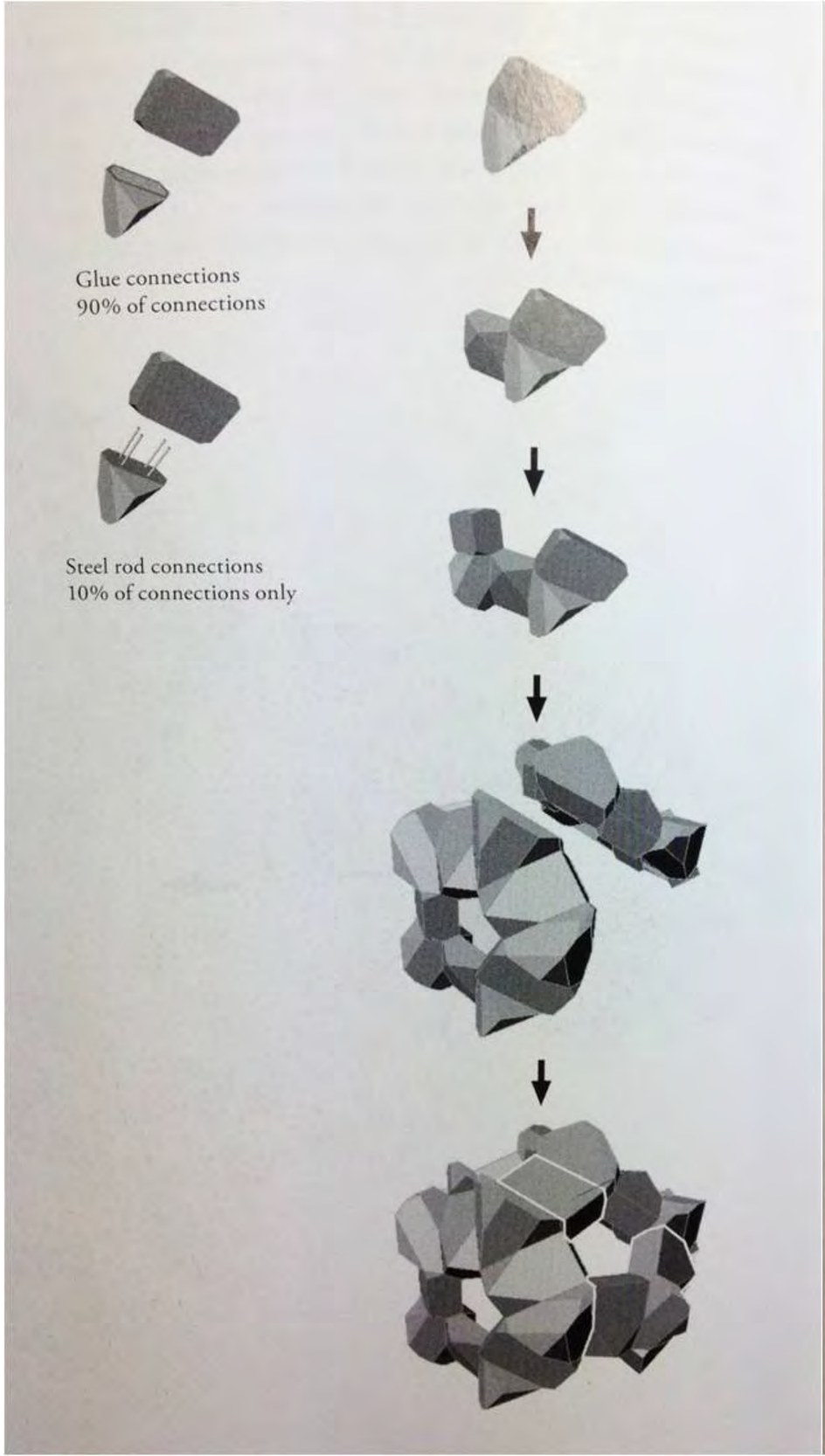
1. Balls

2. Erasers

3. Plugs

4. Monsters

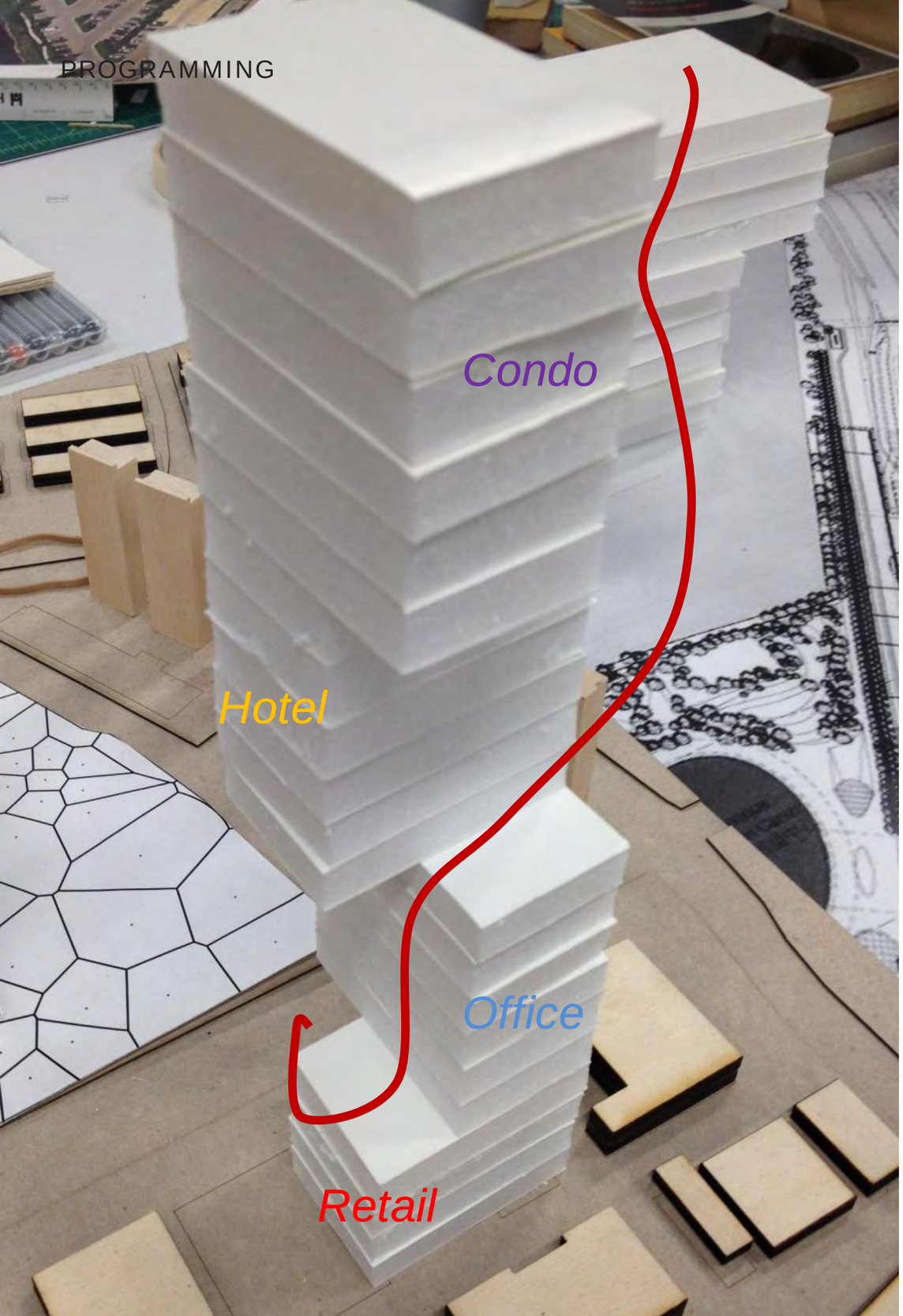
VORONOI STUDY



VORONOI STUDY

Tiling assembles a patterned tectonic

PROGRAMMING

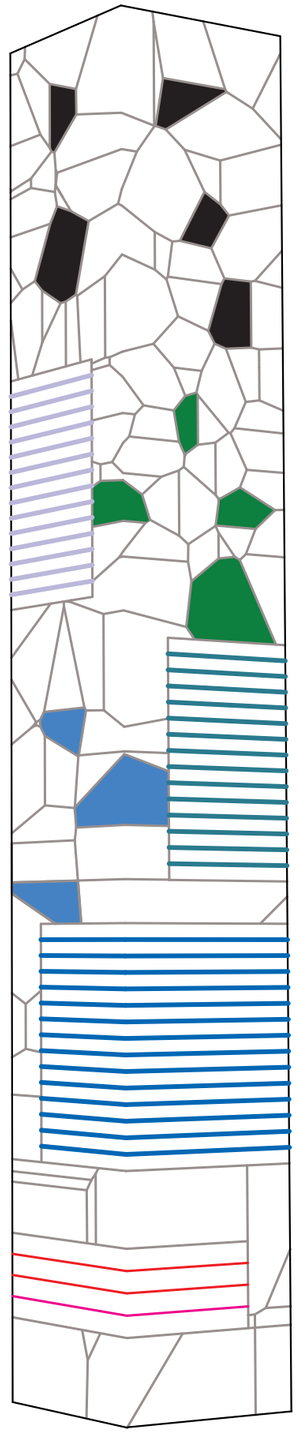


PROGRAMMING

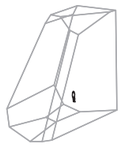
Diversity + Efficiency

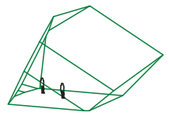
PROGRAMMING

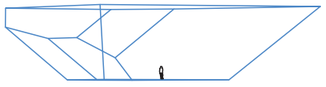
Condo + Gardens



Sky Vallage





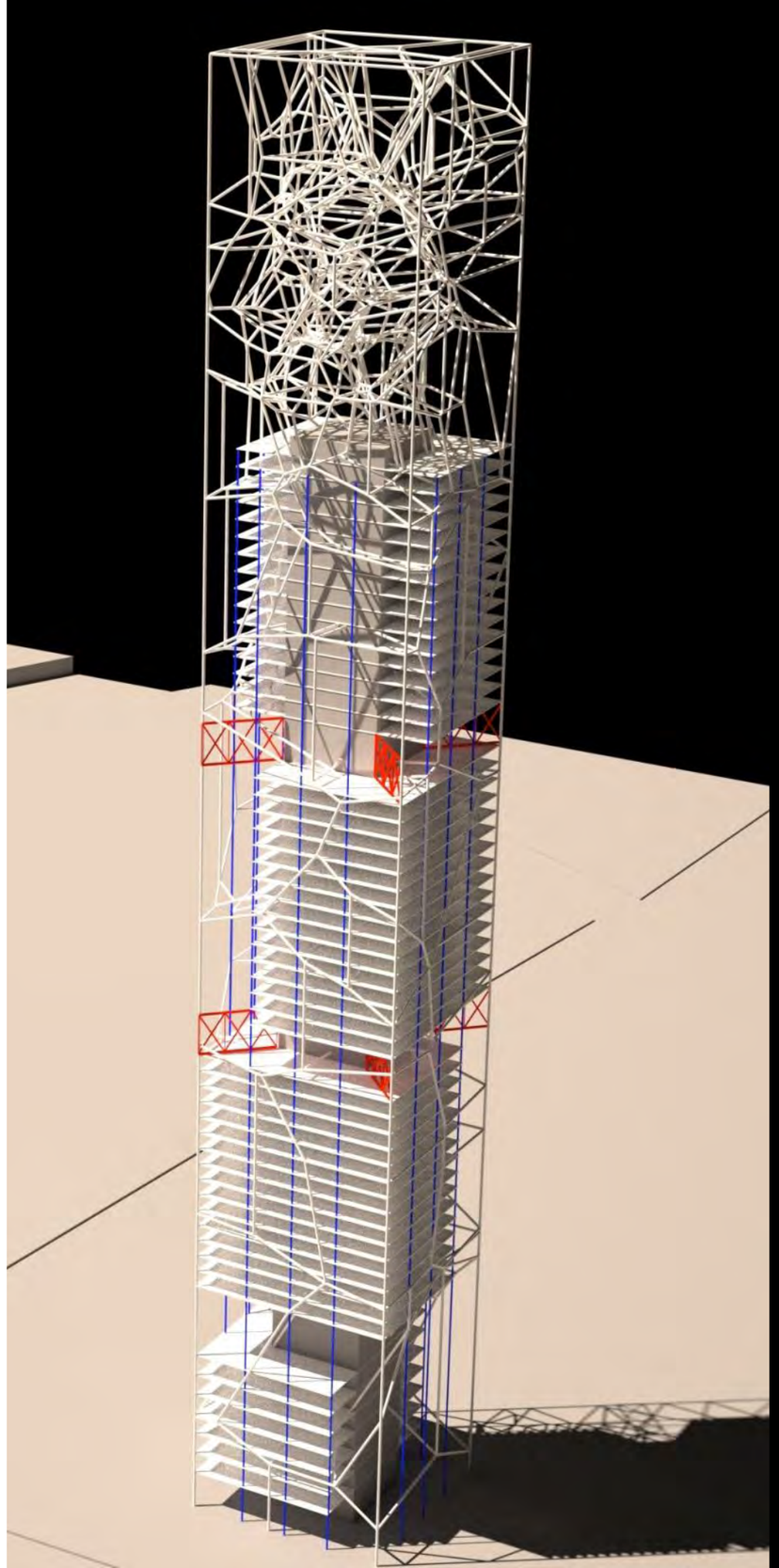


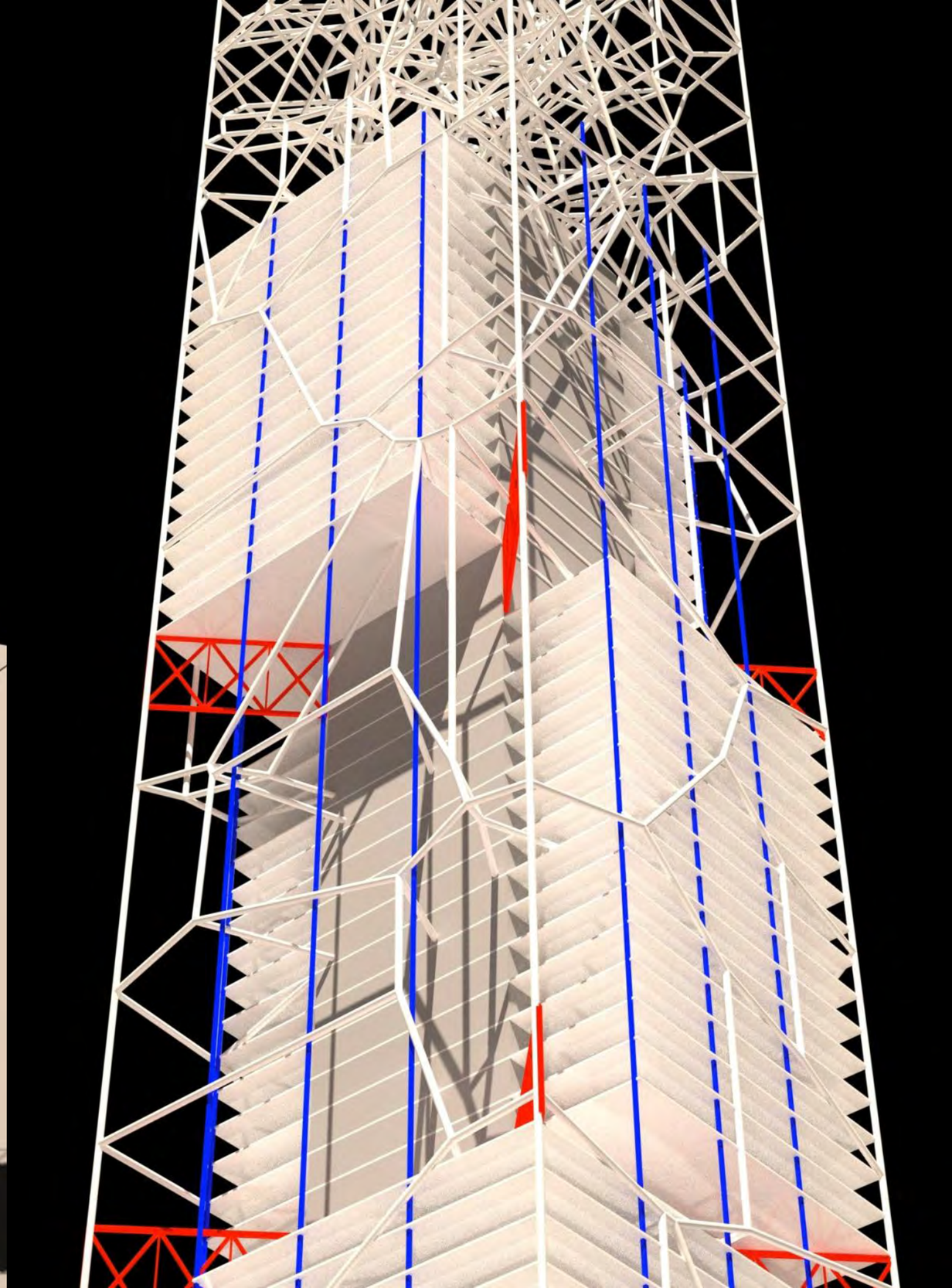
Office + Gallery, Library, auditorium,
Conference room

Hotel + Swimming Pool / Spa / Caffe / Restaurent

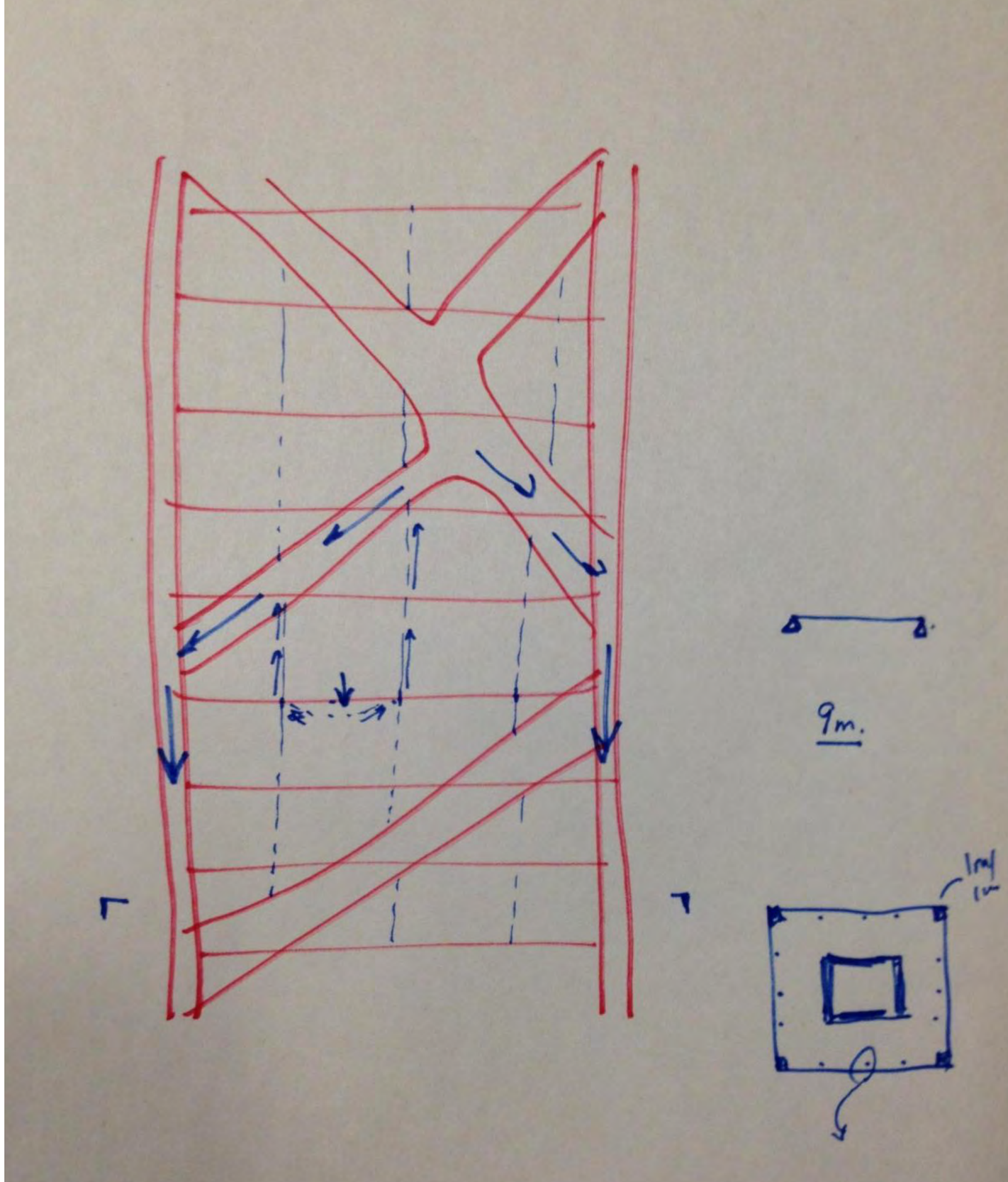
Retail + Social Space

STRUCTURE ANALYSIS

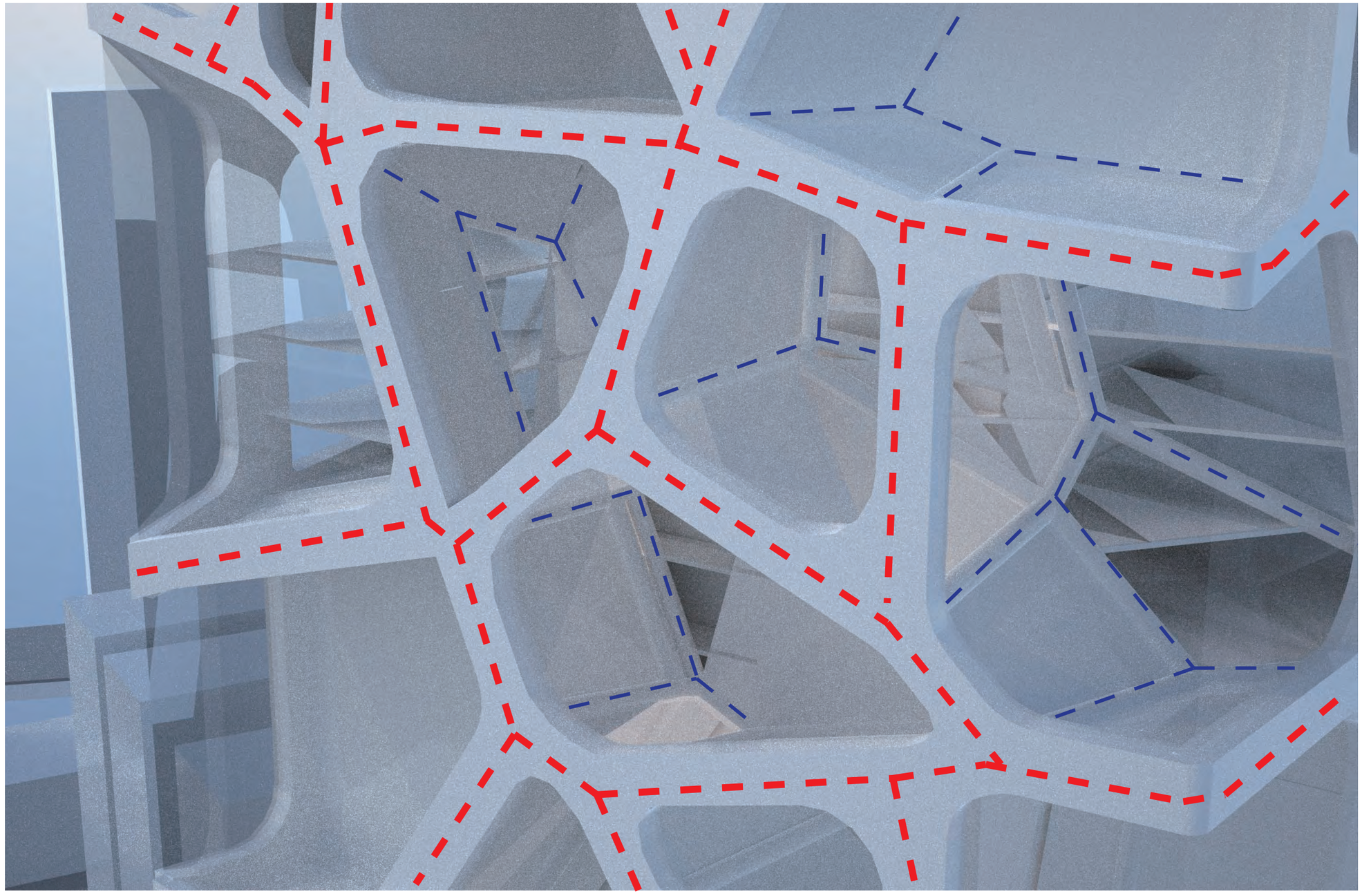




STRUCTURE ANALYSIS



STRUCTURE ANALYSIS

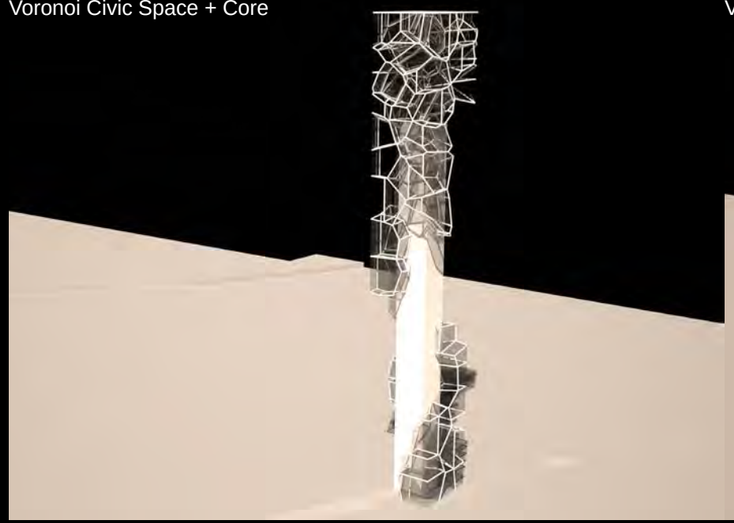


Inner Voronoi Space structure System

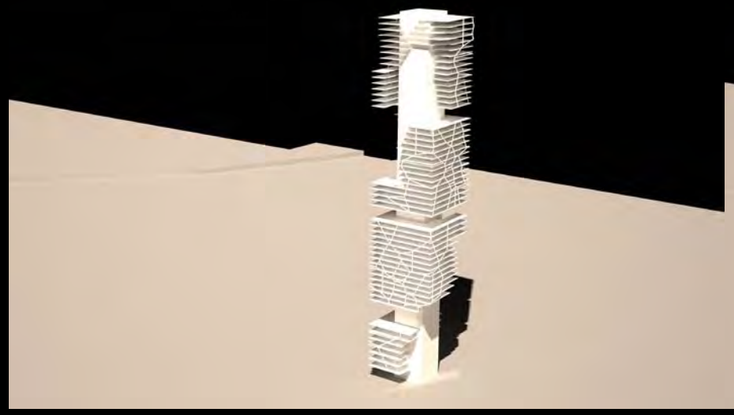
Outside Facade structure System

EVOLVING

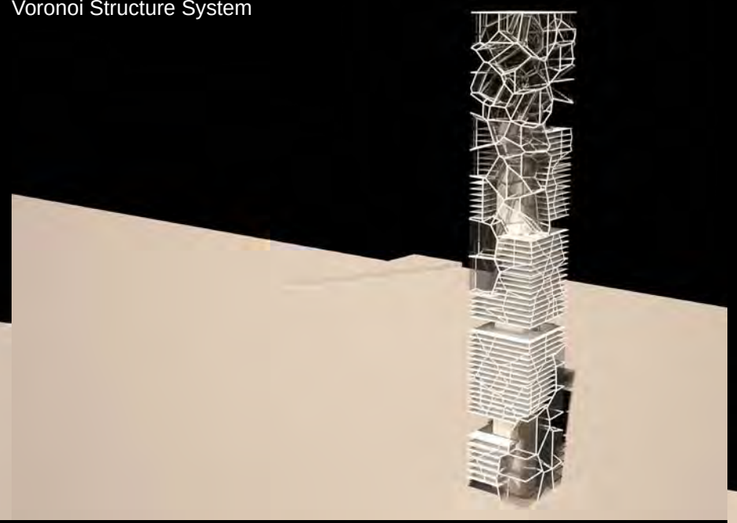
Voronoi Civic Space + Core



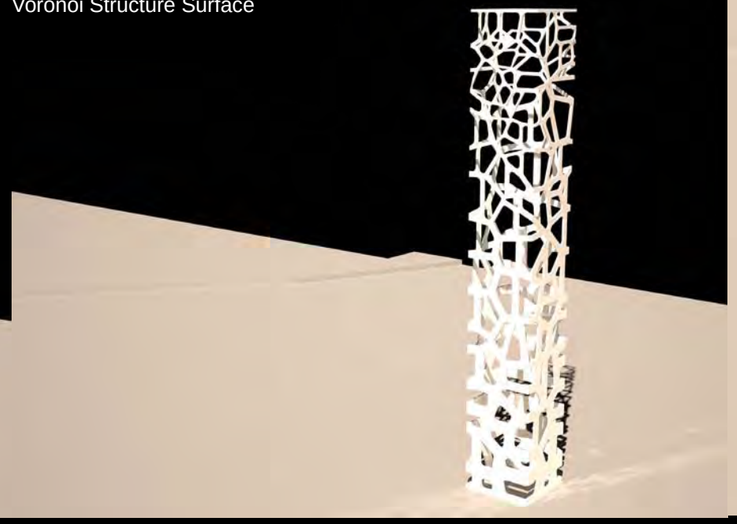
Conventional Slab + Core

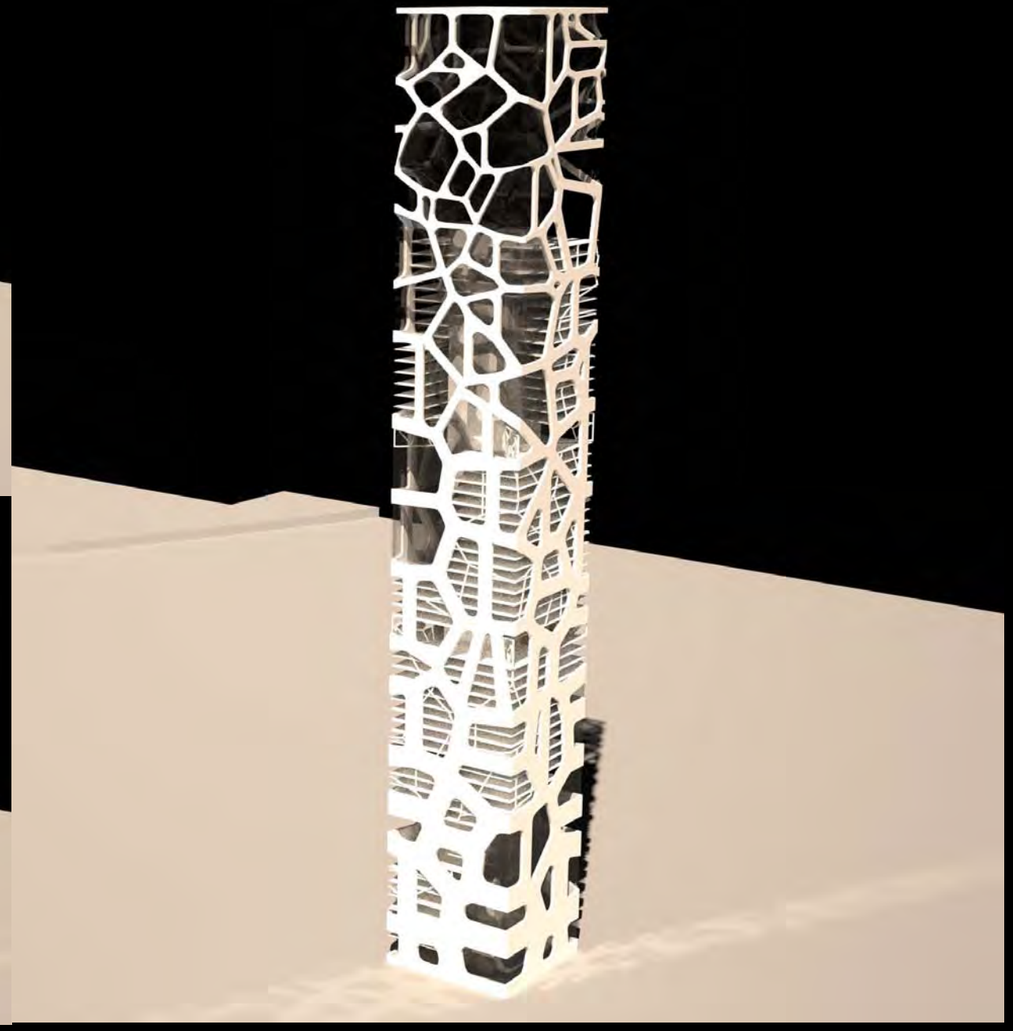


Voronoi Structure System

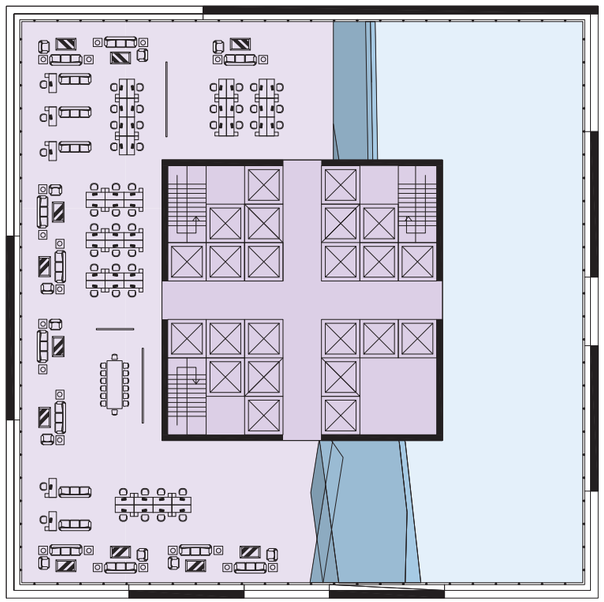


Voronoi Structure Surface

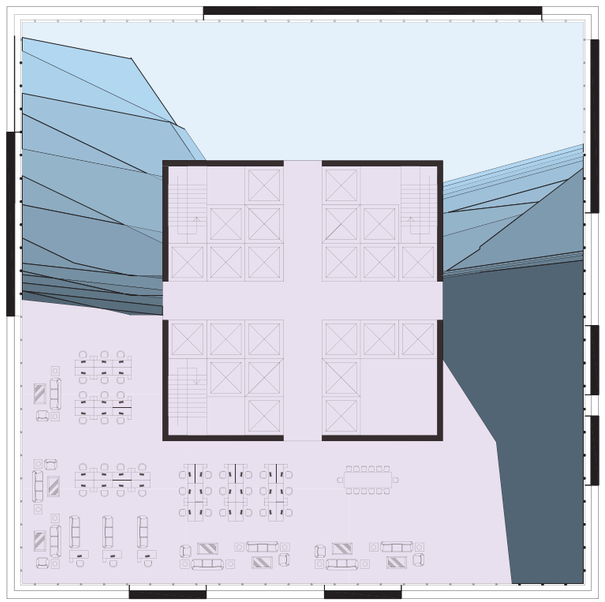




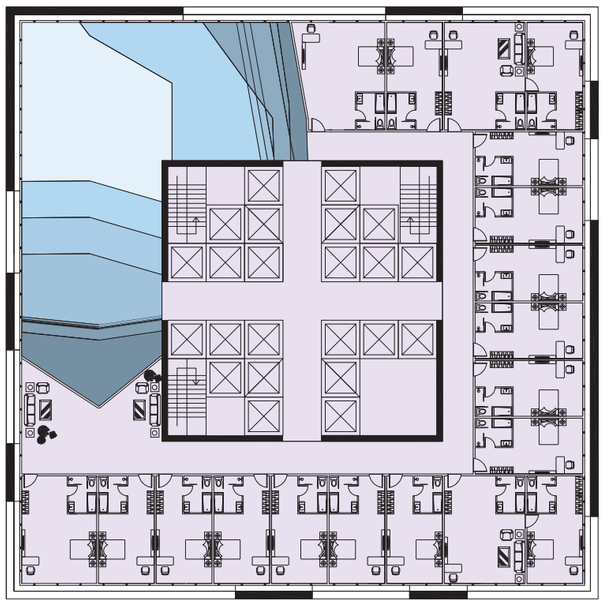
PLANS



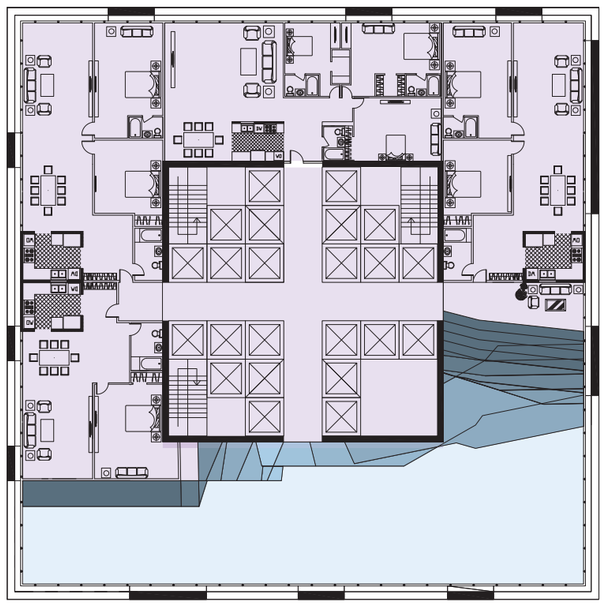
Retail (1-6 Floors)



Office (9-24 Floors)

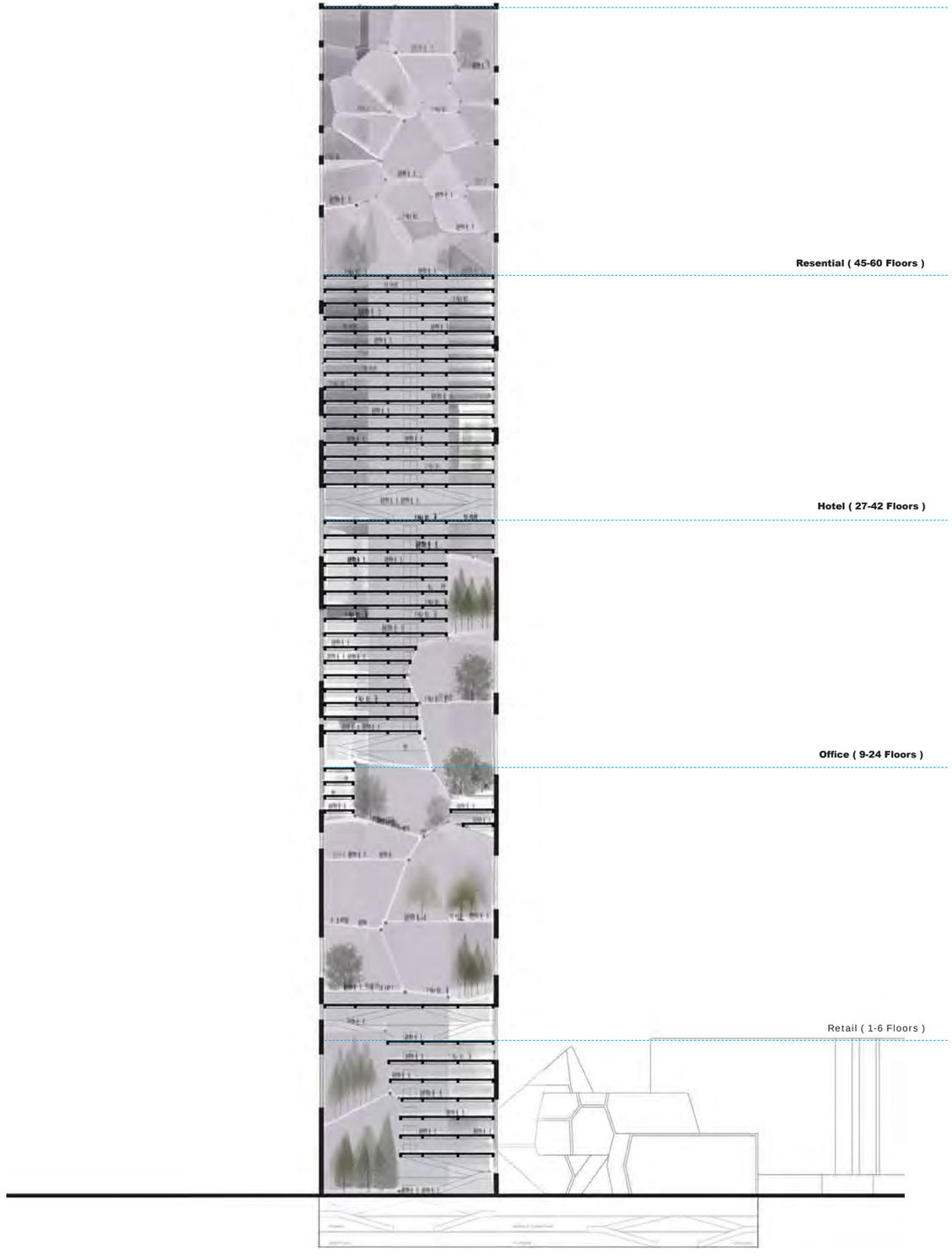


Hotel (27-42 Floors)



Resential (45-60 Floors)

SECTION


Sky vallage (62-72 Floors)
Resential (45-60 Floors)
Hotel (27-42 Floors)
Office (9-24 Floors)
Retail (1-6 Floors)

PHYSICAL MODEL PICTURES

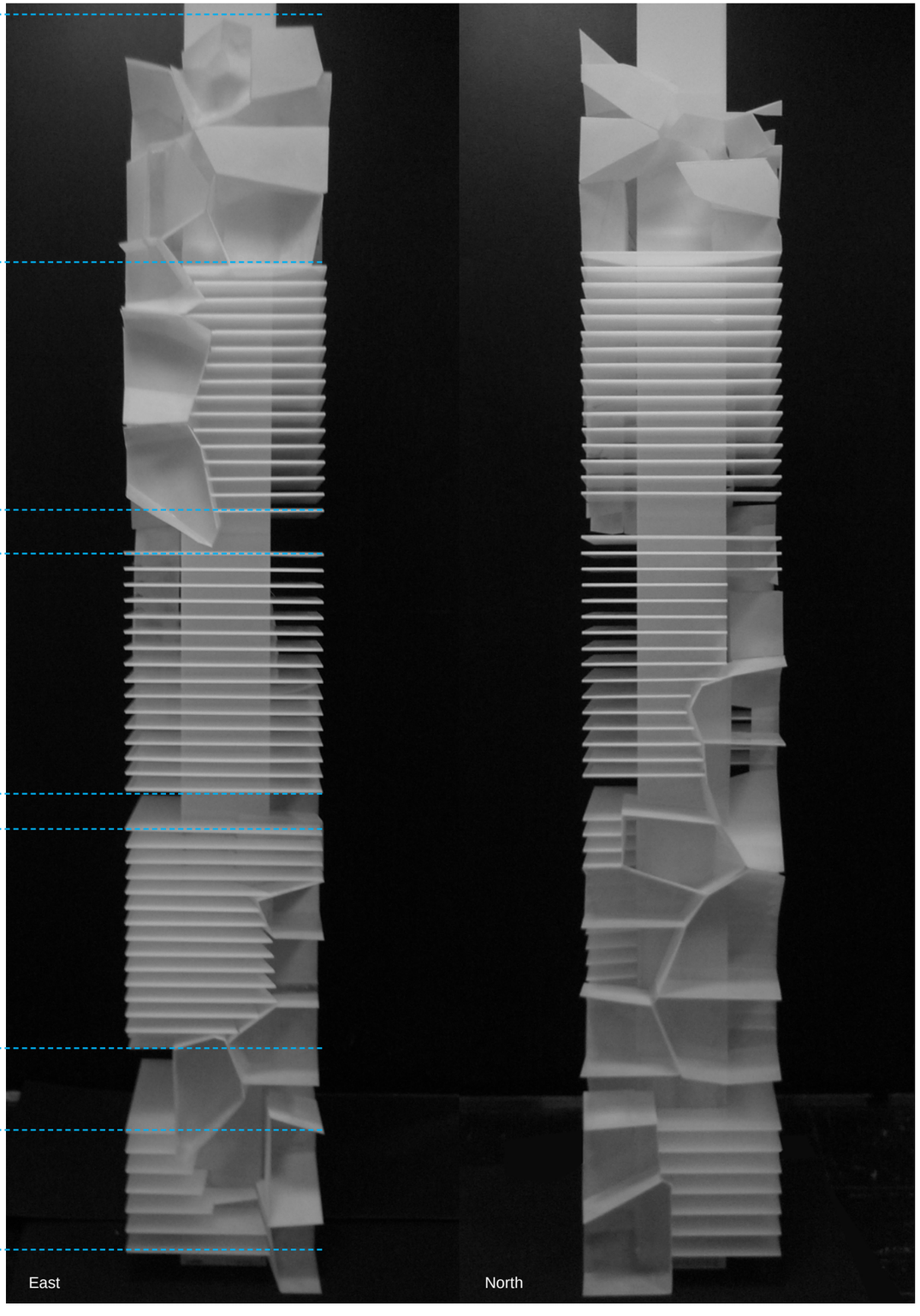
Sky vallage (62-72 Floors)

Resential (45-60 Floors)

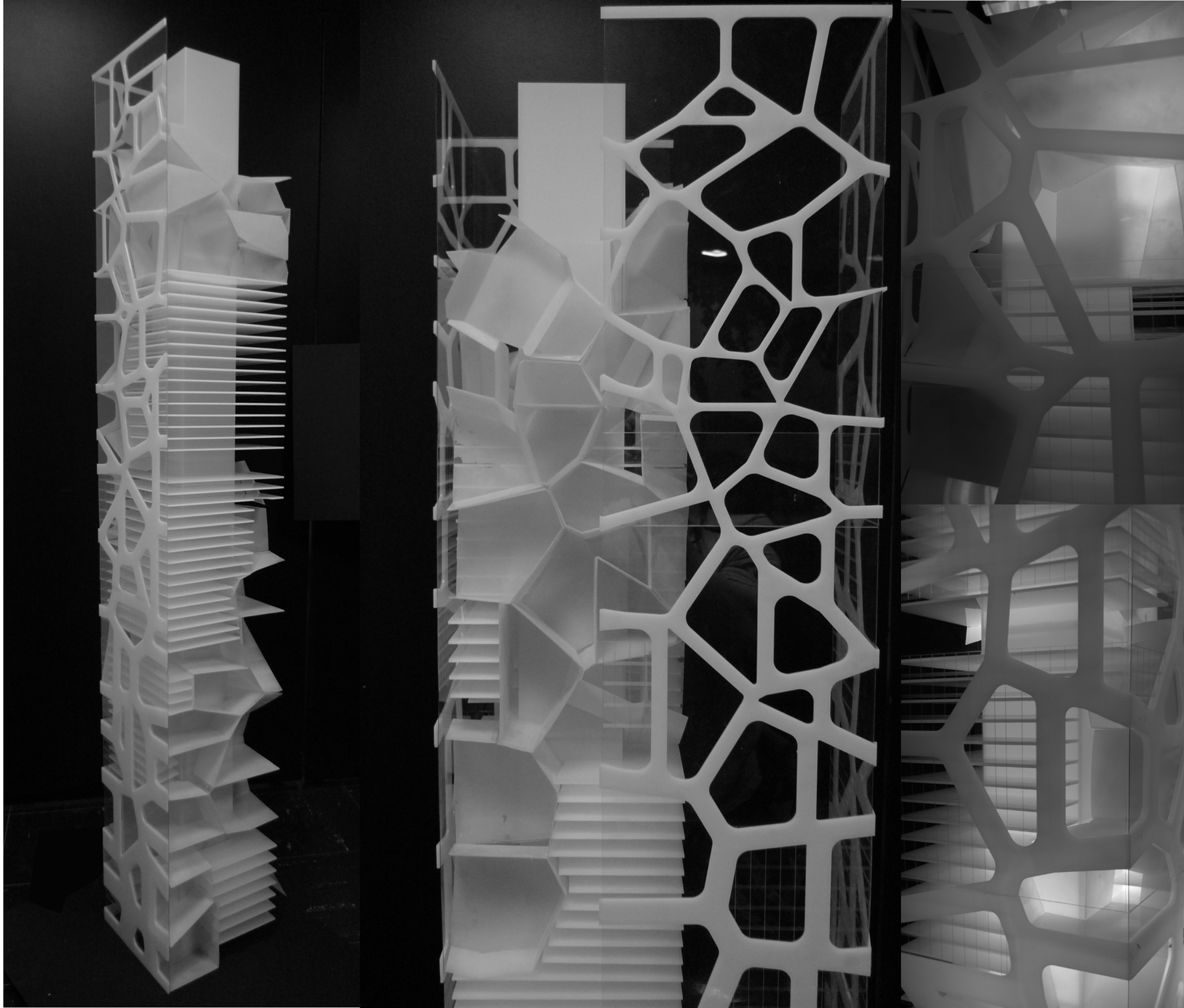
Hotel (27-42 Floors)

Office (9-24 Floors)

Retail (1-6 Floors)



PHYSICAL MODEL PICTURES



PERSPECTIVE

Art Gallery + Conference Room + Social Space

PERSPECTIVE

Swimming pool + Bomboo Gardens

PERSPECTIVE

NIGHT VIEW HONGKONG