

# Visionary Healthcare

## New Health Centre Design at Eklandagatan

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Master thesis at Chalmers Architecture  
Gothenburg, 4 June 2015

Graduation Master Thesis Wenhao Shang  
Gothenburg, 4 June 2015

Visionary Healthcare  
\_New Health Centre Design at Eklandagatan

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**CHALMERS**

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My purpose of this master thesis is based on my experience and interest in healthcare design. The world's population is growing rapidly, especially in cities. Hospitals today are facing many problems related to excessive visitors. People taking treatment at general hospitals far away from their homes have to face problems like long waiting time, limited in-patient beds, need of patient hotels...and the energy consumption of transportation would keep increasing. To solve these problems comprehensively, I want to propose one reasonable and sustainable vision of future healthcare design instead of just designing a larger and more expensive general hospital.

This thesis work includes two parts. Firstly I study the advantages and drawbacks of global healthcare design from different historical periods and typologies. Then propose one possible future trend based on the difficulties we are currently facing. My proposal is the compact general hospitals would be more of a specialist institute in the future, and community hospitals would provide more treatment as a system. With development of communication technology, different healthcare levels compose a strong information system to share diagnosis data and treatment. This method will be more medically efficient and more sustainable in reducing transportation energy.

The second part is architectural design, I chose to redesign a health centre at Eklandagatan 80-82, Gothenburg into a community hospital in the future. With the knowledge of Evidence Based Design [EBD] and lessons from case study from current healthcare designs, I wish to achieve four points: 1. An active public space within urban context; 2. A healthier living and working space for patients, staff and common citizens; 3. A more sustainable building considering on different aspects; 4. One reasonable healthcare system with future vision. Both research and design parts contribute 50 percent each to my whole master thesis.

**Key words: healthcare, decentralized, EBD, sustainable**

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Finally Wenhao,

you will never regret of the efforts you have made today, and please keep on fighting for your dream to become an excellent architect.

### Why a health centre?

The reason why I previously chose Healthcare studio is out of curiosity, because this topic has never been taught on undergraduate level in China. After one semester intense work, I found my interest in healthcare design and wish to strengthen my knowledge by designing more architectures.

Previously, we have planned a hospital extension project in Östersund, Sweden (Fig. 1). As the only hospital of the whole county Jämtland, the hospital is facing many problems, such as limited in-patient beds, urgent need of patient hotel, demand of more parking places and better connection of the helicopter transportation...

Instead of designing a larger general hospital with the most advanced technology, could we discover methods to solve these kinds of problems? To respond the situation problems, I will suggest a decentralized healthcare system with different levels. Which means the health centre would play a more important role as community hospital, and works together with highly specialist hospitals by advanced information technology.



Fig. 1



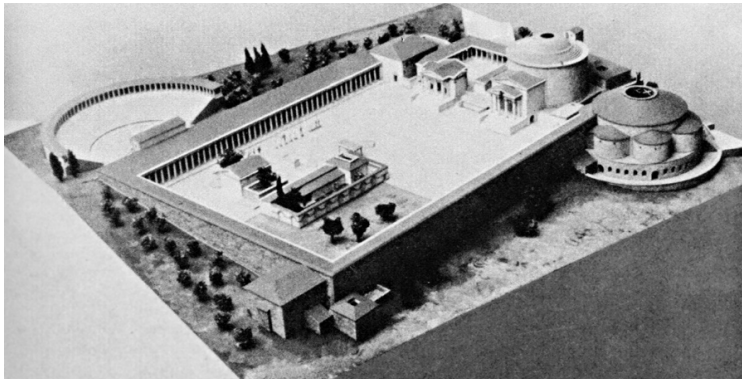


Fig. 2

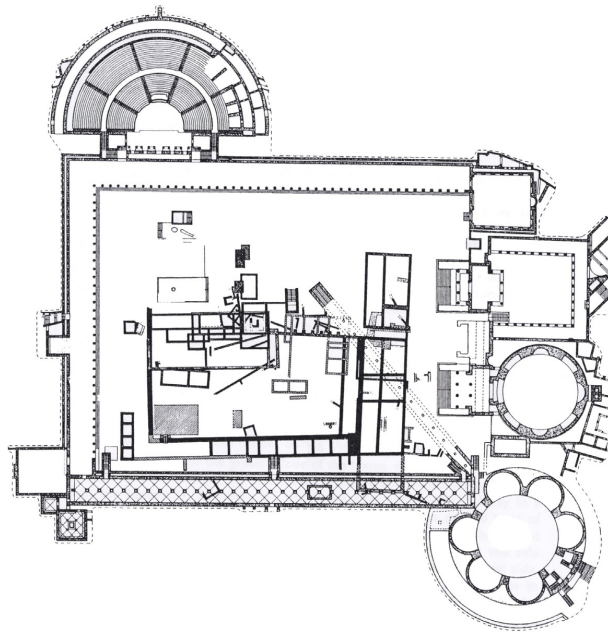


Fig. 3

### The Greek Asclepieions (5th century B.C.)

**Faith in God, connect to environment, artistic endeavors, physical exercise**

The myth in the 5th century B.C. provided a healthcare building type which puts people in the context of their total environment. The concept of healing was closely linked to the Greek God Asclepios. Cures were based on the psychological strengthening of the patient's faith in the healing capabilities of Asclepios, and on the application of pharmaceutical treatments practiced at the same time.

The pursuit of a healthy way of living and the holistic approach, which included participation in artistic endeavors and physical exercise, formed an important part of the care and the cure. Water played a major part in the treatment and also as a soothing natural element contributing to the creation of ideal psychological conditions. Healing was seen as a product of harmonious collaboration between nature and man.

The Asclepieion at Pergamon lays about 800m from the city centre, the central open space was 130m long and 110m wide. The buildings and structures within the central space including mud-baths and other pools as well as sleeping-rooms specially used for incubation and auto-suggestion which were the two most important forms of psychiatric treatment(Fig.2, fig.3).

## 4.1.2 The Medieval

The Medieval (5th–15th centuries)

**Connection with God, for poor people, Cruciform, central nursing station**

During the Middle Ages, when Europeans looked upon illness as a condition caused by supernatural forces and thus cured only by actions steeped in religion. The first hospitals in Europe were guesthouses for pilgrims and places where the most disadvantaged could get shelter.

However, health care services for those able to pay were mostly provided at home, there is no doubt that hospitals during medieval times were mainly associated with death. The hospitals also built to protect those outside, rather than to benefit those housed within their buildings.

A common plan form used during the late Middle Ages was the cruciform (Fig. 4) with the nuns' nursing station in the centre and an altar at one end, placed in such a way that all the sick could see it. Medical treatment was indeed inadequate and communication with God was seen as more urgent than that with the staff.

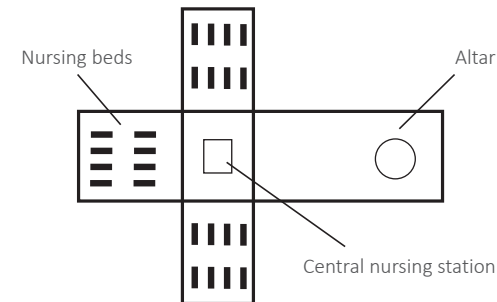


Fig. 4 Cruciform

### The Renaissance (15th century – 1750)

#### Revolution, urban landmark, modular, generic plans

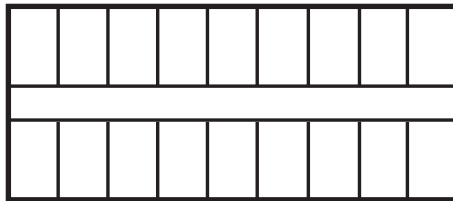


Fig. 5 Corridor hospital

The character of hospital kept remaining at the beginning, the rich still had their servants and were able to command the medical services of qualified physicians in their homes, whereas the poor were dependant on charity and the kind of institutions as in the Medieval time.

With the revolution coming up, the hospital was also to be seen as an essential urban public service where internment should be replaced by increased control and openness. The hospitals in big cities are nevertheless prime examples of urban landmarks which have, through refurbishment and sensitive replacement of buildings, managed to respond to new challenges. The generality of these urban palaces (Fig. 5) has proved to be an asset and their role as invaluable lasting symbols for healthcare.

### The Pavilion Hospital (1750 – 1930)

#### Detached units, prevent infection, Florence Nightingale, hygienic condition

*'It may seem a strange principle to enunciate as the very first requirement in a hospital that it should do the sick no harm. It is quite necessary nevertheless to lay down such a principle, because that actual mortality in hospitals especially those of the large crowded cities, is very much higher than any calculation founded upon the mortality of the same class of patient treated out of hospital would make one expect.'* \_ Florence Nightingale, 1859

The basic typology of pavilion hospitals is many detached ward blocks be connected with one corridor (Fig. 6), in order to prevent spread of infection in the hospital. With the critical perspective on healthcare situations, famous Florence Nightingale claimed that people have a better chance of survival outside a hospital. She supported and introduced pavilion hospital philosophy both in Britain and the rest of the world. In this case nurses could have more direct visual supervision of patients, while the hospital has considerably higher levels of fresh air and daylight, that way better hygiene standard improved the healthcare to another level.

During the second half of 19th century, many major innovations have been made and the notion of hospitals was more about life rather than death. Anaesthetics were discovered in 1846; Lister's carbolic sprays radically reduced infections and post-operative fatalities around 1860; In 1886, Von Bergman developed aseptic techniques to sterilize instruments and in 1895 Röntgen innovated the use of X-rays as a diagnostic method...all these innovations brought health care to a modern stage and made curing process the core value.

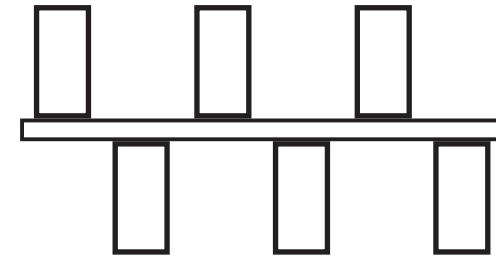


Fig. 6 Pavilion hospital



The Modernism and Sanatoria (1930 – 1940)  
**Modern Movement, Functionalism, patient centred**



Fig. 7

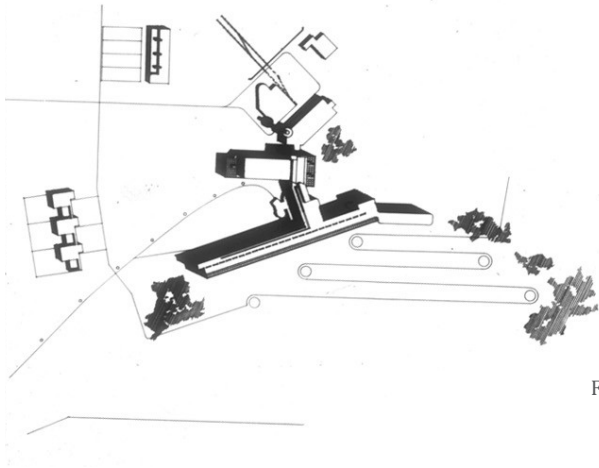


Fig. 8

With the inevitable architectural movement taking place, healthcare design became increasingly idiosyncratic in style and functional interpretation by the influence of Modern Movement. Just as the famous slogan, 'form follows function', dressed by the American architect Louis Sullivan, the building itself acted as healing component during curing process.

Designers got involved in the healthcare profession, created the buildings responding directly to the patients' requirement. One famous example of this period is the Paimio Sanatorium designed by Alvar Aalto in 1933 (Fig. 7, fig. 8). Tuberculosis was a disease exacerbated by the growth of the cities which was accelerated by the industrial revolution and resulted in polluted air, the only cure was fresh air and sunshine.

Aalto was aware of the fact that patients spent considerable periods of time at the sanatorium and all his design decisions were based on what today would be described as patient-centred approaches. He emphasized those qualities in a ward room that might have a conducive effect on the healing process by, for example, designing the light fittings so the light source was outside the range of vision of recumbent patients and creating special washbasins with particular attention being paid to eliminating noise in use.

## 4.1.6 The Megahospital

The Megahospital (1940 – 1970)

**Expansion, medical specialization, logistical system**

The modern hospital began to grow up during the 1950s. New functional units, such as radiology departments, clinical laboratory units, central sterile supply departments, and medical record centers were technology-intensive and required centralization for economy reasons. A compact hospital block for 800-1200 patients was developed (Fig. 9). During the 1960s, British authorities and the WHO recommended building three 1000-bed acute care hospitals for each one million inhabitants in order to improve economic efficiency and to use professional resources fully.

The first phase of this period would be treated as repeating and expanding on the previous hospital structure, in the way respects the original architectural and logistical ideas of the building. The second phase is described as 'The Heroic Era' because a tremendous number of new hospitals have been established with different emphasis however sharing one concept of 'machine for healing'. The 45 degree angle had been a common feature in concrete buildings which was influenced by the ward model (Fig. 10).

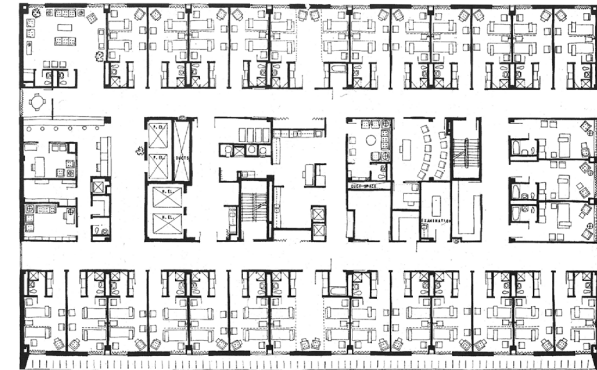


Fig. 9 Compact hospital

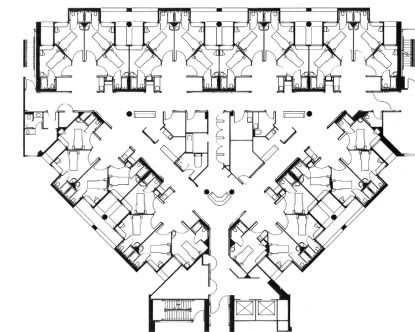


Fig. 10 ward model with 45 degree

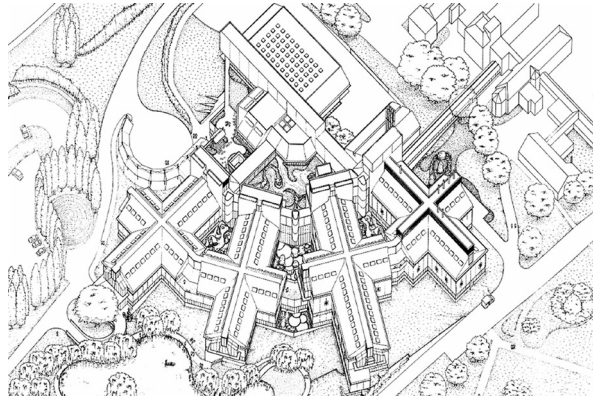


Fig. 11

### The Post-Modernism (1970 –)

**Patient-centred, aesthetic expression, spatial atmosphere**

The first hospice was opened in London as early as 1967. Gradually the architecture of hospices started to affect the way people thought about health care buildings. A general appreciation of a 'home-like' atmosphere, small scale and diversity of form started to manifest itself. Meanwhile the megahospitals were claimed as incapable of addition and demolition. This development was strongly supported by the international critique of Modernism which led to the advent of Post-Modernism.

Just as the movement established, the building should be an expression of its cultural environment, as opposed to the minimalist megahospitals which were the same all over the world. The hospitals were designed and built in which content, context, history and regionalism became key elements (Fig. 11). Post-Modernism certainly contributed by bringing a more patient-centred thinking to the forefront of health care design.

As any kind of architectural typologies, healthcare design develops along with different social backgrounds, building technologies and also medical innovations through history. The timeline of healthcare typologies shows how buildings have always reflected the medical and institutional practices that evolved over time. However, because healthcare closely relates with people's daily life, healthcare design become much more sensitive to surrounding changes to meet all aspects of requirements. For example, from the overall attitude of architectural design, healthcare experienced ancient world, middle age, enlightenment, industrialization and globalization; from medical improvement perspective, healthcare design experienced ventilation requirement and discoveries of microscope, anaesthesia, X-rays, and information technologies; also from the sickness aspect, tuberculosis, Black Death, Cholera, AIDS, SARS and currently Ebola all have drawn attention to a reconsideration of healthcare design.

It is necessary to understand the history because only the right decision would be made after analysis of relevant social background and requirements from all sections of users. To achieve a more sustainable and effective healthcare environment, this kind of study is crucial before designing. In another way of thinking it is also very interesting that different historical periods overlap with each other and even take a cycle or flashback after a while. Although the general background is totally different, but the lessons could still be taken from history to avoid unnecessary mistakes.

Although it is thousand years back to ancient Greece in the 5th century B.C., the core values of healthcare designs of that time still have practical values for the discourse today. The Greek Asclepieions were the original therapeutic environments, the daylight, views, greenery and moving water all set up the connection between a healing nature with man; Lessons from Renaissance could be taken as the urban adaptability and flexibility, which means hospitals play as a social role in the urban fabric and be accessible to everyone; We could learn from Modernism is that the building itself could play an active role in healing process, only if architects and healthcare professions working together to achieve the common goal based on belief in a certain type of care model.



## 4.2.1 Evidence Based Design [EBD]

Evidence-based design, or EBD, is a field of study emphasizing credible evidence to influence design. This approach has become popular in healthcare to improve patient and staff well-being, patient healing, stress reduction and safety. Evidence-based design is a relatively new field, borrowing terminology and ideas from disciplines such as environmental psychology, architecture, neuroscience and behavioral economics.

As the definition, EBD is based on the credible research to achieve the best possible outcome. Studies have examined how the physical environment can influence well-being, promote healing, relieve patient pain and stress and reduce medical errors, infections and falls. Many hospitals, community health centers and residential care centers are adopting evidence-based design for new construction, expansion and remodeling. Here are some fields where improvements could be utilized to enhance healthcare performance.

### 1. Larger single room

Single patient rooms are the most effective intervention to improve clinical outcomes by reducing hospital acquired infections, adverse drug events, and also falls. This also improve patient satisfaction, and the larger room size allows family members to stay overnight with the patients.



### 2. Larger windows

Increasing window size can increase light and enlarge views from interior. Natural light and views set up the connection between man and the environment, which is calming and instrumental in patient recovery and creating a delighting working space of staff.



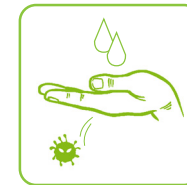
### 3. Enhanced indoor air quality

HEPA filtration is 99.97 percent effective in removing harmful particulates to reduce health care associated infections. Infections can be reduced further if outside air is exhausted after a single use, rather than recirculated.



### 4. Hand-hygiene facilities

Hand hygiene is the most important measures for preventing the spread of pathogens. Convenient access to sinks in all patient rooms and other points of care units helps to increase hand-washing compliance.



### 5. Noise-reducing measure

Noise is a common problem for patients and staff, which causing patients sleep deprivation, slower recovery, and increased stress. The effective methods could be applying high-performance, sound-absorbing acoustical ceiling tiles, carpeting where possible, sound-absorbing finishes, noise and vibration-isolated mechanical rooms, and single patient rooms.



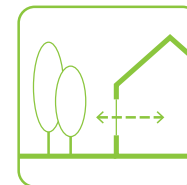
### 6. Healing art

Certain type of artwork in public and patient care areas can improve patient health outcomes. Art that depicts calming views of nature can reduce anxiety and depression also speed recovery.



### 7. Healing gardens

Well-designed indoor and outdoor gardens reduce stress and improve outcomes by providing positive distraction and restorative nature contact for patients, families, and staff.



### **Livsrum**

Building type: Cancer Counseling Center

Architect: EFFEKT

Location: Næstvedgade, 2100 Copenhagen, Denmark

Area: 740.0 sqm

Year: 2013

### **Ideology**

Livsrum is EFFEKT's 1st prize project in the competition for a new cancer counseling center at Næstved hospital in Denmark in collaboration with Hoffmann and Lyngkilde. The center is designed as a cluster of seven small houses around two green outdoor spaces. Each house has its own specific function and together they form a coherent sequence of different spaces and functions such as a library, kitchen, conversation rooms, lounge, shops, gym, and wellness facilities.

### **Own observations and investigations**

1. This building is open to all common users, who suffering from cancer and their family members, as well as people waiting for diagnosis in the nearby hospital prefer to stay in the delighting atmosphere here.
2. Large windows are opened at many places and with different orientations, they connect the environment with interior space. Stay inside the centre people could receive various qualities of daylight during different time through every day, and the lighting energy during evening is supplied by the solar panel's collection during the day.
3. The doors facing two courtyards open towards different orientations, so they could be opened at the same time avoiding strong wind directly go through the building.
4. The building is located between the highway and the ambulance path towards the nearby hospital, however the special designed windows filtrate the noises caused on both sides to a comfortable standard.



Human sized & Home like

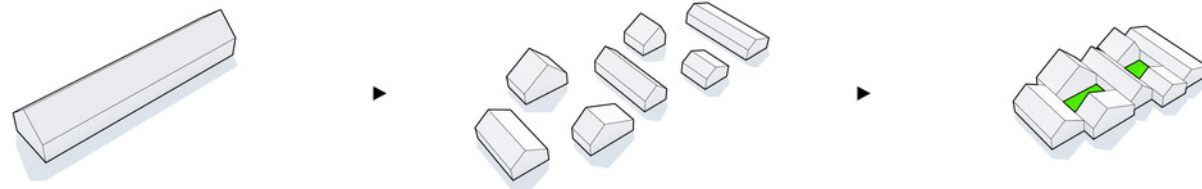


Fig. 12



Fig. 13



Fig. 14



Fig. 15

### **St. Olavs Hospital**

Building type: General hospital, university hospital

Architect: Nordic - Office of Architecture

Location: Prinsesse Kristinas gate 3, 7030 Trondheim, Norway

Area: 220000 sqm

Year: 1998-2013

### **Ideology**

The planning and design of St. Olav's Hospital is the result of winning first prize in an international competition in 1995. The main objective has been to integrate the university and the teaching hospital to produce an effective patient-oriented processing facility for health and welfare services. This has been achieved by the development of an efficient hospital plan and structure, which highlights this quality.

The location of the university hospital within the grid based city structure of Trondheim imposes a design discipline for the development of the various clinics, buildings and facility centers. Six clinical centers are built around a central square, each center with its own landscaped central area – these centers are linked below ground with technical and service culverts and on the first floor with bridges for patients and staff.

### **Own observations and investigations**

1. The whole building process could be taken as a historical turning point, the new hospital smoothly integrates with the urban context with six low rise building blocks, and holistically replaces the 'match box' shaped tower which is typical hospital typology in 1950s.
2. The six blocks have different functions but sharing one same idea, which is artistic interior design and comfortable courtyard landscape work together to compose a patient-oriented space. The rich design of facade and landscape along the main street creat a lively urban space, in this way the hospital is absolutely taken as an active open space rather than the a giant block stands in the city alone.

Integrate with urban context



Fig. 16

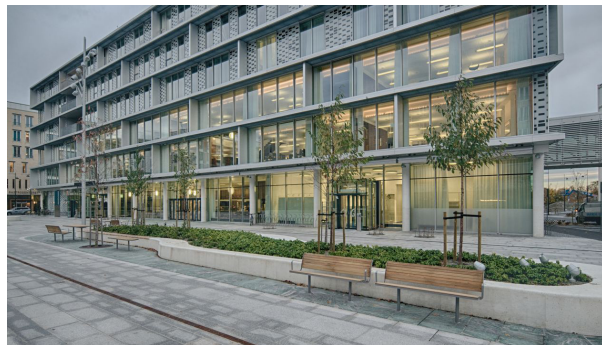


Fig. 17



Fig. 18

### **New Karolinska Solna University Hospital**

Building type: University hospital

Architect: White and Tengbom team

Location: Solna, Stockholm, Sweden

Area: 330 000 sqm

Year: open in 2016

#### **Ideology**

The assignment for the new university hospital, which will open its doors to the first patients at the end of 2016, is to provide highly specialised healthcare and conduct basic research, patient-focused clinical research and education.

The guiding principle is “the patient always first” where the patient’s safety, integrity and comfort are at the centre. Patients will meet a state-of-the-art hospital where planning and design have always been based on what will be best for them.

#### **Own observations and investigations**

##### **1. Humane and patient safe surroundings**

All inpatient rooms are harmoniously designed single rooms with WC/shower. Single rooms provide increased safety, integrity and comfort. There will also be space for relatives to stay overnight.

##### **2. Close connection**

The New Karolinska Solna will be created with close links between the reception, the care units, imaging, laboratories, and surgical devices for example. Close relationships and effective transportation and logistics will also be forged between the care and research facilities.

##### **3. Shared resources**

The New Karolinska Solna will create favorable conditions for rapid knowledge transfer between basic research, clinical research and specialized care, and translational research.



## Generality & Flexibility



Fig. 19

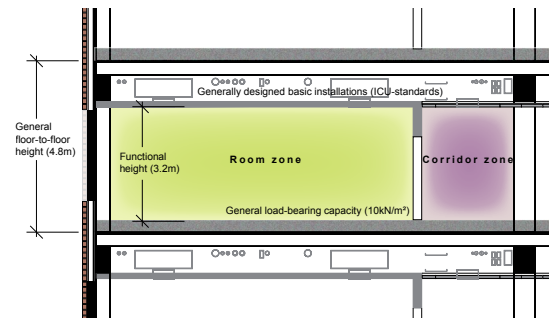


Fig. 20

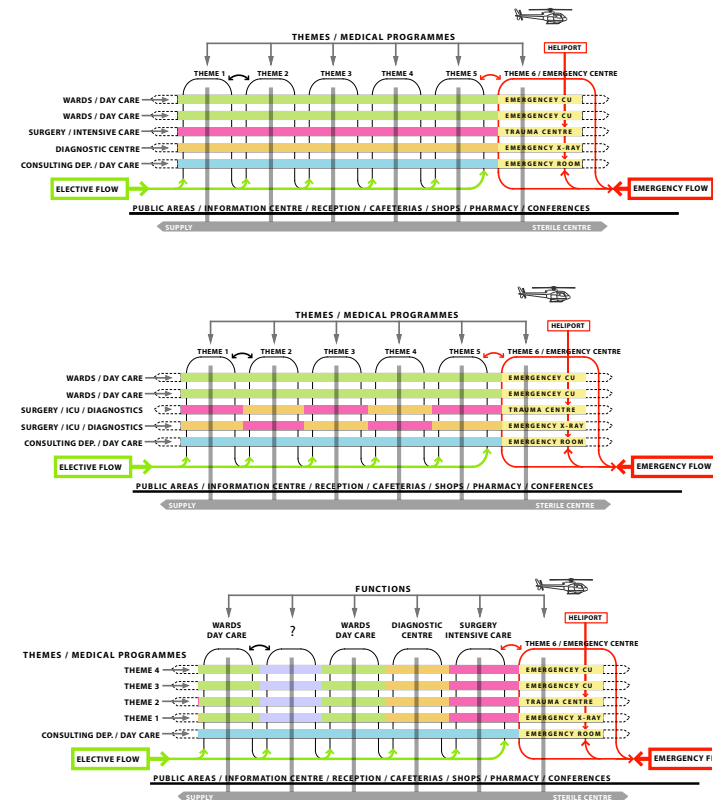


Fig. 21

### **New Nordsjælland Hospital**

Building type: Regional hospital

Architect: Herzog & de Meuron and Vilhelm Lauritzen Architects

Location: Dyrehavevej 29, 3400 Hillerød, Danmark

Area: 120 000 sqm

Year: 2014, competition 1st prize

### **Ideology**

From the architects' website:

'The proposal's huge strength is the highly successful and completely fundamental fusion of architecture and function. The Hospital's overall functional idea is also the architectural idea of the whole proposal. It really is the patient's hospital, at a very human scale, where closeness and security are paramount. It is an original idea, the opposite of monumental, and contextual and in harmony with the landscape it will be built in'.

### **Own observations and investigations**

1. The low rise hospital and emergency department on ground floor provides convenience of efficient treatment.
2. The design takes the most advantages of surrounding greenery, the green courtyard and roof also strengthen the concept of 'bringing nature in'.
3. Although using a curvilinear volume, the hospital still takes a grid system to support the construction. The generous 9 metre grid system will fulfil the requirement of extension both vertically and horizontally.

## Artistic & Nature



Fig. 22

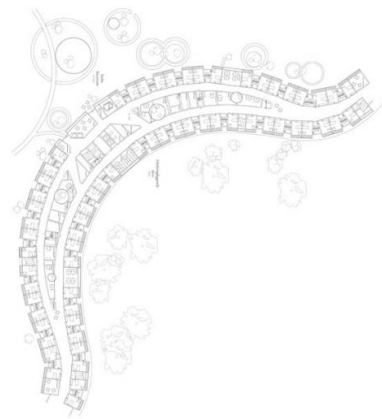


Fig. 23



Fig. 24



Fig. 25



Fig. 26

## 4.2.4 CONCLUSION

There are many new healthcare projects using totally different methods from each other to achieve a better healthcare environment, this is quite inspiring that all these designs have no need to look like 'healthcare' as it in people's mind, the core value is how do they organize the programs and cooperate all aspects of the design.

Properly designed healthcare buildings can contribute notably to more effective care, promote healing and prevent infections; Cooperating with healthcare professions will bring scientific guidance to Architectural design; Evidence Based Design(EBD) which is established by Professor Roger Ulrich has already proofed design with more natural elements like day-light and greenery will affect the curing process in a positive way.

From the learning of study trips and references, it is obvious that the core value of healthcare design today is patient centered and also interact with the urban context. From the perspective of a sustainable future, using general grid construction system and environmental friendly materials are also crucial points in current designs.

To provide a possible vision of future healthcare environment, I would firstly take advantage of the positive evidences from today's healthcare design. On the other hand, we are still facing many challenges in this continuously changing reality, such as environment pollution and the problems caused by increasing population. So as most of the designs appeared in our history, my design will also response to the problems we are facing, and provide my conclusion to achieve a better healthcare environment in the future.





**Imbalance between rising population and limited resources**

The world population is projected to reach 8.1 billion in 2025 and 9.6 billion in 2050, according to a new United Nations report, World Population Prospects: The 2012 Revision, 13 June 2013. According to the Agenda 21 statement from the UNCED(1992) Rio de Janeiro environment summit, 60% of the Earth's population will live in cities in the year 2050. It is necessary to discover how urban life would be like in the future.

In most countries, investments put in health care will be limited to less than 10%, this number in Sweden is 9.1% in 2008. The need of use medical technology will grow perhaps 15% annually, but the GDP growth of 4th quarter in 2014 is only 1.1% comparing with previous season. The pressure on health care providers for more economical solutions is increasing.



Fig. 27

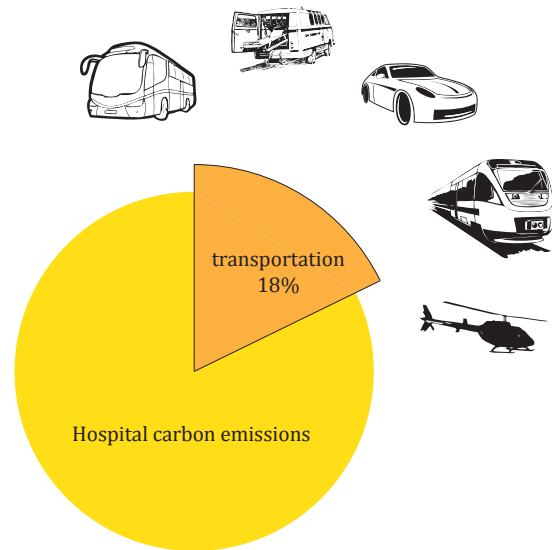


Fig. 28

### Increasing pollution from patient transportation

The health sector, with its fleets of ambulances, hospital vehicles, delivery vehicles, and staff and patient travel is a transportation-intensive industry. Air pollution impacts from health care are concentrated near large-scale hospital facilities. The UK National Health Service estimates that the CO<sub>2</sub> emissions related to transportation of staff and patients to healthcare settings equal approximately 18% of its total carbon emissions.

This significant finding makes people to consider siting facilities close to public transportation infrastructure and within communities, thereby reducing vehicle miles travelled by patients. Telemedicine is another strategy for reducing transportation related emissions. As WHO notes, “well designed tele-health schemes can ...reduce the travel related carbon footprint of health care, while improving access and outcomes for vulnerable groups.”

## 4.3.3 Decentralized Healthcare System

### Decentralized Healthcare System

Trends in the design and utilization of acute care hospitals are beginning to suggest that large centralized facilities can become inefficient and costly. As various medical technologies have become more widely distributed, networks of smaller facilities have become more efficient and have created the concept of regionalization. It is the regionalization that will add a human element and will permit systems to be adapted more to the culture of areas or regions served.

The compact hospital body with patient towers has remarkable difficulty in expanding its functions. As knowledge of evidence based design (EBD) becomes more widespread and communication network improving, portable technology will make specialty centres more universally distributed. Such development will further strengthen the trend toward ambulatory care.

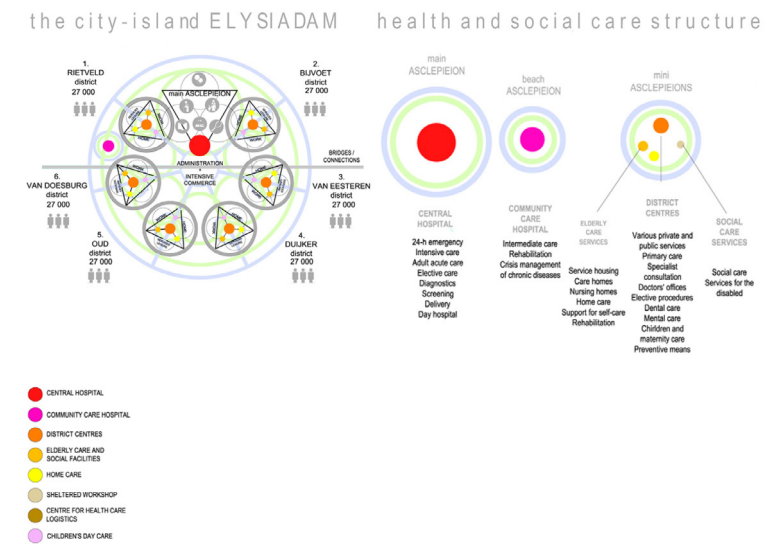


Fig. 29

SETTING	FACILITY	SERVICES
Home	Home Nursing homes Pharmacy Cyber café Health kiosk	Self care Monitoring Automated treatment Information and advice
Health and social care centres Up to 10k population Close to home	Surgeries Drop in centres Healthy living centres	Social care Primary care Outreach care Information and advice
Community care centres 100k population Heart of the community	Resource centres Community hospitals	Basic diagnostic services Day interventions Minor injuries Nurse led inpatient care Intensive rehabilitation Chronic care management
Specialist care centres 250k, 500k, 1000k population On central city sites	Diagnostic and treatment centres Secondary care Tertiary care	Planned interventions Emergency care Complex diagnostic treatment & inpatient care

Table. 1

### 1. Imaging Technology

At the present time, there is no doubt that imaging technologies have become more sensitive and specific. Over time, one could expect that these imaging technologies will become more portable and more universal.

With respect to imaging modalities, the hospital of the future may become the command post from which images are ordered and analyzed. Improved communication networks will make it possible for the isolated practitioner to be connected to the most sophisticated medical centres.

In the same sense that health care networks are developed today, the network of the future will de-emphasize physical facility and will emphasize communication and diffusion of technology to disparate locations.

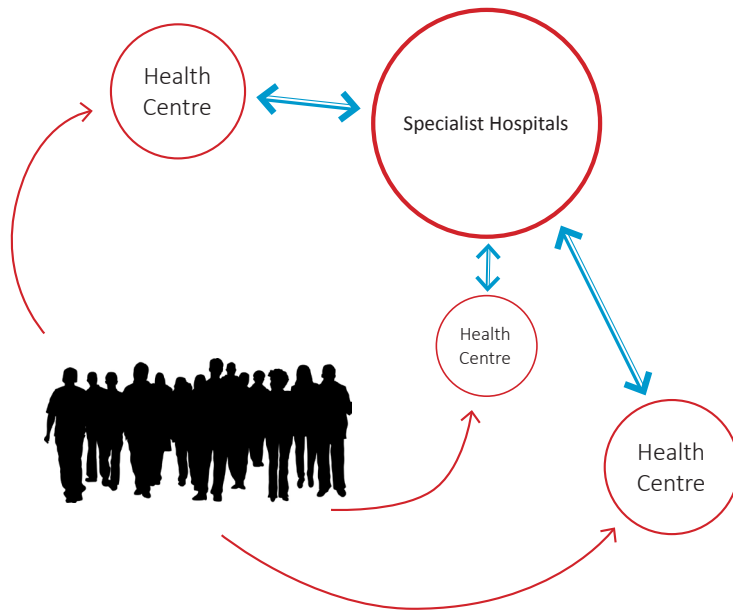


Fig. 30

## 4.3.4 Possible medical technologies in the future

### 2. Improved Diagnostic Methods

Improved imaging technology will make it possible for visualization of diseased organs and tissues by noninvasive technologies. For the future, one might project that laboratory studies done only in central laboratories can be performed in peripheral sites through the development of intelligent sensors that might relay abnormalities in blood detected by noninvasive methods to central processors.

As the same token before, one might foresee that hospitals today could become command posts from which medical care is directed. Technology will become more portable, to the point where diagnostic laboratories will be widespread and freely accessible.



Fig. 31

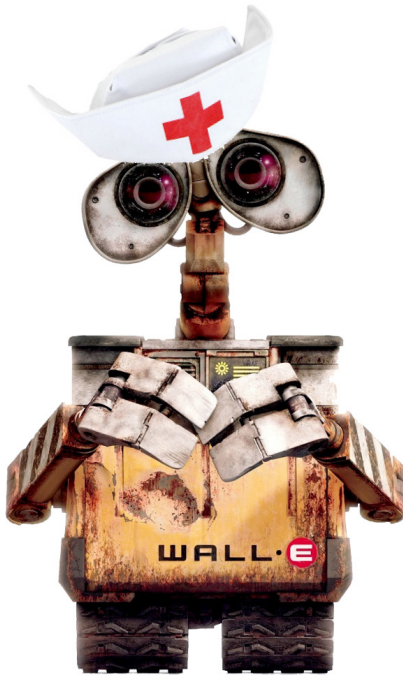


Fig. 32

### 3. Improved Surgical Techniques

The future of surgical techniques is already being defined by the development of minimally invasive surgical centers. With such centres, the disciplines of radiology, anesthesia, surgery, and medicine interact and use combined services.

There is also expectation that some surgical procedures will be performed by robots directed by surgeons in remote locations. The architecture of the hospital of the future may be based on communication architecture.

Again, demands for large centralized hospitals will lessen as technology becomes more portable and access to health care more widely distributed.

Life expectancy in Sweden is high and the country performs well in comparisons related to disease-oriented indicators of health service outcomes and quality of care. The Swedish health system is committed to ensuring the health of all citizens and abides by the principles of human dignity, need and solidarity, and cost-effectiveness.

The state is responsible for overall health policy, while the funding and provision of services lies largely with the county councils and regions. The municipalities are responsible for the care of older and disabled people. The majority of primary care centres and almost all hospitals are owned by the county councils.

Health care expenditure is mainly tax funded (80%) and is equivalent to 9.9% of gross domestic product (GDP) (2009). Only about 4% of the population has voluntary health insurance (VHI). User charges fund about 17% of health expenditure and are levied on visits to professionals, hospitalization and medicines.



Fig. 33



The number of acute care hospital beds is below the European Union (EU) average and Sweden allocates more human resources to the health sector than most of the Organization for Economic Co-operation and Development (OECD) countries.

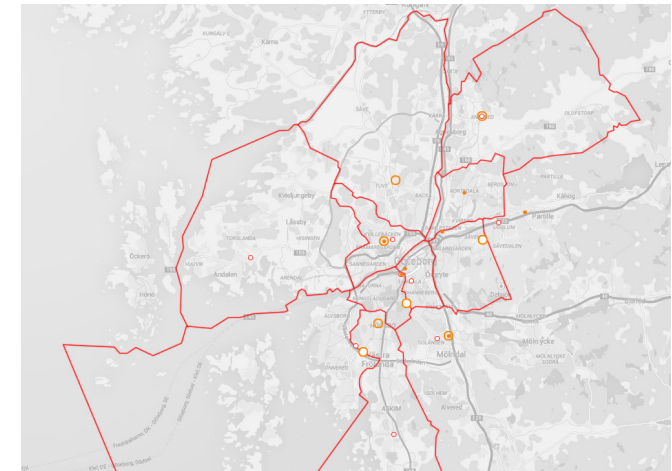
In the past, the Achilles' heel of Swedish health care included long waiting times for diagnosis and treatment and, more recently, divergence in quality of care between regions and socioeconomic groups. Addressing long waiting times remains a key policy objective along with improving access to providers.

Recent principal health reforms over the past decade relate to: concentrating hospital services; regionalizing health care services, including mergers; improving coordinated care; increasing choice, competition and privatization in primary care; privatization and competition in the pharmacy sector; changing co-payments; and increasing attention to public comparison of quality and efficiency indicators, the value of investments in health care and responsiveness to patients' needs. Reforms are often introduced on the local level, thus the pattern of reform varies across local government, although mimicking behavior usually occurs.

## 4.3.7 CONCLUSION

As learned from the Swedish healthcare system, Sweden has an advanced patient centred health care and clearly divided into many categories on different levels. All the medical facilities such as regional hospital, health centre, acute centre and dentistry are directly in charge of local government or themselves. This is a privilege to apply the decentralized healthcare system with clear division of medical facility levels.

As my proposal of the future healthcare system, the health centres today in Sweden will work as the community hospitals taking care of all citizens nearby, the regional general hospitals would be more like a specialist institute. In such a way the excessive visitors in hospitals today would be distributed into many community health centres to have efficient treatments. With advanced information technologies in the future, high performance treatment is accessible at any areas through a mature network.



- District boundary
- Hospitals
- Health centres
- Acute centres

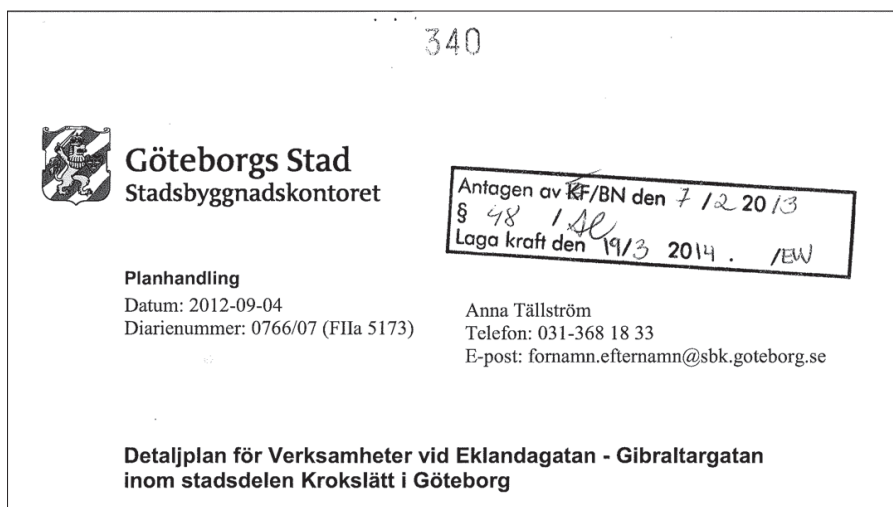
Fig. 34 Regional healthcare facilities in Gothenburg, Sweden



## 5.1.1 SITE

Eklandagatan 80-82  
Plot area: 2100 sqm  
Planned building area: 4000 sqm  
(this number is from the company)





Planning area consists of properties Krokslätt 102:2 and 102.:9 and covers approximately **2100 sqm**. The land is owned by **Eklandia AB**.

#### Existing buildings:

Within the planning area is now a converted villa. The villa is built of red brick in 1.5 floor. The villa was built in **1960** and has undergone a number of extensions and conversions.

During the 1980s changed the use of the building from being home to an extension of the office could be built. **2004** the use from offices to private practice.

In real estate 102:9 was formerly a garage that was demolished at the end of **2011**. The repair shop was built as a service station in 1961. Discontinued 1996.

**Semrén+**  
**Månsson**



The company Semrén & Månsson Arkitektkontor AB has made a proposal at this plot, the client is a plastic surgery clinic. For some reasons the project does not keep on going, so this plot still keeps empty.



## 5.1.2 Surrounding views



View A to Korsvagen



View B to Chalmers



View C to South





Bus stops: easy accessibility

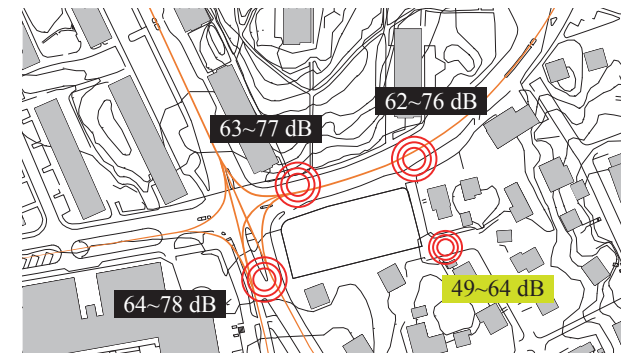


Two main flows come from the city centre



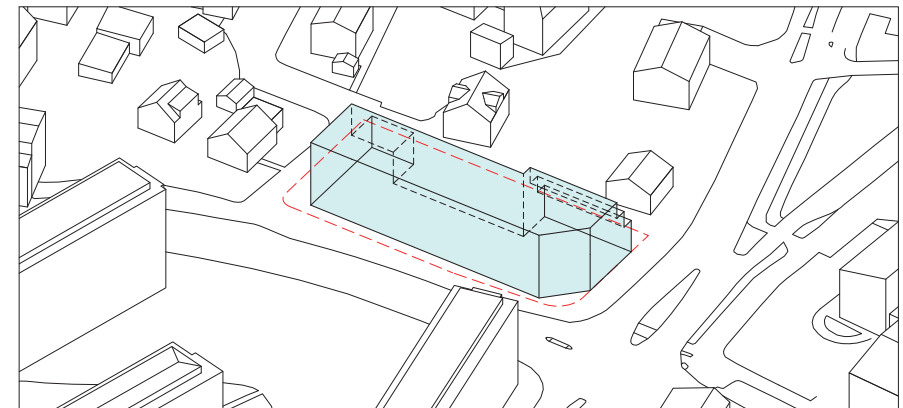
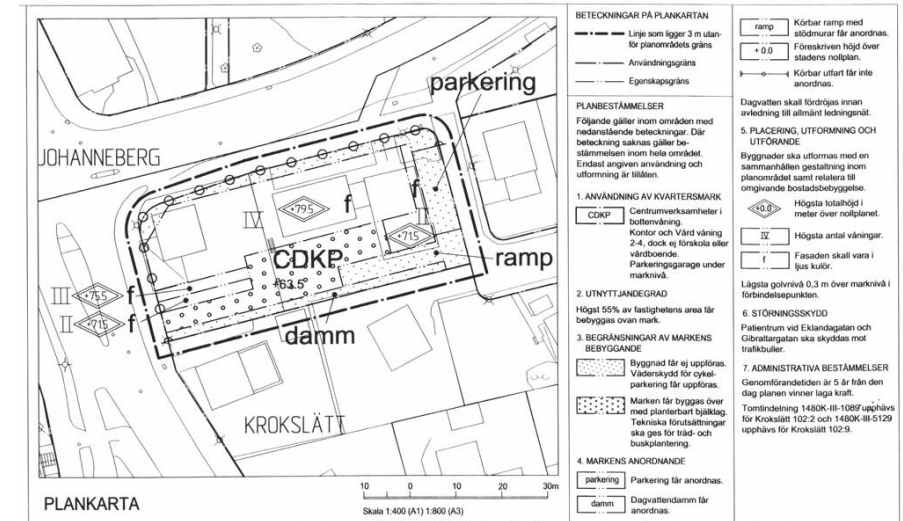
Surrounding noise level

As next to the busy crossroad, the site is facing a very crowded traffic during rush hour. However, the surrounding bus stations also make the site accessible easily.





## 5.1.4 Detail plan



Based on the city detail plan, there is a suggesting building volume at this design plot. However, to create a new landmark of central Johanneberg, and also an active urban space, the volume would be developed during the design process.



The new health centre will performance as a community hospital in the future, different medical departments share the similar ratio as a hospital. However the room area will still meet the design disciplines of different medical requirements.



#### Program area: m²

Emergency: 3800  
Operation: 3000  
Imaging: 3600  
Delivery: 500  
In-patient wards: 27300  
Out-patient: 26500  
Sterilisation: 800  
Mortuary: 700  
Labs: 2100  
Rehabilitation: 5000

Changing room: 800  
Work shop: 500  
Kitchen: 1500  
Canteen: 750  
Gym: 2000

Goods delivery: 1600  
Technical support: 7800

**In total: 88250**

#### Program area: m²

Emergency: 175  
Operation: 135  
Imaging: 160  
Delivery: 25  
**In-patient wards: 1200**  
**Out-patient: 1200**  
Sterilisation: 35  
Mortuary: 30  
Labs: 100  
Rehabilitation: 200

Changing room: 35  
Work shop: 25  
Kitchen: 70  
Canteen: 35  
Gym: 100

Goods delivery: 75  
Technical support: 350

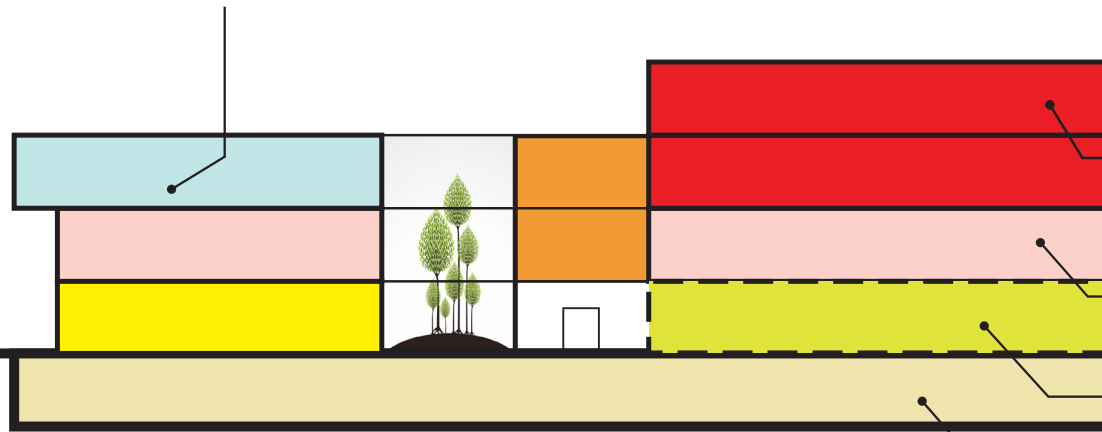
**In total: ~4000**

<b>In - patient:</b> 450 m² 8 beds patient wards: 30×8=240 m² stuff support: 210 m²	
<b>Out - patient:</b> 700 m² working space: 300×2=600 m² waiting space: 100 m²	
<b>Operation department:</b> 540 m² 3 operating theatres OP theatre area: 70×3=210 m² OP support functions area: 330 m²	
<b>Image department:</b> 300 m² 3 X-ray units, 60 m² each	
Maternity/Delivery: 50 m²	
Sterilization: 100 m²	
Lab: 100 m²	
Ambulance hall: 100 m²	
Kitchen: 50 m²	
Canteen: 100 m²	
Rehabilitation: 300 m²	
Mortuary: 30 m²	
Goods delivery: 100 m²	
Technique: 350 m²	
Changing room: 60 m²	
<b>In total: 3300 m² (exclude circulation)</b>	

## 5.2.1 Program

### East Box: In-patient and Day room

Patient short-term accommodation



View from north

### West box: Treatment

Examine rooms, Imaging department,  
Operating department

### Level 2: Reception, Diagnosis

Examine rooms, offices

### Level 1: Common space, Information

Gym, Cafe, Media centre, Meeting room,  
Reading area... ..

### Underground level:

Parking lots, Technology support, store



- an active **urban space**

Which is open to all kinds of users, either patients, doctors, staff or common citizens. This health centre will be equipped with more public functions than only a clinic.

- a **healthier** living & working environment

Which is providing pleasant environment for both patients and staff though enough natural view and daylighting.

- a health centre with **future vision**

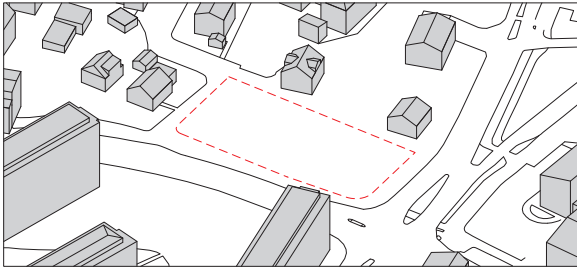
Which is suggesting a more efficient decentralized health care system.

- a **sustainable** future

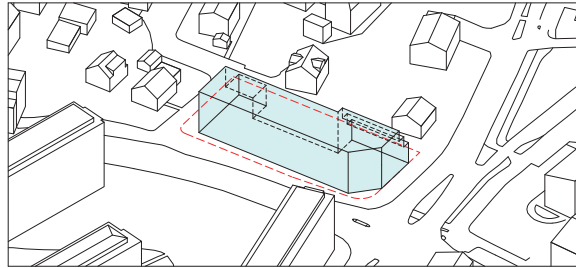
Which has less energy consuming from patient transportation and re-construction of the building, the project will apply the concept of flexibility and sustainability into design process.



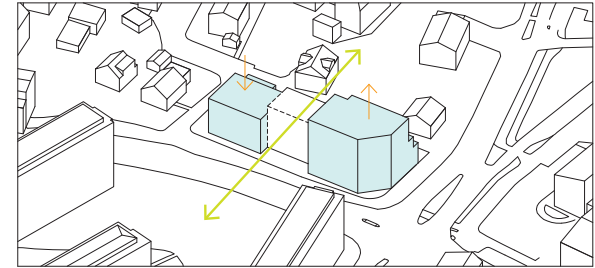
## 5.3.1 Shaping the building



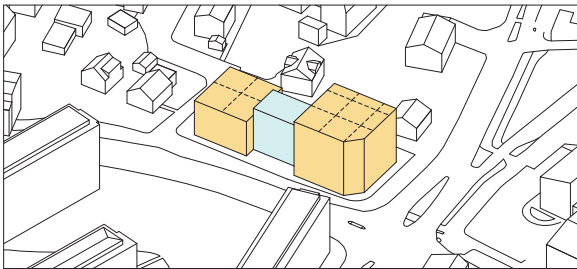
Design site



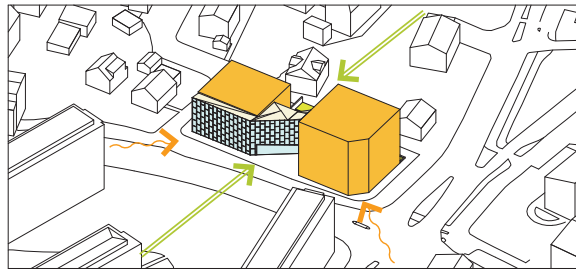
Volume of the city detail plan



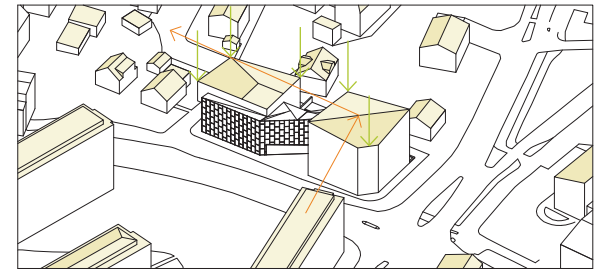
To form a new district landmark



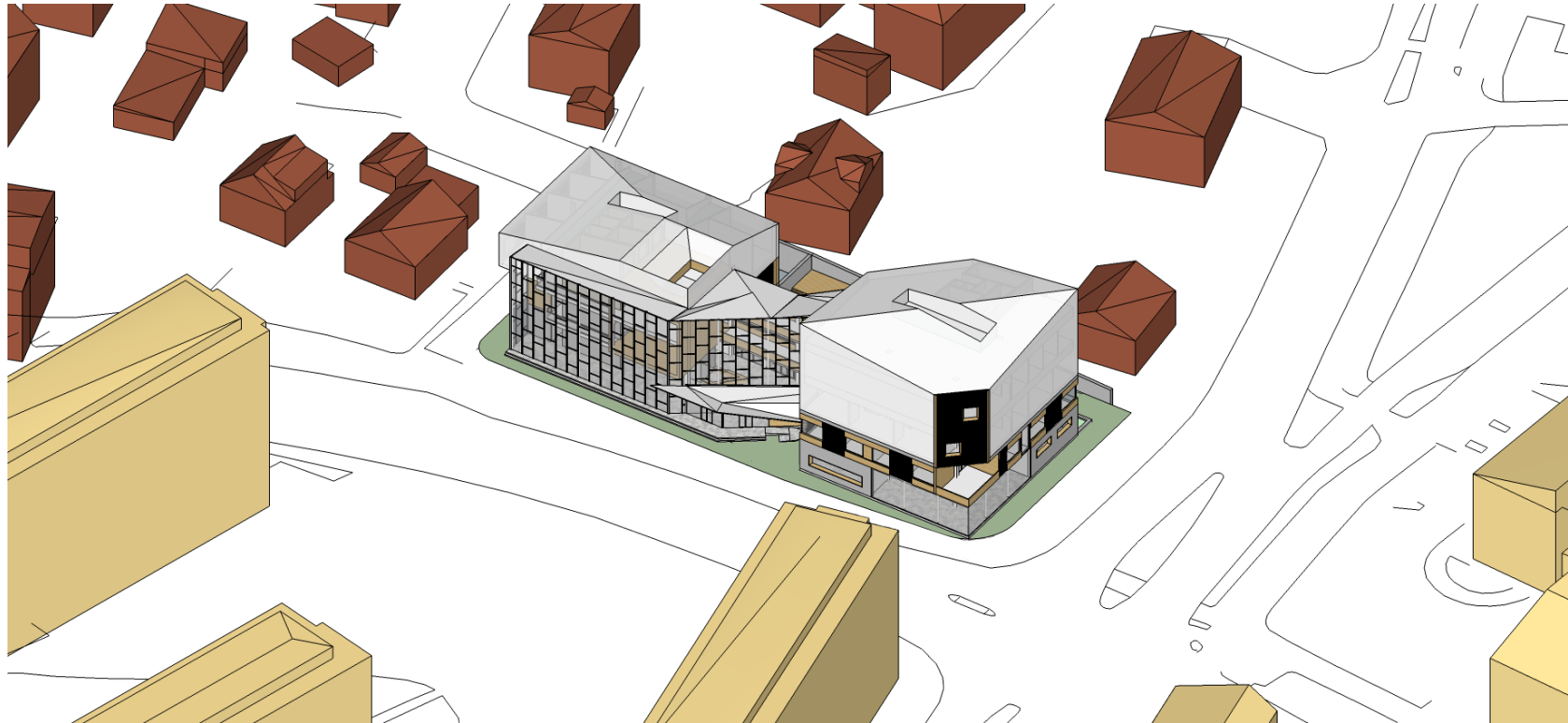
To achieve Flexibility\_9M grid system



Bring surrounding greenery and views



Shape the building as a bigger villa, response to the surrounding building environment, set up connection between the residential block and villas on the south side.



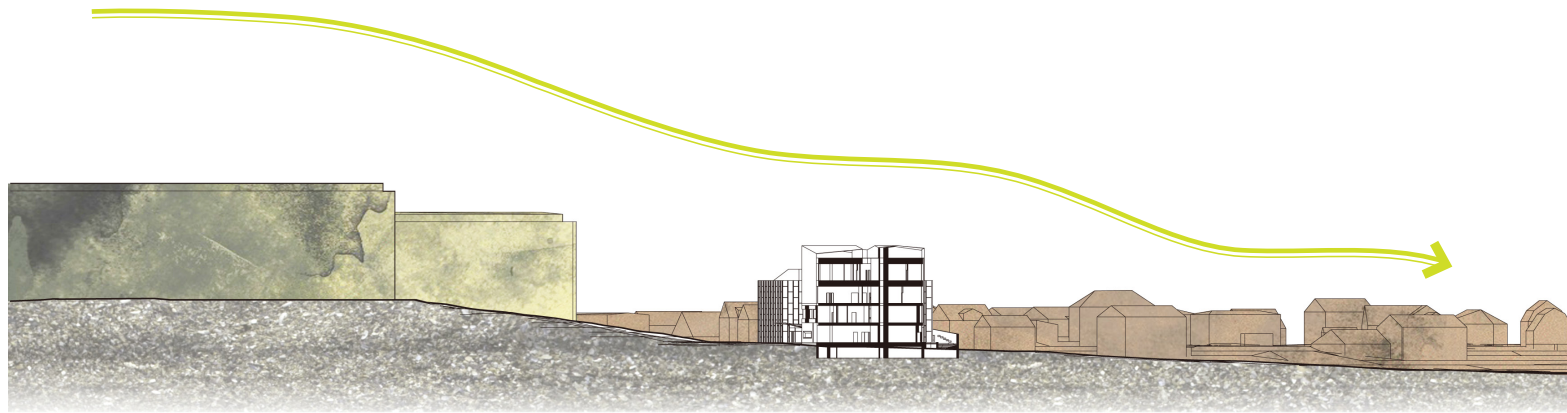
## 5.3.2 Master plan 1:1000



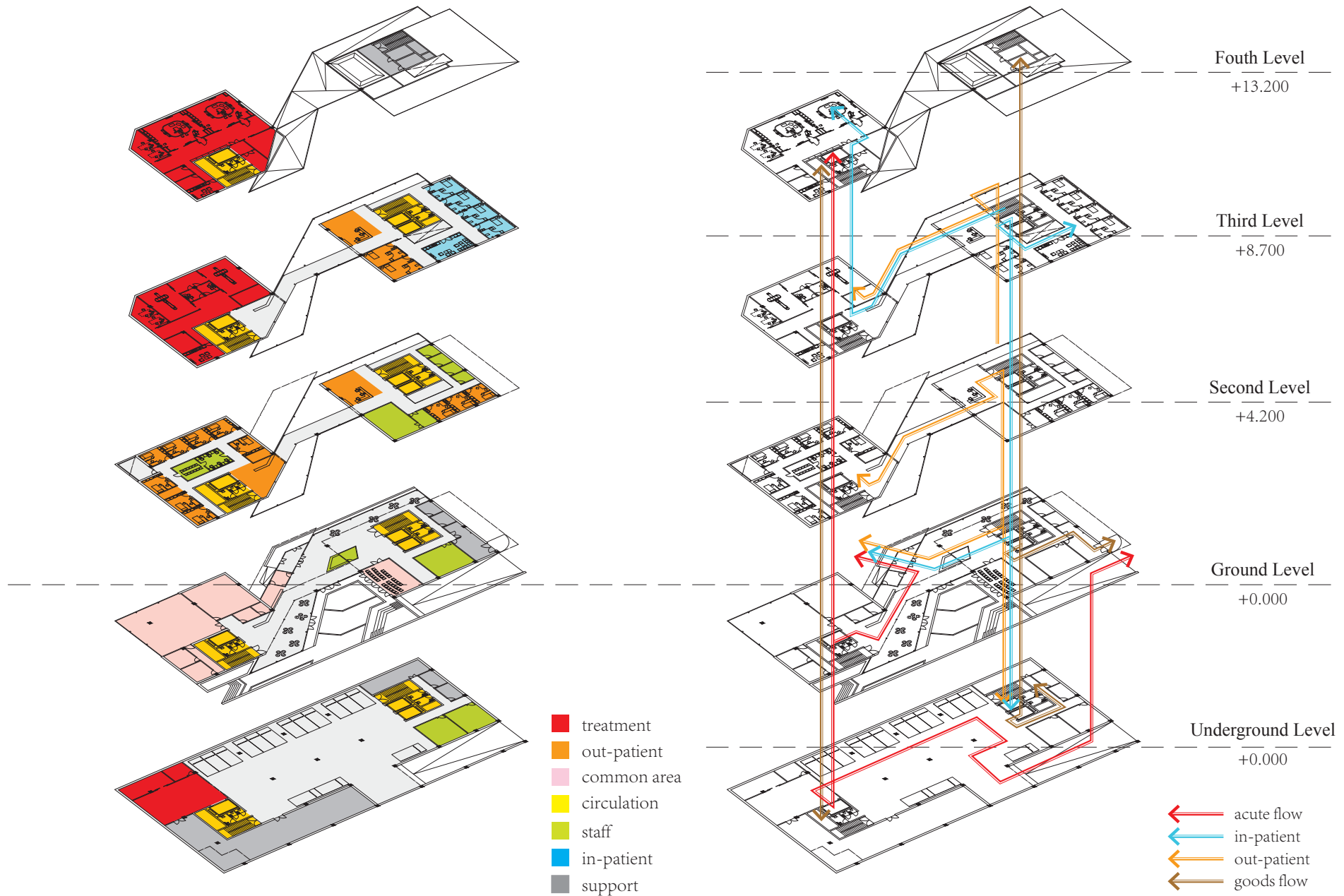




## 5.3.2 Section A-A

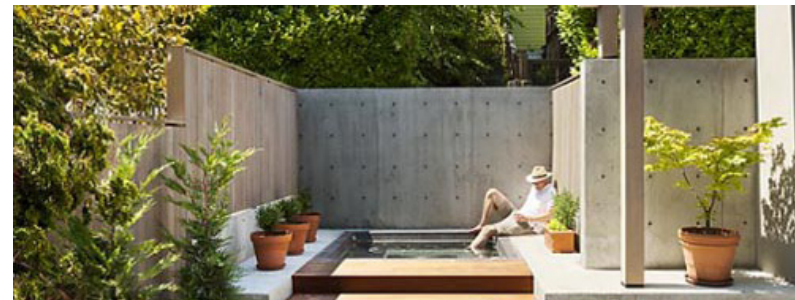
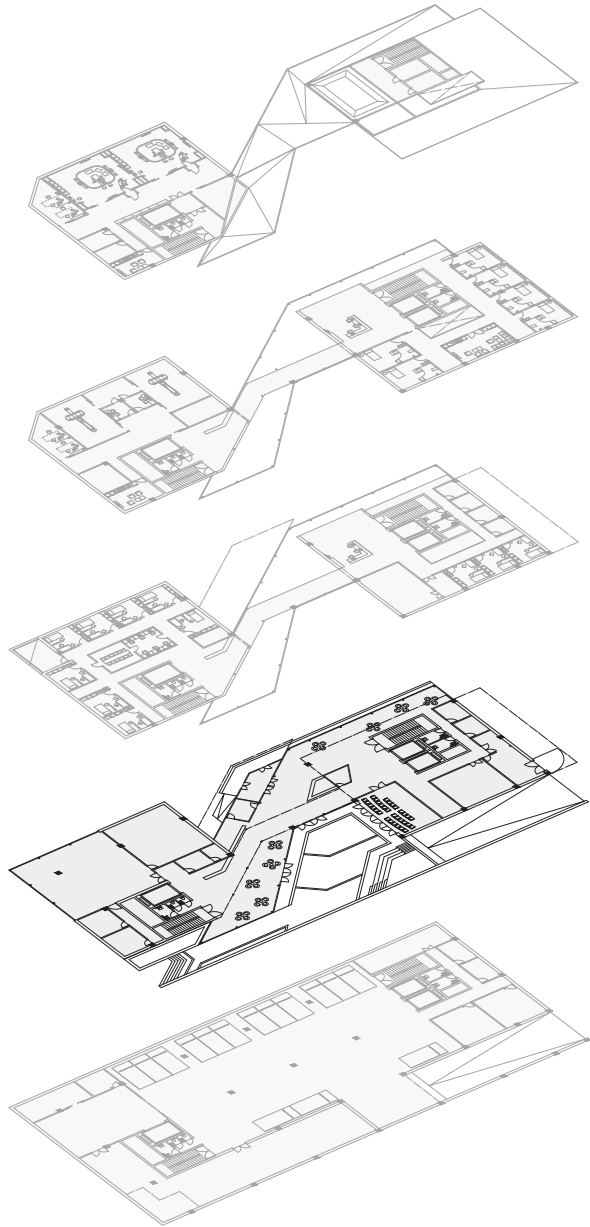


The new proposal smoothly connects different types of buildings on both sides of the site, creates a continuous skyline of the city.

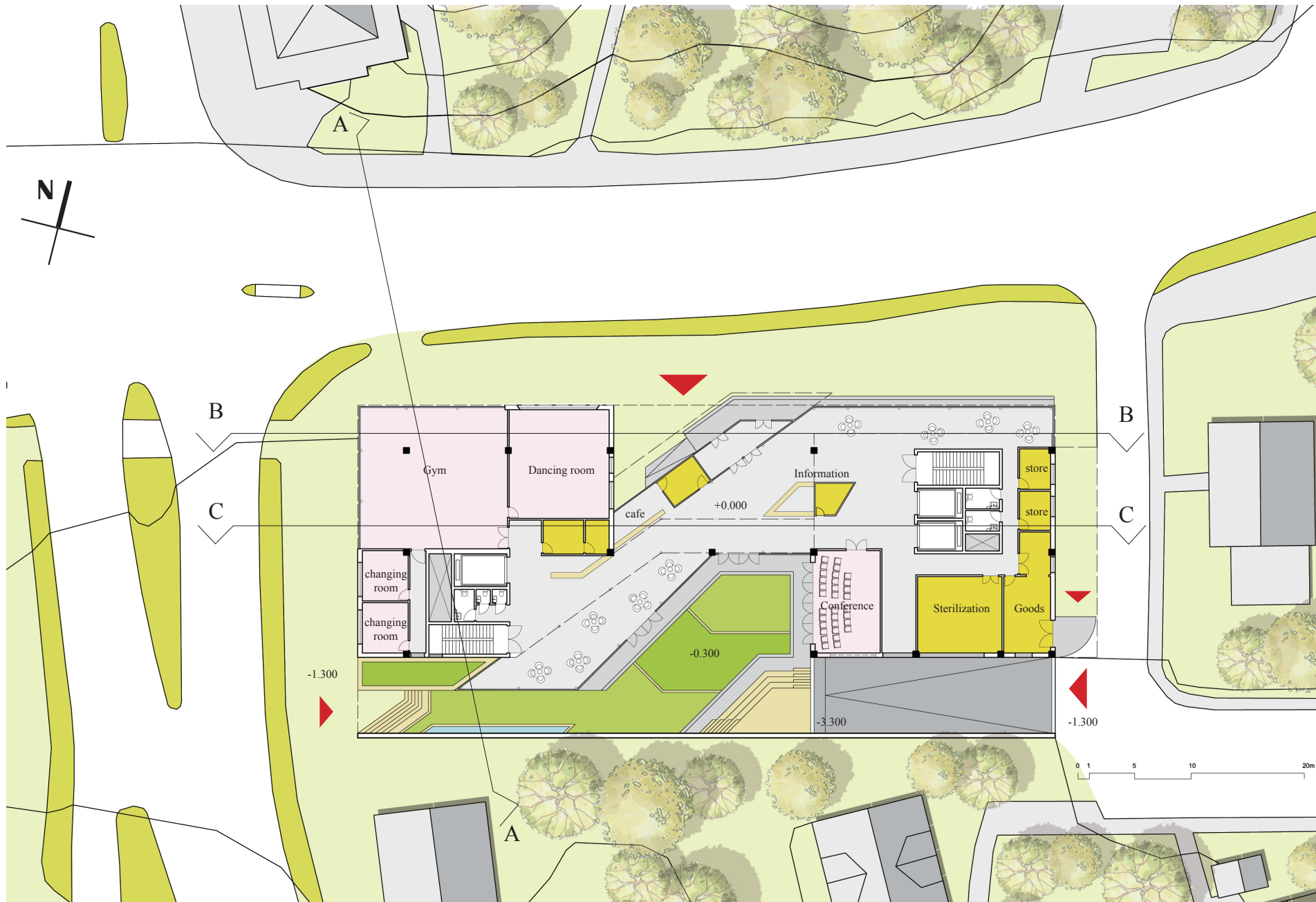




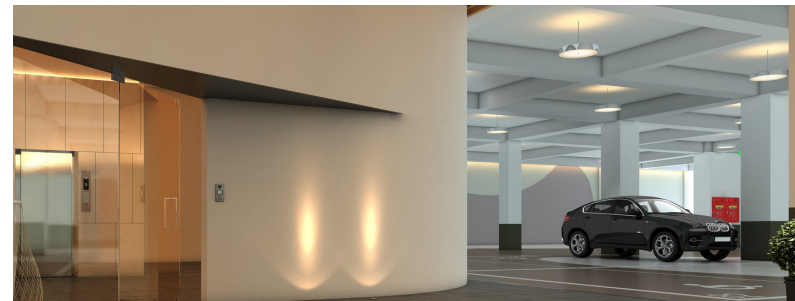
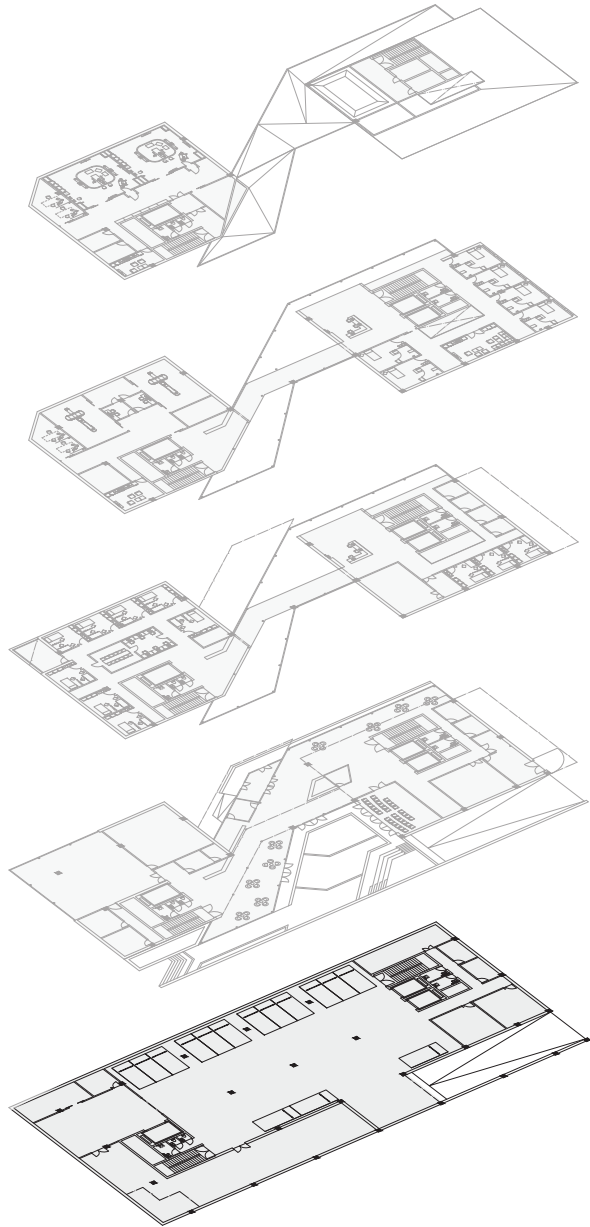
## 5.3.4 Ground floor plan



Ground Floor Plan - Public Service

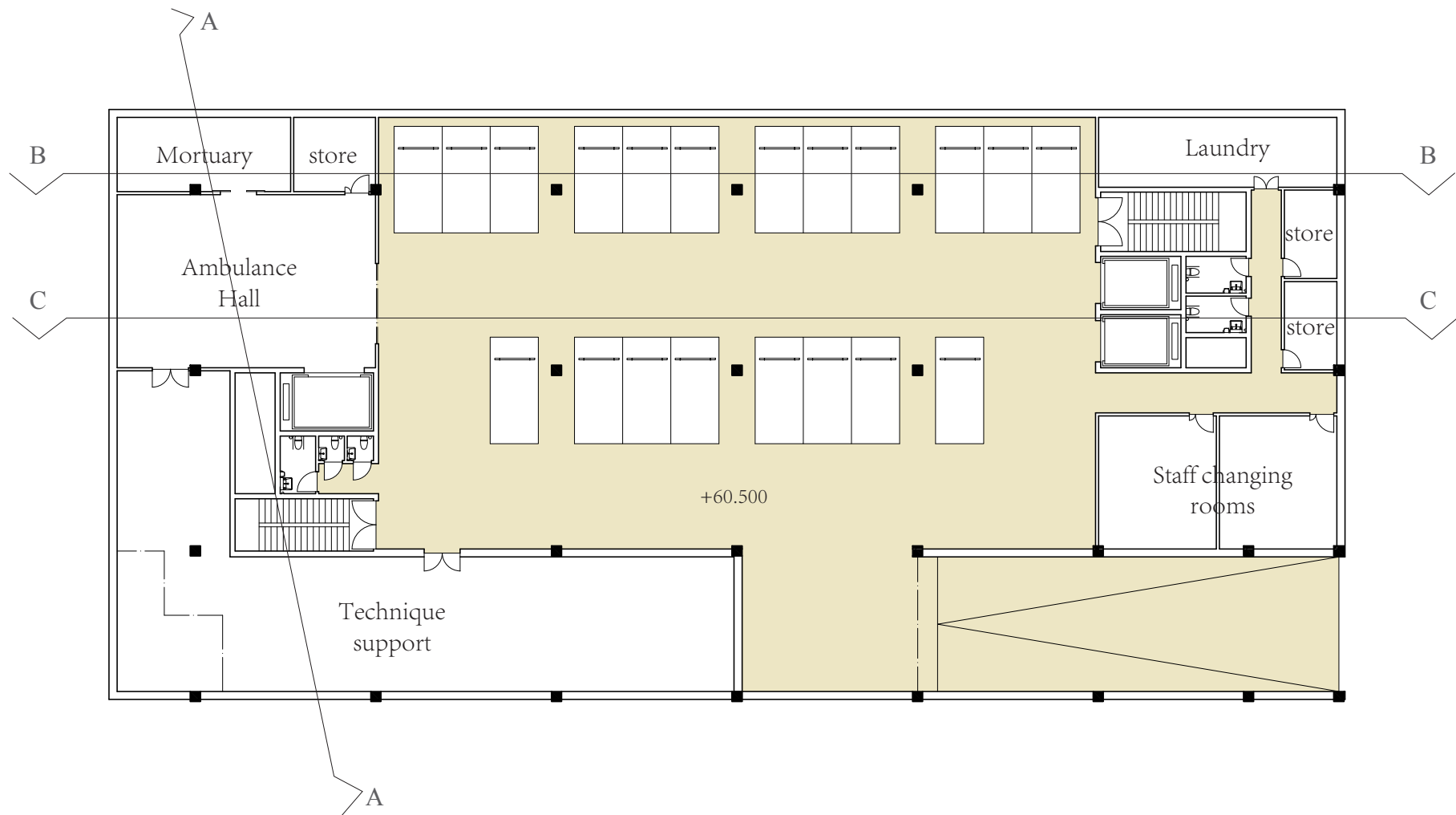


## 5.3.4 Underground floor plan

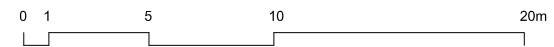


Underground Floor Plan - Emergency and Support

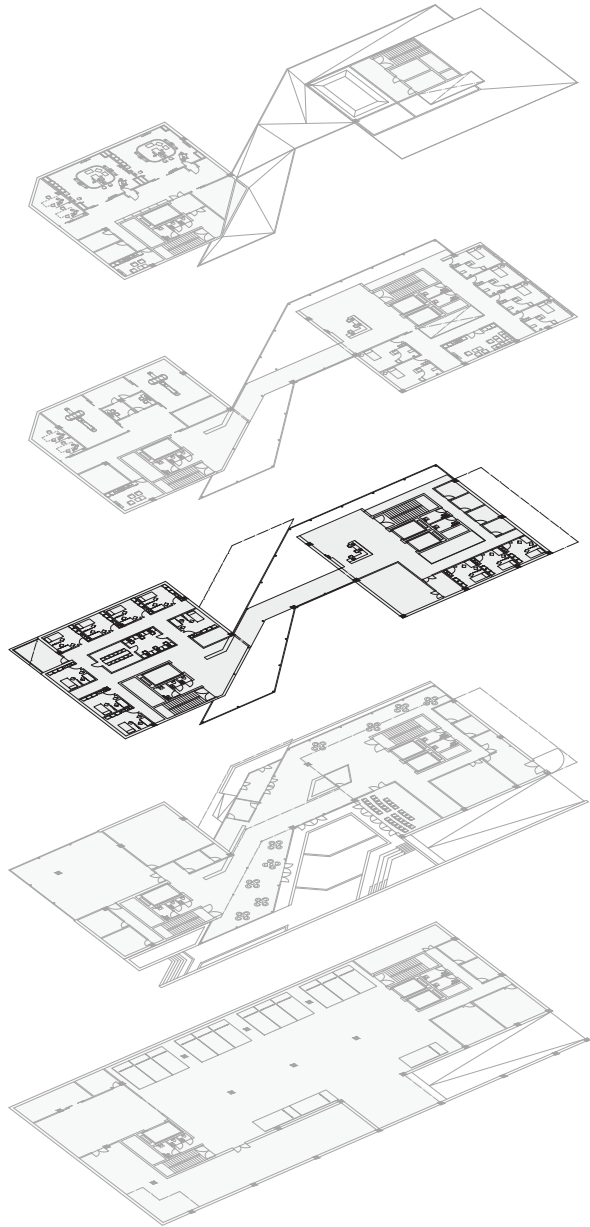




Underground floor plan 1:300, 1660 sqm

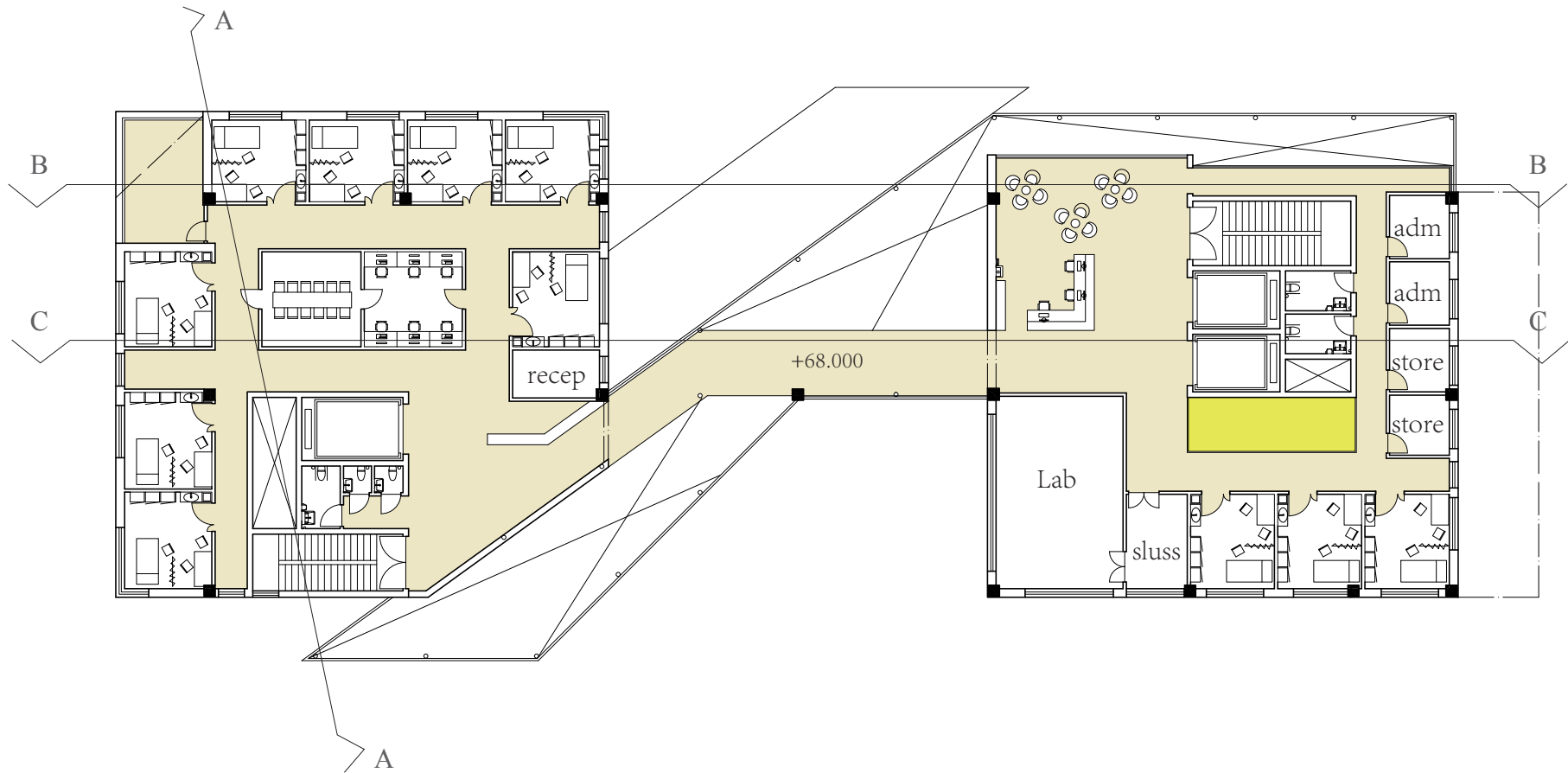


## 5.3.4 2nd floor plan

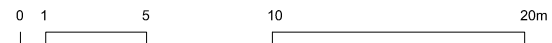


2nd Floor Plan - Diagnosis

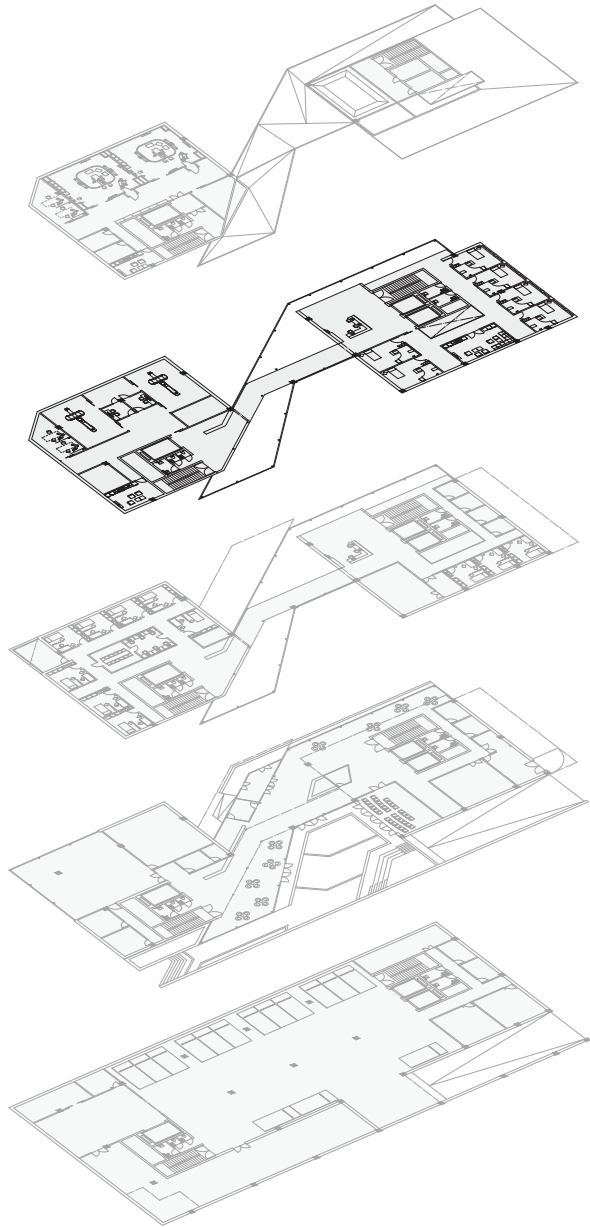




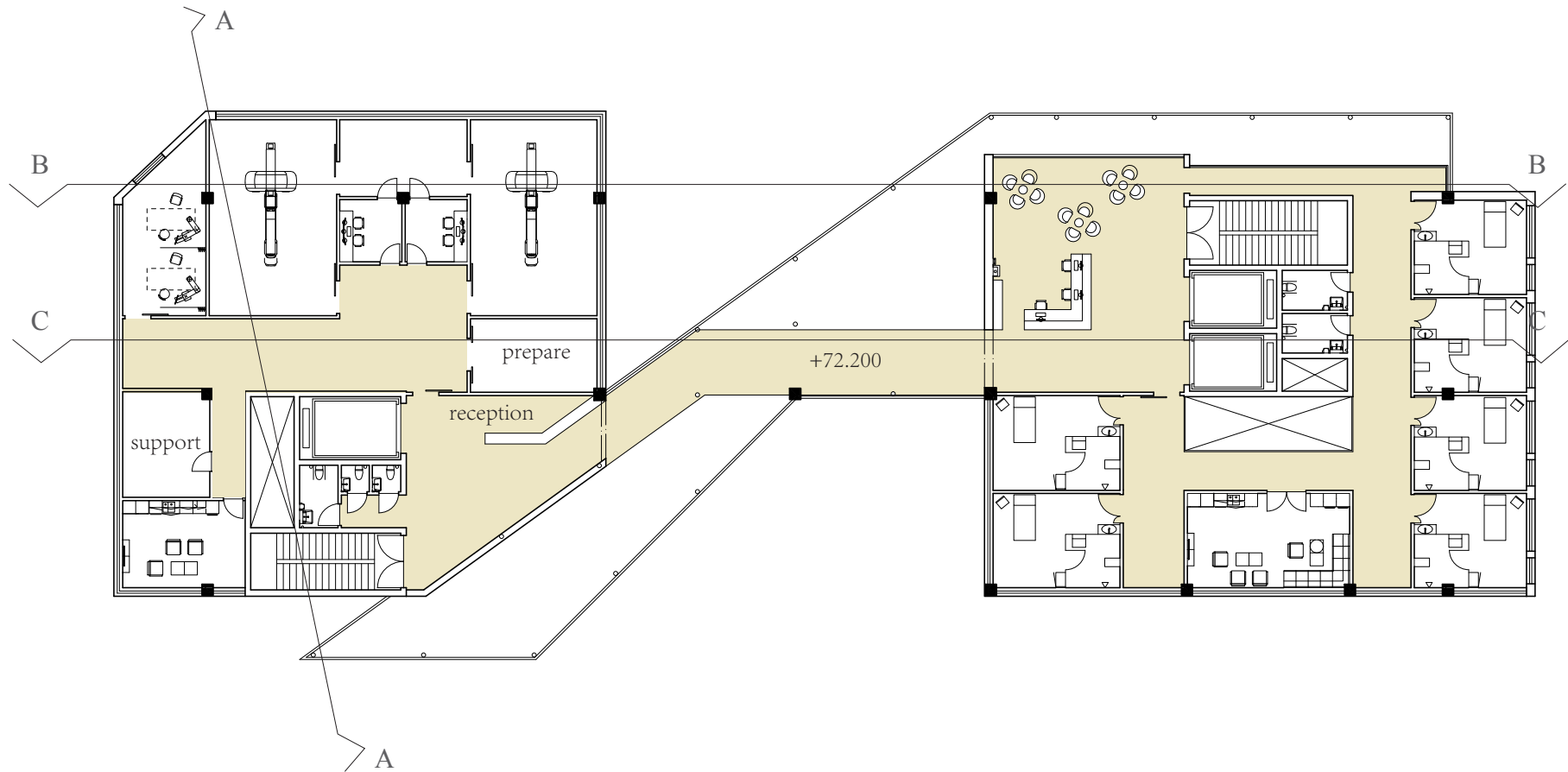
2nd floor plan 1:300, 956 sqm



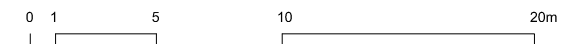
## 5.3.4 3rd floor plan



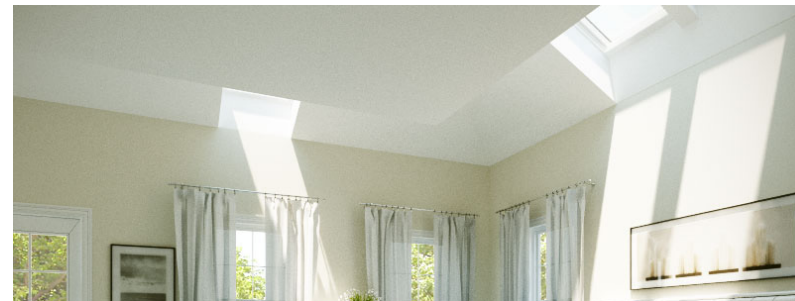
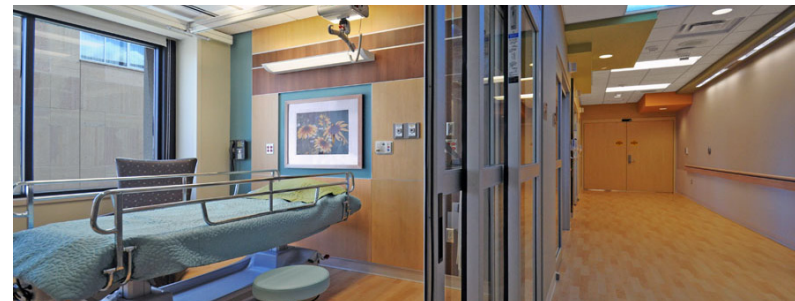
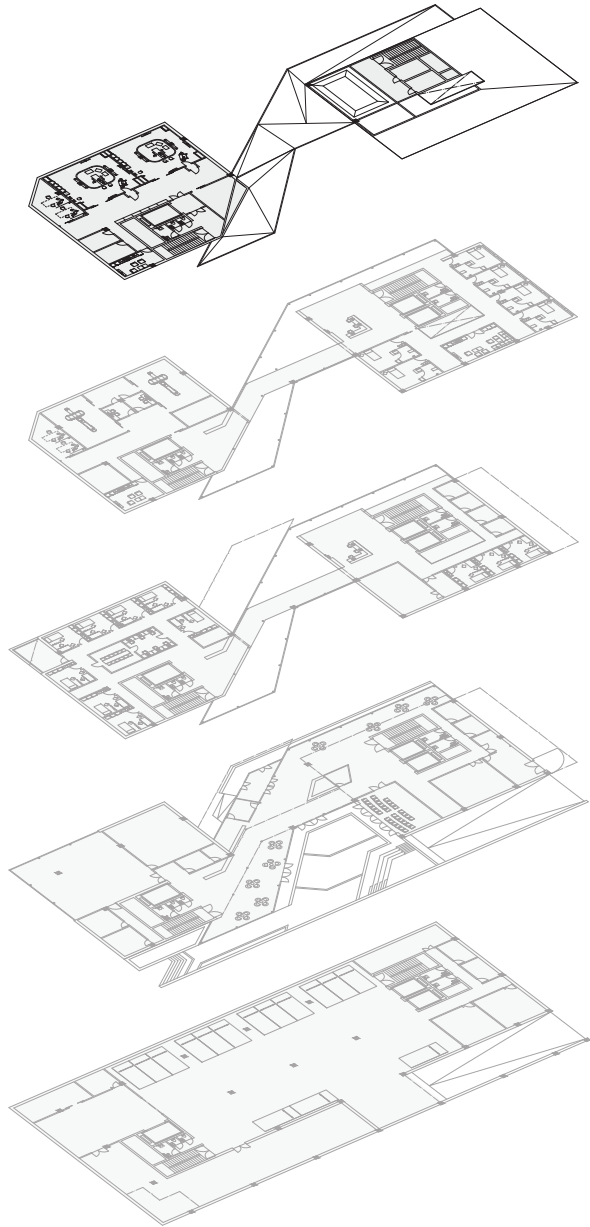
3rd Floor Plan - Imaging and In-patient



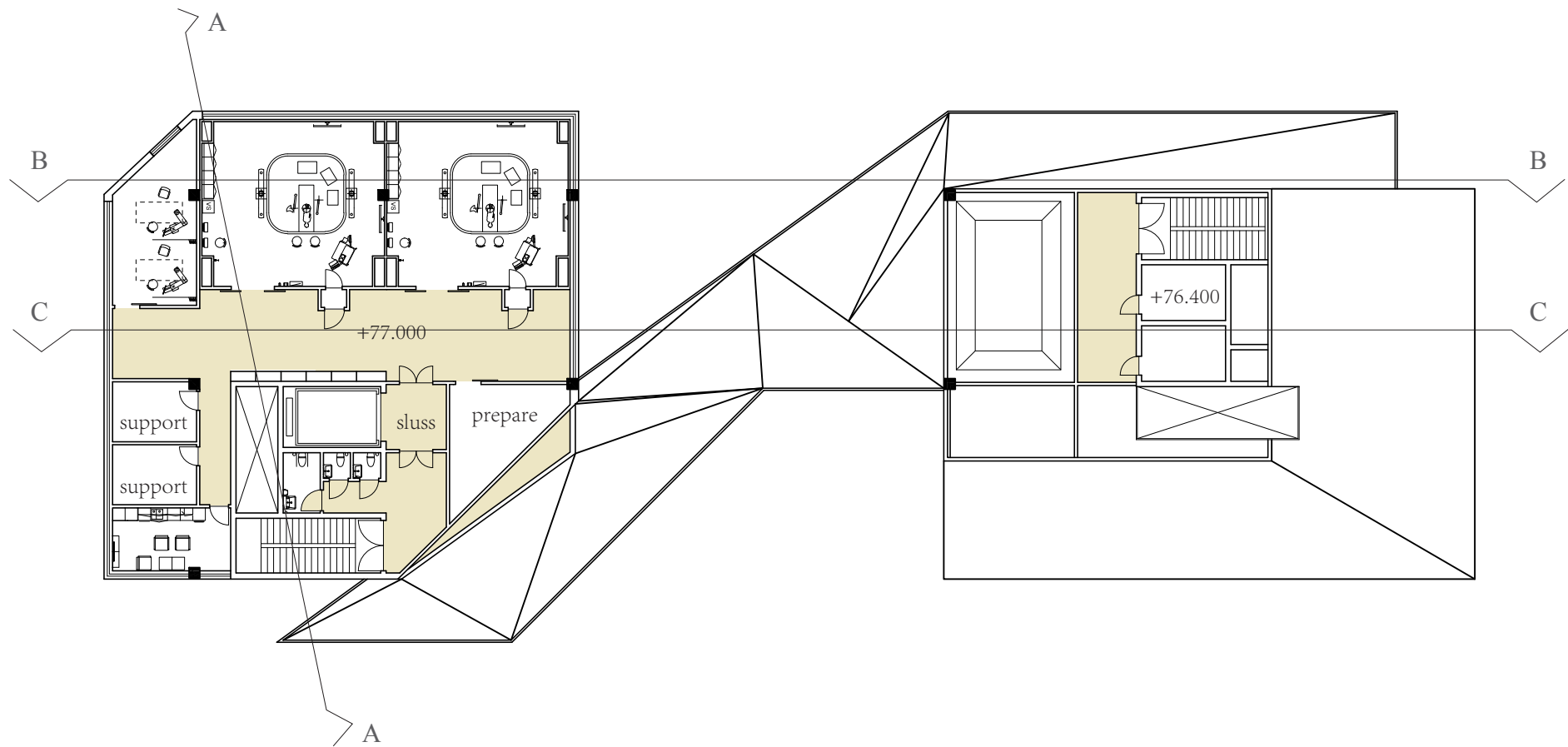
3rd floor plan 1:300, 836 sqm



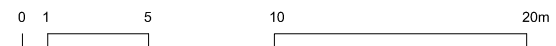
## 5.3.4 4th floor plan



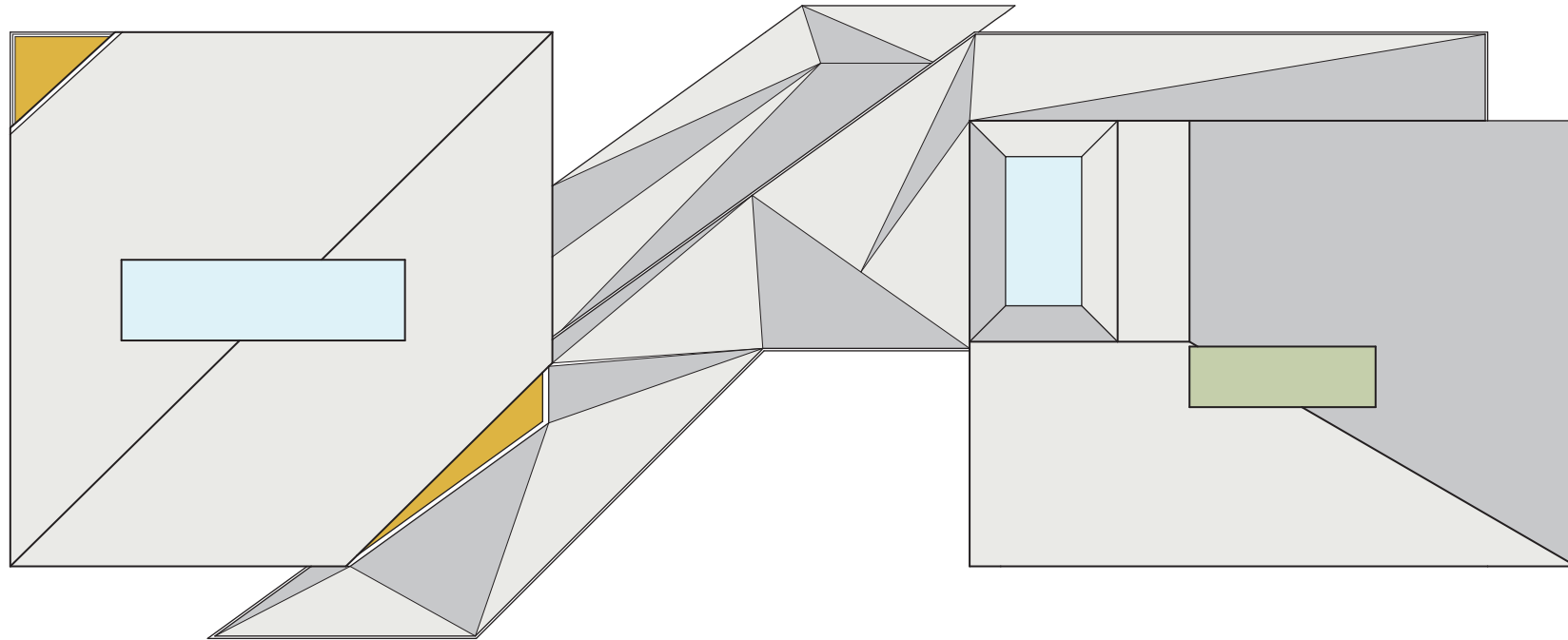
4th Floor Plan - Operation Department



4th floor plan 1:300, 547 sqm

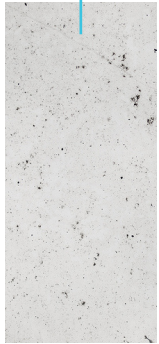
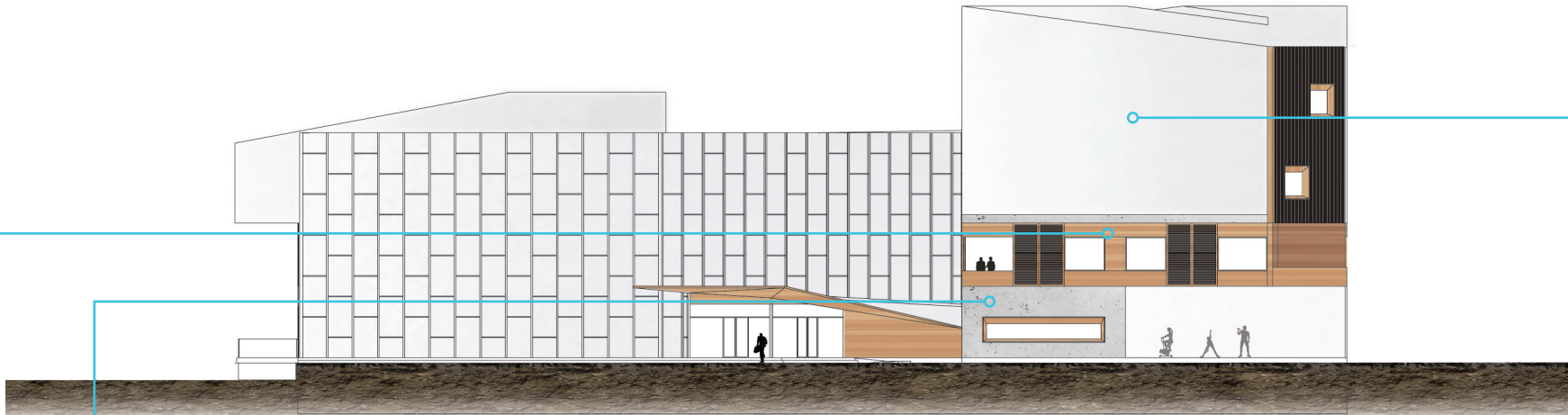


## 5.3.4 Roof plan

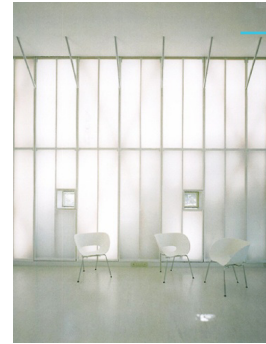


Roof plan 1:300





concrete

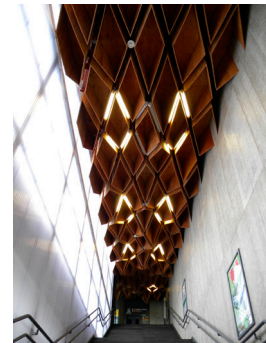
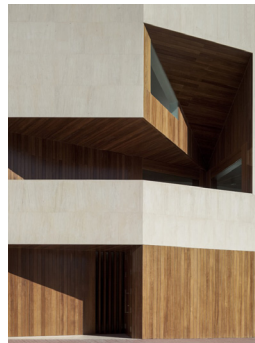


transparent

The treatment departments such as imaging and operation are wrapped by semi-transparent fabric, which blocks the sight from outside towards patients, also brings natural daylight into the living space.

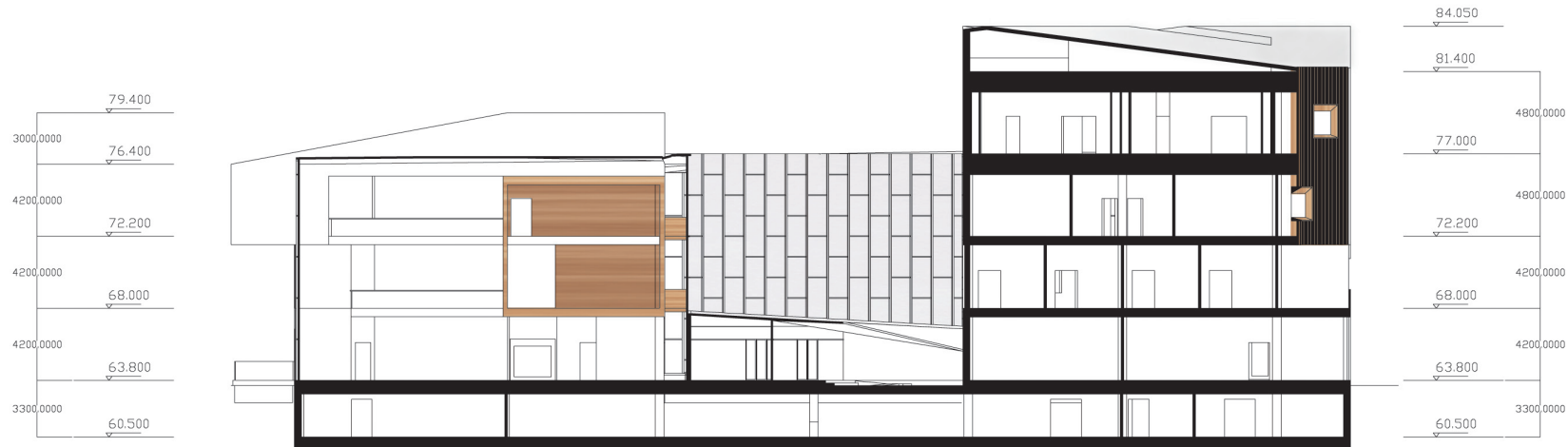


timber

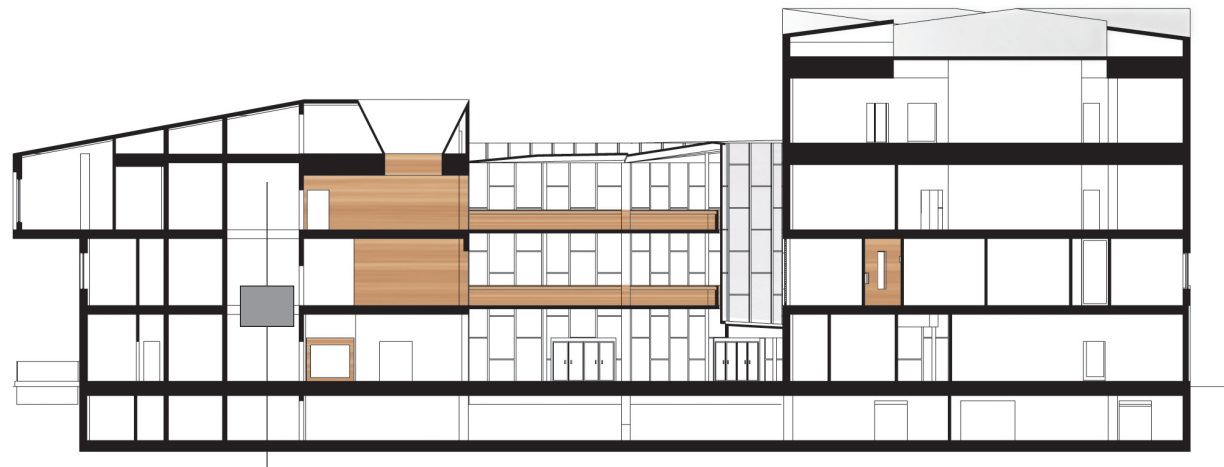
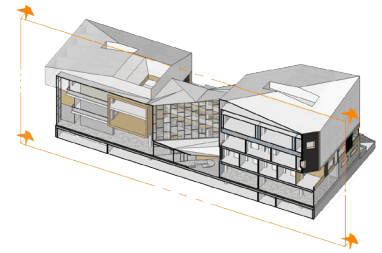


## 5.3.5

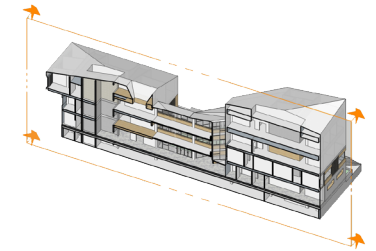
### Facades and sections



Section B-B



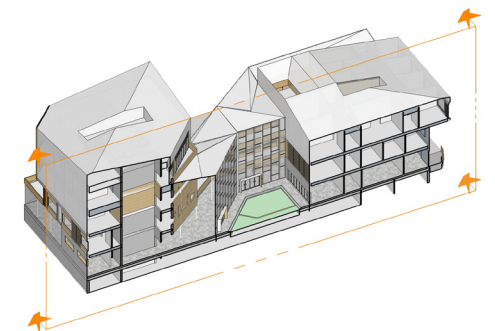
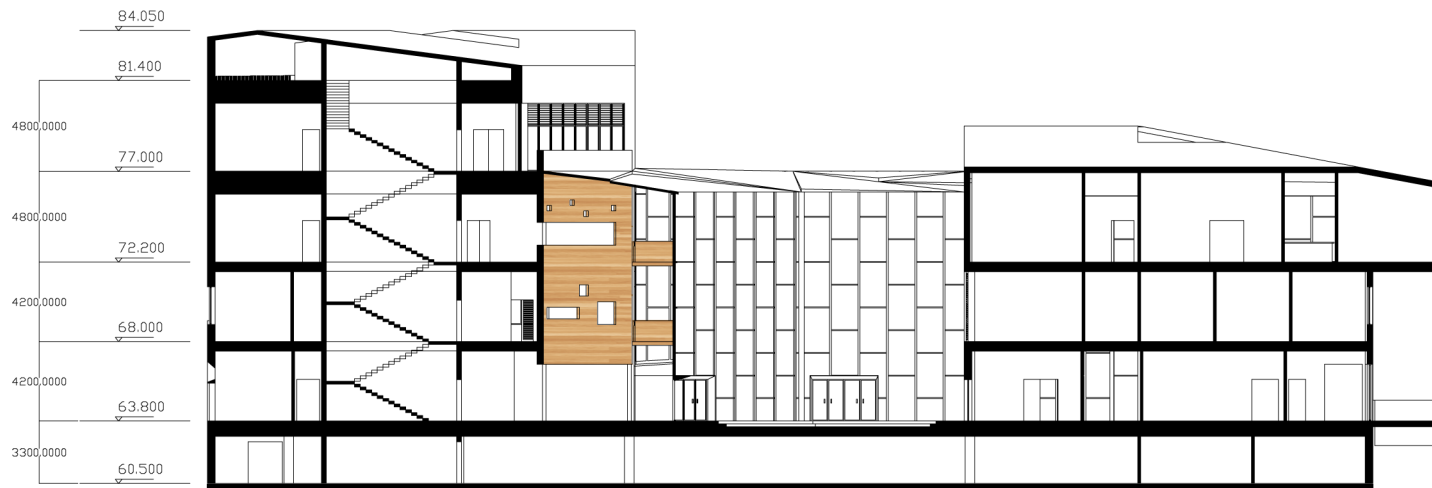
Section C-C







South facade and section



- an active **urban space**

Which is open to all kinds of users, either patients, doctors, staff or common citizens. This health centre will be equipped with more public functions than only a clinic.

- a **healthier** living & working environment

Which is providing pleasant environment for both patients and staff though enough natural view and daylighting.

- a health centre with **future vision**

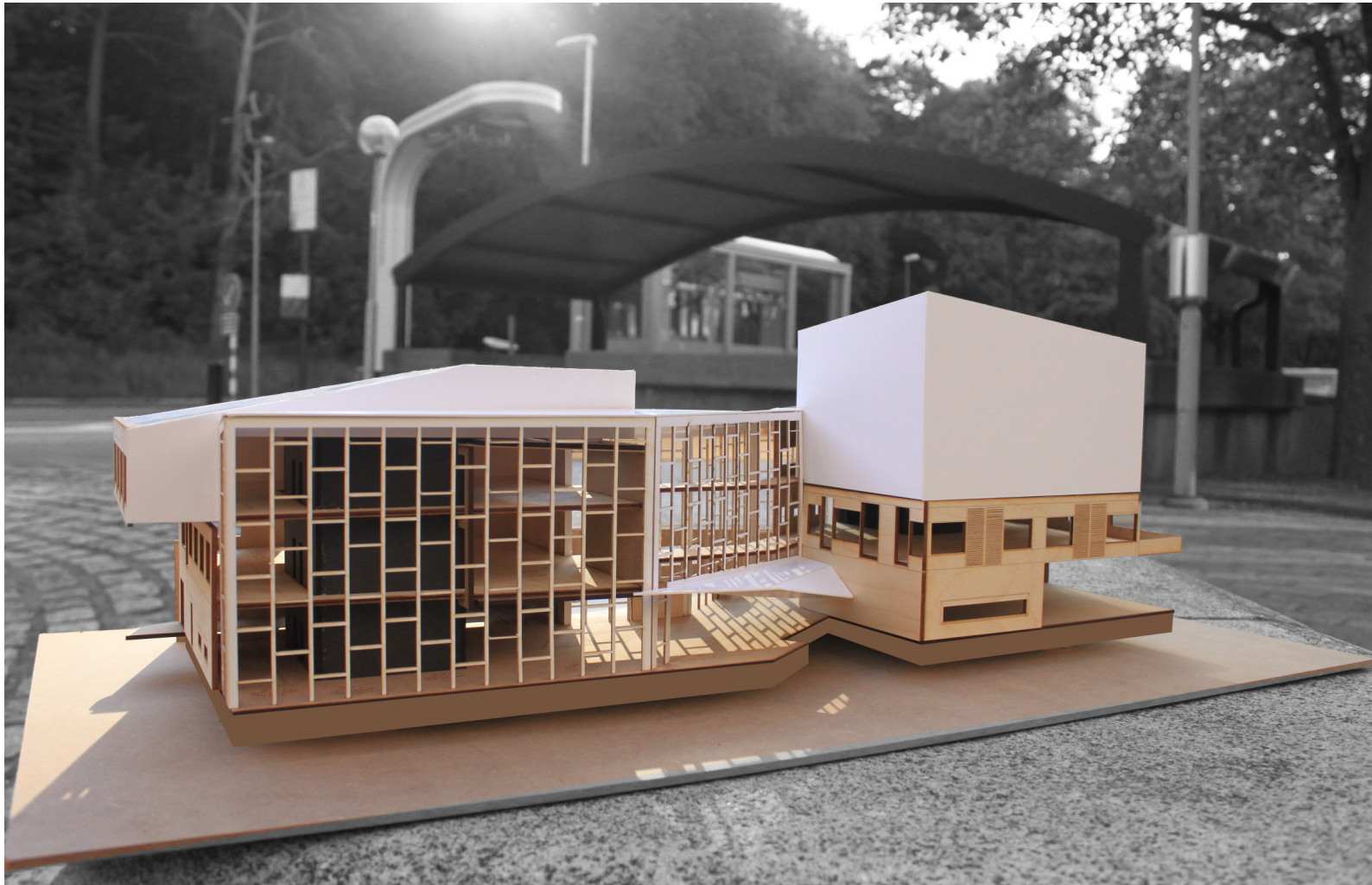
Which is suggesting a more efficient decentralized health care system.

- a **sustainable** future

Which has less energy consuming from patient transportation and re-construction of the building, the project will apply the concept of flexibility and sustainability into design process.



## 5.4.1 an active urban space







The courtyard is open to public

## 5.4.2 a healthier living & working environment



Perspective of the main lobby



Perspective of the waiting area on level 3



## 5.4.3 a health centre with future vision

In-patient wards



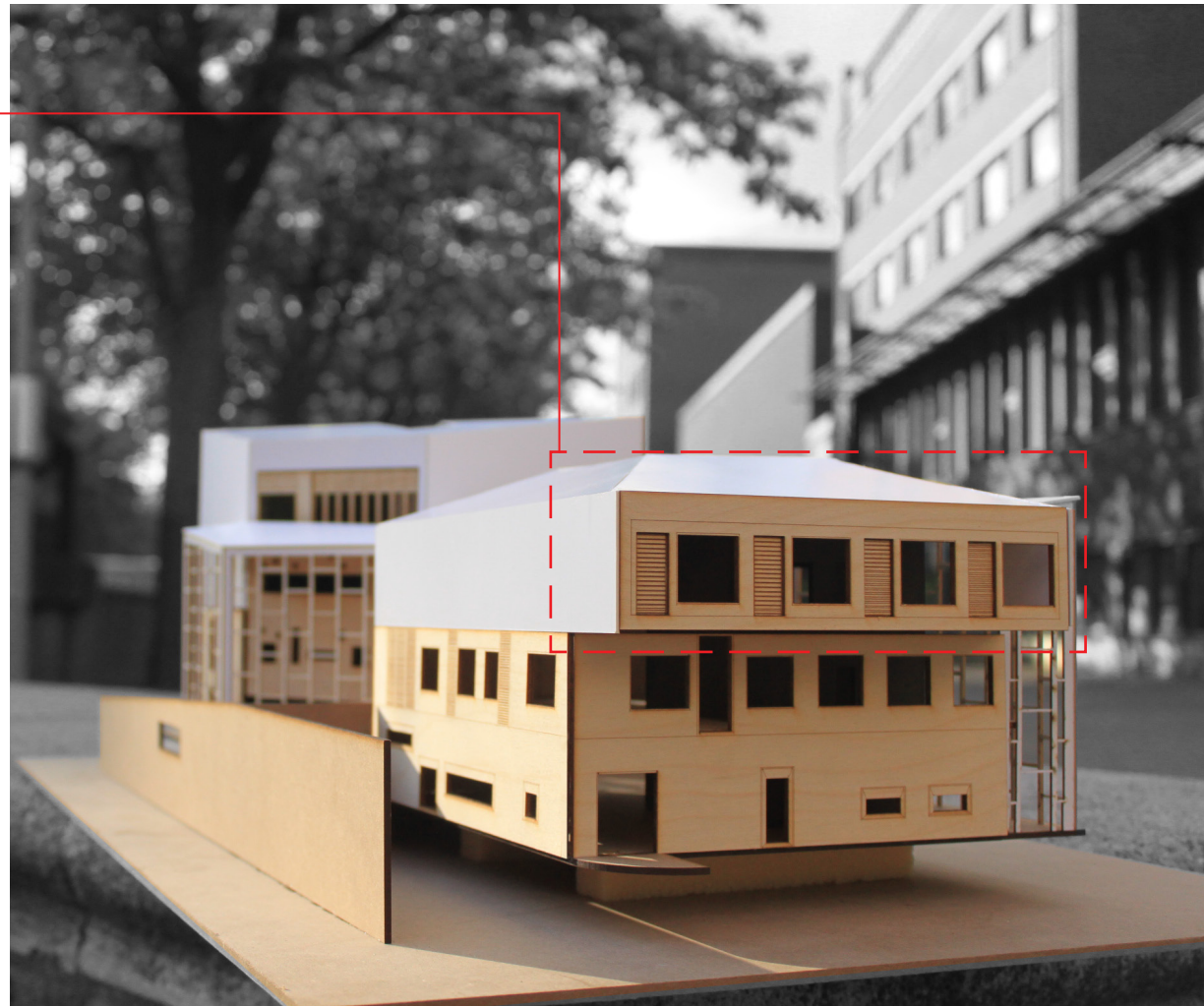
Larger single room



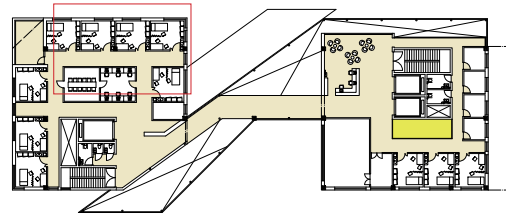
Larger windows



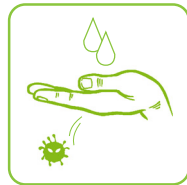
Noise-reducing measure







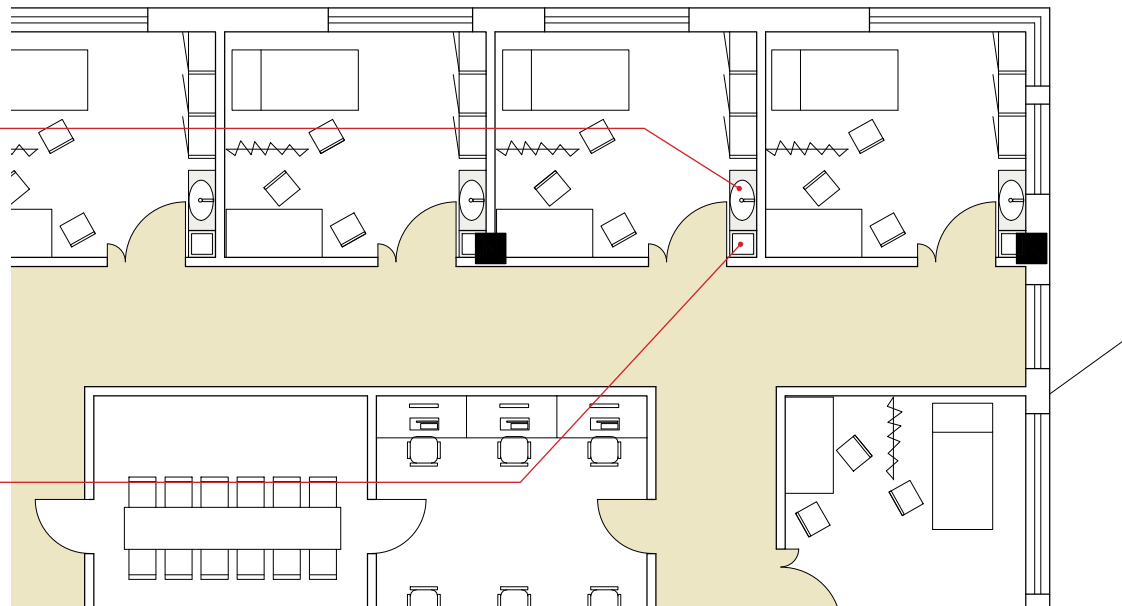
Based on the disciplines of EBD, all treatment rooms have been equipped with washing basins and ventilation shafts next to the door. This method will provide a high hygiene medical environment, and reduce the infections within the health centre.



Hand-hygiene facilities



Enhanced indoor air quality



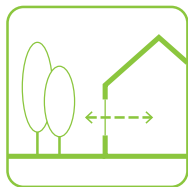
Part of second floor plan 1:100

## 5.4.3 a health centre with future vision

Active courtyard

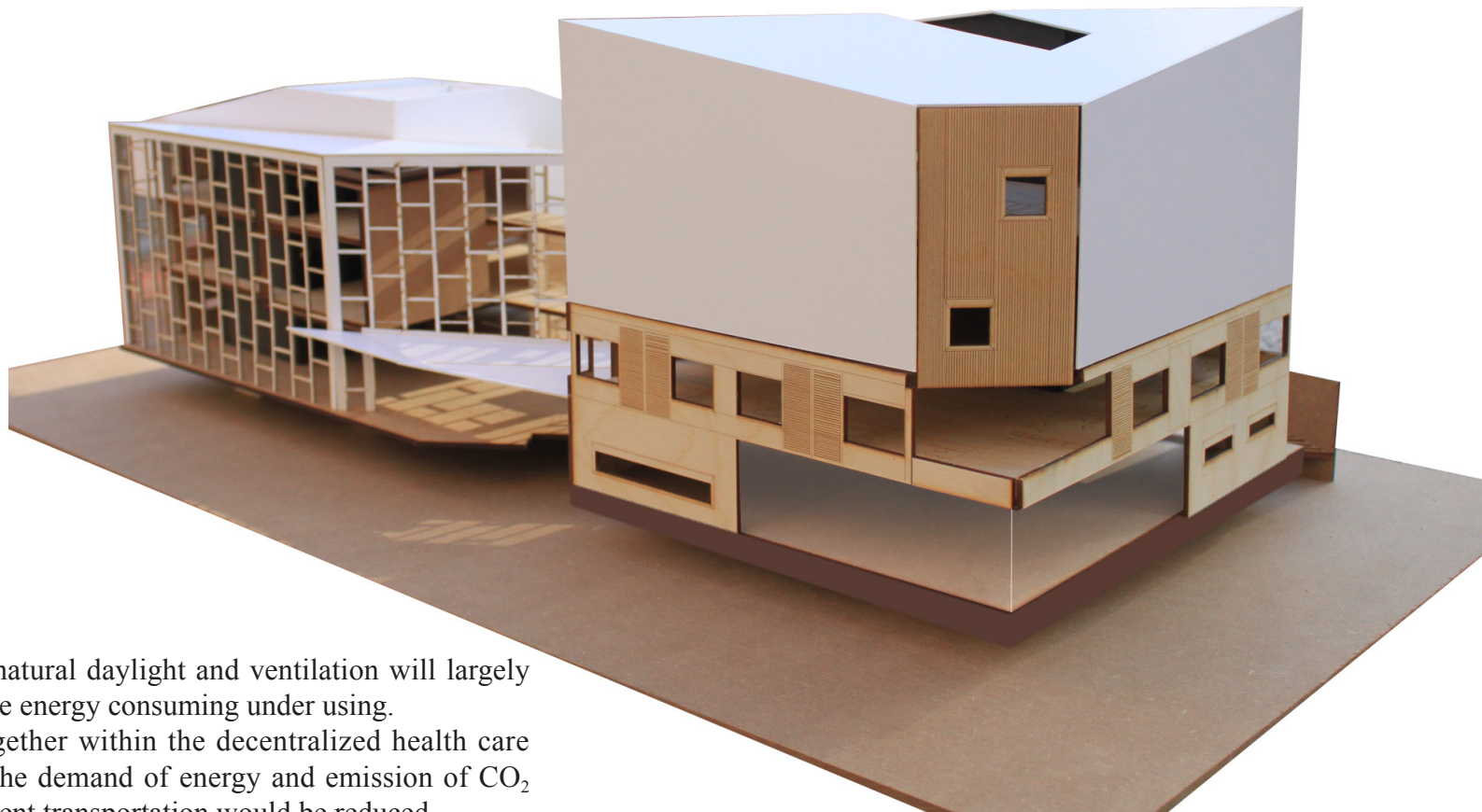


Healing art



Healing gardens





Enough natural daylight and ventilation will largely reduce the energy consuming under using. Work together within the decentralized health care system, the demand of energy and emission of CO<sub>2</sub> from patient transportation would be reduced.



Master thesis is much more than a design project, it is curtail to focus on both theoretical analysis and architectural design, what is more to combine these two aspects together and make them interact with each other. The whole process is also a valuable experience which is full of discovery and achievements.

The study from historical healthcare design gives me a comprehensive understanding of the background and foot print of civilization development. It becomes obvious by comparing from the healthcare design of different period of time, the building was largely influenced by the social background and building technology of different time. The architecture will not exist isolated from the cultural and physical environment.

After the study trips and case studies, it is exiting to know the current discourse of healthcare design which is more design has been taken care both aesthetically and functionally. Healthcare design is facing more possibilities as the building starts playing a more active role in the healing process. The various requirements from patients, medical professions and also the common citizens will result thousands of design works and sometimes even radical. This fact definitely gives me confidence to conduct my own design work with more freedom, and also makes the process more interesting and enjoyable.

It is very important to find the questions and propose solutions during the thesis process, I tried my best to answer the questions I have found from my previous design works and also the study during the process. I am satisfied of the volume of my design work which connects the surrounding building environment smoothly and builds up a new landmark at the center of Johanneberg. I am also pleased of the thesis work which gives me better understanding of healthcare design, then I could use the knowledge flexibly more as a tool to guide my design than a restriction.

Finally it is still a very complicated and huge topic of healthcare design, as it gets too many aspects of concerns involved. My work is a very tiny step based on my own study and experiences from one year close touch of this discourse, I will definitely keep on discovery in this area and hopefully to achieve my studies into an effective reality.





Alberti's famous remark (*De Re Aedificatoria*, 1450), "the city is like some large house and the house like a small city." Leon Battista Alberti: On the art of building in ten books.

Susan Francis, Rosemary Glanville. (2001). *Building a 2020 vision: Future health care environments*. The Nuffield Trust.

Robin Guenther, Gail Vittori. (2008). *Sustainable Healthcare Architecture*. John Wiley & sons.

Hennu Kjisik. (2010). *The Power of Architecture: towards better hospital buildings*. Helsinki University of Technology.

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Table 1. Model developed for the Nuffield Trust by MARU, London. Courtesy of the Medical Architecture Research Unit at South Bank University, London.

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