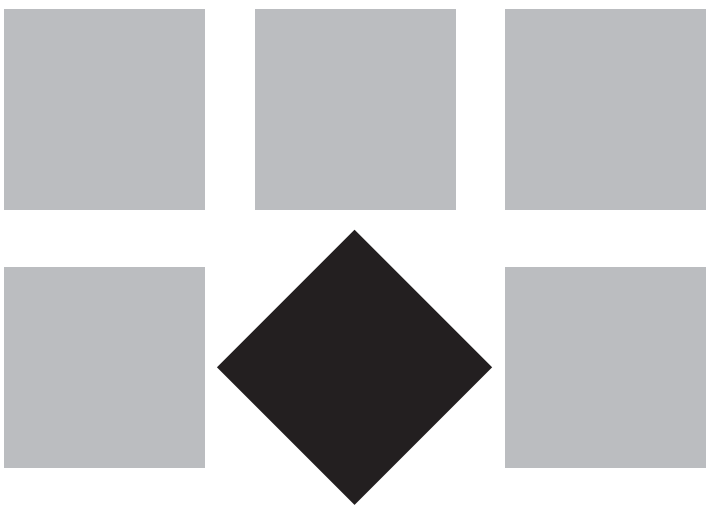

VÄSTERÅS

OPERATION CENTER

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Thank you.

Sincerely,
Fabien & Niranjan.

- Abstract

«There is nothing permanent except change»...Heraclitus.

The statement is especially true for healthcare architecture which changes with change in medical technology, invention of new medicines and equipment. We feel one involved in healthcare architecture should always be prepared for these changes, and be able to work with existing structure and find ways to integrate a new into old for better sustainability. A new structure should be future proofed.

Västerås hospital proposed constructing a new operation building to confront problem of air circulation in operation theatres and to meet the new demands in operation. The hospital has proposed a site in a u-shaped courtyard which already has existing buildings that shall not be demolished.

Designing a new operation hall with good connection to existing facilities and also keeping existing building on the site intact without compromising daylight was our biggest challenge. Henceforth, we decided to use these obstructions as a trammel to explore our design ideas.

We cogitated in a way that there is daylight for all operation rooms, corridors and support rooms with attention to daylight situation in existing buildings keeping important connection to existing structure on several ways so that we reuse the existing wards and intensive care unit. We would also like to highlight that we concluded our structure in a way without affecting the existing additions to hospital and its flows that are working well at the moment.

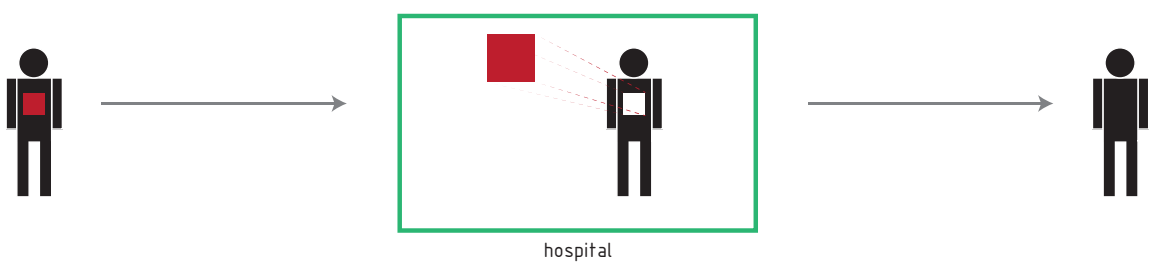
By being involved in this project we have learnt to deal with flows and complexity of operation theatres, its connection to other parts of the hospital like wards, intensive care units and sterile centre. The need to build over the existing structure has helped us to explore different structural possibilities as well.

We believe we have managed to come up with a way to solve the problem faced by Västerås hospital without having to build more than what needs to be changed, reuse and keep the existing structure without sacrificing daylight which shall not be compromised in a healthcare building.

Table of Content :

- 5: Our Proposal
  - -Current situation
  - -Existing situation
  - -Hospital demands
  - -Obstructions
  - -Design principles
  - -Circulation
  - -Staff area
  - -Operation flows
  - -Sterile center
  - -Facade
  - -Overview

1: Preface



Requirement from Västerås Hospital

The project is about designing a new operation complex in the Västerås hospital with 20 to 26 operation rooms, 6 of which will be for day surgery along with other necessary services such as pre and post operating rooms and a sterile centre. The existing operation rooms are to be replaced as they no longer satisfy the standards regarding space, area and ventilation/air quality.

Initial Thoughts and Research

After getting some initial information about the project, we started wondering about things we want to explore with the project which was not really constructed into any direction but as some random thoughts. In all honesty most of our thoughts are generated from the past experience we have had in hospital studio where we worked on a proposal of psychiatric hospital with pediatric care for Linkoping university hospital. During that time we rendered the idea of hospital architecture not being just a shell for carrying out medical function but something that can play an active role in helping the patients who are subjected to more mental stress than other healthy individuals. So we were convinced that we need to create something that do not just satisfy the basic functional requirements but also feature healing environment.
What are these healing environment?
Malkin (1992, p.10) explains that healing environment consists of the components:

Air quality,
Thermal comfort
Noise control
Privacy
Light
Views of nature
Visual serenity for those who are very ill
Visual stimulation for those who are recuperating.

Furthermore these components have been expanded by people working with healing environment into:

Access to nature
Positive distraction.
Access to social support
Option and choice (control)
Elimination of environmental stress such as noise, glare and poor air quality.

In additon it is also about operation theaters. We always had this naïve image of operation rooms being a dark segregated space where surgeon operates without getting distracted in a focus light. But in some way the prior examples of operating rooms in our own countries consist of a 2-corridor system.1 for clean sterile goods and another for the dirty after surgery goods. But as we went through the examples of operating rooms in Sweden , we learned that operation room without daylight is unacceptable and perhaps for this reason here building operation rooms with a common corridor for both dirty and clean goods are the most favourable solution.furthermore, this practice saves a lot of space and also advocate daylight into the operation rooms.

So why is daylight desired in operating theatres?
Operating costs are very high; operations are more economical if the operating rooms are used continually one after another. Because of this reason there is a possibility of staff and doctors working continuously up to 8 hours in an operating room.Some of the operation go on for long period of time i.e. a spinal cord surgery can span up to 14 hours and there have been cases where some of the surgery has went on for days.

Gertrude Levandowski survived a 96-hour procedure at a Chicago hospital to remove a giant ovarian cyst; this is the longest surgery recorded. The second longest surgery was 40 hours long and that was to remove 6 limbs from a 8 limed baby in India. http://wiki.answers.com/Q/What_is_the_longest_surgery»

Also, as a patient it must feel strange to go into the transition from being around the people you know in somehow a normal space to this sterile clean and strict space if it did not have a natural light. Yes, it helps when you know that you are going to get well after the operation and so on but still it is a place where you no longer have control over your body. In this regard the natural light with normal window helps in to create an environment which might not be alien to us.

Furthermore, there has been a lot of evidence which directs to the positive outcome of daylight in healing. There are studies which shows there is a significant effects of daylight on our circadian rhythm. Campbell et. Al. (1988) imply that light is the most important environment input in controlling bodily function after food.(La grace,2004).similarly, CABE(2004)commission for architecture and building environment clearly indicate that the access to natural light is one of the crucial factor affecting patient recovery. The presence of visible light in an indoor environment influence the physiological response, mood as well as visible needs.(schweitzer,2004).
Most psychiatrics generally agree that seasonal affective disorder (SAD) with symptoms of depression, fatigue and irritability may be triggered by shorter hours of exposure to daylight due to seasonal change.(Morris 2001,Evans,2003 and Bower 2005).

Research evidence by means of observation and qualitative analysis has found that lighting strategy i.e. artificial and day lighting in a controlled environment have a positive impact on managing behavior disturbances of the Alzheimers type (Noel-waggoner, 2002).
Daylight off course not only has a positive impact on the patients but also it can provide restorative benefits to other users in the respective environments such as medical staffs. The survey conducted in hospital environment an access to natural light .Jana et al (2005) claim that 70% of the medical staff rated increased natural light as having positive impact on their work life.

Goal

Our goal is design the operation building in Västerås to fulfill the current need of the hospital.By the end of the project we aim to know all about operation theatres and its flows.How the goods and personnel move within it.We would also like to focus on architectural aspect as how we can advocate daylight in the context.We would not go in depth regarding evidence based design however, We would like to keep it in the back of our mind while designing the operation theatres.

Initial Questions:

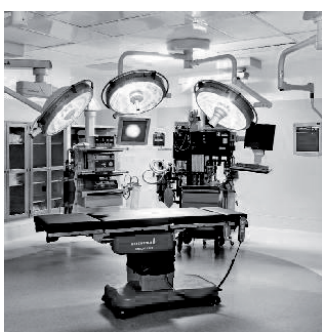
How can Architecture assist in improving the mental preparation and physical recovery of patient before and after the operation ?

How operation theatre is working ?
Is it the central core of the hospital ?
What are the relation between the sterilisation center and the operation center ?
How the logistic of the goods/ staff and patients is working?
As a patient, how would I feel waiting for the operation in the lobby ?
How can architecture make them feel better and less anxious ?
As a staff, doctors, nurses working long hours in operation theatre with lot of stress architecture can make the working condition better ?
What is the process after operation for a patient?
Lighting in operation rooms?
Equipment, ventilation in operation theatre ?
How to implement a new structure in an existing building ?

2: Evolution of the Operation Theatre

The operation theater is a structure completely independent from the rest of the hospital where surgical procedures are performed and actions of anesthetics needed to conduct the surgery.

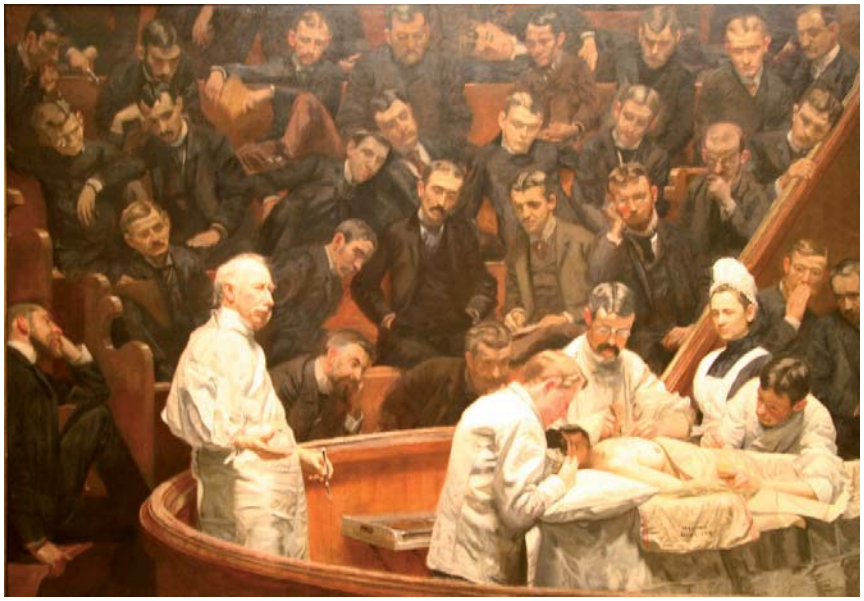



The Beginnings

In recent years, changes in surgical practice offers a variety of procedures and methods that are clearly different compare to the creation of the first operating theatre. Indeed, with the development of the surgical intervention, the means and the new technology, the operation theatre are working and functioning differently. Before being a complex area with many connection and where a lot of function have to work together, the Operation Theatre was totally different.

Historically, the operation theatre had a raised table in a center of a room, where doctors are performing operations. This room is surrounded by several row of seats for spectators or students who can observe the case in progress. The common name to describe this kind of organization is «Amphitheatre». The term of operation theatre came after due to the public aspect of this spectacle.
Doctors wore normal clothes with a scrub on a top to protect them from blood stains. They operated bare-hand without anesthesia. The patients were drunk to avoid the feeling of the pain. The equipment and supplies was unsterilized and the packing gauze was made of sweepings from the floors of cotton mills.



Thomas Eakins, The Agnew Clinic 1889

Here are some of the most important key inventions regardings the operation theatre:

-1867 : Dr Joseph Lister first identifies airborne bacteria and uses Carbolic acid srpay in surgical areas.
-1880 : Johnsons introduce antiseptic surgical design
-1884 : German surgeon Gustav Neuber implemented a comprehensive set of restrictions to ensure sterilization and aseptic operating conditions through the use of gowns, caps, and shoe covers, all of which were cleansed in his newly-invented autoclave.
-1885 : Gustav Neuber designed and built a private hospital in the woods where the walls, floors, hands, arms and faces of staff were washed with mercuric chloride, instruments were made with flat surfaces and the shelving was made of easy-to-clean glass. Neuber also introduced separate operating theaters for infected and uninfected patients and the use of heated and filtered air in the theater to eliminate germs.
-1890 : Surgical gloves were introduced to the practice of medicine by William Halsted. Antiseptic surgery was pioneered in the United States by Charles McBurney.

Some aspect of the operation theatre was completely different in terms of function and organization of rooms.

During that time , the idea which was leading the construction of any operation theatre was guided by the fact that you have one kind of surgery per operation theatre. The equipments specific to the surgery was stored inside the rooms in function of the surgery provided within the operation theatre.
Moreover they did not have any anesthesia or pain killer so patients were suffering a lot. In addition, the idea of sterilization center and sterilization area was not existing either.There was a huge risk of infection after operation..

The Current Situation

Issues

As the hospitals gradually improved the amount of people using hospitals increased as well. In this context, the operation theatre became a term for describing an area composed of operation rooms and their facilities. Generally and operation theatre is composed of five or ten operation room with corridors, lockers, waking up room, preparation room and anesthetic room.
Today, regarding the development of the healthcare facilities and the constant evolution of the new technology; a hospital need to deal with three main issues.

The first issue of an operation theatre is the daylight. People work everyday and for long hours. This makes it important to consider aspect of daylight early in the design process of the building because the orientation and the position of the room will depend upon it. To understand the impact of the daylight, it is important to consider the three effects of this issue which are : the healing, the functional and the asthetical effect.

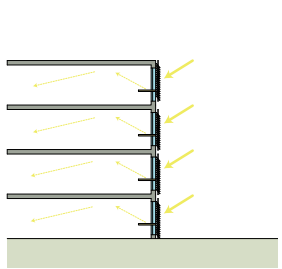
Regarding the healing effect of the daylight in hospital, studies show that daylighting can reduce the mental and physical strain of patients, doctors and nurses. Hence, lighting and heating costs as well as physiological and psychological states can be reduced by using natural light in hospital. Indeed, exposure to bright light affect the natural clock of patients and employees in hospital. In certain illnessees, the biological regulatory system plays an important role in maintaining the well-being of the individual. The daylight is also important for the waking up room when patients are recovering. The daylight post surgical facilities improve the mental well-being of patients and their recovery rate. It also help to reduce the stress associated with this environment.

A Litterature Review of Effects of Natural Light on Building Occcupants by L.Edwards and P. Torcellini.

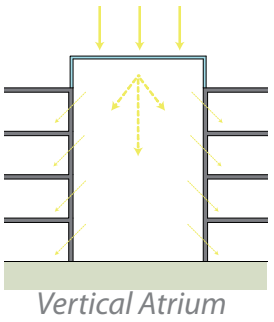
There are several solution to provide daylight in a building. Here some diagrams to show how to make light enter inside a building.

Diagram of the daylights solutions

The function and the asthetical aspect of the daylight in a building are sometimes neglected. Some recent studies show that function and asthetical aspect of daylight can emphasize the healing process of patients.

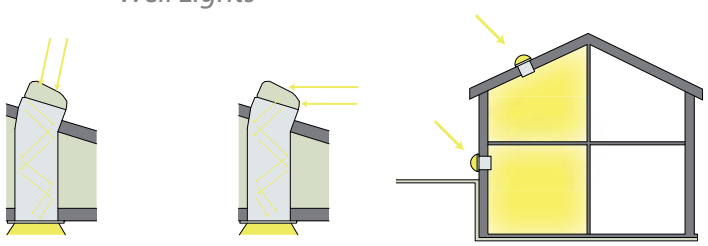


Light Magnifier



Vertical Atrium

Well Lights



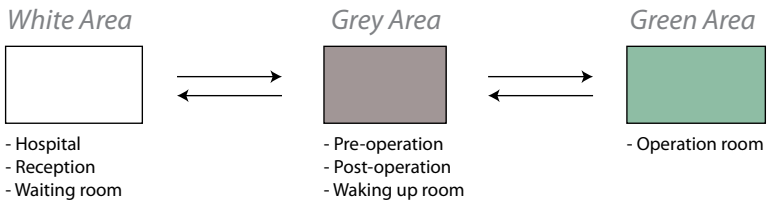
Pierson 1995: Studies show that gall-bladder surgery patients with landscaped views had fewer negative evalution from nurses, took fewer pain reliever, and had fewer minor post-surgical complications.

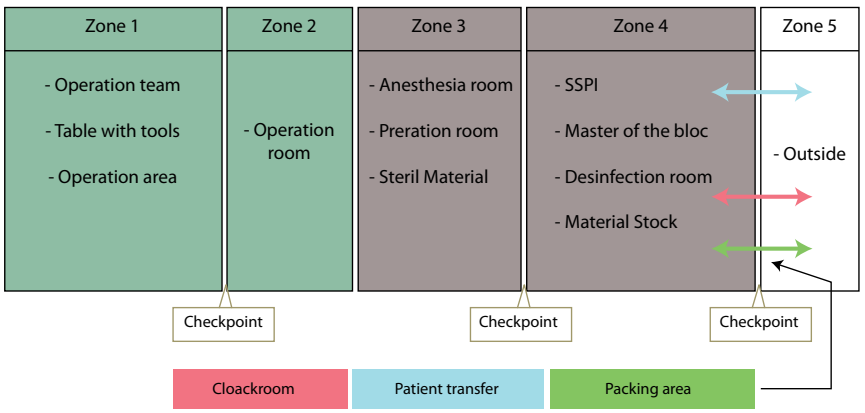
The daylight can be use also for helping the patient to find his way in the healthcare facilities. n that case the function and the esthetical work together in order to help actors of hospital.

The goal is to use the daylight to provide a sense of calmness and clarity for patients staff and visitors.

The second issue of an operation theatre is the sanitarization. To enter an operation room one needs to cross several zones. Based on the degree of sanitization,there are three areas.: the green area ; the white area ; the grey area.
Generally one pass from lower sterile zone to higher.

Diagrams of the steril areas

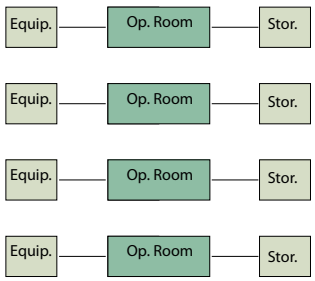




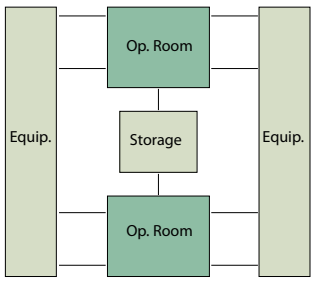
The connection between these zones are usually separated by various check points.These check points can be dressing room where scrubs are put on and off or a sluss.The focus usually is to maintain a connection at all times and simultaneously give the signal of change from one zone to another.

The third issue of an hospital is the flexibility. We are living in a time where the technology and materials are constantly in evolution. Hence, It is important to plan new healthcare facilities with this principle in mind to allow the building to be adaptable for the futur. Many rooms or many functions that are provided today will change in the future. Some of them could get extinct or even merge into one. Others will probably upgrade their importance in the hospital.Hence,for these reason it is important to think about the organization of the flow and function within the perifery with future in mind.. It become important that the rooms are flexibles and not rigid in its layout.

Flexibility Diagram



Before



Today

The main idea of flexibility is to have the operation rooms that are not specific to any particular operation but could be used for more than one kind of surgery. For example the operation room used for orthopedic surgery shall be easily converted into a vascular surgery room. They should be changed into specific operation room by only adding some movable equipment and machines. This helps in effective use of operation rooms. There will be very little vacant operation rooms and number of operation rooms shall be reduced as well.

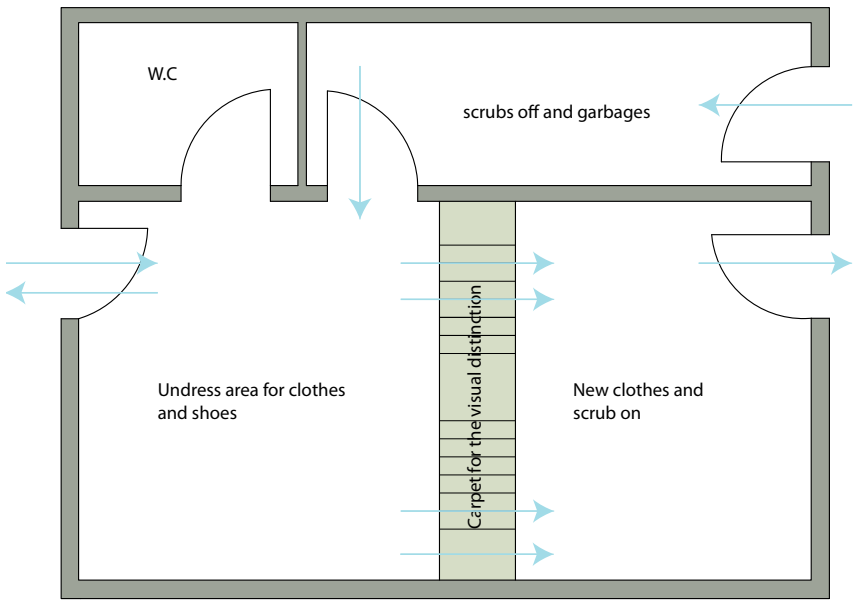
Facilitites

In order to understand exactly what is an operation room and how an operation theatre is really working, it is necessary to detail and explain the facilities needed in this scpace.

1 : Here is the list of the supporting rooms of an operation theatre:

- Cloackroom with WC for post/pre operation
- Dressing room :
    - Need to separate woman/man of having some cabins when people can undress
    - Having a part that can be locked by the staff
    - Shoes store
    - Need to separate area by a strip on the ground

Here a picture of the dressing room



- Staff Room (close to the operation room)
- Small laboratory
- Radiology + computer + room for making pictures from X-ray
- 2 lift for the equipment.
- SAS (control the flow of people), close to the reception
- Nurse office (Next to the entrance and close to the reception)
- Storage of the bed/chair/semi-bed outside of the operation room
- Storage area:
    - Steril products (clothes + medic equipment)
    - Non-Steril product (clothes + materials)
    - Pharmaceutic storage (medicaments)
    - Materials in sale (prothèse)
    - Material expensive
- Anesthesia area + product:

Equipment + anesthesia material and reanimation material. (artificial breathing machine)

- Storage of Material as radioscopie, echography, endoscopy.

Can be a big or several small rooms. Material can be tidy up in function of their uses.

- Waking up room:

This room has to be inside the operation theatre due to some sanitarization reglementation. In fact, the fnction of this room is very strategic beccause it is the first environment that the patient will experience after his surgery. In that way, the room need to be comfortable with plenty of daylight and a strong atmosphere of calmness and peacefullness.

- Relaxing room:

Can be inside or outside the operation theatre. Daylight + fika + sofas

- Computer room:

Can be outside or close to the reception. Need to see what is happenning in the operation theatre and also being able to see the information regarding the patient.

2 : Surgeon and Assistant Equipment:

People in the operating room wear surgical clothes to help prevent germs infecting the surgical incicsion. The surgical clothing includes the following :

1 - A protective cap covering their hair
2 - Masks over their lower face, covering their mouths and noses
3 - Shades or glasses over their eyes
4 - Vinyl gloves on their hands
5 - long gowns
6 - Protective covers on their shoes

The surgeon mal also wear special glasses that help them to see more clearly.

3 : Operating Room Equipment:

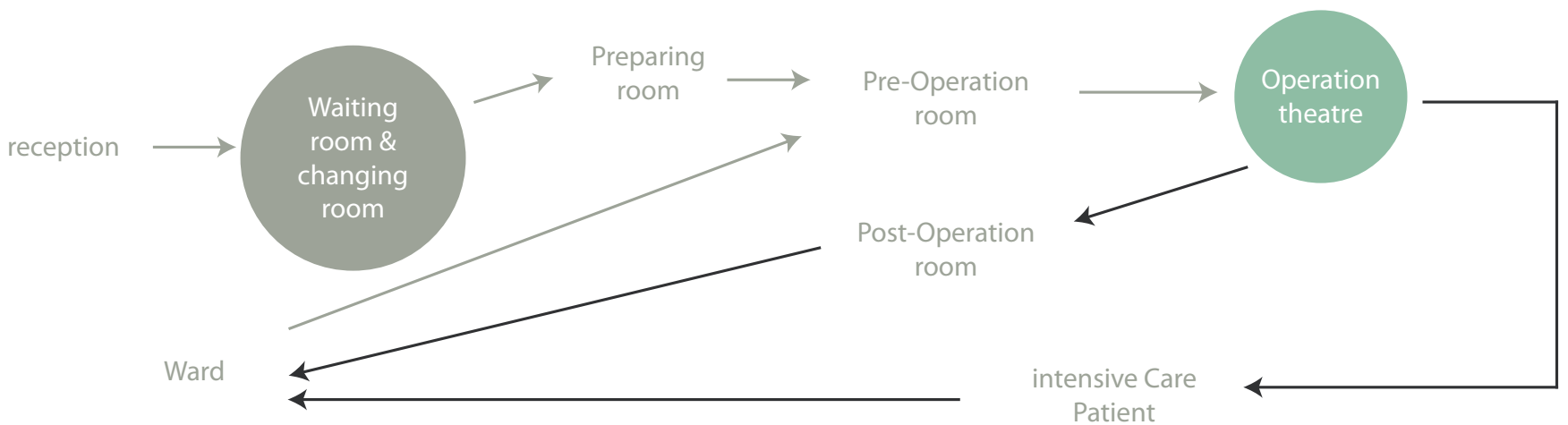
1 - The operating table in the center can be raised, lowered and tilted in any direction
2 - The operative room lights are over the table to provide bright light, without shadows, along the surgery
3 - The anesthesia machine is at the head of the operating table. This machine has tubes that connect to the patient to assist him in breathing during the surgery, and built-in monitors that help control the mixture of gases in breathing circuit.
4 - The anesthesia cart is next to the anesthesia machine. It contains the medications, equipments and other supplies that the anesthesiologist may need.
5 - Steril instruments to be used during are arranged in a stainless steel table.
6 - an electronic monitor are placed on patient s chest
7 - The pulse oximeter machine attached to the patient s finger mesure the amout of oxygen contained in the blood
8 - Automated blood pressure measuring machines that automatically inflates the blood pressure cuff on patient s arm
9 - An electrocautery machine uses high frequency electrical signals to cauterize blood vessels and may also be used to cut through tissues with a minimal amout of bleeding
10 - Special equipment for special surgery. It depend on the needs of the surgeon.

Flows In Hospital

Finally, in order to appreciate the function of an operation theatre in an hospital, it is relevant to know all of the flows surrounding the operation rooms. The focus will be done on actors and equipments.

Diagram of the patients:

InPatient



Out-Patient

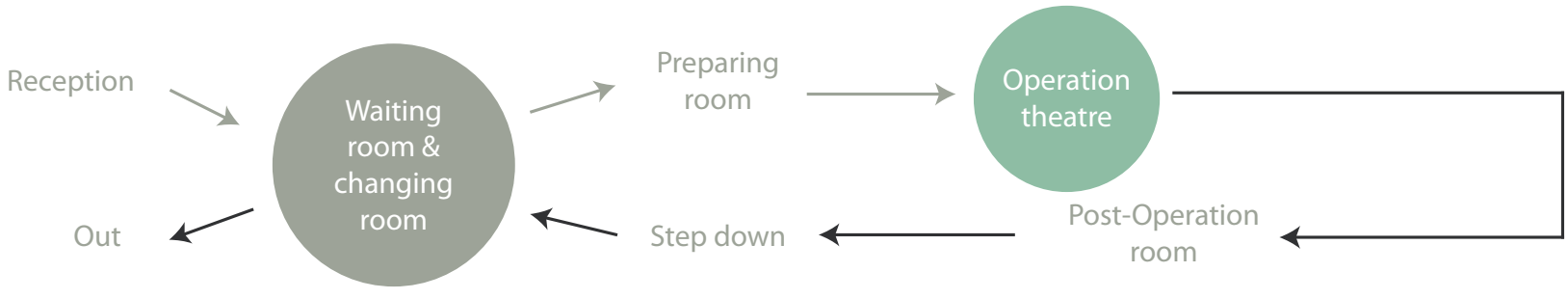


Diagram of the hospital:

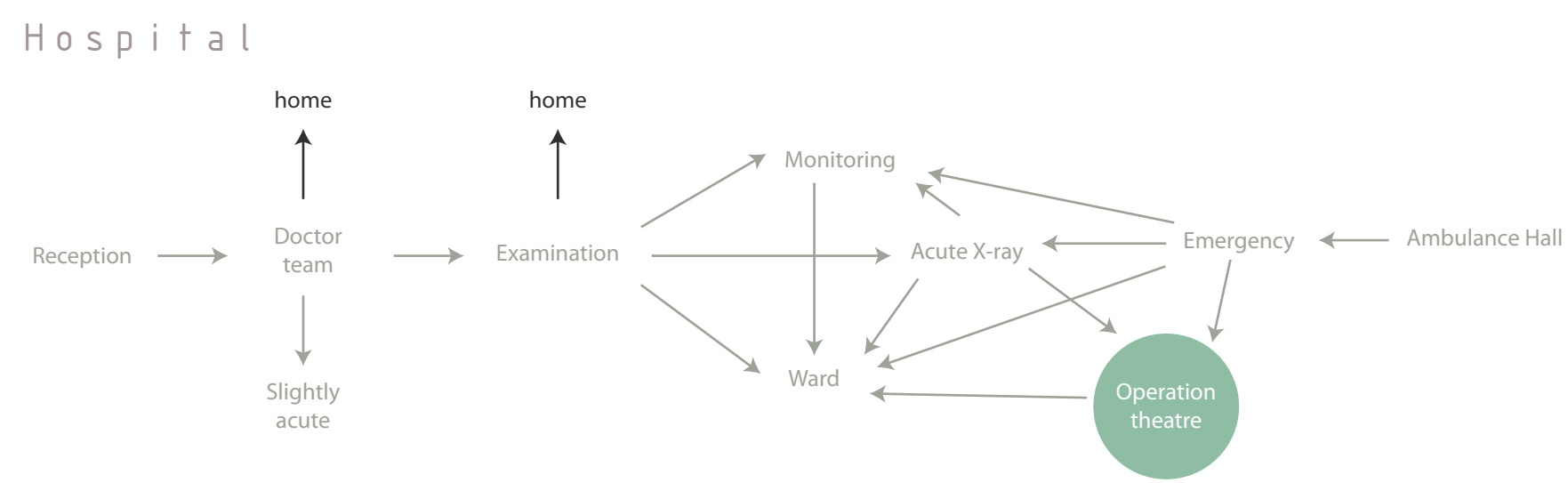
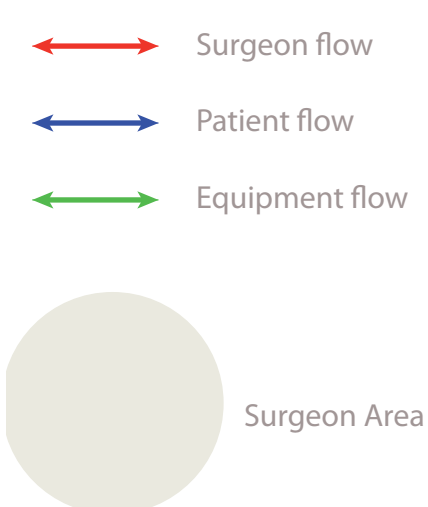


Diagram of the Operation Room:



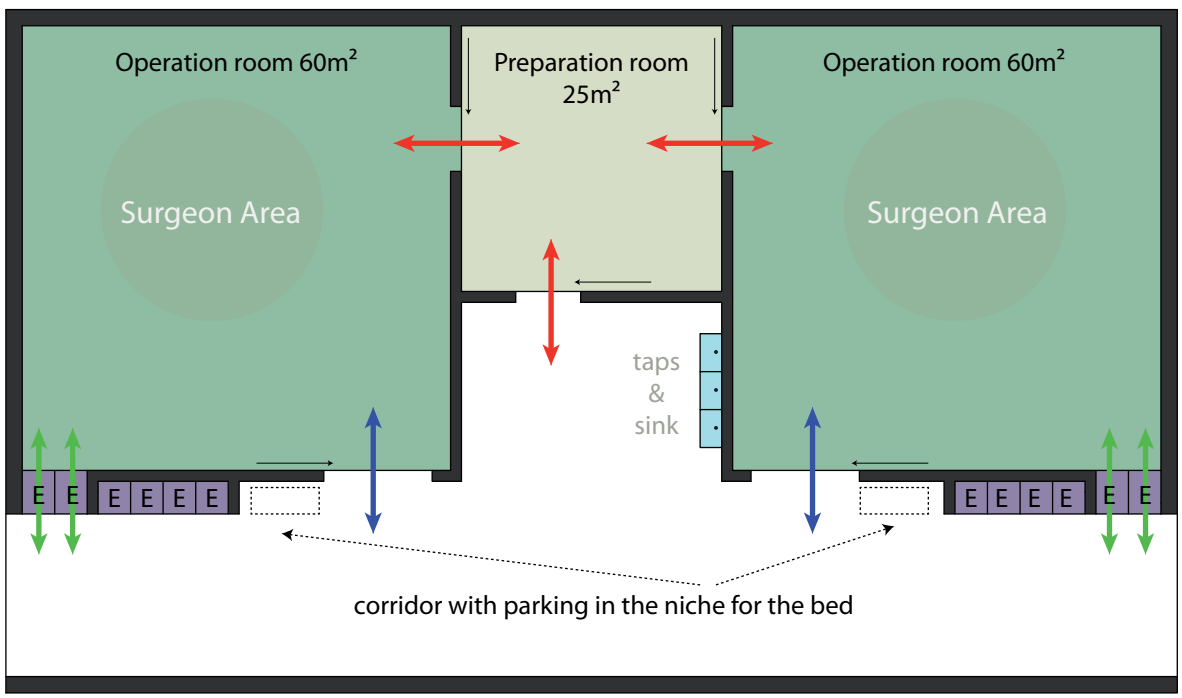


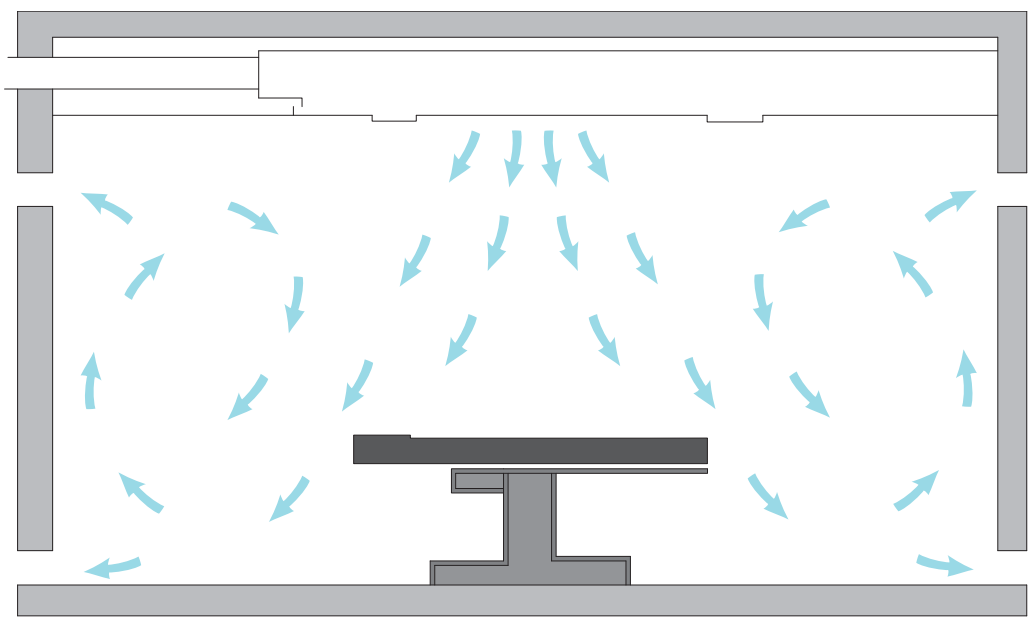
Diagram of the air-flow in the operation room:

Ventilation system : low speed movement

Characteristics:

Principle :

Flow in direction of the table in order to have a steril fence around this area. Very good solution for the sanitizing regle-mentations



Advantages :

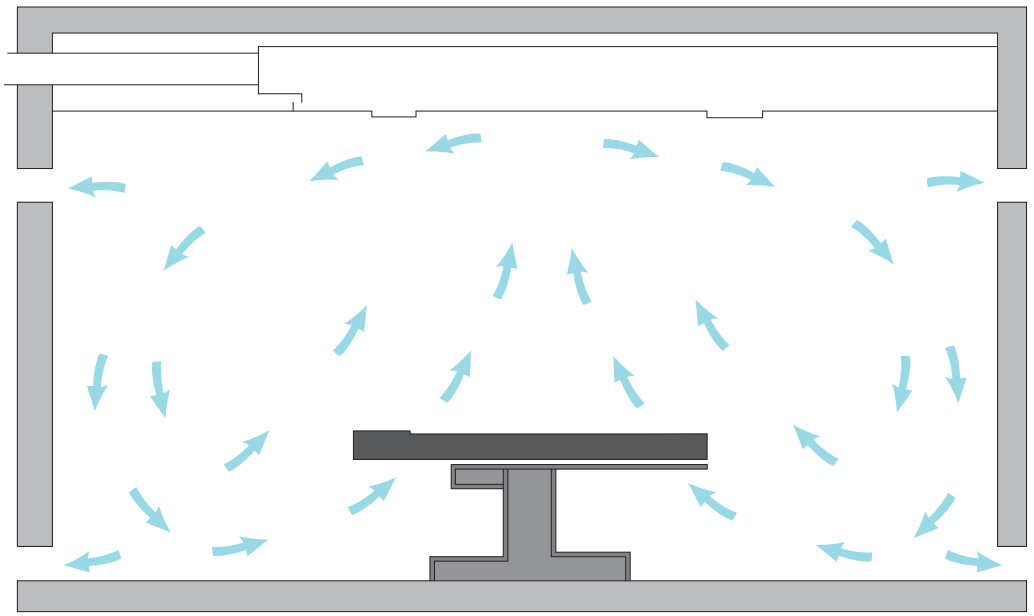
- Very good air quality
- good comfort (audio+thermical)

Ventilation system : Turbulent Flow

Characteristics:

Principle :

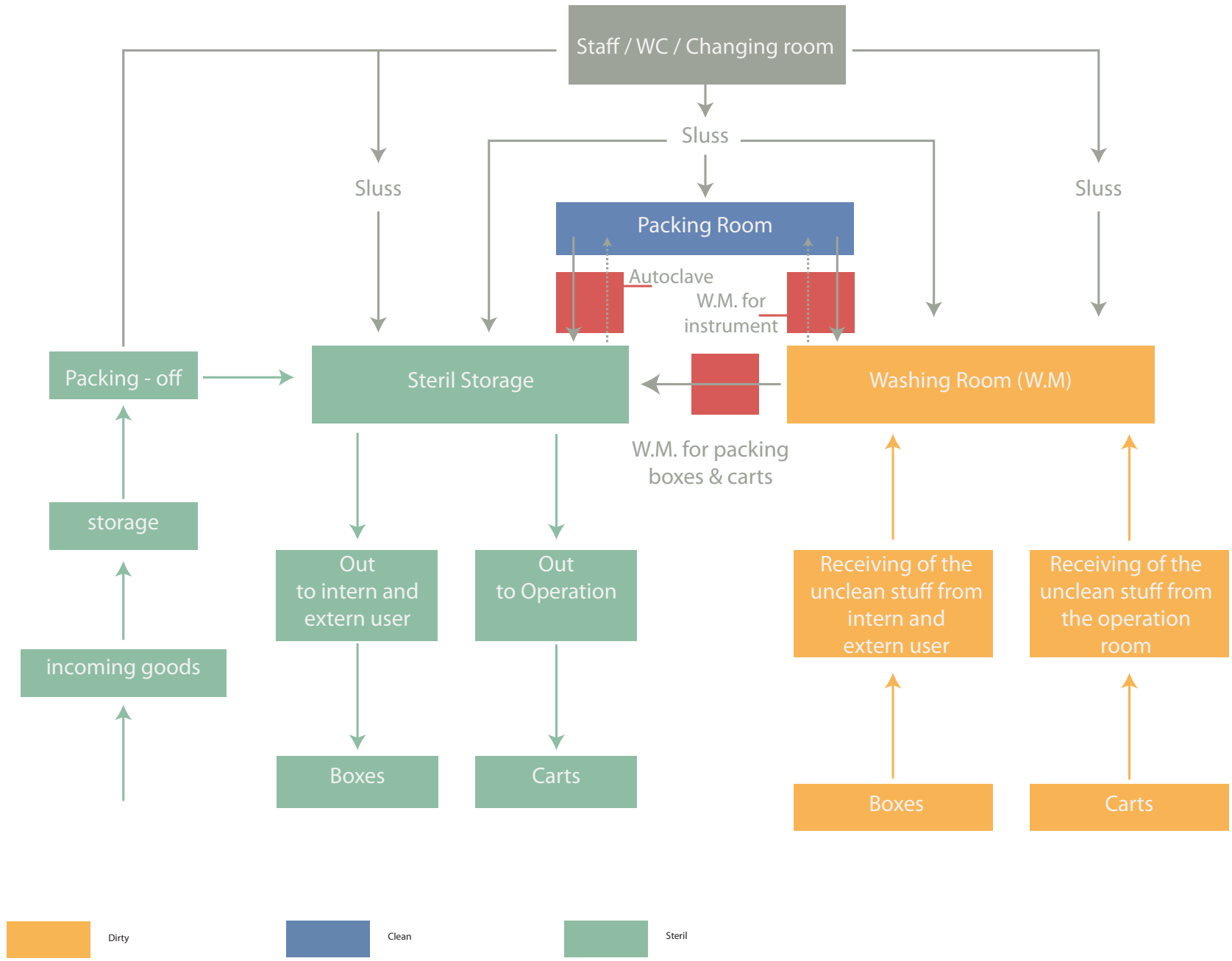
One or several system to send the "clean" air in the ceiling



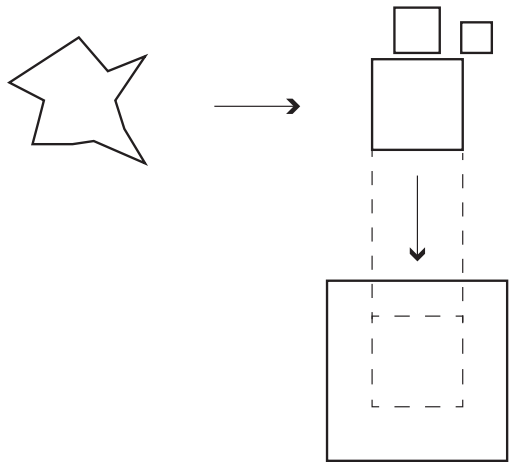
Advantages :

- Economical
- Easy to assemble
- low maintenance

Steril center



Perspective of Future



The invention of equipments and technology is dependent on the need of human and his behaviour,The act of human evolution is difficult to predict which infact can diverge into any direction,However,The prediction of architecture is related to the invention of technology.Thus architecture of operation room shall be flexible in way that it can be divided into smaller rooms or converged into larger room without difficulty

some principles for future

.- Should have a flexible structure that can evolve in the future in function of the volume and surface of the new rooms.

- Operation rooms should be around $60m^2$. In case of evolution in hybrid operation, two current operation room could be mixed in order to have an hybrid operation room of $100m^2$.

- Rooms should be adaptable in term of function. In fact you need to have a lot of daylight in the building because in case of changement, you have a lot of possibility to exchange the function of some rooms.

- Should have some green, grey, white area with a clear transition between each. Circulation should be clear.

- Surgery table is not the main point of the operation rooms, but the flow of the staff working inside.

So, we have to create our operation theatre in a way, that it work effectively today. Yet, it should be able to transform itself so that it could be used in future with little change without complication.

Here a diagram of the transformation for future

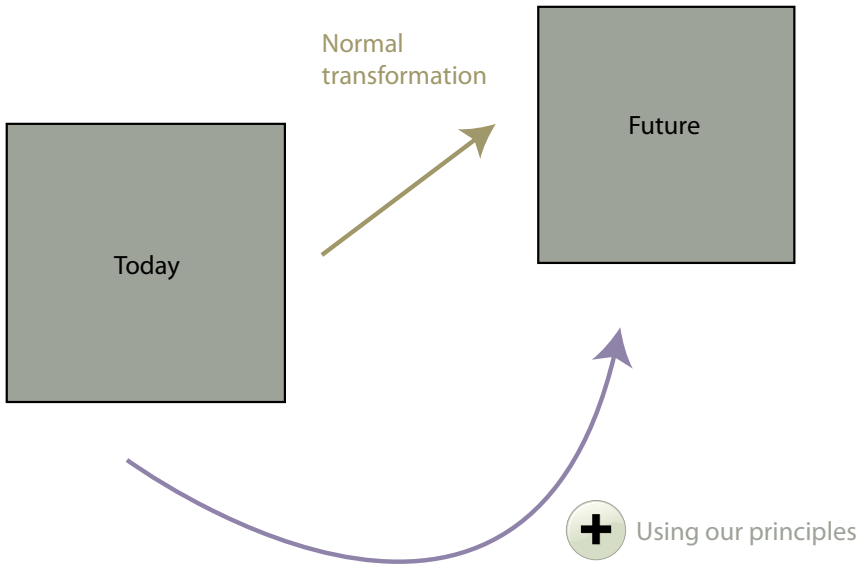
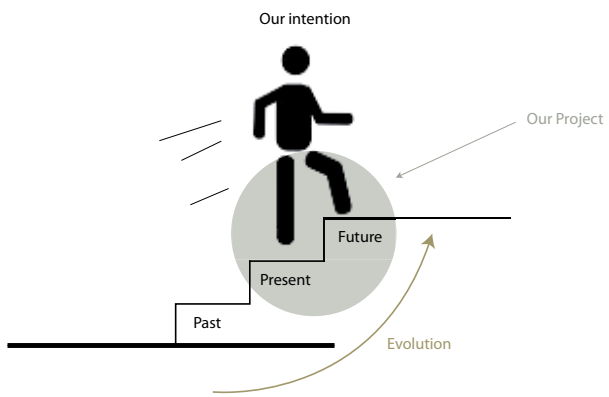


Diagram of our intention



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Conceptprogram: Locum, 2009

Variop, the modular system for flexible room design: Maquet Getinge Group, 2012

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Health Building Note 10-02: Day surgery facilities: Department of Health, 2012

Centrallasarettet Västerås Operationsverksamheten: Johan Nordenadler, 2010

New specialized care buildin at Örebro University Hospital: Master Thesis of Michael Zulueta, 2010

Evidence-Based Design for Multiple Building Types: D. Kirk Hamilton and David H. Watkins

Evidence-Based Design in Healthcare; A Theoritical Dilema: M. Stanko and B. Schwarz

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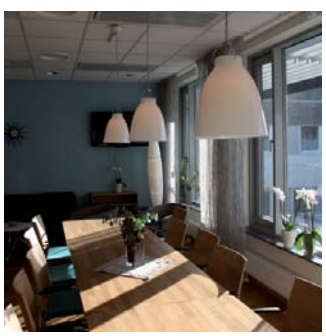
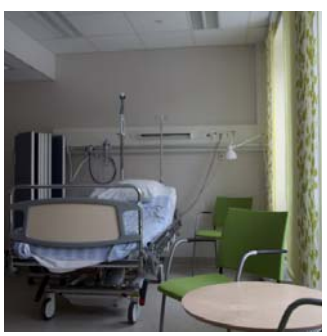
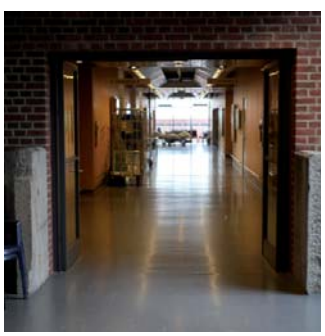
Daylight in hospital design: S. Aripin "Healing Architecture,

3: Case Study

Study Visit of Sahlgrenska
Study Visit of Kungälv
Inspiration



Sahlgrenska Sjukuset, Göteborg

Informations Sahlgrenska :

Organization :
- 3 Operation wards :
  - Stomach
  - Breast
  - Lung

Guidelines :

- 1 acute operation theatre
- 1 department for the fat people
- 1 corridor for the administration and 1 corridor for the patient : Not mixing the different flow of people
- They moved to this spot 4 years ago

Issues :

The new unit is built with a close collaboration of architects and health care staff. The idea was to identify the different categories of patient and provide them different space/room ideal to need of particular group of patients. In addition it also helps in separating the patients who are in different stages of their sickness.
The rooms are designed in way to achieve utmost flexibility as a realization of changes in future. The purpose for this is that all room should be able to welcome any kind of profession/personal (doctors/patients/staff).This indicates the current trend in healthcare architecture which greatly favors future proofing as a way of sustainable building.
However, rooms can be seen to have worked out in a way that they bear similarity to each other even though they are different to one another. This helps in binging unity to space as a whole.
One of the striking features of design is its segregation of spaces in hierarchical way in function of degree of sickness of the patient. Patients who are very sick and at a different stage of the disease don t meet with the patients who are not very sick.
To control the patient flow, It has a large reception where

patient will get a card with a number which leads them to their desired room and the staff could do further investigation.Here, the doctors/staff can inform patients about their desease, treatment methodology etc. Doctors may orgonize some lectures/meetings about the next step. This provides a way for staff and patient to get well aquainted with each other and helps to create a comfortable enviroment in future.

Examination room

Connection Bridge

Kungälvs Sjukuset, Kungalvs

<u>Historical Part :</u>

- Creation 1964 :
  - = First part of the hospital
  - = 2 wards + 1 reception
- 1975 : Administration
- 1985 : Terrain (Mud area)
- 2000 : Psychiatric
- 2006 : Operation theatre
- Now : New operation theatre + post operation room

<u>Guidelines</u>

Time schedule for the project management of the building site. 2008 – 2012

Connection point for the different parts of the wards level 4 -> connection point between the patients and the Emergency

Post operation room: 60 sqm / 8 person
Operation room : 57 sqm

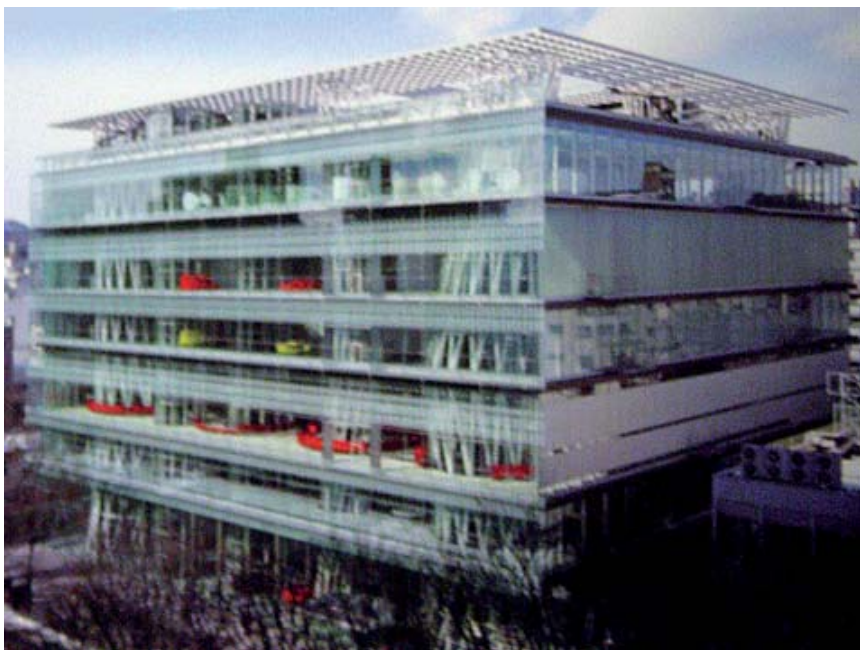
Operation room

Operation door

Corridor

Inspiration Projects

Surry Hills Library and Community Center, Australia
Francis-Jones Morehen Thorp, 2010



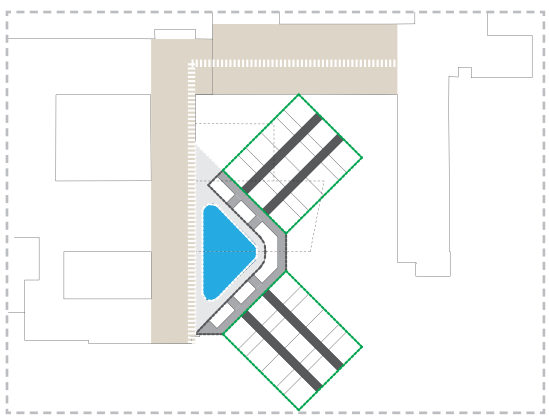
Sendai Mediathèque, Sendai, Miyagi Prefecture, Japan,
Toyo Ito & Associates, 2001

Karlsatd hospital Rebuilding of Operation room
Sweco, 2012

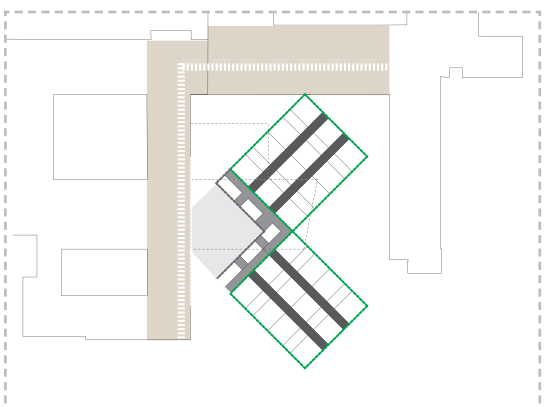
Orestad Gymnasium, Denmark
3xn Architects, 2007

4: Workshops

Planning Exploration



1



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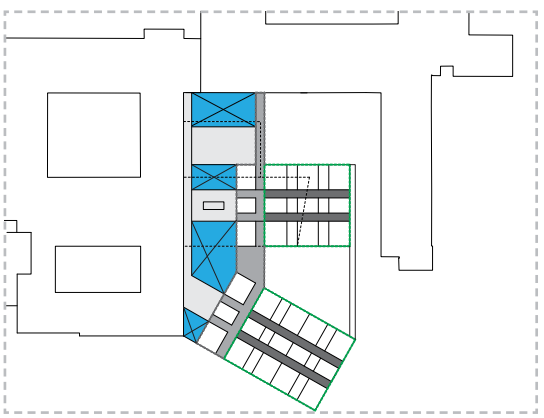
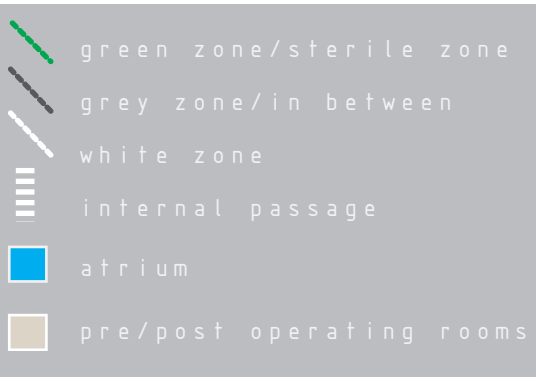


3

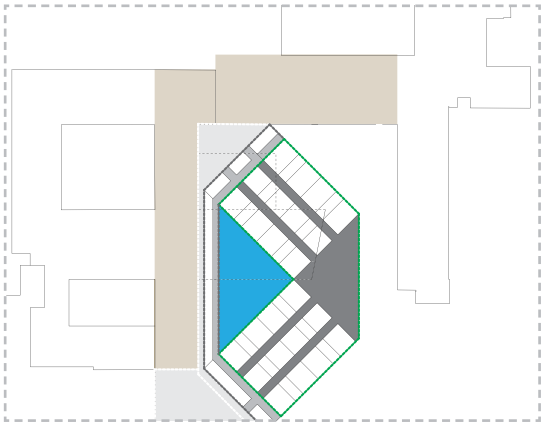
1 - The new operation facilities are connected to existing building with pre and post-operative rooms and also with wards and intensive care unit. This proposal will not have enough space for pre and post-operative facilities in new building which forces them to be isolated from operation rooms.

2 - This illustrates the same idea as shown in figure 1 but the connection is made smaller to increase the daylight situation in nodes as well.

3 - This solution prove to be better in terms of keeping the ambulance hall and radiology department as the building walls are parallel to the walls of existing structure. It represents the comb system of building hospitals which are proven to be effective in terms of function. The problem however remains with the connection to existing building. This is long and throughout the façade of existing building thus creating a bad condition of daylight in the rooms facing this direction.



Planning Exploration



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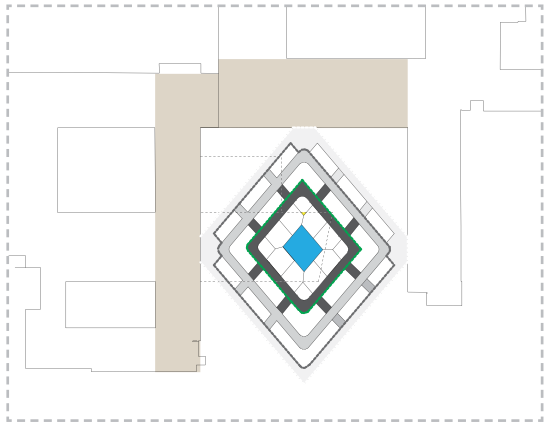

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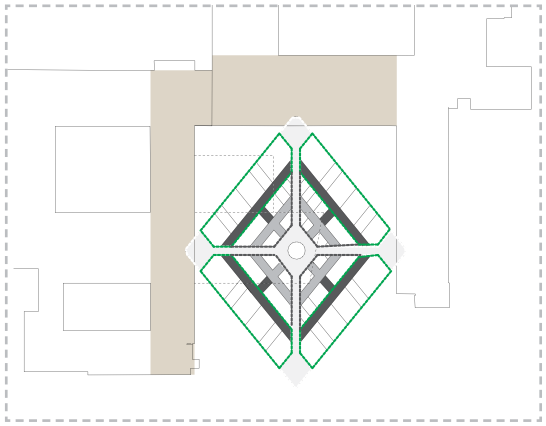


6

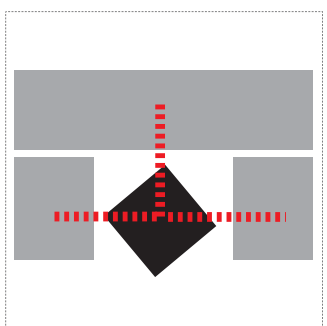
4 - Here, the cluster of operation rooms are converging towards each other which increases open space between the buildings but the distance between two operation cluster increases from inside.

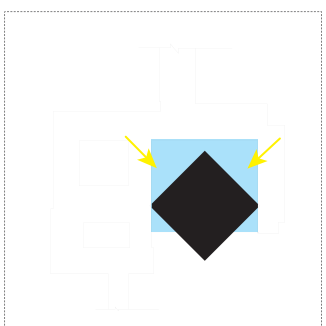
5 - This is the first trial with a rotated square where the operative rooms are clustered inwards. It is like a circle with layers first layer is the pre and post-operative wards, second being the support facilities and staff rooms and the last cluster being operation rooms. The daylight in operation rooms are provided by the void in the center. However in the current context, where we have a fixed site with constrained dimension, it is difficult to follow this principle.

6 - This follows the same principle as 5 but here the operation rooms are in the exterior circumference. In both cases connections can be seen from all sides of existing functions.

Facade Exploration

5: Our Proposal



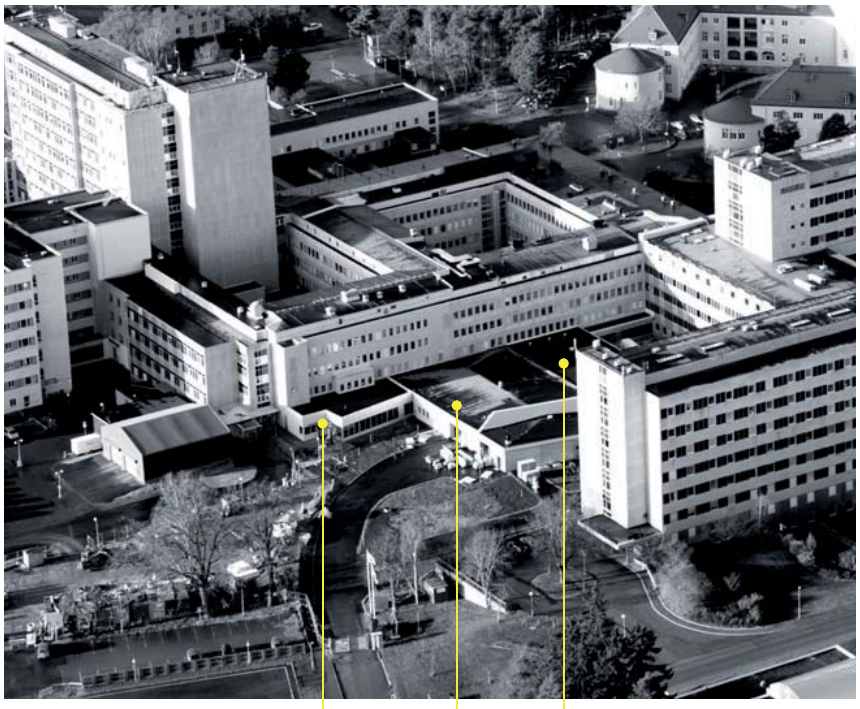


Current Situation

Map of Sweden

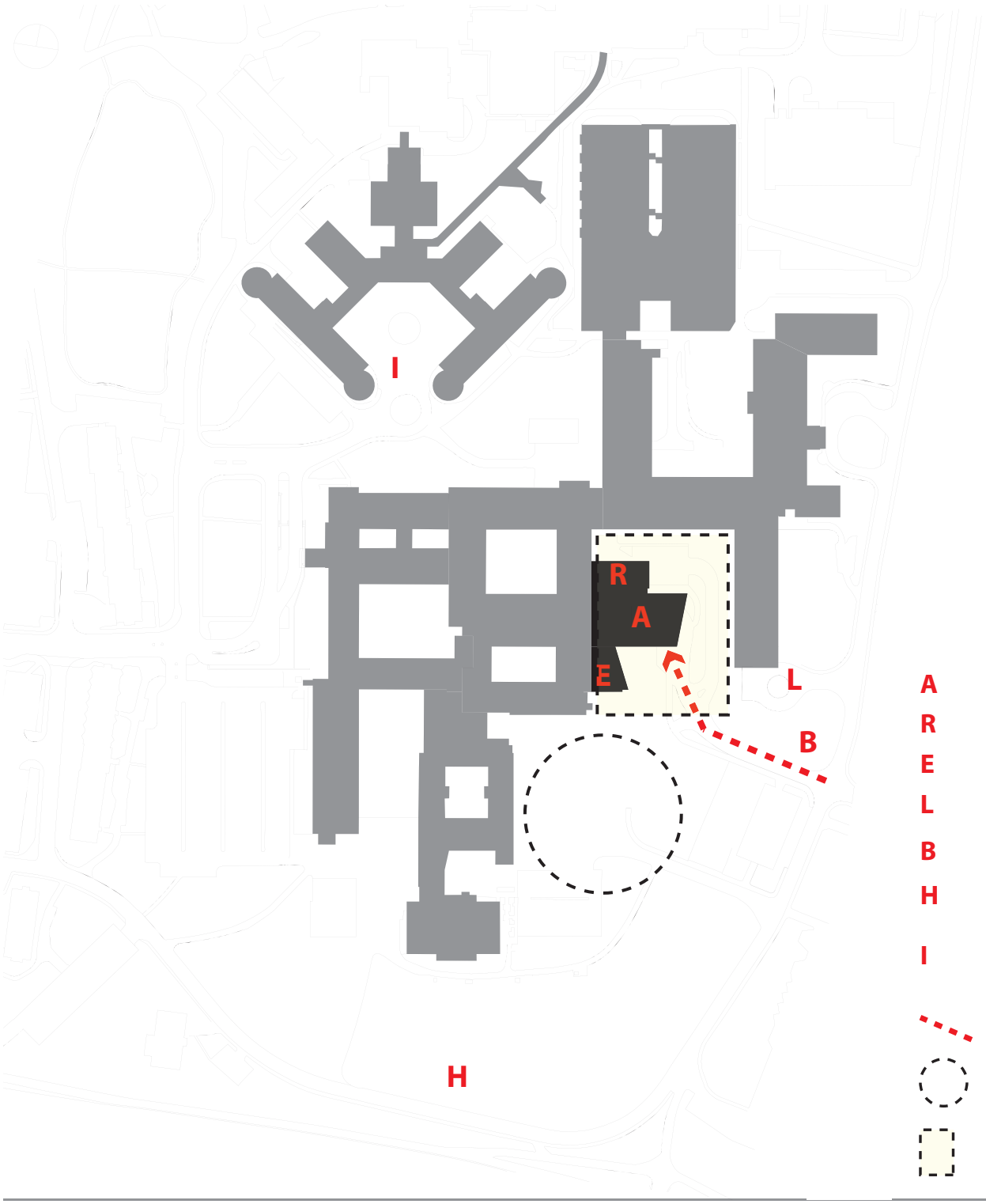
Map of Västerås

Västerås is one of the oldest cities in Sweden located on the shore of Lake Mälaren.
Västerås hospital is one of the largest hospitals in Västmanland County. It has around 3000 employees, around six hundred beds and 25 sections. The hospitals are owned by Västmanland county council.
The site for new operation building as shown in the picture below is located in a u -shaped courtyard open in the south and surrounded by buildings in north, east and west. The site consists of some existing structure that is added later like an entry hall, ambulance hall and radiology. The ambulance hall and radiology shall not be removed while building a new structure.



Västerås Hospital

Existing Situation



A ambulance hall

R radiology department

E entrance

L level difference of +3m from abulance hall

B bus stop

H heli-pad

I Historically important building that shallnot be demolished

Ambulance entry

furure extention of wards

site for new operation building

birds eye view

main entrance hall

main entry

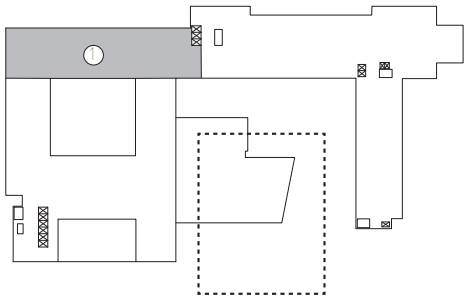
waiting area

view from east

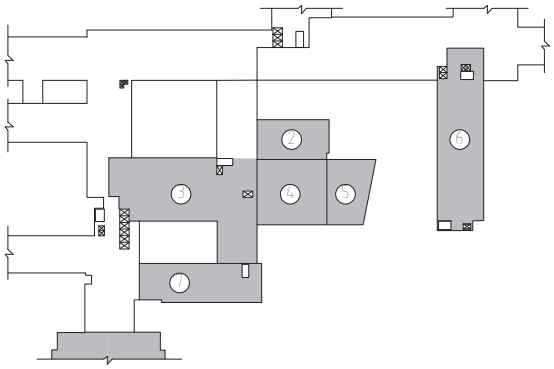
proposed site for new operation center

Existing Floor Plan

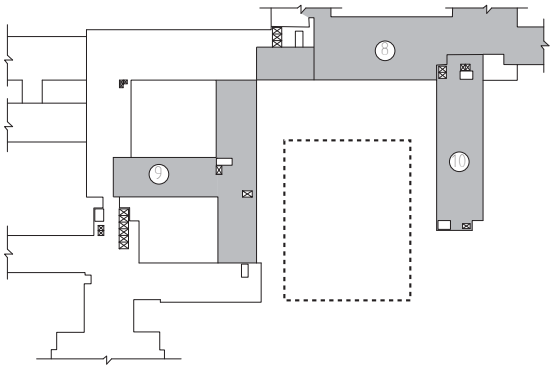
plan 0



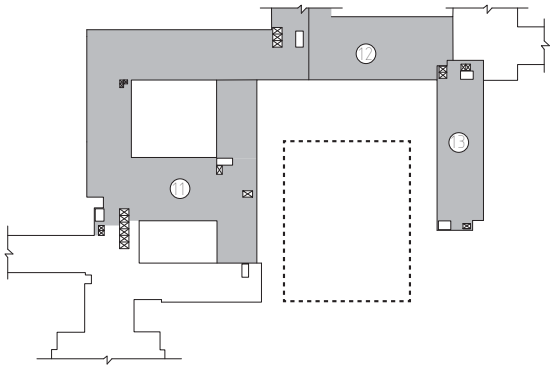
plan 1



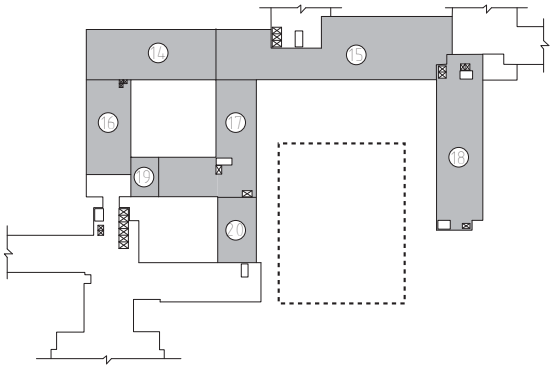
plan 2



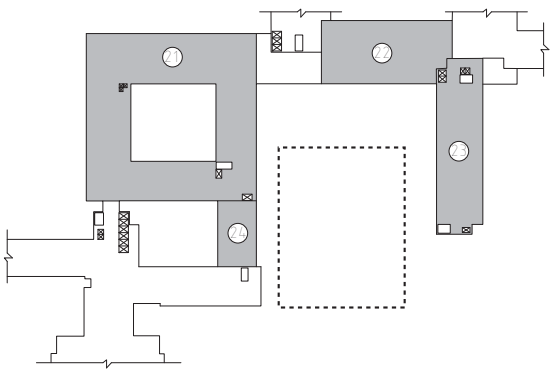
plan 3



plan 4



plan 5

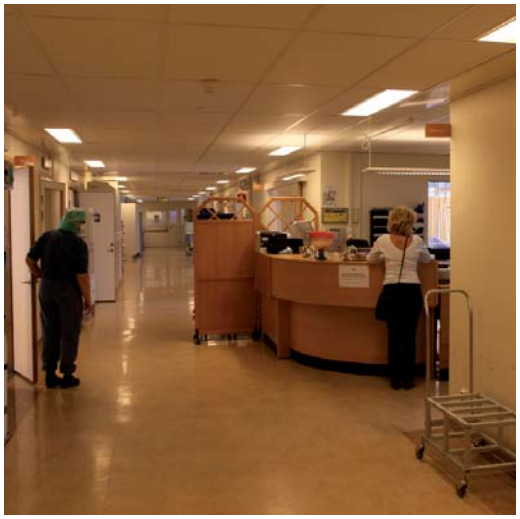


1.sterile centre.
2.radiology
3.old trauma centre
4. newly added trauma
5.ambulance hall
6.onkology
7 administration
8 gynocology reception
9 child birth
10 laboratory
11 x-ray
12 eye surgery
13 eye reception
14 day surgery
15 wards
16 wards
17 intensive care unit
18 onkology ward
19 pre-post operation
20 vascular operation
21 rehabilitation
22 jorrum/control room
23 avd.85
24 administration

packing room,sterile centre

autoclave,sterile centre

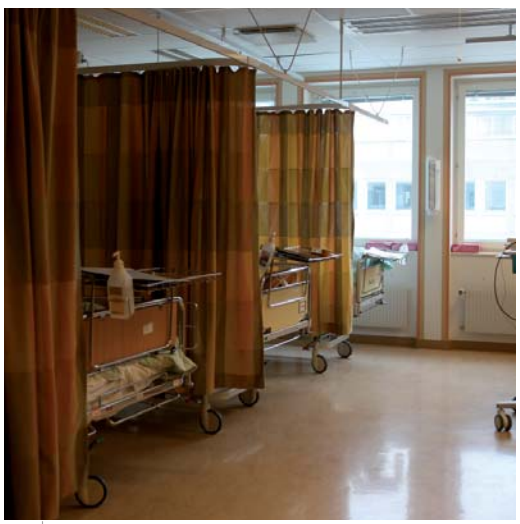
ambulance hall



reception,operation zone

beds in operation corridor

operation room



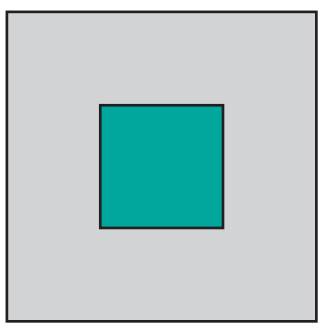
wake up area

equipments in corridor

staff fika room

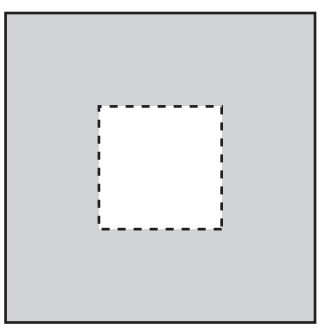
Hospital Demands

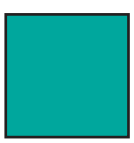
1



Currently Västerås hospital has operation department with 16 operation rooms of around 43 square metres adjacent to wards and intensive care units. The problem in the operation department today is the clear height in operation room which is smaller than reccommended height which affects in the ventilation of room as the air in operation room needs to be changed almost every minute.

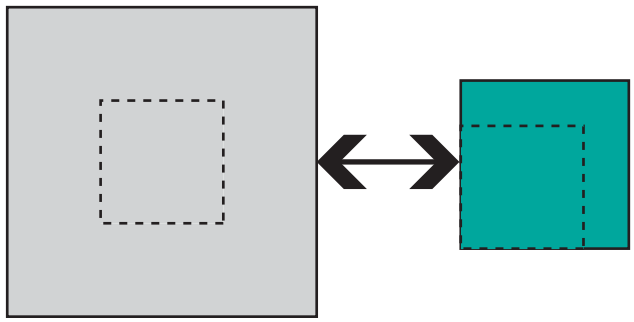
2





hence, västerås hospital wants a building to house new operation department.

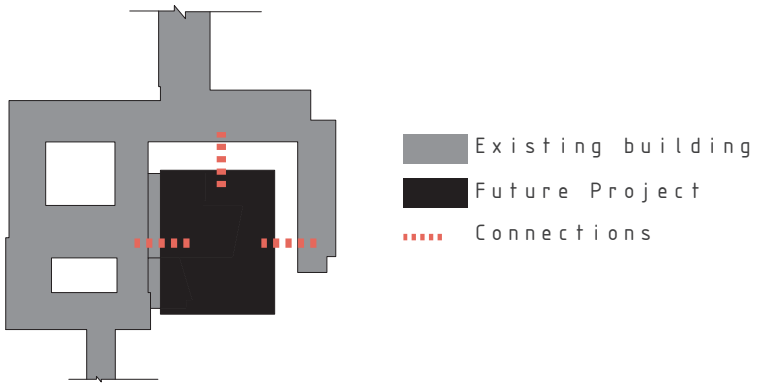
3



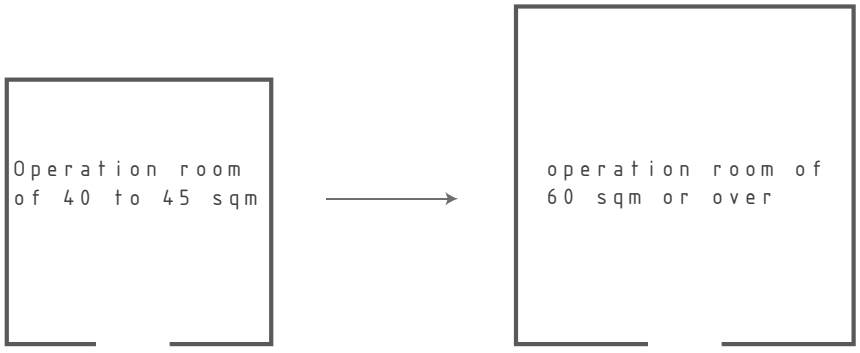
The new operation building should consist aroun 20-26 operation rooms, should be large enough to hold all present day equipments .also, when the operation department is moved the empty existing operation rooms shall be used for extention of wards and intensive care units.Hence, there should be a close connection between new and old.

operation

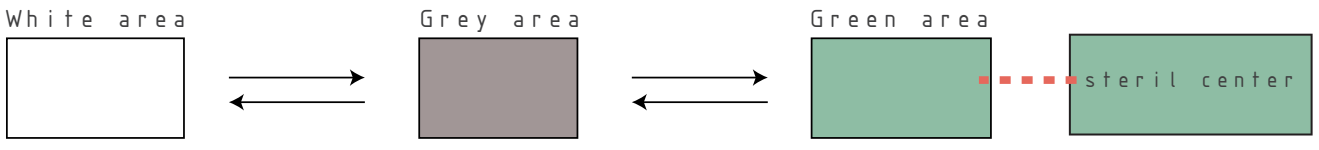
wards and intensive care units



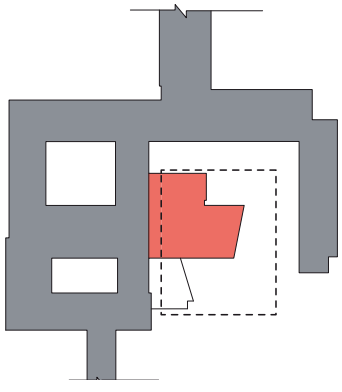
New building shall be built with a sound connection to existing structure that consists of existing operation rooms, wards and intensive care units. The existing operation rooms will be change into wards and intensive care units.



The operation rooms shall be larger in size. The existing operation rooms are around 43-45 square meters. They are relatively small to fit in all the equipment used today. Some of the equipment can be seen lying in corridor itself. The operation rooms shall be around 60 square meters. (Based on equipment used today and case study).60 square meter is also the minimum size required for a hybrid operation. The best for hybrid however is twice this size.



A close connection with sterile center is very important to consider for effective running of operation centers. The operation center shall have white, grey and green zones. These zones are showing the different degree of sanitization with white being the minimum and green, the maximum.

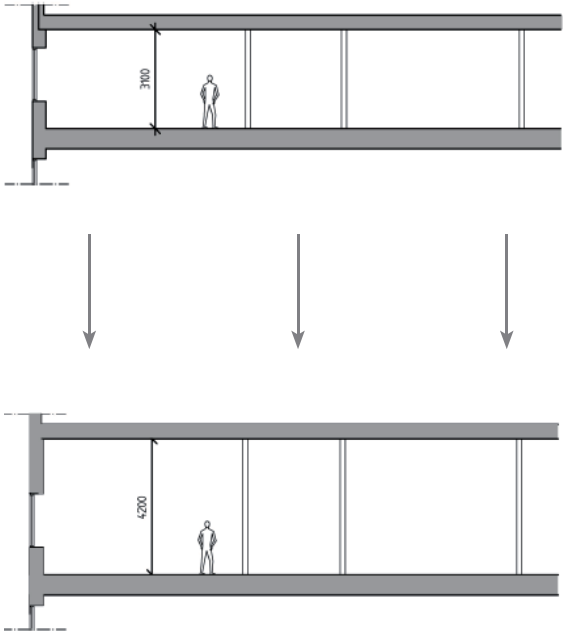


Existing building

ambulance hall
& radiology

Future building

The existing buildings like ambulance hall and radiology which the hospital has built as an annex to main structure to gratify the contemporary needs shall be kept. Although they may act as a nuisance while building a new operation center on top, the hospital thinks it is working well and shall not be removed.



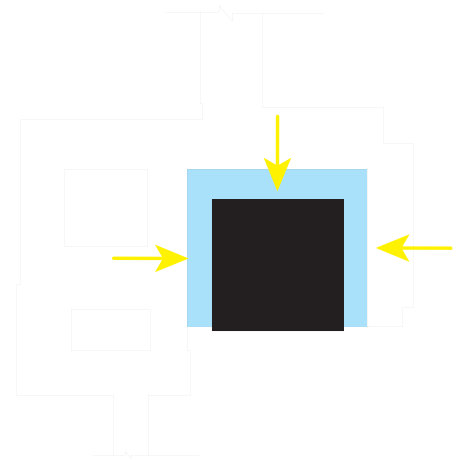
The current floor height is low. It affect in the air circulation of operation theatres. The air is changed every minute during operation. Because of this, there is need to use sophisticated and expensive equipment and masks. Thus, The height of operation rooms should be bigger.

projekt engagemang

sections taken from Johan Nordenadler

Obstructions

By obstructions, we mean the major factors that will affect the outcome of our proposal. It is something that we shall consider on all stages of the design process. The sole aim of working around obstruction is to confine the design exploration around the main architectural objective of the project.

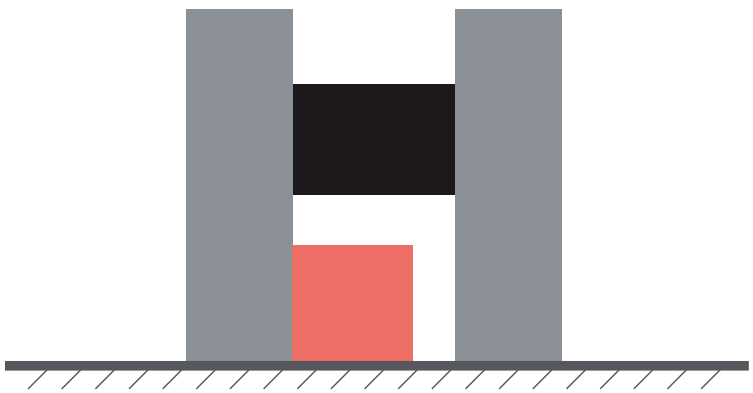


light through facade

light condition

future project

One of the challenge of building between the existing structures is daylight condition in both new and old structure. The illustration explains the day light condition if the new structure is placed in courtyard in the shown manner. The obstruction here is to have daylight in all the operation rooms, support facilities, pre/post-operative rooms without ceasing the daylight in existing facilities.



existing building

ambulance hall

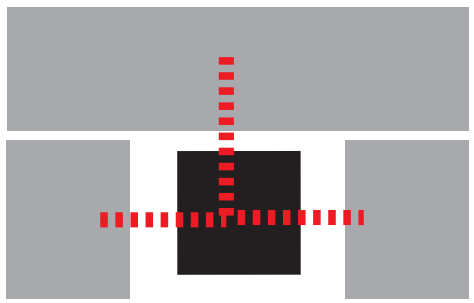
future project

Another obstruction for us is to keep the connection with existing structure so that existing wards and intensive care units can be used and also the existing operation rooms could be used as an extension to the wards and intensive care units.

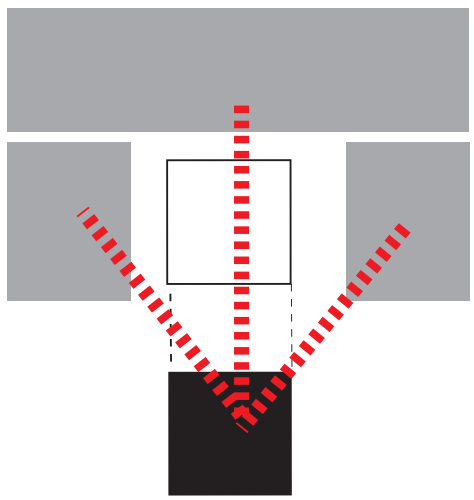
Furthermore, the ambulance hall and radiology shall be kept untouched along with its existing flows.

Design Principles

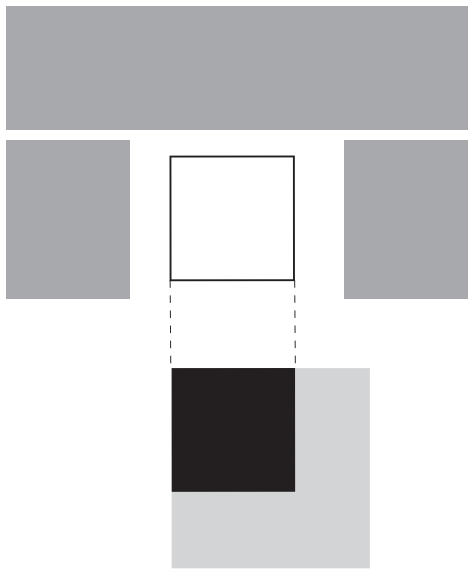
a



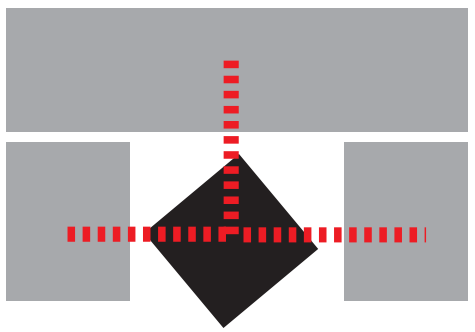
b



c



d

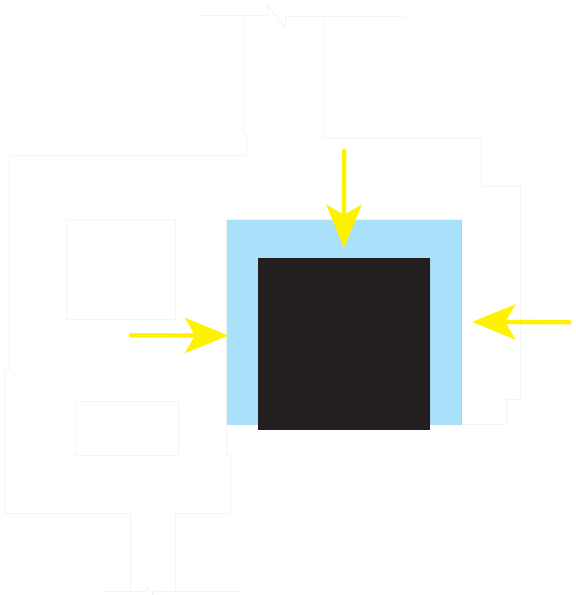


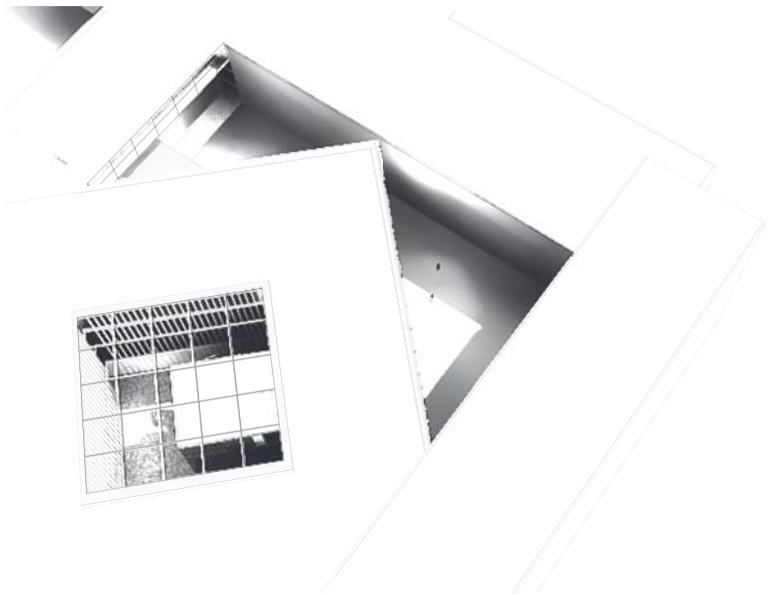
a the possibility of day-light is less although the connections with existing buildings are better.

b daylight condition is much better but distance from operations to wards might cause incomfort for the staff and patients.

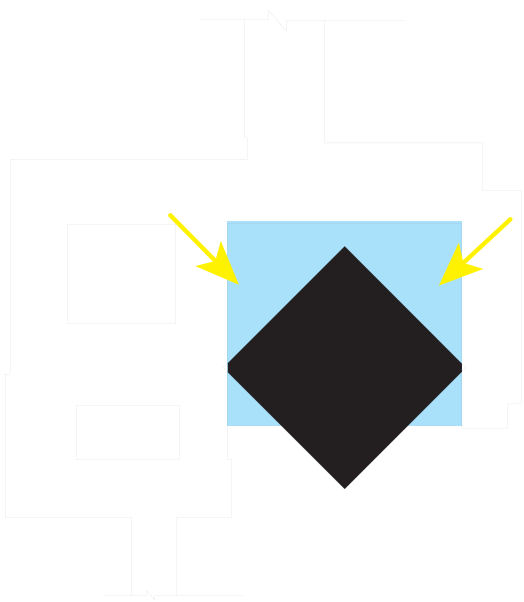
c need to build more and the building would be bigger because of the bad connections

d turning the new building 45 degrees and build it withing the courtyard which opens up daylight condition for the building as well as keeping the connections.

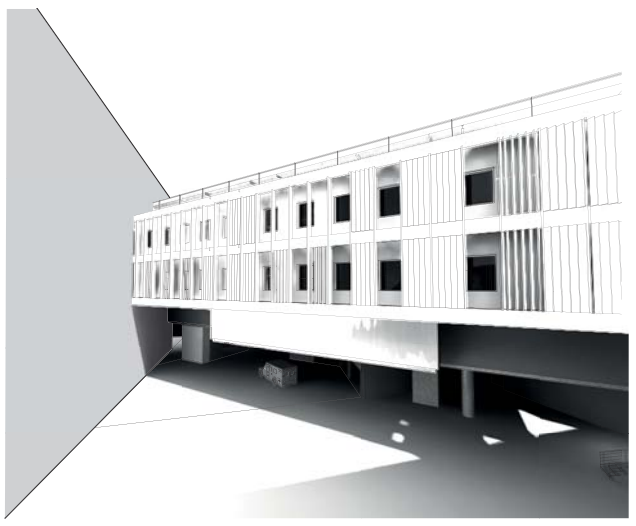




view from top

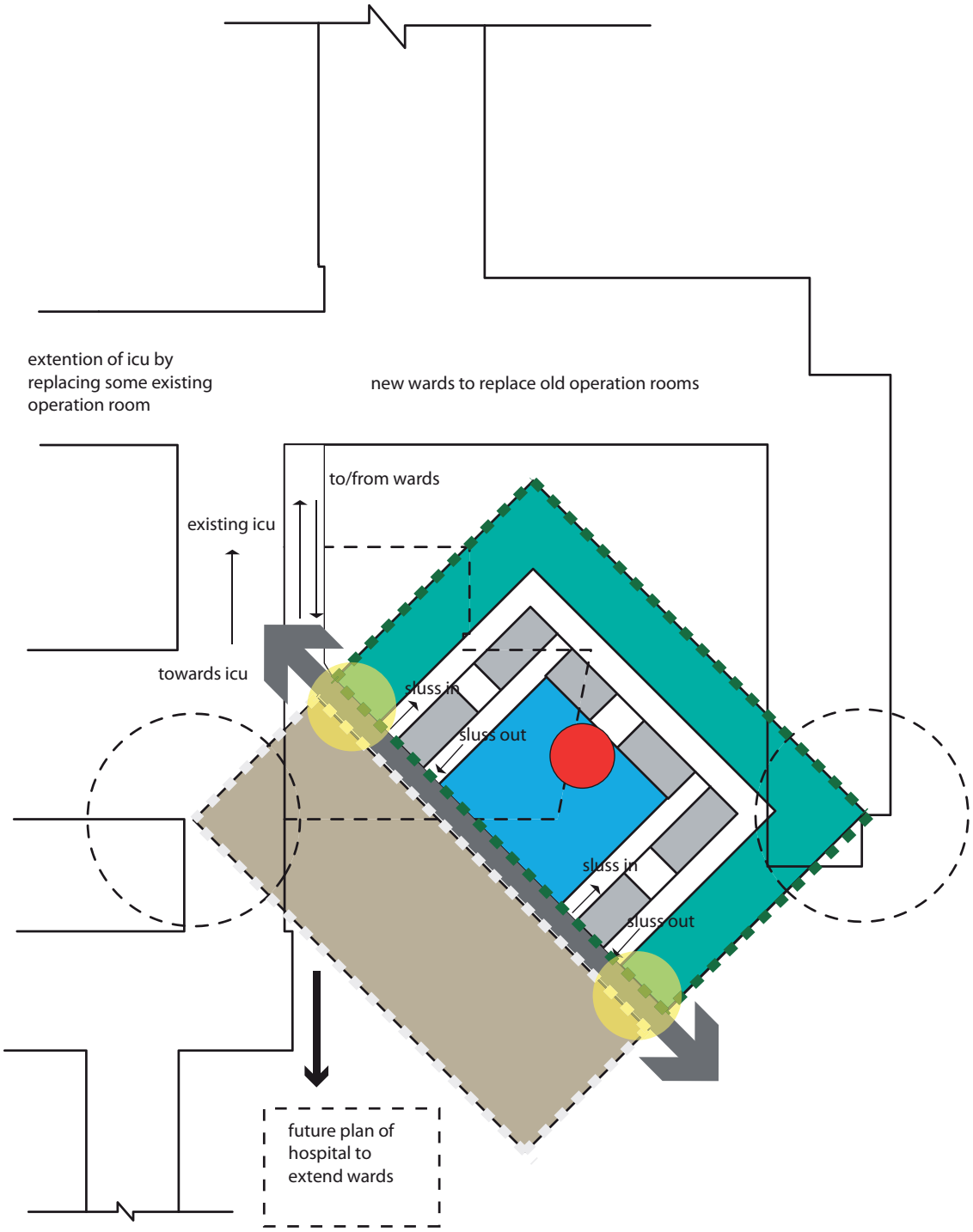


From alleys to smaller courtyards



view from a window of ward situated in the existing building, a little bit of blue and a little bit of green, advantage of rotating the new building.

Shematic Operation Floor



pre and post operative areas

operation rooms with a provision of daylight

support rooms for operation

atrium

staff

white zone

grey zone

green zone

connection point to
existing building

provision of direct
entrance to operation
possibly for children and
infected patients

Schematic Brief:

The operation floor consists mainly of Pre/post-operative rooms, operation rooms and support rooms along with staff areas. It also consist of a main corridor that helps in visual separation from the group of operation rooms and support rooms yet provides a physical connection between these two zones of different degree of sanitization in more than location. In addition it also has an atrium in the middle that helps in bringing the daylight into the corridors and support facilities. In contrast to the main grey corridor this atrium physically separates the different zones yet visually connects them as a whole single area.

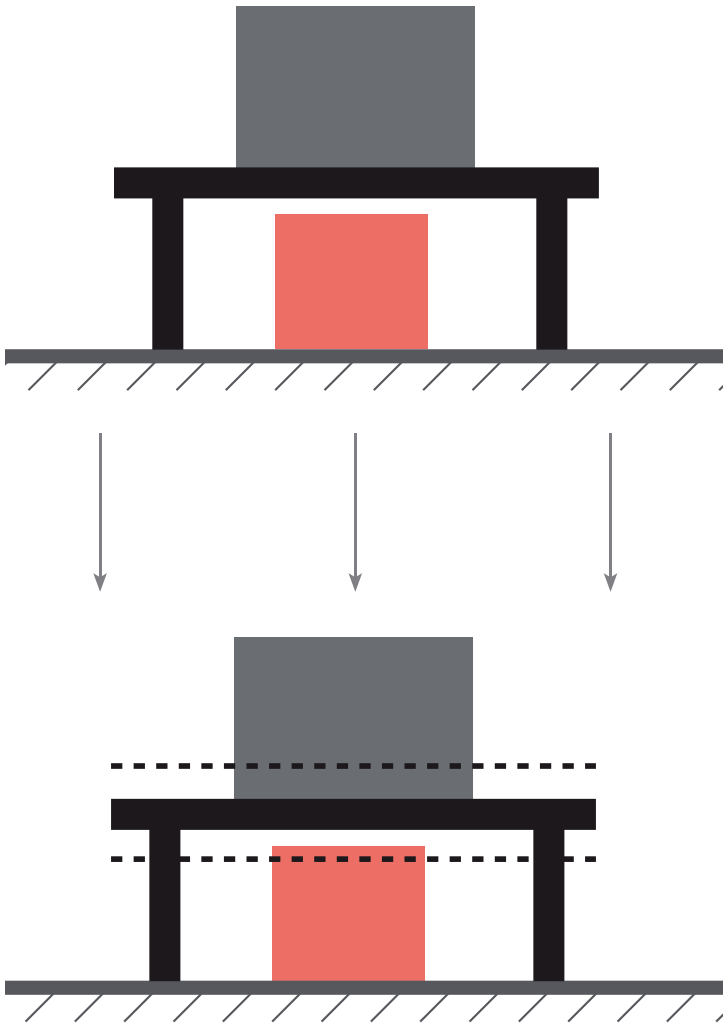
The pre and post-operative area that involves wake up room and a step down zone after operation are strategically located facing towards the open area so as to expose the patients that are waking up after the operation with maximum daylight and view towards the nature with regard to the study made from evidence based design that patients tend to heal faster when they have ample daylight and view towards the nature.

All the operation rooms have access to natural daylight. They are approached through a corridor connected to main grey corridor through a sluss (sluss in), provided in two far ends. The support rooms however have 2 different corridors so that it is easy to take the required goods to operation room laid out in c-form.

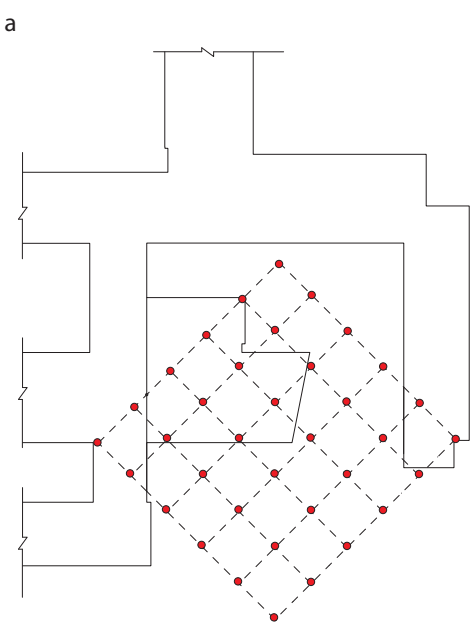
The staff facilities are provided in the middle of the floor, with a separate vertical connection to another operation floor above and also to the staff floor consisting of doctors/staff area below.

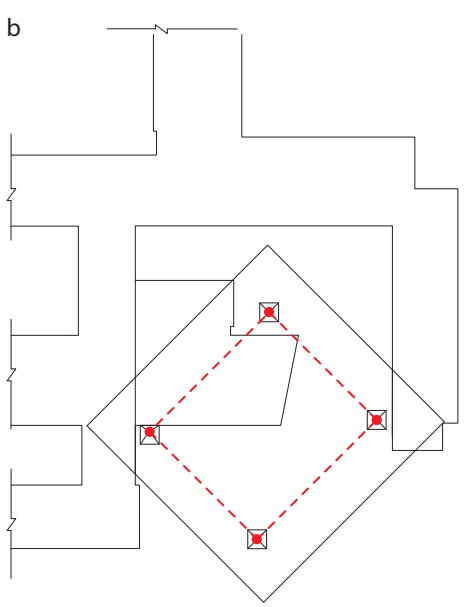
The floor is also connected through existing structure consisting intensive care units and wards through the main 4m wide grey corridor which meets a bridge outside existing structure leading towards the wards.The main corridor also is connected to a node between the wards and operation.

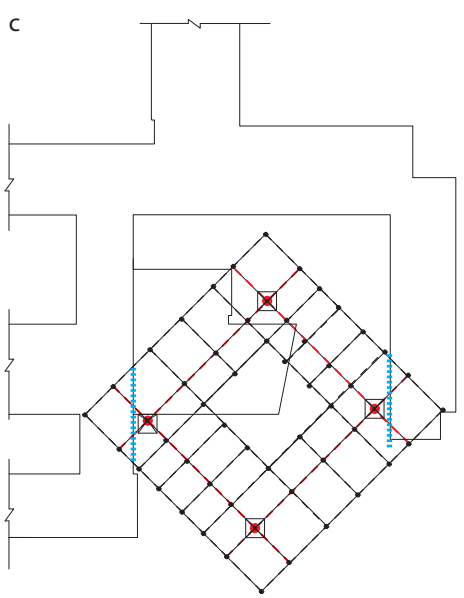
Structural Principle



The first idea was to build over a platform in order to avoid the pillars from operation rooms to affect the existing structure underneath as shown in figure (a). however, due to the load of the building it was possible that beams might be thicker and affect the buildings beneath as the level of operation floors are constrained to fourth floor of existing building as shown in figure(b).



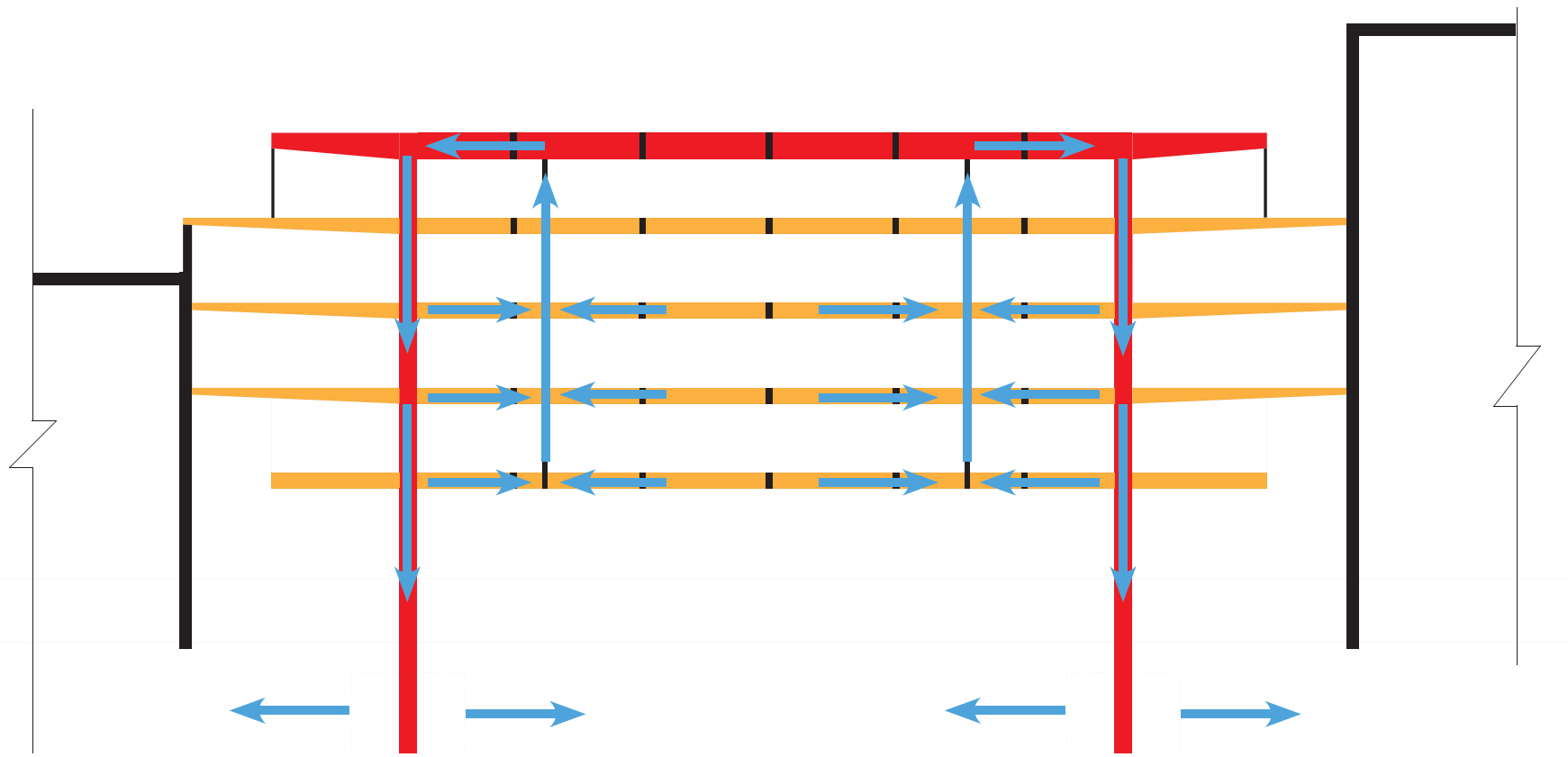




a If the pillars are laid as they are normally laid, there is a high possibility that they might hinder the ambulance flow and penetrate into the existing structure.

b The main pillars around the size of 1m are strategically placed to avoid the existing structure underneath. A main beam shall run on top of the structure from which a series of secondary beams and tensile strings will hang the floor. As the main beam is on the top of the structure it will not affect the floors below even if the depth of the beam vary.

c This diagram illustrates the main beam and columns that are shown in red. Secondary beams and pillars are shown in black. The secondary pillars are in the form of tensile strings (wood or steel) that holds the slab of each floor. By placing the tensile members around atrium and exterior of slabs, a pillar free interior can be achieved. This provides more flexibility in structure. The blue line indicates the joint between existing and new structure. This connection will provide horizontal support to new structure.



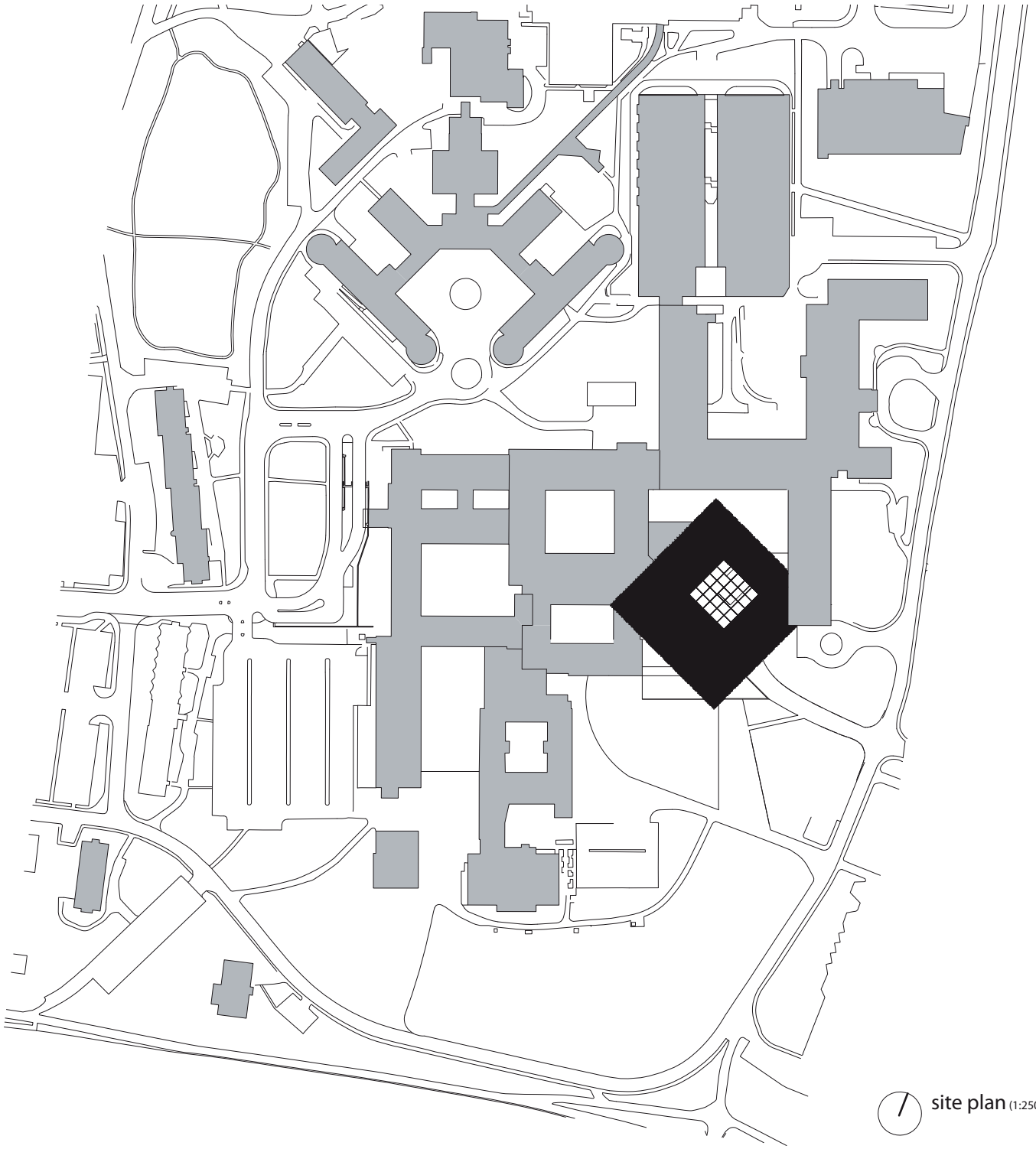
main beams and columns

slabs with beam system

secondary beams and columns

force

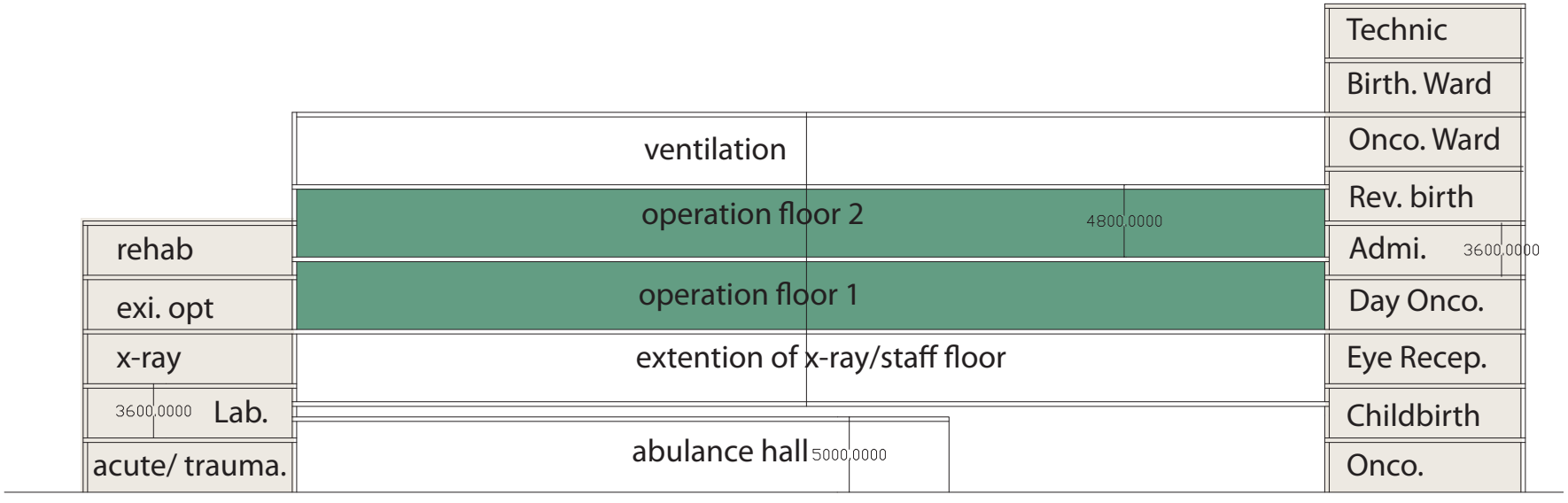
Site Plan

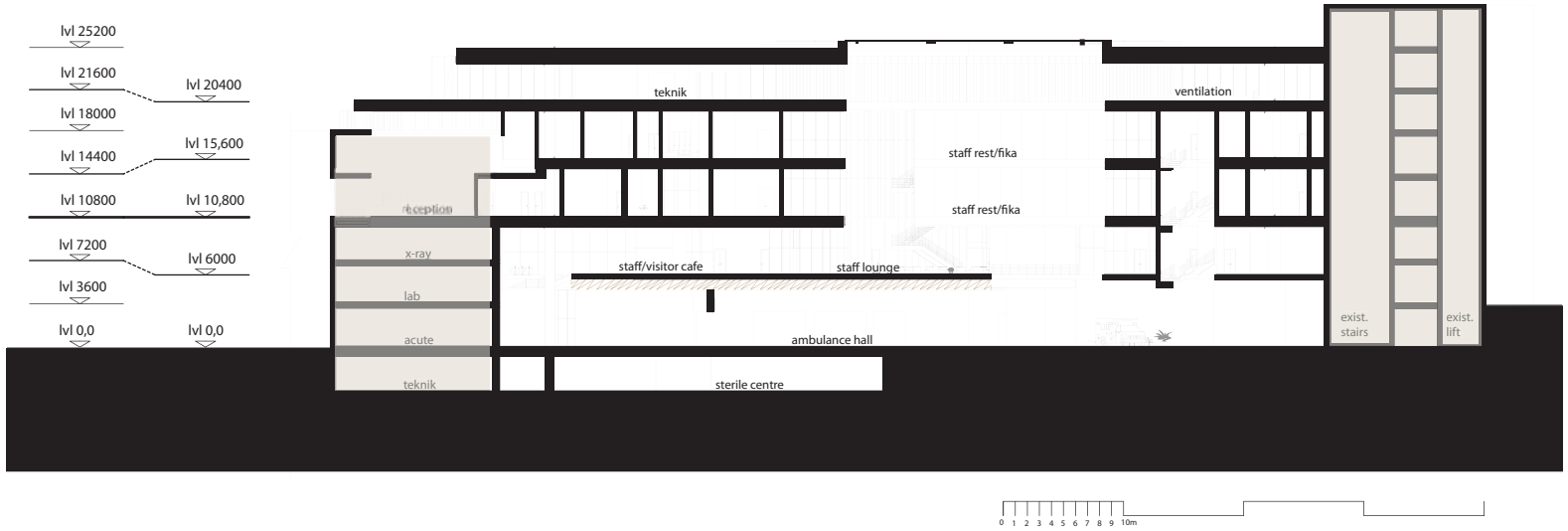


site plan (1:2500)

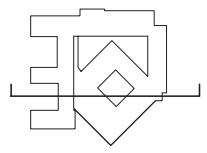
Levels and Connections

Schematic section shows the various function kept in different levels. The operation floors are divided in two levels.

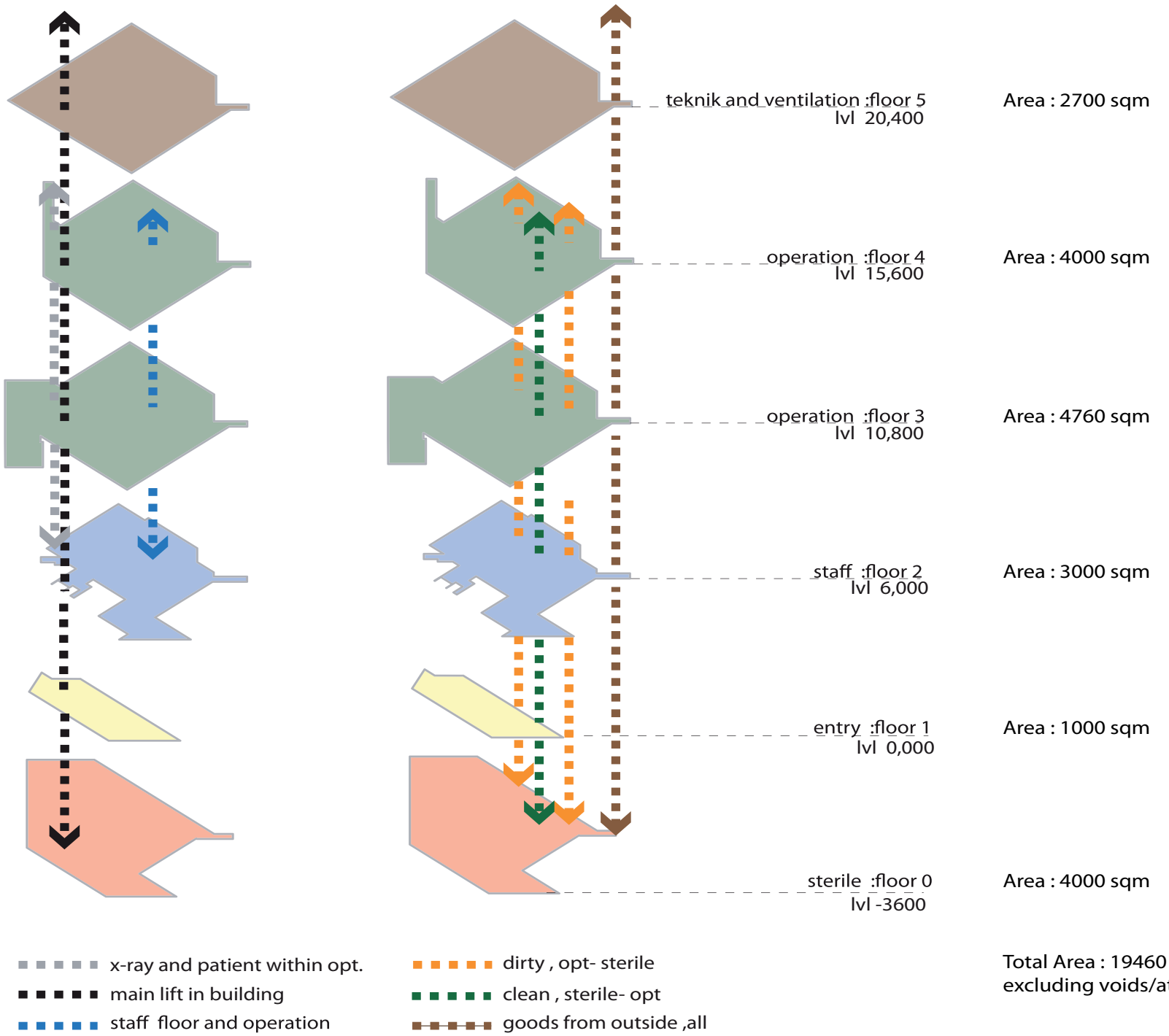




The first floor of operation starts from the same level of that of existing operation floor. Apart from this connection there are several other connection as shown in this section.

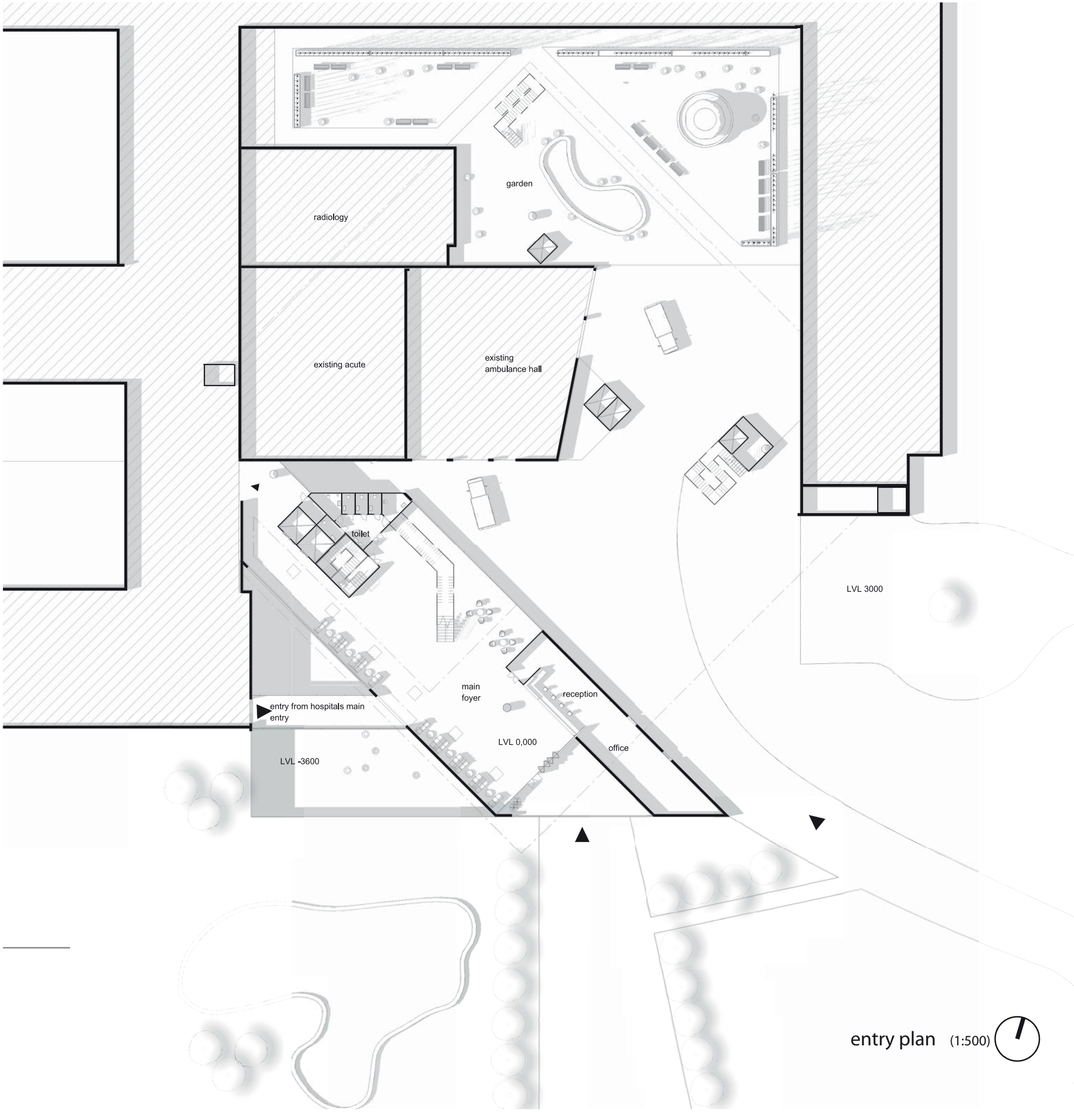


Vertical Circulation



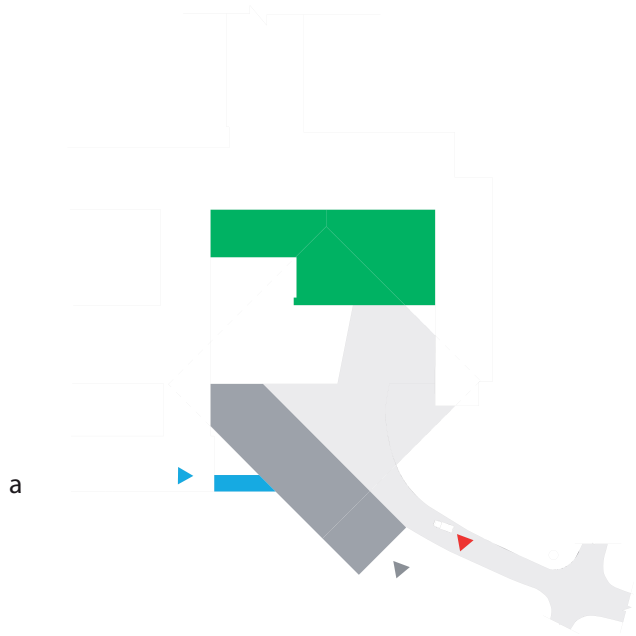
Total Area : 19460 sqm
excluding voids/atrium

Plan 1



entry plan (1:500)

Entrance

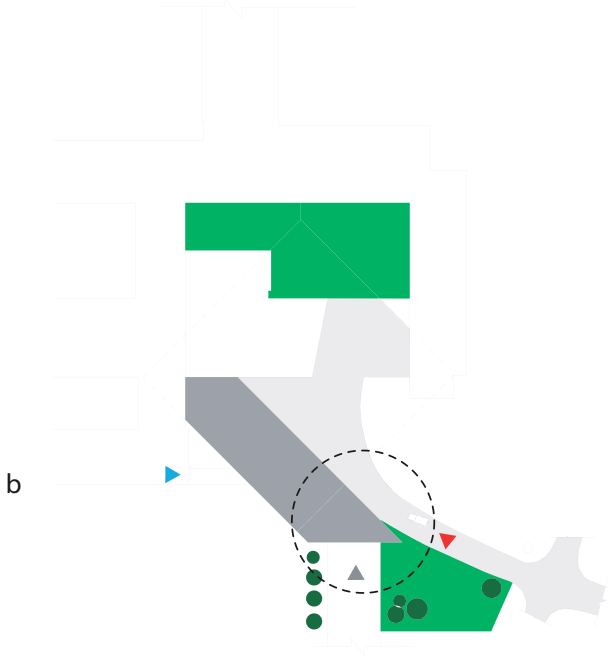


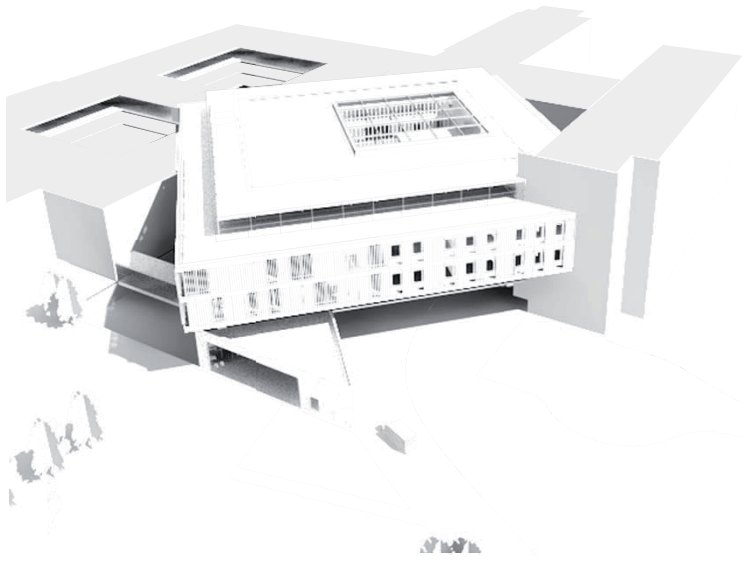
[▶] approach for entrance by walking

[▶] approach for entrance from main hospital entry

[▶] entry for ambulance

The diagram (a) illustrates schematic entry plan to the new operation building. The entrance is made prominent with a rectangular tube that sticks out from the main structure. This tube shall contain the main reception, waiting area and the connection from main hospital entry.
However, this has given rise to the condition that when it is coupled with the existing acute entrance through ambulance. The flow of people from normal entry and that of ambulance is directed towards the entry from the same direction.
This condition is not favorable because the idea of enhanced entry is to make people approaching relaxed and calm whereas the principle of acute entry to have a quick and direct flow of ambulance. The experience of both entries is very different.
With respect to the obstruction mentioned in earlier part that the ambulance hall and its flow shall be kept in all cost, one way to separate these entrances is to turn the direction of normal entry to another direction as shown in diagram (b).
This explains the turned face of rectangular entrance tube. In addition to separating flows it also advocate the principle of having a calm entry as it is turned to the southern direction which has a large green open space. This allows people coming normally to converge through a natural walkway with trees and garden towards the entry.

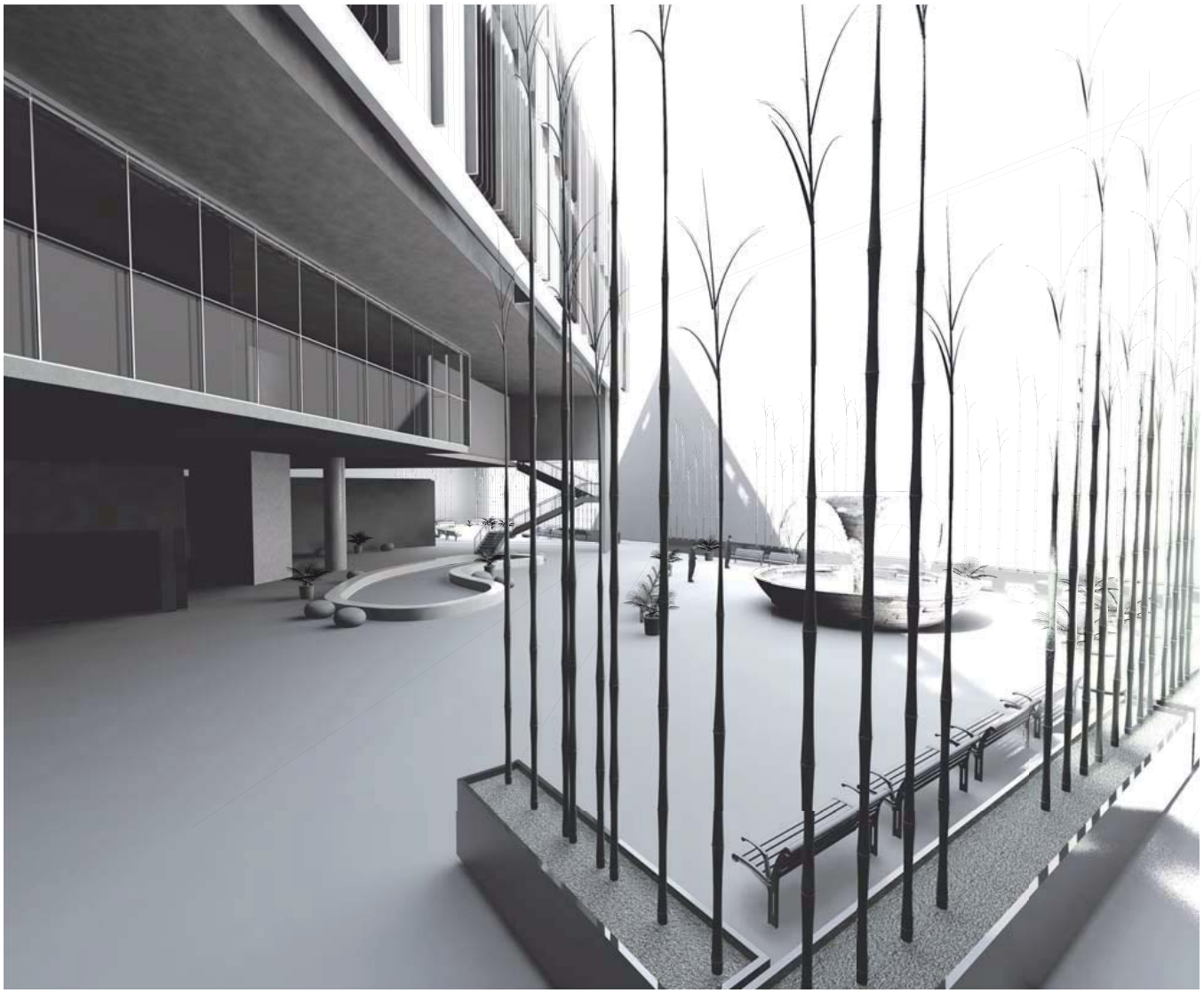




view from walkway

view of the accute entry

View From the Ward



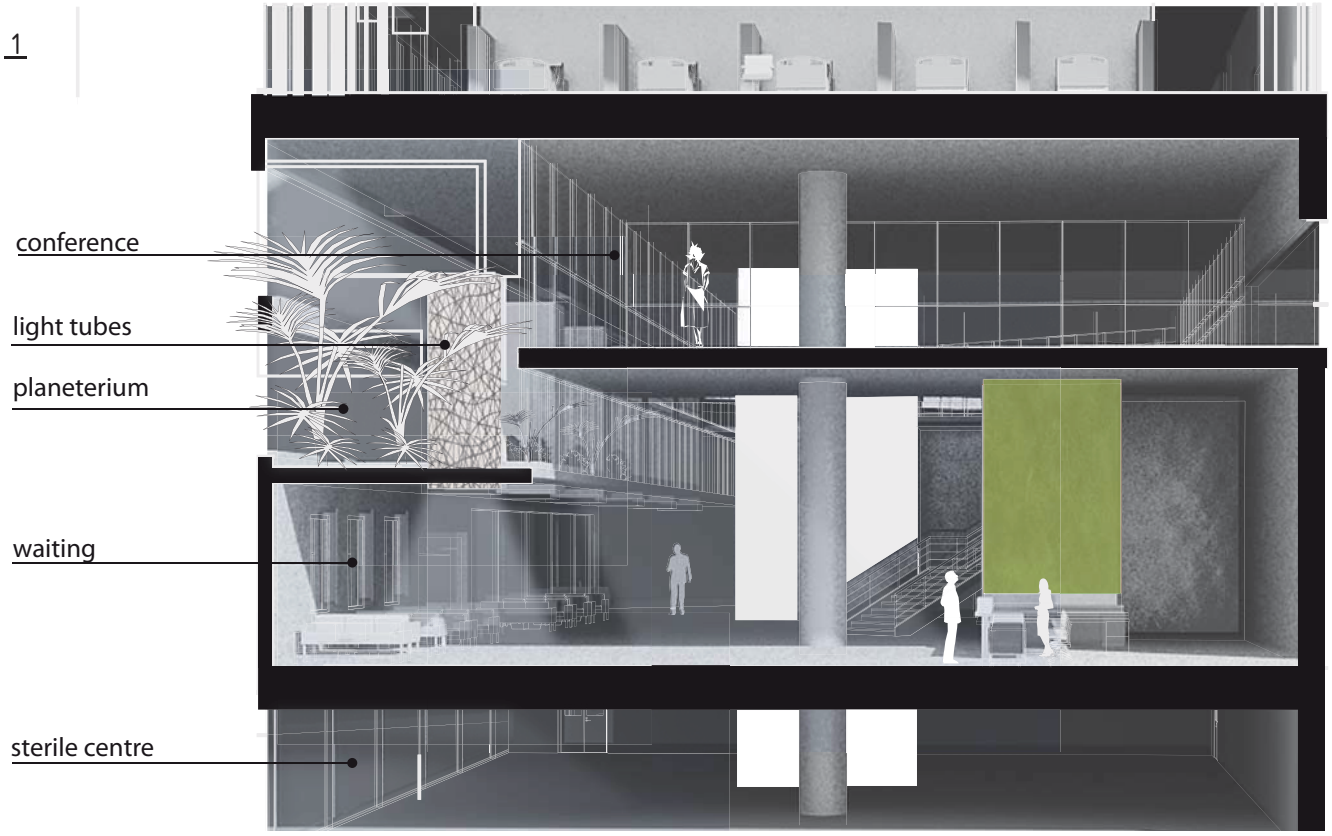
The image illustrates the condition of courtyard created by new operation center. Although the open space might not have as good day light as they have today .However, this seems to be one of the better option than to create a small dark alley.by placing the new structure in 45 degrees to old, the shadow on the façade of both structures are relatively reduced. It also provides an opportunity to design small garden for people to wait or for better view from the wards inside.

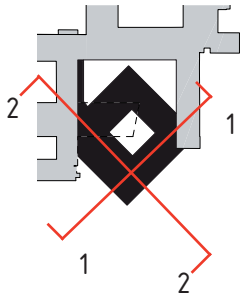
Entry

Patient, staff, visitor approaching the entrance of operation center in Vasteras hospital through the green walking path will be welcomed by the bright distinctive and joyful reception wall .Behind this wall is back offices for reception. The wall guides towards the reception counter inside.

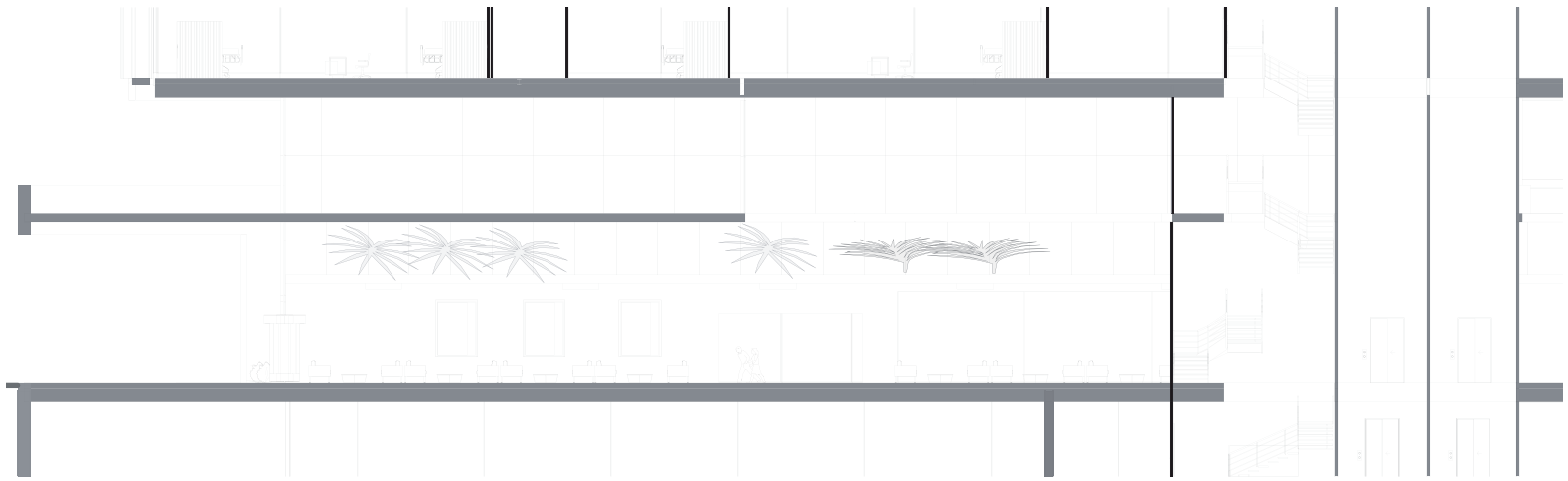
Entrance Hall

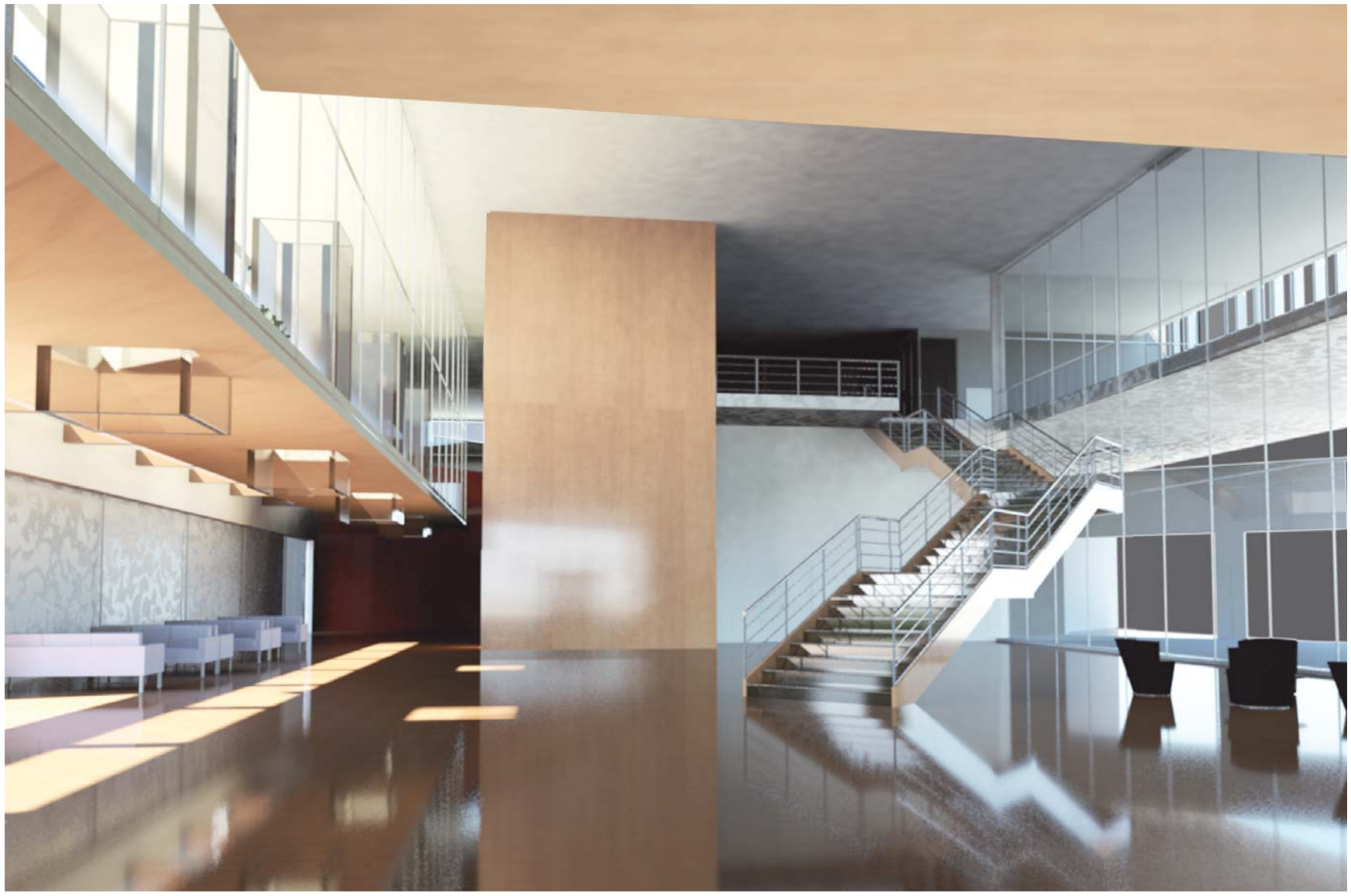
1



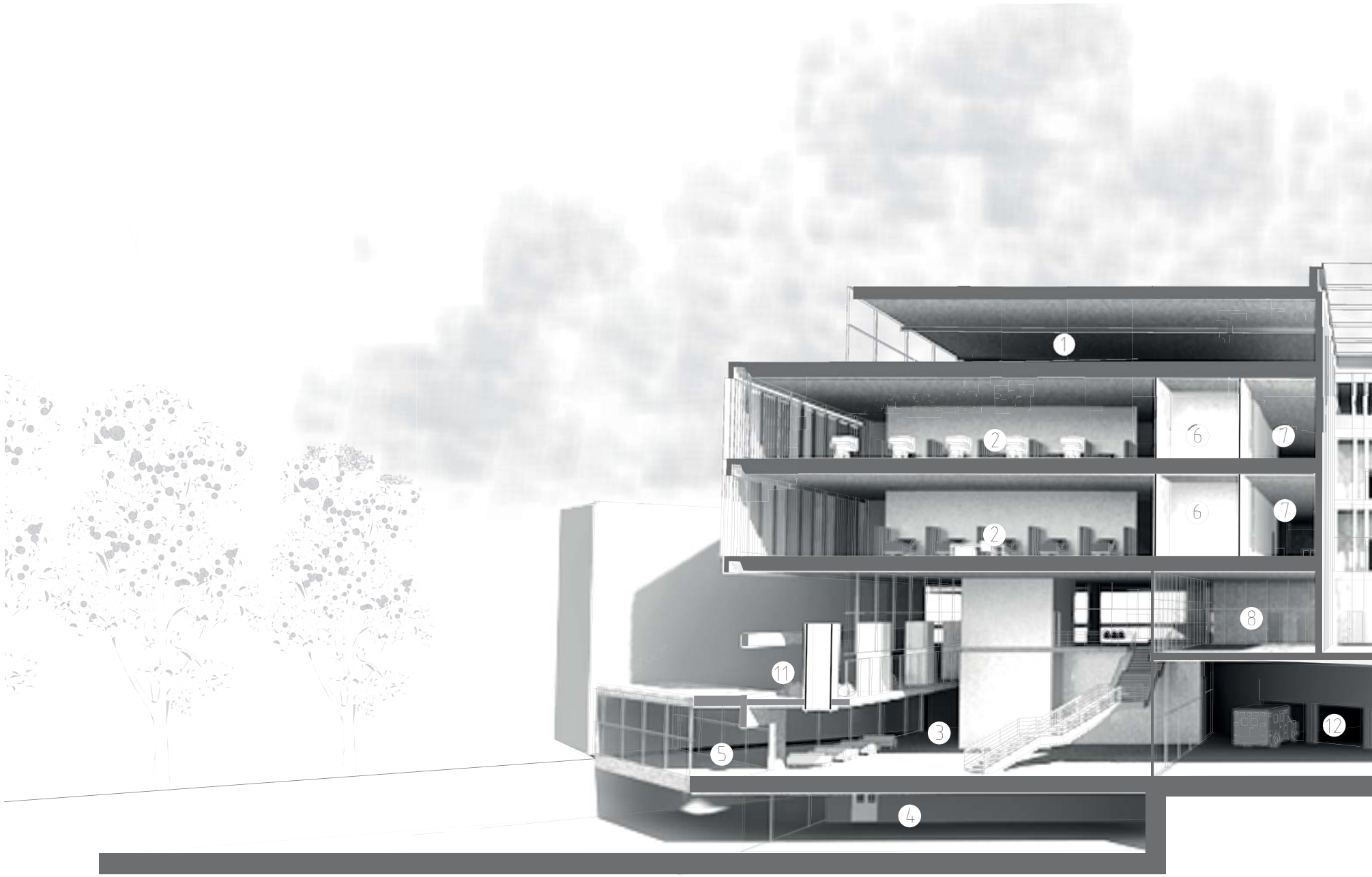


2





The patient/staff/visitor upon reaching inside the building will feel already acquainted with the space as he/she comes across the reception with similar walls as seen outside in the entry porch. The waiting spaces are located in the opposite side of reception. It advocates the view outside towards the open space which helps in calming the stressed patients or visitors alike.
The greenery and daylight is brought inside the entrance hall through a planetarium - It is a glass box containing plants as an aquarium consists of water and fish. This box cuts inside a 6m high space to bring exterior inside the interior. Vertical shaft highlighted in white is located in the center divides the flow into trauma center and existing parts of the hospital and to the operation and staff floor above through a dynamic stair.



1 ventilation

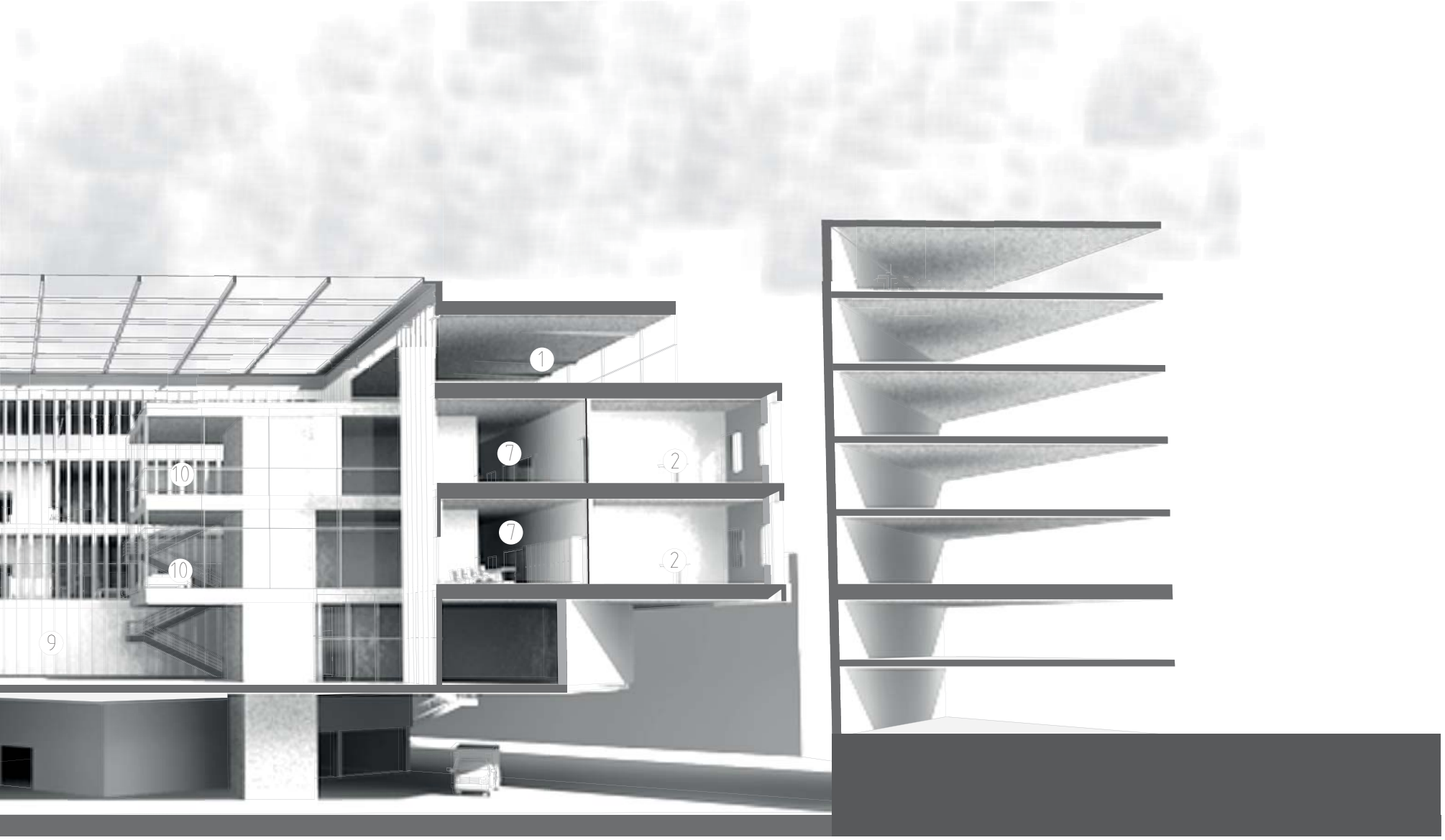
3 entrance hall

5 main entrance

2 operation

4 sterile center

6 support rooms



7 corridor

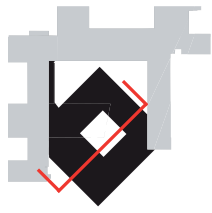
9 atrium/staff lounge

11 planetorium

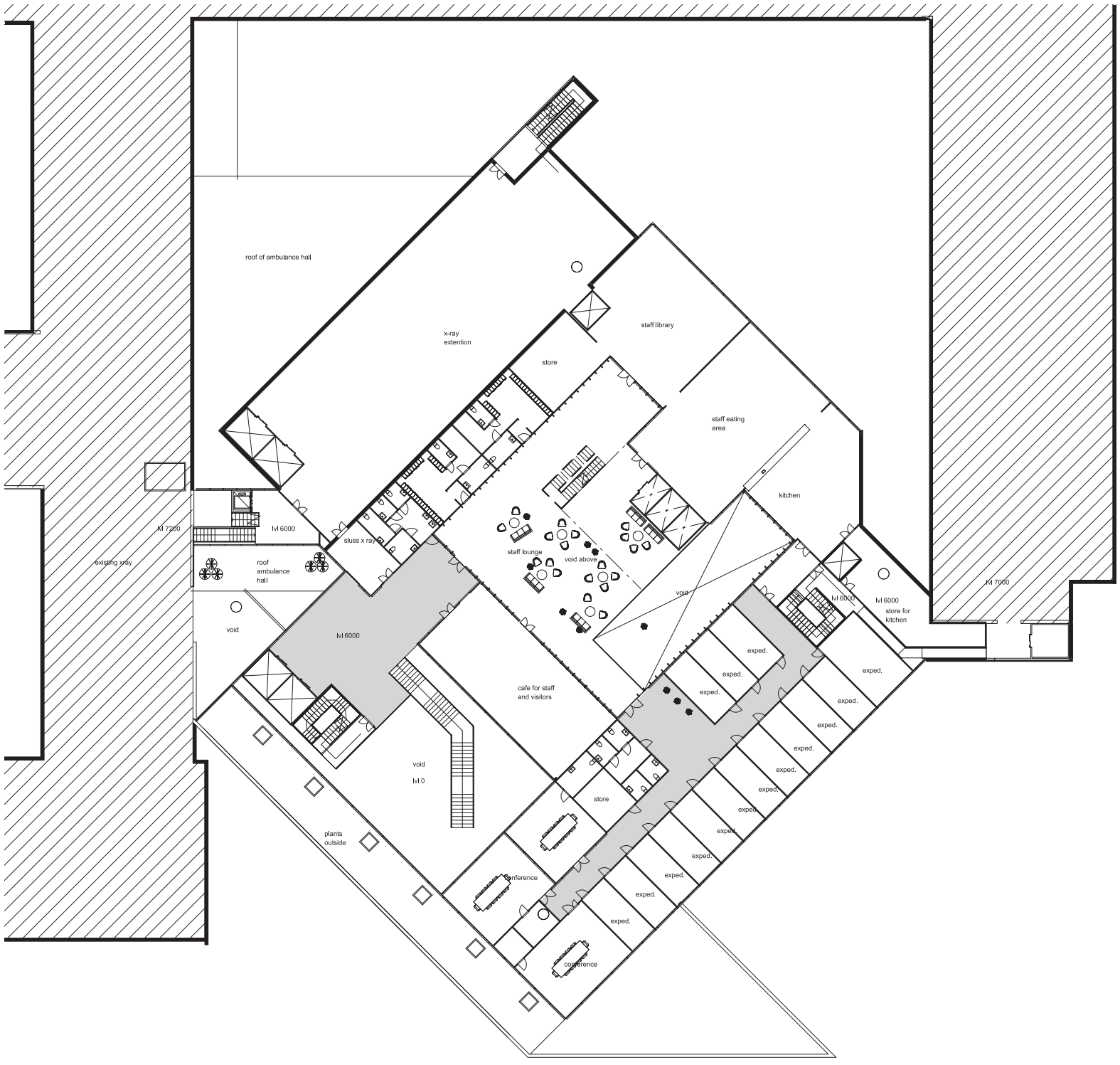
8 café

10 staff fika

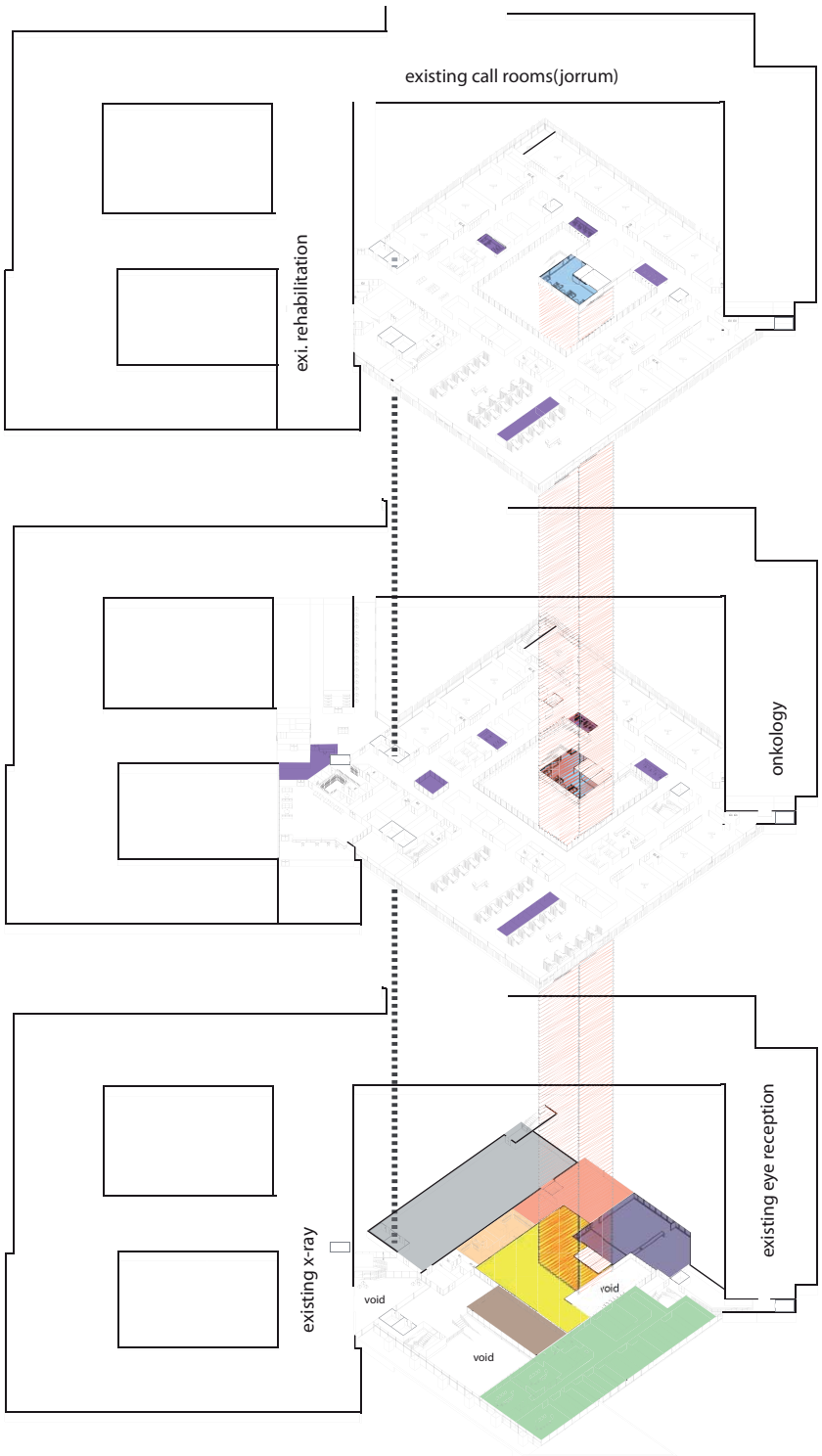
12 ambulance hall



Plan 2


roof of ambulance hall
x-ray
extention
staff library
store
staff eating
area
kitchen
lvl 7200
lvl 6000
sluss x ray
staff lounge
void above
existing xray
roof
ambulance
hall
void
lvl 6000
void
lvl 6000
store for
kitchen
lvl 7000
exped.
cafe for staff
and visitors
void
lvl 0
store
plants
outside
conference
conference

Staff Circulation



staff library

staff eating

single room doctors

doctors/nurse lounge

staff/public cafe

staff changing rooms

extention of x-ray

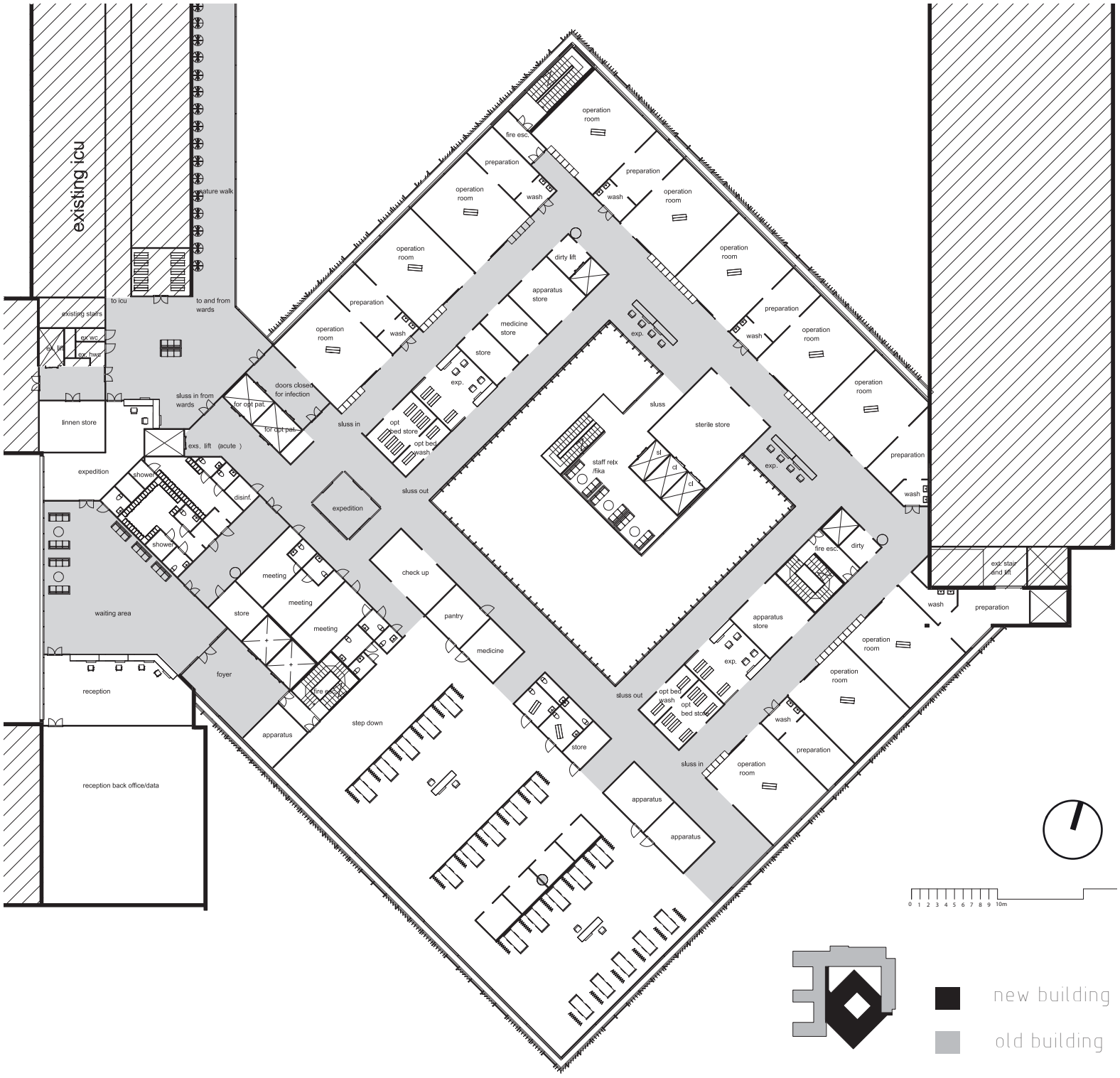
expedition

staff fika

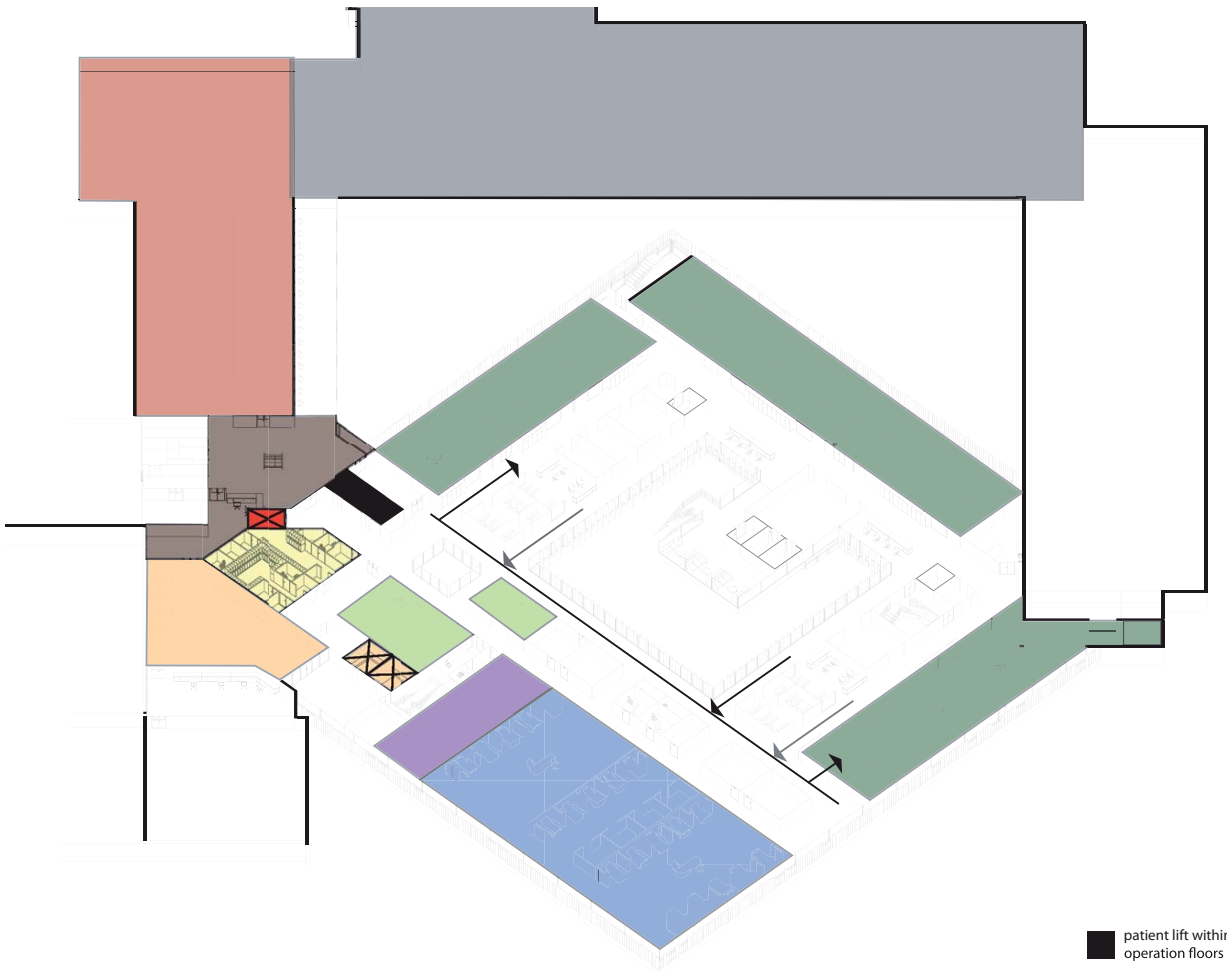
vertical circulation staff within operation and staff floor

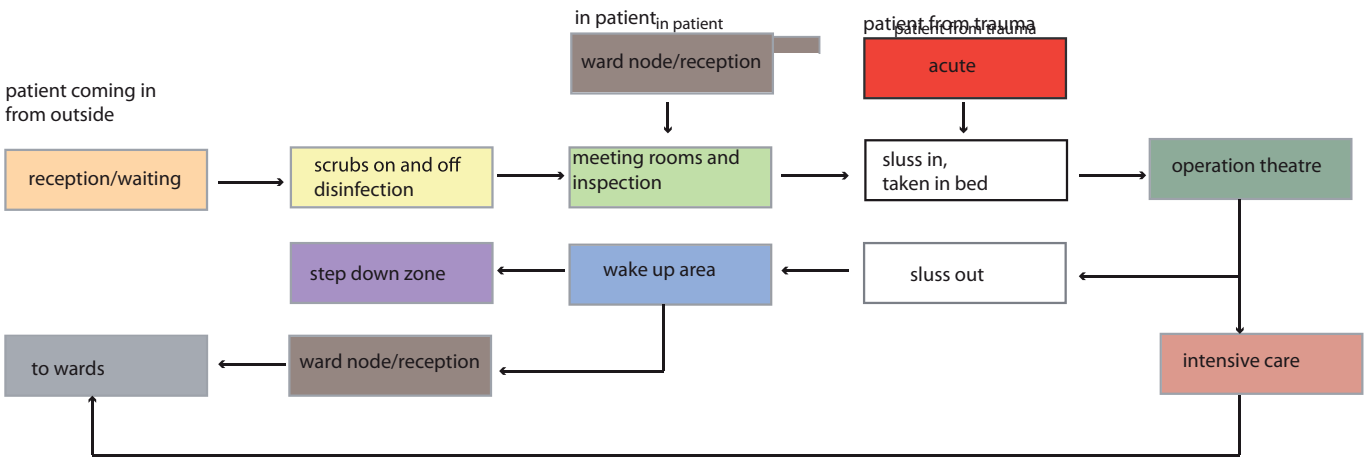
vertical circulation x-ray

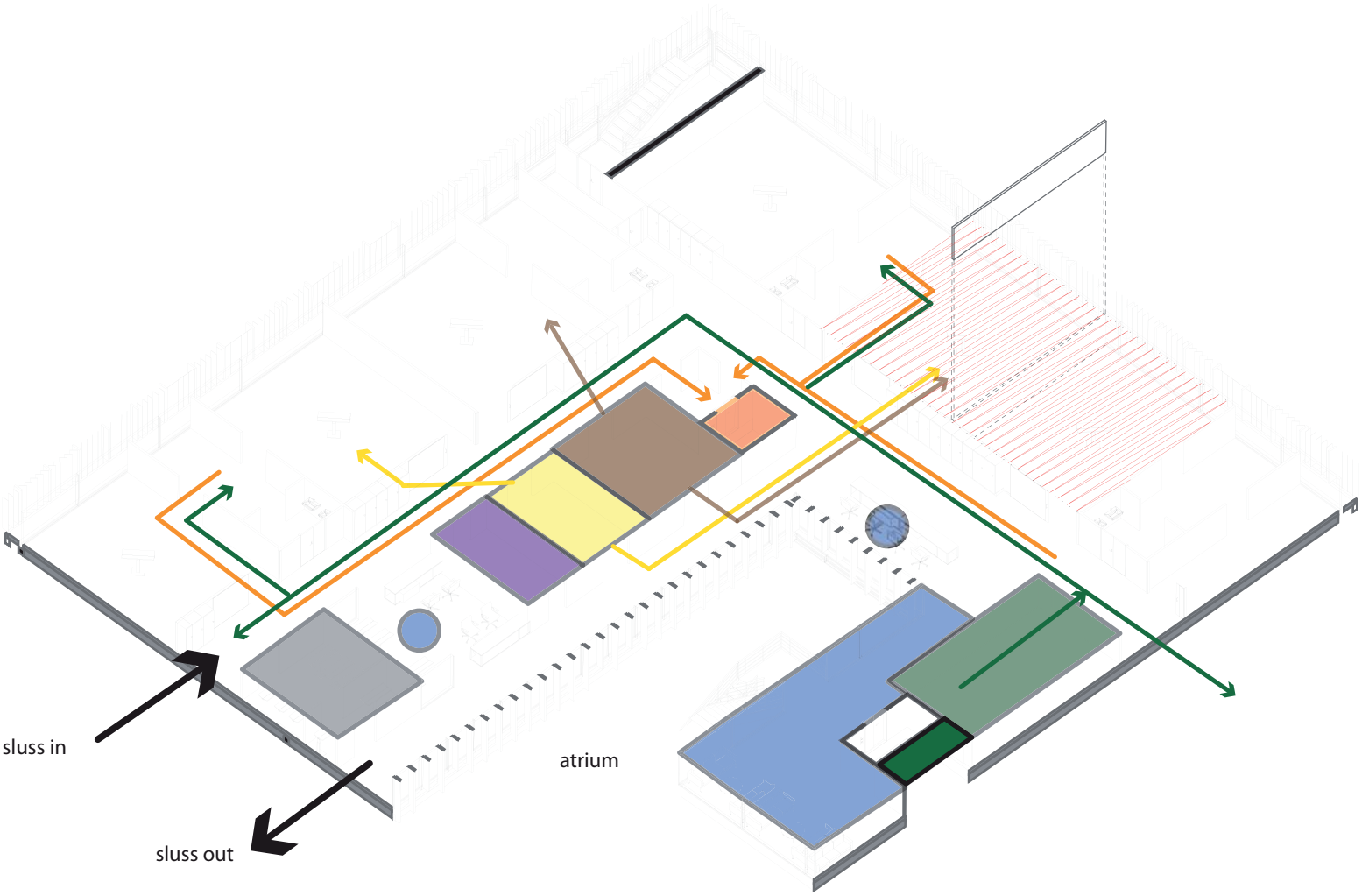
Plan 3


existing icu
nature walk
to icu
to and from wards
existing stairs
ex. wc
ex. lift
ex. hwc
sluss in from wards
doors closed for infection
for opt pat.
for opt pat.
linnen store
exs. lift (acute)
expedition
shower
shower
disinf.
waiting area
meeting
meeting
meeting
store
foyer
reception
reception back office/data
fire esc.
step down
apparatus
expedition
sluss in
sluss out
check up
pantry
medicine
store
operation room
preparation
wash
operation room
preparation
wash
operation room
preparation
wash
operation room
preparation
wash
operation room
dirty lift
apparatus store
medicine store
store
exp.
opt bed store
opt bed wash
sluss
sterile store
staff relx /fika
sl
cl
cl
exp.
fire esc.
dirty
apparatus store
exp.
opt bed wash
opt bed store
sluss out
sluss in
operation room
operation room
wash
preparation
operation room
apparatus
apparatus
ext. stair and lift
wash
preparation
preparation
wash
0 1 2 3 4 5 6 7 8 9 10m
new building
old building

Operation Flows







bed cleaning and storage

storage

medicine store

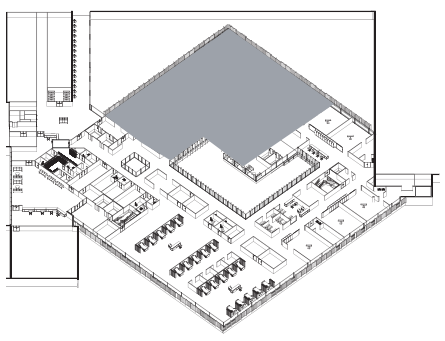
apparatus store

dirty lift

clean sterile storage

staff

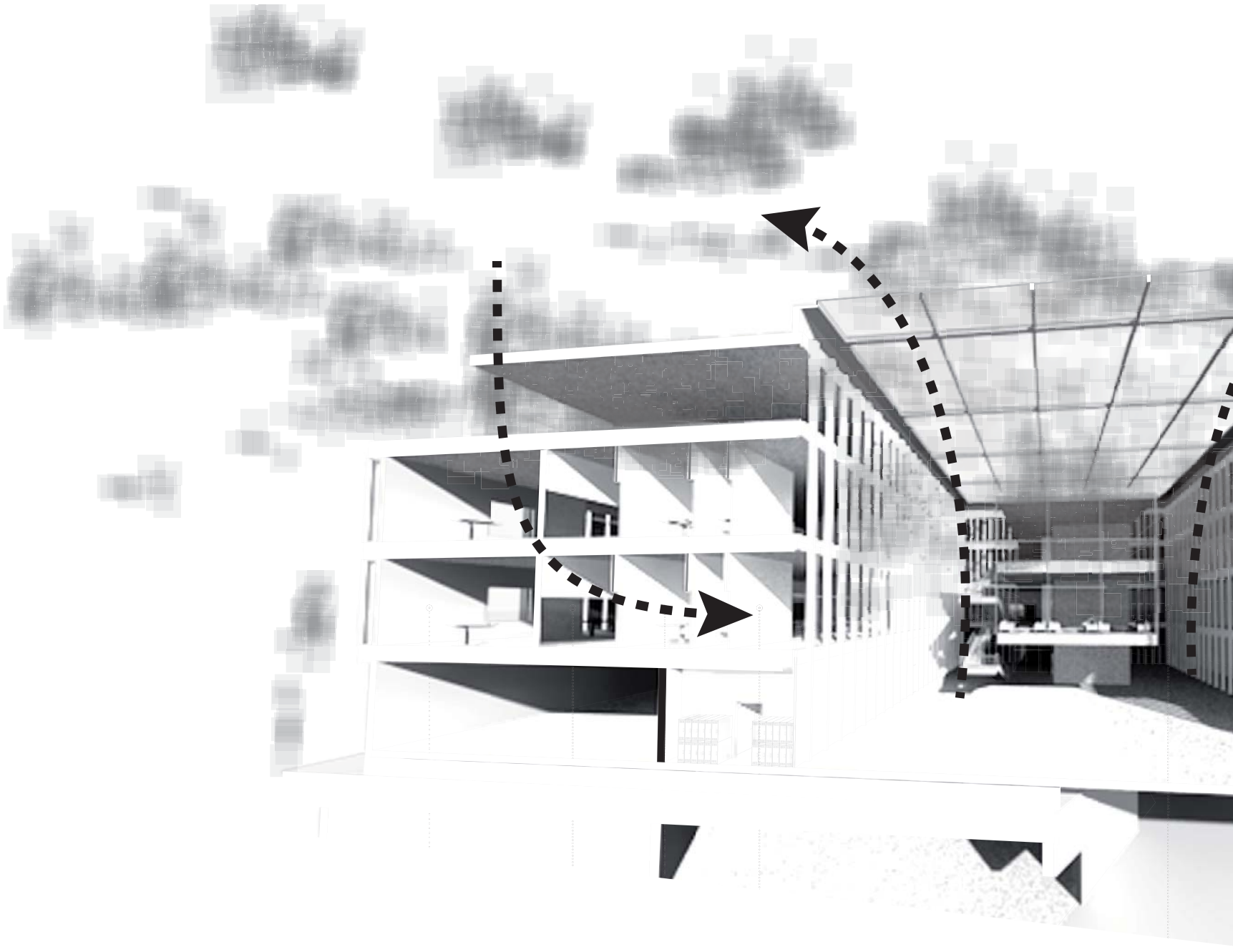
hybrid-if needen in future



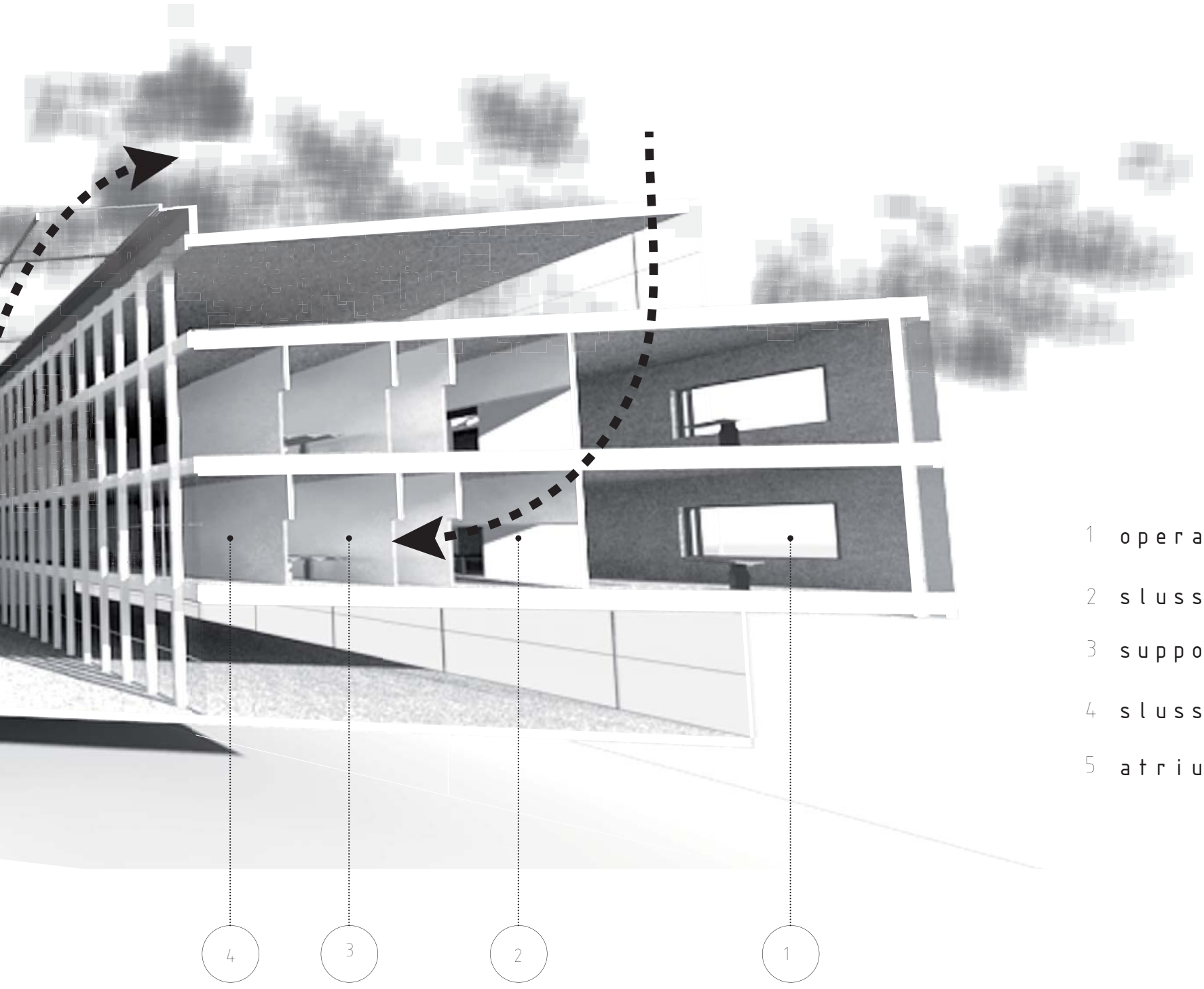
Waking Up

view of the wake up area with view towards nature and controllable facade to control light

Waking Up



1 2 3 4 5



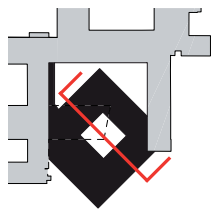
1 operation room

2 sluss in

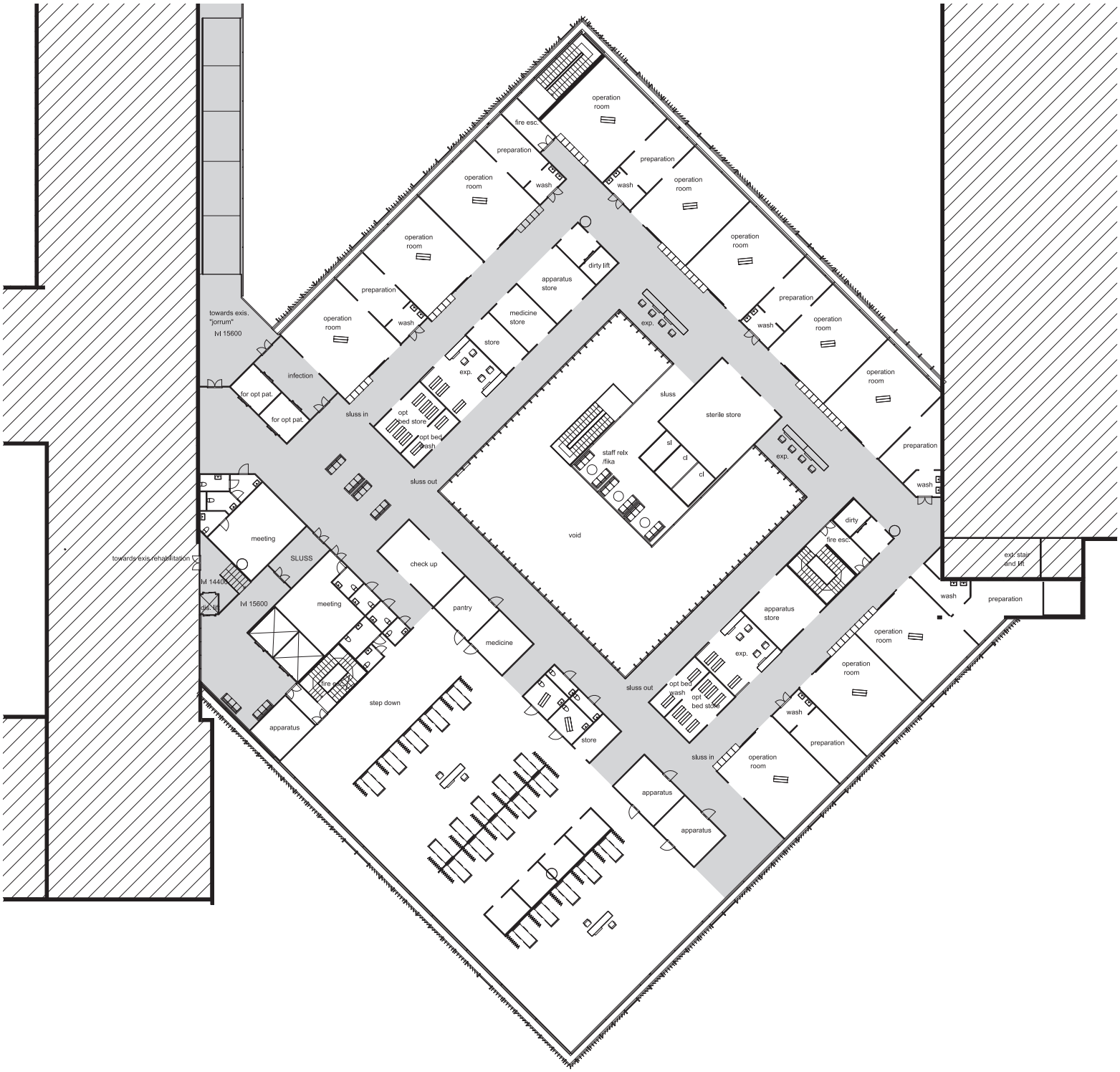
3 support rooms

4 sluss out

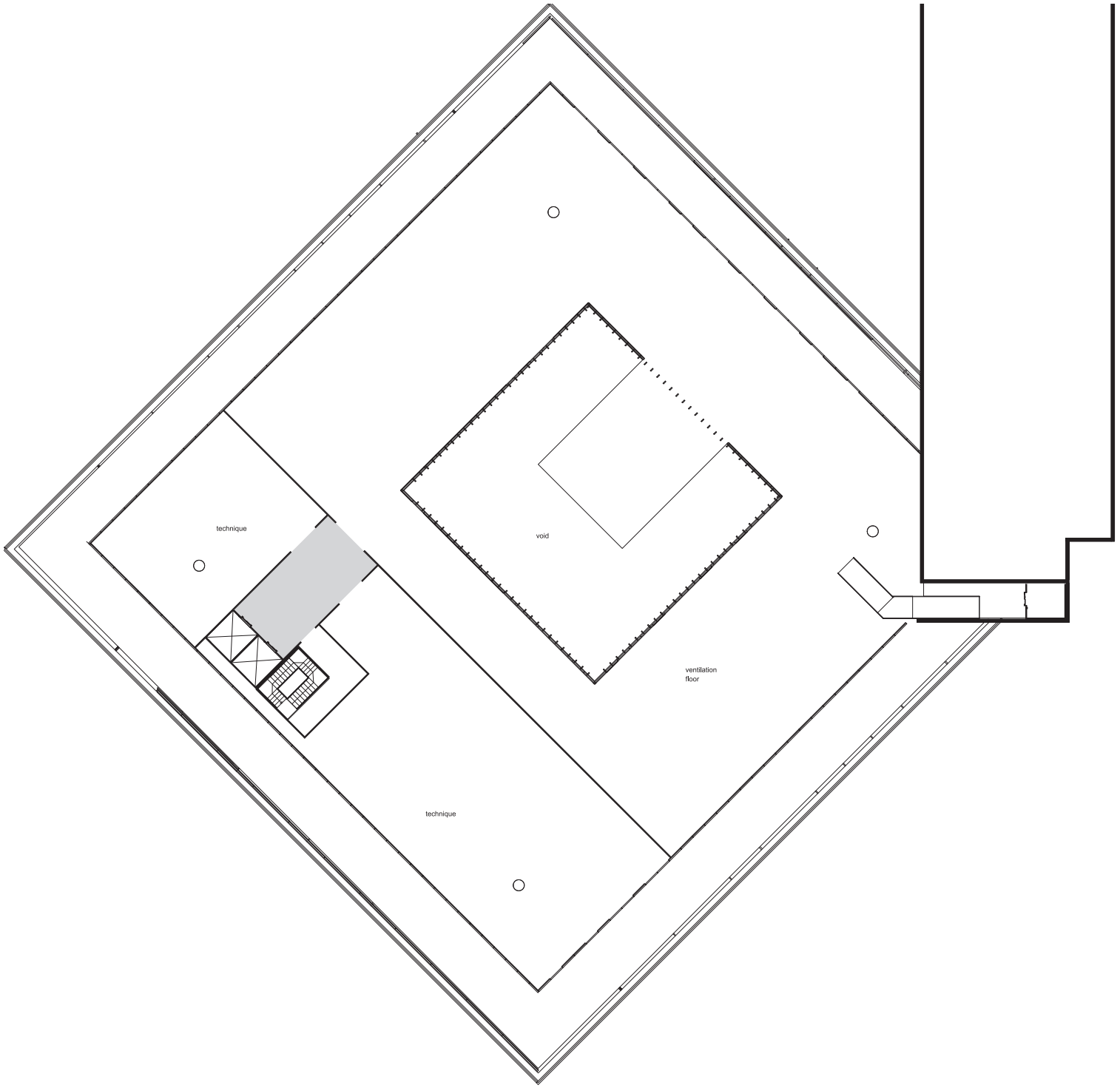
5 atrium



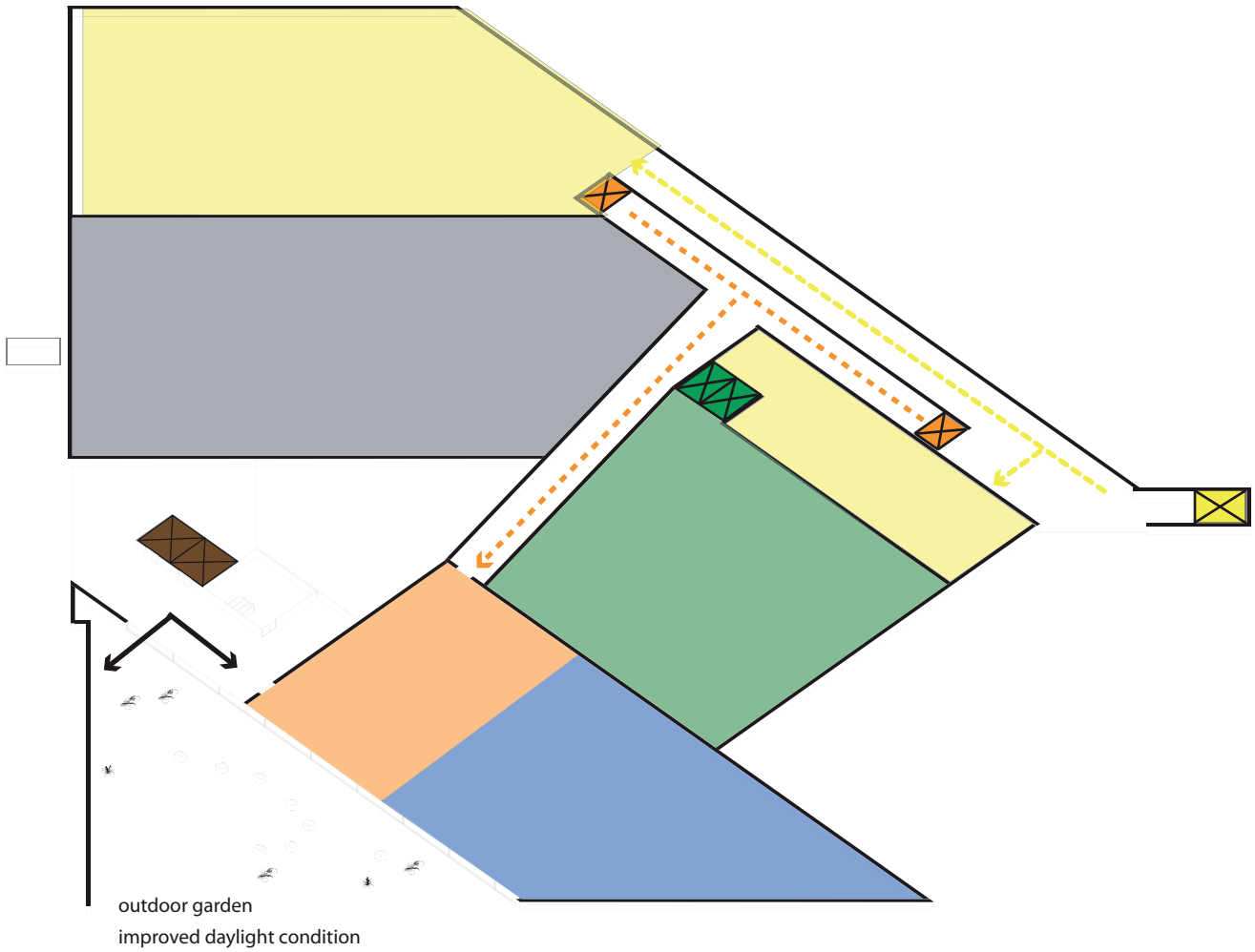
Plan 4

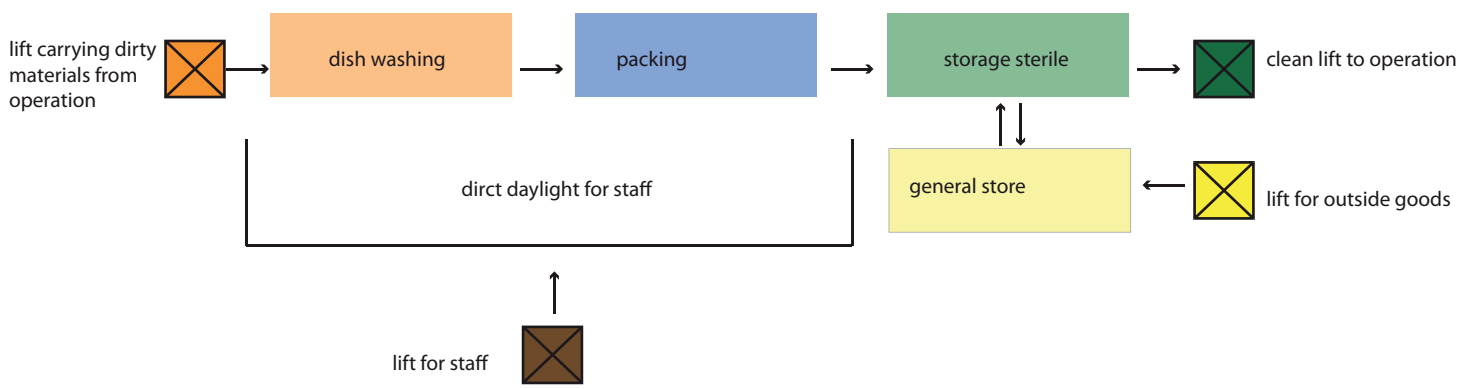

operation room
fire esc.
preparation
operation room
wash
operation room
preparation
operation room
wash
operation room
dirty lift
apparatus store
preparation
operation room
wash
medicine store
exp.
store
towards exis. "jorrum"
lvl 15600
infection
for opt pat.
for opt pat.
sluss in
opt bed store
opt bed wash
exp.
sluss
sterile store
staff relx /fika
sl
cl
cl
exp.
preparation
wash
sluss out
void
dirty
fire esc.
ext. stair and lift
towards exis. rehabilitation
lvl 14400
lvl 15600
dirty lift
meeting
SLUSS
meeting
check up
pantry
medicine
wash
preparation
apparatus store
exp.
operation room
operation room
fire esc.
step down
sluss out
opt bed wash
opt bed store
wash
preparation
apparatus
store
sluss in
operation room
apparatus
apparatus

Plan 5

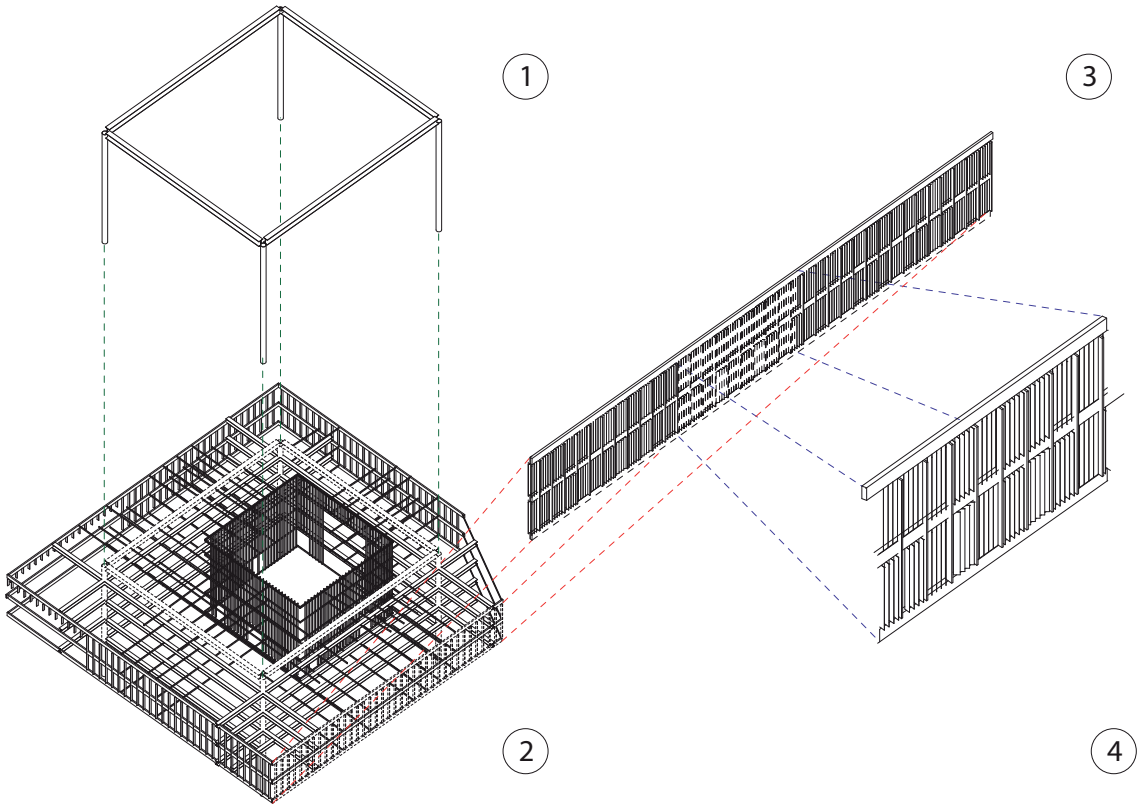


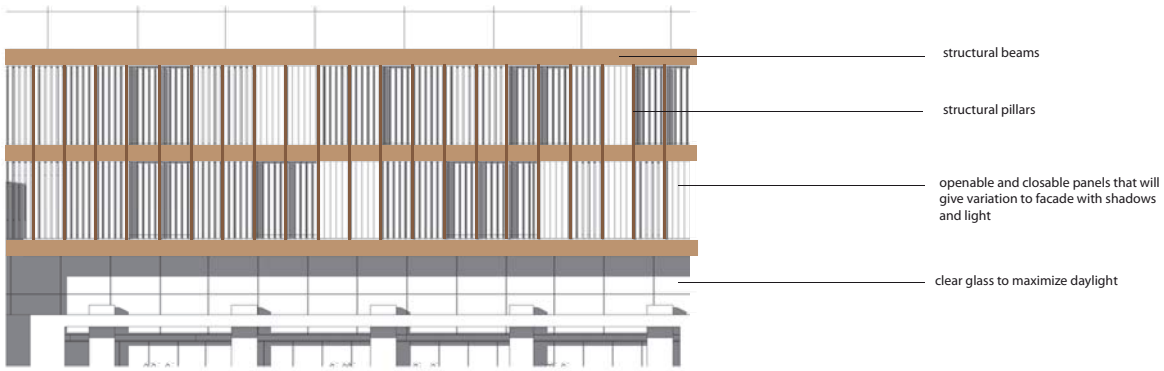
Plan 0: Sterile





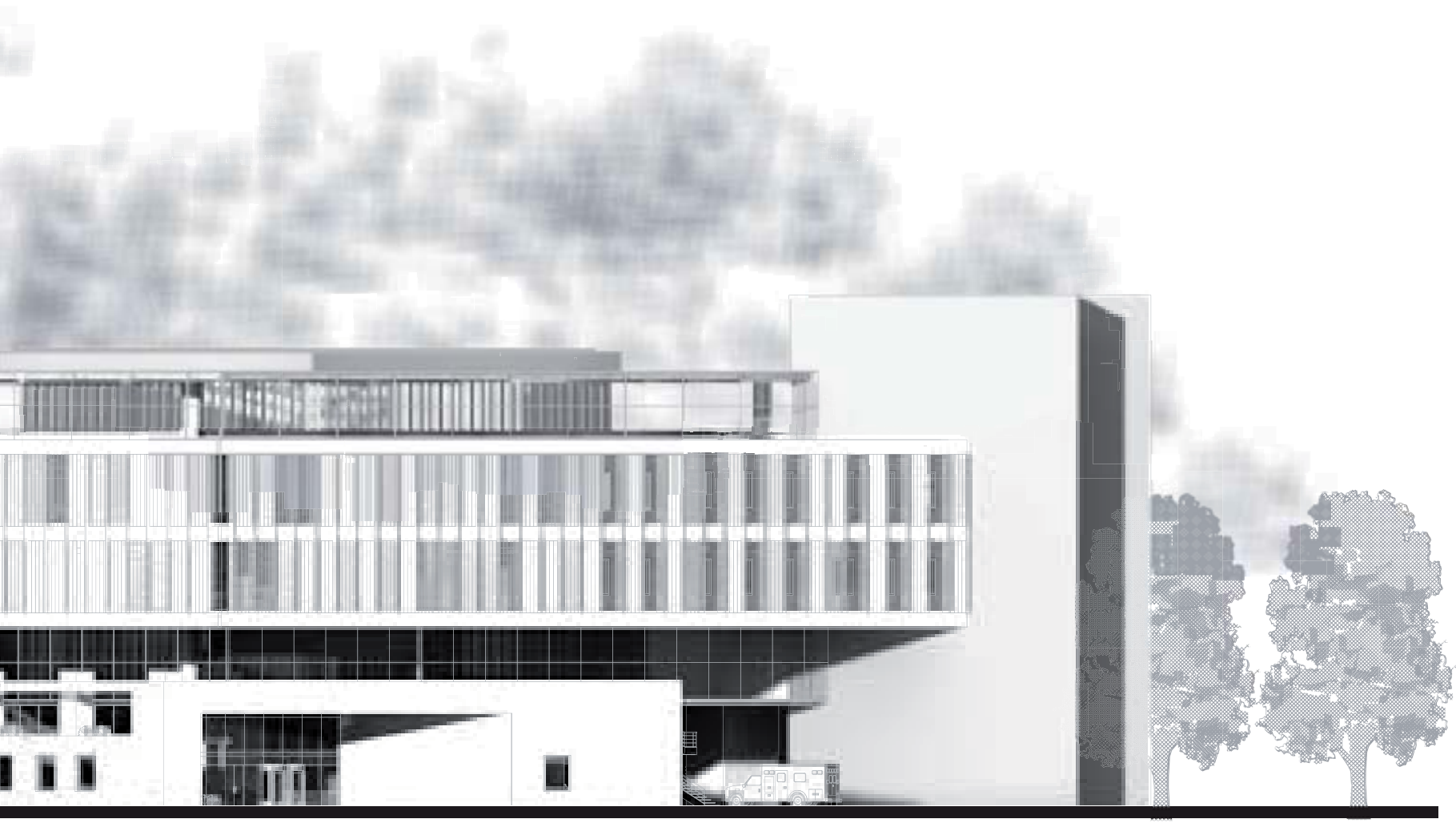
Facade





facade system

south facade




AMBULANCE

Overview

THE BEGINNING

" Every new beginning comes from some other beginning's end. "... Seneca