CARE FOR CHANGE

A design proposal exploring convertibility between
wards and outpatient departments

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CHALMERS
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ABSTRACT

Buildings last for decades. Healthcare change constantly. A contradiction in time which tend to entail costly and extensive reconstructions in hospitals. Planning for changes can prolong the lifespan of buildings in a sustainable manner by means of construction reuse and reduce the use of new materials. This forms the point of departure for this master's thesis project.

This thesis addresses the future-proof approaches flexibility and generality in a case at Hallands Sjukhus Varberg. Within a short time, the hospital requires a permanent evacuation building during renovation, interchanging wards and outpatient departments. The existing hospital was built with elasticity, however, with full occupancy, this new proposal will be situated at one of the few remaining spaces in the hospital area. As one of the most dynamic sectors, the building will last in an unknown future. Hence, in a longer time perspective, it is of importance to future-proof for uncertainties by proposing a structure that enables changing conditions. Planning for generality and flexibility will create robustness of the hospital overall.

Through a combined research for design and by design approach, the purpose of this thesis is to develop a design proposal of a permanent evacuation building to Hallands Sjukhus Varberg. The aim is to through design explorations, literature studies, interviews and relevant case studies find solutions that address generality and flexibility to hold wards and outpatients functions, with minimal interventions in the building design. Simultaneously, the architecture should support an environment for wellbeing and recovery.

Sustainability is consequently addressed from various directions; at an initial stage, it acts as an evacuation building to enable continued use of the existing hospital. The second stage is to extend the life of the evacuation building itself, by proposing a structure that enables and allows for changing conditions and thus reduces the need for future new construction.

The outcome of the thesis shows that wards and outpatient departments have several commonalities. Which, when identified, can reduce the need for reconstruction when converting between them and thus being more resource efficient.

Keywords: *flexibility, generality, outpatient department, ward, healthcare architecture*

THANKS TO

Lin
Louise
All interviewed
Family and friends
Ann-Britt

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Since attending the healthcare studios, I have come to an understanding of the complexity of designing healthcare facilities. It incorporates dealing with a great variety of perspectives and intersection of knowledge. Adding another layer, healthcare is one of the most dynamic sectors making the aspect of change particularly prominent. This complexity and possibility to affect people is what is making me interested in healthcare architecture.

EDUCATION AND EXPERIENCE

Architecture and Urban Design, Msc Program — 2021 – 2019
Chalmers University of Technology

Residential healthcare	Dementia village, Kungsbacka
Architectural heritage and transformation	Museum of modern art, Gothenburg
Healthcare architecture	High-tech university hospital, Lund

Property Management Department, Summer internship — 2019
City of Gothenburg

Degree of Bachelor of fine Arts in Architecture — 2019 – 2016
Umeå University

Degree of Bachelor of Science in Political Sciences — 2016 – 2013
with a major in Public Administration
University of Gothenburg

”

”because the only certainty
in health care is change”

- Gressel & Hilands, 2008, fifth paragraph

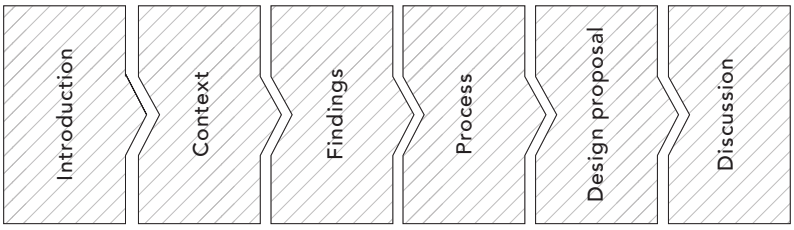
CONTENTS

READING INSTRUCTIONS

THESIS STRUCTURE

The layout of this thesis consists of six chapters and should be read as a spread. Each introduction page describes the contents of the upcoming chapter. It starts with an introduction, describing the project background, research question, its purpose, how it has been conducted and its limitations. The following second part processes the context, thus information about the existing hospital, introducing the site and its relation to the city. The third part describes the theoretical research, reference projects and interview summary. This chapter ends with a conclusion of the principles to be implemented in the design phase. The fourth chapter introduces the brief and program in detail, followed by an analysis of commonalities, a volume study and the concept. Chapter five presents the outcome of a design proposal, including analyses and explanations. The thesis ends with a concluding discussion.

Illustrations and images are produced by the author if not marked differently.



VOCABULARY

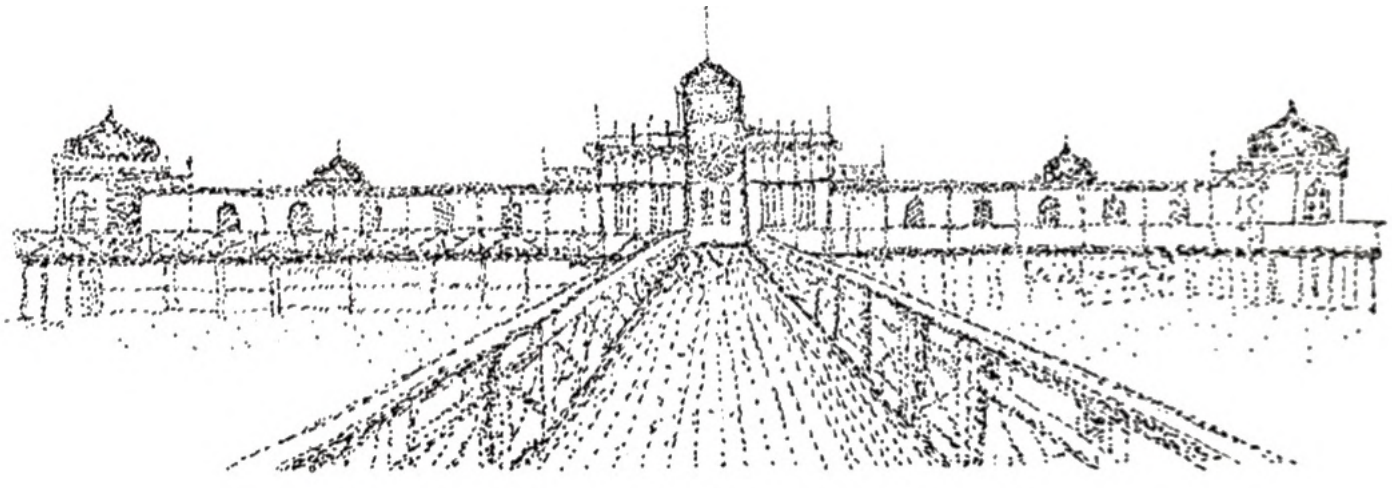
DEFINITIONS

There are a great variety of concepts related to future-proofing (Karlsson, 2019). A vocabulary is presented below to get a coherent understanding of the chosen approach when reading the thesis. The definitions are interpreted from Swedish literature (Andrén, 2008; Montgomery, 2014; Karlsson, 2019).

Flexibility	implies an easily changeable building that enables varying use. The building change with changing activities.
Generality	implies a constant building that enables varying use. The building does not change during changed activities. In practical means, this implies identifying commonalities or to have the most demanding activity form the basis. Generality can be implemented at different layers of the building. Here it comes, therefore, to identify which parts can be general and which needs to be flexible.
Elasticity	implies expanding or decreasing borders of the building, either internal or external.
Redundancy	refers in this thesis to duplicate functions or systems.
Future-proofing	is a general concept of the terms that all describe how to approach a changing future. Includes, for instance, generality, flexibility and elasticity (Karlsson, 2019).
Ward	for in-patient care in, in Swedish *vårdavdelning*.
Outpatient department	the care in outpatient departments is conducted during the day, which implies that the main flow of patients arrives from outside of the hospital, in Swedish *mottagning*.

01

INTRODUCTION



[Kallbadhuset Varberg]

CHAPTER ONE

This chapter introduces the project background, the question of research, the purpose and aim of the thesis, how it has been conducted, the limitations and focus of the study.

PROJECT BACKGROUND

WHY

This thesis project was initiated by a practical case at Hallands sjukhus Varberg. Originally built in 1972, several of the buildings at the hospital area are today in need of extensive renovations. The prognosis implies another seven years of use. As the hospital is fully occupied, it needs to be expanded. The immediate need is an evacuation building to hold the programme of two wards, two outpatient departments or one of each, in the same period (C.Olsson, personal communication, 29 Oct 2020). An evacuation building is of importance since it implies reduced disturbances in operational activities, as it could proceed during the time of renovation. For the same reason, it enables renovation (Andrén, 2008).

There is also an identified but unspecified need for further use. The healthcare sector is dynamic, creating unknown conditions for the future. Simultaneously, buildings last for decades. As the building will last in an unknown future it is of importance to plan for changes (Karlsson, 2019).

This is particularly prominent in the current pandemic situation where the lack of care places complicates the work in healthcare.

Using the resources already existing is an important part of achieving sustainable development. Adaptability alines with the conception that the existing building is the most sustainable (Schmidt & Austin, 2016). Planning for changes can prolong the lifespan of buildings in a sustainable manner through construction reuse and reduce the use of new materials. By implementing a high degree of generality within the building, the number of reconstructions can decrease. In these buildings, the general level of reconstructions is five per cent yearly. In healthcare facilities with low generality, the level of reconstruction is in general 15 per cent. If a building is designed for the current need, it will soon be outdated as activities change at a faster speed. This will catalyze reconstructions and it is therefore essential to consider the long-term use of buildings (Andrén, 2008). Having buffer space that can easily be adjusted to several activities, creates robustness for the hospital.

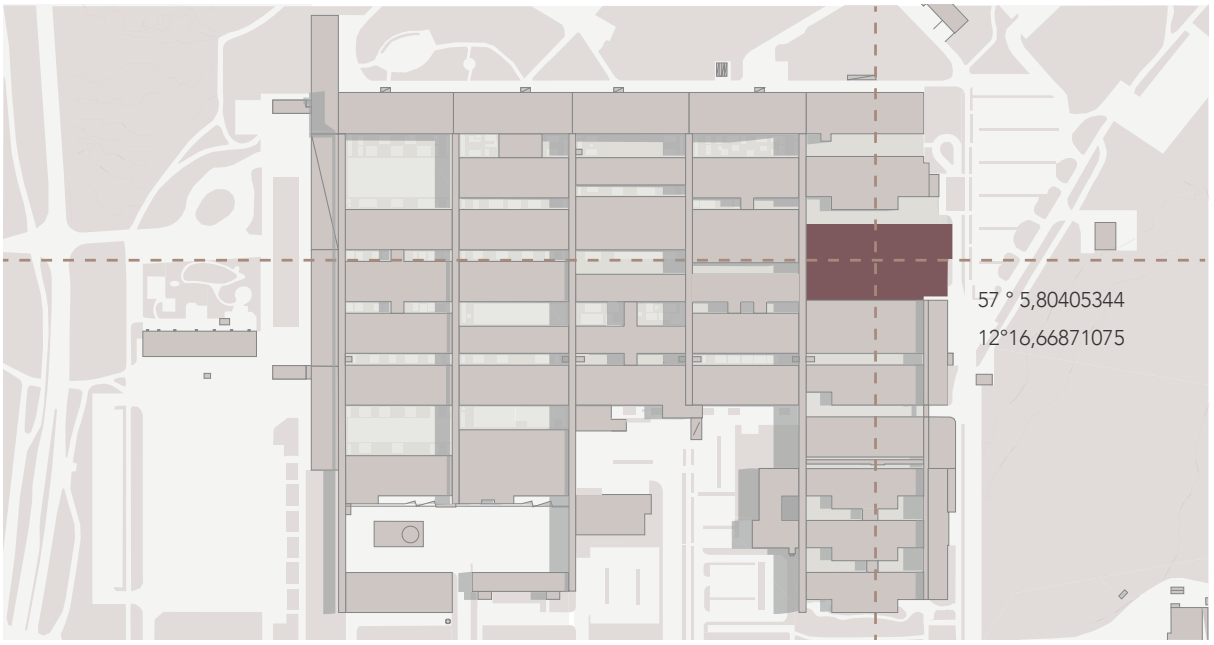


Figure 1. Site for expansion.
Illustration by author based on drawing provided from Region Halland.

RESEARCH QUESTION

How can a hospital extension be designed for convertibility between wards and outpatient departments?

PURPOSE AND AIM

DESIGN PROPOSAL

The purpose of this thesis is to explore how a hospital building can be planned for convertibility between wards and outpatient departments through the implementation of generality and flexibility. The aim of the outcome is a design proposal to enable change with minimal interventions in the building design and simultaneously providing an environment for wellbeing and recovery.

Hopefully, the outcome of this thesis will act as an example of how to design for convertibility between wards and outpatient departments, which can be applied in designing evacuation buildings. It will hopefully as well contribute with design suggestions to the stakeholders at Hallands Sjukhus Varberg.

METHODOLOGY AND PROCESS

HOW

This thesis is based on a combined research for design and by design approach. Design explorations are combined with literature studies, evidence-based design, interviews and case studies.

LITERATURE STUDIES

There are much existing literature presenting strategies for future-proofing. Also, there are several research-based planning publications from PTS forum, which can be used to understand the programme and regulations.

INTERVIEWS

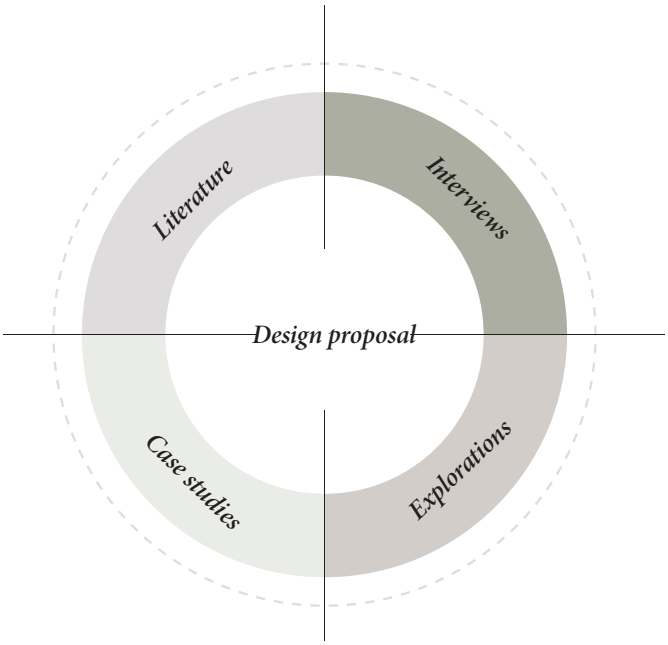
The purpose of the interviews is mainly to deepen the understanding and inform the hospital project, of needs and preconditions. Interviews is a qualitative method used to get personal input of perceptions and experience and could be used as a tool to "verify and humanize" data (Hanington & Martin, 2012). Interviews have been conducted with the construction project manager from the real estate organization, two function planners and two architects that are involved in reconstruction projects of the hospital. There has also been made two interviews with stakeholders at other hospitals as case studies. The current pandemic situation has limited the possibility to interview staff from operational activities. Interviews have been made together with Louise Sivertsson.

CASE STUDIES

An additional method has been case studies of how future-proof strategies have been implemented in existing hospitals, architectural strategies for wellbeing and floorplan layouts of wards and outpatient departments, to find similarities and differences thereof. The method is used to understand and gain knowledge of one or multiple aspects, to receive information or for comparison (Ibid).

EXPLORATIONS

One important method has been iterations of different aspects by the use of digital models, sketches and diagrams. Several of these are found in the appendix.



DELIMITATIONS

It is important to observe the specific conditions of each hospital project when applying principles of future-proofing (Andrén, 2008). This means that the found strategies will be evaluated to the desired outcomes and prerequisites of Hallands sjukhus Varberg and of this thesis. When it comes to future-proofing, costs are often the obstruction. The task is therefore to optimize rather than aiming for functionality in all future scenarios (Ibid). Emphasis will hence merely be on strategies adequate to the specific context, project and aims for optimization instead of maximization.

Change can further appear at different levels, the approach will since be building-related and not emphasise changes of organizational or operational character. The thesis will further not focus on economy, politics or technical installations.

The new hospital addition will be planned for activities not including high technological equipment. As stated in the report Fullt flexibelt (Andrén, 2008), it should be taken into consideration to separate heavy and light activities when planning for flexibility. High technology care requires specific measurements and which in turn implies over dimensions for the lighter. This means higher costs and energy demands.

THESIS FOCUS

APPROACH

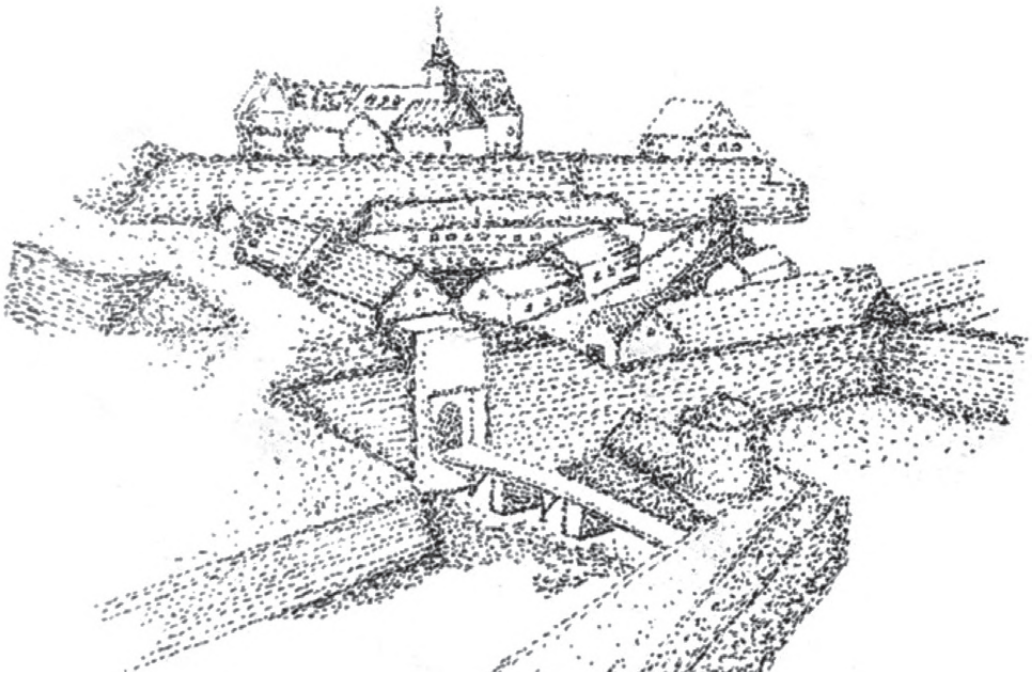
The focus of this thesis will be on flexibility and generality to find differences, commonalities and identify what stays fixed and what needs to be flexible in wards and outpatient departments. The priority will therefore be on these two functions, which may limit other aspects as it is a large field of topic. Other future-proof strategies may be implemented in the project, but are not in focus. It will further examine how the physical environment can support wellbeing and recovery.

As the access to evacuation premises creates robustness for the hospital, the position has been made that the building will stay as a healthcare building after the primary use.

This thesis is based on a real case, in which the needs and wishes of the stakeholders involved will form a basis. However, adjustments and changes have been made in both the programme and focus to match the aim and purpose of this thesis.

02

CONTEXT



[Varbergs fästning]

CHAPTER TWO

This chapter presents the existing hospital, the surroundings, internal flows, site photographs and existing plans of one ward and one outpatient department.

HALLANDS SJUKHUS VARBERG

ABOUT THE HOSPITAL

Hallands Sjukhus consists of three hospitals in Kungsbacka, Halmstad and Varberg. The hospital in Varberg is an emergency hospital with a delivery department (Region Halland, 2020). The hospital was completed in 1972 and has around 88 000 doctor visits per year (Region Halland, 2011). Outpatient clinics are situated in low widespread buildings connected by corridors, while wards are placed in a six-storey high building at the eastern part of the hospital area.

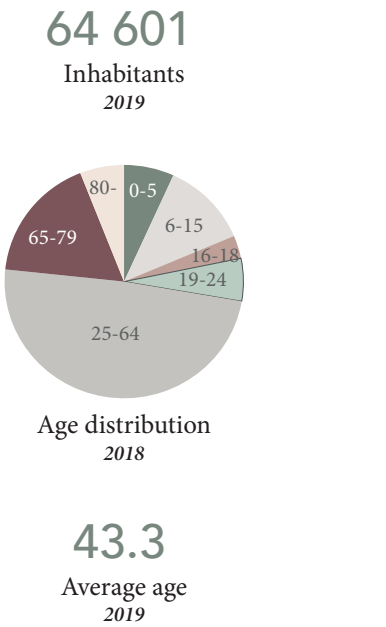


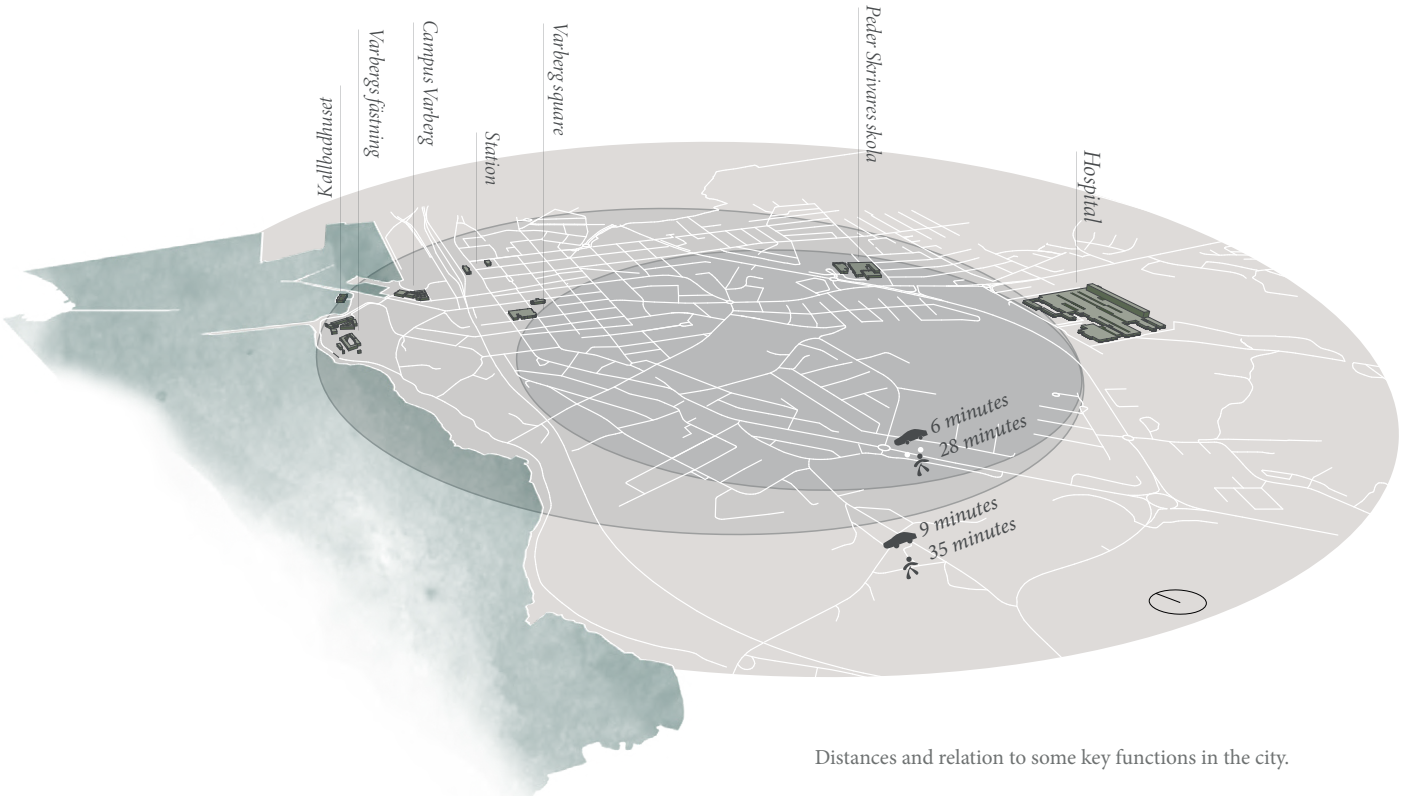
Figure 2. Varberg in numbers. (SCB, u.å.)

Figure 3. Hospitals in Halland.

Figure 4. Stakeholders. (Region Halland, 2019.)

RELATION TO THE CITY

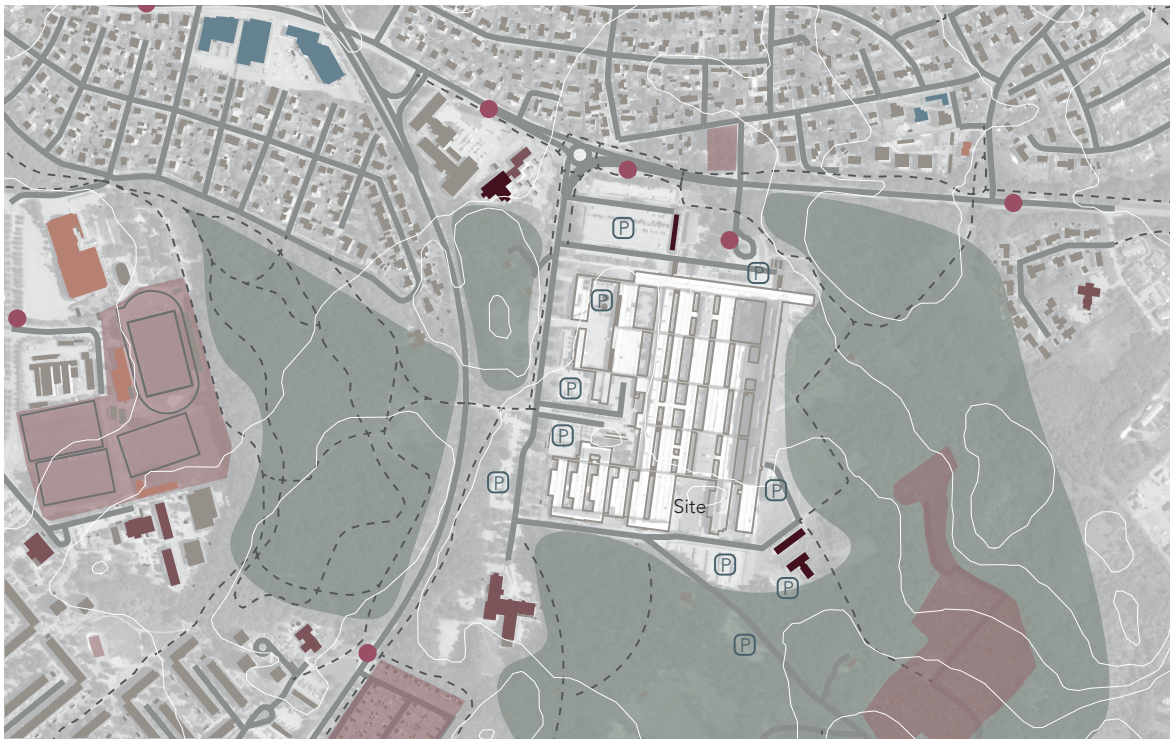
VARBERGS STAD



Distances and relation to some key functions in the city.

SITE ANALYSIS

RELATION TO CONTEXT



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Hospital
Hospital buildings
Schools / Preschool
Green areas
Pedestrians and walking
Roads
Leisure
Store
Recreational and allotment
Parking
Bus




Photos of the existing hospital.

SITE PHOTOGRAPHS

Photo taken from the south-eastern part of the site.

Photos taken from the south-western part of the site.

LEARNING FROM THE PAST

Built from 1964 to 1972, Hallands sjukhus Varberg is an example of the healthcare architecture ideals of the time. A spatial division into zones, modules implementation of generality and flexibility for thoughts of the future characterized the hospitals (Fröst, 2019). Today, many of these buildings are in need of renovation, as is the driver for change in this project.

In the original plan of the hospital area, there was space left for future expansion. The site is located in one of these remaining spaces. The hospital is based on type rooms and a modular system of 7.2 meters with a pillar-beam structure. The width of the buildings are dimensioned by 9 times 7.2 meters and the depth varies from 2 to 4 times 7.2 meters. Windows are placed on row to allow for changing conditions. Installations, for example, ventilation and electricity are placed in the corridors outside of the buildings (Varberg Lasarett Originalskrift, 1972).

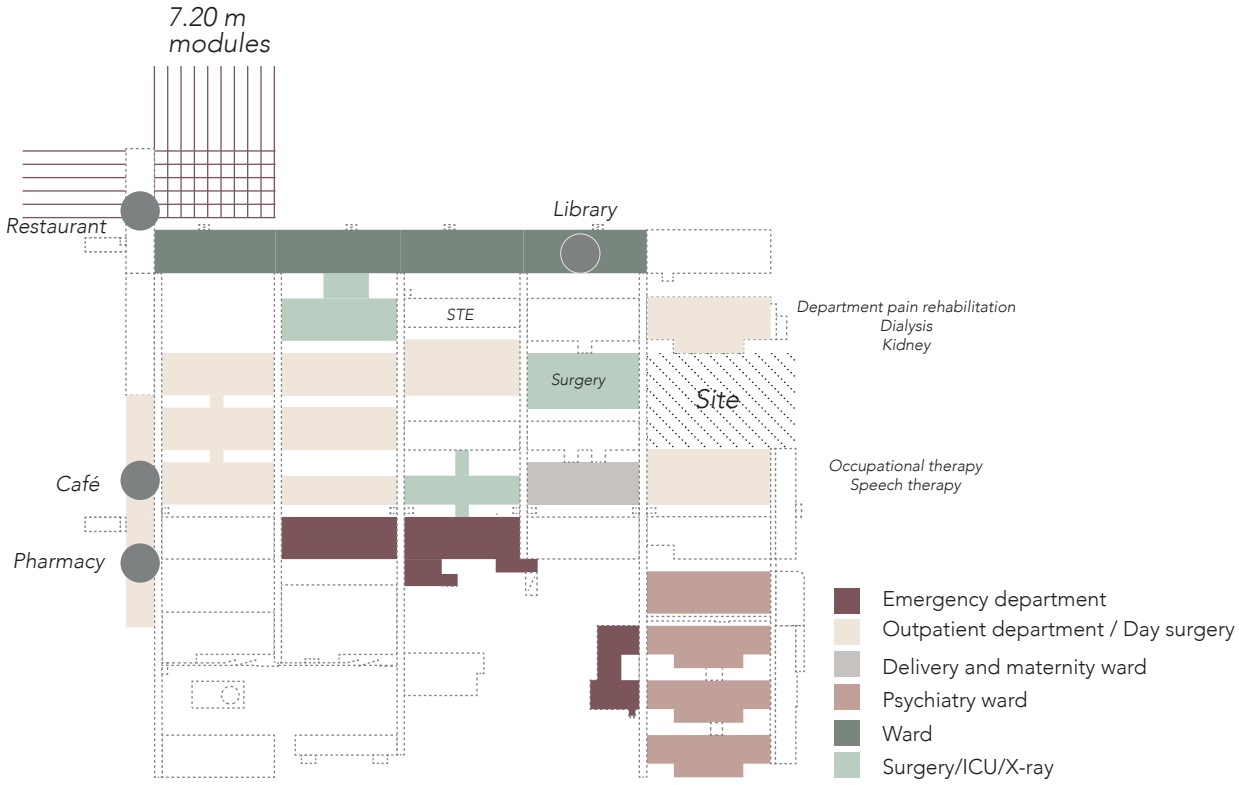


Figure 5. The structure and zoning within the hospital.

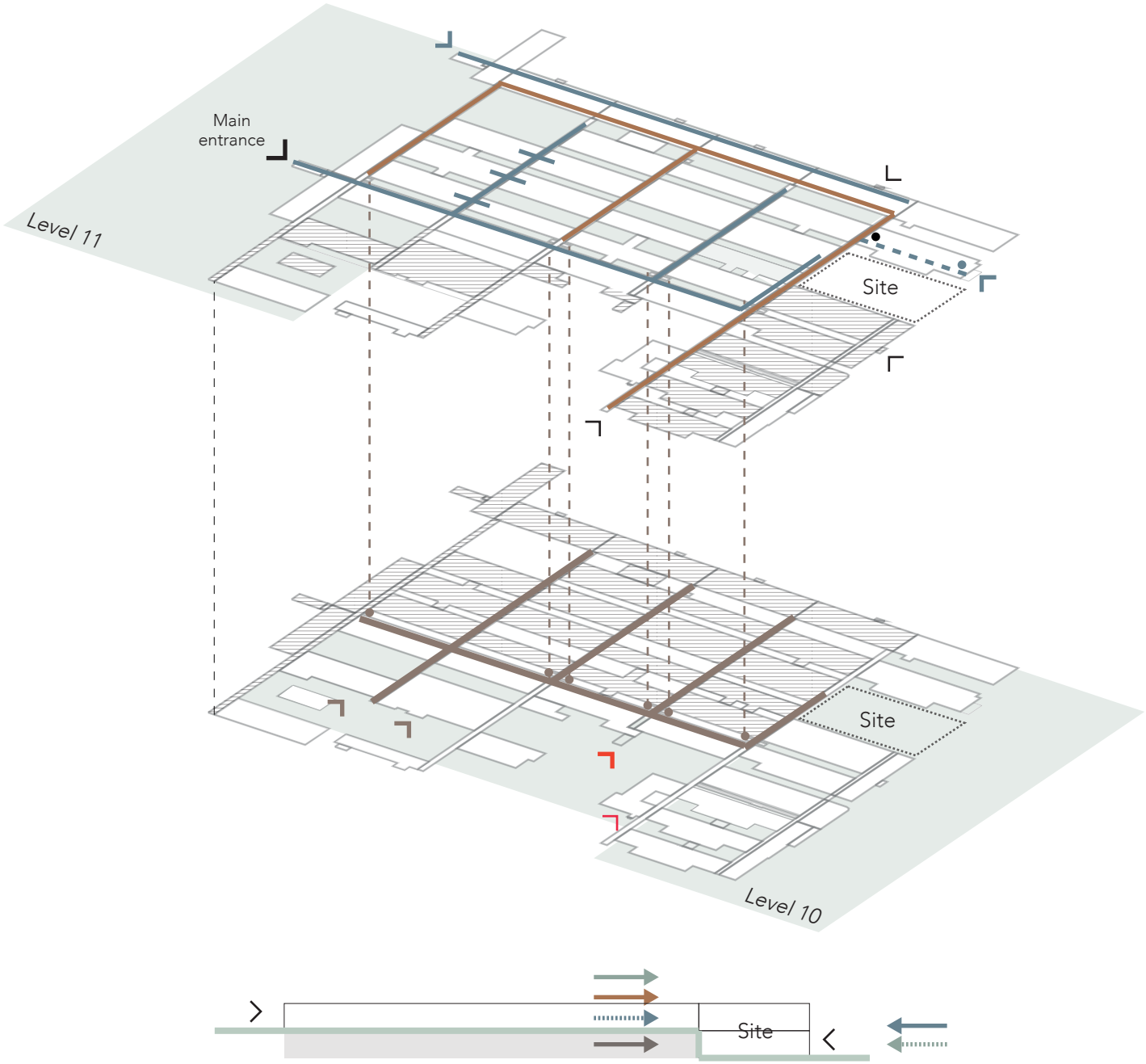


Figure 6. Diagrammatic section.

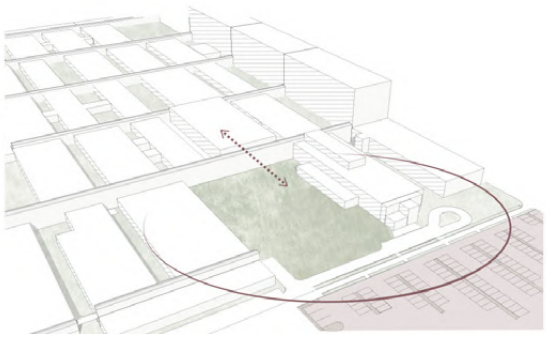
Outpatient/visitor
Staff
Goods
Patients in bed

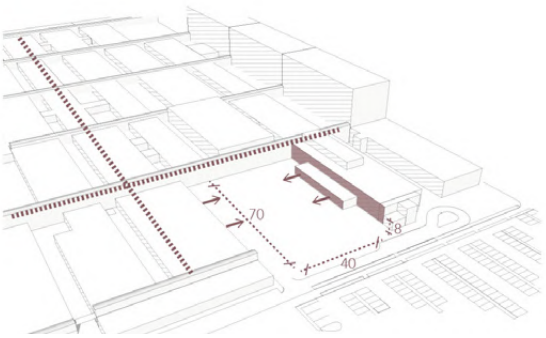
The hospital is in a souterrain position, which implies that the entrance floor of the main buildings will be the first floor in the evacuation building which limits the culvert system.

Figure 7. Internal flows (Varberg Lasarett Originalskrift, 1972).

The appendix includes an explanation of how the flow separation has been handled.

SWOT ANALYSIS





STRENGHTS

The site is facing south which creates good daylight possibilities and few shadows from surrounding buildings.

Close access to nature.

The site is well integrated with the existing hospital which creates efficient flows. There is a good media supply of electricity, heat, cooling and water in the connected building.

Good communication possibilities with bus and parking opportunities.

Adjacent buildings are general and flexible which means that adjustments can be made. The existing grid system has worked well over time.

No nearby heavy-traffic roads.

WEAKNESSES

Insights

The narrow site is surrounded by windows which decreases the integrity of patients

Scale

The measurements of the site create limitations.

Detailed development plan

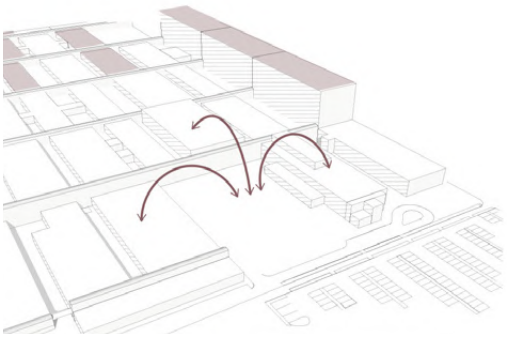
The hospital has been identified as a culturally and historically valuable building of regional interest and should be kept. There is no current legal restriction but it could be protected when a new detailed development plan is developed. This will create height restrictions on the site to eight meters (Riksantikvarieämbetet, 2009).

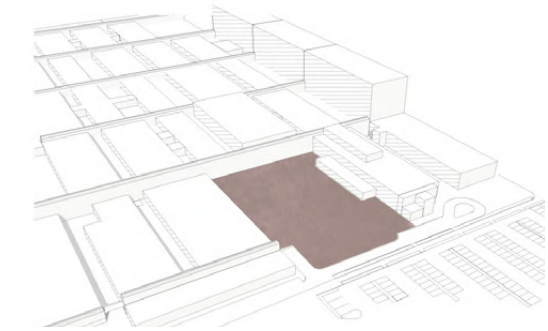
Long distances and flows

Long internal corridors in the existing hospital create long distances to other functions. Flows are also hard to separate.

Height restrictions

The existing building to which the new extension will connect is limited in height, which will limit technical installation possibilities.





OPPORTUNITIES

An evacuation building enables the renovation of the existing hospital and thereby creates robustness.

Implementing flexibility allows the hospital to quickly meet new circumstances, in the event of, for example, a pandemic.

There is a need for premises, a possibility for many future uses.

THREATHS

Removed qualities

Adding a building to the site removes a green area and outlooks from surrounding buildings.

A rapid rate of change in the healthcare sector.

Specific measurements of functions related to wards and outpatient departments and vertical connections can imply large investments to remodel

There is uncertainty about the future of the hospital.

The hospital area is soon fully occupied which limits future expansion. One scenario is for the hospital to move.

EXISTING PLANS

ANALYSIS OF OUTPATIENT DEPARTMENT

Medicine Department

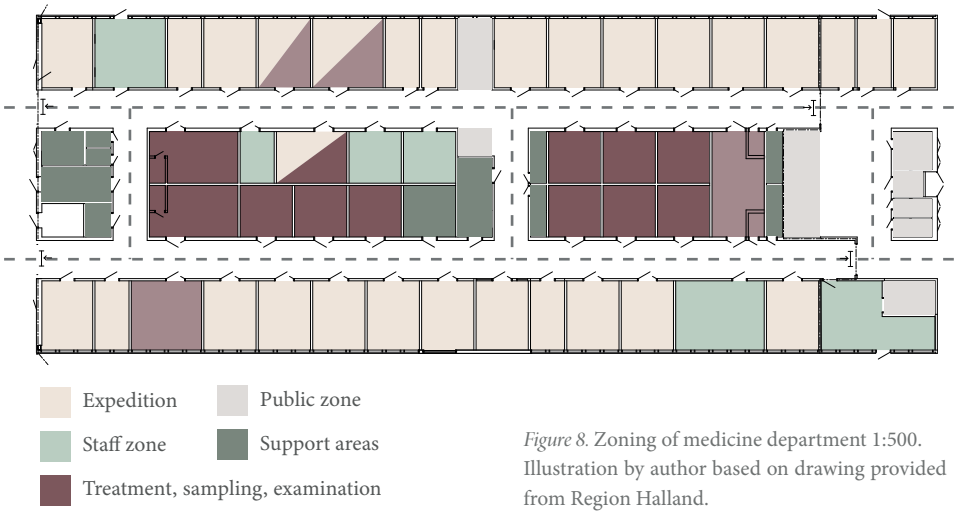


Figure 8. Zoning of medicine department 1:500. Illustration by author based on drawing provided from Region Halland.

PROS

General rooms enable relocations.

Dubble corridor shortens the distance.

Support areas are centrally located.

Space for relatives or language interpreter in examination rooms.

Separating the examination room and expedition avoids a scenario when the examination room is occupied for administration.

Clear patient zone and wayfinding.

CONS

No daylight in examination rooms. Few views to surroundings.

No larger common administration areas for sharing of knowledge.

Insight between buildings.

EXISTING PLANS

ANALYSIS OF WARD

Ward

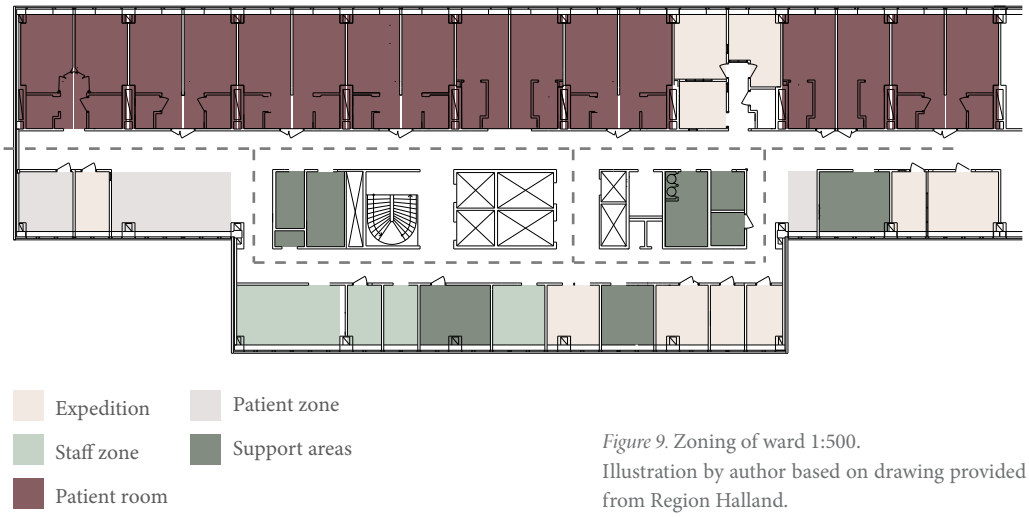


Figure 9. Zoning of ward 1:500.
Illustration by author based on drawing provided from Region Halland.

PROS

Support areas are centrally located.

Elevators are centrally located.

Clear wayfinding.

Green views and no external outdoor insight into patient rooms.

CONS

Few single-patient rooms.

Long distances to the day room from several patient rooms.

No overview of the patient rooms from the corridor or team station.

No RWCs in the patient rooms.

03

FINDINGS

[Stadshotellet Varberg]

CHAPTER THREE

This chapter introduces a theoretical background to the project, explaining the different building layers, the chosen focus within the field of future-proofing and evidence-based design principles for wellbeing and recovery. It thereafter presents the case studies and two interview summaries. The chapter ends with the design strategies brought into the design process.

LAYER SEPARATION

THE FREQUENCY OF CHANGE

Often mentioned in the discourse of change is the building viewed as a set of layers. Perceived in a time perspective, these components are caused by change at different time spans (Brand, 1997). Brand separates the site, skin, structure, services, space plan and stuff.

Stuff

Is viewed as the most dynamic layer. This category includes, for instance, furniture. Change can appear on a daily basis for up to a month.

Space plan

The space plan includes things connected to the interiors and is durable for 3 up to 30 years. This includes flooring, partition walls, doors and ceiling.

Services

In the services category positions for example vertical communication systems and technical systems which usually last 7 to 15 years before they change.

Skin

The skin layer has a lifespan of up to 20 years and refers to the façade.

Structure

Lasting in 30-300 years is the structure, which means the loadbearing elements such as slabs and pillars.

Site

The least dynamic layer is the site which is viewed as eternal (Ibid).

The more independent and separate the layers are, the more adaptable is the building. If the layers are interconnected, there will be more costs and restrains to adapt one layer. However, it is important to notice that one change at a lower hierarchical layer can fasten change in a more lasting layer. This could be illustrated in an example where procurement of new technical equipment, stuff, entails that the floor needs to be raised due to installation, space plan (Brand, 1997). The layer relation must be considered for the specific project, regarding expectancy, complexity, organization and uncertainty (Schmidt & Austin, 2016).

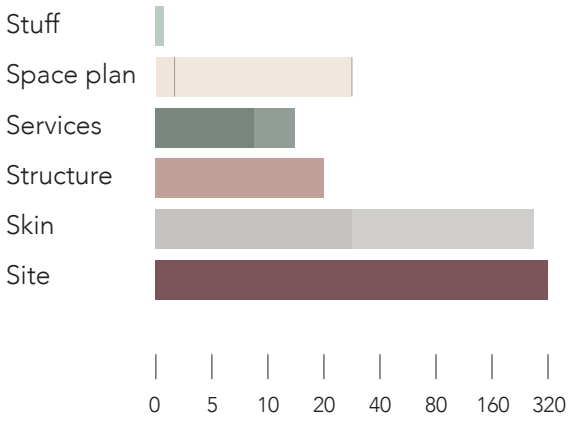


Figure 10. Different lifespans of the layers.

CONVERTIBILITY

GENERALITY AND FLEXIBILITY

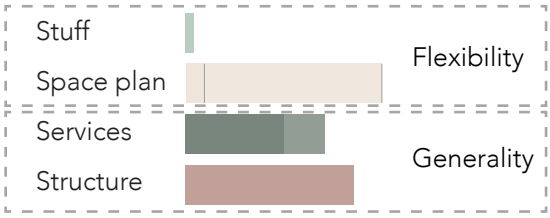
As the lifespan of buildings differs from the lifespan of activities inside, strategies to meet the future needs to be implemented in the planning process (Montgomery, 2014). There are a large number of tactics and strategies of future-proofing and further also a variety of meanings (Karlsson, 2019). This thesis will focus on convertibility which means "the ability to convert the environment to new uses" (Pati et al., 2008, p.205f). In specific, it addresses generality and flexibility as strategies for finding a durable structure to manage change between wards and outpatient departments.

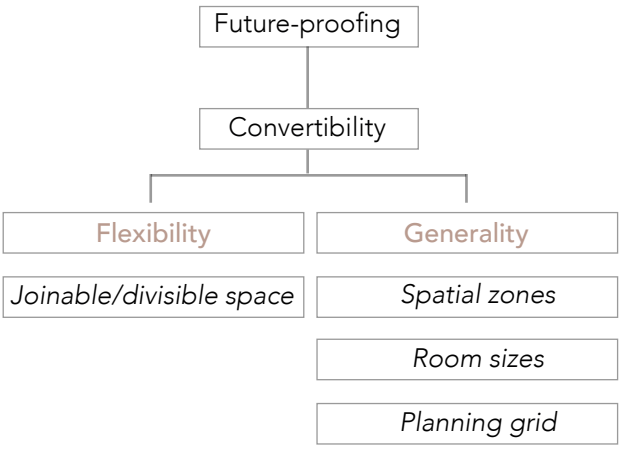
Generality implies that there are no changes made to the building when the internal activities change. It should therefore be implemented in the more costly and fixed building layers as services and structure (Montgomery, 2014). By further clustering these into spatial zones ease the change in other spaces (Schmidt & Austin, 2016). Room sizes, grid, the position of fixed services and heights, as examples, are dimensioned according to the most demanding activity. The activities can therefore change without any need for reconstruction (Andrén, 2008). Schmidt & Austin (2016) further discusses the balance between standardized room sizes and rooms of various sizes and characteristics. While general sizes enable relocations, does a variety of spaces support several activities. Having a balanced mixture of the two is the key.

Flexibility means that there can be made minor changes to the building to suit the needs of the activities. This should then be applied to the layers space plan and stuff where changes occur more often (Montgomery, 2014; Andrén, 2008). Flexibility could be to remodel the internal partition walls to join or divide space (Schmidt & Austin, 2016).

"Generality provides flexibility for the function"

(Fröst et al, 2016, p. 50, my translation)





WELLBEING

A PLACE FOR RECOVERY

The role of architecture as a means for patient wellbeing and recovery is today of increasing focus (Andrén, 2008). Research has shown that architectural design has an impact on the wellbeing and recovery of patients. In the publication "Evidensbas för våderns arkitektur 1.0" it is listed several design features evidenced to have positive impacts (Ulrich, 2013). There are also biophilic principles contributing to increased wellbeing and decreased stress (Browning et al., 2014). A selection of these are presented below:

Single-patient rooms

Decreased risk of infections, Facilitates sanitation, Fewer transfers of the patient, Creates a quieter environment, Supports communication with staff, Creates integrity for the patient, Supports possibilities to meet relatives.

Shorter distances for staff

Long corridor distances between patient and support functions create less time for the care of the patient. This could be achieved by placing storage and work stations closer to the patient room.

Patient observation

To be able to observe the patient from the work station. Decreased falling-rates.

Daylight

Supports wellbeing, Patients feel less pain, Decreases depression, Increases the ability to sleep, Reduces stress.

Orientation and wayfinding

Disorientation can be associated with stress. Outdoor views and interior orientation marks can support wayfinding.

Implement positive distraction

Can reduce stress, pain and increase wellbeing. Implement views of nature, planned outdoor environment (Ulrich, 2013).

Visual connection with nature

Decreased stress. Planned outdoor environment, greenery, implement green walls, provide exercise opportunities outdoors, to be able to keep the visual connection sitting (Browning et al., 2014).

Material connection with nature

Use of natural colour scheme and materials as wood and stone (Browning et al., 2014).

REFERENCE PROJECTS

ASPECTS OF STUDY

The case studies are chosen based on recommendations during interviews or found in the literature. The projects will be studied based on the following criterias:

Hospital information

About the project
Year of completion
Location
Area

Healthcare typology

Local hospital *Specialist hospital* *Emergency hospital* *County hospital* *University hospital*

Project

Renovation *Extension* *Evacuation* *New construction*

Program

Ward *Outpatient department*

Implemented aspects of future-proofing

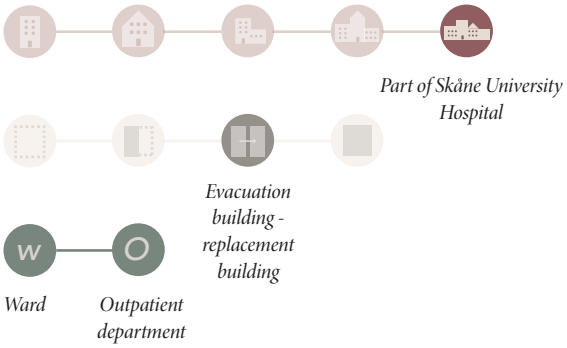
A selection

What I bring with me

ERSÄTTNINGSBYGGNAD 95

CASE STUDY

Year	2016
Location	Malmö Hospital area
Area	9 200 *[2 300 per floor]*



About the project

Ersättningsbyggnad 95 form one of the evacuation buildings during the transformation of the hospital area in Malmö. The program includes both outpatient departments and standard wards with 28 patient beds, single-and double- patient rooms combined. On one floor, the ward has a double corridor with a core of support areas and the outpatient department has a single corridor with examination rooms and expeditions mixed. A central courtyard provides good daylight conditions. The building was at an initial stage intended to consist of wooden or steel modules, which contributed to the height and width measurements. Due to several reasons, the building became a permanent structure (C. Spannel, personal communication, 9 Feb 2021).

Aspects of future-proofing

A tight time schedule and module measurements led to standardized rooms and repetition. Patient RWC is located in between the rooms which allow for the outpatient departments on the opposite side to place expeditions between examination rooms.

What I bring with me

The durability of the evacuation building. The generality, repetition and standardized measurement that allows for generality and flexibility.

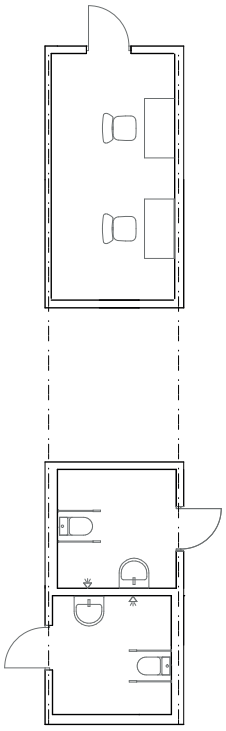
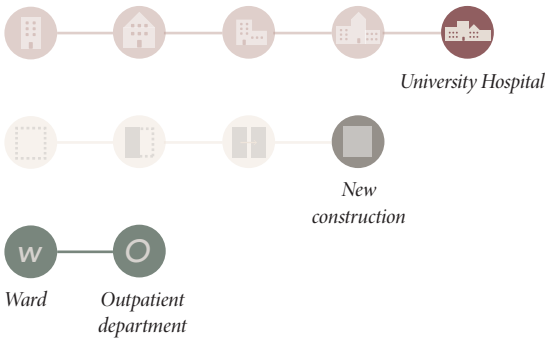


Figure 11. Expeditions have the same width as RWCs.

NYA KAROLINSKA SOLNA

CASE STUDY

Year	2018
Location	Stockholm, Solna
Area	330 000 sqm



About the project

Nya Karolinska Solna is a new high-tech university hospital of a large scale. Although the scale is a completely different scale than the hospital in Varberg, it nevertheless has qualities as a structural hospital to be studied. Principles of future-proofing are far-reaching and the implementation of general solutions has been one of the project goals (Stockholms läns landsting, 2007).

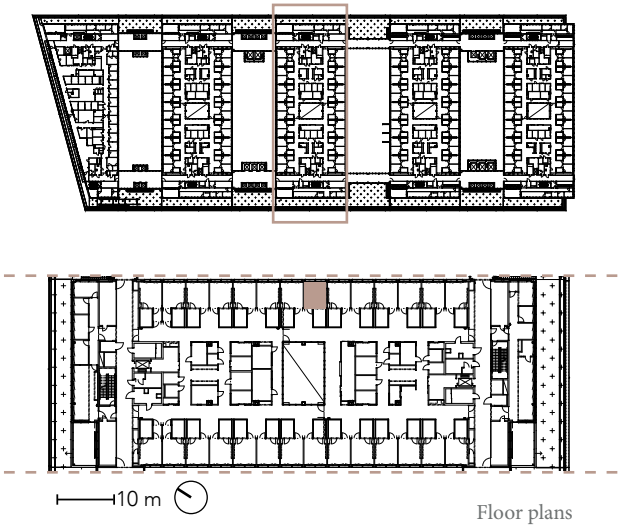
Aspects of future-proofing

The building is divided into life-span layers, in which the long-lasting support structure is designed to be general, allowing for different use. Parts that changes more often are designed to be flexible. The structure and dimensions are general which will result in flexible use. The most demanding high-tech care activities have set the dimensions throughout the building, which includes floor heights and load-bearing structure. Type rooms were used in the process for common and recurring rooms.

The premises consist of double corridors with a core of support functions. The grid is 9 x 12 meters, with a core of 12 meters and three meters wide corridors. It was set by patient rooms as well as operating theatres (Ibid).

What I bring with me

The use of type rooms, the general rooms to be able to change between functions, to set grid by patient rooms.



Floor plans
(Karlsson, 2019), adapted by author.

INTERVIEW SUMMARIES

Two interviews have been made with one architect and two project managers of other hospitals. The following summaries are extractions from answers to questions regarding future-proofing, important aspects in the design of healthcare facilities and reflections on convertibility between wards and outpatient departments.

Interview summary
Cecilia Spannel, Architect

To be able to convert the use between wards and outpatient departments it is of importance to find a suitable grid. Sometimes a grid can work for wards but can be less suitable in outpatient departments. In the project Ersättningsbyggnad 95, the grid was set according to the patient rooms.

It is also about finding the right depth of the building to gain daylight and create a mixture of support areas and activity areas. In single corridor systems, the corridors can become long. When designing healthcare facilities it is important to study flows, logistics, closeness, overviews, outlooks, hygiene, integrity for patients as well as for staff and to imagine yourself using the premises.

When it comes to implementing principles of future-proofing there needs to be a balance and to find a proper solution. Dimensioning for every possible scenario creates high costs for things that may not occur. Future-proofing could, for example, be about general measurements.

Kim Bergehed, Susanne Edström, Project managers
Framtidens US

Generality and flexibility must be evaluated in relation to cost. It is about finding the balance and to what degree the generality is reasonable, for instance in ceiling heights and in the load-bearing structure. There are further different levels of preparation. If there is no current need for, for instance, a piece of technical equipment, space could be prepared for future installation of it without any later larger reconstructions.

In the project of Linköping hospital, type rooms were made in wards, which means that different wards could use the same premises. It is about finding things that are repetitive and use that in the project to a far extent, it could be what you see when you enter the building or for instance staff areas.

Important aspects when planning Framtidens US, which is the new developments and reconstructions of Linköping University hospital, has been the principles of flows, patient safety, orientation, generality, sustainability and a holistic principle.

Grid
Set according to patient rooms

General measurements and rooms

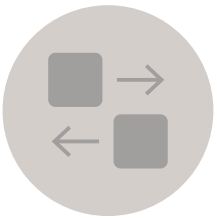
Prepare for future installations

Type rooms
Commonalities

DESIGN STRATEGIES

GOALS AND STRATEGIES

Future-proofing



Convertibility

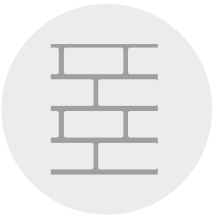
Spatial zones
General room sizes
Variety of spaces
Identify commonalities
Type rooms
Shared spaces
Prepare for future installations

Health promotion

Increase access to nature

Outdoor access
Balconies and terraces
Roof terrace
Greenhouse
Views of nature
Planned courtyards
Wooden interior where allowed

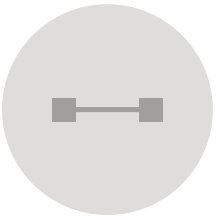
Context



Identity

Connecting to the materiality
Connecting to the 7.2-metre grid

Logistics

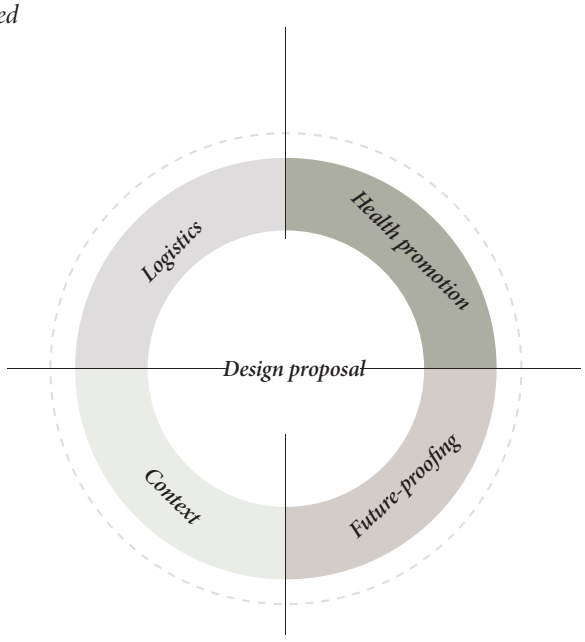


Shortening distances for staff

Central core of support functions
Double corridor system
Central entrance
Doubled functions

Clear wayfinding

Orientation marks
Outlooks
Symmetrical building
Clear zones



04

PROCESS

[Åkulla bokskogar]

CHAPTER FOUR

This part describes the programme, what is included in wards, outpatient departments and outpatient specialities. The programmes are thereafter compared to find differences and similarities thereof. The following pages illustrate the volume study, volume development, scenarios and at last the concept.

THE OUTPATIENT DEPARTMENT

PROGRAMME

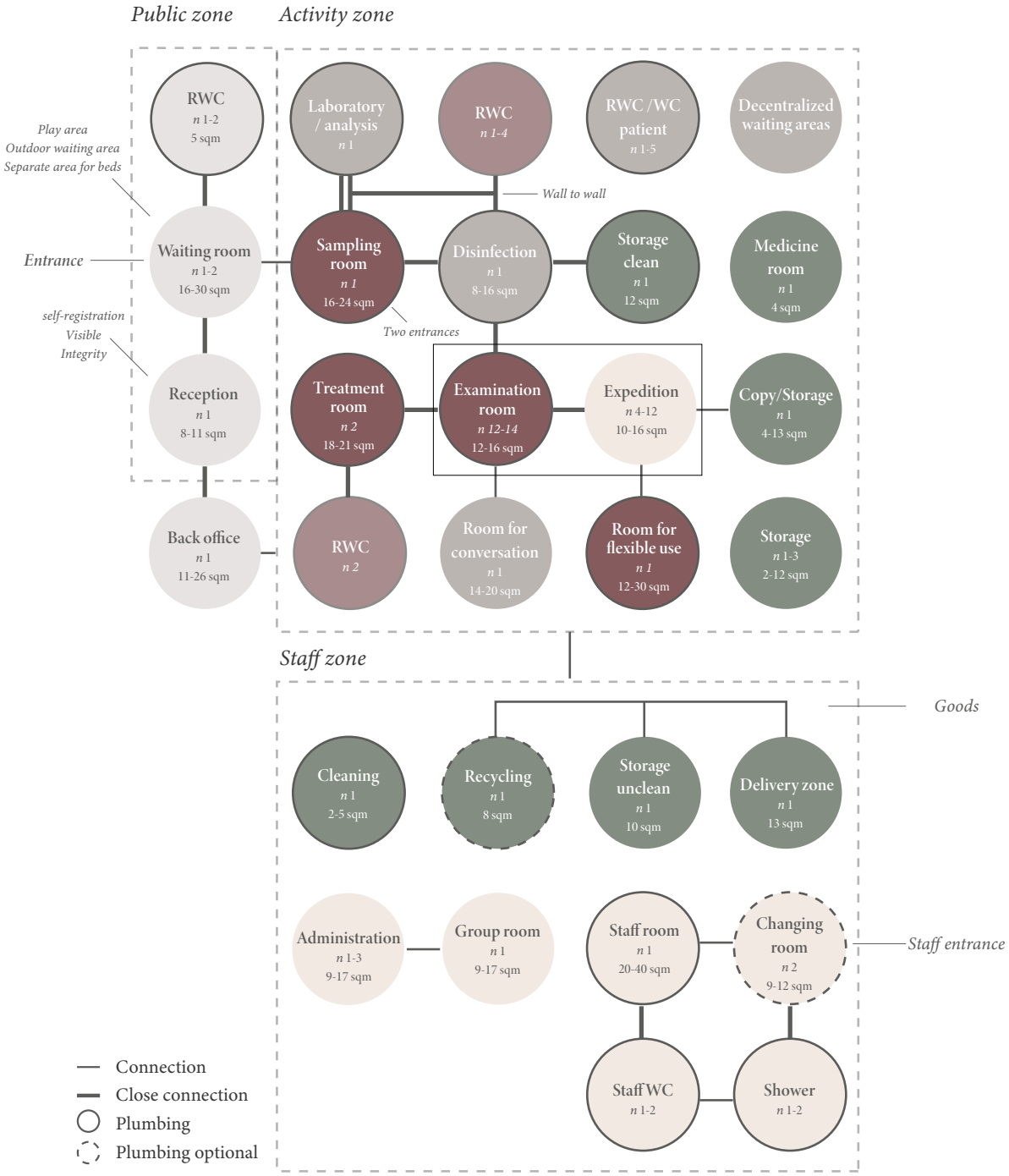


Figure 12. General outpatient department. Functions, connections, areas and quantities. The diagram is made by the author and is based on an analysis of several case studies, interviews and literature.

There are several specialities of outpatient departments, in which the evacuation building will be planned to possible hold. They are listed below. The specialities have different spatial requirements, which in the design proposal will be solved by identifying the most demanding and recurring spaces to propose a general department. A flexible room will be used to be converted according to the different needs.

ADDITIONAL SPATIAL REQUIREMENTS

Urology
Examination and treatment of diseases related to urinary tract and kidney.

+ Disinfection 16 sqm divided into a clean area and unclean area with two entrances or pass-through cabinet from sampling room. The use of ultrasound requires larger examination rooms for technical equipment and to be able to have the bed detached from the wall.

Mammography
Health examination with X-ray for breasts.

+ Requires a room for an x-ray. A fast flow.

Skin
Examination and treatment of diseases related to the skin, as psoriasis or eczema.

+ Requires sampling room and lightroom, placed within the dark core.

Eyes
Examination and treatment of diseases related to the eyes.

+ One room for minor surgery treatments, which implies hygiene requirements. One room with a minimum of five meters to board for a sight test.

Hearing
Measuring and testing of technical equipment related to hearing.

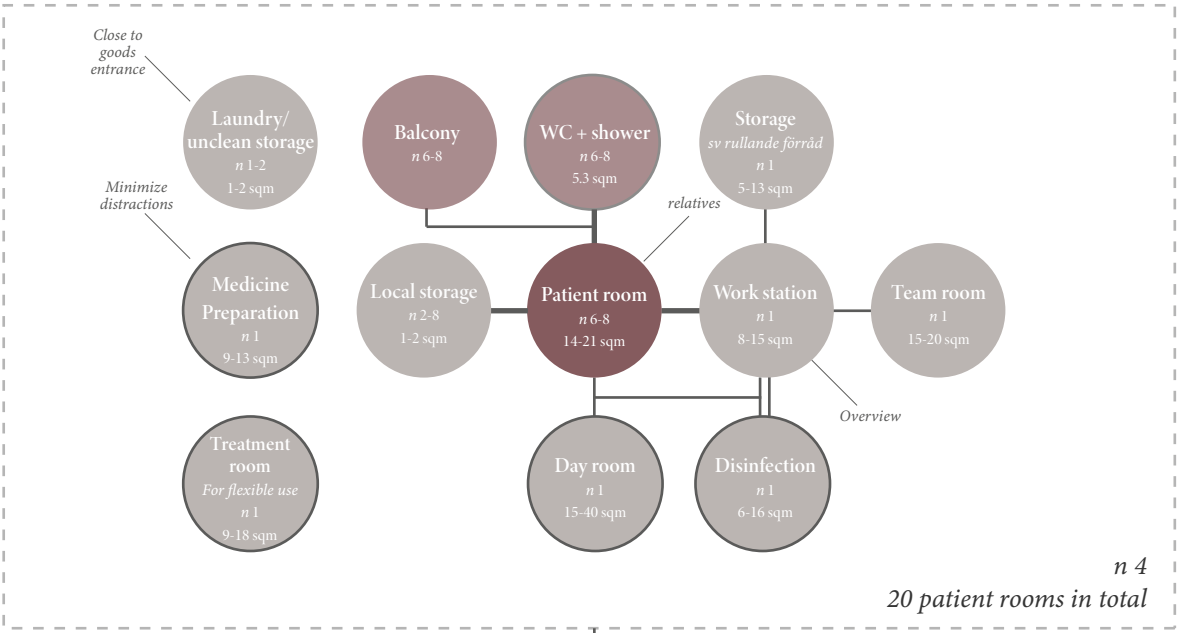
+ One room with a high sound rating.

Medicine
Diseases related to allergology, diabetes and hormonal and gastrointestinal.
(1177 Vårdguiden, u.å.)

+ One ordinary examination room for EKG. One room for EKG during cycling or running with good ventilation connected to RWC, changing room and resting room. (M.Jönsson and M.Bengtsson, personal communication, 8 March 2021).

Unit

Spaces often used



n 4
20 patient rooms in total

Complementary support areas

Spaces that can be placed at a further distance

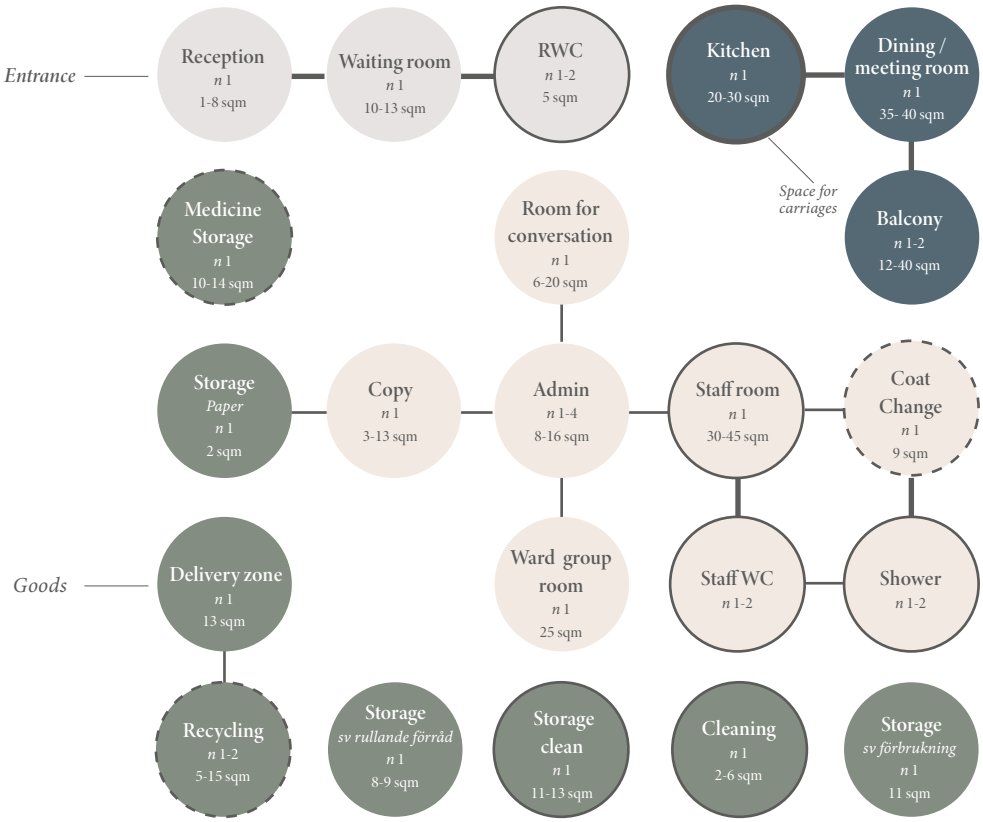


Figure 12. Functions, connections, areas and quantities.

COMMONALITIES

IDENTIFIED SIMILARITIES

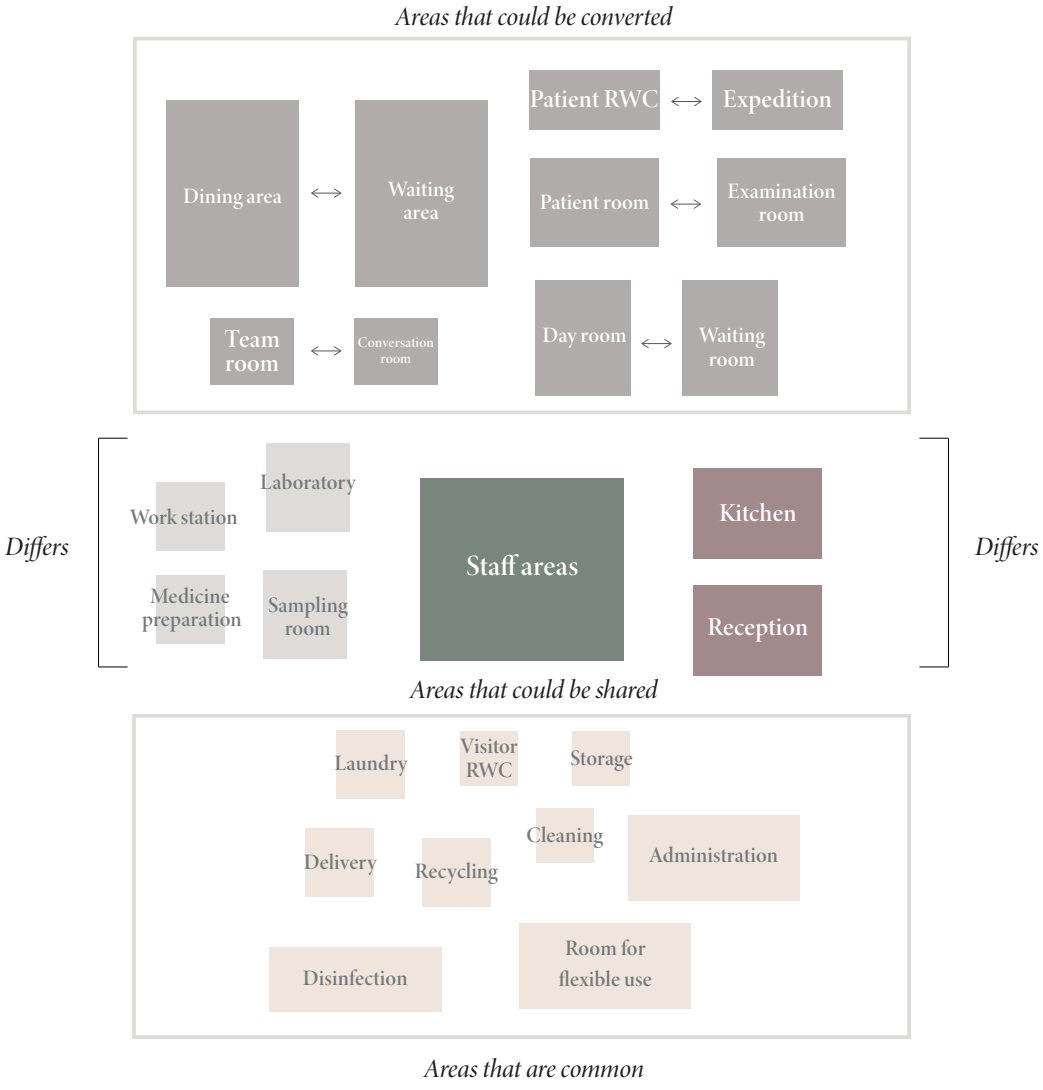


Figure 13. Identification of areas that are common, differed and areas that could be shared. The analysis is made by the author.

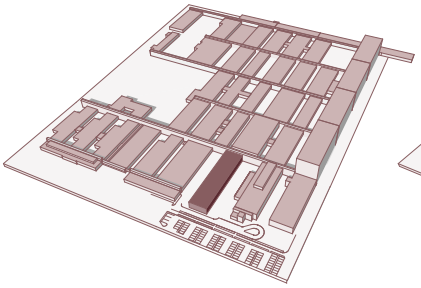
Areas that could be converted are areas with similar sizes, amounts needed and are located similarly. They all, with the exception of the RWCs, belong to the same hygiene class which affects the use of materiality. In the category *areas that could be shared* could be fixed as they could be used by both the ward and outpatient department.

Areas that are common are identified to stay fixed between the two as they are included in both scenarios. *Areas that differ* might need to be reconstructed or could easily be used as storages or other less demanding activities.

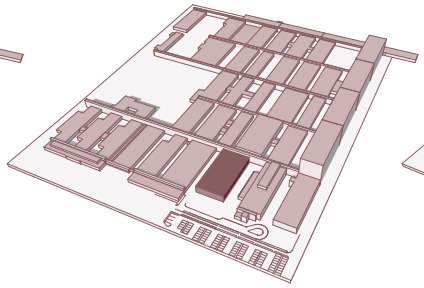
VOLUME STUDY

EXPLORING MASSING OPTIONS

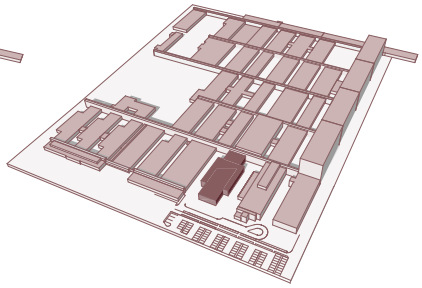
Initial exploration



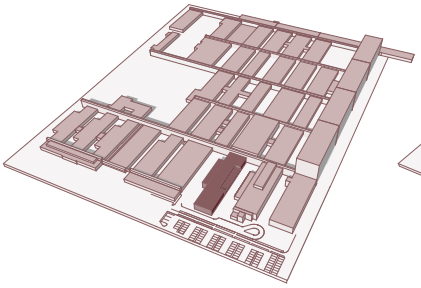
Volume single corridor
Good daylight conditions
Creates long corridors



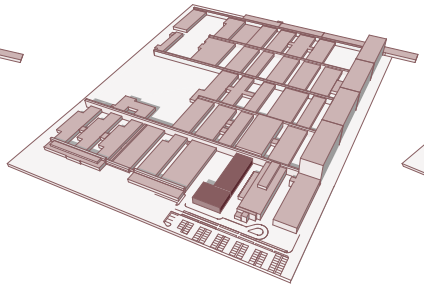
Volume double corridor
Creates shorter corridors



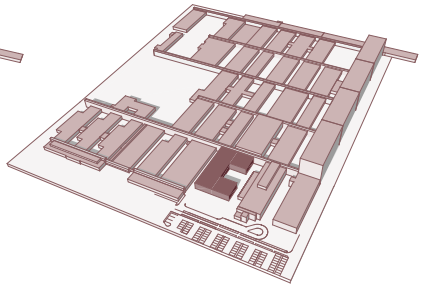
A combination
Marks the entrance
Cast shadows
Creates defined courtyards



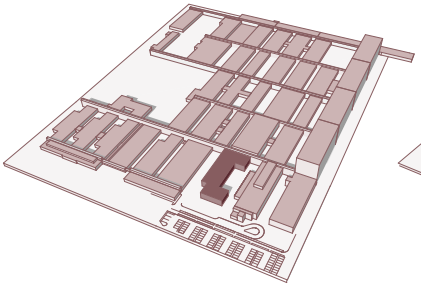
Adjustments to surrounding buildings



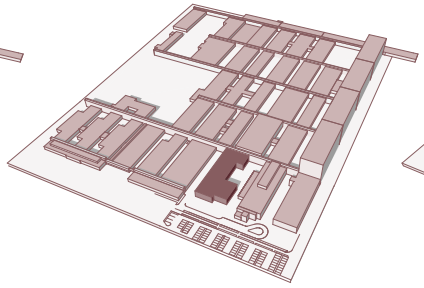
Creating a larger courtyard at one side
Insight east building



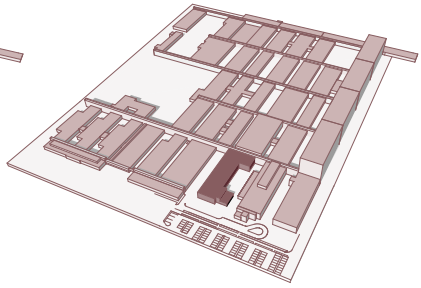
Maximizing facades to south
Space in front of the building
Insight west building



Distance to the west building
Defined courtyards
Marked entrance
Facades to south



Distance to the west building
Marked entrance
Facades to south

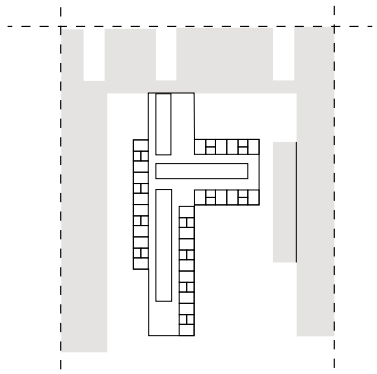


Lower part to avoid shadows

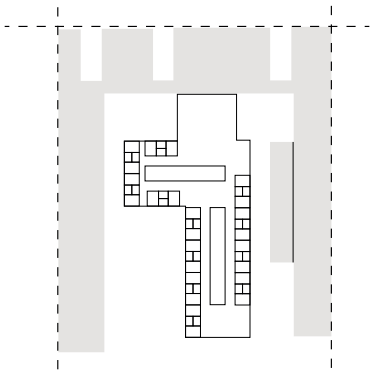
SHAPE EXPLORATION

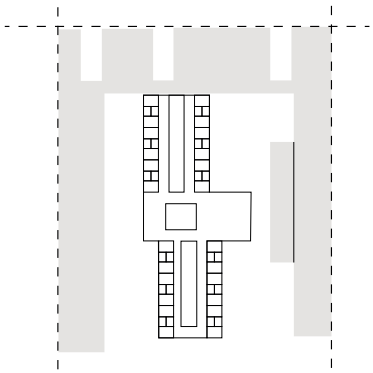
USING THE GRID

Second exploration

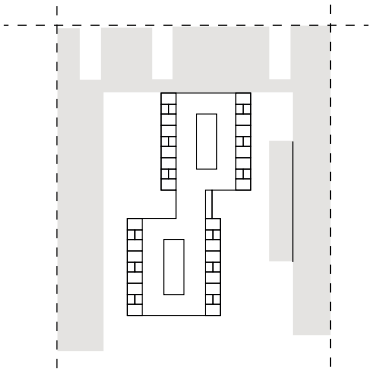


Too close to surrounding buildings. No symmetry in units. Framed outdoor environment.

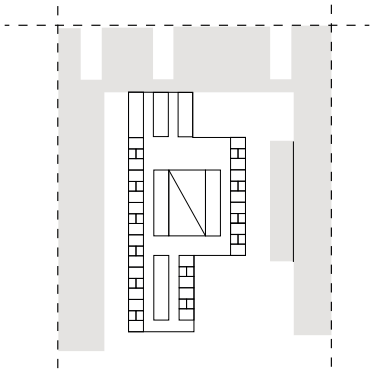




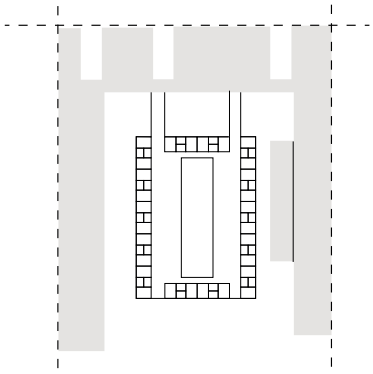
Adjusting the "L".

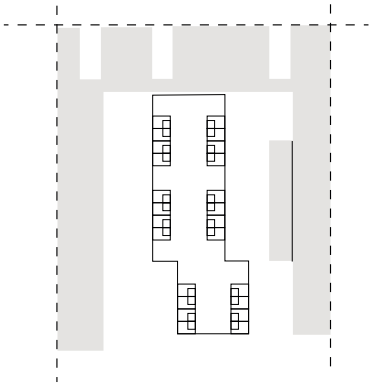


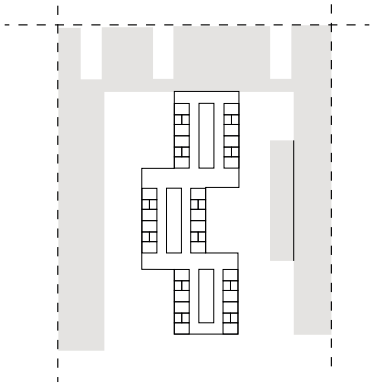
A courtyard or central core in two symmetrical volumes. Too close to surrounding buildings.

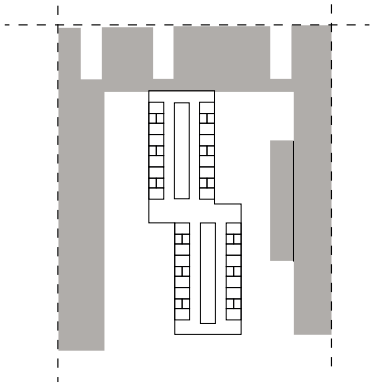


A courtyard or central. Too close to surrounding buildings. No symmetry in units.



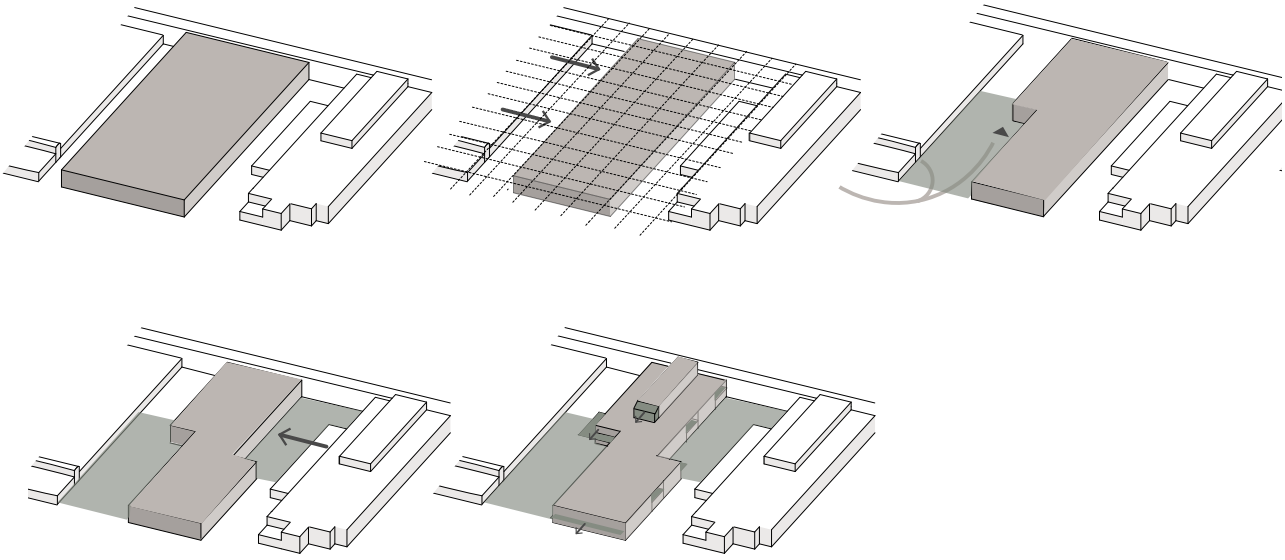






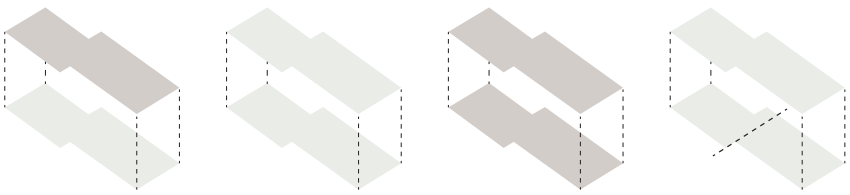
Chosen shape. Only a few rooms close to surrounding buildings. Breaks up the volume, creates overview and clear wayfinding as well as equal distribution of units. Creates two types of outdoor environments. Possibility for central entrance.

VOLUME DEVELOPMENT



1. Site
2. Adjust to the 7.2-metre grid. Distance from surrounding buildings.
3. Add central entrance to shorten internal distances and make it dividable. Entrance facing the direction of main flows. Add a public courtyard.
4. Create a distance from the eastern building. Create two mirrored volumes for equal distributions of functions. Add a semi-private courtyard to increase access to nature.
5. Add balconies, a roof terrace and a greenhouse to access outdoors.

SCENARIOS



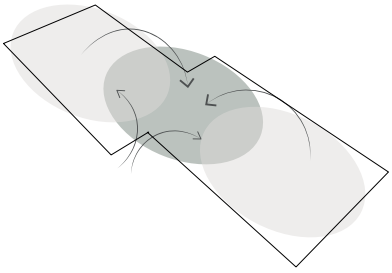
Ward
Outpatient department

Outpatient department
Outpatient department

Ward
Ward

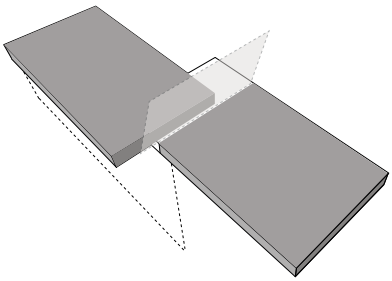
Divided

CONCEPT



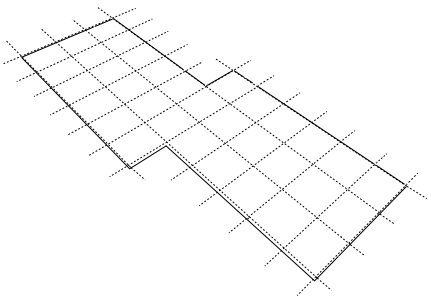
CENTRAL CORE

Placing shared functions and support functions within a central core create shorter and equal distances for staff as the site measures up to 70 meters in length. It also supports wayfinding as it acts as an orientation mark. Placing the entrance and waiting areas centrally also makes the building dividable.



DIVISION

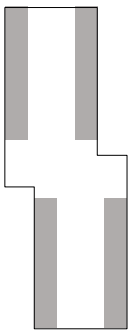
Several of the outpatient specialities require less area, which makes the ability to divide the building central. Several activities can therefore occur simultaneously. It could also be divided to prevent infection outbreaks. A basement for the transportation of goods creates a possibility for the building to act as two independent systems. Support functions within activity areas and units are therefore doubled to create redundancy.



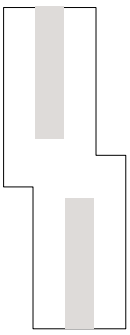
THE GRID

The existing hospital is characterized by a throughout grid of 7.2 meters. The concept was to make it flexible and general. As an extension, it has therefore been important to continue the existing language and using the grid in the new evacuation building. It is also a suitable grid for wooden construction. Throughout the process, alternative measures have been tested. A wider grid of 9.6 meters will not be suitable for wooden construction and a narrower grid implies more pillars. Explorations on 7.2 meters have therefore been made as it can be suitable for both wards and outpatient departments. These explorations are to be found in the appendix.

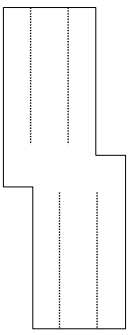
GENERAL STRUCTURE



Equal distribution of functions
A symmetry of units to ease wayfinding.



A core of support functions
Creates faster flows.



A double corridor system
Shortens distances for staff.

05

DESIGN PROPOSAL

[Apelviken badplats]

CHAPTER FIVE

This chapter illustrates the design proposal, including drawings, explanations and analyses.


7.
3.
9.

1. Connecting corridor
2. Dialysis
3. Occupational therapy, speech therapy, administration
4. Delivery ward
5. Surgery
6. Administration
7. Main hospital entrance
8. Car parking
9. Bus stop
10. Entrance
11. Staff entrance

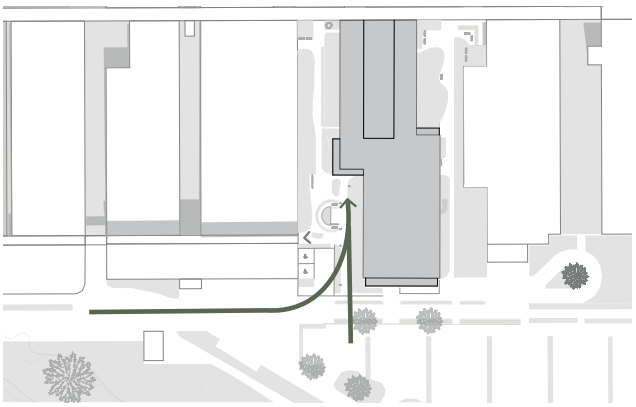
The extension is surrounded by green areas and has close access to parking opportunities. The building has its own entrance to ease the flows within the existing hospital. The entrance is facing the direction of the main flows and visitors pass a courtyard when entering.

SITUATIONAL PLAN

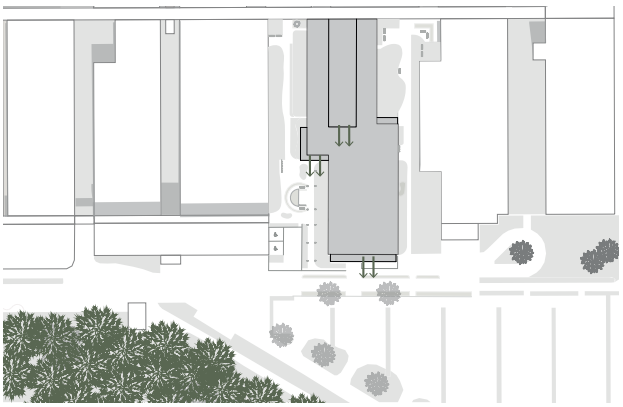
1:2000

ANALYSIS

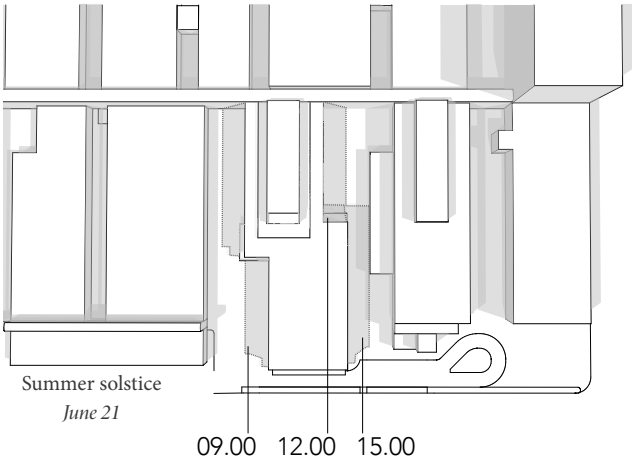
SURROUNDINGS



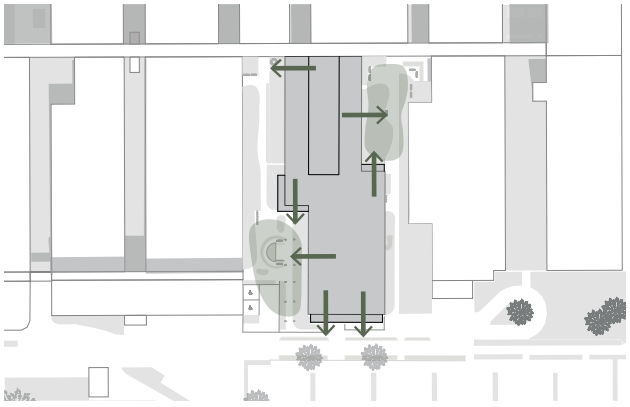
The main flow of visitors



Views from common areas and balconies towards the forest



Shadow analysis



Outdoor access and courtyards

As views of nature have several health benefits, increasing access to nature is important in the proposal, a quality common for both healthcare typologies. There are two planned courtyards, one public leading visitors to the entrance and one semi-private. Greenery is further used as insight protection. When approaching the building visitors see a greenhouse on the roof which also could be used as a cafeteria and to provide a longer outdoor season.

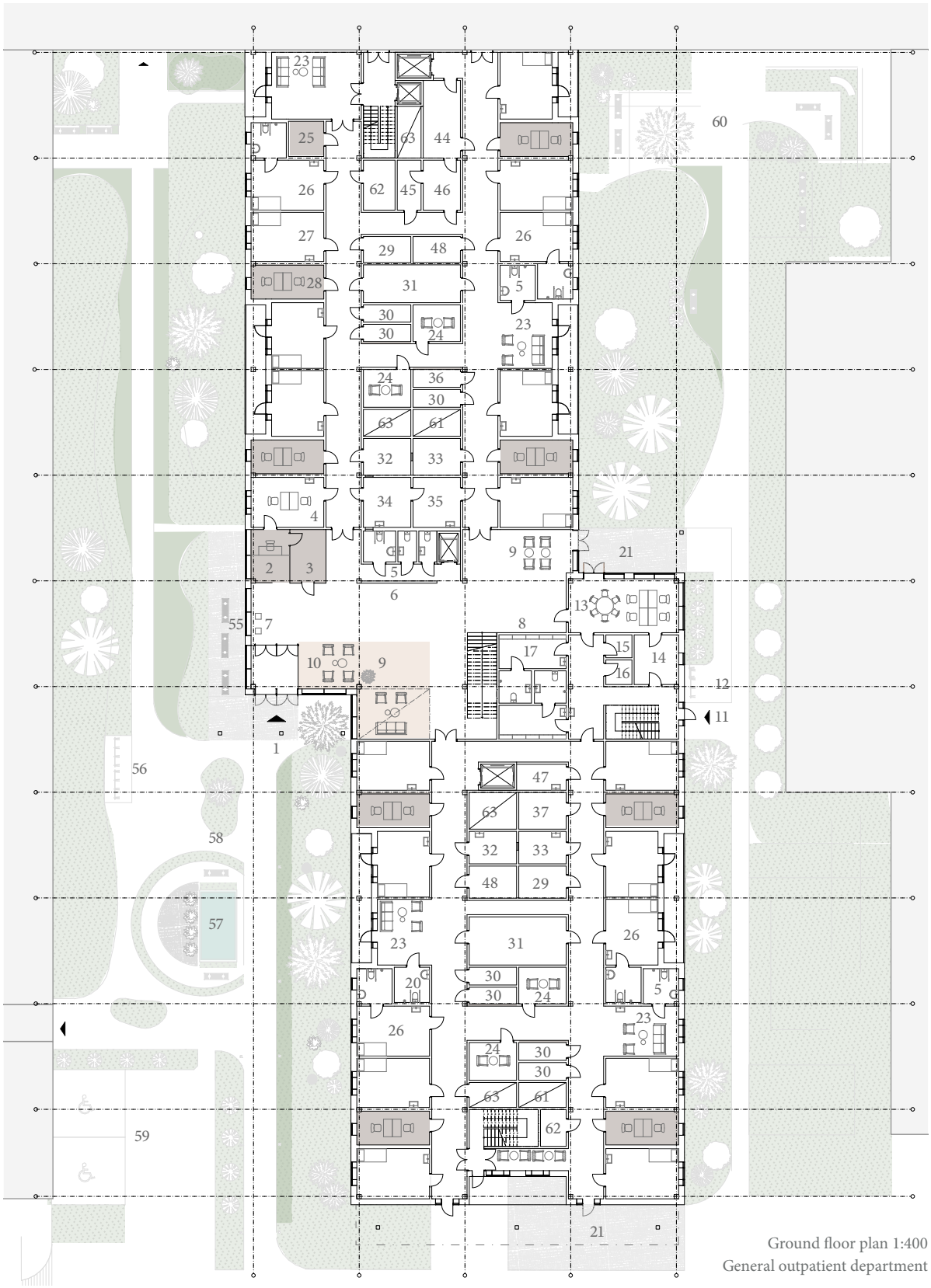
A roof terrace aims to give back space that the building is occupying. It is reached from a neutral zone at the main building which makes it still reachable if the ground floor is converted into a ward. The roof is sedum, creating green views from the high existing ward building in the hospital area. There are further several common and private terraces as well as balconies providing access to the outdoors.

GREENERY

ACCESS TO NATURE

Common terrace *Greenhouse and roof terrace* *Private balcony* *Balcony day room* *Sedum roof* *Common balcony*

View of main entrance. Visitors pass a public courtyard before entering.

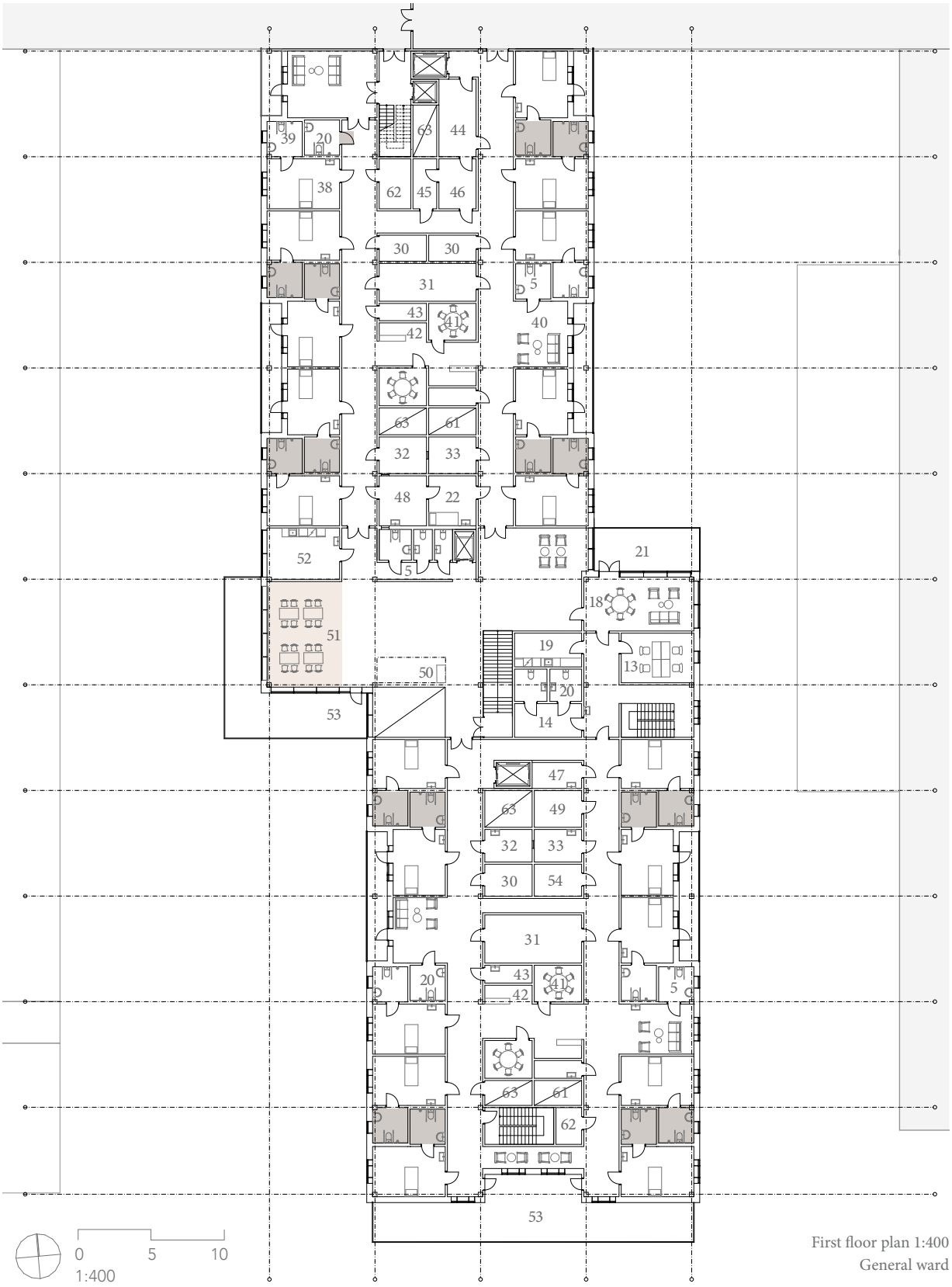


Ground floor plan 1:400
General outpatient department

Changes for convertibility

Changes related to the space plan and services layer
Wall, doors and technical installations

Changes related to the stuff layer
Furniture



First floor plan 1:400
General ward

To ward

Amount of doors moved: *10*
Amount of doors added: *7*
Amount of walls removed: *(4)*
Amount of RWCs added: *16*
Kitchen added: *1*

⟷

To outpatient department

Amount of doors moved: *9*
Amount of doors removed: *8*
Amount of walls removed: *8*
Amount of walls added: *(4)*
Amount of RWCs removed: *16*

FLOOR PLAN LEGEND

Entrance area
1. Entrance
2. Reception
3. Room for conversation
4. Backoffice
5. Visitor RWC/WC
6. Information board
7. Digital check-in
8. Wheelchair parking
9. Waiting room
10. Children play area

Staff areas
11. Staff entrance
12. Bicycle parking
13. Administration /group room
14. Copy /paper storage
15. Laundry clean
16. Laundry unclean
17. Changing room
18. Staff room
19. Pentry
20. Staff WC
21. Terrace
22. Resting room

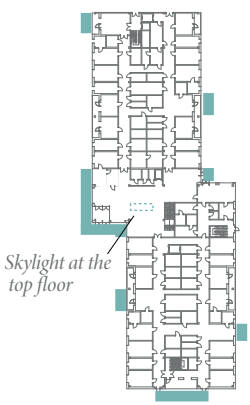
Activity zone
23. Waiting area
24. Conversation
25. Bed waiting area
26. Treatment room
27. Examination room
28. Expedition
29. Medicine room
30. Storage
31. Room for flexible use
32. Disinfection unclean
33. Disinfection clean
34. Laboratory / analysis
35. Sampling room
36. Patient changing room
37. Resting room

Unit
38. Patient room
39. Patient RWC
40. Day room
41. Team room /conversation
42. Work station
43. Medicine preparation

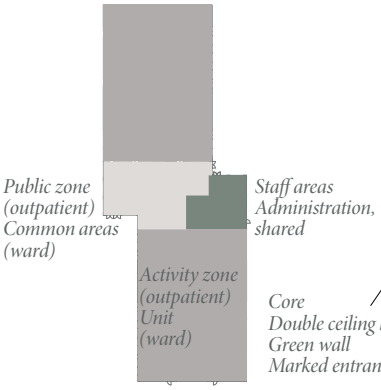
Support areas
44. Unpacking
45. Laundry
46. Recycling
47. Cleaning
48. Rolling storage
49. Storage clean/linen
50. Arrival station
51. Dining/meeting room
52. Kitchen
53. Balcony
54. Medicine storage

Outdoor environment
55. Outdoor waiting area
56. Bicycle parking
57. Pond
58. Public courtyard
59. Parking
60. Semi-private courtyard

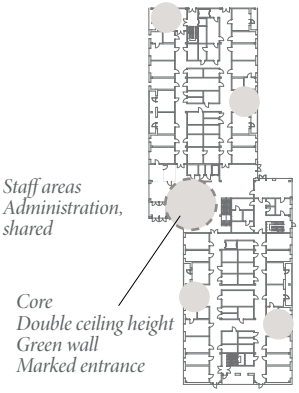
Technical rooms
61. Ventilation
62. Electrical station
63. Shaft



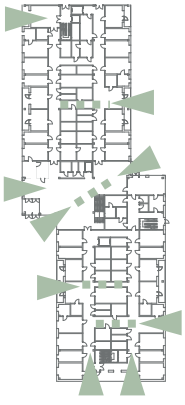
Daylight



Zones



Orientation marks



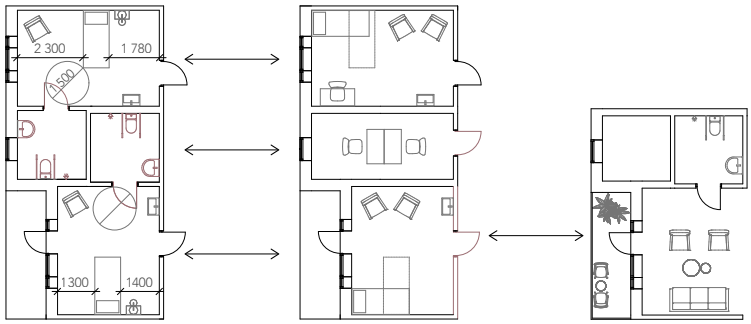
Views

View from the patient room. The wood in window sills provides a material connection with nature.

CONVERTIBILITY

WARD AND OUTPATIENT DEPARTMENT

Type rooms A



17 sqm

Patient room
Treatment room

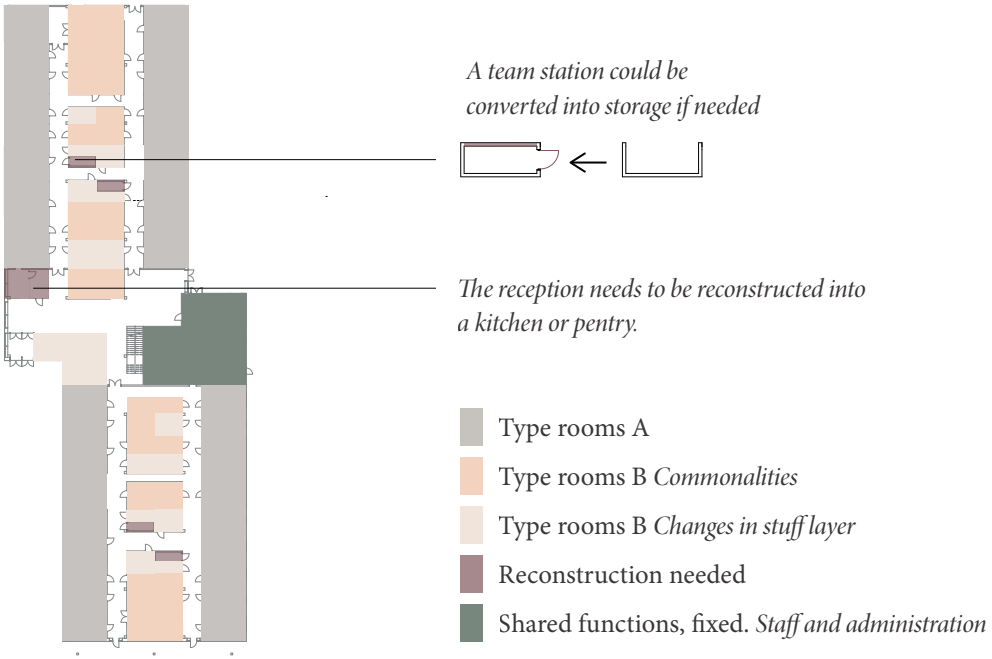
Examination room
Expedition

Day room
Decentralized waiting room
(Team station)

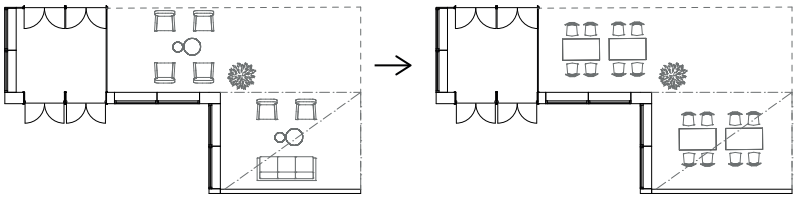
Type rooms B

Storage
Team room ⇔ Conversation room
Disinfection
Dining room ⇔Waiting area
Visitor RWC
Room for flexible use
Unpacking
Laundry
Recycling
Cleaning

To convert between the ward and outpatient department, general room sizes suitable for both patient rooms and examination rooms were studied. The result form type room A, which require reconstructions in converting RWCs into expeditions. In this case, the shafts are prepared to also convert an expedition into a RWC. Several rooms are provided with balconies to increase the access to nature for the patients and could be used as separate entrances in case of infection outbreaks. Type rooms B are common between the ward and outpatient department or require changes in the stuff layer, furniture. Other rooms are specific to the care typology and could be converted into storages or other less demanding uses with changes in the stuff layer. A further exploration of room sizes and shafts is to be found in the appendix.

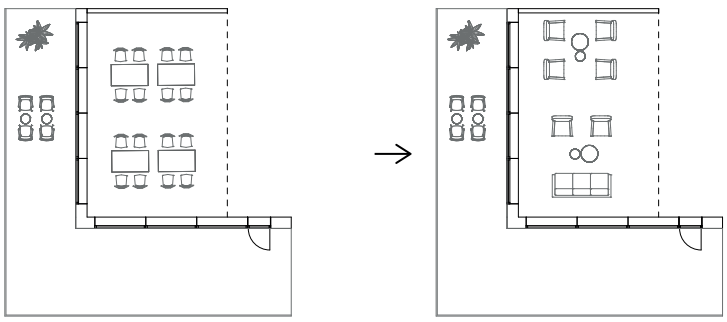


View of the dining area on the first floor. The terrace, wooden walls and ceiling create a connection with nature. The space could be converted into a waiting area as it has the same hygiene class.



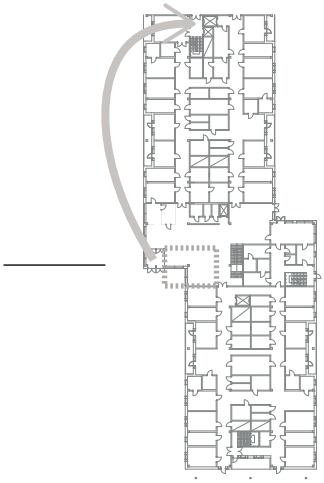
Ground floor outpatient department
Waiting area

Ground floor ward
Dining area



First floor ward
Dining area

First floor outpatient department
Waiting area area



The waiting area on the ground floor becomes the dining area if the floor is converted. In such a scenario the entrance could be moved to the northern part as the visitors to the inpatients will come from the main hospital entrance.

CONVERTIBILITY

OUTPATIENT SPECIALITIES

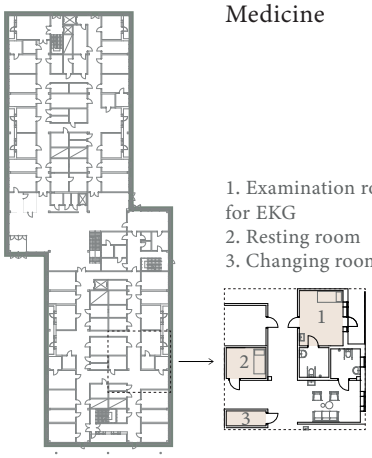
The convertibility could also occur between the outpatient specialities. These require different area, in which the divisibility of the building becomes central. The most demanding and reoccurring rooms have formed the basis for the general ward and is complemented with a room for flexible use that could be converted according to the needs of the different specialities.

Reconstruction
Related to the space plan and services layer

Changes of loose furniture
Related to the stuff layer

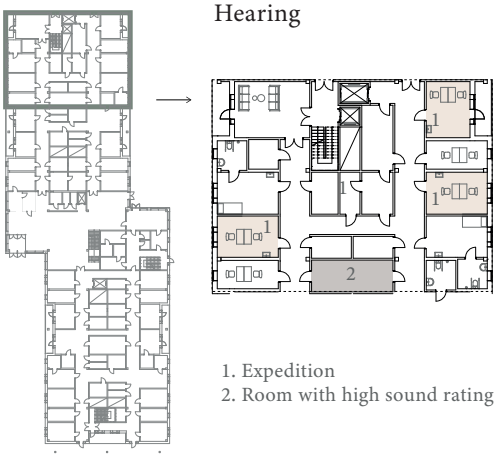
Occupying area

Medicine



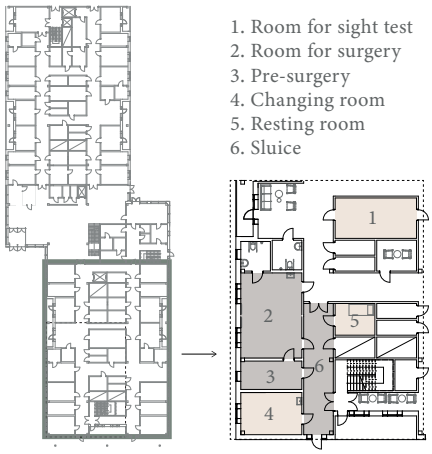
1. Examination room for EKG
2. Resting room
3. Changing room

Hearing



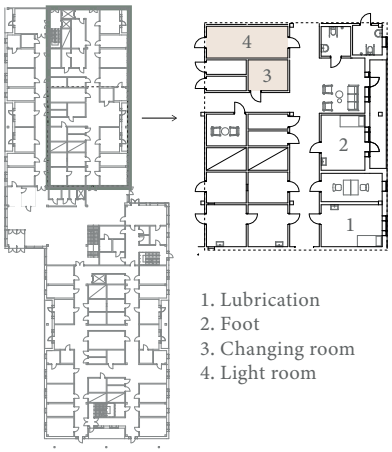
1. Expedition
2. Room with high sound rating

Eyes



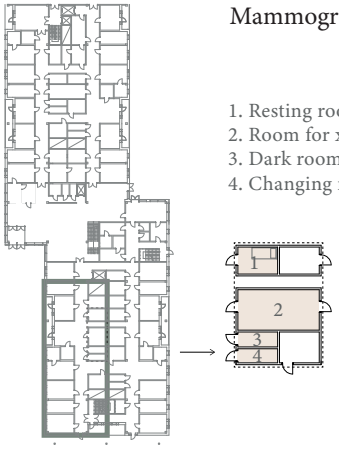
1. Room for sight test
2. Room for surgery
3. Pre-surgery
4. Changing room
5. Resting room
6. Sluice

Skin



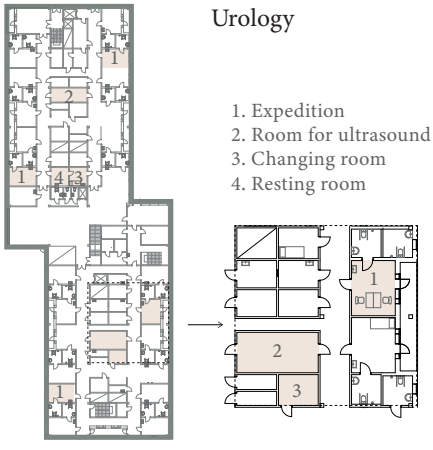
1. Lubrication
2. Foot
3. Changing room
4. Light room

Mammography



1. Resting room
2. Room for x-ray
3. Dark room
4. Changing room

Urology



1. Expedition
2. Room for ultrasound
3. Changing room
4. Resting room

Proposed time plan

Ward	Urology department	*No need for reconstruction*
General outpatient department	Medicine	*No need for reconstruction*
General outpatient department	Skin - Mammography	*No need for reconstruction*
General outpatient department	Hearing - Eyes	*Some need for reconstruction*

View of the greenhouse and roof terrace. The greenhouse is extending access to the outdoor season.

View of the waiting area on the ground floor. Visitors have a visual connection with the outdoors. Organic materials in walls and the ceiling provides a material connection with nature. A green wall continues up to the dining area on the floor above and acts as an orientation mark. The space could be converted into a dining area if the floor is converted into a ward.

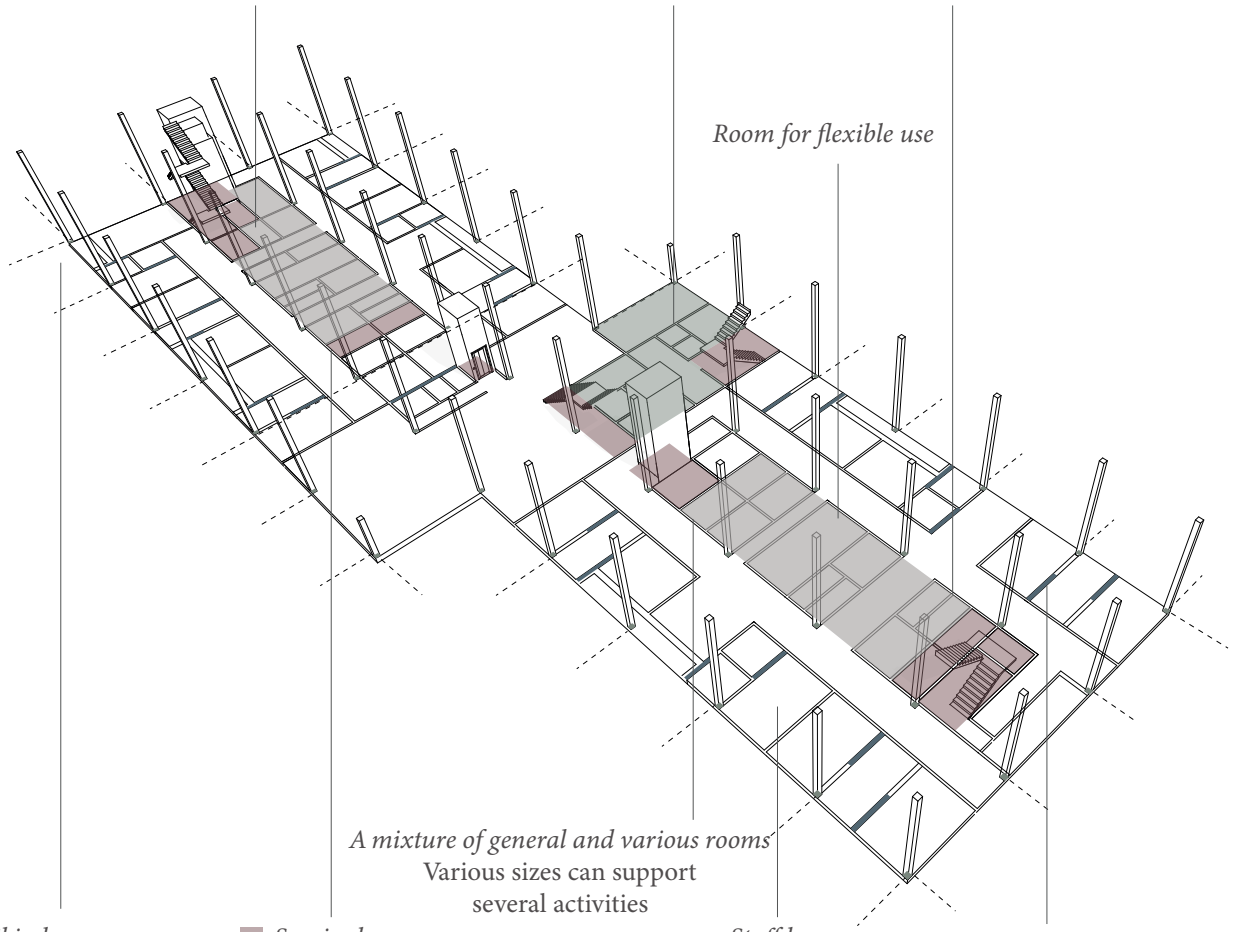
FUTURE-PROOFING

IMPLEMENTED STRATEGIES

Redundancy
Doubled support functions
allows for divisibility

Staff and administrative areas
Shared, fixed

Space plan layer
Spatial zones of fixed elements
allows for flexibility in remaining spaces



A mixture of general and various rooms
Various sizes can support
several activities

Skin layer
Separated from structure
Durable

Service layer
General position
Clustered into spatial zones

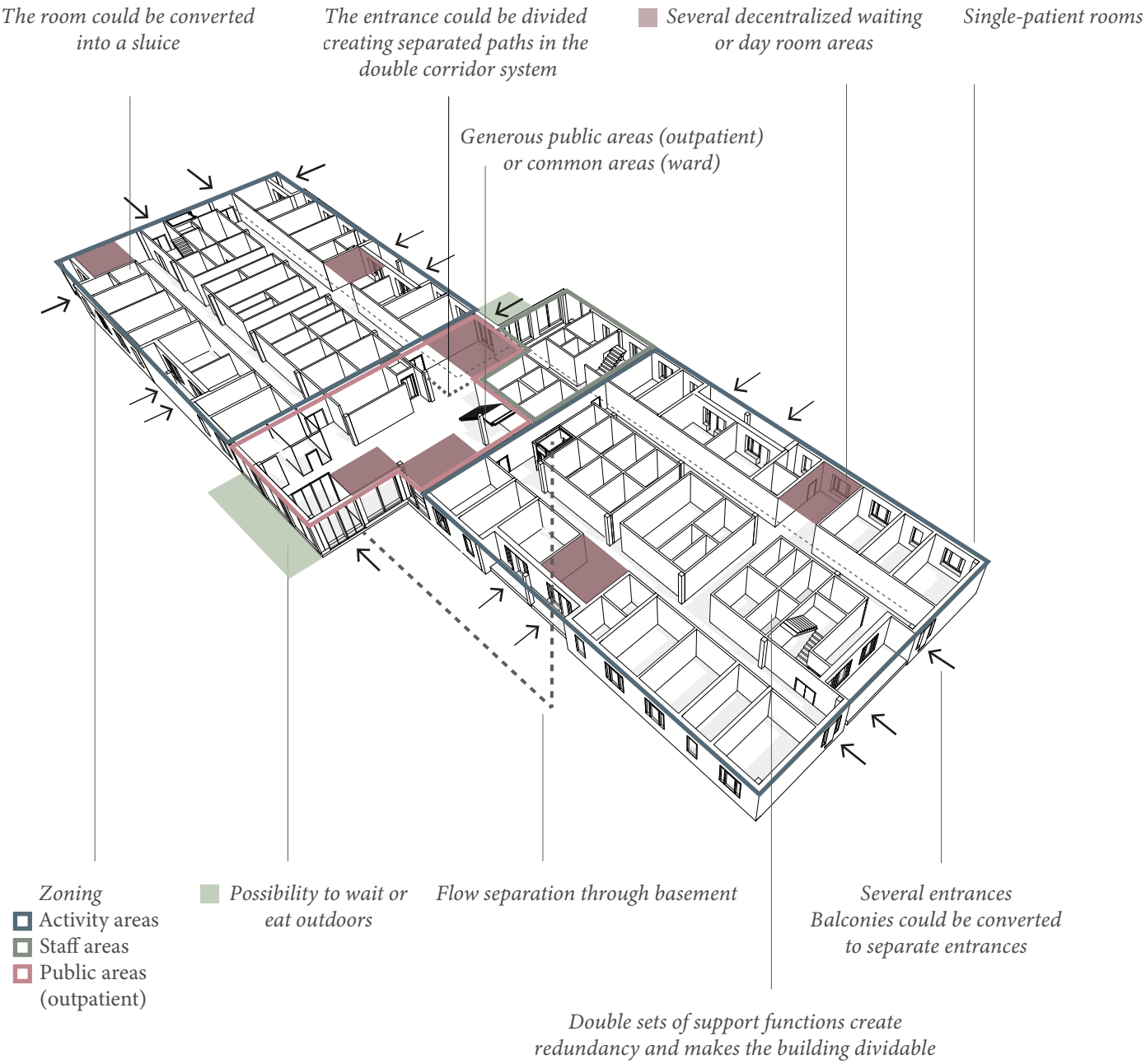
Stuff layer
Flexible
Identified commonalities form
general room sizes allowing
for different use

Service layer
Shafts prepared for
future installations

INFECTION PREVENTION

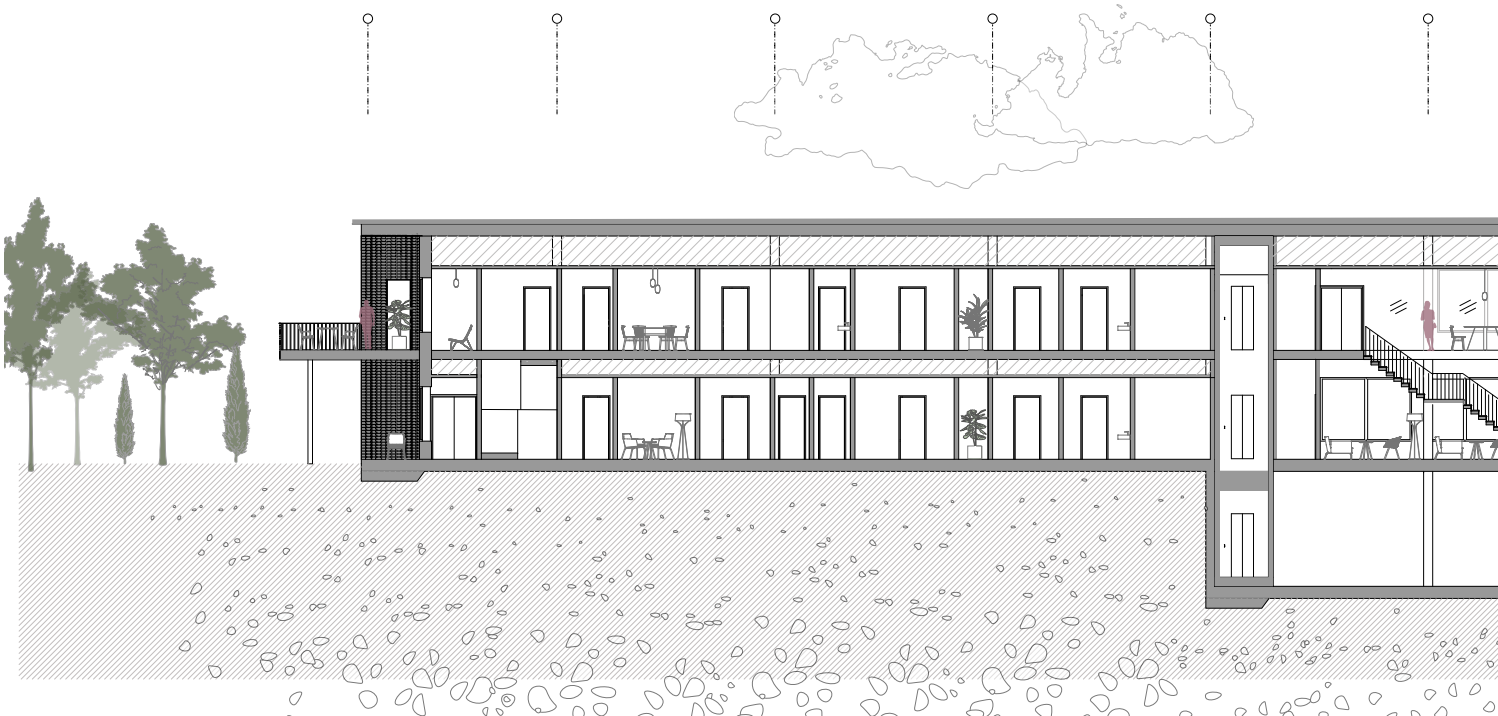
STRATEGIES

The management of infection risks and the post-antibiotic era is increasingly important in healthcare. Adaptation of healthcare facilities has proved to be highly relevant now during the pandemic. This page illustrates some strategies to handle this issue, with a focus on airborne disease.



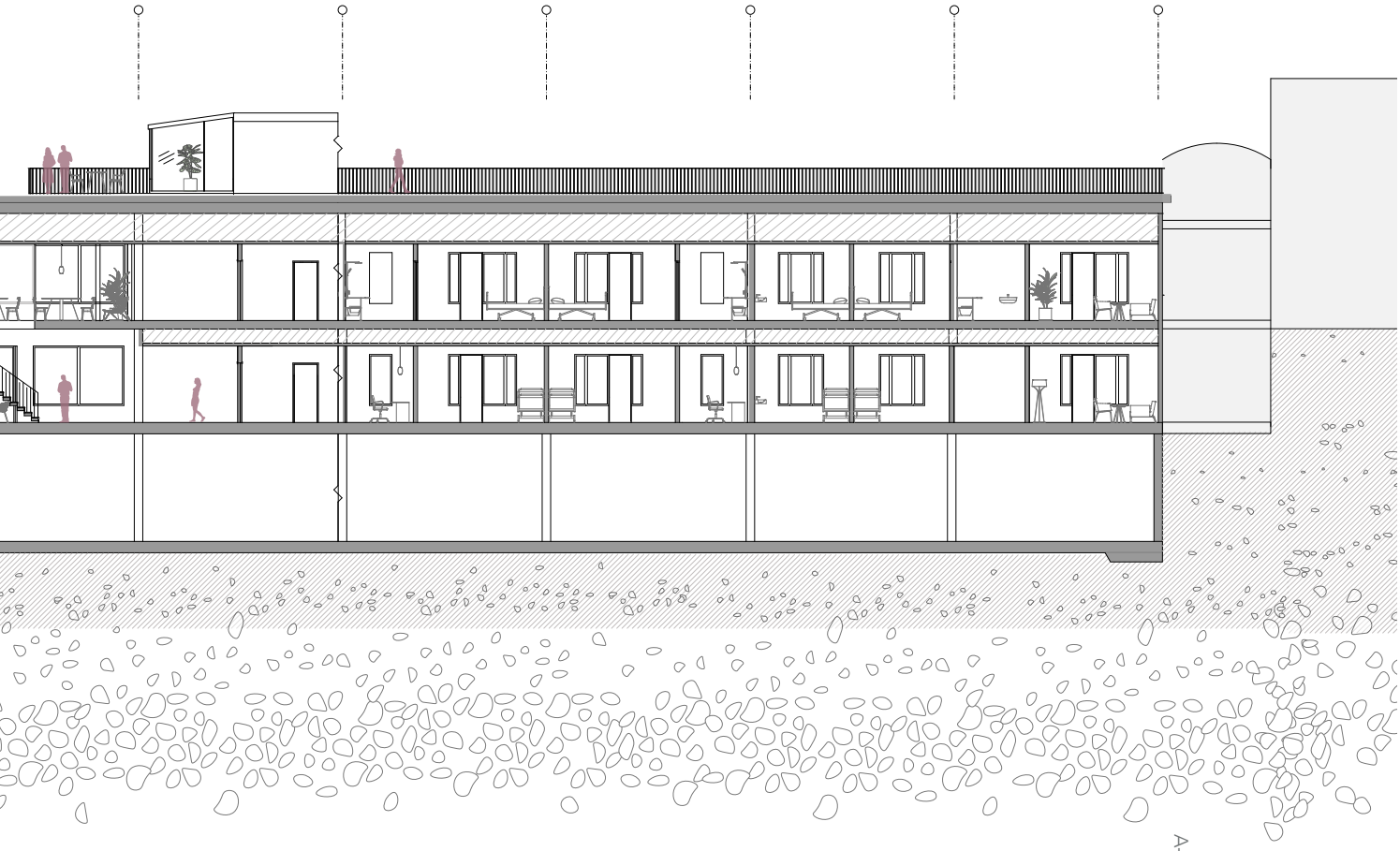
SECTIONS

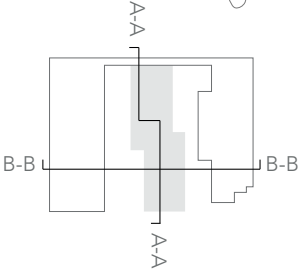
On the ground floor, section A-A shows a cut through the core of support areas, the central core with waiting area and double ceiling height as well as through expeditions and examination rooms. The first floor also shows the dining area and patient rooms. It also shows the souterrain ground and the basement which makes the building dividable and creates buffer space for storage. Section B-B shows staff areas, the reception, dining area and terrace, the greenhouse as well as the outdoor waiting area.

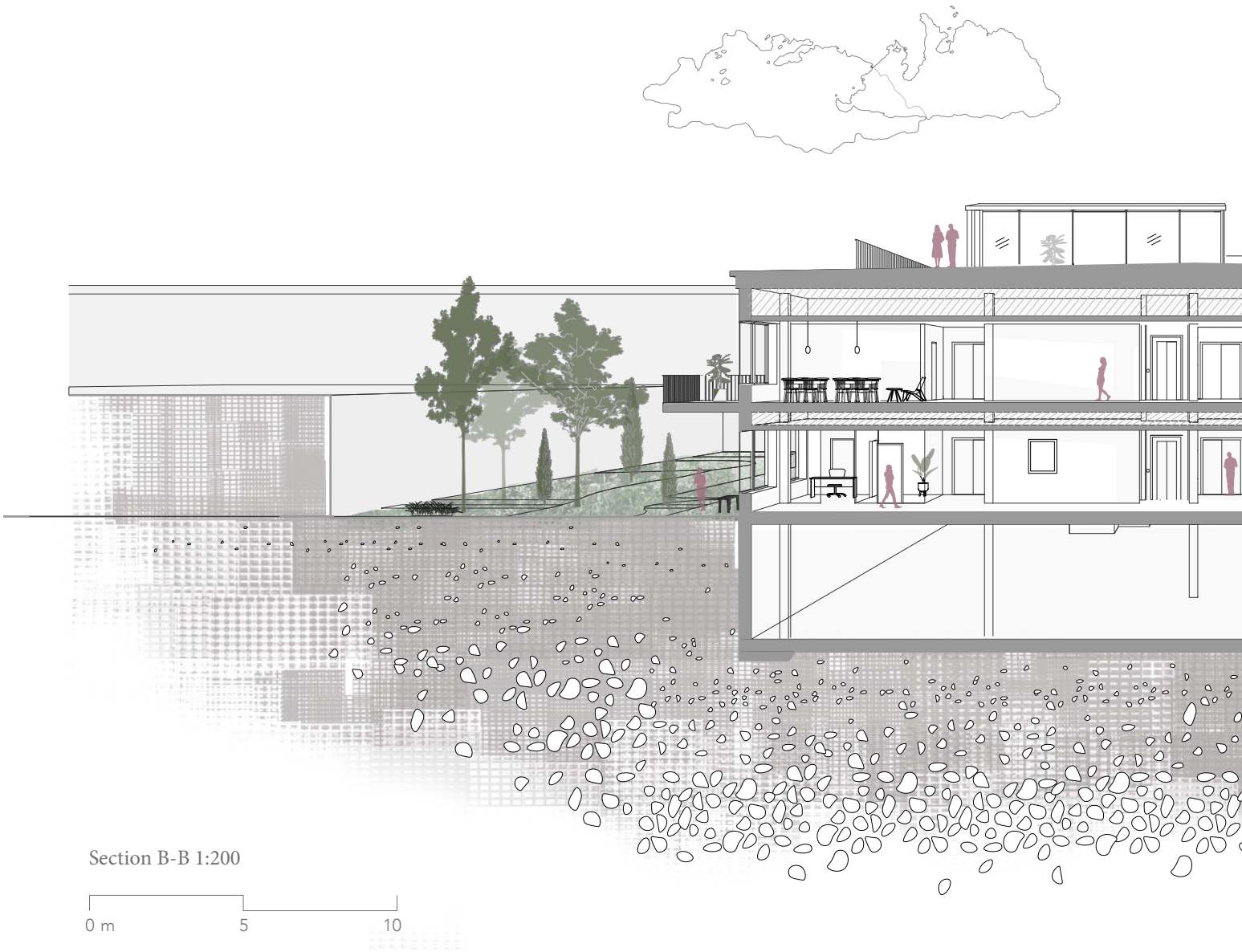


Section A-A 1:250

0 5 10

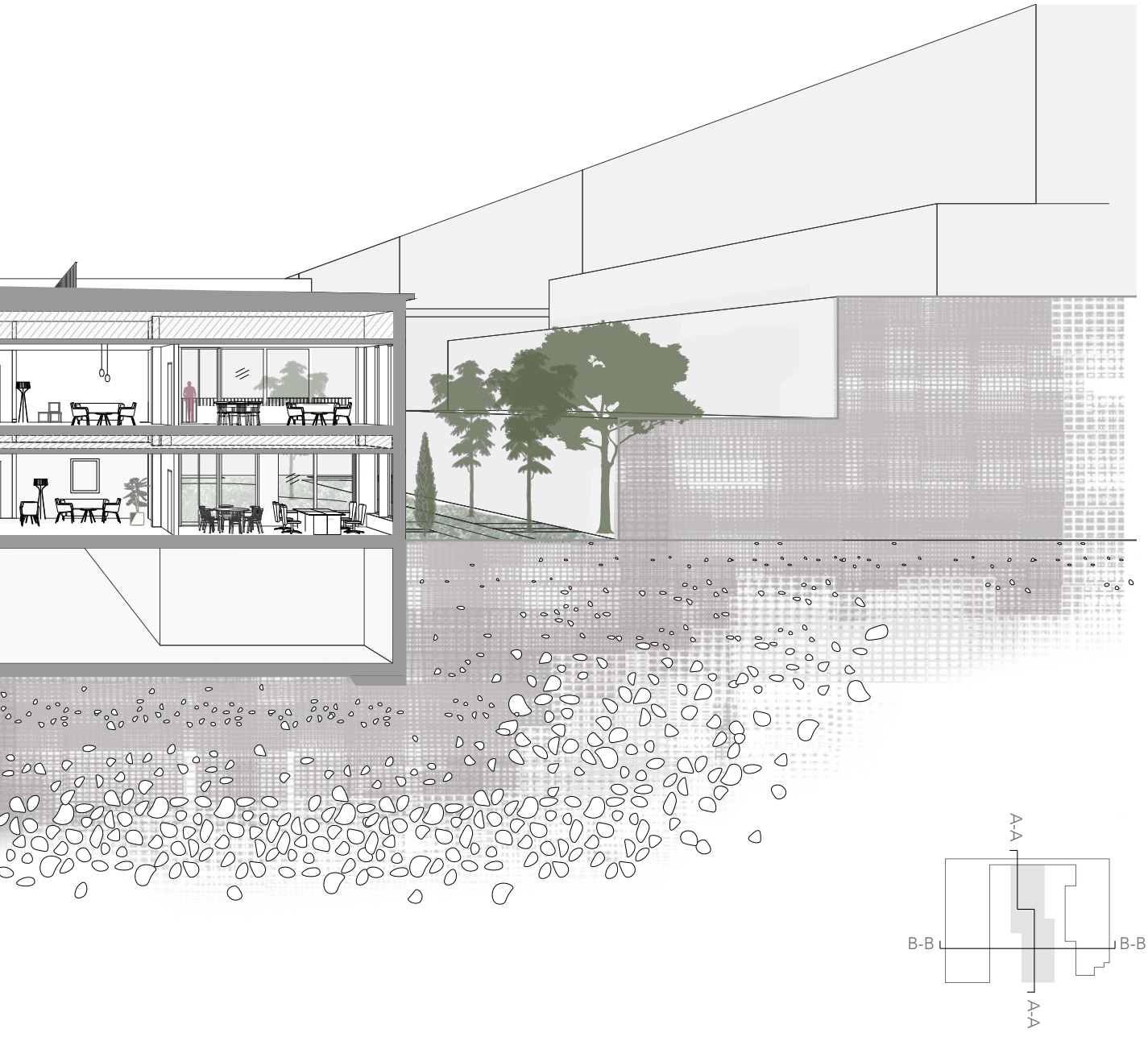



A-A
B-B
B-B
A-A



Section B-B 1:200

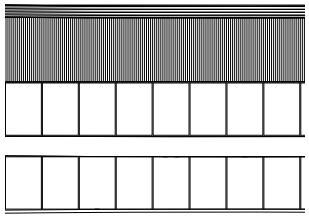
0 m 5 10


A-A
B-B
B-B
A-A

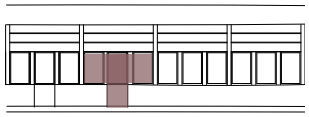
FAÇADES

INVESTIGATIONS

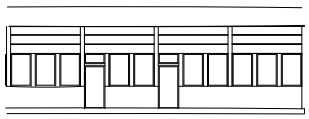
Existing facades

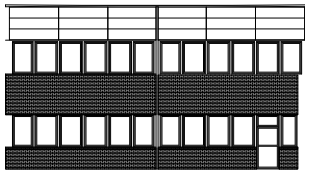


Black plate

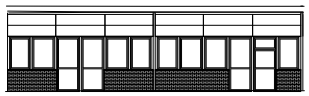


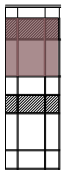
Window- door-window





Red bricks

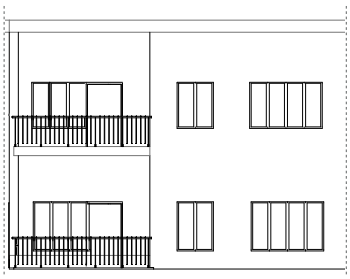


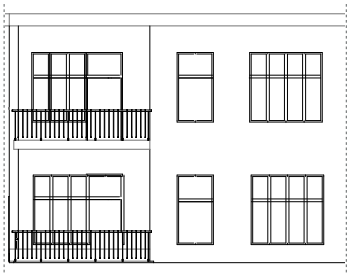


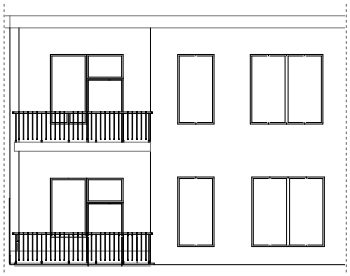
Combination of wider and thinner frames.

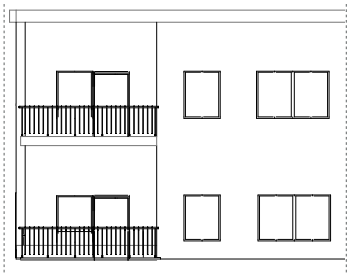
Texture

Windows









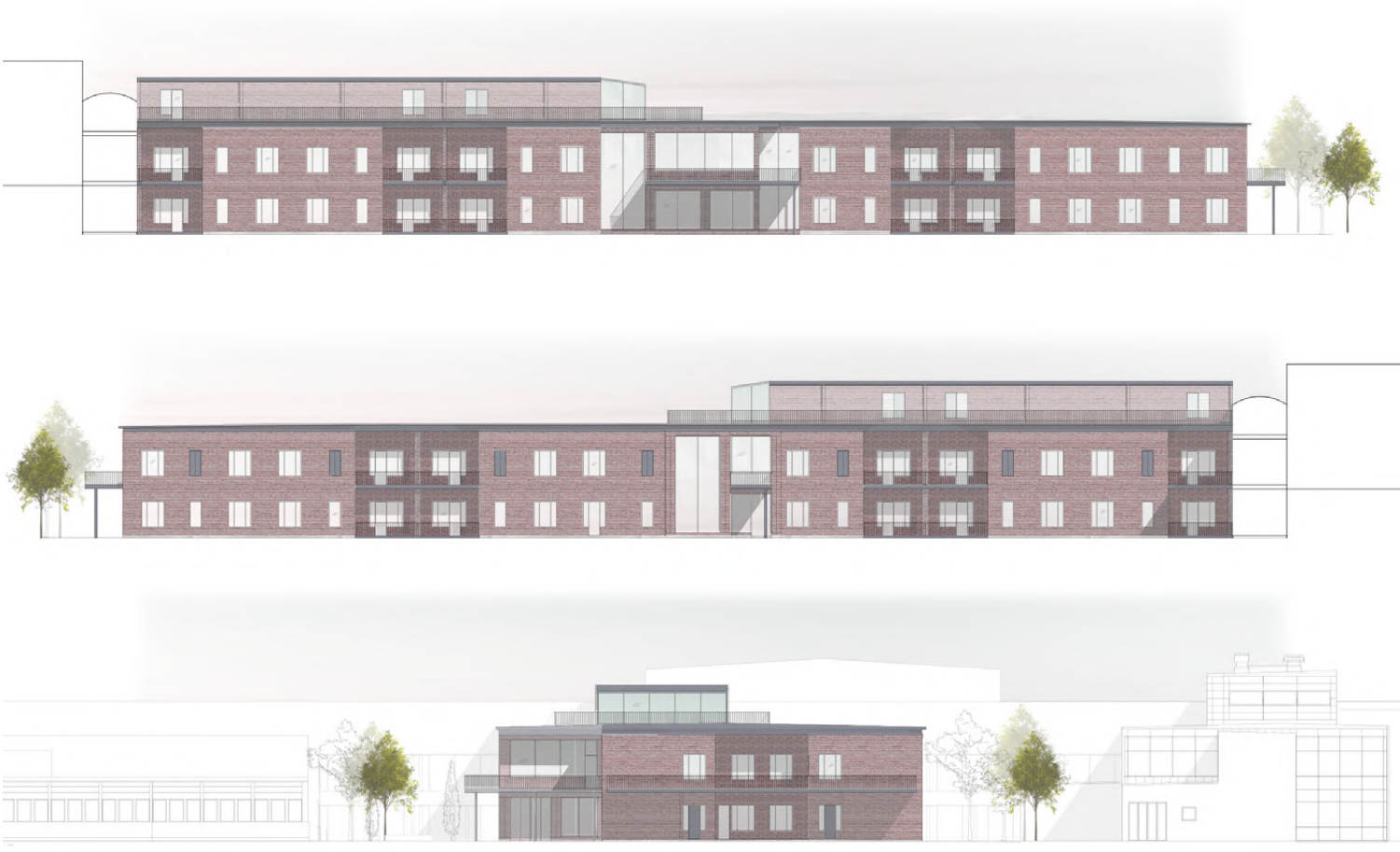
Further tests are to be found in the appendix.

FAÇADES

PROPOSAL

The window configuration of the chosen facade is inspired by existing facades at the hospital area and studied in relation to which rooms could be divided and possible furniture used. The sill height allows for outlooks from beds and insights are adjusted with greenery and window blinds going down and up. The materiality of the proposal is red bricks as in the main hospital and as it is classified as historically valuable.

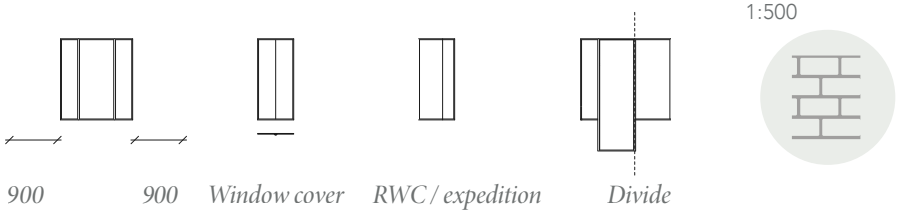
The main entrance is glassed to provide outlooks and be marked out. Window frames and detailing consist of a black plate and are found on-site in the connecting corridors. A designed coverage for the windows in the same materials is used for RWCs and could be removed when converted into an expedition, which is illustrated in the east elevation.



South elevation

0 5 10

1:500



900 *900* *Window cover* *RWC / expedition* *Divide*

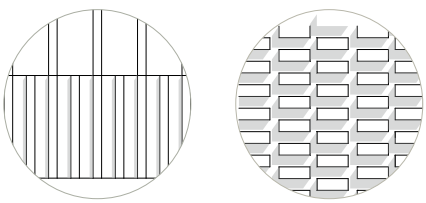
FAÇADES

DETAILS

Facade detail.

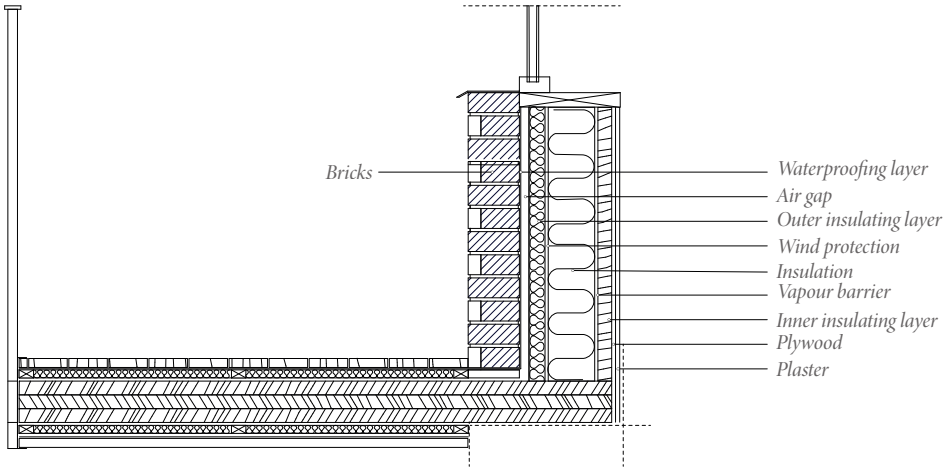
1:50

0 m 1 2



Tactility.

The tactile brick pattern at the balcony niches creates shadow lines. The railing attachment consists of a black plate forming a texture.



Detail. Section through exterior wall and balcony.

06

DISCUSSION

CHAPTER SIX

This concluding chapter includes a discussion around the process and outcome.

DISCUSSION

CONCLUDING REMARKS

Designing for convertibility between wards and outpatient departments has been a constant reminder of the probability of future-proofing. Implementing general solutions that may never occur is not cost or resource-efficient. Hence, the process has been characterized by compromising. There has been a balance between the knowledge from theory, the testing and best solutions for this scenario, the physical and historical context and as well principles of health promotion. As it is a hospital extension and evacuation building in which the programme is set for the upcoming years, this question has become relevant. The programme of wards and outpatient departments has itself further been limiting and it had been easier to implement principles of flexibility if it was not to be prepared for future convertibility between the two.

The divisibility, convertibility and access to nature have become important aspects of the proposal. To answer the question of how to design for convertibility between wards and outpatient departments, the process began with a study of the rooms for care, which became the first type room. Fixed and flexible elements were further studied, as well as the commonalities between wards, outpatient departments and specialities.

One challenge has been the balance between health promotive aspects, as important in healthcare typologies, and generality. Every step away from repetition and general solutions has been a step away from future-proofing. However, by studying what elements needed to be changed or could be shared between the wards and outpatient departments, as well as hygiene classes, it gave the freedom to examine the atmosphere in for example waiting areas and to provide qualities for both types of care.

The conclusion shows that it is possible to design for this convertibility, as wards and outpatient departments have several commonalities, although there is a need for reconstruction of patient RWCs. By preparing the shafts for future installations, expeditions in outpatient departments could be converted. The shift between outpatient specialities was shown to require less or none need for reconstruction. By identifying recurring elements to propose a general department and by implementing a room for flexible use, it could in several cases only be a need for interventions in the flexible room. As the different departments require different areas, the divisibility of the building becomes a central solution.

This thesis has contributed with an example of how to design for convertibility between wards and outpatient departments. As there were few case studies to be found on the specific approach, the suggestion fills a gap. It is however clear that the specific circumstances of each project need to be taken into consideration and this proposal is much determined by the context. The principles of the results may be of use when designing evacuation buildings where convertibility of this kind is likely to occur. It could also be used at spaces limited in size and where the convertibility becomes relevant. To prepare an outpatient department or a ward for convertibility between the two could be important in case of extraordinary circumstances, as the outbreak of a pandemic- it creates robustness of the hospital at large.

By planning for changing circumstances, resources of both economical and material character could be saved, aiming towards a goal of sustainable development.

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- INTERVIEWS -

Carl Olsson,
Construction project manager
Regionfastigheter, Region Halland
29 October
22 February

Cecilia Spannel
Architect at Arkitema
9 feb 2021

Framtidens US
John Gentz, *Project manager / Head of Unit US*
Susanne Edström, *Project manager US (Projekt-och projekteringsledning)*
Kim Bergehed, *Project manager US (projekteringsledning)*
16 February

Anna Arias
Anne-Marie Börjesson Revellé
Architects at White
17 February

Madeleine Jönsson
Marie Bengtsson
Function planners
Regionfastigheter Region Halland
8 March

- IMAGES -

All drawings of Hallands sjukhus Varberg are provided and used with permission by Region Halland.

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APPENDIX

PROCESS

The appendix includes a suggestion and explanation of how the flow separation has been handled. It further illustrates the process of exploring rooms and sizes relative to the grid. This is followed by an exploration of shafts in patient rooms and ends with further facade explorations.

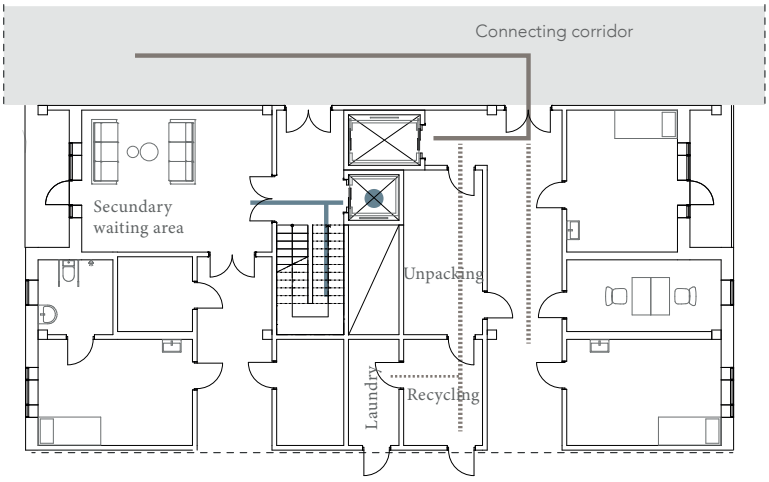
FLOWS

A STRATEGY TO EASE THE SEPARATION

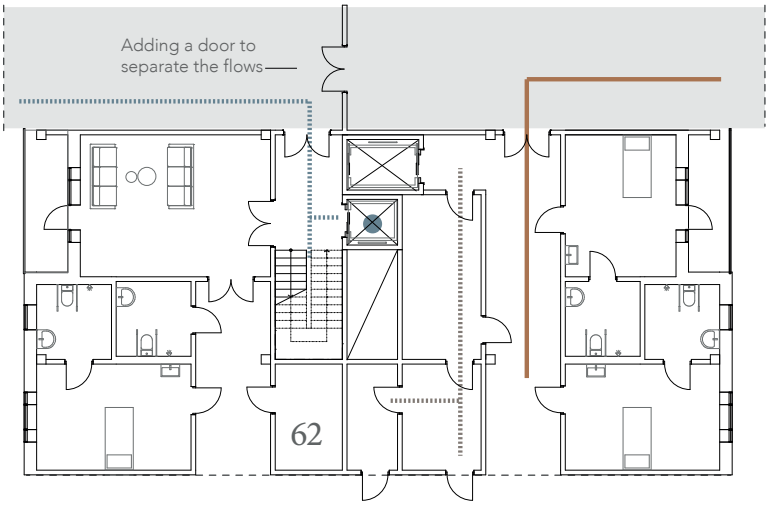
Fow separation - a conflict

The site is located in a souterrain position, which means that the culvert for the rest of the hospital becomes the ground floor in the new extension. Visitors from the main entrance and patients from other hospital activities gather on the upper floor. They have earlier been separated horizontally, which now will not be possible on the new site. To solve the collision of flows, it is in the proposal suggested to add a door dividing the connecting corridor into two parts on the upper floor. Visitors and outpatients can now reach the extension through a neutral zone at the left part and the in-patient flow will be from the right side. The two buildings at the right of the site have separate entrances.

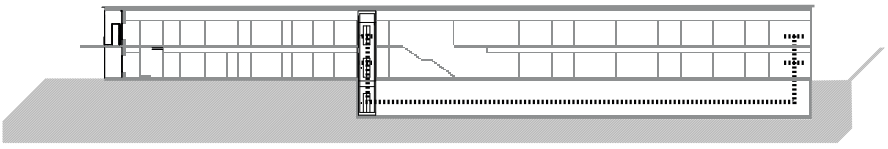
The main flow will however be from the outside to a separate entrance. This entrance is placed centrally in order to shorten the distances for staff and for the building to still function with the same entrance if it is divided.



Ground floor: Outpatient department



First floor: Ward



Flow through the basement separates the flows and makes the building dividable.

Outpatient/visitor

Goods

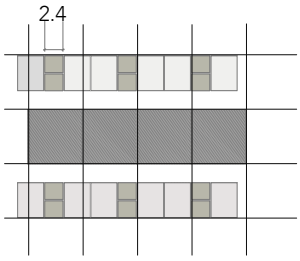
Patients in bed

EXPLORATIONS OF ROOMS AND SIZES

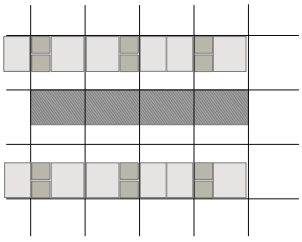
INVESTIGATING THE GRID

The existing hospital is characterized by and built according to a 7.20 meters module grid, with the aim of generality and flexibility. This page illustrates some of the explorations made on how the structure can connect to this grid, continuing the language of the hospital.

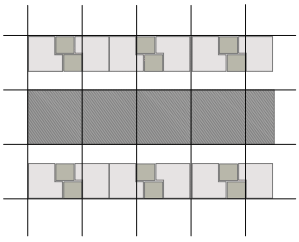
- PROS AND CONS -



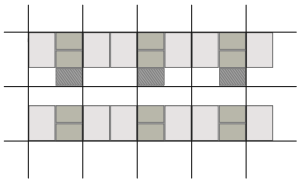
The structure becomes irregular to the rooms, which affects the facade. A suitable room size of both patient rooms and examination rooms of 15.8 sqm.



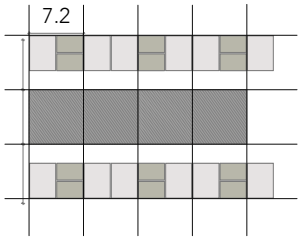
Some of the rooms become larger but the grid is regular to the rooms.



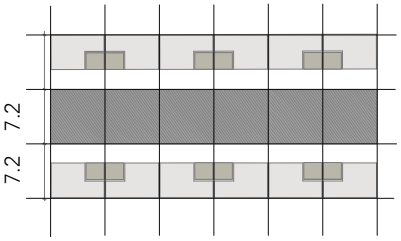
A generous size of the core creates flexibility and faster flows. This option creates suitable room sizes and a regular grid but require larger interventions.



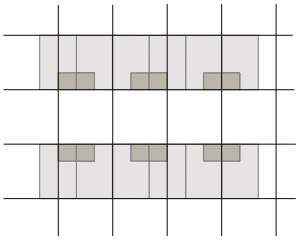
The Patient RWCs and corridor becomes wide.



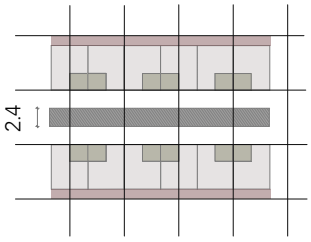
The Patient RWCs becomes wide.



Creates a long corridor but fits within the grid. The room sizes are not optimal for convertibility.



Short distances but creates a wide corridor and large examination rooms.



Adding balconies. Creates large examination rooms.

The patient room
RWC
Support core
Balcony

EXPLORATION

HOW CAN THE PLACEMENT OF SHAFTS AFFECT FLEXIBILITY?

Option 1

Grid: 7.2. RWCs shifted to follow the grid and to create regularity.

- Pros -

Follows the 7.2-metre grid.

The rooms can with some interventions be transformed into a size that is suitable for more typologies. The rooms are not locked to the width of the RWCs.

9 Examination rooms can be created from each unit.

- Cons -

Requires a bigger intervention.

The placement of shafts is more expensive than placing them between the RWCs.

- Pros -

The placement of shafts between the two RWCs is a cheaper option.

- Cons -

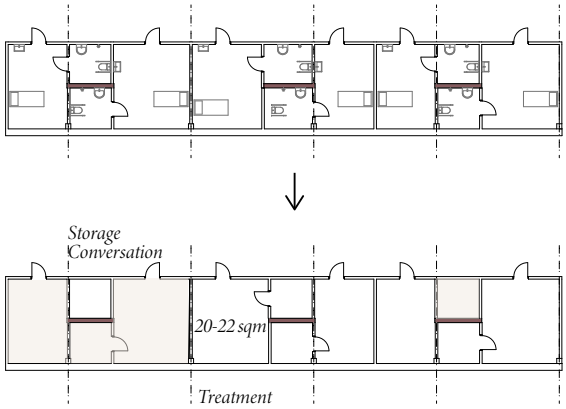
Few options to reconstruct as the shafts are placed in the middle of the rooms.

The rooms are specified for specific use.

This page illustrates the exploration and tests of flexibility and convertibility on a unit level. The placement of shafts and pillars are fixed elements and has therefore an impact on the flexibility.

Option 2

Grid: 7.2. RWCs are aligned. Different room sizes to follow the grid.



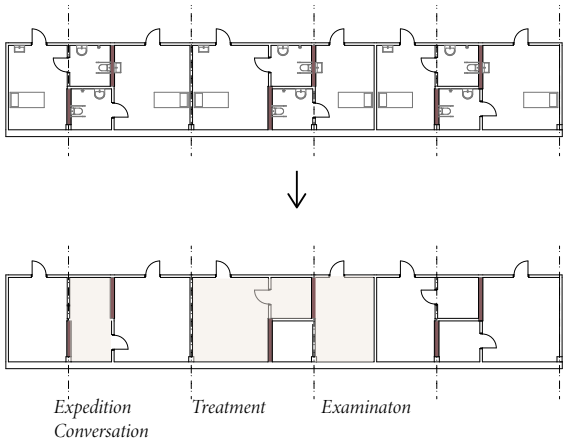
- Pros -

The larger ward rooms provide space for relatives.

A handrail can be placed from bed to RWC in patient rooms.

- Cons -

Different room sizes to follow the grid.



- Pros -

Faster convertibility with small interventions.

The larger ward rooms provide space for relatives.

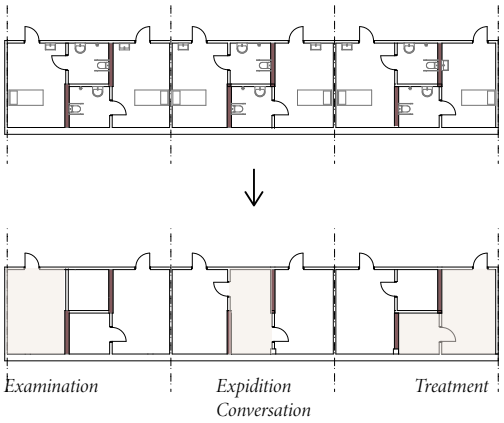
A handrail can be placed from bed to RWC in patient rooms.

- Cons -

RWCs could only be converted into expeditions or conversation rooms.

Option 3

Grid: 9.6. RWCs are aligned.



- Pros -

The length of the unit becomes shorter.

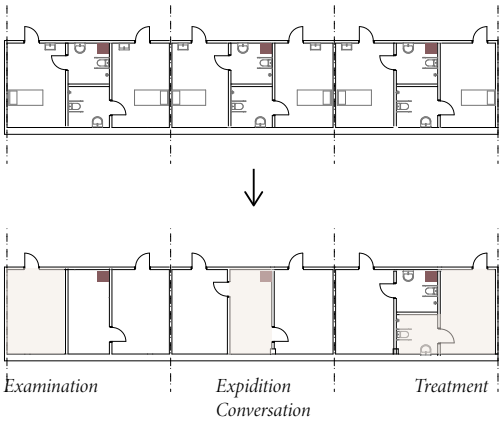
- Cons -

Does not follow the grid.

Less need for reconstruction.

A 9.6 limits the construction possibilities.

Pillars are not placed by the shafts.



- Pros -

Rooms could be opened up.

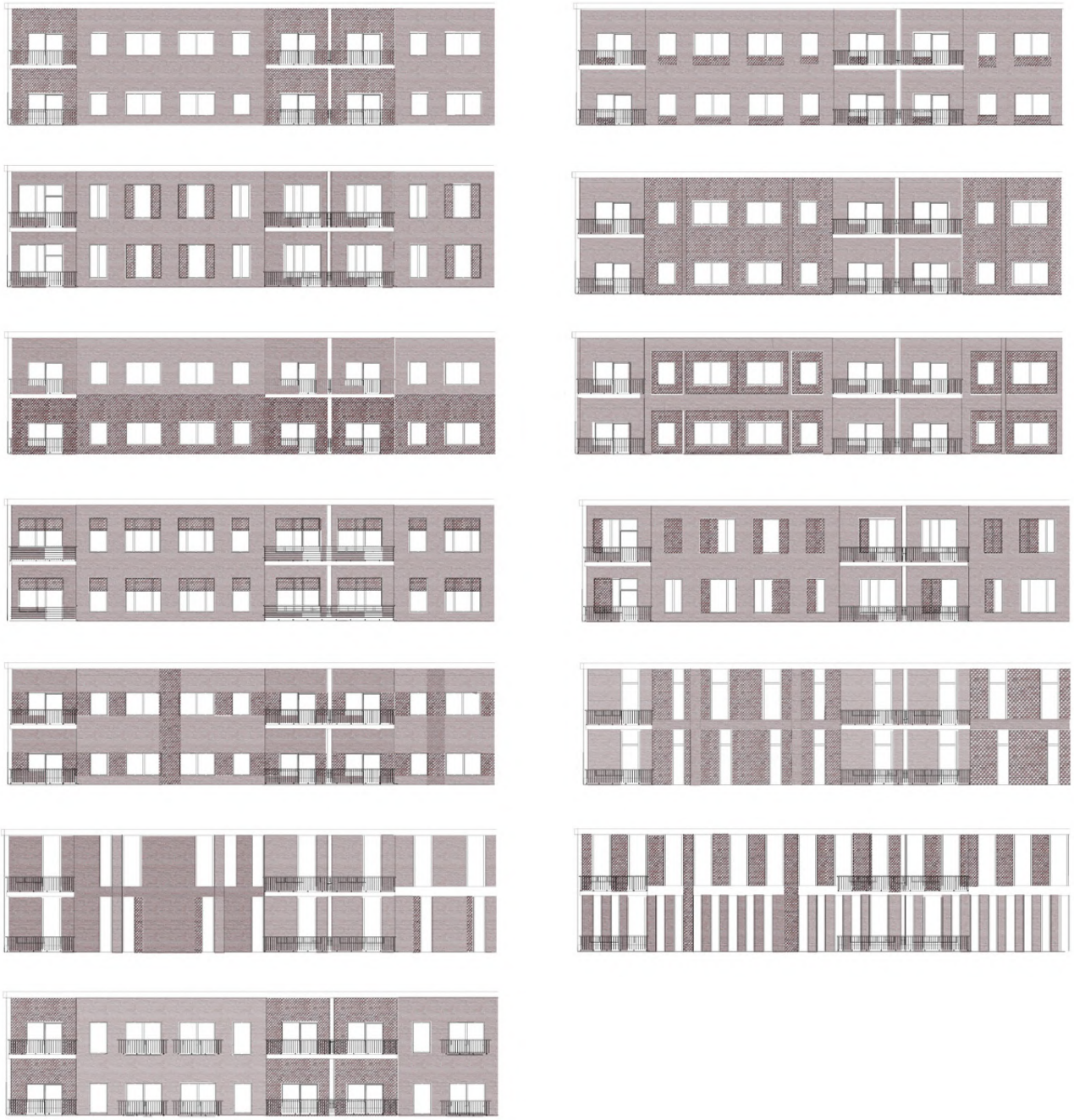
- Cons -

Shafts occupy space in the hygiene rooms which is needed for accessibility.

Odd placement of shafts in the rooms if they are opened up.

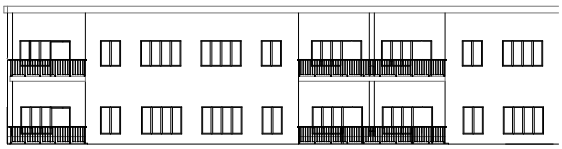
FACADE EXPLORATION

TEXTURE

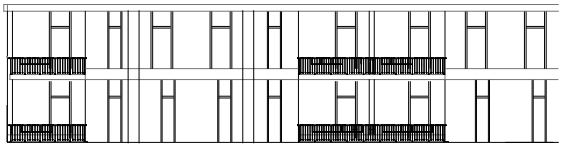


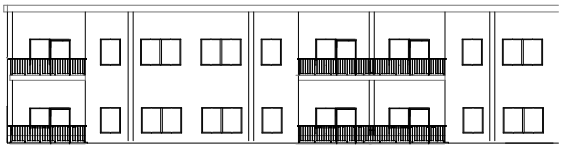
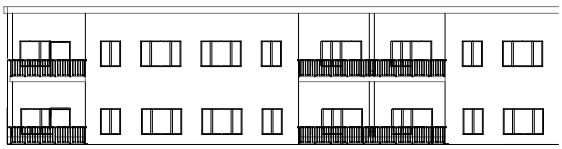
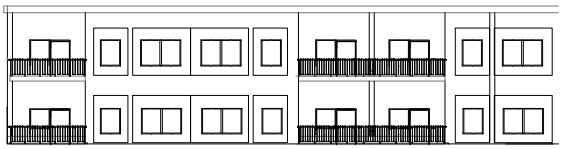
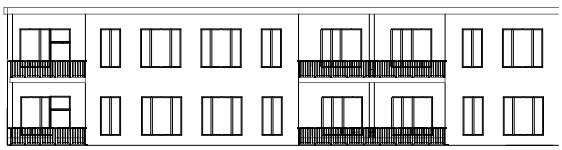
FACADE EXPLORATION

WINDOWS





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