PIET'S CENTRE

Explore lab
Graduation Report

by

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ACKNOWLEDGEMENTS

I would like to express my sincere gratitude to my tutors, who have supported me from the very beginning of this project. I am especially thankful to Roel van de Pas for pushing me throughout the process and helping me find confidence in my design, and to Yagiz Söylev for continuously asking the right questions, which helped me develop the strongest version of my project.

I would also like to thank Clara Kastelein, Annelies Kok, and Annemarie Eikelenboom for participating in the semi-structured interviews and sharing their valuable perspectives.

I am grateful to my family their insights into Cystic Fibrosis and the health-related aspects of the project.

Finally, I would like to thank Nick Brown for sharing the PARC findings, which formed an important starting point for this project, and Sofia Souvatzoglou for sharing her insights and graduation project with me.

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Me and my younger brother Piet (own image).

FOREWORD
Cystic Fibrosis

My motivation to focus on hospitals is personal: my younger brother, Piet (19), has Cystic Fibrosis. Cystic Fibrosis is a genetic condition that primarily affects the lungs and immune system, making patients particularly vulnerable to infections. In addition, people with Cystic Fibrosis can be dangerous to one another, as they may carry different bacterial strains that are relatively harmless to healthy people but potentially life-threatening to other CF patients. Preventing cross-infection is therefore a central concern in CF care.

Historically, this has not always been the case. Until the late 1980s, care for people with Cystic Fibrosis was often organized to encourage interaction, sociability, and mutual support. However, from the early 1990s onwards, clinical studies demonstrated a clear connection between social contact and the spread of cross-infectious and antibiotic-resistant bacterial strains (such as variants of the Burkholderia cepacia complex and later transmissible strains of Pseudomonas aeruginosa). As a result, CF care shifted radically towards strict infection-control measures based on physical separation and isolation (Brown et al., 2020).

Today, reducing cross-infection increasingly depends on spatial and organizational strategies: carefully choreographed movement through buildings, restrictions on shared spaces, and the avoidance of waiting rooms, corridors, elevators, and other public indoor areas. Infection control has therefore become a question of architectural design, where spatial layout, circulation, and the organization of movement directly influence the risk of transmission.

Visits to the hospital bring these challenges into focus. My brother often wears an FFP3 mask to reduce the risk of infection, yet awkward situations frequently arise in waiting areas or during interactions with staff. It was through these experiences that I became aware of how standard hospital routines and spatial configurations can clash with the needs of patients who are particularly vulnerable to infections.

For this graduation project, I want to explore whether architectural strategies could help address this issue, by designing a specialized hospital within an existing medical network for patients who must avoid infections.

This project therefore aims to explore how architectural and organizational design could create environments that better support patients for whom “not getting sick” is a constant condition. My ambition is to examine architectural strategies that would reduce unnecessary encounters and lower the risk of airborne and contact-based cross-infection. In doing so, the project combines personal motivation with a broader architectural question: how can design play an active role in protecting those for whom standard hospital environments are not enough?

PART I

AMBITION
Why?

.1 Architectural Context and Problem Definition

The contemporary hospital is confronted with a renewed architectural challenge. Many hospital buildings designed during the antibiotic era (characterized by dense layouts, shared waiting areas, and hotel/mall-like spatial models) are increasingly incompatible with the needs of patients vulnerable to infection. Research on Cystic Fibrosis (CF) clinics demonstrates how antimicrobial resistance (AMR) and airborne transmission risks reposition the built environment as an active component in infection prevention (Brown et al., 2020).

Historically, hospital architecture evolved from miasma-era principles of air and light, through germ theory's emphasis on surfaces, toward compact, efficiency-driven hospitals enabled by antibiotics (Brown et al., 2019). Today, the needs of immunocompromised patients show that these spatial models fall short. CF clinics illustrate this tension clearly: staff must constantly choreograph patient movement and enforce segregation often in opposition to the spatial constraints of existing buildings.

.2 Relevance and Urgency

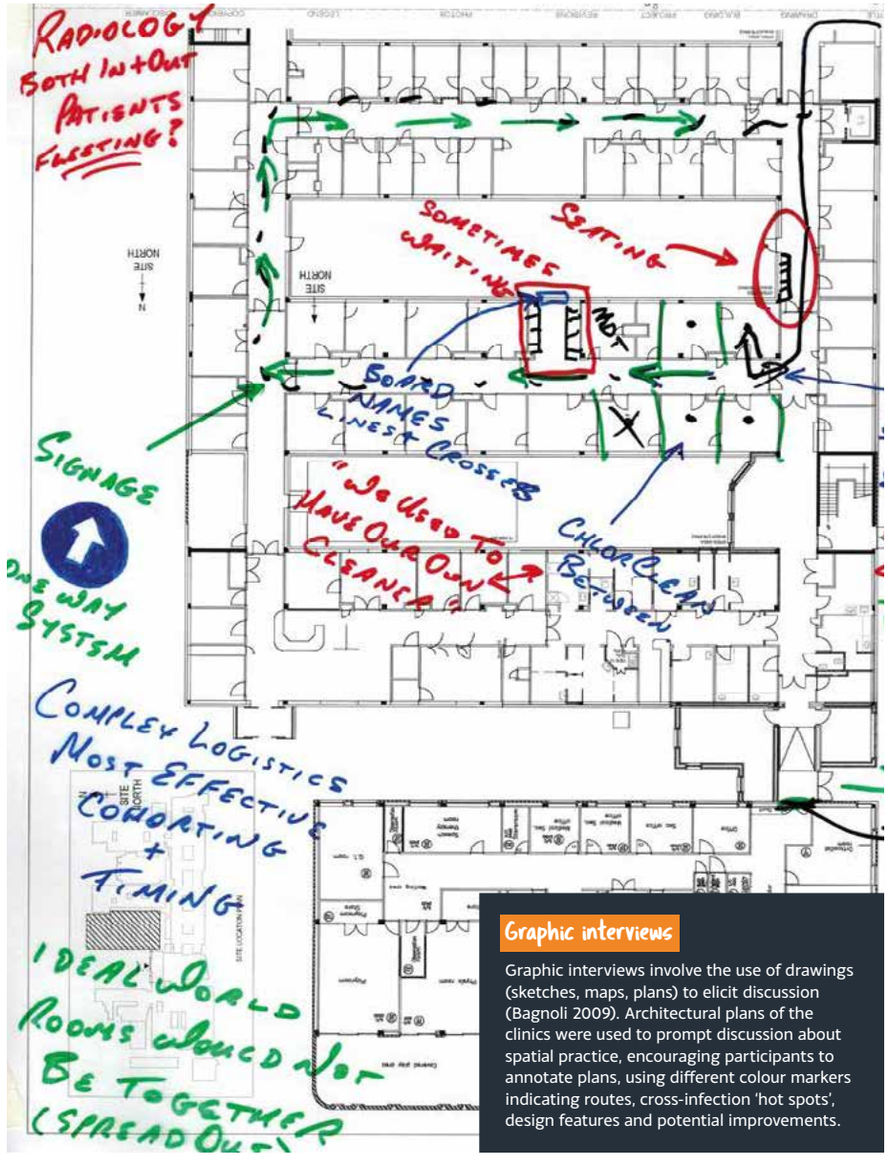
The urgency of this architectural problem has been reinforced by the COVID-19 pandemic. Long before COVID-19, CF clinics operated under strict regimes of distancing, isolation, and spatial choreography. The pandemic rendered these once-specialized practices widely visible and exposed how poorly many healthcare buildings support airborne infection control. Reports such as the PARC study (2020) show that shared waiting rooms, inadequate ventilation, and rigid layouts repeatedly undermine infection-prevention efforts for immunocompromised patients.

.3 Target Group and Personal Motivation

This project focuses on immunocompromised patients who are particularly vulnerable to infection and cross-contamination. Cystic Fibrosis patients form an important reference group, as CF care is organized around strict segregation due to the risk of cross-infection between patients. In this project, CF patients are therefore assumed to be treated primarily within an autonomous outpatient setting.

Additional target groups include patients undergoing chemotherapy, whose vulnerability extends throughout treatment cycles, and stem cell transplant patients, whose care is largely inpatient-based during highly vulnerable recovery phases. Together, these groups highlight a shared architectural challenge: existing hospital environments insufficiently support patients for whom "not getting sick" is a constant condition.

My personal motivation for this topic stems from direct experience with CF care, where everyday hospital routines often conflict with the spatial needs of vulnerable patients. This personal perspective informs the project but is positioned within a broader architectural question.



Graphic interviews

Graphic interviews involve the use of drawings (sketches, maps, plans) to elicit discussion (Bagnoli 2009). Architectural plans of the clinics were used to prompt discussion about spatial practice, encouraging participants to annotate plans, using different colour markers indicating routes, cross-infection 'hot spots', design features and potential improvements.

Sketch reportage illustrating patient movement through a CF clinic (Brown et al., 2020).

DESIGN PROJECT
What?

.1 Main Design Question

How can architectural design contribute to infection safety and overall well-being for immunocompromised patients within the hospital environment?

.2 Sub Design Questions

- **Social interaction:** How can architecture enable safe interaction between patients, staff, and visitors?
- **Inside vs. outside:** How can transitions between inside and outside support healing and controlled exposure?
- **Routing and priority:** How can circulation separate flows and define priority between patients, staff, and visitors?
- **Well-being:** How can form, light, greenery, and scale support patient and staff well-being?

.3 Research Questions

- **Patient Experience & Movement**
  What can be learned from the experiences, movement patterns, and behavioural adaptations of Cystic Fibrosis (CF) patients within hospital environments?
- **Historical Hospital Typologies**
  How can the historical development of hospital architecture, including pre-antibiotic models, inform future infection prevention and spatial organization?
- **Circulation & Spatial Hierarchies**
  What can be learned from the way pathways, corridors, and circulation systems in contemporary hospitals across different spatial scales?
- **Evidence-Based Design & Health Outcomes** How can Evidence-Based Design (EBD) inform and support architectural strategies aimed at improving infection safety and well-being for immunocompromised patients?
- **Infectious Disease & High-Containment Facilities**
  What can be learned from the architectural, spatial, and operational principles of infectious disease centres and high-containment healthcare facilities?

4. Location and Context

The proposed specialised hospital is located in Utrecht, within the Utrecht Medical Cluster. This location was selected because it combines a high concentration of immunocompromised patients with a spatial context that supports the objectives of the project.

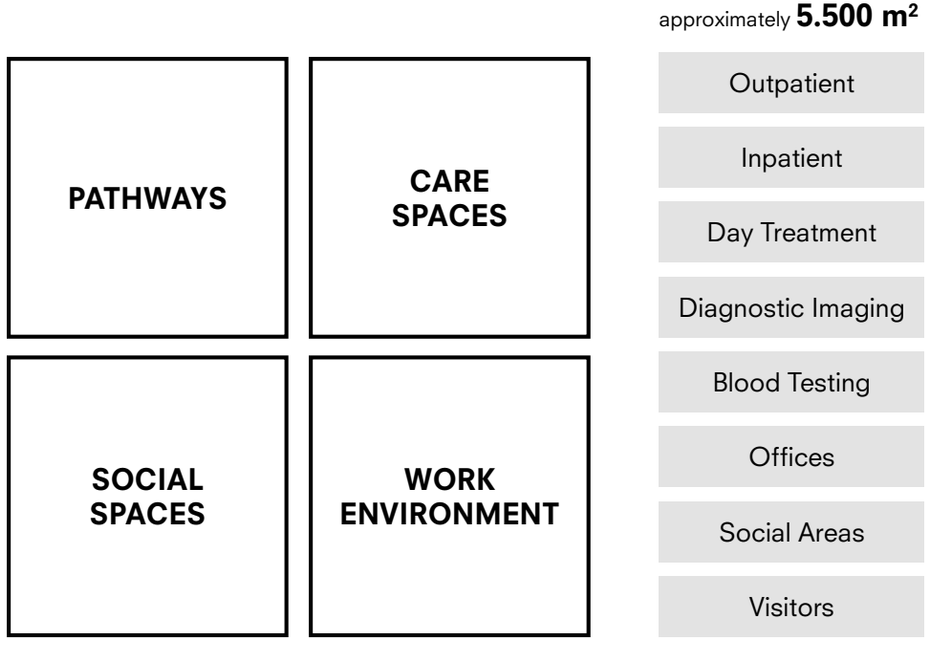
UMC Utrecht treats substantial numbers of patients from the project's primary target groups. On an estimated annual basis, care is provided for approximately 344 adult and 156 paediatric cystic fibrosis patients, 100 adult and 50 paediatric stem cell transplant patients, and 1,297 adult and 181 paediatric chemotherapy patients. These figures indicate that a significant proportion of patients receiving CF, SCT, and chemotherapy care in the Netherlands are treated within this medical network. A more detailed analysis of patient flows is provided in the results chapter.

UMC Utrecht is situated within the Utrecht Science Park, a campus environment characterised by open space and surrounding greenery. Research indicates that access to daylight and views of nature can support patient well-being and reduce stress in healthcare settings (Masip-Tresserra, 2016). These environmental conditions are relevant for patients who experience prolonged or repeated hospital visits.

The combination of patient concentration and spatial context makes the Utrecht Medical Cluster a suitable location for the proposed specialised hospital.

5. Programme

- The programme comprises a specialised hospital for immunocompromised patients. Core clinical functions include outpatient consultation and monitoring, chemotherapy day treatment for adult and paediatric patients, inpatient units for stem cell transplant patients and Cystic Fibrosis patients. These functions form the core of the hospital and are organised to limit unnecessary movement and contact between patient groups.
- Supporting medical services such as blood testing, pulmonary testing, diagnostic imaging (CT, MRI, PET, X-ray, DEXA, and echography), and pharmacy are integrated within the same facility to reduce infection risk.
- The programme includes staff and organisational spaces that support multidisciplinary care and staff well-being. Recognising the demands of complex and intensive treatment, and the need to share specialists within the existing medical network.
- In addition, the programme provides social and supportive spaces for patients and families, intended to enable controlled social interaction and support social cohesion within an infection-safe setting.
- Ancillary functions such as storage, kitchens, linen, and technical spaces support daily operation.



PART II.



Overview of book covers used in the literature study. Source: see reference list.

THEORETICAL FRAMEWORK I
Establishing the problem

The theoretical framework was used to understand the relation between infection risk, healthcare practices, and architectural space. The main body of literature is based on the Pathways, Practices and Architectures: Containing Antimicrobial Resistance in the Cystic Fibrosis Clinic research program. The article by Brown et al. (2019) formed an important base for the project, as it directly connects the spatial organization of Cystic Fibrosis clinics to infection prevention and everyday care practices.

Through direct contact with Nick Brown, the PARC findings summary was obtained and used alongside several peer-reviewed articles written by overlapping research teams. These texts examine how architectural layout, circulation, airflow, spatial boundaries, and daily routines influence infection risk and patient experience in cystic fibrosis care environments (Brown et al., 2019; Brown et al., 2020a; Brown et al., 2020b; Buse et al., 2020; Martin et al., 2022). This literature was especially relevant because it showed that infection prevention is not only a medical or technical issue, but also a spatial one.

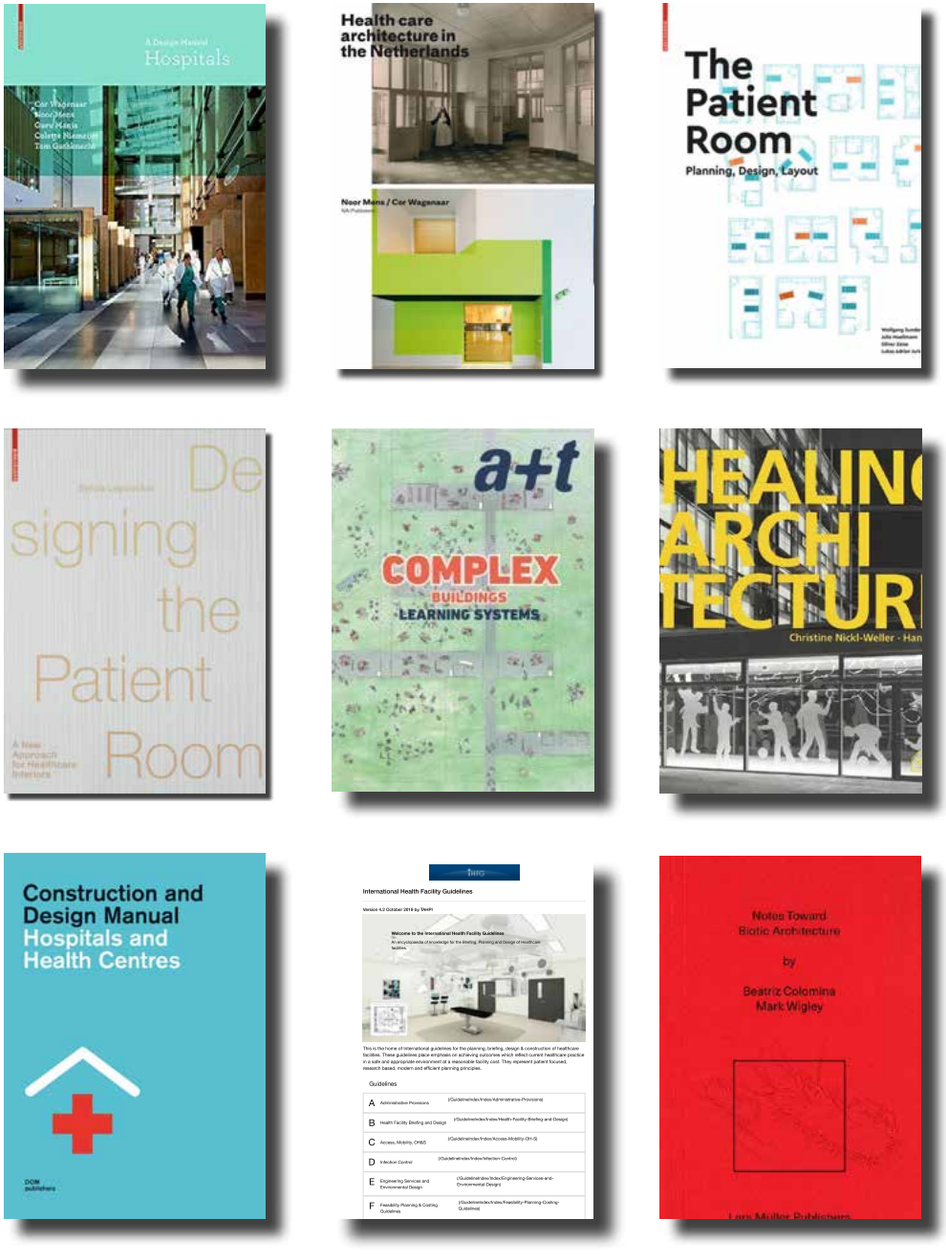
The literature helped to frame the project around the question of how architecture can support patients who are vulnerable to infection. It also made clear that spaces such as corridors, waiting areas, entrances, consultation rooms, and transitional zones are not neutral. They influence how patients move, how risk is managed, and how care is experienced. For this reason, the project approaches infection prevention as a design problem that involves routing, air, distance, contact, waiting, and atmosphere.

Clinical standards for Cystic Fibrosis care were also consulted to connect these spatial findings to medical requirements and operational protocols (Southern et al., 2023). These standards helped to understand the specific needs of cystic fibrosis patients in relation to infection control, multidisciplinary care, and long-term treatment. Together, the PARC research and clinical standards formed the basis for understanding the problem from both a spatial and healthcare perspective.

The theoretical framework was further supported by research into evidence-based design. Masip-Tresserra's work on polycentricity, performance, and planning was used to position the project within a design approach that is informed by research and measurable spatial performance (Masip-Tresserra, 2016). This supported the intention to work with design principles that can be argued through precedent, literature, and testing rather than only through intuition.

Research on biophilic design in healthcare environments was also used to inform the direction of the project. Miola, Boldrini, and Pazzaglia (2025) describe the healing potential of nature in healthcare facilities. This became relevant for the project because the design does not only focus on protection and separation, but also on creating a care environment where fresh air, gardens, daylight, and contact with nature become part of the spatial strategy. This research contributed to the choice of the site in Utrecht.

Municipal and future development documents were used to understand the site context. The Intentiedocument: UMC Utrecht: Herontwikkeling UMC Utrecht, noordzijde provided information about the future development of the northern side of the UMC Utrecht campus (Gemeente Utrecht & UMC Utrecht, 2023). This helped to position the project in relation to the existing medical campus, the WKZ, the Princess Máxima Centre, and the surrounding landscape.



Overview of book covers used in the literature study. Source: see reference list.

THEORETICAL FRAMEWORK II

Precedent / References

Because there is no direct precedent for a building specifically designed for immunocompromised patients, the project uses a broader set of architectural references from which spatial principles could be extracted.

An important precedent was the Emergency Clinic and Clinic for Infectious Diseases by LINK Arkitektur and C.F. Møller. Although this project is designed for infectious patients rather than immunocompromised patients, it became relevant because of the way it organizes infection safety through architecture. The building uses separated circulation, controlled transitions, pressure differences, and direct outdoor access as part of its spatial strategy. In this project, that principle was reversed. Instead of only protecting others from infectious patients, the design explores how vulnerable patients can be protected from contamination coming from outside.

This precedent helped to define the importance of clean routes, controlled thresholds, pressure concepts, and fresh air. It also introduced the idea of the loop as a spatial organization. The loop became a way to think about movement without unnecessary crossings, while still allowing the building to remain connected to gardens, outdoor space, and daylight.

Alongside this specific precedent, a broader study of hospital architecture was conducted. Books on hospital design and patient rooms were used to understand basic healthcare planning principles, spatial dimensions, room organization, routing, and the historical development of hospital typologies (Meuser & Labryga, 2019; Sunder, 2020; Leydecker, 2017; Nickl-Weller & Nickl, 2013; Wagenaar & Mens, 2019; Mens & Wagenaar, 2010). The International Health Facility Guidelines were also used as a practical reference for healthcare planning requirements and room standards (International Health Facility Guidelines, 2025).

This research showed how contemporary hospitals are often organized around efficiency, compactness, logistics, and standardization. At the same time, the historical study showed that earlier hospital models placed more emphasis on air, light, outdoor space, and separation. This contrast became important for the project. It raised the question of whether certain pre-antibiotic spatial principles, such as fresh air, distance, gardens, and separated routes, could become relevant again when designing for immunocompromised patients today.

The precedent research also included Maggie's Centre. These buildings were studied because they show how architecture can create a strong identity for a specific patient group. They are able to form a sense of community and recognition without feeling like a conventional hospital. This was relevant because the project aims to design for patients who need protection and separation, but who should not be reduced to isolation. The Maggie's Centres helped to think about atmosphere, scale, domesticity, and the emotional experience of care.

In addition, the project was informed by architectural thinking around bacteria and the built environment. In Praise of Bacteria: Notes Toward Biotic Architecture by Colomina and Wigley (2025) was used to reflect on the relationship between architecture, microbes, and the idea of clean space. This helped to question the assumption that healthcare architecture should only be sterile and sealed. Instead, the project explores a more nuanced idea of cleanliness, where fresh air, controlled exposure, and spatial organization are used as architectural tools.

Together, these precedents and references provided a framework for the design. They helped to define the main spatial themes of the project: protected movement, clean air, thresholds, pressure, gardens, community, atmosphere, and care-specific architecture.

READING GUIDE
Method through report booklets

The research and design process is documented through several report booklets. Each booklet focuses on a different part of the project, but together they form the method through which the design was developed.

Report Part II: Design Framework

The design framework focuses on the architectural and theoretical background of the project. It examines how healthcare architecture has developed and how the current hospital model could be reconsidered from the perspective of immunocompromised patients.

The booklet starts with a historical study of hospital architecture. This study examined the shift from pre-antibiotic hospital models, where air, light, distance, and outdoor space played an important role, toward compact and efficiency-driven healthcare buildings. This raised questions about generic hospital typologies and supported the need for more care-specific spatial design.

Maggie's Centres were then studied as examples of patient-specific architecture. Although they do not have the same medical requirements as the proposed clinic, they show how architecture can create a strong identity and atmosphere for a specific patient group. They helped to explore how a healthcare-related building can offer community and comfort without becoming institutional.

A comparative plan analysis of contemporary healthcare buildings was conducted across different scales. This analysis looked at circulation, zoning, thresholds, and transitional spaces. It showed that larger hospitals often have more structured and rigid circulation networks, while smaller healthcare buildings allow more informal and direct routes.

The framework then shifts toward the perspective of the users. Because the project focuses on a very specific patient group, it questions which spatial conditions patients might be willing to accept when these conditions clearly contribute to safety, comfort, and freedom elsewhere in the building.

The booklet ends with atmospheric collages that translate the research into spatial imagination. These collages helped to develop an architectural language around protection, gardens, domesticity, clean air, separation, and community before the final building form was determined.

Report Part III: Programmatic Framework

The programmatic framework defines the users, care trajectories, and spatial requirements of the project. Because there is no direct example of a hospital for immunocompromised patients, the program was developed by comparing patient groups with similar vulnerabilities. The research expanded from Cystic Fibrosis (CF) patients to include Stem Cell Transplant (SCT) patients and Chemotherapy patients. These groups share comparable needs regarding infection prevention.

This booklet includes research into patient numbers, treatment processes, care routines, and the relationship with UMC Utrecht, the Wilhelmina Children's Hospital, and the Princess Máxima Centre for Pediatric Oncology. The proposed clinic is not intended to replace existing hospital services, but to support them by accommodating specific patient groups in a more controlled and care-specific environment.

The programmatic framework also contains qualitative research. Semi-structured interviews were conducted with Clara Kastelein, Annelies Kok, and Annemarie Eikelenboom. These interviews provided insight into daily healthcare routines, spatial constraints, infection prevention, patient experience, and organizational challenges. A CF outpatient appointment was also attended as participant observation, which made it possible to observe movement, waiting, routing, and separation in practice.

The positive pressure room, discussed during the interview with Clara Kastelein, became one of the important technical and spatial principles in the project. Combined with the idea of fresh and clean air inspired by the Clinic for Infectious Diseases in Malmö, informed the first design principles for patient rooms, thresholds, and circulation.

Report Part IV: Research by Design

The research-by-design booklet documents the iterative design process. During the project, research and design constantly informed each other. Literature, precedents, interviews, and site research led to initial design principles, while design tests revealed new spatial questions that needed to be explored further.

The research-by-design process started with physical maquettes. These models were used to test spatial extremes, massing, scale, courtyard structures, loops, and the relationship between the building and the surrounding hospital campus. The aim was not to choose one extreme solution, but to understand the positive and negative effects of each model.

As the project progressed, the design experiments became more specific and shifted toward digital modelling. Digital models were used to test the form of the building, the organization of loops, patient-room clusters, pressure concepts, entrance sequences, and the relation between program and site. This made it possible to compare variations more precisely and to gradually develop a coherent architectural proposal.

Report Part IV therefore shows the design process as a method of investigation. It documents how spatial principles were tested, adjusted, rejected, or developed further. The final design is the result of this iterative process, in which the research framework, programmatic requirements, precedent studies, interviews, and research-by-design experiments into one design. The booklet contains the final drawings of the project, including the site plan, floor plans, sections, elevations, atmospheric images, and technical elaborations.

Report Part V: Final Design

Report Part V presents the final architectural proposal. It brings together the theoretical framework, programmatic research, precedent

STUDIO SCHEDULE A1

	week	date	activity	task & output	achieved
Introduction	W2.1	10.11 - 14.11	Kick off Xlab 41	**Brainstorm**	Location options, ref. EID malmo
	W2.2	17.11 - 21.11	Group Tutorial 10.15 Elise Workshop Elise	Literature, **research on topic**, "how to make it architectural?", for who are we designing?	PARC research, target group
	W2.3	24.11 - 28.11	Group Tutorial 10.15 Roel	**Reaching out**, UMC site visit, making appointment, look at people flows, references Yaz	people flows, zoom out to hospital design
	W2.4	01.12 - 05.12	Group Tutorial 9.00 Elise	Kick-off meeting team, interviews, **combining the ground work** for pitch	interview, new ideas, 3 extremes
Design Brief	W2.5	08.12 - 12.12	**Pitch** Informal with studio	History + Framework	Pitch, Manifesto, and future vision + typology
	W2.6	15.12 - 19.12	16 dec Annelies EMC	Redefining	Social interaction with masks?
	Break	22.12 - 02.01	--	Brief	Defined the brief + patient numbers
	W2.7	05.01 - 09.01	5 jan Piet hospital visit	Redefining	Developed the brief, site choice
	W2.8	12.01 - 16.01	**UPLOAD PART 1&2 OF GRADUATION REPORT 15 JAN**	Redefining / Assemblage	Design questions, Site model 1.1000
	W2.9	19.01 - 23.01	**A1 Vrijdag 23 jan** Kick-off	Prep A1 Formal assessment of the graduation setup in week 2.9-2.10	Presentation feedback
	W2.10	26.01 - 30.01	29.01 Feeback Yaz & Roel	1.500 Framing	Focus: scenography - use models

STUDIO SCHEDULE A2

	week	date	activity	task & output	Achieved
Geometry	W3.1	02.02 - 06.02	06.02 Feedback Roel	1.500 Design Concept	Site model 1.500 + From Studies
	W3.2	09.02 - 13.02	12.02 Feedback Yaz	1.200 Design Concept / Structure / Materials	Site redesign / Site choice
	W3.3	16.02 - 20.02	17.02 Feedback Roel	1.50 the patiënt room & radioligy	Defined grid / patient room layout
	Break	23.02 - 27.02	xx	xx	xx
	W3.4	02.03 - 06.03	05.03 Feedback Yaz + Roel	1.200 Layout / Loops / Movement scheme	First concept of 3 loops
	W3.5	09.03 - 13.03	12.03 Feedback Yaz 13.03 Feedback Roel	1.200 Roof design / 1.100 Floor plan design / Construction / maquette studies	Concept structure + facade
	W3.6	16.03 - 20.03	17.03 talk with Sofia Souvatzoglou 19.03 Feedback Roel	Iterations on previous choices / Material connections / atmosphere	Development FP / Development Construction
	W3.7	23.03 - 27.03		1.20 development / Materiality /	xx
Craft	W3.8	30.03 - 03.04	**02.04 A2** Midterm	Progress review of the preliminary research/design in week 3.8 or 3.9	Presentation feedback
	W3.9	06.04 - 10.04	Feedback Roel	Development products / Find the main elements (architecture+construction)	Materiality
	W3.10	13.04 - 17.04	16.04 Feedback Yaz Feedback Roel	Development products / Find the main elements (architecture+construction)	1.20 development

STUDIO SCHEDULE A3 & A4

	week	date	activity	task & output	Achieved
Final Design	**W4.1**	**20.04 - 24.04**	23.05 Feedback Yaz	based on feedback	1.20 development
	W4.2	**27.04 - 01.05**	01.05 Feedback Yaz	Concept: What tells the story?	axonometric drawing as main visual
	W4.3	**04.05 - 8.05**	07.05 Feedback Roel 07.05 Feedback Yaz	Visuals: what do I need?	first Renders
	W4.4	**11.05 - 15.05**	11.05 Feedback Roel	Visuals / Maquette	finish 3D model
	W4.5	**18.05 - 22.05**	21.05 Feedback Roel 21.05 Feedback Yaz	Maquette / 3d detail	first version report
	W4.6	**25.05 - 29.05**	26.05 Feedback Roel 28.05 Feedback Yaz	hand in report	V1
	W4.7	**01.06 - 05.06**	**A3** Green Light	Formal assessment of the final research/design in week 4.7-4.8	Presentation feedback
	W4.8	**08.06 - 12.06**	xx	xx	xx
	W4.9	**15.06 - 19.06**	**A4** Finalisation	Assessment of the public presentation for a lay audience of the final research/design of the A3	Presentation feedback
	W4.10	**22.06 - 26.06**	xx	xx	xx

PART IV.

CONCLUSION
Sub-questions

Social interaction

How can architecture enable safe interaction between patients, staff, and visitors?

Architecture can enable safe interaction by defining clear spatial boundaries between different users, while still allowing moments of contact. In the final design, patients and staff are given separate routes through the building. The main patient circulation is placed outside, in fresh air, while the staff route is organized inside to provide comfortable and efficient working conditions. This separation reduces unnecessary crossings, but does not fully isolate patients from social life.

The design also recognizes that personal protective equipment can support safe interaction when it is used correctly and consistently. For this reason, the building includes a social centre where patients, staff, and visitors can meet while wearing appropriate protection. Inspired by the atmosphere of Maggie's Centres, this space allows social contact to become part of the care environment rather than something that is excluded from it.

At the same time, not every form of social interaction can or should depend on masks. Eating, drinking, resting, and informal encounters require other conditions. Therefore, outdoor social spaces are also included in the design. These spaces use fresh air, distance, furniture placement, and playful elements to create safer forms of interaction without making separation feel forced.

Inside and outside

How can transitions between inside and outside support healing and controlled exposure?

The transition between inside and outside is used as both a technical and atmospheric principle. By keeping the main patient circulation outside, patients remain in fresh air for a large part of their movement through the building. When they enter interior spaces, positive pressure rooms and clean-air transitions help maintain a protected indoor environment.

However, the design also recognizes that being outside in the Netherlands is not always comfortable. The architecture therefore does not simply expose patients to the weather, but creates protected outdoor conditions. Mesh railings, covered routes, filtered edges, and semi-open façades allow air to move through the building while reducing wind and rain exposure. In this way, the design accepts a certain level of outdoor discomfort in exchange for cleaner air, but uses architecture to make this condition more comfortable and usable.

The inside-outside relationship therefore becomes more than a visual connection to nature. It becomes part of the infection-safety strategy, the healing environment, and the daily experience of the patient.

Routing and priority

How can circulation separate flows and define priority between patients, staff, and visitors?

The design separates flows by giving different users different routes and by adjusting the hierarchy of circulation according to the type of care. On the ground floor, where outpatient treatment and radiology create more movement and a higher patient turnover, patients are given more space and autonomy. This allows them to keep distance from others and choose how they move through the building.

On the inpatient levels, the routing becomes more controlled and gives priority to staff movement. An important principle in hospital design is reducing walking distances for staff, since they use the building continuously and work there for longer periods of time. For this reason, the staff route is positioned on the inner loop, creating a more direct and efficient circulation system. Patients move along the outer loop toward their rooms. Although this route is relatively longer, patients use it less frequently than staff. In this way, the circulation system balances infection-safe separation with the practical needs of hospital work.

This approach also influenced the technical design. In a regular hospital, mechanical ventilation is often hidden above lowered corridor ceilings. In this project, the corridors remain architecturally important spaces with height, daylight, and clear views. The ventilation is instead integrated into the patient room, where the lowered ceiling above the bed becomes both a technical element for supplying clean air and an architectural element that creates a more intimate bed zone. The technical requirements are therefore not only solved functionally, but are used to support the spatial quality of the room.

Well-being

How can form, light, greenery, and scale support patient and staff well-being?

Well-being is supported by combining infection-safe organization with light, greenery, and human scale. By separating patient and staff routes, the patient rooms are positioned between two corridors: an indoor staff corridor and an outdoor patient route. This creates rooms that receive light from both sides. At the same time, staff also benefit from continuous access to daylight, which is often lacking in hospital work environments.

The site also contributes to the well-being strategy. The building is positioned in relation to the green structure of the UMC Utrecht campus, and the design introduces courtyard gardens as part of the daily routing. Patients moving between appointments or toward inpatient rooms cross or pass these gardens, meaning that contact with greenery becomes part of the care sequence rather than an optional addition.

The design therefore uses nature, daylight, scale, and movement to create a calmer healthcare environment. Infection safety is not treated as separate from well-being, but as something that can be supported through nature inclusive healing.

CONCLUSION
Main question

How can architectural design contribute to infection safety and overall wellbeing for immunocompromised patients within the hospital environment?

Architectural design can contribute to infection safety and well-being by creating the spatial conditions in which a safer care system can function. The final design shows that infection prevention is not only a matter of medical protocols, ventilation systems, or personal protective equipment. It is also shaped by routing, thresholds, room organization, outdoor space, material choices, visibility, distance, and atmosphere.

For immunocompromised patients, the hospital is a contradictory place. It is the place where care is provided, but also one of the places where exposure to infection can be most dangerous. The design responds to this contradiction by reorganizing the hospital environment around protection, clean air, and controlled interaction. Separate routes reduce unnecessary contact, positive pressure rooms create protected interiors, outdoor circulation provides access to fresh air, and courtyard gardens support nature inclusive healing.

At the same time, the design avoids turning protection into isolation. Social spaces, outdoor meeting areas, daylight, greenery, and patient autonomy are included as essential parts of the care environment. The project therefore searches for a balance between control and freedom. It accepts that immunocompromised patients may need specific spatial conditions, but argues that these conditions can also create new forms of comfort.

The conclusion of the project is that architecture cannot remove medical risk completely, but it can define the boundaries within which care, movement, interaction, and protection take place. By using the right research methods, technical principles, and design strategies, the architect can help compose a working system in which infection safety and well-being support each other rather than compete with each other.

Implications and recommendations

The final design suggests that architecture has a larger role to play in the future of healthcare for immunocompromised patients. This patient group is often overlooked because their needs are highly specific and not always visible to the wider public. The COVID-19 pandemic made the vulnerability of shared air, close contact, and infection risk more understandable to society. For many healthy people, these concerns have become temporary memories, but for immunocompromised patients they remain part of everyday life.

This project argues that healthcare architecture should respond more directly to this reality. If hospitals are places where vulnerable patients go to receive care, they should not also become the places where these patients feel most at risk. Designing for immunocompromised patients therefore asks for a shift in priorities: from generic efficiency toward care-specific environments that combine medical safety with spatial quality.

A specialized clinic of this kind would require investment and would not be a simple or inexpensive building type, especially when it includes specific departments such as radiology. However, the architectural profession should not only respond to what is easiest to build. It should also question where existing healthcare environments are failing specific patient groups and how design can help improve them.

In this sense, the project returns to a basic principle of hospital design: “The very first requirement in a hospital is that it should do the sick no harm” (Nightingale, 1859). This principle remains relevant today, but for immunocompromised patients it requires renewed architectural interpretation. Doing no harm is not only a medical responsibility. It is also a spatial one.

REFLECTION
Complex but possible

This project showed that designing for immunocompromised patients is not only a spatial and technical challenge, but also a challenge of knowledge. Although COVID-19 made society more aware of infection risk, shared air, distancing, and vulnerability, the specific needs of immunocompromised patients are still not widely understood. This made the design process more complex, because many decisions first required explaining why certain risks or restrictions mattered.

A clear example was the idea of adding water elements to the courtyard gardens. From the perspective of nature-inclusive healing, water could have contributed to a calm atmosphere and a relaxing experience. However, for Cystic Fibrosis patients, standing water can contain Pseudomonas aeruginosa, which forms a serious infection risk. This showed how an element that is usually considered positive in healing environments can become unsuitable for a specific patient group.

Although the research included Cystic Fibrosis, Stem Cell Transplant, and Chemotherapy patients, the project was most strongly informed by Cystic Fibrosis. This was due to personal knowledge of the condition and the opportunity to visit the pulmonary department through existing connections. Contact with other departments was more limited. If the project were developed further, more interviews with all patient groups and medical staff would be needed, as each group may have specific risks, routines, and spatial needs that were not fully uncovered in this project.

During the design process, conventional hospital functions were also reinterpreted. At the start, the idea was that spaces such as large waiting rooms and entrance halls would not be part of the building. Looking back, these functions did not disappear, but returned in a different form. The entrance became an open spatial moment with a void and a view toward the sun deck, while smaller social zones near vertical circulation can also be understood as distributed waiting areas. This showed that the project did not reject familiar hospital functions, but translated them into forms that better fit the needs of the patient group.

The importance of patient autonomy also became clearer throughout the process. Immunocompromised patients often move through environments that are not designed to protect them. Therefore, the design gives patients the possibility to assess situations before entering them. For example, the glass elevators allow patients to see whether someone is inside before deciding whether to enter. In this way, safety is not only created through separation, but also through visibility and the ability to make personal decisions.

Reflecting on the process, a real project of this kind would require close collaboration between architects, patients, medical staff, infection prevention experts, and facility managers. One of the biggest challenges would be creating a shared understanding of why certain spatial choices matter, especially when they challenge conventional hospital design. At the same time, the project shows that with careful research, testing, and consultation, architecture can respond to very specific healthcare needs.

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PIET'S CENTRE

Explore lab
Design Framework

by

Lotte Annabelle Schut
5276462



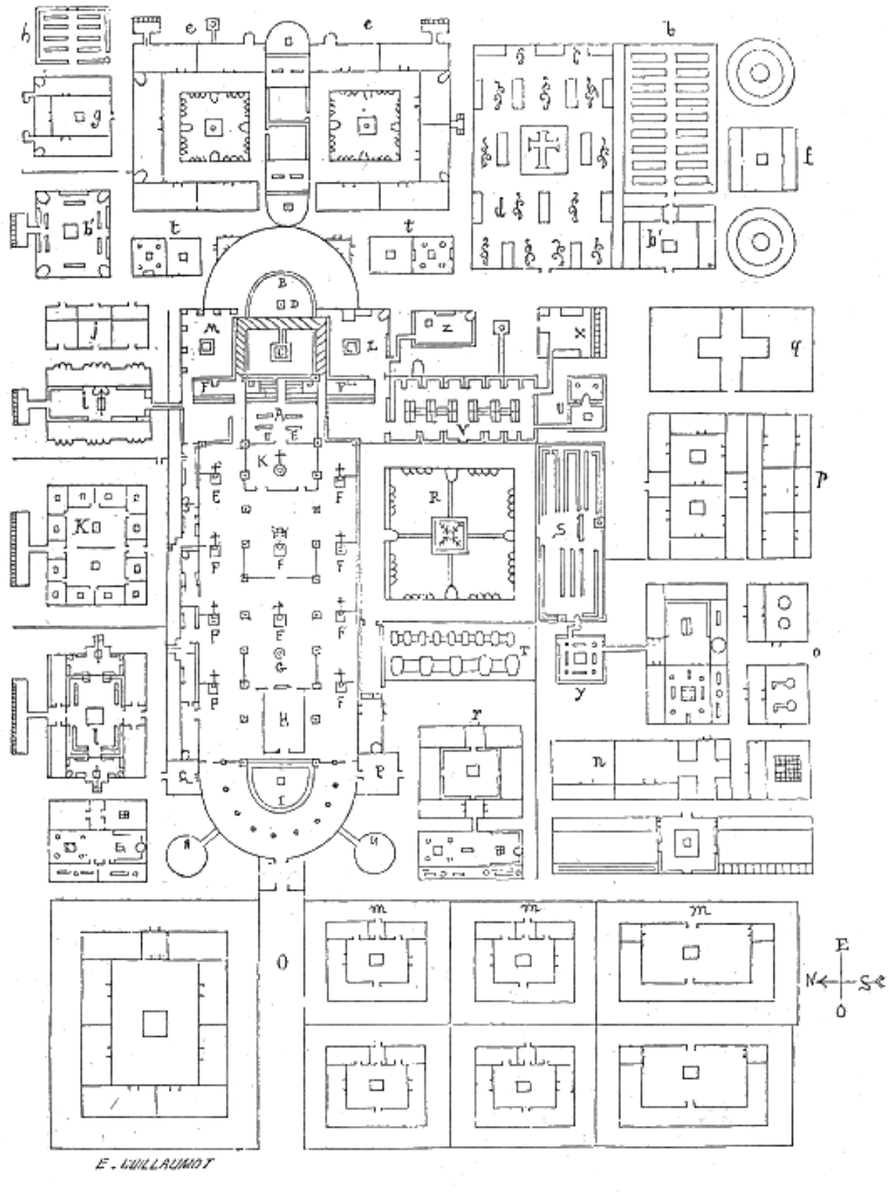
Roel van de Pas (RS) & Yagiz Söylev

THE BASILICA
c. 900-1800

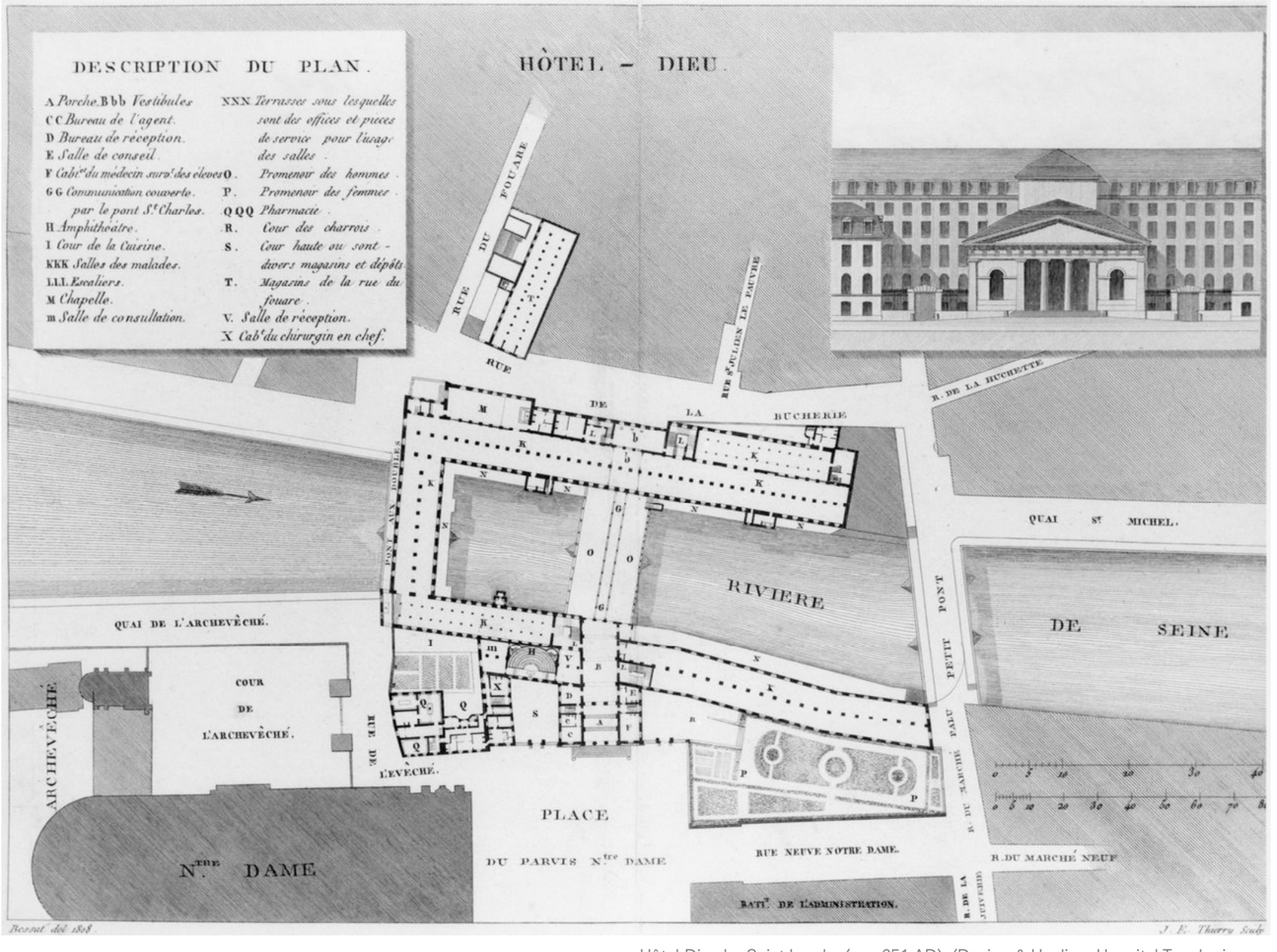
The origins of the hospital as a recognizable architectural and social institution emerged gradually between the 7th and 12th centuries, when care for the sick became increasingly intertwined with religious life and charitable practice (Wagenaar et al., 2018).

The architectural lineage of these early hospitals can be traced back to antiquity, where the basilica functioned as a large public hall for civic and commercial activities. As Christianity rose in prominence, pagan temples lost their central role, and basilicas were re purposed as religious buildings; during the Middle Ages, they commonly served as churches and cathedrals. Over time, as more people sought care and refuge, the basilica form began to merge with early hospital functions (Cooper Hewitt, Smithsonian Design Museum, n.d.). These facilities were modestly furnished and integrated into self-sufficient monastic compounds, such as the Abbey of Saint Gall, where spaces like infirmaries, botanical gardens, and blood-letting rooms foreshadowed later clinical typologies (Wagenaar et al., 2018)

A significant formalization of this charitable model occurred in 816, when the Council of Aix-la-Chapelle instructed the Church to establish institutions dedicated to aiding the poor. This directive strengthened the link between religious authority and hospital care and contributed to the spread of the hôtel-Dieu tradition, most famously represented by the Hôtel-Dieu in Paris, which remains in use today (Wagenaar et al., 2018).



Abbey of Saint Gall by Peter Thumb (c.a. 1755 - 1768), (Limited, n.d.)



Hôtel-Dieu by Saint Landry (c.a. 651 AD), (Design & Healing: Hospital Typologies - Google Arts & Culture, n.d.)

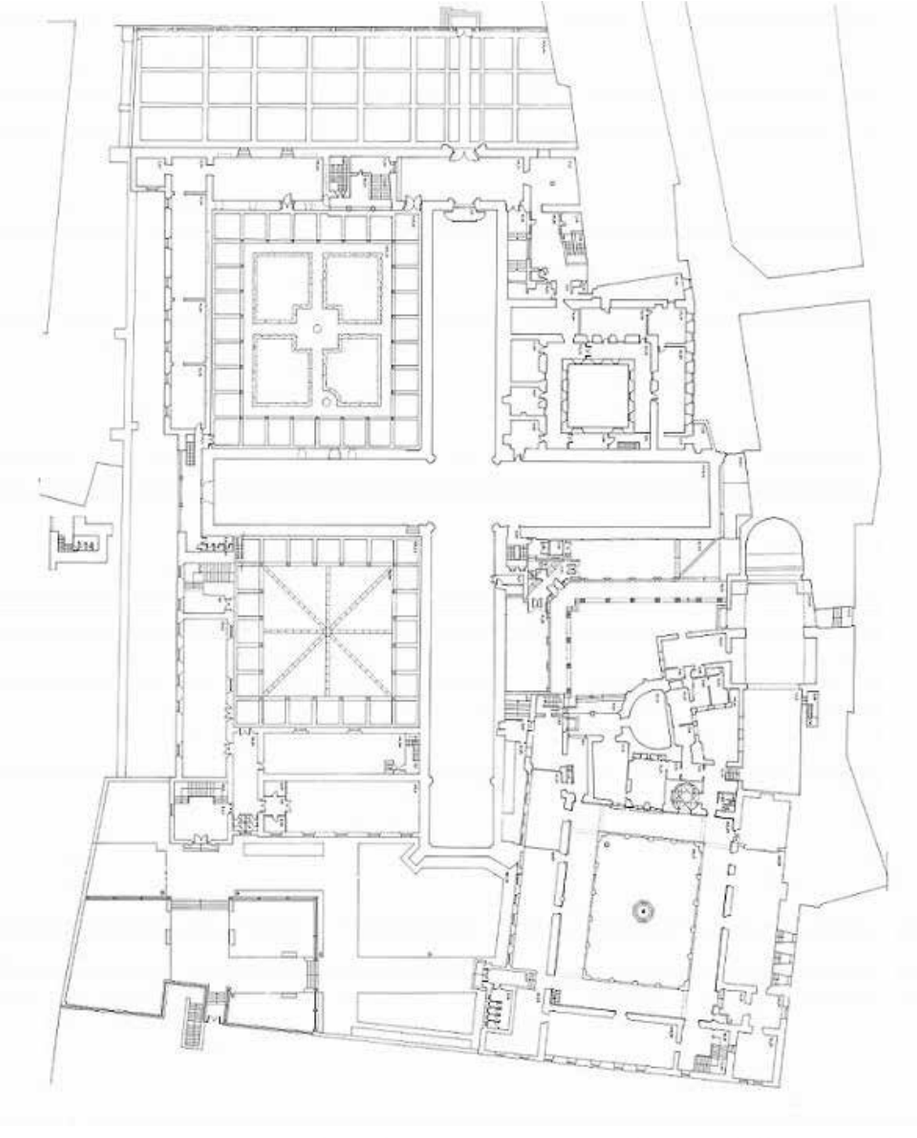
CROSS WARD
c. 1400-1700

The cross-ward hospital developed during the Renaissance as a response to the need for greater ward capacity. Earlier hospitals were usually expanded by making the wards longer, since their width was restricted by the vaulting techniques available at the time. However, this approach created a practical and spiritual problem: patients positioned at the far ends of the ward could be too distant from the altar to properly hear Mass.

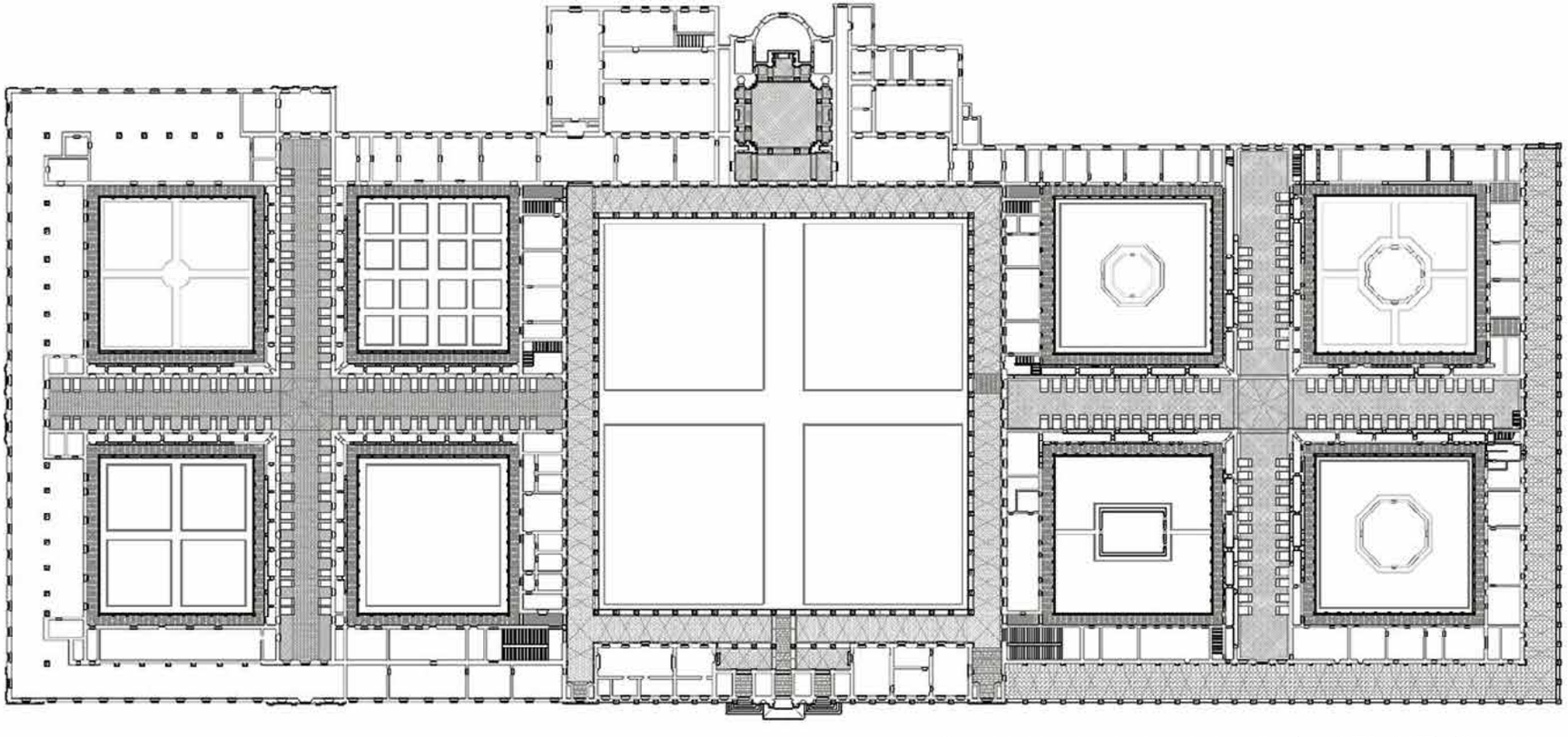
The cross-ward layout addressed this issue by arranging four open wards at right angles around a central altar. This configuration allowed the hospital to increase its capacity significantly while maintaining each patient's visual and auditory connection to religious worship (Cooper Hewitt, Smithsonian Design Museum, n.d.).

The Ospedale Maggiore in Milan is a distinctive example of Renaissance hospital architecture. As a civic institution, it marked a shift away from the Church's dominant role in healthcare and was among the early hospitals to consider hygiene as an important architectural and medical concern.

From the 13th century onward, the growth of cities, beginning in Italy and Flanders and later spreading across Europe, encouraged the emergence of healthcare systems that were not solely religious in character. Brunelleschi's Foundling Hospital in Florence is often regarded as the building that introduced Renaissance architectural principles, yet the Ospedale Maggiore in Milan became one of the better-known hospital examples from this period. Designed by Antonio Averulino, also known as Filarete, the hospital was founded in 1456 and brought together several smaller institutions into one larger complex. Its design was highly innovative: it applied Renaissance ideas of geometry and order while also expanding hospital care beyond the charitable and spiritual services traditionally provided by the clergy. By involving secular physicians, the institution broadened the medical services available to patients. Unusually for its time, Filarete also incorporated concerns about hygiene into the building's design. During this same period, cities were increasingly responsible for managing contagious diseases, often by placing simple temporary structures outside urban areas to isolate infected people and limit the spread of illness (Wagenaar et al., 2018).



Hospital de la Santa Cruz by Antón and Enrique (1500-1515), (Sanvito, 2020)



Ospedale Maggiore by Antonio Averulino (c.a. 1456 - 1465), (Ospedale Maggiore - References - Professor Adam Caruso - ETH Zürich, n.d.)

MILITARY HOSPITAL
c. 1650-1750

By the 18th century, the state had joined churches and cities in supporting hospital construction, motivated by the belief that a healthy population was essential for economic strength and military power. This led to the development of military hospitals, echoing the logic of Roman valetudinarian. Early examples such as Christopher Wren's Chelsea Hospital (1682) and the Greenwich Royal Naval Hospital (1694) introduced pavilion layouts, which were later refined by Alexander Rovehead at the Royal Naval Hospital in Stonehouse (1756–1764), where the wings evolved into fully separated pavilions (Wagenaar et al., 2018).

The Royal Naval Hospital at Stonehouse had represented a genuine advance based on medical ideas, representing perhaps the first major manifestation of science on hospital architecture. It had been noted on the battlefield that wounded soldiers left to recover in the draughty tents of field hospitals made quicker and more complete recoveries than those accommodating more substantial buildings. This discovery led the hospital's builders to experiment which consisted of a series of smaller pavilion buildings, each naturally and thoroughly ventilated and connected via a spine of covered but open-air arcades or colonnades. The pavilion hospital dealt with the prevalent interpretation of infection as something caused by 'miasma' (bad or stale air) (Jencks & Heathcote, 2010)..

The pavilion hospital proved successful yet take-up was slow; it was to be nearly another century before these ideas spread beyond the military, even though they had simulated so much debate and discussion in Paris after the Hôtel-Dieu fire (Jencks & Heathcote, 2010).



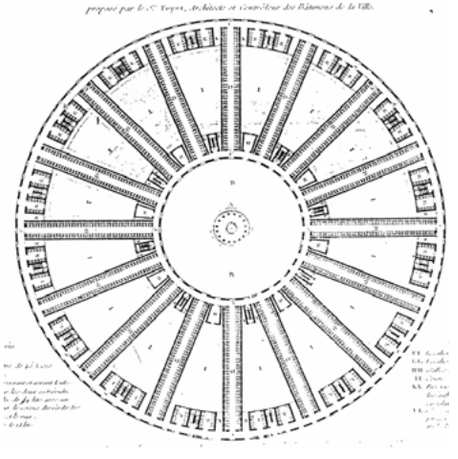
Royal Naval Hospital by Alexander Rovehead (1762), (Limited, n.d.)

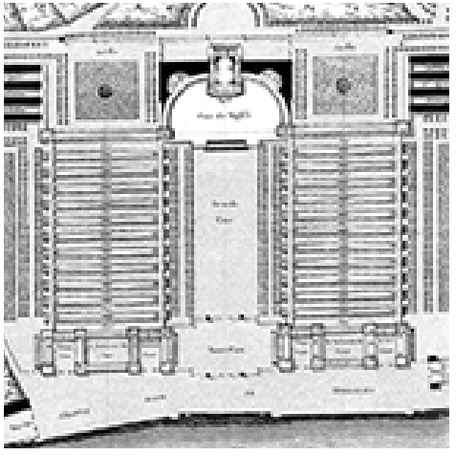
HOTEL DIEU DESTROYED BY FIRE
c. 1772

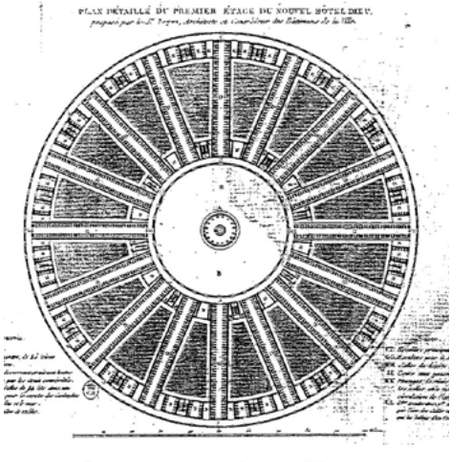
In late-18th-century Paris, emerging scientific theories of miasma and new ventilation technologies—borrowed from mining—sparked a radical rethinking of hospital design. After the Paris Hôtel-Dieu burned down in 1772, its catastrophic conditions and high mortality rates fuelled widespread support for a secular, scientifically informed hospital model. Designers proposed more than 200 schemes that treated the hospital as a machine à guérir (a healing machine) built to maximize fresh air (Wagenaar et al., 2018).

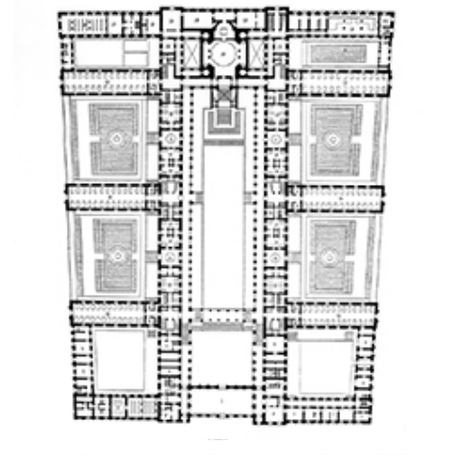
Competing visions emerged: circular "ventilator" hospitals, like Antoine Petit's six-spoked radial plan (1774) or Poyet and Coquéau's vast 16-wing hospital for the Île des Cygnes (1785), emphasized continuous airflow through monumental geometry. Others, led by Jean-Baptiste Le Roy and architect Charles-François Viel, promoted a rectangular pavilion system composed of separate, well-ventilated blocks organized around courts.

One of the clearest examples of the pavilion hospital model was constructed in Paris, although it was completed more than a century after the devastating fire of 1772. This new Hôtel-Dieu, designed by Emile Jacques Gilbert, was built on the northern side of the square facing Notre-Dame Cathedral. The location had been proposed by Georges-Eugène Haussmann, the planner whose large-scale transformation of Paris created the city's well-known boulevard system (Wagenaar et al., 2018).









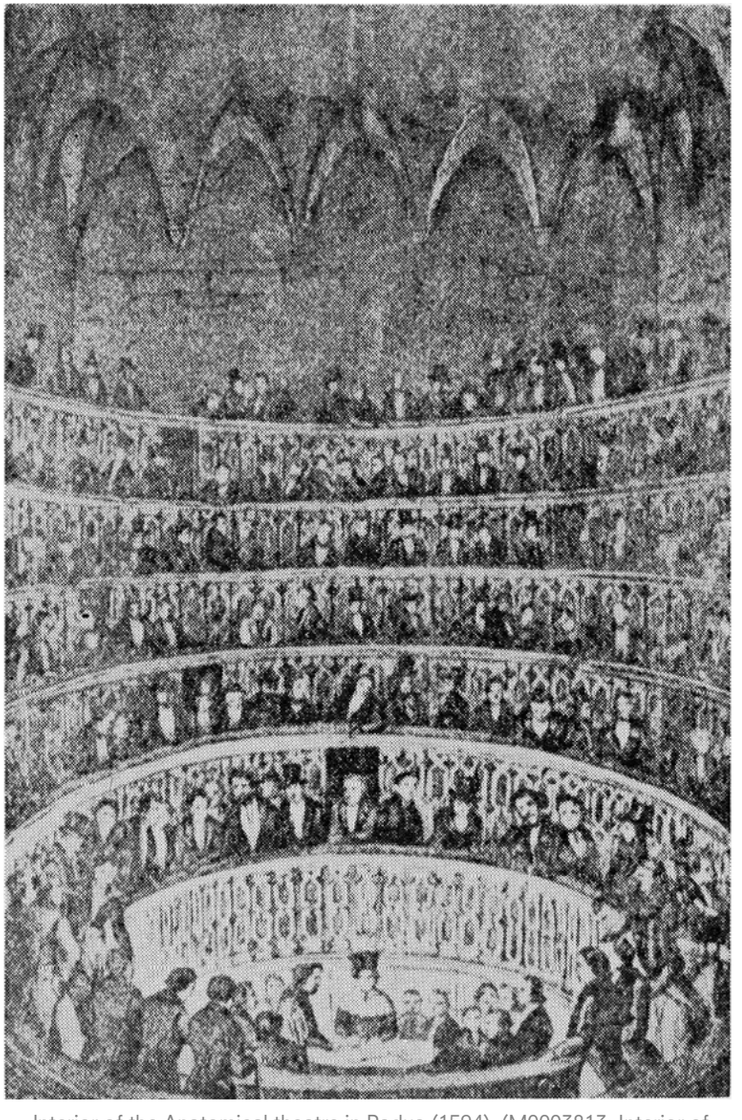
Hôtel-Dieu by Antoine Petit (1774), Hôtel-Dieu by Bernard Pyet (1785), (Wagenaar et al., 2018)

Hôtel-Dieu by Jean-Baptiste Le Roy (1773), The New Hôtel-Dieu byEmile Jacques Gilbert (1866-1877), (Wagenaar et al., 2018)

A HEALING MACHINE
c. 1700-1800

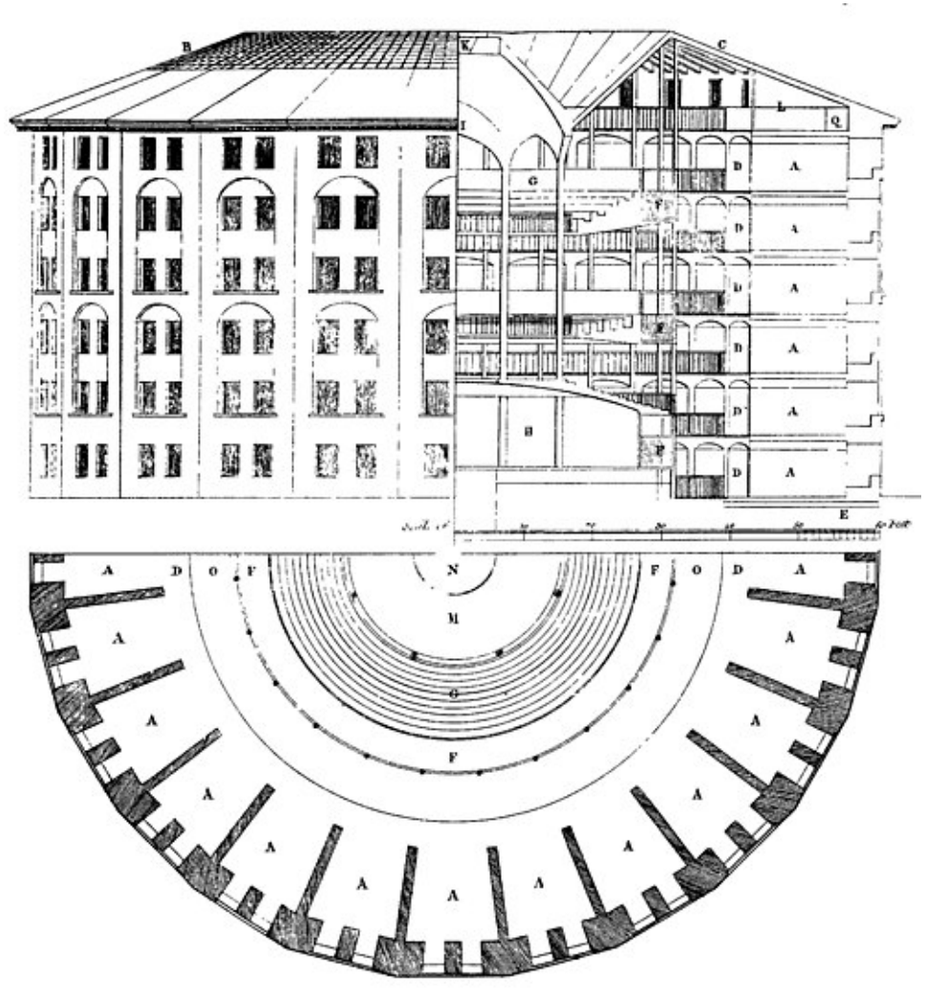
During the Renaissance, scientific inquiry gradually began to challenge medieval, religion-based understandings of the human body, and empirical medical research gained prominence. Teaching hospitals emerged, centred around anatomical theatres where students observed dissections from tiered seating; the oldest surviving example is the 1594 theatre in Padua. For centuries, dissection and specimen collection formed the core of anatomical knowledge, a tradition transformed in the mid-19th century when Rudolf Virchow at the Charité advanced pathological anatomy as a scientific discipline (Wagenaar et al., 2018).

By the late 18th century, hospitals shifted from charitable institutions to environments explicitly designed for curing. Influenced by miasma theory and supported by new tools such as statistical analysis and medical cartography, architects and physicians re conceived the hospital as a machine à guérir: a healing machine focused on maximizing fresh air. The Allgemeines Krankenhaus in Vienna (1784) exemplified this transition, integrating early ventilation technologies to supply clean air and remove what was believed to be contaminated air (Wagenaar et al., 2018).



Interior of the Anatomical theatre in Padua (1594), (M0003813: Interior of the Anatomical Theatre in Padua, Italy, n.d.)

PANOPTIC
c. 1800-1900, 1960-70



Panopticum by Jeremy Benthan (1971), (Design & Healing: Hospital Typologies - Google Arts & Culture, n.d.)

Panoptic hospitals drew on Jeremy Bentham's eighteenth-century panopticon concept, using radial ward configurations to maximize sightlines from nursing stations to patient beds. This heightened capacity for surveillance led to the adoption of the radial model in various institutional settings, including asylums, military hospitals, and prisons such as the Glasgow Lunatic Asylum (c. 1814) and the Eastern State Penitentiary in Pennsylvania (c. 1829) (Cooper Hewitt, Smithsonian Design Museum, n.d.).

FIELD HOSPITAL / BARRACKS

c. 1800-

The barracks hospital is typically used in situations where healthcare facilities must be provided quickly, such as during wars, emergencies, or natural disasters. Its main advantages lie in its rapid construction, straightforward assembly, and capacity for later expansion.

Developed from temporary military accommodation, this hospital type is often designed as a system of interchangeable components. It may be prefabricated off-site or built using inexpensive, simple, and easily accessible materials, allowing it to respond efficiently to urgent medical needs (Cooper Hewitt, Smithsonian Design Museum, n.d.).



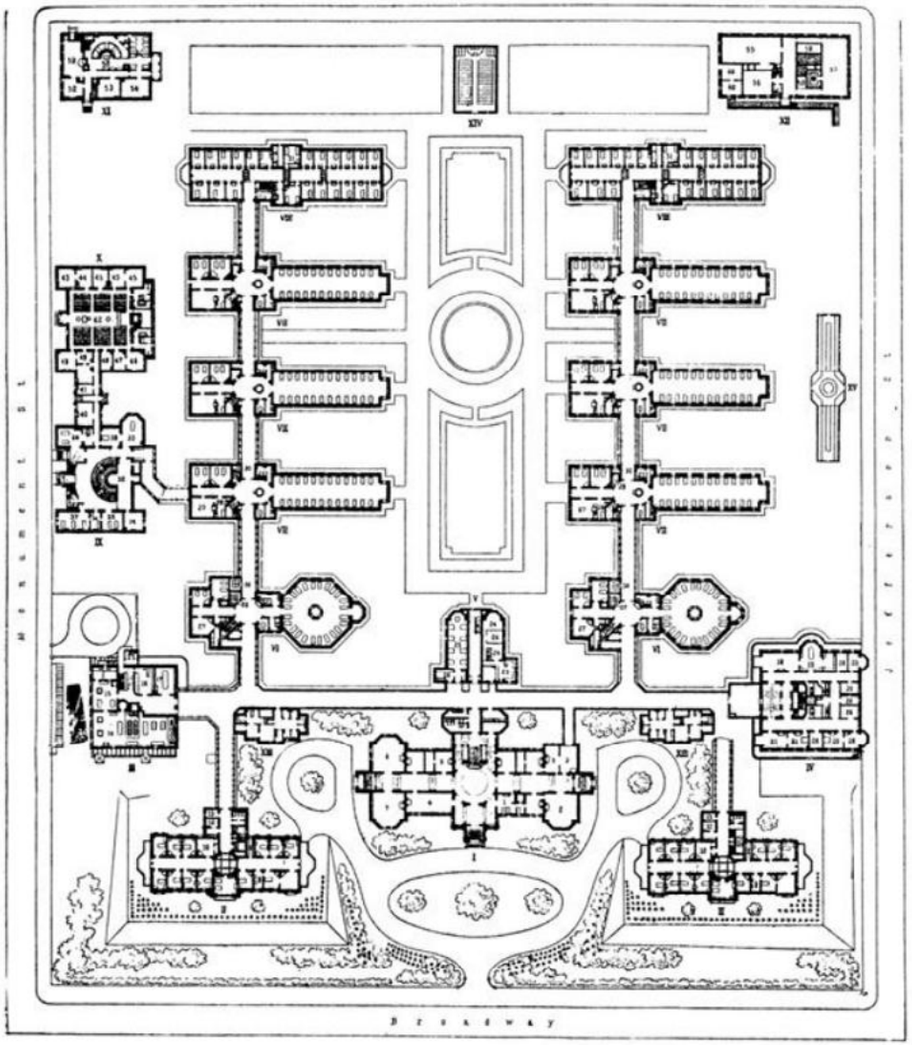
Baragwanath Hospital (1942), (Design & Healing: Hospital Typologies - Google Arts & Culture, n.d.)

PAVILION
c. 1800-1900

The pavilion plan (later popularized by Florence Nightingale) called for narrow, naturally ventilated wards arranged along a central circulation spine, with windows lining the long walls and doors placed on the short ends to promote continuous airflow (Cooper Hewitt, Smithsonian Design Museum, n.d.). Although the pavilion concept had been proposed earlier, its widespread adoption was delayed until military healthcare innovations demonstrated its effectiveness. During the Crimean War (1854–1856), the British army constructed field hospitals composed of separate barracks, a configuration Nightingale strongly endorsed. In Notes on Hospitals (1859), she argued for pavilion wards and supported her case with extensive statistical evidence showing significantly improved outcomes in well-ventilated hospitals (Cooper Hewitt, Smithsonian Design Museum, n.d.).

Nightingale's influence resulted in several important hospital projects in Britain, most notably the Royal Herbert Military Hospital in Woolwich, built between 1859 and 1871 and designed by Douglas Galton, and St. Thomas' Hospital in London, constructed between 1866 and 1871 to designs by Henry Currey. In Paris, the pavilion hospital reached one of its most developed forms with the new Hôtel-Dieu, designed by Émile Jacques Gilbert and completed more than a hundred years after the destructive fire of 1772. Located to the north of Notre-Dame Cathedral, the hospital was closely connected to Georges-Eugène Haussmann's wider reconstruction of the French capital (Wagenaar et al., 2018).

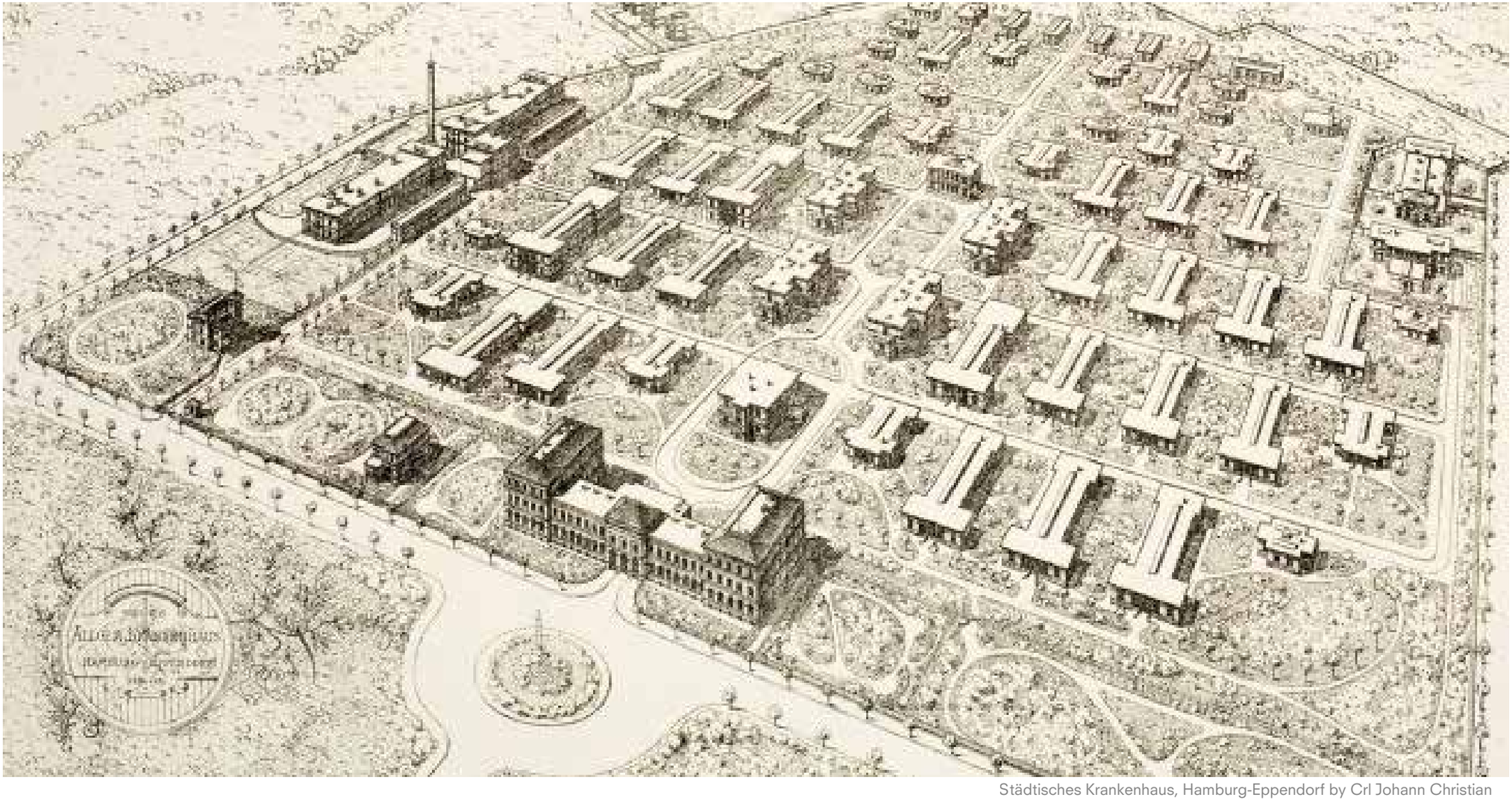
By the end of the nineteenth century, the pavilion system had become the preferred model for hospital design across Europe and the United States. Its appeal lay partly in its flexibility, as hospitals could be enlarged gradually through the addition of separate pavilion blocks. Early German examples included the Städtisches Krankenhaus am Friedrichshain in Berlin, designed by Martin Gropius and Heino Schmieden between 1868 and 1874, and the considerably larger Städtisches Krankenhaus in Hamburg-Eppendorf, built between 1884 and 1889 with more than fifty individual pavilions. However, when applied on such a large scale, the system also exposed practical weaknesses. The increasing distance between separate buildings made shared facilities, including kitchens and laundries, more difficult and inefficient to manage (Wagenaar et al., 2018).



Pavilion John Hopkins (1889), (Design & Healing: Hospital Typologies - Google Arts & Culture, n.d.)



Royal Prince Alfred Hospital interior (1880-1893), (EXPO – History Health & Healing, n.d.)



Städtisches Krankenhaus, Hamburg-Eppendorf by Crl Johann Christian Zimmerman and Friedrich Ruppel (1884-1889), (UKE - Humangenetik - Geschichte, n.d.)

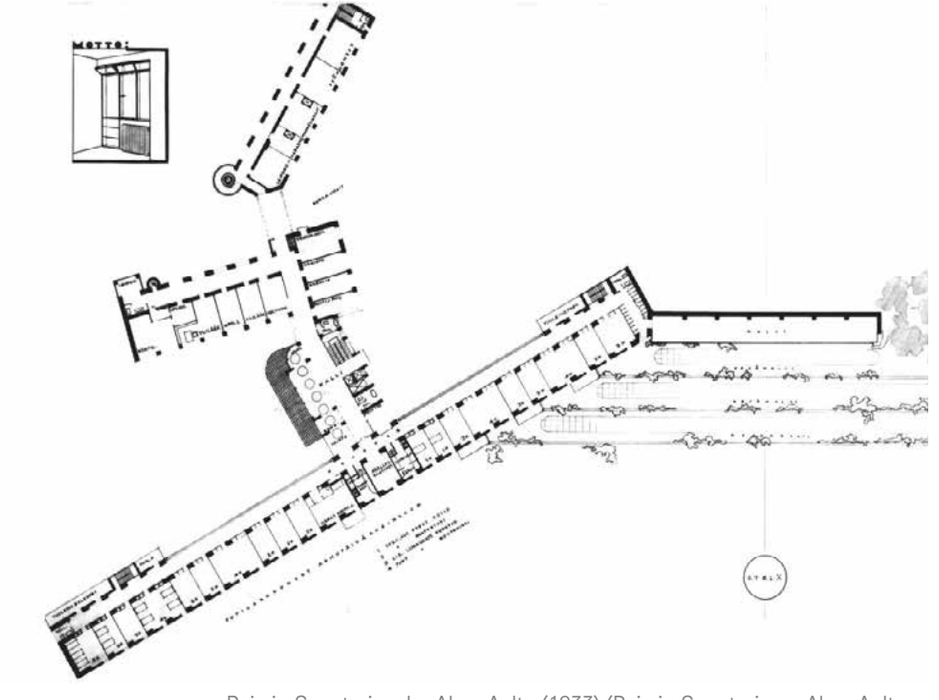
PAIMIO SANATORIUM - BY ALVAR AALTO

Location: Finland - Paimio / 1933

In the early twentieth century, improvements in sanitation and the emergence of new medical technologies drew middle- and upper-class patients into hospitals for the first time, resulting in hybrid institutions that combined traditional open wards for poorer patients with private rooms for wealthier ones. This period also introduced more complex planning strategies to accommodate increasing medical specialization and a growing technical apparatus (Cooper Hewitt, Smithsonian Design Museum, n.d.).

Amid these developments, Alvar Aalto's Paimio Sanatorium (1929–1933) became a seminal work in healthcare architecture. Designed as what Aalto called a "medical instrument," the building prioritized the patient's perspective, most notably the "clear view from the bed", and treated architectural form, materiality, and light as therapeutic elements. Scholars argue that the Paimio Sanatorium shifted architectural thinking from the vertical, upright body to the horizontal, resting patient, emphasizing recovery through environmental design (Daryl Martin et al., 2024). Built in response to the tuberculosis crisis, the sanatorium embodied early twentieth-century beliefs in the healing potential of fresh air, sunlight, and hygienic surroundings, principles that shaped sanatorium construction across Europe (Wagenaar et al., 2018).

At the same time, scientific research strengthened the case for therapeutic environments. Experiments such as Dr. W. Gilman Thompson's 1906 rooftop "fresh air" ward demonstrated measurably better outcomes for patients exposed to open-air conditions, prompting widespread adoption of fresh-air facilities in hospitals throughout the United States (Designs to Promote Healing, 1900s–1950s).



Paimio Sanatorium by Alvar Aalto (1933) (Paimio Sanatorium - Alvar Aalto Foundation | Alvar Aalto -säätiö EN, 2025b)



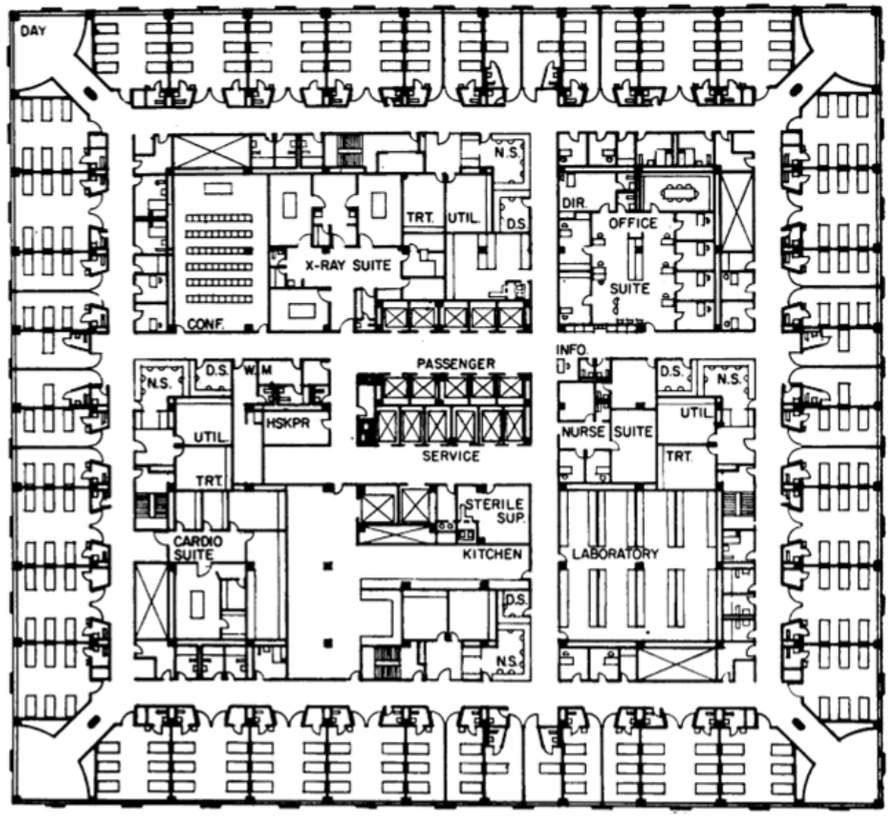
Patients in the top floor terrace in 1934. Photo: Gustaf Welin Alvar Aalto Foundation

BLOCK
c. 1950-

By the mid-twentieth century, the block hospital had become the dominant model, reflecting the rise of "machine medicine" and widespread faith in technological healing. Defined by minimal modernist forms, specialized program zones, and long-span structures, these hospitals embodied a new, highly rationalized approach to healthcare architecture (Cooper Hewitt, Smithsonian Design Museum, n.d.).

This shift grew out of decades of research into efficiency. Early twentieth-century studies, ranging from pedometer measurements of nurses' walking distances to experiments with compact ward layouts and centralized nurse stations, demonstrated that design could directly impact patient outcomes (Kisacky, 2024). World War II intensified this focus, leading to standardized "type plans," time-and-motion studies, and hospitals planned through operations research, such as the horizontally organized Greater Baltimore Medical Centre.

Surgical design also evolved rapidly: standardized operating rooms reduced infection and procedure times, while wartime successes in specialized recovery units revived the recovery room concept and ultimately spurred the creation of intensive care units in the 1950s (Kisacky, 2024).



Typical floor plan, Bellevue Hospital (1763), (Design & Healing: Hospital Typologies - Google Arts & Culture, n.d.)

MEGA-HOSPITAL
c. 1960-80

By the mid-twentieth century, advances in medical technology and the expanding public healthcare sector led to the emergence of the mega-hospital—large, multifunctional institutions designed as flexible "medical machines." These complexes prioritized efficiency, specialization, and technological integration, often adopting monolithic, high-density forms that departed from earlier pavilion ideals (Cooper Hewitt, Smithsonian Design Museum, n.d.). In Europe, this shift culminated in landmark projects such as the Klinikum Steglitz in Berlin (1959–1969), a 1,450-bed "bed castle" that consolidated clinics, treatment spaces, logistics, and laboratories into a single vertically organized complex. Its highly automated, centralized layout became a model for university hospitals across the 1960s and 1970s, inspiring similarly massive structures such as the Universitätsklinikum Münster and the Großklinikum Aachen (Meuser, 2011a).

While celebrated for technical sophistication and operational efficiency, these buildings also drew early criticism for their scale and impersonality. As concerns mounted over patient dignity and individualized care, hospital boards began questioning hyper-rationalized mega structures. By the late 1980s, many institutions shifted toward more flexible, human-centred additions rather than expanding existing mega-hospitals, marking the end of the era of the monumental "healing machine" (Meuser, 2011a).



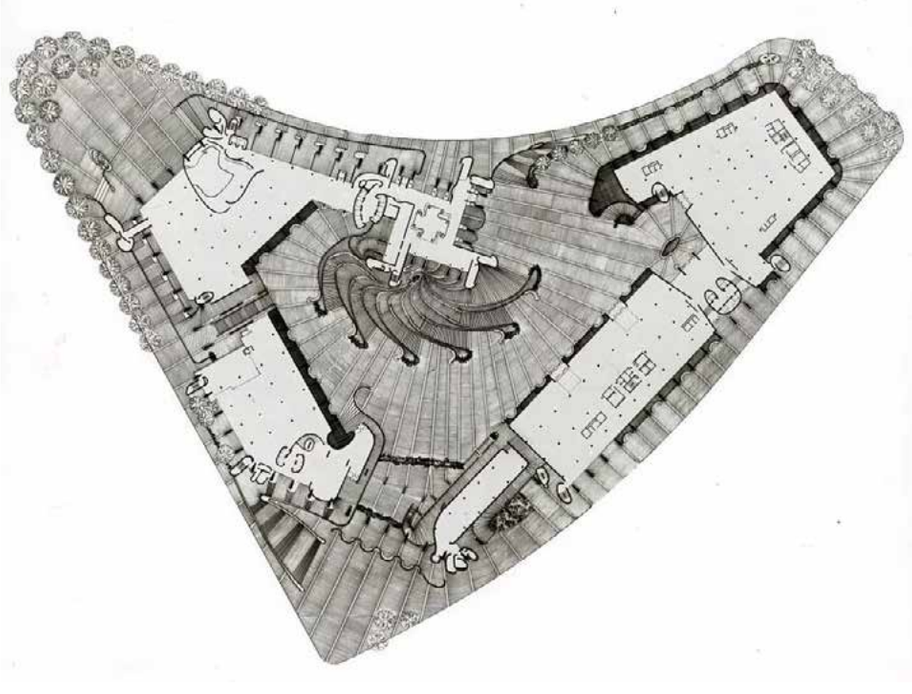
Klinikum Steglitz in Berlin (1959–1969), (Goos, 2021)

UTOPIAN
c. 1960-70

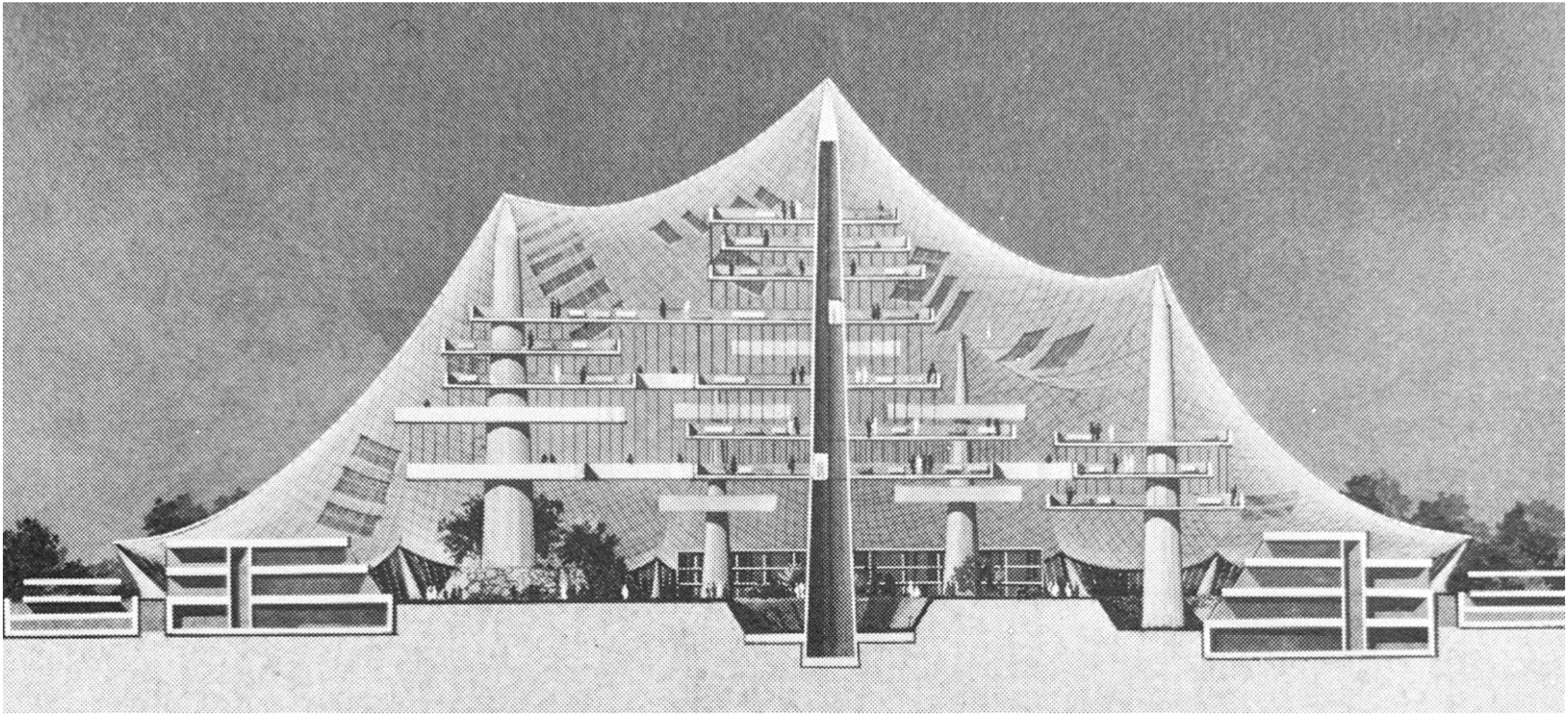
In the mid- to late twentieth century, some architects began to explore the labyrinth as a way to soften the institutional character often associated with healthcare environments. Rather than treating complexity as a problem, they used labyrinthine spatial arrangements to introduce moments of curiosity, movement, and discovery within the hospital experience (Cooper Hewitt, Smithsonian Design Museum, n.d.).

During the mid-twentieth century, the block hospital remained the dominant architectural type. Nevertheless, a small number of alternative proposals emerged, many of which can be understood as utopian in nature. Although these schemes differed widely in form and concept, they shared a desire to move beyond the conventional logic of the block, at least in appearance. In the United States, many of the most notable examples were developed by E. Todd Wheeler, who worked as a partner at the healthcare architecture firm Perkins and Will between 1936 and 1972.

Wheeler produced several experimental visions for future hospitals, responding to some of the major design concerns of the period. These included the need to control environmental conditions, explored through proposals such as underwater and tent hospitals, as well as the demand for greater flexibility and future expansion. Other drawings drew on contemporary cultural references, including drive-in theatres and atrium spaces, suggesting a broader attempt to rethink the hospital as a more dynamic and adaptable architectural form (Cooper Hewitt, Smithsonian Design Museum, n.d.).



Boston Government Service Center by Paul Rudolph (1960s), (Design & Healing: Hospital Typologies - Google Arts & Culture, n.d.)

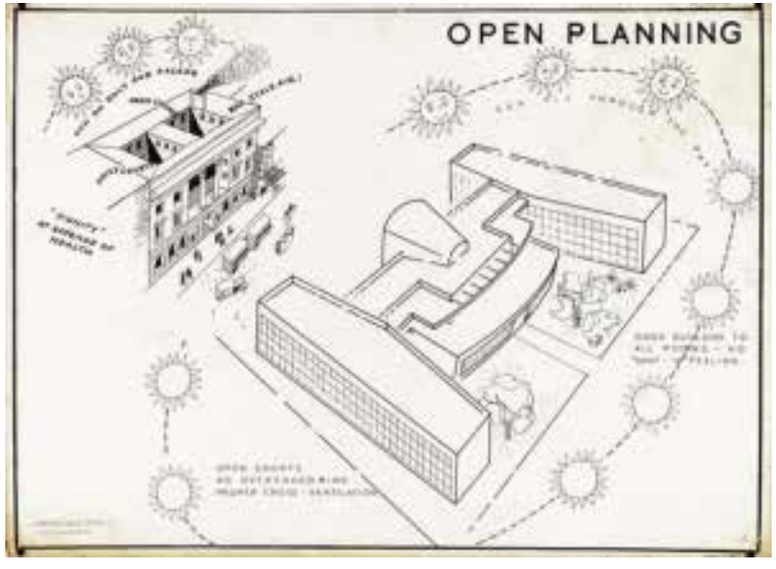


Tropicarium, E. Todd Wheeler Concept Rendering, (Design & Healing: Hospital Typologies - Google Arts & Culture, n.d.)

DE-INSTITUTIONALISATION & "HOTELISATION"
c. 1980-

From the early twentieth century onward, designers increasingly recognized that patient comfort could influence recovery. Studies on hospital noise in 1906 led to designated "quiet zones," while emerging colour theory challenged the dominance of stark white interiors and promoted more therapeutic palettes (Wagenaar et al., 2018). By mid century, architects such as Alden B. Dow integrated views of nature, calibrated colour schemes, and a range of sensory distractions (including art and music) to improve patient well-being. These developments helped lay the groundwork for architectural psychology in the 1960s, when new research methods and environmental test laboratories enabled designers to study how spatial variables affected patient experience (Wagenaar et al., 2018).

By the 1990s, hospital planning processes, already slow to absorb medical and architectural innovations, shifted toward strategies aimed at strengthening institutional identity and competitiveness. Facilities began adding amenities associated with hospitality and leisure, a trend described internationally as the rise of the "healing hospital" (Meuser, 2011a). This shift paralleled a broader professional turn toward research-driven design. Although evidence had long informed hospital architecture, the 1950s and 1960s marked the moment when architects more broadly acknowledged the need for systematic study of how buildings affect occupants. The increasing methodological rigour of this work set the stage for modern evidence-based design (EBD), of which Ulrich's 1984 study is often cited as a key milestone (Wagenaar et al., 2018).





Tecton's Finsbury Health Centre (1983), (Design Is a Force for Good - Annual Review - BDP.com, n.d.)

HEALING ENVIRONMENTS
c. 1990-

"The stereotyped institutional appearance of hospital rooms in the past has contributed little to the patient's recovery. Pleasant, liveable surroundings on the other hand have healing value. Colour balance on the inside of the room and an inviting view of the outside through large windows make the patient's lot more liveable by providing that variety" (Wynne, 2025).

Dow's hospital design marked a clear break from the conventional institutional character of earlier healthcare buildings. The complex was arranged as a low, single storey structure of brick and glass, extending along a 300-foot T-shaped plan. Large, uninterrupted windows connected the interior spaces to the surrounding landscape, allowing views of nature to become part of the patient experience. A central aspect of Dow's approach was his deliberate use of colour as a means of supporting recovery. Instead of following the sterile white aesthetic commonly associated with hospitals, he emphasized the healing potential of comfortable, domestic-like surroundings, created through carefully balanced interior colours and expansive views to the outside. This idea was particularly visible in the lobby, where red linoleum floors, pale green walls, and yellow upholstered furniture produced a lively and welcoming atmosphere. In the patient rooms, softer shades of green, blue, and pink were used to create a calmer and more reassuring environment. The sun rooms placed at the ends of the corridors further strengthened the building's focus on daylight, warmth, and psychological comfort (Wynne, 2025).







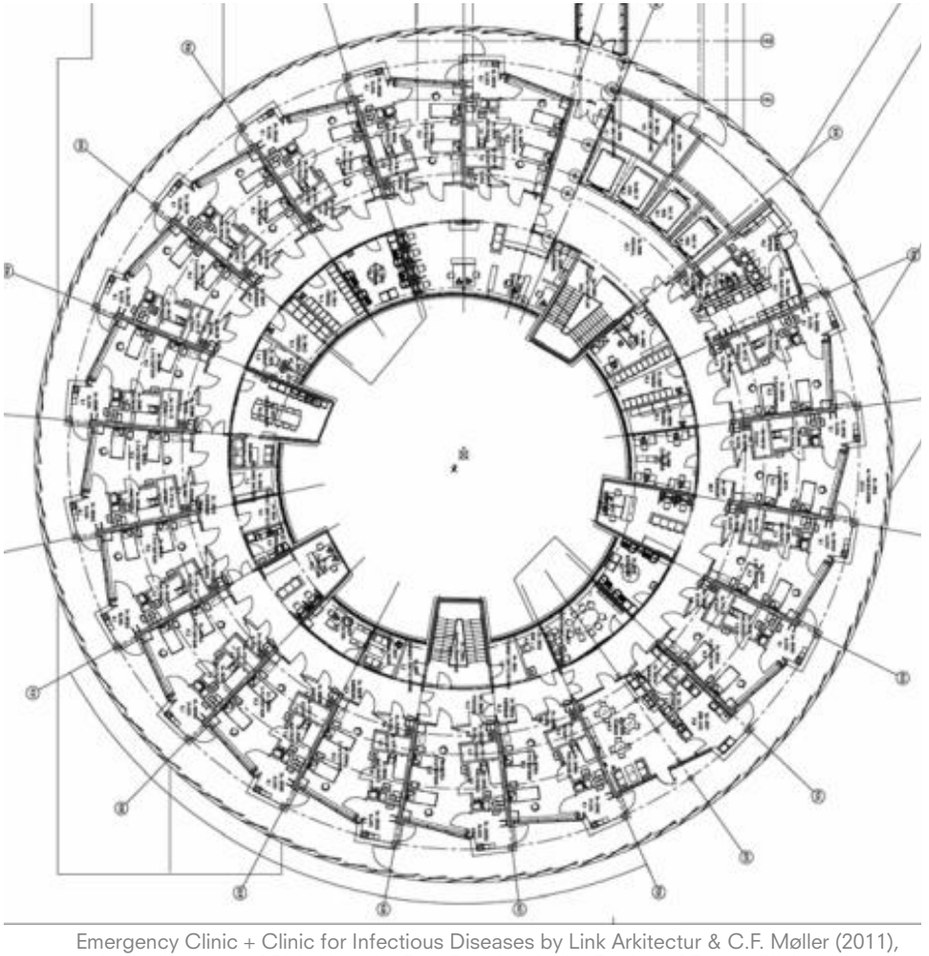
Interior Midland Hospital by Alden B. Dow (1944), (Wynne & Wynne, 2025)

RESILIENCE DRIVEN
c. 2010-

Since the early 2010s, hospital architecture has increasingly prioritized resilience.. A leading example is the spherical Infectious Diseases Unit (IDU) at Skåne University Hospital in Malmö, designed by CF Møller and LINK Arkitektur. Commissioned in the wake of SARS, the IDU was conceived as a testbed for next-generation infection control, funded by regional and municipal authorities to model how hospitals could function during emerging global health threats. Its layered circular plan with open-air terraces, segregable circulation routes, and an inward-facing clinical core demonstrates how architecture can actively structure airflow, visibility, and containment to limit cross-infection (Daryl Martin et al., 2024). Long before COVID-19, the building embodied a shift toward "segregated design," foregrounding spatial strategies for antimicrobial resistance and airborne disease management.

Globally, the years leading up to 2020 saw a growing recognition that buildings themselves can either amplify or mitigate epidemics. Case studies such as the 2006 XDR-TB outbreak in Tugela Ferry revealed how poor ventilation and overcrowded waiting areas contributed directly to transmission, underscoring the architectural stakes of airborne disease control. Subsequent public health crises: cholera in Haiti and Ebola in West Africa showed that spatial decisions about wastewater management, material porosity, isolation infrastructure, and temporary versus permanent facilities could shape both the trajectory of an epidemic and the long-term health of communities (Murphy, 2020). These lessons reinforced a broader disciplinary shift toward designing spaces capable of prevention and containment

When COVID-19 emerged in 2020, these insights gained urgent relevance. The pandemic made clear that airflow, spatial separation, outdoor circulation, and flexible clinical infrastructure are not optional features but core components of resilient design. Architects worked alongside public health officials to retrofit existing buildings, design temporary clinics, and rethink ventilation, surfaces, and circulation patterns. As Murphy (2020) argues, the crisis repositioned architecture from a passive backdrop to an active agent in pandemic response: one capable of shaping trust in public space and determining the effectiveness of emergency healthcare systems. The emphasis on resilience that had been building for a decade thus became central to architectural practice, marking COVID-19 as both a test and an acceleration of new design paradigms.



Emergency Clinic + Clinic for Infectious Diseases by Link Arkitectur & C.F. Møller (2011), (An Architecture of Risk: How the Past Breathes in the Design of Future Clinical Space | Ephemeral Journal, 2025c)



Alternative Healthcare Facilities:
Architects Mobilize their Creativity in Fight against COVID 19 by Delfino Sisto Legnani and Marco Cappelletti

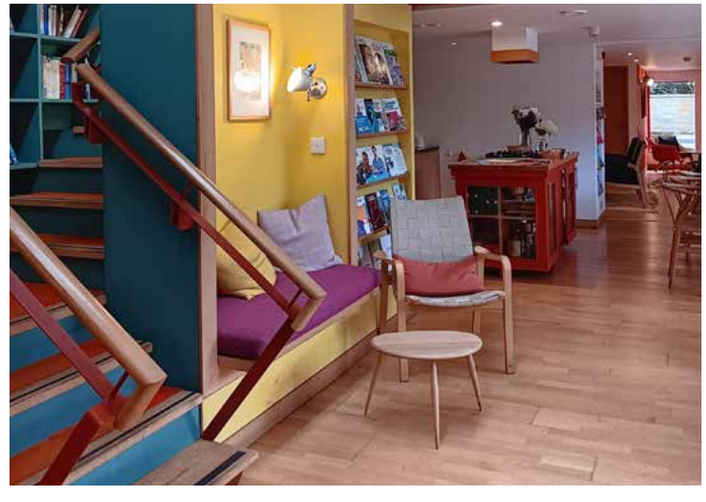
MAGGIE'S CENTRE
c. 1996-

Maggie's Centres have developed into an international network of supportive environments for people affected by cancer, offering free care within buildings shaped by carefully considered architecture.

Architecture is closely connected to human experience. The spaces people inhabit can influence their emotional, social, and physical well-being, affecting how daily life is perceived and lived. Buildings are therefore never neutral; they can either support or diminish the people who use them, as well as the wider context in which they stand. Maggie's Centres represent a distinctive architectural and care-based model, first imagined by Margaret Keswick Jencks, who, while living with terminal cancer, argued that treatment environments should be shaped by thoughtful and humane design. Today, this idea has expanded into centres across the world, where cancer patients and their families can access free support in architecturally ambitious settings.

These centres combine places for rest, reflection, privacy, and social connection, often integrating gardens, intimate rooms, and shared gathering spaces. Together, they demonstrate how architecture can contribute to care and recovery, suggesting a broader movement toward healing environments in healthcare design (Baldwin, 2022).





(Maggie's, n.d.)

MAGGIE'S EDINBURGH
1996 by Richard Murphy Architects





(Baldwin, 2022)

MAGGIE'S DUNDEE
2003 by Frank Gehry





(Baldwin, 2022)

MAGGIE'S CHELTENHAM
2005 by Sir Richard MacCormac





(Baldwin, 2022)

MAGGIE'S HIGHLANDS - INVERNESS
2005 by Page and Park





(Baldwin, 2022)

MAGGIE'S FIFE
2006 Zaha Hadid





(Baldwin, 2022)

MAGGIE'S CHARING CROSS
2008 by Rogers Stirk Harbour & Partners





(Baldwin, 2022)

MAGGIE'S GARTNAVEL - GLASGOW
2011 by OMA

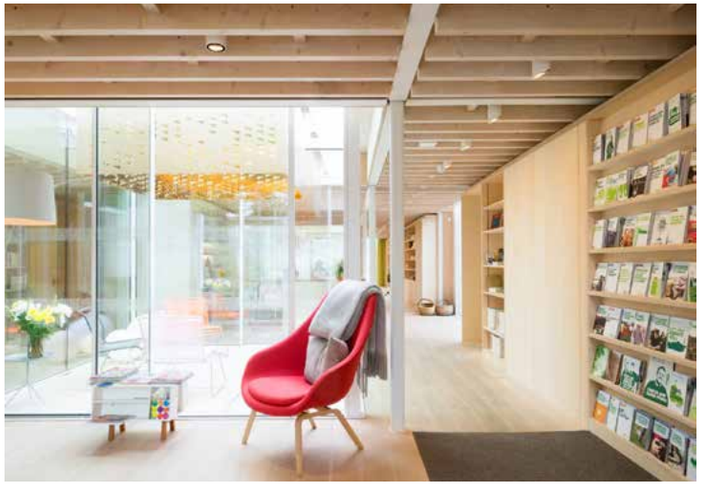




(Baldwin, 2022)

MAGGIE'S ABERDEEN
2013 by Snøhetta





(Maggie's, n.d.)

MAGGIE'S LANARKSHIRE
2014 by Reiach and Hall





(Baldwin, 2022)

MAGGIE'S MERSEYSDE
2014 by Carmody Groarke Studio





(Maggie's, n.d.)

MAGGIE'S LONDON (ROYAL MARSDEN)
2023 by Ab Rogers Design





(Maggie's, n.d.)

MAGGIE'S MANCHESTER
2016 by Foster + Partners





(Baldwin, 2022)

MAGGIE'S BARTS
2017 by Steven Holl Architects





(Maggie's, n.d.)

MAGGIE'S CARDIFF
2019 by Dow Jones Architects





(Pintos, 2025)

MAGGIE'S LEEDS
2020 by Heatherwick Studio





(Maggie's, n.d.)

MAGGIE'S ROYAL FREE - HAMPSTEAD
2023 by Studio Libeskind





(Maggie's, n.d.)

MAGGIE'S CENTRE GRONINGEN
2024 by Marlies Rohmer Architecture & Urbanism

CONCLUSION / MANIFESTO

MANY CONTEMPORARY HOSPITALS ARE DESIGNED PRIMARILY AS LARGE, EFFICIENT SYSTEMS. THEIR SCALE AND ORGANIZATION ARE OFTEN DRIVEN BY OPERATIONAL EFFICIENCY, LOGISTICS, AND STANDARDIZATION RATHER THAN BY THE SPECIFIC NEEDS OF PATIENTS.

AS MEDICAL RESEARCH PROGRESSES, THERE IS INCREASING KNOWLEDGE ABOUT THE DIFFERING NEEDS OF SPECIFIC PATIENT GROUPS, INCLUDING PHYSICAL, PSYCHOLOGICAL, AND ENVIRONMENTAL REQUIREMENTS. CURRENT HOSPITAL BUILDINGS ARE OFTEN TOO LARGE AND TOO GENERIC TO ADEQUATELY RESPOND TO THESE DIFFERENCES. AS A RESULT, SPATIAL DESIGN CAN WORK AGAINST PATIENTS' BASIC HEALTHCARE NEEDS INSTEAD OF SUPPORTING THEM.

THE FOCUS ON LARGE, CENTRALIZED HOSPITAL BUILDINGS MAKES IT DIFFICULT TO ADAPT SPACES TO SPECIALIZED FORMS OF CARE. THIS LIMITS THE ABILITY OF ARCHITECTURE TO RESPOND TO NEW MEDICAL INSIGHTS AND TO CREATE ENVIRONMENTS THAT CONTRIBUTE POSITIVELY TO HEALING AND WELL-BEING.

HOSPITAL ARCHITECTURE SHOULD THEREFORE RECONSIDER ITS SCALE AND ORGANIZATIONAL MODEL. SMALLER, MORE SPECIALIZED FACILITIES OR CLUSTERS OF CARE ENVIRONMENTS MAY BETTER SUPPORT PATIENT-CENTRED DESIGN BY ALLOWING SPACES TO BE TAILORED TO SPECIFIC TREATMENTS AND USER GROUPS.

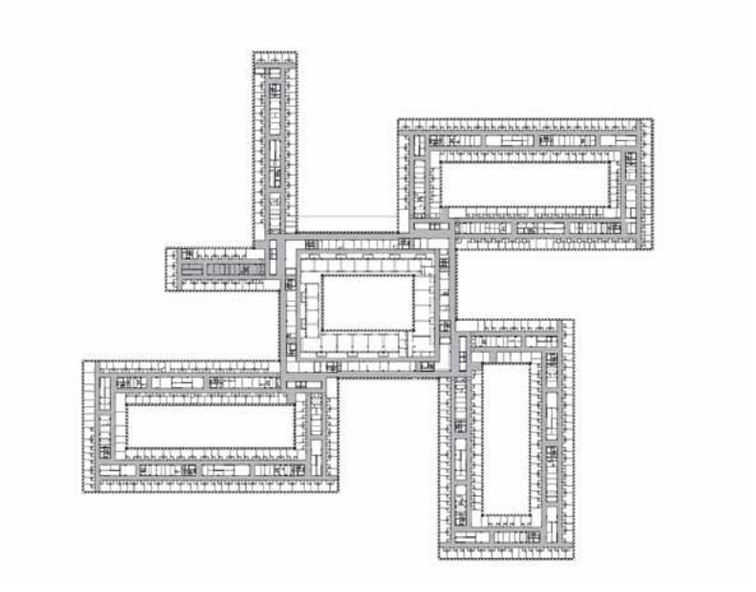
DESIGNING HOSPITALS SHOULD SHIFT FROM PRIORITIZING SYSTEM EFFICIENCY TOWARD BETTER INTEGRATION OF PATIENT NEEDS AND CONTEMPORARY MEDICAL KNOWLEDGE.

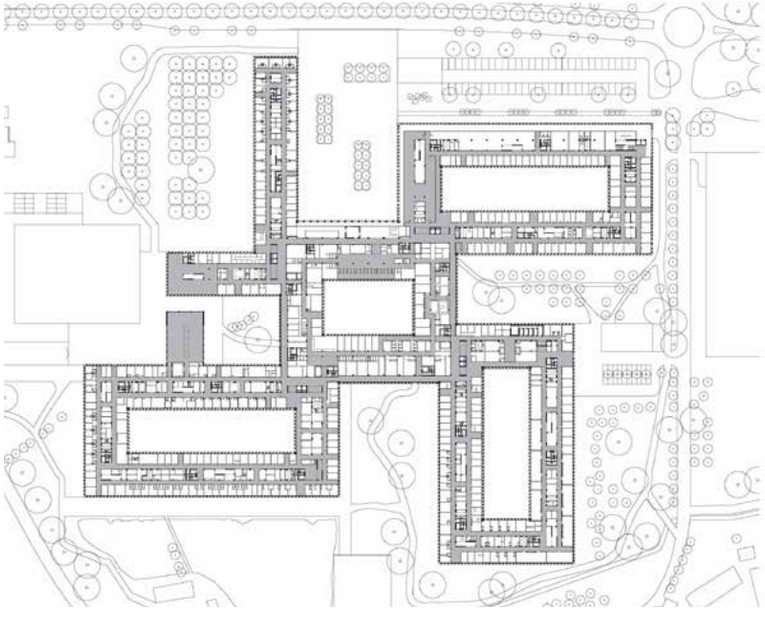
FROM ONE-SIZE-FITS-ALL BUILDINGS TO SPACES DESIGNED AROUND SPECIFIC FORMS OF CARE.

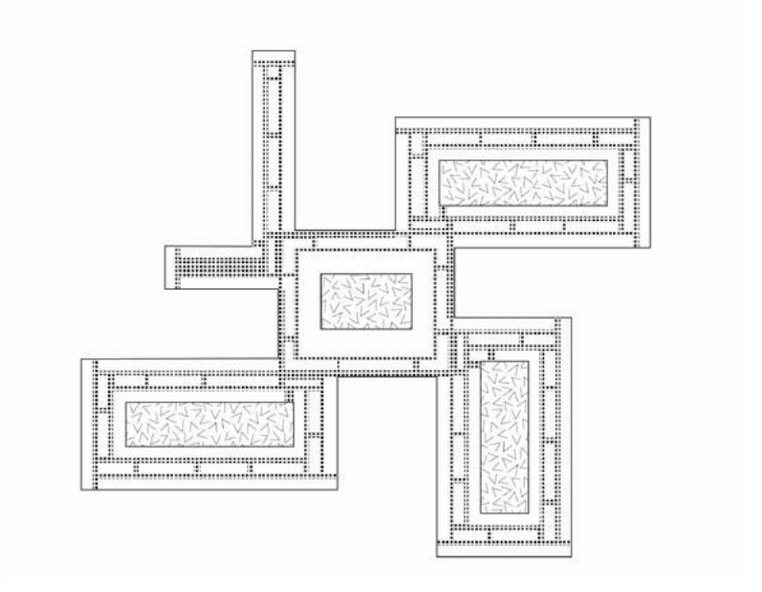
THE FUTURE OF HOSPITAL ARCHITECTURE IS NOT LARGER.

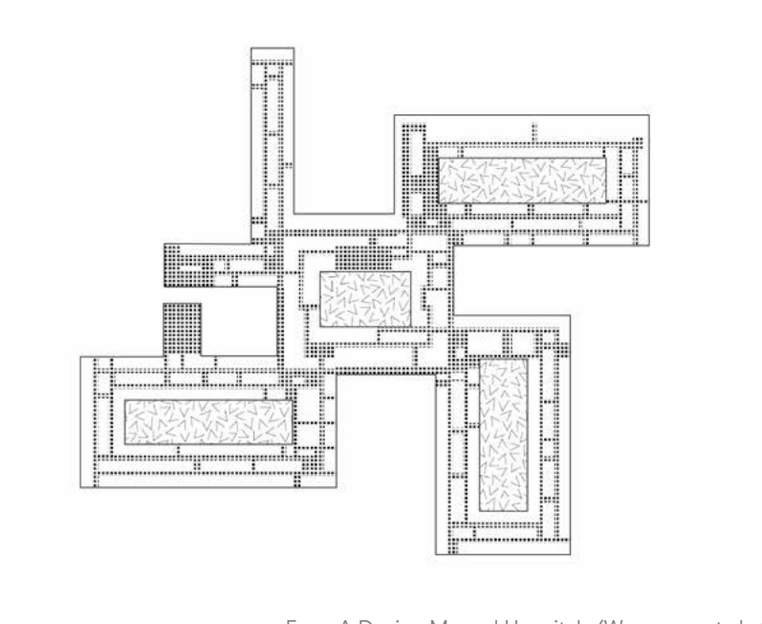
IT IS MORE HUMAN.

AZ GROENINGE
Kortrijk, Belgium (2010)



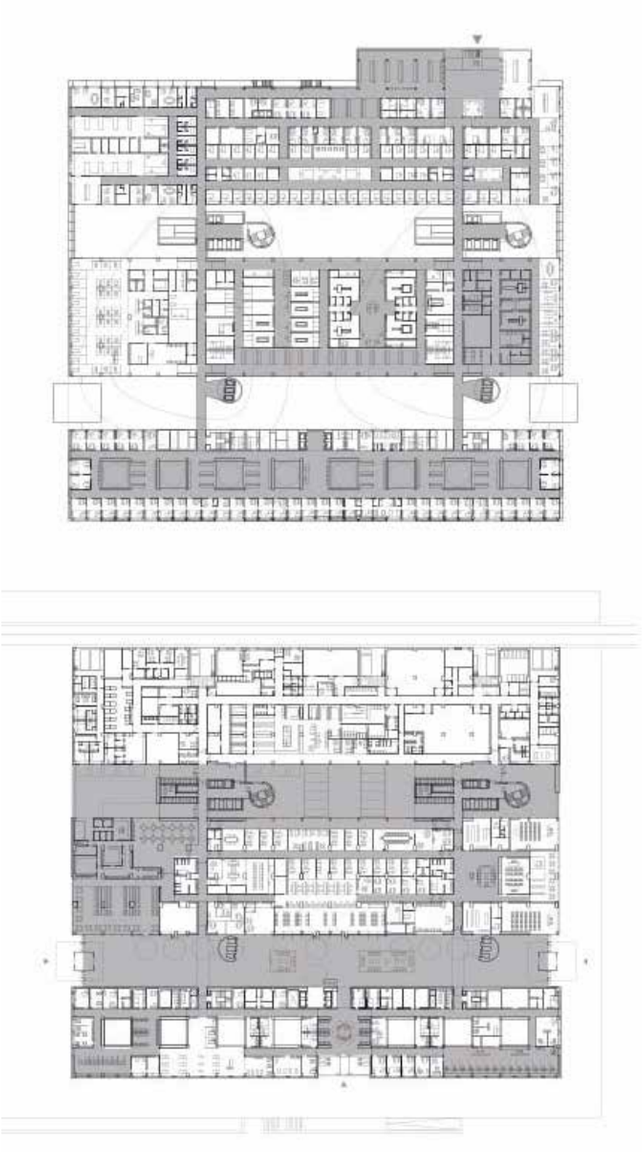


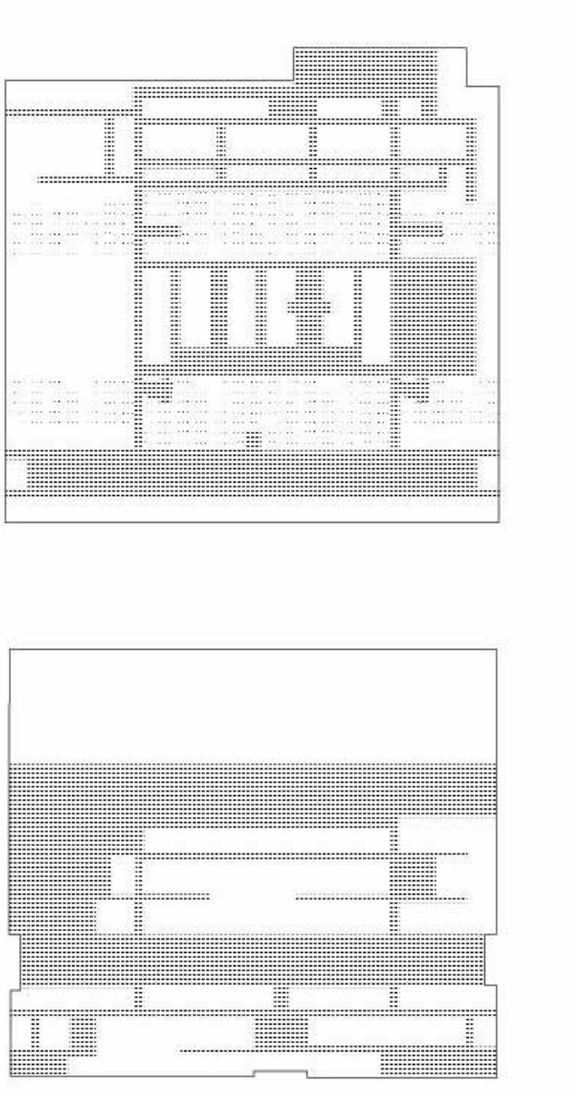




From A Design Manual Hospitals (Wagenaar et al., 2018).

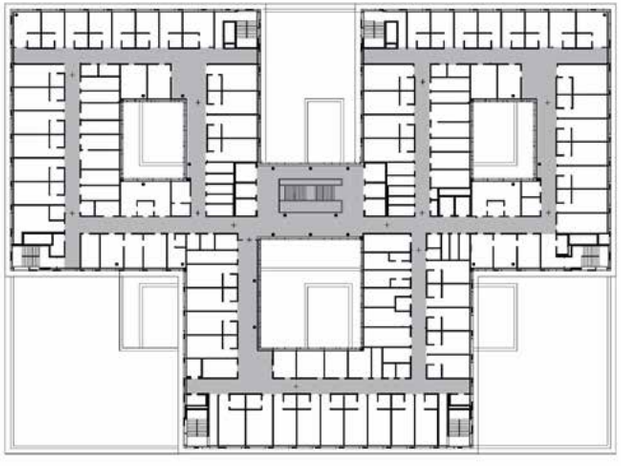
REY JUAN CARLOS HOSPITAL
Madrid, Spain (2012)



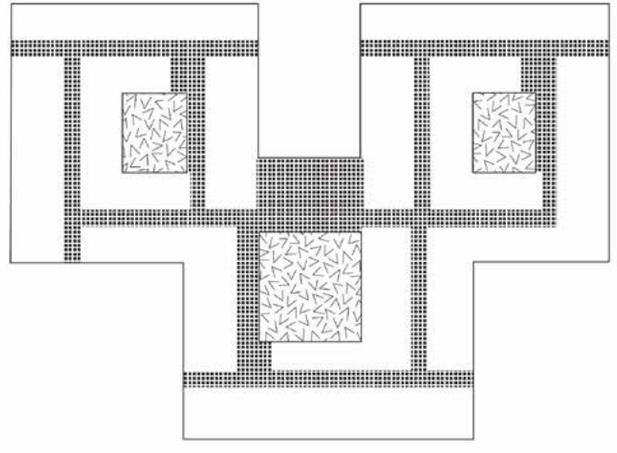


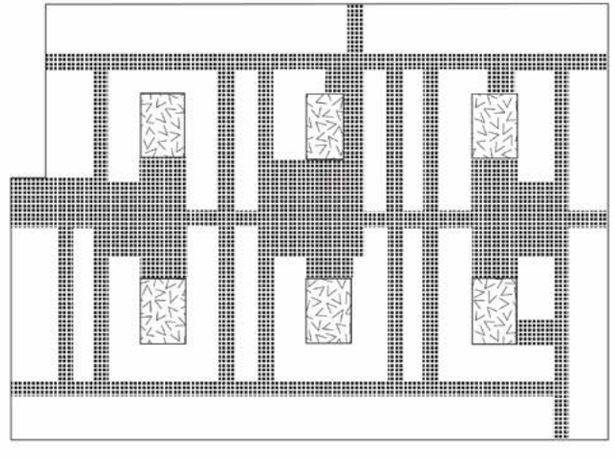
From A Design Manual Hospitals (Wagenaar et al., 2018).

MOTHER-CHILD AND SURGICAL CENTER KAISER-FRANZ-JOSEF-SPITAL
Vienna, Austria (2016)



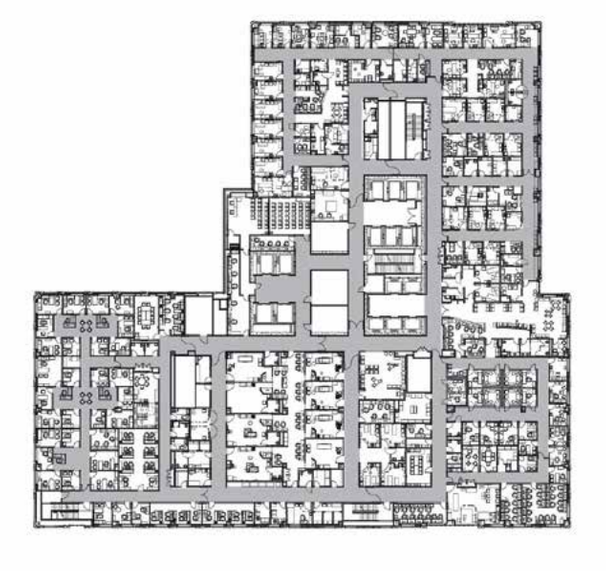


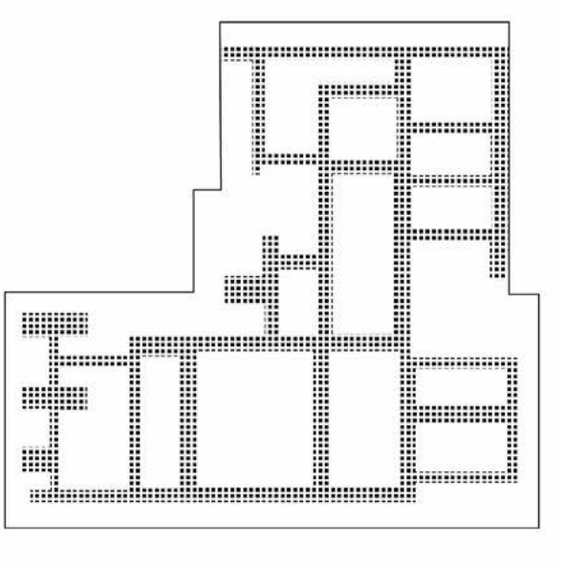


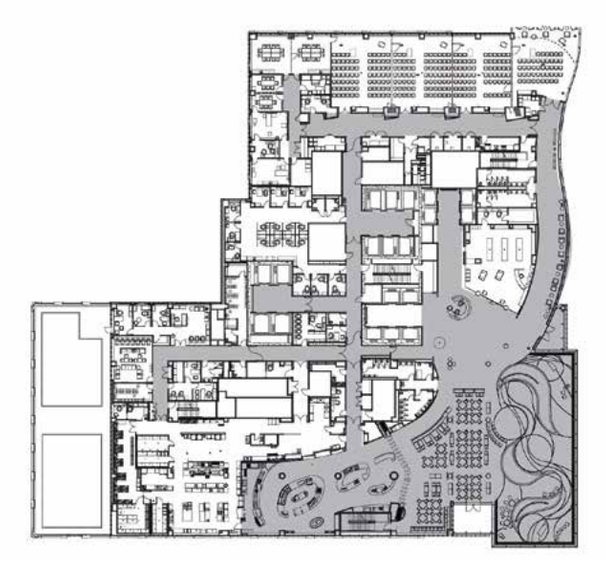


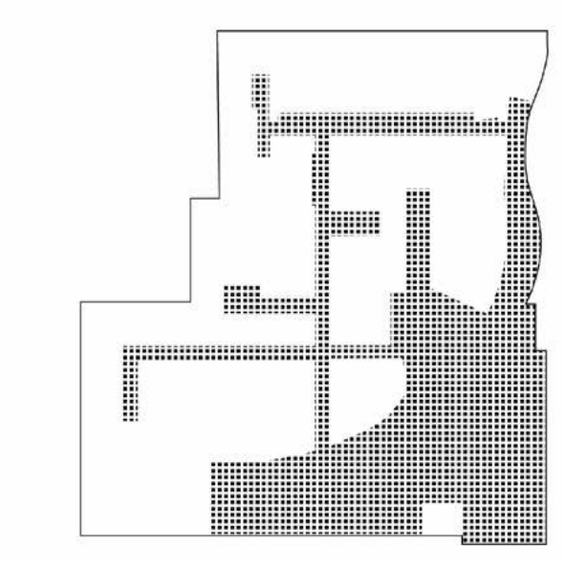
From A Design Manual Hospitals (Wagenaar et al., 2018).

ANN & ROBERT H. LURIE CHILDREN'S HOSPITAL
Chicago, Illinois, USA (2012)



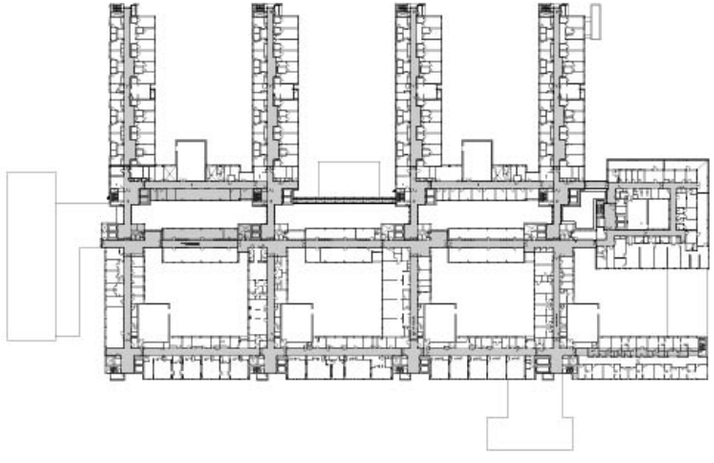


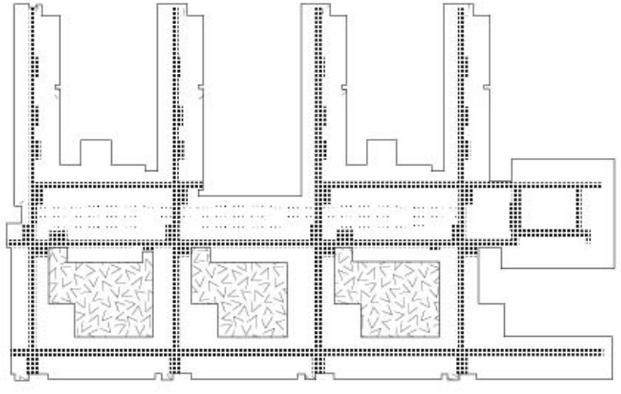


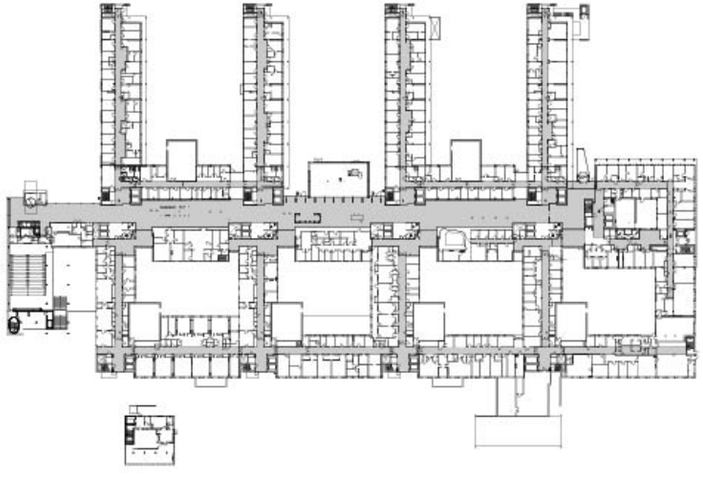


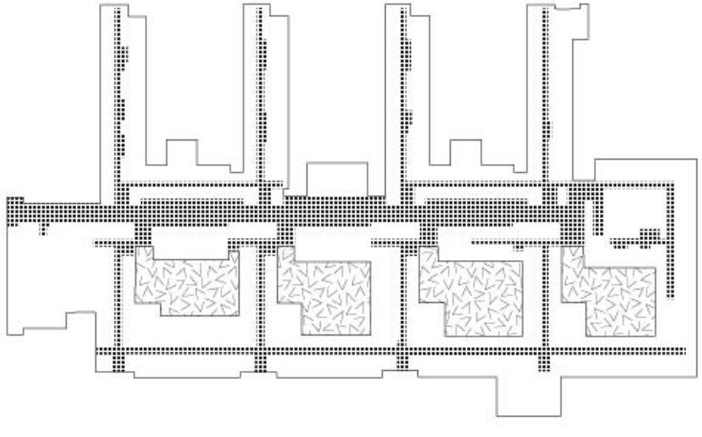
From A Design Manual Hospitals (Wagenaar et al., 2018).

AKERSHUS UNIVERSITY HOSPITAL
Oslo, Norway (2014)



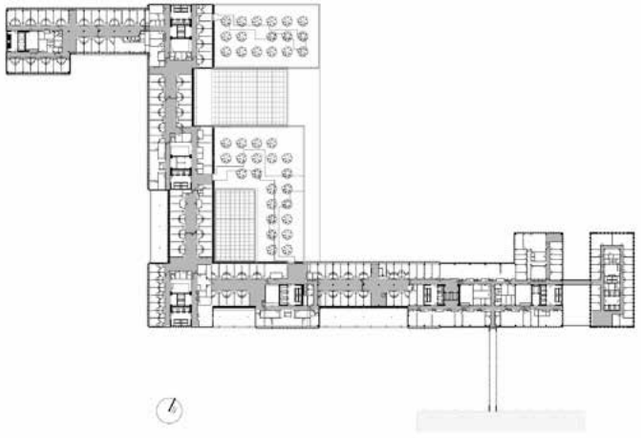


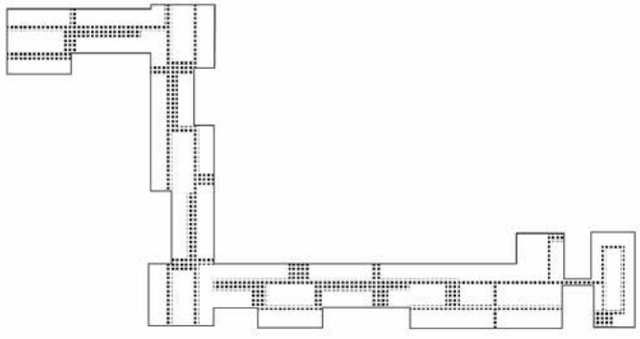


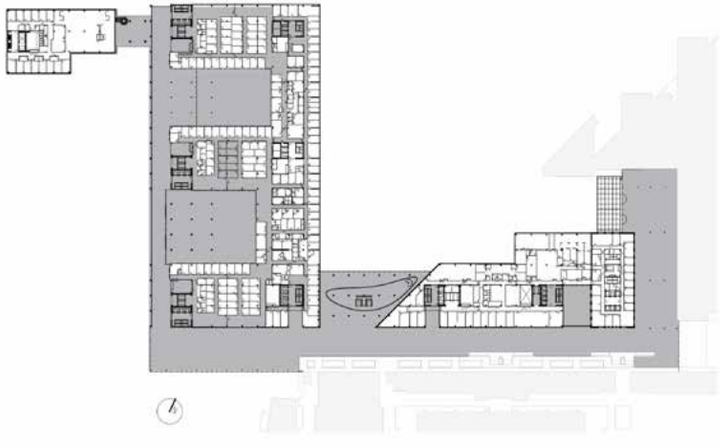


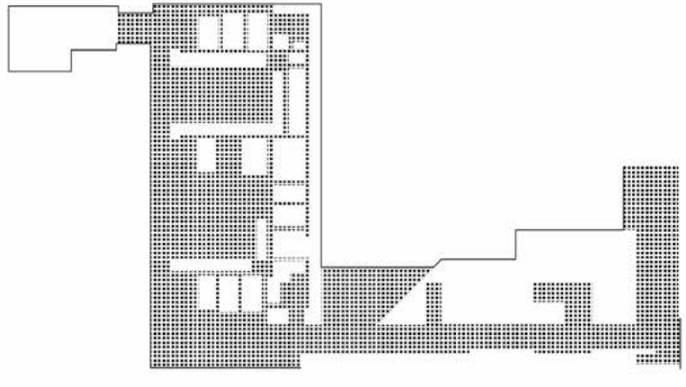
From A Design Manual Hospitals (Wagenaar et al., 2018).

ERASMUS MC HOSPITAL AND EDUCATION CENTER
Rotterdam, the Netherlands (2017)





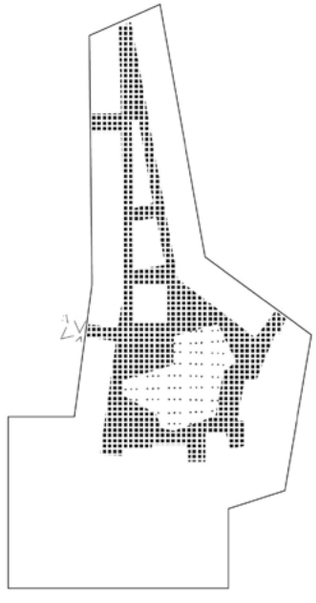




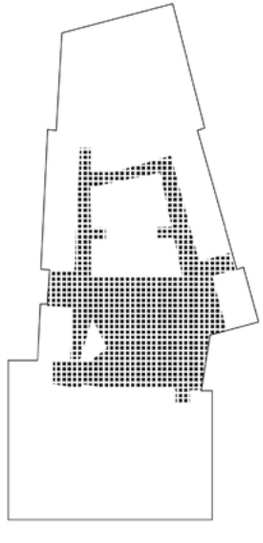
From A Design Manual Hospitals (Wagenaar et al., 2018).

NATIONAL CENTER FOR TUMOR DISEASES
Heidelberg, Germany (2010)



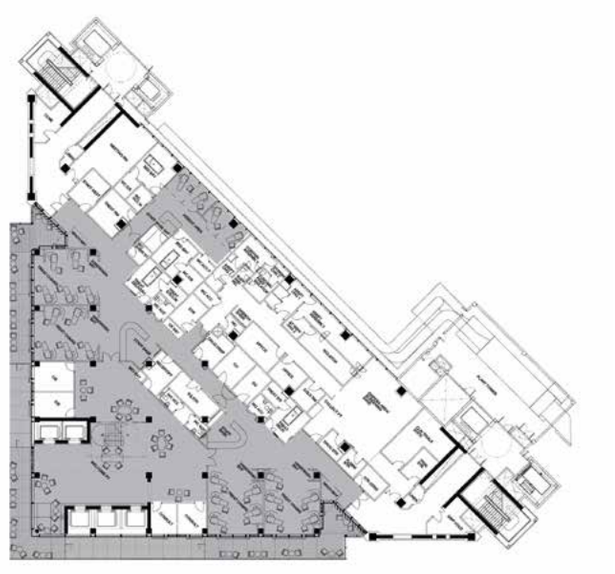


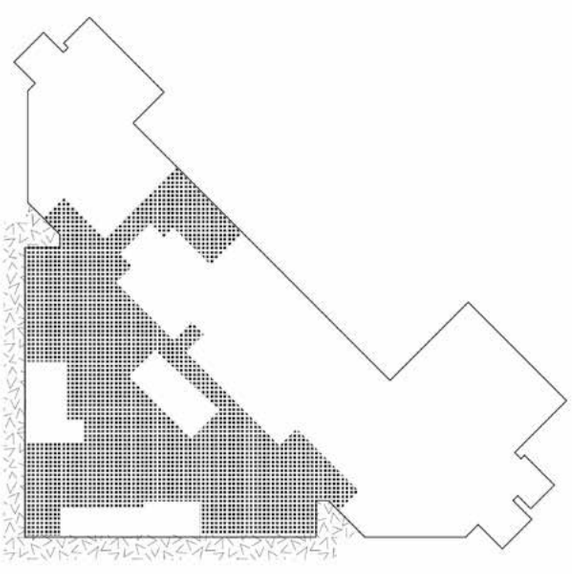




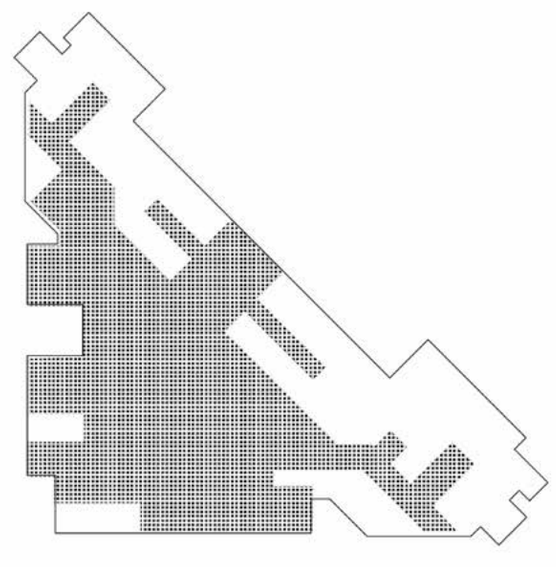
From A Design Manual Hospitals (Wagenaar et al., 2018).

CANCER CENTRE AT GUY'S
London, UK (2016)



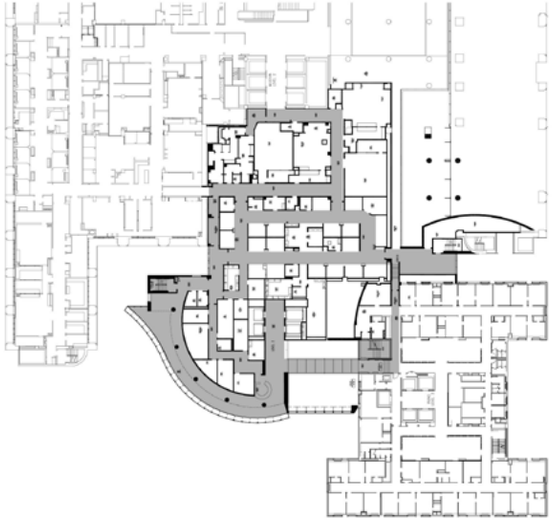


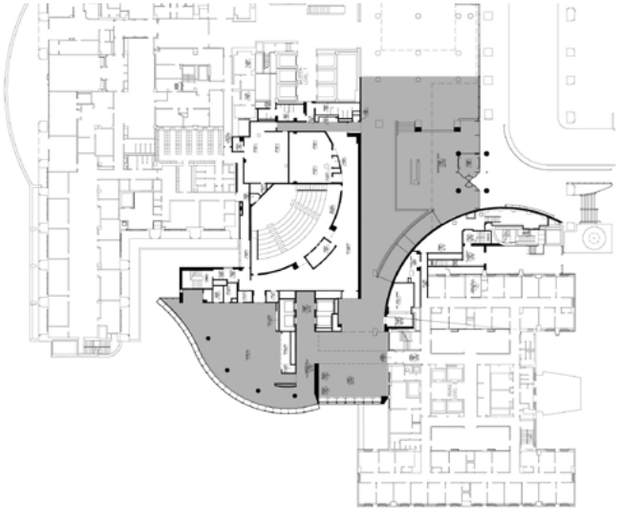


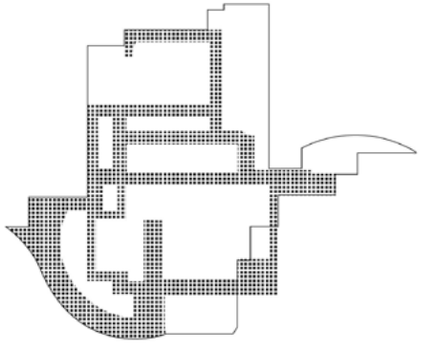


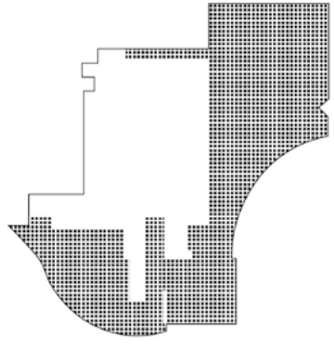
From A Design Manual Hospitals (Wagenaar et al., 2018).

MILSTEIN FAMILY HEART CENTER NEW YORK-PRESBYTERIAN HOSPITAL
New York, New York USA (2010)



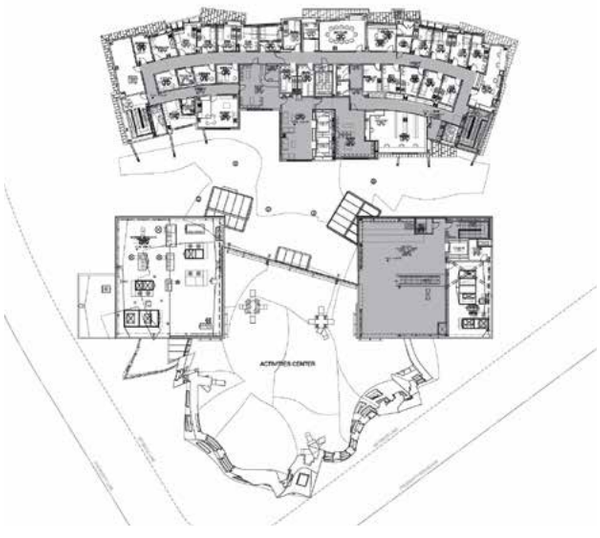


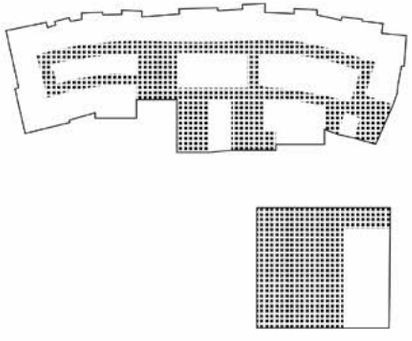




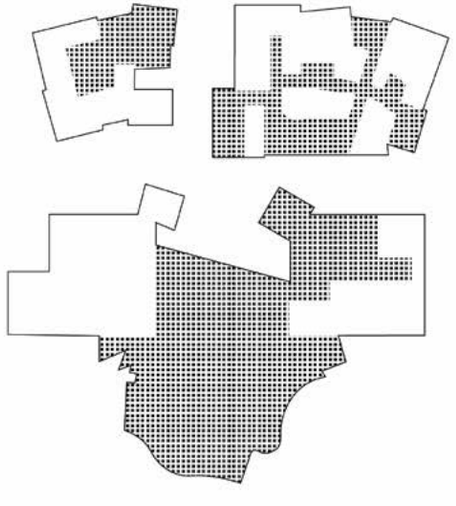
From A Design Manual Hospitals (Wagenaar et al., 2018).

CLEVELAND CLINIC LOU RUVO CENTER FOR BRAIN HEALTH
Las Vegas, Nevada, USA (2010)



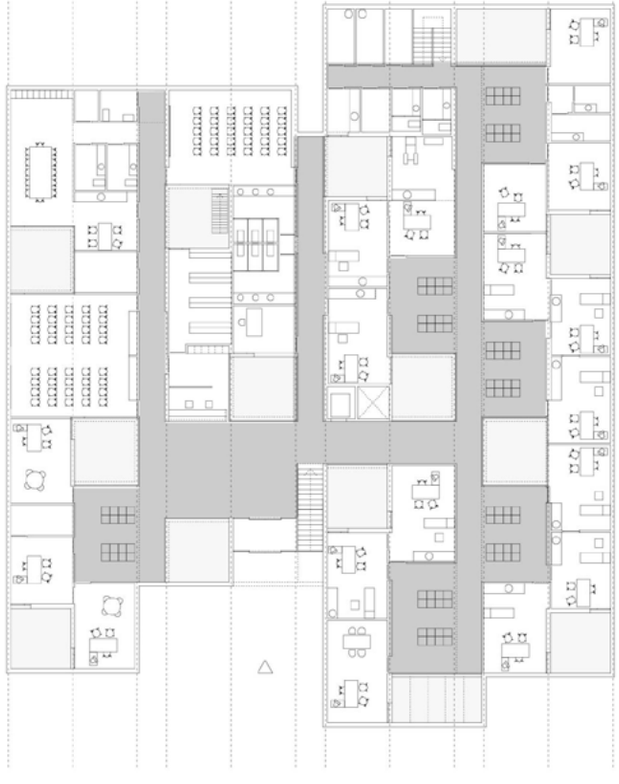


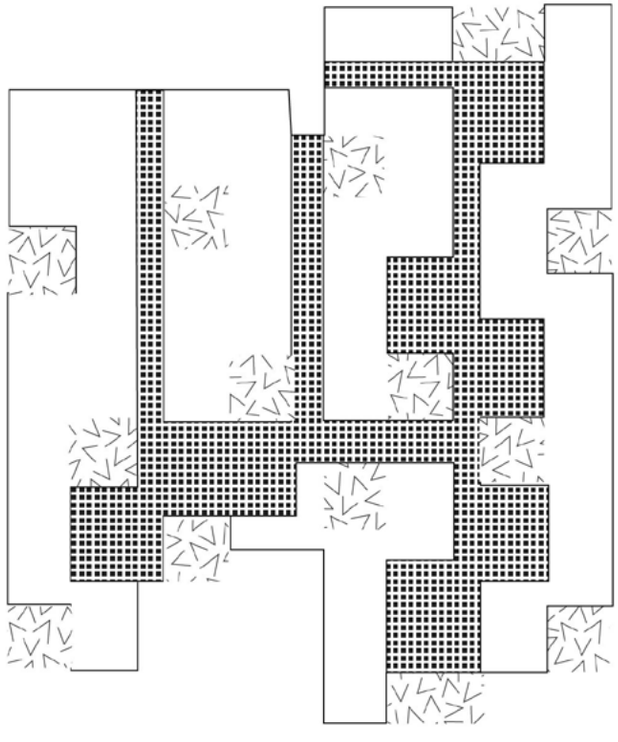




From A Design Manual Hospitals (Wagenaar et al., 2018).

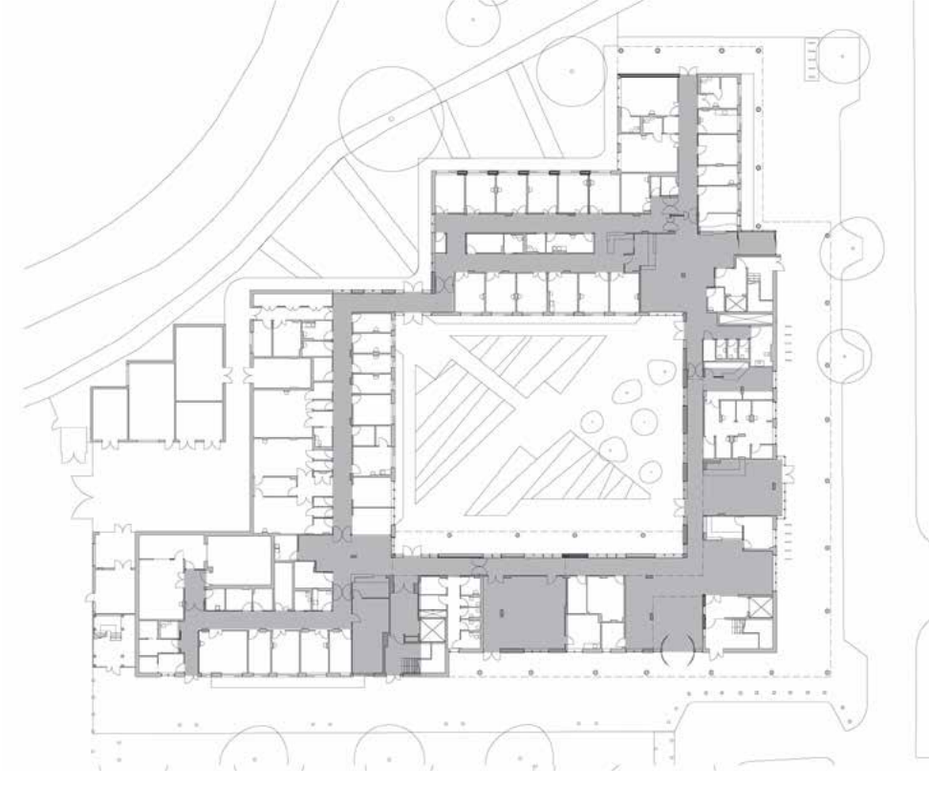
MUNICIPAL HEALTHCARE CENTERS SAN BLAS, USERA, VILLAVERDE
Madrid, Spain (2010)

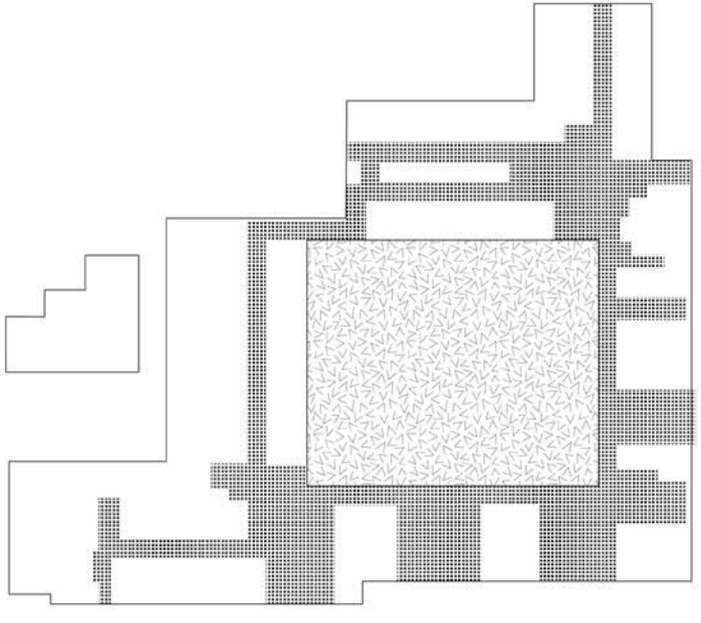




From A Design Manual Hospitals (Wagenaar et al., 2018).

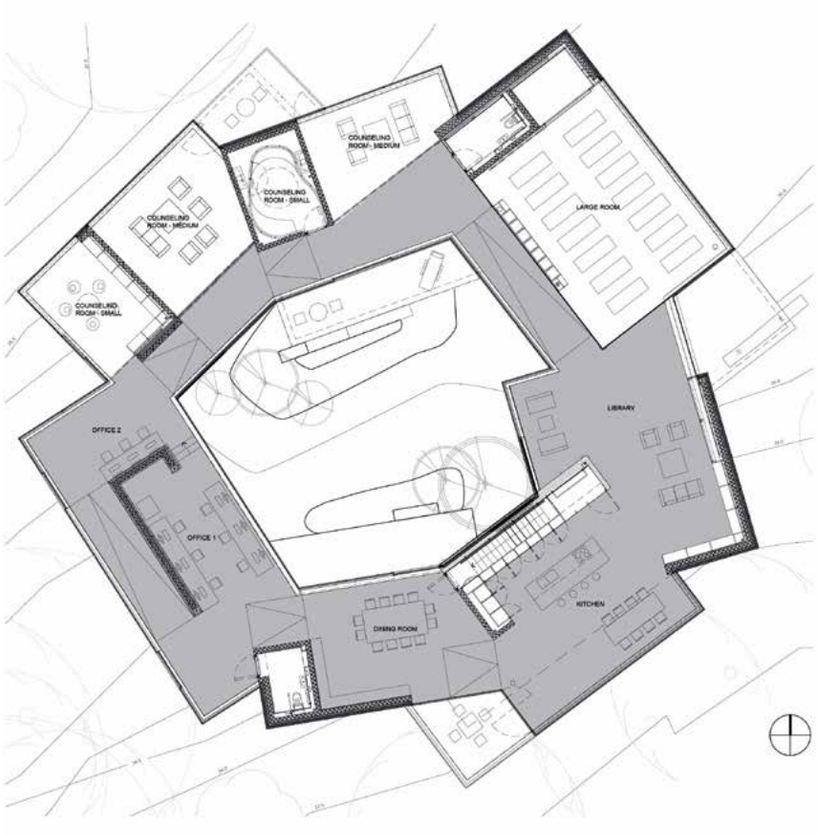
NEW QEII HOSPITAL
Welwyn Garden City, UK (2015)

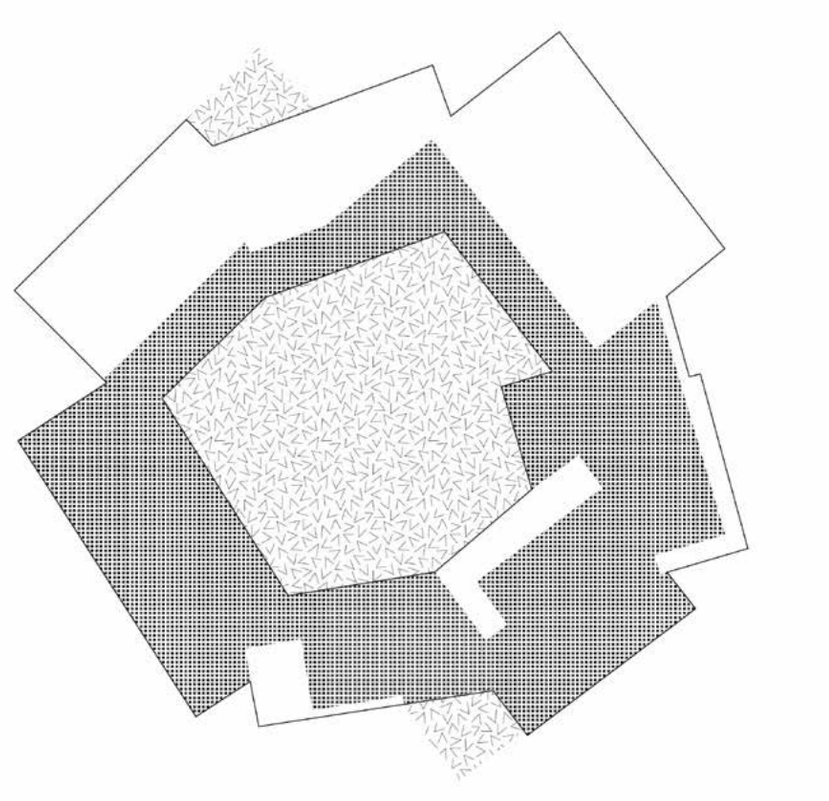




From A Design Manual Hospitals (Wagenaar et al., 2018).

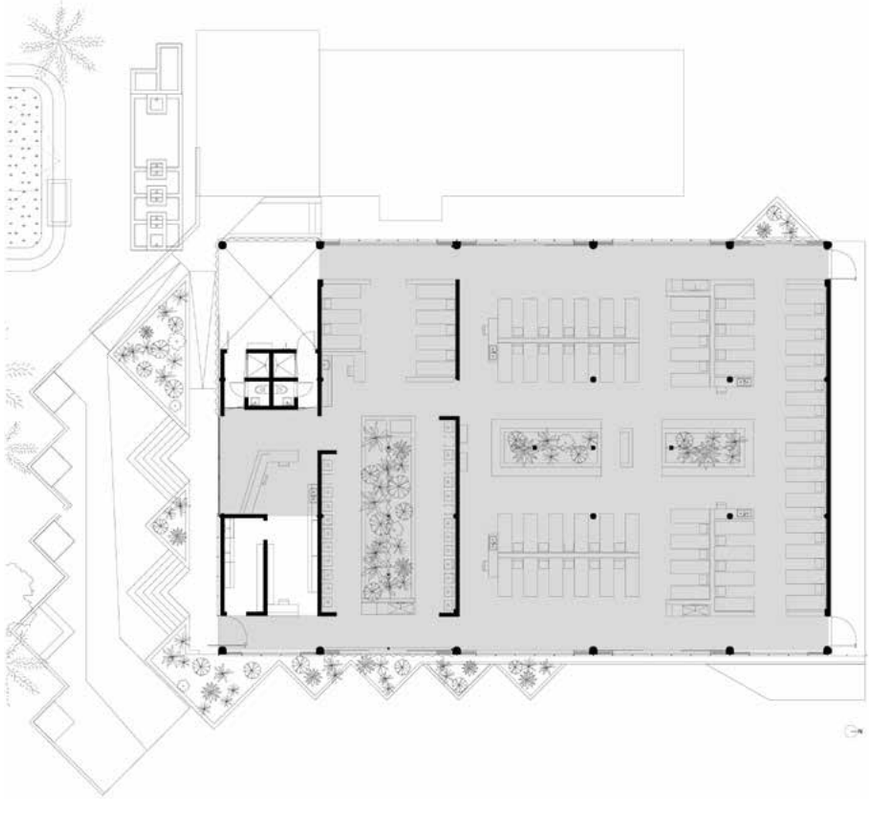
MAGGIE'S CENTRE GARTNAVEL
Glasgow, UK (2011)

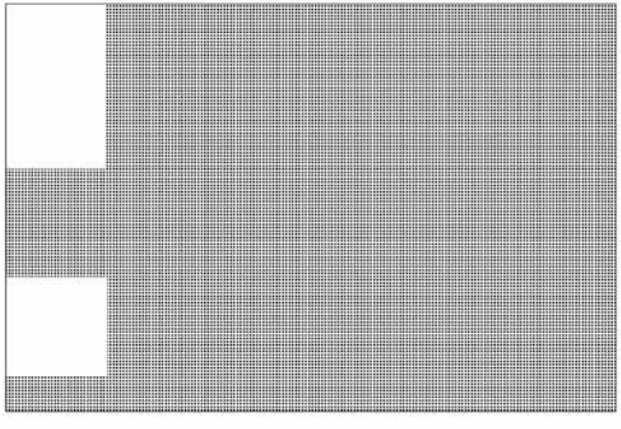




From A Design Manual Hospitals (Wagenaar et al., 2018).

GHESKIO CHOLERA TREATMENT CENTER
Port-au-Prince, Haiti (2015)





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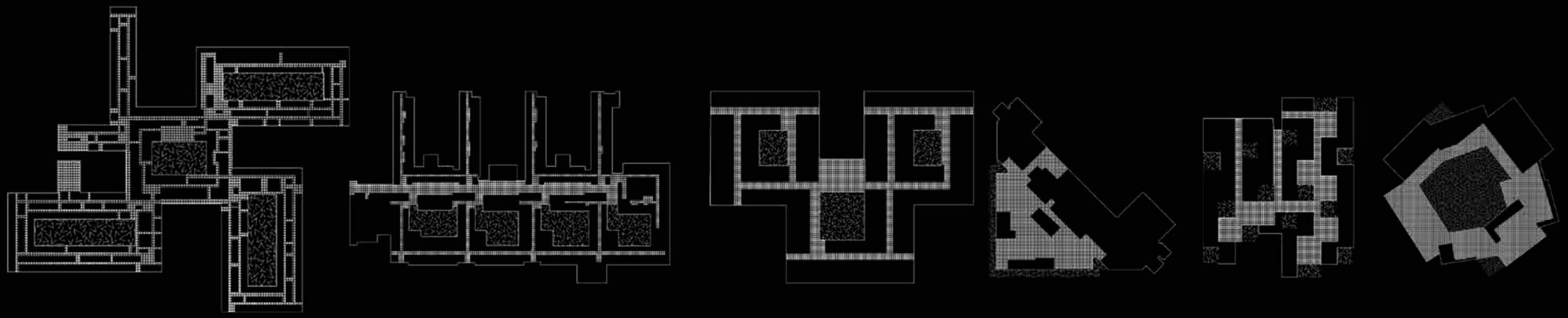
TYPOLOGYS, SCALE AND COMPLEXITY
Transitional Care Landscapes



THE LARGER THE HOSPITAL THE MORE COMPLEX THE TRANSITIONAL CARE LANDSCAPE

REDEFINING
Outside



Patients in the top floor terrace in 1934. Photo by Gustaf Welin Alvar Aalto Foundation



1964: Skiers relax in deck chairs on the slopes of Verbier, Switzerland. Photo by Slim Aarons/Getty Images)



Outdoor gallery of the Clinic for Infectious Diseases / LINK arkitektur + C.F. Møller
Photo by LINK arkitektur



Galerijflat Hoog Lindoduin. Photo by Luuk Kramer

REDEFINING
Outpatient is only a day visit



Koopgoot Rotterdam (Rotterdam Shopping Guide: Top Shops, Markets & Boutiques, n.d.)



The markets in Delft (Delft op Zondag, 2020).

REDEFINING
The waiting room: ‘Waiting in motion’ / ‘Car is waiting room’



Mekel Park (TU Delft Campus, 2023)



Drive in Theatre, waiting room in the car (Scordo, 2020)

REDEFINING
Indoor Socializing zones = safe with masks on



Kids wearing masks to class (Balzer, 2021)



Group of adults wearing face masks talking (Freepik, n.d.)

INFECTION PREVENTION DOES NOT RELY ON A SINGLE SOLUTION. ARCHITECTURAL DESIGN CAN WORK TOGETHER WITH HUMAN INTERVENTIONS.

ENTER THROUGH OVERHANG

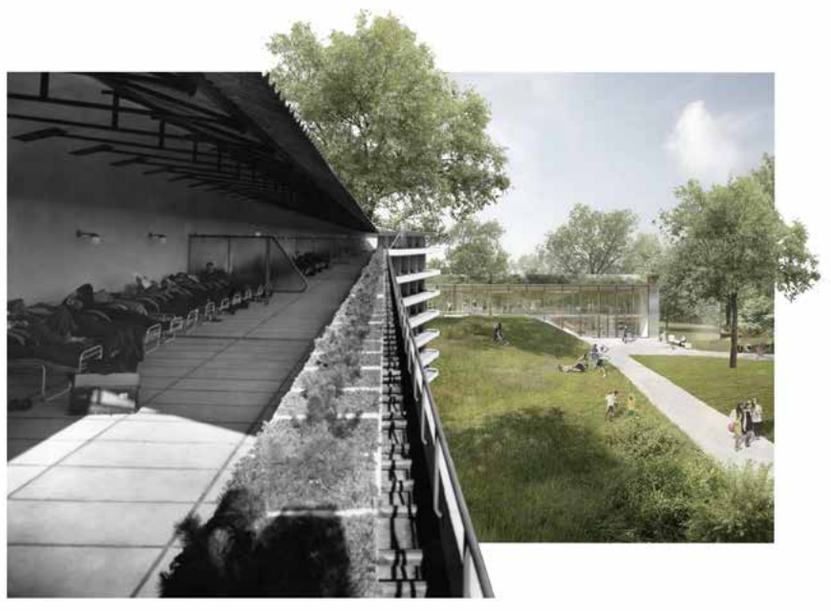




SOCIAL CENTRE



SUN DECK







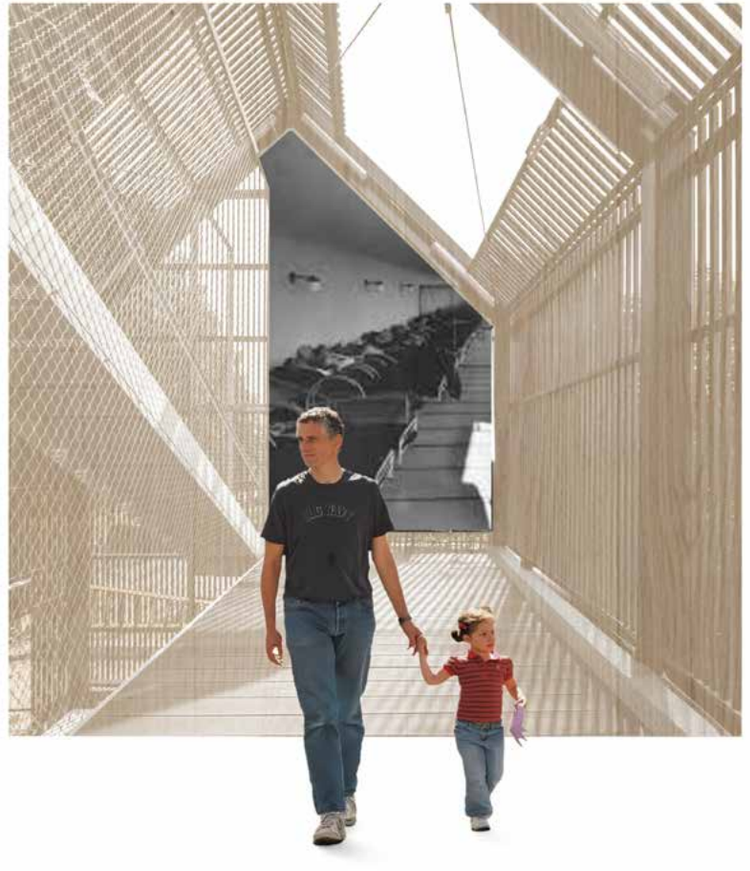




CONNCETIONS PATIENTS



MAIN ENTRANCE



STAFF INDOOR ROUTE



MEET IN PATIENT ROOM



STAFF OFFICE



SOCIAL DECKS



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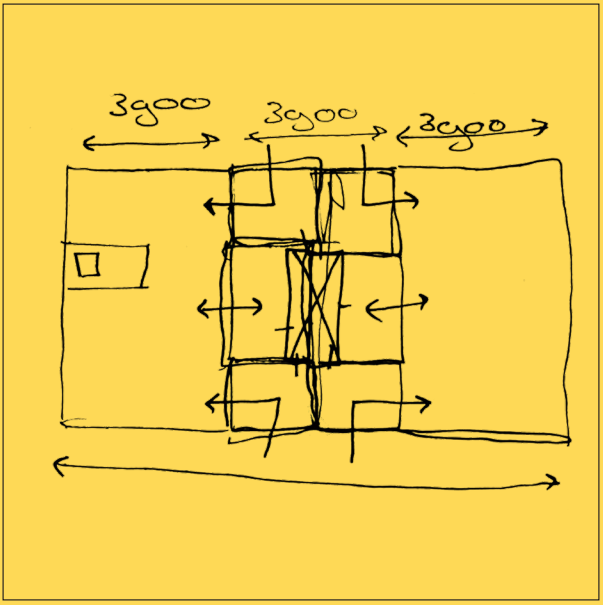
PIET'S CENTRE

Explore lab
Programmatic Framework
by

Lotte Annabelle Schut
5276462



Roel van de Pas (RS) & Yagiz Söylev

BRIEF FRAMEWORK

BRIEF FRAMEWORK

Patient volumes and staffing considerations

This framework is based on research into patient numbers, care trajectories, and spatial requirements for a specialised clinic that would operate in collaboration with UMC Utrecht (UMCU), Wilhelmina Children's Hospital (WKZ), and the Princess Máxima Centre for Paediatric Oncology. The clinic is not intended to replace existing hospital services, but to support them by accommodating specific patient groups in a controlled environment.

The design focuses on three patient groups: Cystic Fibrosis (CF) patients, chemotherapy patients, and stem cell transplant (SCT) patients. During the research process, differences as well as overlaps between these groups became apparent, which informed the functional organization of the clinic.

CF patients are continuously vulnerable to infections and are at risk of cross-infection from contact with other CF patients. For this reason, CF care is typically organized with strict segregation. Based on this, the design assumes that CF patients would primarily be treated in an autonomous outpatient clinic, limiting the need to enter larger hospital buildings.

Chemotherapy patients use the clinic mainly during periods in which they receive treatment. However, their vulnerability to infections extends beyond the moment of chemotherapy administration. During treatment cycles, patients require consultations, blood draws prior to each chemotherapy session, and additional appointments related to their therapy. These functions are therefore included within the same clinical setting.

For stem cell transplant patients, care is largely inpatient-based. Patients are most vulnerable after conditioning therapy and during the recovery period following transplantation. As a result, inpatient rooms form the main spatial requirement for this group, with outpatient visits occurring mainly before transplantation and in later follow-up phases.

Based on these care trajectories, the required number and type of rooms were analysed. Some functions are shared between patient groups. Radiology is used by all three groups, while blood draw facilities are required for both CF and chemotherapy patients. These overlaps were taken into account when defining shared clinical spaces.

The availability of patient number data varied between the patient groups. For CF care, national annual reports provide hospital-specific patient numbers and information on inpatient care (Zomer-van Ommen et al., 2025). For stem cell transplantation, fewer public sources were available. UMC Utrecht reports approximately 100–150 stem cell transplants per year (UMCU, n.d.), and an individual clinician source indicates that approximately 50 of these involve paediatric patients (Bierings, n.d.). Based on this information, an estimation was made, which is further explained later in this report.

For chemotherapy patients, hospital-specific treatment volumes were not publicly available. Chemotherapy is not reported as a separate care category, and treatment pathways vary by cancer type and patient characteristics. National data from the Netherlands Cancer Registry (NKR, 2024) were therefore used to estimate patient numbers, supplemented by assumptions regarding the distribution of patients across hospitals in the Utrecht region. Based on available literature, an estimated proportion of cancer patients receiving chemotherapy was applied. The resulting patient numbers were used as input for the spatial and staffing calculations presented in this report. A more detailed explanation of these assumptions and calculations is provided in a later chapter.

Finally, staffing requirements were examined. Literature providing Whole-Time Equivalent (WTE) staffing guidance was available for CF clinics (Conway et al., 2014) and stem cell transplant units (Elfeky et al., 2025). Comparable guidance was not found for chemotherapy outpatient care, radiology, or blood draw facilities. For these functions, staffing levels were estimated using proportional logic derived from the CF and SCT models.

INPATIENT ROOMS (BEDS)

Bed-days model with occupancy

Bed Occupancy Rate (BOR)
Length of Stay (LOS)

Beds needed = (Annual cases × LOS) ÷ (365 × BORS)

According to the National Audit Office, bed occupancy levels of approximately 85% are considered efficient. Occupancy above this threshold increases the risk of periodic bed shortages, while rates exceeding 90% are associated with recurrent bed crises. Maintaining a proportion of unoccupied beds, although resource-intensive, is therefore necessary to accommodate unexpected demand and to safeguard quality of care (Bosque-Mercader & Siciliani, 2022).

A) HSCT (stem cell transplant) inpatient rooms

Typical inpatient LOS figures vary by regimen and complications, but many sources report ~4-5 weeks which is approx. ~32 days median inpatient time for allogeneic HSCT (UMCG Hematologie, 2025).

1. Approx. Annual HSCT inpatients UMCU: 50 child + 100 adult = 150 inpatients

2. Assume average inpatient LOS 32 days

3. Annual bed-days = 150 × 32 = 4,800 bed-days

4. Beds at 85% occupancy = 4,800 ÷ (365 × 0.85)
= 4,800 ÷ 310.25 ≈ 15.5 ~16 single inpatient rooms

5. Rule-of-thumb output: ~16 HSCT inpatient rooms
(6 paediatric, 11 adult)

B) CF inpatient rooms

A report of the Dutch Cystic Fibrosis Resitration of 2024 by Zommer-van Ommen et al. (2025) reported 5.3% of children and 8.6% of adults need in-hospital treatment, with an average stay of 27 days. Since a peak in inpatient treatment occurs during seasonal changes we will go for a 80% capacity in order to counter this.* The introduction of highly effective CFTR modulator therapies has significantly reduced pulmonary exacerbations and severe infections in Cystic Fibrosis patients, leading to fewer hospital admissions and a decreased need for permanent inpatient bed capacity (Zommer-van Ommen et al., 2025).

CF patients: 344 adults and156 children

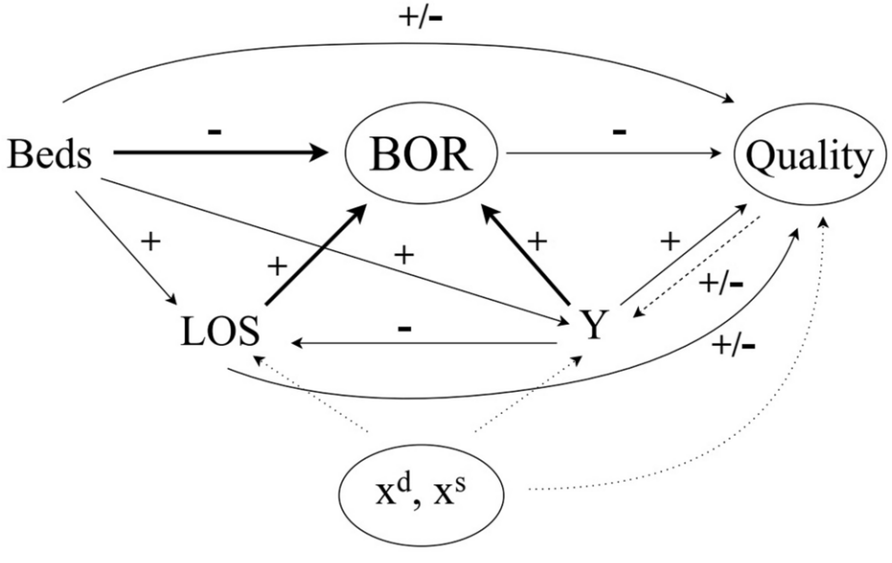
1. Approx. Annual CF inpatients: (344 x 0.086) + (156 x 0.053) = 33 inpatients

2. Assume average inpatient LOS 27 days

3. Annual bed-days = 33 × 27 = 891 bed-days

4. Beds at 80% occupancy = 891 ÷ (365 × 0.8)
= 891 ÷ 292 ≈ 3,05 ~ 4 single inpatient rooms

5. Rule-of-thumb output: ~ 4 CF inpatient rooms
(2 paediatric, 2 adult)



Conceptual framework. BOR bed occupancy rate; LOS length of stay, Y volume, xd demand shifters, xs supply shifters (Bosque-Mercader & Siciliani, 2022).

DAY TREATMENTS
Chemo chairs

Required chairs =
Annual number of chemotherapy visits ÷ (operating days per year × patients treated per chair per day)

Because no public data are available on the number of chemotherapy patients or chairs at UMC Utrecht, an estimation was made based on national and regional data.

A) Estimated number of chemotherapy patients

For this estimation the NKR was used.
The Netherlands Cancer Registry (NKR) is a nationwide database managed by the Netherlands Comprehensive Cancer Organization (IKNL). Since 1989, it has systematically collected data on all newly diagnosed cancer patients in the Netherlands, with the aim of improving cancer care, supporting clinical research, and informing health policy and planning.

In Utrecht there are three large hospitals so a rough estimation was made on how this group of cancer patients would have been distributed in Utrecht.

Adults:
30% UMC Utrecht
45% St. Antonius Ziekenhuis
10% Meander Medisch Centrum
15% Other

Children:
95% Wilhemina Kinderziekenhuis
5% Other

The annual cancer incidence (NKR) of 2024 in Utrecht in the age group of 20 - 85+ amount to: 9198 adult patients.

Because paediatric oncology care in the Netherlands is highly centralized, the Wilhelmina Kinderziekenhuis (WKZ), part of UMC Utrecht, functions as a regional referral centre. Therefore, pediatric oncology demand in this study was estimated using cancer incidence data from Utrecht and surrounding provinces: Noord-Holland, Zuid-Holland, Flevoland, and Gelderland. The annual cancer incidence (NKR) of 2024 in Utrecht and surrounding provinces: Noord-Holland, Zuid-Holland, Flevoland, and Gelderland in the age group of 0 - 19 amount to: 405 paediatric patients.
Then that means that this design will house the chemotherapy for the adults from UMC Utrecht and form the children from Wilhelmina Kinderziekenhuis.

B) Number of chemotherapy visits

Although no single direct source was found that reports the overall percentage of cancer patients receiving chemotherapy, this proportion is inherently complex and highly dependent on cancer type, stage, and treatment pathway. An analysis by Integraal Kankercentrum Nederland (IKNL, 2024) examining differences in cancer treatment by income level reports that approximately 39% of patients with a low income and 54% of patients with a high income receive chemotherapy.
For the purpose of this project, the average of these values, 47%, is used as a pragmatic estimate of the proportion of cancer patients receiving chemotherapy.

9198 Adult cancer patients in Utrecht:
approx. 47% get Chemotherapy -> 4323 patients
approx. 30% get treated at UMCU -> 1297 patients

405 Pediatric cancer patients in Utrecht and surrounding provinces:
approx. 47% get Chemotherapy -> 190 patients
approx. 95% get treated at WKZ -> 181 patients

C) Chair calculation

A standard course of chemotherapy consists of approximately four to eight treatment cycles. This range is often used because it provides enough repeated treatment to target the cancer effectively, while also limiting the likelihood of serious side effects. The precise number of cycles required depends on several factors, including the cancer type, the stage of the disease, and the patient's general health condition (Lewis, 2025).

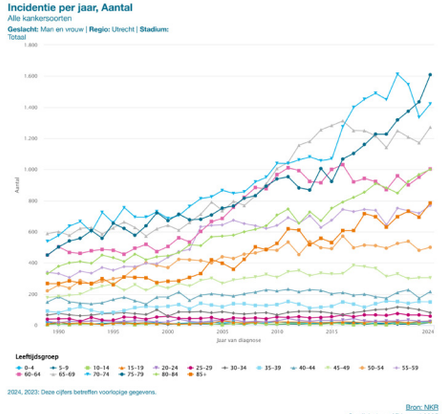
1. Average chemo day visits per year: 4–8

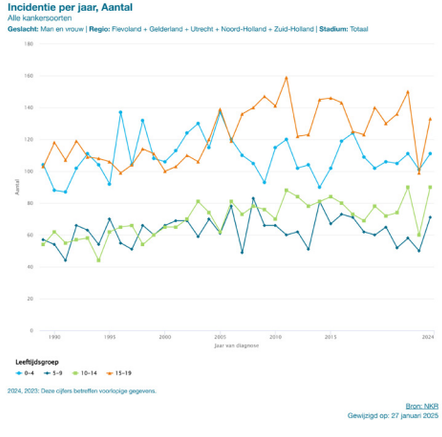
2. 1297 patients × 6 visits =
7782 adult visits/ year
181 patients × 6 visits =
1086 paediatric visits/ year

3. Operating assumptions:
- 50 weeks, 5 times per week: 250 days
- Adult patients per chair per day: 2
- Child patients per chair per day: 1

4. Adult chairs
7782 ÷ (250 × 2) = 16 chairs (for 1.5 = 21 chairs)
Paediatric chairs
1086 ÷ (250 × 1) = 5 chairs

5. Output: ~ 21 chemo chairs (5 paediatric and 16 adult)





Incidentie per year in Utrecht (adult) &
Incidentie per year in Utrech and surrounding provinces (pediatric) (IKNL, 2024)

OUTPATIENT CONSULT ROOMS

Visit-hours model time-based

Consult rooms needed = (Annual visits × Visit duration) ÷ (Annual room-hours × target room utilization)

- Annual room-hours = (clinic hours/day × days/year)
- Target room utilization (often <100% because of DNA/no-shows, cleaning, turnaround). For immunocompromised flows you can justify lower utilization due to cleaning/segregation.

Patients using consult rooms:

CF Full time-clinic use
HSCT Pre-, peri-, and early post-transplant
Chemo Only during vulnerable cycles

A) Frequency assumptions:

CF patients - Always at risk:

- Have 3x regular check-up and one large one (full day).

  ~ 3 regular visits for CF Patients
  ~ 1 full day visit for CF patients

SCT patients - at risk after transplantation for 6-12 months:

- The first 3-6 weeks they are inpatient (no visits)
- After a stem cell transplant, patients require regular medical monitoring and testing until the new bone marrow begins to function effectively and no major complications are present. During the first three months after discharge from the hospital, follow-up appointments may take place daily, weekly, or every two weeks, depending on the recovery process and the return of blood cell counts to normal levels (Du Cancer, n.d.).
  ~ once a week for the first 3 months

  4 x 3 = 12 visits.

- After 3 months, the doctor will decide how often follow-up needs to be done. If there are no serious problems, follow-up may be done less frequently as time passes and the risk of problems becomes lower.(Du Cancer, n.d.).

  ~ Approx 1-2 visits for 9 months
  1.5 x 9 = 14 visits.

- After the first year, the immune system usually returns to normal and the bone marrow produces blood cells normally again. But it might take longer for some people, especially if they are on immune-suppressing drugs. (no visits).

  ~ 26 check-up visits per year for HSCT patients

Patients receiving Chemotherapy - at risk after and during their appointments:

- Interim check-up in case additional monitoring is required. Estimated 0.25 is needed after each cycle. approx. 1.5 visits (not a regular occurrence)
- Imaging and treatment evaluation every 2-3 months, approx. 4 visits.
- One final visit after chemo is done, 1 visit.

  6.5 check-up visits per year for Chemo patients

B) Annual Room hours:

Outpatient clinic open 08:00–17:00 -> 9 hours/day
5 days/week x 48 weeks / year = 240 days / year
~annual room-hours = 9 x 240 = 2160 hours/room/year

2160 x 0.7 = 1512 usable hours / room

C) Visits per patient / year

Regular visit = 30 min
Full day visit = 60 min

CF (3x0.5) + 6 = 7.5 hours / CF patient / Year
HSCT 26 x 0.5 = 13 hours / HSCT patient / Year
Chemo 6,5 x 0,5 = 3,25 hours / Chemo patient / Year

CF 1,7 x 500 = 850
HSCT 13 x 150 = 1950
Chemo 3,25 x 1478 = 4804
7604 hours / year

7604 / 1512 ≈ 5 consult rooms

Output: ~5 outpatient consult rooms

BLOOD TESTS
Pre-chemo & CF large check-up

A) Number of patients

Patients receiving Chemotherapy are at risk after and during their appointments:

- You get a check-up before you start chemo therapy, which is approx. 6 visits per year (Lewis, 2025).

CF patients - Always at risk:

- 1 large check-up per year, any additional tests

Children:
(6 x 181) + (1.5 x 156) = 1320 blood tests per year

Adults:
(6 x 1297) + (1.5 x 344) = 8298 blood tests per year

B) Room hours

Outpatient clinic open 08:00–17:00 -> 9 hours/day
5 days/week x 50 weeks / year = 250 days / year
Target room utilization: 85%

~annual room-hours = 9 x 250 x 0.85 = 1913 hours/room/year

C) Rooms needed

20 minutes per blood draw adults ≈ 0.33 hours
40 minutes per blood draw children ≈ 0.66 hours

Paediatric: (1320 x 0.66) ÷ 1913 = 0,5 ≈ 1
Adult: (8298 x 0.33) ÷ 1913 = 1,4 ≈ 2

Output: ~ 3 blood test rooms
(1 paediatric and 2 adult)

RADIOLOGY
Pre-chemo & CF large check-up

A) Patient volumes using this radiology unit

These rooms are not sized like a full hospital radiology but for:

- CF (routine + annual “large visit”)
- SCT (follow-up, complications)
- Chemo (baseline, toxicity, response checks)

They replace repeated transfers to the main hospital, especially when patients are vulnerable.

B) Modality-by-modality necessity

1x DEXA
- CF (all): annual bone density
- SCT: baseline + follow-up
- Chemo: selected regimens only

1x Echo
- CF: routine cardiopulmonary monitoring
- Chemo: cardiotoxicity monitoring (anthracyclines etc.)
- SCT: pre/post transplant cardiac checks

1x MRI
- Oncology follow-up (brain, soft tissue, marrow)
- CF complications (e.g. liver)
- Pediatric imaging without radiation

1x CT
- Oncology staging / response
- SCT complications (lung, abdomen)

1x PET-CT
- Mainly oncology
- CF: routine annual large visit

1x X-ray
- Chest X-ray for: Acute SCT lung issues

WHOLE-TIME EQUIVALENTS PER CLINIC SIZE

Following the estimation of patient numbers and clinical capacity, the next step was to determine the staffing requirements needed to support these functions. This was done using Whole-Time Equivalents (WTEs) as a standard measure for staffing size. For each patient group and major room function, a scheme was developed outlining the required staff roles. These schemes are based on the previously calculated patient volumes, treatment frequency, and capacity assumptions:

- Role: the staff function required to support clinical activities
- Clinic size reference: based on the estimated number of patients per patient group or function
- WTE / number: the estimated staffing requirement expressed in whole-time equivalents
- Core function: a brief description of the role's primary responsibilities
- P / S / R:
  -Permanent (P): Fixed CF MDT role, daily presence, continuity essential - -
  -Shared (S): Dedicated CF role, but may be employed across campus or sites
  -Rotational (R): Training or service posts that rotate by definition
- Maximum capacity logic: the operational assumption linking staff availability to patient throughput

Workplaces: the number of physical workstations required to accommodate the role
The WTE values were determined either from available literature (where applicable) or through proportional reasoning based on comparable clinical models. The purpose of these schemes is to translate functional staffing needs into spatial requirements, specifically the number of workplaces that must be accommodated within the design.

Because the specialised clinic is conceived as an extension of, and physically connected to, UMC Utrecht, Wilhelmina Children's Hospital, and the Princess Máxima Centre for Pediatric Oncology, an additional distinction was made between staff roles that would be permanently based within the specialised clinic and those that could be shared with the adjacent hospitals. Certain functions require continuous presence and therefore necessitate dedicated workplaces within the clinic. Other roles, particularly medical specialists, may be fulfilled by clinicians who primarily work in the larger hospitals and attend the specialised clinic as needed.

Each patient group and room function was initially analysed separately to clarify specific care logic and staffing needs. After establishing these individual schemes, the next step is to combine the results and identify overlapping roles and shared specialties. This consolidation informs decisions on shared workplaces and supports an efficient spatial organisation.

Role Cf adult 350x	WTE / number	Core function	P / S / R	Maximum capacity logic	Work-places
Consultant (CF)	3.5	Outpatient & inpatient CF care, MDT coordination	P	≈1 consultant per 100 CF adults	2-3 offices
Staff grade / fellow	1	Supports consultants, clinics, ward care	S	Provides continuity without training rotatio	1 shared desk
Specialist registrar	1.5	Day-to-day medical care under supervision	R	Training post	1 shared desk
Specialist nurse (CF)	5	Supervised clinical work	P	≈1 per 70 patients	2-3 desks
Physiotherapist	6	Airway clearance, exercise therapy, inpatient & outpatient care	S	High-frequency contact for all CF patients	2-3 desks + therapy room
Dietitian	2	Nutritional optimisation, enzyme management	S	CF nutrition requires frequent monitoring	1 shared desk
Clinical psychologist	2	Mental health, adherence, chronic disease coping	S	Embedded but may work across services	1-2 consult rooms
Social worker	2	Housing, finance, employment, psychosocial support	S	≈1 per 175 patients	1-2 consult desks
Pharmacist	1	CF-specific medication management, antimicrobial therapy	P	High drug complexity and continuity required	1 desk
Secretary	2	Scheduling, correspondence, MDT administration	P	High outpatient volume	2desks
Database coordinator	1	Registry reporting, audit, quality monitoring	P	Mandatory for CF registries and benchmarking	1 desk
Ward Nurse	~20–25	Inpatient CF care	P/S	~1:3–1:4 ratio	Nurse station 2N

Role CF CHILDREN 150X	WTE / number	Core function	P / S / R	Maximum capacity logic	Work-places
Consultant (CF)	1.5	Outpatient & inpatient CF care, MDT coordination	P	≈1 consultant per 100–120 children	1-2 offices
Medical trainees	1.5	Supervised clinical care	R	Training role only	1 shared desk
Specialist nurse (CF)	3	Family coordination, education, infection prevention	P	Higher intensity than adults	1-2 desks
Physiotherapist	3	Airway clearance, developmentally adapted therapy	S	Frequent contact, but shareable	2 shared desk + TSP
Dietitian	1	Growth, nutrition, feeding support	S	Intensive early-life input	1 shared desk
Clinical psychologist	1	Child & family psychological care	S	Embedded but shared	1 consult room
Social worker	1	Family, safeguarding, school & social support	S	≈1 per 150 children	1 consult desk
Pharmacist	1	Paediatric CF medication safety	P	Dosing complexity & continuity	1 desk
Secretary	1	Scheduling, family communication	P	Lower volume than adults	1 desk
Database coordinator	0.8	Registry, audits, outcomes tracking	P	Smaller cohort than adults	1 shared desk
Ward Nurse	~12–15	Inpatient CF care	P/S	~1:2–1:3 children	Nurse stations 1 N

Role SCT CHILDREN 50X	WTE / number	Core function	P / S / R	Maximum capacity logic	Work-places
Consultant (paediatric HSCT)	5-6	Full clinical responsibility, inpatient rounds, long-term follow-up	P	Max ~10 HSCT/ consultant/year;	3–4 offices
Programme director (consultant)	1 (included above)	Clinical governance, accreditation	P	Mandatory (JACIE)	1 office
Middle-grade doctor (non-rotating)	2	Day-to-day continuity, inpatient care	S	At least 1 non-rotating required	1-2 shared desks
Medical trainees	1-2	Supervised clinical work	R	Training role only	1 shared desk
Clinical Nurse Specialist (HSCT)	5	Donor coordination, patient pathway	P	1 per 10 HSCT	2-3 desks shared off
Ward nurses	≈48	24/7 inpatient care	P	1:2 inpatient ratio (1:1 at high acuity)	nurse sta-tion onl 4N
Psychologist	1.5–2	Child & family psychological care	P	Embedded; paediatrics require more input	1-2 therapy rooms
HSCT coordinator	1	Scheduling, donor logistics	P	Cannot be trainee	1 desk
Data manager	1	Registry, reporting, audits	P	Fixed mnimum	1 desk
Quality manager	1	Quality & safety systems	S	May be shared with adult HSCT	0.5 desk (shared)
Pharmacist (HSCT)	2	Chemotherapy, TDM, protocols	S	1 per 20 HSCT	1 shared desk
Social worker	2	Family, housing, finance, safe-guarding	S	1 per 25 HSCT	1-2 consult desks
Dietician	1	Nutrition optimisation	S	High frequency inpatient	1 shared desk
Physiotherapist	1	Prehabilitation, rehab	S	≥2 sessions/week	0.5 desk + therapyspac
Occupational therapist	1	Development, fatigue, daily function	S	Weekly inpatient	0.5 desk + therapyspac
Speech therapist	0.5	Swallow, neuro issues	S	Case-dependent	shared desk
Play therapist	1	Developmental & emotional support	PW	Daily weekday presence	1 desk+ playroom

Role SCT ADULTS 100X	WTE / number	Core function	P / S / R	Maximum capacity logic	Work-places
Consultant (paediatric HSCT)	10	inpatient & outpatient care, MDT leadership, on-call rota	P	Max ~10 HSCT/ consultant/year;	4-5 offices
Programme director (consultant)	1 (included above)	Clinical governance, accreditation	P	Mandatory (JACIE)	1 dedicated office
Middle-grade doctor (non-rotating)	3-4	Day-to-day continuity, inpatient care	S	At least 1 non-rotating required	2 shared desks
Medical trainees	2-3	Supervised clinical work	R	Training role only	1-2 shared desks
Advanced Nurse Practitioner (ANP)	2-3	Prescribing, continuity	P	Supports medical rota	1-2 desks
Clinical Nurse Specialist (HSCT)	10	Donor coordination, patient pathway	P	1 per 10 HSCT	3-4 desks shared
Ward nurses	≈50	24/7 inpatient care	P	1:2 inpatient ratio (1:1 at high acuity)	station only 8N
Psychologist	2-3	Pre-, peri- and post-transplant mental health	S	Embedded HSCT psy-chology	1-2 consult rooms
HSCT coordinator	2	Scheduling, donor logistics	P	Cannot be trainee	2 desks
Data manager	2	Registry, reporting, audits	P	27 h/week + 2.9 h per 10 HSCT	2 desks
Quality manager	1	Quality & safety systems	S	May be shared with paediatric HSCT	1 shared desk
Pharmacist (HSCT)	5	Conditioning, TDM, complex prescribing	S	~1 senior per 20 HSCT	2 shared desks
Social worker	4	Family, housing, finance, safe-guarding	S	1 per 25 HSCT	2 consult desks
Dietician	2	Nutrition pre/during/post HSCT	S	High frequency inpatient	1 shared desk
Physiotherapist	2	Prehabilitation, rehab	S	≥2 sessions/week	1 shared desk + TSP
Occupational therapist	1-2	Function, fatigue, ADL support	S	Weekly inpatient + outpatient	1 shared desk + TSP
Speech therapist	0.5-1	Swallow, neuro issues	S	Case-dependent	shared desk

Role Chemo adult 1297x	**WTE / number**	**Core function**	**P / S / R**	**Maximum capacity logic**	**Work-places**
Consultant oncologist / hematologist	2	Medical responsibility, chemo approval, complex consults	P	~1 consultant per 15–20 active chemopatients day	1 office
Staff grade / fellow	0.5	Continuity, routine reviews, toxicity checks	S	Supports consultants without training rotation	1 shared desk
Specialist registrar	1.5	Supervised clinical care	R	Trainig post	1 shared desk
Nurse practitioner / PA	1.5	Chemo reviews, side-effect management, access issues	P	~1 per 8–10 chairs	2 desks
Oncology nurse (day unit)	8.5	Chemo administration, monitor-ing, infection control	P/S	~1 nurse per 3–4 chairs	Nurse station 1.5N
Pharmacist (clinical, non-compounding)	0.5	Protocol oversight, medication safety	P	High chemo complexity	1 desk
Psychologist	0.5	Coping, anxiety, adherence	S	Shared oncology role	1 consult room share
Social worker	0.5	Work, finance, psychosocial support	S	~1 per 250 patients	1 consult desk
Secretary	1.0	Scheduling, coordination, patient contact	P	High visit volume	1 desk
Database / care coordinator	0.6	Treatment tracking, outcomes, MDT support	P	Required for oncology reporting	1 shared desk

Role Chemo child 181x	**WTE / number**	**Core function**	**P / S / R**	**Maximum capacity logic**	**Work-places**
Pediatric oncologist	1	Medical responsibility, family consults	P	Consultant supervision, not chair-based	1 shared office
Medical trainee	0.5	Supervised care	R	Training role	1 shared office
Nurse practitioner / PA (peds)	1	Daily continuity, toxicity review, coordination	P	Independent clinic operation	1 dedicated desk
Pediatric oncology nurse	3.5	Chemo delivery, monitoring, family support	P/S	~1 nurse per 1–2 chairs	Nurse station 2N
Pharmacist (pediatric oncology)	0.5	Pediatric dosing safety	P	High-risk medications	1 shared desk
Child psychologist	0.5	Child & family coping	S	Embedded but shared	1 consult room
Social worker	0.4	Family support, school, safeguarding	S	~1 per 150 children	1 desk
Secretary	0.6	Family communication, scheduling	P	Lower volume, higher intensity	1 desk
Care / database coordinator	0.4	Registry, outcomes, coordination	P	Smaller cohort	1 shared desk

Role Blood Tests	**WTE / number**	**Core function**	**P / S / R**	**Maximum capacity logic**	**Work-places**
Phlebotomist (adult)	2.5	Adult blood draws	P	~4,500 tests/WTE/yea	2 adult rooms
Phlebotomist (pediatric)	1	Pediatric blood draws	P	Lower throughput, child-focused	1 child room
Nurse (complex access)	0.8	Ports, difficult access, chemo patients	P	Case-based support	1 shared desk
Blood testing assistant	1	Patient flow, labeling, cleaning	P	Throughput-based	1 shared desk
Admin / scheduling	0.5	Appointment planning	P	~35–40 bookings/day	1 desk
Lab courier / logistics (shared)	0.2	Sample transport	R	Timed runs	Shared

Role Radiology	**WTE / number**	**Core function**	**P / S / R**	**Maximum capacity logic**	**Work-places**
Radiologist	1.6	Reporting, protocoling, MDT consults	P	~25–30 studies/day/WTE	2 reading desks
Nuclear medicine physician	0.6	PET-CT supervision & reporting	S	~5–6 PET/day	1 reading desk
Radiology tech (CT/ MRI/PET)	5	Operate CT, MRI, PET-CT	P	1 technologist per scanner per shift	3 control rooms
Radiology tech(X-ray/ DEXA)	1.8	X-ray + DEXA	P	Short exams, shared role	2 control areas
Sonographer	1	Echo (adult & pediatric)	P	~8 echos/day	1 echo room
Radiology nurse	2	IV contrast, PET prep, sedation support	P	1 per CT/MRI/PET block	2 shared desks
Radiology assistant	1.5	Patient flow, cleaning coordination	P	Throughput-based	1 desk
Admin / scheduling	1	Appointments, coordination	`P	~40 bookings/day	1 desk
Medical physicist (shared)	0.3	QA, radiation safety	S	based in UMCU	no desk
PACS / IT support (shared)	0.2	Imaging systems	S	based in UMCU	no desk

INTERVIEWS & OBSERVATIONS

Clara Kastelein
Interview 03/12/2025

Interview Notes: Structured & Translated (English)

"Hospitals are designed by healthy people."

1. Scheduling and Patient Flow for CF Patients

- Doctors use a specific code for CF patients so staff know in advance and can take precautions.
- Two CF patients are never scheduled consecutively; there must always be another patient in between.
- Tables and chairs are wiped down with cleaning wipes between CF patients.
- Staff rely on the hospital's ventilation system for safety, as it is a new hospital. (Own remark during the interview: is the ventilation really designed for this?)
- CF patients walk through the large waiting room. Along the corridor, sets of two chairs are placed with distance between each set so the patient and their partner can wait at a safe distance from others.

2. Diagnostics and Mobility of Equipment

- Question: Could the lung function test device be mobile?
  - Answer: No, it is a fixed device in a room.
  - However, when a patient is in an isolation room, the device can be placed in the hallway, and the tube can be extended into the isolation room.
  - (Uncertainty raised: but if it can be moved into the hallway, is it technically "mobile"?)
- If a CF patient is admitted, they go to the pulmonary ward, which mainly consists of single-patient rooms.

3. Problems Identified in the Current Erasmus MC Ward Design

3.1 Privacy at Room Entry

- Knocking does not work effectively.
- There is no curtain, so staff enter directly and immediately see the patient.
- A barrier would be helpful.

3.2 Ceiling Lift System

- The ceiling lift does not continue into the bathroom.
- This is inefficient: the patient must first be placed in a wheelchair and then moved to a shower chair in the bathroom.
- This is not very common in CF but was an issue in neurology (nurse's previous workplace).

3.3 Storage and Material Logistics

- Storage cabinets for materials are centrally located, requiring a lot of walking.
- Current workaround: trolleys, but these must be restocked by other staff and are inconvenient.
- Materials brought into a patient's room cannot be taken back out due to new infection-prevention rules.
  - Example: If two catheters are brought in and only one is used, the unused one must be discarded, high waste.
- A potential solution mentioned: a pneumatic tube (buizenpost) system per room.

3.4 Dirty Laundry Handling

- A hatch system for dirty laundry would be useful, as the current rules are complex.

3.5 Storage for Sterile Materials

- Sterile storage requires overpressure.
- Because of the technical installations, central placement is logical; everything must be aligned vertically.

4. Spaces for Outpatient CF Care

- Large research/assessment appointments take place in a dedicated lounge for adult patients.
  - This lounge does not have overpressure.
  - The equivalent lounge in the Sophia Children's Hospital does have overpressure.
- In the lounge, patients see physiotherapy, dietetics, and nursing.
  - Doctors do not visit the lounge for adults; they call afterwards.

Blood Collection

- Blood is drawn in the lounge due to extremely long waiting times at the main phlebotomy centre (a lab is closed).
- This is mainly for patient convenience; keeping CF patients out of crowded areas is only a positive side effect, not the primary reason.

5. Other Diagnostics and Cross-Infection Risk

- For other appointments (ultrasound, lung function, DEXA scan, CT, thorax X-ray) patients must go to other departments.
- When asked whether it is dangerous for


Clara Kastelein (Erasmus MC, z.d.-b)

CF patients to encounter each other there, staff said the risk is extremely small and cannot always be monitored.

6. Effects of Single-Patient Rooms

- All rooms are now single rooms.
- Positive effects: reduced cross-infection and improved privacy.
- Negative effects:
  - Loss of "second pair of eyes", previously, two patients could look out for each other; now only nursing staff does.
  - Reduced social interaction: previously, patients could talk or support each other.
  - Increased loneliness.
- Staff question whether relying on a roommate for safety was ever an appropriate responsibility for patients, but the loss of social support is still significant.

Annelies Kok
Interview 16/12/2025

Interview Notes: Structured & Translated (English)

"The diagnosis determines the atmosphere."

1. Atmosphere, comfort, and well-being

- The atmosphere in a hospital is important.
- Hygiene is important.
- Feeling "not alone" matters.

2. Visibility, privacy, and staff working conditions

- It is important that nurses can see patients. We cannot assume that parents will always be in the room to check on the children.
- What stands out is that staff often do not have daylight.

3. Groot Onderzoekskamer (large examination room)

- The room is empty and simple: a desk, a sofa, and two chairs, comparable to the adult "large examination lounge."
- At the back, one wall is a cabinet:
  It includes a baby changing table, a microwave, connections for the nebulizer.
  One part is a cupboard with children's toys; kids can choose a toy to play with during the day.
- An important point: In the large examination room, nothing happens against the patient's will.

4. Blood draws and associations (psychological logic)

- They prefer not to do blood draws in the large examination room, because children generally find it unpleasant and scary.
  Blood draws are done elsewhere so the association with the large examination room stays positive. This means patients walk more, but the goal is maintaining positive associations for children, more psychological than practical.

5. Waiting areas, furniture, and infection prevention

- In Erasmus, chairs have been separated in groups in the hallways. There are integrated armrests for people with reduced mobility; interesting to observe how furniture affects use.
- Furniture is used to guide CF patients to sit with their own group; chairs and benches are spaced apart.
- In the blood draw waiting are for children a, there is one long bench: This is not good: sick people sit close together.
  For adults the waiting area is larger, but has similar benches: In the morning it is extremely busy. People try to sit elsewhere, but then they cannot see the screen.
- Personal experience: She used to wait with a friend from oncology who was more vulnerable. They preferred not to sit in the large group and sat around the corner where it was calmer, but this is no longer allowed.

6. Suggestions / references mentioned

- Tip: look at a tuberculosis hospital.
  Or: a daycare with outdoor sleeping places.
  Or: open-air schools in Rotterdam (there is one).
  Something that makes contact less easy.

7. Time per patient and implications for spatial sizing

- Doctors have 20 minutes per patient.
  In design, it is important to consider:
  - The relationship/time per patient group.
  - How many people will be waiting at the same time.
  - Whether the waiting room capacity matches that.

8. Children's routine (sequence of appointments)

- For children, the routine is roughly:
  1. Blood draw (so it is done first)
  2. Lung function test
  3. CT scan or sometimes MRI
  4. Visit to the pulmonologist
  5. Throat swab/culture ("kweek")
  6. Afterwards a DEXA scan

9. Current outpatient clinic – rooms and mismatch with the original plan

- Current situation:
  - 6 consultation rooms.
  - If needed, the 2 ultrasound rooms can also be used as consultation rooms.
  - 5 lung function rooms.
  - 2 ultrasound rooms.
  - 1 ergo room, but this is now more often done in the lung function area.
  - 4 staff rooms.
  - Around 3 staff per room.
- Originally, all staff rooms were intended as consultation rooms.
  - They forgot to build staff rooms, so the space was converted again.

10. Storage needs and practical privacy issues in consultation rooms

- Storage is needed in the consultation room:
  - Demo models or paper explanations for patient-friendliness and reviewing information.
  - Not everything can be digital.
  - Where do you leave your laptop? It contains privacy-sensitive information.

11. Way finding / navigation

- In your design it's important that people can easily find where they need to go.
  - Erasmus uses letters now.
- She explained that following room numbers can confuse you: You turn a corner, follow the numbers, and end up in a corridor with a different letter and feel completely lost.


Annelies Kok (Erasmus MC, z.d.-a)

12. Observations about child patient groups (CF and oncology)

- Children with CF are very positive children. Parents of children with a chronic illness are positive about everything they do; you think that is why those children are relatively cheerful.
- In the past, oncology and CF were on the same ward: They used to have 6 children in one room.
- There was a lot of mischief:
  - Running through corridors with IV poles when they had antibiotics and felt healthy.
  - Putting cups of water above the door so people got wet when entering. A lot of water fights.
- Observation:
  - Children who ended up in oncology were seen as "pitiful"; parents felt they were pitiful; it became negative, and the children felt pitiful too.
  - The CF children's mischief and fun positively influenced the oncology children and brought them into the cheerful atmosphere.

Annemarie Eikelenboom
Interview 19/12/2025

Interview Notes: Structured & Translated (English)

During the interview with Annemarie Eikelenboom, we discussed the current stage of my project on hospital design for patients who are vulnerable to infectious diseases. I presented the design approach and explained that the primary aim is to reduce infection risks through architectural strategies such as spatial organization, circulation, and separation of patient flows.

Annemarie questioned the absence of face masks in the design strategy, asking, “Why no face masks?” This led to a discussion about the relationship between architectural solutions and behavioural or operational measures. While the project initially focused on solving infection risks through design, it became clear that face masks remain an effective and accessible additional layer of protection. Relying solely on architectural measures may be insufficient, especially in situations where close proximity between users is unavoidable.

We also discussed that wearing a face mask when no one else is doing so can be socially uncomfortable and may discourage use. However, this discomfort could be reduced if mask use is not optional but required to access certain spaces. Introducing clearly defined zones where face masks are mandatory could support both infection control and social acceptance, as everyone entering these areas would follow the same rules.

The discussion continued with the value of Maggie’s Centres as an example of environments that support patient well-being. This connected to earlier observations that oncology patients and cystic fibrosis (CF) patients can benefit from limited social interaction. A key question was how such interaction could be facilitated without increasing the risk of infection. Designated shared areas with mandatory mask use were discussed as a possible approach. This would have spatial and programmatic consequences, as activities such as eating and drinking would not be possible in these areas.

Finally, Annemarie pointed to several reference projects and typologies relevant to the project, including historical and contemporary examples of healthcare architecture that address infection control and healing environments. These included:

Paimio Sanatorium by Alvar Aalto (1933)

Zonnestraal Sanatorium by Jan Duiker and Bernard Bijvoet (1931)

The Emergency Clinic and Clinic for Infectious Diseases by LINK Arkitektur and C.F. Møller

Sanatoria as a general healthcare typology

Radboudumc as the national expertise centre for tuberculosis (TBC) and non-tuberculous mycobacteria (NTM)

These references were identified as useful precedents for further development of the design.



Annemarie Eikelenboom (Van Litsenburg & Van Litsenburg, 2018)

Jaap Schut
Three-month check-up 05/01/2026

Observational Report: Structured & Translated (English)

1. Context and Arrival

Today, I accompanied my brother Piet, who has cystic fibrosis, to his three-month check-up appointment at Erasmus MC. The appointment was scheduled for 8:30 a.m. We left home at 7:15 a.m., but due to snow, ice, traffic jams, and several accidents on the road, we arrived at the hospital at 9:15 a.m.

Because multiple patients had cancelled their appointments that morning, it was still possible to proceed with the consultation. This showed that the outpatient schedule can absorb some disruption, but it also highlighted how external conditions can influence patient flow.

2. Waiting Areas and CF Segregation

Upon arrival, we took a seat in the general waiting lounge. In a previous interview with pulmonologist Carla Kastelein, I was told that CF patients are normally directed to a specific corridor with designated seating to reduce infection risks. On this occasion, we were not guided to this area and instead remained in the general lounge. Later, during the consultation, the doctor pointed out that we should have been seated in the CF-designated chairs.

Carla Kastelein also explained that CF patients are normally not scheduled directly after one another. It is unclear whether this principle is still applied during disruptions such as extreme weather, when appointment times shift and patients arrive late. This raises the question of how reliably such protocols can be maintained under pressure.

3. Pulmonary Function Testing

The first appointment was the pulmonary function test. The room had a basic layout and felt spatially inefficient. Its elongated shape made movement awkward, particularly when switching between the lung function test and the height and weight measurements. The patient and healthcare professional had to pass each other several times in a limited space.

It also became clear that the pulmonary function device was fixed in place rather than mobile. This has direct implications for how these rooms need to be designed and furnished.

4. Waiting Between Appointments

After the pulmonary function test, we returned to the waiting area. Again, this was the general lounge rather than the CF-designated seating, reinforcing how easily intended segregation can be bypassed in practice.

5. Doctor Consultation

The consultation with the physician took place in a standard examination room with a desk and an examination bed. Here, the results of the pulmonary function test and earlier blood work were discussed. The room supported both conversation and brief physical examination without difficulty.

6. Throat Swab

After the consultation, we went directly to another room for a throat swab. The patient was asked to cough while the nurse swabbed the back of the throat. This step was carried out efficiently, with minimal waiting time between rooms.

7. Radiology Waiting Area

We then proceeded to the radiology department to wait for an echocardiogram. While waiting, I overheard people commenting on Piet wearing a face mask and questioning why he was doing so, an if he might have some disease. This illustrated how wearing protective equipment can draw attention in shared public spaces.

Piet wore a mask throughout the hospital visit and only removed it when required for examinations. This situation demonstrated how shared waiting areas can increase both medical and social exposure for vulnerable patients.

8. Observation of the Oncology Day Unit

While Piet was undergoing the echocardiogram, I briefly visited the oncology day unit and received a short tour from staff. The department was busy, and the space was densely occupied. Waiting benches were arranged back to back, and many patients were accompanied by family members. Some family members were using the waiting time for activities such as puzzles.

I counted 21 chemotherapy chairs arranged in groups of five or six. At the end of the corridor, there were chemotherapy beds arranged as one group of five, two groups of four, and two single rooms, resulting in a total of 15 beds. Considering the number of oncology and immunology patients treated at this hospital, this distribution aligned, albeit a higher number, with earlier capacity estimates.

9. Overall Reflection

This visit demonstrated how small disruptions in scheduling, way finding, or seating allocation can affect infection control measures in practice. It also showed how spatial layout, clinical routines, and patient experience are closely connected. For patients with increased vulnerability to infection, the way spaces are organized and used has a direct impact on both safety and comfort.



Jaap Schut (own image)

PRESSURIZED ROOMS

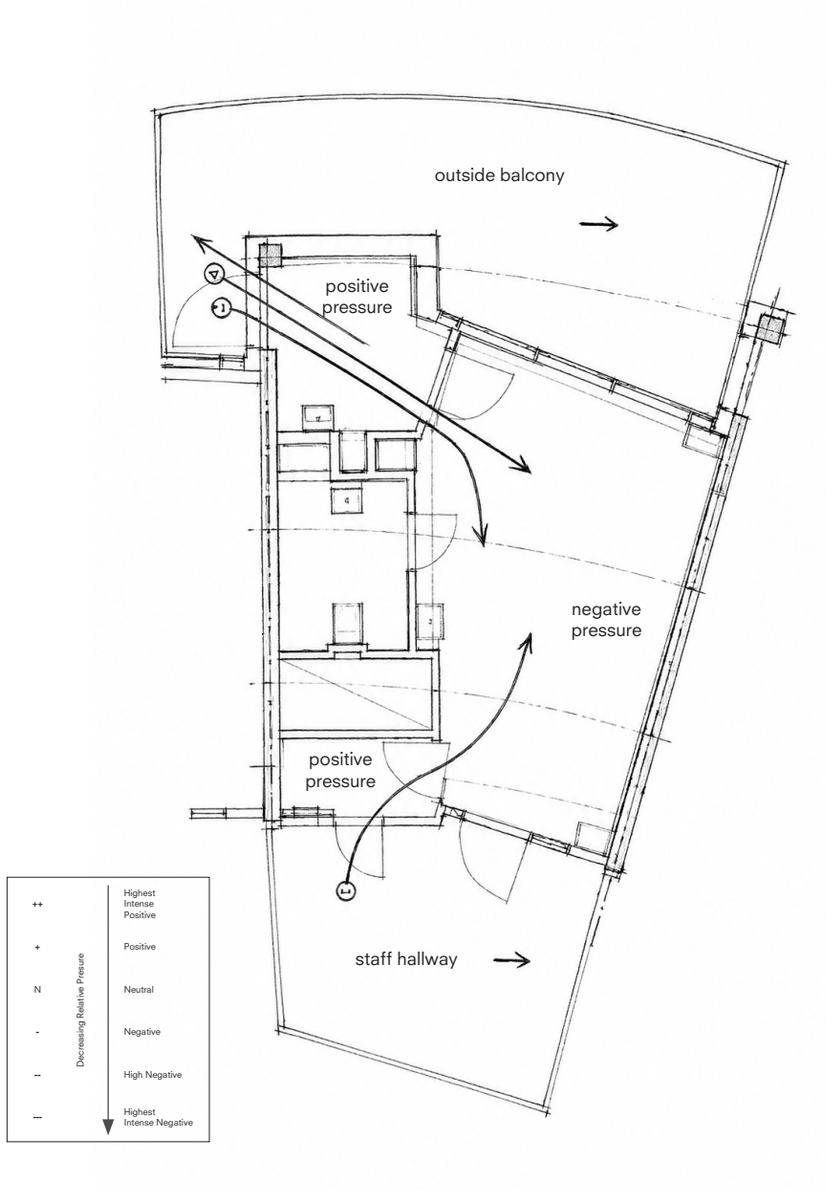
Infectious Disease Centre in Malmö
Reference

The infectious disease centre in Malmö by C.F. Møller uses the layout of the building as part of the infection-control strategy. Patients enter the isolation ward through an airlock from the walkway around the building, while staff, supplies, and clean materials use the internal route. This separates the patient route from the staff route before they meet at the patient room (C.F. Møller Architects, n.d.).

In this reference, the outdoor balcony works as a separate access route for patients. The staff stay within the inner circulation of the hospital, while patients approach the rooms from the outside. The two routes meet at the antechamber and patient room. This makes the pressure system part of the floor plan, instead of only a technical installation.

The patient room is based on negative pressure. A negative pressure room has a lower pressure than the adjacent spaces, so air is drawn into the room. This helps prevent contaminated air from leaving the room and spreading to other hospital areas (TSI Incorporated, n.d.-a). Negative pressure rooms are used for patients with airborne infectious diseases, because the aim is to protect the surrounding spaces from the patient room air (TSI Incorporated, n.d.-b). The air can then be filtered, usually with HEPA filtration, before it is exhausted or recirculated safely (TSI Incorporated, n.d.-a).

The main principle taken from this reference is the combination of separated circulation, an antechamber, and controlled air pressure. In Malmö, the aim is to keep contamination inside the room. In this project, the same spatial principle is reversed, so the aim becomes to keep contamination outside the room.



AI-assisted hand-drawn sketch of Emergency Clinic + Clinic for Infectious Diseases by Link Arkitectur & C.F. Møller (2011), (An Architecture of Risk: How the Past Breathes in the Design of Future Clinical Space | Ephemeral Journal, 2025c)

Reversing the principle
Positive pressure for vulnerable patients

The hospital design has a different requirement. The patients are vulnerable and must be protected from contaminants in the hospital environment. Because of this, the patient rooms are designed as positive pressure rooms instead of negative pressure rooms.

A positive pressure room has a higher air pressure than the surrounding spaces. When the door opens, air flows out of the room instead of into it. This outward airflow helps prevent unfiltered air, dust, micro-organisms, and other airborne particles from entering the patient room (TSI Incorporated, n.d.-a). Positive pressure rooms are used for protective isolation. The aim is to reduce the risk of airborne infection reaching a susceptible patient (International Health Facility Guidelines, n.d.).

The room needs a continuous supply of clean, filtered air. Positive pressure rooms typically supply air through HEPA filters, so the air entering the room is cleaner than the air in the surrounding spaces. The system is based on supplying more clean air than is extracted, which creates a constant outward airflow. This is especially important when doors open, because the air movement should still be directed away from the protected room (TSI Incorporated, n.d.-a).

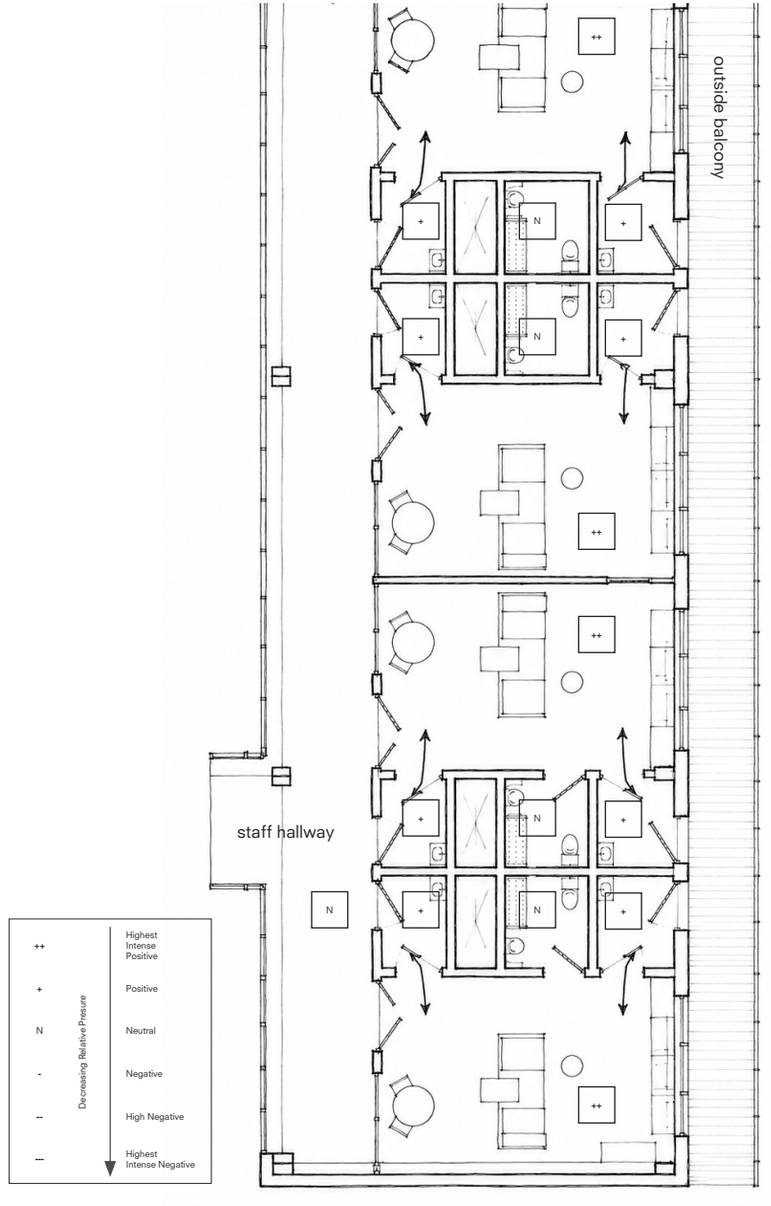
The pressure sequence is also important. In a Class P positive pressure isolation room, the bedroom is the most positively pressurised space. The antechamber is also positively pressurised compared to the corridor, but less than the bedroom. This means that air flows from the bedroom into the antechamber, and from the antechamber into the corridor. Correctly balanced rooms prevent air from entering from the corridor into the antechamber, bedroom, or en suite (International Health Facility Guidelines, n.d.).

The antechamber therefore works as both a pressure buffer and a hygiene space. It reduces the direct exchange of air between the corridor or outside route and the protected room. It also gives space for hand hygiene before entering the room. The guidelines describe the antechamber as a controlled area for transfer, a barrier against pressure loss. (International Health Facility Guidelines, n.d.).

For the pressure system to work properly, the doors are also part of the design. The antechamber should operate as an airlock with self-closing, interlocking doors, so both doors are not open at the same time. This prevents a direct air connection between the patient room and the corridor. The room should also have an alarm that activates when the pressure difference is lost, and pressure monitoring should be visible near the entrance. A HEPA filter is required on the supply air, while a HEPA filter is not required on the exhaust air because the exhaust air is not considered infectious in this type of room (International Health Facility Guidelines, n.d.).

Air Innovations gives several basic design requirements for positive pressure rooms. These include at least 12 air changes per hour, a minimum positive pressure differential of 0.01 inches, constant-volume airflow, and HEPA-filtered supply air. If an antechamber is used, the airflow should move from the patient room to the antechamb``er and then to the adjacent corridor (Air Innovations, n.d.).

In the project, the same circulation idea from the Malmö reference is used, but with the opposite pressure logic. Patients approach the room from an outside route, either from the balcony or from the courtyard. Staff enter from the internal corridor. Both routes meet at the antechamber and the patient room. The patient room is protected by positive pressure, while the antechamber works as the transition between the two circulation systems.



AI-assisted hand-drawn sketch Patient rooms. a

Pressure rooms in the building grid
Radiology

The pressure-room concept is connected to the floor plan through a 7.8 × 7.8 meter grid. This grid makes it possible to repeat the same circulation principle in different parts of the building, while still allowing different room sizes.

On the top floor, patients enter from the outside balcony. On the ground floor, patients enter from the courtyards. In both situations, the staff route is placed on the opposite side of the building, in an indoor hallway. The patient route and staff route meet in the middle, at the antechamber and patient room.

This creates a clear organization. The patient side is connected to outside air, while the staff side is connected to the internal hospital circulation. The antechamber is placed between these two routes. It works as the point where the two systems meet, but also as a controlled buffer before entering the positive pressure room.

The grid also supports departments that need larger or more specific rooms, such as radiology. Radiology rooms are not all the same, because different devices need different forms of protection. Some rooms mainly need enough space for examination, staff movement, patient transfer, and equipment. (International Health Facility Guidelines, n.d.-a).

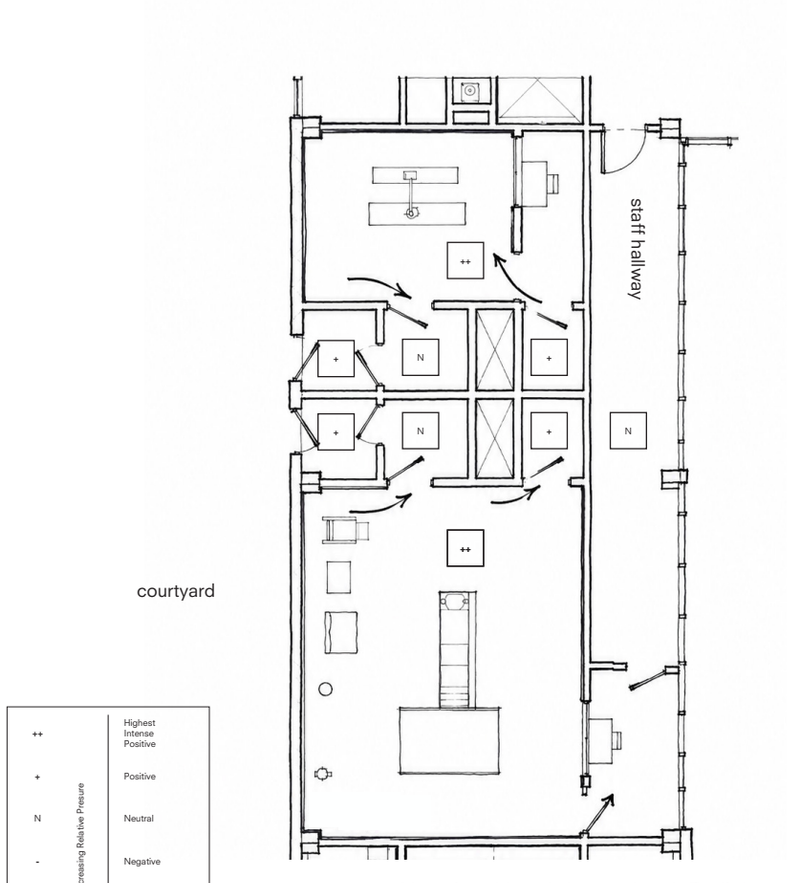
Radiology rooms often need more than this basic room size. Depending on the device, they can require extra shielding, thicker wall build-ups, special glass, controlled access, or technical service zones. MRI rooms have even more specific requirements. The International Health Facility Guidelines describe that MRI rooms may require electromagnetic shielding, also called a radio frequency enclosure, to reduce radio frequency interference. They also include a Faraday cage as shielding to the walls, floor, ceiling, doors, and glazing, depending on the project requirements (International Health Facility Guidelines, n.d.-b).

This means that the grid needs to allow both standard rooms and more technical rooms. Some radiology devices need a complete protected envelope, while others only need local shielding or extra space around the machine. By using the 7.8 × 7.8 meter grid, rooms can be combined when larger areas are needed, without changing the overall circulation concept.

Radiology is placed on the ground floor because the equipment is heavy and can cause vibrations. The ground floor is therefore more suitable structurally and technically. It also makes it easier to bring in, replace, or maintain large machines.

The ground floor location also fits with the way radiology is used. Radiology works more like an outpatient department, with patients arriving for an appointment and leaving again after the examination. This creates more movement than in the patient rooms. By placing radiology on the ground floor, patients can move more freely and the courtyard then becomes part of the waiting area, instead of only a circulation space.

In this way, the grid is used as both a structural system and an organizational system. It allows different room types to fit within the same layout, from standard consultation rooms to larger radiology rooms with specific shielding requirements. At the same time, the separation between patient circulation, staff circulation, and protected patient rooms remains consistent.



AI-assisted hand-drawn sketch Radiology.

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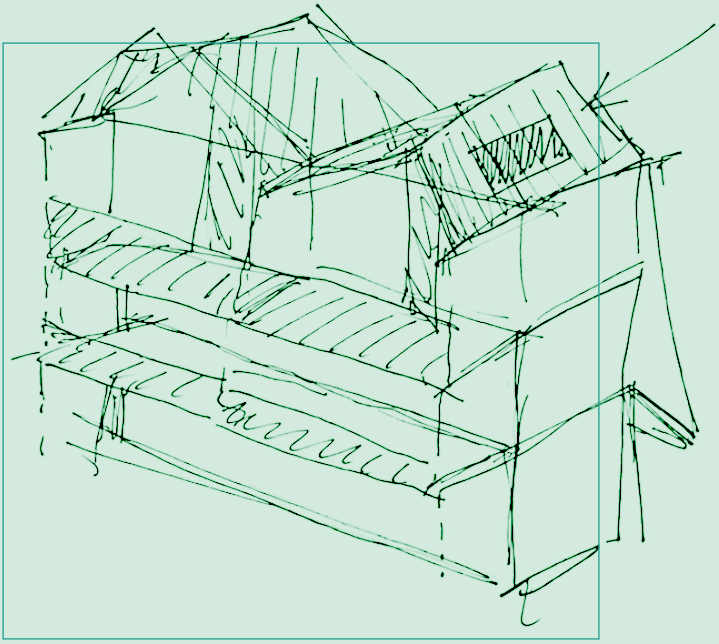
AI statement:
AI was used in this project as a visualization aid to transform existing floor plans into a hand-sketched style. This was applied to my own floor plans and to the floor plan of the reference project. The architectural layouts themselves were not generated by AI and are my own work.

PIET'S CENTRE

Explore lab
Research by Design

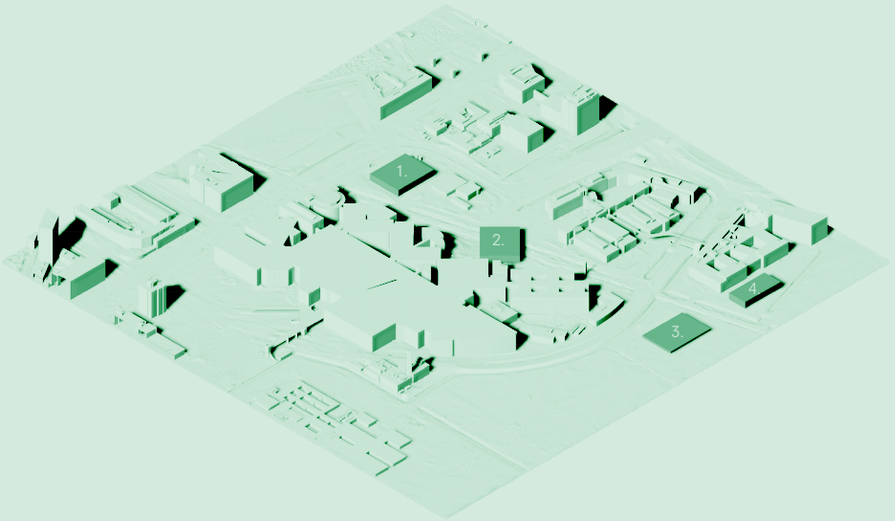
by

Lotte Annabelle Schut
5276462



Roel van de Pas (RS) & Yagiz Söylev

SITE OPTIONS
Plot 1/2/3/4



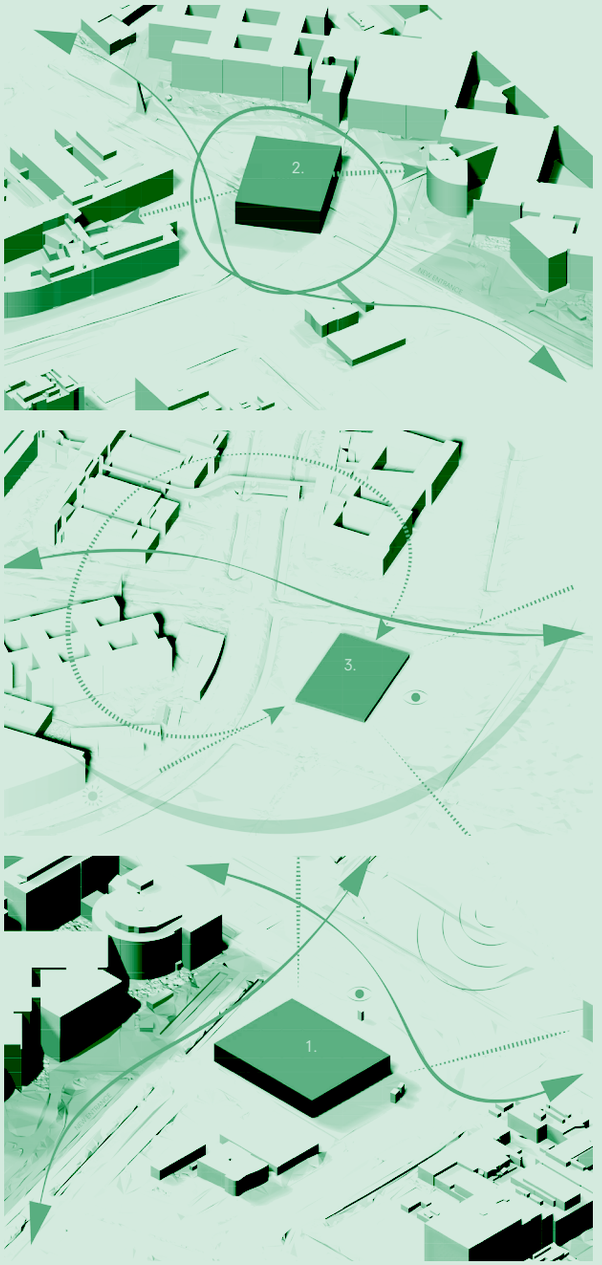
Based on three site ambitions: connection to the existing hospital network, access to green space and optimal daylight conditions four site options were identified. For each option, different spatial scenarios were explored to evaluate the opportunities, constraints, and trade-offs of the site. This comparative analysis helped to assess the strengths and weaknesses of each location and to determine which site offers the most suitable qualities for the proposed design. These scenario studies were carried out for Plots 1, 2, and 3. Plot 4 was excluded from this phase, as development on this site would obstruct views from the Máxima Centre. Additionally, this plot is the furthest from UMC Utrecht, making it less favorable in terms of institutional connectivity.

PRO'S/CON'S
Plots 1/2/3

The three plots each offer different qualities and limitations for the proposed hospital. Plot 1 benefits from its location near the Ronald McDonald House, which is useful for families of patients receiving stem cell transplantation or long-term inpatient care. It is also positioned along a garden path and near a possible future campus entrance. However, it is relatively far from the Wilhelmina Children's Hospital and the Prinses Máxima Centre, and the nearby sports fields may cause noise disturbance.

Plot 2 has the strongest existing connection to UMC Utrecht and the Wilhelmina Children's Hospital. It is located above the underground passage between these buildings, while the Prinses Máxima Centre is connected to the children's hospital by an elevated bridge. This allows staff to move between departments for consultations, collaboration, and the shared use of specialized equipment. The surrounding area already contains green space and, according to the 2040 vision, the adjacent road will become more pedestrian-friendly. A point of attention is whether shadows from UMC Utrecht could reduce daylight on the site.

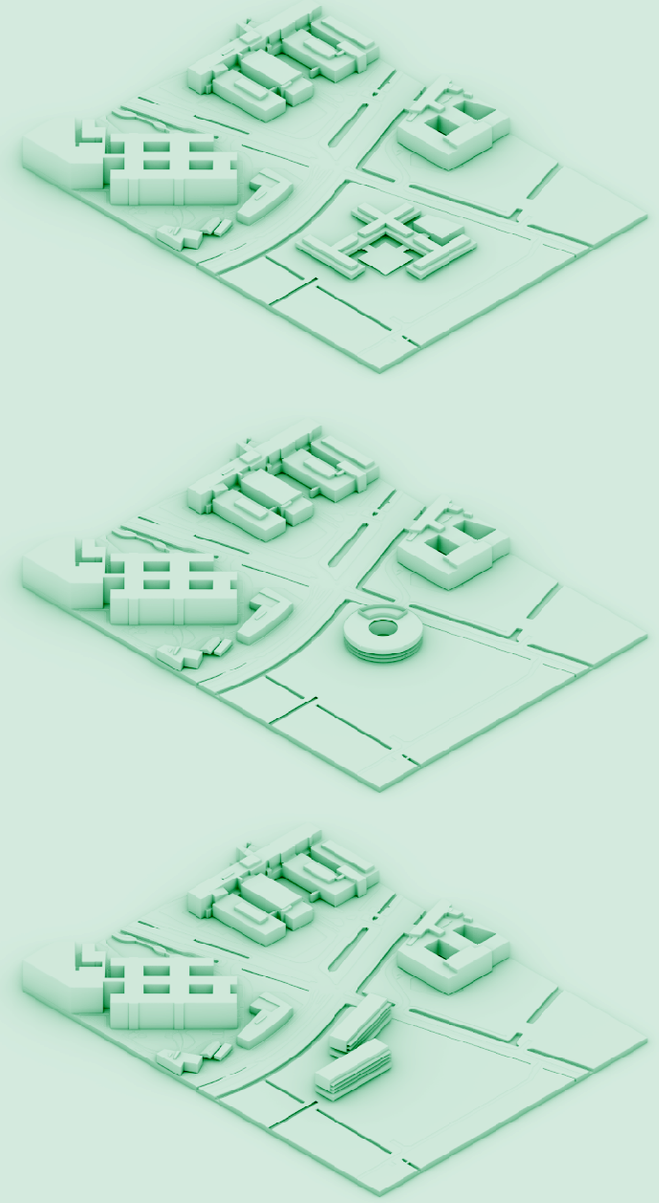
Plot 3 is closest to both the Prinses Máxima Centre and UMC Utrecht and connects well to the green corridor proposed in the 2040 vision. It has good daylight conditions, views of the landscape, and access by car and public transport. Although the tram line separates it from UMC Utrecht and the Wilhelmina Children's Hospital, the plot offers the opportunity to extend the green corridor and spatially connect the hospital institutions, for example through a central rotunda. The surrounding buildings also help reduce noise from the sports fields.



PLOT 3
Experimenting

For Plot 3, three design options were tested based on the safe movement of patients, staff, and visitors through the building. The aim was to explore how different routes could guide people through the hospital without unsafe crossings between vulnerable patients and other users. This principle was inspired by infrastructural systems, where cars are directed through roads, crossings, bridges, and roundabouts to prevent conflicts and allow movement to happen safely.

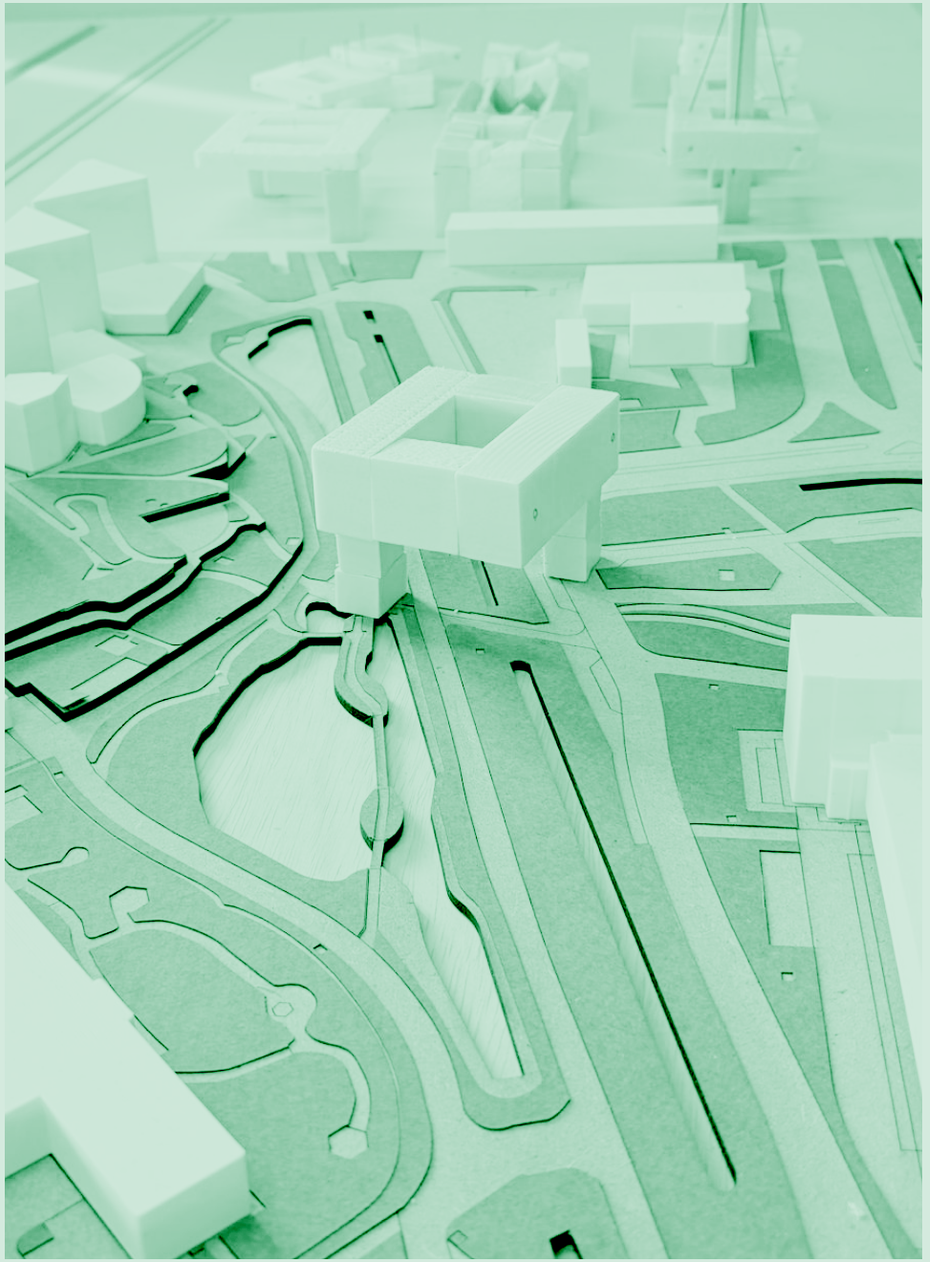
The first option was a rotunda, where staff and patient routes remain separated but come together at the patient rooms. The second option treated the building more like a viaduct, with separate routes that cross each other on certain floors without directly interfering. The third option was a ground-bound modular cross, which made patient movement more direct and accessible, but also increased walking distances for staff. Together, these three options tested how circulation could become a main design tool for safely transporting immunocompromised patients through the building.



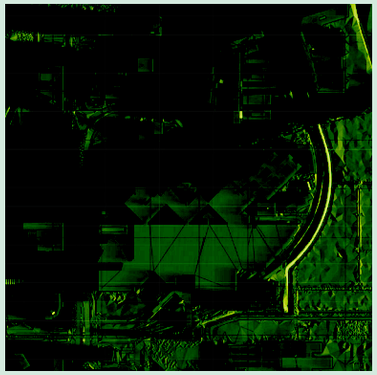


PLOT 2
Experimenting

After exploring Plot 3, Plot 2 also started to show more potential. The connection to the surrounding hospital buildings was stronger, with the possibility of linking a new underground route to the existing passage. Because the plot sits directly on the green axis, design options were tested that left space underneath, such as floating volumes or hanging structures. Since the building is lower than its surroundings, many patient rooms would face the roof, making the roof an important part of the design. Ideas from the earlier studies, such as loops and separated routes, were also carried into this exploration. The main concern for this location was a possible lack of direct sunlight due to the surrounding buildings. However, through a solar study, it was determined that the plot receives enough sunlight to support the design potential of this location.



SUN ANALYSIS PLOT 2
21/09/2026 from 8am-19pm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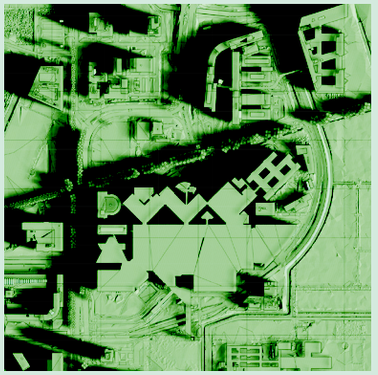
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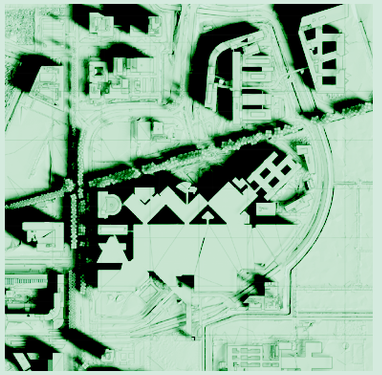
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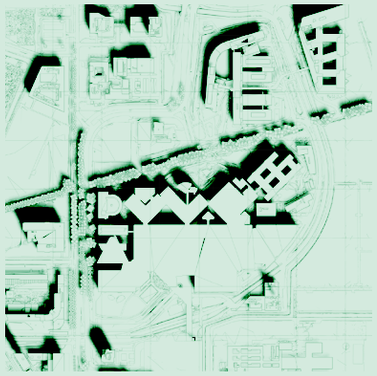
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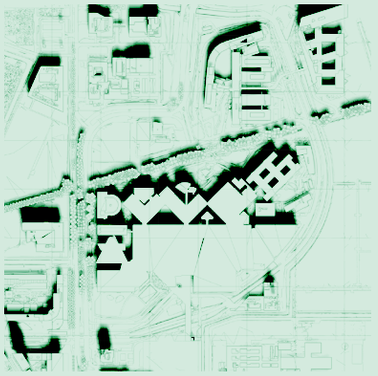
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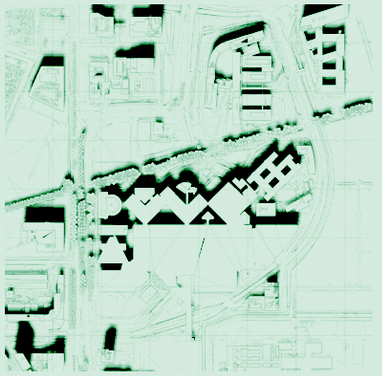
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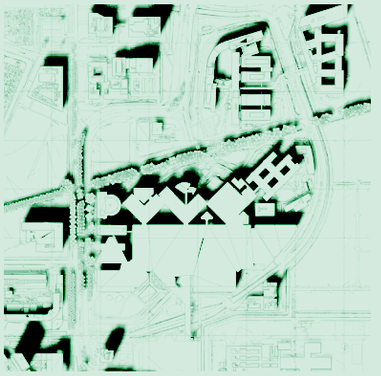
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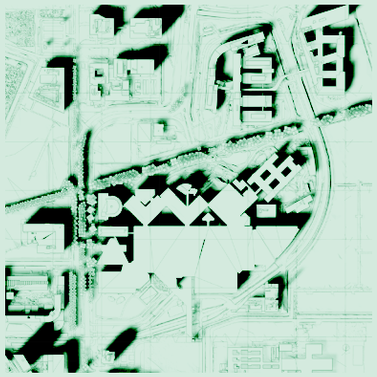
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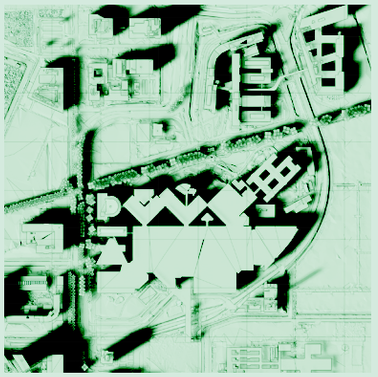
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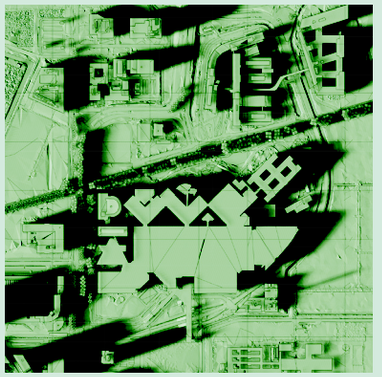
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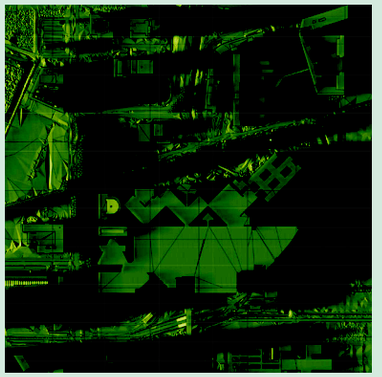
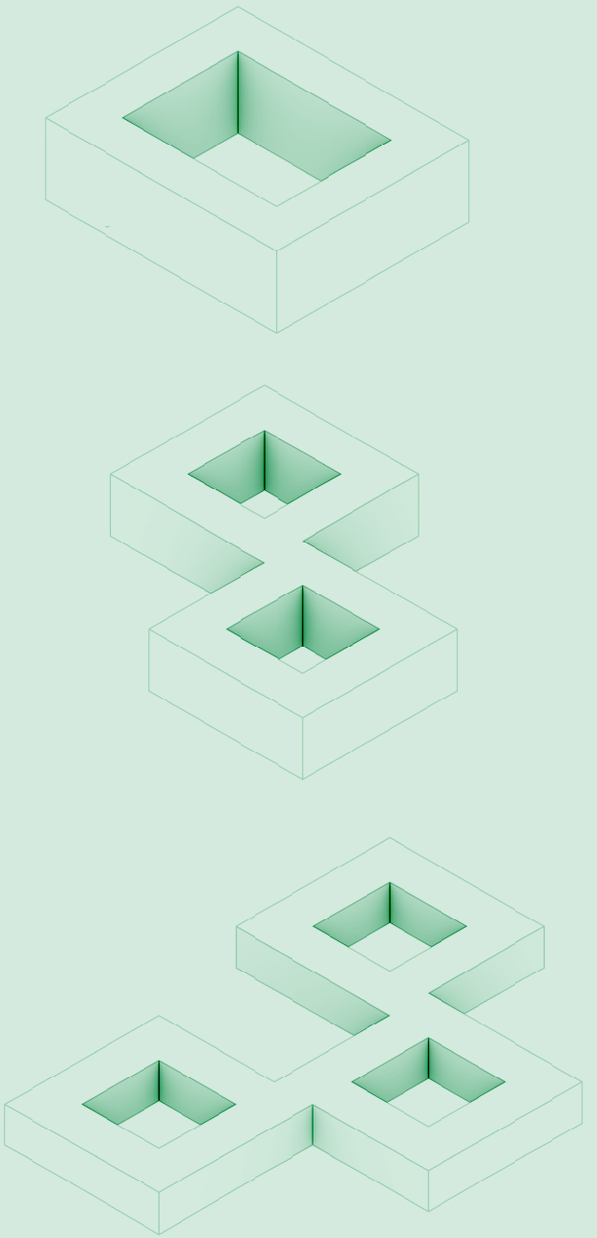

19.00

SITE CHOICE
Part of the green axis



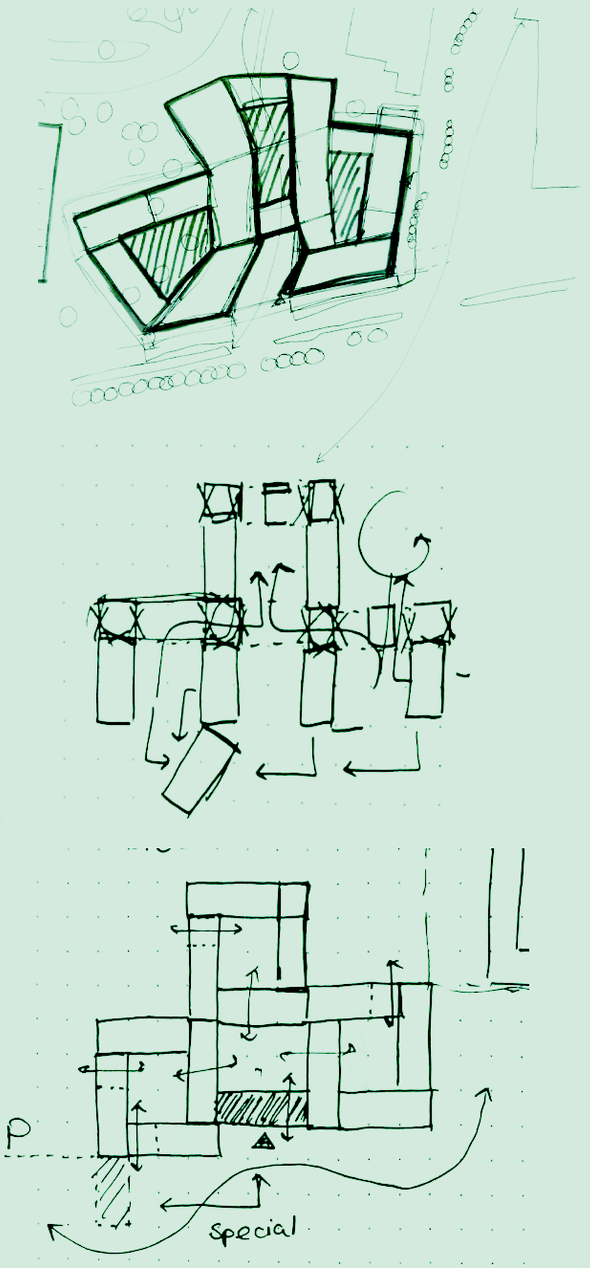
After further consideration, a location close to Plot 2 was chosen, but placed to the side of the green axis. Plot 2 had an important quality because of its strong connection to the surrounding hospital buildings, but placing the building directly on the green axis created a conflict. It would either interrupt the green route, or require the building to be lifted, making it harder for patients to easily access the landscape. By shifting the location and redesigning the space around the green axis, the project could keep the hospital connections while also strengthening the relationship with green space. In relation to the future plans for Utrecht Science Park, the area between the new parking garage and the Wilhelmina Children's Hospital offered a strong opportunity for the final design.

THE LOOP CONCEPT
Hierarchy



The concept of “loops,” inspired by the CF Møller project, was explored through different configurations. A single loop resulted in longer walking distances, limited short cuts for staff, and a taller building. Since maintaining a strong connection to the ground level was important, reducing the overall building height became a key consideration. A scheme with two loops improved the layout, but did not create a clear hierarchy between the volumes. This led to the development of a three-loop configuration, which reduces the overall building height and introduces a clearer hierarchy between the different volumes.

RESEARCH BY DESIGN
Initial sketch

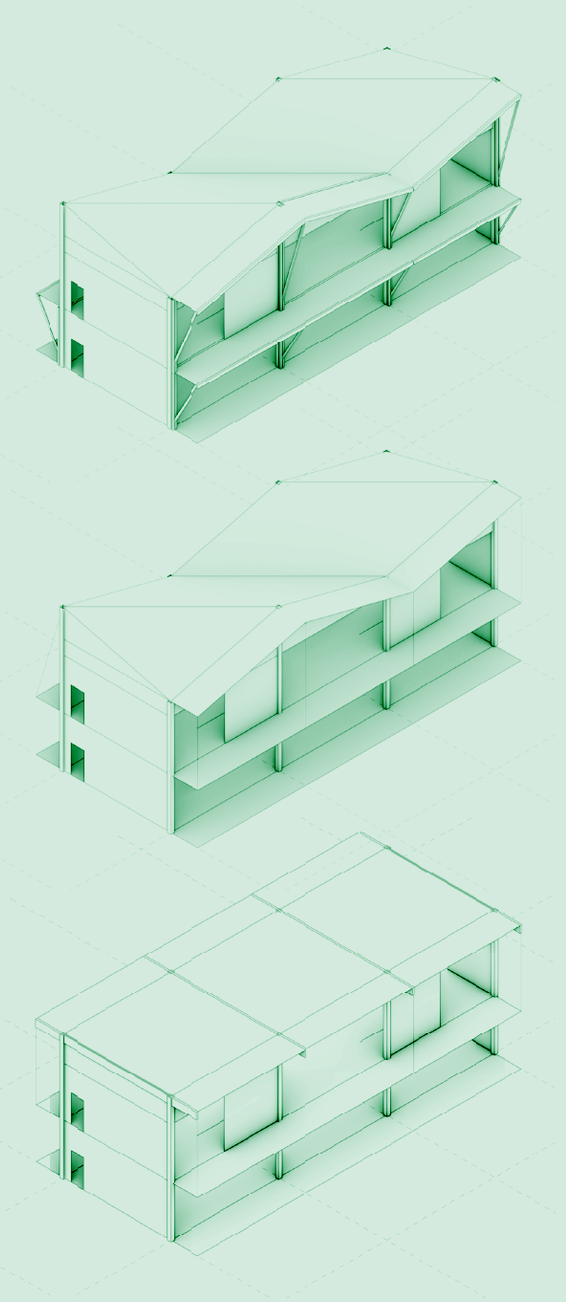


The initial sketch followed the lines of the surrounding context. The idea was to organise four patient rooms in linear strips, with the connecting zones accommodating the vertical circulation.

After feedback, the question arose: which geometries in the site are actually relevant? In a floor plan, all lines and angles appear to have equal importance, but in reality, the perception on site is different. The surrounding buildings are dominant, while elements such as the angle of a cycling path are less defining.

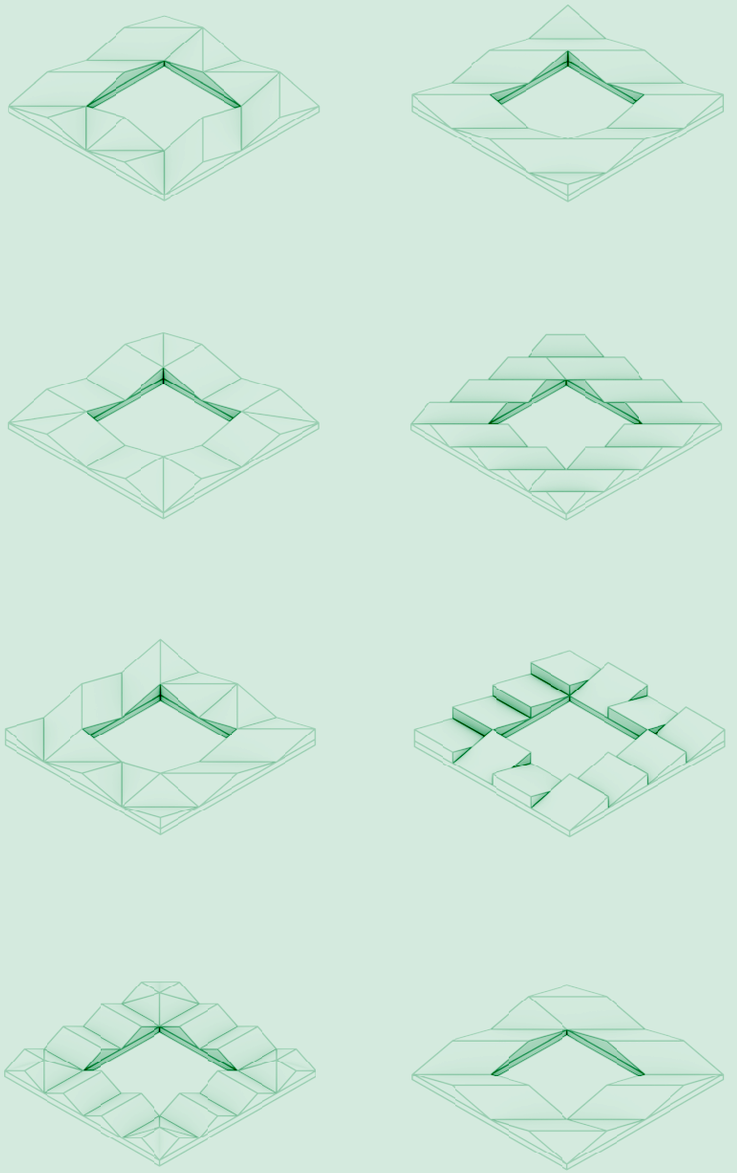
Based on this, the design focus shifted towards the more prominent geometries in the context, specifically the zigzag forms of the parking structure, the Ronald McDonald House (RMDH), and the WKZ children's hospital.

FAÇADE DESIGN
Balcony construction



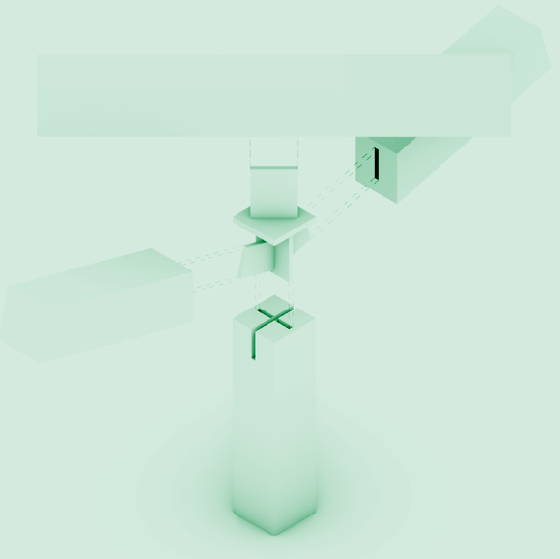
For the façade design, it was first established that patients on level 1 would move along the outer ring of the building, making the balcony an important part of the façade study. Different construction options were tested, including a balcony supported from below, and a suspended balcony structure. The supported balcony introduced too many different structural expressions in the façade, while the flat roof option did not create the same spatial quality or interesting building shape. At the same time, the roof landscape was explored, inspired by the Centre for Cancer and Health by NORD Architects, where a 45-degree pitched roof creates a more articulated roof form. For this reason, the option with the suspended balcony and sloped roof was chosen.

ROOF STUDIES
Responding to surroundings



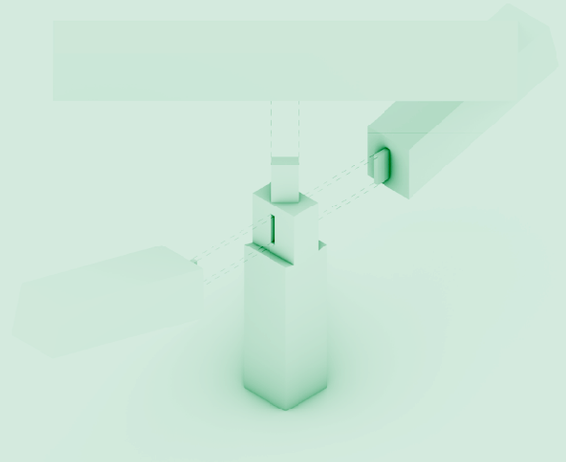
The roof study started from the idea that the building should have an interesting roof landscape. This was important both from the ground level, where children and adults would experience the building, and from the surrounding UMC patient rooms, which look directly onto the site. The 45-degree roof angle responds to the shape of the UMC building and creates a visual connection with its context. It also produces different angles and views, making the roof more dynamic and less predictable. At first, the middle-left option seemed strongest because it created the most variation. However, while developing the building further, the three-loop organisation became more important. In that overall layout, the bottom-right option worked better because it supported the three loops more clearly.

CONSTRUCTION
Future disassembly

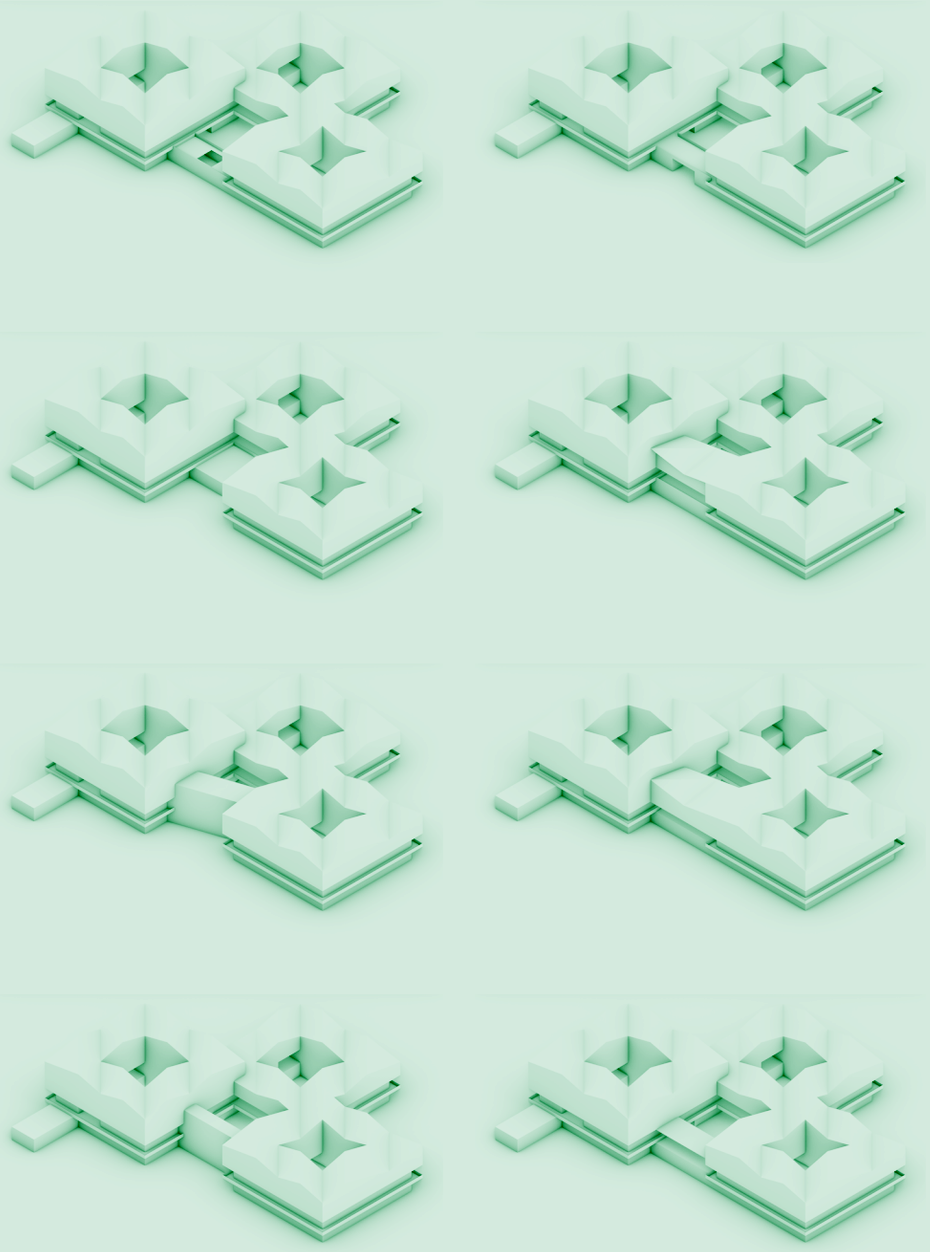


The roof and suspended balconies also raised questions about the construction. Two connection principles were tested. The first was based on Japanese timber joinery, which has become more accessible through CNC milling. This option allows for precise timber connections, but it also requires specific cut-outs, making the process more labour-intensive and reducing the future reuse potential of the beams.

The second option was based on the construction principle used in Alliander Westpoort in Amsterdam by De Zwarte Hond. Here, a demountable steel node allows timber beams to continue over the columns with minimal cutting and fixing. The steel becomes the adaptable connecting element, while the timber remains more intact and easier to reuse. Because this option simplified assembly and supported future disassembly, this construction principle was chosen.



ENTRANCE DESIGN
What language?



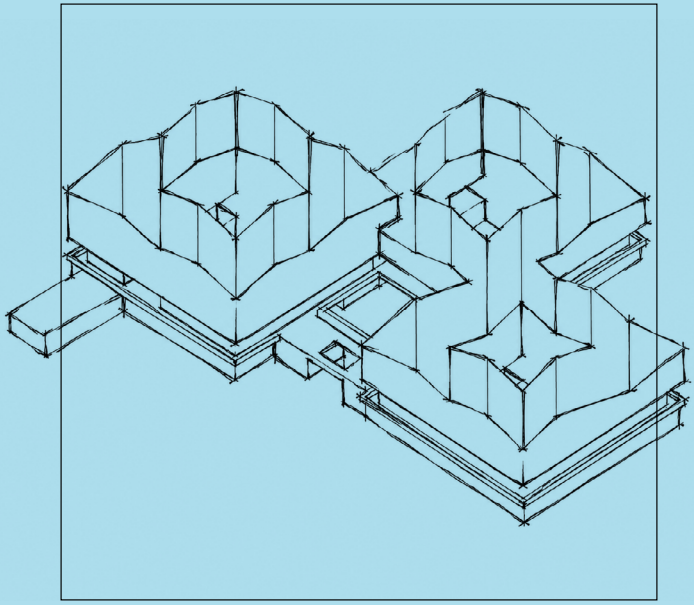
Another design question was how to shape the entrance volume. The entrance needed to be a clear orientation point where patients could check in and ask questions, while still fitting within the architectural language of the building. Different shapes were tested, but the final option became a volume similar to the social centre, with a void in the middle to create a visual connection to the social route. This made the entrance easier to understand and showed patients that there are more spaces to use within the building. The middle-right option was therefore chosen, as it gave the clearest entrance structure while also meeting the design goals.

PIET'S CENTRE

Explore lab
Project Results

by

Lotte Annabelle Schut
5276462



Roel van de Pas (RS) & Yagiz Söylev

RESULTS
What has been achieved?

Report Part V presents the final architectural proposal. It brings together the theoretical framework, programmatic research, precedent studies, interviews, and research-by-design experiments into one design. The booklet documents the final design.

The final design answers the question: How can architectural design contribute to infection safety and overall well-being for immunocompromised patients within the hospital environment?

The result is a specialized hospital for immunocompromised patients, located in the Utrecht Medical Cluster. The hospital is designed for Stem Cell Transplant patients, Chemotherapy patients, and Cystic Fibrosis patients. Because this patient group is relatively small, but also includes both children and adults, the hospital is placed within a larger medical cluster. This makes it possible to share knowledge, staff, facilities, and care systems with existing hospitals.

The location in Utrecht was chosen after comparing hospitals in the Netherlands that treat these patient groups. Many hospitals treat Chemotherapy and Stem Cell Transplant patients, but only a limited number provide care for Cystic Fibrosis patients. UMC Utrecht and Erasmus MC became the most relevant options because they treat a large number of patients and are centrally located. However, UMC Utrecht has an important spatial advantage: it is located within Utrecht Science Park and is surrounded by more green space, while Erasmus MC is much more embedded in the city of Rotterdam. This made Utrecht more suitable for a hospital where nature, air, light, and outdoor space are part of the care strategy.

Nature-inclusive design became an important part of the project. In this design nature is used as part of the spatial and environmental system of the hospital. Gardens, courtyards, daylight, fresh air, green façades, and outdoor routes are used to support both infection safety and patient well-being. This connects to research on biophilic design in healthcare, which describes how contact with nature can support healing environments (Miola et al., 2025). The project also relates to a wider way of thinking about architecture as something that is connected to living systems, air, bacteria, and the environment, instead of being fully separated from them (Colomina & Wigley, 2025).

The site strategy responds to the future vision for the north side of UMC Utrecht. The intent document for the redevelopment describes ambitions such as green connections, a future parking facility, and the relocation and expansion of the Ronald McDonald House (Gemeente Utrecht & UMC Utrecht, 2023). In my proposal, Piet's Centre is placed between the Wilhelmina Children's Hospital, the future Ronald McDonald House, and the future parking garage. The car road is rerouted, which creates a more pedestrian-friendly green zone between the buildings. This green zone becomes an extension of the hospital and strengthens the nature-inclusive concept.

The building also responds to the architectural language of the site. The surrounding buildings have strong geometries: UMC Utrecht uses several 45-degree angles, while the buildings on the other side of the green bicycle route have a more zigzag-like pattern. The design responds to both. The main volume follows the zigzag logic of the neighbouring buildings, while the roof refers more to the 45-degree geometry of UMC Utrecht. The hanging balconies and mesh facade give the building a clear silhouette from different approach routes.

The hospital is organized around the combination of infection safety and well-being. Patient rooms use positive pressure, which means that clean filtered air is blown into the room so that less clean air cannot easily enter. The rooms are entered through an antechamber and include an en suite bathroom. Because these rooms require a lot of air, the air handling units are divided over the roof level. This makes the technical system part of the architectural organization.

The route system was inspired by Emergency and Infectious Diseases Unit in Malmö where patients move along outdoor balconies before entering their rooms. In this design, patients move through outdoor air or controlled environments, while staff use indoor routes. This creates a system of loops. Patients walk on the outer loop, staff move through the inner loop, and they meet in the patient room. This also gives the patient rooms daylight and views from both sides. Several loop options were tested during the design process. One loop created walking distances that were too long for staff. Two loops improved short cuts, but gave less hierarchy to the volume. Three loops created better short cuts, a clearer organization, and a stronger fit with the site.

The final design is structured through three main routes: the patient route, the staff route, and the social route.

The patient route starts at the entrance, which is covered but still open to fresh air through lamella walls. Patients can check themselves in and move towards the outpatient areas, radiology, blood testing, or the vertical circulation points (which pass underneath the indoor staff route). The ground floor contains spaces where patients can move more freely around the courtyards. On the upper levels, patients reach the rooms through the outdoor balcony loop. Chemotherapy and inpatient rooms are located on levels two and three. The outdoor slide is also part of this route. It reflects the fact that the hospital is for all ages, and that children should still have moments of play within the hospital environment.

The staff route is separated from the patient route. Staff need acclimatized working spaces and shorter walking distances, while patients need either outdoor air or controlled indoor environments. On the upper levels, staff move through the inner loop, while on the ground floor the system changes so they can reach the outpatient areas. The staff route also connects to the extended underground passage, which links UMC Utrecht, the Wilhelmina Children's Hospital, and Piet's Centre. A staff cluster near the entrance provides changing facilities, and the pharmacy is located close to the chemotherapy levels to make medicine transport more efficient.

The social route is about creating spaces where patients can remain socially connected while still being protected. The design does not only focus on isolation, but also on how patients can meet, eat, play, and experience the hospital in a more positive way. The social centre allows patients to meet indoors when wearing the right personal protective equipment. Because eating with masks is not possible, level one includes a covered outdoor cafeteria where patients can eat together. Activities such as ping-pong are placed in areas where distance can naturally be maintained. On level three, the sun deck gives patients a place to sit outside, enjoy sunlight, and look out over the green zone between the hospital and UMC Utrecht. This idea is partly inspired by Aalto's use of sun decks in healthcare architecture.

Materiality also supports the concept. The outer façade uses blue panels, because colour is used as an additional design tool. Blue tones are often connected to calmness and reduced stress in healthcare environments, which can support patient well-being (Pulmonology Advisor, 2024). The balconies combine metal and wood. Level one uses a metal grid, while level two uses CLT to prevent dirt and rainwater from falling through to the route below. Mesh railings protect patients from wind and rain, especially on the higher levels, creating an outdoor route with more controlled conditions.

The main structure is wooden, with hanging balconies. These balconies create the strong silhouette of the building, provide shading, and allow for a more open ground floor. The floor system is also developed with attention to hospital requirements. Hospitals often use concrete floors to reduce vibrations, but this design explores a CLT-based floor build-up with added mass. Inspired by the office block in Alpnach by Seiler Linhart Architekten, the idea is to combine timber with limestone filling to improve sound insulation and reduce vibrations.

The inner courtyard façades continue the nature-inclusive strategy. Patients are protected from rain by overhangs, while plants grow along mesh elements that continue up towards the roof. These plants retain water, provide shading for the glazed staff routes, and pull the greenery of the courtyards into the vertical facade system. In this way, the courtyards, balconies, roof, and climate concept become one connected system.

The climate sections show how these different ideas come together. They show the air handling units on the roof, the ventilation strategy, the positive pressure rooms, the courtyards, the shading, the balconies, and the mesh facade. The final design therefore combines technical infection control with spatial qualities such as daylight, fresh air, nature, movement, and social contact.

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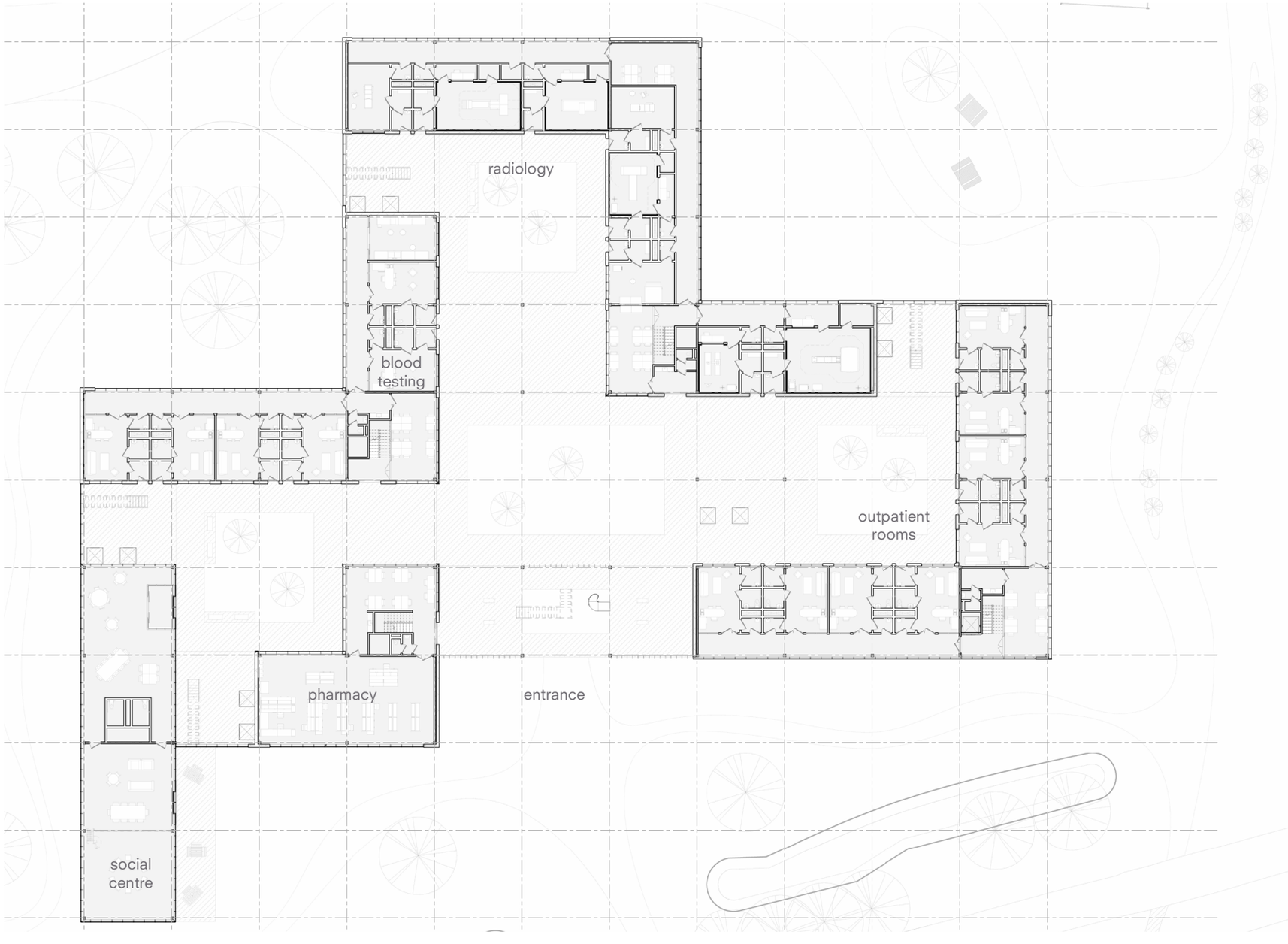
Miola, L., Boldrini, A., & Pazzaglia, F. (2025). The healing power of nature: Biophilic design applied to healthcare facilities. Current Opinion in Psychology, 64, 102049. https://doi.org/10.1016/j.copsyc.2025.102049

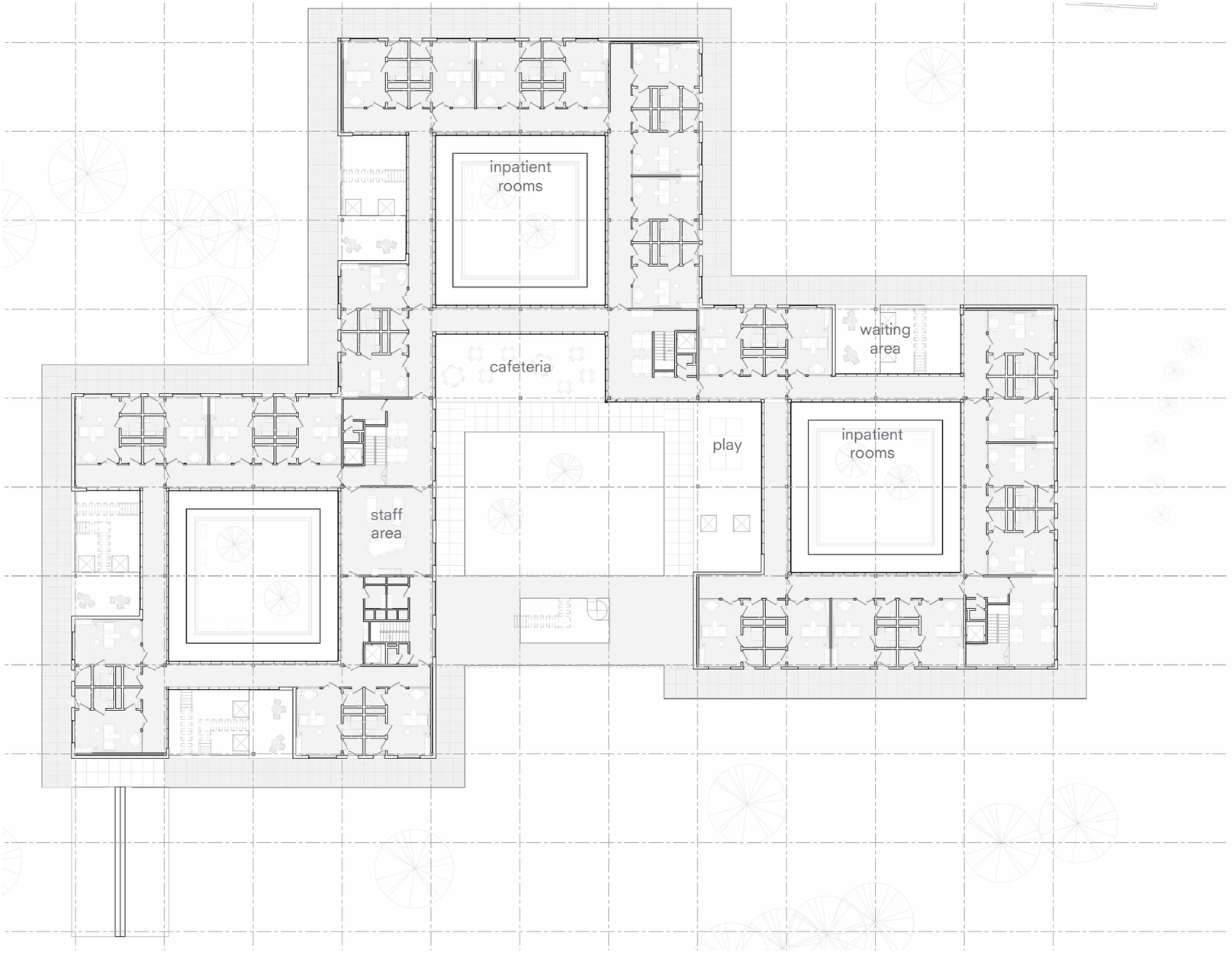
Pulmonology Advisor. (2024, October 4). Color in health care: How mindful design can improve clinical spaces. https://www.pulmonologyadvisor.com/features/color-in-health-care-design-spaces/

AI Statement: AI was used to enhance greenery, add project-specific furniture such as nurse trolleys, and support some colour adjustments in selected render impressions. The original geometry, base renders, spatial design, and architectural layout were created by me.

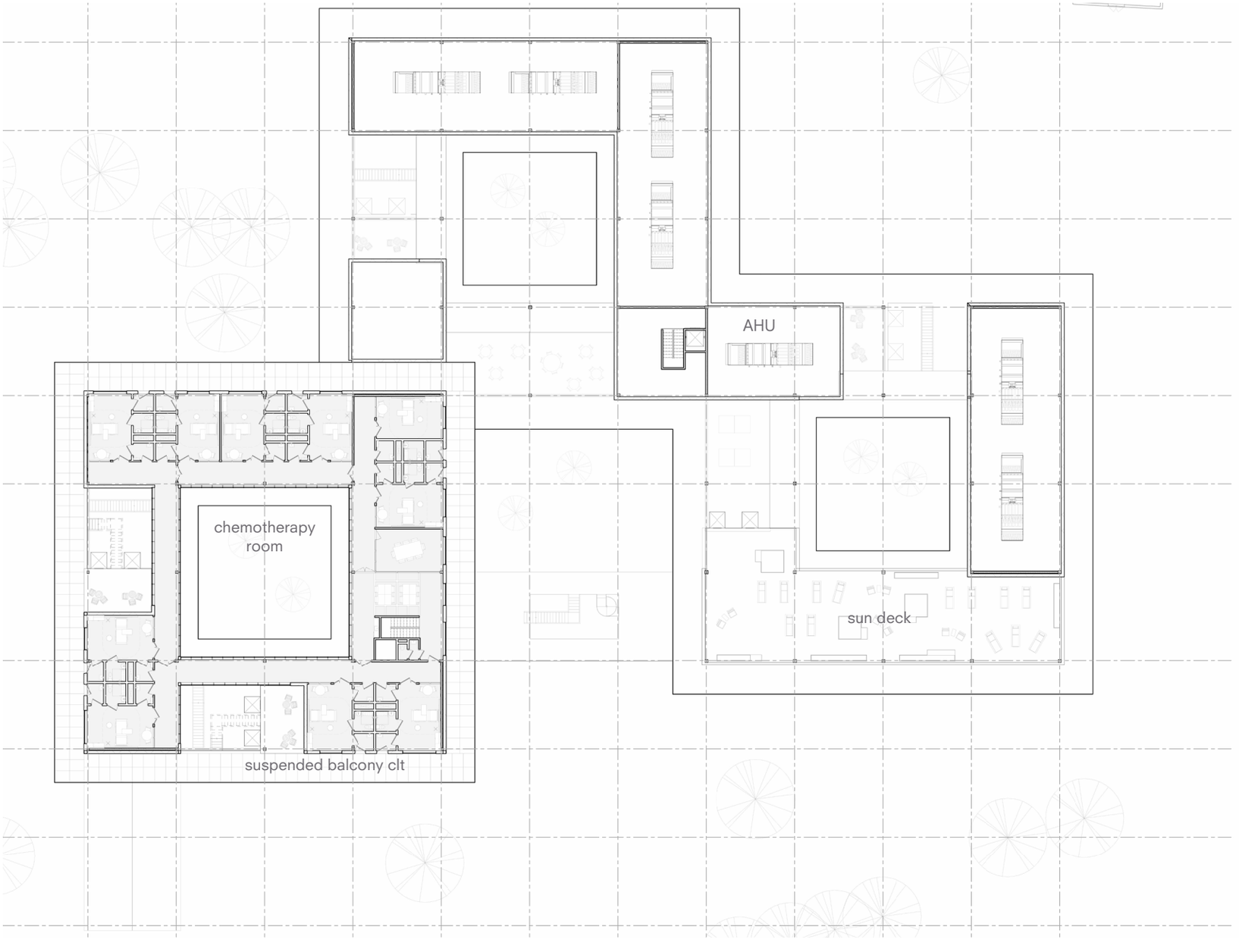
FLOOR PLAN 1.100 SCALED
Ground floor



FLOOR PLAN 1.100 SCALED
Lvl 1

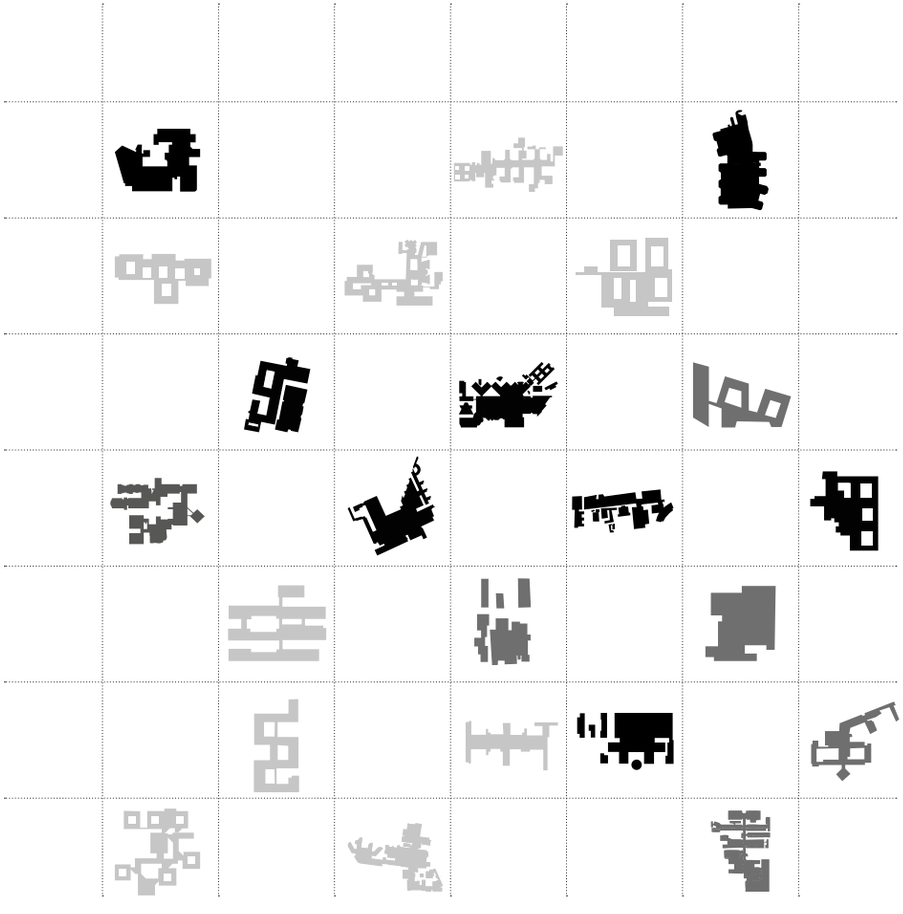


FLOOR PLAN 1.100 SCALED
Lvl 2





PART OF AN EXISTING MEDICAL NETWORK
Analysis



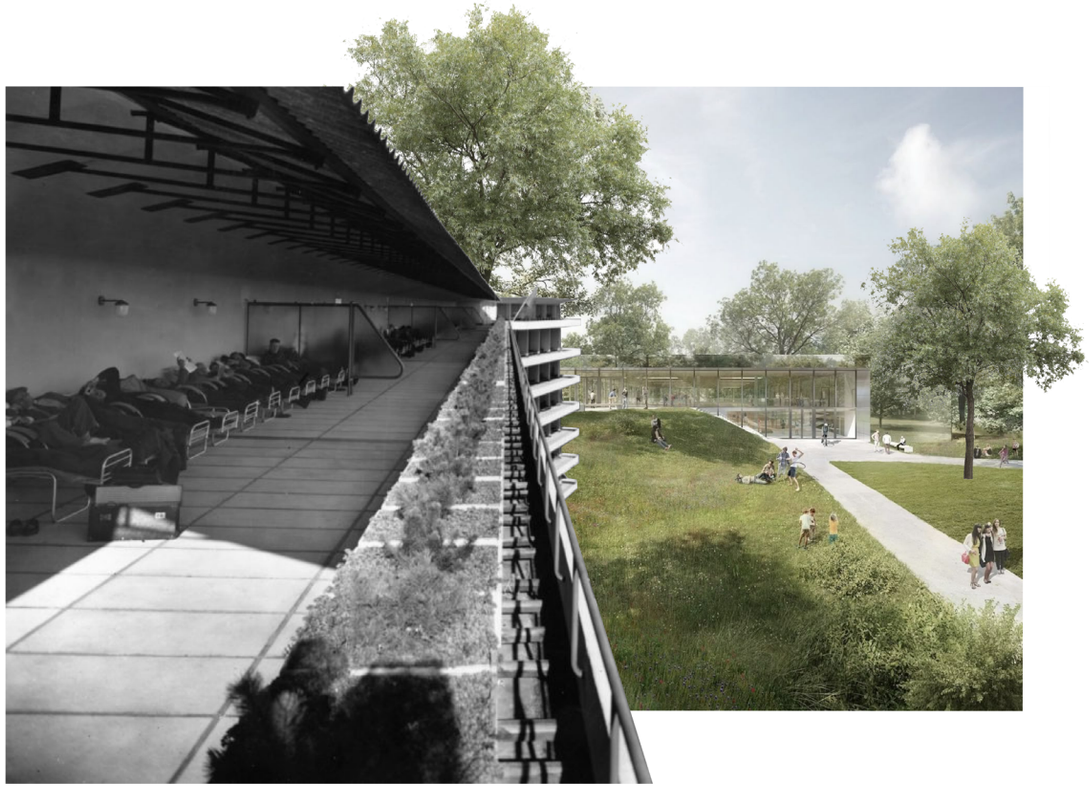


A selection of hospitals in the Netherlands

A selection of hospitals in the Netherlands that do SCT

7 Hospitals in the Netherlands that treat CF

NATURE INCLUSIVE HEALING



(Colomina & Wigley, 2025)

(Miola et al., 2025)

GREEN
Site choice

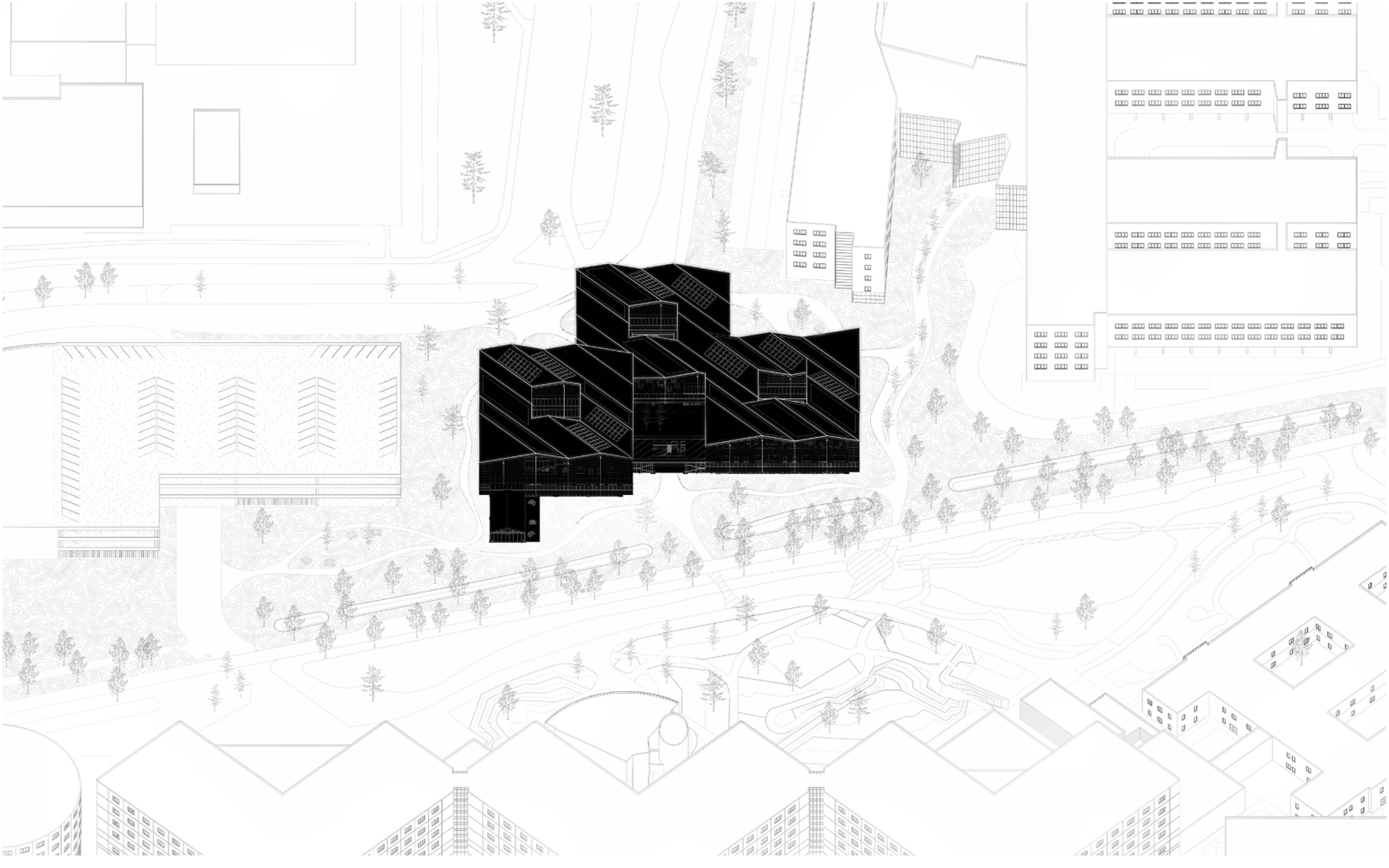


UMC UTRECHT

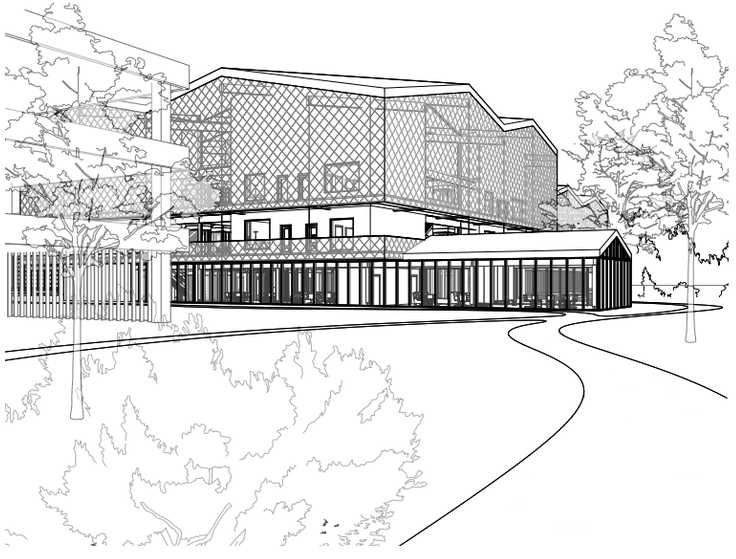


ERASMUS MC | ROTTERDAM

1.500
Interventions & Connection form roof with UMC



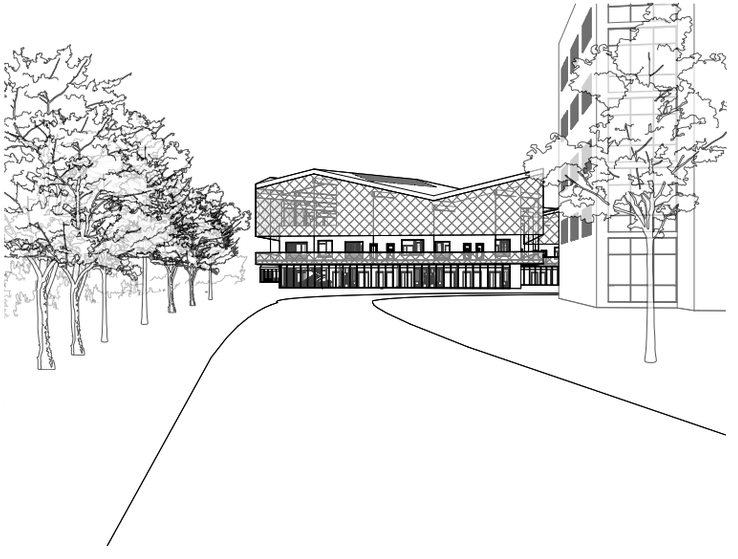
SITE VIEWS
How do you approach the building?



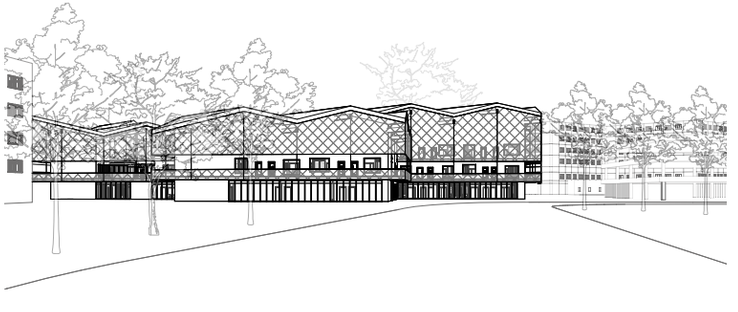
Parking Garage



Bicycle

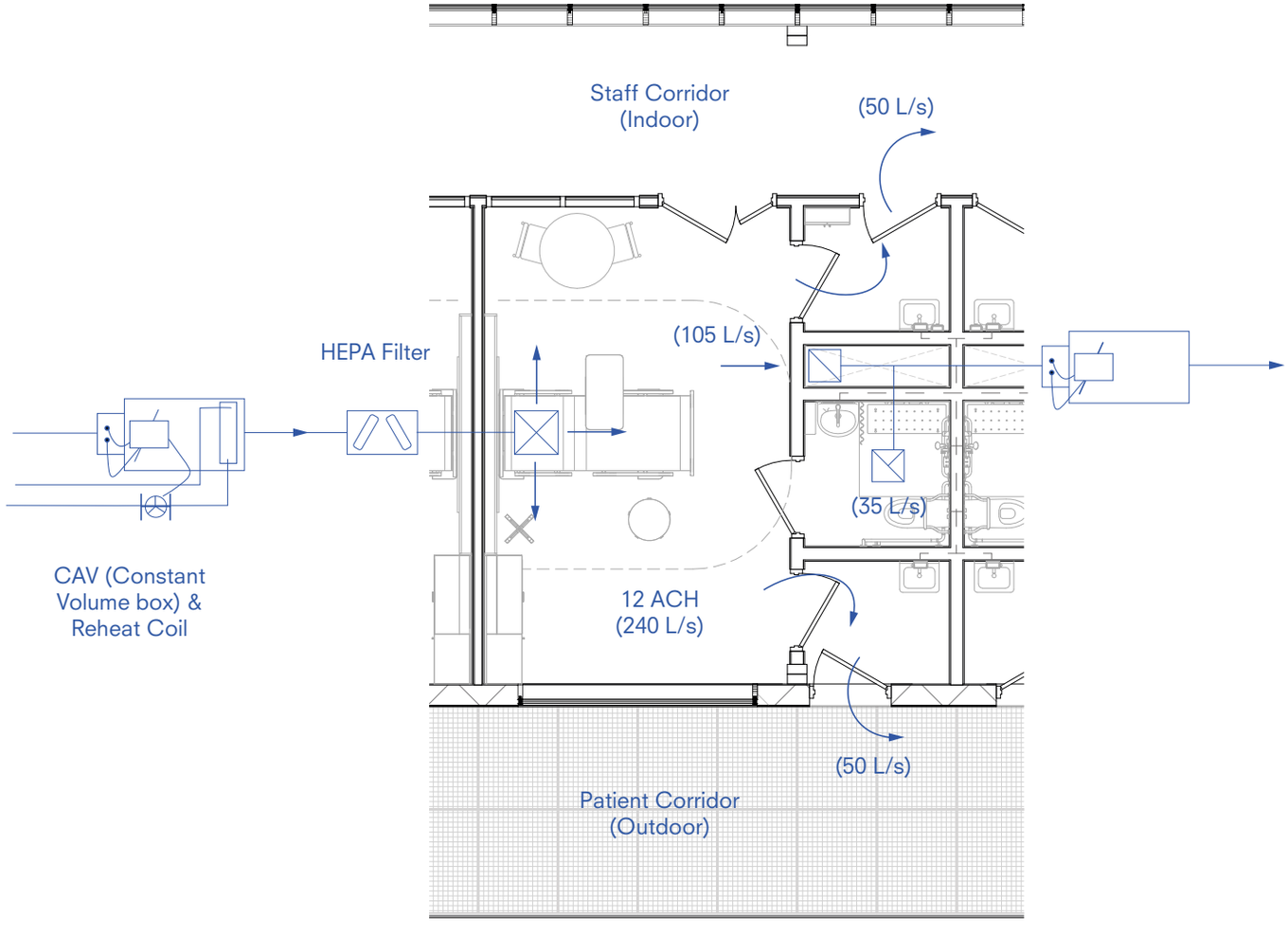


Public Transport

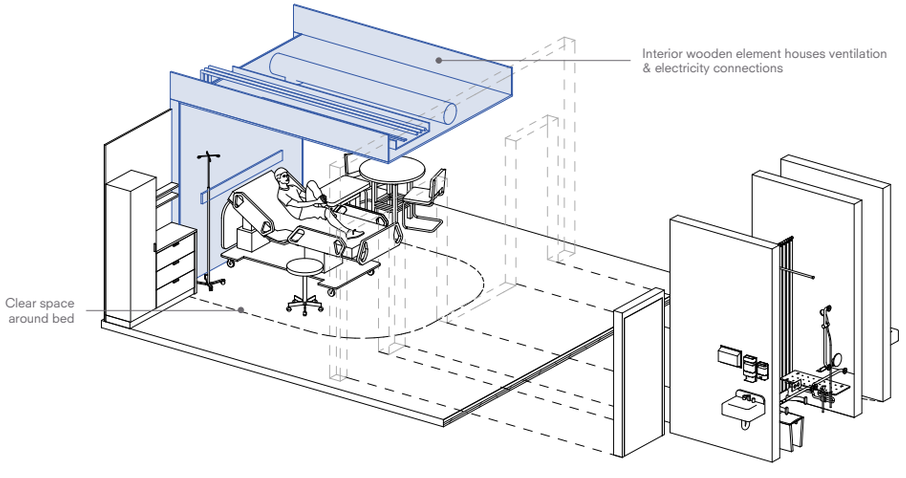


Kiss & Ride

POSITIVE PRESSURE ROOMS
Air Changes per Hour (ACH)

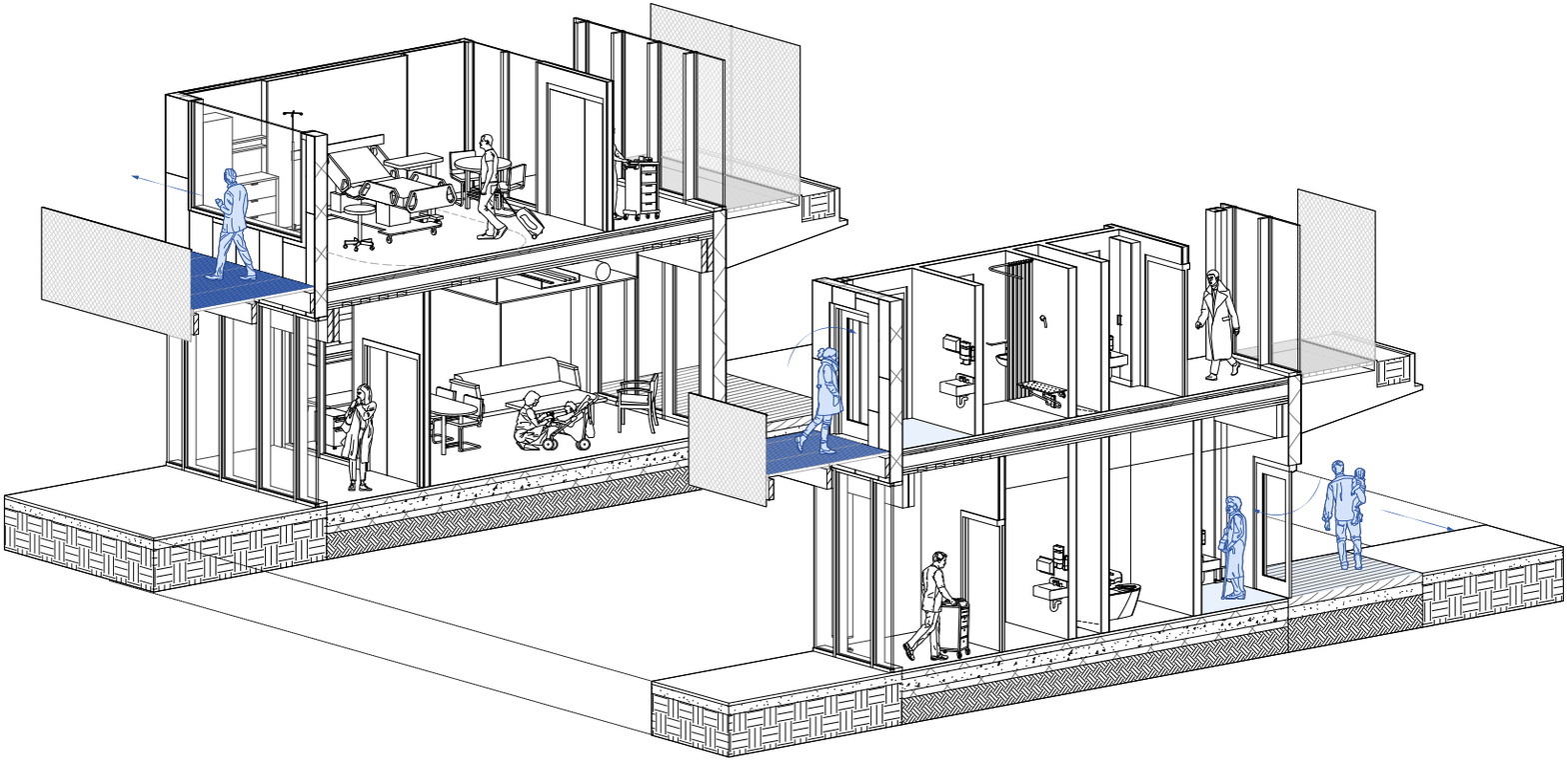


PATIENT ROOM
Interior design

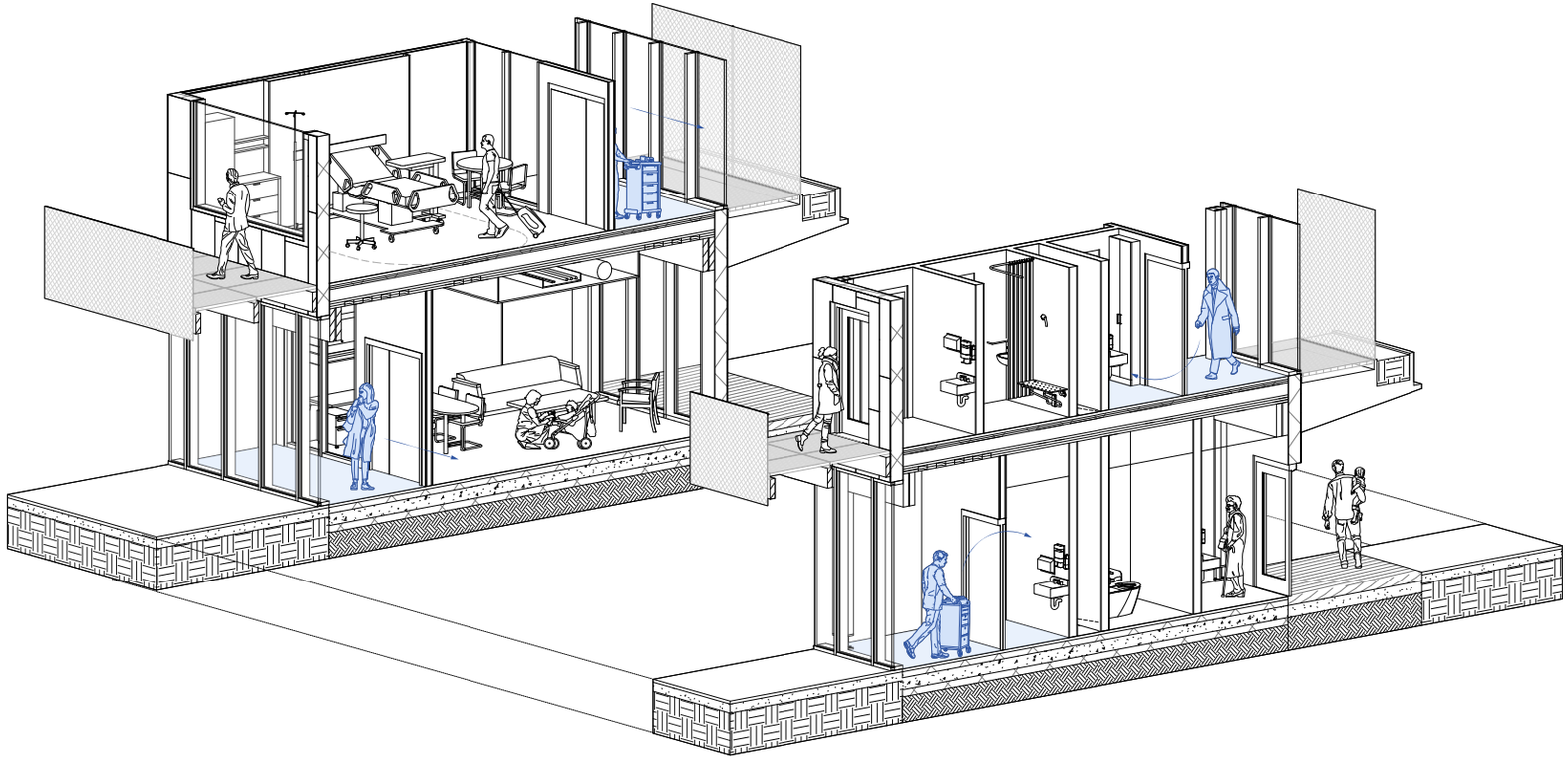




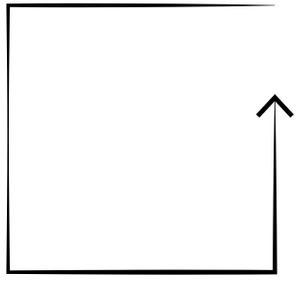
PATHWAYS
Patient / sunlight from both sides of the room



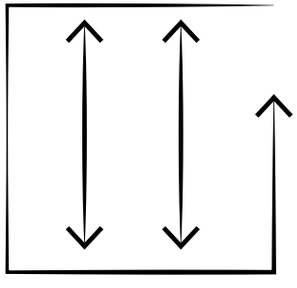
PATHWAYS
Staff



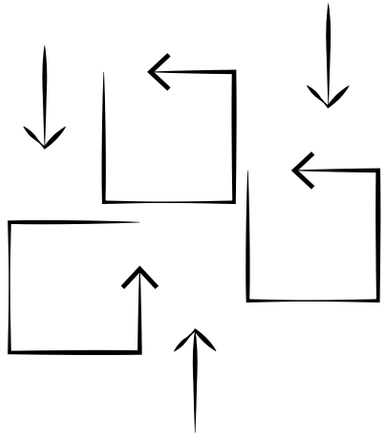
CONCEPT



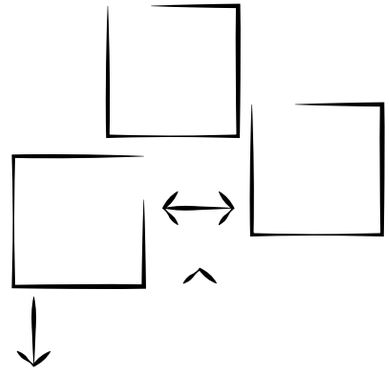
Loop



Short Cuts

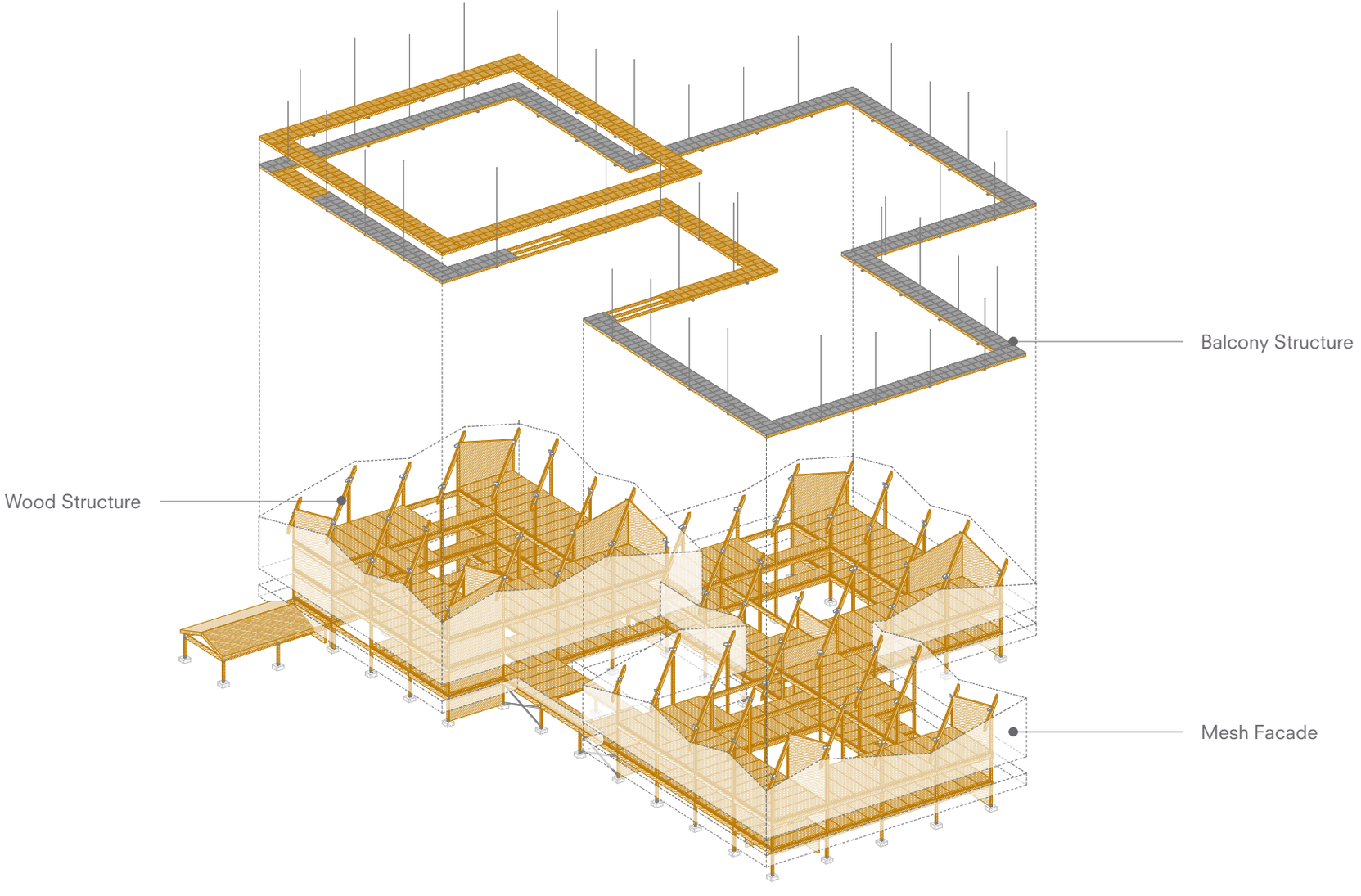


Volume



Additional Volumes

AXO STRUCTURE
Balcony & Mesh



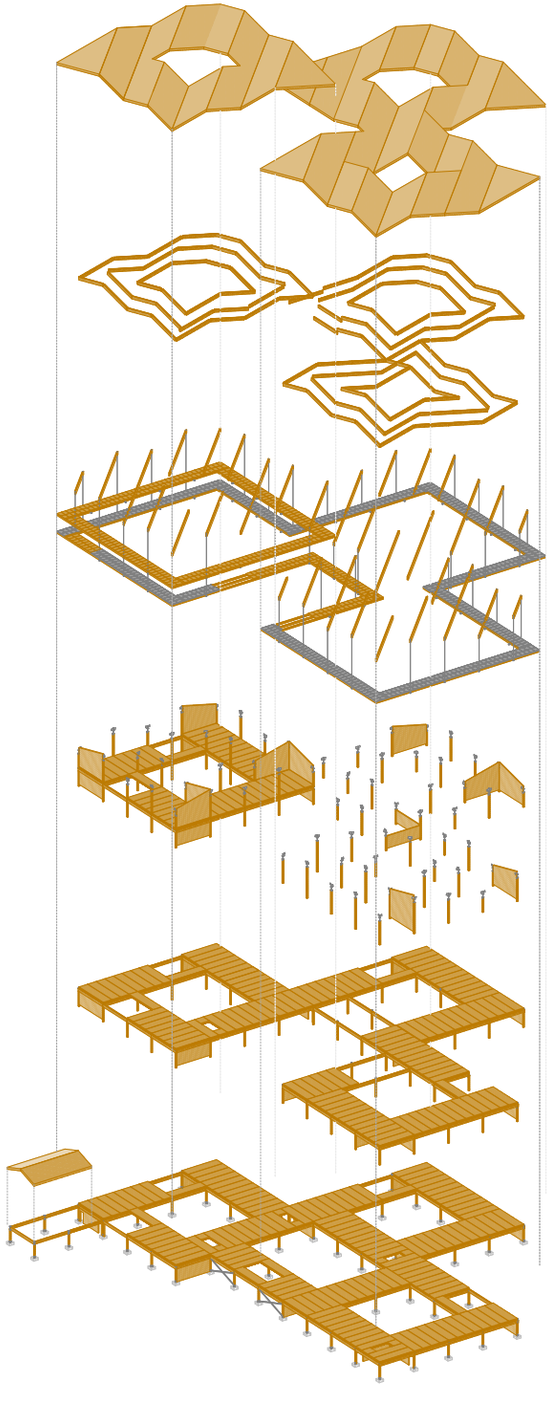
AXO STRUCTURE
Total

The building is based on a timber column-and-beam structure. Between the structural frame, CLT wall elements are placed to provide stability and lateral stiffness. In the entrance building, steel wind bracing is used instead of closed stabilising walls, allowing the space to remain more open and transparent.

The visible 45-degree timber beams form the main structural base for the roof construction. These diagonal beams also continue towards both sides of the building, where they support the hanging balconies. The balconies are fixed to the main beam structure with a cantilever connection on one side and are additionally suspended with tension rods connected back to the 45-degree beams. This makes the balconies part of the overall structural system, rather than separate added elements.

The roof construction consists of CLT roof elements supported by timber roof beams. The roof beams are positioned so that the roof overhang remains beamless at the edge. This creates a thinner and more slender roof profile, making the diagonal beams appear almost floating.

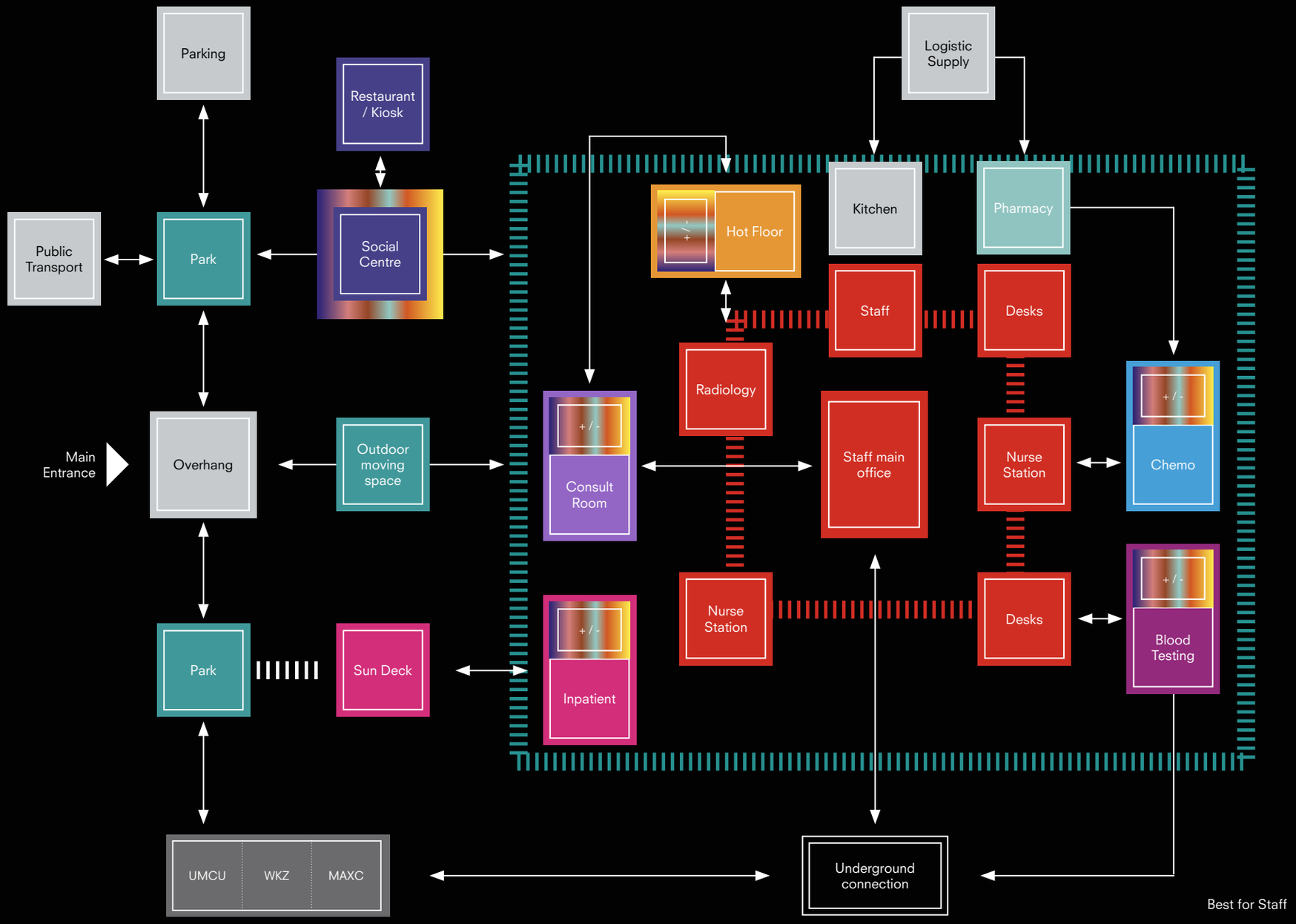
The main connections between columns, beams, diagonal elements, roof structure, and balconies are made with steel node connections. The 1:20 fragment further explains these structural joints and the detailed build-up of the construction.



PLAYFUL WINDOWS
Unique rooms

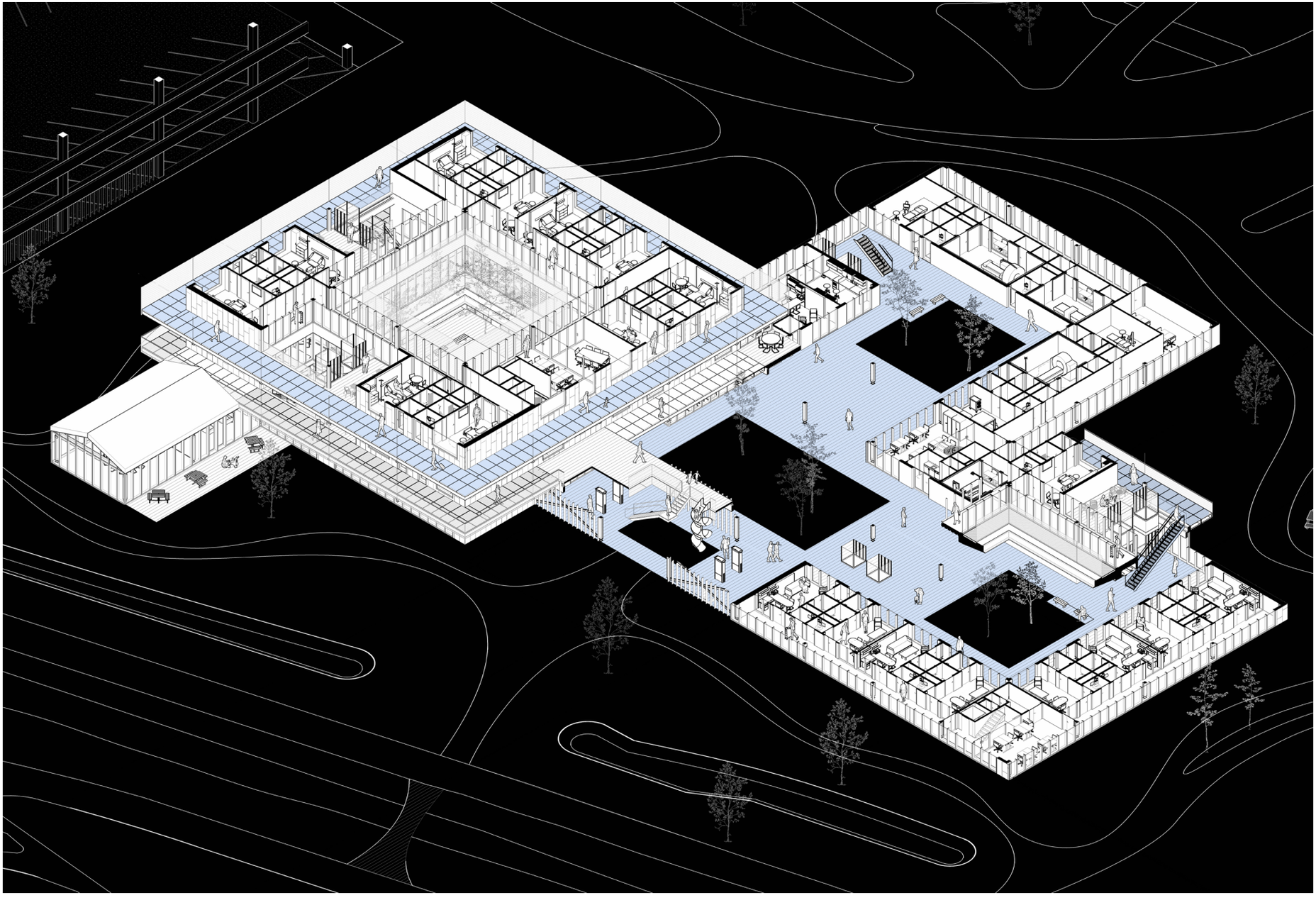


PROGRAM

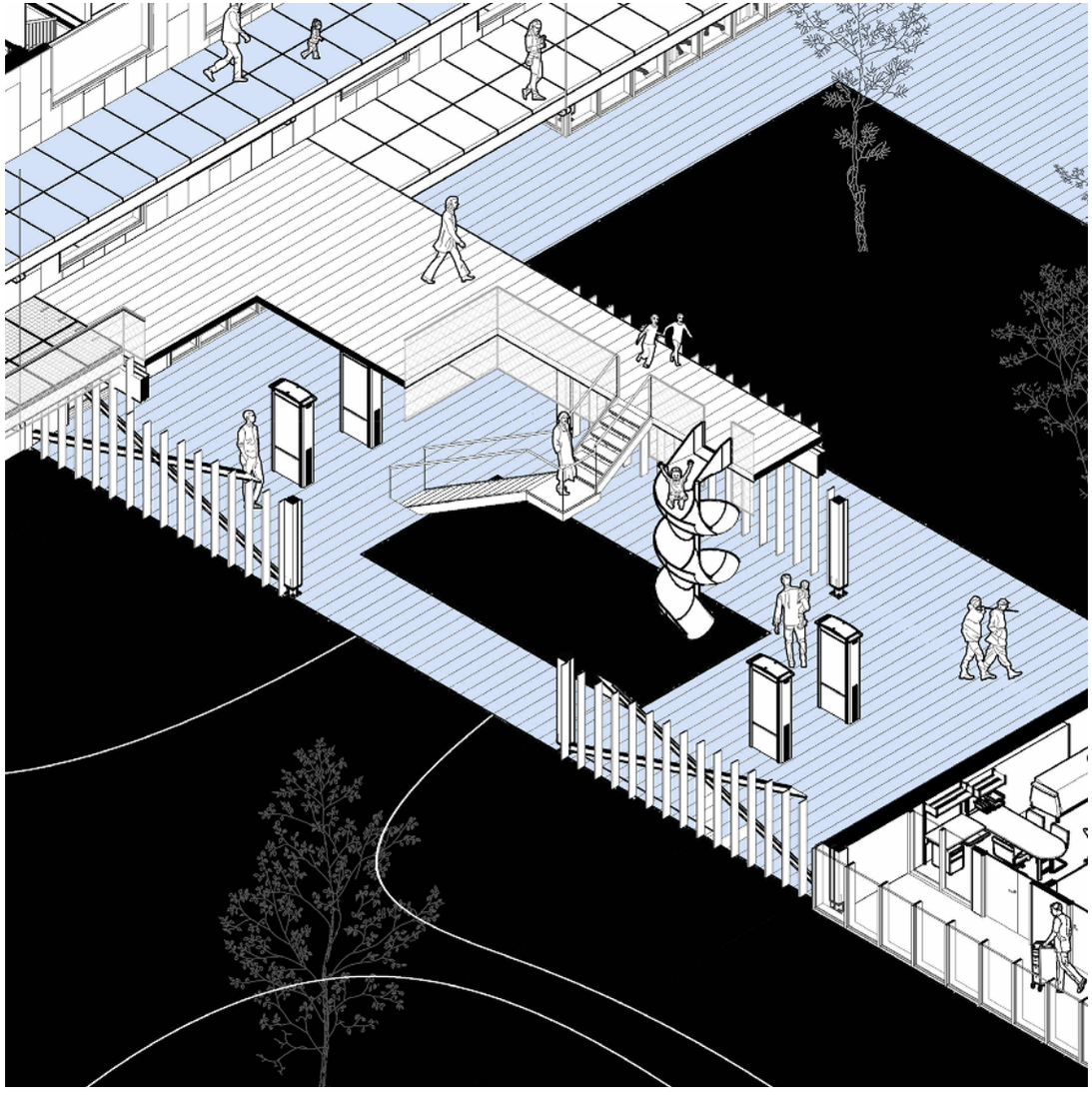


Best for Staff

ROUTE: PATIENT
Overview



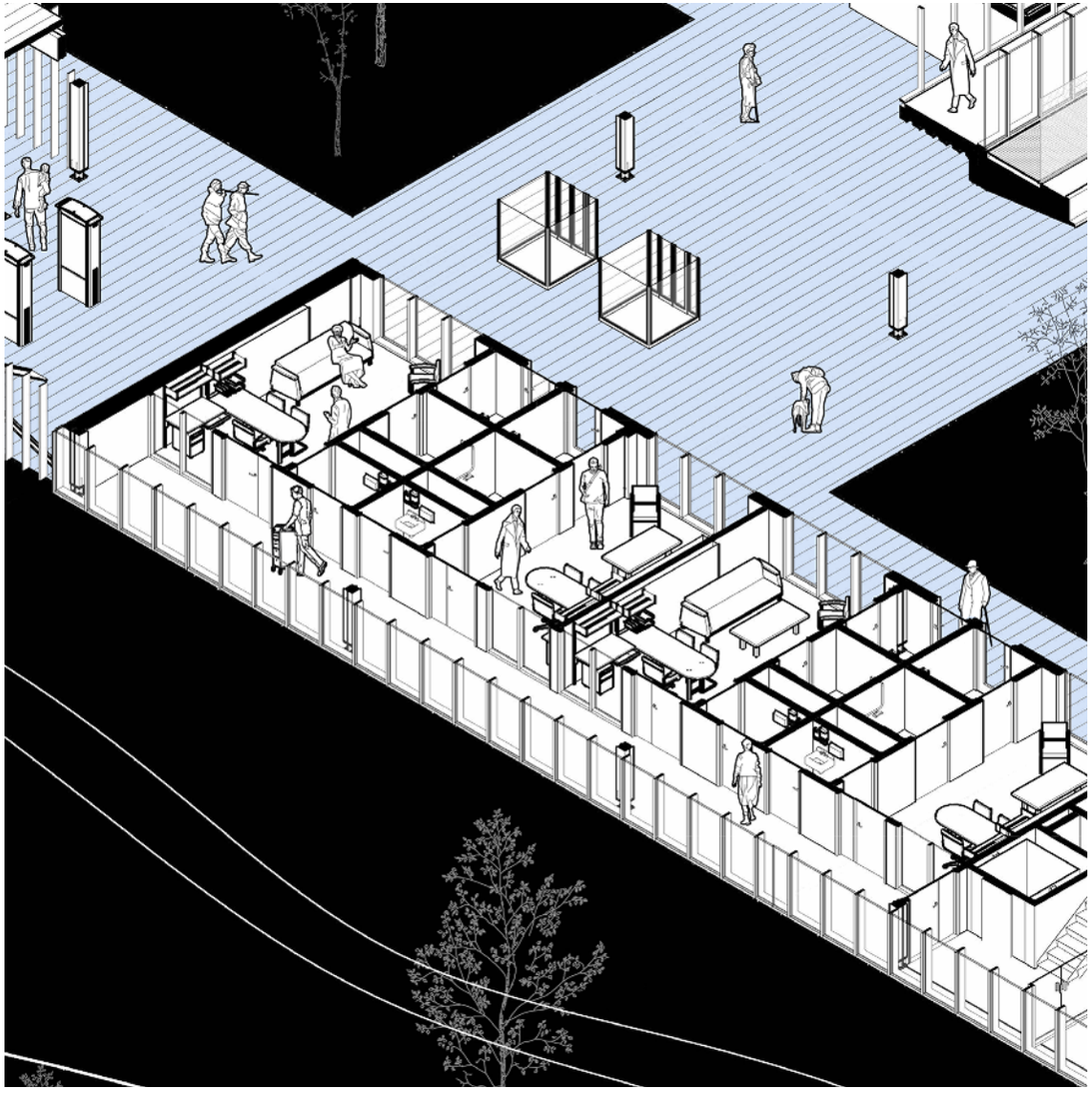
ROUTE: PATIENT
Entrance



ROUTE: PATIENT
Entrance Impression



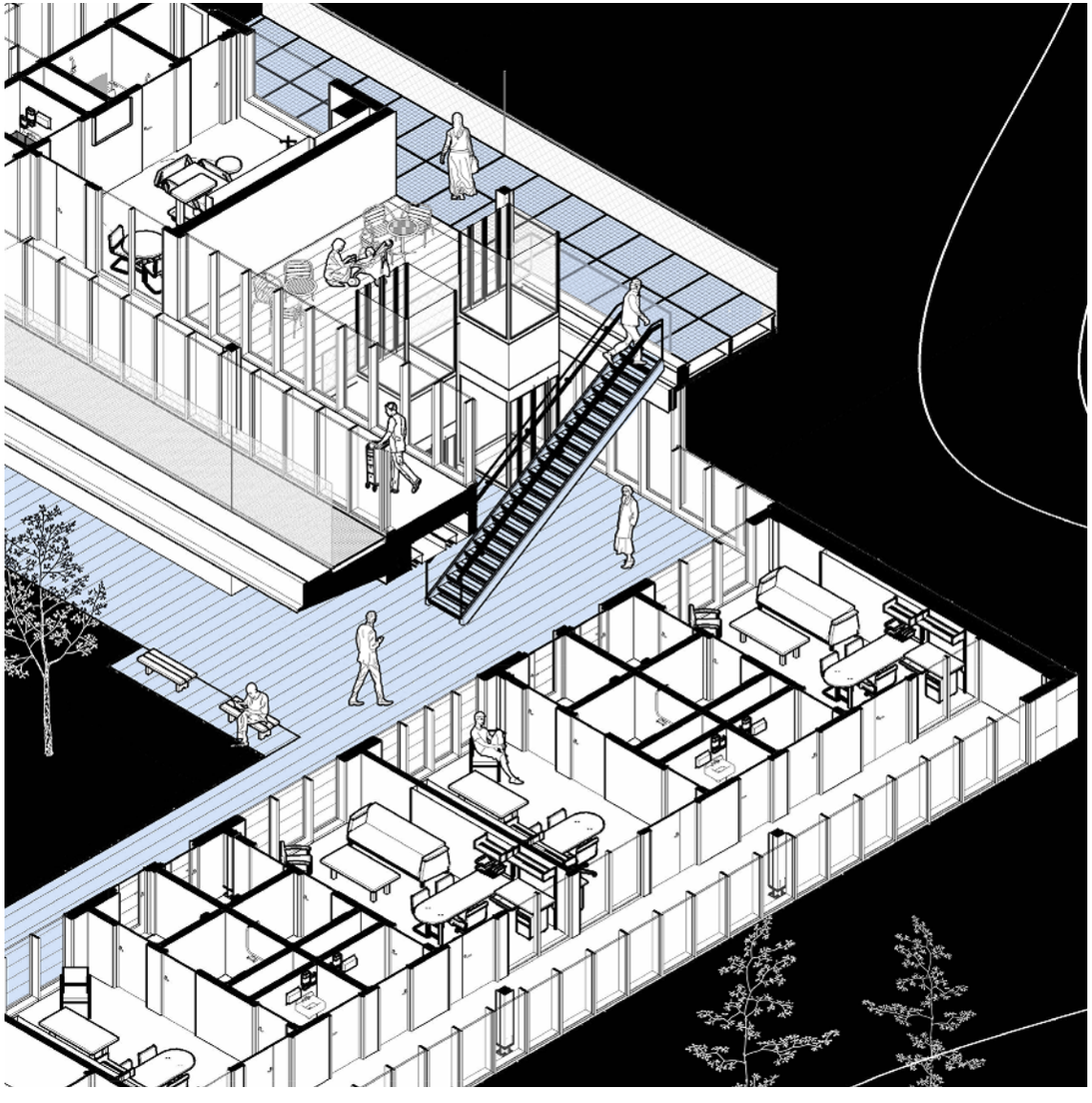
ROUTE: PATIENT
Ground Floor



ROUTE: PATIENT
Ground Floor impression



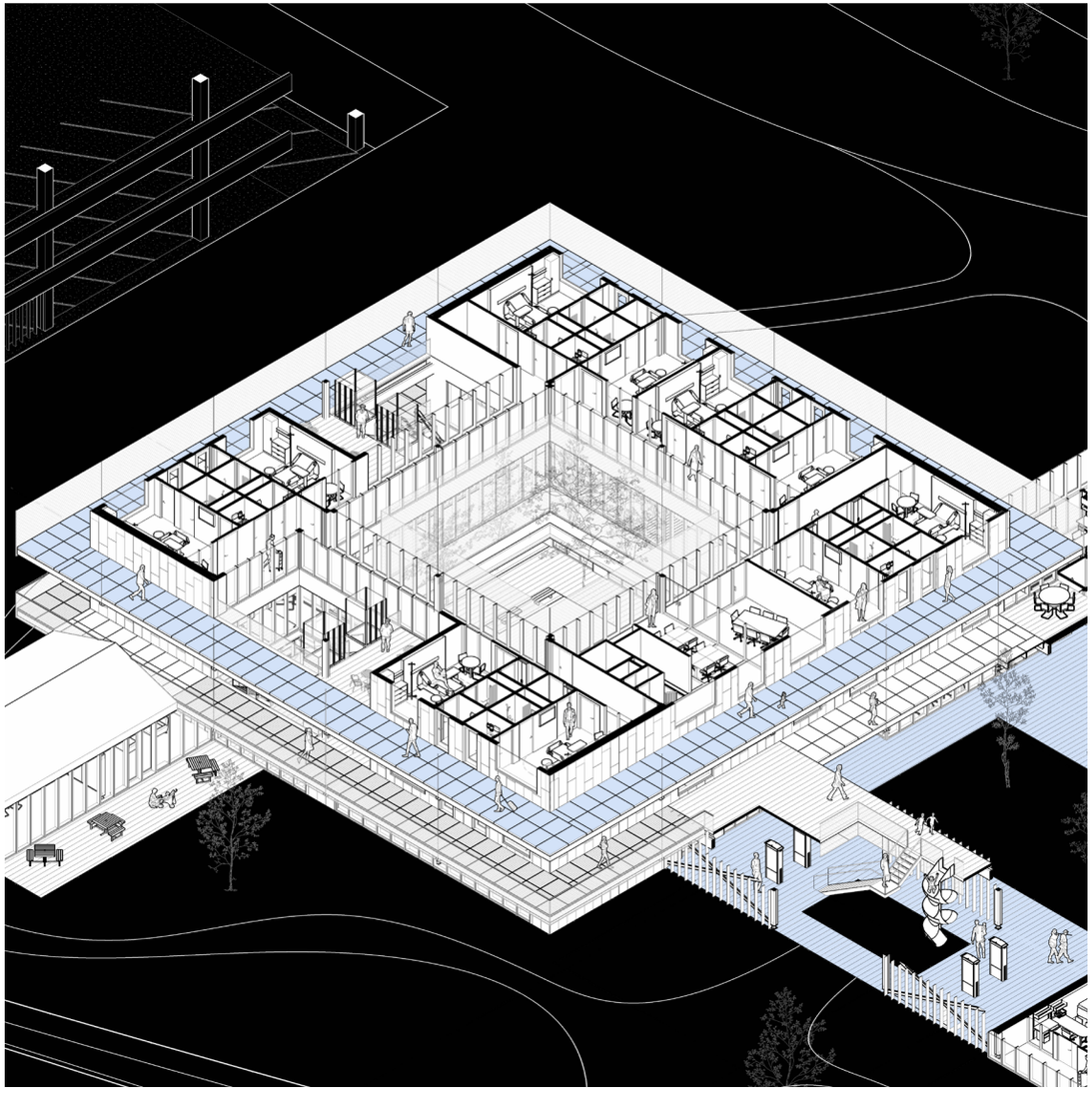
ROUTE: PATIENT
Vertical Movement



ROUTE: PATIENT
Vertical Movement impression



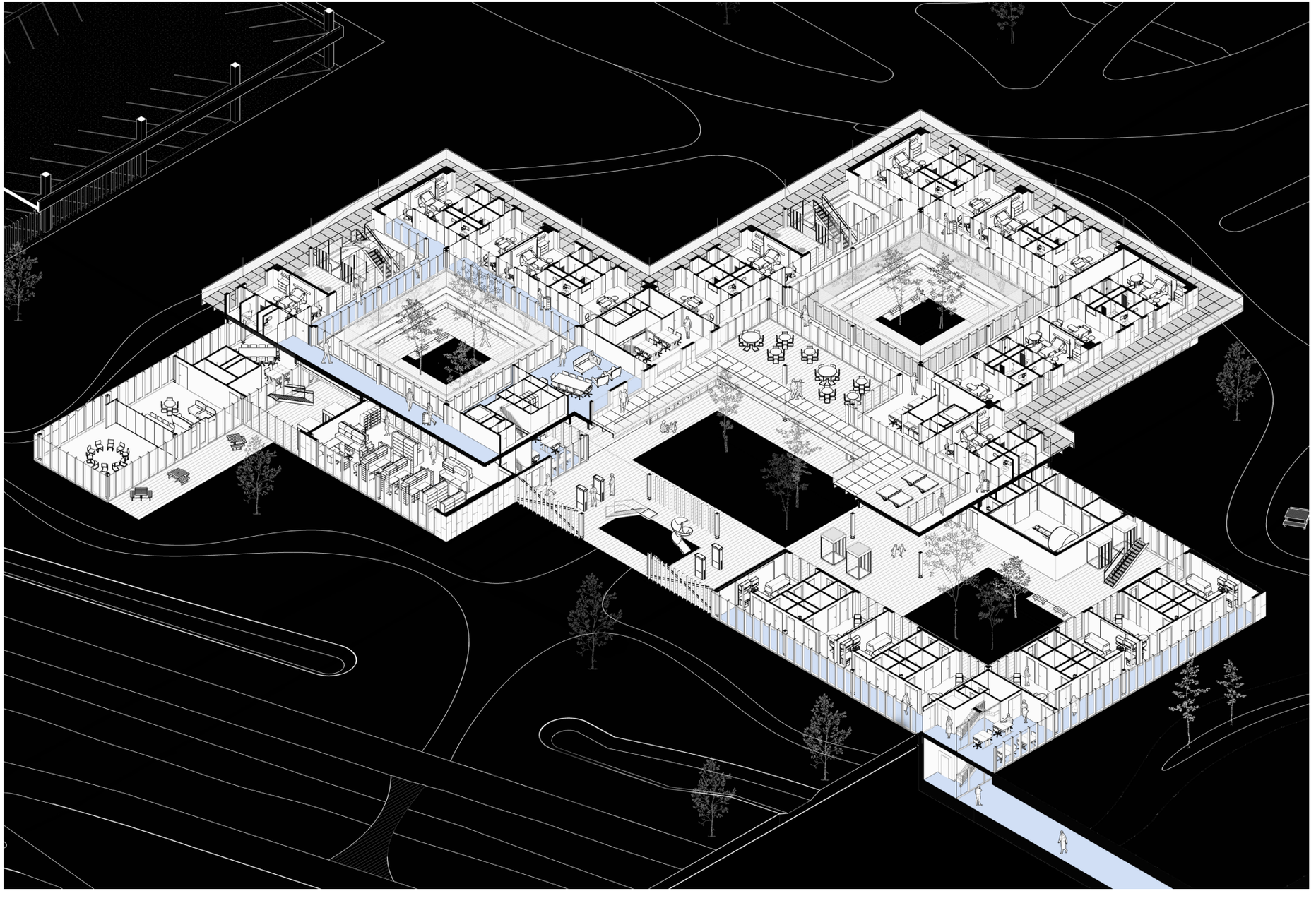
ROUTE: PATIENT
Balcony Loop



ROUTE: PATIENT
Balcony Loop impression



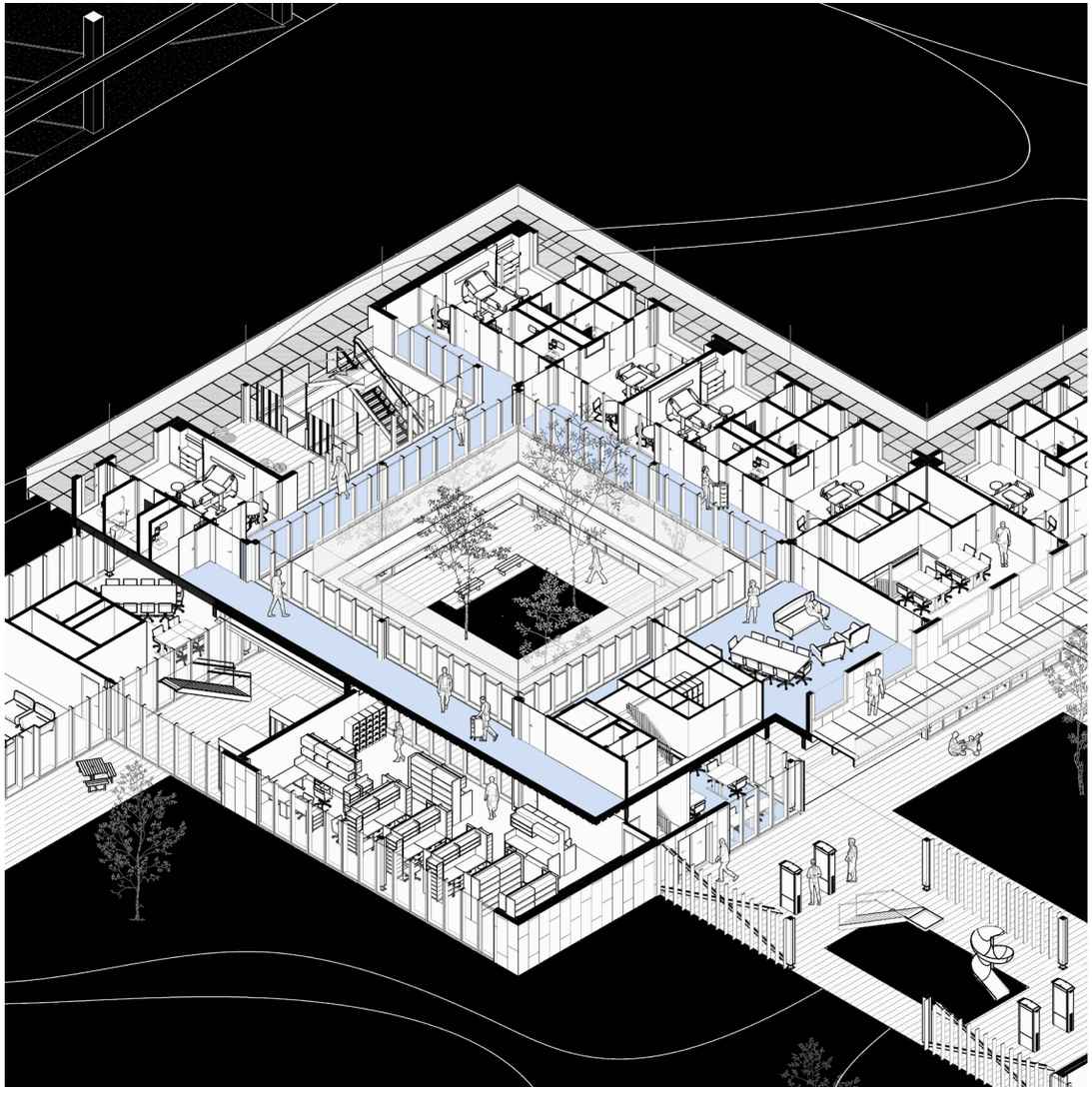
ROUTE: STAFF
Overview



ROUTE: STAFF
Impression



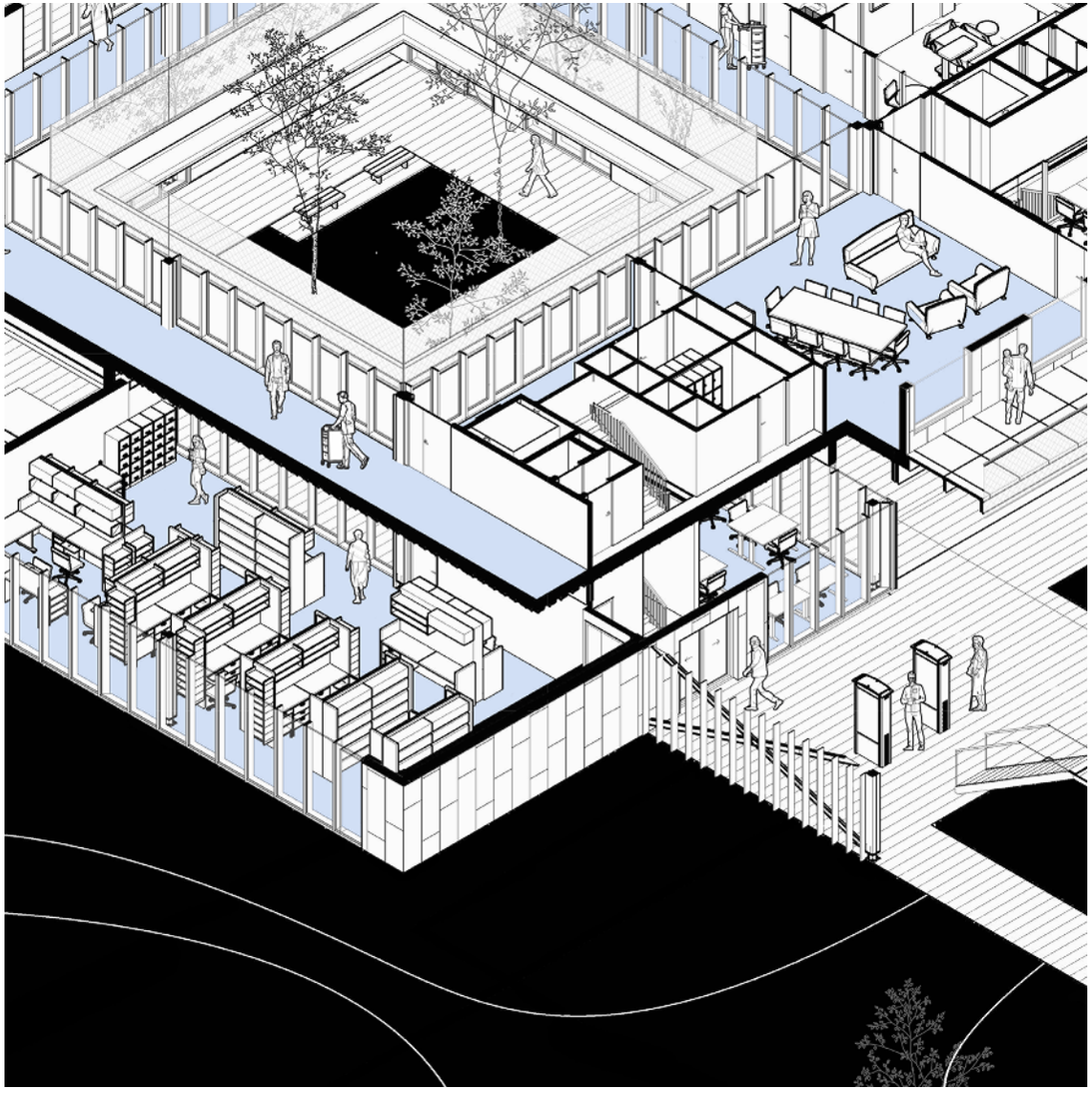
ROUTE: STAFF
Inner Loop



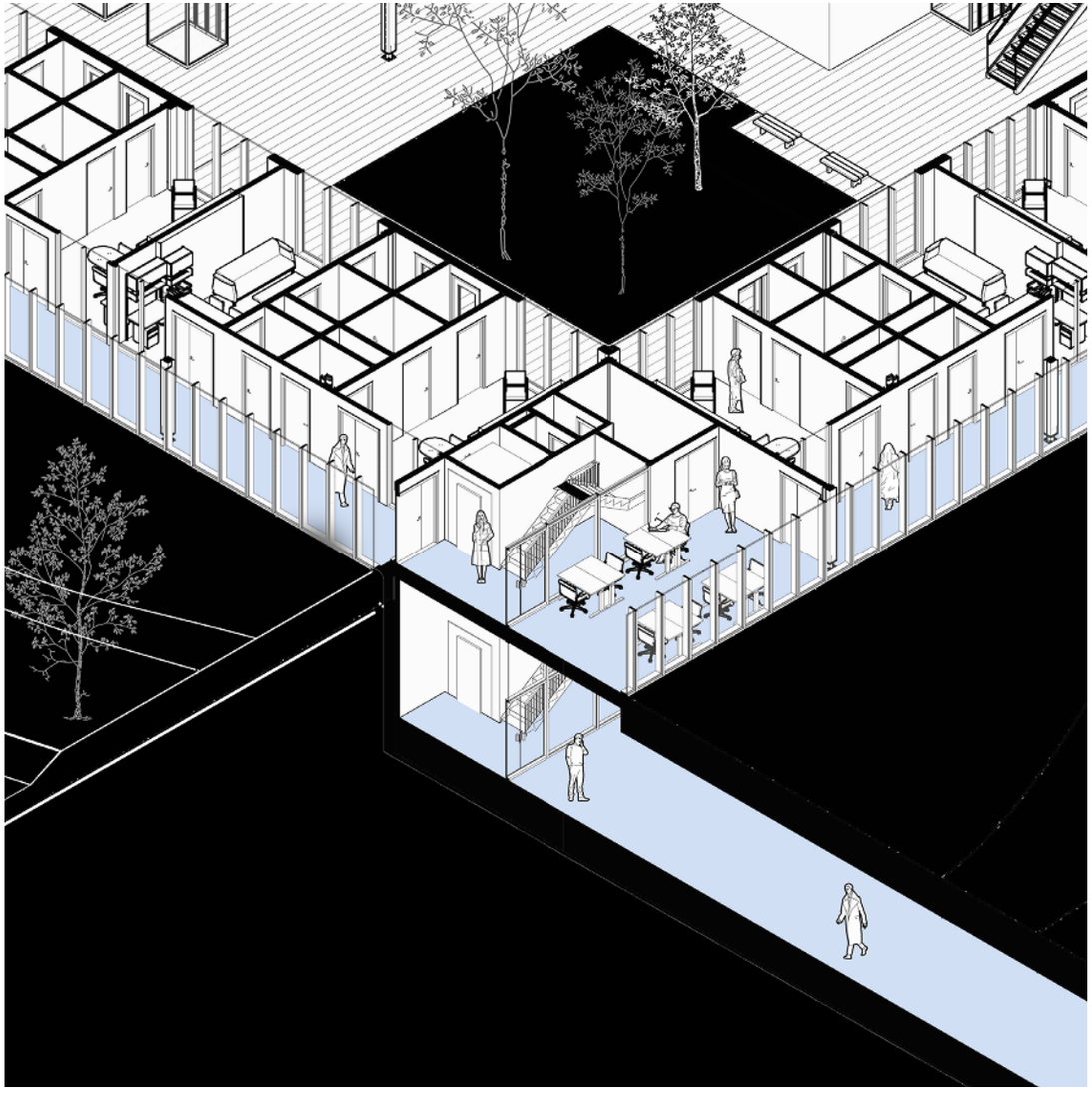
ROUTE: STAFF
Inner Loop impression



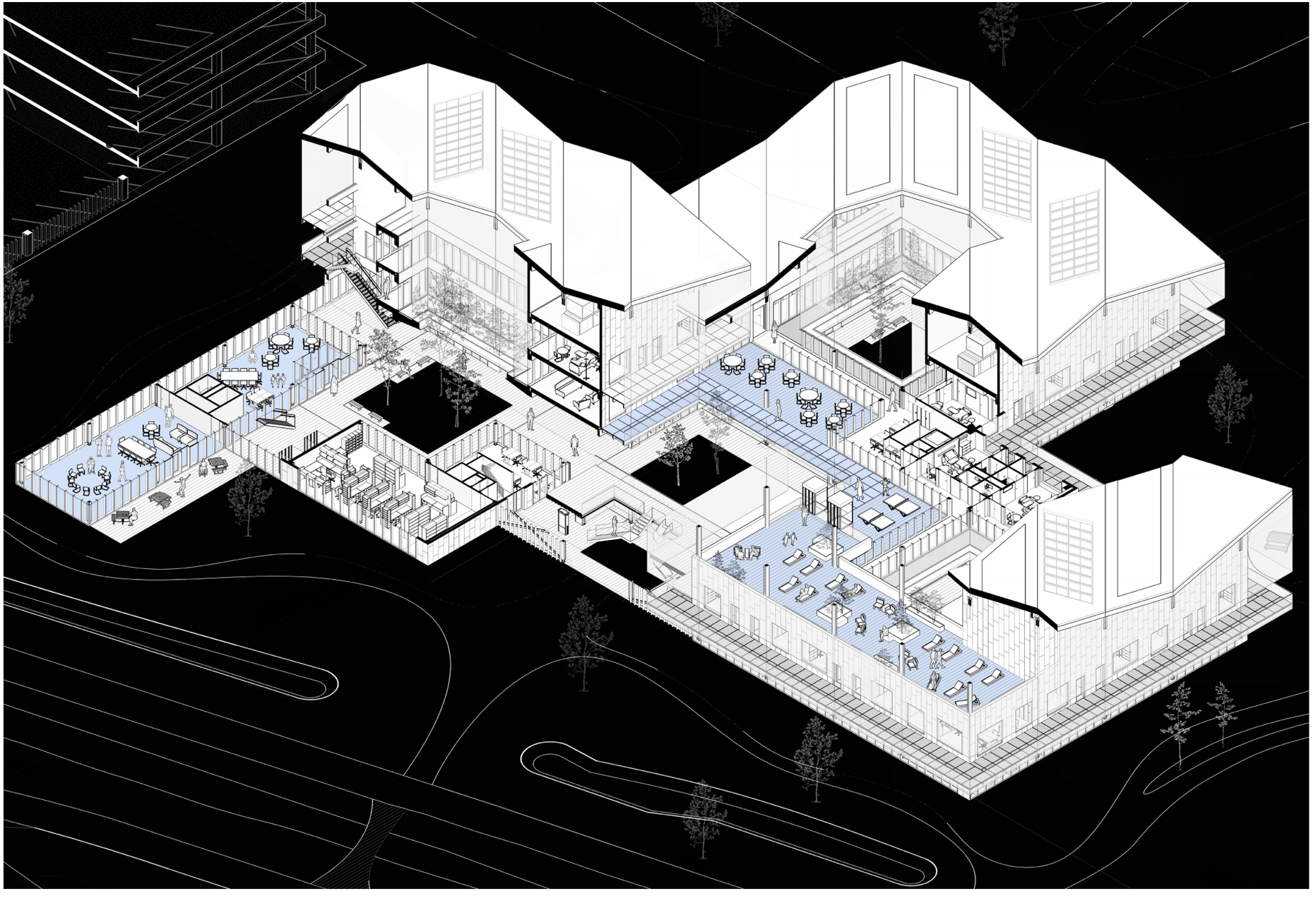
ROUTE: STAFF
Hot spot with pharmacy, entrance, break area



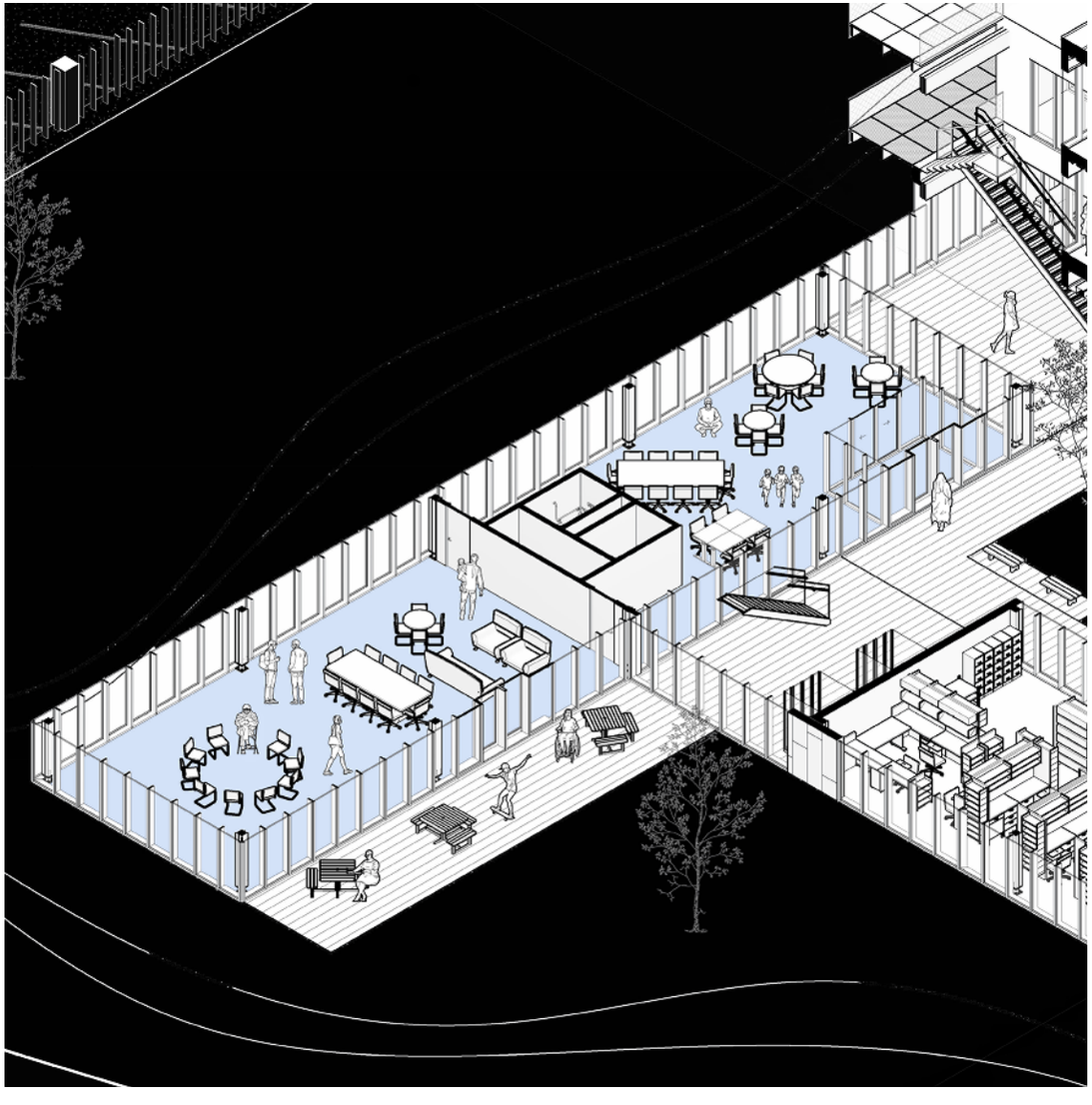
ROUTE: STAFF
Underground connection & GF hallways



ROUTE: SOCIAL
Overview



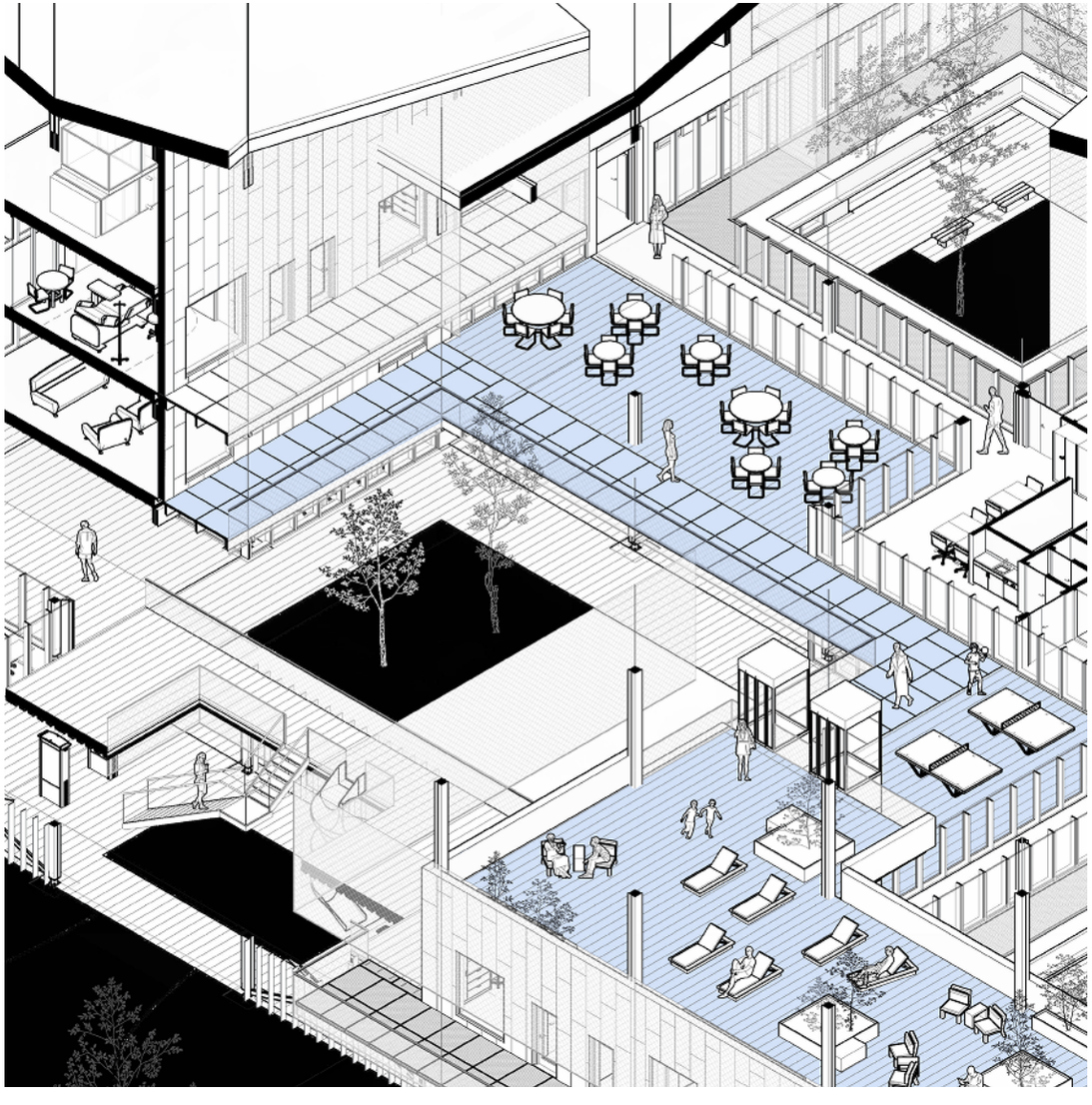
ROUTE: SOCIAL
Social centre indoor with masks



ROUTE: SOCIAL
Social centre impression



ROUTE: SOCIAL
Cafeteria & Play



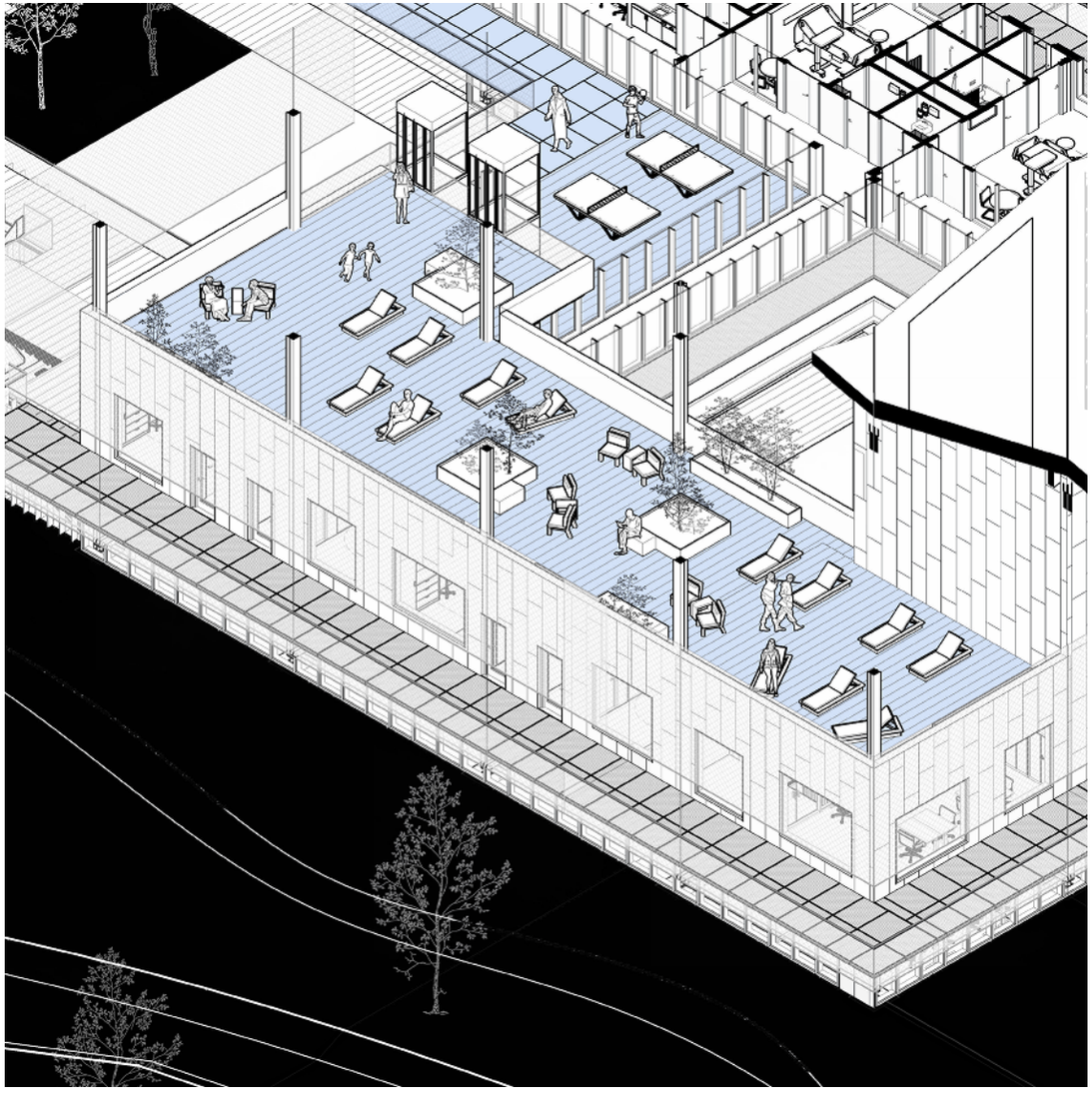
ROUTE: SOCIAL
Cafeteria & Play impression



ROUTE: SOCIAL
Play impression



ROUTE: SOCIAL
Sun Deck

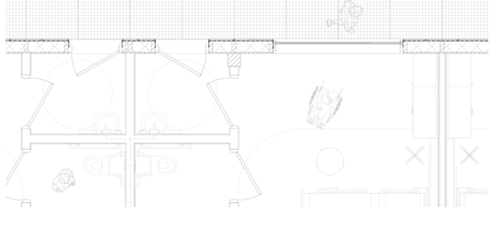


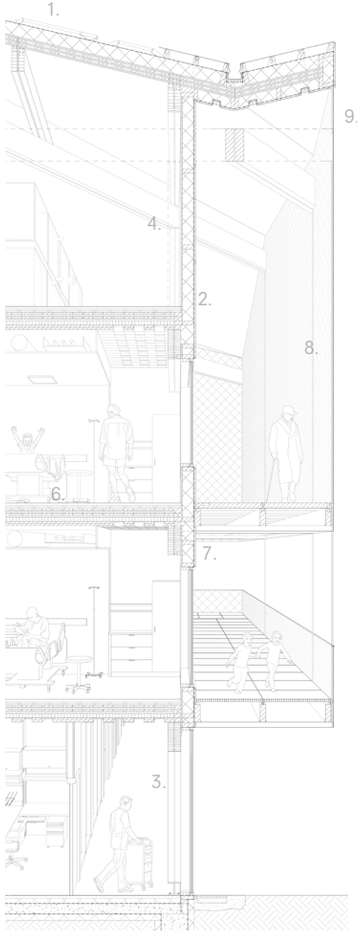
ROUTE: SOCIAL
Sun Deck impression



FRAGMENT 1.20
Facade outside



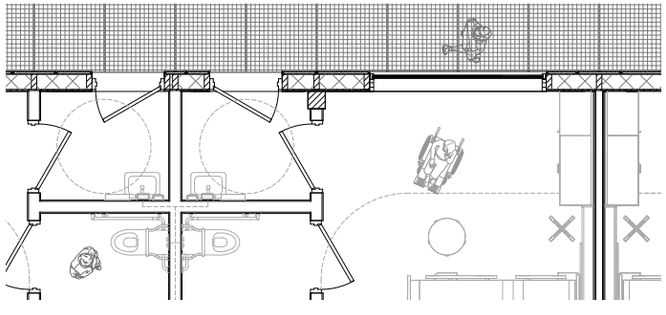


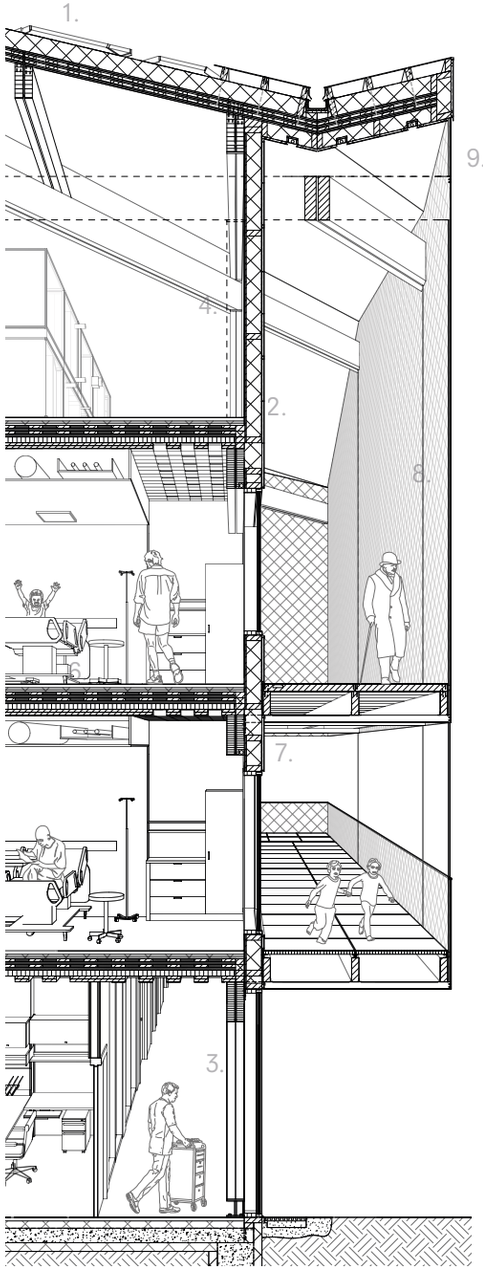


Fragment
Scale 1.20 - Rescaled

1. Roof build-up photovoltaic roof element; Glass / foil photovoltaic module; Metal frame; Sarking layer; 250 mm XPS thermal insulation; Vapour barrier; 190 mm cross-laminated timber panel.
2. Rockpanel® facade panels blue; 300/1800 mm; Vertical ship lapped arrangement; Mechanically fixed with nails; Continued over facade, roof edge and underside of overhang.
3. Column
   240/240 mm glued laminated timber column
4. Demountable beam-column connection; Continuous timber beams in long lengths; Minimal fixing to reduce damage to timber; Demountable steel node over column; Avoids loading timber perpendicular to grain; Column loads transferred through steel connection.
5. Structural bracing; CLT walls used as main stabilising elements; Steel wind bracing where open walls or façades are required.
6. Floor build-up; 5 mm seamless floor finish, linoleum; 45 mm solid beech layer, grooved for underfloor heating; 60 mm wood fibre board impact sound insulation; 4 layers 190/40 mm softwood cross-laminated boarding; Limestone chippings in cavities for acoustic mass; 80 mm solid beech layer; 2-layer soffit grid, 190/40 mm beech boarding; Integrated light fittings and acoustic matting in soffit cavities. *See exploded detail.
7. Cantilevered balcony structure; Steel cantilever profiles fixed back to the primary glulam beams behind the facade; Primary structure formed by paired 2 × 110/550 mm glulam beams; Steel profiles form the main balcony support; Secondary timber beams placed on top of the steel profiles; Balcony deck fixed above the timber beams: open steel grating or closed CLT panel; Outer edge stabilised by steel tension rod connected to paired 2 × 110/600 mm diagonal glulam beams at 45 degrees. * See details for further elaboration.
8. Balcony railing / mesh screen; Stainless steel mesh railing; 1000 mm high on level 1; Full-height mesh screen on level 2; Wind and rain buffer.
9. Cable fixing; Steel cables fixed to 45-degree angled beams; Secondary stabilisation of balcony edge

FRAGMENT 1.20
Vector images

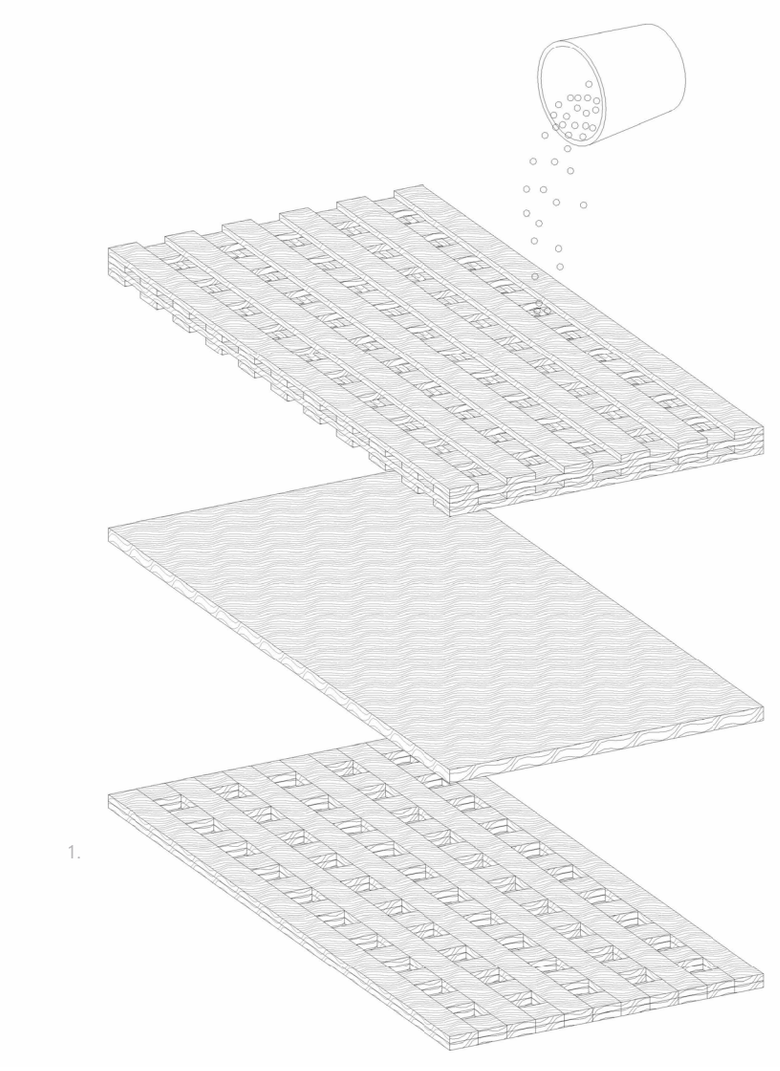




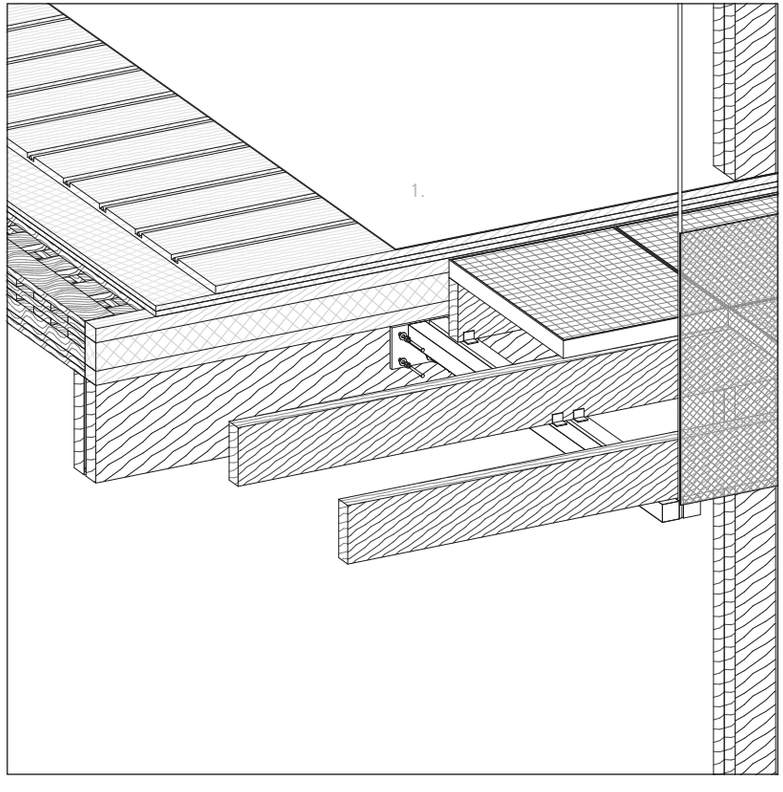
EXPLODED DETAIL
Floor Build-Up

Axonometric Detail
Scale 1.10 - Rescaled

1. Floor build-up; 5 mm seamless floor finish, linoleum; 45 mm solid beech layer, grooved for underfloor heating; 60 mm wood fibre board impact sound insulation; 4 layers 190/40 mm softwood cross-laminated boarding; Limestone chippings in cavities for acoustic mass; 80 mm solid beech layer; 2-layer soffit grid, 190/40 mm beech boarding; Integrated light fittings and acoustic matting in soffit cavities.



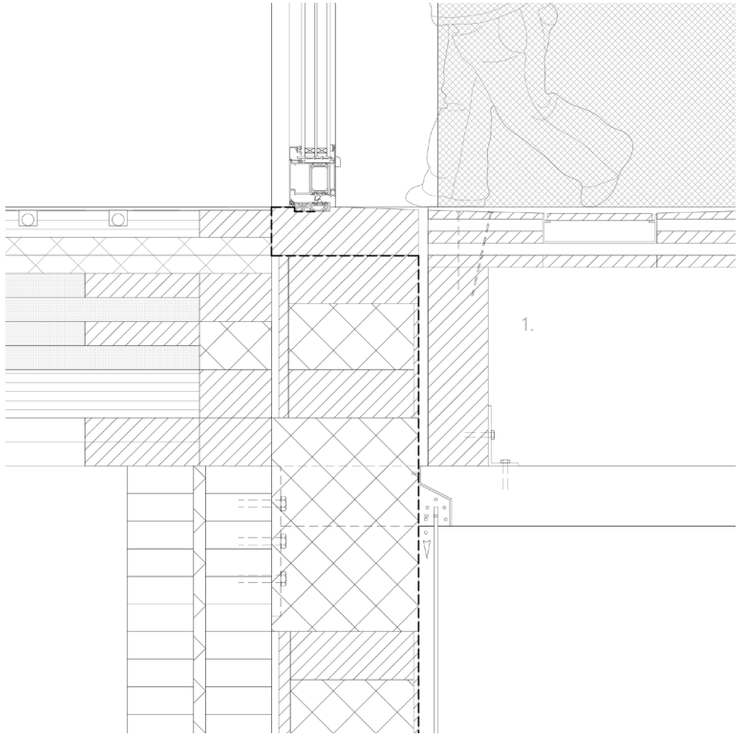
EXPLODED DETAIL
Balcony Connection

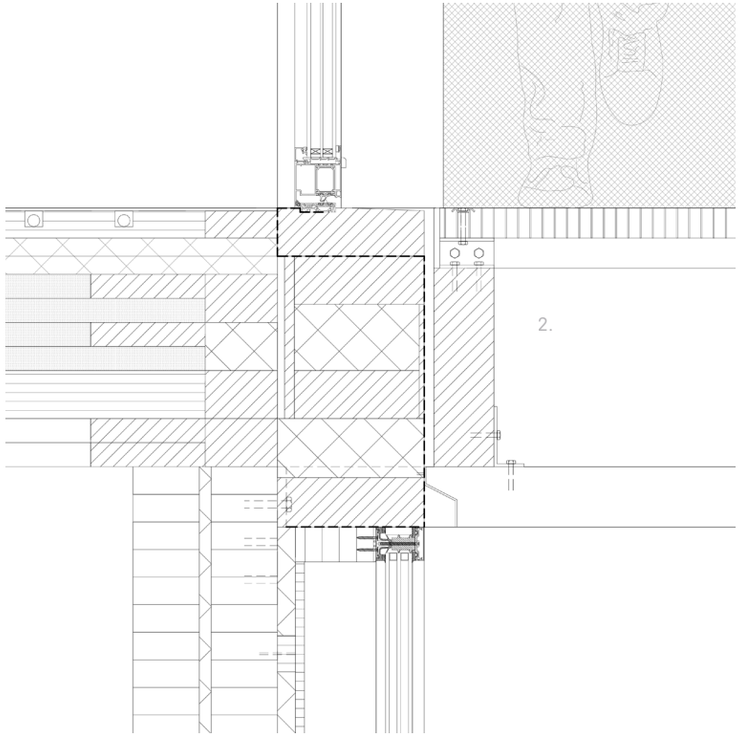


Axonometric Detail
Scale 1.10 - Rescaled

1. Cantilevered balcony structure; Steel cantilever profiles fixed back to the primary glulam beams behind the facade; Primary structure formed by paired 2 × 110/550 mm glulam beams; Steel profiles form the main balcony support; Secondary timber beams placed on top of the steel profiles; Balcony deck fixed above the timber beams: open steel grating or closed CLT panel; Outer edge stabilised by steel tension rod connected to paired 2 × 110/600 mm diagonal glulam beams at 45 degrees. * See details for further elaboration.

DETAIL 1.5
Materiality

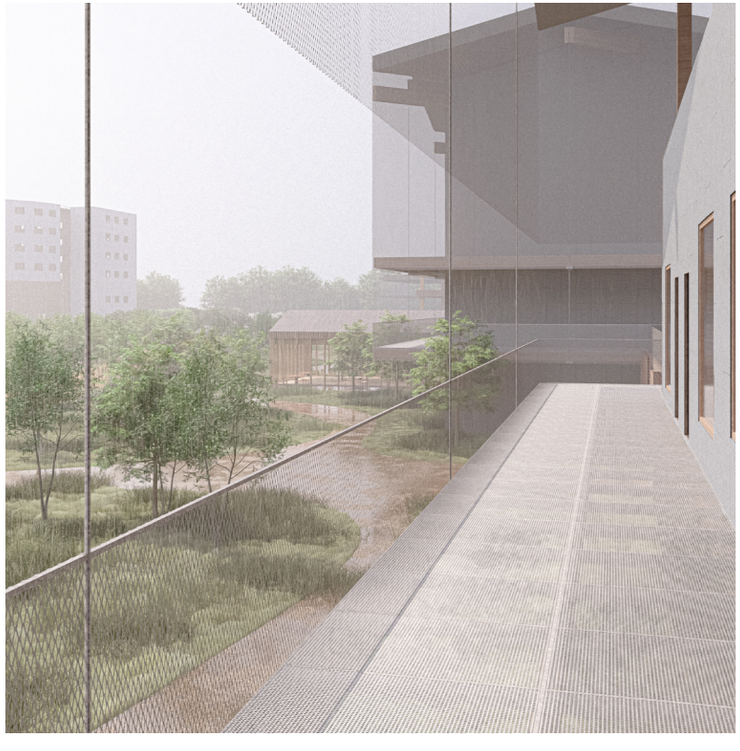




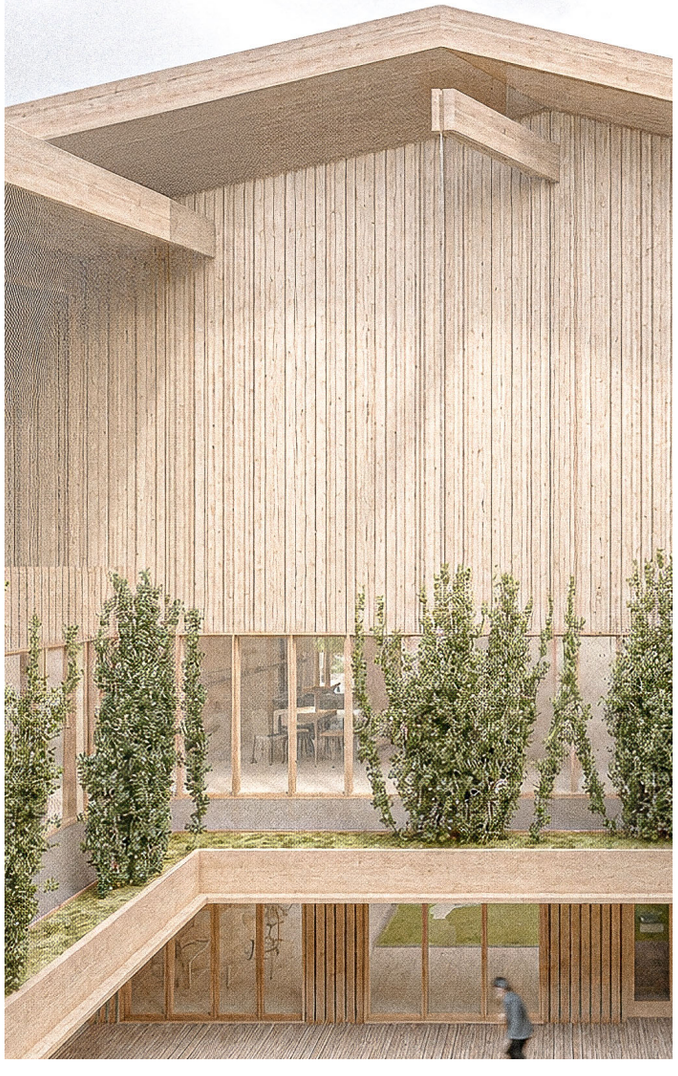
Detail
Scale 1.5 - Rescaled

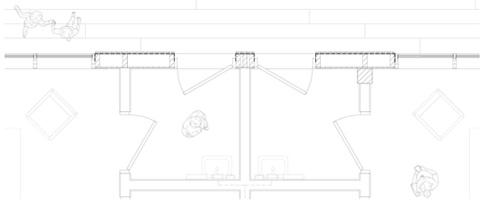
1. Open balcony deck; Steel grating on timber balcony beams; Repeated steel hold-down plates; Screw-fixed to timber support; Open raster for rainwater and air passage.
2. Closed balcony deck; 100 mm CLT deck panel; Nailed to timber balcony beams; Closed walking surface; Pre-grooved drainage channel to drain.





FRAGMENT 1.20
Facade inside



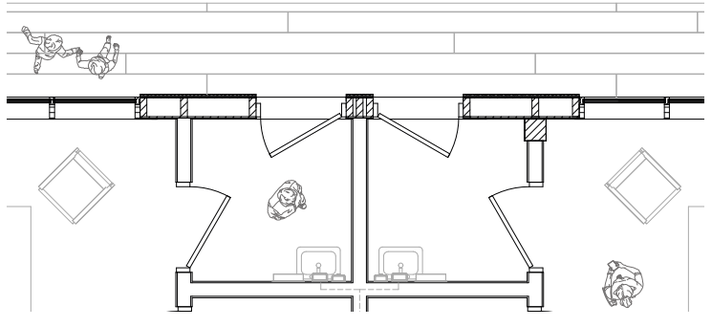


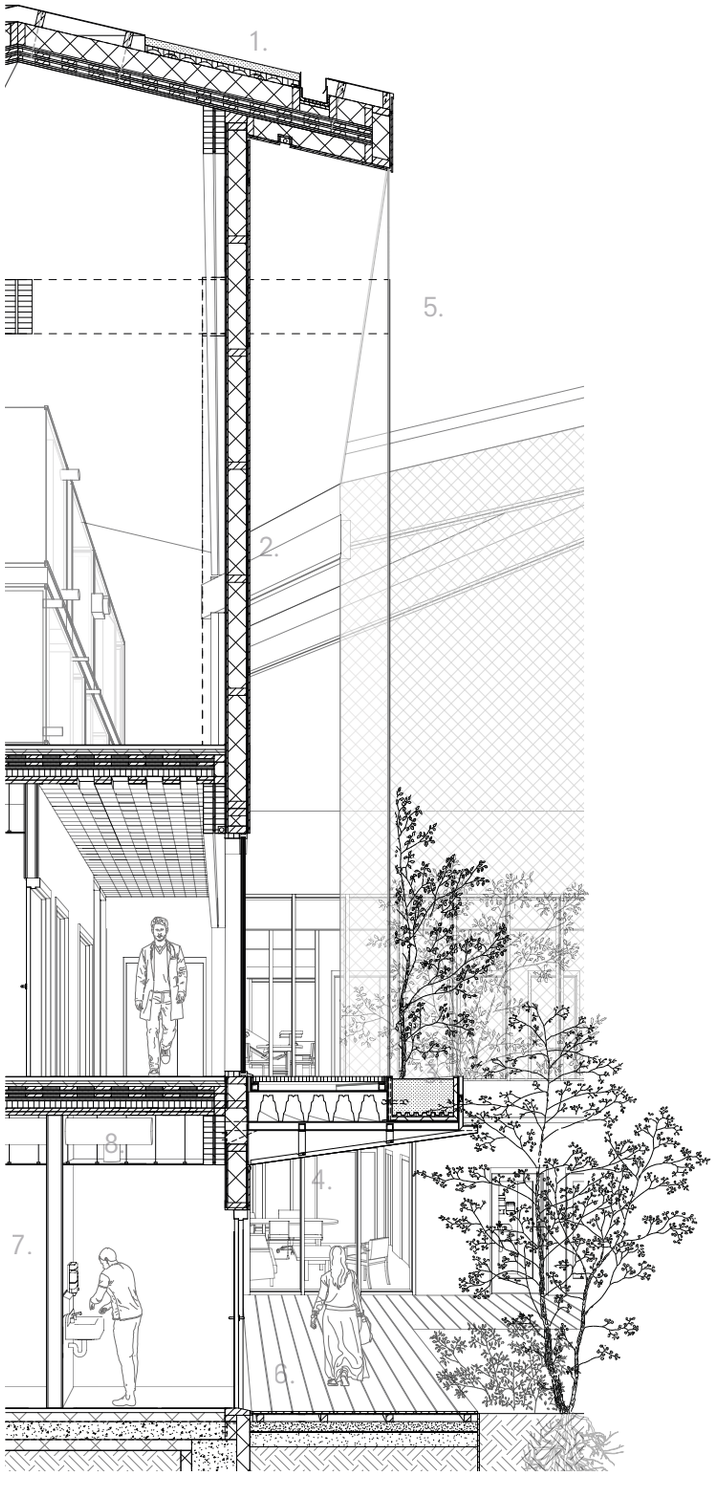


Fragment
Scale 1.20 - Rescaled

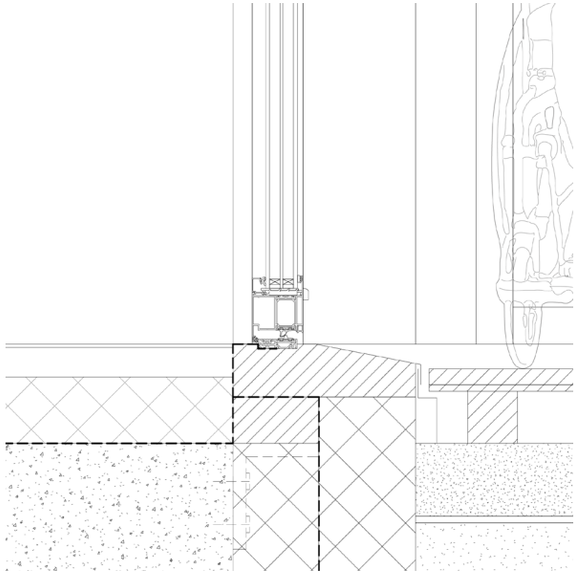
1. Roof build-up green roof; 100 mm substrate; 75 mm fall-forming elements; 250 mm XPS thermal insulation; Vapour barrier; 190 mm cross-laminated timber panel; 2 × 110/500 mm timber beams with insulation between.
2. Timber facade build-up; 35/16 mm vertical timber lamellas; European larch timber; Fixed to 40/16 mm horizontal timber battens; Vapour barrier; Prefabricated timber-frame wall element; 8 mm external board; 210 mm thermal insulation; 13 mm timber board;12 mm gypsum internal lining; Fixed to 2 × 550/110 mm glulam timber beams with insulation between.
3. Planting trough; 450/650 mm planting trough; 5 mm canted sheet steel; Thermal insulation; Irrigation system; Emergency overflow.
4. Balcony railing / mesh screen; Stainless steel mesh railing; Full-height mesh screen; Support for climbing plants that provide shading.
5. Cable fixing; Steel cables fixed to 45-degree angled beams; Secondary stabilisation of balcony edge
6. Level access; Interior floor, door threshold and exterior timber deck set at one level; Step-free passage for wheelchair users, and walking aids. *See details for further elaboration.
7. Internal wall build-up; 180 mm internal service wall; Space for water supply and drainage pipes; Used around bathroom and sink zones.
8. Lowered roof zone; Lowered ceiling / roof zone for ventilation shafts; Duct routing for positive pressure ante chamber.

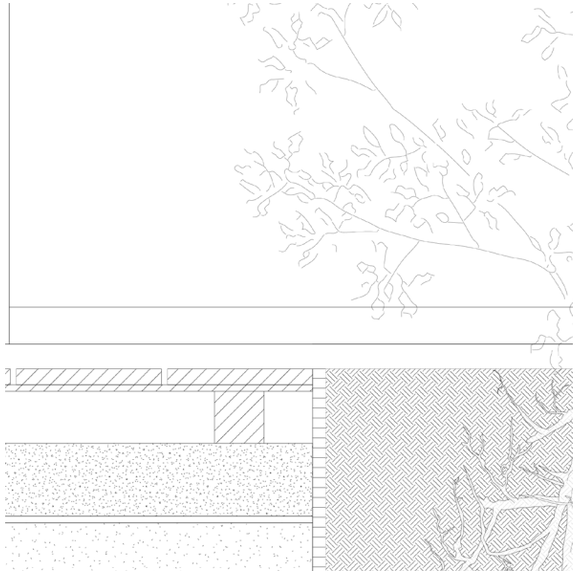
FRAGMENT 1.20
Vector images

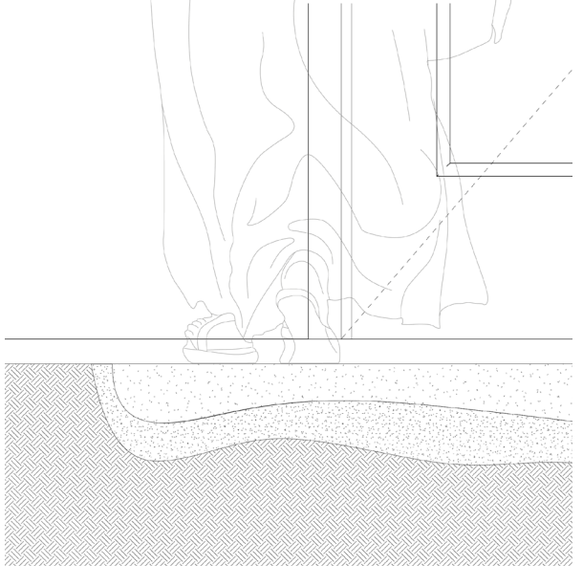




DETAIL 1.5
Accessibility







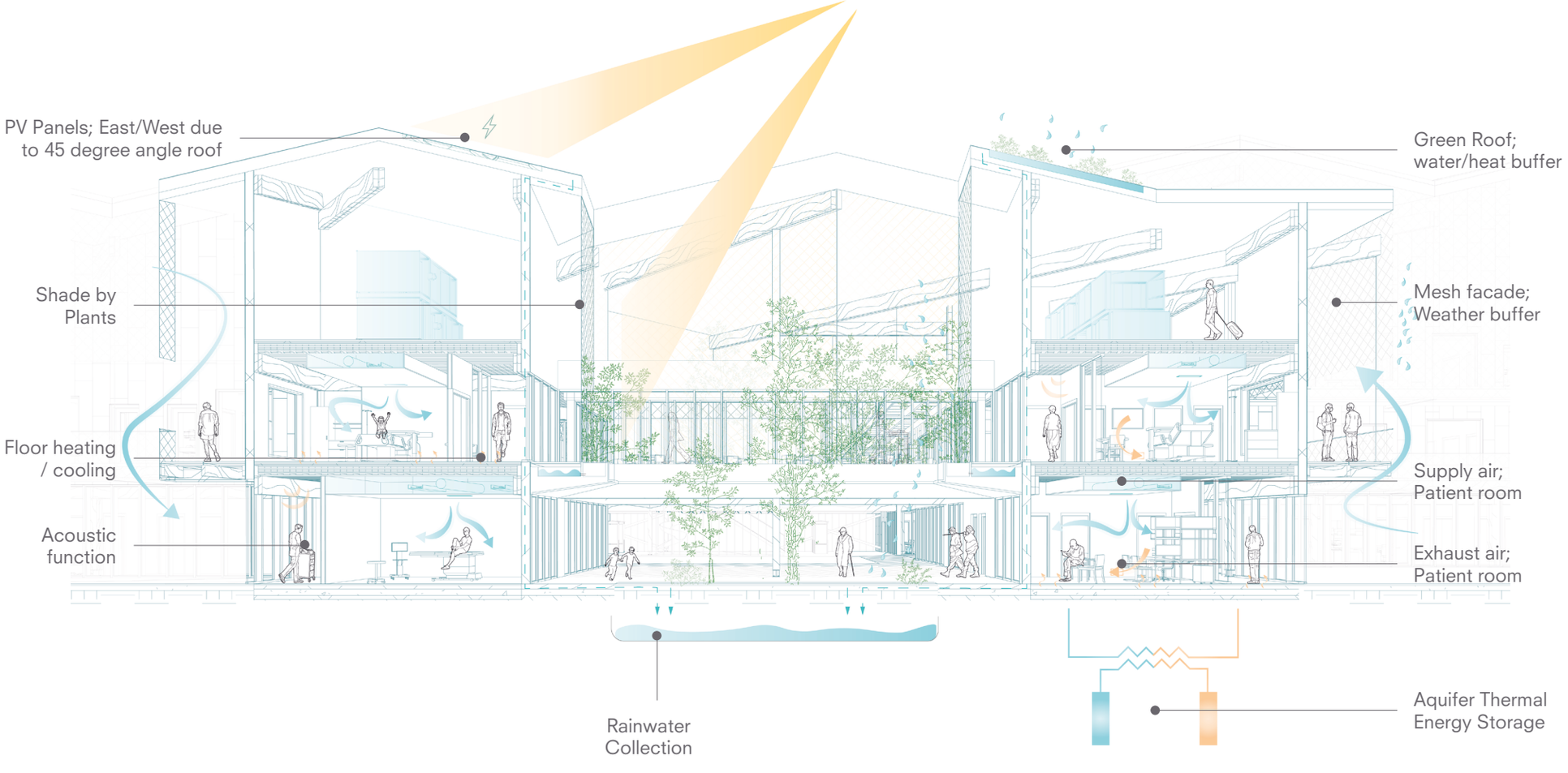
Detail
Scale 1.5 - Rescaled

1. Level access; Interior floor, door threshold and exterior timber deck set at one level; Step-free passage for wheelchair users, and walking aids.
2. Recessed door threshold; Door frame set into grooved timber floor element; Lowered threshold profile; Reduced height difference between interior floor and exterior deck.
3. Internal floor build-up; 5 mm linoleum seamless floor finish; 45 mm solid European beech layer, grooved for underfloor heating; 100 mm rigid thermal insulation, PIR;
   Vapour barrier; 200 mm reinforced concrete slab; Damp-proof membrane below slab; 120 mm pressure-resistant ground insulation.
4. Exterior deck build-up; 220/24 mm timber decking planks; 10 mm timber levelling board; 75/75 mm timber battens; Firm sand bedding layer; Loose sand levelling layer; soil below.
5. Root protection membrane; Anti-root membrane between planting soil and deck build-up; Prevents root growth into sand bedding and timber structure; Prevents lifting and shifting of the walking surface.
6. Drainage principle; Exterior deck laid with slight fall away from facade.; Open joints and sand layers allow water drainage.

DETAIL 1.5
Accessibility impression



CLIMATE SECTION



Technical room:
Heat pump and hot / cold buffer tank

IMPRESSION OF ROUTES



