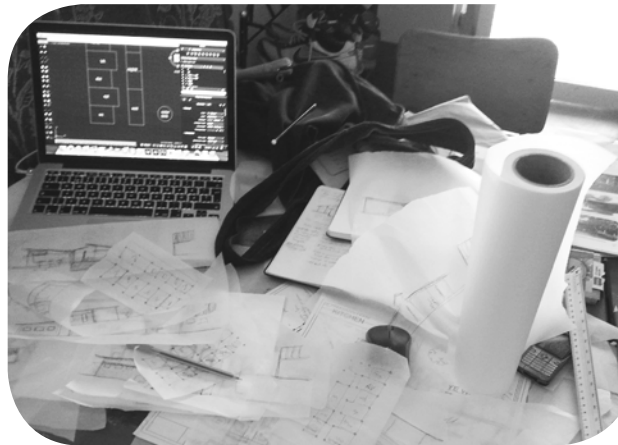


HEALTHY HOSPITAL DESIGN

- the case of Kolandoto Hospital in Tanzania



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ABSTRACT

The built environment at some hospitals in emerging contexts are inadequate for delivering on the human right to health which includes the access to quality healthcare in an environment free from factors causing illness or poor health. This is the case at Kolandoto Hospital in Tanzania, a district hospital with a large outpatient department and 168 inpatient beds for medical and surgical treatments. The hospital has scarce resources in terms of personnel, money, material, quality water, sufficient electricity, and adequate spaces for healing free from risks of errors, delays and infections. Possible help to counteract this problem might come from within the international development sector. However, there are issues regarding ownership and benefit when people from a different part of the world bring in resources to specific projects that often are based on a limited understanding of the reality.

The purpose of this master thesis is to explore how an architect can apply the concept of a sustainable and healthy hospital design in the international development sector by taking different roles in a concrete development project. The goal is to show feasible designs for people's health, for a healthy environment and for a healthy approach to development. Kolandoto Hospital is the case and a collaborative development project with non-governmental organizations forms the framework.

Three scales in which I as an architect can approach the project in different roles was identified. In each scale a design proposal was developed through an immersive design process on site in Kolandoto and in close collaboration with the hospital management. I was a planner, process leader and hospital environment specialist when creating a masterplan for the development during the next 10 years. I was a designing architecture consultant when creating a design proposal for a new eye clinic building with sustainable building techniques. I was a project manager when building an extension to the maternity operating theatre.

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1. PROJECT BACKGROUND

Giving the wider picture of the thesis, the context it is set in and the case Kolandoto Hospital.

1.0. THESIS OVERVIEW

INTRODUCTION

PURPOSE AND GOAL

COLLABORATIONS

RESEARCH QUESTION

In what roles can an architect's skills and knowledge be applied in a project about healthy hospital design in the international development sector?

METHODS

observations, research, interviews, study visits, discussions, workshop, strategy analysis, flow analysis, zoning analysis, site analysis, sketching, full scale feeling

PHYSICAL CONTEXT

OVERARCHING ISSUE

CASE PROBLEM

SUB- QUESTIONS

MASTERPLAN

the right to health

lack of a long-term building plan

How can a masterplan for Kolandoto Hospital support the access to appropriate healthcare in a healing environment free from factors causing illness or poor health?

EYE CLINIC DESIGN

sustainable building techniques

congestion in the eye department

How can sustainable building techniques for a tropical climate be applied to a building design at Kolandoto Hospital?

MATERNITY THEATRE EXTENSION

relation to international development sector

unsafe conditions for c-sections

How is it possible to implement a good quality architectural intervention at Kolandoto Hospital during a two months study visit?

THREE SUB-PROJECTS

OUTPUT

SCALE

masterplan

*large scale
planning*

*eye clinic
design*

*middle-size
building design*

*maternity
theatre
extension*

*small
extension*

DISCUSSIONS

*HEALTHY HOSPITAL
DESIGN...*

*THE ARCHITECT'S
ROLE AS...*

*A RICH
PROJECT WITH...*

*... for people's
health*

*... a hospital planner
and process leader*

*... different
scales*

*... for a healthy
environment*

*... a designing
architecture
consultant*

*... several
focuses*

*... for a healthy
approach to
development*

*... a project
manager*

*... many
stakeholders*

1.1. INTRODUCTION

Purpose and goal

The purpose of this master thesis is to explore how an architect can apply the concept of healthy hospital design within the international development sector by taking different roles in a concrete development project. The goal is to show designs for people's health, for a healthy environment and for a healthy approach to development. The designs should be feasible and in three different scales - the large scale of a masterplan for long term development, the middle scale of a building design, and the small scale of a building intervention realizable during the master thesis period. Kolandoto Hospital in Tanzania acts as a case study with scarce resources in terms of personnel, money, material, quality water, sufficient electricity, and adequate spaces for healing. The collaborative development project that forms the framework is the project 'Healthy Hospital' that aims at improving the building, electricity and water infrastructure at Kolandoto Hospital in Tanzania in a sustainable way.

Collaborations

Healthy Hospital project:

This thesis is part of the development project 'Healthy Hospital'. The project is a collaboration between Kolandoto Hospital in Tanzania, and the three swedish NGOs 'I Aid Africa' (IAA), 'Architects without borders' (ASF), and 'Engineers without borders' (EWB). The project aims at supporting a sustainable development of water, electricity and building infrastructure at Kolandoto Hospital. The project is divided in three phases. The first phase focus on in-depth understanding of problems and suggesting possible solutions, but also include some quick interventions to improve the water and building infrastructure. The second phase is about implementing recommended designs and solutions from the first phase. The third phase is about maintenance and further development. Two master theses are done within the first phase of the project. This architectural thesis called 'Healthy Hospital Design', alongside an engineering thesis called 'Healthy Hospital Water'.

Kolandoto Hospital:

The hospital has 168 beds, was founded in 1913 and is run by the African Inland Church Tanzania. It is an educational hospital located in a village close to Shinyanga town, a regional capital in the north west of Tanzania.

I Aid Africa:

IAA is an NGO working with mostly health issues in Tanzania. It has an established collaboration with Kolandoto Hospital since 2008.

Architects without borders Sweden:

ASF is an NGO that works for a sustainable, equal and fair development of the built environment across the whole world.

Engineers without borders Sweden:

EWB is an NGO contributing to a better world by applied engineering, science, entrepreneurship and project management through volunteer projects in primarily Africa as well as inspiring young people to become engineers and broadening the minds of professional engineers in Sweden.

Andreas Berg and Daniel Kallus:

Andreas and Daniel are two engineering students at Chalmers University of Technology. Their master thesis is about the water situation at Kolandoto Hospital. During the first phase of the 'Healthy Hospital' project Daniel, Andreas and I made a comprehensive survey report of the current water, electricity and building situation and needs at Kolandoto Hospital, which also included recommendations for improvements.

Overarching issues and case problems

Issue 1: The right to health

The first issue is the topic of the right to health (WHO and OHCHR 2008), which covers the access to and quality of healthcare in general, as well as underlying factors of ill health such as access to potable water, adequate sanitation and healthy environmental conditions (WHO 2013). The importance of this right is clearly manifested in some hospitals in the emerging world, where one can observe the lesser quality of health care due to scarce resources in personnel, money, material, quality water, sufficient electricity, and adequate spaces for healing free from risks of errors, delays and infections.

Problem 1: Lack of a long term building plan

The current logistical flows of patients, staff, material and air throughout the hospital site are assumed to create room for errors and cause infections, and a long term plan could gradually change that. At the moment the development of the built environment at the hospital is perceived to happen without a comprehensive overview and goal, which might lead to that some decisions on specific building development projects and their placement can prevent the hospital from reaching its goals for health care service provision in the years to come. Lastly, looking at the access to health care services, a council hospital in Shinyanga Urban district is missing, and Kolandoto Hospital is in the process of becoming a Council Designated Hospital to fill that void. But certain prerequisites regarding the built environment apply before that is possible, and a strategic plan for that development is needed.

Issue 2: Sustainable building techniques

The second issue is that of sustainable development (WCED 1987), and to adapt the way we build to ensure that we fulfill the needs of today without jeopardizing our environment, the social fabric and the economy. This needs to be at the core for any building development, not the least one focusing on health. In specific, the techniques for constructing environmentally sustainable buildings have to be adapted to the local climate. Aspects of building energy efficiency, incorporating water systems in the building, using local material, and providing natural ventilation and light should be climate adapted.

Problem 2. Congestion in the eye department

Kolandoto Hospital has a specialized eye department consisting of an inpatient ward, an outpatient clinic and an operating theatre. Currently the eye clinic and eye ward is in the same building. The spaces for the eye clinic are often overcrowded with many patients sitting uncomfortably waiting outside on the paths or inside the actual examination rooms. The lack of space compromises the patients privacy during examinations and consultations. In addition, the congestion of inpatients and outpatients in small spaces in the same building also poses a risk for transmission of diseases and infections between patients.

Issue 3: Relation to international development

The third issue, that is apparent in many emerging contexts, is that of its relation to the international development sector. Questions of who benefits and has the ownership over development arise when people and organizations from a very different part of the world brings in money and other resources to specific projects that often are based on a limited understanding of the reality.

Problem 3. Unsafe conditions for c-sections

Kolandoto Hospital has an operating theatre at the maternity department, which is closely connected to the delivery room. The theatre is supposed to be used for performing c-sections. However, the theatre is not in use due to that the hospital does not feel like it can guarantee the needed hygienic conditions for performing safe c-sections. Today, the pregnant mothers who are in delivery and need emergency c-sections have to be transported out of the building, and along an outdoor path to go into the general operating theatre.

Research questions

The overall research question is:

- In what roles can an architect's skills and knowledge be applied in a project about healthy hospital design in the international development sector?

In addition to that three sub-questions related to the sub-projects are formulated:

- How can a masterplan for Kolandoto Hospital support the access to appropriate healthcare in an healing environment free from factors causing illness or poor health?

- How can sustainable building techniques for a tropical climate be applied to a building design at Kolandoto Hospital?

- How is it possible to implement a good quality architectural intervention at Kolandoto Hospital during a two months study visit?

Methodology

The whole master thesis has been done through an immersive design process happening mainly on site in Kolandoto village in Tanzania. The three sub-projects have all been developed with the conceptual methodological steps of first diagnosing the current context, then dreaming of the future, then developing alternatives and consensus, and lastly defining a way forward (French, M.A. 2011). An overall method has been to work with the built environment in three different scales, and use the knowledge gained from working with one scale to the other scales. For example, the knowledge gained through supervising a construction process have informed the building design.

Some of the methods used include:

observations
literature research
interviews
discussions
meetings
workshops
strategy analysis
flow analysis
zoning analysis
sketching
site analysis
full scale testing
study visits

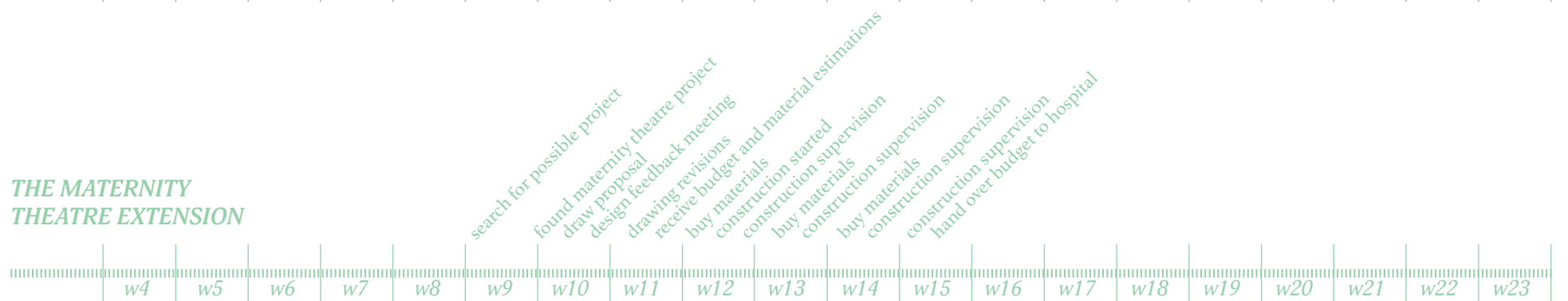
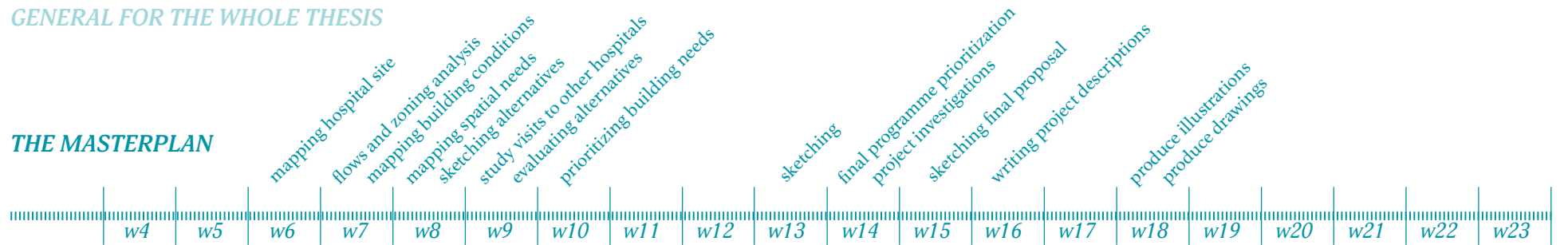
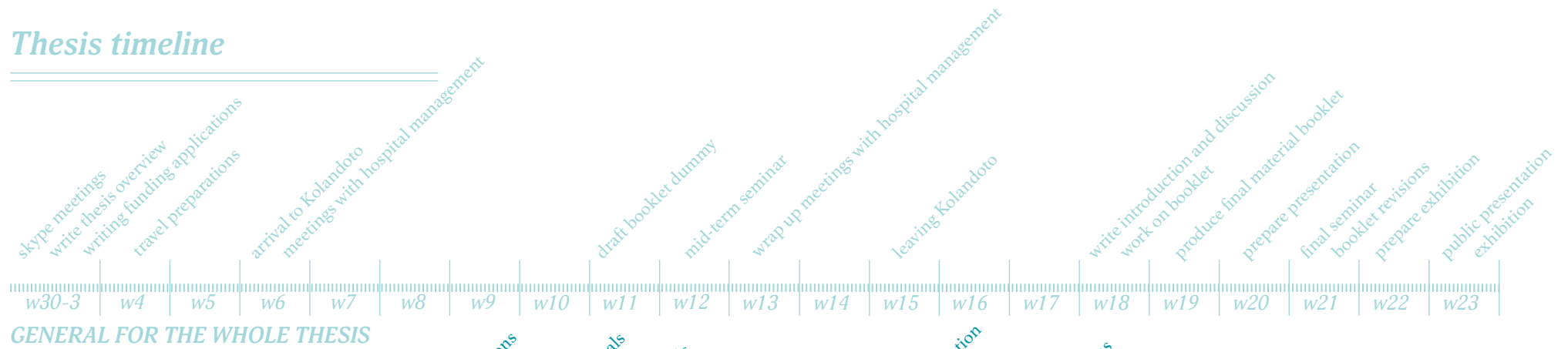
Delimitations

The master thesis is done with the point of departure of considering sustainable development in its broadest sense all through. That means that aspects such as local culture, economic feasibility, historic aspects have been thought of alongside of an environmentally friendly development.



The pathway outside the general ward.

Thesis timeline



1.2. TANZANIA, SHINYANGA AND KOLANDOTO

Location and quick facts

Tanzania



The largest city Dar es Salaam located by the coast to the Indian Ocean, and the capital Dodoma is located roughly in the middle of the country. The second largest city is Mwanza, situated along the shoreline of Lake Victoria in the northwest.

Shinyanga



Shinyanga region is one of 26 administrative regions in Tanzania and is situated in the northeast part of the country. It has a population around 1,5 million people. It takes about 2h to go to Shinyanga by car from Mwanza by Lake Victoria.

Kolandoto Village



Kolandoto Village is located 15 km from Shinyanga town, and around 150 km from Mwanza. The village is located in Shinyanga Urban District and has a population of about 10'000 people. The name comes from a tree that used to be green all year round.

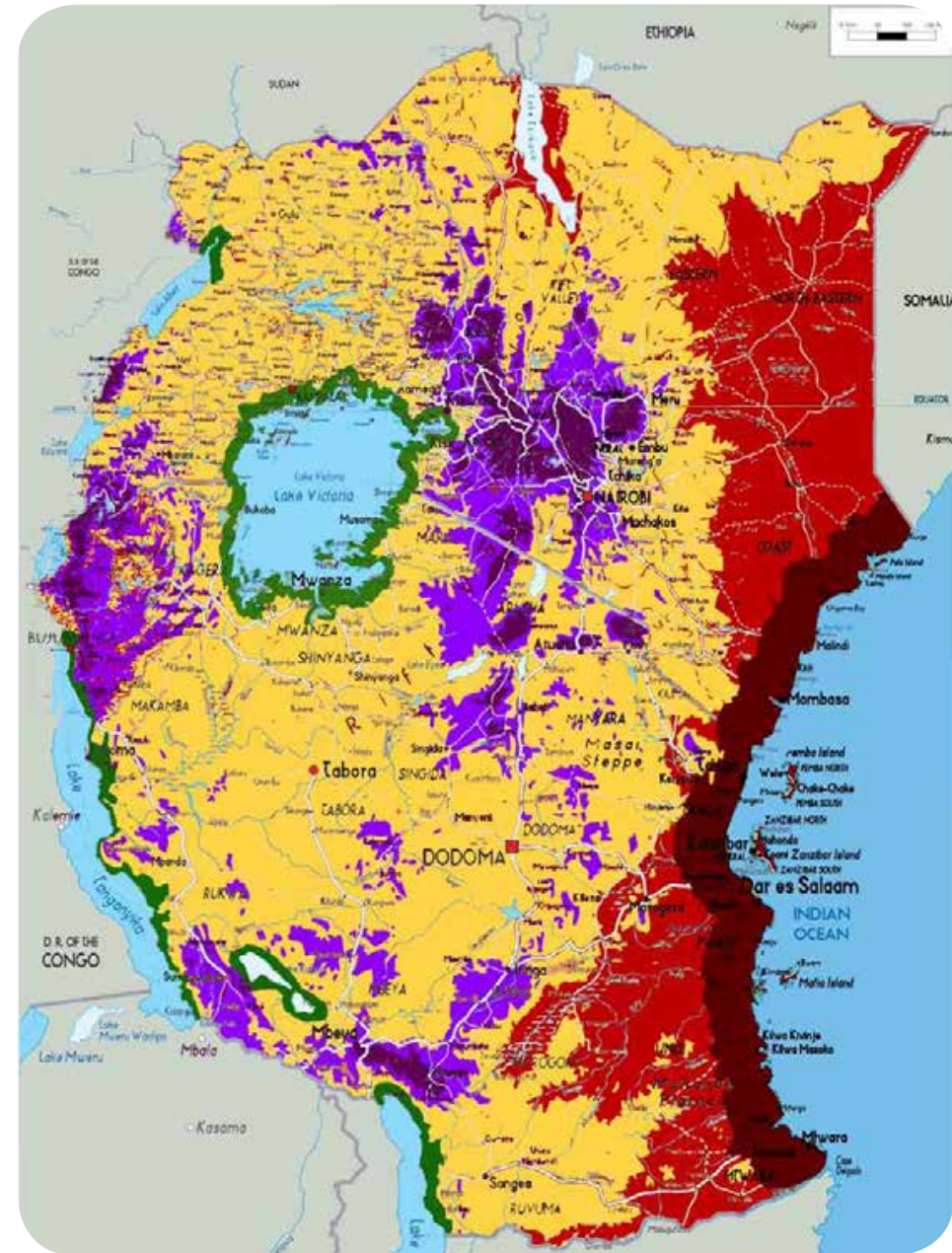
Climate

East africa

There are six different climatic zones within the tropical climate experienced in East Africa, seen in the map to the right. Shinyanga region and Kolandoto is located in the hot semi-arid / savannah zone. In this zone the mean air temperature range is 20-22 °C. In the warmest periods the temperatures are about 29-31 °C, but can rise to 33 °C in semi-arid areas. The mean relative humidity is about 65%, but it can go down to 40% in the savannah plains. The mean annual rainfall ranges from 500-750 mm in semi-arid areas, and 1000-1500 mm in savannah areas. (UN-Habitat 2015)

Shinyanga region

	min. temp in °C	max temp in °C	relative humidity at 6 am	relative humidity at noon	rainfall in mm
jan	19.1	30.7	75	47	37.8
feb	19.5	31.4	83	54	138.3
mar	19.3	30.0	83	56	98.1
apr	19.1	29.0	79	50	96.0
may	18.7	29.9	66	37	18.9
jun	17.7	29.9	63	32	5.7
jul	14.9	29.7	59	31	0.0
aug	17.9	31.1	57	29	20.9
sep	19.9	32.6	49	26	0.0
oct	21.33	33.2	57	32	27.3
nov	20.3	32.1	70	44	66.9
dec	19.7	29.3	73	44	191.0



■ hot-humid ■ hot-arid ■ high upland
■ hot-semi arid/savannah ■ upland ■ great lake

East Africa can be divided into six different climatic zones. (UN-Habitat 2015)

1.3 KOLANDOTO HOSPITAL

History of the hospital

Missionaries

In 1913 the hospital was started by the missionaries Doctor Nina Maynard and Rev. William Maynard from USA.

Latest major rehabilitation

The hospital has grown and changed at different times. The latest major rehabilitation of the hospital built environment was done in collaboration with some dutch NGOs in 1998. At that time the process started with the NGOs coming to Kolandoto to do an initial assessment of the conditions at the hospital. The NGOs decided to fund a major renovation. The renovation included that the usage of many buildings were adapted, all buildings were renovated and that some new buildings were constructed. The water supply system and electricity was expanded at the same time.

The hospital today

General information

Kolandoto Hospital is a private hospital run by the African Inland Church Tanzania (AICT). It has 168 beds and is also an educational hospital. Kolandoto Hospital provides health care services consisting of outpatient care, inpatient care, surgery, a special leprosarium, and an eye department for the whole region. In addition to those on site services it runs an outreach program with a mobile clinic going to different villages. The mobile clinic does vaccinations, health education and family planning.

In addition to Kolandoto Hospital, AICT also runs one more hospital, two health centers and 14 dispensaries. The AICT dispensaries only refer patients to the two hospitals run by AICT, but government dispensaries can refer patients to anywhere the patient wants.

Mission and vision

Mission:

To render affordable, quality and sustainable health services to the community through the love of Christ.

Vision:

To have sustainable health services that significantly contributes to more equitable, accessible health services to the community.

Wards

Wards	# of beds	Bed occupancy
Paediatrics ward	23	44.2 %
Private ward	17	34.6 %
Eye ward	35	44.1 %
Leprosarium	10	61.6 %
Male general ward	30	61.4 %
Female general ward	29	52.7 %
Maternity ward	24	48.6 %
TOTAL	168	49.4 %

Catchment population

Total population	14759
Under 1 year	466
Under 5 years	2834
Pregnant women	548
Family planning	2834
Women in bearing age	2834

The hospital in the future

A council designated hospital

The system of health care facilities in Tanzania is from smaller to larger: dispensary, health center, district hospital, regional hospital, and national referral hospital. Kolandoto Hospital is at the moment not in that system, since it is a hospital run by a faith based organization. However, a hospital at the district level is missing in Shinyanga Urban District, which Kolandoto Hospital is located within.

In 2010 Kolandoto Hospital and the Ministry of Health and Social Welfare signed an agreement for Kolandoto Hospital to become a Council Designated Hospital to fill that void in the health service system. The agreement says that the government agrees to support Kolandoto Hospital with paying staff salaries and some drugs and materials. The agreement also states what infrastructural improvements that Kolandoto Hospital has to do. The agreement is partially implemented at the moment. The government pays some staff and some the medication costs. Kolandoto Hospital has done some of the improvements stated in the agreement.

A full implementation of the agreement will have considerable effects for the health care provision to the communities in Shinyanga Urban District. The number of qualified staff at Kolandoto Hospital will increase. The patient fees will be lowered and hence an increase in number of patients is expected. This is especially the situation around maternity care and child health, since those two areas of healthcare should be provided almost for free in a government affiliated hospital.



Kolandoto Hospital.



View over the landscape that Kolandoto is set in.

2. THE MASTERPLAN

A story of a masterplan that defines the development at the hospital the next 10 years.

Annika Danielsson - June 2015

2.1. DIAGNOSING THE CURRENT CONTEXT

Starting point

The first point of departure for the collaborative development project was that Kolandoto Hospital needed to do something about its problems concerning water shortage and quality, and its unreliable power supply. But individuals involved would also like to have a more comprehensive overview and see more of the whole situation at the hospital, to create really sustainable solutions. The conclusion was to include an overview of the buildings and flows at the hospital, through teaming up with Architects without Borders as well. In June 2014 the three Swedish NGOs started looking for engineering and architecture master thesis students who could be part of the project. That is when I got in contact with them. At the time I was living in Nairobi, Kenya, and decided to go to visit Kolandoto Hospital for a week. During that week I got an initial overview of the hospital, the buildings, the water system, the electricity situation, and problems that the hospital faced. It was compiled into a Visit Report (Danielsson 2014) that then became the starting point for discussions around creating a masterplan for the hospital.

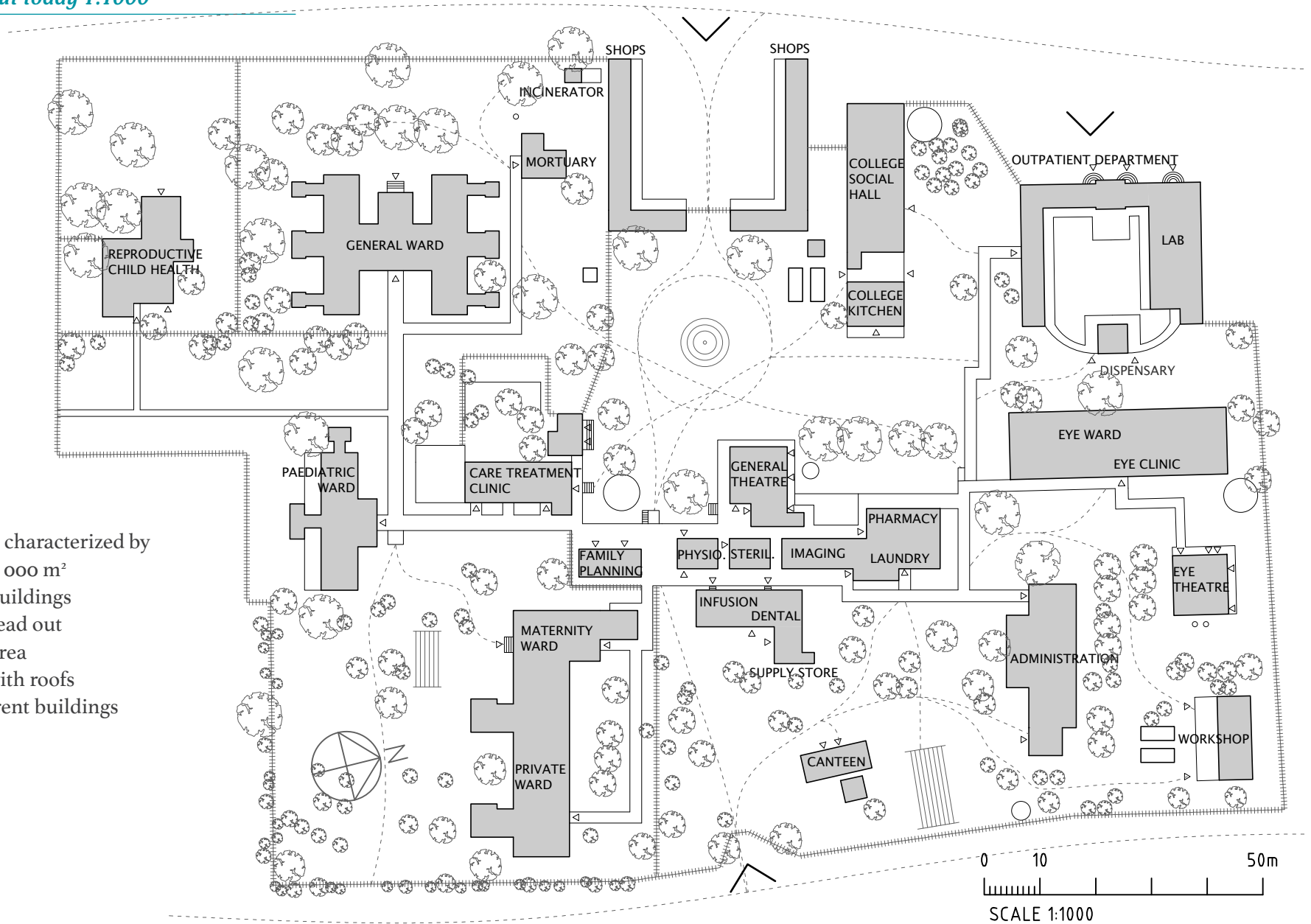


View from the main entrance to Kolandoto Hospital.

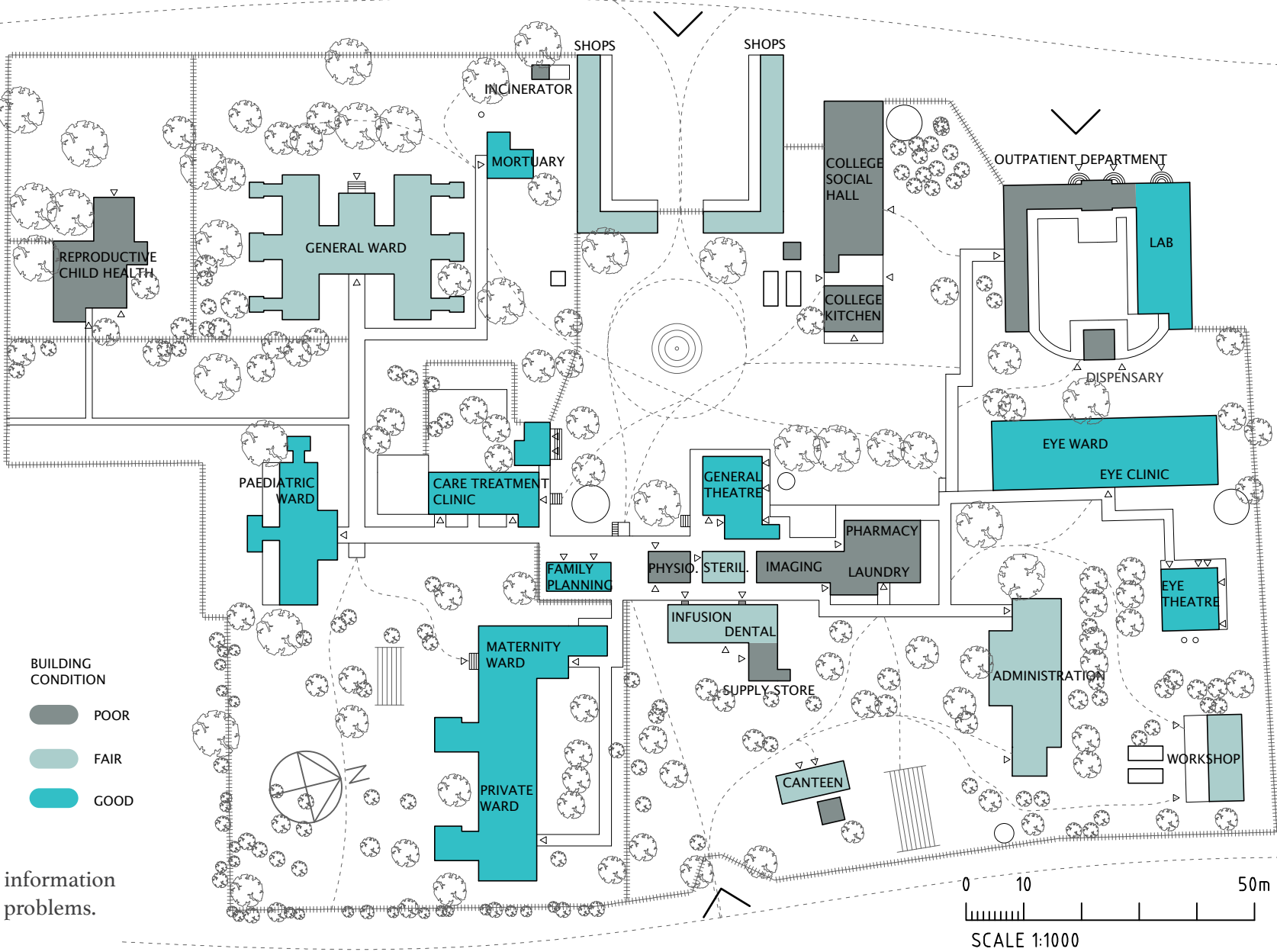
Mapping of the site

The hospital layout today 1:1000

- The hospital site is characterized by
- approximately 27 000 m²
 - only one storey buildings
 - buildings are spread out
 - a lot of outdoor area
 - outdoors paths with roofs connect the different buildings



State of buildings analysis



See appendix XI for more information on the buildings and their problems.



The outpatient building has a unique design.



The reproductive child health clinic.



The pharmacy building is one of the oldest.



The infusion unit is in the old administration.



The administration used to be a paediatric ward.



The social hall for the students at the college.



The general theatre building.

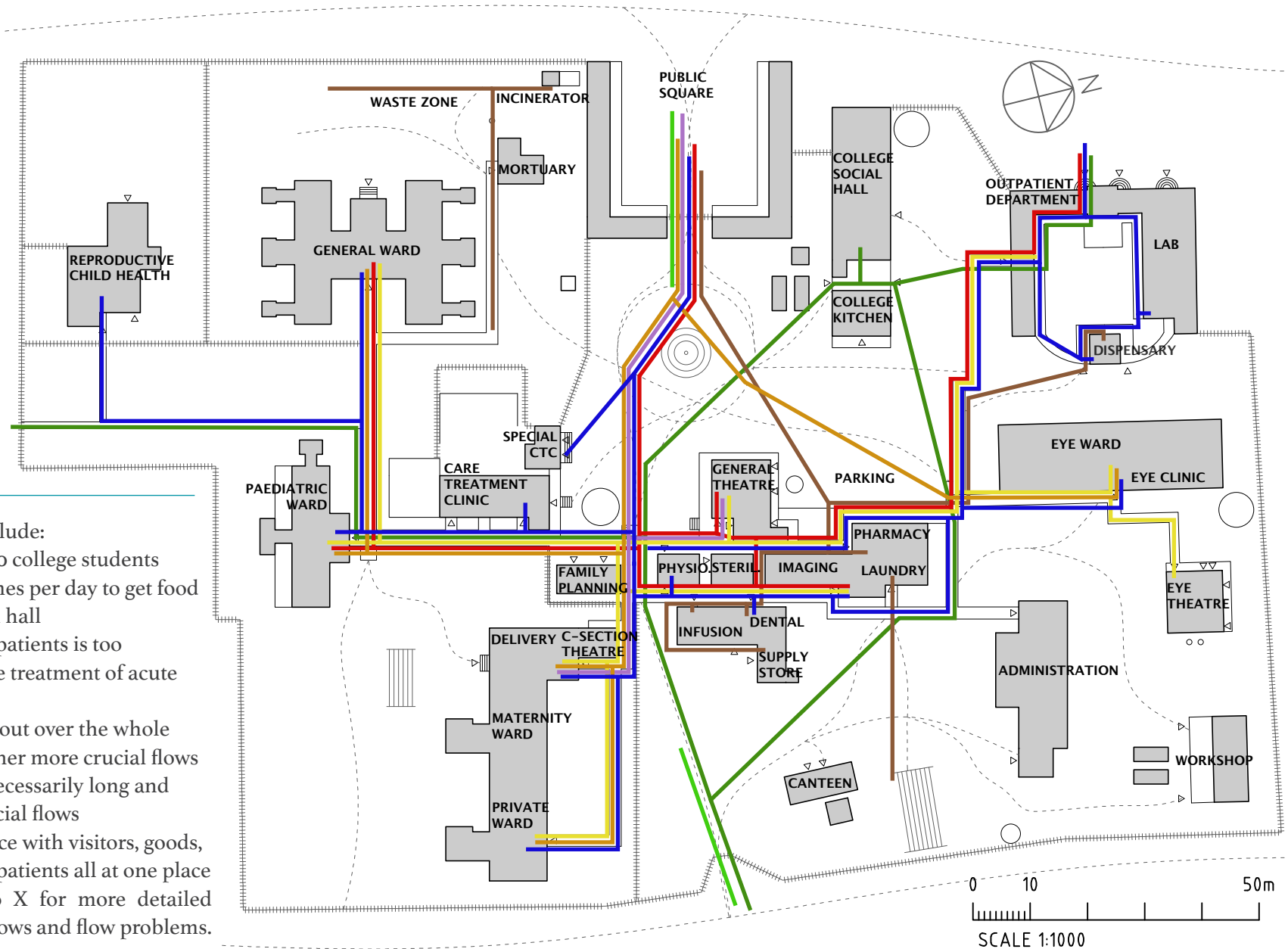


The pathway leading to the general ward entrance.



The maternity building.

Flows analysis

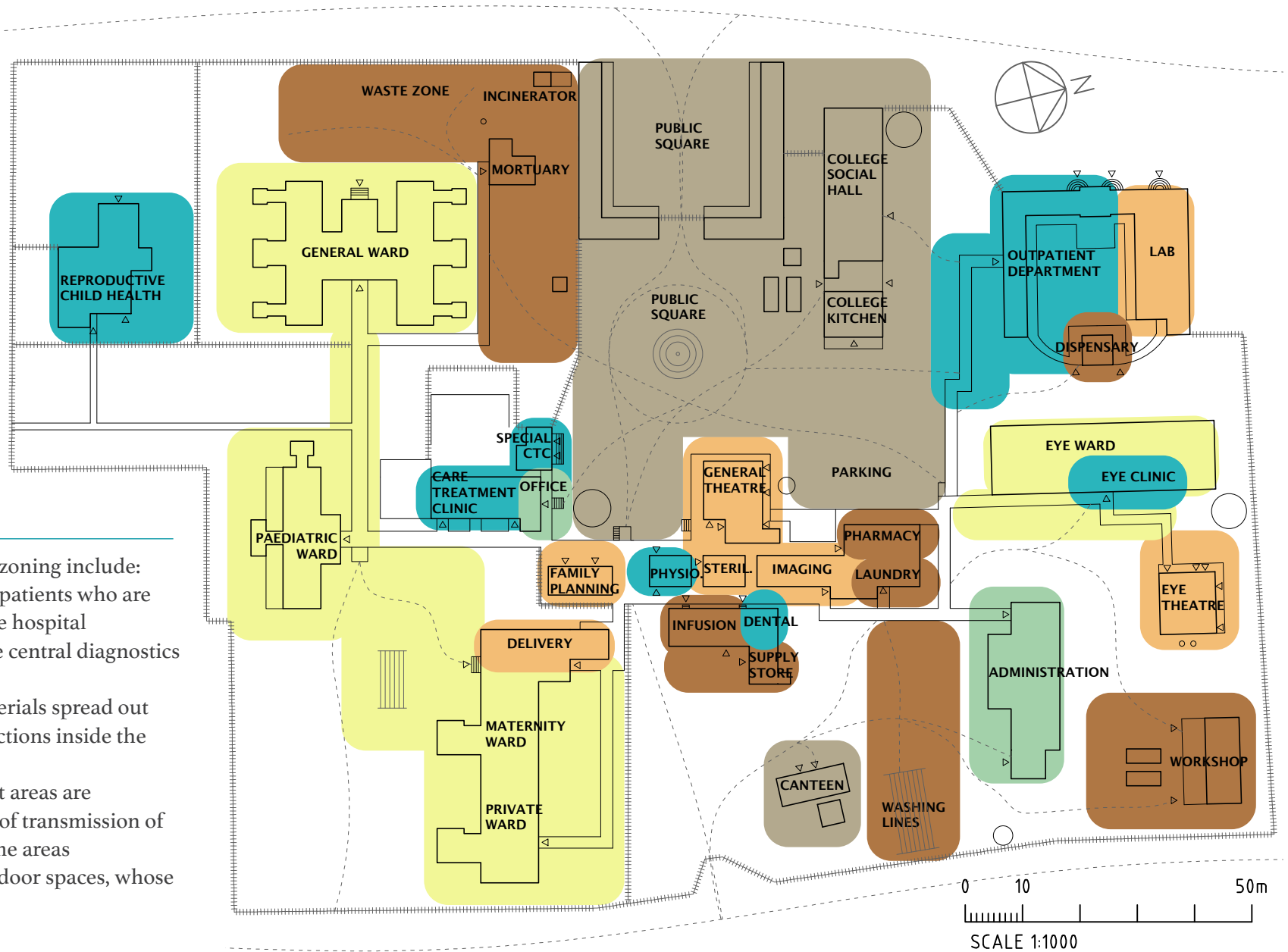


Flows today 1.1000

Issues with the flows include:

- unnecessary flow of 500 college students passing the site three times per day to get food in the kitchen and social hall
- the emergency flow of patients is too inefficient and delays the treatment of acute patients
- outpatient flow spread out over the whole hospital and crossing other more crucial flows
- the visitors flow is unnecessarily long and crossing other more crucial flows
- congested main entrance with visitors, goods, outpatients, emergency patients all at one place
- See appendix VI to X for more detailed information about the flows and flow problems.

Zoning analysis



Zoning today 1.1000

- Issues with the functional zoning include:
- poor wayfinding for outpatients who are spread out over the whole hospital
 - easy public access to the central diagnostics and treatment functions
 - support, goods and materials spread out
 - unnecessary public functions inside the hospital site
 - inpatient and outpatient areas are overlapping causing risk of transmission of infectious diseases in some areas
 - plenty of undefined outdoor spaces, whose potential is not used

Analysis of water, sewage and electricity

The illustration contains rough estimations on where the water lines, the water tanks, the electricity lines, and the septic tanks are located at the hospital.

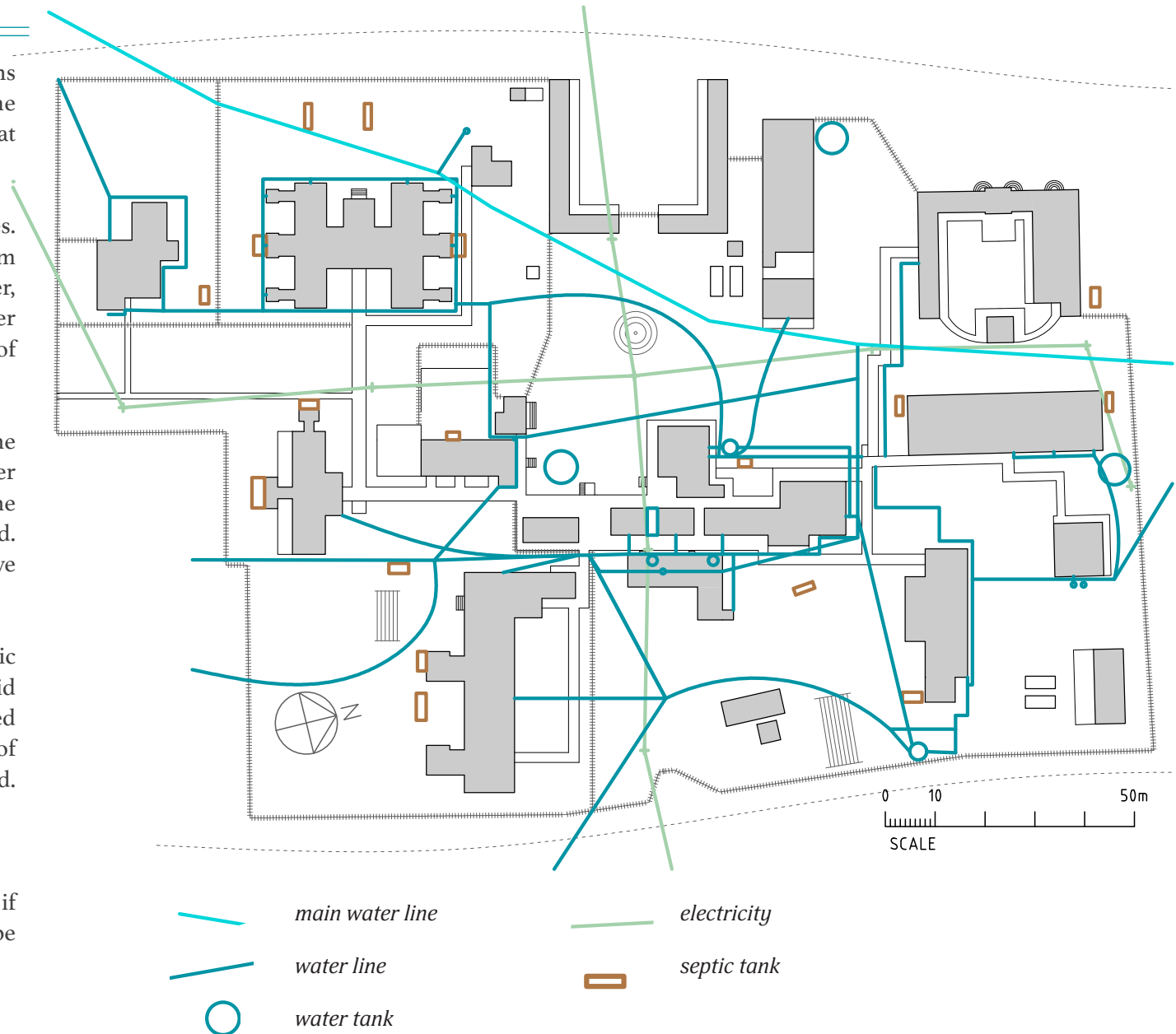
The hospital receives its water from two sources. The main source is a borehole located about 1 km away from the site. The second source is rainwater, which is collected on some of the roofs. The water is distributed to the hospital through a system of water tanks and water lines.

The hospital receives its electricity from the national power grid by TANESCO. There are power cuts approximately 2 days per week, and then the generator is running to cover the electricity need. The distribution system within the hospital is above ground.

The solids in the sewage is taken care of in septic tanks spread out in the hospital, and the liquid waste then goes underground to an infiltration bed located on the other side of the road just west of the hospital site. The sewage system is not mapped.

Conclusions:

- avoid building on top of main water line
- consider that it will be more expensive to build if the water, electricity or sewage systems have to be moved
- avoid building on top of septic tanks in use



Weather and climate analysis

Kolandoto Hospital is in the semi-arid / savannah climatic zone.



Wind: The prevailing wind direction is from east to west. There are enhanced wind situations in the narrow corridors around the sterilization, imaging and physiotherapy.



Sun paths: The sun goes west to east, with a few degree to north since it is south of the eqator. It stands high between 8 am to 6 pm and rises and sets fairly fast.



Stormwater: The whole site has a slight slope towards the west. Hence the direction of storm water flowing on the ground is towards the west as well. This sometimes results in that the soil by the entrance is moved with the large amounts of water, and that there is a need to add new soil at times.



Vegetation and microclimate: Vegetation lowers the perceived temperature quite a bit, and hence a lot of people often want to sit under trees or close to other vegetation.



Rainfall: The rainy season is from November to April, with a peaks in December and February when it can be up to 190 mm of rain in one month. The dry season is between May to October. Some rain might come, but it could also be almost no rain July to September.

Temperatures: The average maximum temperature for each month varies between 29-33 °C. The average mimimun temperature for each month varies between 15-21 °C.

2.2. DREAMING OF THE FUTURE

Vision

In 2025 Kolandoto Hospital provides equitable and accessible health care services to the communities in the catchment area in a pleasant and healing environment that is free from factors causing illness or poor health. The hospital site is well organized with clear circulation and flows, appropriate zoning, and well defined outdoor spaces. The organization for the site is adapted to the local climate to provide good conditions for both pleasant and comfortable indoor and outdoor spaces. The health care services are expanded and provided in high quality buildings that apply sustainable building techniques for the local climate. Well planned renovation projects, retrofitting projects and new construction projects have taken place step by step during 10 years. The hospital has been in control of this development and has the tools to continue steer the future development of the facilities as well. As part of the process, Kolandoto Hospital fully became a Council Designated Hospital in 2020.



Participants discussing at the programming workshop.

Programming workshop

I held a workshop with the head of departments at the hospital in which they through a stepwise process got to discuss and list down the hospital's needs in terms of buildings/rooms/functions during the next 10 years. The outcomes from the workshop are: 1) a comprehensive list with building/room/function needs for the next ten years including justifications for each need, 2) a map with suggestions from the staff in terms of placement of the different needs on the hospital site (appendix I). Below is a summary of the building/room/function needs expressed during the workshop.

Diagnostics and treatment

- separate minor theatre from major
- extend maternity theatre
- casualty unit
- recovery room at the theatre
- extend general theatre
- waiting space for laboratory department
- extend general theatre with sluice room
- separate water supply to the minor theatre
- connect the OT and the CSR buildings
- family planning
- modernize CSR
- labour room with 4-6 delivery beds

Support, goods and materials

- kitchen
- extend mortuary
- new modern main store / pharmacy

Outpatient areas

- expand OPD: room for doctors, waiting room, registration
- minor theatre at OPD
- eye OPD
- extend RCH: immunization, post natal exam, waiting area
- move RCH closer to OPD
- waiting bay for patients

Wards

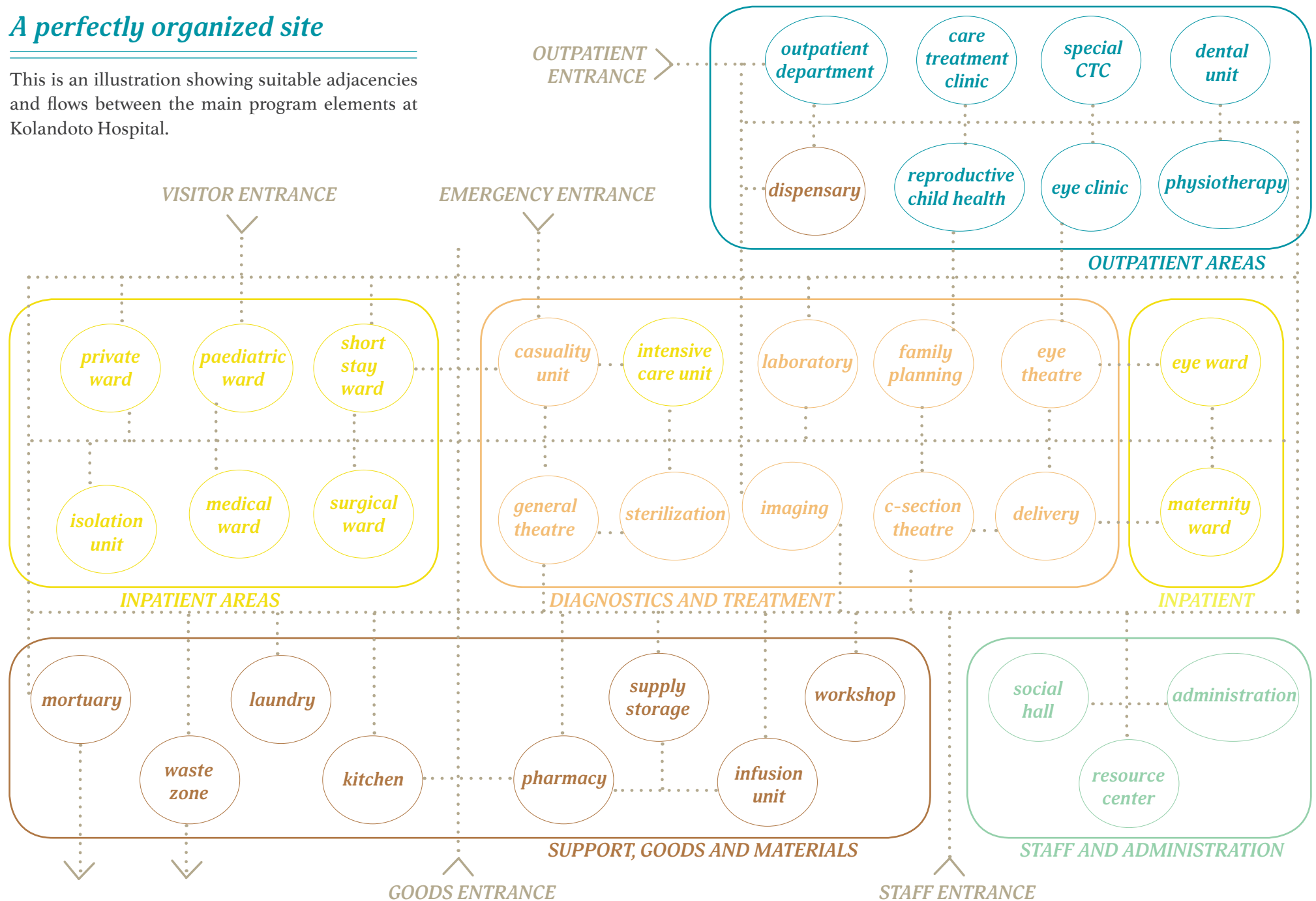
- ICU
- extend paediatric ward
- extend maternity ward
- place for patients to eat outside general ward
- renovate isolation rooms in general ward
- add office room for pediatric ward
- new leprosy ward
- room for children at eye ward
- new general ward
- playground
- new private ward
- malnutrition room in pediatric ward

Staff and administration

- social welfare office
- resource center
- social hall
- resting room for doctors, clinicians and lab technicians on call
- administration office
- reception at the entrance

A perfectly organized site

This is an illustration showing suitable adjacencies and flows between the main program elements at Kolandoto Hospital.



The right to health principles

The right to health includes the access to appropriate healthcare over time, provided in a healing environment free from factors causing illness or injuries. To incorporate the right to health in the overall design of Kolandoto Hospital some principles on this topic have been formulated here.

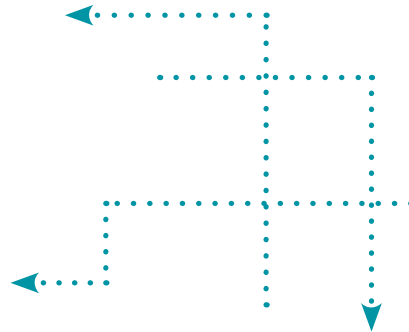
Flows and circulation

” Separate different types of flows to decrease the risk of medical errors and nosocomial infections. ”

Site circulation and flows of patients, staff, materials and visitors across the hospital area plays an important part in making sure the hospital is an environment that does not cause illnesses or poor health. Appropriately designed flows will decrease the risk of medical errors and nosocomial infections or diseases (WHO 2002), and it will also improve the wayfinding for patients and visitors. Access to the site for different types of flows also need to be considered.

Flows to consider include:

- emergency care
- inpatients
- outpatients
- delivery
- visitors
- staff
- students
- goods and material



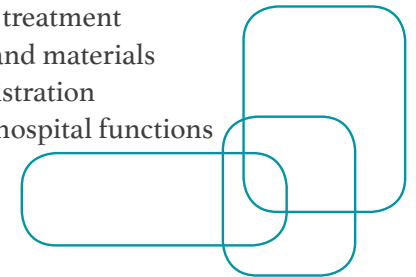
Functional zoning

” Differentiate between different categories of functions to provide healing and safe environments. ”

Functional zoning in masterplanning divides the site so that public areas are easy to reach and areas requiring privacy or clinical isolation are restricted (MASS Design Group 2013) Zoning could be a tool to control the flows through a hospital and control the feel and cleanliness of areas and spaces. Different types of functions have different needs. In a masterplan layout one could strive to differentiate between different types of functions in zones. The justification is to decrease the risk of transmission of communicable diseases and nosocomial infections, to safeguard the security and safety of patients, to differentiate between non-sterile spaces and sterile spaces, to ensure appropriate privacy to patients, to create an environment that minimizes room for errors, to ensure a good healing environment for patients, and to ensure a good working environment for the staff.

Six different types of functions within the hospital have been identified and categorized into zones:

- Inpatient areas
- Outpatient areas
- Diagnostics and treatment
- Support, goods and materials
- Staff and administration
- Public and non-hospital functions



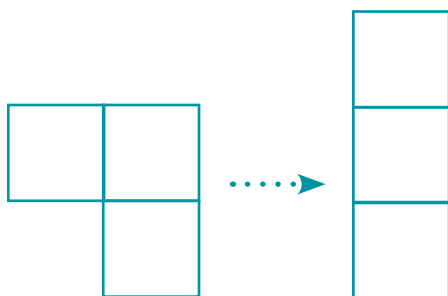
Future proofing

” Plan for uncertainty and design for change since healthcare philosophies and technologies change fast. ”

The healthcare building facilities constructed in a certain period will most probably be used under circumstances that were unpredictable during the time of planning and construction since the type of health care needed, the philosophies around health care provision, alongside with technological development in health care, constantly are changing. Hence, it is important to plan for uncertainty and design for change when building a hospital (Francis 2007).

There are three core concepts connected to future proofing that should be considered:

- Flexibility: the possibility for space to change
- Generality: the possible use/functions of spaces to be widespread, not only specific
- Elasticity: the ability of space to swell and contract according to need



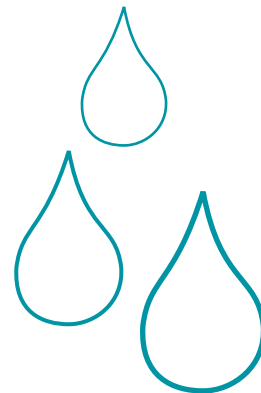
Water and sanitation

” Consider flows of water and waste when planning a hospital, since those can cause illness if treated poorly. ”

Some of the more obvious factors that can cause illnesses at a hospital are solid waste, water, wastewater, and storm water. Solid waste and wastewater that is not handled properly might cause illnesses or infections. A lack of water immediately reduces the possibility of keeping good hygienic conditions for health care. Storm water or wastewater that become stagnant are good breeding grounds for mosquitoes and increases the risk of contracting malaria.

Hence some of the topics to consider in a master plan are the location, flow and treatment of:

- water sources and distribution system
- stagnant water
- waste water
- storm water
- solid waste
- biological waste
- dirty equipment
- dirty linen



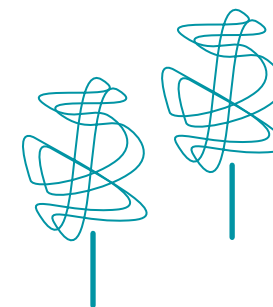
Healing design

” Design clear spaces with access to nature and positive distractions adapted to local culture. ”

Hospitals are areas for healing. The design of the physical environment of healthcare facilities can affect safety and satisfaction of patients and staff, as well as quality and costs of the healthcare (Clancy 2008, Sadler et al 2011). Evidence based design (EBD) explores what design features of a building that can improve the healing process of patients as well as prevent patients and staff from getting injured or ill from being at hospitals.

Some aspects to consider for the hospital as a healing environment include:

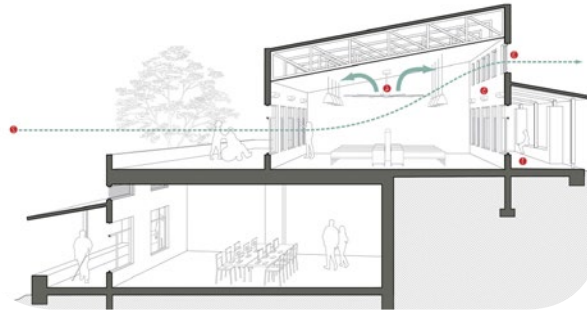
- Way-finding
- Cultural sensitivity
- Patient privacy
- Positive distractions
- Nature
- Accessibility
- Natural lighting
- Acoustics
- Natural ventilation (Mkony 2009)



Reference examples

Butaro District Hospital

The Butaro District Hospital on a hilltop in a rural district of Rwanda was finished in 2011. With its 140 beds and services in maternity health, internal medicine, surgery and pediatrics it now provides healthcare to the region's 340,000 inhabitants. The architect is MASS Design Group who through an immersive work process in the field, and in collaboration with the Rwandan Ministry of Health and Partners in Health, designed a state of the art facility as well as designed a construction process in which only local workers were employed and trained in the necessary skills to build the hospital. The hospital is specifically designed to mitigate and reduce transmission of airborne diseases such as for example tuberculosis, through its overall layout, patient and staff flows, and natural ventilation. (MASS Design Group. Butaro Hospital / MASS Design Group 2011. Cary, J. and Martin, C. E. 2012. Butaro Hospital 2011.)



A section. (c) MASS Design Group



The beds in the wards are turned towards the views.
(c) Iwan Baan

Mpongwe Mission Hospital in Zambia

The project of developing a masterplan for the Mpongwe Mission Hospital in Zambia is a good reference of a similar project to this one. With the aim of creating a masterplan that can guide the development and also be of help in resource mobilization and prioritization. The project was done in collaboration with White architects in Sweden. (Caira 2011)



A nice booklet with the masterplan was produced.



The site is located on a hill with beautiful views.
(c) Iwan Baan



There are clear signs in the central courtyard.
(c) MASS Design Group



The masterplan defines flows and new building projects.

Shinyanga Regional Hospital

A study visit to Shinyanga Regional Hospital, the referral hospital for Kolandoto Hospital 15 km from Kolandoto, was made to get a feeling for hospitals in general in the local context of western Tanzania. This helped the process for example through getting a better understanding of what staff meant when talking about new planned services such as a casualty unit and an intensive care unit.



The waiting area at the outpatient department.



The outdoor walkways at Shinyanga Regional Hospital.



An inpatient ward.



The main room in the intensive care unit.



An outdoor walkway at Mwadui Hospital.



An examination room.

2.3. DEVELOPING ALTERNATIVES AND CONSENSUS

Site layout scenarios

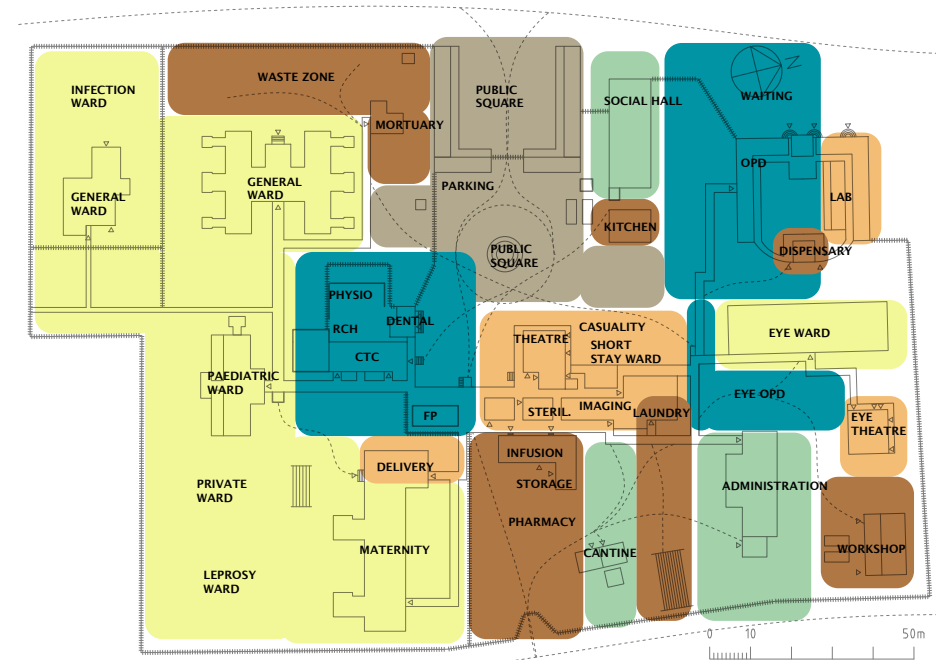
Five different site layout alternatives was developed to be able to analyse the context and what changes to the built environment that would be economically and culturally feasible to suggest. Three of the scenarios are roughly explained here. The scenarios was presented to and discussed with the medical officer in charge.

The following conclusions were made based on the discussion:

- avoid moving functions that are working well and have been renovated recently
- try to collect the outpatient areas
- assess the need for a building project against the level of investment
- very well justified larger investments are feasible if they make it possible to reach the level of care
- investments need to be medically justified
- larger investments are feasible if they are medically justified in a clear way

"Keep as much as possible"

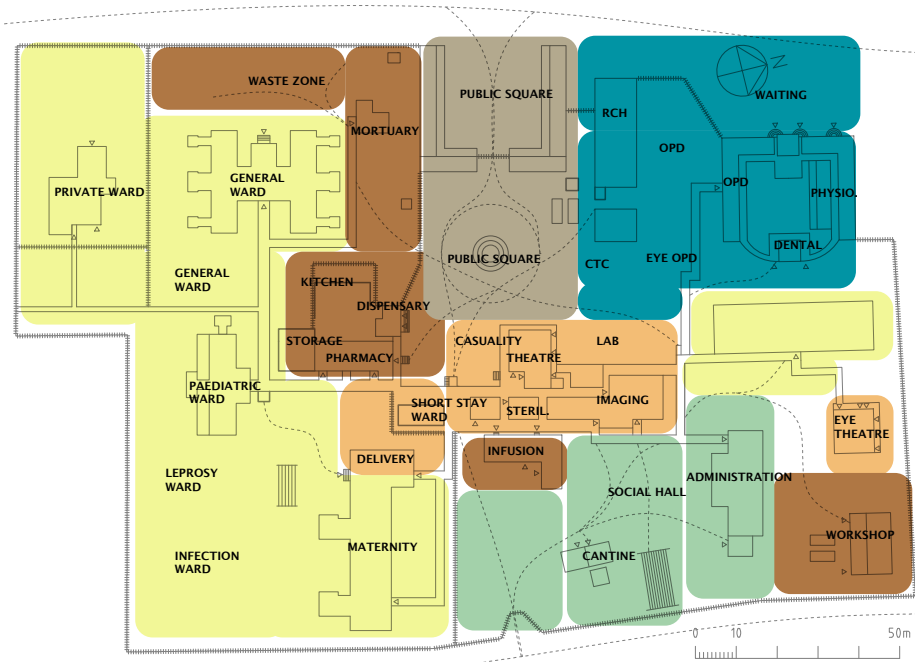
In this alternative the buildings for social hall and kitchen keep their function but are used for the hospital instead of the college. In addition, functions like the care treatment clinic, the lab and the canteen are kept in their current places. The only large department that is moved is the reproductive child health clinic. Otherwise the large investments are on new functions and buildings.



"Collect all outpatient areas"

In this alternative all the outpatient areas are moved to the same area. The diagnostics and treatment functions of lab and imaging are placed in between the outpatient area and the rest of the diagnostics and treatment. The logistical spaces for medical supplies and drugs are also all collected in one area in between the delivery point through the public square, the large inpatient areas and the diagnostics and treatment areas.

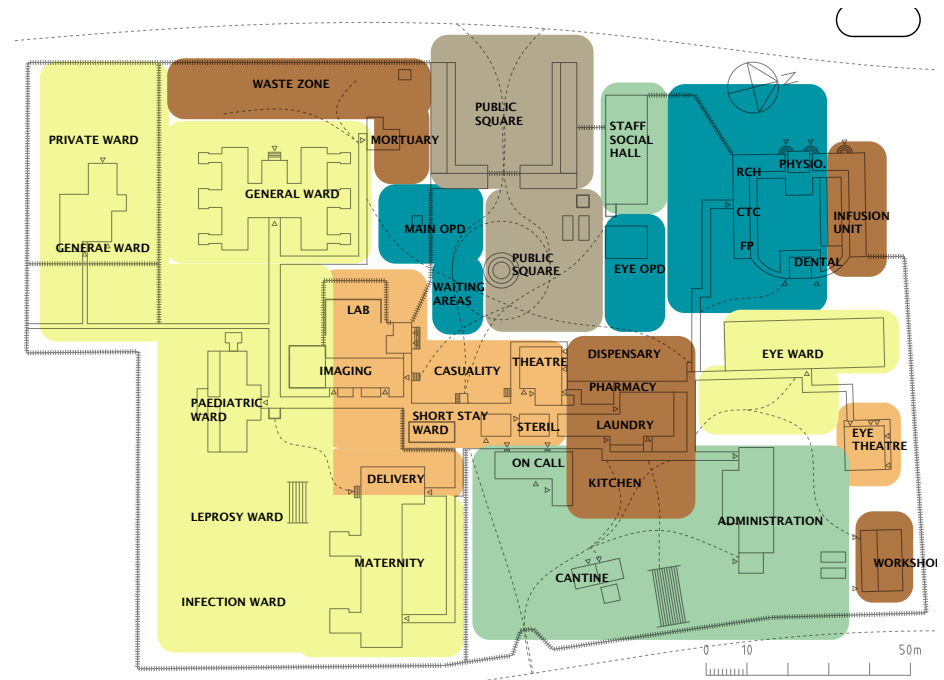
- INPATIENT
- OUTPATIENT
- DIAGNOSTICS & TREATMENT
- SUPPORT, GOODS AND MATERIALS
- PUBLIC AND NON-HOSPITAL FUNCTIONS
- STAFF AND ADMINISTRATION



"Big investments allowed"

In this alternative many of the functions have been allowed to move. There is a large waiting area by the public square. On one side of it is the new main outpatient department, and on the other side is the casualty unit which is closely connected to the new lab, the new imaging, and the general theatre. The clinic functions move in to the current outpatient department building instead.

- INPATIENT
- OUTPATIENT
- DIAGNOSTICS & TREATMENT
- SUPPORT, GOODS AND MATERIALS
- PUBLIC AND NON-HOSPITAL FUNCTIONS
- STAFF AND ADMINISTRATION



Priorities within different types of projects

A meeting with some of the management staff at the hospital was held to identify priorities among the needs for buildings/rooms/functions that were identified in the programming workshop. In the meeting the flow analysis and the zoning analysis was presented. After that the programme summary list produced during the programming workshop was presented and discussed. The staff were asked to prioritize within certain categories of function needs. 1 being the highest priority to 5 being the lowest priority. The outcome is presented here.



Participants reflecting before the discussion started.

Diagnostics and treatment

1. casualty unit: for emergency cases and night time
2. extend maternity theatre
3. labour room with 4-6 delivery beds
4. extend general theatre: recovery room, sluice, separate scrub and water supply for minor theatre, connect to sterilization room,
- x. family planning is already under construction

Outpatient areas

1. eye OPD
1. waiting bay for patients: both outside OPD and inside OPD
2. move RCH closer to OPD, and extend it with immunization room, post natal exam, and waiting area
3. surgical room at OPD: for minor injuries, bruises, cuts etc
4. expand OPD: widen doors for accessibility of stretchers, room for doctors, registration room,
5. Parking at OPD: for both staff and visitors, safety is important

Support, goods and materials

1. extend mortuary
2. new modern pharmacy
3. kitchen
4. cement floor under the washing lines for laundry

Wards

1. extend maternity ward
1. new private ward
1. room for children at the eye ward (will happen when the eye OPD is built)
2. extend paediatric ward: more beds, malnutrition room, playroom, office
3. general ward: build one new which is for medical male and female, include proper isolation rooms with separate toilets in the new building, renovate the existing general ward to only be for surgical male and female, include extension of the existing one for area for leprosy patients,
4. ICU
5. place for where visitors/relatives can meet the patients who are mobile, recreation/dining room/ space for patients

Staff and administration

1. on call room for doctors, clinicians and lab technicians
2. social welfare office
3. resource center
4. social hall
5. new layout for the OiC in the administration office

Priorities within different sizes of projects

After the prioritization meeting with the staff, it became evident that another type of prioritization was needed as well - a prioritization based on the size and investment level of the projects instead of the type of the projects. A reorganized list including all the 'larger' and 'smaller' building intervention projects was made and given to the medical officer in charge who together with some staff filled in the priorities with this new division of larger and smaller. The outcome is presented here.

Larger projects

1. new eye OPD (see section 3 in this thesis)
1. build casualty unit
2. new private ward
2. extend maternity ward + labour room 4-6 beds
3. new pharmacy
4. new general ward and renovate and reorganize the current one
5. extend general theatre
6. extend paediatric ward
7. renovate and reorganize OPD
8. new RCH closer to OPD
9. build resource center
10. build social hall
11. build ICU

The kitchen as a project was forgotten on the list and is hence not in there at this stage in the process.

Smaller projects

smaller:

1. separate children's room at the eye ward (happens when the eye OPD is built)
1. extend maternity theatre (see section 4 in this thesis)
2. extend mortuary
2. waiting bays for patients, both inside and outside OPD
3. new layout for OiC in the administration
4. cement floor under the washing lines
5. recreational area outdoor for general ward patients (appendix IV)
5. new signs by the site entrances
6. parking for staff and visitors outside OPD
6. new public path (appendix III)
6. buy ISSB machine
7. widen x-ray doors (appendix V)
8. social welfare office

2.4. DEFINING A WAY FORWARD

A masterplan for people's health

” Kolandoto Hospital masterplan supports the access to appropriate healthcare in a healing environment free from factors causing illness or injuries. ”

Access to appropriate healthcare

This masterplan with agreed priorities and medical justifications can be used for resource prioritization and mobilization to implement some of the needed building projects to deliver appropriate healthcare services to the surrounding communities.

A healing environment

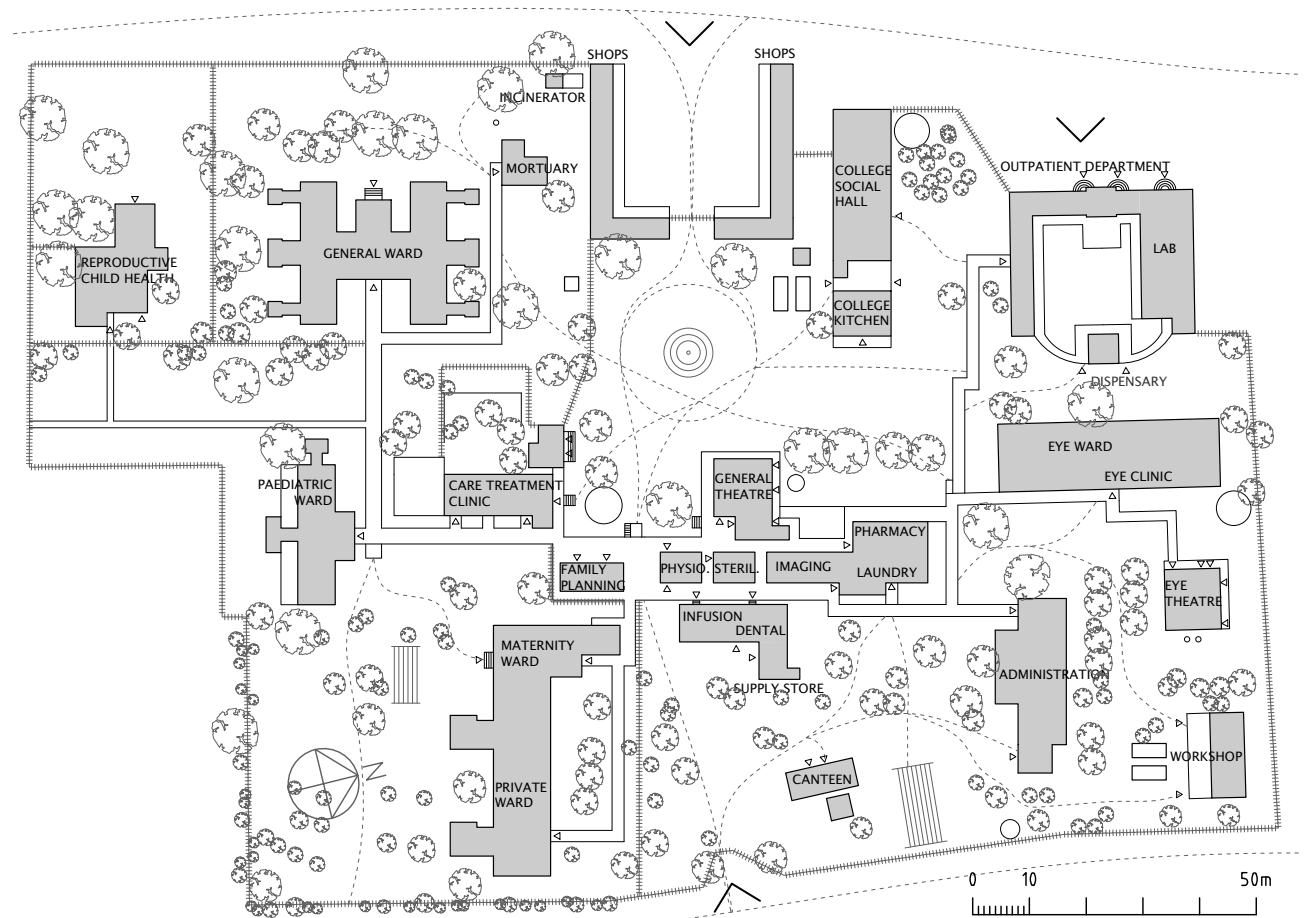
This masterplan improves the healing environment through being adapted to local culture and traditions, through defining outdoor spaces so they can be designed and part of a healing natural environment, and through improving wayfinding for patients and relatives to have less stressful experiences at the hospital.

Free from factors causing illness or injuries

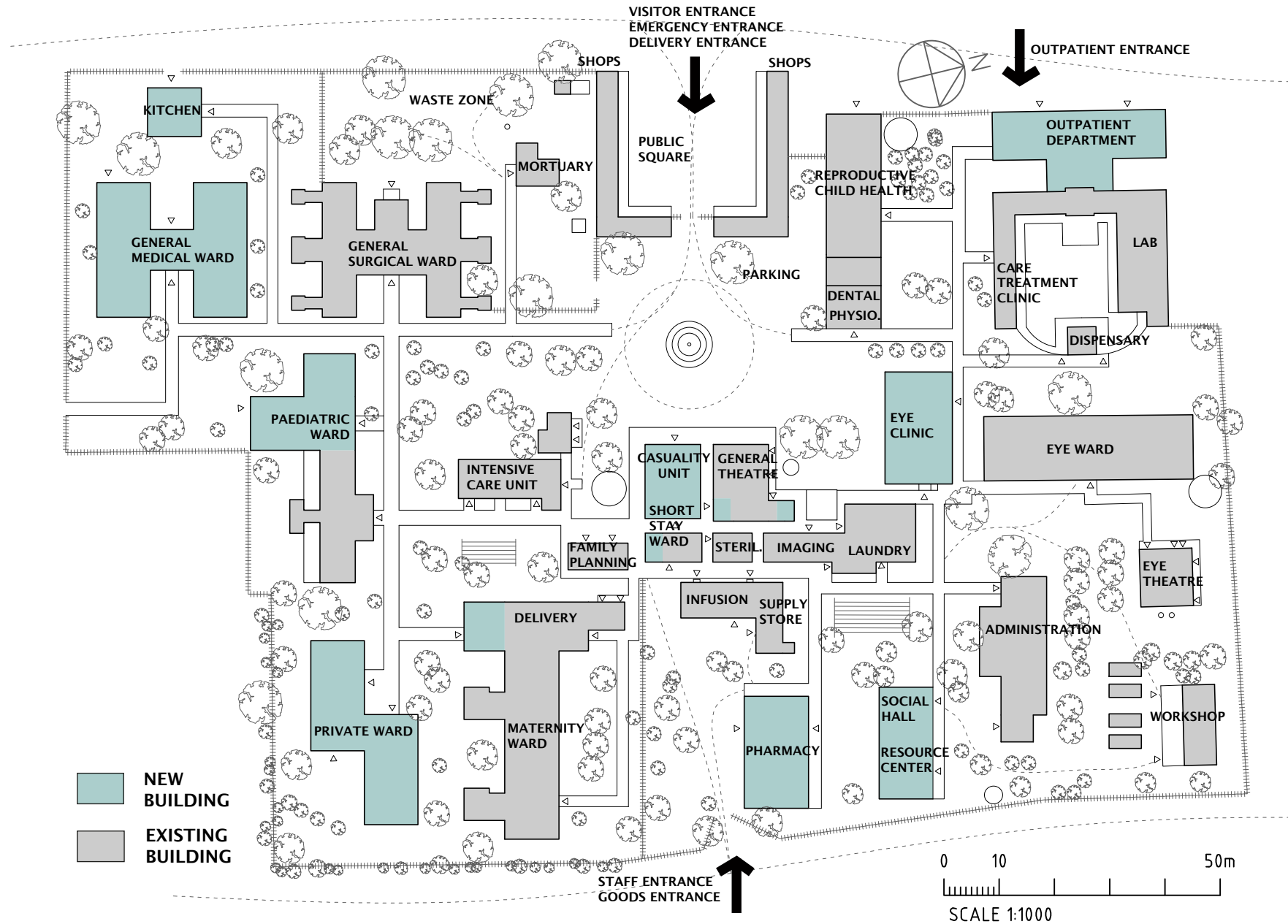
This masterplan tries to counteract factors causing illness or injuries through designing functional zoning and flows of patients, staff, material and air throughout the hospital area. The aim is to minimize dangerous delays in service delivery, to reduce the chances of mistakes, and to eliminate congestion and crossing of flows that can cause infections.

Site plan proposal

Existing site plan

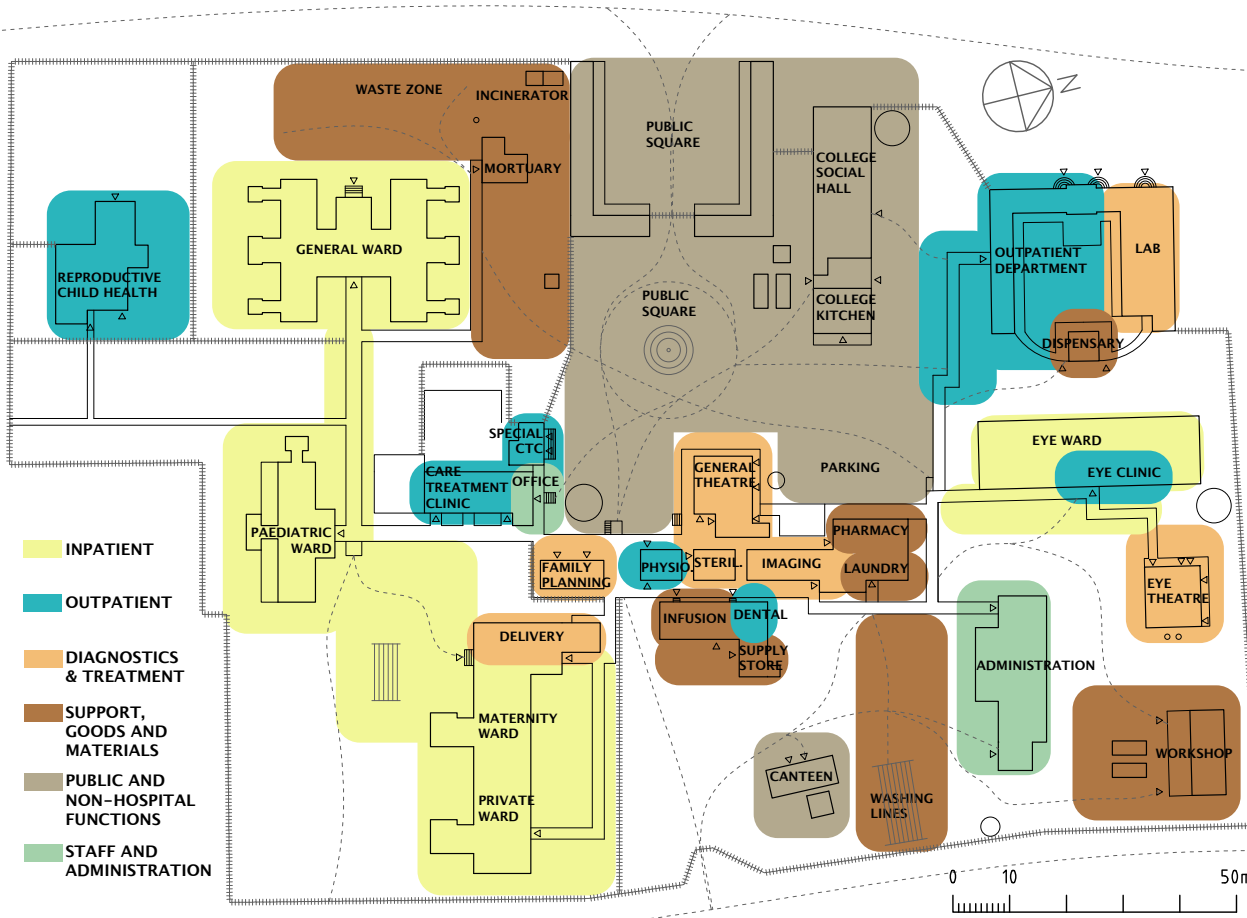


Site plan in the future 1:1000



Zoning plan proposal

Existing zoning plan

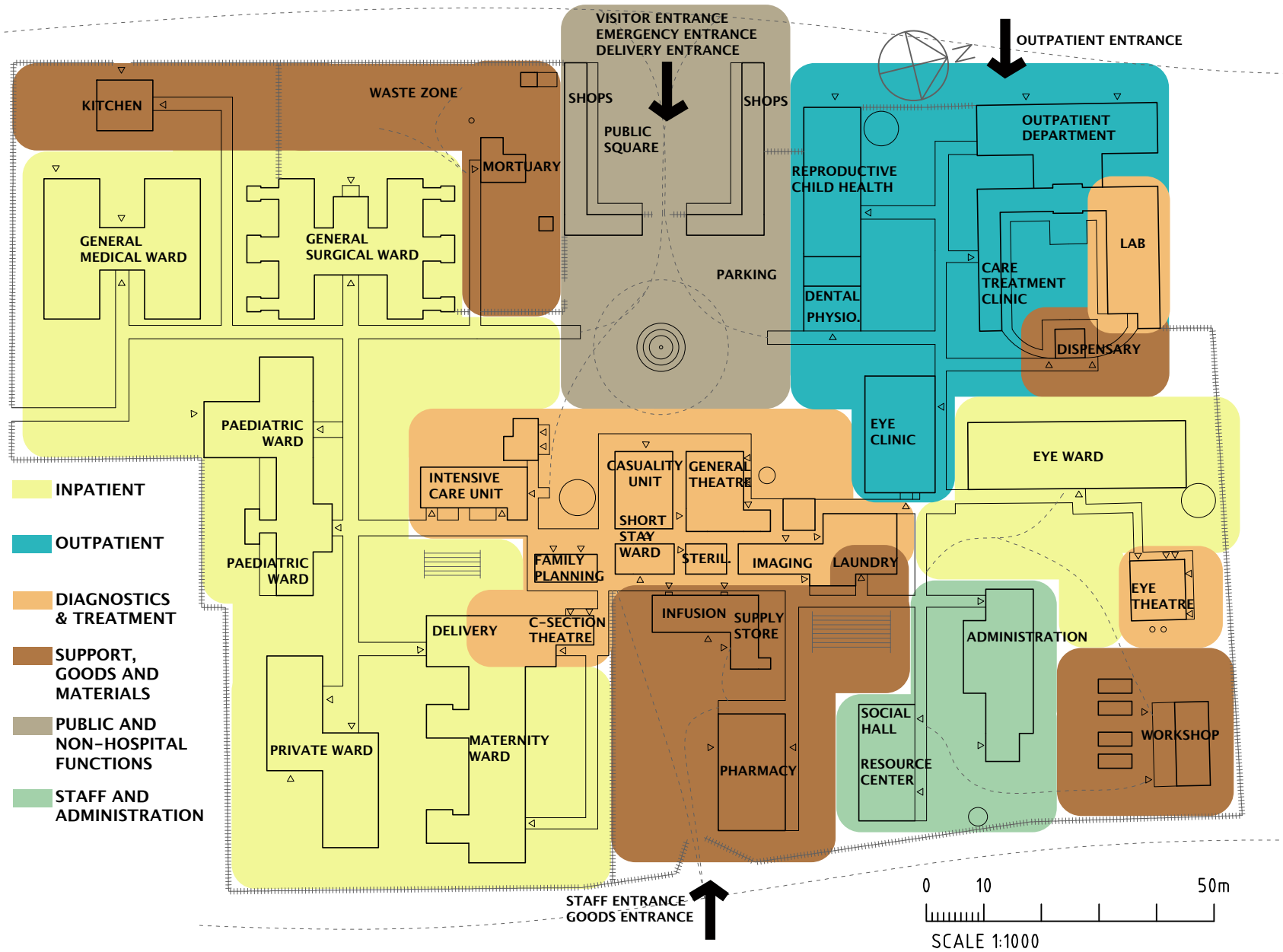


Main differences

The main differences between the zoning today and in the future are:

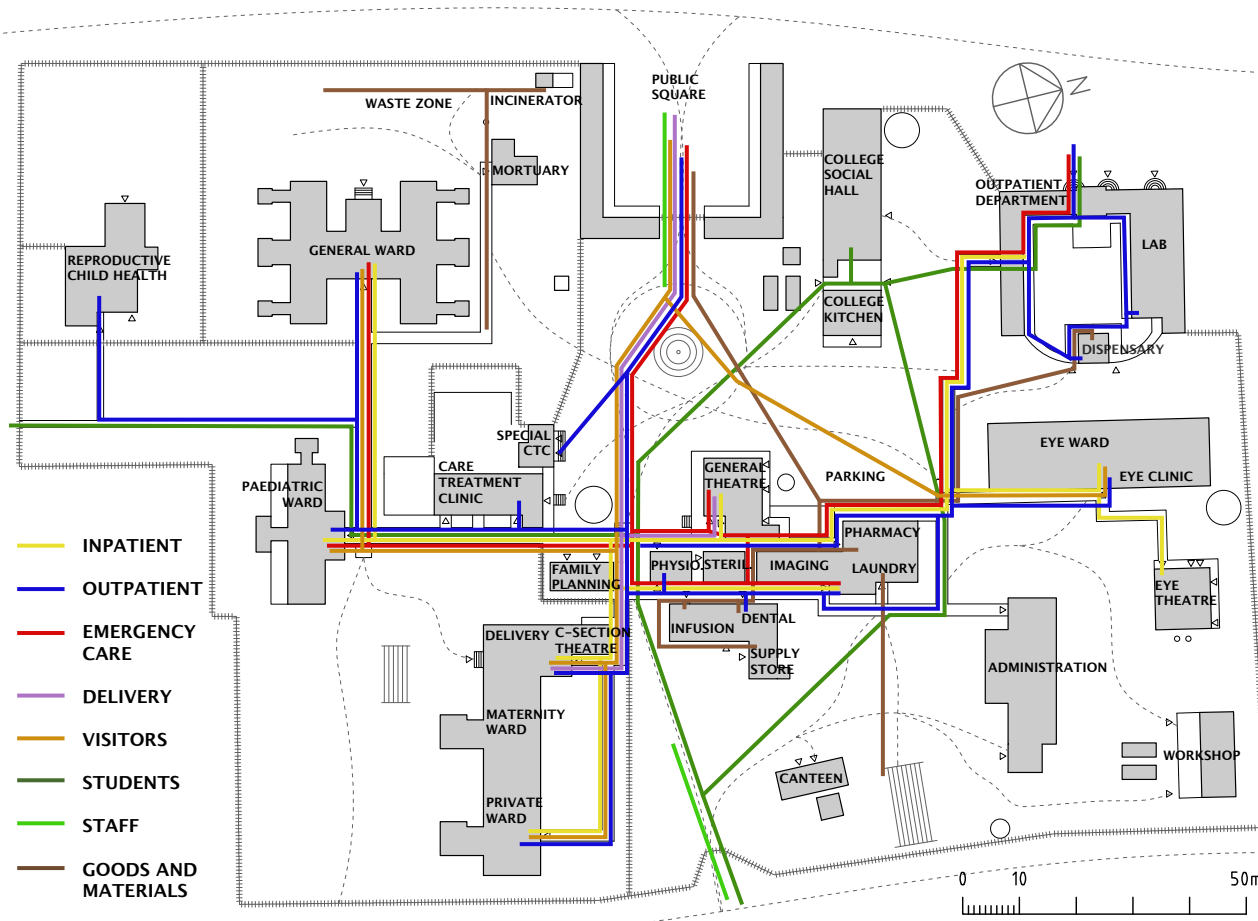
- main diagnostics and treatment zone is less interrupted
- collected outpatient areas around the outpatient department
- some goods and materials areas more kept together
- public functions of college kitchen, college social hall and the canteen have moved outside the hospital site
- more defined outdoor spaces
- less overlapping of inpatient and outpatient areas

Zoning in the future 1:000



Flow plan proposal

Existing flow plan

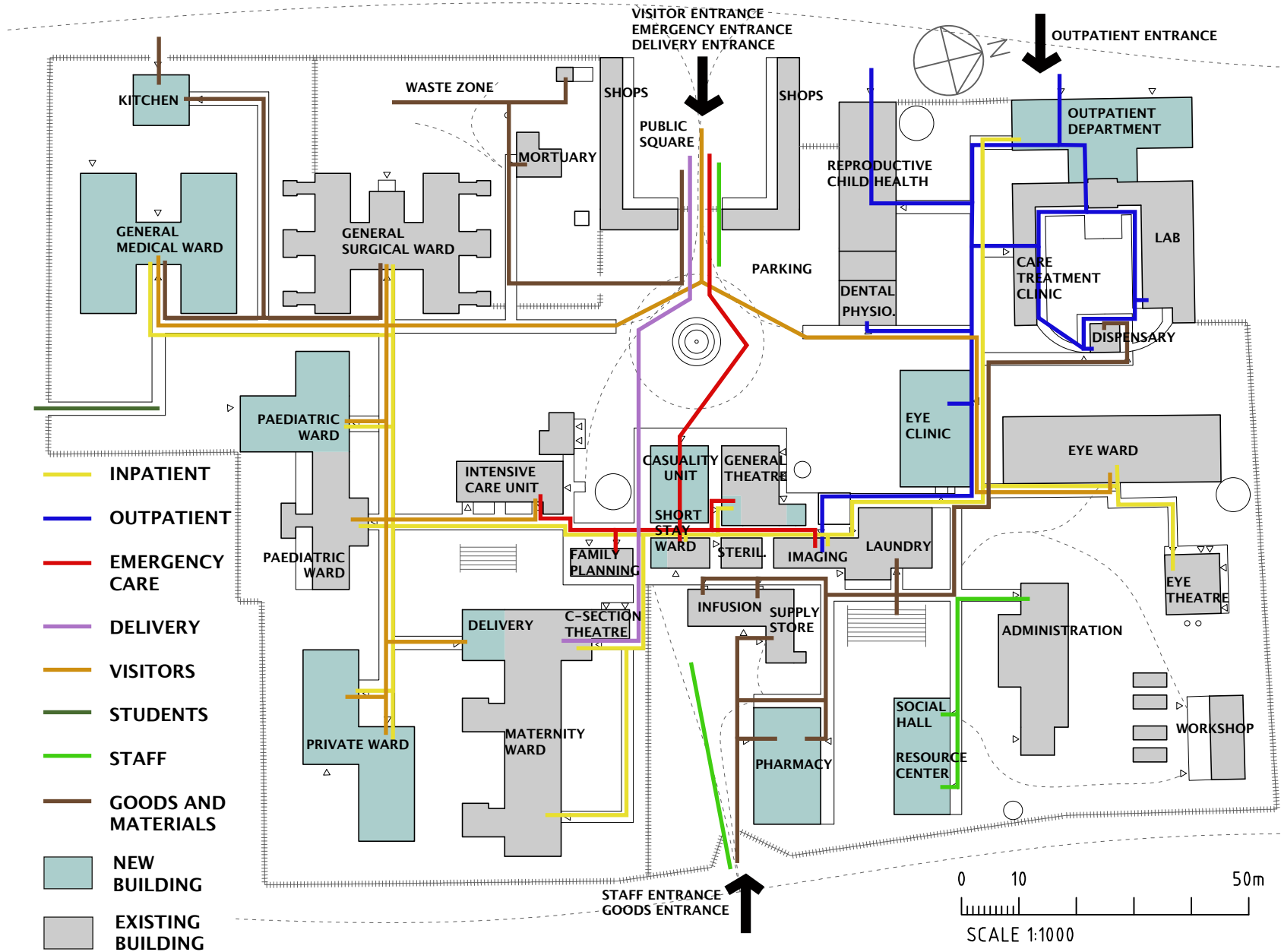


Main differences

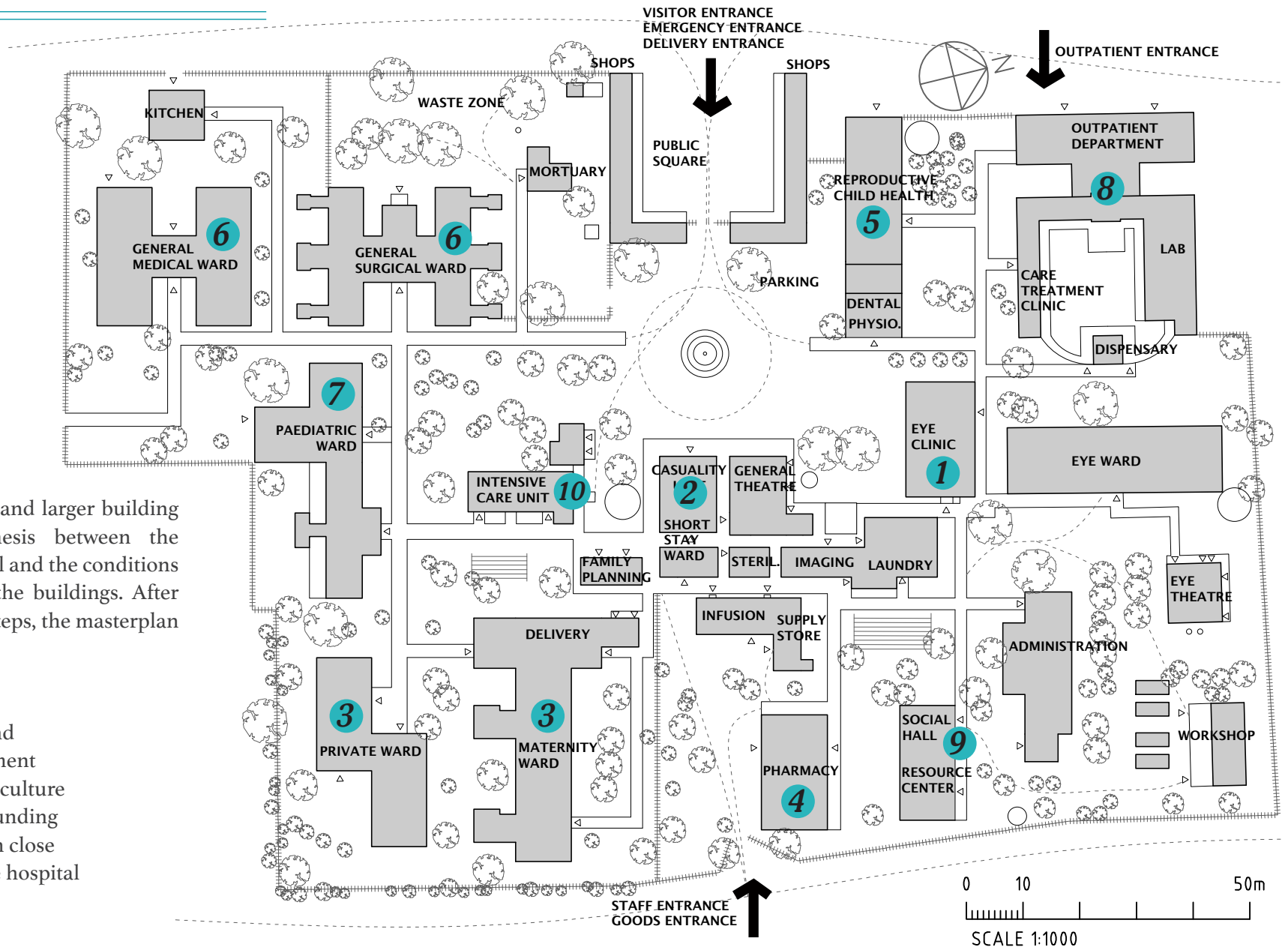
The main differences between the flows today and in the future are:

- no college students passing the site except for when having practical courses
- the emergency flow is defined, clear and a lot shorter
- the outpatient flows are collected in one main area
- the visitor flow is diverted so it does not pass the central diagnostics and treatment areas
- the kitchen and corresponding food flow is close to the general wards
- the delivery flow is kept to only going to one building
- the entrance for goods deliveries is changed to the east side of the hospital so the main entrance is less
- the goods deliveries and the outpatients no longer enter through the entrance by the public square which makes it less congested

Flows in the future 1:1000



Proposal for gradual development in 10 steps and building projects



The following 10 steps and larger building projects are a synthesis between the priorities of the hospital and the conditions given by the site and the buildings. After completion of the ten steps, the masterplan is fully implemented.

Why 10 steps / projects?

- to allow for gradual and pre-planned development
- to be sensitive to local culture
- to adapt to source of funding
- to plan for each step in close collaboration with the hospital

Step 1: Eye clinic

Problem description

Kolandoto Hospital has a specialized eye department consisting of an inpatient ward, an outpatient clinic and an operating theatre.

Currently the eye clinic and eye ward is in the same building. The spaces for the eye clinic are often overcrowded with many patients sitting waiting outside on the paths or inside the actual examination rooms. This is uncomfortable and compromises the patients privacy.

Another issue is that due to that the inpatients and outpatients are congested in the same building there is a risk for transmission of diseases and infections between patients.

To deal with the current building infrastructure challenges in the eye department a new building for the eye clinic is needed.

” *Build a new eye clinic between the other eye department buildings and the outpatient department through which patients arrive.* ”

Preliminary programme description

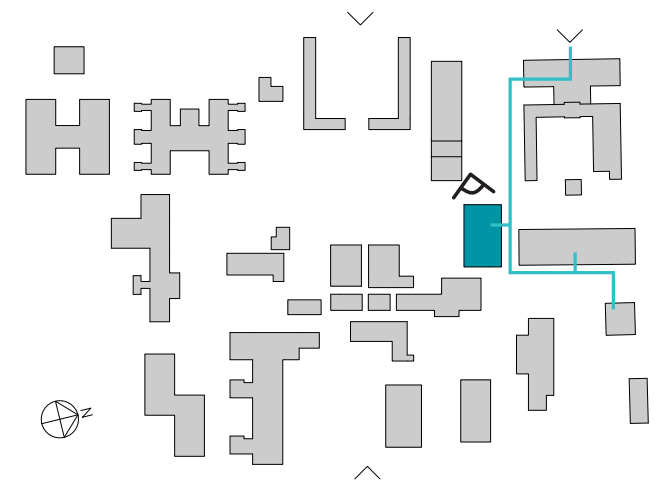
Eye clinic:

- a small room for registration and keeping files
- a visual aquity room
- a doctors room
- an optometry room
- a nurse room to enable patients to receive counseling
- a tea and rest room for staff
- toilets for both patients and staff
- a waiting area for patients

The site



The site is located in between the outpatient department and the other eye department buildings.



Step 2: Casualty unit and emergency flows

Problem description

One of the most troublesome flows at the hospital today is the flow of patients arriving in a state of emergency. The main issue is that the emergency flow is too inefficient to provide good emergency care, and has no assigned place as to where the care should take place.

Highest up on Kolandoto Hospital's list of priorities for larger building projects is to build a casualty unit. Kolandoto Hospital has also expressed that such a casualty unit should include some observation places for patients who might not need to stay at the hospital for long or for patients who need a bit of closer attention for a while before being able to receive care in the general wards. This could be called a 'short stay ward'.

In addition, the hospital has also expressed that there is a need of renovating and extending the general theatre. The area for building a casualty unit is around the current general theatre. Due to the closeness of the areas and the needed proximity of these units, it is recommended to implement the casualty unit at the same time as a short stay ward and an extension of the general theatre.

” Build a casualty unit and short stay ward with easy access from the main gate, and renovate the general theatre and the imaging department to create good connections. ”

Preliminary programme description

Casualty unit and short stay ward should include:

- a drop off area for ambulances
- a waiting room
- a reception room: with examination bed, IV drip stand, cupboards etc
- consultation room: with examination bed, desk etc
- a space for attending minor injuries: with bed, shelves, trolley etc
- a storage room: for drugs and medical supplies
- one female observation room: with space for 2 patients
- one male observation room: with space for 2 patients
- WCs
- easy connection to the walkway outside the current physiotherapy building for further transport of patients to general theatre, the maternity theatre, or the wards.

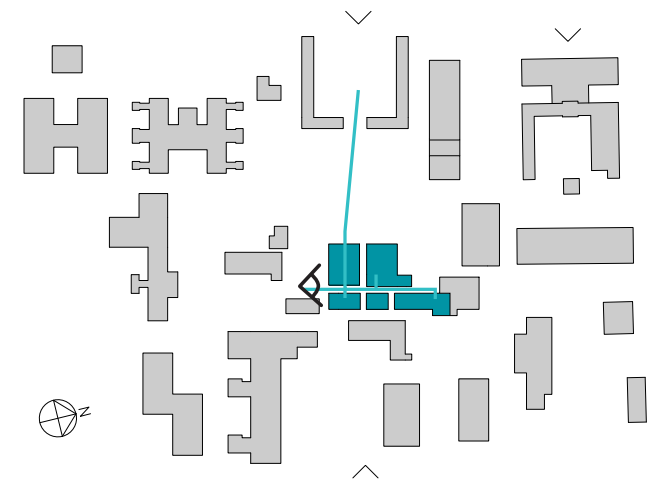
Renovation of the general theatre should include:

- a recovery room
- separate water supply to minor theatre
- a sluice room for the minor theatre
- a larger sluice room for the major theatre
- possible closer connection between the central sterilization room and the general theatre

The site



The site for the casualty unit and short stay ward is where the car is parked in front of the general theatre.



Step 3: Private ward and maternity ward

Problem description

The current maternity ward has 24 beds and two delivery beds in the delivery room. Once Kolandoto Hospital fully becomes a Council Designated Hospital maternal health care should be provided for free and then a large increase in the number of pregnant mothers coming to give birth at Kolandoto Hospital is expected. When that happens, the current amount of inpatient beds and delivery beds will not be enough.

The private ward today has 17 beds divided in two levels: private I and private II. Patients who choose to get admitted to the private ward pay more than other patients in the other wards. This provides for a good opportunity for income to the hospital. An idea is to build a new private ward with even better standards in terms of toilets, washrooms, and indoor climate. This would make it attractive for several companies to use Kolandoto Hospital as their standard hospital if their employees need hospital care, and would hence also be an even better income opportunity for Kolandoto Hospital.

Currently the private ward and the maternity ward are in the same building. This project includes to build a new private ward in the open area south of the current building, and use the whole current building for a larger maternity ward. In addition, a new entrance for visitors to the maternity ward should be opened on the south side of the building.

” Build a modern private ward, and extend the maternity ward to use the old private ward areas and have a new main entrance to the building. ”

Preliminary programme description

Private ward:

- private I to have 10 single patient bed rooms with separate toilets and washrooms
- private II to have 5 twin patient bed rooms with separate toilets and washrooms
- nursing station
- medication room
- store room for bed sheets etc
- store room for tables and other bigger things
- preparation room for dressing, injections etc
- sluice room
- counseling room

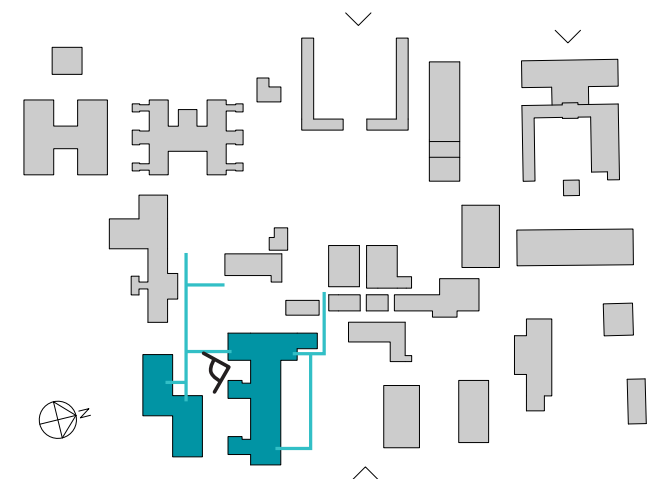
Maternity ward:

- include 50 beds
- delivery room with 4-6 delivery beds
- an antenatal room with 20 beds
- a post-natal room with 15 beds
- a premature room with 10 beds
- a post-caesarian room with 5 beds
- toilets and washrooms
- an examination room
- a c-section operating theatre including changing room, scrubbing room and sluice room
- nursing station
- medication room
- store room for bed sheets etc
- store room for tables and other bigger things
- preparation room for dressing, injections etc
- sluice room

The site



There is a large open area to the south of the existing maternity ward and private ward building.



Step 4: Pharmacy

Problem description

The current pharmacy department is made up of 4 units: the main-store/pharmacy, the supply store, the dispensary, and the infusion unit. The pharmacy is where most medications are kept and also other supplies. Staff from the different departments and wards come here to collect medications. Medical supplies are transferred from the main store to the supply store, from which staff from different departments and wards can collect medical supplies. The dispensary room is located in the outpatient department, and is only used for dispensing medications to outpatients. The staff from the dispensary comes to the main store to collect medications. The infusion unit produces IV-fluids that are then stored in the main-store/pharmacy.

The pharmacy is in the most urgent need of improvement. The current problems with the facilities for the main store today are:

- too small
- shelves are attached to the walls and get attacked by insects
- too warm for storage of medication
- windows lead light into areas that should be dark
- not enough space for walking with a trolley
- difficult to clean due to the small spaces and the floor inclinations
- lack sinks for washing hands
- too small doors to bring in larger items

Preliminary programme description

Pharmacy building:

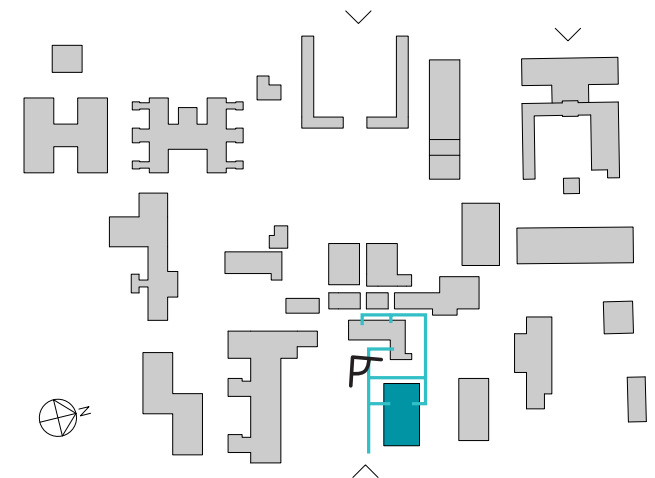
- Total size needed is estimated to be approximately 180 sqm
- storage room with AC, no sunlight reaching the medications, free standing 2 m high shelves, space for trolley to be used in the room
- fridges to keep certain medications extra cool
- one office for dispensing to the wards
- one office for management of the pharmacy department
- sink for hand washing
- floor should be easy to clean

The site



Currently there is a canteen on the identified site for the pharmacy. The canteen is a public function and should move outside the hospital area.

” *Build a new pharmacy building close to the back entrance of the hospital site and the infusion unit and supply store.* ”



Step 5: Reproductive Child Health Clinic

Problem description

The current Reproductive and Child Health Clinic (RCH) is located in the south end of the hospital site, while the main outpatient areas and the laboratory department are in the north of the hospital site. This forces expectant mothers, the mothers and children to first walk across the whole hospital to reach the clinic, and then back to the laboratory if any tests are needed, and then sometimes back to the RCH for consultations. The building in which the RCH clinic is today, is also in a quite poor condition at the moment. A new RCH clinic should be located closer to the other outpatient areas and the laboratory.

Preliminary programme description

New RCH:

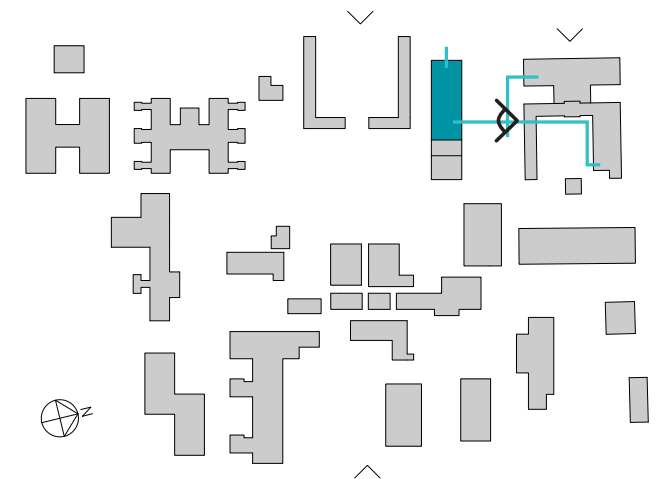
- waiting areas
- education room
- place for weighing babies
- room for information for preventing mother-to-child transmission of HIV (PMTCT)
- a room for HIV early infant diagnosis (HEID)
- an evaluation room
- a couple of storage rooms including space for a refrigerator
- a tea room
- a room for examinations
- a post-natal exam room
- an immunization room

The site



The plan is to renovate the current social hall college building to be a new RCH. The college is planning to build a new social hall on their land.

” *Renovate the old social hall to become a reproductive child health clinic located close to the outpatient department and the laboratory.* ”



Step 6: Surgical ward and medical ward

Problem description

The general ward is divided into male and female sections. There are 29 beds for females - 13 surgical, 14 medical and 2 for isolation. There are 30 beds for males - 14 surgical, 14 medical and 2 for isolation. One problem is that at the peaks of amount of patients it happens that some patients have to stay on mattresses on the floor. Staff expresses that the general wards often are congested and overcrowded. Another problem is that the isolation patients who have infectious diseases share toilets and bathrooms with the patients in the medical wards. This can cause transmission of infectious diseases to other patients.

Another connected problem is the current leprosy ward. It is located far away from the rest of the hospital. A plan is to include the leprosy patients in the surgical ward since they are mostly surgical patients. No new cases are admitted anymore. This would make the leprosy patients less isolated and stigmatized.

In addition to the current problems, the hospital is also expecting an increase in patients the coming years when the hospital fully becomes a Council Designated Hospital. Then the amount of inpatient beds in the general wards will be too few.

A new kitchen for cooking food for patients should be built in connection to the surgical and medical wards.

Preliminary programme description

General medical ward - a new building on the site of the current RCH building:

- female ward with 25 beds, and toilets and bathrooms
- 5 isolation rooms for female patients, including separate toilets and bathrooms
- male ward with 25 beds, and toilets and bathrooms
- 5 isolation rooms for male patients, including separate toilets and bathrooms
- nursing station
- medication room
- store room for bed sheets etc
- store room for tables and other bigger things
- preparation room for dressings, injections etc
- sluice room
- counseling room
- toilet for staff

General surgical ward - reorganization of the current general ward:

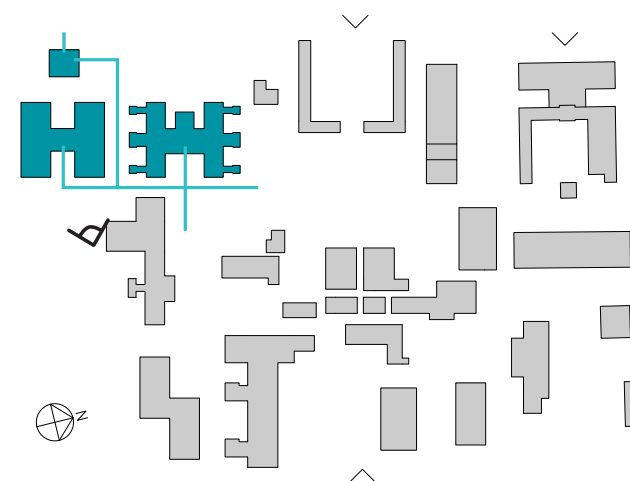
- female ward with 25 beds, and toilets and bathrooms
- male ward with 25 beds, and toilets and bathrooms
- nursing station
- medication room
- store room for bed sheets etc
- store room for tables and other bigger things
- reparation room for dressings, injections etc
- sluice room
- counseling room
- toilet for staff

” Build a new medical ward next to the existing general ward, and reorganize the previous general ward to become a surgical ward. ”

The site



The site for building the new medical ward is where the current RCH building is. The building is in poor condition and situated next to the current general ward.



Step 7: Paediatric wards

Problem description

The current paediatric ward has 23 inpatient beds. Once Kolandoto Hospital fully becomes a Council Designated Hospital health care for children below five years of age should be provided for free and then a large increase in the number of patients coming to the paediatric ward is expected. When that happens, the current amount of inpatient beds will not be enough.

When extending the paediatric ward the current building should also possibly be reorganized.

Preliminary programme description

The whole paediatric wards, including the existing and the new:

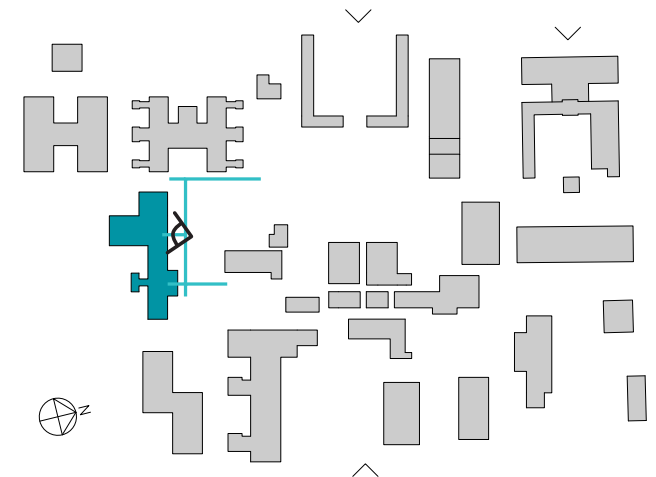
- at least 50 inpatient beds in total
- 5 beds for patients in need of isolation, with separate toilets and bathrooms
- 30 beds for medical patients: including diarrhea case room and malnutrition room
- 15 beds for surgical patients
- nursing station
- medication room
- store room for bed sheets etc
- store room for tables and other bigger things
- preparation room for dressings, injections etc
- sluice room
- counseling room
- toilets for patients and staff

” Renovate the existing paediatric ward and build a new paediatric ward in connection to it. ”

The site



The site for the new paediatric ward is on or just to the right of this existing pathway which will be moved to the west closer to the general wards.



Step 8: Outpatient areas

Problem description

One of the troublesome flows at the hospital is the outpatient flow and the fact that outpatients move all over the hospital. This should be dealt with by trying to collect many of the outpatient areas within the same area around the current outpatient department (OPD). The current OPD building needs to be renovated, reorganized and extended to also include areas for the physiotherapy, the dental unit and the care treatment clinic.

The outpatient department is in a nicely designed building, with lots of light and air. It has a central courtyard in which patients wait. Rainwater runoff from the roofs is integrated in the building design. However some of the roofs are leaking and rainwater ends up in places it should not be and it damages the building.

The area for waiting at the outpatient department building is often overcrowded - both before registration outside the OPD building, and after registration waiting for seeing the doctor inside the OPD. Another problem in the OPD is that several of the rooms are too small for their activities, for example the reception room and the dispensary.

The OPD building is not adapted for people who have trouble walking and need wheelchairs. There are stairs leading up to the reception at the entrance. Inside the building, many doors and the half-outdoor corridors are not wide enough.

” Build a new main building for the outpatient department, and move other outpatient functions into the previous outpatient department and kitchen buildings. ”

Preliminary programme description

Outpatient department :

- spacious waiting areas for patients, both outside the OPD and inside the OPD
- surgical room at OPD for minor injuries, bruises, cuts etc
- widen doors for accessibility of wheelchairs and stretchers
- expanded dispensary room
- reception/registration room
- parking outside OPD for both staff and visitors
- payment office
- dressing room
- injection room
- toilets
- several consultation rooms
- national health insurance room
- social welfare office

Dental unit:

- examination and treatment room
- room for developing scans

Physiotherapy:

- room for examination and treatment
- storage room

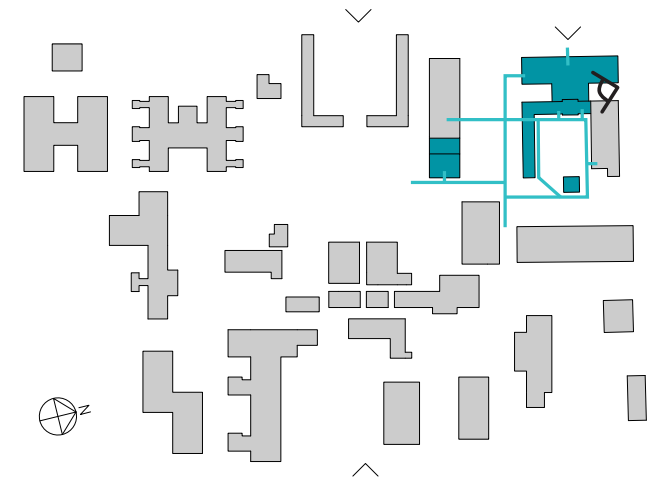
Care treatment clinic:

- waiting areas
- educational areas
- several consultation rooms
- toilets

The site



A new building and main entrance outside the current entrance to the OPD is recommended.



Step 9: Social hall and resource center

Problem description

The hospital has clinical meetings with staff from all the departments every morning. These meetings are held in the church outside the hospital area since a space for such meetings is missing. Large staff meetings of other types are also hard to organize due to the lack of a proper big social hall for such meetings.

Another issue is that the hospital lacks space for its staff for having periodic trainings, individual knowledge development, and the possibility to do research. Hence a resource center with access to magazines, books and computers with internet connection is needed.

These two functions, the social hall and the resource center, are preferably combined in the same building.

” Build a social hall and resource center for staff meetings and trainings close to the existing administration building. ”

Preliminary programme description

Social hall:

- meeting space for 50-100 people

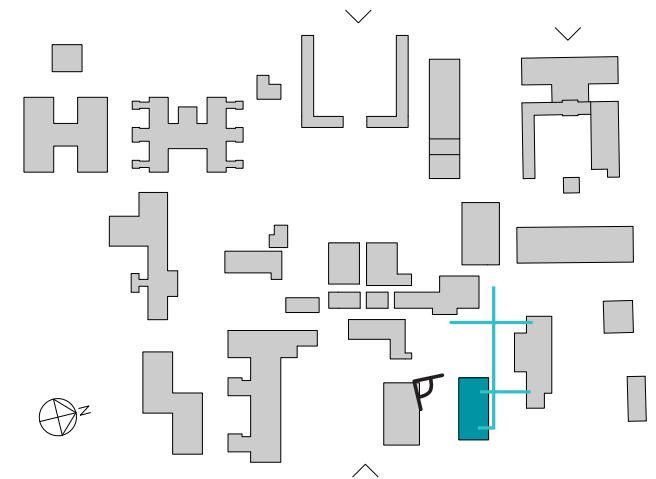
Resource center:

- space for a library with bookshelves
- space for computers for research
- space for discussions
- toilets

The site



The site for a social hall and resource center is where the washing lines currently are placed. This site is big enough and it is close to the administration building to the far left in the picture.



Step 10: Intensive care unit

Problem description

Today the hospital lacks the facilities to take care of critically ill or injured patients. What is needed is to have an intensive care unit (ICU) in which advanced care can be done. Having an ICU also requires an ambulance that can be used for transport of patients in need of referral to another hospital.

The ICU is the last identified project on the list since a lot of developments in other areas are needed. For example, it is important to ensure proper and stable water and electricity supplies, as well as having specialized staff to provide the care.

Preliminary programme description

ICU:

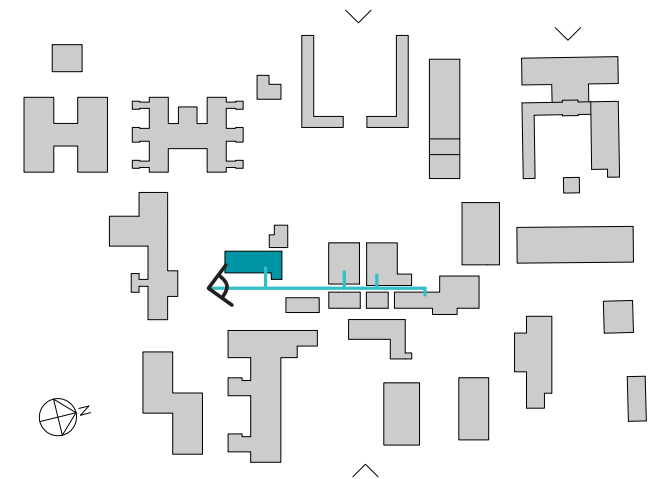
- 10 inpatient beds
- toilets and washrooms for patients
- nurse station overlooking the patients
- medication room
- store room for bed sheets etc
- store room for tables and other bigger things
- preparation room for dressings, injections etc
- sluice room
- counseling room
- toilet for staff

The site



The current CTC building was actually built to be an intensive care unit from the beginning, and has suitable proportions and location to be that.

” *Build an intensive care unit in or on the site of the previous care treatment clinic building, closely connected to the casualty unit and general theatre.* ”



3. THE EYE CLINIC BUILDING

From the justification of a new building to a detailed building proposal design.

Annika Danielsson - June 2015

3.1. DIAGNOSING THE CURRENT CONTEXT

Starting point

When I came to Kolandoto I had in mind that I wanted to draw a building proposal. I was looking for the right project. Already the first week the hospital management told me about their ongoing plans to build an eye clinic through a collaboration with CBM (www.cbm.org). The hospital was in the process of creating a funding application with justifications of the need of the building as well as information about the needed funding. A draft of this application already existed, and I was asked to improve it with more information through text, pictures and illustrations. A proposal for a building design together with a tender from a local company had been prepared before. After I produced this funding application I asked the hospital if they would allow me to draw another proposal for the eye clinic, explaining that I wanted to do it through many discussions with the staff and also incorporate ideas of how to make it a climate adapted design.

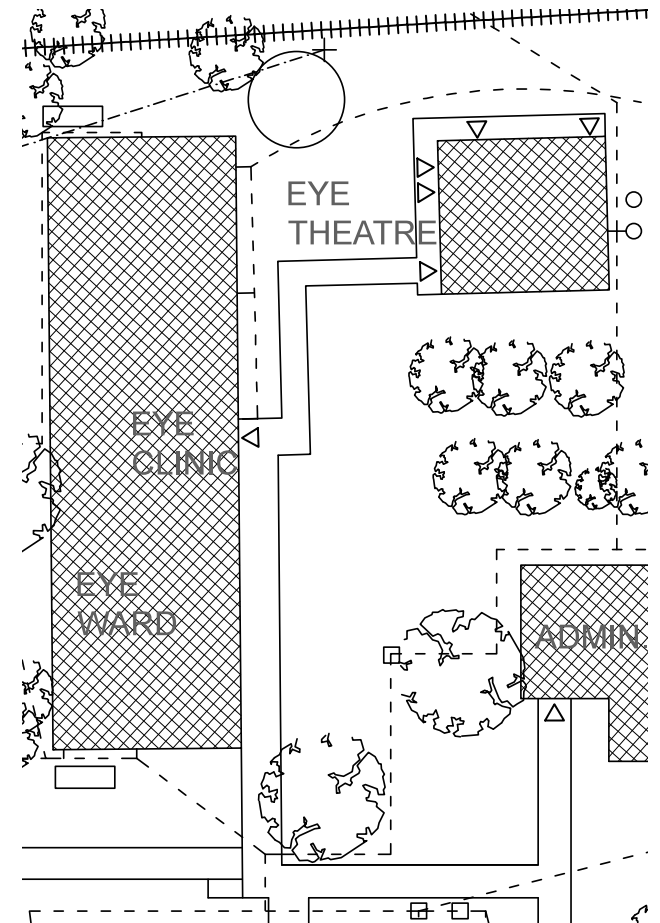
Background information

Kolandoto Hospital Eye Department

Kolandoto Hospital Eye Department consists of three units:

1. First, there is the eye clinic to which patients come to see the ophthalmic nurses or specialized eye doctor if they have any troubles concerning their eyes.
2. Second, there is the eye operating theatre in which a wide range of eye surgeries are done each week, from cataracts to removing foreign objects.
3. Third, there is the eye ward to which patients can get admitted while in need of more close eye care, which often is before and after surgeries.

Kolandoto Hospital Eye Department is one of two hospitals in Shinyanga Region that offers eye clinic services. The other one is the Government Regional Hospital of Shinyanga. However, it is only Kolandoto Hospital that provides the service of eye surgeries in the region and some surrounding regions. Shinyanga Region has a population of more than 1.5 million people. They and the people in surrounding regions are the target group for this project.





The female wing in the ward.



The operating theatre.



The doctors room in the clinic.



The existing building for the eye clinic and the eye ward.



The eye theatre to the left, and the eye ward and clinic to the right - connected by a path with a roof.

The problems

Small and crowded spaces

There is currently a shortage of space to accommodate the amount of patients and activities in the eye department. On average the eye outpatient clinic sees about 40 patients per clinic day and the space available is not adequate to facilitate the appropriate sitting/waiting area, screening, vision testing, counseling and doctor consultation. Patients especially the elderly, women and children are thus faced with an uncomfortable and crowded waiting area that exposes them to sitting directly under the sun for long hours as well as sitting on the ground.

Poor patient privacy

As an effect of the lack of space, the patient privacy is also poor. Patients often sit and wait in the same room as where other patients are being examined. It is also common that treatment of patients is discussed in areas where other patients and relatives can hear due to that there are rarely any rooms empty of people to do counselling in.

Risk of transmission of infections

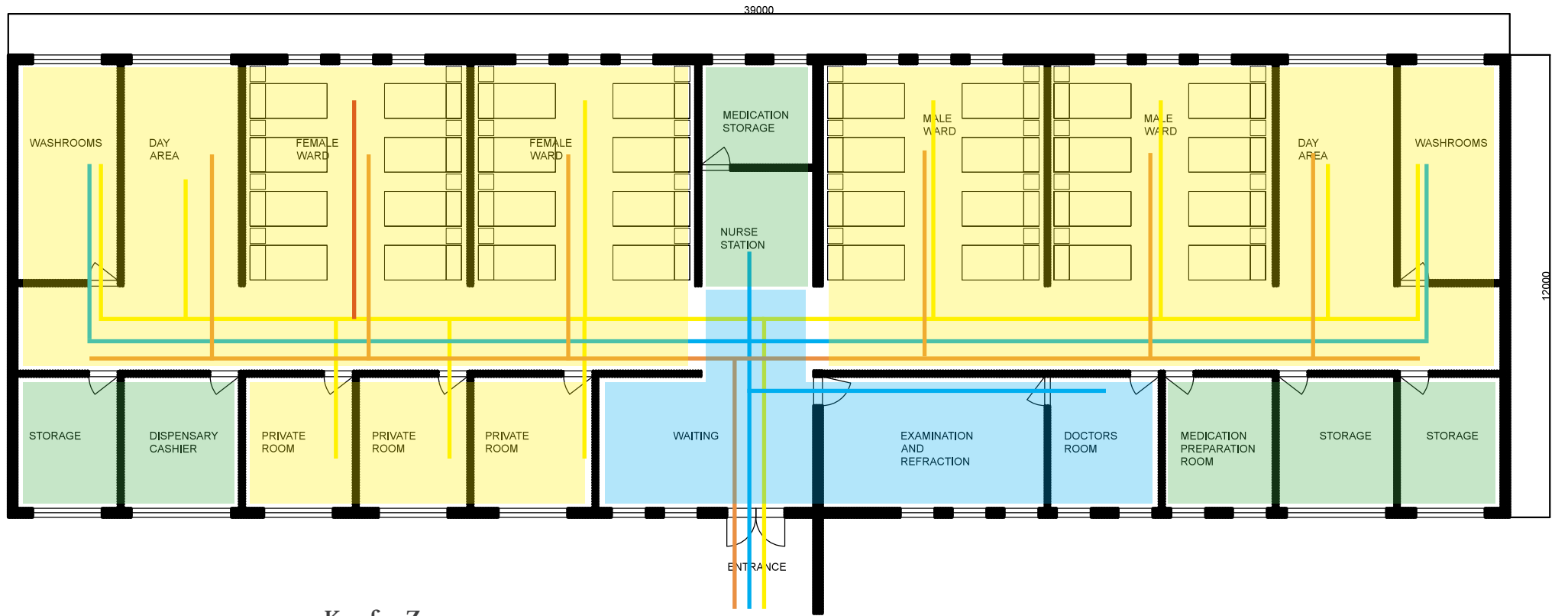
The risk of transmission of diseases and infections between inpatients and outpatients is high due to that some spaces are shared and the flows of the two types of patients cross each other in crowded spaces. In the current situation the outpatients sit and wait in a small space which is connected by open indoor spaces to the wards where the inpatients are staying. Relatives of inpatients have to pass all the waiting outpatients to bring food to their sick family members three times per day. Inpatients coming back to the ward from a surgery also has to pass through all the areas where outpatients wait. All outpatients often arrive in the morning, and many have to wait before seeing the doctor, and if they need to use the washroom in that time they walk through the inpatient ward to use the same washrooms as the inpatients.



Patients waiting inside the examination and refraction room.

The current building layout

Scale 1:150



Key for Zones

- = zone for OUTpatients
- = zone for INpatients
- = zone for only STAFF

Key for Flows

- = flow of OUTpatients
- = flow of INpatients
- = flow of relatives and visitors

3.2. DREAMING OF THE FUTURE

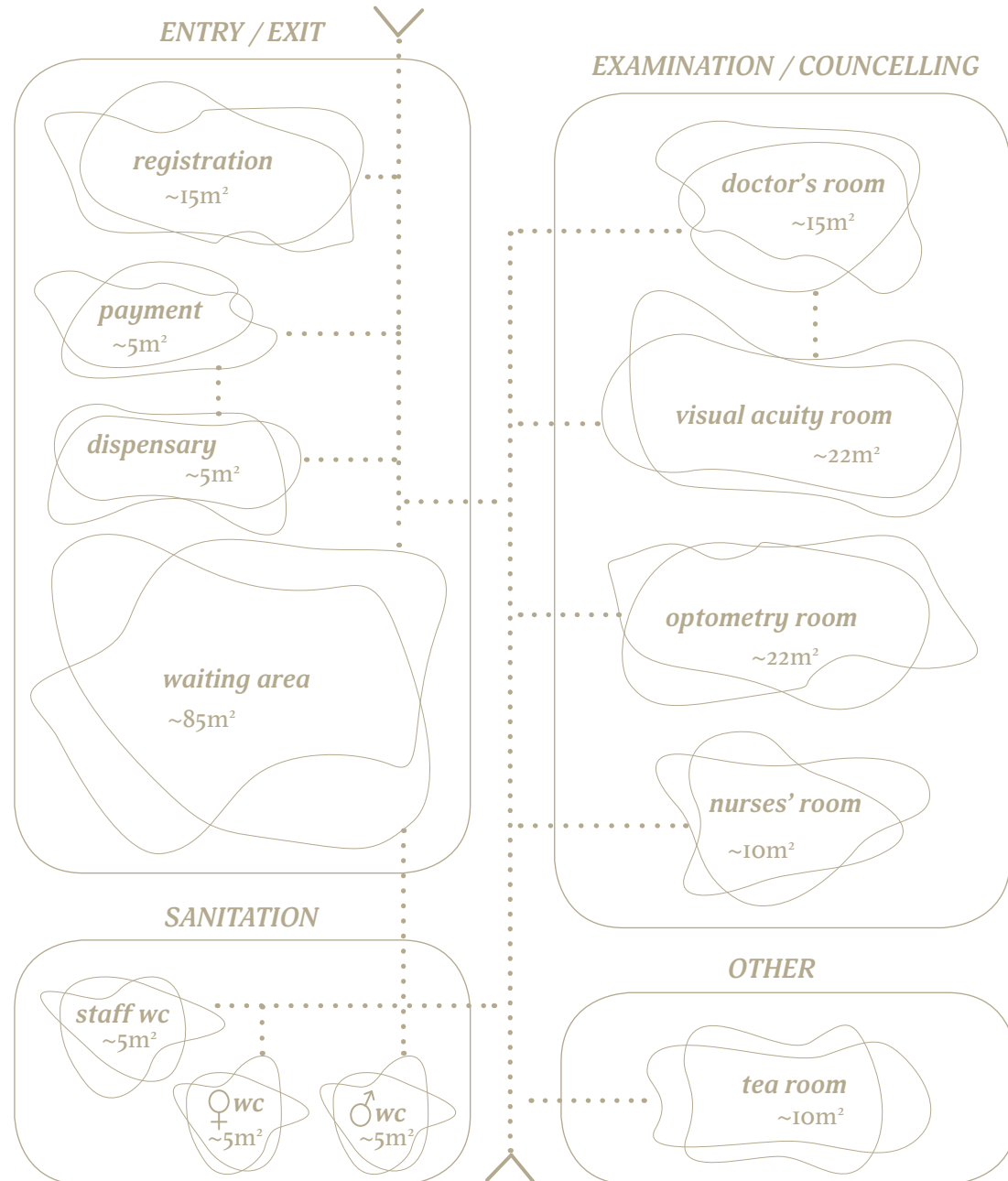
Vision

In 2017 Kolandoto Eye Department is a great example known in the whole country for its efficient and quality eye care services that are provided in up-to-date buildings that includes a newly built eye clinic building, an inpatient ward, and an eye operating theatre. The buildings facilitates for a good flow of people, comfortable waiting areas, and privacy to patients receiving counseling. The buildings also prevents overcrowding of spaces as well as crossing of inpatient and outpatient flows that could lead to transmission of communicable diseases.

Building programme and connectivity

The commission is to design a new building for the eye clinic. To the right is a diagram that shows what rooms are needed and how they should be connected. This information is obtained through study visits, interviews, literature reviews and observations.

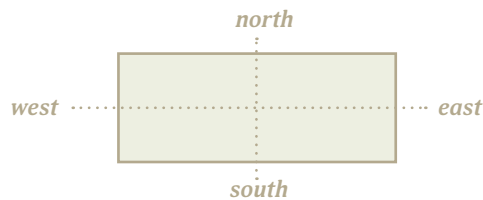
Total size: 235m²



Sustainable building techniques

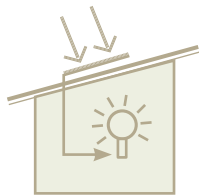
The following are criteria for creating an environmentally friendly building with a good indoor climate in the climatic zone defined as semi-arid / savannah tropical climate. (UN-Habitat 2014 and UN-Habitat 2015)

Building orientation



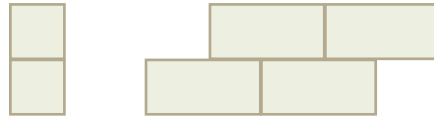
- Orient the building with the long axis going west to east to reduce the amount of solar radiation reaching the walls.
- Adapt up to 30 degrees to catch the prevailing winds.

Solar energy strategy



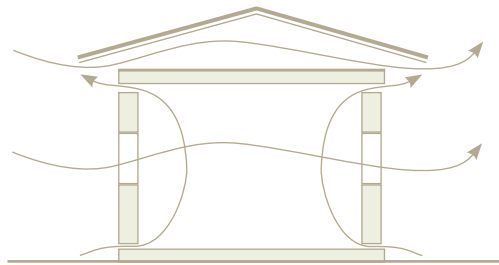
- Solar panels placed at a slight angle towards north.
- Use the energy for equipment and lights in the building.

Wall characteristics



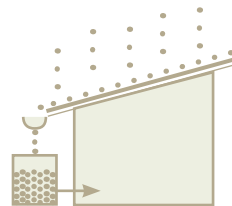
- Light colors to reflect solar radiation.
- Medium thick walls with medium weight materials.

Natural ventilation



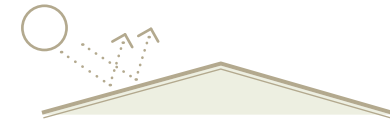
- Vents at floor and roof level.
- Opposite openings for cross ventilation.
- Separately ventilated roof.
- Limited ventilation during daytime to avoid hot air, and increased ventilation at night to cool the structure.

Water strategy



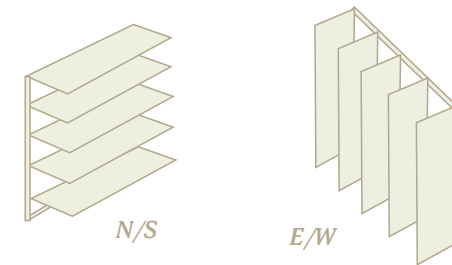
- Collect the rainwater.
- Use the rainwater within the building.

Roof characteristics



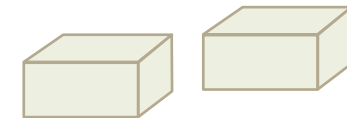
- Mid-weight material with high reflectivity.
- Ventilated both below and above inner ceiling.

Window characteristics



- Medium sized windows.
- Maximize windows on N/S facades and minimize windows on E/W facades.
- Provide outer solar shading devices: horizontal on N/S facades, and vertical on W/E facades.
- Provide windows in opposite walls for cross ventilation.

Building materials



- Use locally produced material to minimize transport needs and also support local businesses.
- Look for low energy usage in production and assembly of the material.

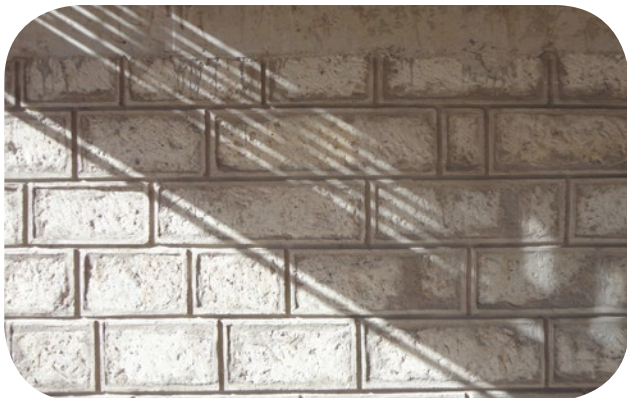
Reference examples

Skills Center for the Youth of Nairobi

The Skills Center for the Youth of Nairobi is a boarding school where youths could come to learn practical skills like metal work, woodcrafts and sowing. The center is built using local materials and there is a clear systemic approach to natural resources. The toilets are separating urine and feces, and both are reused in different ways in the garden. Electricity is provided by solar panels on the roofs.



The roof is made of bamboo from Kenya.



The stone for the walls come from a quarry nearby.

Outpatient department building in Kolandoto

The outpatient department at Kolandot Hospital is well designed with lots of light and air. Stormwater drainage is well incorporated in the design. Patient waiting areas are around a central courtyard with half-outdoor corridors. There are trees and nature present for positive distraction for the patients, and the semi-permeable bricks used around the courtyard give it a pleasant look.



Rainwater is directed to the ground inside the pillars.



Patients wait around a green and open courtyard.

Econef Children's home

Econef Children's home is an orphanage in northern Tanzania. The architects behind the prototype building is Asante architecture & design from Sweden. The materials used are local and the building form is adapted to integrate rainwater collection in the roof design. (pics from effect.se)



The water tank is integrated in the design.



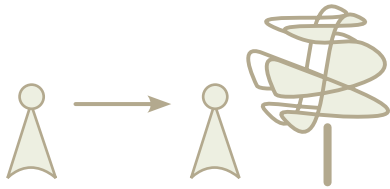
The roofs are leaning to the middle of the building where the rainwater is collected in a gutter.

Key words

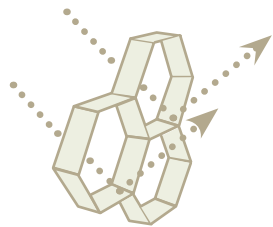
Calm



- natural colors



- views to nature and where people walk

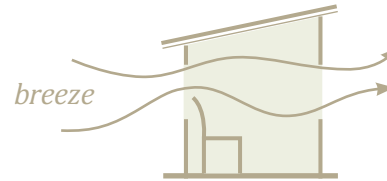


- diffused light through semipermeable brickwork

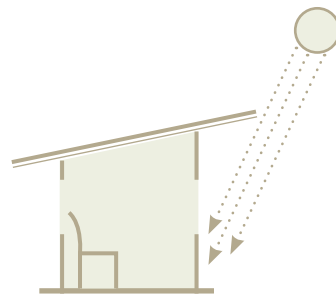
Comfortable



- a range of types of shaded waiting areas

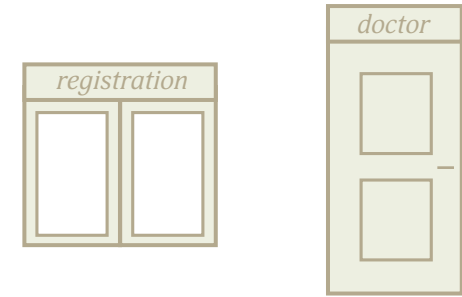


- well ventilated building catching the small breeze

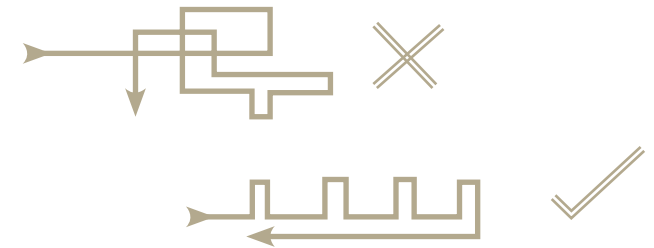


- windows protected from solar radiation

Clear



- supportive signs in the design



- logical movement for patients

3.3. DEVELOPING ALTERNATIVES AND CONSENSUS

The first building proposal

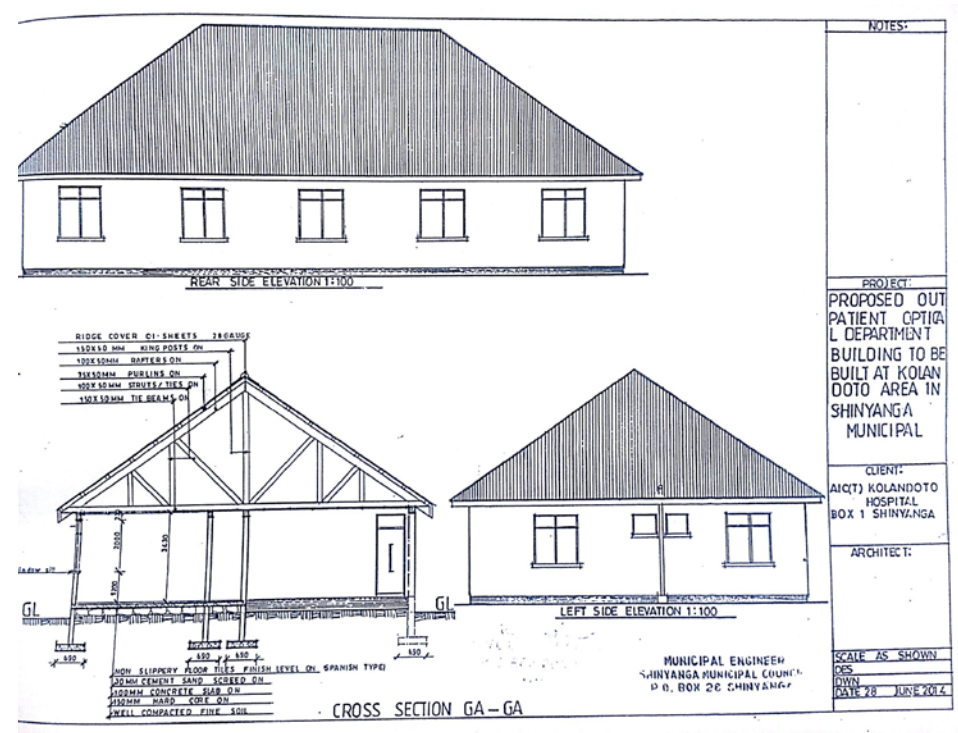
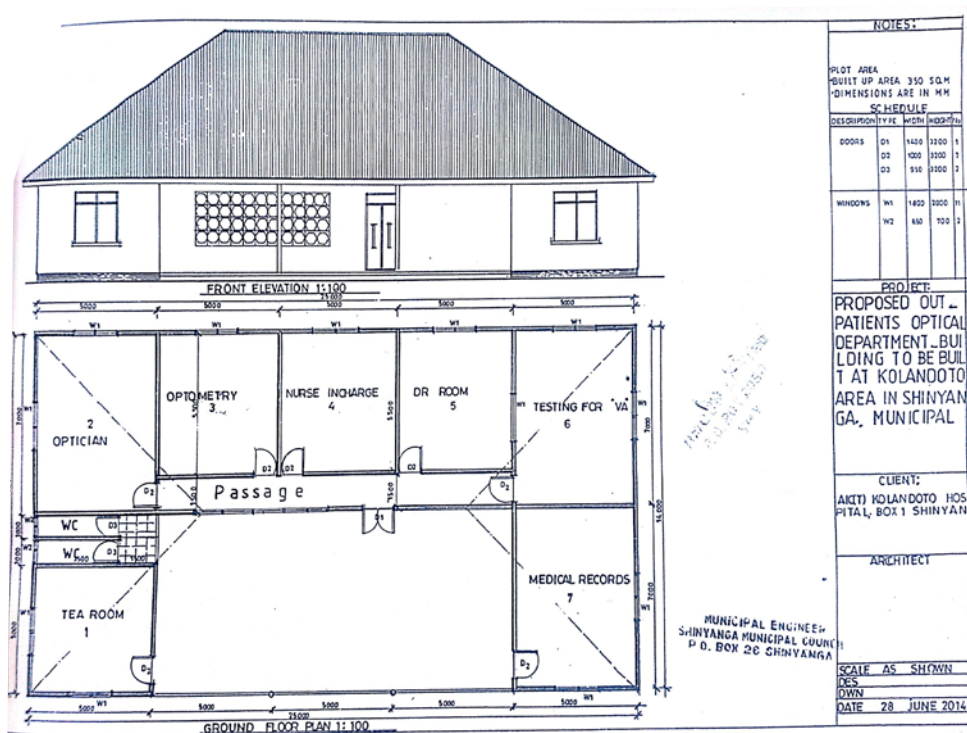
The drawings

This building proposal was developed by JIMCON LTD in 2014, who also provided a tender with a budget for constructing the building. The total cost for the building would be maximum 102'307 euro. Please note that these drawings are not to scale in this document.

Opinions

- The first building proposal poses a lot of questions:
- where is it placed? the site is missing...
 - how do you arrive to the building?
 - where is north and south in the building?
 - is the sunshading sufficient?
 - where is the staff toilet?
 - is this considered aesthetically appealing?
 - is there a risk for congestion in the corridor?
 - do you want the staff tea room next to the main waiting area?

- why have both an optometry room and an optician room?
- maybe the rooms are too large?
- maybe the whole building is too large?
- how can rain water collection be incorporated in the design?
- how can the cost estimated be lowered?



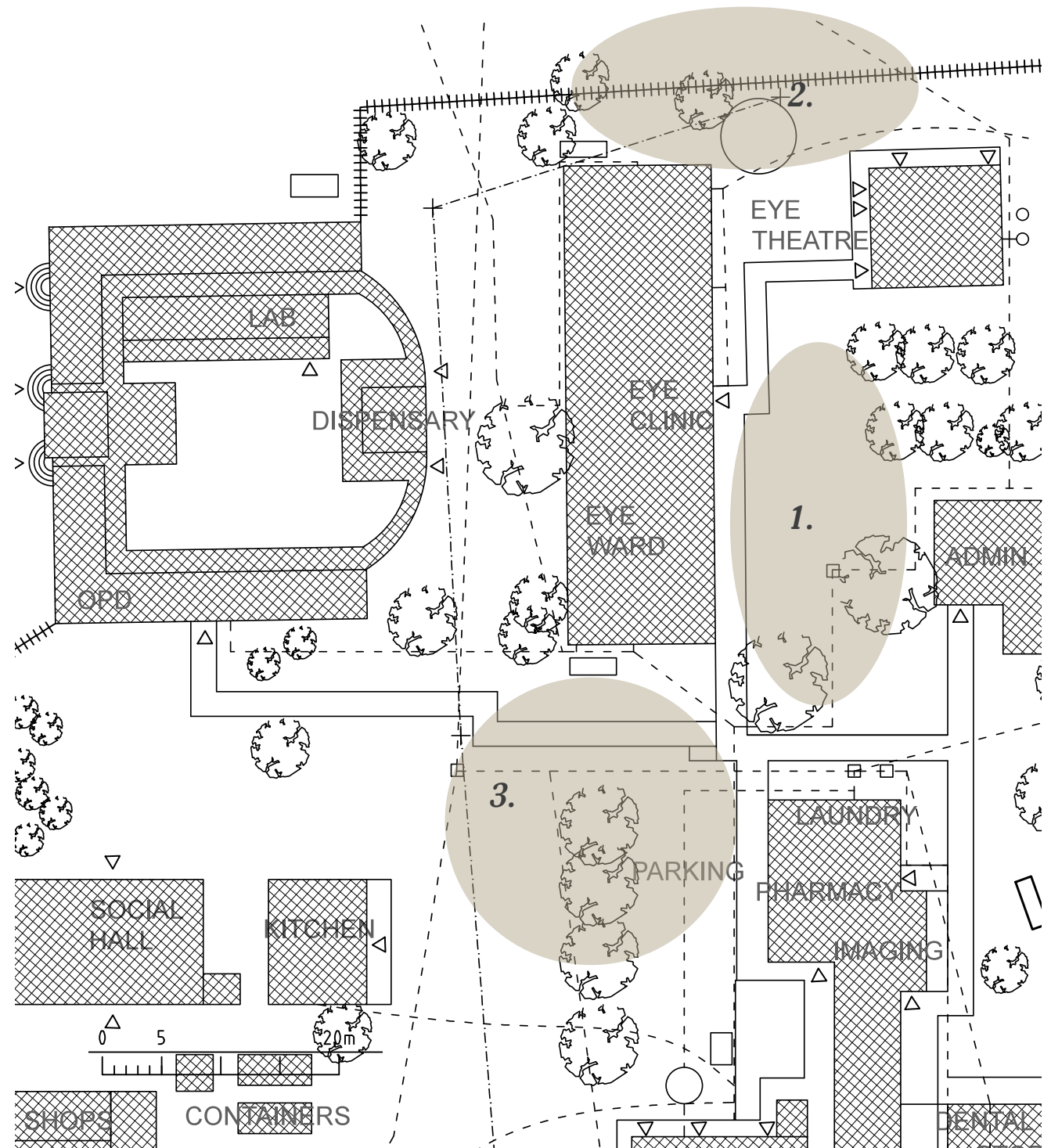
Finding a site

Site plan around the eye department

The first step was to find an appropriate site for the eye clinic building. This was done very much in parallel with the first sketches for the masterplan that overall defines where different new buildings should be placed within the whole hospital site.

The site had to be in the vicinity of the existing eye department and also big enough for a building of approximately 235 m². Three sites, shown in the illustration to the right, were considered and discussed with the hospital management.

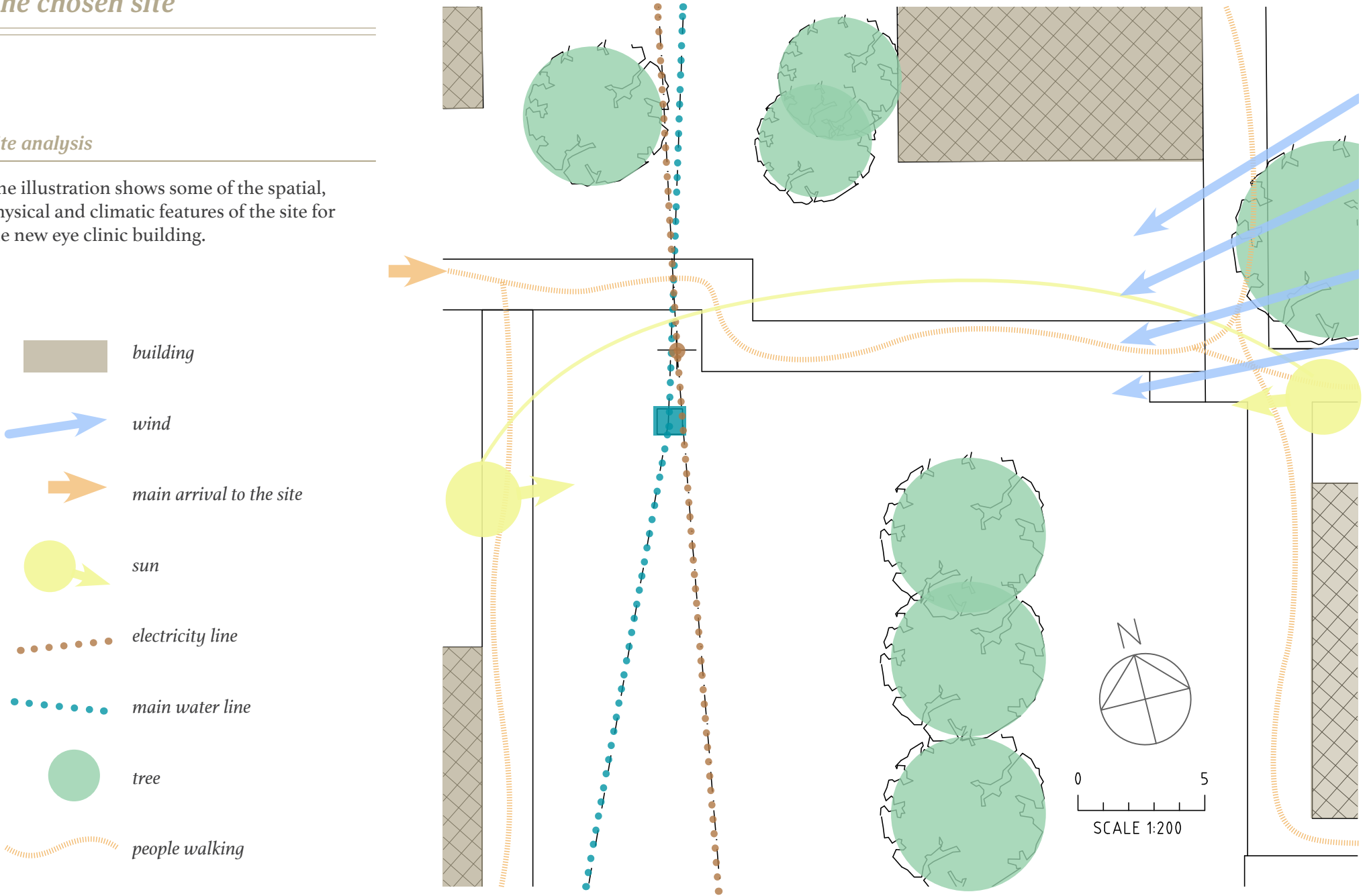
In the end we chose site 3 which is on the current parking lot. The largest benefit with that site is that it is located along the path from the main outpatient department to the eye department. The site is large enough for a building to be placed there and still allow for outdoor spaces.



The chosen site

Site analysis

The illustration shows some of the spatial, physical and climatic features of the site for the new eye clinic building.



Pictures of the site



This panorama is taken from the kitchen building. The eye ward is in the green building to the left. The building at the far end is the pharmacy. To the left in the grass you can see an inspection hole for the main water line that passes from right to left in the picture.



In this panorama you see three buildings that defines the site. The kitchen is to the left, the outpatient department building is in the middle, and the green building is the current eye clinic and ward building.



This panorama is taken from standing by the gable of the eye ward. Patients coming to visit the eye department enter the hospital site through the outpatient department and then walk along this corridor to arrive to the eye department.

Sketching alternatives

Process

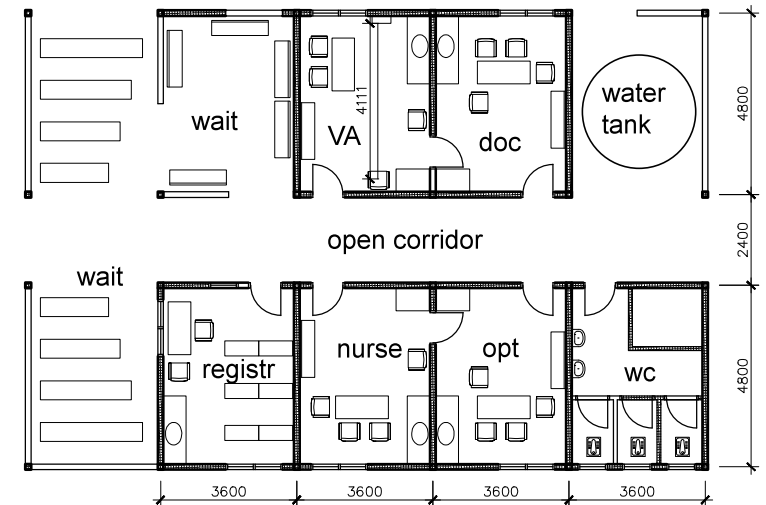
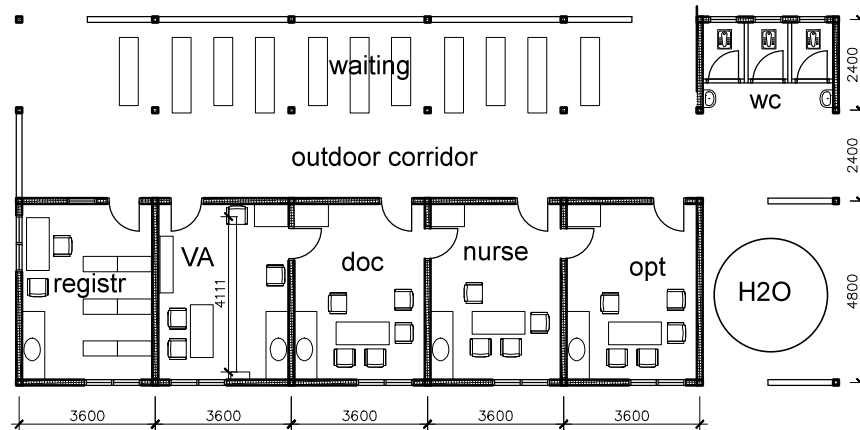
Through a sketching process three different layout alternatives were developed. These were presented and discussed with the ophthalmic nurses and the eye doctor to really understand the programmatic and spatial needs for specifically Kolandoto Eye Department. This process was part of creating the diagram about programme and connectivity shown on page 62.

Alternative LONG

In alternative LONG, all the necessary rooms are organized along one semi-outdoor corridor. The corridor is connected to the waiting area for patients all along the corridor. The roof is planned to be a pent roof, leaning towards south where the gutter leads the rainwater to the water tank that is integrated in the design of the building. This alternative requires to have a visual acuity screen for 4 meter testing (normal is 5 meter). One of the existing rooms in the eye clinic/ward building is used as a tea room.

Alternative WIDE

In alternative WIDE, the building has a corridor in the middle, and rooms on each side. The waiting area is clearly visible from the connecting outside path that the patients arrive through from the main outpatient department. The water tank for rainwater collection is integrated in the design of the building. The roof is planned to be a gable roof but opposite, meaning that the rainwater flows inward towards one gutter above the corridor, and then is led to the rainwater tank. This alternative requires to have a visual acuity screen for 4 meter testing (normal is 5 meter). One of the existing rooms in the eye clinic/ward building is used for tea room.



Alternative 5 METERS

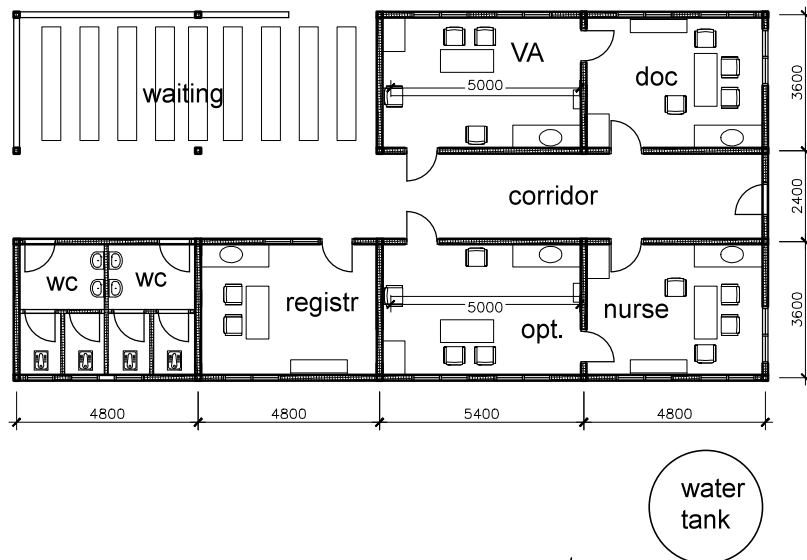
In alternative 5 METERS, the building is adapted to having a visual acuity room for 5 meter testing. Also the optometry room is 5 meters long. The washrooms are close to the waiting area, which in turn is facing the path through which patients arrive through in an open way. There are rooms on two sides of a central corridor. The roof can be a normal gable roof, on which water is collected to a gutter on the south side leading to an external rainwater tank. And solar panels are facing the ideal direction slightly towards north on the north side of the roof. One of the existing rooms in the eye clinic/ward building is used for tea room.

Feedback

This is a summary of design opinions from the ophthalmic nurses and eye doctor:

- The VA room needs to be 6m so that it is possible to check visual acuity on 5m.
- Keep the WC away from waiting areas since it will be smelly. Also since some patients wont go to the toilet if others in the waiting area will know where they are going.
- Have WC next to waiting area so it is easy to access.
- Ensure good ventilation around the WC.
- Separate the registration room from the room for medications and payment, since the one dealing with money should be alone.

- Ensure good ventilation in the whole building.
- Waiting areas can be half outside and half inside.
- 1 toilet for staff is needed, 2 toilets for patients are needed.
- Prefer a design with rooms on two sides of a corridor because it provides better privacy to patients.
- Have space for examination bed in the doctors room.
- The nurse room could possibly be multipurpose, and function as tea room too, even though it is not ideal.
- Have a TV in the waiting area to entertain patients.



3.4. DEFINING A WAY FORWARD

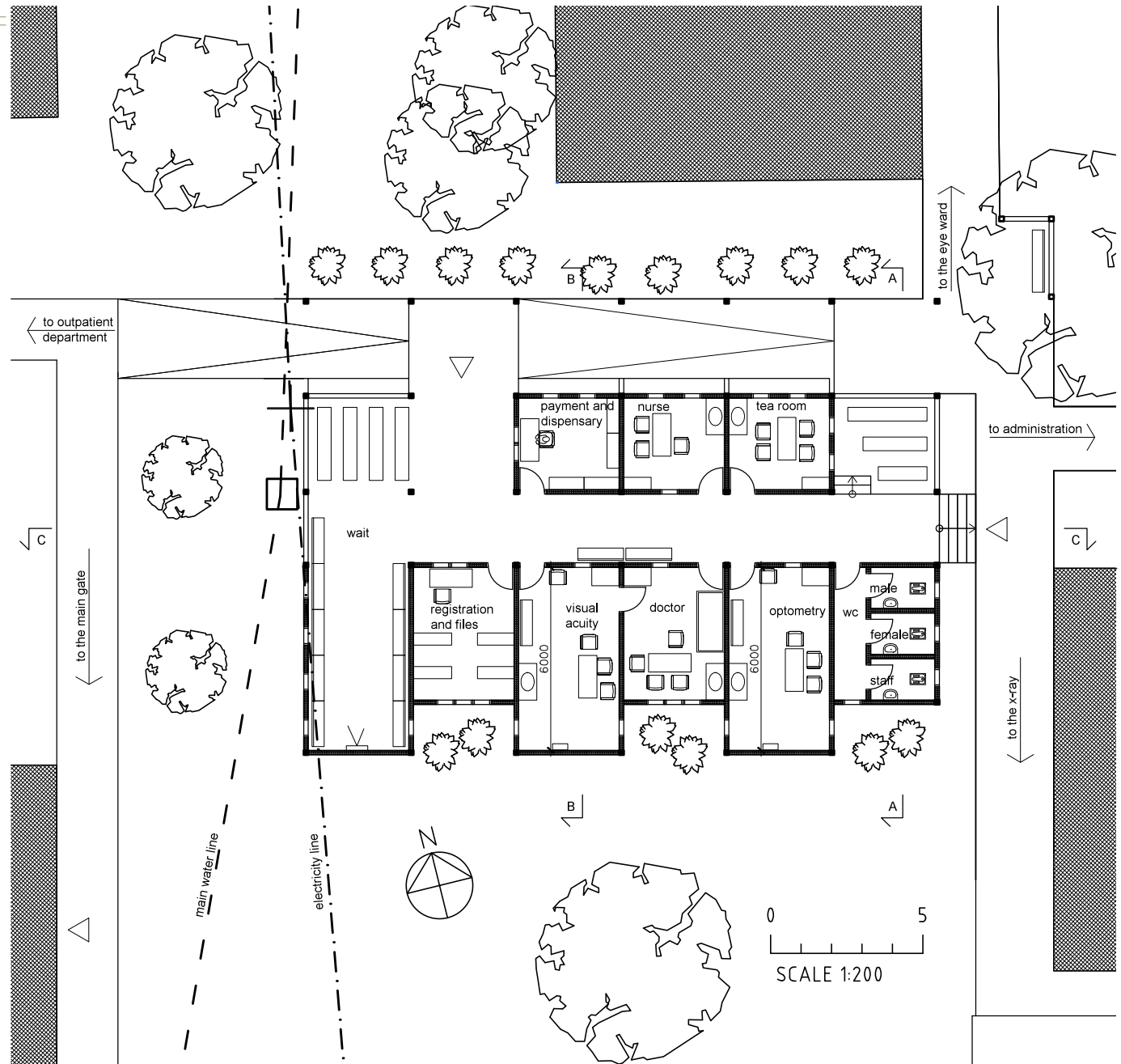


Plans and perspectives

Site plan 1.200

The proposal is to build the new eye clinic building on the current parking area. This area is in between the outpatient department and the rest of the eye department. This makes the location good, since it is easy to find and access for patients arriving through the outpatient department. At the same time the new clinic building is well connected to the inpatient ward.

The building has its long axis west-east to minimize solar radiation. The path on the north side of the building is integrated in the building design.





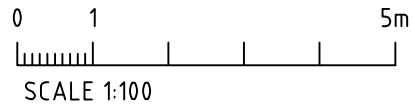
When a patient arrives to the waiting area he/she starts by the registration and payment before sitting down to wait for an examination or consultation. There are several different types of waiting areas with different characters to choose between. One waiting room is more indoor than outdoor, it has wooden benches and a TV for distraction. Another waiting area is more outdoor in an area still under

the roof of the building but it has half walls are made of semipermeable bricks instead of normal brick walls. Another alternative is to sit along the outdoor path, where the patient can look at people passing by. If a patient is going to the optician he/she can sit and wait in the waiting area that is a bit raised on top of the underground water tank.

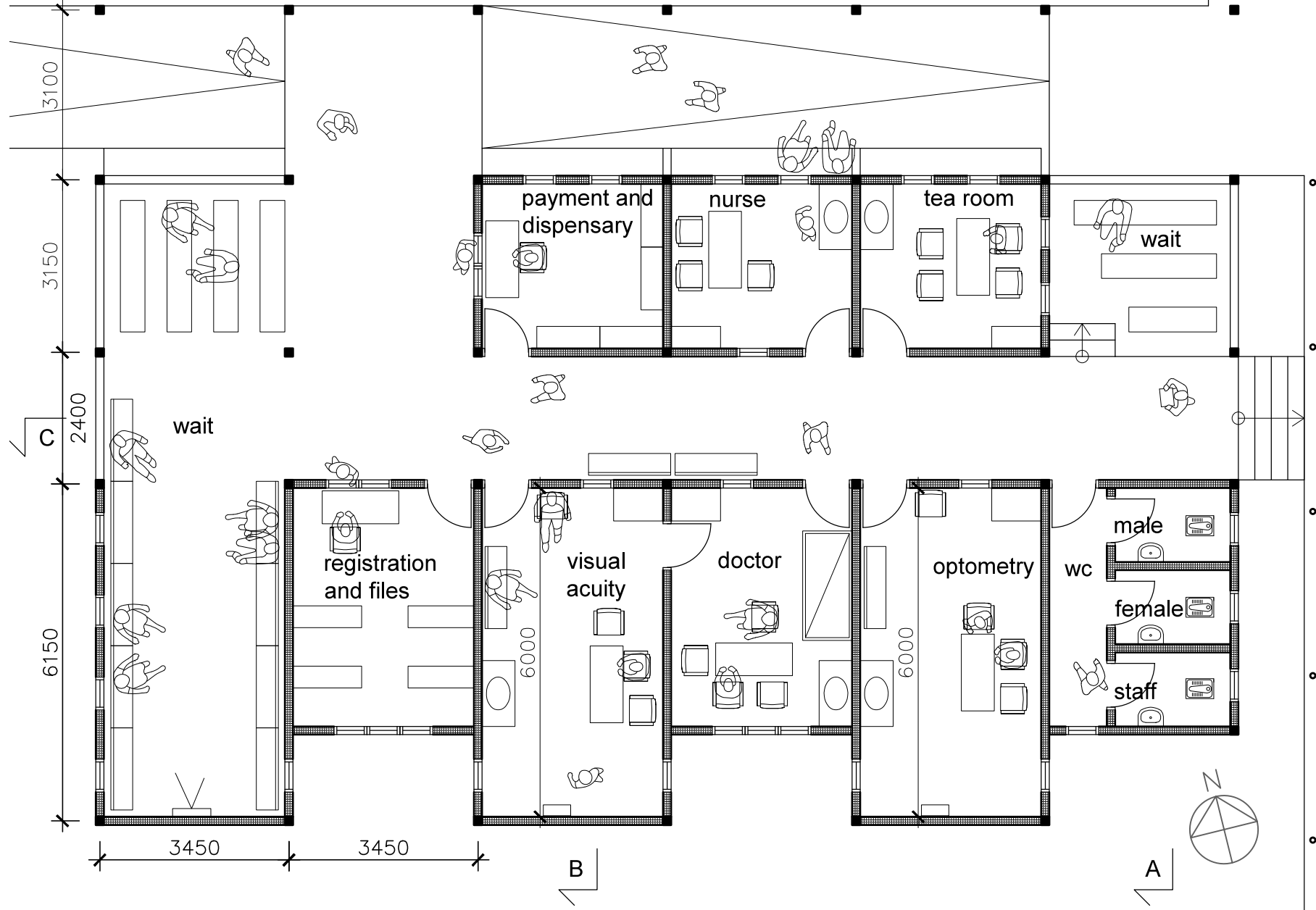
The examination room that most patients go to first is the visual acuity room, where their sharpness of vision is tested. This room needs to be at least 6 meters long for the test to be done well. After the visual acuity test, the patient leaves the room to sit on a bench in the corridor that forms a line to see the doctor who is in the next room. If surgery is needed a date is booked and he/she goes to the payment and medication room to pay for the surgery.

Plan 1.100

B



A



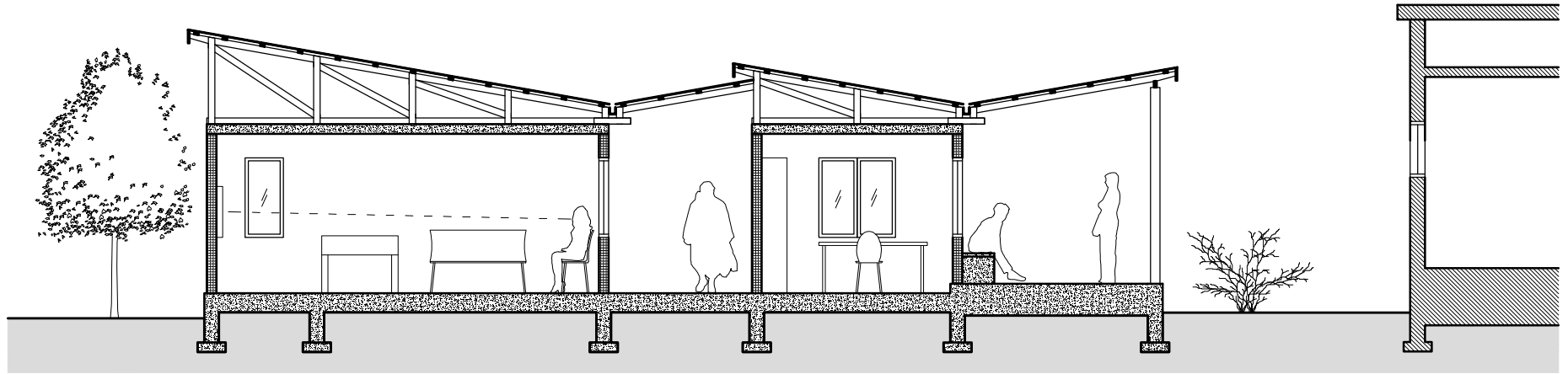
C



A

Sections and perspectives

Section B-B 1:100

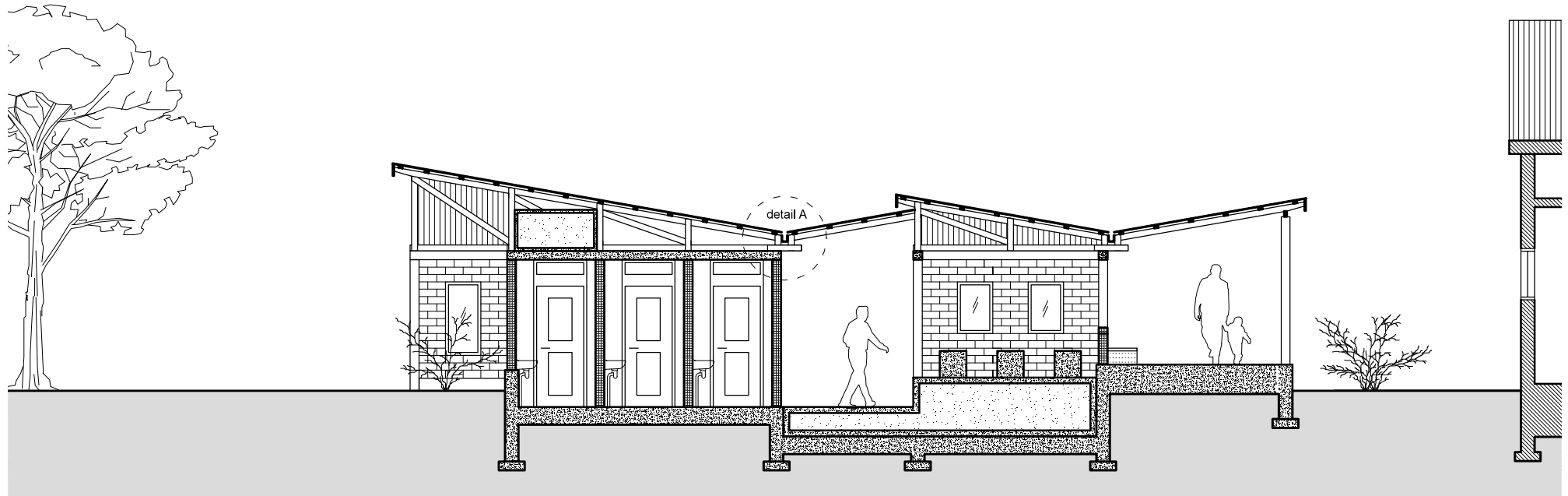


This section is through the visual acuity room, the inner corridor, the payment and medication room, and the outer corridor. It is important that the room for visual acuity is 6 meters long to actually be able to measure the sharpness of vision properly. The wall where the testing board is hanging does not have any windows to disturb the test. Instead there is one window on each long side of the room to give good light on the test board.

The perspective shows the outer corridor in the building. Along the corridor there are seats for patients waiting, and to the right the eye ward building is visible.

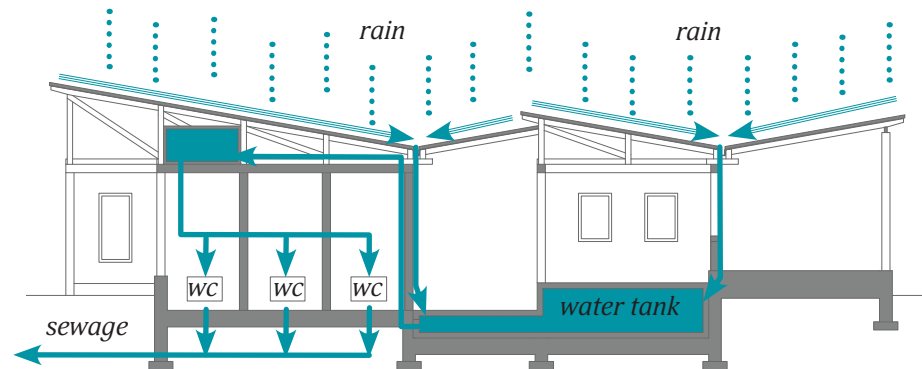


Section A-A 1:100



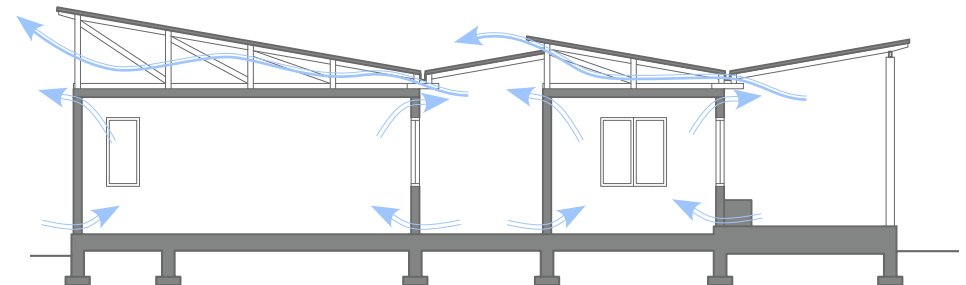
Water principle

Rainwater is collected through the roof and led to an underground water tank. The water is then pumped up to another tank above the toilets, before being used for flushing and washing hands.



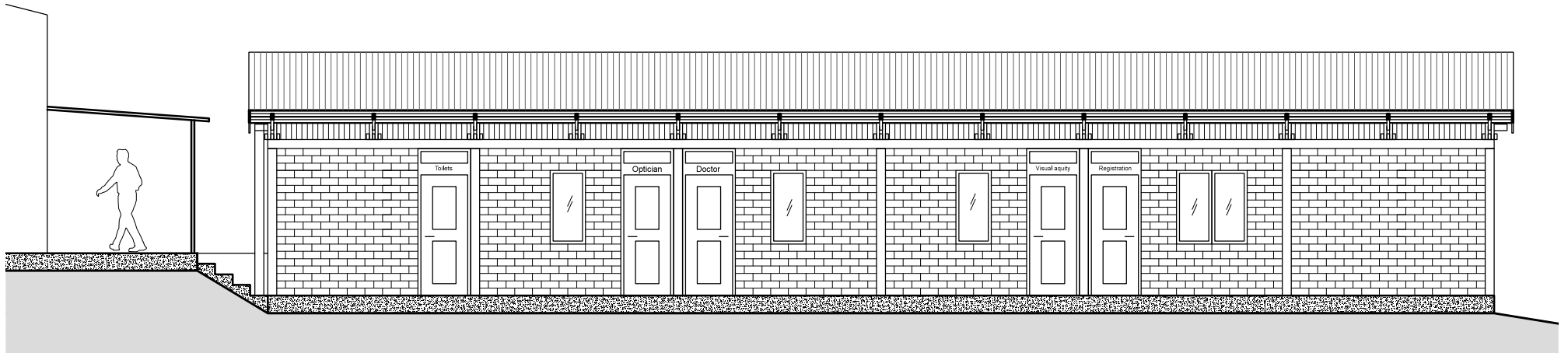
Water principle

The roof is adapted to catch the prevailing wind for good ventilation. The roof is ventilated between the roof and the ceiling. Each room also has its own vents both at floor level and ceiling level.



Section C-C 1:100

This section is through the middle corridor.



This section is through the inner corridor of the building. The site for the building is in a slight slope. However, all the rooms and the inner corridor are on the same height, as is visible in this section.

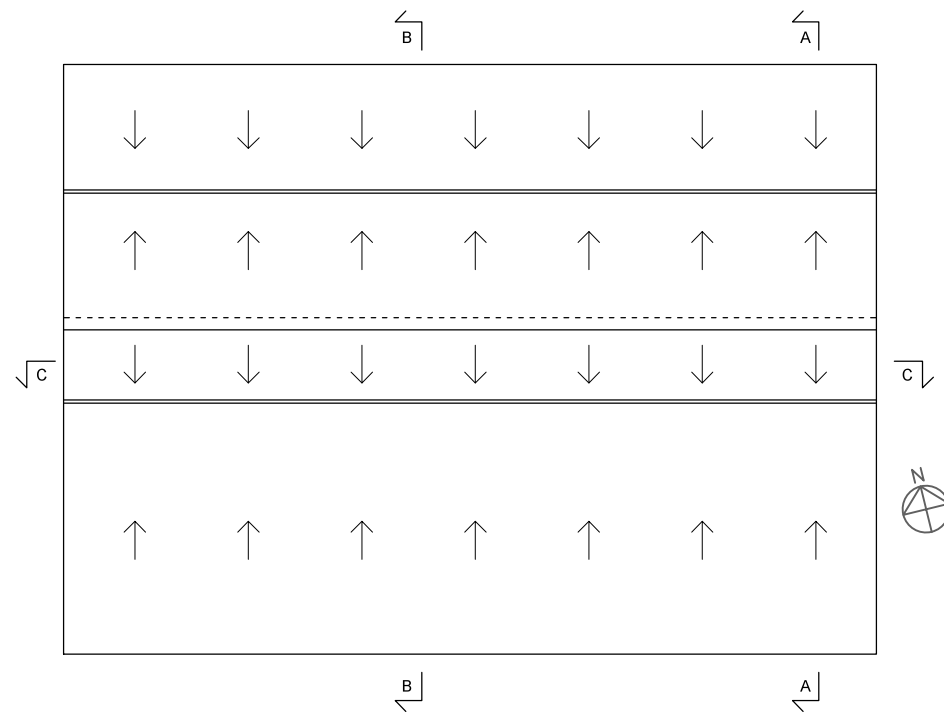
The perspective is a view from the waiting areas in through the inner corridor. There is a small staircase at the end of the corridor that connects to the outdoor path along the pharmacy building.



Roof

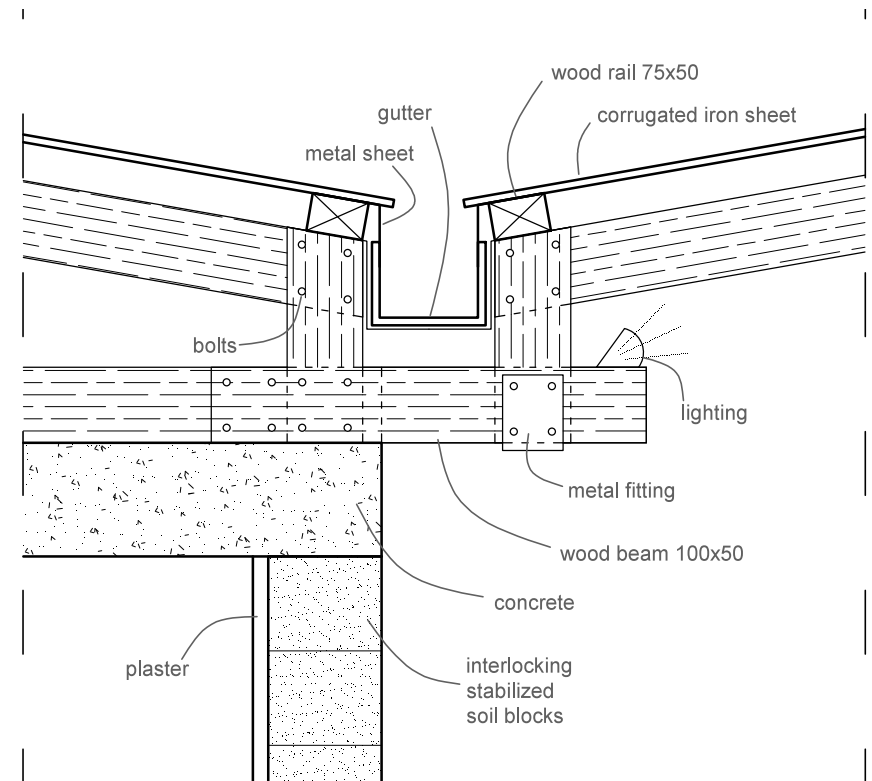
Roof plan 1.200

The roof is designed to collect rainwater. Water is directed to two gutters that lead to an underground rainwater tank.



Detail A 1:10

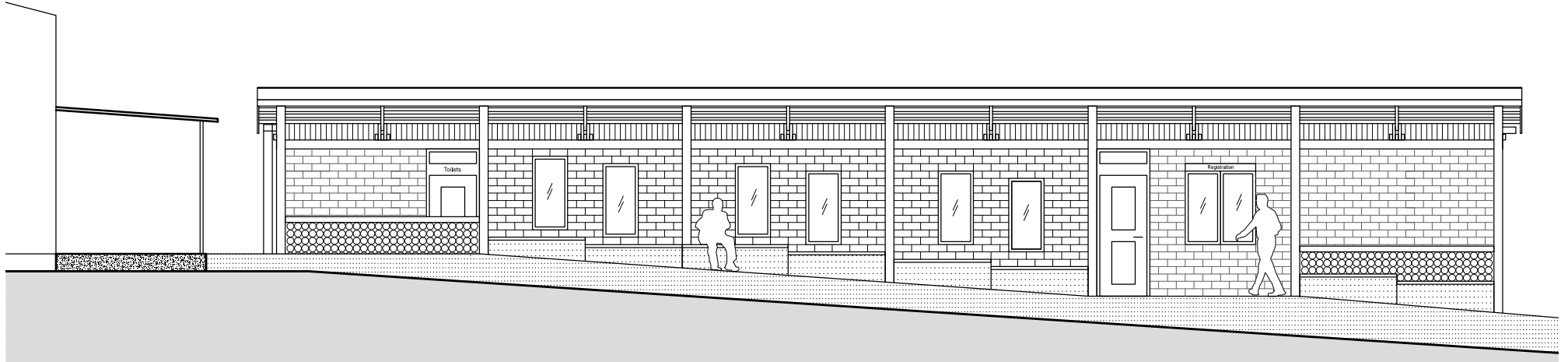
This detail shows the meeting point between the wall, the ceiling, the wooden trusses, the gutter and the iron sheet roofs. Lighting for the corridors is also integrated in the detail.



Elevations

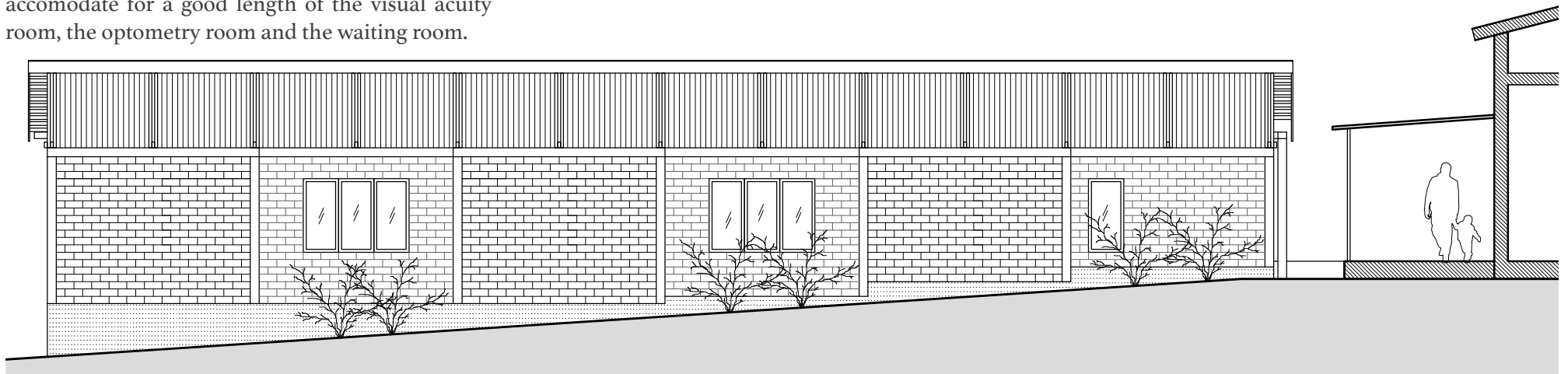
North elevation 1:100

This facade is along the outer corridor of the building. The corridor is divided in two long ramps to connect the surrounding lower areas with the higher areas.



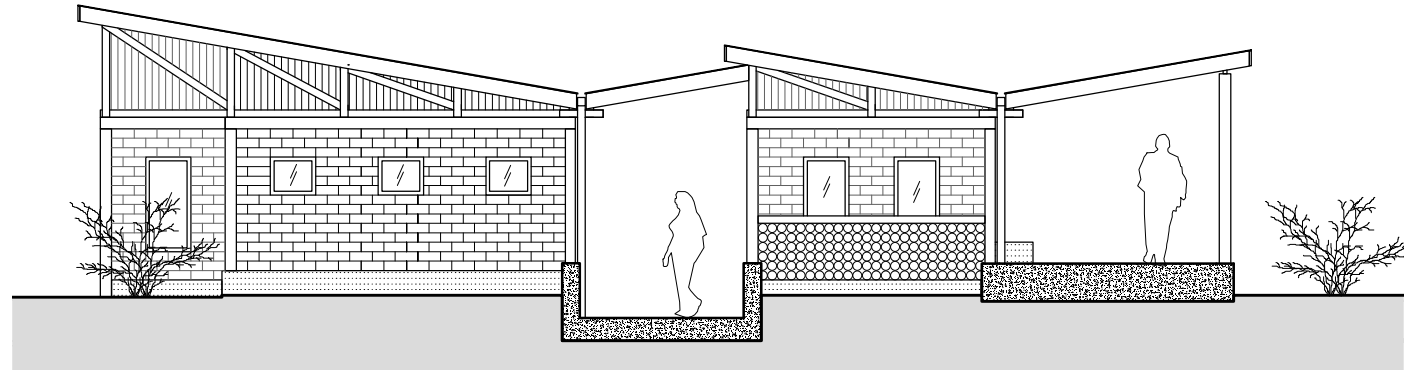
South elevation 1:100

This facade is moving in and out a little to accommodate for a good length of the visual acuity room, the optometry room and the waiting room.



East elevation 1:100

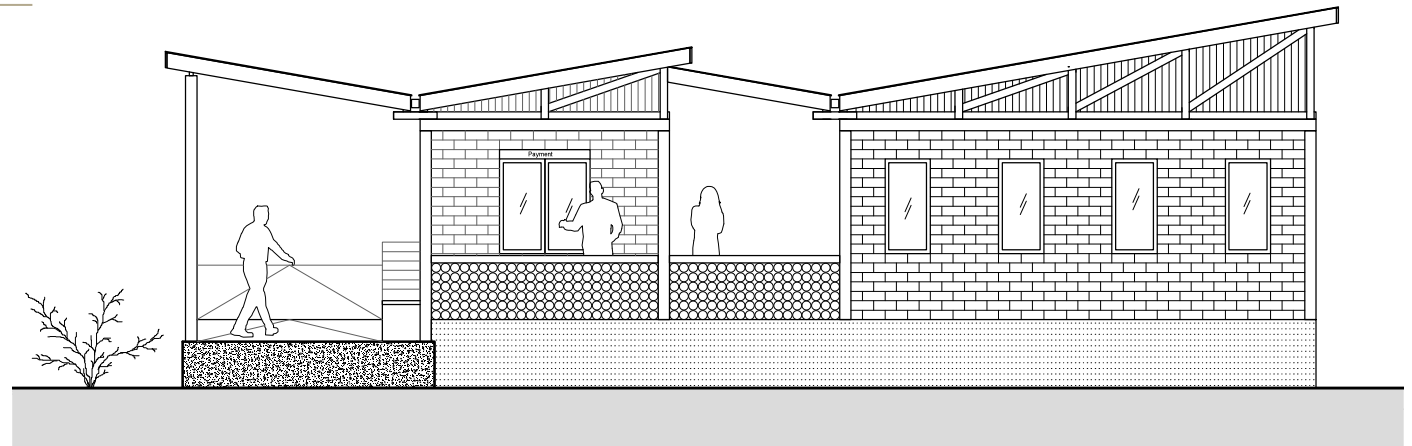
In this facade the small high windows for the toilets are visible. Once again one can see that the two corridors are on different heights, but both connects to the existing path system - one through ramps and the other one through a staircase.



West elevation 1:100

Most of the waiting areas are located along this facade. The indoor waiting area is inside the windows to the right. The more outdoor waiting area is just behind the semipermeable bricks. The outer corridor with its seating and ramp is visible to the left.

Local sisal poles are used as a sparse cover that still lets a lot of air through in between the ceiling and the roof.



Materials



*Between ceiling and roof: local sisal poles.
(extotig.gr)*



*Walls: interlocking compressed soiled blocks
(Makiga Engineering)*



*Locally manufactured bricks of compressed soil
and a small portion of cement.*



Walls inside: plastered and painted off white



*Roof cover: green iron sheets which is
considered beautiful by many locals*



Roof structure : wooden trusses



Half-walls: semipermeable bricks



*Floor: polished concrete floor with
exposed aggregate*



Columns and ring beam: reinforced concrete.

Collaborations

It has come forward in discussions with the hospital management, that they are interested in using this design proposal for the eye clinic and implement it. A first step is to secure the funding, which is hopefully soon done through the collaboration with CBM. I will, through Architects without Borders, continue to develop the proposal based on feedback from Kolandoto Hospital. Kolandoto Hospital will look for a local contractor who would be able to build it.

Budget

There is a budget that was estimated for the first building proposal. The idea is that if this proposal is taken forward, it has to be able to be built within the same budget. But to know that, more detailed drawings of the building proposal are needed. Before asking a contractor for a tender for constructing the building.

The budget in the justification and funding application for the first building proposal is between 86'701 - 102'307 EUR. That means that that proposal costs maximum 293 EUR / m² to build.

The new building design proposal is 285 m². If it has the same cost per square meter, the maximum total cost would be 83'505 EUR, which is 18 % less than the original proposal. However, the guess is that this new building proposal will cost a bit more per square meter, so maybe it is still possible within the given first budget.

4. THE MATERNITY THEATRE EXTENSION

A story about finding a building project and then trying to implement it fast in a good way.

Annika Danielsson - June 2015

4.1. DIAGNOSING THE CURRENT CONTEXT

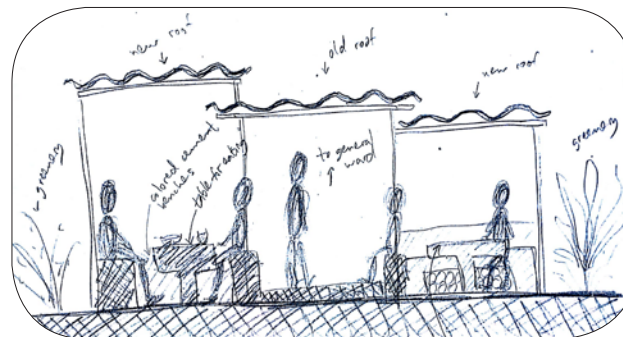
Starting point

There was a thought from the beginning of the collaborative development project to do some quick and easy interventions connected to the building, water and electricity infrastructure during the two months long stay in Kolandoto. The funding came from three different sources. The NGO 'I Aid Africa' gave 20 000 SEK and the NGO 'Engineers without borders' gave 20 000 SEK. In addition, the two engineering students and I had together received a scholarship of 50 000 SEK from 'ARQ forskning'. So there was a joint budget of 90 000 SEK that needed to be split through prioritizing among different projects. In the end approximately 45 000 SEK was used for water related projects such as testing the water quality, doing a test pumping of the existing borehole, and buying and installing a new water pump. Approximately 5 000 SEK was used for renovating the doors to the general theatre. And approximately 30 000 SEK was used for the maternity theatre extension.

These projects were however not identified or decided upon before arriving to Kolandoto. So, when I arrived there, I had still no idea of what type of or scale of building related intervention that we would do.

Finding a project

I started the process of finding a building related project to do by sketching 8 different ideas based on observations from the hospital. The project ideas included building recreational social areas outside the general ward (appendix IV), to renovating the general theatre doors to eliminate the dust coming in (appendix II), making new entrance signs to the hospital, constructing a new public path for visitors (appendix III), build a roof over the waste collection area by the incinerator, and buying a machine for manufacturing special building blocks. The ideas were summarized on one A4 each and presented to the medical officer in charge along with the information of that we probably had 20 000 SEK available for this. He then in turn talked with his staff during a morning meeting in which they decided that they would like to start with renovating the general theatre doors, but they would also like to start an extension to the existing maternity operating theatre.



Sketch for social areas outside the general ward.

The problem

I was told that the existing operating theatre for c-sections at the maternity department apparently was not in use due to that the hospital felt that they could not guarantee the needed hygienic conditions for performing safe c-sections. There was no proper place for the doctors to change clothes or scrub before the surgeries, and no proper place for cleaning the used equipment and linen. Instead, pregnant mothers who were in delivery and in need of emergency c-sections had to be transported out of the maternity building, and along an outdoor path to go into the general operating theatre.



The small inadequate space for scrubbing, washing equipment and changing clothes.

4.2. DREAMING OF THE FUTURE

Goal

The goal of the intervention was that Kolandoto Hospital should be able to conduct safe c-sections in a good environment.

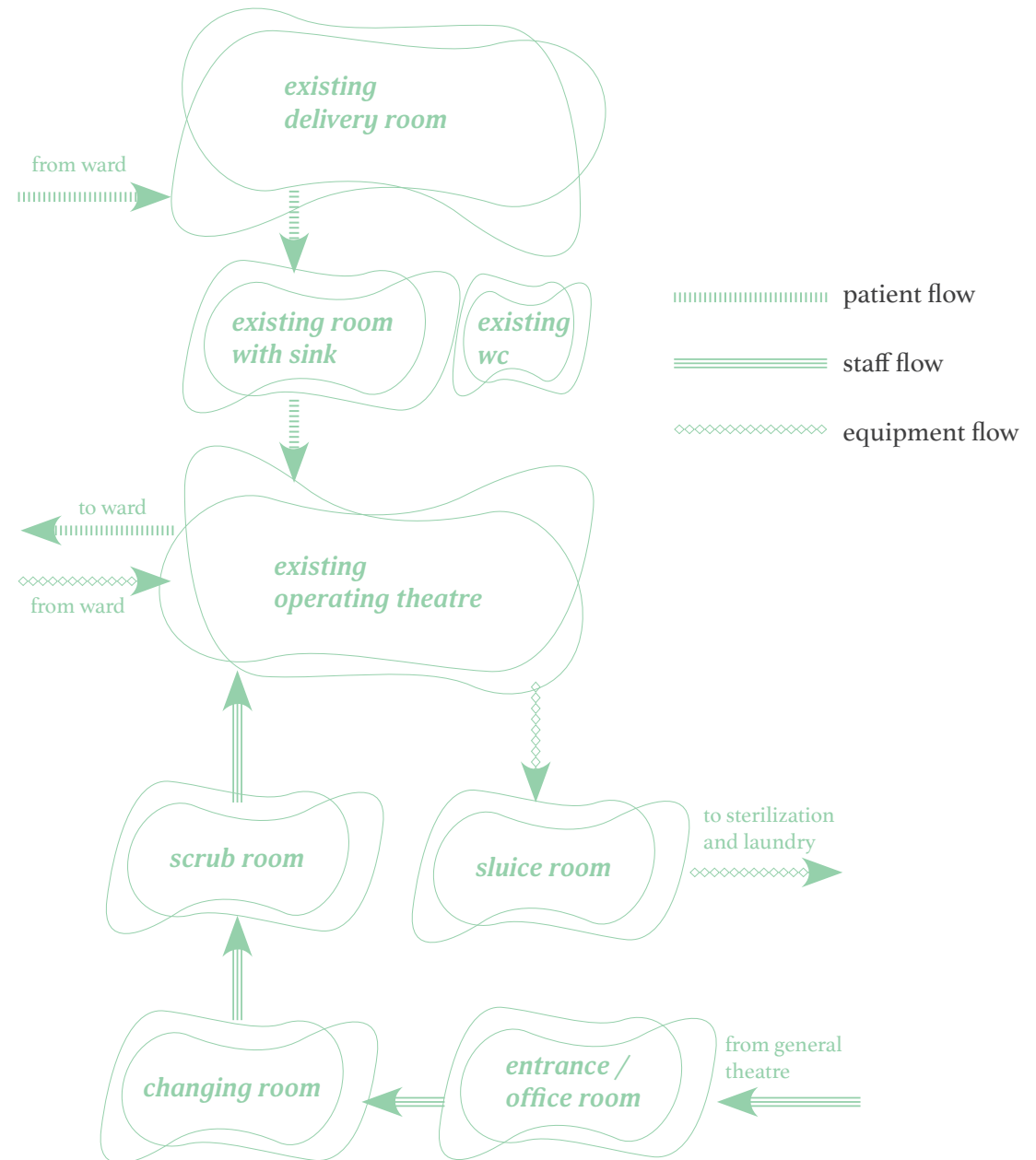
We wanted to improve patient safety. The c-sections can after this intervention be done under proper hygienic conditions in a place that is solely kept for conducting c-sections. The pregnant mothers who are in delivery and need emergency c-sections should not have to leave the building but instead be transported directly from the delivery room into the operating theatre.

Building programme

A first sketch and site adapted building programme with flows was created during a meeting on site.

The rooms that needed to be added were:

- an entrance / office room for administrative work
- a changing room for putting on clean clothes
- a scrub room for washing hands
- a sluice room for rinsing dirty equipment and linen

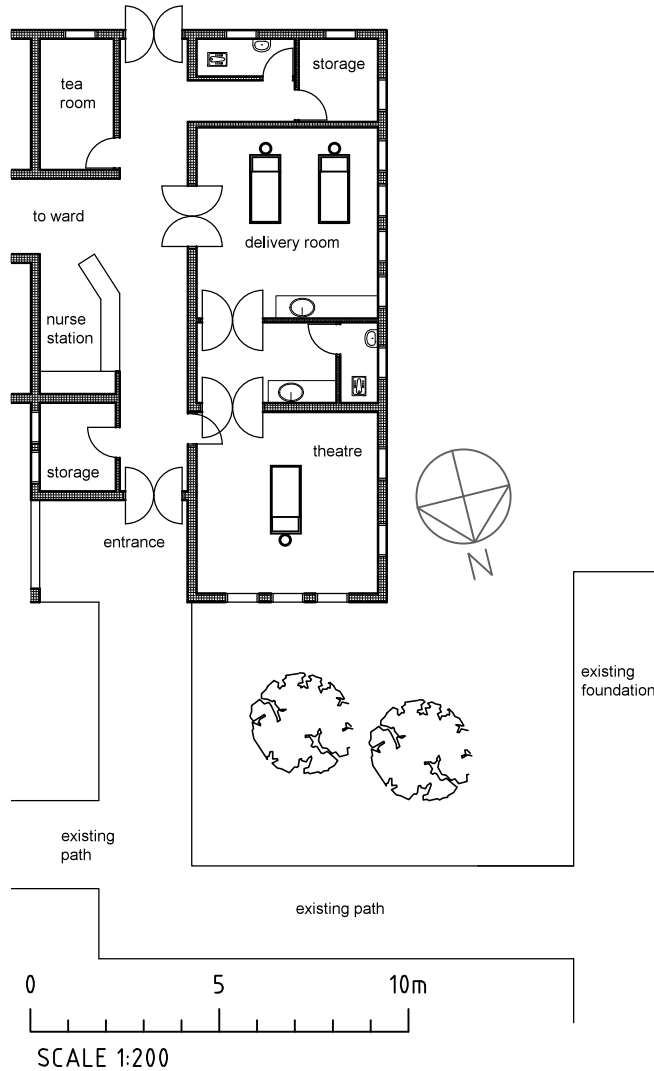


4.3. DEVELOPING ALTERNATIVES AND CONSENSUS

The site

Pictures of the site

Plan 1.200



The maternity building seen from a distance.



The direction from which patients and staff arrive to the maternity building.



This in the area where an extension is possible to do. The existing theatre is just inside the wall.



There are three windows in the wall of the existing theatre towards the side for the extension.

Initial design proposal

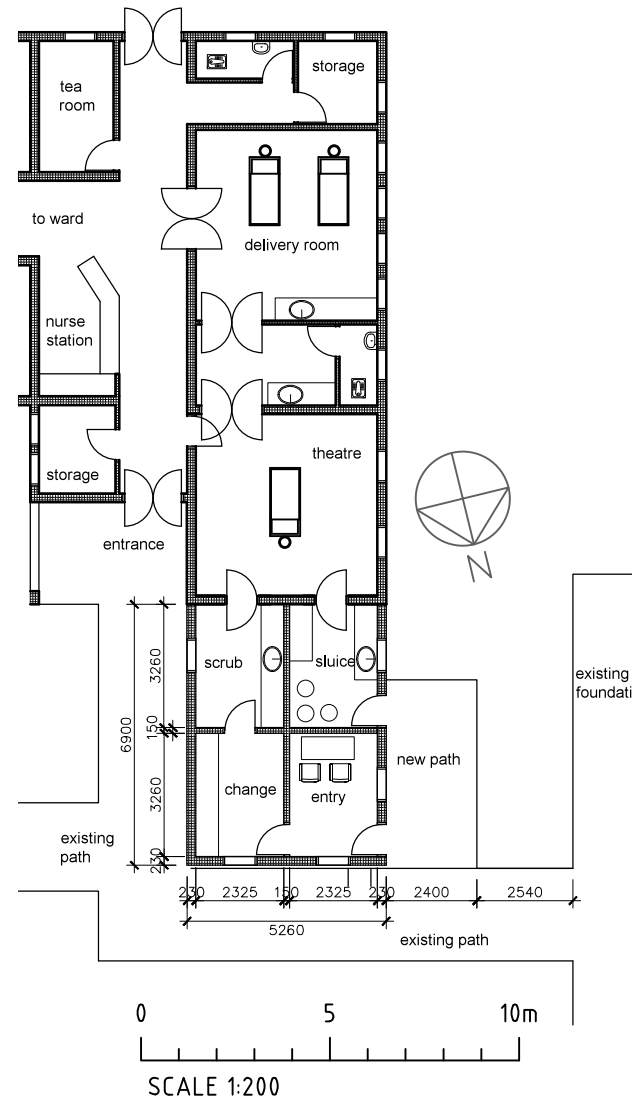
Design decisions

The decision to continue in the same building type and style as the existing maternity building was taken before the design was developed. This means using cement blocks for the walls, wooden trusses and iron sheet roof. We needed to keep the costs down to be able to implement the building. Several design decisions are related to those two preconditions for the construction. One such decision was to carefully take out the existing two windows and use them in the new extension. The location of the doors connecting the existing to the extension was put in the same location as those windows. Another such decision was to only construct towards the north to be able to easily continue and connect to the existing gable roof.

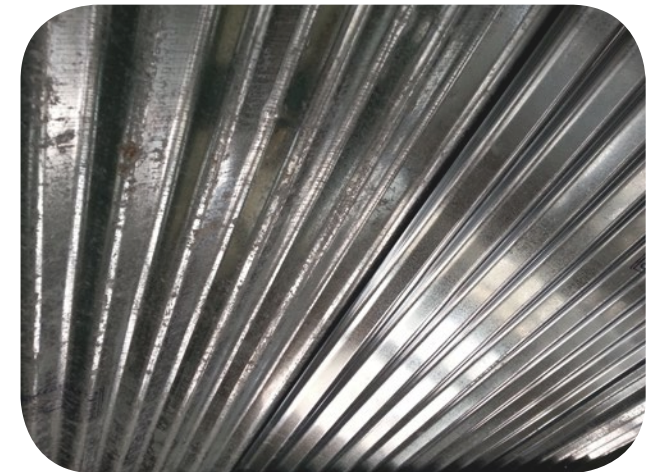
Feedback meeting

The drawing to the right was presented and explained at a meeting with several doctors and management staff. At that time I also showed the exact real size of the rooms for the people to really comprehend the size and comment on that as well as the flows of material, patients and staff through the building. The one feedback that the staff had was to have only one sink in the scrubbing room and also to change the side of the sink so that it was to along the wall to the sluice room. That way the plumbing would be done easier and shorter towards the western facade where one inspection chamber could be built. At this meeting the decision was taken to move forward with the building plans.

Plan 1.200



Concrete bricks.



Iron sheet roof.

4.4. DEFINING A WAY FORWARD

Final design proposal

Revisions

Some additional revision were made to arrive to the construction drawing.

- The width of the new path on the western side was decreased.
- All rooms were shortened a bit to ensure that the iron rods holding up the roof over the path to the north would not need to be moved.
- An updated measurement of the existing building was made and the width of the extension was slightly adjusted to that.
- A small indention of the new concrete block walls shown in the construction drawing was made, to make it possible for the plaster to connect smoothly to the existing building.
- The width of the concrete block walls were adapted to the actual width of the block we were to buy for the construction.

Materials

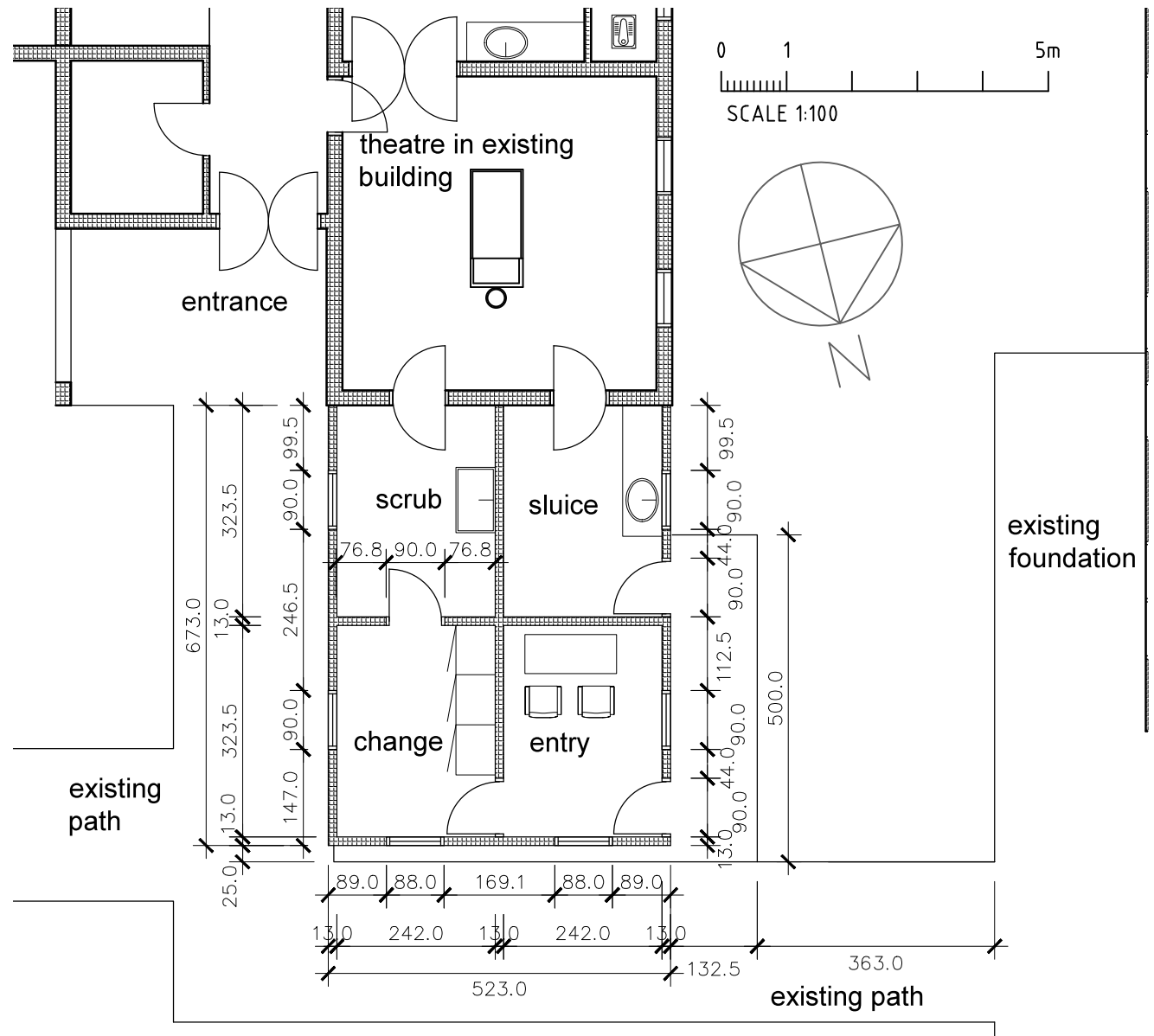
Roof: wooden trusses and iron sheets

Walls: cement blocks

Doors: wooden doors

Windows: aluminium frames

Plan 1.100



Budget

Bill of quantities

Material and cost estimations were done in close collaboration with the hospital management. The hospital management knew different local craftsmen who were asked to come and look at the site and the drawing, and based on that make bill of quantities - lists of the amount of material needed as well as the cost of that material.

Together, the hospital management and I tried to have an overview over the whole process. We went back to several of the craftsmen to ask them about why they needed different items on the list. We reminded the craftsmen on aspect they had forgotten when doing the estimations. We double checked prices through different sources. This work was tricky to me due the language barriers. Some of the bill of quantities were written completely in Swahili, and some of the craftsmen only spoke swahili.

Initial budget

The different bill of quantities were compiled into a full budget for the extension.

Category	Budget in TZS.
Masonry	1 774 000
Roofing	2 427 800
Plumbing	477 000
Electricity	276 000
Windows	1 136 000
Doors	4 047 000
Painting	875 600
Floor tiles (might exclude)	1 414 000
TOTAL (including tiles)	11 406 000
TOTAL (excluding tiles)	9 992 000
Funding from Swedish donors	6 863 600

Budget decisions

The initial budget was discussed with the hospital management. The budget was higher than hoped for and it was obvious that the construction could not be completed with only the funds from the Swedish donors. Then it was decided that the hospital would add the remaining needed money to complete the building, as they had offered before as well. The floor tiles were removed from the project, and a simple cement floor was chosen instead.

Timeplan

All the craftsmen were asked how much time they needed for their work and this was compiled into an overview of how long the extension would take to construct. It became obvious during this process that a detailed timeplan for each day would be very difficult to create, and the we took the decision to move ahead and plan as we constructed.

Category	Days needed
Masonry	8 days
Roofing	2 days
Plumbing	8 days
Electricity	2 days
Windows	2 days
Doors	5 days
Painting	2 days
TOTAL	29 working days ~ 5 weeks

4.5. CONSTRUCTING THE BUILDING

Buying material

After the lists of materials were agreed upon the responsible craftsman, myself, a driver and often a hospital employee who acted as a translator went together to buy the material. The lists of materials with the estimated costs was of big help in the cost negotiations to not be tricked into paying too much. Sometimes we also decided to now buy everything at once. For example, we did not buy all of the estimated 39 kg of nails for the roofing at once, but added more later when it was needed.



Plastering around one of the door frames.



Visiting the brick manufacturer to buy bricks.



Blue skies over the construction site.

Construction coordination

Once the construction started I spent a lot of time on coordinating the different craftsmen and the time management of the construction. Throughout the construction we tried to keep a good speed to be able to finish as much as possible before I was going to leave Kolandoto.

With my previously limited knowledge on construction processes in the context, it was difficult to try to make a detailed timeplan so I relied to a large extent on the experts - the craftsmen. I tried to make a comprehensive plan in the beginning and stick to it. But I realised fast that it had to be dynamic since people were a bit time optimistic sometimes and since the exact order of the steps in the process not was clear from the beginning.

In general I asked the craftsmen on site every morning what they planned to do during that day, the following day and the day after that. The information and the corresponding timeplan changed almost every day. But based on the information, I coordinated so that the right craftsmen were on site the right days, and so that the material they needed was available in time. Communication was again a challenge. Concerning easier topics the craftsmen and I managed to communicate in a mix of basic Swahili and English, and sometimes google translate was a good friend. I also got a lot of help from some hospital staff to translate.

Construction supervision

I supervised and checked the quality of the work at the construction site. Several changes had to be made during the process. One issue that was up for discussion among the roofing craftsman, the hospital management and me was that the inclination of one of the roofs over the paths was leaning towards the facade. At first a gutter was the plan to divert the water from the facade, but this later changed into changing the inclination of the roof to the other direction instead.

A similar discussion was held around the installment of the small windows that we wanted to reuse. Once the walls were up and we looked more in detail at how to install them we realised that we needed to make the size of the hole for the windows smaller to install the aluminium windows without needing a wooden frame as well.

Concerning the doors, the medical officer in charge and I discussed the direction to open the doors many times. Especially the need of swinging doors leading from the extension to the existing theatre was explained several times to the door craftsman.

When I came to the site every day I tried to check and make sure that everything was done in a proper way. A few times I had to instruct the craftsmen on changes. One door frame was for example installed so the wood was badly skewed and would prevent a door from being able to fit well. At another point the ceiling was put up above the vents that are supposed to ensure that there is proper ventilation between the ceiling and the roof.



The holes for the small windows were adjusted.



The roof is ventilated between the roof and the ceiling.

Book keeping

During the whole construction process I was responsible for the book keeping to be able to report to the Swedish donors in a proper way and also to create a hand over to the hospital once they took over the construction process. To the right is an extract from the budget handover to the hospital. As you can see, some of the costs exceeded the budget. This was mainly due to under estimations in material needed. The budget for the doors was changed once when the craftsman was changed. Some categories that were not in the original budget were added, such as administrative costs, demolition staff, and a new AC.

Category	Budget / TZS	Expenses until 10/4	Difference
Masonry	1 774 000	2 616 100	- 842 100
Roofing	2 427 800	2 341 000	86 800
Plumbing	477 000	528 000	- 51 000
Electricity	276 000	268 500	7 500
Windows	1 136 000	0	1 136 000
Doors	2 570 000	1 080 000	1 490 000
Painting	875 600	0	875 600
AC	1 200 000	0	1 200 000
Demolition cost	30 000	0	30 000
TOTAL	10 766 400	6 863 600	
Donation	6 863 600		
KNH contribution	3 902 800		

Documenting the process



1. The site for the extension.
The existing theatre is just inside the wall.



2. The two trees has been taken down.



3. The roof over one of the paths is taken down and the water pipes crossing the site are being moved.



4. Digging for the foundation.



5. The first cement blocks have been places and the craftsmen are double checking the measurements.



6. The walls are coming up and one can start to see where the windows and doors will be.



7. The walls are higher and the AC in one of the existing windows is removed.



8. The wooden frames for the ring beam of steel reinforced concrete is taken down.



9. Another layer of bricks above the ring beam. Holes for the plumbing were made.



10. Wooden trusses are put in place for the roof, and preparations for electrical wiring is done.



11. The wood was treated to last longer.



12. The iron sheets and the gutter boards are put up.



13. The stump of the tree is removed and the ground smoothed in preparation for the new path to be built.



14. Plastering the walls.



15. Building the new path for the entrance doors, at the same time as electrical wiring is going on.



16. The wooden frames for the doors are installed, and so are the switches for internal and external light.



17. The inclination of roof over the path to the left was changed to direct rainwater away from the building.



18. The corners for the windows and doors are plastered to look good.



19. Pipes for the water and plumbing are installed.



20. The cement floors are made, and one more layer of brick is added for the new path.



21. An inspection chamber for the plumbing is made, and the ceiling boards have been put up.



22. Wooden doors and aluminium framed windows are installed.



23. The doors are varnished and glass installed above the doors.



24. The building is painted.

5. DISCUSSION AND REFLECTION

Reflections on the process, result and continuation of the project.

5.1. HEALTHY HOSPITAL DESIGN ...

... for people's health

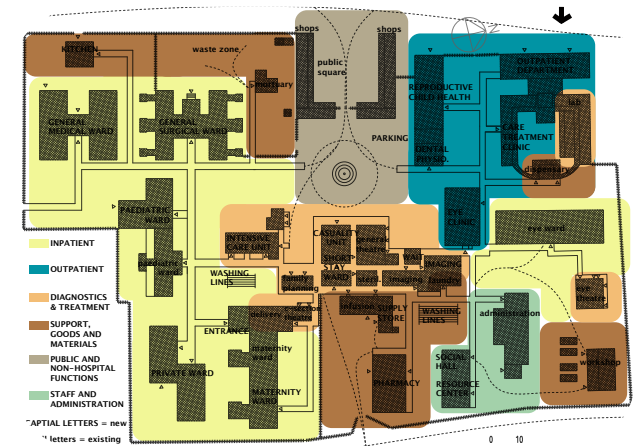
This relates back to the overarching issue of the right to health and the question posed in the beginning: How can a masterplan for Kolandoto Hospital support the access to appropriate healthcare in a healing environment free from factors causing illness or poor health?

During the process of developing the masterplan for Kolandoto Hospital several different angles to approach the question were revealed. There are some ways to deal with creating an environment that does not cause illness or poor health, some ways to try to create a healing environment, and some ways to improve the access to appropriate healthcare.

One way to try to make the environment in the masterplan proposal less dangerous for people's health has been to analyze and design the flows of patients, staff, visitors and goods at the hospital site. Dangerous delays in service delivery are minimized in the proposal, as was the case with the long and inefficient emergency flow. The flow of outpatients have been defined, shortened, and kept to one area in the hospital site in an attempt to decrease the risk of spread of infections and infectious diseases. Unnecessary congestion of visitors around more clean and critical services such as the general theatre and the maternity theatre are decreased in the proposal to minimize risk of infections and delays.

The masterplan proposal improves the healing environment by for example suggesting more defined outdoor spaces that can be used as part of the care and care giving environment with recreation in nature. Wayfinding and clarity that will make the experience more pleasant and less stressful for patients who are already in a stressful situation is also improved in the proposal.

The process of creating a masterplan in itself is an approach to improve the access to appropriate healthcare. A proper masterplan with agreed priorities and medical justifications can be used as a base for resource prioritization within the hospital, and resource mobilization from possible donors for implementation of the identified building projects. It also provides better possibilities for the hospital management to really have ownership over the development process at the hospital, especially in relation to the international development sector and possible donors. This might speed up the process for delivering the needed and future needed health care services to the surrounding communities. The resource mobilization and prioritization possibilities are also of help in the ongoing process for the hospital to become a Council Designated Hospital and provide cheaper service to the people and fill a service void in the health care system.



A masterplan for people's health.



A climate adapted sustainable design for an eye clinic.

... for a healthy environment

This topic relates back to the overarching issue of sustainable building techniques and the question posed in the beginning: How can sustainable building techniques for a tropical be applied to a building design at Kolandoto Hospital?

The climate adaption of a building and building for a healthy environment was investigated through the process of creating a design proposal for a new eye clinic. Early on in the process it became clear that the first step was to clarify what type of tropical climate Kolandoto has, since there are six different defined climatic types within the tropical climate. Kolandoto Hospital is in the hot semi-arid / savannah zone. The next step was to research and summarize different techniques that are applicable to that specific climate.

The last step was to merge and incorporate the techniques together with all other design criteria regarding flows, connectivity, room size, and atmosphere for the building into the final design proposal. The building is oriented with the long axis going east-west in the design proposal, and windows are well protected from sun rays to minimize solar radiation and create a good indoor climate without using mechanical climate control systems. The roof is ventilated between the ceiling and the high reflectivity roof for similar reasons. The walls are suggested to be built with compressed soil bricks which is a technique that require less cement during manufacturing and assembly of the bricks. Another benefit for the environment is that the bricks are locally produced and hence need less transport.

... for a healthy approach to the international development sector

This topic relates to the overarching issue of the relation to the international development sector and the question posed in the beginning: How is it possible to implement a good quality architectural intervention at Kolandoto Hospital during a two months study visit?

Within the collaborative development project setting of this thesis I was in a situation where I could be part of creating problems concerning ownership over and benefits from the project. To try to mitigate this risk I used different approaches in finding and implementing a building related intervention.

One approach was to try to incorporate a shared ownership throughout the process by first being aware of the possible power imbalance due to history and the sources of funding in a project of this kind, and trying to counteract it. This started in the process of trying to find a project. I gave several alternatives of smaller projects to the hospital management along with a request to give project ideas of their own, and also gave information about the exact available funding. With that, I handed over the decision of what to try to implement to the hospital management who held a discussion in an occasion when I was not there and then came back to me with their decision. I avoided the situation in which I would come with a project suggestion, and the hospital saying yes to the incoming funding irrespectively of their internal priorities around development. In the end, the hospital as well as I as a

representative within the international development sector shared the ideas, the decisions, the funding, and the responsibilities during construction for the maternity theatre extension project.

Another approach is to make the process participatory, through communicating a lot with different people in different formats and settings. We had office meetings, site meetings, skype meetings and informal side discussions. The meetings and discussions were with nurses, doctors, management staff, patient relatives, craftsmen, funding organizations, material suppliers etc. In each meeting I tried to have a humble approach and listen to the expert knowledge of different aspects for the project.



A maternity theatre extension through joint efforts.

5.2. THE ARCHITECT'S ROLE AS ...

... a hospital planner and process leader

In the large scale of creating a masterplan for Kolandoto Hospital I had the chance to be a hospital planner that needed to apply a holistic approach to the multitude and complexity of design considerations to find a feasible proposal. I used my previous knowledge about specific requirements for hospital environments alongside an openness to the specific requirements of Kolandoto Hospital. As a process leader for the masterplan I had to see situations from different perspectives and apply my skills in facilitating workshops and meetings to get other people's ideas and knowledge to the surface before merging them, the priorities of the hospital and my expertise in a final masterplan proposal.



At a workshop.

... a designing architecture consultant

In the scale of a middle-sized building design I had the opportunity to be a designing architecture consultant who got the specific task of drawing a design proposal for a new eye clinic building presented to me from a client. Different creative methods had to be used to understand the conditions of a site, the size and connectivity requirements of a programme, and generate ideas for the design of the building. The work required to move between abstract design concepts of the building being calm, clear and comfortable, to tangible and technical details of construction. The connections between small scale choices for materials to the global vision of building environmentally friendly were seen and highlighted in the design process.



At the desk.

... a project manager

In the small scale of building an extension to the maternity theatre my job was to be a project manager. The work included finding a good project for the available funding, designing the building, supervising and coordinating the construction, time planning and book keeping. With those tasks I had to handle uncertainties and make sure the project moved forward in a good way anyway. Problems needed to be solved along the way and decisions connected to quality and budget and outcomes had to be taken in collaboration with different actors.



At the construction site.

5.3. A RICH PROJECT WITH ...

... different scales

The sub-projects in the thesis spans over a variety of scales - from the large scale planning work of creating a masterplan proposal, to the middle scale of an eye clinic building design proposal, to the small scale of building a minor extension to the maternity theatre. Outcomes of the different scales of sub-projects supported the other sub-projects. The knowledge about available building materials and local construction techniques gained through implementing the building extension, was useful when designing the building proposal. Knowledge and understanding of how indoor and outdoor space normally is used at the hospital was gained in the eye clinic sub-project, and later used in the masterplan proposal in terms of the layout of building volumes in relation to each other. The trust built through clearly showing that the hospital should do the prioritization of projects in the masterplan process, is assumed to have made it easier for hospital staff to clearly voice their opinions concerning the design of the maternity theatre extension project without fearing that the donors would leave. Another example is that the credibility of my intention to create feasible design proposals for the masterplan and eye clinic building was probably supported through implementing the concrete building extension to the maternity theatre. In addition to the aforementioned scales of the sub-projects, the long-term timescale of the collaborative development project that forms the framework of the thesis was a good foundation for a successful thesis.

... several focuses

The three sub-projects in the thesis had different focuses, but knowledge from the different focus areas was also integrated in the other sub-projects. The overarching issue in focus for the eye clinic design proposal was sustainable building techniques, and knowledge from that was also applied in the maternity theatre extension project through for example the naturally ventilated space between the roof and the ceiling to create a good indoor climate. The research done for the masterplan project regarding the overarching issue of the right to health, was also used in the design proposal for the eye clinic building design through for example incorporating clear wayfinding in the design proposal, which is a feature that is part of a healing environment for people's wellbeing. The overarching issue of the relation between the hospital and the international development sector was in focus in the maternity theatre extension project, but also well incorporated in the masterplan project. The masterplan proposal is adapted to how the hospital intermittently receives funding for physical improvements from donors in the international development sector. The design of the masterplan with ten stepwise infill building projects is expected to make it easier for the hospital to own the development and clearly communicate to the donors what the hospital would like to prioritize. These are just some examples of how the knowledge gained through the focus in one sub-project has influenced the proposals in the other sub-projects.

... many stakeholders

This thesis was set within the larger framework of a collaborative development project called Healthy Hospital in which many different stakeholders were involved. Kolandoto Hospital played a huge role in terms of being the case and setting for the thesis. The villagers and staff of the hospital were wonderful in welcoming all discussions and ideas that I put forward, and responding with honesty and enthusiasm. The NGO I Aid Africa, was invaluable in acting as the coordinator and project leader with the help of their previous experience of collaborating with the hospital around aid projects. The NGO Architects without Borders was key in providing guidance in architectural discussions for the set up and fulfillment of the thesis. The NGO Engineers without Borders helped with technical knowledge concerning water and energy issues. The tutors and fellow students from Chalmers University of Technology that were involved in the project, provided both encouragement and academic guidance in carrying out the field study and finishing the thesis. Financially, the Healthy Hospital project and the thesis work was supported by the hospital, the involved NGOs and by scholarships from the Swedish International Development Cooperation Agency (SIDA), Stiftelsen Åforsk foundation and ARQ foundation. To take in and balance the diversity of perspectives, experiences and opinions from the many stakeholders have been both a huge challenge and a crucial framework for the realization of the thesis.

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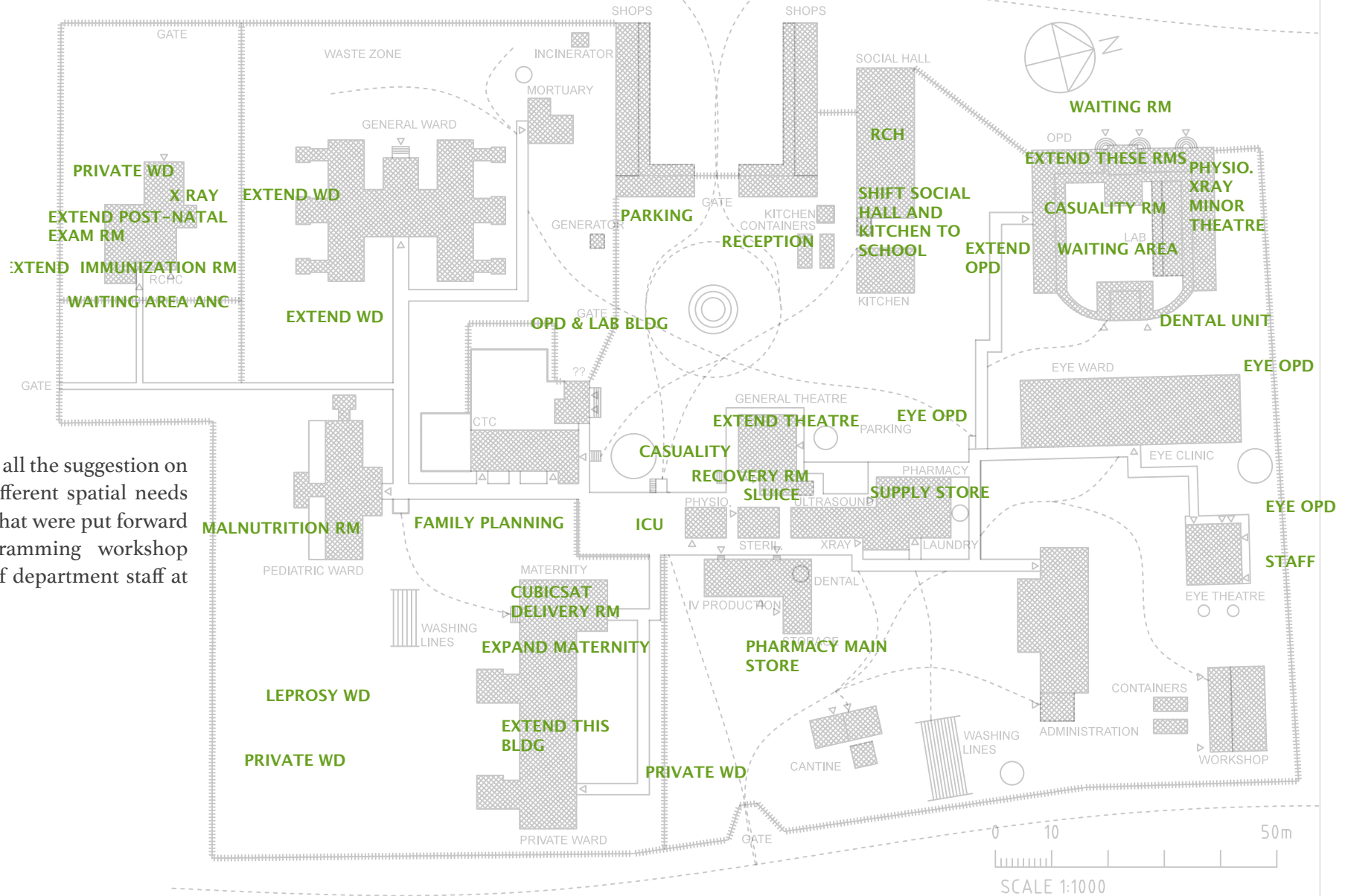
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Sunset over the village.

7. APPENDICES

Appendix I: Placement suggestions



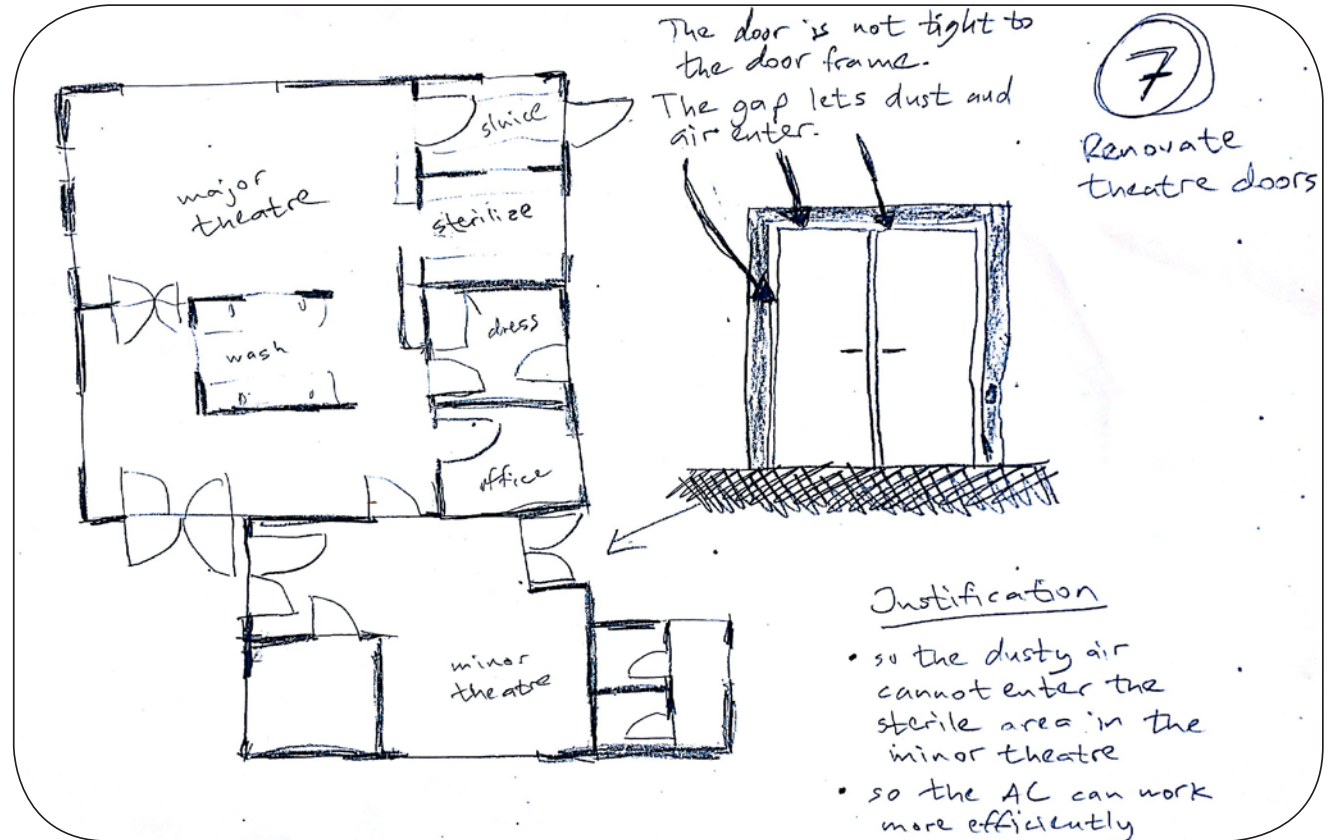
This map shows all the suggestion on placement of different spatial needs at the hospital, that were put forward during a programming workshop with the head of department staff at the hospital.

Appendix II: Door renovation

In the process of identifying building related quick interventions, the idea of renovating the doors to the general theatre building came up. It was decided to be implemented.



The door gap lets air and dust enter directly into the theatre.



We went to the timberyard to find the best material.



The inner parts of the old doors are reused.



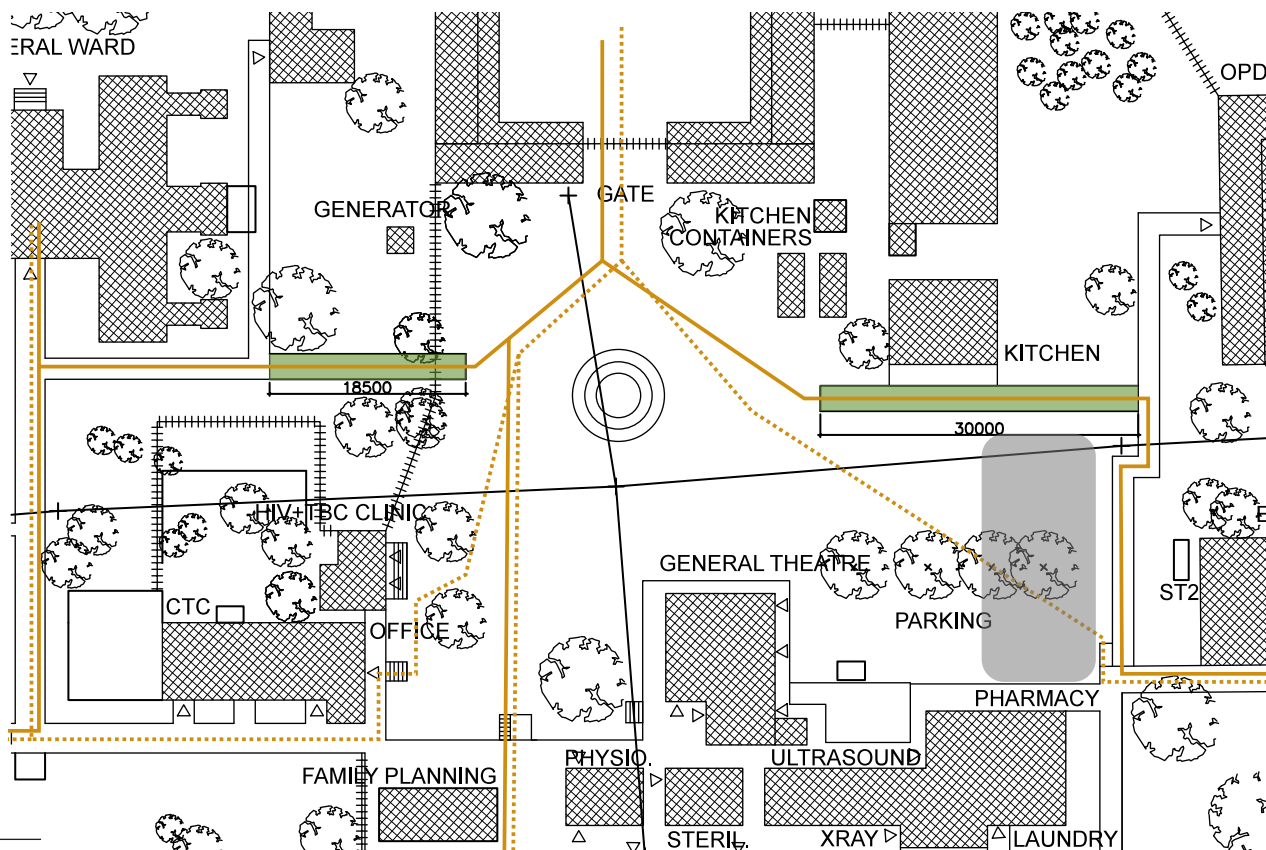
Two of the three doors we renovated, before painting.

Appendix III: A new public path

This proposal originates from the analysis of flows through the hospital. The aim of the proposal is to have less congestion around the paths in front of the family planning and CTC. Today all visitors that to the general ward, the pediatric ward, the maternity ward and the private ward start by walking up to the family planning building, and then from there go to the different wards. A new piece of a public path from the entrance square towards the general ward (left in illustration below) would be useful for all visitors to the general ward and the pediatric ward.

The visitors going to the eye ward today pass over the parking area where the hospital is planning to build a new eye clinic building. A new public path from the entrance square towards the OPD areas (right in the illustration below) and the path connecting to the eye ward would be useful for visitors going to the eye ward. Both of these paths would also be useful for staff walking between the general ward and the laboratory in the OPD area. A cost estimation for building this public path was done and is included in the Survey Report given to the NGOs.

Proposal: It is recommended to only start with the path going from the gate to the general ward. The path going from the gate towards the OPD should only be constructed once the new eye clinic building is finished. When the final design for the public path is made, it is also important to consider the rainwater and that the whole hospital site is sloping slightly towards west and the main entrance area.



People already walk along part of the suggested path.

- - - - - current visitor flow
- future visitor flow
- new public path
- new eye clinic building

Appendix IV: Social areas outside general ward

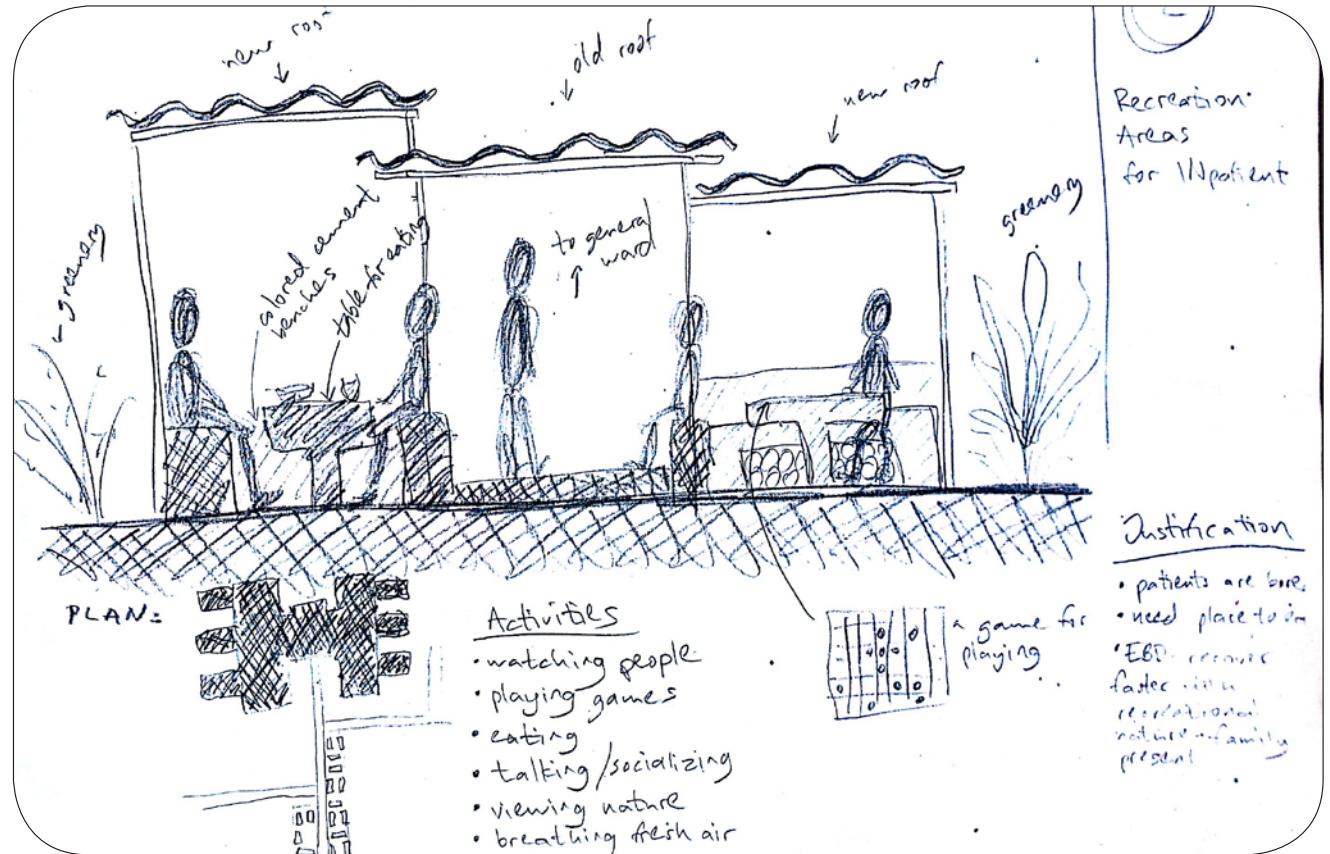
Problem description:

The general ward accommodates both patients who are immobile and mobile. The more mobile patients sometimes gets bored from trying to stay in bed the whole day and are hence often walking outside the ward to sit along the walkway. Relatives bring food for the inpatients three times per day. Patients sometimes eat the food by their bed, but many also walk outside to sit along the walkway, on the walkways or on the ground to eat.

Proposal:

The proposal is to build social areas for inpatients in connection to the general ward. The social areas should facilitate for sitting under a roof. Some of the activities that would take place in the social areas include: looking at nature, breathing fresh air, playing games, talking/socializing, watching other people passing by, and eating the food brought by relatives. It has been shown that patients recover/heal faster if they have regular contact with family and nature.

To the right is a section sketch showing the current walkway leading to the general ward in the middle. The suggestion is to add two new roofs along that walkway, one on each side, under which benches and tables are built. A closer assessment of exactly where along the path this is suitable, and how many seating places can be included, along with a more detailed design, should be made before implementation is started.



Cost estimation:

A preliminary cost estimation for a section of benches and roof on one side of the existing walkway for 10 meters was done and is included in the Survey Report to the NGOs. The total cost estimated for those 10 meters is 1046000 TSH. A guess is that it would be good to provide such social areas for approximately 30 meters in total, which means that a budget on approximately 3138000 TSH is advisable. While budgeting for such an intervention is is however advisable to maybe increase the budget with minimum 20%, which makes for 3765600 TSH.



Patients eating on the ground.

Appendix V: Reorganization of the imaging department

Problem description:

The layout of the imaging department today is a problem since the doors for entering the department are too narrow for a stretcher to go through without trouble. This means that there are situations in which patient who cannot walk have to be carried on his/hers mattress to be able to enter the x-ray room. This is troublesome, dangerous and painful for the patients who sometimes are severely injured. The current entrance situation also causes the patients going for x-ray to have to enter and then turn back 360 degrees in the building which makes taking an x-ray even more troublesome for the patient and the staff.

Proposal:

The proposal includes changing the layout of the imaging department to facilitate for an easier and not dangerous entrance situation for patients.

The proposal includes three modifications to the building: 1) Exchanging a current window in the x-ray room to become a door. This window is 1260 mm wide, and the staff express that a door this size would also be enough for patients on stretchers. The door has to be thick with metal protection. 2) Remove one old piece of a wall in the current reception room to make the room have enough space for accommodating ultrasound examination activities. Before making this one has to ensure that the stability of the building structure is not affected. 3) Building a floor and roof for the new waiting area. It is an area of 2.8 m times 5.1 m. This probably requires four new pillars.

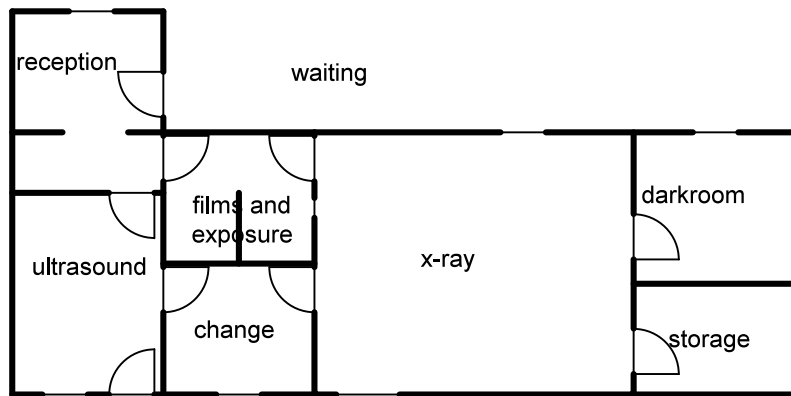
Cost estimation:

A preliminary cost estimation was provided in the Survey Report to the NGOs. The total preliminary cost is 1345000 TZS.

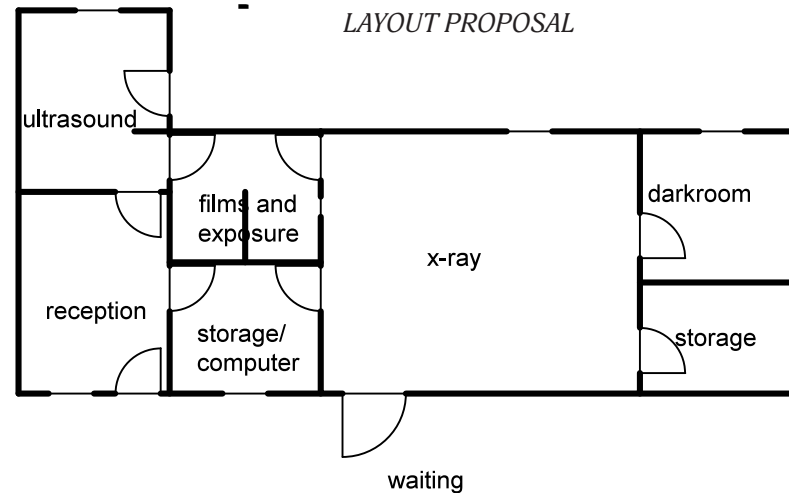


Carrying a patient through the door.

LAYOUT TODAY



LAYOUT PROPOSAL

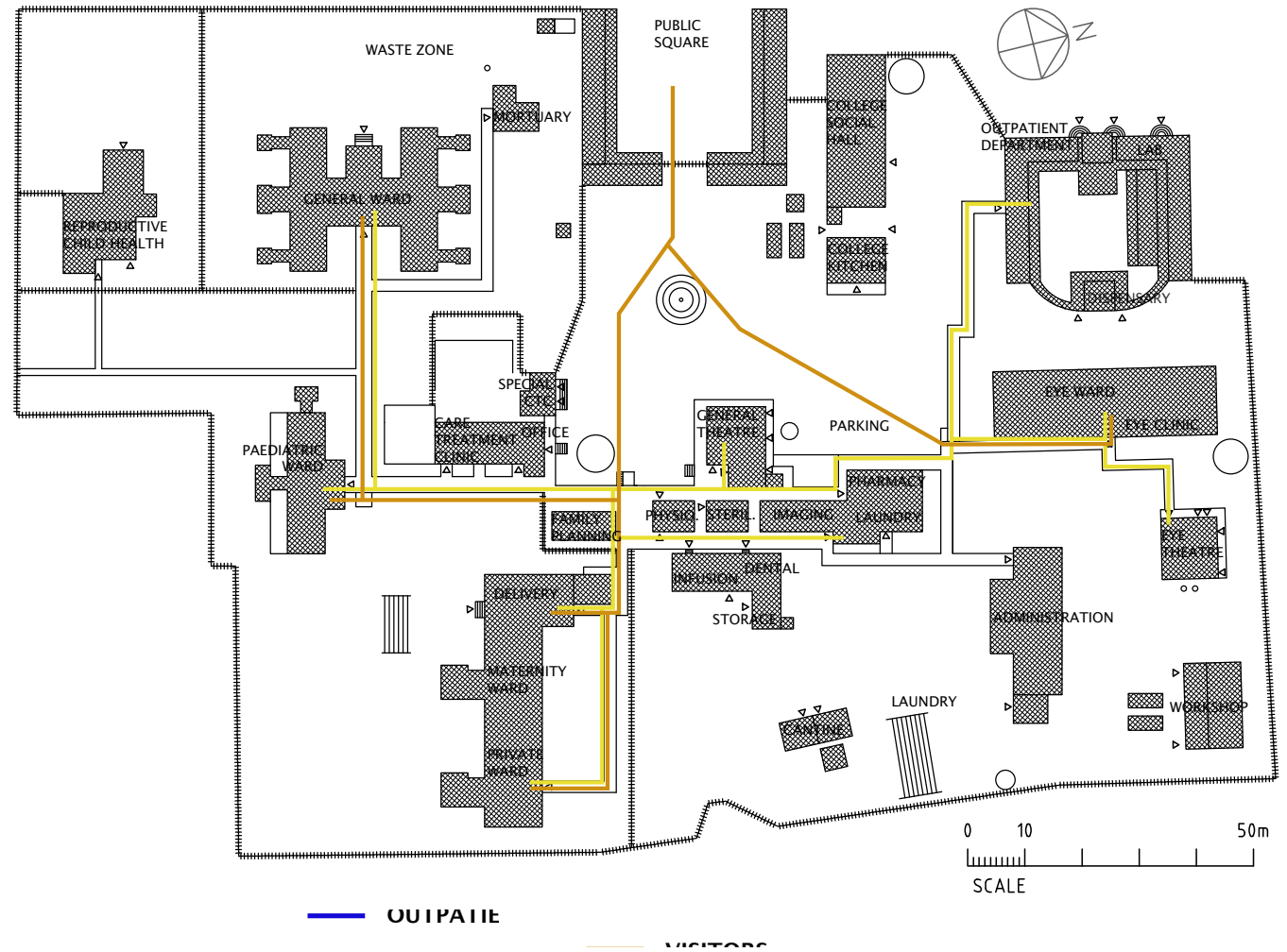


Appendix VI: Inpatient and visitor flows

The inpatient flow is today starts by registration at the OPD before the patients are brought to their respective appropriate wards. From the wards, the patients sometimes goes to the center of the hospital to the x-ray department or the general theatre.

The patients at the hospital are not served food by the hospital. Instead, their relatives come to deliver food to the patients during visiting hours three times per day. This means that the visitor flow is quite high with peaks in the morning, around lunchtime, and in the late afternoon. Visitors enter through the main gate and then walk to the respective wards.

An issue with the visitors flow is that it is unnecessarily long. At the path in front of the family planning and the CTC the visitor flow is part of causing congestion where more clinical flows should not be restricted.



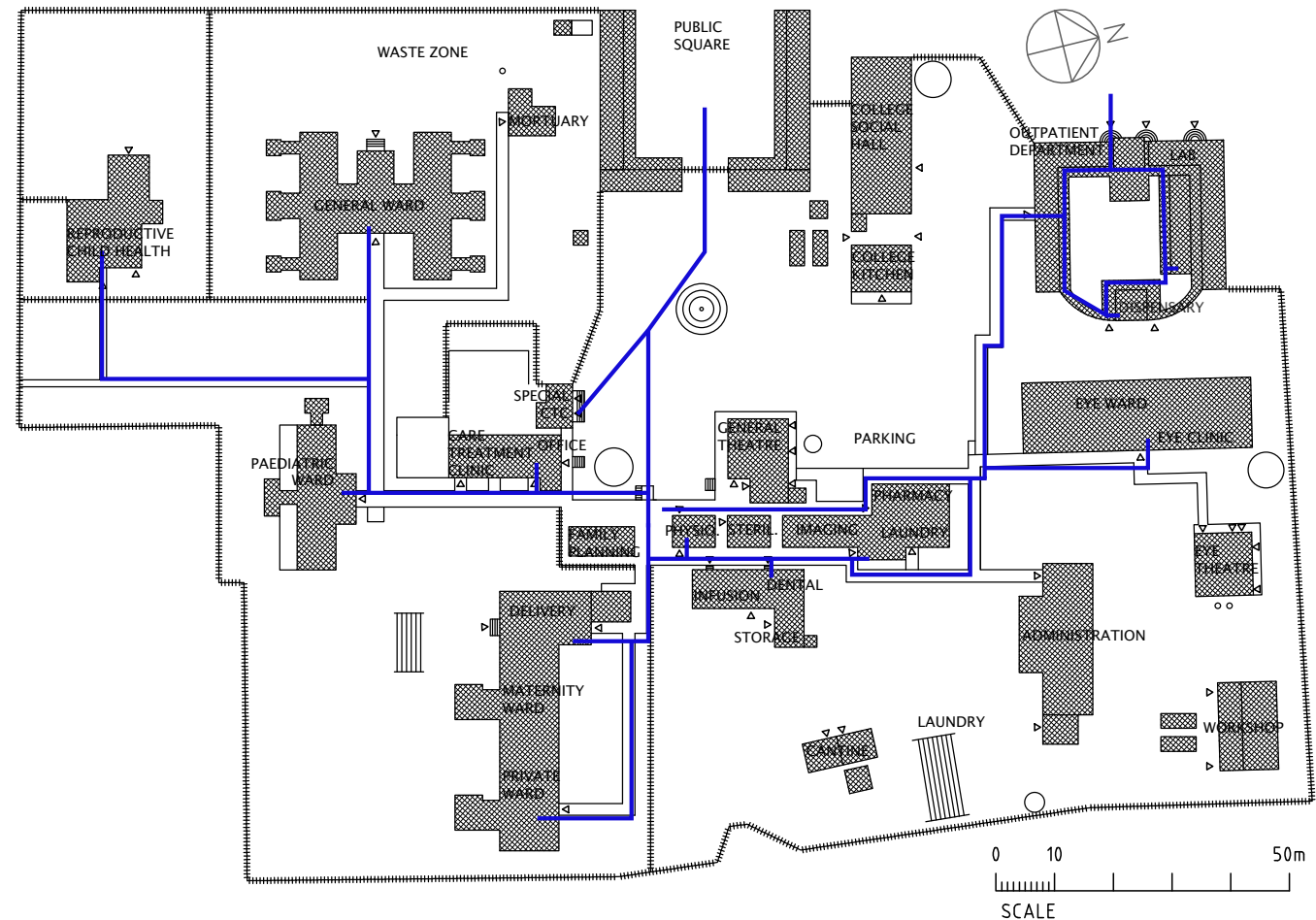
Appendix VII: Outpatient flow

The outpatient flow often starts at the OPD with registration and payment. The consultations and examinations of patients happen at the OPD during daytime. A lot of outpatients are only in that area since the laboratory department is also within the same building.

Some clinics are however not situated close to the main OPD, but instead the patients have to cross other areas to reach their destination. That is the situation for the patients going to the Care Treatment Clinic (CTC), the Reproductive Child Health Clinic (RCH), the physiotherapy, the dental clinic and the x-ray department. This movement is probably most problematic for pregnant mother coming to the RCH, who sometimes have to walk all the way there, then go back to the laboratory and then back again to the RCH.

At nighttime the OPD is closed. This has the effect that outpatients will enter through the main gate, and are then expected to find their way to the appropriate ward where the examination and consultation can take place.

An overall issue with the outpatient flow is that is quite spread out throughout the whole hospital area. This causes confusion and also means that the outpatient flow is crossing for example the inpatient and emergency flow.



— EMERGENCY

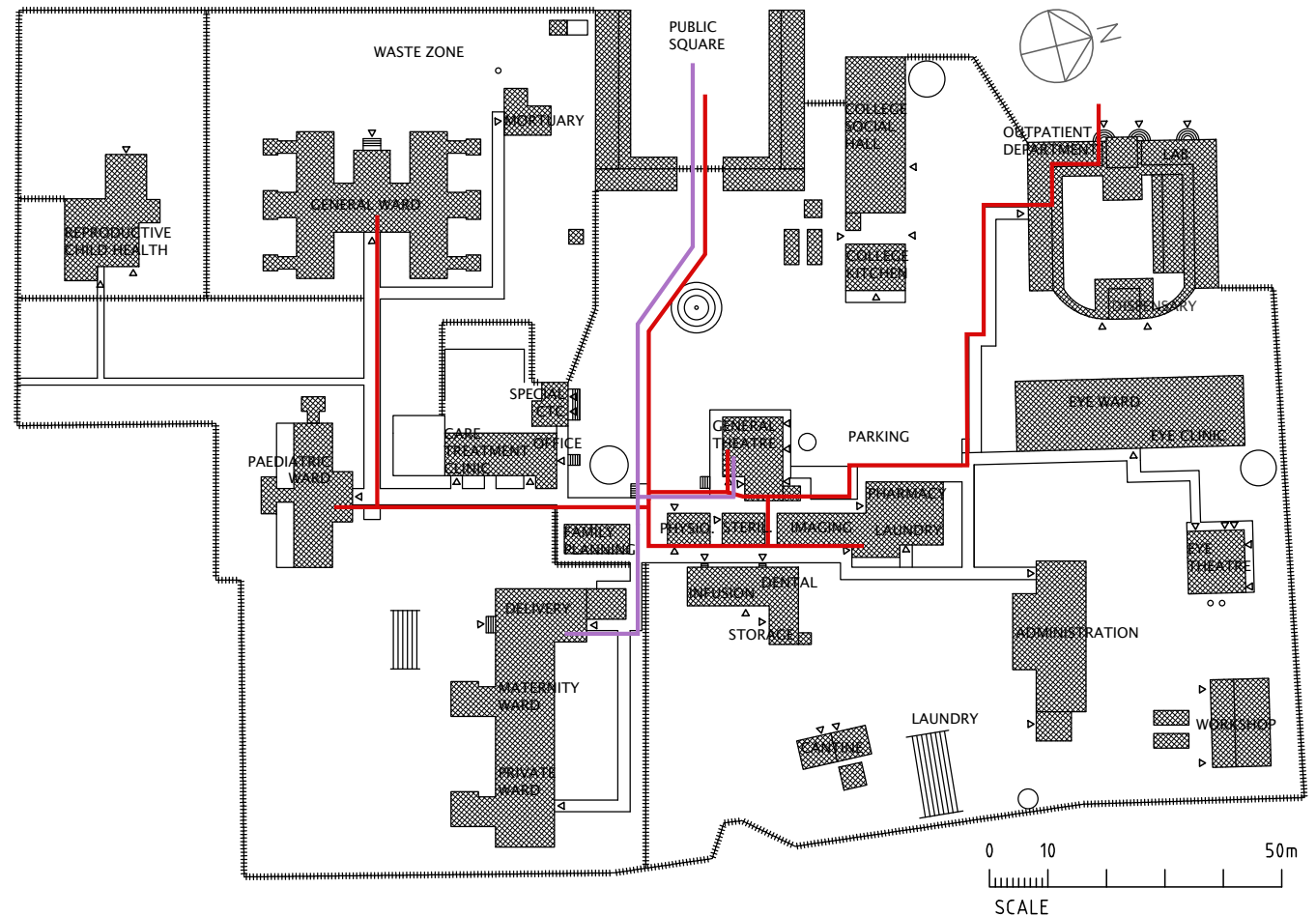
Appendix VIII: Delivery and emergency care flow

The emergency flow is the most problematic in the hospital. The emergency patients sometimes arrive through the main gate and sometimes through the OPD. They can arrive by motorbike, car or ambulance depending on the transport available for them. It is not clear where someone from the staff will receive and assess the patient. Sometimes it can happen in the corridor at the OPD, sometimes on the open space in front of the family planning building, and sometimes in the different wards. Transporting patients on stretchers is especially troublesome as well. The doors at the OPD are not wide enough, and that is also the case with the x-ray department. This means that it happens that the staff has to gather enough people to carry the patient through the doors on a mattress.

The main issue is that the emergency flow is too inefficient to provide good emergency care, and has no assigned place as to where the care should take place.

The delivery flow is that the pregnant mothers mainly come through the main gate. They are taken to the maternity ward where they are examined. If the mother needs to wait before delivery, she might be admitted to the ward. If the delivery is ongoing, she might immediately enter the delivery room in the maternity ward.

However, if the mother needs a c-section she will be transported out from the maternity ward and on to the general ward where the c-section will



be performed. There is an operating room for c-sections in the maternity building, but it is not in use at the moment since the staff feel they cannot ensure proper hygienic conditions due to the lack of a changing room, a scrub room and a sluice room.

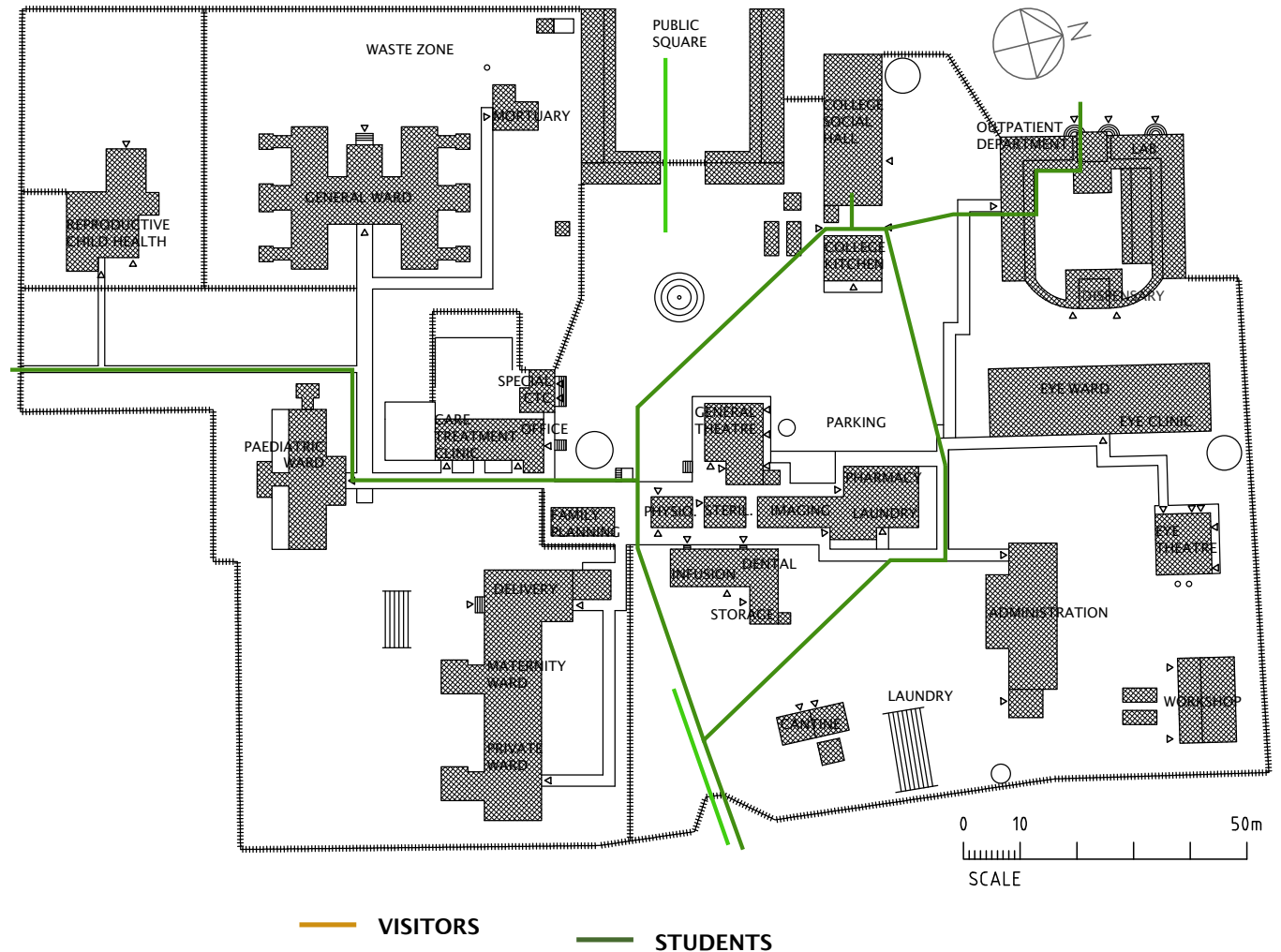
— DELIVERY CARE

Appendix IX: Staff and student flow

Kolandoto College of Health Sciences is located to the left outside the hospital site in the plan below. The college and the hospital are closely related and collaborate on many areas. Part of the education for the students is done at the hospital taking part in the everyday care.

Two buildings that are used for purely college purposes are located within the hospital area - the kitchen and the social hall. This results in that 500 students pass through the hospital area three times per day to get their food at the kitchen and social hall. This flow is unnecessary and not related to the care provision of the hospital, hence it should not be there at all. The students are also part of creating congestion along the path in front of the CTC and family planning. The students also take the opportunity to exit in other directions than to the college, using the hospital area as a way of taking a shortcut to reach other parts of the village.

What there is to say about the staff flow is that they enter from two gates and then the flow of staff is all over the hospital and is hence not mapped further.

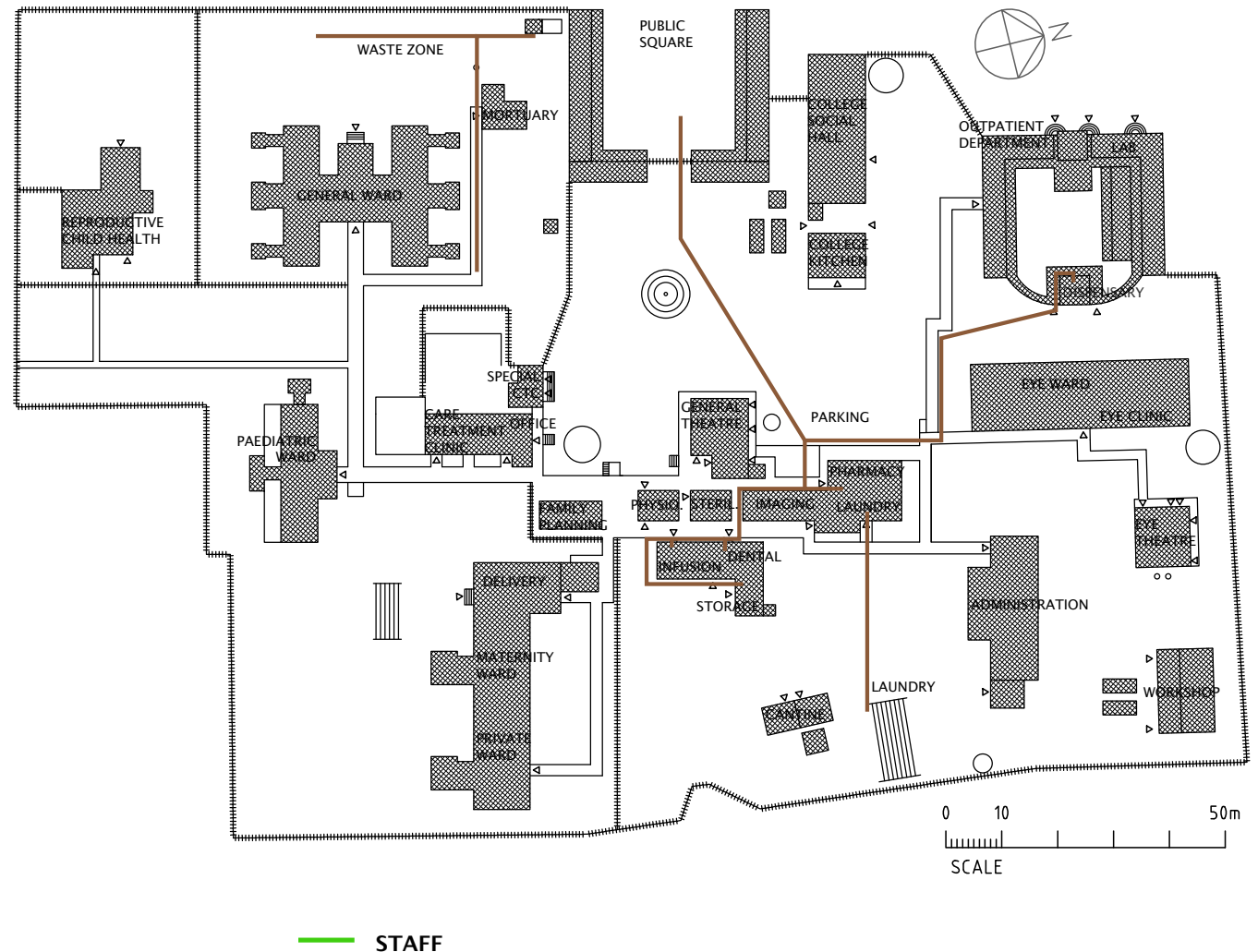


Appendix X: Goods and materials flow

The flow of equipment and consumables can be divided into the goods that arrives to the hospital, the goods that are considered waste from the hospital, and goods that are used and reused at the hospital.

The goods delivered to the hospital mainly arrives through the main gate to the pharmacy building. From there, medications for outpatients are taken to the dispensary in the outpatient department building, and medications for inpatients are collected by staff from the different wards. Medical supplies are kept in the supply store, from which staff comes to collect what is needed in the different departments. IV-fluids are produced in the infusion unit, and stored in the pharmacy.

Used equipment in need of sterilization is taken to the central sterilization room. Laundry moves from and to the wards. Solid waste is carried in buckets to the waste zone, where it is either burnt in the incinerator or thrown in pits dug in the ground. The illustration is a rough simplification of the flows of equipment and consumables.



Appendix XI: Mapping of buildings

General theatre

Approximate size: 140 m²

Building condition: good

Quick problems:

- lack water for minor theatre
- lack sluice for minor theatre
- sluice for major theatre is too small
- lack recovery room
- air and dust flow into the building



The general theatre building.

General ward

Approximate size: 570 m²

Building condition: fair

Quick problems:

- lack of beds
- isolation patients share toilet and washroom with other patients
- lack space for eating and socializing with relatives



A view from inside one of the inpatient rooms.

Private ward

Approximate size: 230 m²

Building condition: good

Quick problems:

- small rooms
- only medium standard



The nursing station during a tea break.

Maternity ward and delivery

Approximate size: 390 m²

Building condition: good

Quick problems:

- too small rooms in general
- congested
- lack changing room, scrub room and sluice room for the c-section operating theatre



The maternity building.

Paediatric ward

Approximate size: 230 m²

Building condition: good

Quick problems:



The entrance to the paediatric ward.

Eye ward and clinic

Approximate size: 470 m²

Building condition: good

Quick problems:

- have both eye ward and eye clinic in the same building
- congestion



The path outside the building leading to the entrance.

Eye theatre

Approximate size: 100 m²
Building condition: good
Quick problems: ?



The eye theatre.

Pharmacy

Approximate size: 210 m²
Building condition: poor
Quick problems:
- small rooms
- small entrance
- difficult to clean
- sunlight
- lack sink for washing hands



The entrance pharmacy building is one of the oldest.

Laundry

Approximate size: 70 m²
Building condition: poor
Quick problems:
- laundry falling on the ground while drying



The laundry room.

Imaging department

Approximate size: 100 m²

Building condition: poor

Quick problems:

- narrow doors
- tricky internal logistics for patients



Patients waiting for the x-ray.

Central sterilization unit

Approximate size: 40 m²

Building condition: fair

Quick problems: ?



The central sterilization room.

Physiotherapy

Approximate size: 30 m²

Building condition: poor

Quick problems:

- too small
- dilapidated



The physiotherapy building is in a poor condition.

Infusion unit

Approximate size: 80 m²
Building condition: good
Quick problems:
- hot and humid inside
- internal logistics



The infusion unit is in the old administration building from 1961.

Supply store

Approximate size: 40 m²
Building condition: poor
Quick problems:
- too small



Inside the storage room.

Dental unit

Approximate size: 40 m²
Building condition: good
Quick problems: ?



The room is well lit with windows in two directions.

Outpatient department

Approximate size: 330 m²

Building condition: poor

Quick problems:

- lack proper waiting areas
- congestion along paths
- poor accessibility
- leaking roofs
- small rooms
- dilapidated



The outpatient building has a unit design.

Laboratory department

Approximate size: 210 m²

Building condition: good

Quick problems:

- stormwater runoff
- lack proper waiting areas



The laboratory is in an extension to the OPD building.

Leprosy ward

Approximate size: ??

Building condition: poor

Quick problems: ?

- far away from the rest of the hospital



A woman sitting outside the leprosy ward.

Reproductive Child Health Clinic

Approximate size: 230 m²

Building condition: poor

Quick problems:

- too small
- lack some rooms
- far away from the laboratory
- dilapidated



The entrance to the building.

Care Treatment Clinic (CTC) and Special CTC

Approximate size: 150 m²

Building condition: good

Quick problems:

- waiting areas for special CTC (patients with both HIV and TBC)



The walkway outside the CTC to the left.

Administration

Approximate size: 300 m²

Building condition: fair

Quick problems:

- internal logistics
- lack large meeting spaces



The administration used to be a paediatric ward.

Social hall

Approximate size: 280 m²

Building condition: poor

Quick problems: ?



There is a social hall located within the hospital area for the students at the college.

Cantine

Approximate size: 60 m²

Building condition: good

Quick problems: ?



The canteen.

Mortuary

Approximate size: 50 m²

Building condition: good

Problems:

Quick problems:

- lack good refridgerator capacity



The mortuary building.

Workshop

Approximate size: 150 m²

Building condition: fair

Quick problems: ?



The workshop is for smaller reparations.

Kitchen

Approximate size: 80 m²

Building condition: poor

Quick problems:

- dilapidated



The kitchen is used for cooking for the college students.

Main entrance

Approximate size: 320 m²

Building condition: fair

Quick problems:

- some unfinished shops

- rainwater runoff



The main entrance to the hospital is through a small square with some dukas (shops) around.

