Assisted Living Facility in Chongqing

- Eldercare in China by Danish standards

Andreas Fardal
Jesper Lassen Nielsen
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Technical supervisor : Claus Topp

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Architecture & Design
Aalborg University

Authors

Andreas Fardal

Jesper Lassen Nielsen

Preface

The number of elderly in China is expected to rise from 13% of the total population today, to 20% in the year 2025. The need for expanded eldercare is imminent, which is why the Chinese government has invited foreign actors to contribute to improve the situation. D'Care is an initiative by the Danish Export Council, that seeks to facilitate partnerships between Danish entrepeneurs and architects, and Chinese investors. The project description states that the vision is to create a pilot project that brands Danish standards in the fields of architecture and eldercare. The facility should contain 300 apartments of 50 m^2 intended for the rich and upper middle-class.

Feeling of home, and well-being among residents is the primary focus in the project. Danish architecture is branded by respecting the physical and cultural context, namely by reinterpreting the traditional family house, the siheyuan. Functionality and sustainability further brands Danish and Nordic architectural characteristics.

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Introduction

Every five years the Chinese government presents a series of social and economic initiatives called five year plans. Keywords in the twelfth plan (2011 - 2015) include addressing rising inequality, sustainable growth, increase domestic consumption and improve social infrastructure and social safety nets [web #1]. Herein lies a plan to address the increasing number of elderly and the lack of eldercare.

In the ten years from 2000 to 2010 the number of people above 60 years rose from ~11% to ~13%, and is expected to reach ~20% by the year 2025, equalling 282 million people in total [Eksportrådet 2012]. The drastically increasing elderly population is a result of China's one-child-policy, in combination with lifestyle changes. The Chinese middle class has increasingly redirected their focus from family to carreer, which consequently causes the average age to rise. To comply with the increasing need for eldercare, the government plans to establish 3.4 million new beds in assisted living facilities by the year 2015 [web #2].

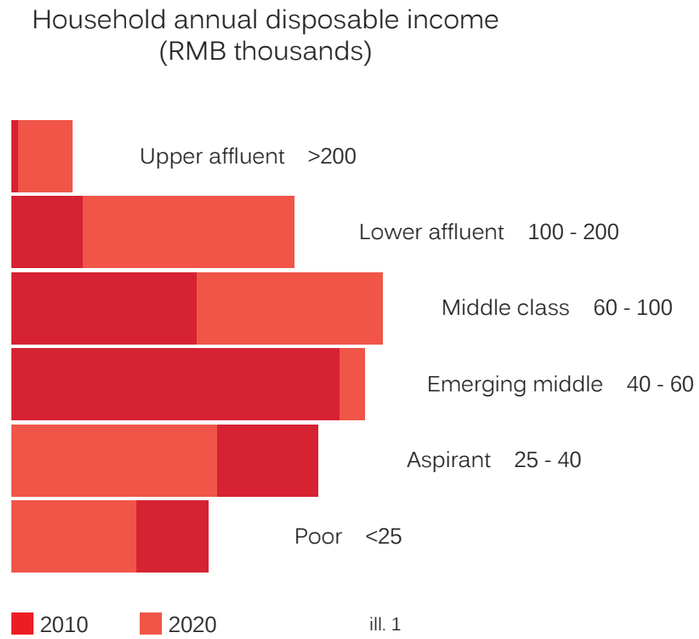
At the same time the Chinese middle class is increasing and higher income causes a demand for better services and higher quality in the eldercare sector. According to a survey conducted at the 2011 China Chongqing Senior Care Expo, 53% of respondents listed "lack of quality" as the main reason for not staying in an eldercare facility. 20% of respondents listed "lack of funding/financial support" as the main reason [att. #1]. The survey supports the claim that there is a need for high-end eldercare facilities. A consequence of the unsatisfactory service in China, is that every year 60.000 elderly, leave the country to seek better care and services, primarily in Japan, South Korea, Singapore and Hong Kong [att. #2]. The amplitude of the shortage in eldercare has caused the Chinese government to encourage private and foreign investors to participate in order to improve the situation.

The Danish Care Project – D`Care is a project by the Danish Trade Council, aiming to help Danish companies onto the Chinese market for eldercare.

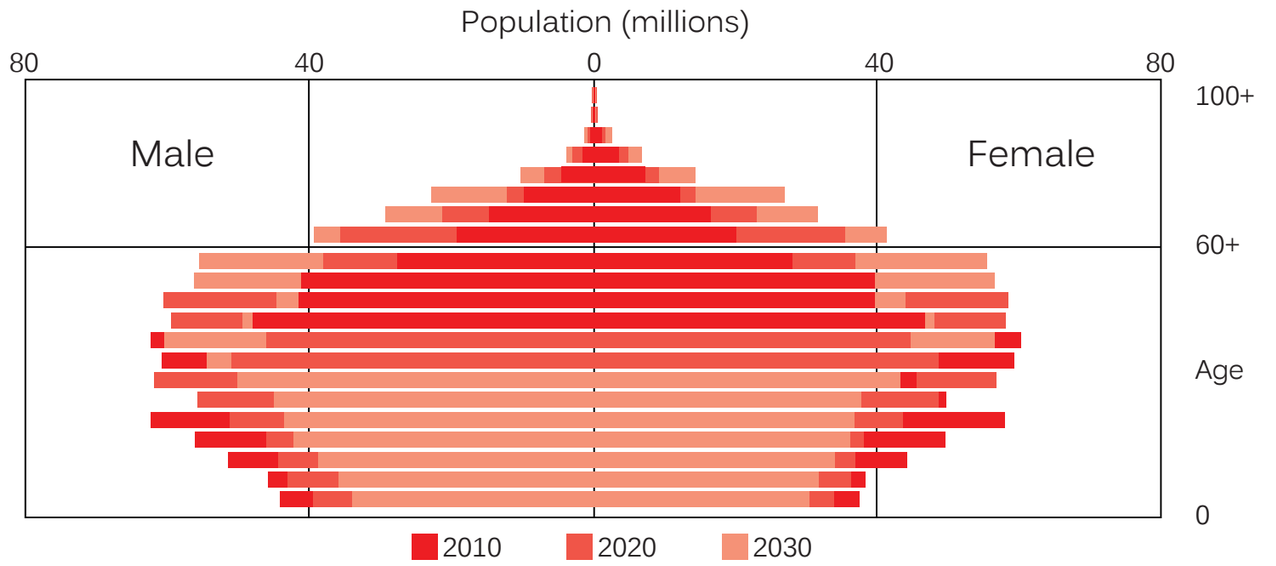
"The Trade Council would like to inspire, facilitate and coordinate the building of low-carbon Danish Nursing Homes (D'Care) in West China -construction by late 2013.The vision is to engage in building China's ultimate multicentre for care and rehabilitation designed for Chongqing's superrich and upper middle-class offering five-star facilities, five-star nursing services and world-class physical rehabilitation" .
[att. #3]

The short-term goal is to create a facility that will serve as a pilot project that demonstrates Danish standards in facilities and services. The assisted living facility will consist of 300 x 50m² apartments and a 7000m² center with state-of-the-art facilities in the fields of physiotherapy, rehabilitation and psychotherapy.

The long-term goal is to create 10 similar facilities in China before 2018. By then the goal is to have created a general perception among the Chinese upper-class that Danish eldercare facilities is the best option when seeking luxury care.



ill. 1



ill. 2

Prospect: Chongqing

In 2000 the “Go-West” strategy, to increase the development in the western parts of China, was initiated. The strategy invited investments in infrastructure and industry and caused Chongqing to become the fastest growing area in China in 2011 with a BNP growth of 16.5%. [web #3]

Chongqing is one of the four direct-controlled municipalities (the others are Beijing, Shanghai and Tianjin) which means that the city is under direct control from the government, and in that way achieve a great advantage in the decision-making process as there is far less bureaucracy. Since Chongqing is a key area for the Go-West strategy, several high-ranking politicians as Bo Xilai and Zhang Dejiang have been stationed in the city which further denotes the citys importance.

Chongqing municipality covers 82.000 square kilometres and has a population of 32 million. The central urban area of Chongqing, and its population of 16 million, is surrounded by the two rivers Yangtze and Jialing.
[att. #3]

As in other parts of China, the need for care homes in Chongqing is imminent. Chongqing uses a 90-6-4 strategy, which means that 90% of the elderly are supposed to be taken care of in their homes, 6% live in community care centers and 4% are in institutional care homes. In 2011 the number of beds needed was 90.000, in the city alone. This number only constitutes the shortage of beds in the 4% institutional care segment. The amount of people over 60 is anticipated to rise from 16.5% today, to 19% in 2015, which means a shortage increase of further 3000 beds. [att. #2]

ill. 3

Site

The site is located just outside Chongqing City at the bank of the Jialing River. The river bends around the site and is visible to the west, south and partly to the east before it disappears behind the hills to the north.

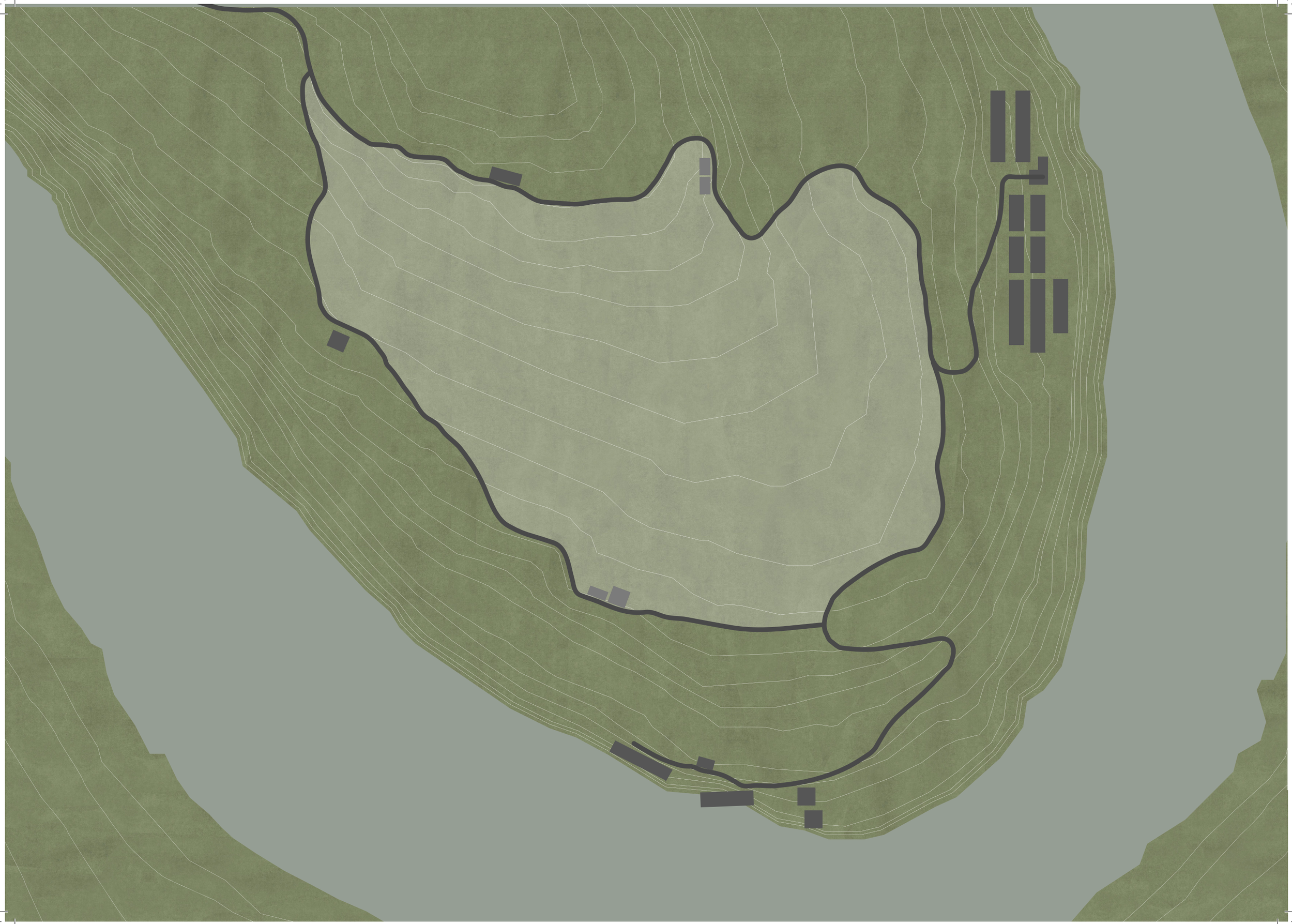
The site is rather slopy, with an elevation difference of 100 meters over a distance of 250 meters and is fairly vegetated. A small number of farms are located in close proximity to the site. By the river south of the site, there is a small dock that is visible from the site. A small industrial area is located to the east, but not visible from the site due to slopy terrain and vegetation.

Located outside the city, the site secures scenic surroundings but also causes it to be more difficult for visitors who live in the city to visit. This problem will be partly solved through planned future investments in infrastructure which will make the site easily accessible for visitors and staff with both public and private transportation.

Regarding the willingness to move among elderly, a survey at the China Chongqing Senior Care Expo 2011 showed that 80% of respondents wished to move to more rural areas to enjoy the space and the view. [att. #1]

ill. 5: Jianling river

ill. 6: site section



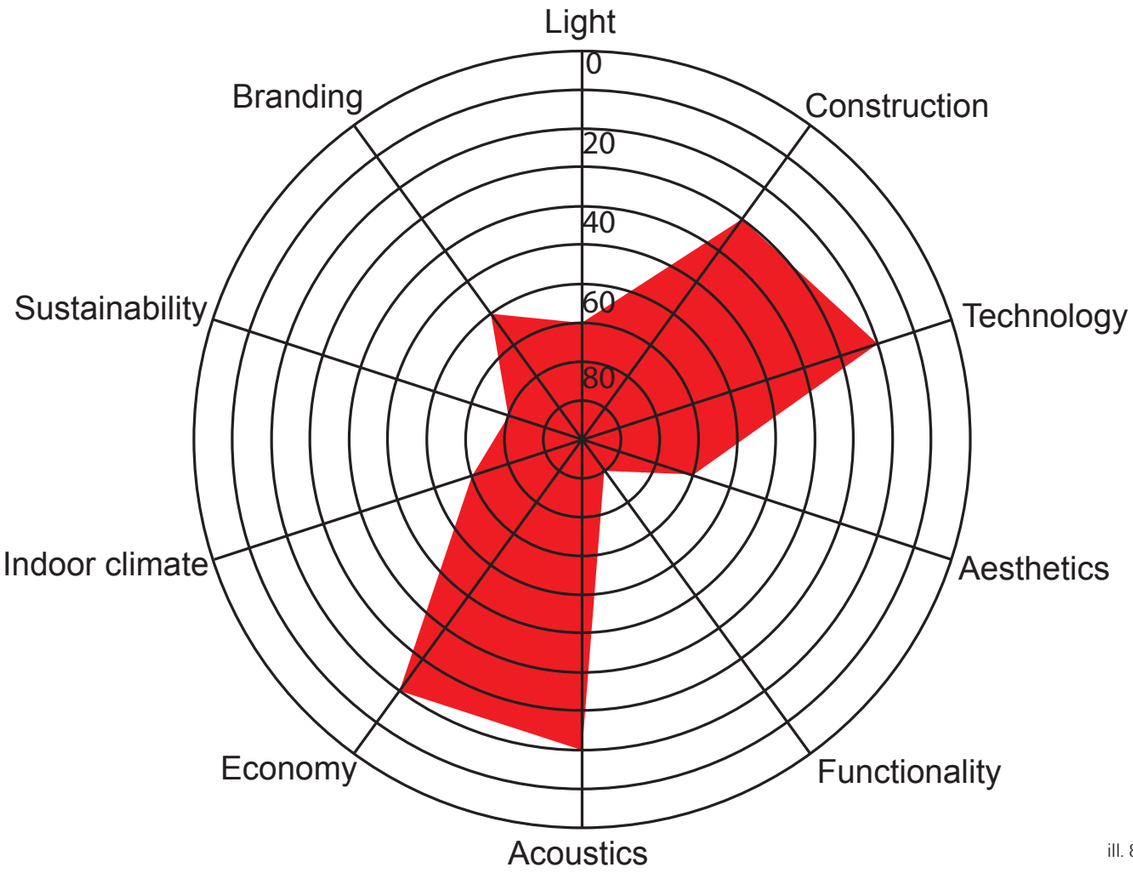
Scope of the Thesis

Because of the limited time frame of the project, a focus assessment needs to be made. Certain aspects of the project are deemed more important than others, based on two things; requirements stated in the Study guide, and requirements expressed by D'Care.

Well-being of residents is the number one priority in the project, and depends on a number of factors; **indoor climate, lighting** and most of all **functionality**. The D'Care project description states that **branding** Danish traditions in the fields of architecture, design and eldercare is the main goal, and will be weighted accordingly. **Aesthetics** naturally becomes an important focus point. It is further emphasized in the D'Care project description that luxury is essential to reach the desired user group, and **economy** is therefore of lesser importance. The D'Care project description also states that **sustainability** should be emphasized, which is why it is being prioritized over a tectonic approach, although general considerations surrounding **construction** will obviously be carried out. Furthermore, D'Care wishes for the facility to contain state-of-the-art **technology**. This will be considered on a general level as obtaining sufficient knowledge in the field would be too time consuming. Other technical aspects that will be accentuated to a lesser extent, include **acoustics.**

The size of the project necessitates certain delimitations when it comes to detailing all the facilities. The living units are assessed to be the most important part of the project and will be designed in detail, while the health care and rehabilitation facilities will be outlined in a general manner. In-depth knowledge in health care design is fundamental to produce satisfying plans for these facilities and based on the given deadline it is assessed that obtaining sufficient knowledge would be too time consuming, and that the main focus will be placed on living units.

Due to lack of access to sources on Chinese eldercare, and the fact that Danish standards are to be fulfulled, Danish research will be utilized regarding well-being of elderly in assisted living facilities.



ill. 8

Method

Wellbeing

When designing an assisted living facility for elderly it is important to obtain knowledge and understanding of the needs and wishes of the user. This knowledge is obtained through literature on the subject.

Nordic architecture

As branding the danish architecture is one of the main purposes of the D´Care project, the principles of Danish and Nordic architecture are described. The findings will be interpreted and serve as basis for the project.

Chinese architecture

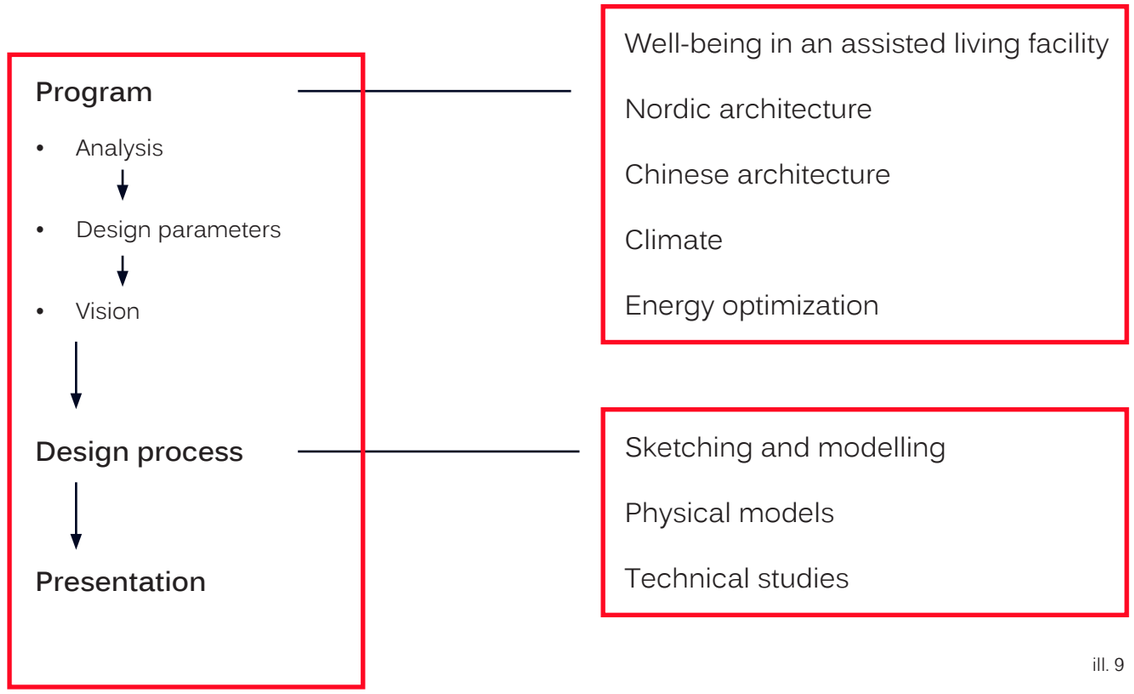
Both tradional Chinese architecture and modern architecture in China will be explored through literature. Chinese building principles will be used as inspiration.

Climate

The precipitation, wind and sun conditions will be studied and taken into consideration when developing the project.

Energy optimization

Passive measures to decrease energy consumption, such as natural ventilation, passive heating and cooling and natural lighting will be decisive in the design process.



ill. 9

Sketching and modelling

Digital modelling and physical sketching will be used throughout the design process.

Physical models

Spatial analyses and volume studies will be conducted through testing with physical models.

Technical studies

Emphasis is placed on indoor climate studies. BSim and Ecotect are two of the programs that will continuously be applied for calculations.

How do we design an assisted living facility which brands Danish architecture while respecting Chinese traditions, and at the same time facilitates state-of-the-art elderly care by Danish standards?

Climate - Chongqing, China

Chongqing is situated in a monsoon-influenced, subtropical climate and has long, humid summers and mild winters. The temperatures in summer, with highs of 33 to 34 °C are among the hottest in China. In winter the temperature drops to lows of 6 to 8 °C.
The meteorological circumstances in the Sichuan Basin, where Chongqing is located entails many days with foggy weather, especially inlate autumn and early spring. Consequently Chongqing only has 1055 hours of sunshine annually, and is for that reason also known as the ”Fog City”. [web #4]

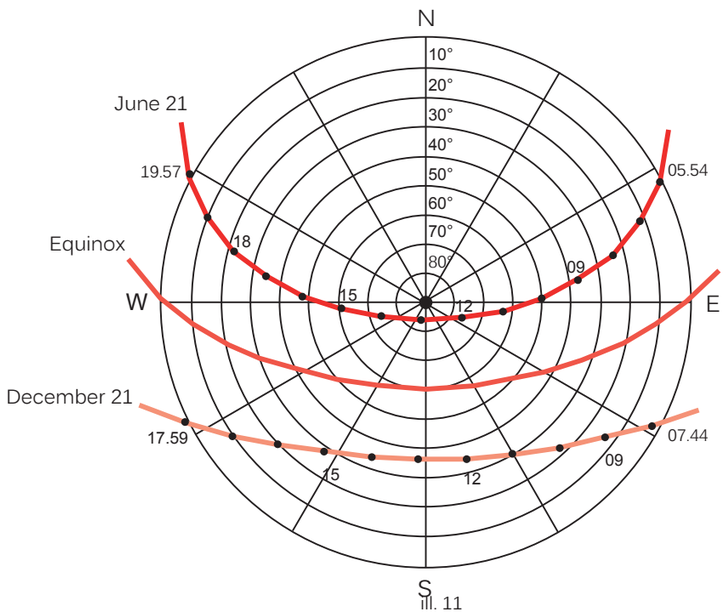
The monsoon climate often causes heavy rain at night in summer as the air above the mainland cools down faster than the air above the ocean. This creates a low pressure area where the humid air from the oceans condensate in the cooler air above mainland.

In winter the situation is reversed as the air above mainland is heated faster and creates a high pressure. To neutralize this, warmer air blows out over the ocean and brings dry weather.
In summer the sun reach a maximum altitude angle of 84 degrees while in winter the altitude by noon drops to 37 °C. Compared to Denmark the sun is in general higher on the sky. In the morning and evening in the summer, the sun crosses over to the north while during the rest of the year it is positioned in the southern half of the sky.

Wind is practically non-existent in Chongqing. Wind speeds rarely exceeds 5 m/s. The highest average wind speed occurs around April 30, when the average daily maximum wind speed reaches 5 m/s.

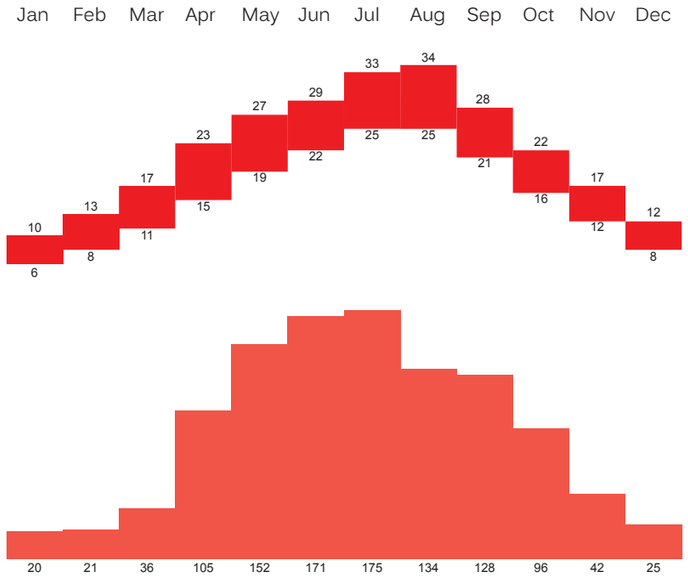
ill. 10 : Chongqing “Fog city”

Sun path diagram
Chongqing



ill. 11

Precipitation totals in mm



Source: China Meteorological Administration

ill. 12

Energy Optimization

The D'Care project description does not elaborate on the importance of sustainability beyond stating that the facility should be low-carbon. It states, however, that the facility is to brand Danish standards, which entails a significant focus on sustainability and low energy consumption. Chinese regulations for energy performance state that consumption cannot exceed 15.6 kWh/m^2 for heating, and 28.6 kWh/m^2 for cooling. Chinese people are more willing to dress according to temperature changes, and this is manifested in the building regulations, as comfort levels stretches from 18 - 28 °C, compared to 20 - 26 °C according to Danish standards. Because D'Care is a project that wishes to brand Danish standards, and because residents are more sensitive due to their physical condition, the Danish comfort levels will be used.

When it comes to energy consumption, alot can be done by utilizing passive measures. If necessary, active measures such as exploitation of solar energy can be implemented.

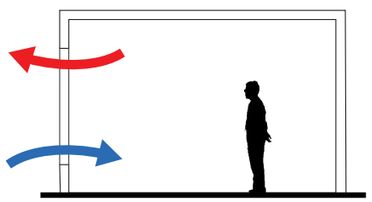
Performance goals

Energy

Heating:	15.6 kWh/m2
Cooling:	28.6 kWh/m2

Indoor Climate

Comfort level:	20 - 26 °C
CO_2-level:	<1000 ppm
Air change rate:	>1 [h^{-1}]



ill. 13

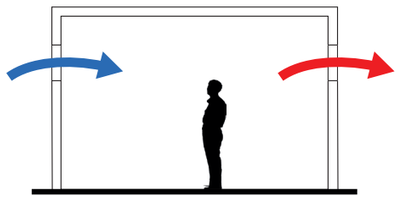
Natural ventilation

There are three types of ventilation; natural, mechanical or a hybrid of the two. By using natural ventilation, energy consumption is decreased. Different types of natural ventilation fit different types of building lay-outs, so which one should be used depends on the design.

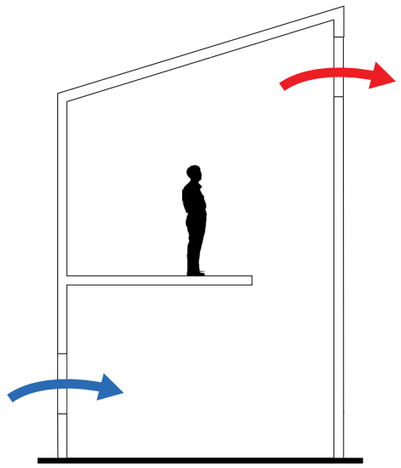
Single-sided ventilation (ill. 13) means that a room is ventilated by opening(s) in one of the exterior walls. Single-sided ventilation works best for smaller rooms with limited depth.

Cross-ventilation (ill. 14) is when there are openings in exterior walls on both sides of a room. Cross-ventilation exploits wind pressure, as air enters the room through an inlet on the windward side of th building, and exits the room through an outlet on the leeward side.

Stack ventilation (ill. 15) exploits thermal buoyancy, as air enters a room through an inlet in the lower part of the room, and exits the room through an outlet closer to the roof. Thermal buyoancy utilizes the difference in air density caused by air temperatures.



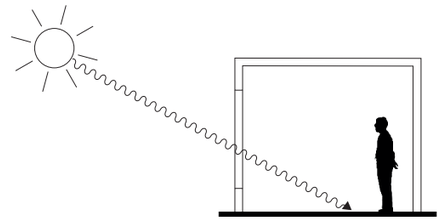
ill. 14



ill. 15

Passive heating

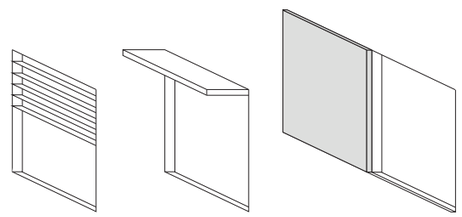
Passive heating (ill. 16) utilizes heat from solar radiation. To optimize passive heating, the buildings orientation and placement and size of windows need to be considered.



ill. 16

Passive cooling

Passive cooling (ill. 17) can be carried out through permanent or movable shading devices, or through the chosen type of glazing. By creating shading from the sun, most effectively on southern facing windows, energy consumption can be brought down. Normally this is done by implementing blinds or an overhang. By using glass with specific properties, indoor temperature can be controlled to a higher degree.



ill. 17

Natural lighting

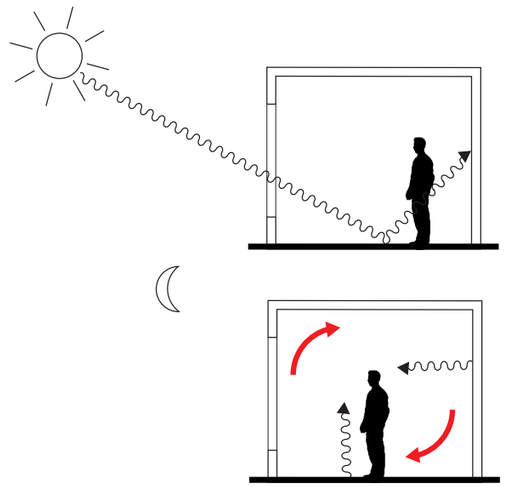
By utilizing daylight to illuminate the interior, the need for artificial lighting can be minimized. It is important to keep in mind the well-being of the users in that respect, as older people are sensitive to light, but at the same time need more light because of weaker sight.

Thermal mass

When walls, floors or other masses in the interior of a building is exposed to direct solar radiation, depending on the materials properties, heat can be stored during the day, and released during the night. Thermal mass (ill. 18-19) is a tool that can be considered to decrease the need for mechanical heating.

Active measures

By incorporating solar cells or solar panels, solar radiation can be utilized to create energy that otherwise would have to be obtained from an exterior operator. When deliberating whether or not to include solar energy technologies, the impact it would have on the architectural expression must be considered.



ill. 18-19

Wellbeing in an Assisted Living Facility

When designing an assisted living facility for elderly it is important to obtain knowledge and understanding of the needs and wishes of the user. The elderly are often victims to deteriorating health, be it mobility, cognitive ability or both. The environment in which they live requires therefore special attention. This is to a large extent the architect's responsibility.

To ascertain what the needs and wishes of the users are, literature on the topic will be analyzed and used as guidelines for the project. The Danish Servicestyrelsen published in 2008 Trivsel & Plejeboligens udformning and Trivsel i plejeboligen - En antologi om trivselsfaktorer i plejeboliger, which describes the findings in substantial research regarding the wellbeing of users in assisted living facilities. Later, in 2010, Erhvervs- og Byggestyrelsen published Modelprogram for plejeboliger which is a set of concrete suggestions on how to design these facilities in the future to ensure good conditions for the users. These publications serve as a foundation for the development of the project. In the following a general description of the findings will be presented, in addition to selected design principals.

Feeling of home

For most people the idea of home is taken for granted. It is a place you are familiar with, that feels safe and creates a boundary around you and your closest both physically and mentally. You feel at home. This feeling is crucial for a person's wellbeing. When moving to a new place it takes time before this feeling of home is restored. When moving to an assisted living facility where your living situation is changed radically, this process often takes a lot longer, in some cases not at all. The social activities that characterize your former home will in an assisted living facility be replaced by new ones. To enhance the wellbeing of the users, their living situation needs to facilitate the likelihood of obtaining a feeling of home, both physically and socially. In other words, the assisted living facility's challenge is to compensate for the users deteriorating health, while at the same time form the basis for social activity [Møller & Knudstrup, 2008]. However, people are different and have different needs, and require therefore different degrees of care and social activity in order to obtain the feeling of home.

ill. 20-29

Structure type

There are four different types of conceptual structures in assisted living facilities [Møller & Knudstrup, 2008]. Angled, come, courtyard and cluster structures. There are structures that might differ slightly from these types, but generally they can be assigned to one of these groups. The four conceptual structures are applicable both to living units, and to entire facilities. The courtyard structure stands out, as it contains many of the qualities highlighted by literature. It offers stimulating and safe walking paths in the enclosed system of walkways. Furthermore, the courtyard provides a foreclosed and safe outdoor area. This is especially suitable for residents with weak cognitive abilities, as they will not get lost within the courtyard.

Living unit size

A survey carried out among personnel in a number of assisted living facilities reveals that the optimal number of residents is 12 [Møller & Knudstrup, 2008]. More residents will make the unit less homely and seem institutional. Less residents hurt the social environment. A survey among future elderly shows the same preference, as most respondents preferred small (6-10 residents), or medium sized (10-16 residents) living units.

Common areas

The layout and placement of the common areas affect residents use of it. If residents can see the common areas, they are motivated to use them more [Møller & Knudstrup, 2008]. Short distances between apartments and common areas further encourage residents to spend time there. The common area is preferably divided in rooms of different sizes with different qualities. The most frequently used common areas are the ones where one can follow the work of the personnel or outdoor activity. Rooms where residents are orientated towards each other are not popular.

Walkways

Walkways can be organized in groups similar to the types of structures previously described. Walkways with short stretches(L-shape) seem less institutional than if they are long and straight(I-shape). Shorter stretches also make walkways more homely and safe [Møller & Knudstrup, 2008]. According to research, walkways in closed courtyard structures is the preferred solution when it comes to well-being.

Outdoor areas

Outdoor areas have a significant importance for residents' well-being. Common outdoor areas should be placed in close proximity to the apartments, and should be easily accessible [Møller & Knudstrup, 2008]. Rather than one large park-like space, small connected spaces are preferred. A direct correlation between accessibility to the outdoor areas, and the use of them, has been uncovered through research. A courtyard environment is highlighted as a optimal solution, as it is easily sheltered from harsh weather, include areas of shade and is close to personnel,

Apartment

The most important part of the unit, when it comes to well-being, is the private apartment. Size is a decisive factor for well-being, and apartments at 40 - 50 m^2 is recommended [Møller & Knudstrup, 2008]. The apartment should be dividable in the sense that it should be up to the resident whether bedroom and living room are separated or joined. View is an important quality in apartments, and windows should be placed at an appropriate height. Doors and windows should not be too large and properly shaded, to avoid excessive use of curtains, and ensure a comfortable indoor climate. Accessibility with aiding tools should be integrated in all aspects of the apartment, including windows and doors that are easy to open and close.

Case Study - Field Trips

To obtain further knowledge about assisted living facilities, and experience the everyday life first hand, three local homes were visited. Gug Plejehjem, Sofiegården and Drachmanns Have are three facilities with different qualities in the architecture and the social character. In the following, a selection of these qualities will be highlighted, and in the design, taken advantage of.

Gug Plejehjem

Gug Plejehjem is built around a central courtyard, and houses 25 residents, including a dementia branch housing eight residents. Apartments are fairly small at 25 m^2 each.

ill. 30

In the hallways, apartments are provided with small niches. The niches offer a place to sit in a semi-private space as an alternative to the private apartment. Also the niches contribute to breaking up the hallways; making them less monotonous. On the opposite side of the hallway there are large windows facing the courtyard. Visual connection to common areas, inside or outside, is stimulating and encourages use of them.

ill. 31

The courtyard is frequently used when the weather allows it. The safe character of the courtyard is reassuring to residents, and is ideal for residents with dementia, as it allows them to freely use the outdoor space without the concern of them wandering off. The courtyard could advantageously be divided into smaller spaces, as the scale would be more adapted to the users. Furthermore, the spaces emerging would be suitable for socializing in smaller groups.

ill. 32

In the facade, windows are placed relatively low to give residents the opportunity to follow outdoor activity while seated or lying down. This seemingly small adjustment to the design can greatly enhance the well-being of weaker residents.

Sofiegården

Sofiegården has 50 residents allocated to four different living units, with apartments at around 45 m^2. Residents are not placed based on condition.

ill. 33

Centrally placed in the building there is a large common area, big enough to house a greater amount of people than the common areas in which residents eat and relax. This space is used for gatherings such as bingo, worship services, birthdays and any other special event. The room becomes a destination within the walls of the facility, and can entice excitement among residents.

ill. 34

Something that should be avoided, is long monotonous hallways. Sofiegården has a prime example of how a hallway should not be designed. It stretches more than 150 meters, and discourages residents to move beyond their own living unit. According to staff members, there is little to no contact between residents across living units despite spending every day less than 40 meters away from each other. The hallway is partly to be blamed for the lack of social interaction.

ill. 35

The hallway recently described, runs through the units' designated dining areas. There is however, not enough space to separate the hallway from the dining space. This has become a nuisance for residents, as the internal flow runs straight by the dining table and causes disturbance.

Drachmanns Have

Drachmanns Have has 28 residents in three different living units, one of which houses 11 residents with dementia. Apartments are medium sized at 35 m².

ill. 36

Drachmanns Have has a large common area with a sizeable kitchen close to the entrance. As in Gug Plejehjem, this common room is an addition to the smaller common areas situated in the living units. The open kitchen allows staff members to keep an eye on residents while preparing food, and serve as additional space for gatherings, and even as a dance floor during parties. The height of the room (7 meters) makes it seem more spacious, which is convenient during large gatherings.

ill. 37

Throughout the building there are small seating groups where two or three residents can socialize. Spots like this are welcome alternatives to the dining/common area where residents in assisted living facilities generally spends most of their time, and strengthen the feeling of home. Seating groups with a view are more attractive and used more frequently.

ill. 38

Plants, artifacts and pieces of art are placed in the hallways to disrupt the repetitiveness of the course. This enhances the feeling of home, and makes the hallways seem shorter and more manageable. Furthermore, it increases the manageability for residents, especially the demented.

Nordic Identity in Architecture

One of the main purposes of the D´Care project, is to brand Danish architecture and design. To fulfill this request it is essential to elaborate on the characteristics of Nordic and especially Danish architecture.

One of the most important attributes of Nordic architecture, is the strong attention to its site and context. The materials are found locally, and their properties are well-known and utilized to their full potential. When a building is erected, landscape and nature are used for inspiration and the building accommodates the surroundings rather than the inverse.

Like the Nordic people, the architecture is not bombastic and does not draw undeserved attention to itself by the exterior alone. It has rather gained its esteem through its functionality, its harmony with the context and fulfilling the needs of the users. As an antithesis to affected importance and excessive ornamentation, the functionalism that Nordic architecture represents insists on practical buildings in a human scale. The design is rational, caused by function and known for its strong shapes, with clear lines. It is easy to define the building volume, as there are no attached components.

“Our [Nordic countries] city halls, hospitals, swimming baths and schools are based on master plans that put people – the user – at the centre. We strive to create something unique each time, by aiming to adapt the building to its actual location and function, and not least to the people who will use the building. Briefly stated, the building must be a joy for people to experience.”
Lone Wiggers, partner C. F. Møller
[web #5]

Another important characteristic of Nordic architecture, is the utilization of daylight as an important aspect of the perception of the building and the rooms in it. The light is used for both optimizing daylight and as an artistic exhibition of the building components.

In urban planning the user is in focus. City master plans are designed with the citizens in mind - in human scale. It has to be easy to get around by either walking, cycling or public transportation. Throughout the cities, space is made available for socialization and momentarily stepping out of the busy city life.

ill. 39: Can Lis, Mallorca, Jørn Utzon

ill. 40: The Norwegian Opera House, Oslo, Snøhetta

Case Study - Nordic Architecture in a Foreign Culture

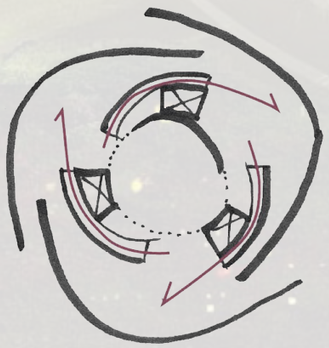
Henning Larsen Architects
Massar Children's Discovery Center

The Massar Children's Discovery Center in Damascus is a Syrian center for education in the field of science and technology. Through experiences and exhibitions the center gives Syrian children the opportunity to meet and explore the world through play [web #6].

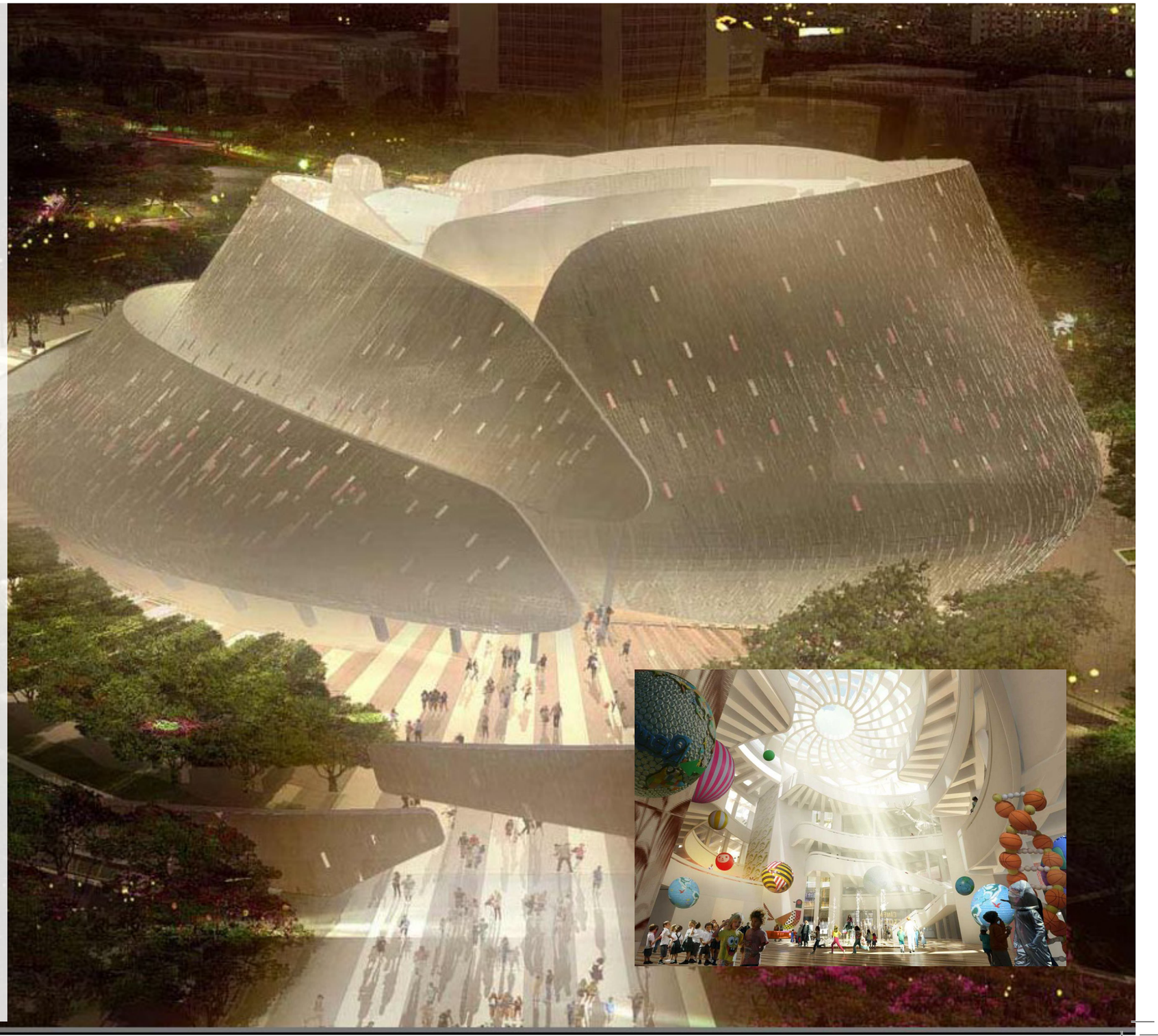
The design is inspired by the Damascus Rose which in Syria, is a symbol of beauty and love [web #7].
Like rose petals, shell structures form the building and lets air flow through the facade while at the same time creating shade for the sun and keeping the need for cooling at a minimum. To strenghten sustainability further, local materials are used and all water in the building is recycled.
Inside the rose petals there are exhibition rooms and administration designed in a way that provides alternating pathways much similar to walking around in the old part of Damascus.

By using local materials and symbols, and referencing local infrastructure, the attention paid to the context is obvious. While the shell structure has an important visual feature, it is also decisive for the lighting conditions and indoor climate and is in that sense highly functional.

These characteristics are all typical for Nordic architecture and makes the building a prime example of the applicability of Nordic architecture in a foreign context.



ill. 41-42



Understanding China

Architectural history

Chinese architecture has gone through a problematic time over the last century. In the early 20th century, the first Chinese architects returned from studies in the West, and brought with them the academic tradition of European architecture. However, in the period 1949 - 1979, China was secluded from the West, and so Chinese architects were left to “fend for themselves”, with some, but limited influence from the Soviet Union. In the 1980’s, the second wave of learning from the West started, as borders opened up and knowledge started flowing. Many of the architects who by now were middle-aged, had already found their individual style of architecture and was not capable of, or interested in learning from the West to the same extent as young, curious architects. This mix of styles and approach left China with no basis for modern architecture, and is at least part of the reason why modern Chinese architecture have not gained recognition in other parts of the world. This state of transition and uncertainty can easily be transferred to the Chinese society as a whole. But as China moves toward a more westernized lifestyle and thereby a more westernized architecture, traditional philosophy still plays a huge role in Chinese architecture, and is likely to remain one of the core values for decades to come. Chinese clients often express a desire to have Western design dominate the projects, but upon seeing proposals they make the architects change elements to comply more with Chinese traditions. The clients are often incapable of describing what was wrong with the proposal, which shows that tradition is still rooted deep inside the mentality of most Chinese people [Lu, 2008].

There is a significant difference between the way we evaluate architecture in Western countries, and the way it is done in China. Evaluation of architecture in China might already take place in the concept phase of a project, and is being assessed based on the mere image the architecture represents. In the West, an architectural design is considered “good” if the building is not just an attractive image, but at the same time provides useful space for its users. We also take into consideration aspects like energy, economy, utility, appearance, ecology and sensitivity to the site.

Consequently, when carrying out the delicate task of designing architecture in China for Chinese people, it is important to strike the balance between attractive modern architecture that creates a strong image, while at the same time taking into consideration the Chinese’s strong emotional attachment to local traditions.

Influence of Chinese philosophy

As mentioned, Chinese tradition and ancient philosophy is to this day very important to the Chinese, and heavily influence how they view architecture and space for living and recreation. One of these philosophies is called tian ren he yi, and describes the harmony between man, nature and the universe. Entirety is a key word, as this tenet of Chinese philosophy claims that one part cannot exist without the other. If the subject is separated from the object, the object is not complete. Philosophy like this can often be difficult to fathom for us, with our European upbringing and mindset. An example to clarify and relate this to architecture is that Chinese architects are unwilling to dissect design problems for analysis. Instead they prefer to view the project as a whole and create an overall plan that meets the requirements. This approach is very different to the analytical methods of Western architects. Chinese emperors have throughout history, to express their power and authority, created palaces that consist of detached buildings carefully planned in relation to each other, instead of grand buildings with enormous facades. The idea is that the group of buildings, adds up to something far more powerful and striking than the sum of the different parts. The Forbidden City in Beijing is an example of this philosophy, as opposed to most famous architectural icons in European history, for example Buckingham Palace in London, the Royal Palace in Madrid or the Reichstag in Berlin[Lu, 2008].

Another philosophy that likely played a huge part in the design of the Forbidden City and other similar projects, is that of philosopher Lao Zi. Thousands of years ago he expressed the idea of “substance” and “space”, reminding architects and builders of the essence of their craft, namely to create useful spaces between the built structures. The Chinese are traditionally masters in landscaping and creating comfortable and spiritual spaces both inside buildings, and between them [Lu, 2008]. Unfortunately, Western architects operating in China at the moment are not being considerate enough to the surroundings and are applying more or less a “tabula rasa” approach to projects. It has become a competition of which building in a given area can scream the loudest and attract the most attention through extravagant design and flashy materials [web #8]. While it is important to create buildings which reflects prowess in architecture, one should remain focused on the primary task; to provide a human scale and useful spaces for living and working.

ill. 45: The Forbidden City, Beijing

ill. 46: CCTV building, Beijing by OMA

Case Study - The Siheyuan

The ground plan of the traditional Chinese family house is known for its symmetry and central courtyard. Whether it is a palace, temple or a small middle class residence, the buildingparts are erected as wings surrounding the courtyard. These buildings are called siheyuans, and follow a strict composition. The siheyuan follows the rules of Confucuian tenants of order and hierarchy.The four buildings are normally positioned in a north-south and an east-west axis, where the building in the northern corner houses living room and master bedroom because of favourable lighting conditions. The buildings in the east-west axis houses bedrooms for children and less important members of the family, while the south facing building has the least favourable lighting conditions, and houses servants dwellings, reception room, and/or space for relaxing or studying. The courtyards provide space and privacy for the residents, much similar to the european gardens, and are carefully designed with space for both vegetation and for furniture. The vegetation is meticulously tended to, as the Chinese culture says that harmony in the environment entails a peaceful life. In recent years the Siheyuan has been subject to reinterpretation, both in large public buildings and in private residences. What they all have in common, is the way the courtyards become a generator for activity and social interaction within the users of the building [web #9].

Materials

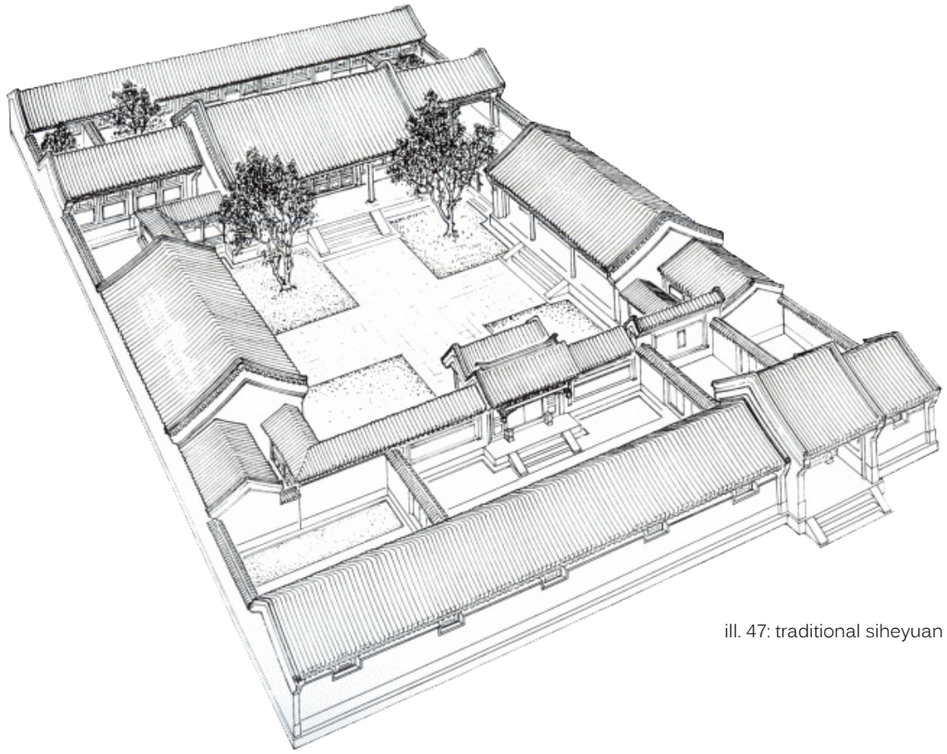
Stone has always been a preferred material in Chinese architecture, and siheyuans are no exception. Bricks in different nuances of grey make up the curtain walls, surrounding windows with wooden decorations. Structural columns from wood or concrete (newer siheyuans) are often painted red as it symbolizes good luck in Chinese culture. Roof tiles are from stone, normally in a slightly darker shade of grey than the walls.

Courtyard

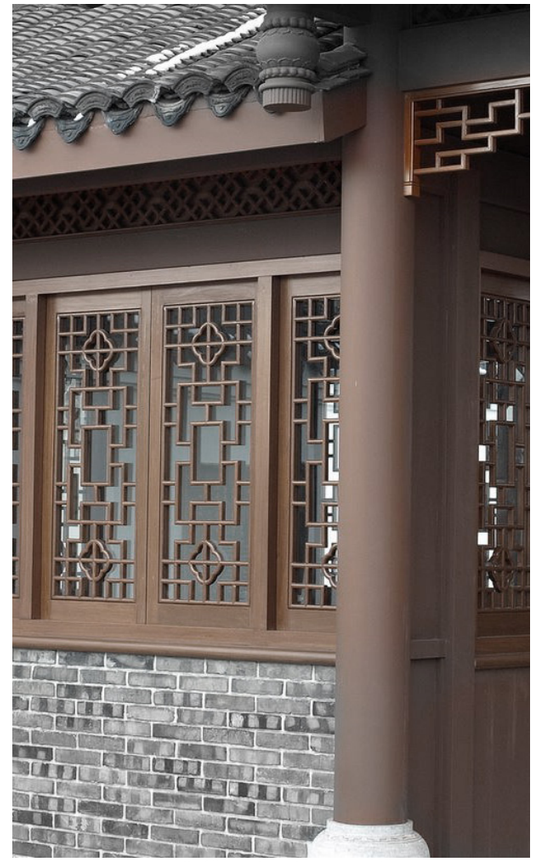
The courtyard itself is divided into segments. Normally with a paved cross, stretching from north to south, and east to west. Small squares in the corners contains planted grass, and often trees to add a green dimension to the courtyard, as it serves as the family's garden. The surrounding buildings are often raised two or three steps above the courtyard.

Applicability of values

The siheyuan features qualities that can be transferred to an assisted living facility, but will have to be modified to fit the requirements for a home for elderly. For instance, the level difference between the buildings and the courtyard has to be cancelled to ensure good accessibility. The sections in the courtyard need to be rearranged if residents are to have access to the direct courtyard-access from all apartments. Generally, the material composition can be maintained, but it might be preferable to slightly alter the color combinations, to comply with the D'Care vision to brand Danish architecture. It is however, important to use local materials in the buildings.



ill. 47: traditional siheyuan



ill. 48: material composition in a siheyuan

ill. 49-50: courtyards in Chinese siheyuans

Chinese Gardens

The Chinese traditionally pay careful attention to the space between buildings. The Chinese gardens are undeniable proof of this, and are renowned throughout the world for their serenity and romantic mysticism. Landscape has always been a popular theme among China's most prominent painters, and have been celebrated by its people throughout history. The desire to re-create these paintings in living form has prompted the rich and powerful to design their own gardens for the last 3000 years. The idea is that the garden is a miniature version of the real world, much like a painting, only in three dimensions as opposed to a two dimensional painting [att. #4]. Another motivation for designing private gardens was the desire to continue ones spiritual advancement after scholarly public life came to an end, and what better way to do so than to build the perfect atmosphere in your own backyard.

Elements of the Chinese Garden

There are certain elements that are ever-present in Chinese gardens; water, rocks, architecture and plants. Common for everything you see in a Chinese garden is that it symbolizes either one of the classical elements, a desired human quality or some other mystical feature. Water represents life, and is the blood of the garden. It gives pulsating life to the garden's other elements. The rocks represent mountains (the Chinese word for landscape is made up from the words for mountain and water), which symbolizes the connection between the earth and heaven. Architecture in the garden is supposed to complement the scenery instead of dominating it. Pavilions also create the possibility to dictate what views are to be in focus. Flowers and plants are chosen based on their appearance during the year. Ideally the garden consists of a variety of plants that creates colorful and beautiful views and smells during all four seasons.

Chinese Gardens

Water
Water is an essential element in Chinese gardens, if not the most important. Gardens are often built around a central pond or lake (depending on garden size). In addition to life, water symbolizes communication and dreams, and encourages philosophical pondering and spiritual discovery. Ponds are often stocked with koi fish or golden carp to further enhance the feeling of serenity. Furthermore, it has a practical function, as it serves as a cooling oasis in the center of the garden [web #10].

Stone
Limestone is the preferred type of rock when designing a Chinese garden, and especially the sculptural Taihu rock is sought after as it represents wisdom and immortality.[att. #4] They are often placed in rock gardens or in and around water elements. This because the water is the yin to the rocks yang; water softens the harshness of the rocks and creates balance.

Architecture
In different locations of the garden architectural structures are placed. They can be admired as aesthetic objects in themselves, but most importantly they provide a point from which chosen sceneries can be viewed. [web #11] The structures are often pavilions, or pavilion-like buildings that are not too dominant in the surroundings, but rather blend effortlessly with other elements.

Plants
Plants, like all other elements in a Chinese garden, are chosen based on the attributes they symbolize, and their adaptability to different climate. Bamboo is normally found in abundance, as it symbolizes respectability and compliance, and is one of the three “friends of winter” (the others are pine tree and flowering plum blossom, and are so called because they provide color during the harsh winter season). Other plants you have a good chance of finding in a Chinese garden are orchids, lotuses, peonies, climbing roses, magnolias, peach blossom and willows (plants used in Chinese gardens are too many to mention).

Walkways
Chinese gardens guide people through it and very much dictates what they are supposed to focus on. An important tool to do so is the path- and walkways. They are carefully planned to make sure people get from A to B while at the same time facilitating views and scenery that initiate deeper thinking and philosophizing. Walkways are normally roofed, at least in certain parts.

ill. 52-56: roofed walkways, willow, orchid, lotus flower, Tai limestone

ill. 57-60: bamboo, plum blossom, walkway, golden carp

ill. 61: Lan Su Chinese garden, Portland, Oregon, US

Application of Chinese garden elements

The qualities of the Chinese garden are to a large extent compliant with the research into well-being in an assisted living facility. It is desirable to establish sensory gardens, where the senses of smell and sight can be used and challenged. [Møller & Knudstrup, 2008] Furthermore, access to sunlight, fresh air, exercise and recreation are all enhancing the mental and physical health of the elderly.

However, there are considerations that need to be made regarding the aforementioned health. Not all residents are physically capable of making relatively long walks. Consequently, the qualities of the Chinese garden should not be restricted to a bounded central garden, but rather spread throughout the site, as to make it accessible to a larger number of residents. Also, there is a question of orientation. With age comes dementia and aggravated coordination. This is not compliant with the traditional layout of the Chinese garden, as it is densely vegetated and composed of many sections. New vistas are revealed as you stroll through the garden, and it can be difficult to get a clear overview of the layout, much like a labyrinth. For the residents, it is important that they know where they are at all times, and can easily find their way back home. Chinese gardens often include level changes where steep declines and raised bridges contribute to sectioning the different scenes. To accomodate weaker residents, these level changes need to be evened out. For the same reason the walking surface must be planar and adapted for wheel chairs, as opposed to the rugged walkways chosen in many Chinese gardens.

The challenge is to combine elements and qualities of the Chinese garden with the transparency needed for residents' ability to orientate.

Design parameters

To verbalize the knowledge gained in the initiating phase of the project, a set of design parameters has been devised. This will serve as a check-list in the design process, as they are pivotal to meet the requirements of users and personnel as well as the architectural concept and the fundamental vision of the D'Care project. To create a better overview, the parameters are organized in categories.

Location

According to a survey conducted at the China Chongqing Senior Care Expo 2011 by Innovare Science & Technology, 80% of respondents stated that they would be willing to move to an elderly care facility in rural areas to live in a more spacious and peaceful environment [att. #1].The Danish Trade Council, who are the initiator for the D'Care project, has also been scouting locations in rural areas (Specific site location depends on where investors and developers have land at their disposal).

- The location provided by the Trade Council will, in the project, be treated as the actual site.

Architectural concept

It is stated in the design brief that it is important that the project brands Danish architecture, design, technology and operation. It is also stated that it is a pilot project in the high-end eldercare sector, and that the architecture should reflect that. It is however important to keep in mind that the most important aspect of the project is to design a facility that is functional for users and personnel.

- The project is a pioneer project for Danish standard, high-end eldercare in China and should express this through the architecture. At the same time it is important to provide functionality and a basis for well-being among users and personnel.

Architectural approach

The goal of the project, based on D'Cares project description is to brand Danish architecture. In a Chinese context it is still important to consider local traditions.

- The facility should through contextual interaction and functionality brand Danish architecture.

- Chinese traditions should be respected, and local architectural concepts should influence the design, namely a reinterpretation of the traditional siheyuan building style.

Apartments

As previously described, different user groups have different requirements. Apartments will be designed to fit the needs of each user group.

- All apartments should have a gross area of ~ 50 m^2, and consist of bedroom and bathroom, and to a varying extent living room, kitchen and entrance.

- Residents should have direct access to the courtyard from their apartment.

- Apartments should be flexible in the sense that bedroom and living room can be joined or separated based on residents wishes.

Living units

Apartments are placed in living units of 12 residents, as research shows that 12 is the optimal number of residents. In a living unit, residents share dining area and different sized common areas.

- Access to common areas should be short and manageable.

- Residents should be provided with the opportunity to choose their degree of privacy at all times.

- There should be visual and physical contact between apartment units to facilitate social community.

Common areas in living units

Social interaction improves most users' well-being. Common areas where users can interact with each other is therefore essential. Common areas are also where meals are served for users with adequate mobility. Furthermore, common areas as an alternative to staying in the apartment is stimulating to the users.

- Living units should house different common rooms of different sizes. Functions can vary, as different user groups prefer different activities.

- Common areas should have views to nature and/or outdoor common areas to stimulate senses.

Services
A facility of this size can be compared to a small village, and a number of services are essential to its inhabitants. Health care facilities are naturally included as users are in declining health conditions. Users, if capable, should be able to carry out every day chores and activities as if they were in their old home.
Facilities for rehabilitation, treatment and prevention should be easily accessible for users.

- Basic services such as super market, café, hair dresser, spiritual room (church) etc. should be incorporated to enhance well-being.

Outdoor areas
Providing outdoor areas where users can move freely will significantly increase well-being as the majority of users enjoy being able to see, hear and feel nature.

- Elements from Chinese gardens should be implemented, as they contain a number of qualities that enhance users' well-being and both physical and mental health.

- Pathways should be closed and manageable to provide users with different routes that will take them home.

Accessibility
Users' mobility ranges from fairly good to very poor. Access to the facility, the apartment units and the individual apartments should be designed accordingly.
Friends and relatives should be encouraged to visit the residents by providing easy access to the site.

- The distance between apartments and common areas, should be manageable for even the weakest users.

- Access to outdoor areas such as terraces and gardens should be designed to encourage users to utilize these spaces without the help of personnel.

- To accomodate visitors, parking should be strategically placed close to the living units.

Lights and colors
Lights and colors are stimulating and increases recognisability.

- The apartments should be oriented as to provide good sun- and light conditions to improve well-being.

- In units designed for the demented, walls can preferably be painted in strong colors to improve orientation.

Climate
In summer the temperature is high and a building needs shading, insulation and ventilation to prevent superheating. In winter the sunlight is necessary for heating, and insulation is essential to keep the heat in the building.

- Glass facades should be shaded to prevent super-heating during summer, while during winter sunlight should be utilized to minimize the need for mechanical heating.

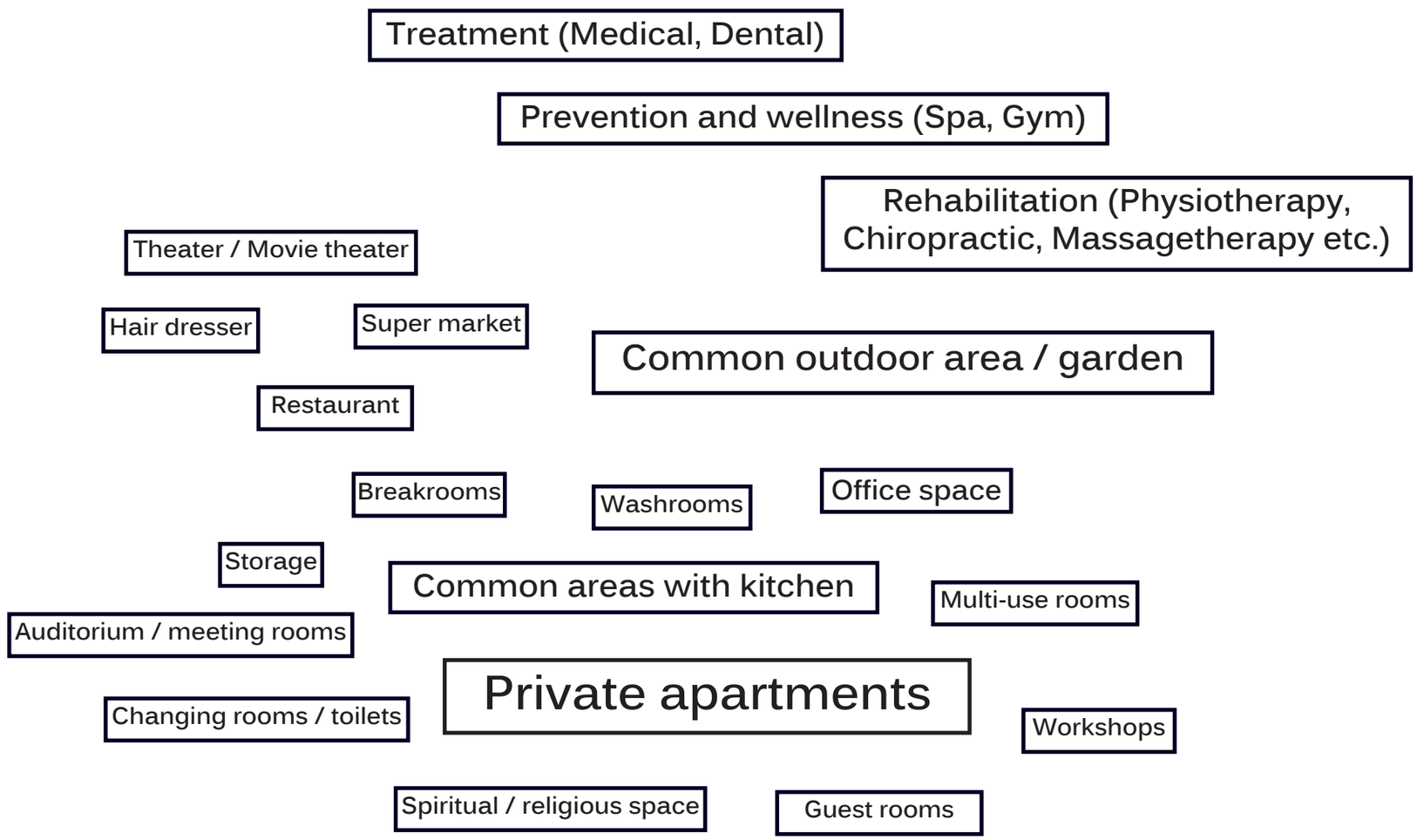
Vision

The vision of the project is to create an assisted living facility which through its design brands Danish architecture with contextual interaction and functionality. Chinese traditions are to be respected, and local architectural concepts should influence the design, namely a reinterpretation of the traditional siheyuan building style.

Based on knowledge obtained through literature, the space created is to enhance the feeling of home, and in extension, the well-being of the residents.

Through sustainable principles, both active and passive, energy performance and indoor climate are to fulfill Chinese regulations, using Danish comfort standards.

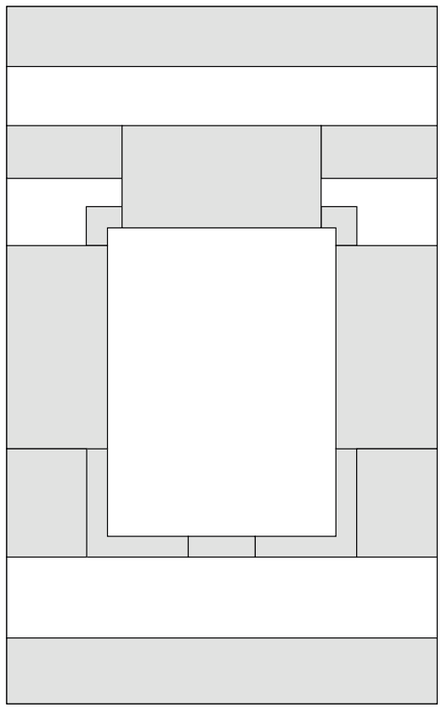
Room Program



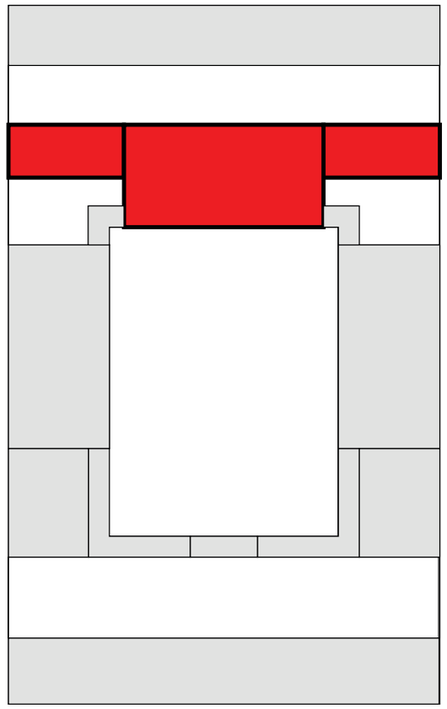
31

Concept Development

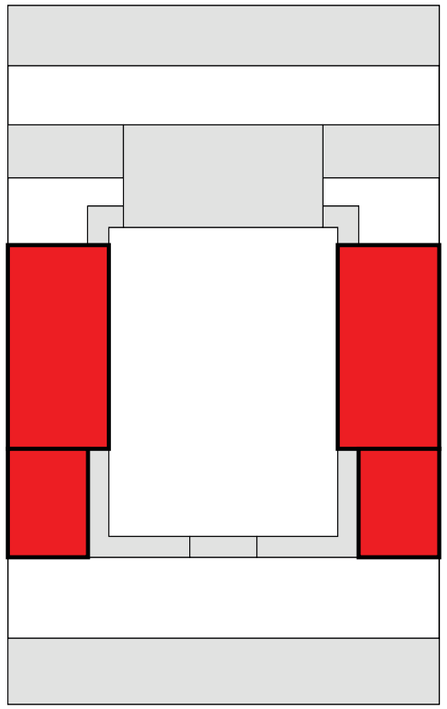
Interpreting the Siheyuan - Registration



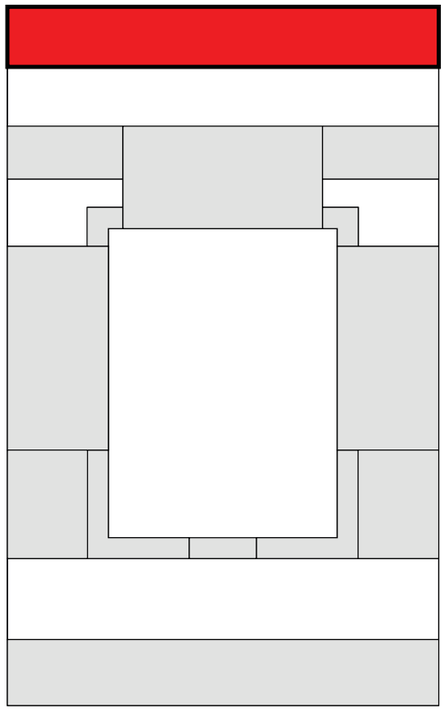
Layout of a traditional siheyuan with buildings surrounding a central courtyard. Stone walls bound the siheyuan where there are no built structures. All buildings are clearly facing inward, making the courtyard the space that connects all interior rooms. Rooms are clearly defined, as buildings with bedrooms are wider than their flanking buildings, and stand out in the courtyard. Different widths, along with roofs of varying height, contribute to making the facade more interesting, instead of long monotonous walls.



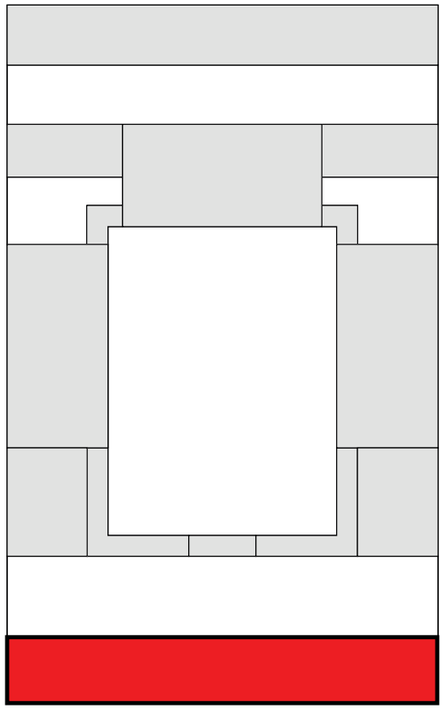
The master bedrooom and associated functions, reserved for the head of the family (usually the grandparents), are found in the northern section of the siheyuan because of favourable lighting conditions [web #12]. They have direct access to the courtyard, and from it's position, full overview over the residence.



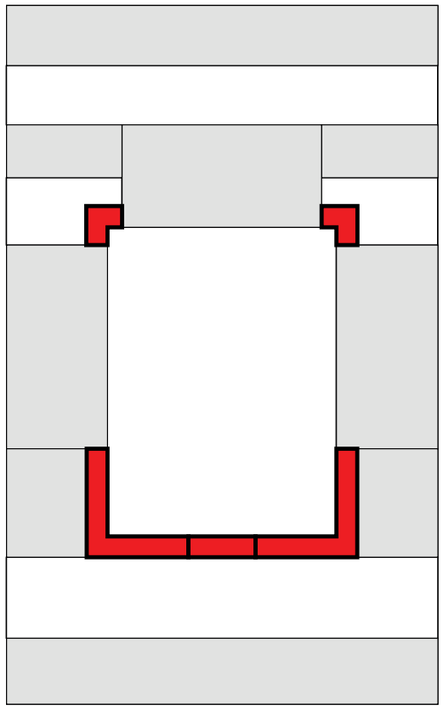
Bedrooms for the children, and other members of the family, are placed on the east-west axis, and receive less sunlight. The eldest son and his wife would reside in the western side house, while younger children would reside in the eastern. They still have direct access to the courtyard where social life within the family takes place.



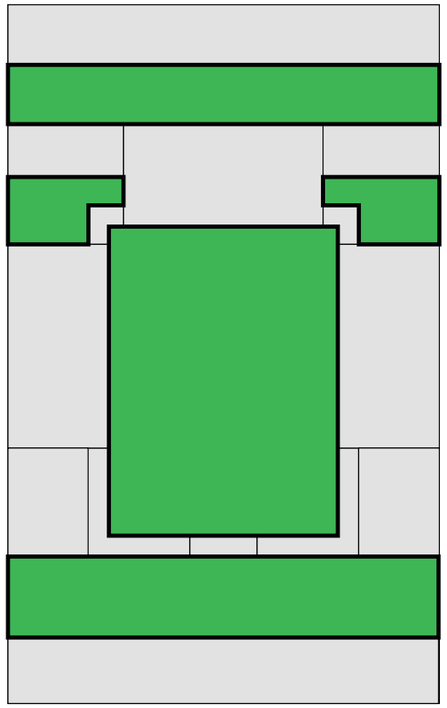
Behind the master bedroom there was usually a building where unmarried daughters and female servants would reside, as they were not allowed direct exposure to the public. The building lies in the shade from the master bedroom, and receives little sunlight. Access to the courtyard happens through the buildings flanking the master bedroom.



The southern section is where male servants resided, and is also where the family would gather to eat, relax or study (The building could contain bedroom for a fully grown grandson). Because of sparse usage of windows, this building receives the less amount of sunlight. Access to the courtyard happens through the screen wall, which is there to ensure privacy and according to chinese superstition protects the family from evil spirits.



Northern, eastern and western buildings are connected by beautifully decorated walkways, that provide shade from the sun during the day, and a patio-like space where one could enjoy the view of the courtyard during the night. The walkways would normally be joined to the screenwall bounding the courtyard in the southern corner.

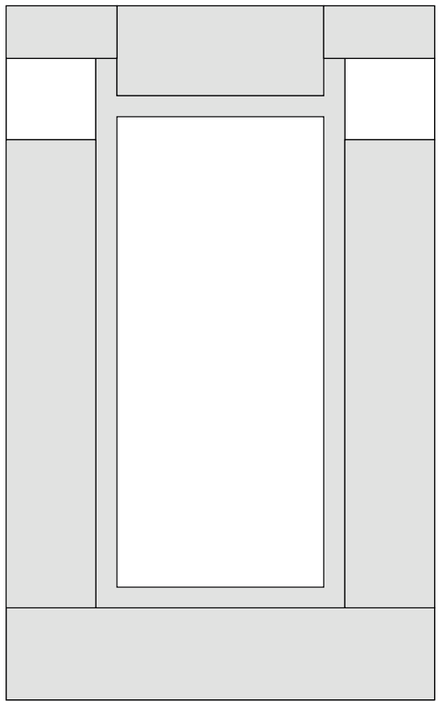


ill. 63-69

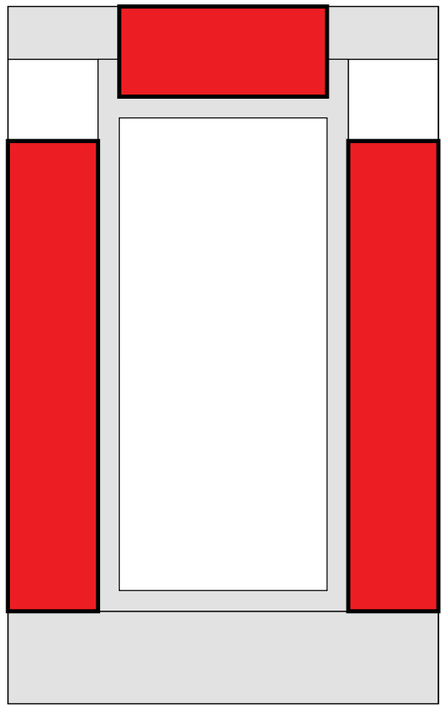
Aside from the central courtyard, traditional siheyuans contain small outdoor spaces serving different purposes. In front of the southern building there is an outdoor space preceeding the courtyard. This also functioned as work space for servants. Surrounding the master bedroom building there are several smaller spaces, both to create some space between the built structures, but also to create more intimate alternatives to the courtyard for relaxation.

Interpreting the Siheyuan - Application

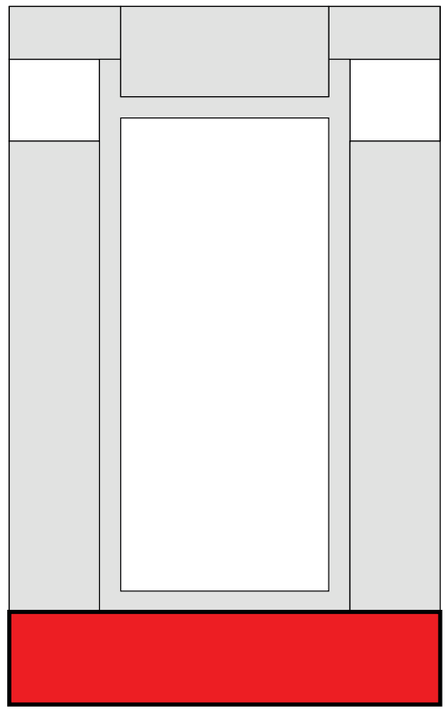
Creating a feeling of home for the residents is one of the corner stones of the design. In that sense, using the traditional Chinese home that is the siheyuan as inspiration, is applicable. However, the qualities that lies within the siheyuan cannot be literally transferred to a unit that a relatively large group of perfect strangers will all call home. In the following, changes and adjustments that comply with the requirements of the user group will be presented.



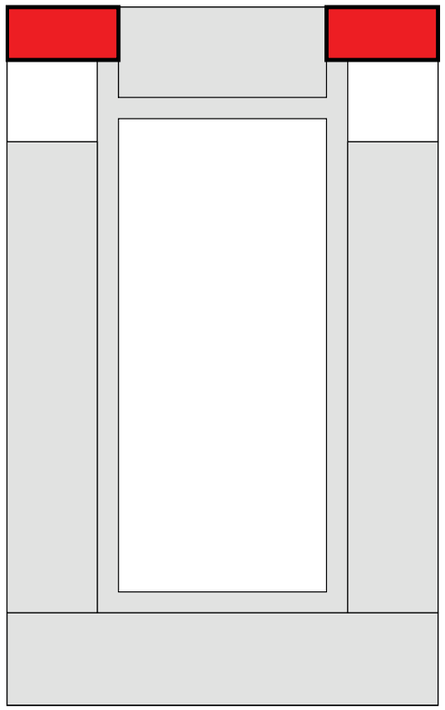
The general layout of the siheyuan can preferably to the user group be clearer and more manageable. Fewer intermediate spaces and shorter distances complies with the need for easily navigated common areas and walkways for the elderly. A much smaller percentage of the traditional siheyuan floor area was bedrooms, compared to 12 relatively large 50 m^2 apartments in the living unit. This automatically creates longer, unchanging facades. The unit could be scaled up to counter this consequence, but distances between functions would increase, which is unsuitable for the residents.



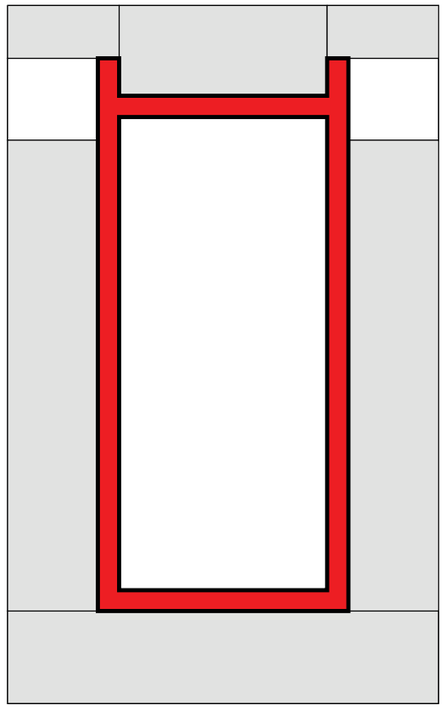
Bedrooms, or apartments, are kept in the northern, western and eastern parts of the building. By maintaining the placement of the apartments, direct access to the courtyard is provided. Ensuring visual contact between apartments and the common area encourages residents to utilize this space, or at the very least, provide a view to social activity and nature. By placing apartments exclusively in the eastern and western buildings, they would all be subject to similar lighting conditions. However, the courtyard would have to be longer, and cause greater distances between different parts of the building. Considering the physical state of residents, distances should be kept to a minimum.



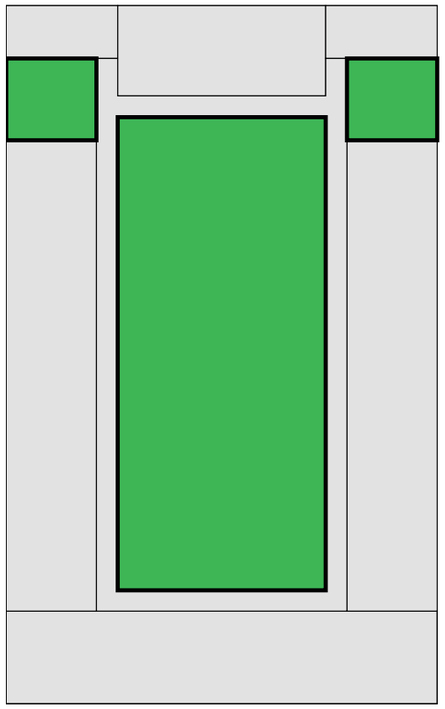
In accordance with the traditional siheyuan, indoor common areas, including the dining area, are placed in the southernmost building. By freeing up one of the sides directly facing the courtyard, there is a direct connection between the in- and outdoor common areas, facilitating the opportunity to extend the dining area into the courtyard in the summer months, and providing the dining area with a view to the yard during the colder months.



An assisted living facility requires a number of facilities that are not needed in a family residence. Common areas where residents can socialize in smaller groups are advantageous from a well-being perspective. Fitness rooms, workshops, game rooms and spiritual rooms are some of the suitable functions. The applicable use of these spaces can preferably be decided based on the user group occupying the unit. For instance, in a unit with physically capable residents, a fitness room and a workshop could be a fitting choice, while in units with weaker residents, a spiritual room and a guest room might be more appropriate. The importance of a view in these rooms are assessed to be lesser than from apartments and the dining area, and are therefore placed in the northern corners.



The walkways that define the transition from dwelling to courtyard in the siheyuan contain qualities that accord with advantageous features in a home for elderly. The walkways create a continuous connection between apartments and common areas, making the building transparent and manageable for the aging occupants. In the traditional siheyuan these walkways were roofed, but not enclosed. Due to relatively cold winters, and with the sensitive health of the residents in mind, the walkways could with benefit be closed, or have the possibilty of being closed during winter. Furthermore, the walkways can serve as roofed patios during summer when the need for shade is greater than that of sunlight exposure.



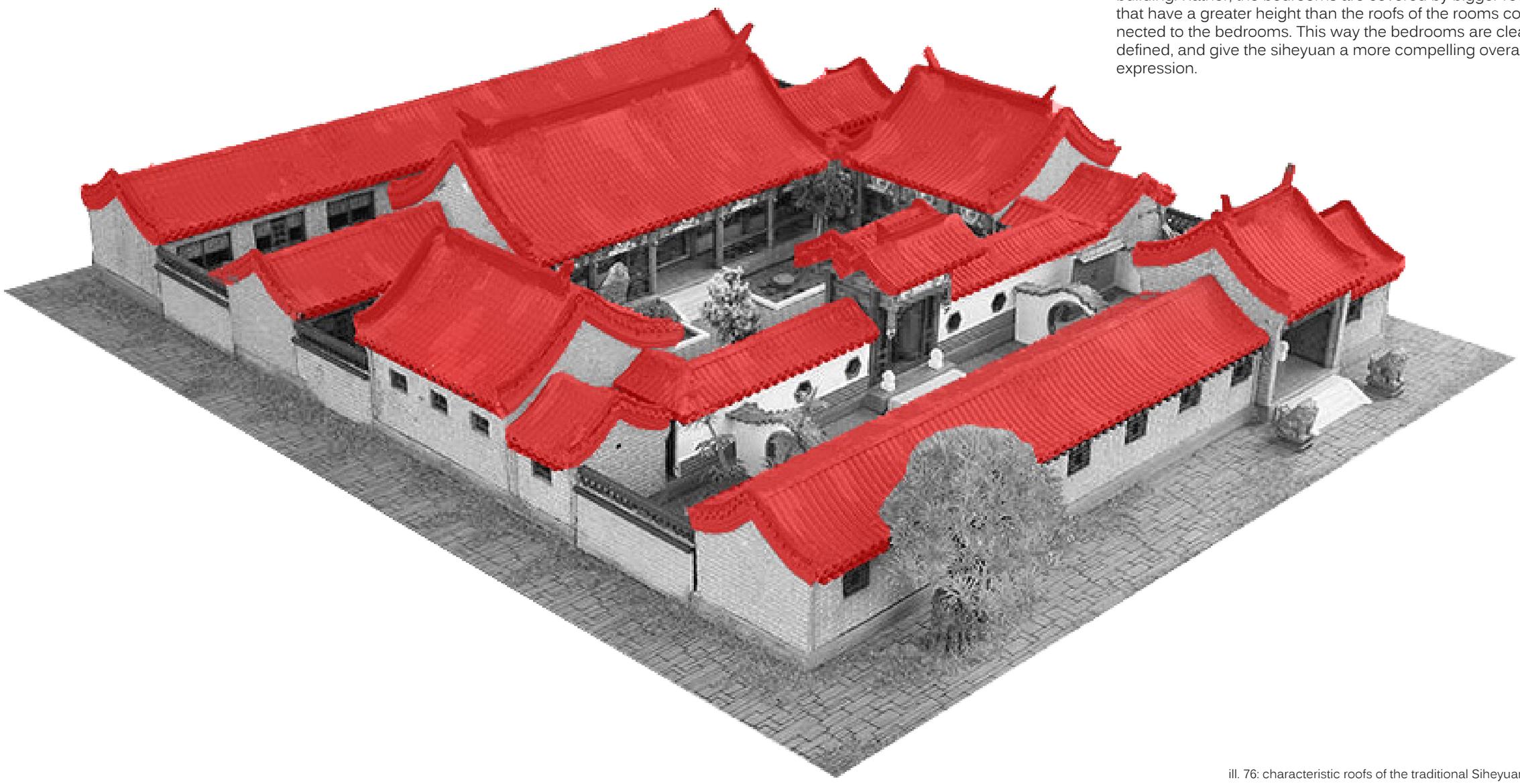
ill. 70-75

The courtyard is the heart of the siheyuan concept, and is conserved in a practically unchanged fashion. Some changes will have to be undergone regarding the placement of plants and furniture, as a larger portion of the courtyard boundaries are occupied by apartments or other functions that are benefited by a clear view to the space. Smaller outdoor areas are placed in front of the common rooms in the north. These could either serve as gardens where residents can tend to plants and flowers themselves, or simply as alternatives to the much bigger outdoor space that is the courtyard.

Interpreting the Siheyuan - Roofs

Roof concept

The roofs of the traditional siheyuan are characterized by their curved inclination and difference in size and height. The roofs give the impression that the siheyuan consists of more buildings than it actually does. For instance, the side houses (bedroom buildings on eastern and western side) do not have a single roof element covering the entire building. Rather, the bedrooms are covered by bigger roofs that have a greater height than the roofs of the rooms connected to the bedrooms. This way the bedrooms are clearly defined, and give the siheyuan a more compelling overall expression.



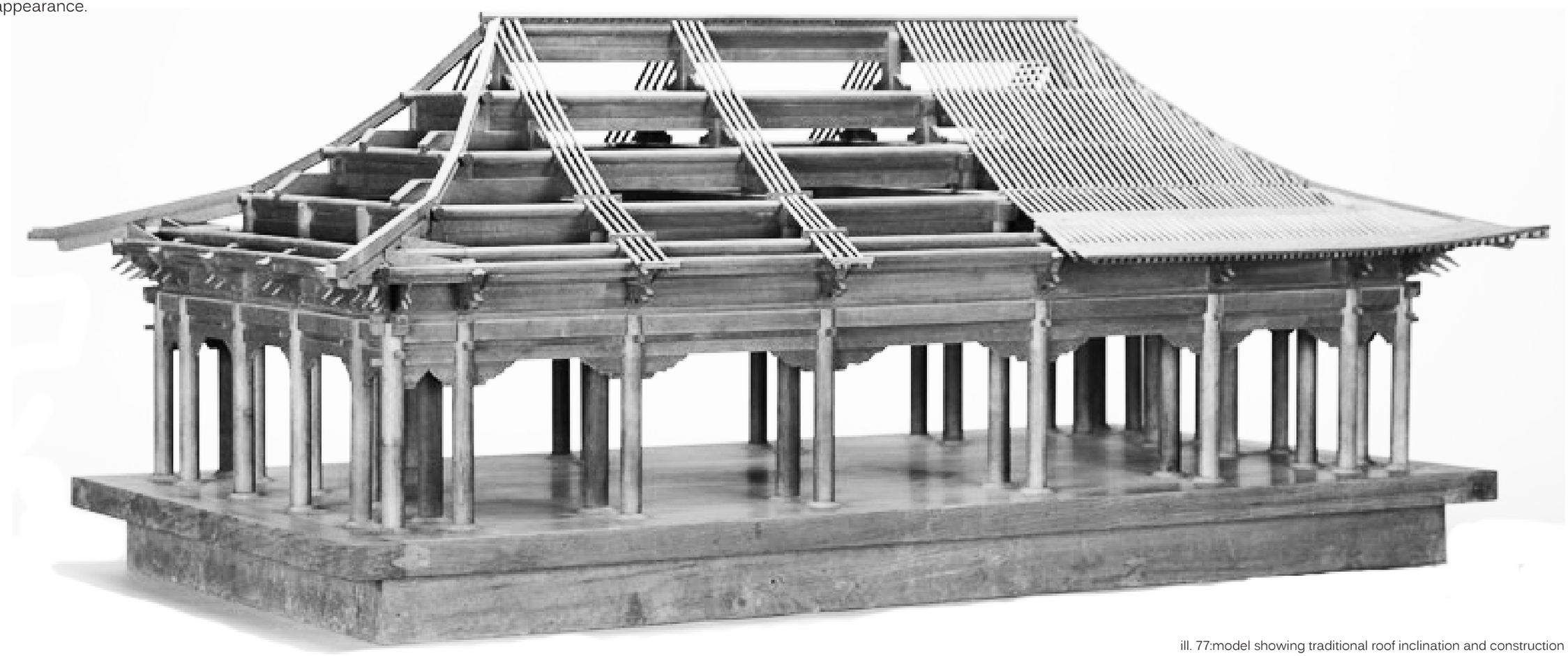
ill. 76: characteristic roofs of the traditional Siheyuan

Inclination and construction

Siheyuan roofs are normally made from dark grey roof tiles, with symbolic carvings on the end tiles. A recurring feature, though not found in all siheyuans, is small sculptures of animals along adjacent walls. There is no system for water diversion implemented, and rain simply falls straight into the courtyard from the roof.

The roof inclination in siheyuans includes the typical curved Chinese shape symbolizing the divine flying bird [web #14]. The curvature is believed to fend off evil spirits as they are allegedly travelling in straight lines. In reality, the roof is not curved at all, but rather consists of three or more straight segments in different angles that when joined give the impression of being curved. The curvature of the roof is not as big as one might think. A slight angle variation is sufficient to create the curved appearance.

The construction principle in Chinese roofs can appear slightly excessive. Structural columns carry an elastic wooden framework created by short beams, posts and purlins. The parts are connected with pins, and can absorb vibrations caused by severe earthquakes. [web #13] Most of the construction is visible from the interior, and creates a compelling pattern that emphasizes the focus on detail in Chinese architecture.



ill. 77:model showing traditional roof inclination and construction

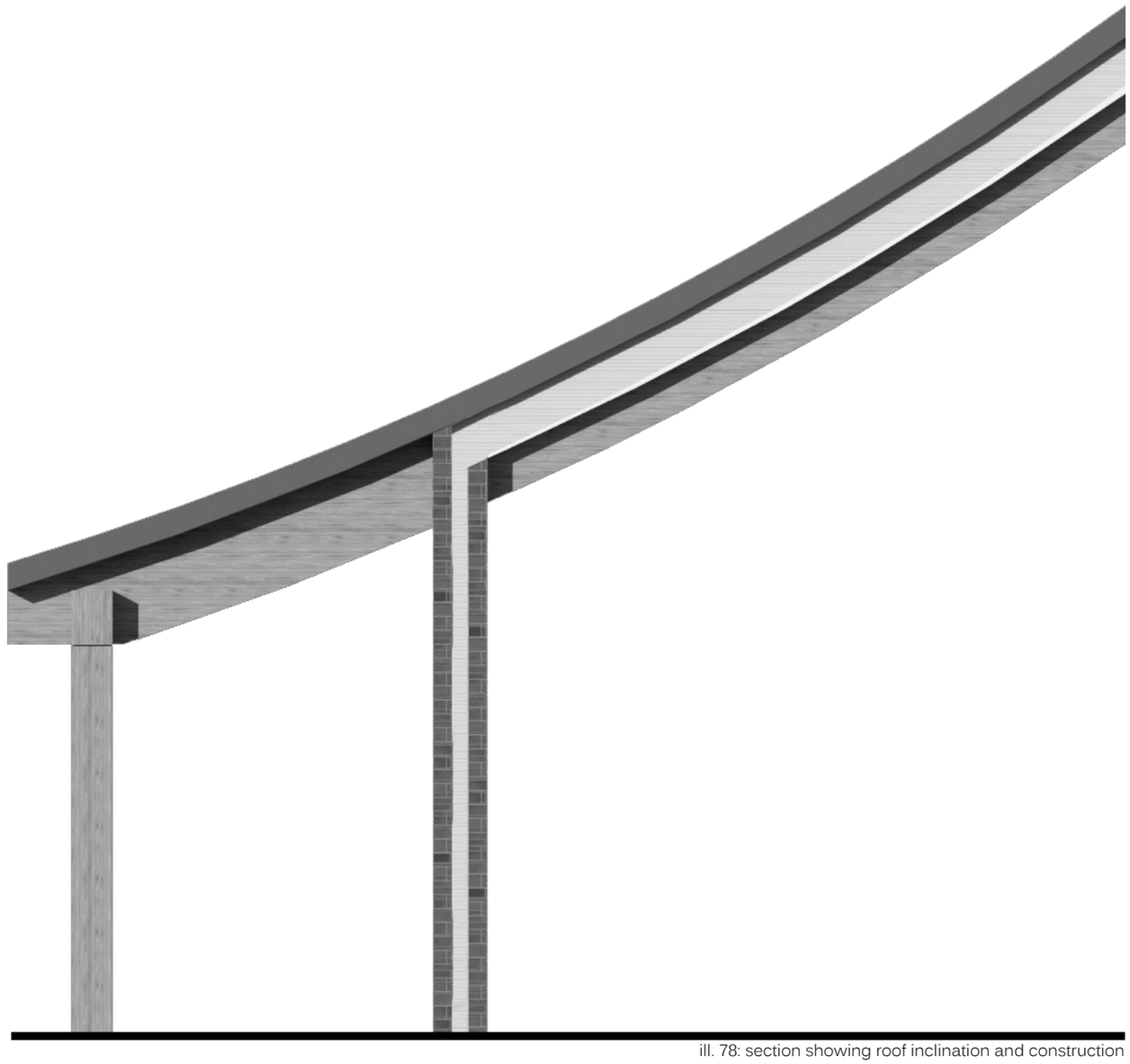
Interpreting the Siheyuan - Roofs

Application

The concept of having different sized roofs at different heights, adds irregularity to a regular and symmetrical plan. Apartments should have the same conditions and consequently the same height. That dictates the overall expression of the building, as the apartments make up such a large portion of it. Still, by differentiating the roofs in each building part, they are defined and given individual identities, which can be beneficial both for residents, and the facades.

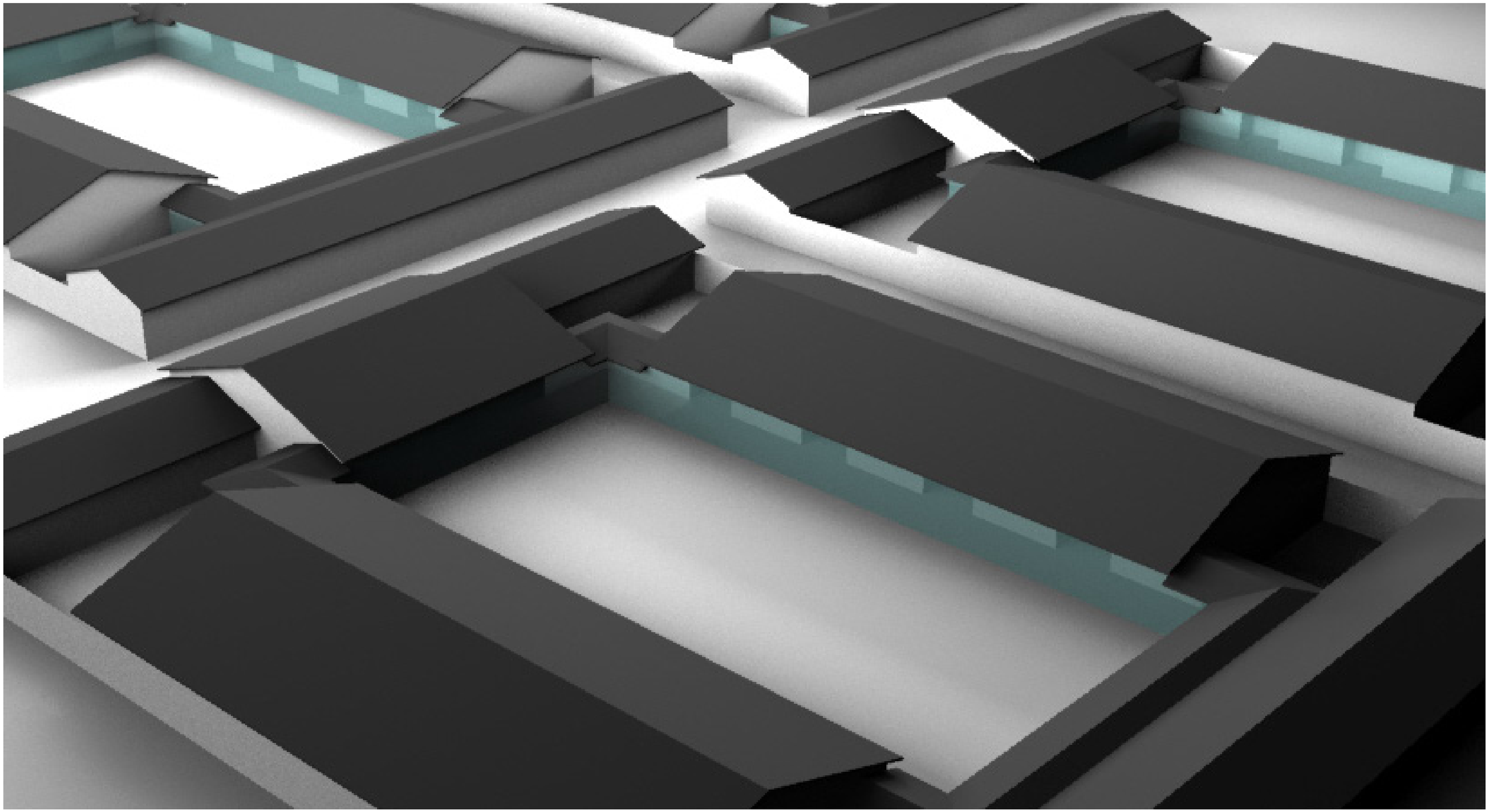
Curved inclination will be implemented to respect the architectural traditions of China. The construction however, will be carried out in a simpler fashion, reflecting the building style of Nordic countries. Most of the substantial Chinese roof construction (it's dead load being three to four times higher than Nordic tiled roofs) is visible in the interior, and is decorated in a way that makes each truss an ornament in itself [web #13]. Visible rafters inside the buildings is preferable compared to a smooth ceiling, as it creates visual variability for residents who spend most of their day in bed. The rafters will be dimensioned to obtain the desired interior expression, given that they suffice structurally. All ornamentation is removed according to the design parameters.

For the same reason, carvings and animal sculptures are removed from the roof. Simpler roofing material will give the building a sharper expression. Furthermore, gutters are implemented to avoid unwanted flow of water from the roof.



ill. 78: section showing roof inclination and construction

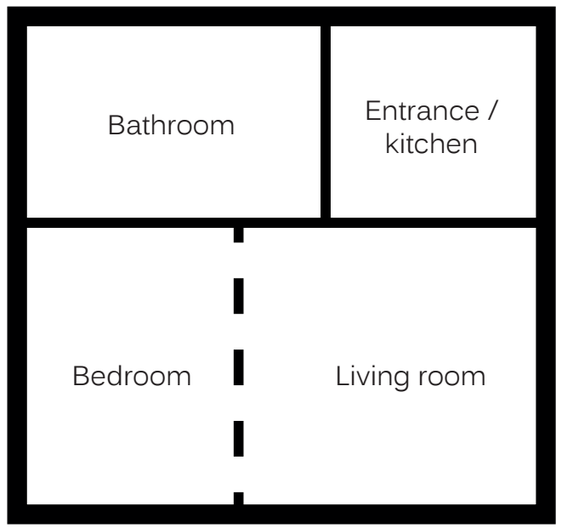
ill. 79: reliminary model showing possible roof solution



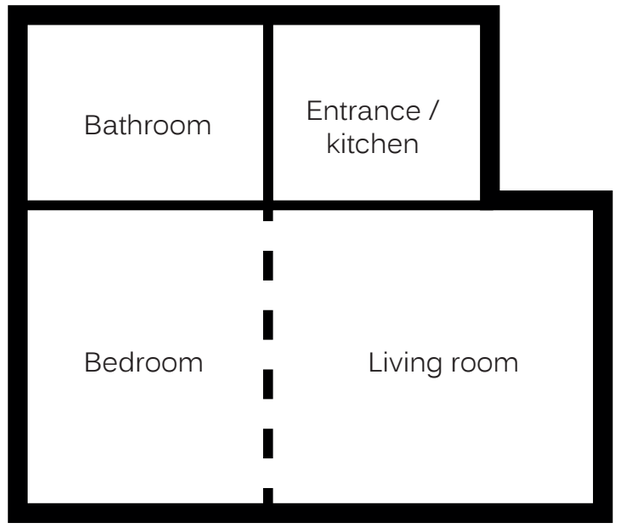
ill. 80: preliminary model showing numerous siheyuans

Private Apartment

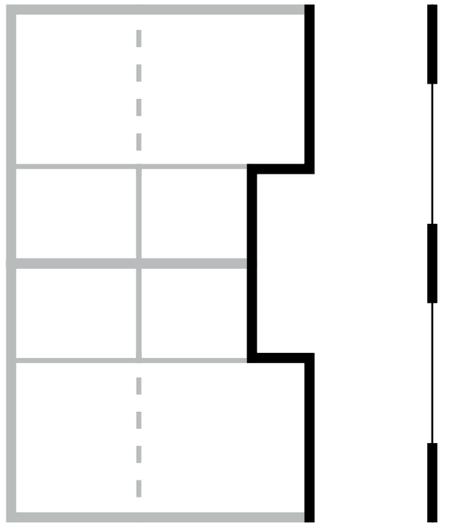
Regarding the layout of the apartments, main focus is to create a feeling of home, facilitate easy access to common areas and a manageable plan. The differences between a family house and an apartment for elderly are many. Thus, references from the traditional siheyuan are not applicable. Substantial research in the field is available, and serve as guidelines for the design.



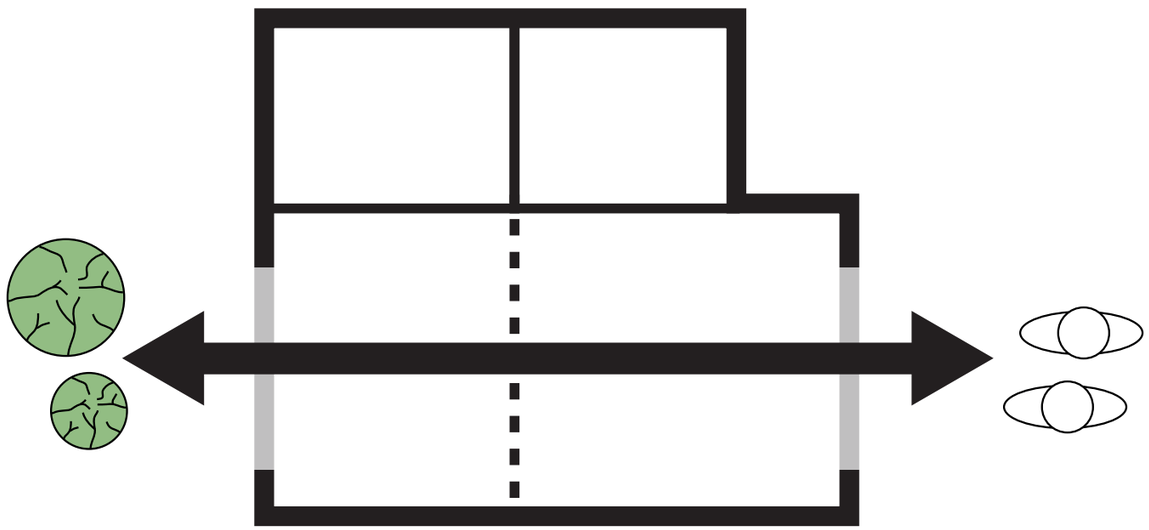
Privacy is crucial when it comes to well-being, and the private apartment is therefore key to make residents feel at home. Each 50 m^2 apartment has certain requirements; bedroom, bathroom, living room, entrance and a small kitchen. It is recommended that the apartment is divisble, either by consisting of two separate rooms, or one room that can be divided by a flexible partition wall. For instance, if a resident is healthy when arriving to the facility, they would appreciate having a separate bedroom, but as their health deteriorates and they spend most days in bed, they prefer being in the same room as their personal belongings. The kitchen is normally rarely used, and should therefore be rather small. To have the opportunity to make coffee for guests etc. is still appreciated, and contributes to feeling at home. The kitchen should be discretely placed, for instance in the entrance area, as noise from the refrigerator etc. might be a nuisance.



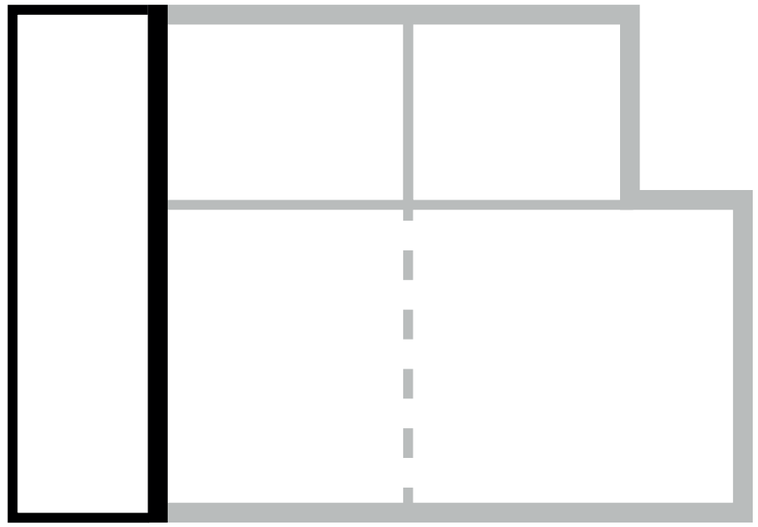
The entrance plays an important role in marking the transition from semi-public to private space, and can preferably be emphasized to underline this transition. A way of doing this is implementing a niche through which one enters the apartment. The small semi-private space in front of the apartment can be used as a place to sit, as an alternative to the private apartment.



Long identical walkways should, according to research, be avoided, as they are institutionalizing and complicates orientation. Well-being is maximized when walkways are non-linear, Especially a closed courtyard structure is favourable, which coincides with the siheyuan concept. The niches in front of the apartments contribute to breaking up the long, identical walkways. With view to the courtyard on the opposite side, the walkways become varying and manageable.



A view from the private apartment is an important parameter for well-being, whether to common areas or nature. Having the courtyard on one side and nature on the other, it is a natural choice to facilitate views to both sides. By providing view to the common area, residents are encouraged to participate in social activities happening in it, and a view to nature stimulates the senses.



ill. 81-85

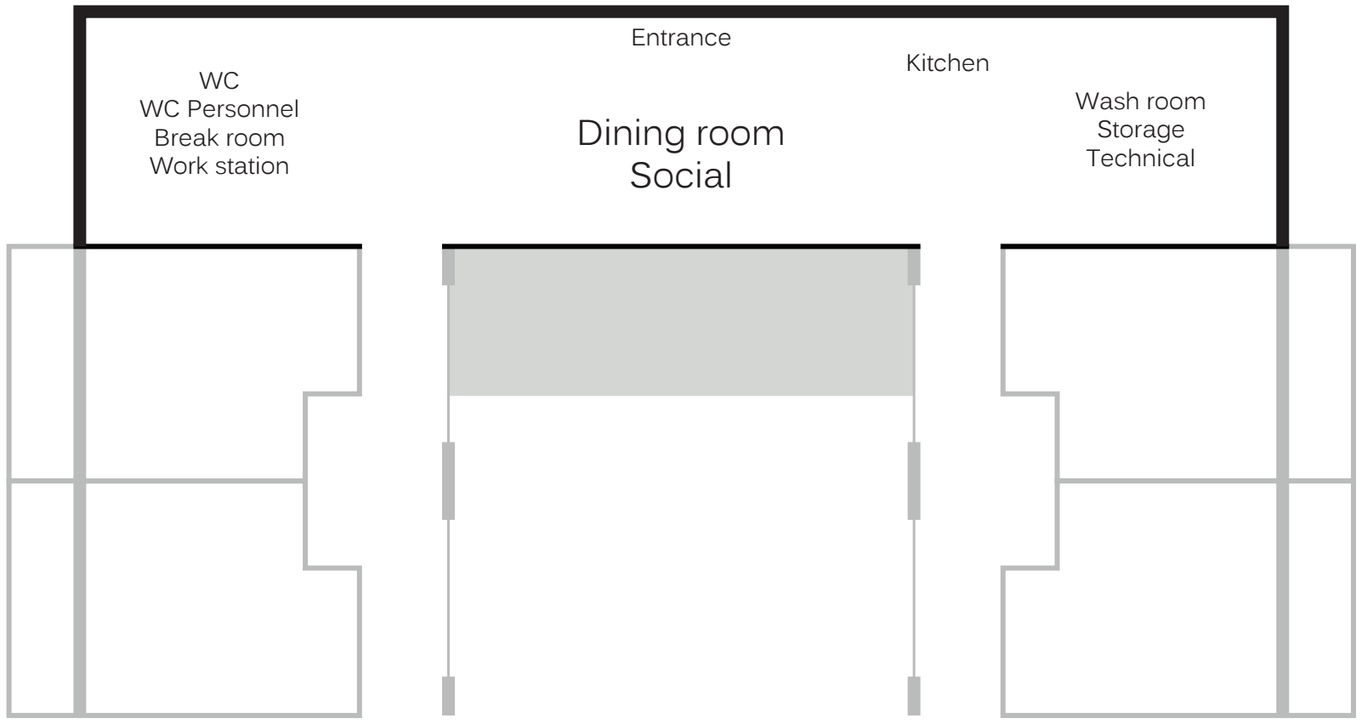
A private outdoor area - garden or terrace - primarily works as a lookout, and should be protected from wind and rain. To be able to come outside for fresh air, and sit outside in privacy can positively affect well-being.

Common Area

A common area where residents eat and relax provides a platform for social activity. Easy access to and from this area is important, as well as being visually connected to the rest of the unit. To place kitchen, dining area and seating groups for relaxation in the same room with views, gives residents the opportunity to follow the activities of the personnel, and observe outdoor activity or nature. The common room possess therapeutical and sensory stimulating potential. To watch food being cooked and enjoy its smells is according to literature equally as satisfactory as participating [Møller & Knudstrup, 2008]. The dining room can advantageously be placed facing the courtyard. Not only will this provide an attractive view, but the dining room can also be extended into the courtyard during warm days.

It is problematic if the personnels use of common area becomes predominant. If the goal is to create an environment that is as home-like for residents as possible, institutional and more private aspects should be kept separate. A break room/meeting room for personnel should therefore be included.

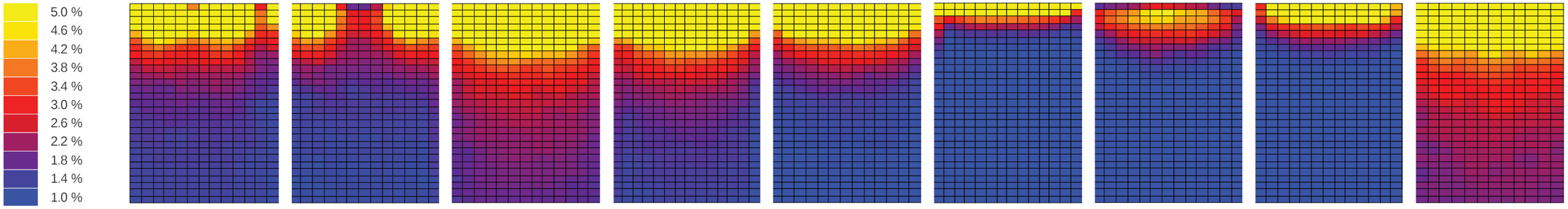
Sufficient storage space is crucial, because in the case of lack of space, aiding tools like walkers are stored in walkways, which inhibits access and is institutionalizing.
Other service functions such as toilets, wash room, technical room and cleaning room are placed easily accessible from the common room.



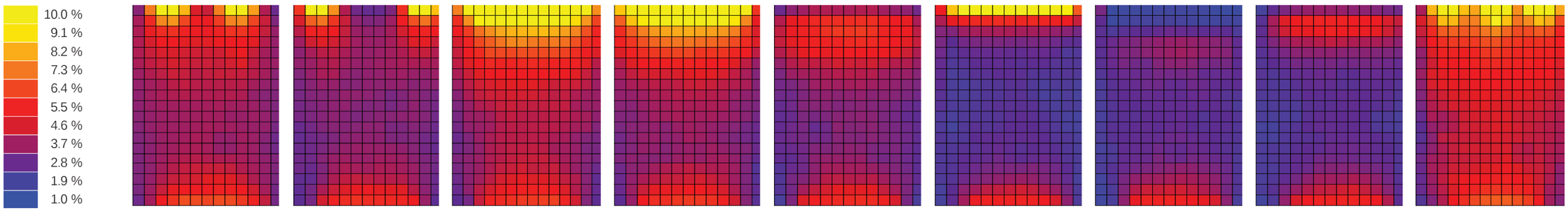
ill. 86

Window Placement

Energy performance and daylight values play a decisive role in the facade design. Substantial tests provide indication as to what solution performs best. The tests lay the foundation of the facades, as light levels are imperative for residents' well being, and windows influence the use of cooling and heating, consequently affecting the energy performance of the building. The tests are made for the terrace-facade opposite the courtyard only. The light from the courtyard-facing windows is indirect because of the walkway separating them from the outside. This makes the gain from them inadmissable in energy calculations, according to building regulations.



Daylight factor test (only counting windows subject of direct sunlight)



Daylight factor test (counting windows subject of direct and indirect sunlight)

ill. 87

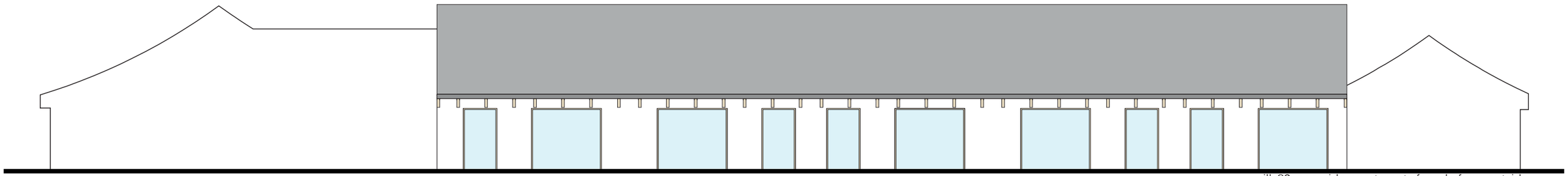
Energy consumption compared to worst solution (100%)	92%	86%	95%	89%	82%	77%	77%	77%	100%

Facades

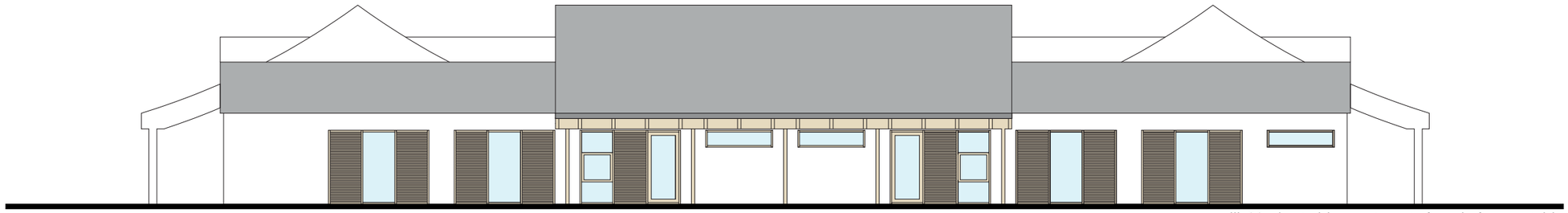
The results from the tests are one of the parameters for the facade design. Research has uncovered that it is an advantage placing windows at a height where residents can open and close them as they wish. In extension of this, it is revealed that residents should have the opportunity to look out when lying or sitting down. As the building facade is made up from five apartment facades, it is important that the facade for each individual apartment, result in a balanced overall facade that compliments the building.

In addition to the apartment facades, the building's architectural expression is affected by the roofs. By referencing the traditional siheyuan through different roof heights in different building parts, the facade does not appear monotonous and static.

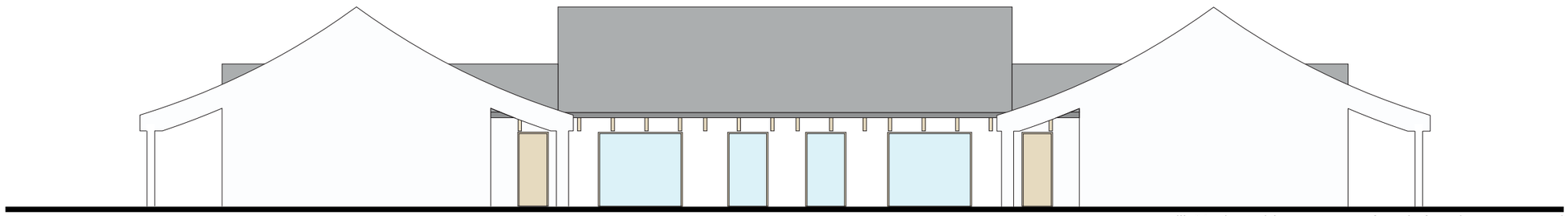
ill. 88: long-side apartments facade from outside



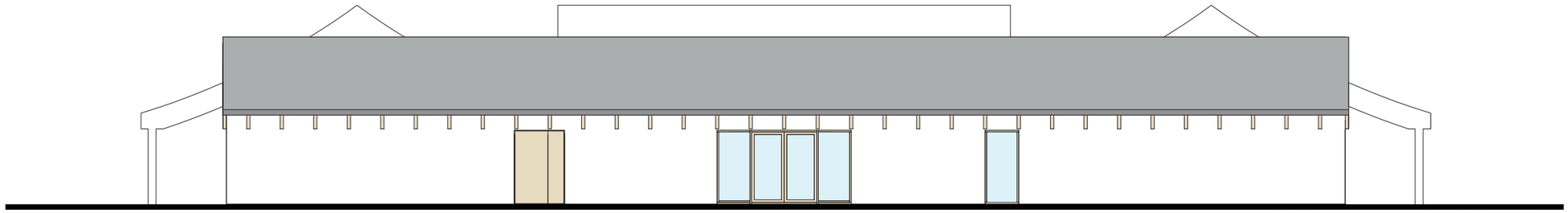
ill. 89: ong-side apartments facade from outside



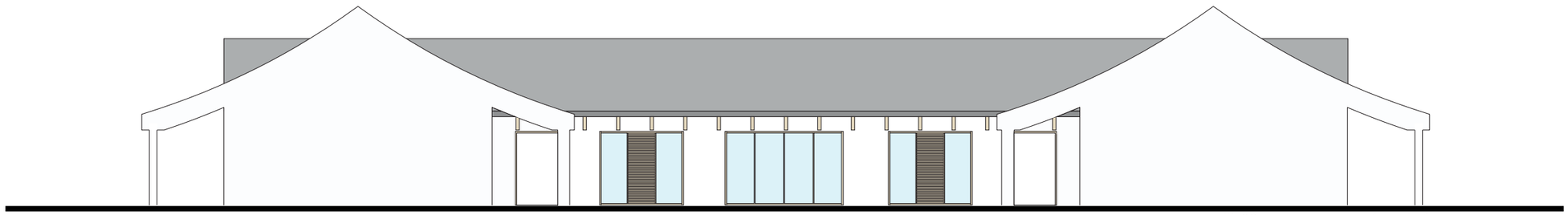
ill. 90: short-side apartments facade from outside



ill. 91: short-side apartments facade from inner courtyard



ill. 92: common room facade from outside



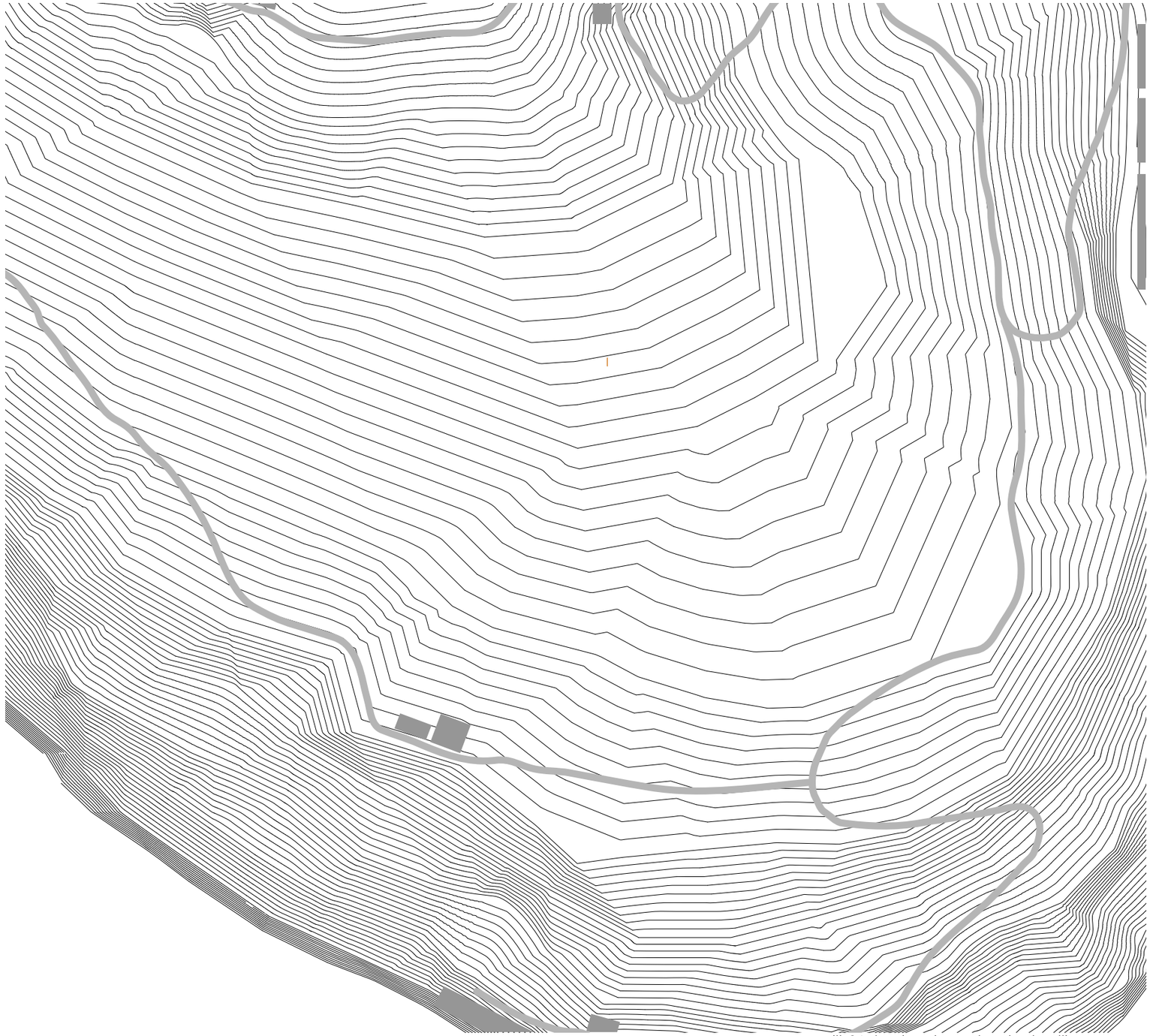
ill. 93: common room facade from inner courtyard

Master Plan Development

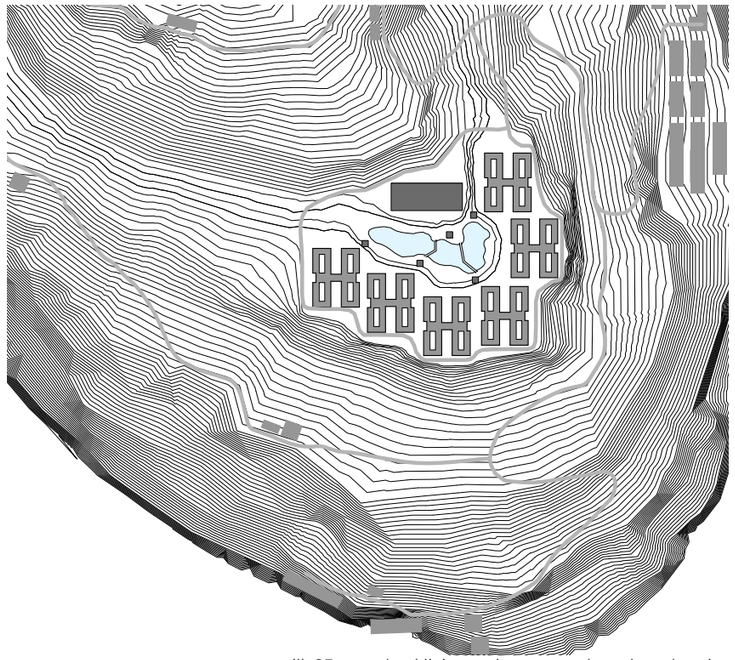
Each living unit houses 12 residents, so to reach the requirement of 300 beds total, 25 living units are required. The site for the facility is in a fairly slopy terrain. Given the physical capability of the residents, large elevation changes are not ideal, so a leveling of the terrain is necessary. A moderate inclination is acceptable and even encouraged, as it challenges residents physically, and can contribute to enhancing their health.

Apart from the dining area located in each living unit, residents have to leave the unit to make use of common facilities, such as larger common areas, restaurant, super market, spa, medical facilities etc. Therefore, it is important that level changes are planned in a way that give all residents equal conditions. Stairs have been completely omitted. All ascent and descent happens on walkways, none exceeding the maximum inclination of 5%.

When developing a master plan with this many identical buildings, the most challenging task is to design an orientation-friendly environment. The area can easily turn into a “jungle” of units, and taken into account the deteriorating sense of direction among residents, placing the units individually can cause the residents with weaker cognitive skills to get lost.



ill. 94: the site prior to elevation levelling

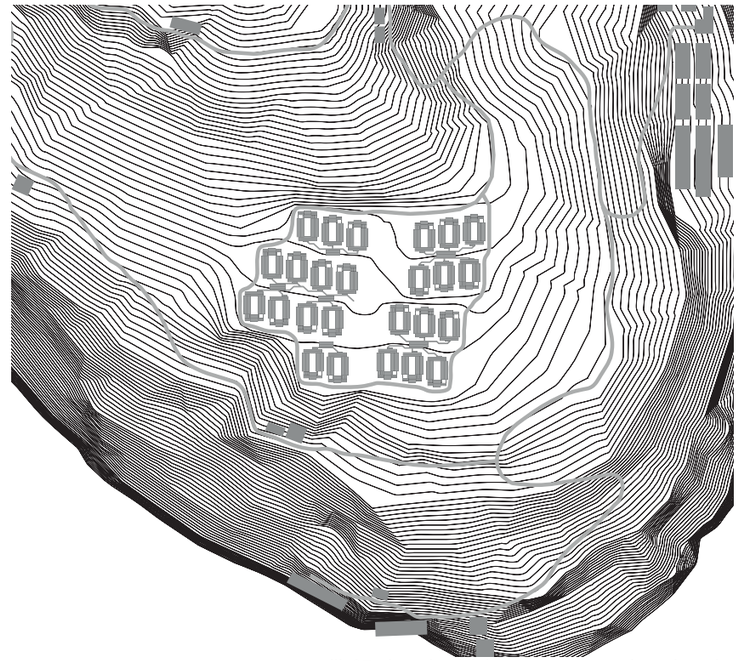


ill. 95: attached living unit groups placed on the site

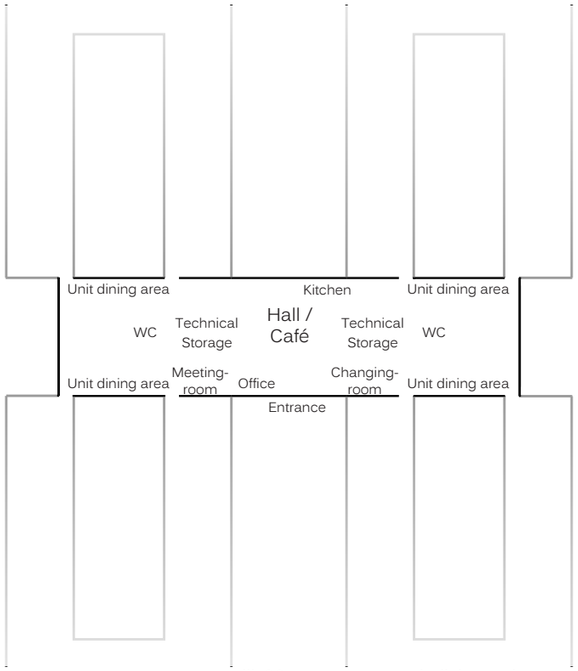
Grouping units

One way to simplify the master plan is to group units together, and thereby enable the possibility to incorporate a larger common area that is shared by such a group. The common area is larger space for gatherings where more than just the residents of one living unit is present. That could be birthdays, small performances or bingo. An advantage of placing four units and this common area together in one building is that the distance between the individual apartments and the common areas become smaller, and even physically weaker residents can utilize the space regularly, and socialize with residents beyond their own unit. One of the disadvantages is that the building becomes extremely large. Thus making it monolithic and imposing and difficult to place smoothly in the terrain. Additionally, by placing the larger common area in the same building as four units, much of the activity on the site is confined to each of the six buildings, and might leave the outdoor areas deserted most of the time.

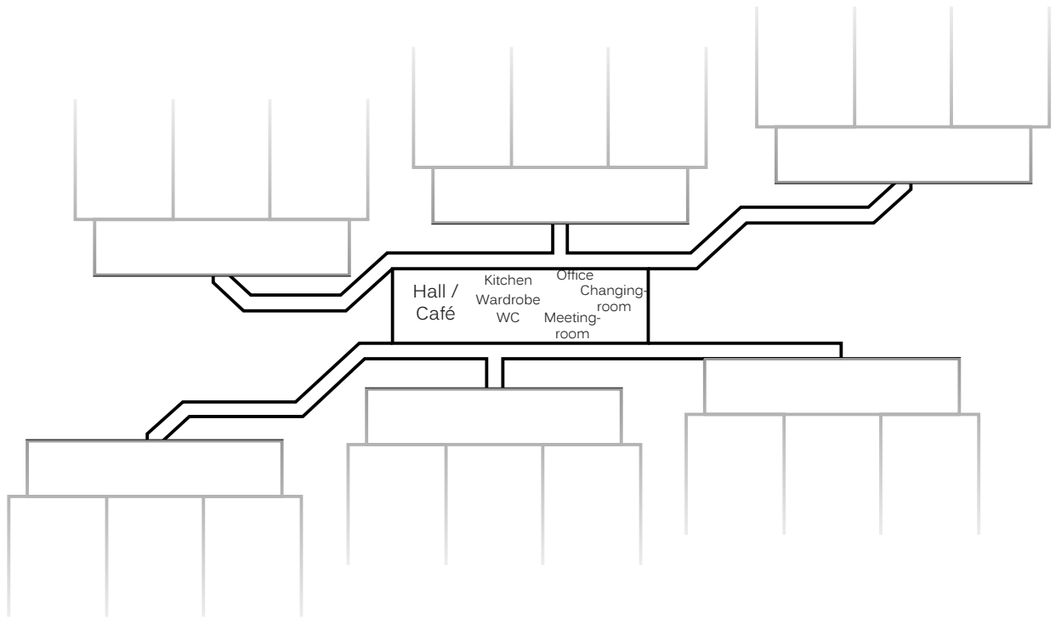
An alternative to this solution is to group units similarly, but place larger common facilities in free-standing buildings between units, connected by roofed walkways referencing the Chinese gardens. Living units are mirrored to simplify the process of grouping them together. To limit the amount of walkways needed, an entrance is placed on both sides of the building, entering the same room. This way, living units become more flexible in the master plan, both when it comes to elevation changes and accessibility. The building also contains changing rooms for personnel, managers office and additional meeting space.



ill. 97: detached living unit groups placed on the site

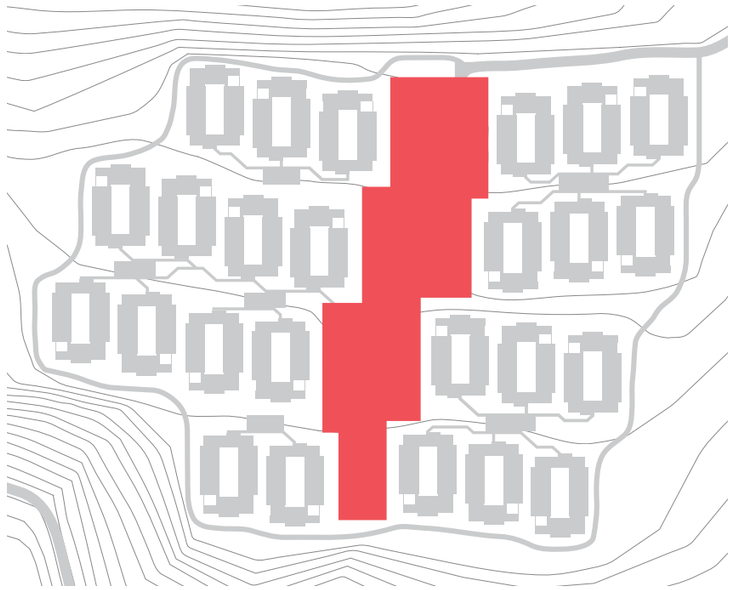


ill. 96: common area in living unit group of four

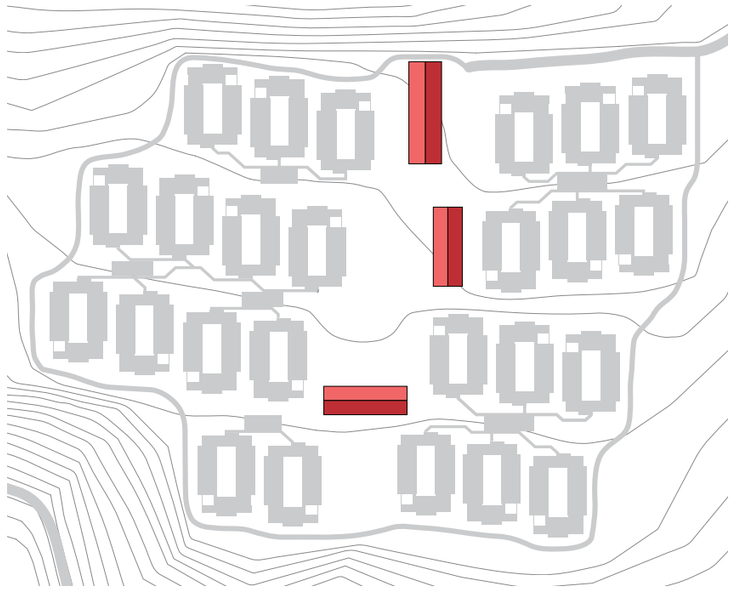


ill. 98: common building in living unit group of six

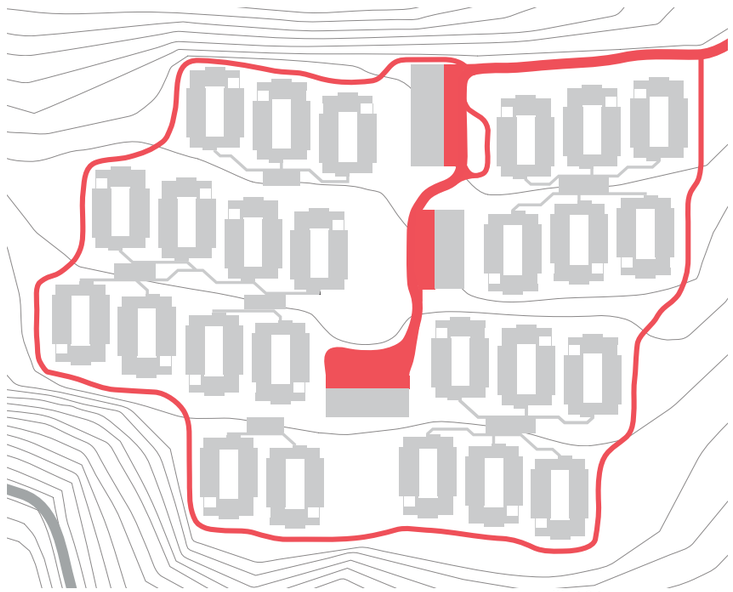
Master Plan Development



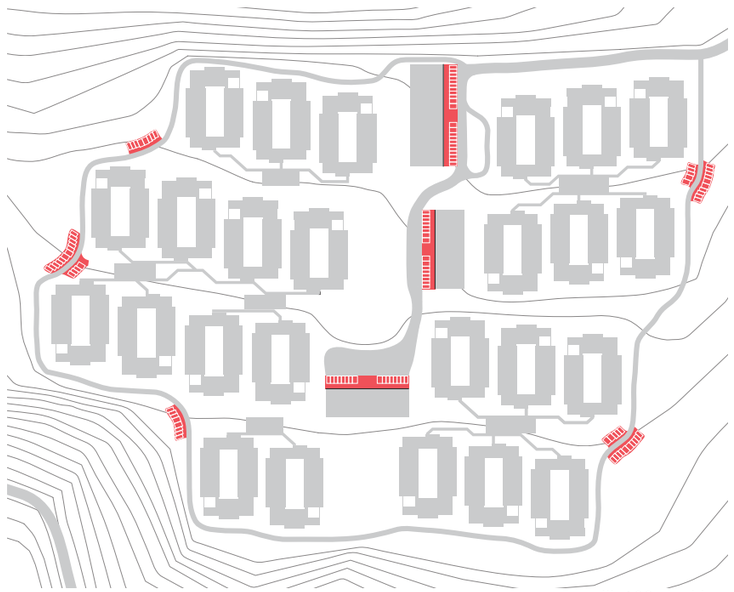
ill. 99: central wedge



ill. 100: center facilities



ill. 101: access roads



ill. 102: parking

Central wedge

Aside from the living units, 7000 m² of center facilities are required. This includes medical facilities such as rehabilitation, psychotherapy, physiotherapy, and facilities more directed at the residents (restaurant, supermarket etc.). Center facilities should be easily accessible to all residents, and are therefore placed in a north-south axis in the middle of the site. The building with facilities for everyday use by residents are given the most attractive location, in the southernmost part of the site, to provide a view to the river for the restaurant. The remaining facilities are placed in two buildings further north on the site. Together, the three buildings define the central social space, wedged between the two clusters of living units on either side.

Access roads and parking

Arrival to the site happens from the north-east, passing three units before reaching the northern-most central facility building. There is a circulation road next to the building, where cars parked next to the building, or cars dropping people off, can circle around without having to drive through the whole site. When passing the middle center facility building cars are met by the main pond. The road curves along the pond and ends up in a roundabout in front of the southern-most center facility.

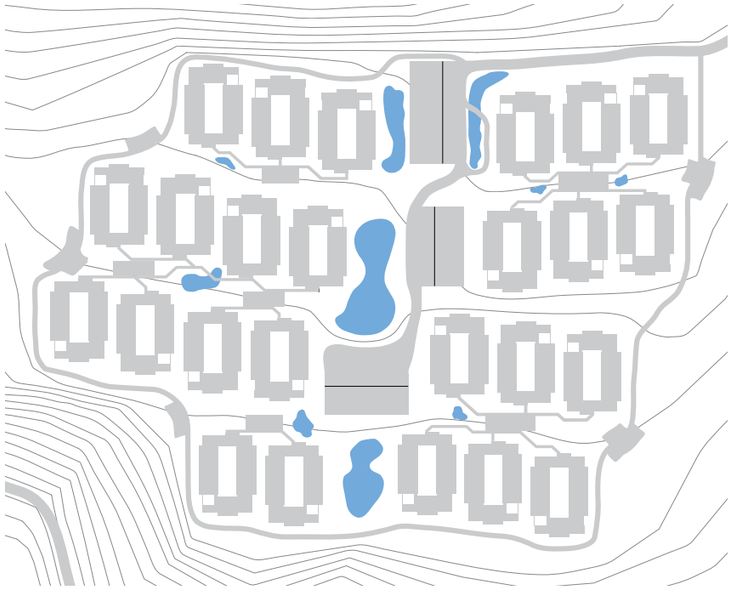
In addition to the access roads leading to the center facilities, an access road follows the periphery of the site, connecting to all living unit groups. Along the peripheral access road, parking is found for each living unit group. The reason for having an access road apart from the main road inside the site is to limit the amount of cars going through the recreational area. Even if it is revealed through research that activity of all kinds is encouraged, thereby also cars, it is evaluated that the activity accumulated in the area through other means, does not necessitate car traffic. In extension of this, the parking for living units is also omitted from the area. The required number of parking lots amount to a number of square meters that would dominate the recreational environment (1 lot per 8 residents/staff members). The peripheral parking also benefits the personnel and the guests of residents, as they can get alot closer to the living units. The center facilities are provided with parking fulfilling regulations for public buildings (1 lot per 125 m²). The peripheral access road is further backed by the necessity of fire roads (fire apparatus access road). The main access road going through the middle of the site is not sufficient to fulfill fire regulations regarding maximum distances.

Water and pathways

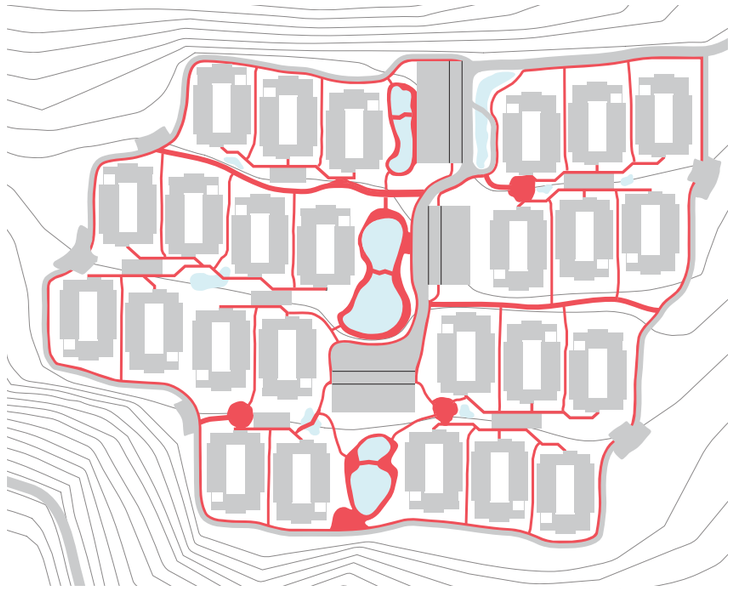
The central wedge not only include the center facilities, but also a substantial network of paths where residents can go for shorter or longer walks. The paths are dictated by bodies of water placed in strategic locations across the site. The largest pond is placed in the center of the site. Two relatively large ponds are placed in the northern part and one is placed in the southern part of the social space, providing residents on all elevation levels with ponds in close proximity. In addition to the large ponds, there are smaller ponds placed along the roofed walkways between the living units, or in connection with the common buildings.

Pavilions

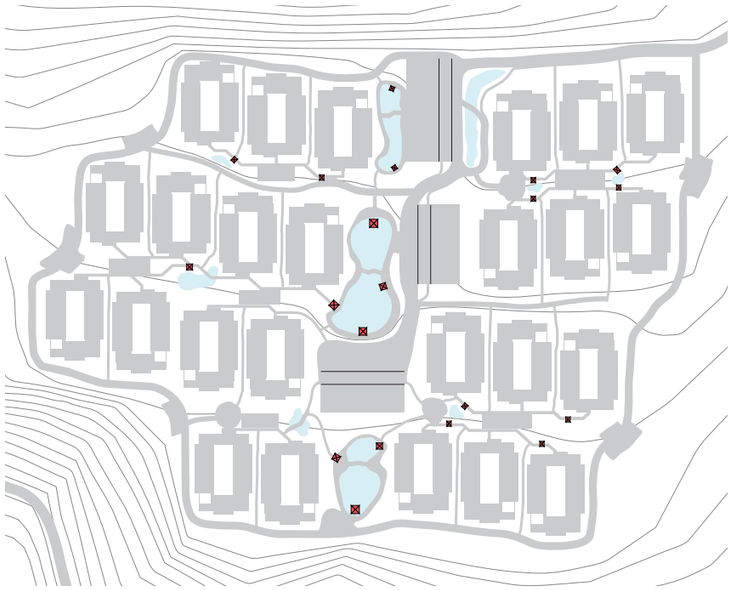
Along the paths there are placed pavilions. The pavilions serve practical purposes such as being a shaded pause on the pathway where residents can sit down and rest when going on a longer walk. Pavilions can also function as small common rooms, where residents can socialize in smaller groups across living units. In Chinese gardens pavilions serve a very specific purpose. They are points from which a carefully designed view, much like a painting, is viewed. Although the site contains elements of the Chinese garden, the deep meaning of the traditional pavilions cannot be recreated with the same impact. Still, emphasis is placed on placing pavilions in spots where there is an attractive view.



ill. 103: water

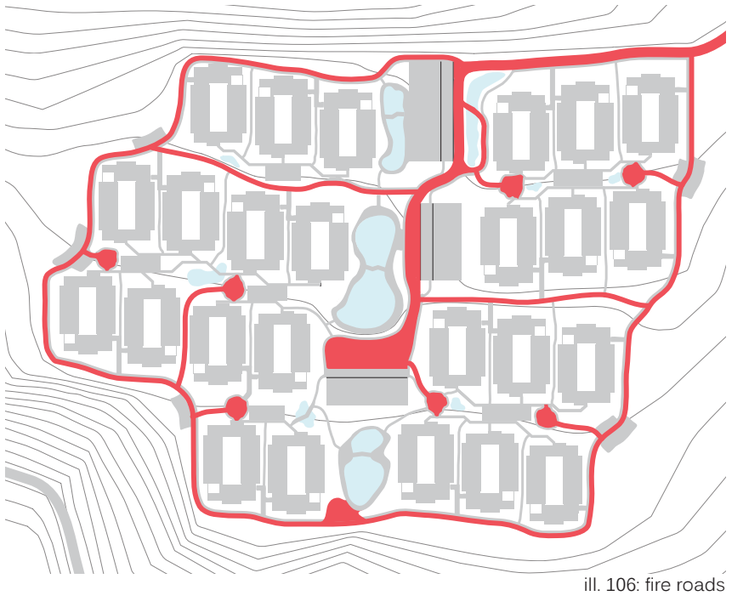


ill. 104: pathways

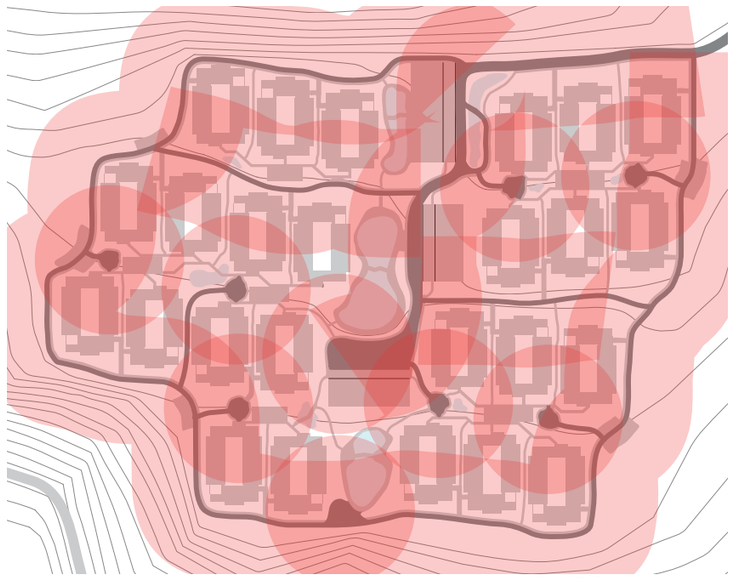


ill. 105: pavilions

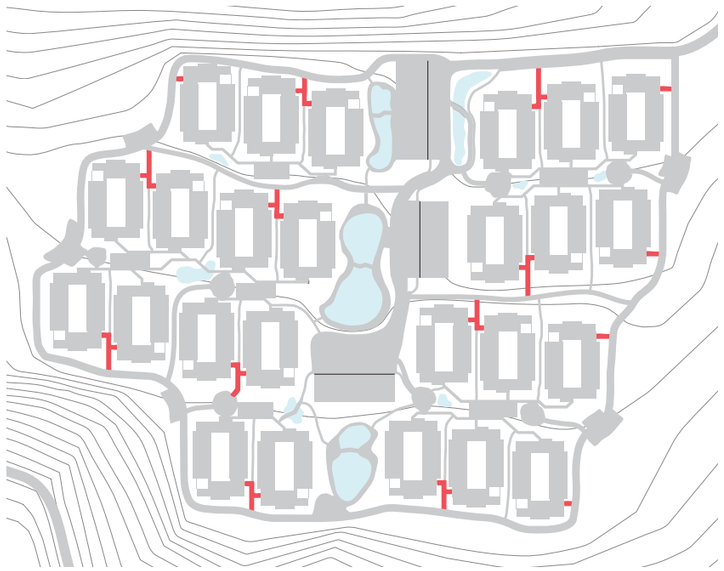
Master Plan Development



ill. 106: fire roads



ill. 107: fire roads reach



ill. 108: hearse access roads

Fire roads

Fire regulations state that the distance from all doors in all building envelopes to a fire road cannot be greater than 40 meters. The main- and peripheral access roads serve as distribution routes to smaller fire roads within the site. The internal fire roads double as supply roads for the living units and common buildings. The fire roads culminate in turnarounds with a diameter of at least 14 meters, the minimum width of turnarounds for fire trucks according to regulation. These roads are not paved like the main- and peripheral road. Instead, they are employed by stone. Stone is a natural material that blends into the nature in a better way than asphalt or tiles, much like the stone pathways in Chinese gardens.

Turnarounds

For Chinese people, and especially the elderly, it is common to gather for group exercise (such as Taiji Chuan) in city squares. The turnarounds are ideal for this activity, and could turn into a daily or weekly happening where residents from several units gather to get some exercise and socialize.

Hearse access roads

Unfortunately, death is a tragic, but very real part of every day life in an assisted living facility. On average, residents spend two and a half year there before passing away. Providing access roads for hearses is therefore imperative. All living units are accessed by using the fire roads and short stone paths leading to the spiritual room in the living units.

User Preferences

Literature on well-being in assisted living facilities describes four user groups with respective preferences. To optimize the well-being of the four user groups, they require customized living arrangements, be it the private apartment, the indoor common areas or the outdoor common areas. Albeit, in the ideal world this organization of residents would work, in reality people can move between groups over time. For instance, someone moving into the facility while being relatively active and with good cognitive abilities, can experience declining physical and mental health. Their preferences with regards to living arrangements will naturally change. The facility could be designed to have the residents moved around to units suitable for their needs, but that is both incompatible with the wish to provide a feeling of home, and the arrangement stated in the D'Care project description; that residents will buy the individual apartments. Measures are, however, taken to accomodate some of the preferences of different user groups.

Private, supporting

The users in this group are in relatively good health, and take little to no part in common activities. Their social life revolves around visiting family and friends. Users in this group would prefer the units in the north-east corner, as they are easily accessed by visitors, and are separated from the other units by center facilities and elevation changes. As they are in good health, they are capable of making the slightly longer walk if they wish to use the large outdoor common area.

Collective, supporting and social, caring

These groups are combined, as they share key preferences regarding the social activity. Users in these groups are still oriented towards the social community, and their social needs are largely attended to by other residents and/or personnel. Users from these groups would prefer units with easy access to outdoor common areas where they could interact with other residents. The physical health of the users vary within these groups. Physically weak users could benefit from choosing a unit close to the outdoor common area, while the stronger users can overcome the inconvenience of living in units placed marginally further away.

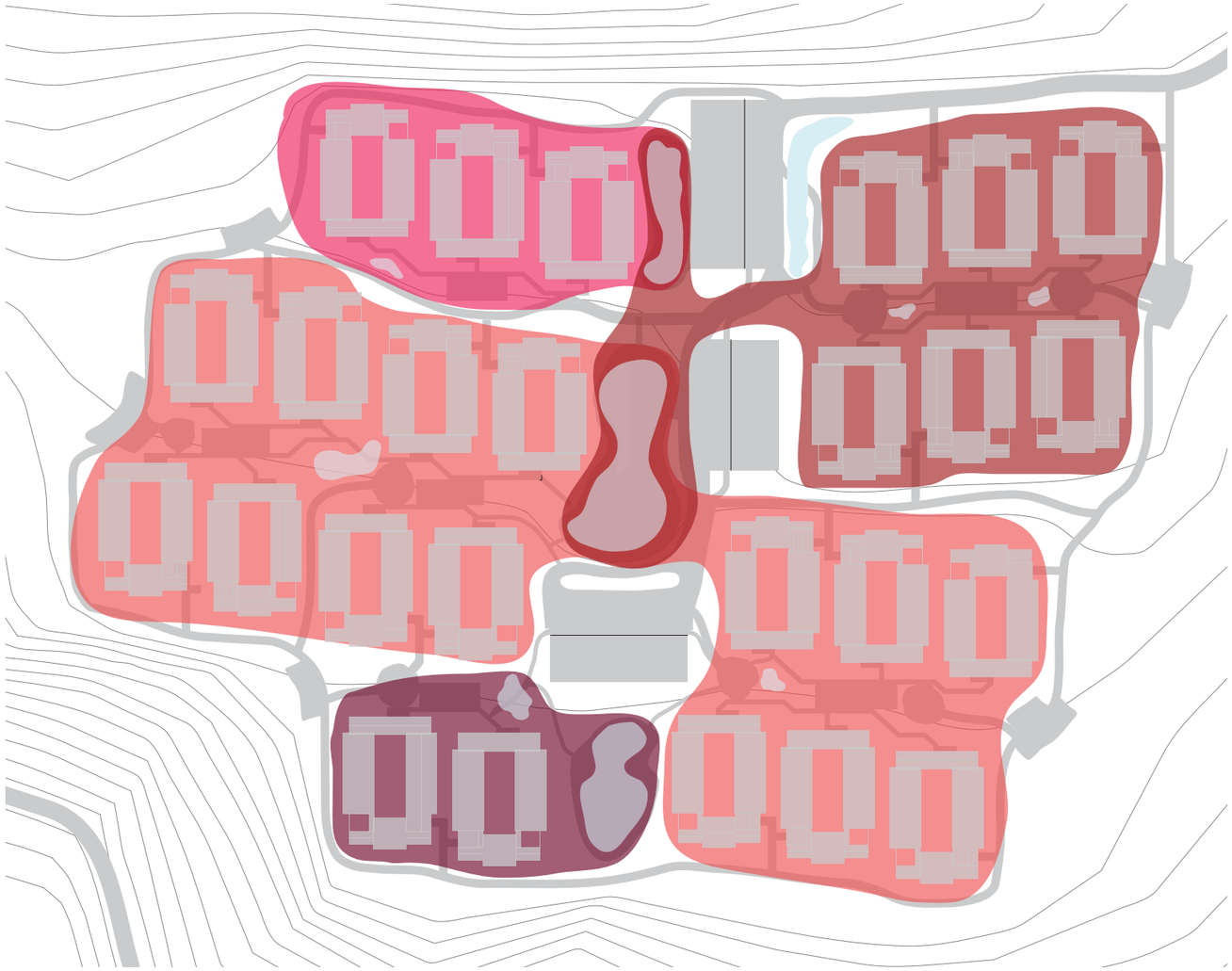
Dementia units

Demented residents is the user group with the most distinct preferences. Both the demented and residents with strong cognitive skills benefit from being separated as conflicts easily occur when mixed. The dementia units are placed in the north-west corner of the site, where hedges and other vegetation bounds the three units. By creating physical boundaries, the likeliness of residents wandering off decreases significantly. The residents can move freely in the secluded area. When using the outdoor common areas, residents should be accompanied by personnel.

Private, relieving

Users in this group are physically weak, and have little to no mobility. They take little pleasure in use of outdoor common areas. Two units for this group are placed in the southern part of the site, where they are separated from most activity on the site. Their location provides a desirable view to the river, which can be appreciated when mobility is limited.

It is important to stress that no units, except the dementia units, are specifically facilitated for certain user groups. This mapping is merely a suggestion to where the different users might find themselves in a unit suitable to their preferences.



ill. 109: user group mapping

Private, supporting

Collective, supporting & social, caring

Dementia units

Private relieving

Energy Performance

Energy efficiency in China

July 1st 2005, the Chinese Design Standard for Energy Efficiency of Residential Buildings was implemented. The new standard meant among other things that the energy consumption had to be decreased by 65% compared to the prior standard. Examinations however, say that less than 6 percent of the recent built dwellings are designed by the standards. [att. #6]

China has individual requirements regarding heating and cooling based on the type and location of the building. The energy requirements for a residential building in the “warm summer cold winter”-zone, in which Chongqing is located, are:

Heating	**15.6 kWh/m2**
Cooling	**28.6 kWh/m2**

[att. #5]
The goal for this project is to fulfill the Chinese Design Standard for Energy Efficiency of Residential Buildings for heating and cooling while at the same time complying with the Danish standards for comfort and indoor climate.

The Danish standards for indoor climate are:

Temperatures	**max 100 hours with temp. > 26 °C** **max 25 hours with temp. > 27 °C** **>20C**
CO2-level	**< 1000 ppm**
Min. airchange rate	**winter : 0.5 h(-1)** **summer: 1 h(-1)**
Rel moisture	**< 70% and <40-45% for more than a month**

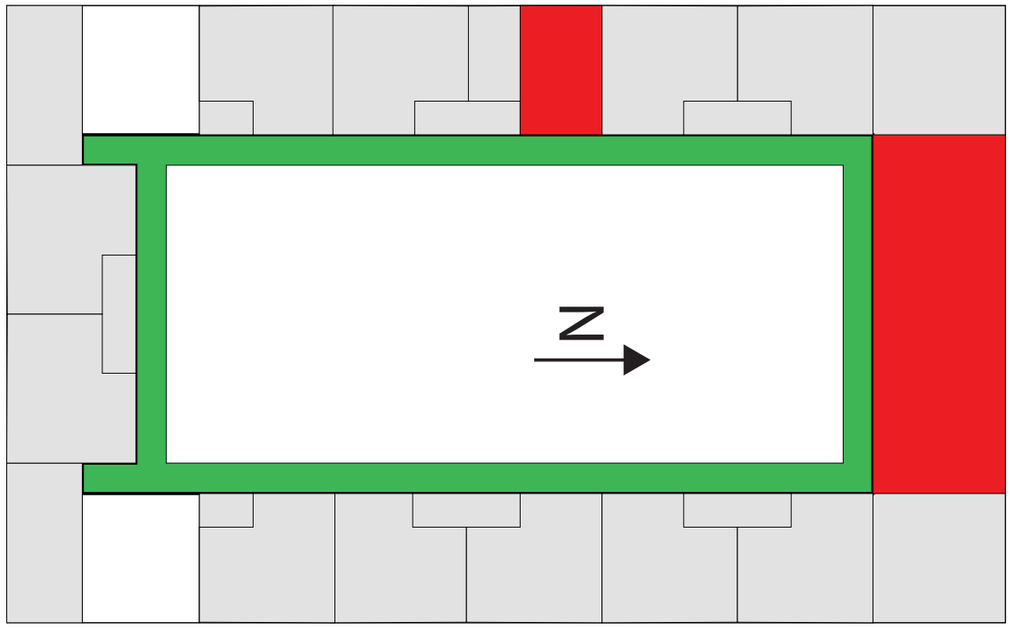
Compared to the Chinese comfort standards (18-28 °C)[att. #6] the Danish standard has a narrower range of acceptable temperatures. This will cause both heating and cooling to be higher than if the goal was to obey the Chinese standards.

Verification of energy

As the living units, apart from the orientation north/south, are identical, only energy consumption in one unit is examined.
An introductory calculation shows that the living unit type with the highest demands for heating and cooling is the one with the common living room/kitchen facing north, and is for that reason chosen to be explored further.

The consumption and indoor climate for one specific apartment living room and the common dining room (marked red)is calculated in the program Bsim.
The energy performance from Bsim is used for comparison and validation of the results from Ecotect where calculations are made on the same two rooms.
Finally the energy consumption for the entire living unit is calculated in Ecotect.

The walkway (marked green) is not subject of heating and cooling and is for that reason not included in the calculations.



ill. 110

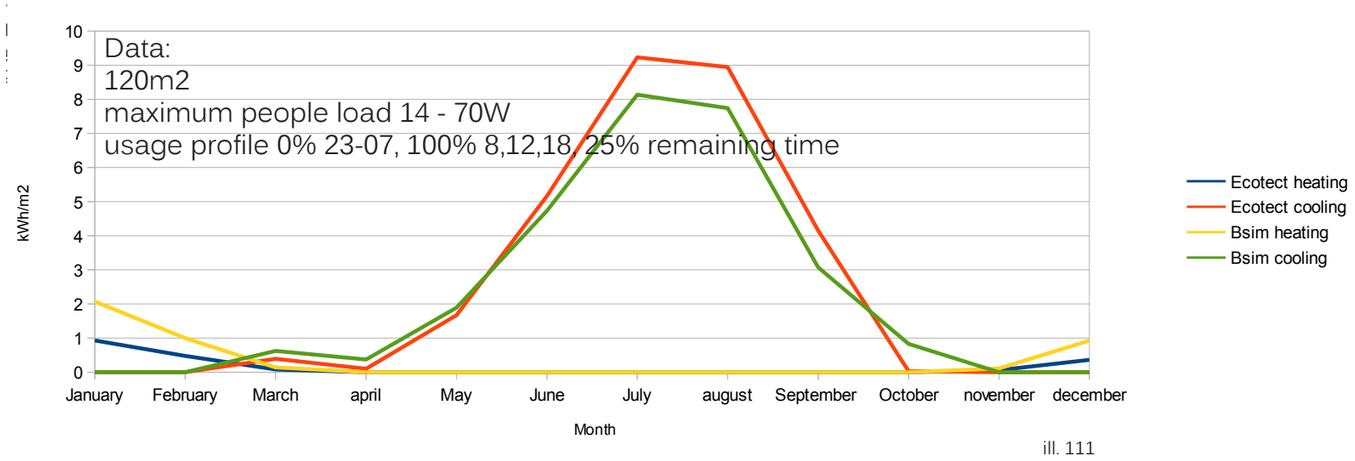
Comparison between energy consumptions calculated in Bsim and Ecotect

Common dining room

Danish standard 20-26 °C

BSim
Heating 4.2 KWh/m2
Cooling 27.4 KWh/m2

Ecotect
Heating 1.4 KWh/m2
Cooling 28.9 KWh/m2



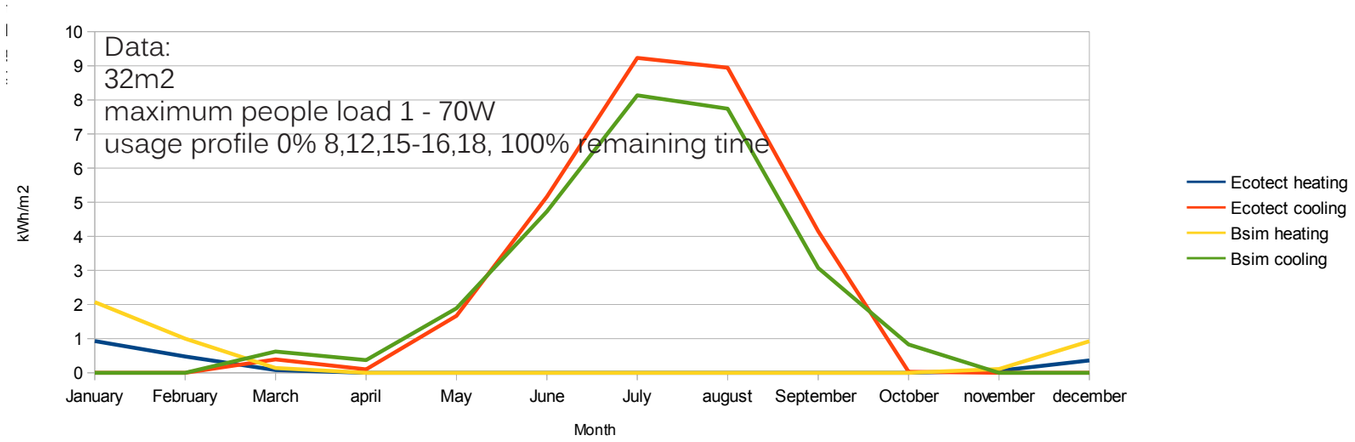
ill. 111

Living room apartment

Danish standard 20-26 °C

BSim
Heating 11.3 KWh/m2
Cooling 24.4 KWh/m2

Ecotect
Heating 8.7 KWh/m2
Cooling 26.8 KWh/m2



ill. 112

The results from Bsim and Ecotect are very similar. The calculation from Bsim indicates a slightly higher need for heating and a corresponding lower need for cooling.
The small difference can derive from the complexity of settings regarding heating, cooling and ventilation in Bsim compared to Ecotect. This can cause minor variations.
Since the results are as similar as they are, it is considered that a simulation in Ecotect is applicable for determining the energy consumption for the entire living unit.

Energy Performance

Indoor climate

To verify that the indoor climate is healthy, the air-change rate, CO2-level, and relative moisture are checked. The two rooms tested are very similar regarding indoor climate, and will be described as one.

The air-change rate and CO2-level are connected as a higher air-change will decrease the CO2-level. However, if the air-change rate is too high it will cause uncomfortable draught. An air-change rate of 1-3/h is considered optimal. In summer time the values are higher but it is anticipated that most doors will be opened and allow air to pass at a comfortable pace.
(For determination of required air-change rate, see appendix)

The CO2-level calculations are based on a outdoor CO2-level of 350ppm. This value may be higher at the actual site, but estimated on the proportion between outdoor and indoor CO2-level, an increase will not cause unacceptable conditions in the room.
The relative moisture is measured due to the risk of mould and house dust mite. The dry air in the winter month exterminates both.

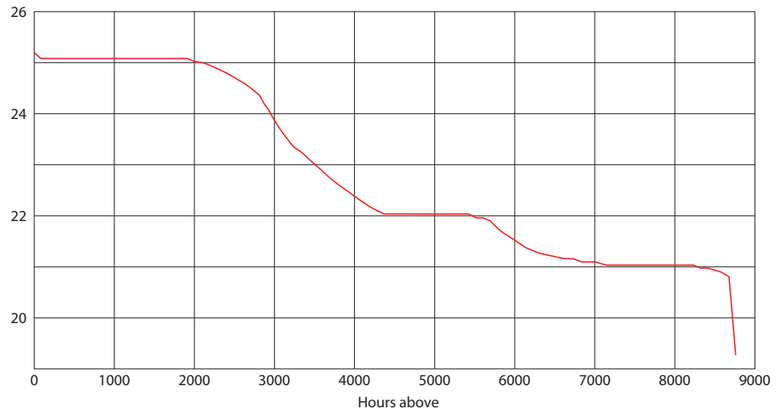
The graph shows that the temperature for very few hours is outside of the comfort range of 20-26 °C.

Living room apartment

	Min	Mean	Max	1	2	3	4	5	6	7	8	9	10	11	12
AirChange	1,19	2,38	7,99	1,63	1,57	1,69	2,3	2,8	3,36	3,7	3,53	2,92	1,91	1,54	1,54
Co2	350	426,6	511,5	448,5	450,3	445,2	427	411,1	400,5	392,8	395,4	409	437,8	451,6	452,1
RelHumid	18,36	59,62	100	35,94	36,68	47,36	55,29	63,84	75,79	85,32	86,84	72,88	60,52	50,7	42,55

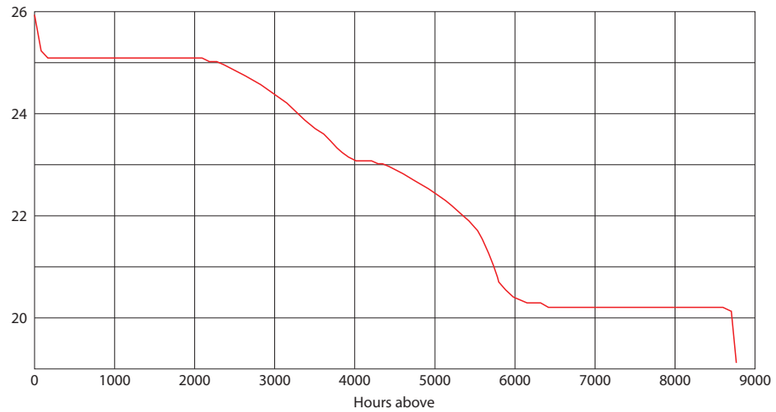
ill. 113

Living room apartment



ill. 114

Common dining room



ill. 115

Common dining room

	Min	Mean	Max	1	2	3	4	5	6	7	8	9	10	11	12
AirChange	1,38	2,56	9,88	1,73	1,65	1,7	3,03	3,61	4,1	3,33	3,21	3,56	1,61	1,6	1,6
Co2	350	497,9	1010,8	536,2	544,7	539	458,6	438,4	435,6	462,1	461,7	449,7	545,3	551,9	553,3
RelHumid	17,9	57,2	100	35,81	35,94	44,15	52,51	60,73	73,34	81,96	83,43	70,57	56,69	48,12	41,57

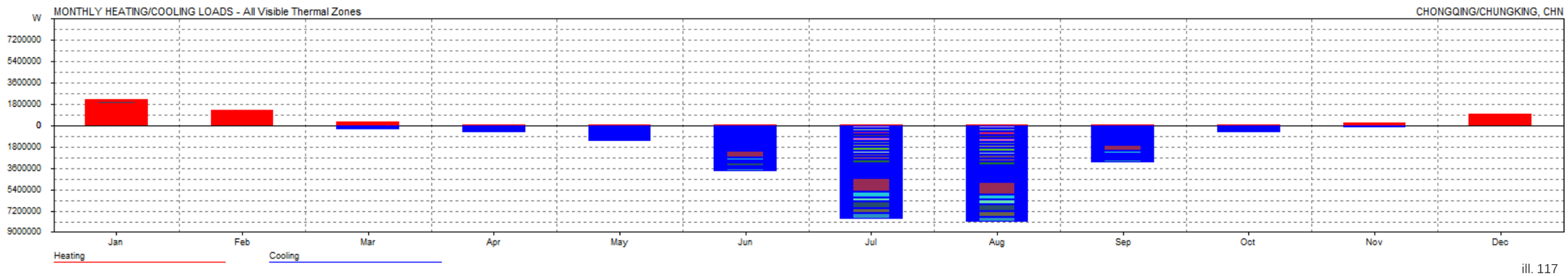
ill. 116

Total energy performance

Requirements	Consumption calculated in Ecotect
Heating 15.6kWh/m^2	Danish standard 20 - 26 °C
Cooling 28.6kWh/m^2	Heating 5.2 kWh/m^2
	Cooling 28.5 kWh/m^2

The total energy consumption for heating and cooling both comply with the requirements. The heating consumption totals a third of what is allowed, while the cooling consumption passes by a small margin.

The reason for the high need of cooling is mainly caused by the great amount of window area in the facade. It is however a wish to secure optimal daylight and for that reason it is accepted to have a relatively high energy consumption from cooling.



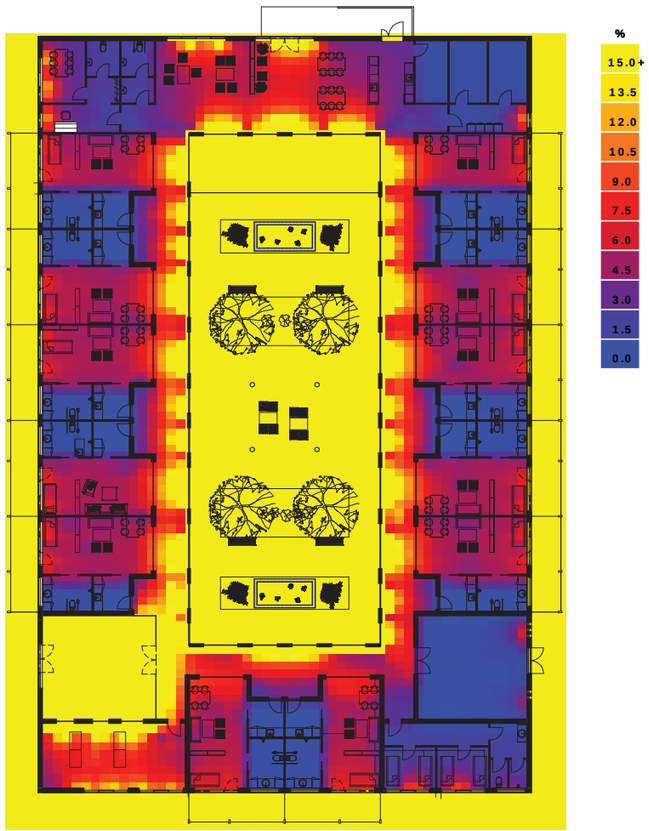
ill. 117

The graph shows the amount of energy used for heating and cooling during each month.

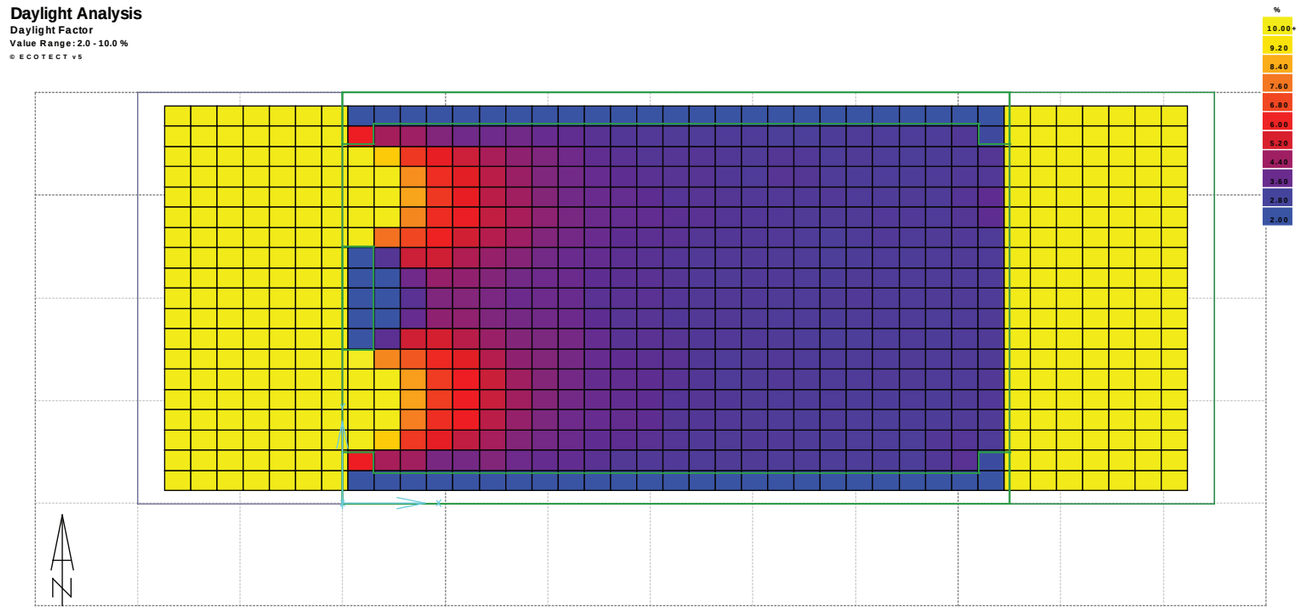
Energy Performance

Daylight

Sufficient daylight levels is an important factor when designing a building. The minimum daylight factor is normally set to 2% [BR10]. In this case the building is intended for elderly people who are often struck by impaired vision, and therefore could benefit from even better daylight conditions.



ill. 118



ill. 119

Early in the design process, a number of daylight studies where made over different window layouts to determine the coherence between daylight and the concomitant risk for superheating.

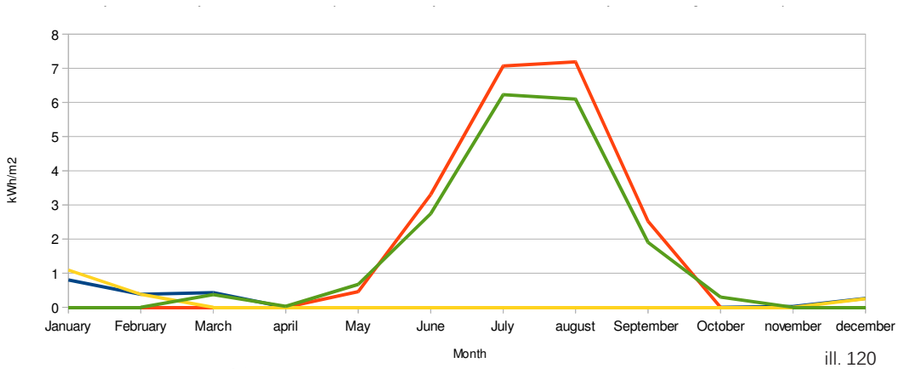
The final design is also tested. As indirect sunlight is not allowed to contribute to the daylight factor, a simulation is made where only light from the windows facing outdoor are activated(above).
The test shows a daylightfactor of over 2.8 in the far end of the room compared to the windows.

The actual daylight in the entire living unit is shown on the illustration to the left. As it appears from the simulation there are daylight factors of 4-7.5 throughout the apartment livingrooms and the common living room/kitchen. The rooms where the daylight factor is below 2% function as entrance, bathroom or storage and do not need as much daylight as the living rooms.

Energy consumption Chinese standards

A final simulation is made to see how the building will perform, if it has to just achieve the lower Chinese standards.

It appears from the results that the energy consumption is considerably lower than the requirements of 15.6 kWh/m2 for heating and 28.6 kWh/m2 for cooling.

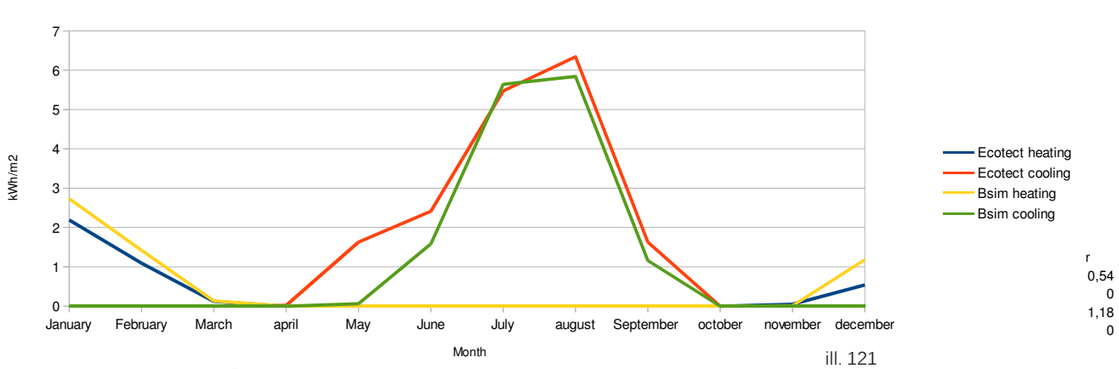


ill. 120

Living room apartment
Chinese standard 18-28C

BSim
Heating 5.4KWh/m2
Cooling 14.3 KWh/m2

Ecotect
Heating 4.0 KWh/m2
Cooling 16.0 KWh/m2

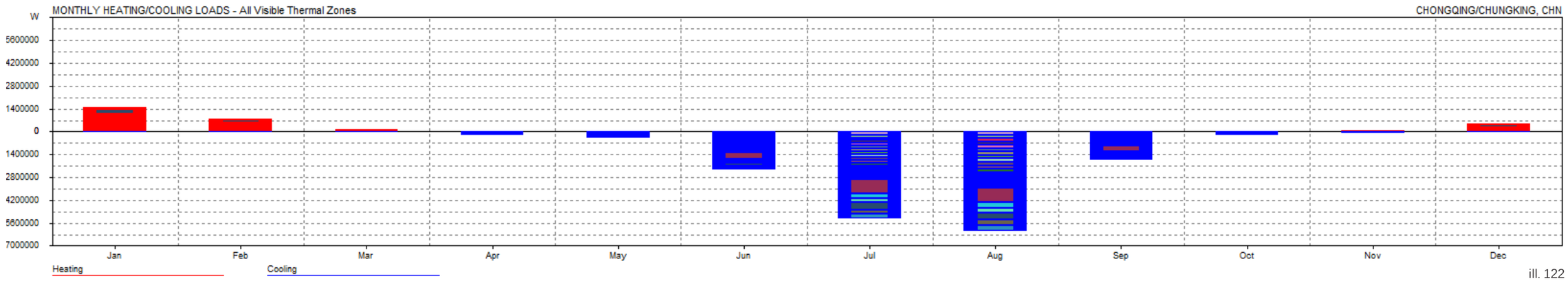


ill. 121

Common dining room
Chinese standard 18-28C

BSim
Heating 1.7 KWh/m2
Cooling 18.3 KWh/m2

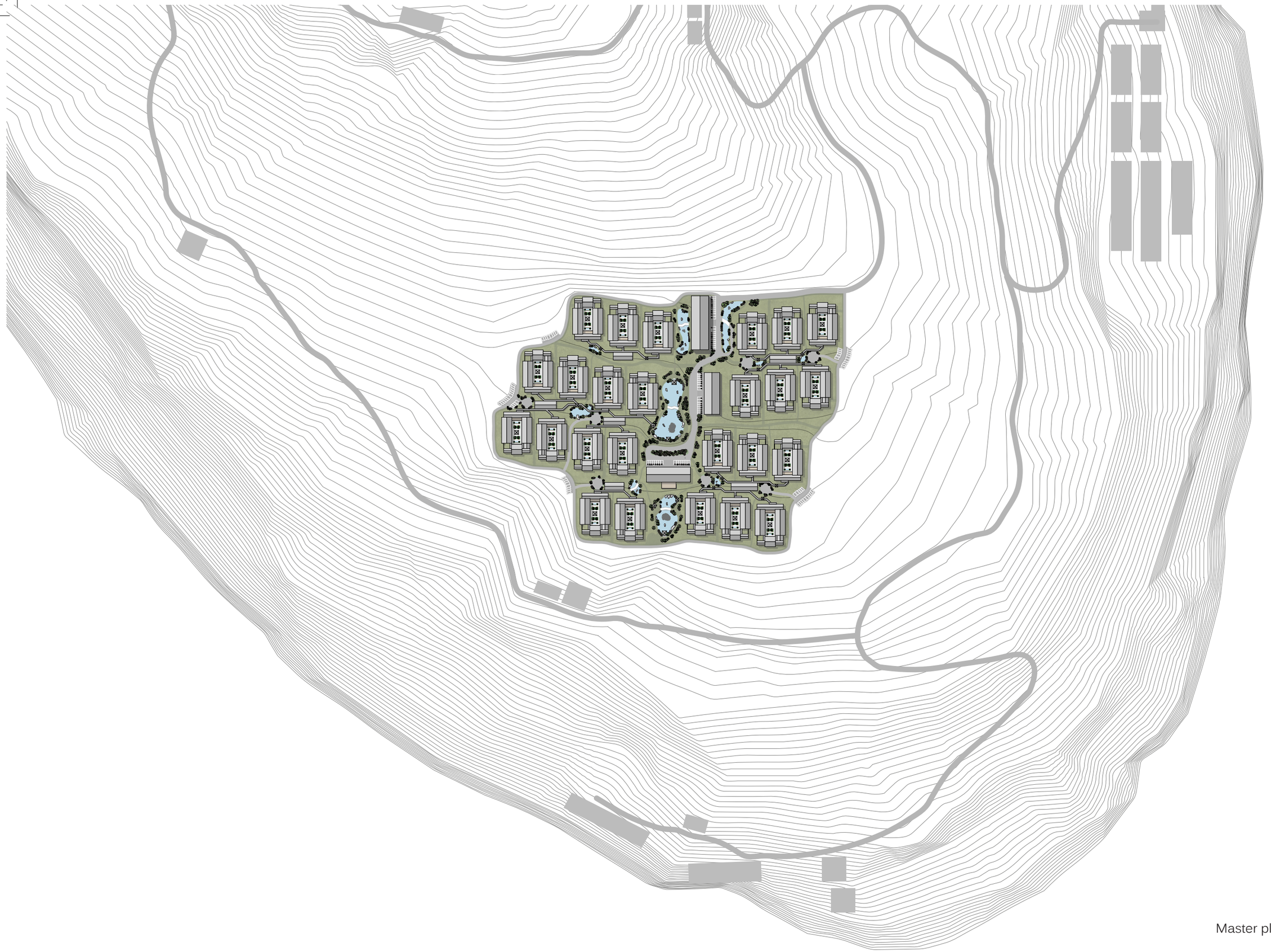
Ecotect
Heating 1.5 KWh/m2
Cooling 19.9 KWh/m2



ill. 122

Entire living unit
Consumption calculated in Ecotect
Chinese standard 18 - 28°C
Heating 3.2 kWh/m2
Cooling 17.8 kWh/m2

Presentation



Master plan 1 : 10 000

Master plan 1 : 2 500

Map of Functions -Living Unit

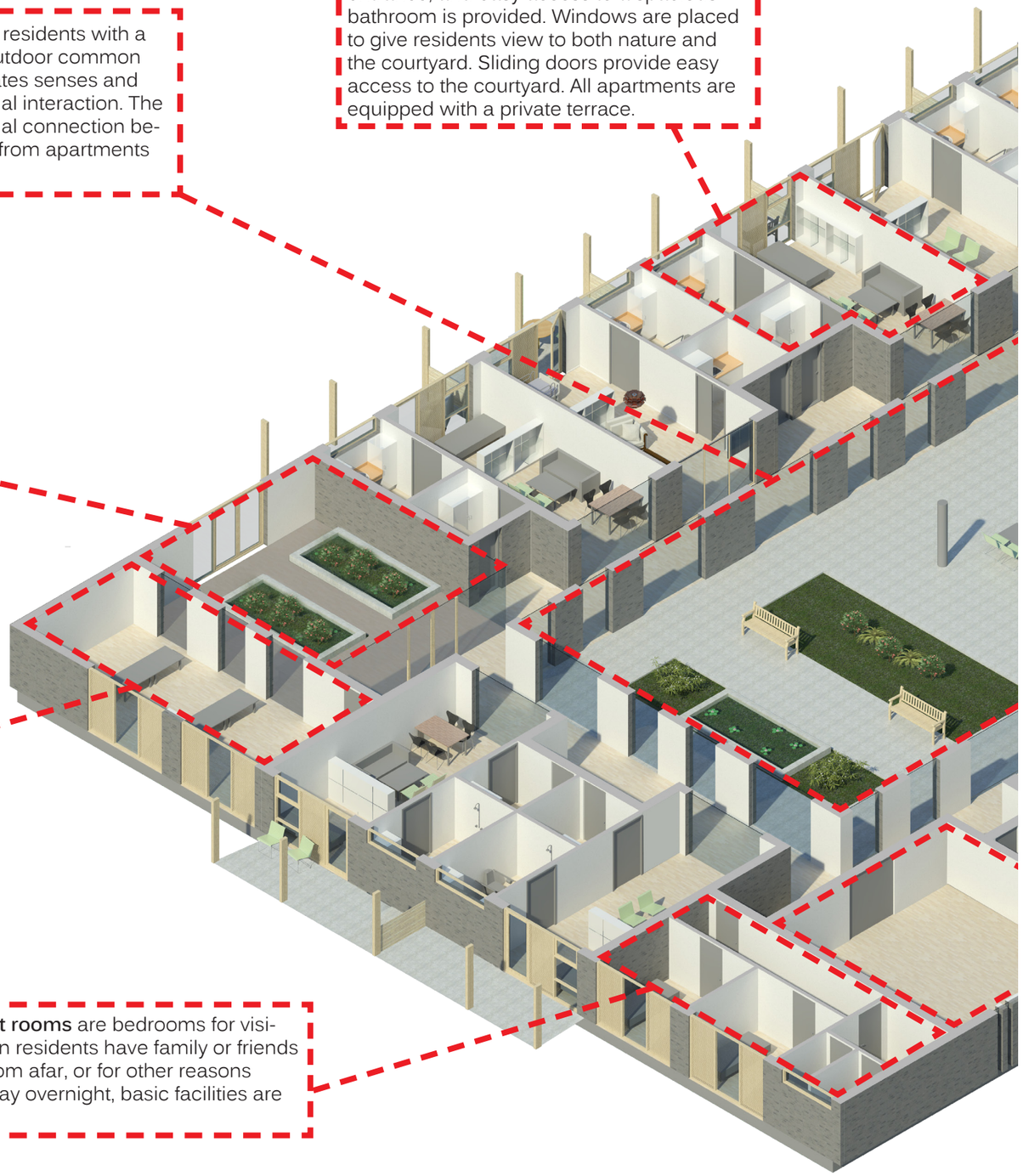
12 **apartments** of 50 m² surround the central courtyard. Apartments are flexible in the sense that residents can separate or join bedroom and living room based on preference. A small kitchen is placed by the entrance, and easy access to a spacious bathroom is provided. Windows are placed to give residents view to both nature and the courtyard. Sliding doors provide easy access to the courtyard. All apartments are equipped with a private terrace.

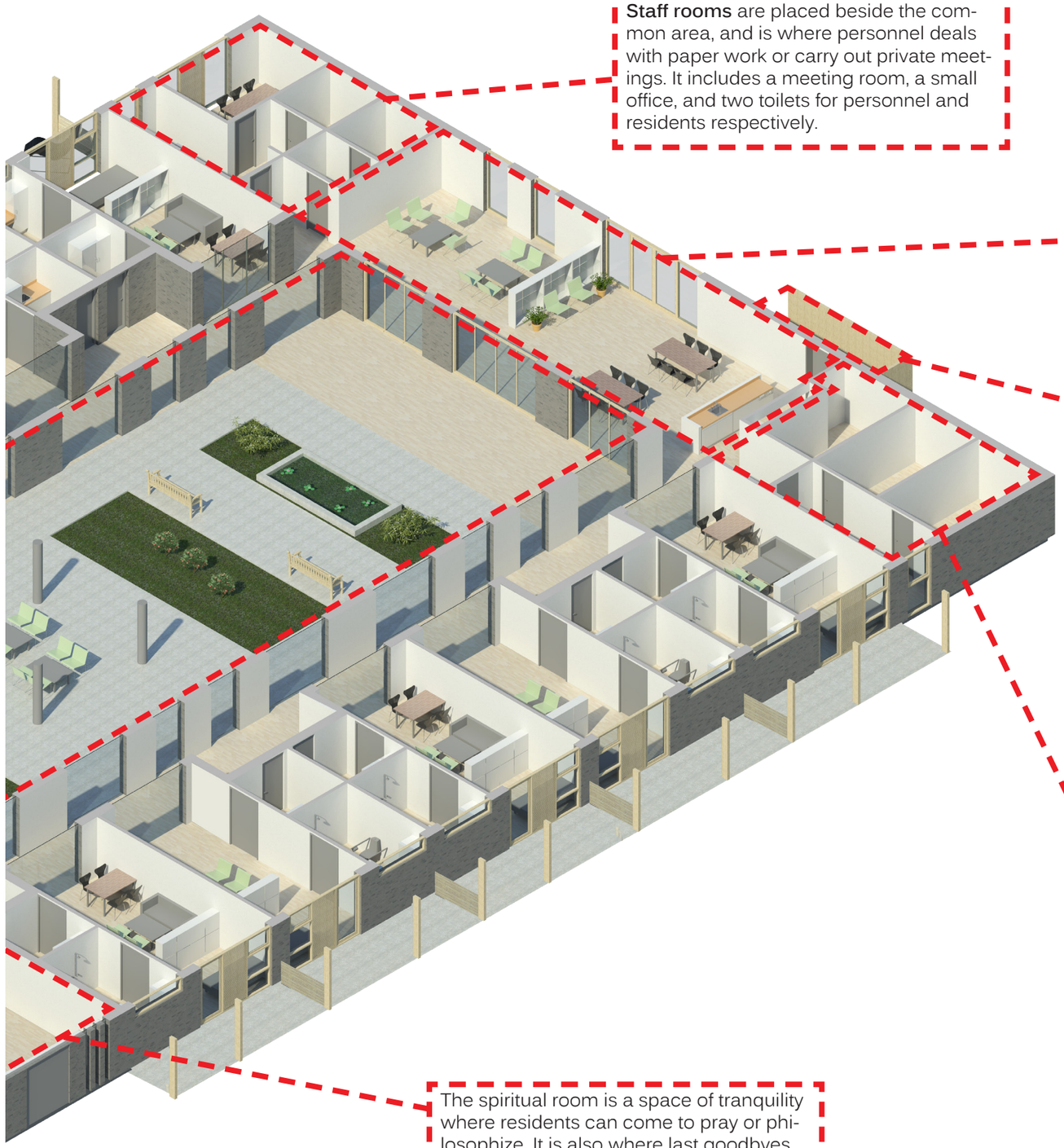
The **courtyard** provides residents with a safe and comfortable outdoor common area. Vegetation stimulates senses and activity encourages social interaction. The courtyard facilitates visual connection between apartments, and from apartments to dining area.

The **flower and vegetable garden** serves as an outdoor alternative to the large courtyard. Residents can grow and tend to their own plants.

The character of the **flexible common room** can be determined based on the condition and preferences of residents. Workshop, game room, fitness room and tv-room are some of the functions the room can serve as. It is a place where residents can come to socialize in smaller groups, as an alternative to the larger dining and common area.

The **guest rooms** are bedrooms for visitors. When residents have family or friends visiting from afar, or for other reasons wish to stay overnight, basic facilities are provided.





Staff rooms are placed beside the common area, and is where personnel deals with paper work or carry out private meetings. It includes a meeting room, a small office, and two toilets for personnel and residents respectively.

The **large common area** is where residents are served meals, and where they can relax throughout the day. The room is divided into two sections to decrease the feeling of institutionalization. The kitchen is facing the common area to provide personnel with an overview toward the residents. The entrance to the unit is located centrally in the room. Large glass doors separate the dining area from the courtyard. For most of the year, the dining area can optionally be extended into the courtyard, while for the rest of the year residents are visually connected to the outdoor area.

Garbage containers are placed in direct connection to the kitchen. The containers are bounded by light wooden walls. To be able to dispose of waste close to the kitchen aids the personnel, and removes any stench brought on by trash.

The **service rooms** are placed in direct connection with the dining and common area to appease the work flow of the personnel. Service rooms include wash room, storage room and technical room.

The spiritual room is a space of tranquility where residents can come to pray or philosophize. It is also where last goodbyes are taken with deceased residents before leaving the facility.

Apartment seen from walkway. This resident has chosen to separate bedroom from living room with a piece of furniture.

View toward walkway from common area. Niches provide a semi-private space for residents and diminish the monotonous character of the walkway.

Dining area with view to the courtyard. White plastered concrete walls contrast the wooden floor and the wooden rafters in the ceiling. Walls can preferably be painted in more distinctive colors in dementia units.

Private terraces in two adjacent living units, and the pathway between them. The overhang protects residents from the wather, and provides shade for the windows. Sliding wooden screens in front of the windows contribute further to ensure comfortable conditions in the apartment. They also allow residents to control their own privacy.

Courtyard seen from the terrace in front of the dining area. Traditional Chinese tiles allow residents to move freely. Green sections and small basins stimulate senses.

Section A_A

Section B_B

Section B_B

Living unit plan 1 : 200

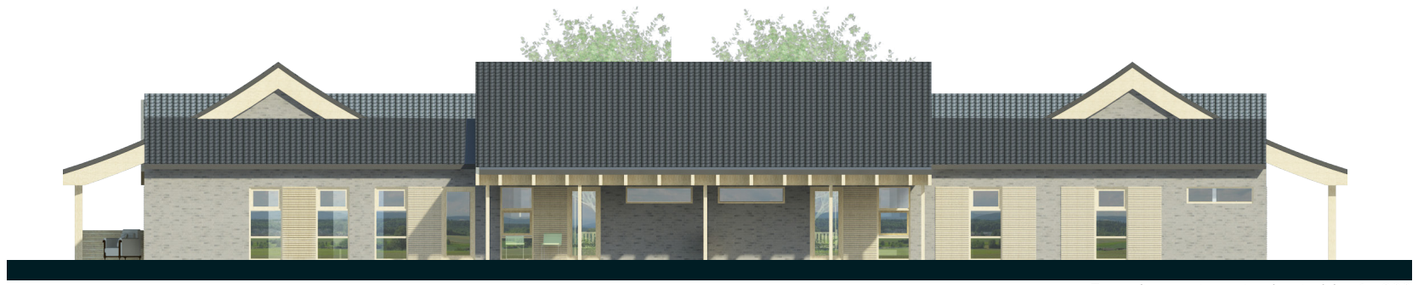
Section A_A

Section A_A 1 : 200

Section B_B 1 : 200

Facade common building from entrance 1 : 200

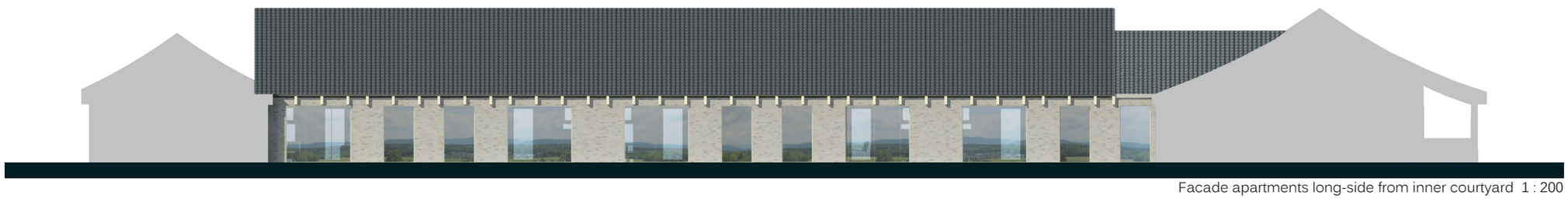
Facade apartments long-side 1 : 200



Facade apartments short-side 1 : 200

Facade apartments long-side 1 : 200

Facade apartments short-side from inner courtyard 1 : 200



Facade apartments long-side from inner courtyard 1 : 200

Facade common building from inner courtyard 1 : 200

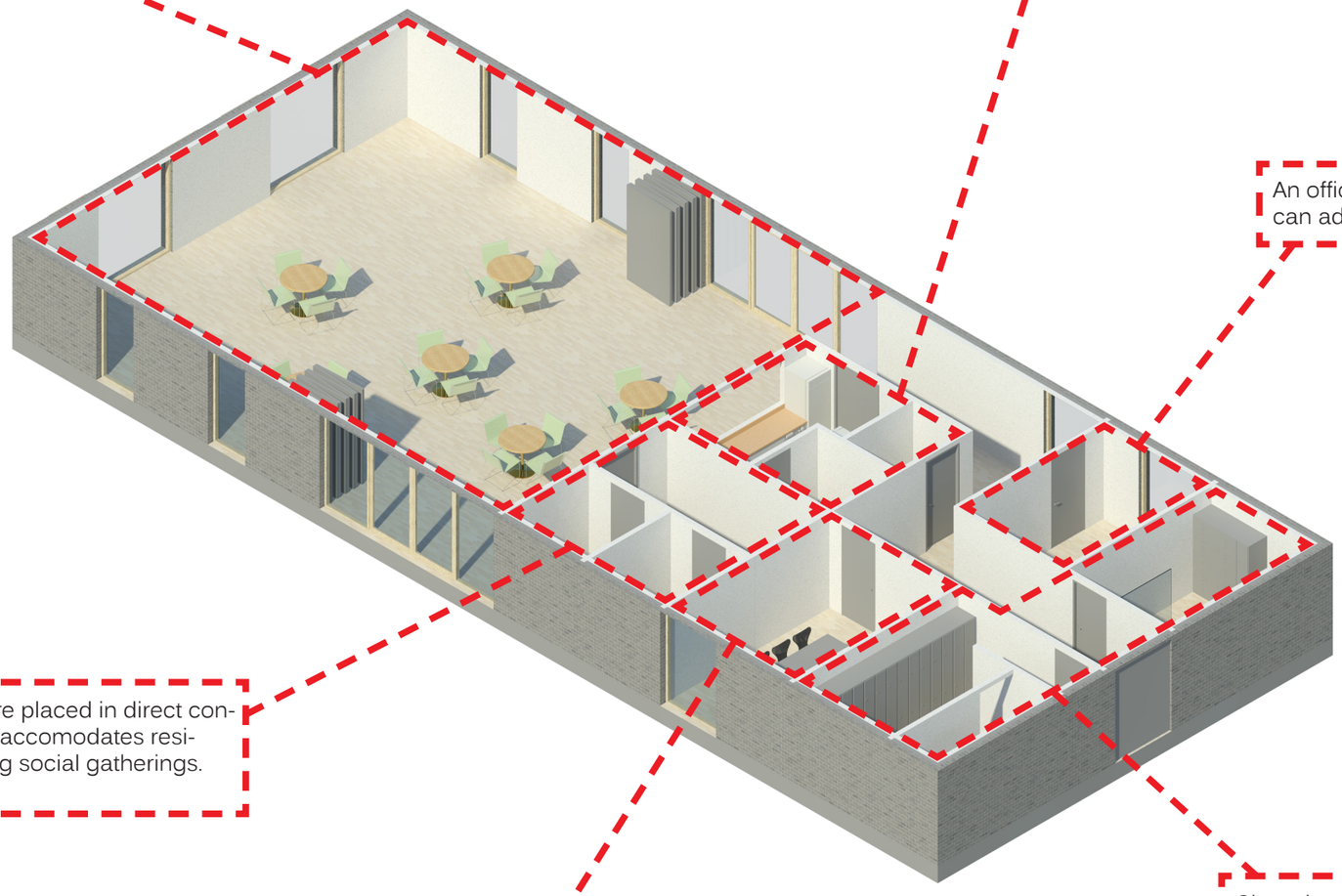
Facade apartments long-side from inner courtyard 1 : 200

Map of Functions -Common Building

The hall is available to residents as an alternative space for socializing. The room is also where larger gatherings are held, such as birthdays, small performances, bingo etc. The room is flexible in the sense that it can be divided into smaller sections. Entrance to the building happens from both sides of the hall.

The hall is provided with a kitchen with accompanying storage space. A toilet is placed behind the kitchen (entrance through hallway) for personnel.

An office is provided, where a manager can administer a group of living units.

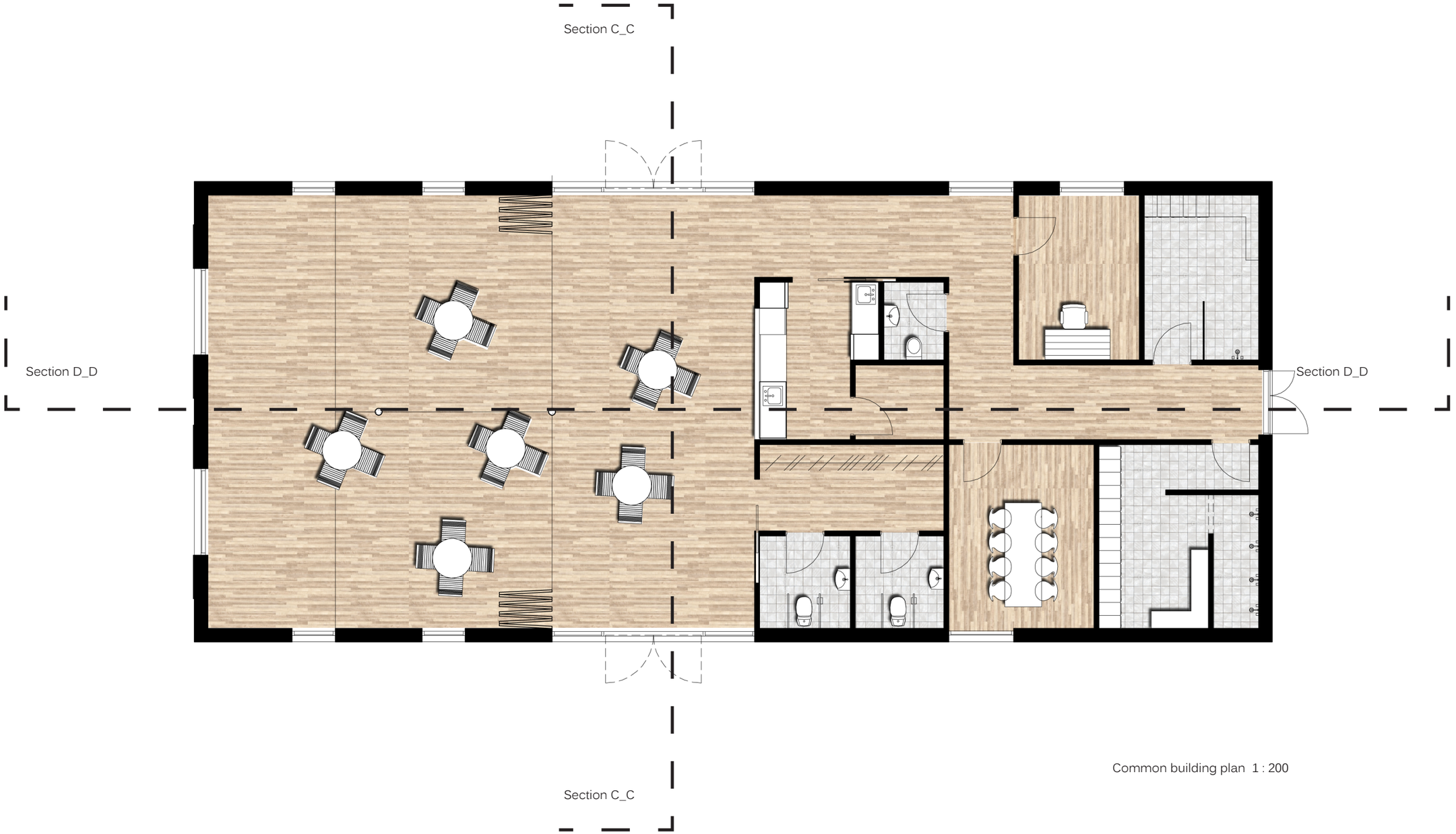


Wardrobe and toilets are placed in direct connection to the hall, and accomodates residents and visitors during social gatherings.

A meeting room is placed in the common building to accomodate personnel, as the meeting room placed in the living unit might prove insufficient.

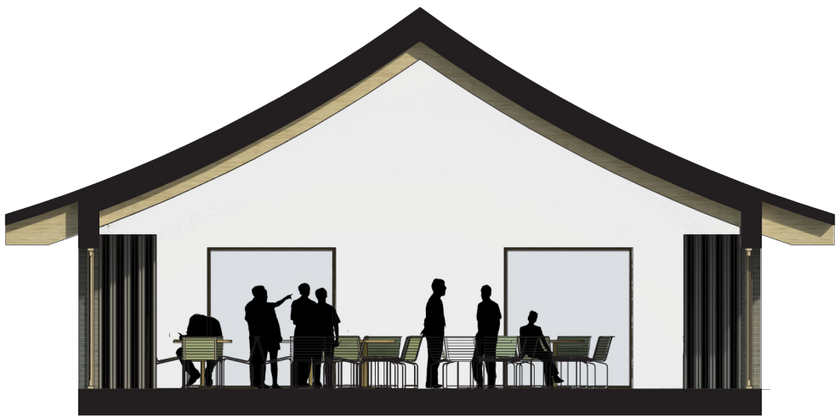
Changing rooms for personnel are placed in the common building, from where they have short walks to the the living units.

The hall in the common building is used for large gatherings. The room can be divided into sections depending on the occasion. The materials used are the same as in the living units.

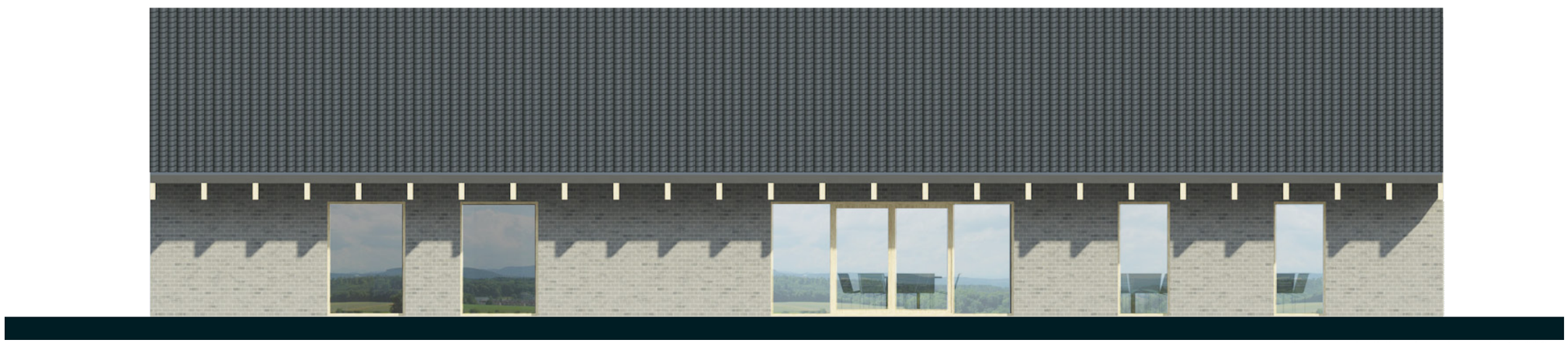


Common building plan 1 : 200

Section D_D 1 : 200

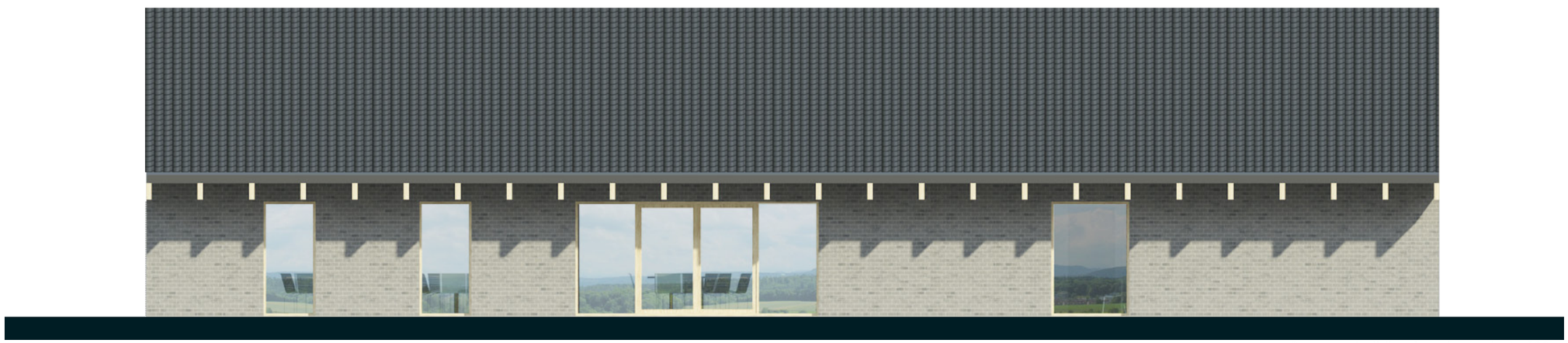


Section C_C 1 : 200

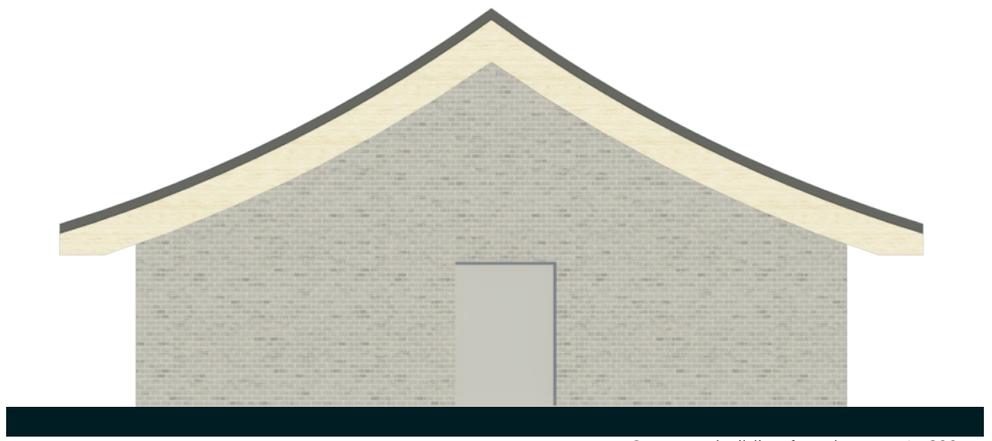


Common building facade north 1 : 200

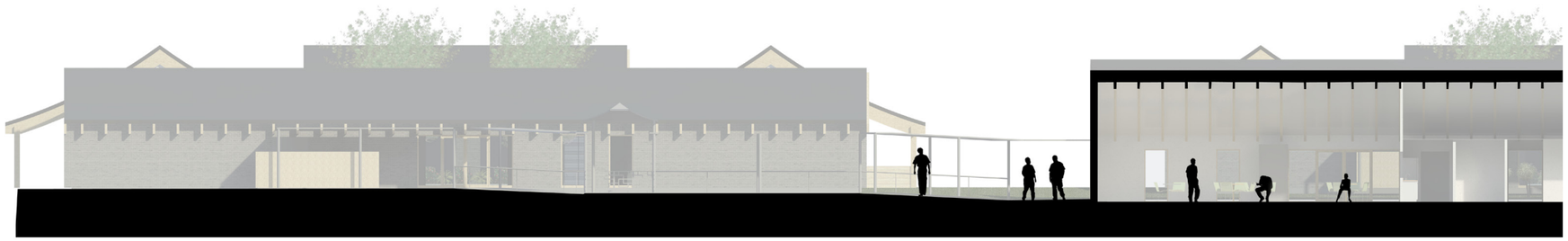
Common building facade east 1 : 200

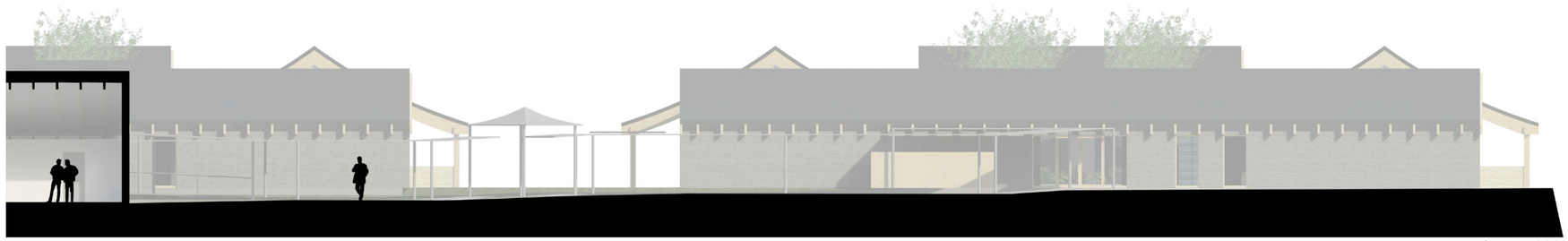


Common building facade south 1 : 200



Common building facade west 1 : 200





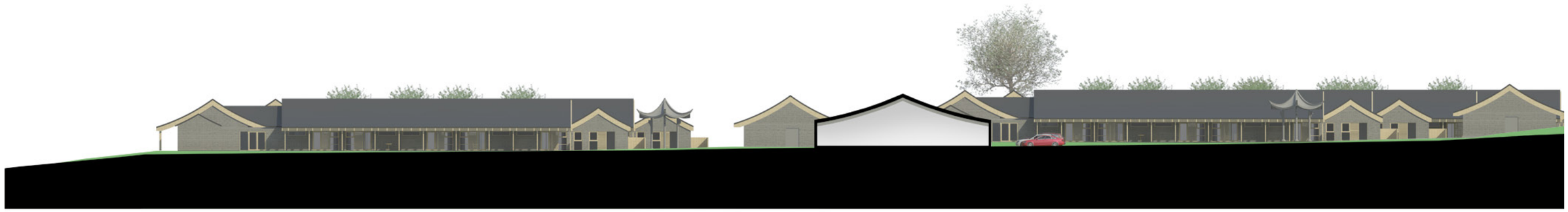
East - west section 1 : 200

North - south section 1 : 200

Central pond with neighbouring living unit. The pathway circling the pond and the crossing bridge provide residents with attractive outdoor areas for exercise and contemplation. The scale of the living unit complements the garden similar to the way architectural structures did it in traditional Chinese gardens. The living unit roofs are cladded with dark roof tiles.

The view that welcomes visitors to the site. The only two-storey building on the site is placed farthest to the north, houses administration and medical facilities, and serves as a landmark on the site.

View from walkway in front of living unit entrance toward the space between buildings. Pavilions serve as breaks in the flow between units and common areas. The pond, stones and plants provide the area with qualities from the Chinese garden, allowing weaker residents to experience the garden close to their apartment. The tiled turnarounds can be used for group exercise.



North-south section site 1 : 2000

Reflection

When we decided to take this project on, we saw it as a great challenge within an interesting and relevant field. The demand for improved and expanded eldercare in China is imminent. D'Care has presented an ambitious project description, that includes a broad range of requirements. The requirements were vaguely described, and therefore difficult to interpret. A physical site for the project was near impossible to obtain. D'Care's role in the project is to facilitate contact between Danish entrepeneurs and architects, and Chinese investors. A site is not chosen before a deal is made, so even after numerous enquiries to the Danish consulate, all we were provided with, was a few photos and an estimated location. This left us having to create a site based on very sparse information. Not having a definite site to work with, hampered our opportunity to take concrete inspiration in the context, and did not provide boundaries we had to respect in the design process. To have physical limitations to what is possible, or feasible, can be a welcome obstruction in project development, as design parameters are easier to lay down.

The D'Care project description states that a "luxurious facility" is desired. We have a good understanding of what luxury means in Western culture, but it must be assumed that it means something entirely different to Chinese people. Literature on the subject has been hard to come by, and we have again been left guessing what it entails.

In addition to apartments and common areas for elderly, the project description states a desire to include 7000 m^2 of "world-class facilities" in the fields of physiotherapy, rehabilitation, psychotherapy, acupuncture, Chinese healing and even a vocational college offering diplomas. In extension of this, D'Care's wish is to make the same apartments available not only to elderly, but also to temporary residents using the facilities for rehabilitation. Professional athletes are even mentioned. In our opinion, designing homes for elderly, where they are to spend the last few years of their life, and designing "hotel rooms" for professional athletes , are two tasks that are fundamentally different. When we decided to focus on the well-being and the feeling of home among the elderly, it excluded the inclusion of temporary residents. Before reading the project description, we were under the impression that the project was about eldercare, and we chose therefore to focus our energy on that part of D'Care, even if it is not 100% compliant with the vision of the project.

Conclusion

Substantial research has revealed a number of suggestions to how well-being is optimized in an assisted living facility. The guidelines have served as design parameters in the project, and provided a way to verify, to a certain extent, whether the final product contains the qualities required to be considered a home by its residents.

The D'Care project description utters a desire to brand Danish architecture. This is achieved through respecting the cultural and physical context, as well as focusing on functionality, which is regarded core qualities in Danish and Nordic architecture. Interpreting traditional Chinese family living is a subtle, yet powerful way of respecting the context. Coincidentally, the qualities of the traditional siheyuan complies with recommended solutions to optimize well-being. The courtyard structure facilitates social interaction, provides sense-stimulation and allows residents to move freely in a safe and sheltered outdoor area. This is especially favorable for residents with weak cognitive skills.

The private apartments are flexible, and provide residents with the freedom of choice when it comes to privacy. Bedroom and living room can be separated or joined, based on individual preference. Views are provided to both the courtyard and nature or neighbouring living units. If one wants privacy, the apartment has good daylight conditions, or one could step out onto the private terrace for fresh air. The niche serves as a semi-public choice where residents can take part in the activity of the living unit while being close to their apartments. During most of the year, the weather allows the walkway to be opened, which turns the walkways into patios where residents can observe courtyard activity, or simply the plants and basins. If one wishes to use the courtyard, it is directly accessible from all apartments. The courtyard has several small seating groups for relaxation and socializing. All living units are equipped with a flower and vegetable garden, that can be soothing and rewarding for some residents. The spiritual room is available for prayer or contemplation, and give all residents the opportunity to pay their respects when a resident passes away. The flexible common room allows residents to socialize in smaller groups over activities such as games, watching TV, exercising or workshopping. If family is visiting they have the opportunity to spend the night in one of the two guest rooms. The dining and common area is easily accessible, and visually connected to the apartments.

Residents can leave the living unit to exercise or seek meeting points where they can socialize with residents of other living units. Living units are organized in different sized groups that share a common building. Living units are connected to the common building by roofed walkways. Pavilions along these walkways include benches and are placed in strategic spots with attractive views. The common building serves two purposes; a sizable hall that hosts large gatherings, and additional facilities for personnel. From the common buildings pathways lead to the center facility area. Here residents can find pathways in attractive surroundings. Ponds surrounded by plants, pavilions and limestone are elements taken from traditional Chinese gardens and encourages philosophical pondering, something the Chinese traditionally appreciate. Center facilities include medical facilities such as physiotherapy, psychotherapy and rehabilitation which is useful for residents with a deteriorating health. Also found in this area is restaurant, supermarket, movie theater, swimming pool, hot springs, sauna, hair dresser etc.

When a person move to an assisted living facility, it is the result of coming to terms with ones increasing physical and/or cognitive limitations. Through the qualities provided in the facility, residents are able to engage in many of the same activities that they did in their previous home, although in more structured and fixed surroundings. By minimizing elements that seem institutionalizing, the foundation for generating the feeling of home in the residents is laid.

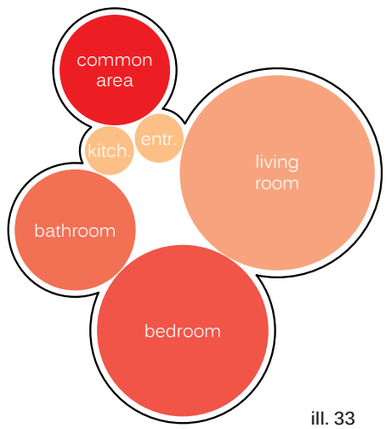
Good indoor climate and lighting conditions play a big part for the well-being of residents. Due to declining vision, daylight values are purposely high in the facility. By using Danish comfort standards regarding temperatures and air change rates, a comfortable indoor climate is provided. China has a long way to go when it comes to sustainability in architecture. By developing a project that fulfills Chinese requirements, but using Danish comfort standards, it is shown that sustainability can be emphasized in a Chinese project without weakening the architectural quality.

Appendix

Appendix A - User groups

To design customized apartments for individual user groups does not serve any purpose in this project, as the elderly are supposed to buy an apartment where they will live for the duration of their stay. However, their condition will most likely change, which would move them to a different user group that needs different qualities. Gaining an understanding of the different user groups that elderly are organized in, is still knowledge that can provide useful in the design process.

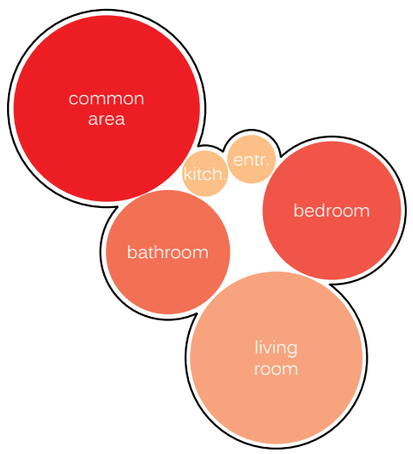
1



ill. 33

The private apartment consists of private entrance, sizeable living room, bedroom, bathroom and kitchenette.

2



The private apartment consists of entrance, living room, bedroom, bathroom and possibly a kitchenette.

Living arrangement 1: Private, supporting

This user is a person who is in relatively good health, requires limited care, and have his or hers social needs attended to by family and friends. They take little or no part in the social life in common areas. When it comes to the staff, what this user needs is to feel safe by having the opportunity to call them at any time. Home for this user consists of the visible, sensuous individual home. It is to host social activity with family and friends and contain personal belongings.

Living arrangement 2: Collective, supporting

This user seeks social relationships with other users in the facility. To a large extent, the other users and the personnel attend to social needs. As for the previous group, this user requires little care aside from the safety aspect. The personnel does however have a responsibility to encourage and solicit social activity between users. Home consists of not only the private apartment, but also common area, kitchen etc. The user is capable of developing his or her own tactic for obtaining feeling of home.

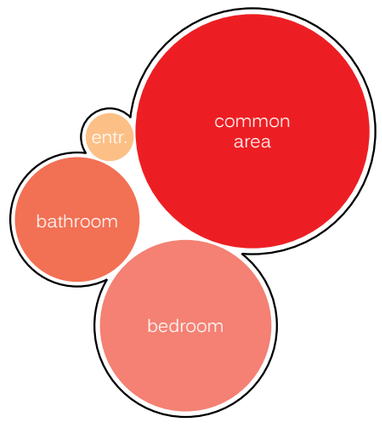
Living arrangement 3: Social, caring

This user needs extensive care because of serious physical deterioration or dementia. They are still distinctly oriented towards the social community and to form social relationships. In this group it is important to make the distinction between users with good cognitive abilities and users with dementia, as conflicts and discontent can easily occur. This user is incapable of carrying out simple tasks, and needs care that compensates. The visual expression is characterized by aiding tools. Social support is extensive as users with dementia tend towards erratic social behavior. Home consists of the private apartment as well as common areas and garden. The user is incapable of developing tactics for obtaining feeling of home, and needs support in that regard.

Living arrangement 4: Private, relieving

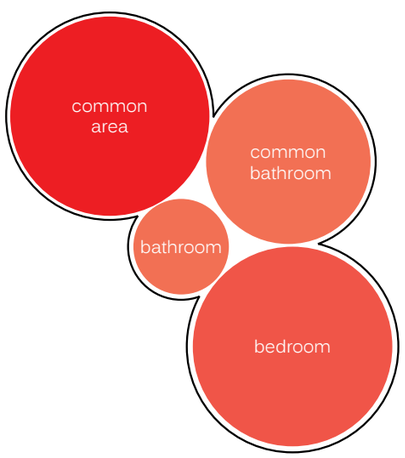
This user has extensive health problems and is incapable and/or does not wish for any social contact apart from close family and staff. Care for this group changes from treatment to relief. Support to come to peace with death becomes an important part of the job. Home consists of the private apartment with plenty of space for aiding tools and personnel, some times more than one at the same time. The apartment requires space for personal belongings and for family members to stay. Common areas are unnecessary, however family rooms can be an option.

3



The private apartment consists of entrance, bedroom and bathroom.

4



The private apartment consists of bedroom and bathroom.

Appendix B - Construction

Building envelope requirements
U-value W/m2.K

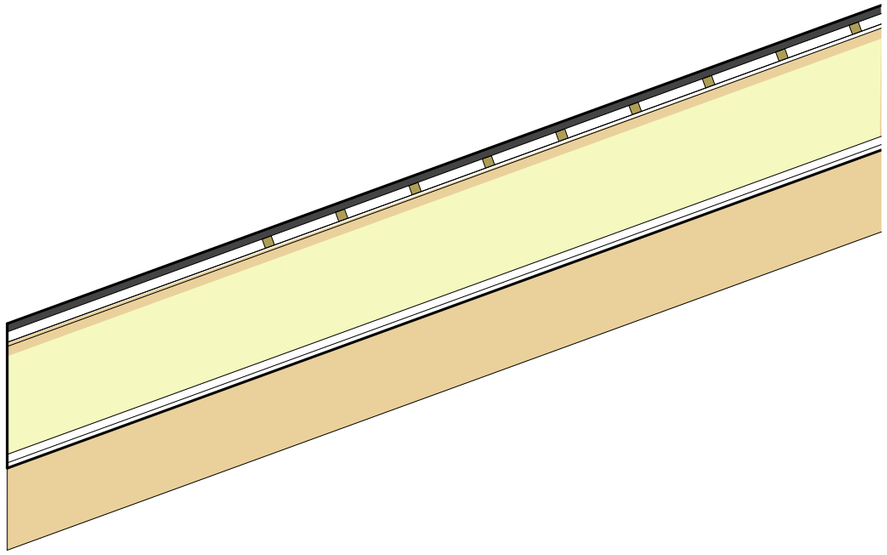
China

Roof	0,6
External wall	0,8
Overhang floor	1,2
Internal wall	2

Denmark

Roof	0,2
External wall	0,3
Ground deck	0,2

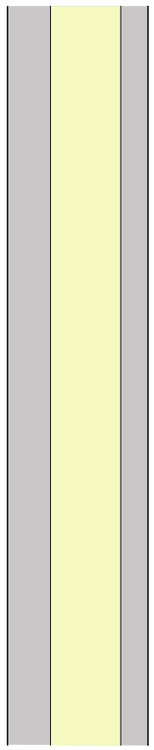
[web #15]



Roof
20mm Rooftiles
25mm Spacer
10mm Air
260mm Insulation
20mm Wood
13mm Ceiling

348mm

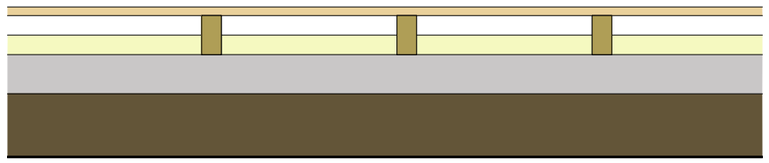
0.15 W/m2.K



External walls
110mm Brick
180mm Insulation
70mm Concrete

360mm

0.22 W/m2.K



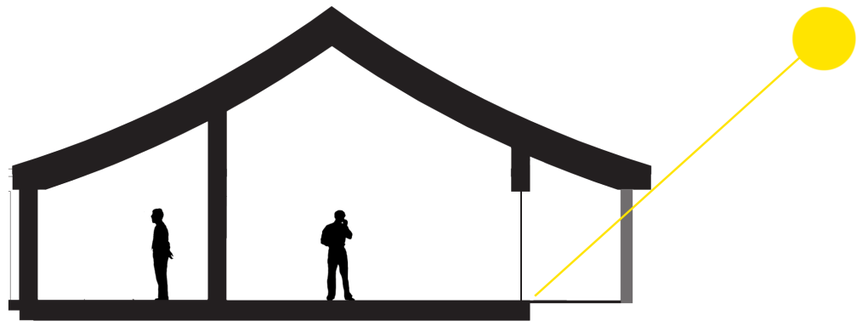
Ground deck
22mm Flooring
50mm Air
50mm Insulation
100mm Concrete
Capillary break layer

422mm

0.12 W/m2.K

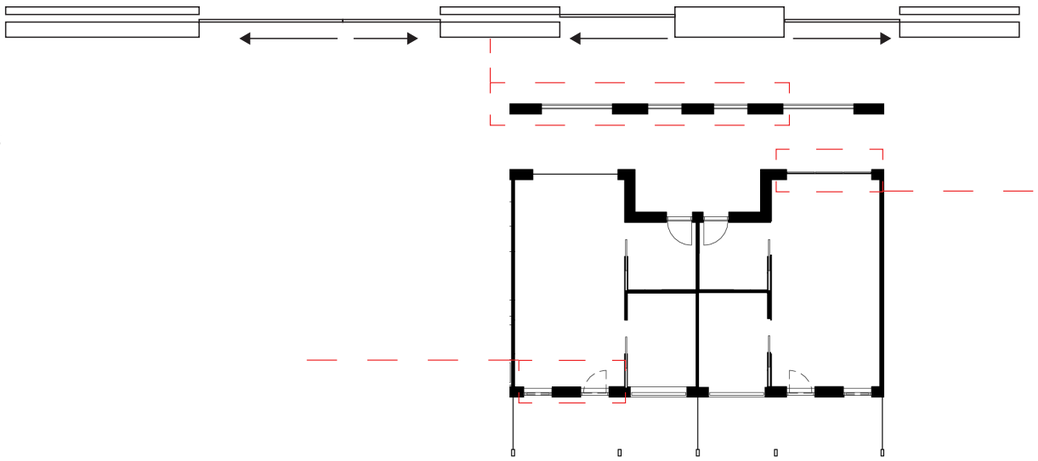
Appendix C - Windows & Shading

To avoid superheating it is necessary to take advantage of shading in different kinds. Windows facing outwards can all be covered by semitransparent screens which runs in a track in front of each window section.
The private terraces are all overhung by the roof, which also provides shading.

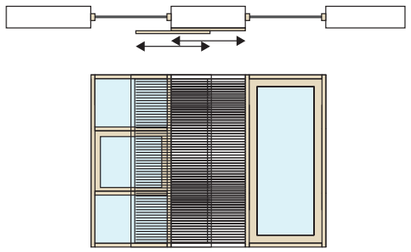


The overhang prevent the sunlight to reach into the apartment, when the sun is high on the sky

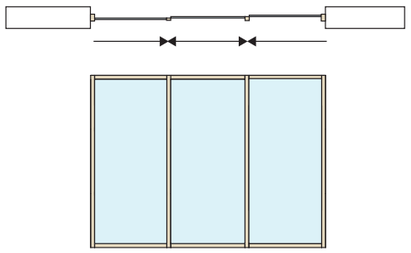
The sliding doors move into the wall and disappears when opened.



The two screens can be slided to both sides



All three sliding doors move freely in the track



Variation in the facade caused by the shading slided into different positions.

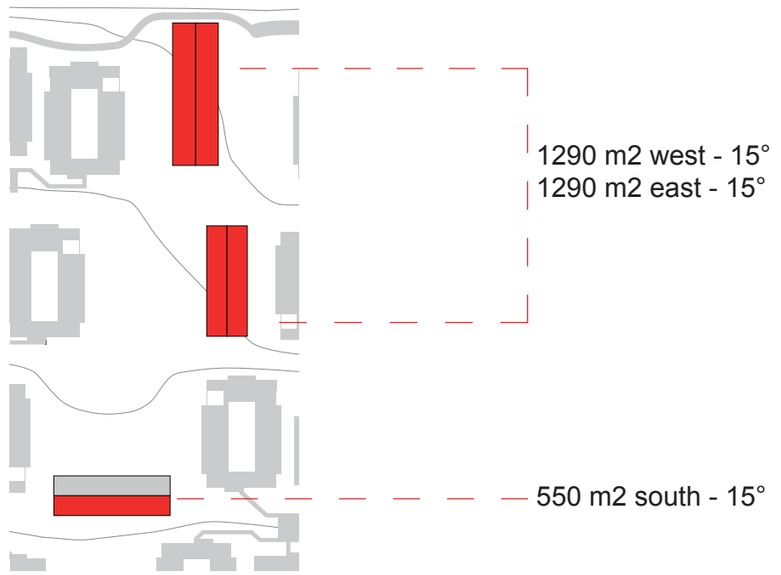
Appendix D - Solar Cells

Even though the energy performance goal for the project is achieved, it is still possible to make enhancements. One way to do this is by installing systems that can convert renewable energy such as wind or sun radiation to energy. As we learned in the climate chapter, wind is practically non-existing and for that reason it would be an inefficient solution to install windturbines at the site.
Solar radiation on the other hand is an obvious source to utilize, therefore it is explored how much of the energy need that can be covered by energy produced at the site.

The calculations are based on Danish solar radiation values which will result in a lower performance than the radiation at the actual site as these are higher due to the closer location to equator. Only the energy consumption in the living units will be included.

25 living units of 923 m2 x (5.2 kWh/m2 heating + 28.5 kWh/m2 cooling) = 777.628 kWh

It is calculated how much energy solar cells installed on the roof of the center facility buildings will produce.



Calculation on grid-connected solar power plant

A: Total area of module	2580	m2

B: Assessment of module efficiency (%) (only modules with ciliciumcells)	Standard	High efficiency
Monocrystalline, packed	12	15
Polycrystalline, packed	10	13
Amorphous / thin film	5	9

C: Installed effect =A*B/100

A	B	C	
2580	15		387 kWpeak

D: Assessment of system factor	Freestanding	Building Integrated
Optimal systems with high efficiency inverter	0,8	0,75
Average Plant with standard inverter	0,7	0,65
Less optimally system, for example. light shade	0,6	0,55

E: Solar radiation kWh/m2

		East			S/East		South		S/West			West
		-90	-75	-60	-45	-30	0	30	45	60	75	90
Horizo	0	999	999	999	999	999	999	999	999	999	999	999
	15	988	1017	1044	1067	1084	1097	1080	1062	1038	1011	981
	30	958	1012	1060	1100	1130	1152	1124	1092	1050	1001	947
	45	914	983	1045	1096	1134	1163	1128	1087	1033	971	901
	60	853	928	997	1052	1092	1124	1087	1042	983	916	839
	75	772	845	912	967	1005	1033	998	957	901	833	759
Vertica	90	671	738	795	841	873	892	867	833	785	726	662

west/east

Annual performance = C*D*E

C	D	E		
387	0,75	988	286767	kWh to grid

A: Total area of module	550	m2

Annual performance = C*D*E

C	D	E		
82,5	0,75	1097	67876,88	kWh to grid

south

Total energy produced = 354.644 kWh

354.644 kWh / 777.628 kWh = 45.6% of total energy consumption in living units

Appendix E - Air Change Rate

The required air-change rate in the common living room/ kitchen is calculated.

The goal is to determine the minimal air-change that keeps the CO2 concentration below the comfort limit.

First a calculation is made for a static situation to find the minimal airchange during maximum people load.

$c\infty = ce + G/qv \rightarrow qv = G/(c\infty - ce)$

$c\infty$ = Comfort limit
ce = Atmospheric CO2 concentration
G = Pollution load
qv = Required air-change

Common living room/kitchen

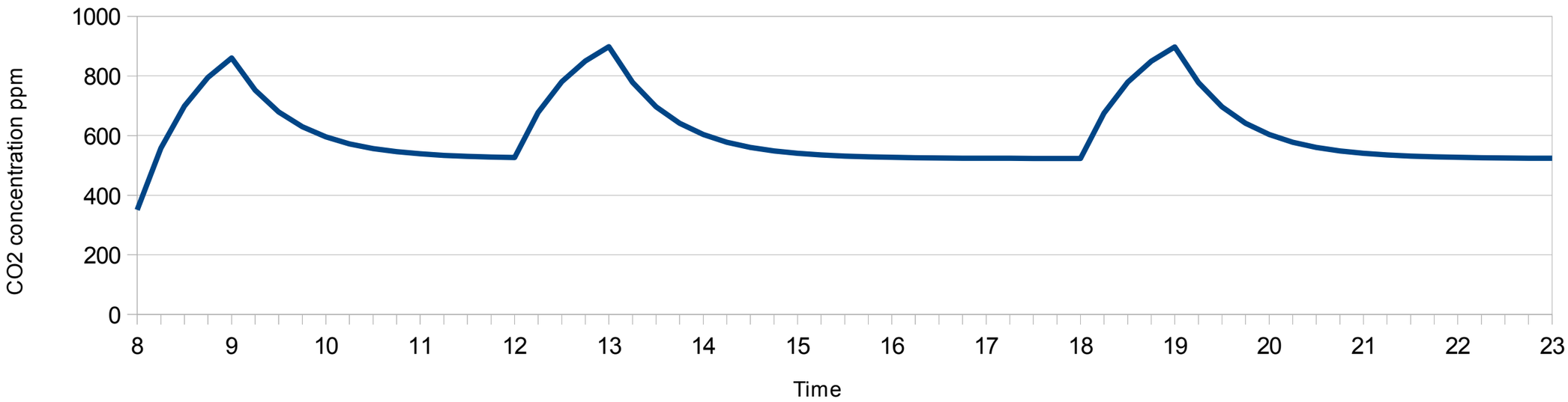
Maximum people load	15 persons
CO2 emission	0.02 m3/h / per.
Comfort limit	1000ppm
Atmospheric CO2 concentration	350ppm
Room volume	300 m3
qv = 15x0.02 m3/h /(0,001-0,00035) =	462 m3/h
Air-change rate	462 m3/h / 300 m3 = 1.54h-1

To find the actual CO2 concentration during a day where the people load peaks during mealtimes, the day is divided into intervals.

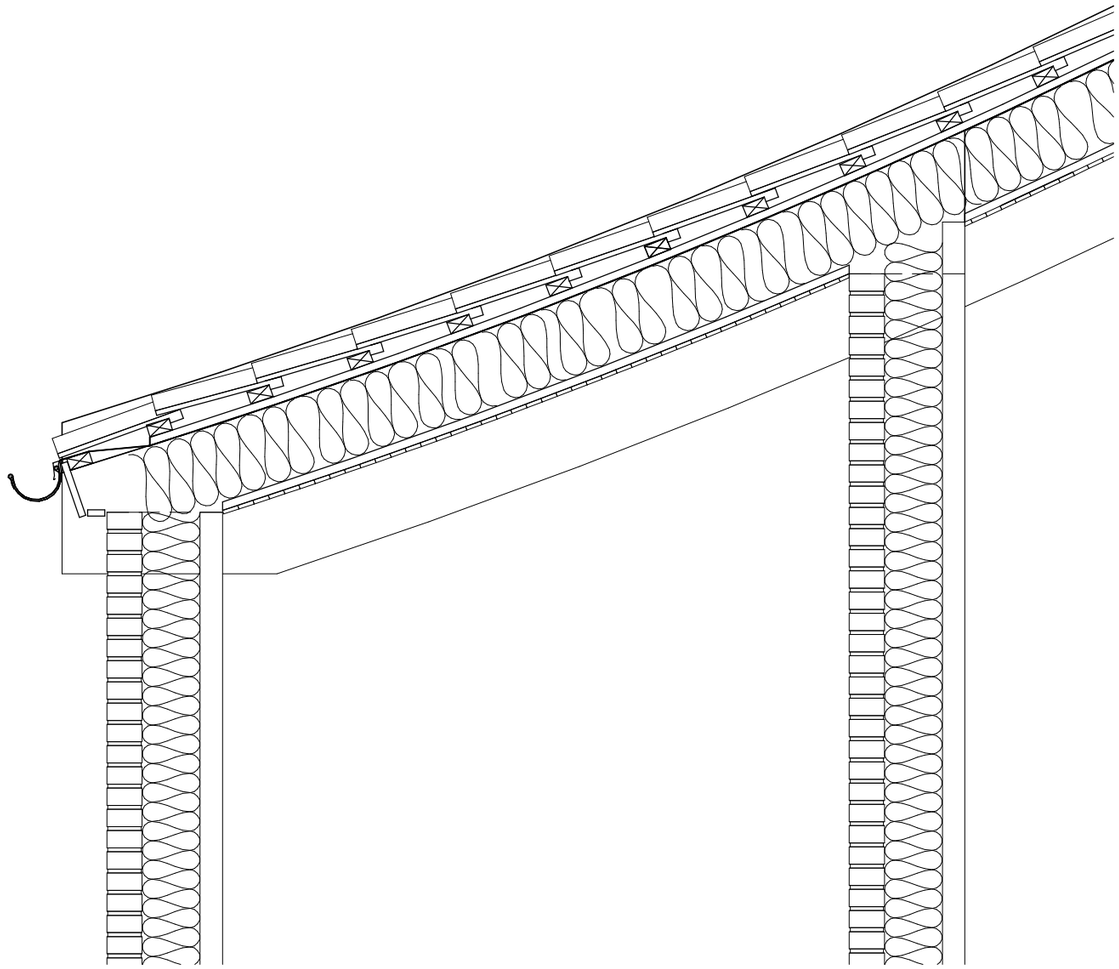
8-9 15 people
9-12 4 people
12-13 15 people
13-18 4 people
18-19 15 people
19-23 4 people

$c = ce + (c0 - ce) \times \exp(-nt) + G/qv (1 - \exp(-nt))$

c = CO2 concentration
ce = Atmospheric CO2 concentration
c0 = Start CO2 concentration in interval
n = Air change rate
t = time in hours
qv = Required air-change
G = pollution load



Appendix F - Roof detail



Roof construction walkway / apartment

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[att. #2]
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ILLUSTRATIONS

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