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BUILDING SUSTAINABLE NEIGHBOURHOOD -- A design-driven, community-based model for Gluckstein Quartier in Mannheim

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Abstract

The project concerns a sustainable residential block in the new “Gluckstein Quartier” development in Mannheim, Germany, which offers a methodology of considering sustainable issues throughout the design process, especially from the architects’ point of view. It is a walkable community consists of approximately 150 homes in a mixture of one-, two- and three- bedroom apartments, family houses and SOHOs(Small Office Home Office), providing a balanced community.
The issue that we are facing today in the building the sustainable neighborhood is dynamic, which not just includes current performance, but also future effects; and complex which

includes environmental stewardship, economic growth and social progress. In this situation, the arrangement of the block should be designed to be flexible and in order to meet changing needs and future developments in living patterns. Developing a sense of community ownership also plays an important role in building a sustainable neighborhood and should be listed in the design strategy.
The concept of “Microclimate” is established to describe the meteorological conditions for specific locations and their direct surroundings. It affects the climate inside a building and the comfortable of human well- being, and protects buildings against undesirable climate effect. The strategies of controlling and making use of the climate elements should be considered before designing a specific landscape or building.
As for a specific building or unit, sustainability exists in all the stages of design process, from the arrangement of the usage orientation to the consideration of the heated areas, from the collection of rain water to the use of solar energy, from the choosing the heating resource to the comparing the effects of shading systems, etc.
The project is meaningful for us, but there is a more important thing—the methodology we try to find out.
It is not just about present but also future.

Abstract in Italia
Il progetto riguarda un edificio residenziale sostenibile nel nuovo "Gluckstein Quartier" sviluppo a Mannheim, in Germania, che offre una metodologia di considerare questioni sostenibile in tutto il processo di progettazione, soprattutto dal punto di vista degli architetti. Si tratta di una comunità calpestabile costituito da circa 150 case in una miscela di uno, due e tre camere da letto, case famiglia e SOHO (Small Office Home Office), fornendo una comunità equilibrata.
Il problema che ci troviamo di fronte oggi nel palazzo del quartiere sostenibile è dinamico, che non comprende soltanto prestazioni attuali, ma anche gli effetti futuri, e complesso, che comprende la gestione ambientale, la crescita economica e il progresso sociale.
In questa situazione, la disposizione del blocco dovrebbe essere progettato per essere flessibile e per soddisfare nuove esigenze e dei futuri sviluppi nei modelli viventi. Lo sviluppo di un senso di appartenenza alla comunità svolge anche un ruolo importante nella costruzione di un quartiere sostenibile e dovrebbe essere elencato nella strategia di progettazione.
Il concetto di "Microclima" è stabilito per descrivere le condizioni meteorologiche per luoghi specifici e dei loro dintorni diretti. Colpisce il clima all'interno di un edificio e la confortevole di benessere umano, e protegge edifici contro effetto del clima indesiderabile. Le strategie di controllo e facendo uso degli elementi del clima devono essere considerati prima progettazione di un paesaggio o di un edificio specifico.
Come per un edificio o di un'unità specifica, sostenibilità esiste in tutte le fasi del processo di progettazione, dalla disposizione dell'orientamento utilizzo alla considerazione delle

zone riscaldate, dalla raccolta di acqua piovana per l'uso di energia solare, dalla scelta del risorsa riscaldamento al confronto gli effetti di sistemi di ombreggiatura, ecc
Il progetto è significativo per noi, ma c'è una cosa, la più importante metodologia cerchiamo di scoprirlo.
E non è solo presente ma anche futura.

BUILDING SUSTAINABLE NEIGHBOURHOOD —— A design-driven, community-based model for Gluckstein Quartier in Mannheim

INTRODUCTION...

By the time you are reading this sentence, we will, for the first time in history, have reached a milestone when more than half the world's population, 3.3 billion people, are living in urban areas. Cities offer tremendous opportunities for community, employment, excitement and interest, which attract many of us. They can also create problems of congestion, noise and pollution which repel many others, or at least those who have the choice. These problems can be addressed, in part, through design, but success depends on recognising trade-offs and getting the balance right.

We are now facing serious environment problems and an acute shortage of resources. Globally buildings account for 36 percent of total energy use and 65 percent of electricity consumption; 30 percent of greenhouse gas emissions; 30 percent of raw materials use; 30 percent of waste output (136 million tons annually); 12 percent of potable water consumption.

Designing, constructing, operating, and maintaining buildings involves large amounts of energy, water, and other resources and creates significant amounts of waste. The building process also impacts the environment and ecosystem surrounding the building site. Even after buildings are constructed, occupants and building managers face a host of challenges as they try to maintain a healthy, efficient, and productive work environment.

It is important to keep the concept of "sustainability" in mind throughout the whole design process, from the improvement of micro climate to the energy saving strategies in the maintenances of a building, from the economic standpoints to the social issues.

CHAPTER 1
BACKGROUND

1.1 The three spheres of sustainability

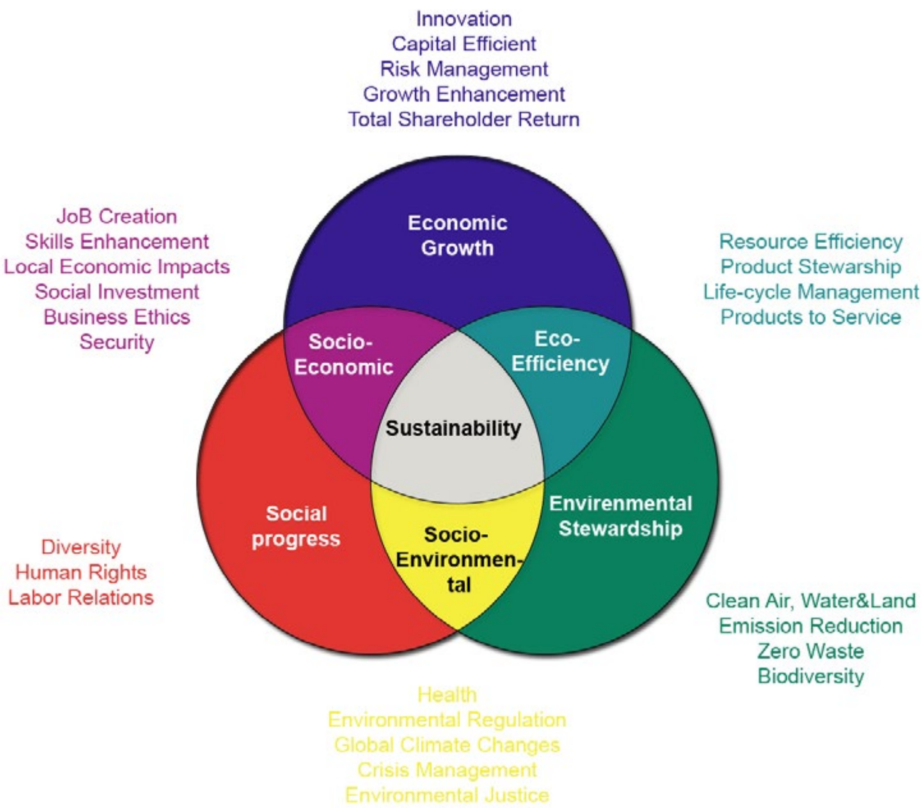
The issue that we are facing today in the building the sustainable neighborhood is dynamic, which not just includes current performance, but also future effects; and complex which includes environmental stewardship, economic growth and social progress.

The three interdependent aspects of sustainability: social, economic and environmental are actually are interrelated and interact on each other

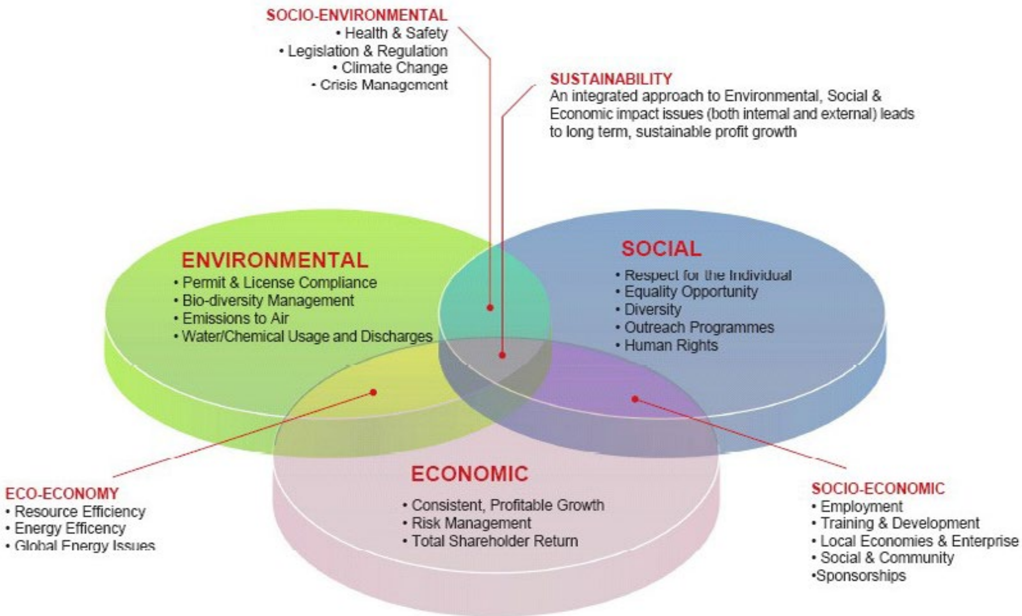
Through a critical analysis of sustainable neighborhoods, this paper questions the design dominance and calls for understanding synergies between technology, politics, economics, society, and environment.

1.2 The issue of sustainability in different scenarios

It is clear from this wide range of issues that sustainable planning and design do not



Innovation
Capital Efficient
Risk Management
Growth Enhancement
Total Shareholder Return
JoB Creation
Skills Enhancement
Local Economic Impacts
Social Investment
Business Ethics
Security
Resource Efficiency
Product Stewarship
Life-cycle Management
Products to Service
Economic Growth
Socio-Economic
Eco-Efficiency
Sustainability
Social progress
Socio-Environmen-tal
Envirenmental Stewardship
Diversity
Human Rights
Labor Relations
Clean Air, Water&Land
Emission Reduction
Zero Waste
Biodiversity
Health
Environmental Regulation
Global Climate Changes
Crisis Management
Environmental Justice



SOCIO-ENVIRONMENTAL
• Health & Safety
• Legislation & Regulation
• Climate Change
• Crisis Management
SUSTAINABILITY
An integrated approach to Environmental, Social & Economic impact issues (both internal and external) leads to long term, sustainable profit growth
ENVIRONMENTAL
• Permit & License Compliance
• Bio-diversity Management
• Emissions to Air
• Water/Chemical Usage and Discharges
SOCIAL
• Respect for the Individual
• Equality Opportunity
• Diversity
• Outreach Programmes
• Human Rights
ECO-ECONOMY
• Resource Efficiency
• Energy Efficency
• Global Energy Issues
ECONOMIC
• Consistent, Profitable Growth
• Risk Management
• Total Shareholder Return
SOCIO-ECONOMIC
• Employment
• Training & Development
• Local Economies & Enterprise
• Social & Community
•Sponsorships

belong to one discipline. Success requires a holistic and integrated design approach that draws on skills in planning, urban design, architecture, landscape design, building and services engineering, community consultation and development, and much more besides.

There can be different ways to solve a problem, and the appropriate solutions often depend on an understanding of the context: environmental, historical, social, etc.The appropriate scale for solutions is something larger than the individual building - it could be the block, the neighborhoods, the city, or the region. Solutions that require fewer resources are more likely to be robust. And so, for energy, the first step is to reduce demand and then examine how to meet it. In terms of movement in cities and towns, the robust solution is the dense walkable community, which does not have a high demand for either public or private transport. There is also a view that passive solutions are best. Things that move in the urban world tend to be less robust and require more maintenance. This is true whether one looks at cars, London Underground's escalators, or pumps for heating systems.

1.3 Introduction of Competition and our main focus

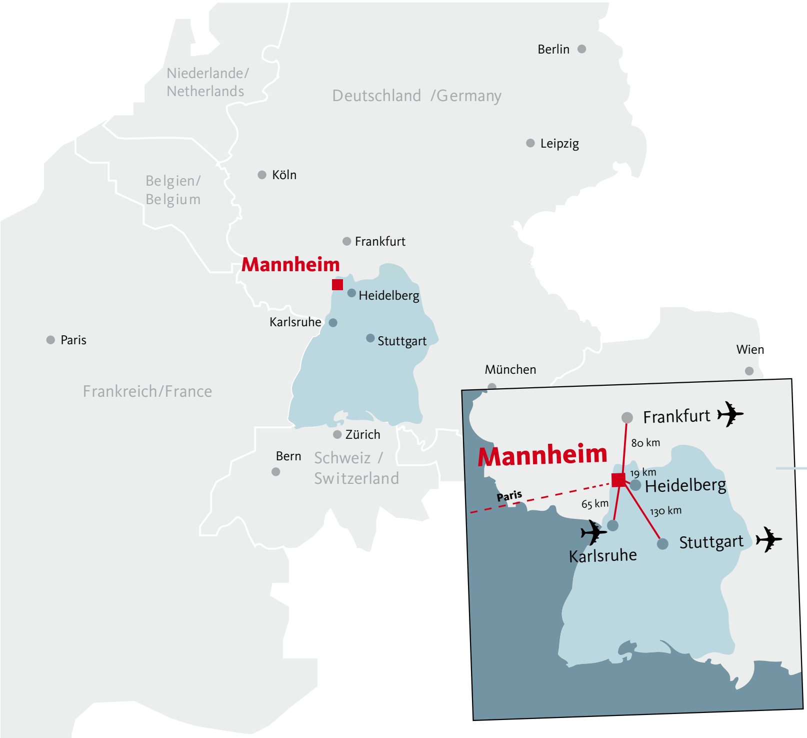
Under the Kyoto Protocol, more than 140 industrialised nations have made a commitment to reduce their CO2 emissions drastically and agreed that the use of energy-saving technologies is a priority in order to save our natural resources.
Overall, the building sector is responsible for 40% of the total energy consumption and CO2 emissions in the world. In order to reduce this, new and renovation projects need to be approached with a focus on energy efficient design.
As the world's cities are becoming larger and more densely populated energy consumption as well as CO2 emissions are increasing.
Reacting to this situation, more and more local authorities are demanding that their new development projects include designs that fulfill the highest requirements in terms of energy efficiency while providing the highest comfort possible for their inhabitants.
This is the case for the new "Gluckstein Quartier" development in Mannheim, Germany.
The project is to build a 150 apartments community in the area, and the try to develop a way of building and living to reduce the energy consumption.

Sustainable urban design is, in part, about balance. There are many good reasons for cities that are dense, have mixed uses and are varied. But such cities will need to manage potential conflicts between varying conceptions of urban form and living, between public transport and individual cars, between public distribution of energy supplies and private control, between man-made environments and more natural ones, and many others. This challenge is about our future - it is demanding and exciting.


VICTORIA TURM
INNENSTADT
HAUPTBAHNHOF
LINDENFOH
LOKSCHUPPEN
HANNS-GLÜCKSTEIN-PARK
MAFINEX
LANZCARRÉ
GLÜCKSTEIN-CARRÉ

The city of Manheim

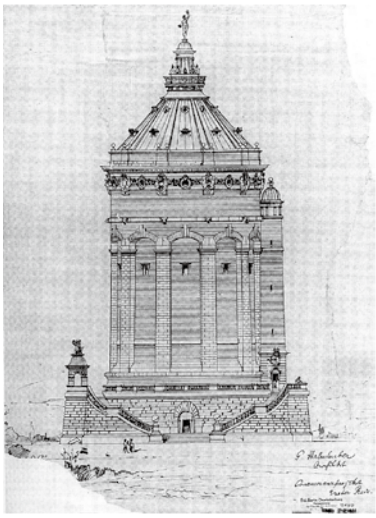
Mannheim is a city in southwestern Germany. With approximately 315,000 inhabitants, it is the second-largest city in Baden-Württemberg, after Stuttgart.



Mannheim is located at the confluence of the Rhine and the Neckar in the northwestern corner of Baden-Württemberg.

Distances:

Heidelberg 19 km, Frankfurt 80 km, Stuttgart 130 km, Cologne 245 km, Munich 350 km Mannheim‘s Central Station is on the edge of the city centre. The pedestrian zone, Water Tower and Rosengarten Congress Centre can be reached by foot in 5 to 10 minutes.



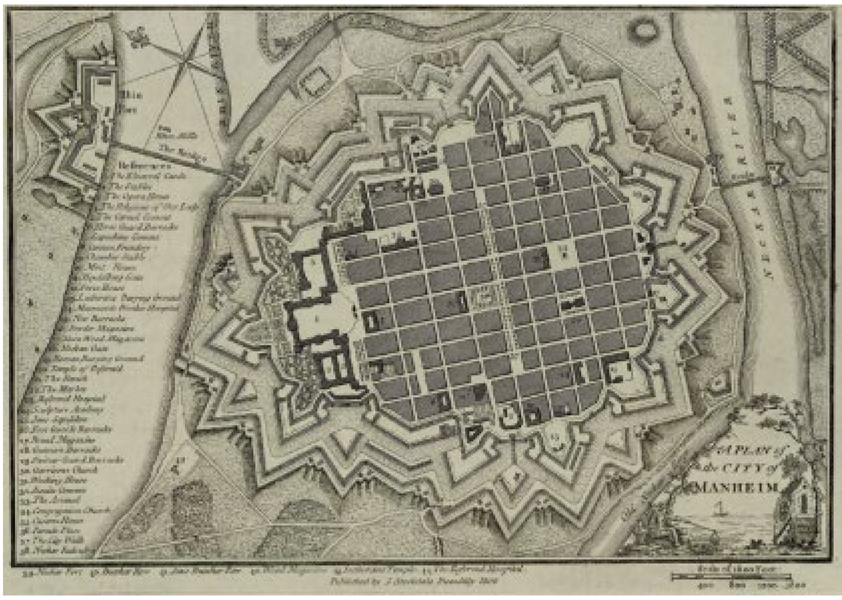
The construction was technically the emerging city and urban planning to set an example. The design should therefore be exceptional, impressive and timeless beauty. Roman monumental style and neo-Baroque elements formed the basis of the architecture and are now part of the largest plant of German Jugendstil. The sculptor Ernst Westphal created the sandstone figures at the tower. At night, the plant provides the lighting of the tower and the water games (weekends and holidays also colorfully lit) a very atmospheric image.

The Friedrich court in Mannheim is one of the most completely preserved neo-Baroque and Art Nouveau elements provided with facilities in Germany .

Mannheim: The City of Squares

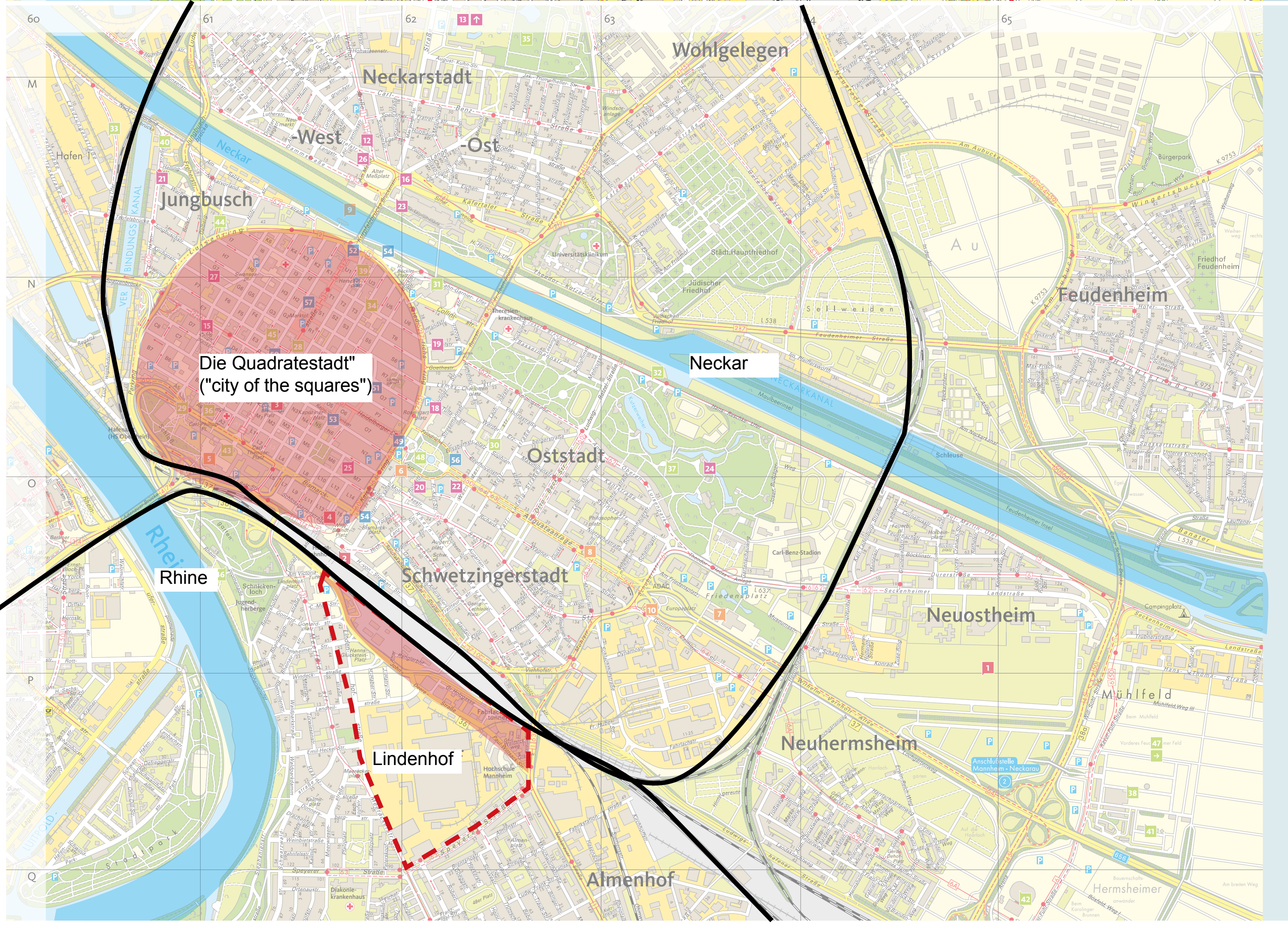
Mannheim, a city in the German state of **Baden-Württemberg**, is known as the City of Squares due to the unique organizational structure of it's city center which sits at the confluence of the **Rhein** and **Neckar** rivers. Instead of giving the streets names, the blocks have been named. Well, not exactly names…they have numbers and **these numbers are organized according to the game of chess**. Needless to say, it can be a little interesting to navigate as a foreigner.

A friend Laura Wilson, an artist who moved to Mannheim several months ago, explained a little of what she thought of her new home. She remarked that it's a nice city to live in with **a good combination of industrial, city culture, and nature with the Rheine and Neckar Rivers running both around or through it.** She feels the city is easy to get around with Stassenbahn (the interurban train) and bike however the chess board city center has been a bit complicated but she's getting used to it. She explains how the city center blocks are organized with a system that extends from the 600 meter long Mannheim Castle frontage:



Starting from the castle, squares on the left-hand side are named A to K, whiles squares on the right-hand side are named from L to U. Square numbers always begin with 1 along the central axis and ascend to the surrounding streets. House numbers begin at the corner located next to the castle. From A to K, numbers count clockwise, from L to U counter-clockwise around the squares.

Neckarstadt
-West
-Ost
Wohlgelegen
Jungbusch
Hafen
Neckar
Rhein
Oststadt
Schwetzingerstadt
Feudenheim
Neuostheim
Neuhermsheim
Lindenhof
Almenhof
Mühlfeld
Hermsheimer
Au
NECKARKANAL
Carl-Benz-Stadion
Städt.Hauptfriedhof
Jüdischer Friedhof
Universitätsklinikum
Hochschule Mannheim
Friedensplatz
Europaplatz
Hauptbahnhof
Campingplatz
Anschlussstelle Mannheim-Neckarau



Die Quadratestadt"
("city of the squares")
Neckar
Rhine
Lindenhof
Neckarstadt
-West
-Ost
Wohlgelegen
Jungbusch
Oststadt
Schwetzingerstadt
Feudenheim
Neuostheim
Neuhermsheim
Almenhof
Mühlfeld

Manheim as an industrial city

Mannheim's inner harbour is setting high standards for Europe. Together with Ludwigshafen, located on the left-hand side of the Rhine, the inner harbour in Mannheim is the second largest harbour of its kind in Europe. The history of the harbour dates back to the 13th century, when a landing pier was mentioned for the first time. Today, the harbour employs nearly 20,000 people. With a total of 1,131 hectares, Mannheim has the biggest inner harbour in terms of area in Germany.

Housing Condition Description in Manheim

The second half of nineteenth century witnessed a progressive easing of each of these three constraints. Those city walls and other defence lines which were still intact at the beginning of Germany's industrial revolution had to make way for wider arterial roads, new civic buildings and railway construction. Many fortification systems were demolished completely, their removal at last providing open access into the space beyond. Meanwhile, developments in passenger transport, and also releases of public land for building purposes.

As a result of these changes most sizeable towns and cities experienced a quite sudden physical expansion which often assumed the form of regular frontal growth, but in some cases appeared as sharply differentiated suburban "sectors". Only rarely, however, did the rate of urban expansion during the industrial revolution match the pace of demographic increases. Indeed, during the four decades following the foundation of the Second German Empire, there were several large cities- for example, Cologne (83214 and 33142) and Mannheim (56204 and 217229) - where population growth was at least twice as fast as the rate of extension of the built-up areas. One case and effect of this was the continued crowding of people, particularly those representing the poorer social classes, into the old, pre-indestrial housing quarters.

CHAPTER 2
SUSTAINABLE URBAN NEIGHBOURHOOD

Each element of the Sustainable Urban Neighbourhood represents an important principle. Sustainable refers to the ability of the neighbourhood and wider urban systems to be sustained over time and to minimise their environmental impact. Urban refers both to the location of the area and to its physical character whilst neighbourhood relates to the social and economic sustainability of the area, the community ties which hold it together and its relationship to surrounding areas.

2.1 Walkable City

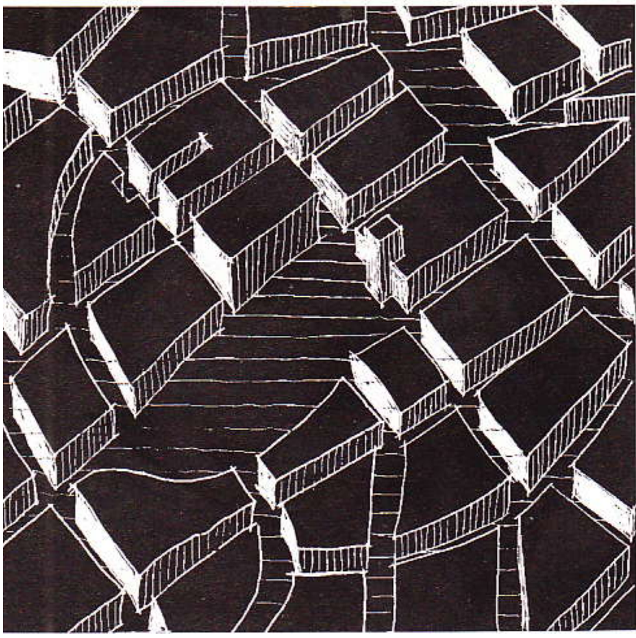


Fig 1.2 Historical Center Street

At the level of the town or city, the walkable community or urban village provides a fundamental building-block in creating a sustainable urban form. The concept is of a polycentric urban structure in which a town or city comprises a network of distinct but overlapping communities, each focused (depending on the scale of the urban area) on a town, district or local centre, and within which people can access on foot most of the facilities and services needed for daily living. Each of these communities is defined by the walking catchment or 'ped-shed' around the centre. This is generally taken to be c.800m, equating to a 10-minute walk.

2.1.1 Characteristic

And reduction of car use is seen by many commentators as likely to be the most profound influence on future development forms. This has a number of implications for design to build walkable neighbourhood.

Density:

Sustainable urbanism believes that for a successful community FARs (floor area ratios - the percentage of land covered by the equivalent of one story buildings) should to be between 0.05 and 0.30

Permeability: People can move through an area by a choice of routes. Each street leads to another street which in turn leads to another street and so on. It also stresses the importance of avoiding long stretches of road without junctions.

Legibility: understand the structure of a neighborhood and to read it as you walk around. Traditional urban areas are generally easy and pleasant to walk around. This relates partly to the variety of buildings and townscape. In areas with no landmarks where everything looks the same, walking is monotonous and it is easy to get lost. Area will look artificial since all the buildings are of the same design.

Transportation:

Re-establish walking, cycling and public transport as the preferred means of moving around urban areas.

Reducing traffic speeds and giving priority to pedestrians and cyclists in town centres is

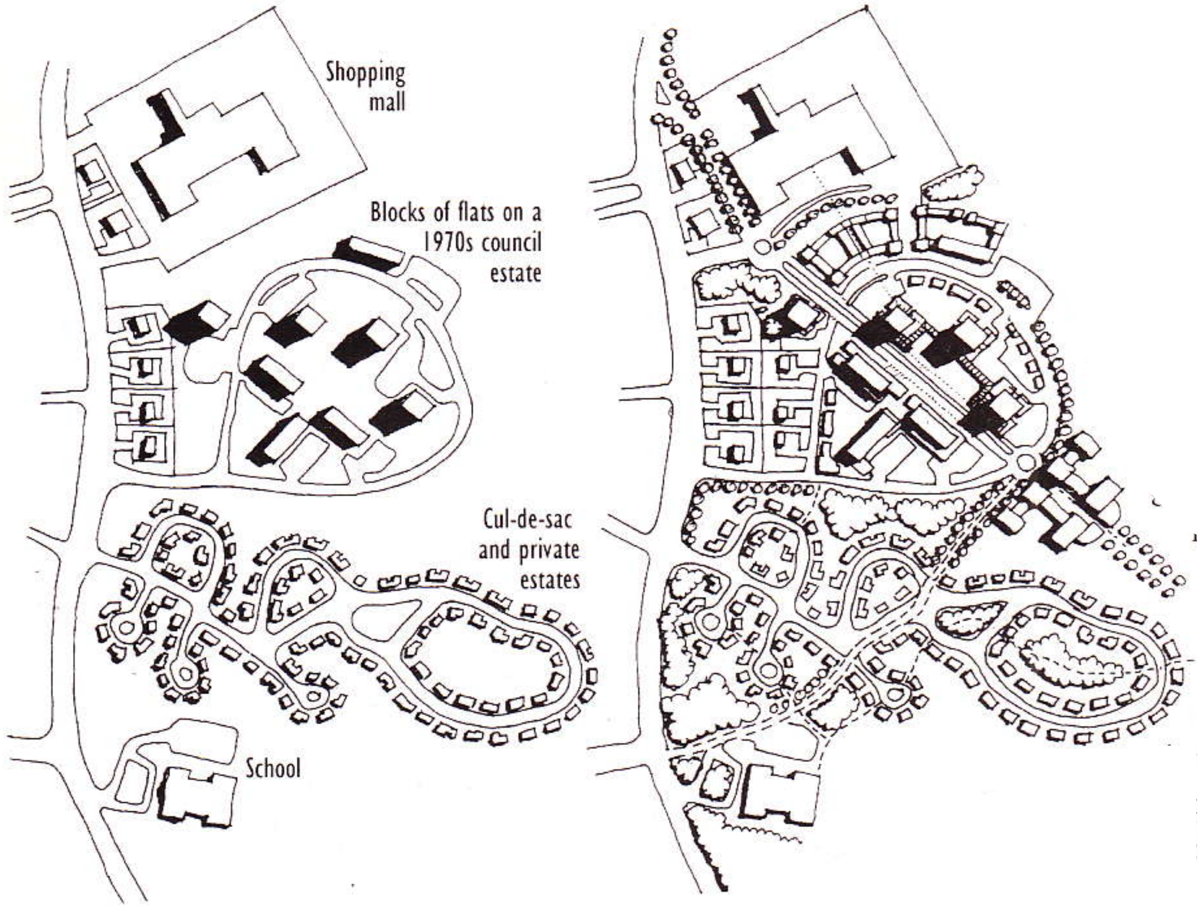


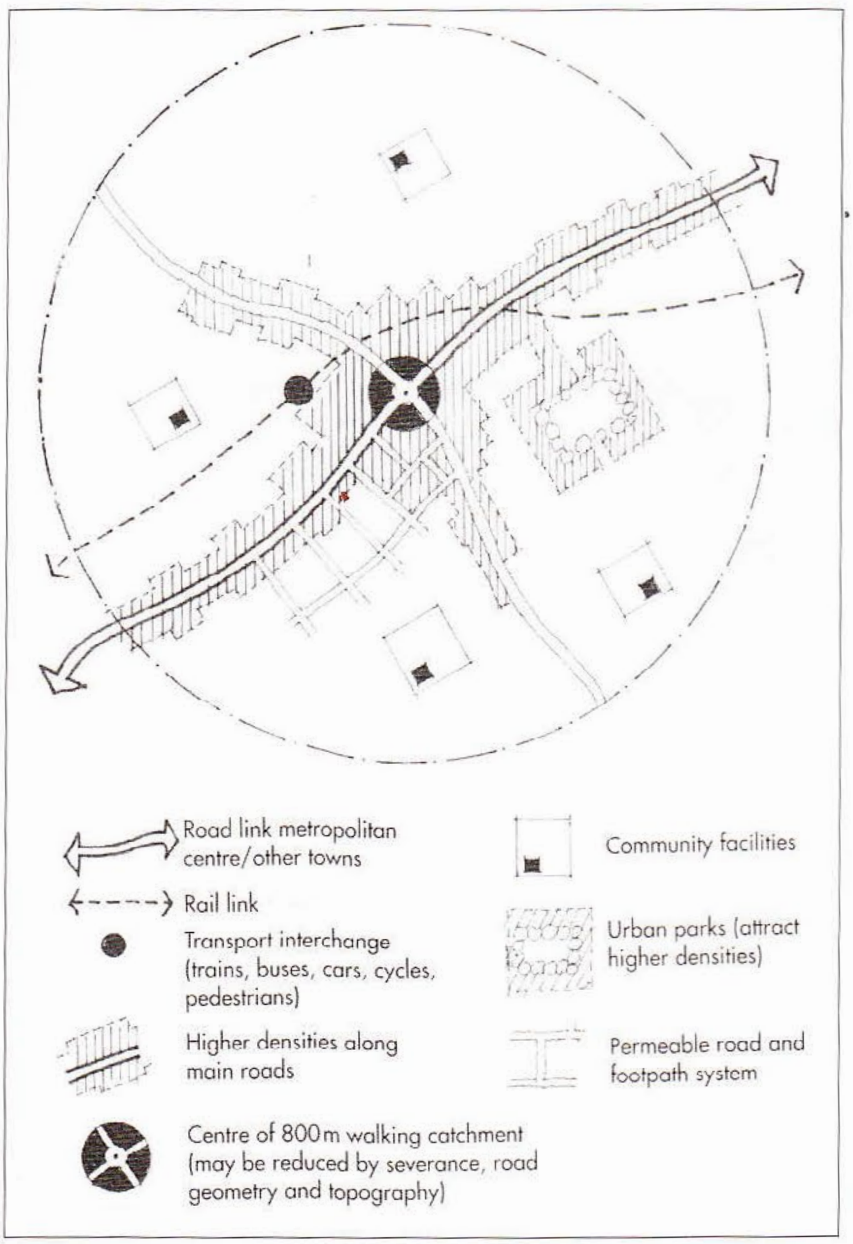
Fig.1.2_The walkable city and the disconnected city.

an important condition to build a sustainable neighborhood. Design residential streets for a maximum speed of 20mph (30 kmph) and create safe routes to schools. Encouraging children to cycle as a leisure activity as well as a means of transport is important. The balance between pedestrians, cyclists and motorists must be reprioritized away from the car in urban centres.

They should be designed with mixed use, good pedestrian and cycle accessibility, good cycle storage, easily accessible Internet facilities and a place to receive and store deliveries, and be flexible enough to adapt to changing needs.

2.1.2 Typical Walkable Community

The figure explains clearly more details of the characteristics of a typical neighbourhood. A number of planning and urban design principles can be drawn out.



· Shops and services tend to be focused along a main street running through the heart of the neighbourhood, at the convergence of movement routes and around key facilities such as a railway station. The degree to which shops and services spread outwards into surrounding streets is a function of the scale and role of a centre, then density of population (and spending power) within its catchment and the degree of competition from neighbouring centres.

· Community facilities such as schools, health centres and open spaces are distributed around the neighbourhood, reflecting more localised catchments and their greater requirements for space

·The neighbourhood provides a wide range of different housing opportunities not just in terms of dwelling size but also in terms of affordability and tenure. This provides the basis for a mixed community representative of society at large rather than having a narrow social focus.

·Housing densities are highest around the edges of the town or district centre, along the

principal transport routes leading to neighbouring centres and overlooking parks, waterfront areas and other amenities. Densities reduce towards the edge of the walking catchment.
·Movement routes are shared by cars, buses (or trams), cyclists and pedestrians and go through the centre rather than around it as well as through residential neighbourhoods.

2.2 Nature and landscape

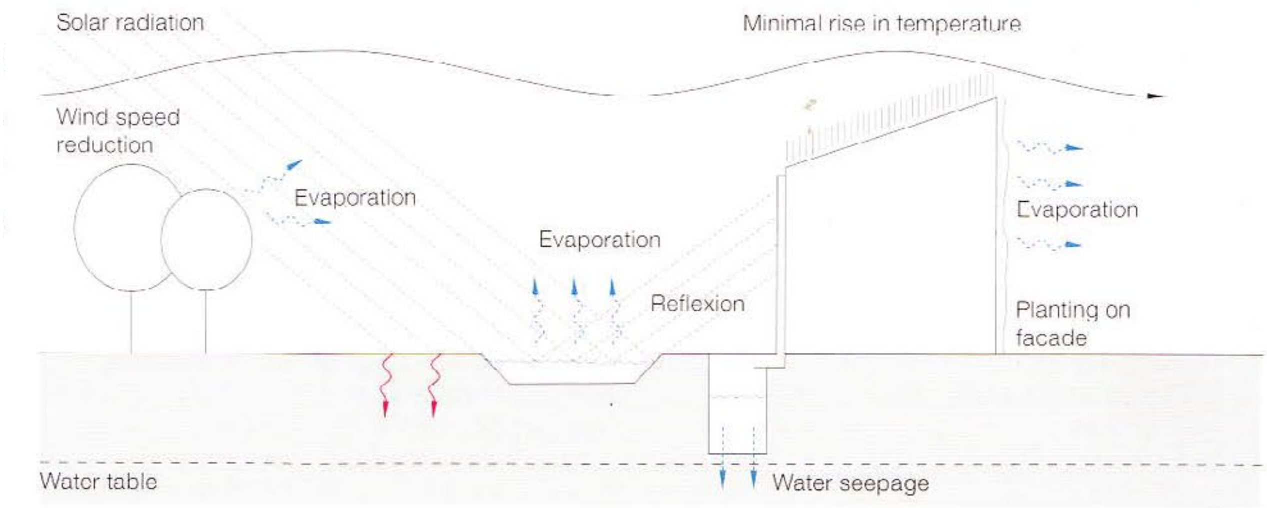
Nature not only has aesthetic value in the city context but also improves the local micro-climate, relieves environmental pressures on the city region and provides mental relief and contrast for urban dwellers. Nature and landscape in the city are therefore important in improving the quality of life in urban areas, and make those areas more sustainable in every sense of the word - ecologically, socially and economically:

. ecologically - affecting micro-climate, creating wildlife habitats;

. socially - making places more likeable, hence increasing the sense of ownership, counteracting urban stress, improving quality of life;

. economically - retaining property values because of a better quality of life.

All these contribute to a more durable development with a longer life span.



2.2.1 Climate

The concept of “Microclimate” is established to describe the meteorological conditions for specific locations and their direct surroundings. Various influencing factors such as the characteristics of the ground or terrain, the position on a slope, valley or plain, vegetation, shading and the neighbouring buildings must be taken into account. The microclimate is influenced by landscaping and building measures; its effects on the climate inside a building amd human well-being are crucial. As a part of a local, microclimate can protect buildings against undesirable climate effect. Climate elements, such as solar radiation, air temperature, air humid, and wind can be used appropriately to create comfortable living space, both outdoor and indoor.

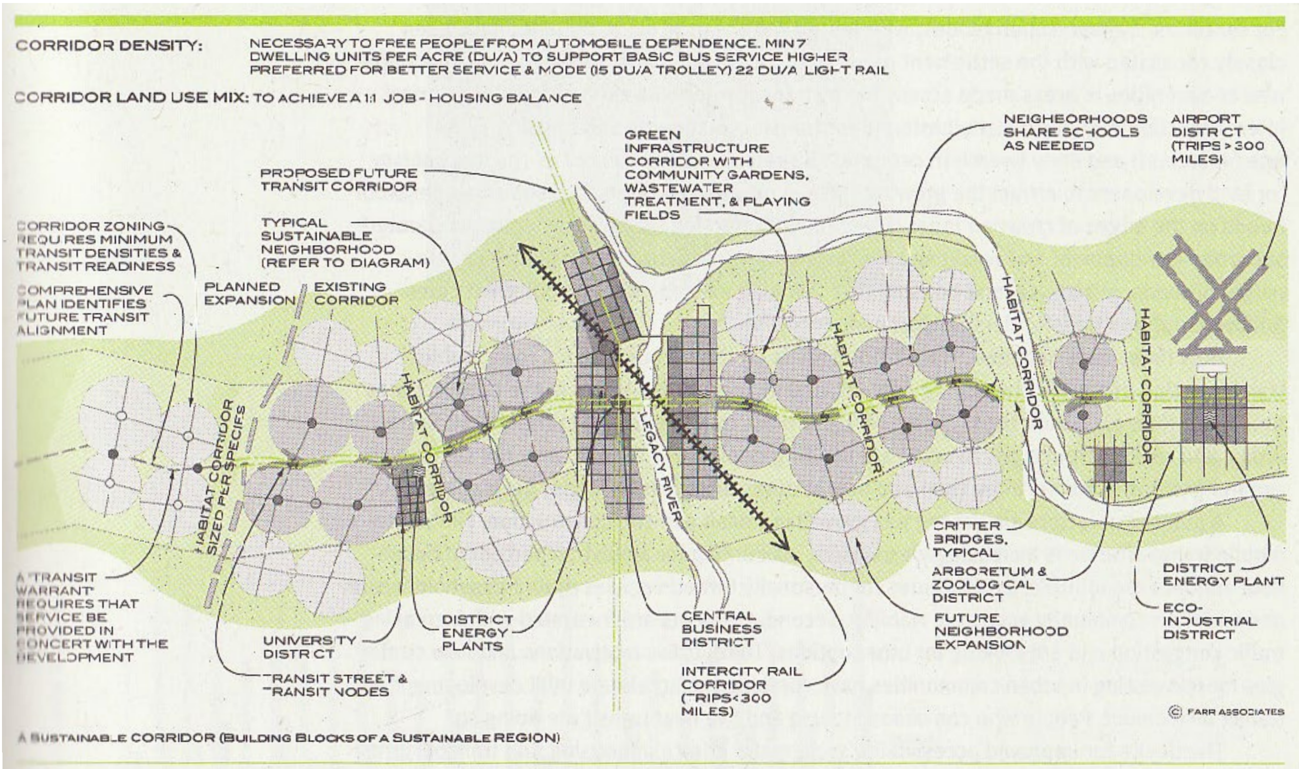
2.2.2 Landscape

The word “Landscape” here refers more to the different forms of land use, buildings and structures, and transitory elements such as lighting and weather conditions. The role and benefits of more nature and landscape in the city are multiple and often interlinked. They affect and improve:

. the micro-climate of the city, making it a more pleasant place to live;

. people's health and quality of life in the city, creating more green spaces of varied nature with more trees and greener views;
. propertly values, through better access to open space;
. the biodiversity, as more species live in the city, creating a real and diverse ecosystem with a range of habitats for wildlife.

For sure landscape planning and design do not belong to one scale. There are some guidelines by the researchers:
1. Landscape and landform influence the appropriate form of development.
2. Landscape and vegetation affect the immediate microclimate by binding airborne particles, absorbing noise, raising humidity and reducing temperature fluctuations, as well as lowering wind speeds.
3. Trees and plants form a contrast to urban development and provide a calmer environment for urban life, while views over green areas soothe the eye and comfort the mind when tired. Parks, trees and planting can help to visually counteract the stress experienced in cities as a result of traffic, noise and pollution.
4. Creating wildlife corridors with interlinked habitats offers the best chance of attracting wildlife and improving the biodiversity of the city. A citywide landscape strategy can set the parameters for wildlife corridors to be developed and can make site-specific open spaces more meaningful.
5. The planning of any site needs to start with a landscape assessment, including topography and microclimatic conditions of the site. This will inform a unique development response with intrinsic landscape elements embedded within the 'place'.
6. Reserve 5 per cent of a site to allow for free drainage or on-site water retention. Sustainable drainage best occurs on the lowest-lying land of the site.



A SUSTAINABLE CORRIDOR (BUILDING BLOCKS OF A SUSTAINABLE REGION)

7. Consider green and brown roofs to provide additional landscape elements in urban development.

water

Water can work as a microclimate regulator. Water stores the component of the solar radiation that is not reflected. A pond next to the building, for instance, can help to regulate the inflow of fresh air, reducing temperature peaks and ultimately leading to a reduced energy requirement in the building.

In order to be able to use our water resources efficiently, water can be used more than once for certain applications.

Rainwater can be used, for example, for flushing toilets and watering garden, but also as a transfer medium for cooling perposes. The filtering required before use can be assisted by planting in the rainwater collecting area.

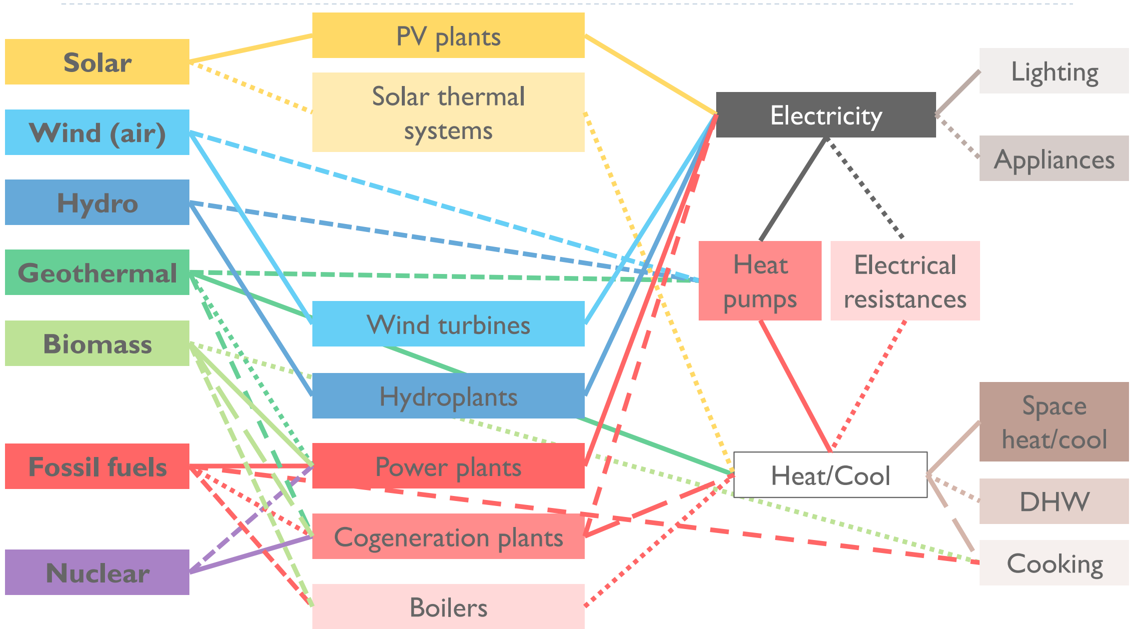
Plants

Trees positioned at a certain distance ahead of the building in prevailing wind direction, can help to reduce the wind speeds acting on the building itself and can shade on it.

2.3 -Energy use

The energy use of buildings needs to be considered at different stages of its life circle. The construction of a building accounts for more than 10% of its total energy use. Energy is then used to service and heat the building, to maintain it and to refurbish or demolish it when it is no longer required.

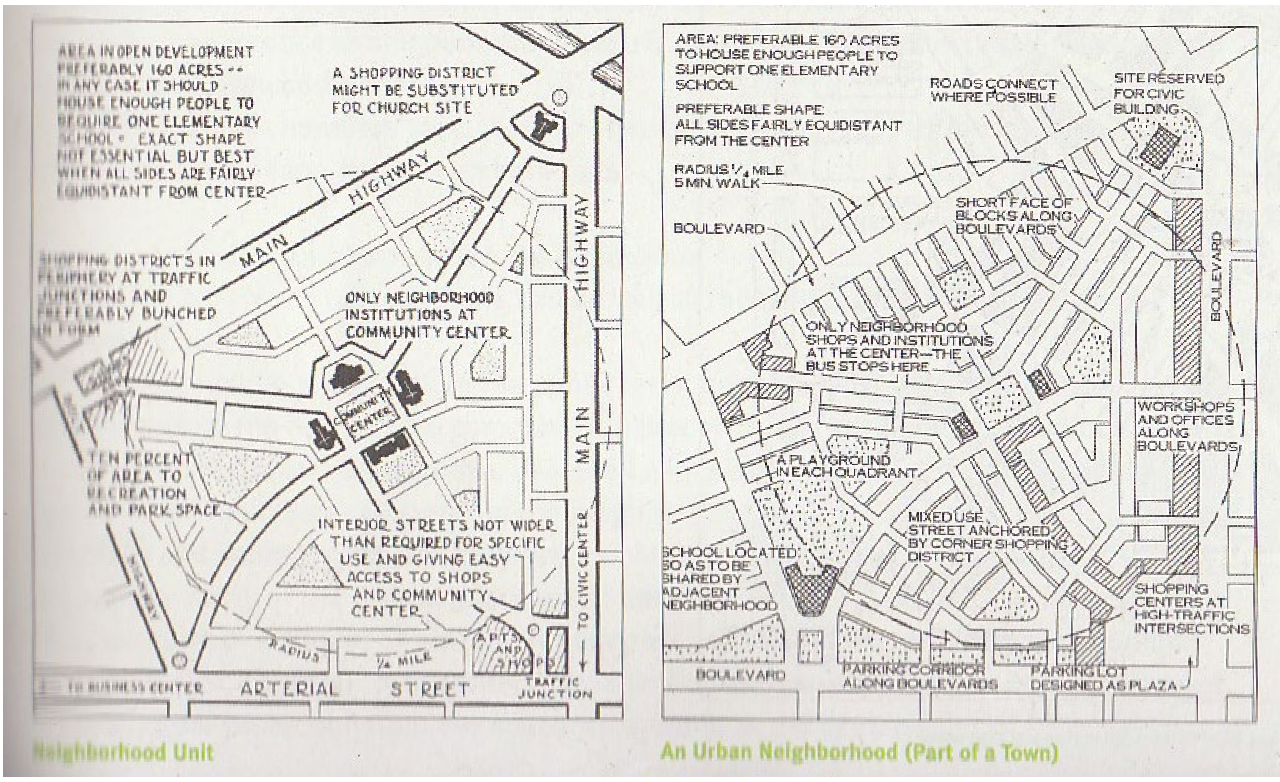
More significant in terms of energy used in construction is infrastructure. Urban development can make use of existing roads, services and facilities to reduce the new input so avoiding the resources that would be required to provide them on green field sites.



The higher density of urban development also reduces the length of roads and service

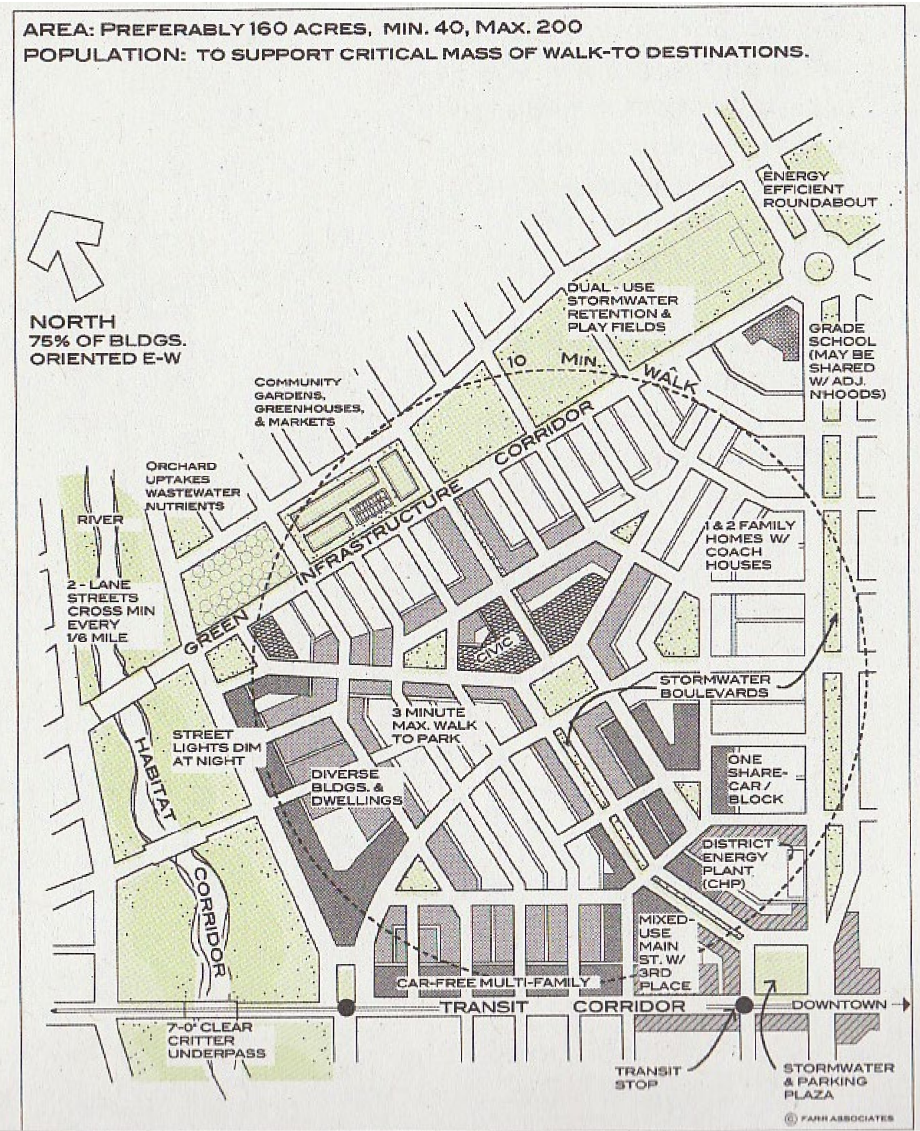
runs required which has both cost and environmental benefits.
As to the building scale, since flats and terraced houses have less exposed wall area, they are more energy efficient than detached dwellings for the same level of insulation.
Each element are not just related to one stage of the designing process, for example, solar design affects both urban and building form, and energy and transport are related and should be considered together.

2.4 -Community



Neighborhood Unit
An Urban Neighborhood (Part of a Town)

The challenge of social sustainability is to build neighbourhoods which last not for twenty or even two hundred years but which are immortal. Like great forests, they develop natually rather than being artificially planted, they are constantly renewed by new growth and they contain a rich variety of species.
We should be creating neighbourhoods which enhance the quality of social and economic life of their citizens, which are a joy to live in or to visit.
The strategies for building a balanced, vigorous and hopeful community:
. The creation of socially mixed and inclusive communities. The lesson must be about recreating a wider mix of housing opportunity and choice, and avoiding concentrations of particular housing types and tenures.
. The provision of services and facilities that meet a range of needs.
. Engaging local communities in discussion about how they see their neighbourhood and their priorities and aspirations for the future. The dialogue should be honest, open, ongoing and with a real commitment to changing plans and designs to reflect people’s views.
. The provision of quality public transport services. This is a fundamental prerequisite in



Third Place Criteria–Outdoor

Target Audience	Needed Facilities	Time of Day (7, 12 pm, 6, 11)
Dog owners	Dog park	
Preschool children	Tot lot	
Students	Play lawns, hangout space	
Nonworking adults	Lawns, benches, and sitting areas	
Working professionals	Lawns, benches, and sitting areas	
Working parents	All of the above	

Third Place Criteria–Indoor

Categories	Urban	Sprawl
Method of arrival	Walk/bike	Car
Parking	Bike	Free parking lot
Operating hours	16/day	16/day
Opening time	6 A.M.	6 A.M.
Days per week	6-7	5-6
Adjacent uses	Bookstore, laundry	Church, library
Siting	Main Street, preferably a corner	Strip mall
Range	Coffee shop/diner/pub	Coffee shop/diner/pub
Information	Kiosks	Kiosks

The Relative Social Capital of Coffee Shops

Categories	High Social Capital	Low Social Capital
Ownership	Locally owned	Chain
Staff profile	A neighborhood character	Barista
Kiosks	Encouraged	Prohibited
Location	Walk-to	Drive-to

reducing reliance on the car.
. The delivery of excellent local facilities and services.
. The recognition that long-term management and maintenance are as important as the initial design.
. The vision of new development as a catalyst for the improvement of existing areas.
This demands excellent design, but it could also include a local ‘community chest’ to pool contributions from a range of development schemes to be spent on local community projects. This could help encourage a more positive public attitude to development and change, which becomes increasingly important the more development moves form a few large sites to a multitude of improvements to the physical environment and community facilities. Such approaches also increase in importance as more emphasis is placed on the re-use of vary small sites.

2.4.1 public space

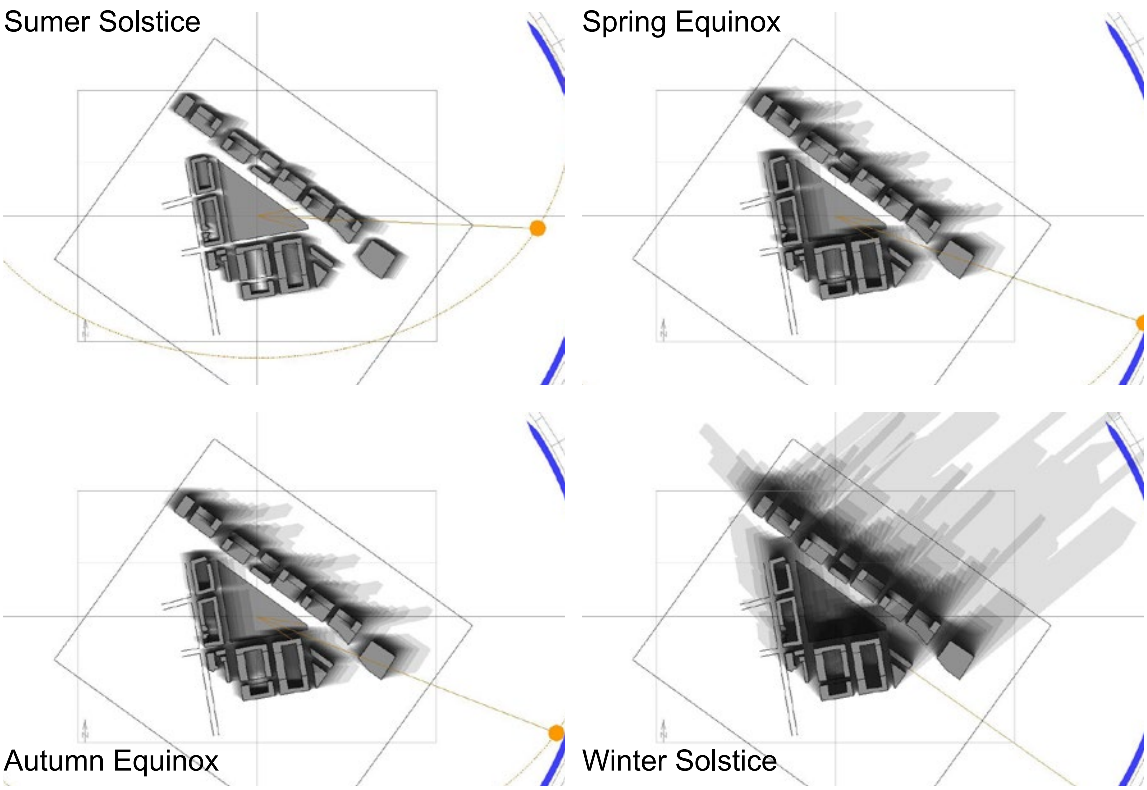
In many urban areas, public space, including parks and streets, constitutes more than half the total area of land. Buildings provide us with homes and workplaces and with commerce, industry and leisure. The space in between the buildings provides vitality, light, and amenity, room to travel and room to rest which can help a lot in developing a sense of community ownership.
Sustainable urban areas are not necessarily those with the largest amount of open space. It is quality not quantity which counts. They need to be overlooked by surrounding buildings or supervised by activity.

CHAPTER 3
HIGH-PERFORMANCE BUILDING

3.1 Use the natural resource

3.1.1 Solar radiation

Solar radiation is crucial to the conceptual design of buildings.
Passive use of solar radiation is characterized by positioning buildings to suit the available sunlight, large openings on south-facing elevations, mainly closed surfaces to the north, roof overhangs to protect against overheating in summer while still allowing plenty of sunlight into the interior in the winter, and an interior layout based on thermal zoning.
Active use of solar thermal energy is to convert the incident solar radiation into thermal energy for generating heat or into electricity.



3.1.2 Plants

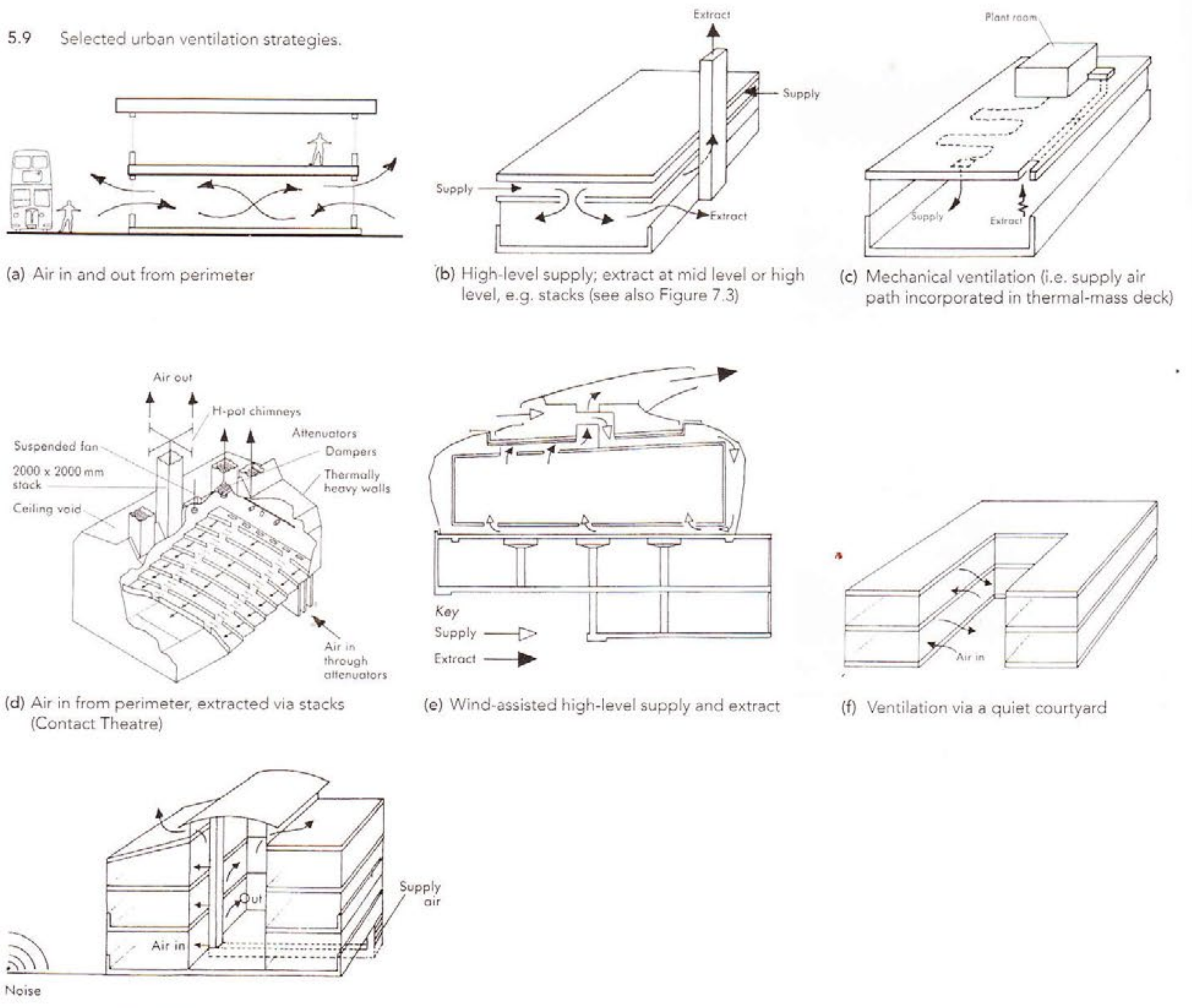
Direct planting on the facade does reduce the ambient temperature around the building owing to the enhanced adiabatic cooling capacity, reducing the risk of overheating in summer and thus improving the interior comfort.

The water retention ability and slowed release of storm water are not the only advantages of green roofs. Planted roofs can also help reduce costs by increasing the life of the roofing materials, reducing wear and tear, and can reduce the urban heat-island effect.

3.1.3 Natural ventilation

The figures show a variety of ‘sustainable’ ventilation strategies, the use of low-energy ventilation (and, in some cases, cooling) system is vital.

5.9 Selected urban ventilation strategies.



(a) Air in and out from perimeter

(b) High-level supply; extract at mid level or high level, e.g. stacks (see also Figure 7.3)

(c) Mechanical ventilation (i.e. supply air path incorporated in thermal-mass deck)

(d) Air in from perimeter, extracted via stacks (Contact Theatre)

(e) Wind-assisted high-level supply and extract

(f) Ventilation via a quiet courtyard

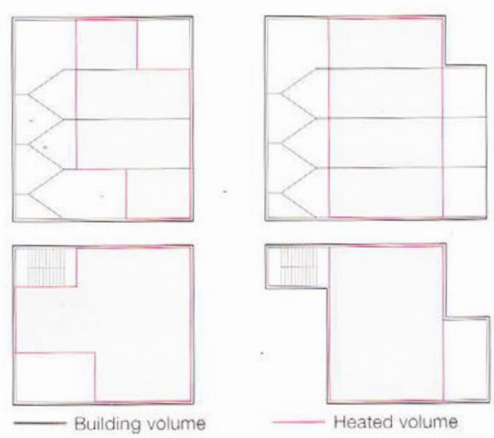
(g) Ventilation from a protected area

3.2 Reduce energy use

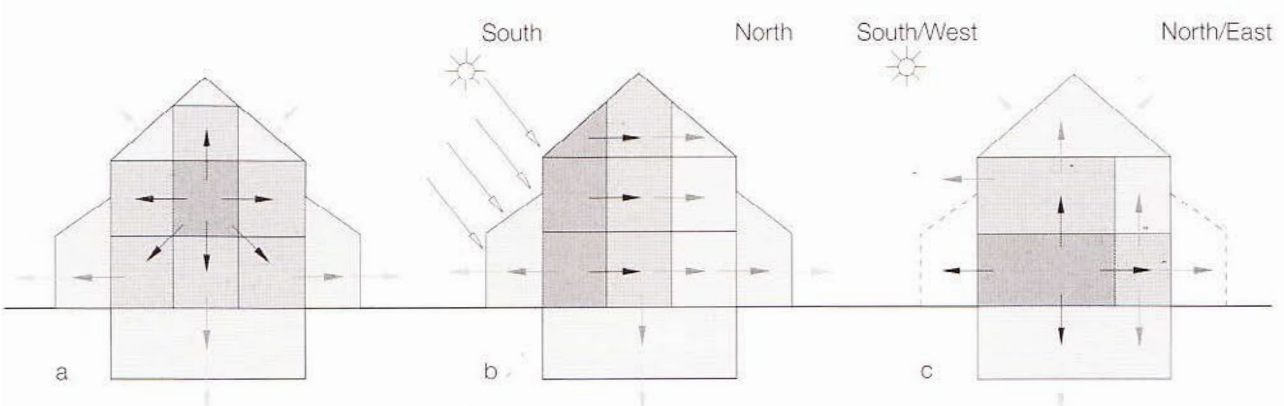
The energy-efficiency planning of the building means guaranteeing that the interior climate conditions necessary can be maintained over the whole year with low energy requirements.

3.2.1maintaining and gaining heat

Energy losses can be minimized and energy gains maximized through the design of the building itself. Surface areas of different sizes have a direct effect on the heat losses: the smaller the envelope area required for a given volume, the lower is the building’s heating requirement.



Usage zones can be arranged according to, for example, temperature or daylight requirements. Thermal zoning is the most effective from the energy



point of view: primary uses are thermally insulated by adjacent buffer spaces or ancillary floor spaces. There are three principle zoning options for building with a high heating requirement.

Concentric zoning: Concentric zoning enables generous building depths. Uses that need to be protected from the climate, that require stable thermal conditions, are places in the center of the building.

Linear zoning: Linear zoning is based on the orientation with respect to the sun. The rooms with the greatest lighting and heating requirements are positioned to face south, east or west, those with lower or only sporadic heating requirements should be face north.

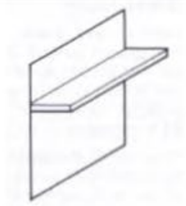
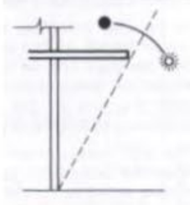
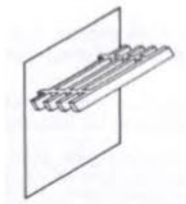
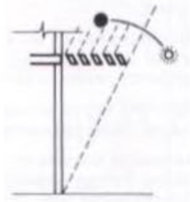
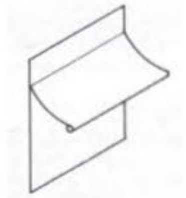
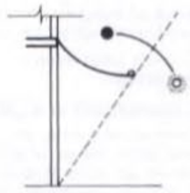
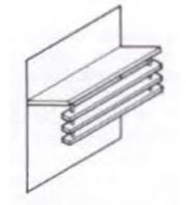
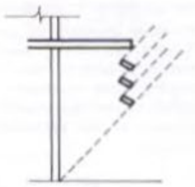
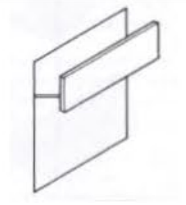
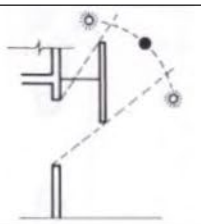
Storey zoning: In a storey zoning approach, the rooms with high thermal requirement are normally places in the middle of a stack of storeys.

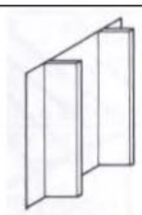
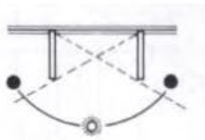
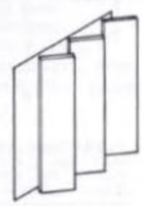
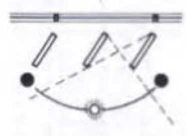
Unheated circulation zones, utility and storage rooms, etc. are not counted as part of the heated volume and therefore must be thermally separated from the heated volume. From the energy point of view, it is not the compactness of the gross volume that is relevant, but rather the volume of the heated parts of the building.

The magnitude of transmission heat losses though opaque building envelops is essentially determined by the thermal conductivity of the components enclosing the heated volume. It depends on the specific properties of the materials and the construction of the components involved. The parameter for the thermal quality of a building component is the thermal transmittance (U-value) measured in W/m2K. It describes the heat flow under static conditions and is calculated as the heat output per square metre for a difference of 1K between the two surfaces of the component, usually between inside and outside. The lower this value, the better is the thermal performance of a component.

3.2.2 Avoiding overheating

Like the thermal performance in winter is intended to protect occupants and users against unpleasant, low temperatures, protection against excessive temperatures in the building must be guaranteed during the summer.

Horizontal types			
Shading Device	Side View	Impact of the view	Comments
			Straight overhangs are most effective on southern exposure.
			Louvers parallel to wall allows hot air to escape and are most effective on southern exposure.
			Awnings are fully adjustable for seasonal conditions and most effective on southern exposure.
			Horizontal louvers hung from solid overhangs cuts out the lower rays of the sun. Effective on south, east and west exposures.
			Vertical strip parallel to wall cuts out the lower rays of the sun. Effective on south, east and west exposures.

Vertical types			
Shading Device	Plan View	Impact of the view	Comments
			Vertical fins are most effective on the near-east, near-west and north exposures.
			Slanted vertical fins are most effective on east and west exposures. Slant toward north and separation from wall minimizes heat transmission.

	Pros	Cons
Fixed shading device	Low cost Do not need active system	Lack of use flexibility Difficulty of obtaining the total shadow of the windows Size, shape, orientation must be design according to the sun paths of the location (compromise between winter and summer demands) Limited performance: During winter, little use of the solar gains During summer, not sufficient control of the overheating
Movable shading device	Use flexibility Possibility to obtain the total shadow of the windows	Needs of a person or an automatic activation system of the shading device as a function of the thermal/lighting needs

Material	Pros	Cons
Vegetation	Change with the seasons During the summer, shading the house During the winter, not impacting the solar gains	Needs of maintains
Inanimate materials	Can not change with the seasons	Less needs of maintains

If the outside air temperature is higher than the room temperature, a heat transfer takes place from outside to inside. To avoid this type of heat transfer, the same principles apply as for thermal insulation in winter. A building envelop optimized with respect to minimizing transmission heat losses at the time therefore provides good protection against overheating in summer.

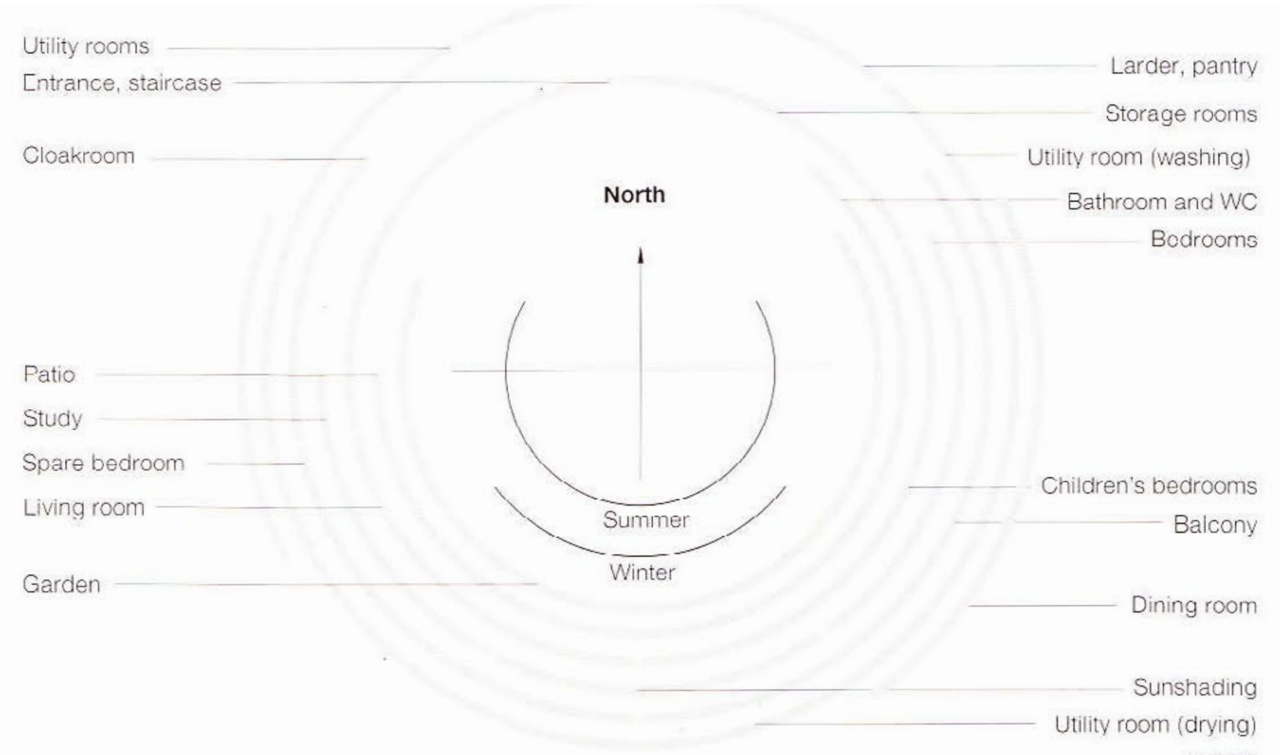
Overhangs, returns or favourable angles of inclination can protect transparent areas against direct sunlight during the summer month.

3.2.3 Decentralised ventilation

From the sustainability viewpoint, a maximum amount of natural ventilation should be the aim. This means that the air change rate for habitable rooms is achieved by way of thermal currents or differing pressures due to the wind.

3.2.4 Using the daylight

Transparent or translucent building components are necessary if we wish to make use of daylight.
As glazed areas generally exhibit a higher thermal conductivity than opaque walls, a large expanse of glazing weakens the wintertime thermal performance of a building envelope. Daylight planning is therefore always closely tied to the summertime and wintertime thermal performance. In particular, it is always necessary to weigh up the energy required for removing the heat caused by excessive incoming daylight and the energy-savings brought about by the shorter period of operation of artificial lighting.



3.2.5 Generating electricity

Photovoltaic technology enables electricity to be generated via the building envelope without any mechanical wear, emissions or noise.

It is eminently reasonable to provide what people want: comfort, fresh air, natural light, and views of the outside - the simple things in life, which contribute to our health and well-being, and might increase our productivity too.

There are many ways to design HIGH-PERFORMANCE BUILDING. Success will come with the right balance (or something entirely opposite and extraordinary). Design buildings so that they possess ‘the lightness and joyousness of springtime which never lets anyone suspect the labors it cost’ (Matisse).

3.3 Promote participation in the building process

3.3.1 Genius loci

It is possible to engender pride and stewardship through the way that housing is planned and managed. Residents can be identified in advance and given opportunity to work alongside planners and architects. They can decide how their houses will be to some extent. Local people usually have a high talent by building or making something using the local material and local language in a very genius way.

3.3.2 Flexibility

In architecture, flexibility means adaptable, universal, movable, transformable and responsive. What typifies a flexible building is its ease of adaptation per use, its relocatable or repositionable structures with capable of being torn down and reassembled in another location, characterized by modular design and responsiveness to usage and the environment.

3.3.3 Third Place

"Third places" is a term coined by Robert Oldenburg, author of The Great Good Place. He defined these locations as those outside of home and work and open to the general public where people informally gather on a regular basis.

As places to go to see and be seen.

Of sixteen hours a day, five or six days a week, for people to drop by.

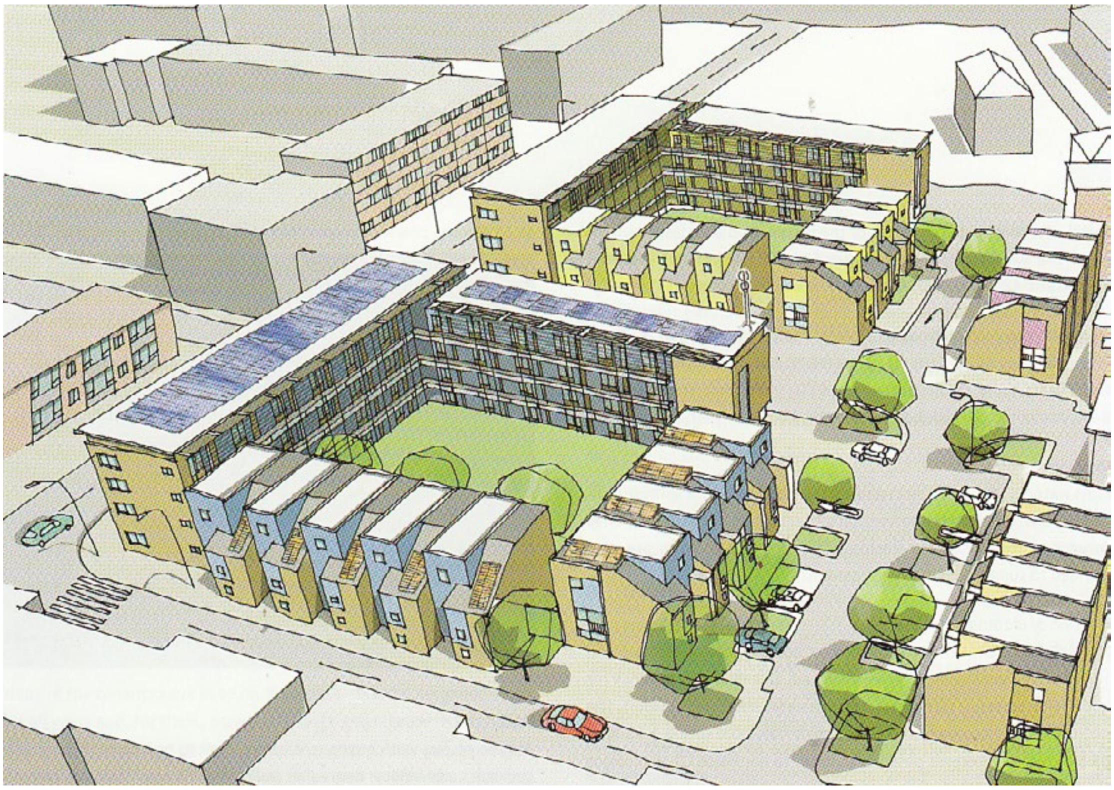
Meet, trust, and for associations.

Located in walk able urban settings and are much less viable in automobile-dependent locations.

CHAPTER 4
CASE STUDY

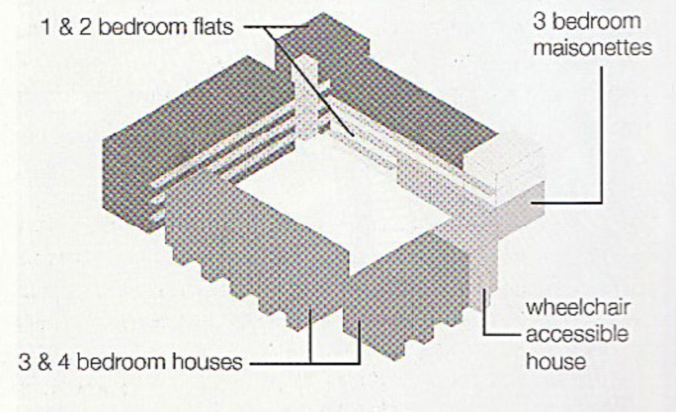
The cases we give more attention on and analyze deeply are those which have been built recently after 2000, and almost have the same climate as Mannheim (Mild temperate/ mesothermal climates in the Köppen Climate Classification)

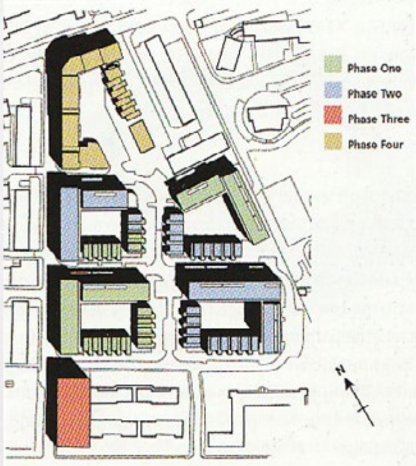
Case n. 1



Location	London, Great Britain
Parameters	Site area: 1.69ha; dwellings per hectare 138
Design strategy	The courtyard form: encourages a sense of community and engenders a strong sense of identity. Courtyards create a clear hierarchy of private, semi-private and public spaces and provide a good model for urban regeneration To integrate architecture and landscape and so provide attractive, legible and easily maintained private and public space.
Landscape strategy	The aim of the landscape design is to create both a physical continuity between the four courtyard blocks and a highly legible space that is easy to understand. Within each courtyard all the properties at ground-floor level have a small patio garden, which opens onto a communal garden. Over time, residents will become involved in the design and management of these spaces. Within the communal gardens there are places for gardening, cycle storage, composting, children's play, seating and picnic.
Traffic control	Assess roads are designed to emphasize their use for pedestrians and not vehicles. The roads are designed in short runs, intersected by squares and traffic-calming measures. They are envisaged as secure and well-used outside spaces, and as a focus for community life.
Energy-saving strategy	Maximizing the daylight penetration into the homes Roofs are designed to face south wherever possible for future retro-fit photovoltaic panels. The sustainable strategy is focused on six key areas: Energy and CO2 emissions; Water conservation; Materials sourcing; Waste management; Transportation and car use; Social well-being
Social strategy	Tenants are encouraged to record their desires and dislikes on Post-it notes stuck to posters in a mobile office. Neighboring estates are included in the events held during the design process to encourage local awareness and good relations. Gardening clubs and workshops are being organized to encourage and assist tenants.
Comments	The courtyard consists of approximately 40 homes in a mixture of one-, two- and three-bedroom apartments and three- or four-bedroom family houses, providing a balanced community. This arrangement has been designed to be flexible and in order to meet changing needs and future developments in living patterns. To develop a sense of community ownership, individual houses and ground-floor flats have gardens to the front and rear, which create well-defined private space. All the properties above the ground level have generous balconies overlooking the courtyards. The road system allows the pedestrians and cyclists to reclaim the streets as they have priority over vehicles which are restricted to just 32kmph.

11.6 Different unit types make up the courtyard community.

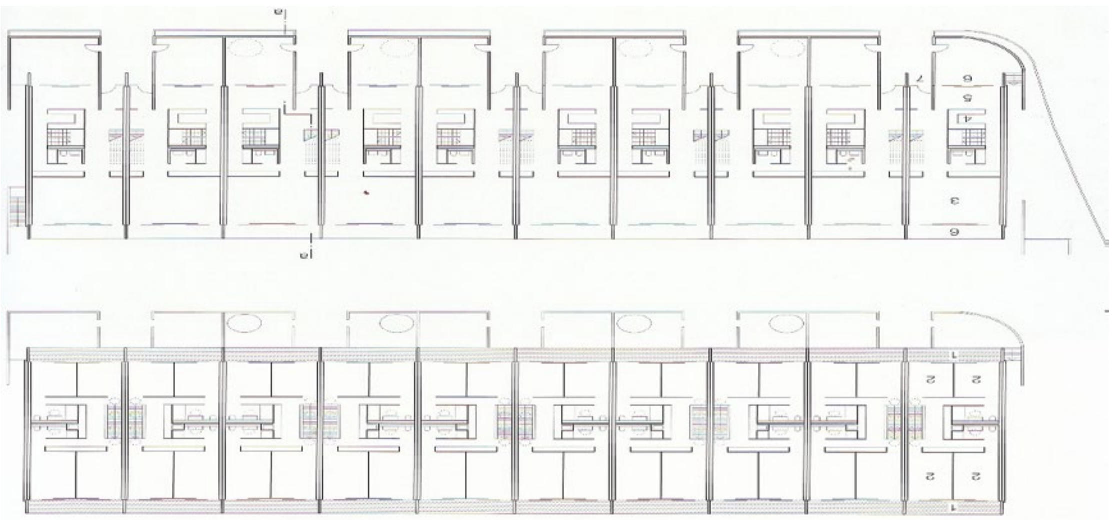


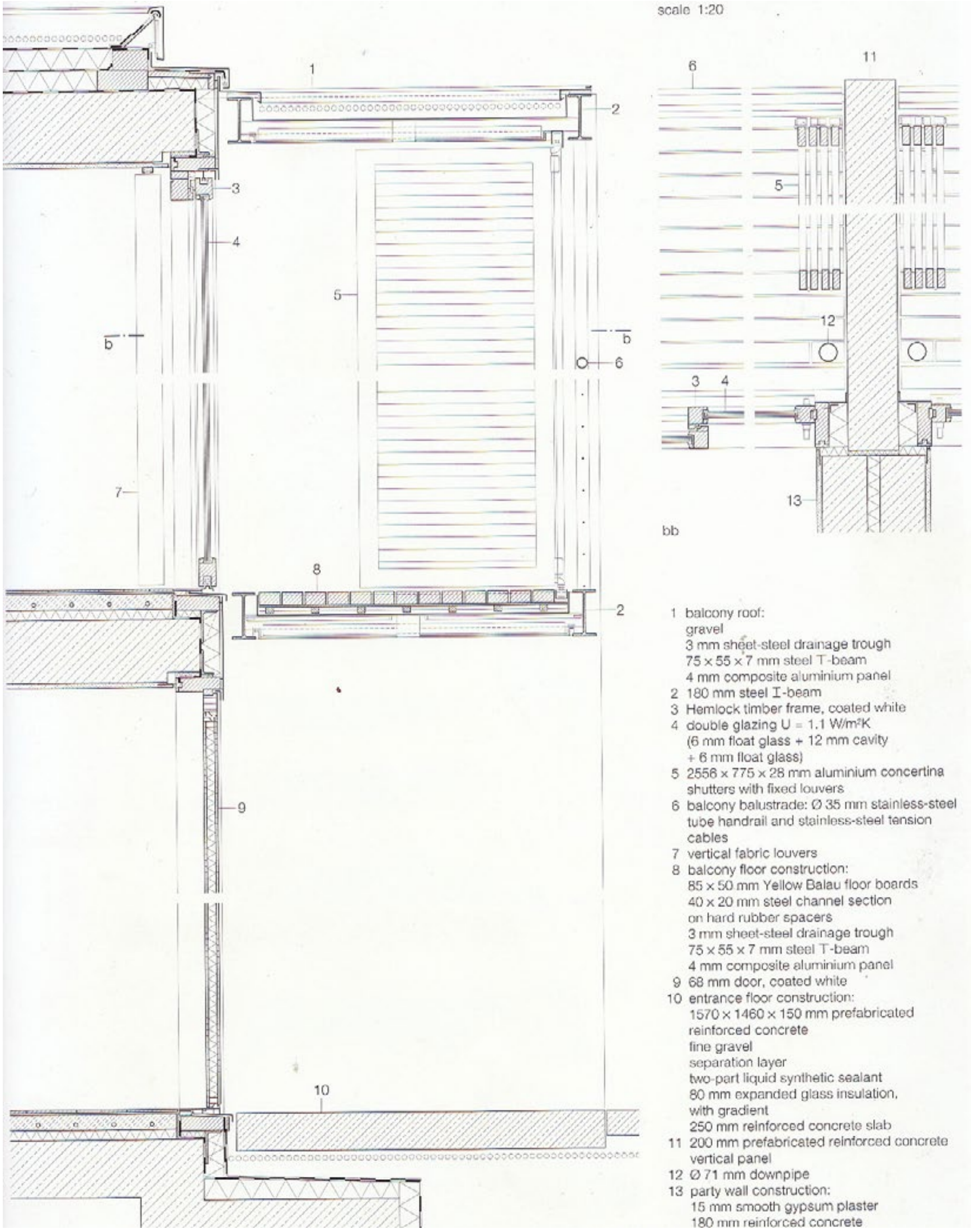


Case n. 2

Location	Stuttgart, Germany
Parameters	37 terrace houses; two types: a four-room house of 112m2, a five room house of 134m2; primary energy requirement: 8.0-9.4kWh/m2a
Building fabric	Building layout: the narrow service and communication core is located on the north-east side, with entry, staircase, kitchen and bathroom, while the living and bedrooms face the gardens to the south-west.
Building material	Timber-frame construction system Wall and floor elements are predominantly prefabricated and assembled on site.
Energy-saving strategy	The fenestration in the north-eastern sides is restricted to small window elements while the south-western elevations offer room-high openings. External shading system: sliding window shutters
Comments	The standard room size allows flexibility of use. Its basic layout: service rooms on the north and main room on the south side Douglas fir sliding window shutters alleviate the formality of the otherwise rigid façade arrangement and effectively create interplay between the open and closed panels.

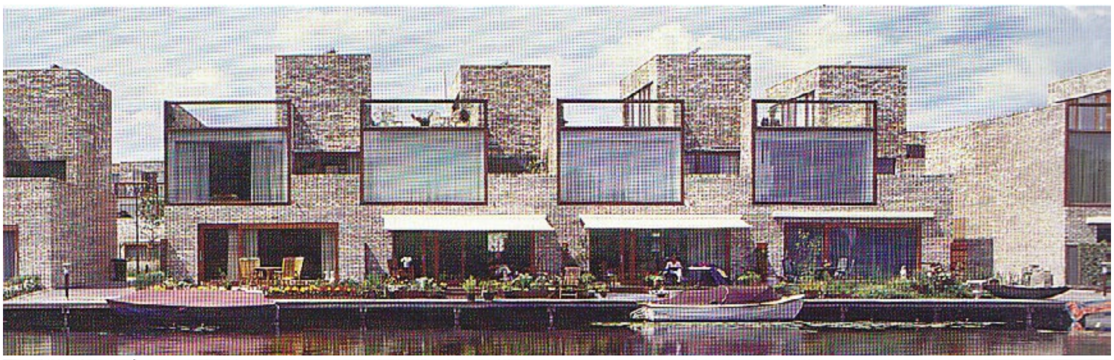
Case n. 3

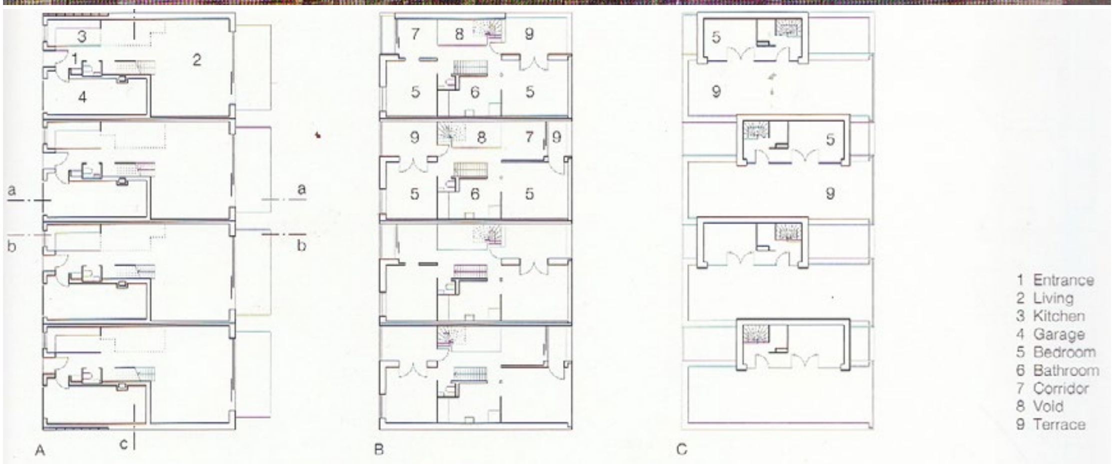




Location	Munich, Germany
Parameters	10 terrace houses;
Building fabric	Building layout: long, narrow units of 6.5 by 17.4 meters, with the principal rooms being located behind the facades and ancillary rooms situated in the center.
Building material	Structure: reinforced concrete The party wall between the two units: a five-centimeter-wide separation joint divides the two layers of the in-situ concrete party walls.
Energy-saving strategy	Sun-shading is provided by the application of folding aluminium shutters to the external corners of the outdoor living areas.
Comments	Every principle room has access to a balcony or terrace facing either the communal green space or the private courtyards. The variety offers the residents the alternative of selecting sunny or shady spots at various times of the day or year. The houses open onto this green space with room-high windows.

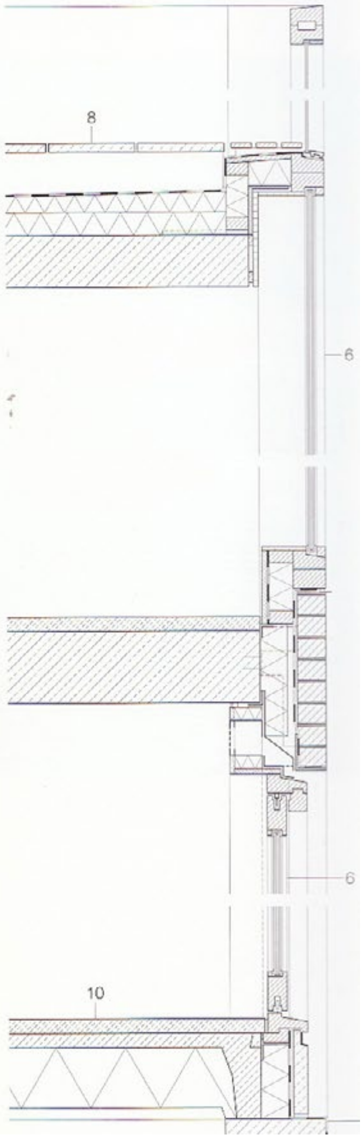
Case n. 4



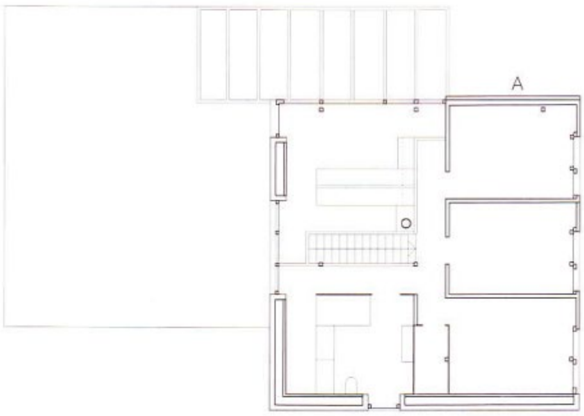


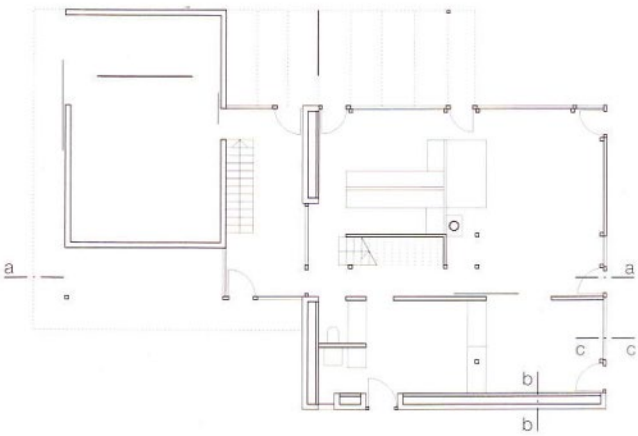
Location	Gouda, Netherland
Parameters	2 types terrace houses, total internal volume: 500m3
Building fabric	Building layout: adjacent to the entrance on the ground floor are kitchen and large living area, in addition to the integrated garage. A single-flight stair provides access to the first floor, where the bathroom and two bedrooms are to be found.
Building material	Structure: reinforced concrete All load-bearing walls are of sand-lime masonry and the double-leaf construction of the party walls fulfills all requirements of sound insulation and fire protection. Clinker face-brickwork was selected for the external walls.
Energy-saving strategy	Internal shading system
Comments	Various terraces and loggias which have been cut out of the building mass. The resultant variations in height and depth simultaneously animate the facades and allow light to penetrate deep into the interiors. Extra zone for play or study in the form of a wide corridor.

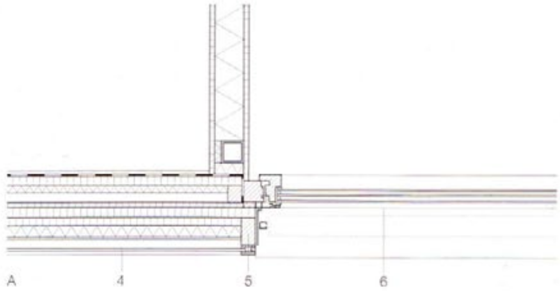
Detail section • East facade section
scale 1:20
1 aluminium parapet flashing
2 roof construction:
bituminous membrane
insulation with gradient
80 mm thermal insulation, 18 mm screed
71 × 171 mm timber beams
vapour barrier, 27 × 44 mm battens
12.5 mm plasterboard
3 wall construction:
100 mm clinker face-brickwork
on steel brackets
35 mm ventilation cavity
wind proofing membrane
95 mm thermal insulation
100 mm sand-lime brickwork,
5 mm internal render
4 first floor construction:
50 mm screed
180 mm reinforced concrete slab
5 brick window lintel on precast
concrete element
6 timber window with double glazing
7 sliding door with double glazing
8 terrace construction:
300 × 300 × 40 mm concrete pavers on
sub-construction, bituminous membrane
70–150 mm insulation with gradient
180 or 250 mm reinforced concrete slab
9 wall construction:
19 mm cedar boarding, 27 × 44 mm battens
wind-proofing membrane
95 mm thermal insulation
vapour barrier, 12.5 mm plasterboard
10 ground floor construction:
50 mm screed, 300 mm precast reinforced
concrete element with perimeter insulation



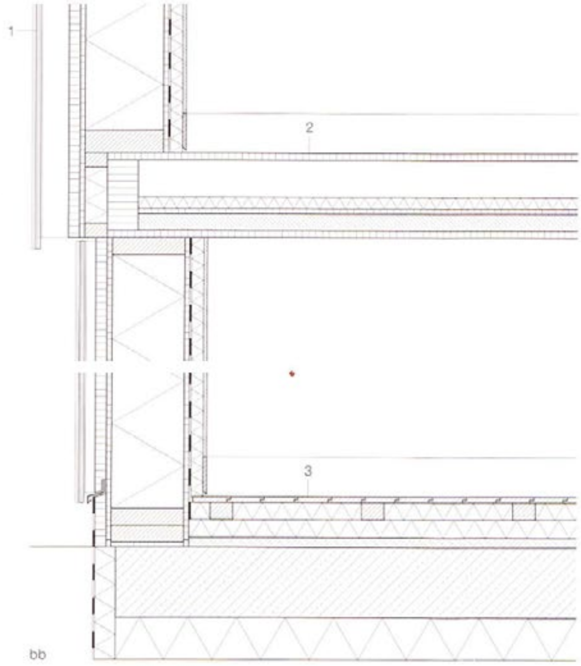
Case n. 5

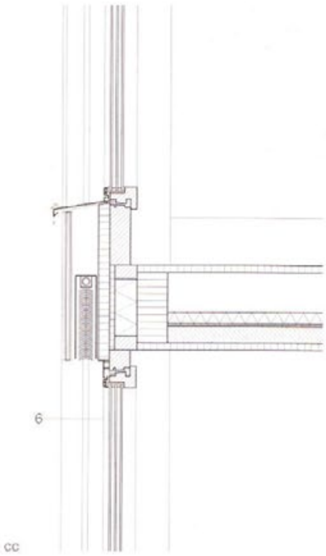






Section • Plans
Scale 1:250
Horizontal section through collector facade
Vertical sections
Scale 1:20





Facade construction, U = 0.133 kWh/m²K:
16 mm polycarbonate twin-wall sheets on
4 mm rubber
100 x 30 mm battens
40 mm wood-fibre board
18 mm OSB
timber frame with
280 mm insulation between
18 mm OSB, vapour barrier
50 x 30 mm battens with
50 mm flax insulation between
12.5 mm gypsum fibreboard
Suspended floor construction:
26 mm 3-ply core plywood, spruce
250 mm glued laminated timber with
40 mm thermal insulation between
18 mm OSB
30 mm chippings
26 mm 3-ply core plywood, spruce
Ground floor construction:
21 mm Douglas fir floorboards
80 x 60 mm battens with
60 mm + 65 mm cellulose insulation between
34 mm levelling screed
250 mm reinforced concrete
150 mm PU foam boards as insulation
to underside

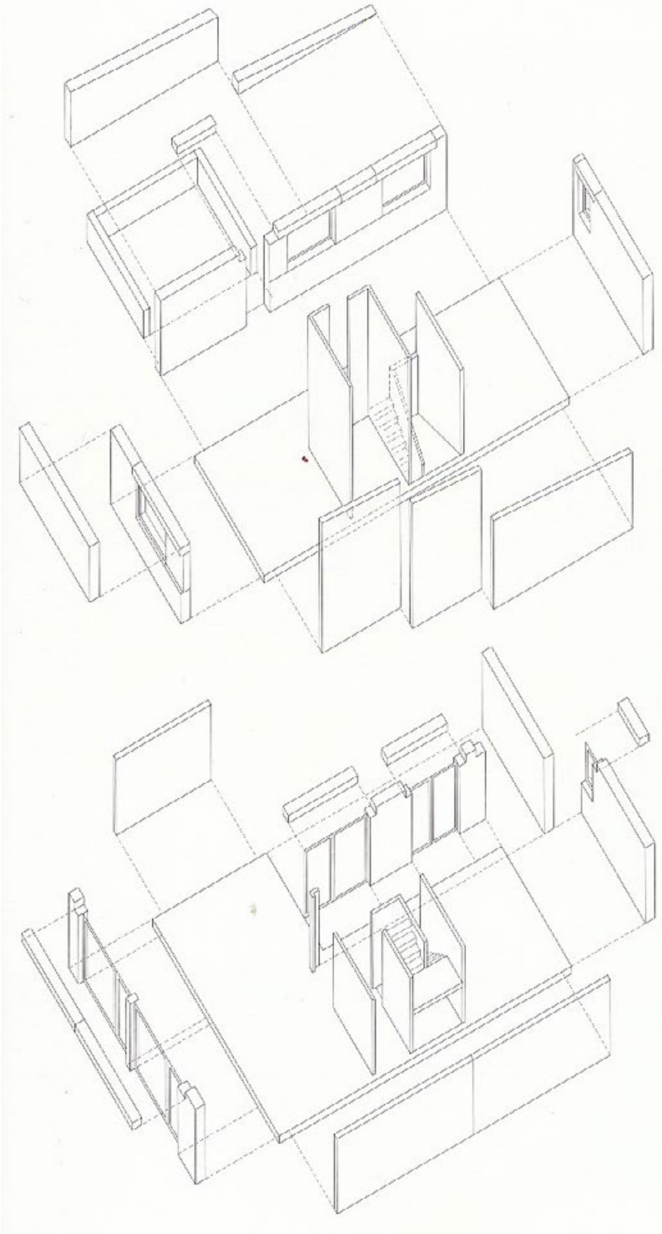
4 Wall construction, collector facade:
120 mm insulation and collector
40 mm wood-fibre board
18 mm OSB
timber construction with
26 mm vacuum insulation panels between
40 mm OSB
vapour barrier
12.5 mm gypsum fibreboard

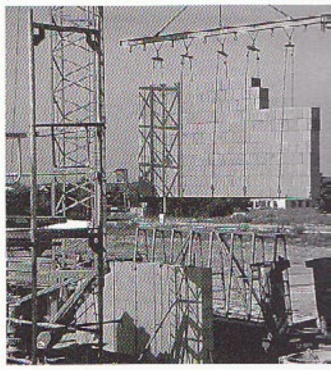
5 Fibre-cement strips, 10 mm
4 mm seal

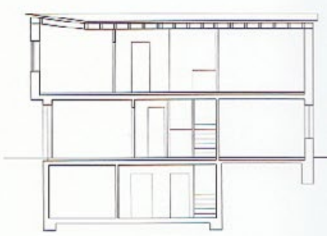
6 Wood/aluminium window with
triple glazing, U_g = 0.7 kWh/m²K

Location	Satteins
Parameters	Gross floor area: 190m2, primary energy requirement: 25.5kWh/m2a; external wall U-value: 0.13
Building fabric	Structure: high building quality due to prefabrication Building layout: house can be divided into 2 parts; certain rooms suitable as offices
Building material	Timber construction Environmental impact: complete prefabrication for optimizes construction process Deconstruction: building can be separated into its constituent materials and recycled
Energy-saving strategy	Building heating: excellent insulation to building envelop Ventilation system with heat recovery High passive solar gains Hot-water provision: heating by solar thermal energy and exhaust-air heat pump
Infrastructure	Water: short pipes Rainwater tank for garden irrigation
Comments	Building volume like traditional surroundings Flexible interior layout and use of rooms Environment-friendly energy strategies

Case n.6







Location	Ulm, Germany
Parameters	20 semi-detached houses; Gross floor area: 123-143 m2,
Building fabric	Structure: high building quality due to prefabrication Building layout: the basic construction module of the individual houses which is capable of providing floor layouts ranging from 70 to 130m2. The minimum volume comprises two rooms and a staircase, with a kitchen, bathroom and WC linked to a central service core. This nucleus can be extended by adding further individual rooms.
Building material	Precast concrete slabs Environmental impact: complete prefabrication for optimizes construction process
Energy-saving strategy	The modular construction system of large-format, dimensionally precise wall and ceiling elements makes simple connections and a chiefly dry form of construction possible, reducing construction time on site.
Comments	The rooms are similar in size and form, so that the houses can accommodate a wide range of user requirements. Self-contained apartment can be divided off without major construction intervention. Highly prefabricated.

CHAPTER 5

PROPOSAL

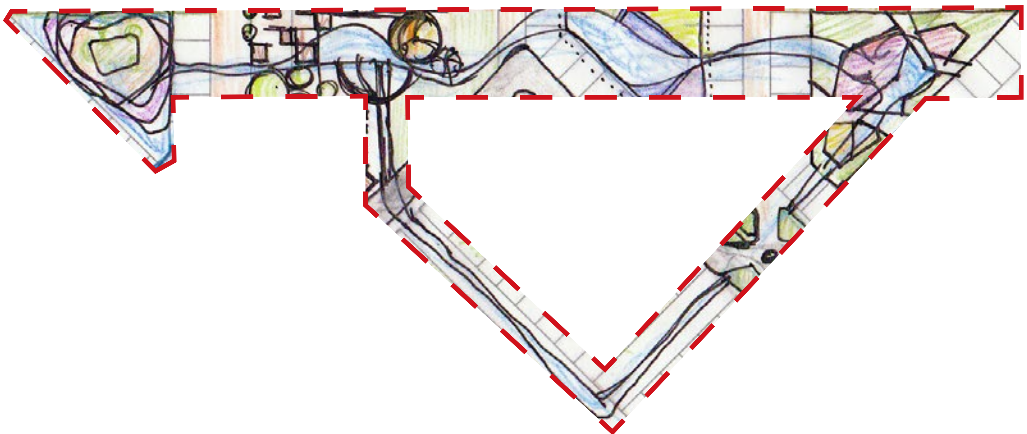
5.1 Masterplan

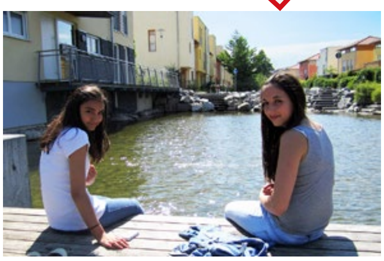
5.1.1 Design Concept

Consider the best orientation, the desity of our community, the quality of public space, the recycle of energy, the "third place" of social life, we propose the masterplan as below.

Main Entrance, Pedestrian

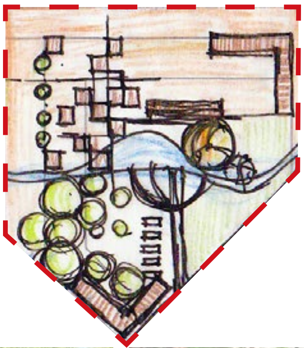
5.1.2 Water system





5.1.3 Public space

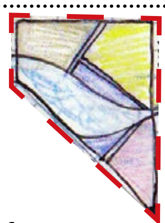
Main Entrance Piazza



Urban Coffee Farm and Brew Bar by HASSELL

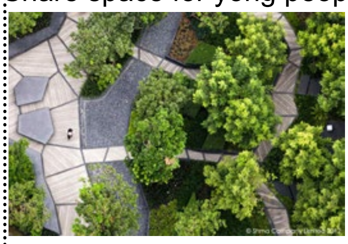
Inner Community Space

Playground for Children

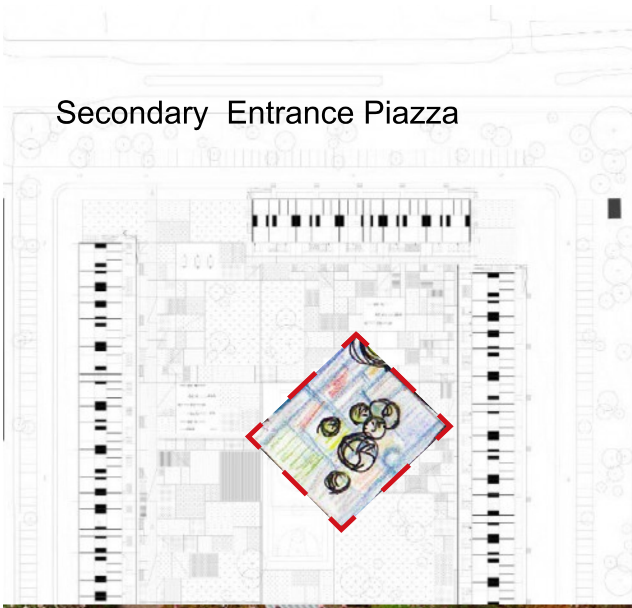


Share space for yong people

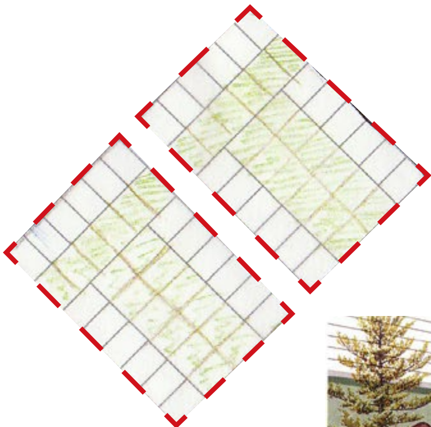
Share space for yong people



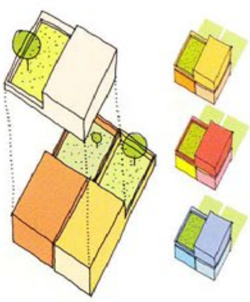
Secondary Entrance Piazza

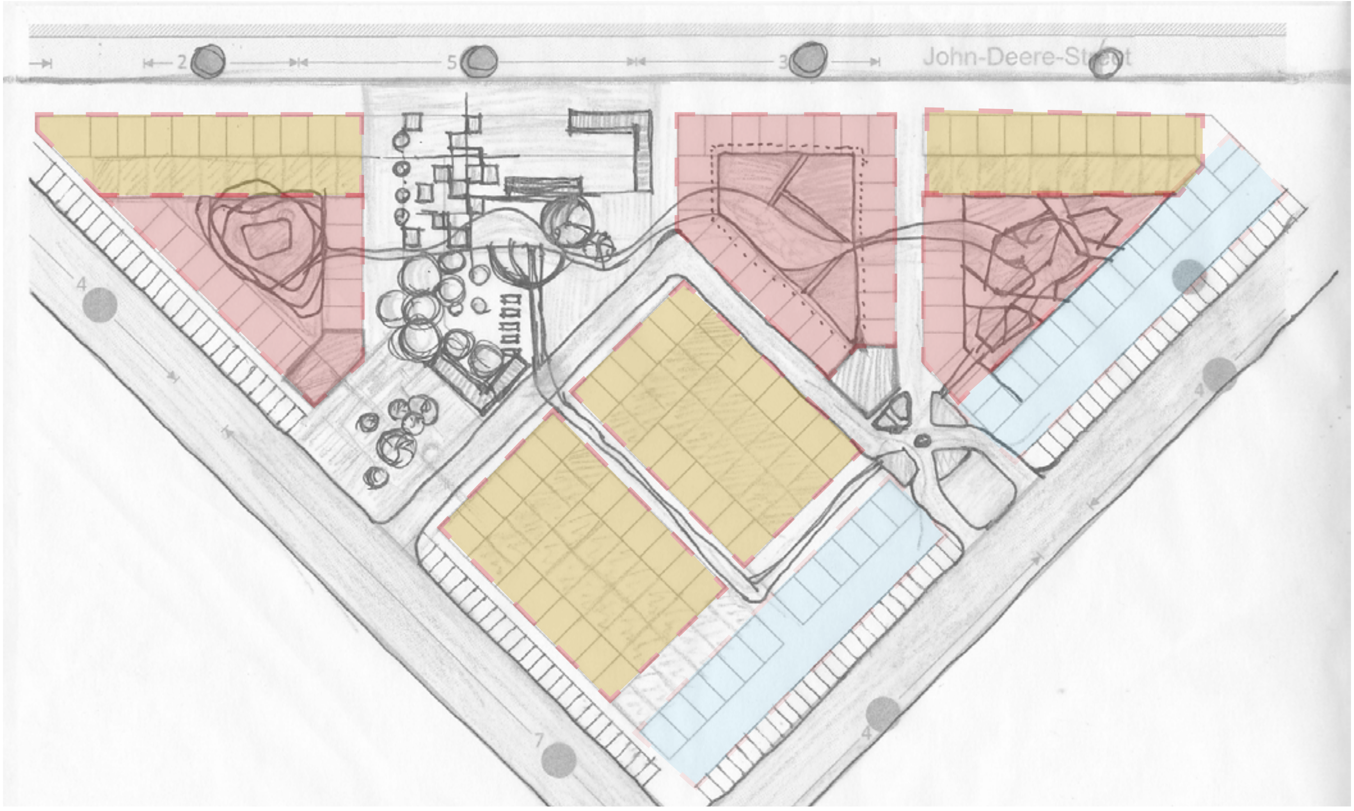


5.1.4 Building Block



Private Garden





House Type: Family, Empty nesters and retirees with private garden

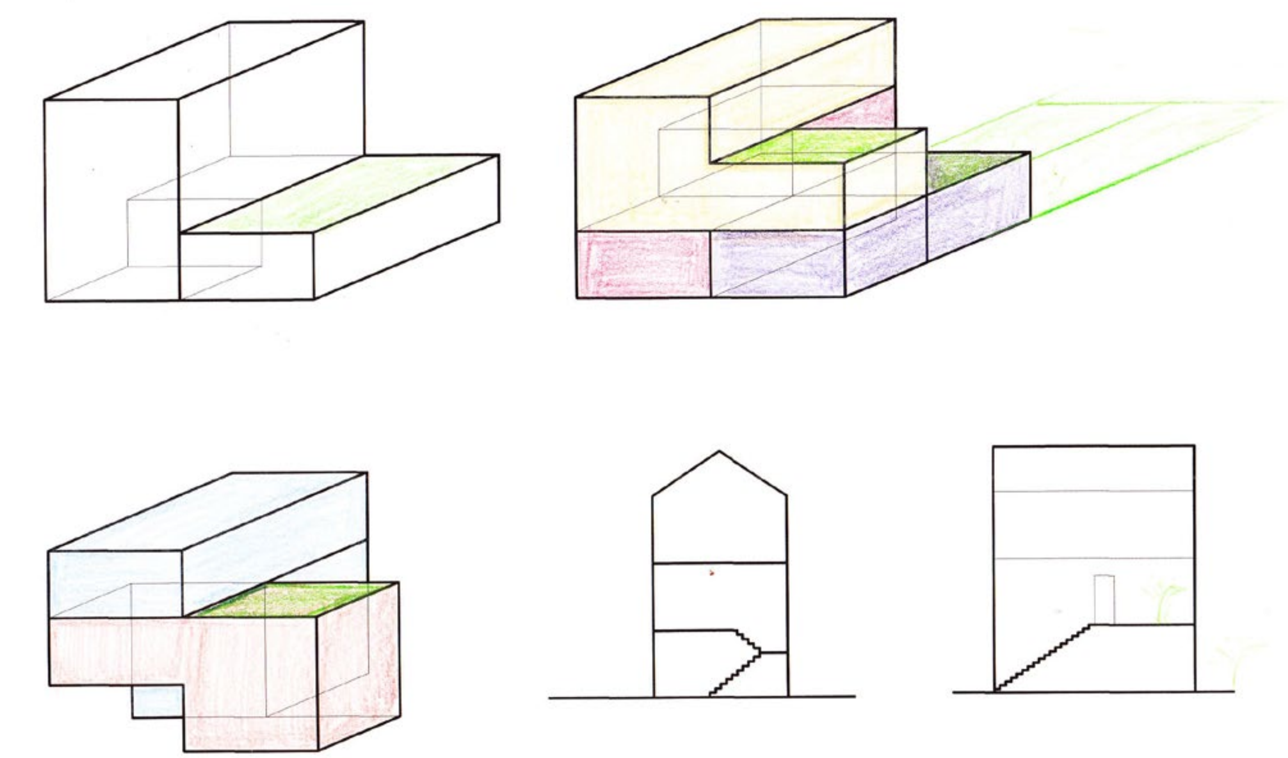
House Type: Young Single and Couple

SOHO

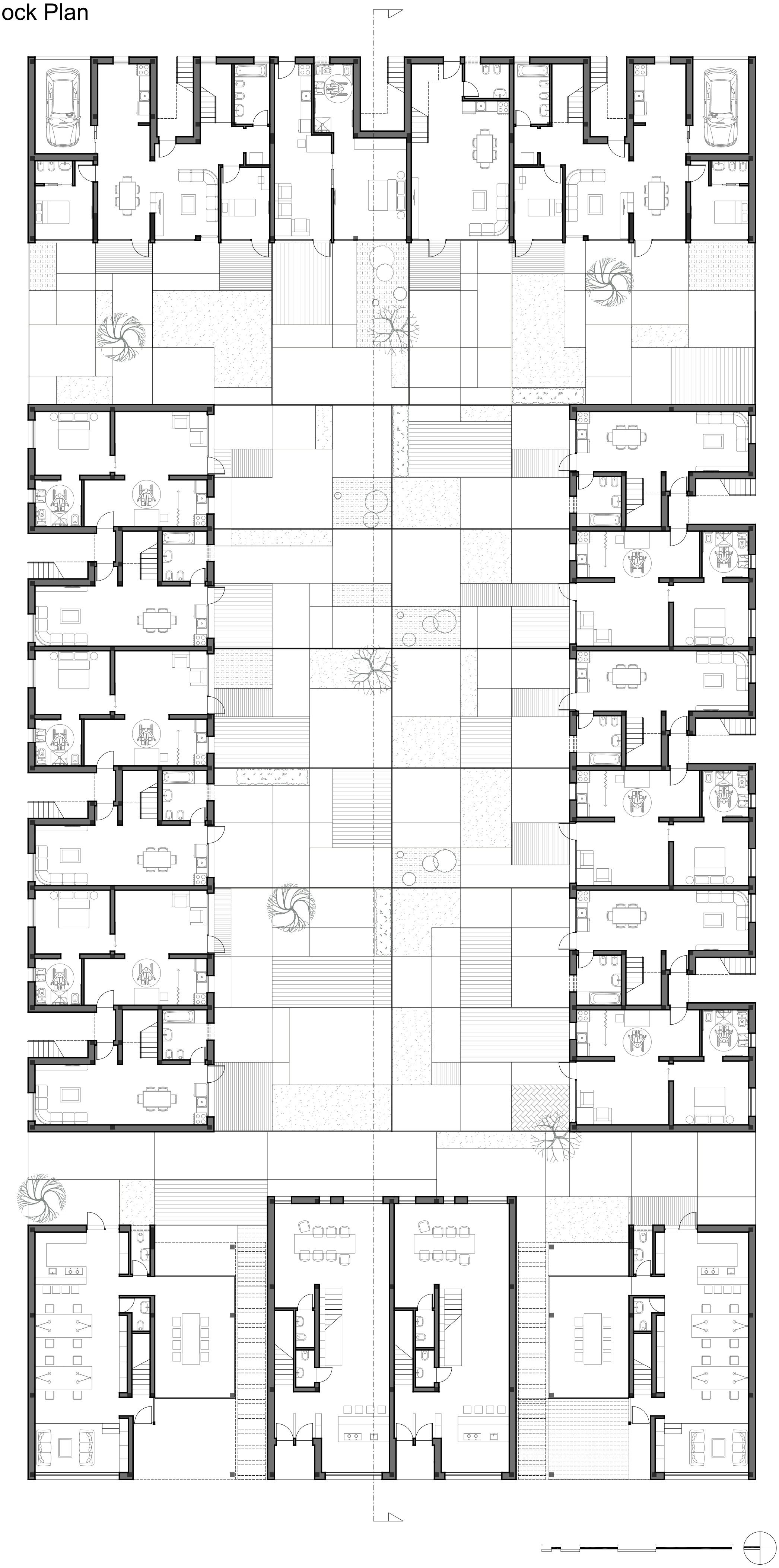
5.2 Architecture design

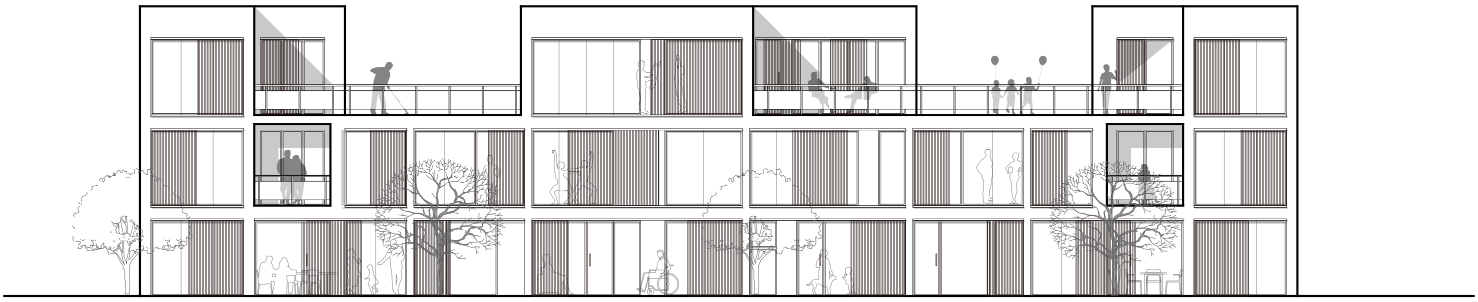
5.2.1 Concept

We take the block on the south corner to be our example to show our methodology for the whole community. As the competition requested, the whole community should have 150 apartments and the overall built area should be limited within 10400 square meters. After calculating the average area of each apartment and Gross Floor Ration, we conclude our average floor of each building is 2-3 floors, and the apearance of the housing type is more similar to Semi-detached House.
The main insist of our design is to provide each family, each apartment of this community a an open green garden and to interlink more than two apartments in each single unit to make opportunity for the residents to communicate and live a "green life".



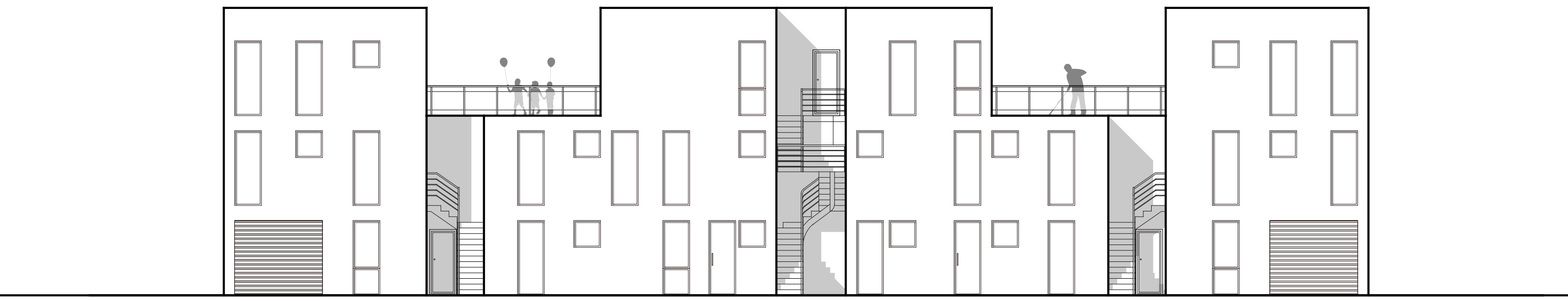
5.2.2 Block Plan





ELEVATION -SOUTH

north-row, seen from garden

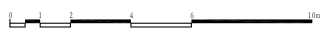


ELEVATION -NORTH

north-row, seen from street

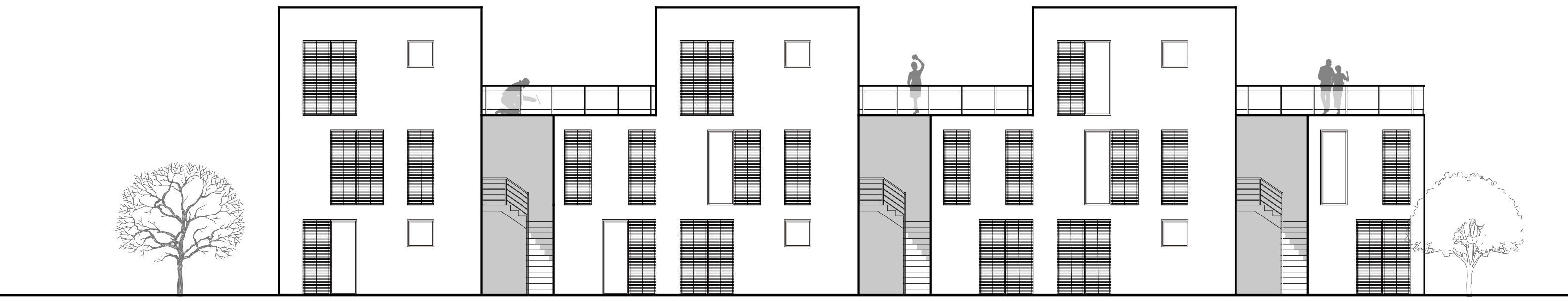
ELEVATION -SOUTH

south-row, seen from street

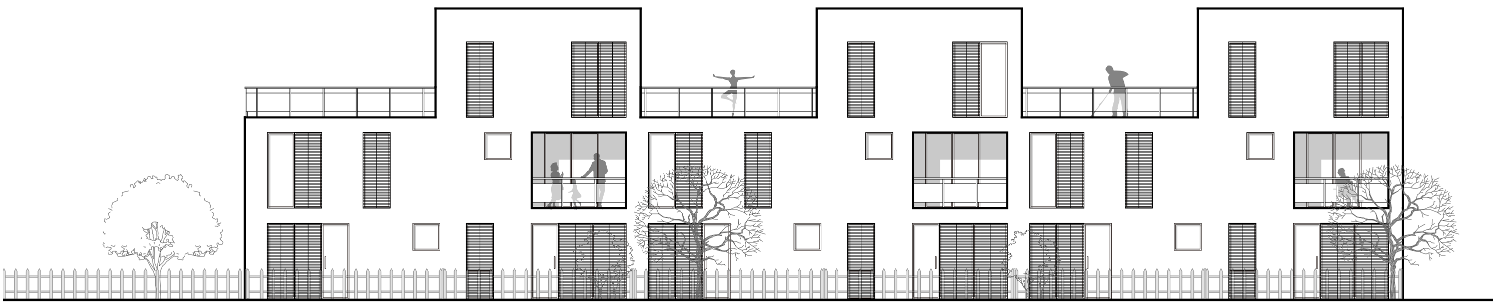


ELEVATION -NORTH

south-row, seen from garden

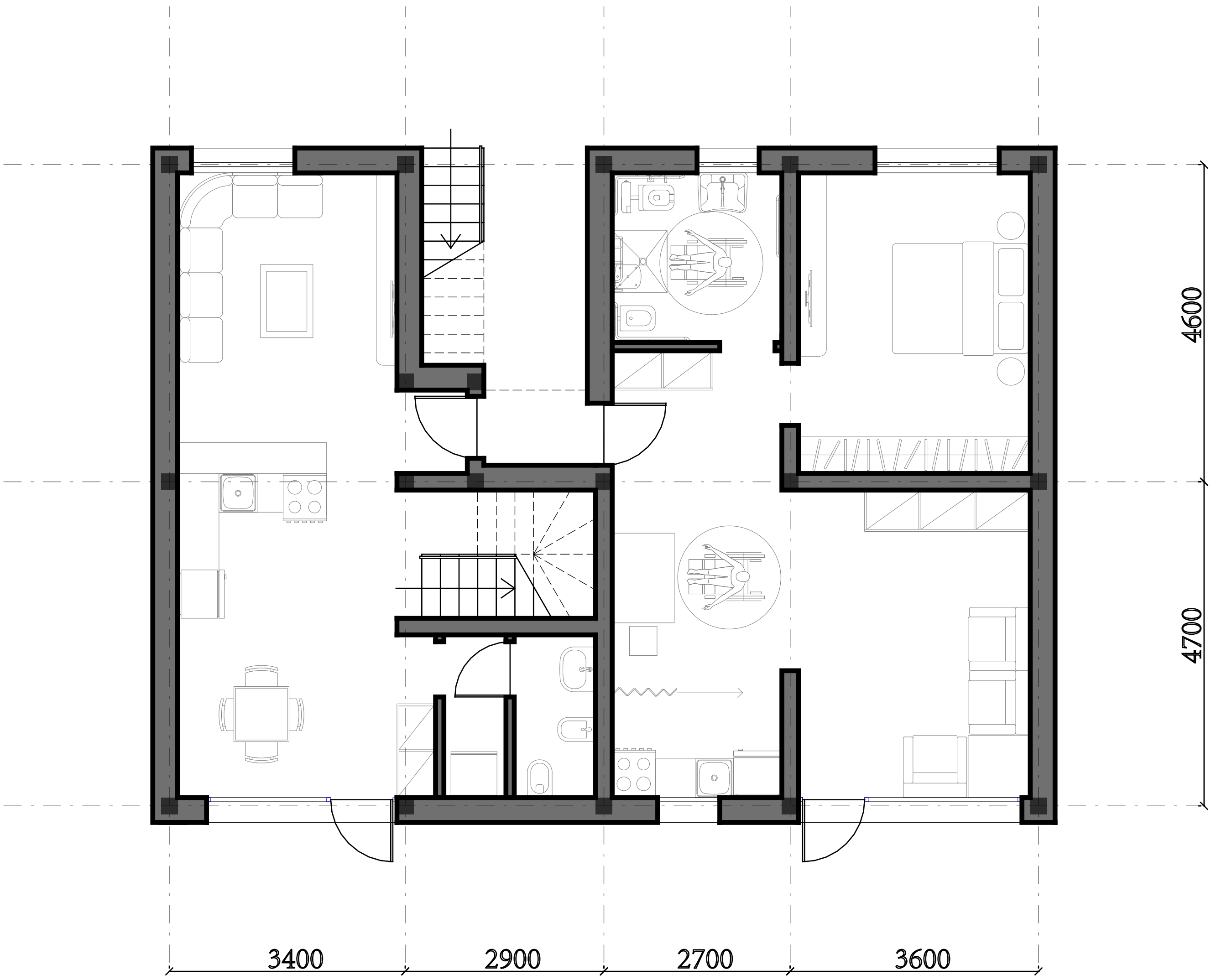


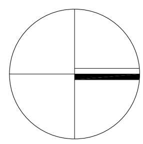
east/west row, seen from street



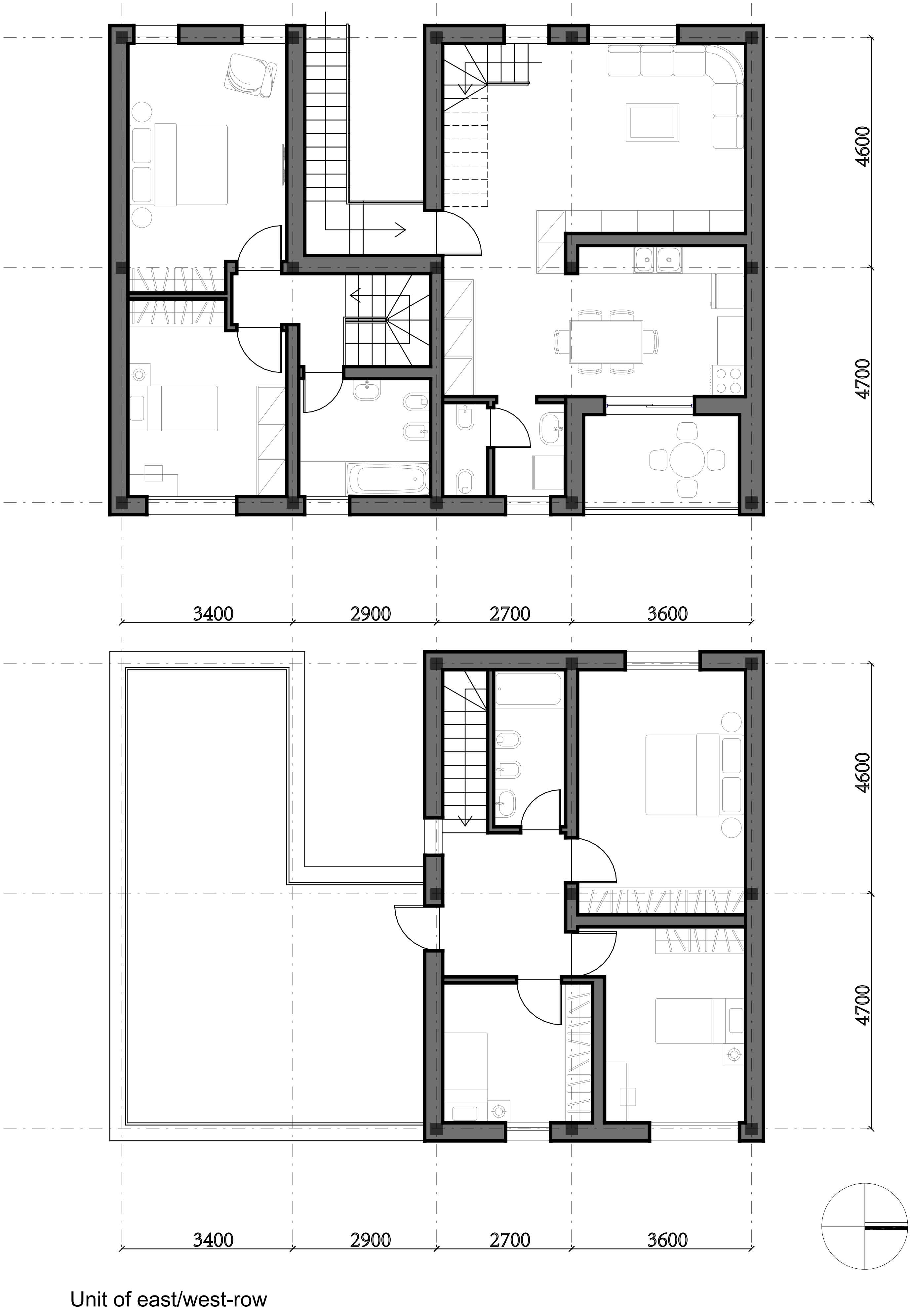
east/west row, seen from garden

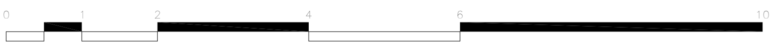
5.2.3 House Type, Drawings



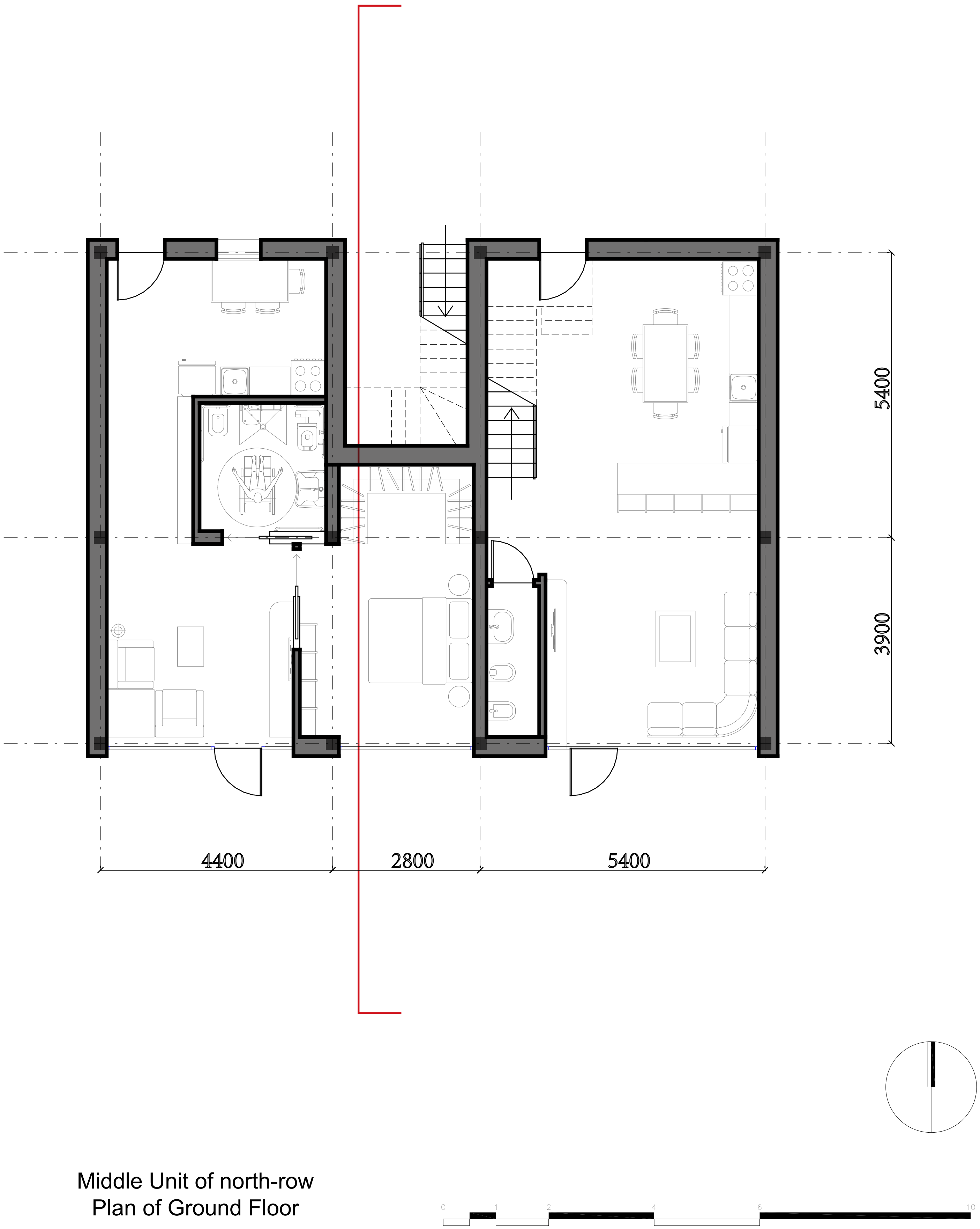


Unit of east/west-row
Plan of Ground Floor

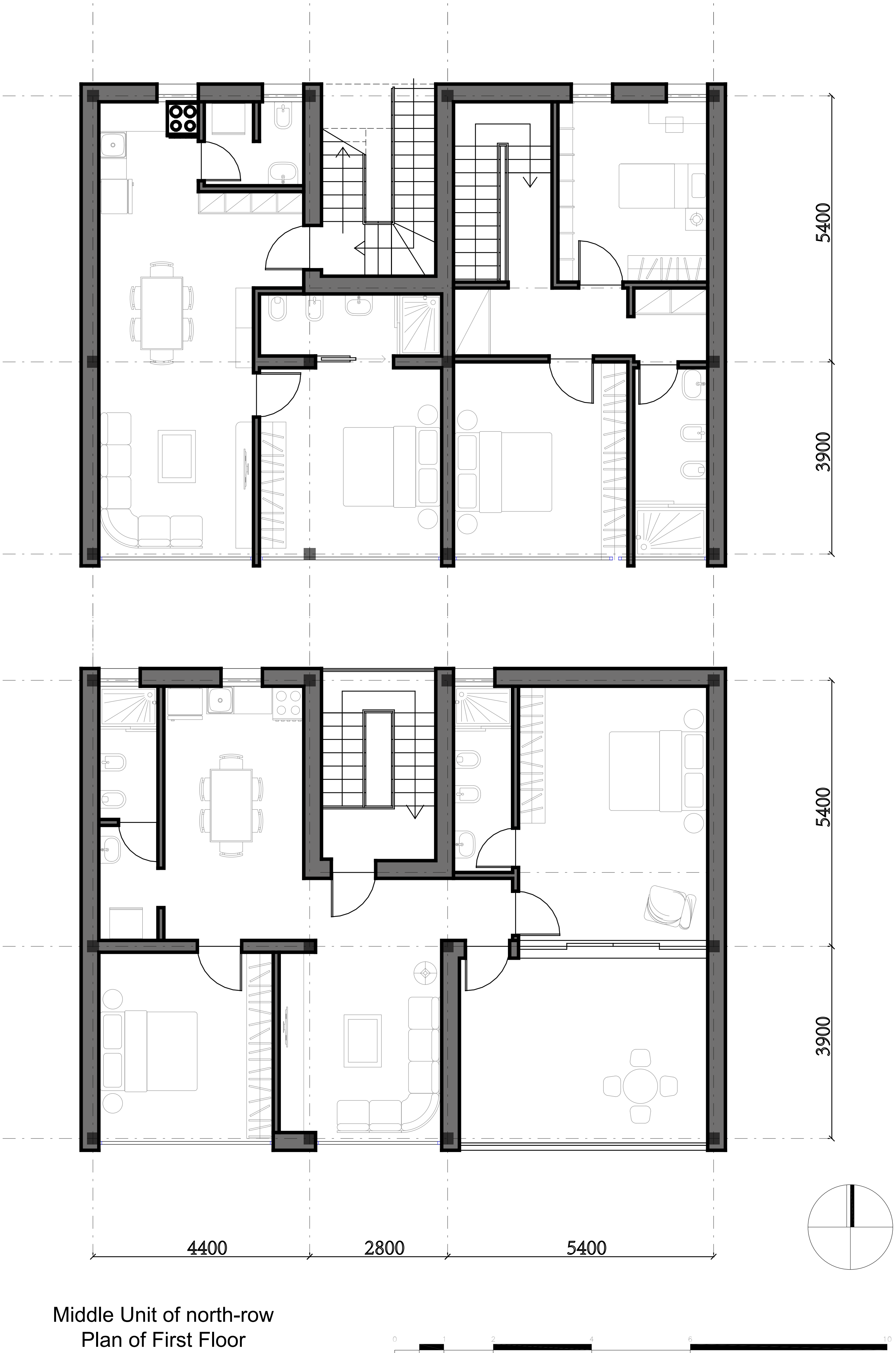




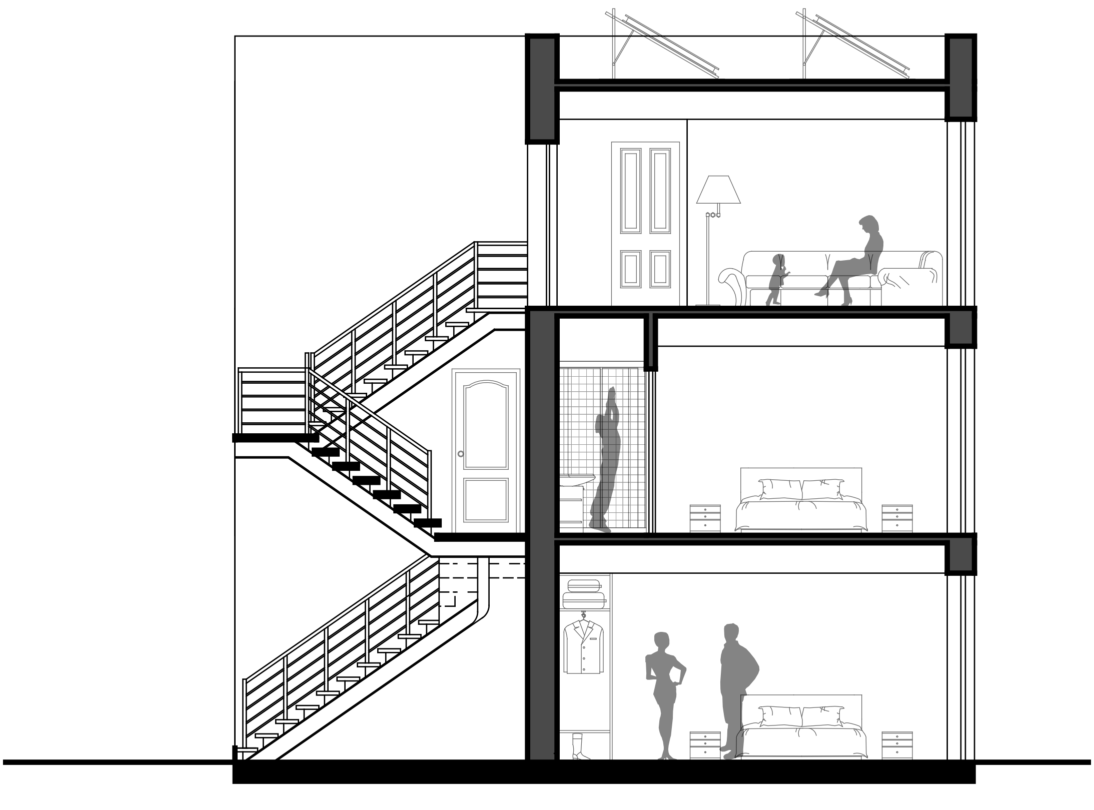
Unit of east/west-row
Plan of First Floor
Plan of Second Floor



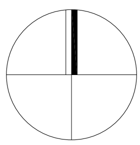
Middle Unit of north-row
Plan of Ground Floor



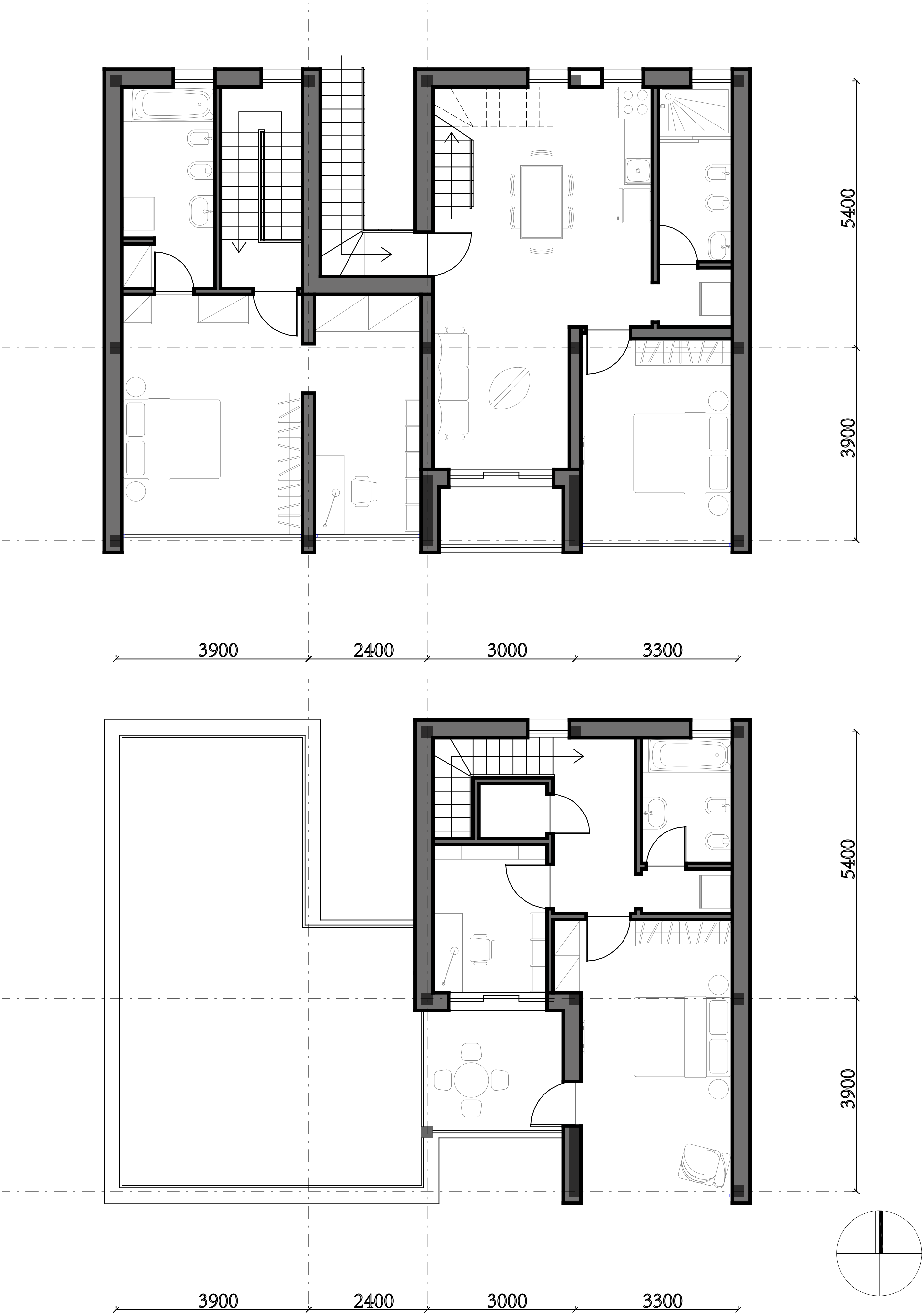
Middle Unit of north-row
Plan of First Floor
Plan of Second Floor



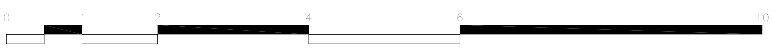
Middle Unit of north-row
Section

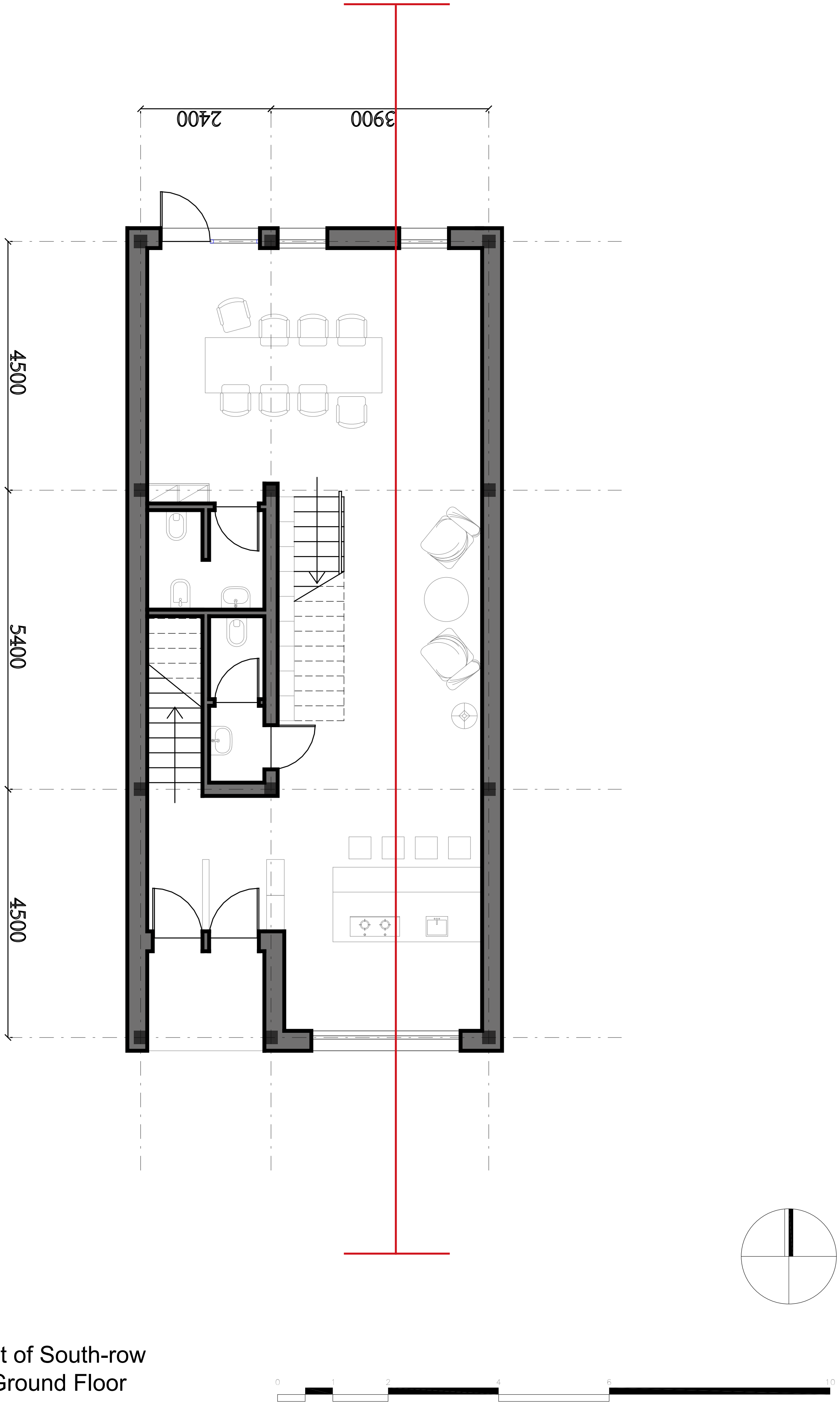


Side Unit of north-row
Plan of Ground Floor

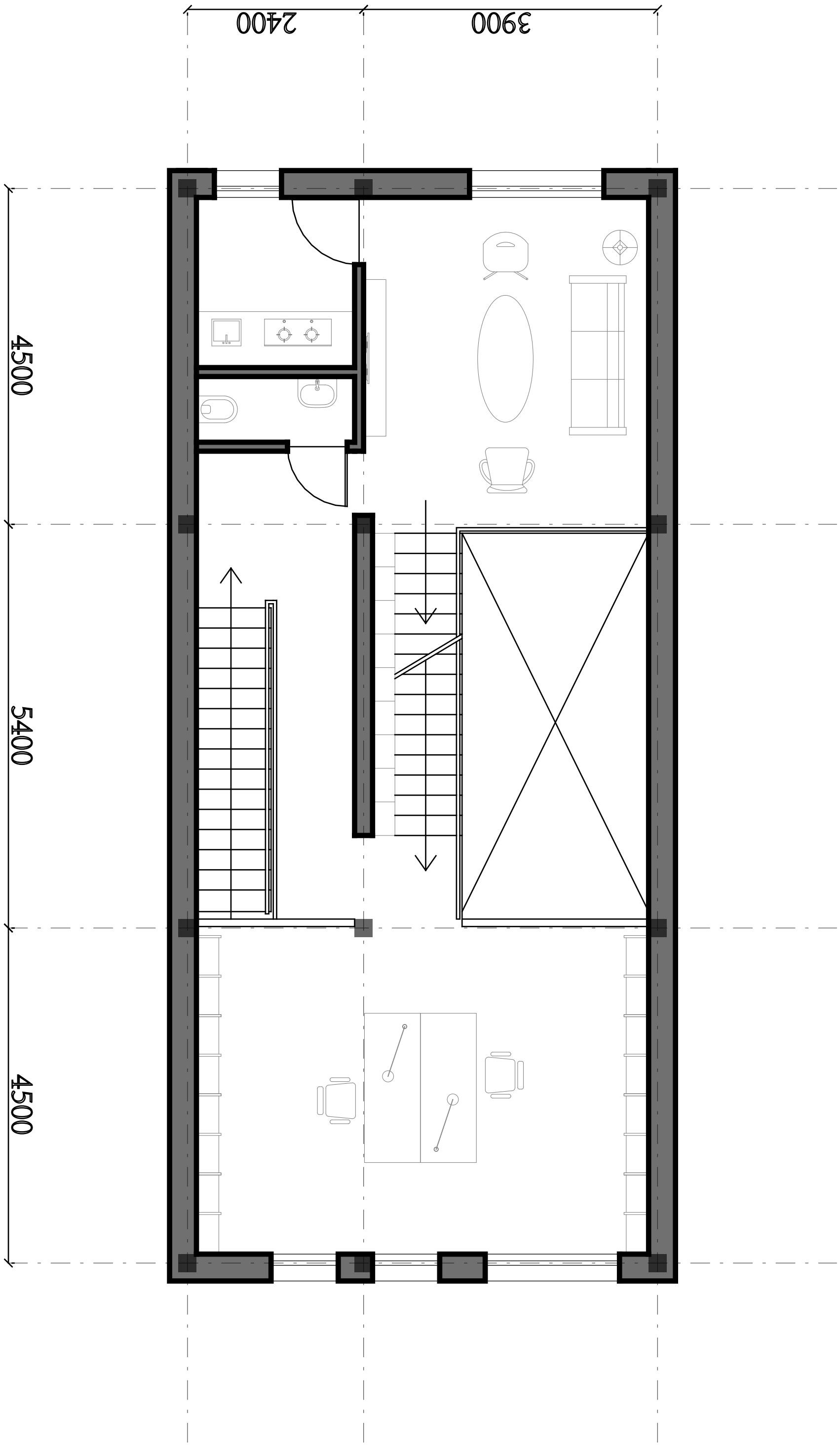


Side Unit of north-row
Plan of First Floor
Plan of Second Floor

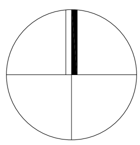


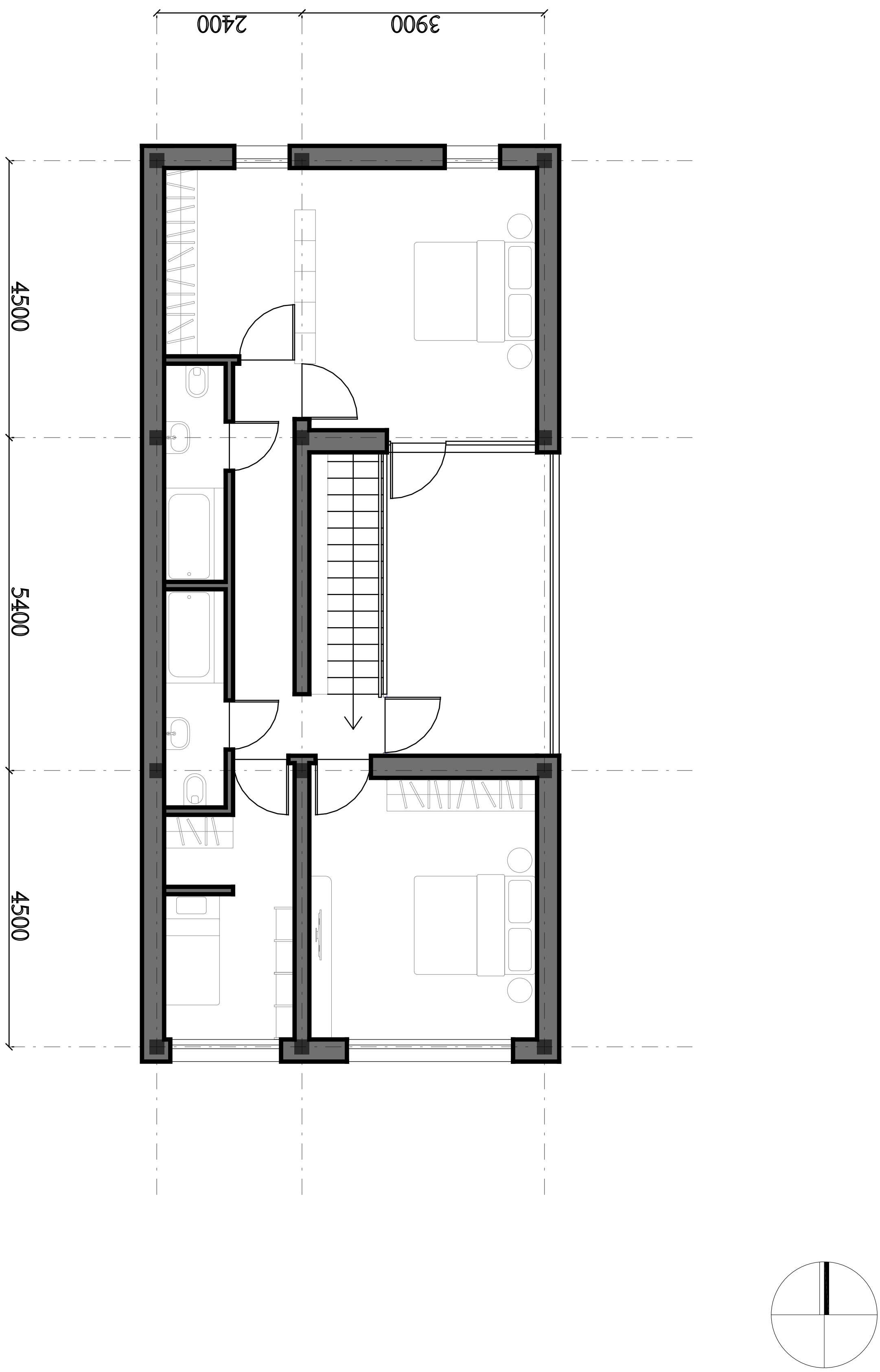


Middle Unit of South-row
Plan of Ground Floor

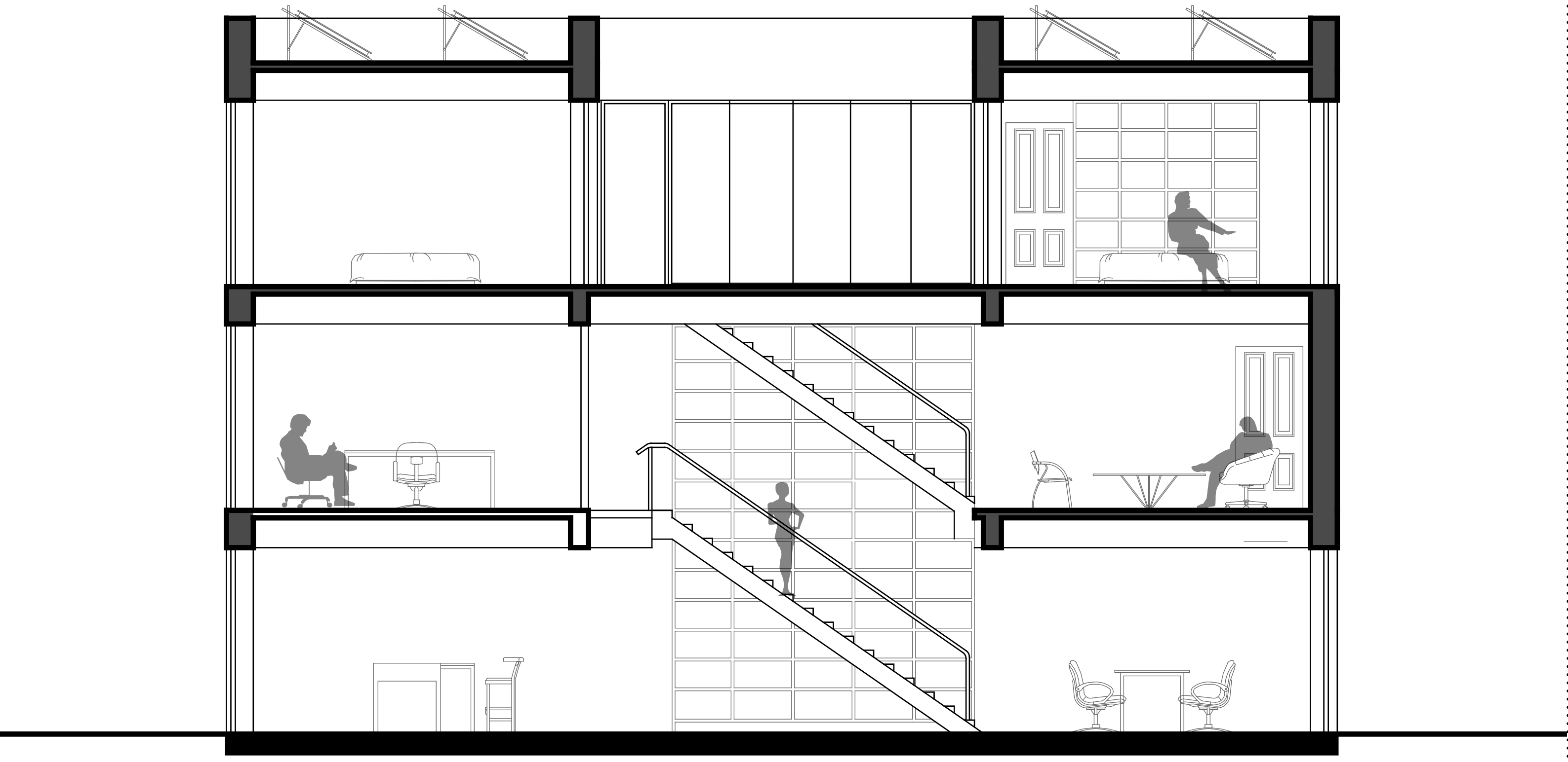


Middle Unit of South-row
Plan of First Floor

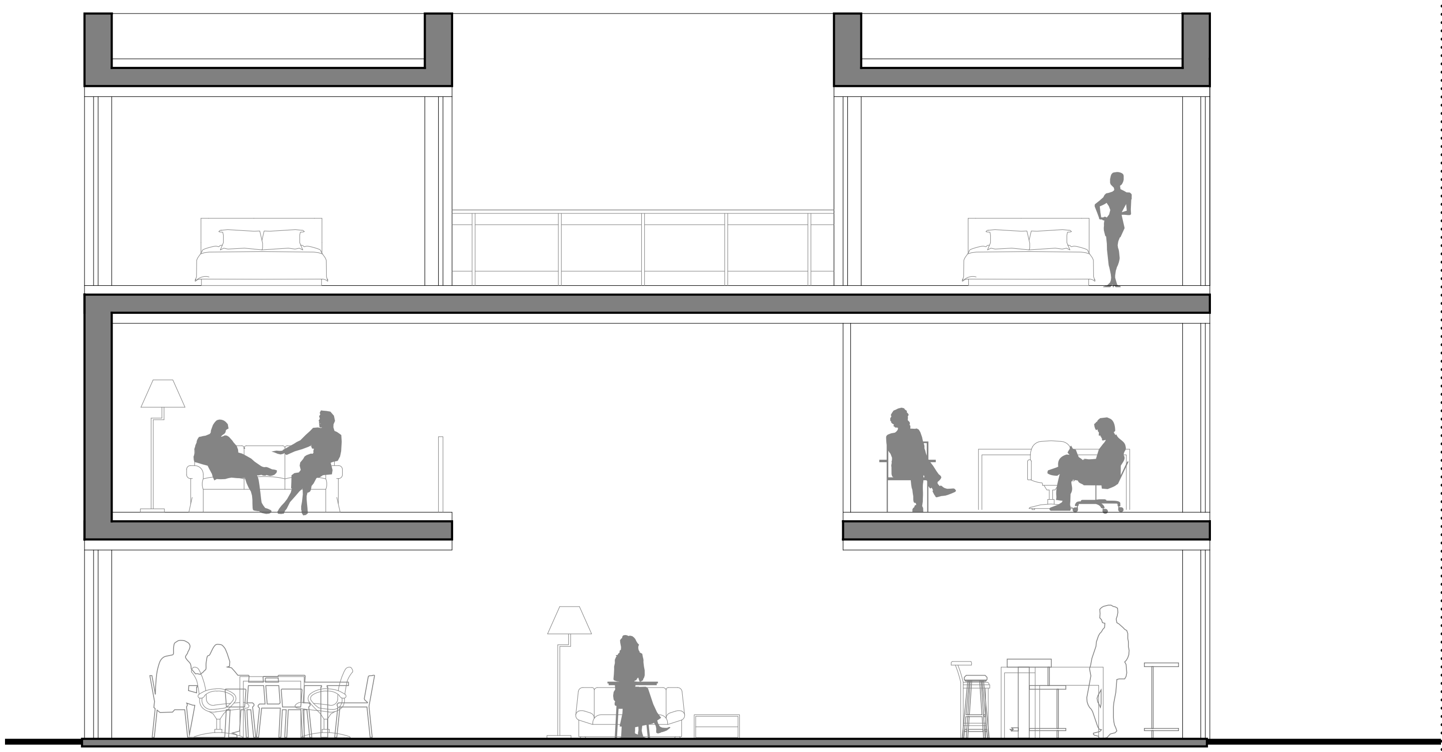




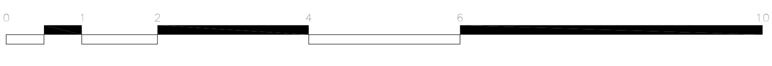
Middle Unit of South-row
Plan of Second Floor

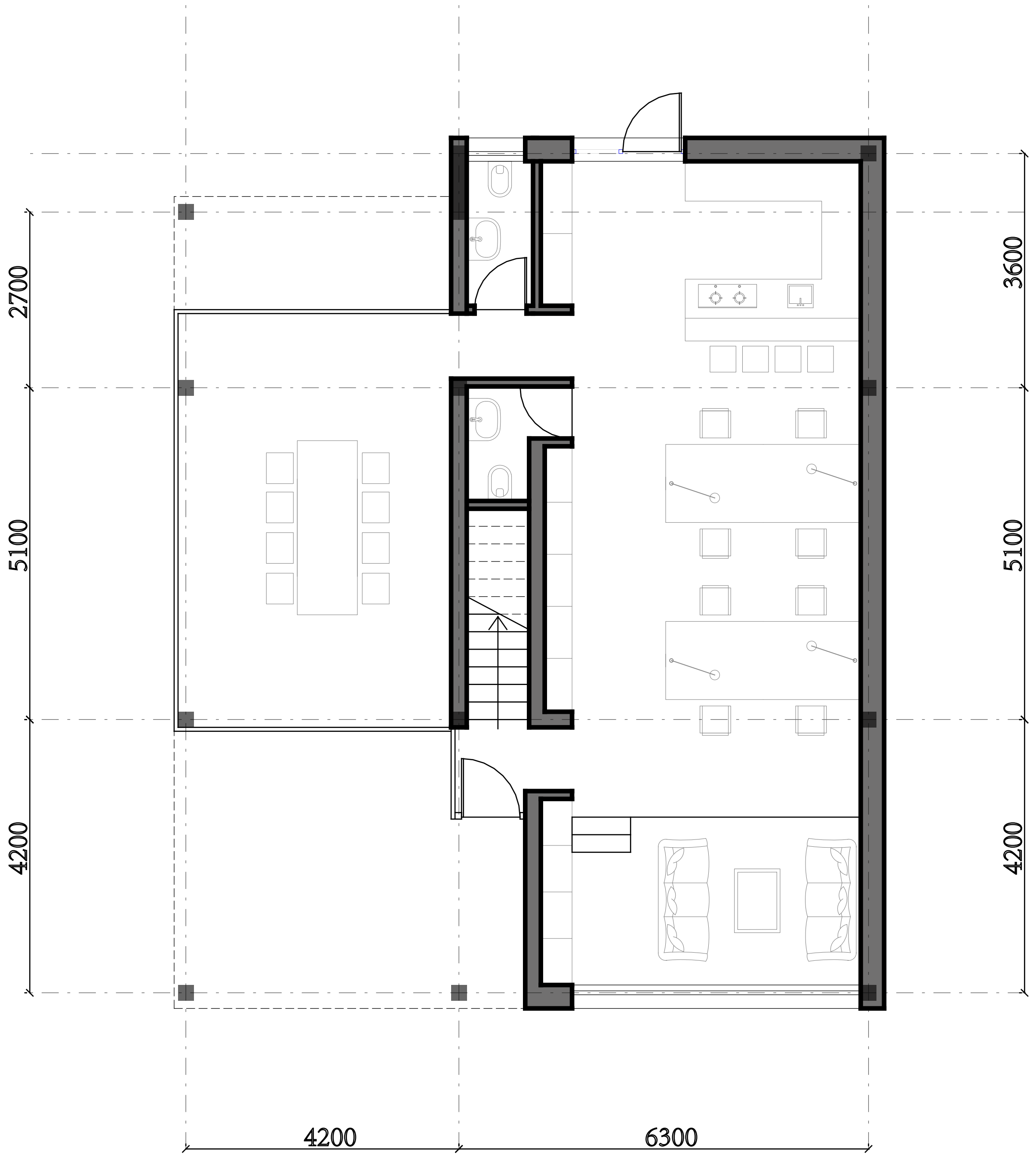


SECTION 1:100

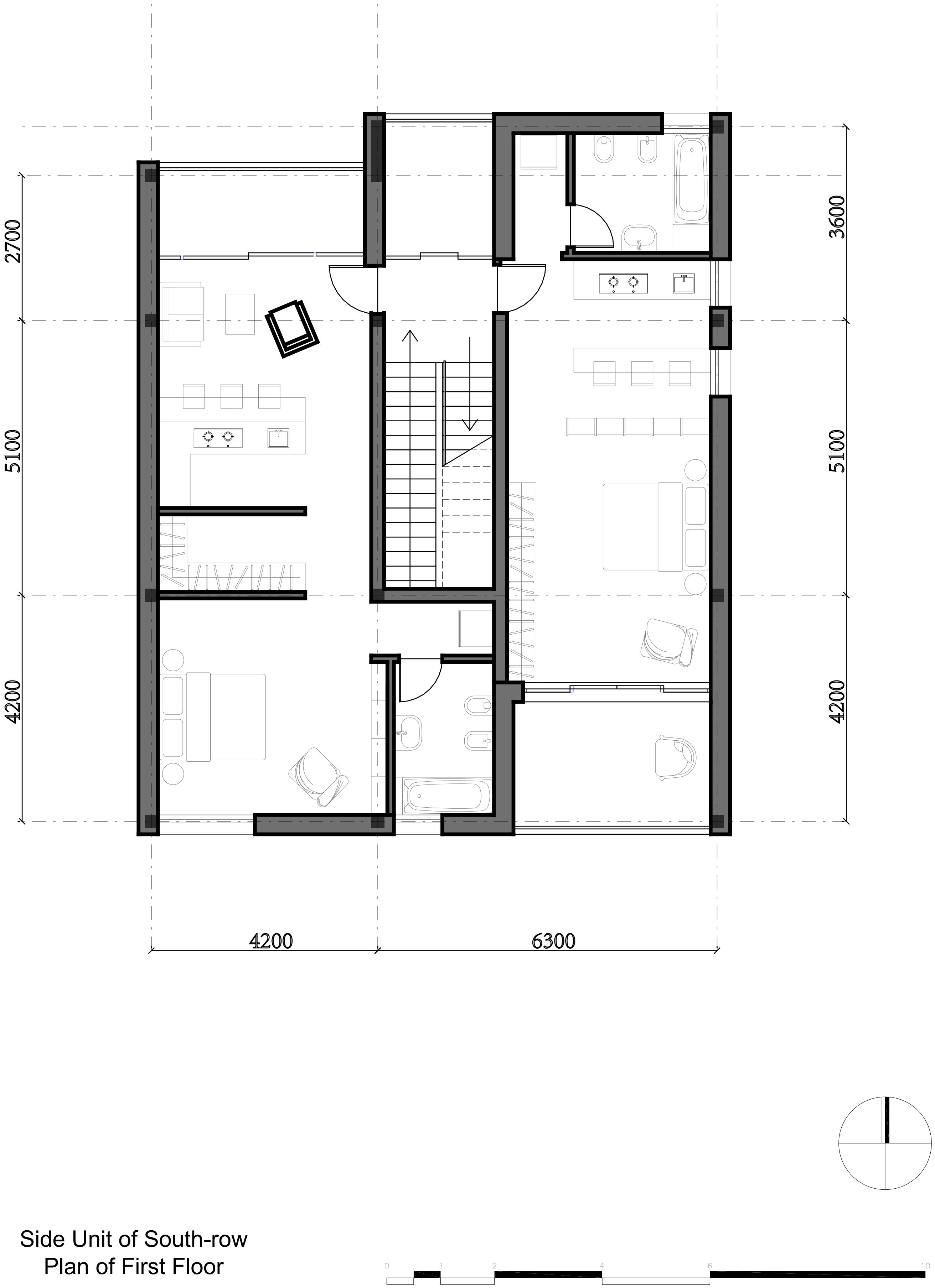


Middle Unit of South-row
Second

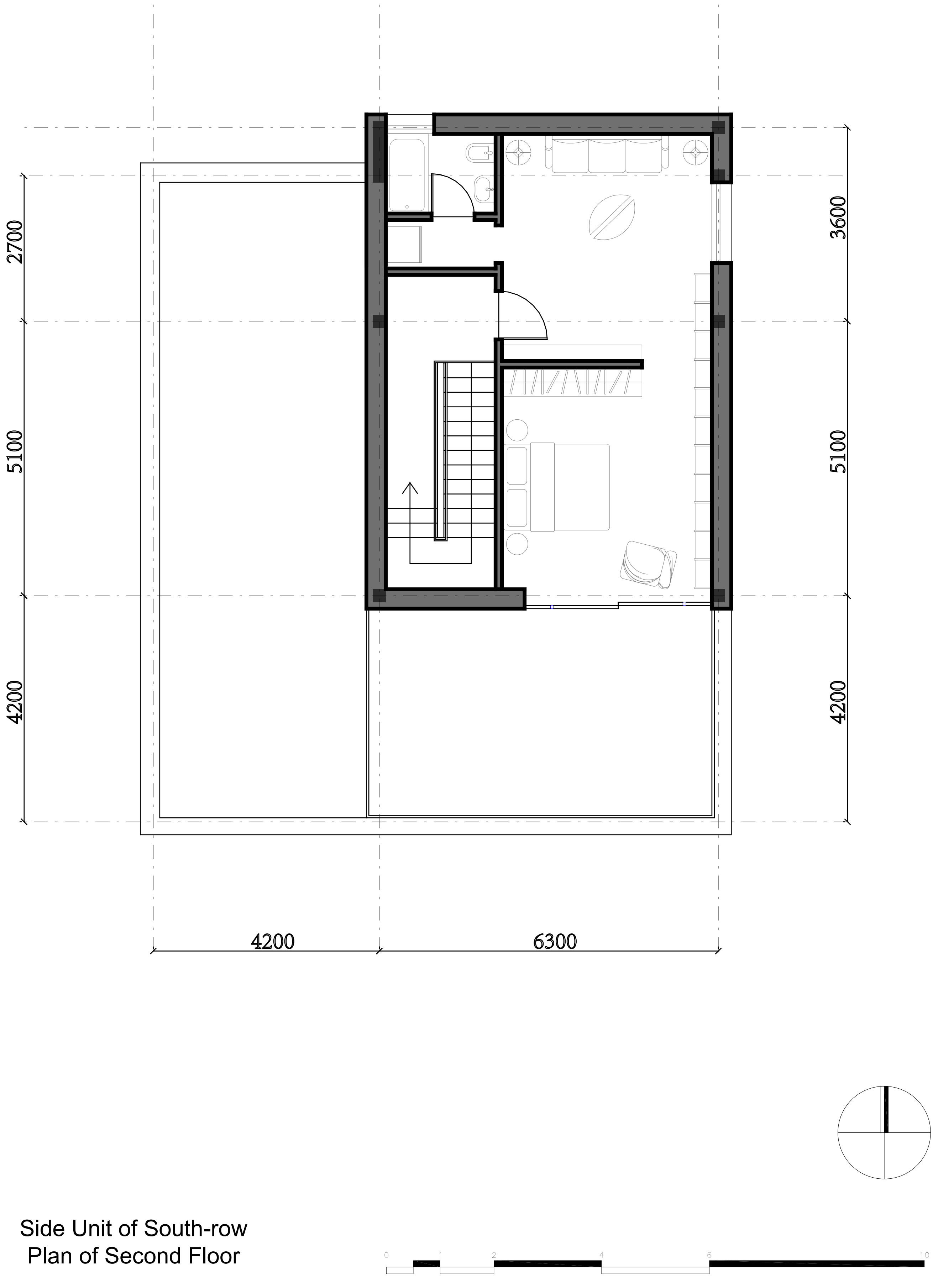




Side Unit of South-row
Plan of Ground Floor

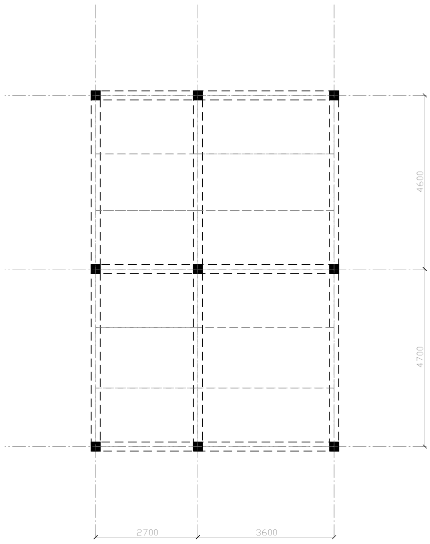


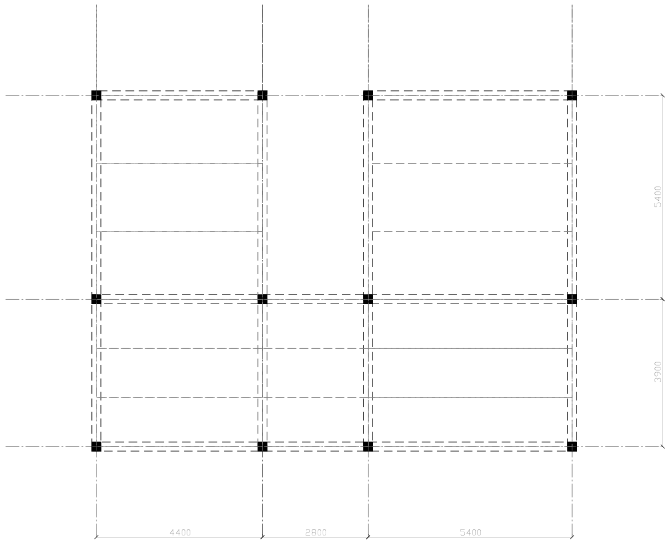
Side Unit of South-row
Plan of First Floor

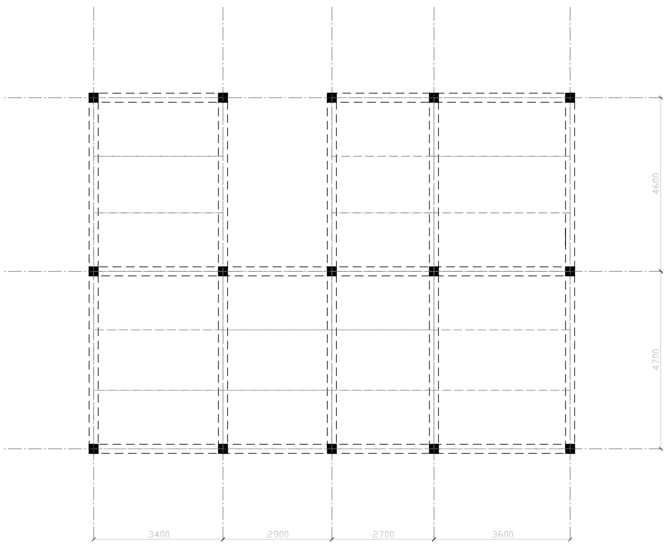


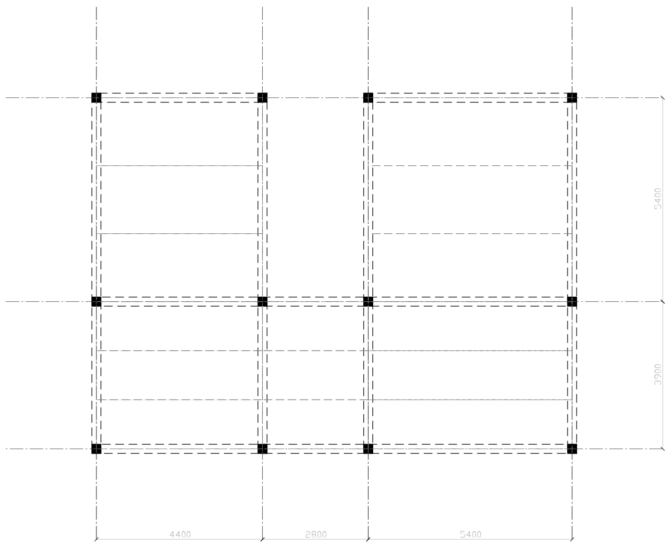
Side Unit of South-row
Plan of Second Floor

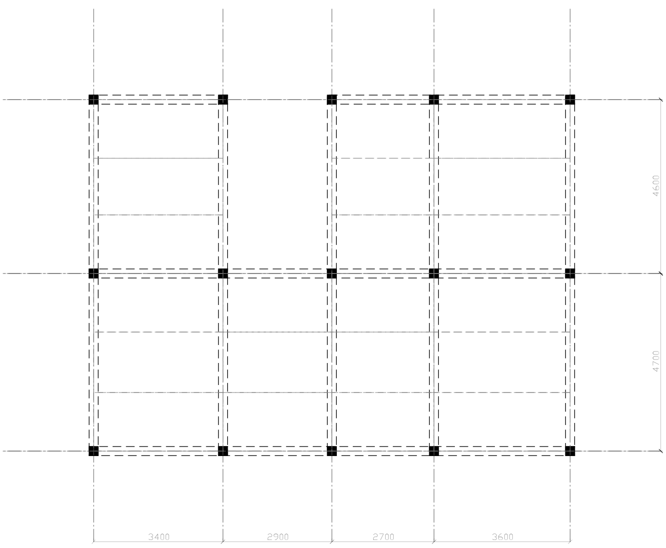
5.2.4 Structural Scheme

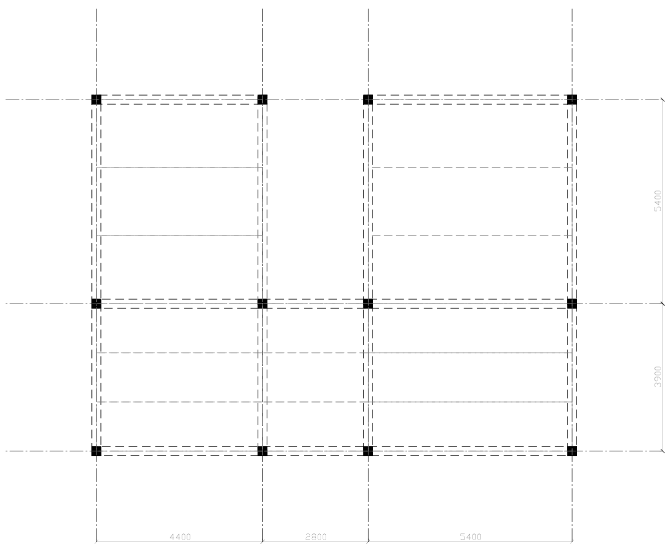






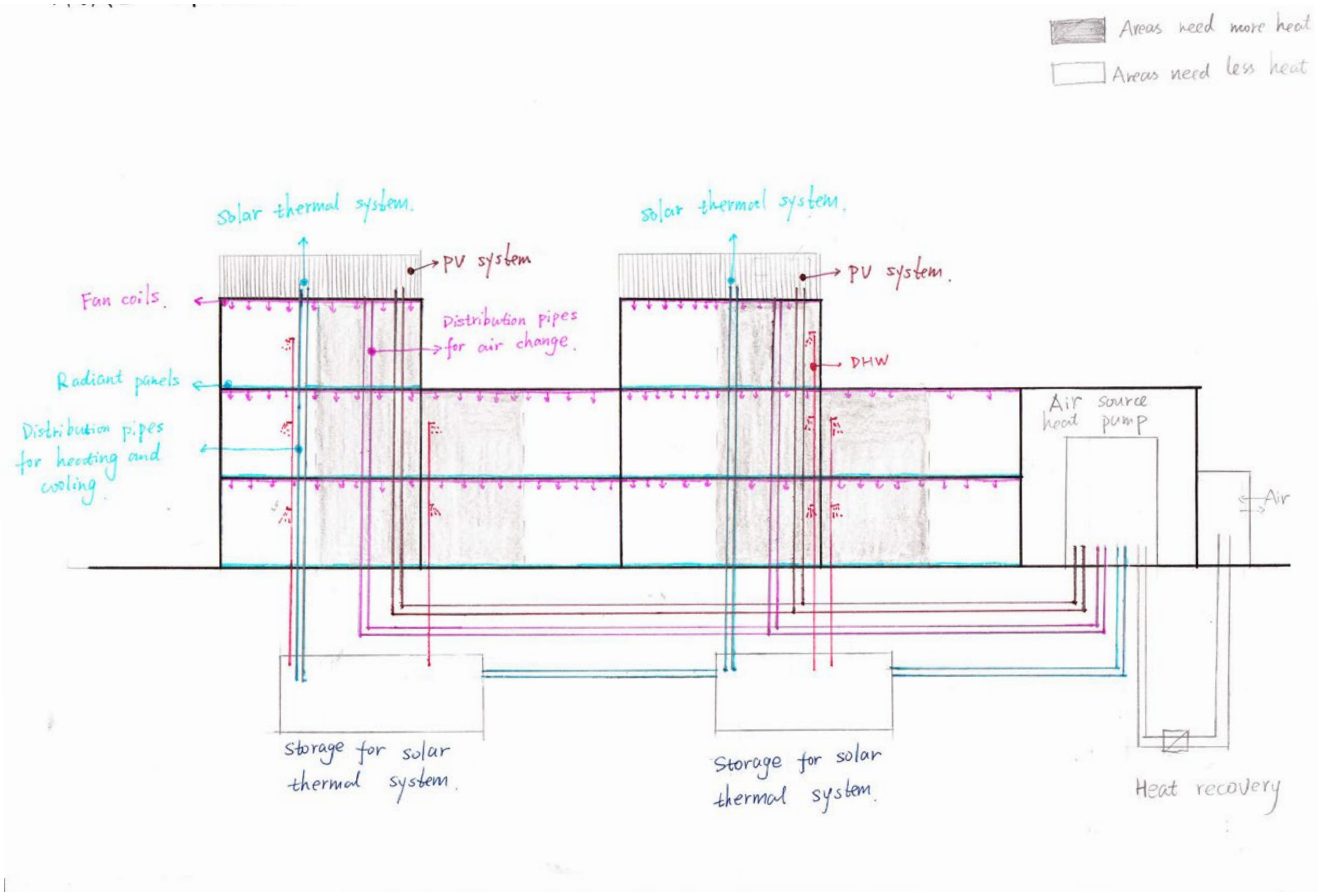




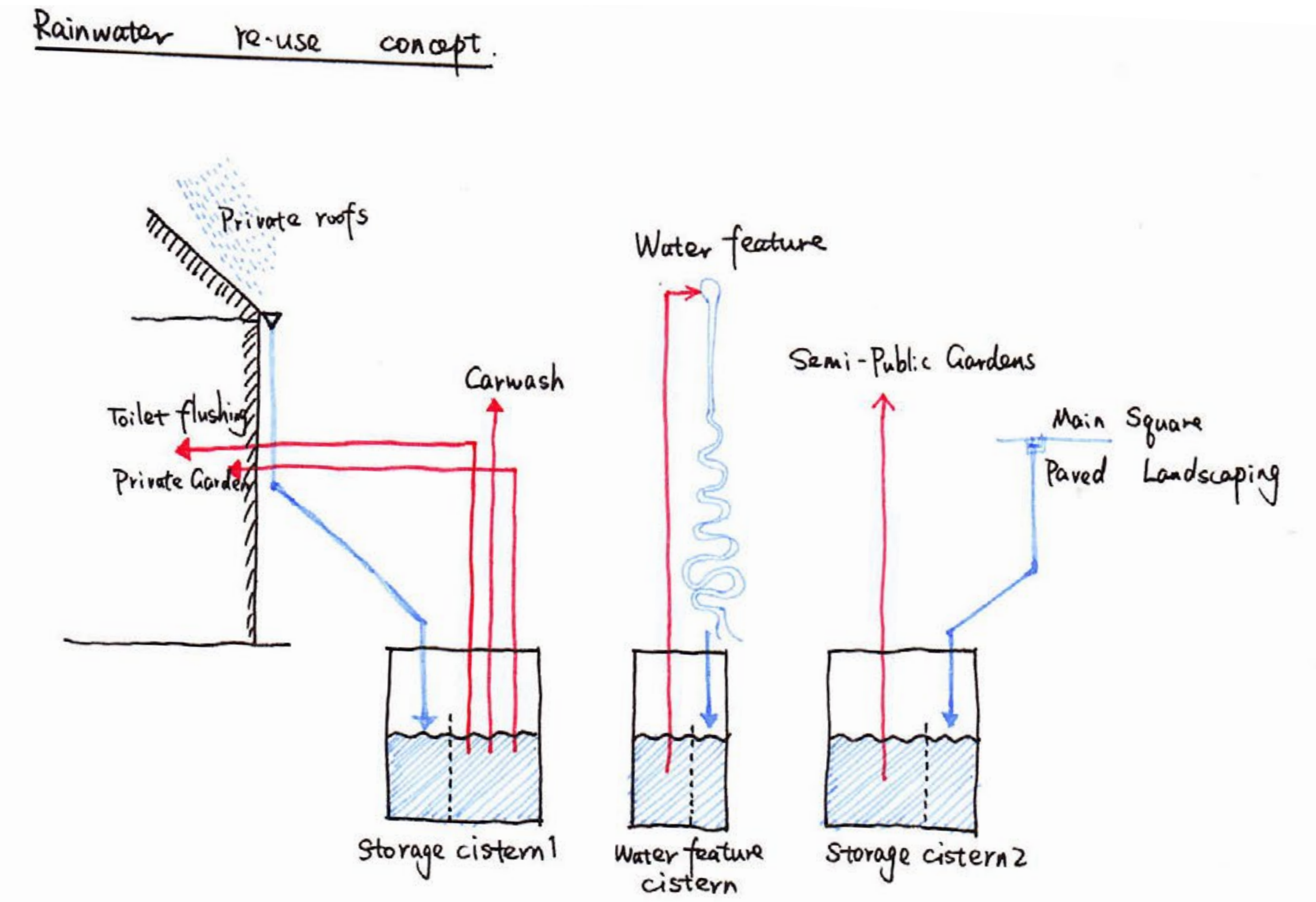


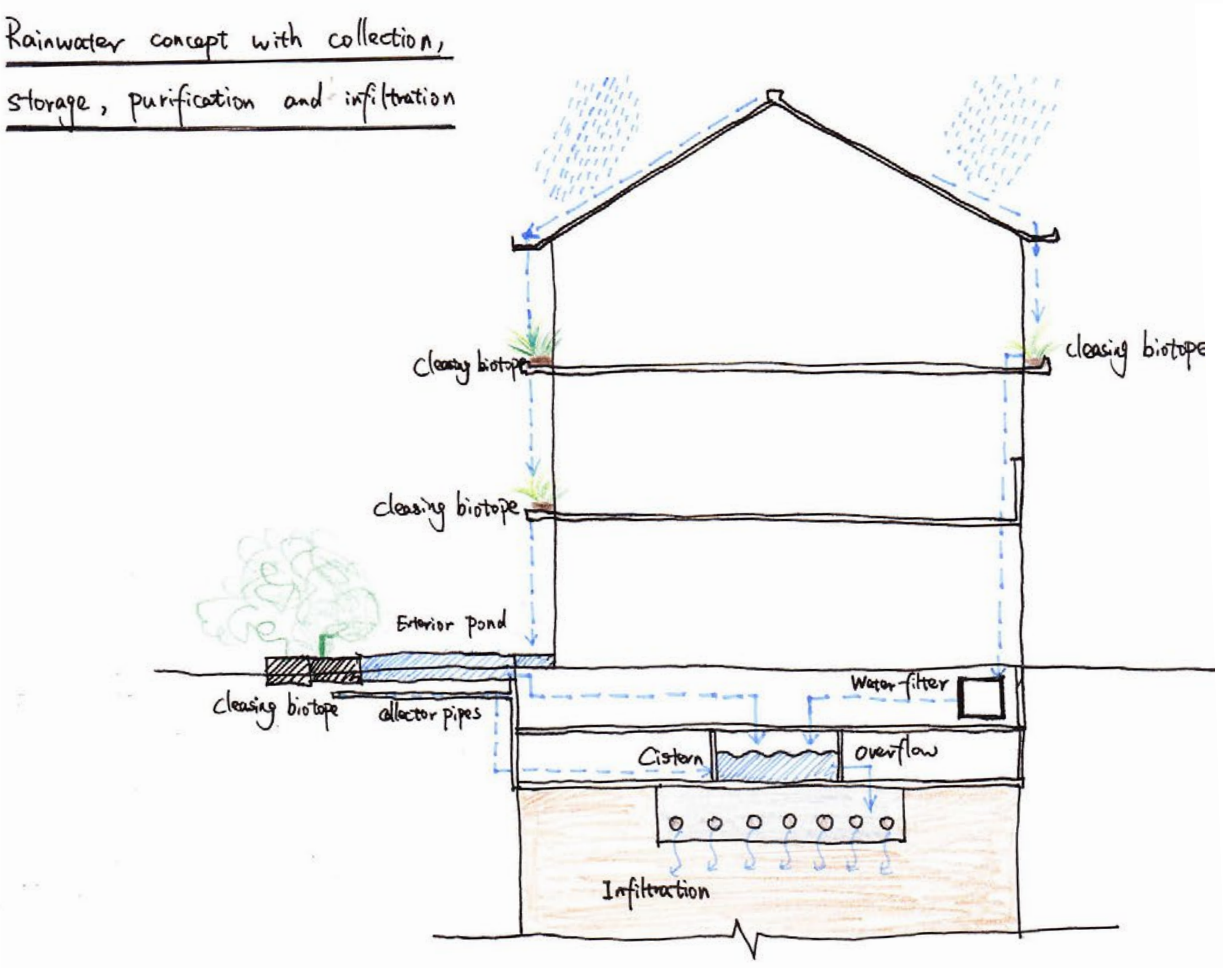
5.3 Building envelop (Transparent/Opaque Ratio**,** Materials and U value**,** Shading**,)**

5.4 Building services (Heating**,** Cooling**,** Ventilation**,** Air Conditioning**,** DHW)



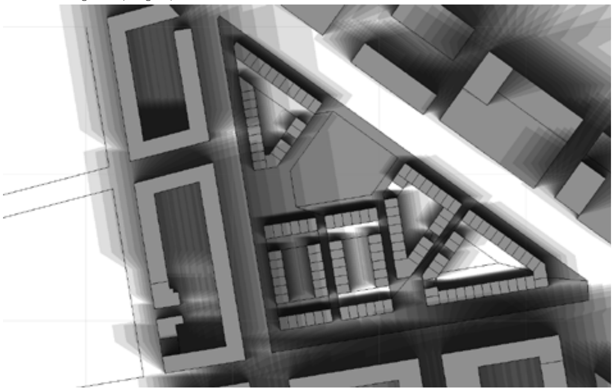
5.5 Recycle (rainwater**)**



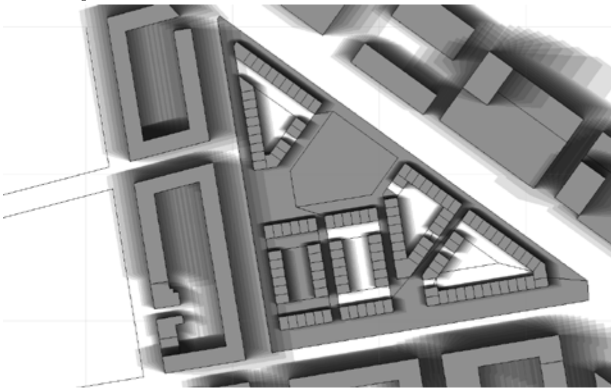


CHAPTER 6
BUILDING PERFORMANCE TEST
6.1 Daylight Factor

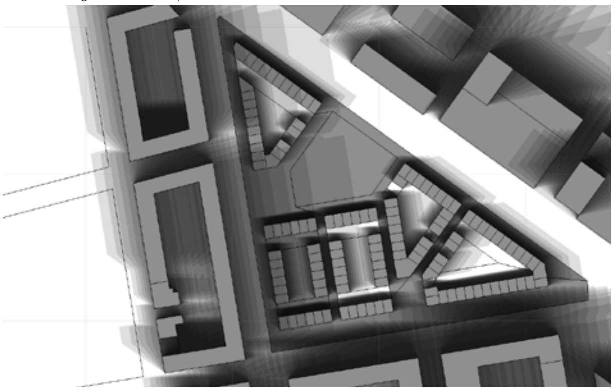
Shadow Range in Spring Equinox



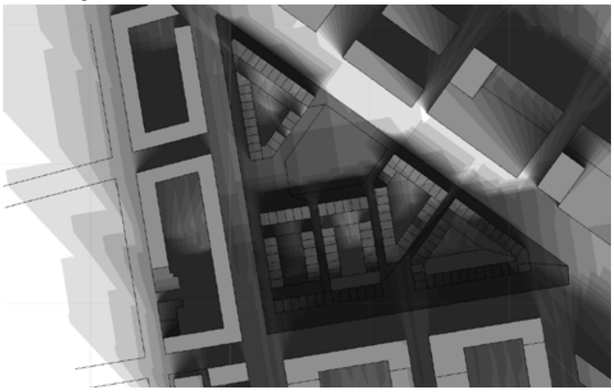
Shadow Range in Summer Solstice



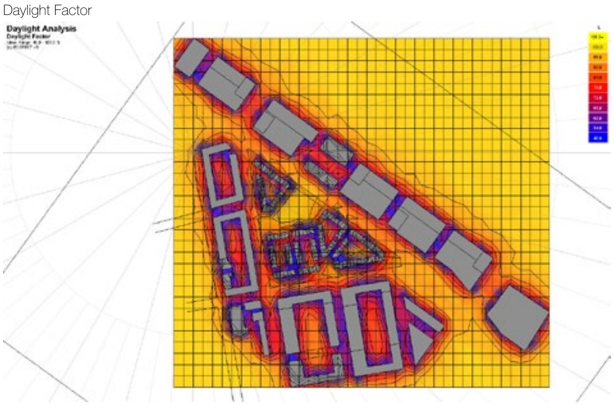
Shadow Range in Autumn Equinox



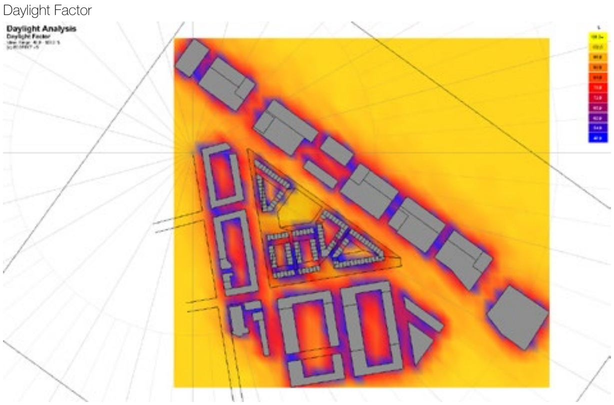
Shadow Range in Winter Solstice



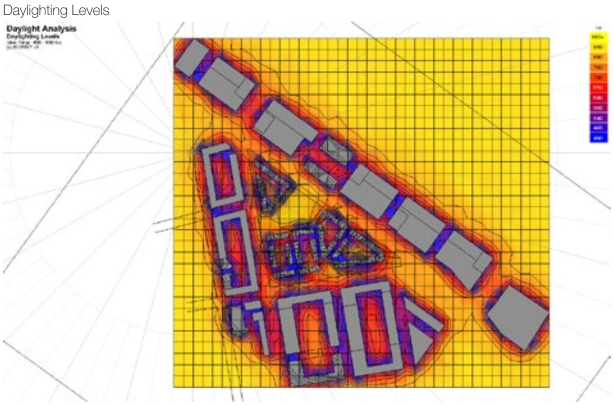
Daylight Factor



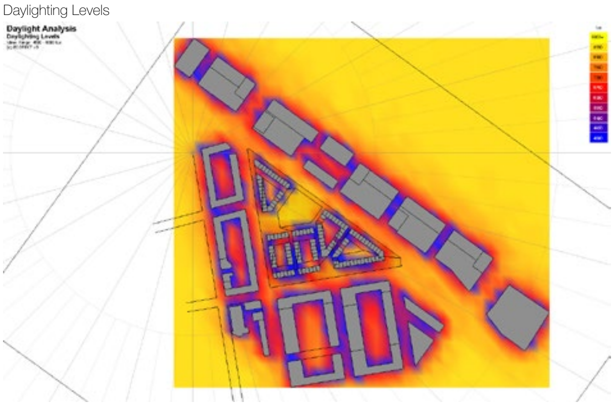
Daylight Factor



Daylighting Levels



Daylighting Levels



BIBLIOGRAPHY

David Rudlin & Nicholas Falk, *Building the 21 century home: the sustainable urban neighborhood*, Architectural press, 1999.

Douglas Farr, *Sustainable urbanism: urban design with nature*, J. Wiley & Sons, 2008.

James Steele, *Sustainable architecture: principles, paradigms, and case studies*, McGraw-Hill, 1997.

Gerhard Hausladen, *Climate design: solution for buildings that can do more with less technology*, Birkhäuser, 2005.

Aurora Fernández Per, Javier Arpa. - Vitoria-Gasteiz, *Density projects: 36 new concepts on collective housing*, a+t ediciones, 2007.

Aurora Fernández Per, Javier Arpa. - Vitoria-Gasteiz, *HoCo: Density Housing Construction & Costs*, a+t ediciones, 2009.

Arc en rêve centre d'architecture, *New forms of collective housing in Europe*, Birkhauser, 2009.

Christian Schittich (Ed.), *In detail: Semi-detached and terraced houses*, Birkhäuser, 2006.

Hegger, *Energy manual: sustainable architecture*, Birkhäuser, 2008

Herbert Dreiseitl, *Waterscapes: planning, building and designing with water*, Birkhäuser, 2001

Adam Ritchie, Randall Thomas, *Sustainable urban design : an environmental approach,* Taylor & Francis, 2009

Gabriele Tagliaventi, Luigi Mollo, *Ecological urban architecture,* Alinea, 2005

WEB SITES

http://www.gis-mannheim.de/mapserver_mann/index.php

http://maps.google.com/