
Improving living quality in Old Mamelodi

The design for a working / living unit



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Date: 6 January 2005

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Preface

Pretoria, January 2005

In the way of innovation projects within the Hogeschool van Utrecht a mandate of the Faculty Science & Technology, Department of the Built Environment, the project (re)search for sustainable urban development in South Africa has been set up. The project is a student exchange project between the Hogeschool van Utrecht and the Tshwane University of Technology in South Africa. The students have to do research for their studies: Building Engineering, Urban Design and Business Engineering.

This is a report with the theme People-Planet-Profit – (re)searching for sustainable urban development. Topics include large scale spatial development in South Africa, new settlements on the edges of cities and residential developments on seemingly unsuitable sites. The broad aim is the same as for the minor programme to be simultaneously conducted in the Netherlands: sustainable urban development in the broadest sense.

The research takes place in Mamelodi, a township in East Pretoria, capital city of South Africa. It takes place between the 12th of September 2004 and the 16th of January of the year 2005.

The subject of research for this report is not a separate assignment. It is just a small part of a five year during research for improving the living quality in Mamelodi. The group where I am in is the first group who participates in this overall research. We are called “The Pioneers”.

The project is split in blocks of between four and six month's research and divided over a group of about twelve people. The project “Living in Mamelodi” has been split in three main assignments which will be fulfilled by three groups of four students.

The workgroup I participate in is R.E.M.P. In this group I had my own share in a bigger assignment about Old Mamelodi. I used some research carried out in the R.E.M.P. project to apply in this research project. The typologies and urban planning developed in the R.E.M.P. research, are recommendations for this project. That is why I am able to substantiate my research.

So in a short period of time I did not only carry out my graduation project, but I did also participate in a minor. The group of students is composed of third and fourth year, graduation-, practical- and minor students from different disciplines. Building engineering, urban planners and business engineers are included in the workgroup.

I am studying building engineering at the Hogeschool van Utrecht. I am in my fourth and final year and the report is about my graduation project. Before the HBO I studied for four years at the MBO building engineering. Between the MBO and the HBO I worked for a year as a draftsman, calculator and building physical at a building consultancy firm at the same time going to evening classes to get the right level of mathematics and physics degrees.

My interests are very wide. That's why I have chosen a liberal set of course options to give me the best possibilities when I have finished my studies. Because of my personal interest in architecture I chose that as my second differentiate.

I signed up for this abroad experience to educate myself in personal, technical and social fields. I saw this assignment as an "once in a lifetime" opportunity. It has been a long desired wish to work abroad and I was curious if I could handle the challenge. I wish to help making the living conditions of the residents of Mamelodi a bit more human.

Acknowledgements

My special thanks go out to the following people, who generously shared their knowledge with us and helped us gathering the information. These people made it possible to carry out the research:

- The Pioneers, the other students who participate in the minor.
- R.E.M.P., the workgroup I participated in.
- Jonathan Mokgalaka, communication worker for the government of South Africa.
- Tebogo Zwane, official guide of Mamelodi.
- Leon de Klerk, freelance project developer and member of the ANC party, Mamelodi expert
- Mauritz Naudé, bound to the National Cultural History Museum
- Francois van der Walt, student of architecture at the University of Tshwane
- Bouwer Daniel Serfontein, student of architecture at the University of Tshwane
- Gerald Steyn, head research of the Tshwane University of Technology.
- Frank Foole, graduation coach of the Hogeschool van Utrecht.
- Ellen van Keeken, supervisor of the Hogeschool van Utrecht.
- All the people that are involved in and helped us with our research.

My special thanks go out to the Tshwane University of Technology and the Hogeschool van Utrecht for giving us the opportunity to make this research and giving their full cooperation.

P.J. van Antwerpen

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Summary

Problem definition

Because of the shattered growing of the area, Old Mamelodi is spread. The distances between living units and work, school, and other amenities are great what makes for a lot of travelling time. The quality of the dwellings that people live in is low. The surrounding area people live in is unsafe. There are little amenities and no places for safe socializing or for children to play because of crime and unsafe traffic situations. There is a lack of community spirit.

Research aim

The research aim for this report is to design a building that integrates living, work and other amenities. With some adaptations in the design of the building it is possible to create for the residents of the building their own private space where they can recreate, practice a sport and socialize.

The aim is also to make the building and the surrounding area safer and to give the population the opportunity to form a community. It will be striven for to adapt the urban plan and infrastructure in such a way as to make for a safer area for residents, pedestrians, bikers and people that go shopping.

The main question

How can we make a design for a living / working which is suitable, useable and buildable for the situation in Old Mamelodi?

Key questions

- *What can we use from the research made by R.E.M.P.?*
- *What demands should meet a working / living unit?*
- *How can the living / working unit be integrated in the urban design of the surrounding area?*
- *What does the design of the working / living unit look like?*
- *How is the design of the working / living unit to be made useable and buildable?*

Results

There is a plan made for a working living unit based on the analysis of the current and wanted situation. The building fits in the urban plan of the surrounding area. The looks of the building are designed at sketch level. The building is proven to be buildable by designing the superstructure and the work performance. The units are proven to be useful by the plan developed for the lay out of the rooms.

The plan of the building complex provides the residents a safe, comfortable area to live, work and recreate within walking distance. Thanks to a critical review at the results from the author, there are some improvements proposed and there are some recommendations for future research made.

The research is a good start but just a beginning. There must be much more researched and worked out to make a realistic building at the end.

Introduction

Problem definition

Because of the scattered growing of the area, Old Mamelodi is spread. The distances between living units and work, school, and other amenities are great which causes much travelling time.

There are lots of people who own and drive a car. That costs a lot of money. It also causes a lot of pollution, inconvenience and unsafe situations. There are few alternatives because there is no sufficient public transport system.

There is no hierarchy or distinction between the different roads. The streets in Mamelodi are mostly the same width and suitable for a lot of traffic. There are no provisions for pedestrians or bikers. Only occasionally steps are taken to slow down the traffic.

There is a lot of crime in Old Mamelodi. It is unsafe to live in certain parts of the area. There is no safe area for people to socialize, recreate and to sport safely. There is a lack of communities.

The quality of the dwellings people live in is very low.

Research aim

A research aim for this report is to design a building that integrates living, work and other amenities. With some adaptations in the design of the building it will be possible to make the residents of the building their own private space where they can recreate, sport and socialize.

Aim is also to make the building and the surrounding area safer and give the residents the opportunity to form a community. The urban plan and infrastructure will be striven for to adapt to make a safer area for residents, pedestrians, bikers and people that go shopping.

Working methods

The methods used to do research were by desk research and field research. Desk research by analysing literature. Field research by interviewing experts and residents of Old Mamelodi and by analysing the current situations. During excursions in the research area, observations are made.

The main question

How can we make a design for a living / working which is suitable, useable and buildable for the situation in Old Mamelodi?

The key questions

- *What can we use from the research made by R.E.M.P.?*
- *What demands should a working / living unit meet?*
- *How can the living / working unit be integrated in the urban design of the surrounding area?*
- *What does the design of the working / living unit look like?*
- *How is the design of the working / living unit to be made useable and buildable?*

Report structure

In chapter one the research carried out by R.E.M.P. has been summarized. The chapter gives background information and understanding about the earlier research outcomes. The research area and the history of Mamelodi is clarified. Only the relevant information and conclusions are being used for this research.

Chapter two shows the brief made by the author of this report, after consultations with the client, some experts from Mamelodi and after analysing the current situation.

Chapter three shows the urban design of the surrounding area of the building. A plan has been developed.

Chapter four shows the vision of the designer of the building. Sketches and substantiations explain the design of the building.

Chapter five shows the build ability and the usefulness of the design. The author of this report presents his vision about the engineering aspects of the design.

In chapter six the author judges his own design, decisions, considerations, solutions and thoughts by reviewing the results. The author of this report shows also the weaknesses of and the possible improvements on the subject.

In chapter seven the author of this report gives recommendations for future research.

In the epilogue the author looks back at the process and the method of working during the research.

All drawings, illustrations and photos are made by the author of this report unless the text says different.

1. Recapitulation research R.E.M.P.

1.1 Introduction

In this chapter the research carried out by R.E.M.P. is summarized. Described is some background information to understand about the earlier research executed. The research area and the history of Mamelodi are clarified. It makes an analysis of the current situation, It gives the desired situation and describes what the desired situation looks like. A recommendation of the R.E.M.P. research is the occasion for this research. Illustrations and sources are all from the R.E.M.P. report.

1.2 History of Mamelodi

The direct cause for pointing out the area of the farm Vlakfontein as a township in 1947 was the huge influx of homeless people in the city during and after World War II. The area of Vlakfontein, later in 1962 renamed to Mamelodi, is structurally and spatially integrated with the 'mother' city Pretoria. Contrary to for example Soweto, this is a satellite city of Johannesburg. This is the result of another apartheid scheme. The government tried to stop and even reverse the influx of black people in white towns. They tried to achieve this by declaring that certain, always rural and poor, areas are independent homelands. And only in these homelands did the black people have permanent residence rights. Because Pretoria was surrounded by poor rural area, which belonged to homelands, the Pretoria counsel had no other space to built a township other than close by the city.

First the counsel made a town plan with fifty 'rondavels' a type of housing common in rural areas. The residents regarded this development as patronizing, demeaning and controlling and refused to remain in or move into these structures.

In 1953 the first houses of Mamelodi, west of the river Moretele. These houses where standardized houses with four rooms, also called the NE 51/6 or 51/9. The town planning was based on the garden towns of England, a lot of space and a front and back garden. In the sixties new houses where developed at the east side of the rivers. In the mean time there was still a shortage of houses, so grown up children moved to vacant land, east of the railroad, and there built their own houses. Later at the end of the sixties, the government upgraded these informal houses with toilets, electricity and water.

1.3 General information about Mamelodi

Mamelodi is a township near Pretoria in the Gauteng province (formerly PWV, Pretoria- Witwatersrand- Vereniging) which was established for maintaining workforce in the city and at the same time exclude black people from the white city. Gauteng is the industrial and commercial centre of South Africa, which means there are many jobs in the area. The province has the highest population density in South Africa. These two factors are the main reasons for the great number of townships in Gauteng (Mashabela). Gauteng does not only divide the economy engine of South-Africa but for whole Africa. Gauteng should be a city profit.

Gauteng has 7000 km of land available.

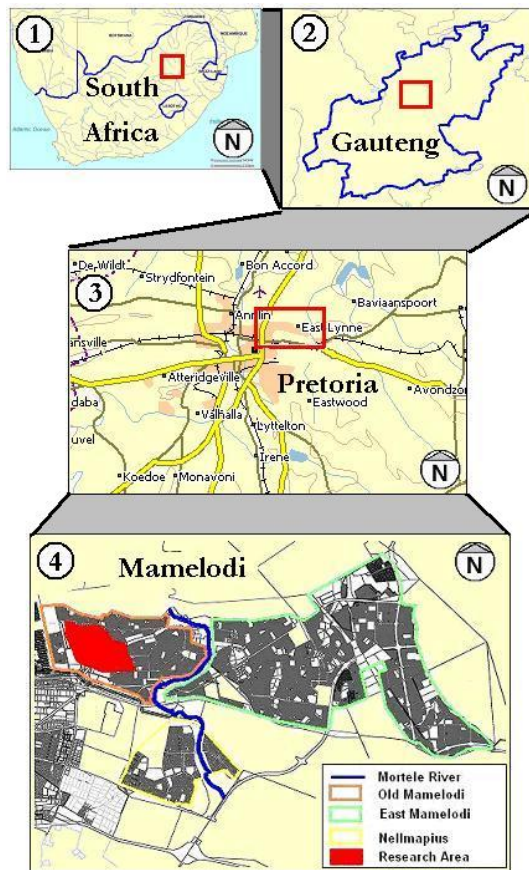


Illustration 1.3.1 Situation Mamelodi

Mamelodi is situated approximately 20 kilometres east of the centre of Pretoria and was established in June 1953 to accommodate African people who were being 'removed' from other areas in terms of the Group Areas Act of 1950.

There was another black township on the west-side of Pretoria, Atteridgeville and there was also a separate township for the coloured people, Eersterus. Coloured people were seen as a different race in the eyes of the apartheid government, because they were partly black and partly white. The status of the coloured people was higher than the status of the black people. This had the geographical result that coloured townships were situated closer to the white city than the black townships. The townships for the Indian population were closest to the city centre, but still outside the city. The people living in Mamelodi generally worked in Pretoria, because there were no jobs in the township.

There are some statistics about Mamelodi, based on a survey conducted in 1987. The population was estimated at 320000 by the

local authority, but according to the Minister of Constitutional Development and Planning there were only 250000 people living in Mamelodi. Nowadays there are about between 400.000 – 650.000 people in Mamelodi.

In 1987, there was one house for every seven people in Mamelodi. Most houses were built immediately after the establishment of Mamelodi, and are still inhabited by the same families, or descendants of these families (Mashabela, 1988). Mamelodi is a large township compared to other townships. Almost one third of the population is officially homeless and living in the informal areas, which is called Mandela village. Many townships have informal squatter areas, but as there are many residents in Mamelodi, Mandela village is a very large informal area.

In 1984, Mamelodi got the municipal status, which meant that a Black Local Authority was established. As in other townships there was serious protest from the population against these authorities. Mamelodi always has been relatively safe. After the BLA was forced to increase the rents, because of financial problems, there were violent outbreaks, but non-violent protest dominated.

1.4 Research area

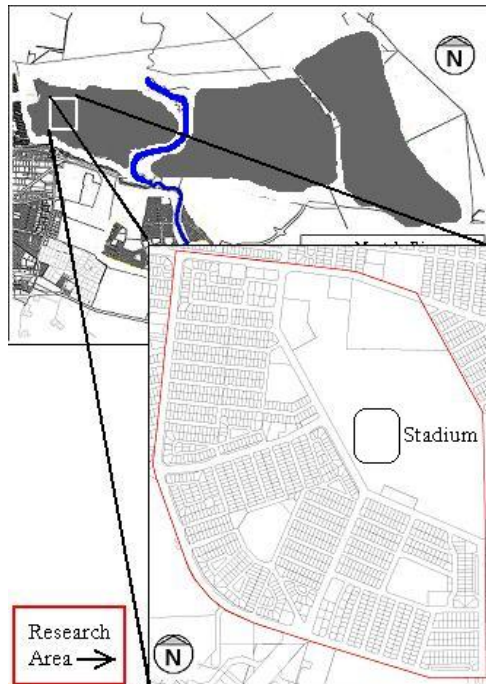


Illustration 1.4.1 Research area

The choice for this area is taken in cooperation with Leon de Klerk, town planner and politic leader for the ANC in the quarter of Nellmapius. He advised our project group to choose this area because of certain aspects. The three research subjects play an important role for the choice of this area. The chosen area is very useful for the R.E.M.P. research because the three subjects fit in very well:

The research area on which this report is aimed is situated in the west of Old Mamelodi. The area has a very recognizable kidney shape, which is easy to discover on a map. The boundaries of the area are the Shabanga Street in the entire southwest, in the east the Kekana Street and Lunga Street and in the north the Sibande Avenue. From the north side of the Kekana Street runs an imaginary line that crosses the Lunga Street. That's how they make up the northeast boundary of the research area.

The northeastern part is a big open field with a stadium and several amenities, while the rest of the research area is used for housing and amenities.

1.5 Analysing current situation

This chapter in the R.E.M.P. report shows the current situation of the buildings in Old Mamelodi.

There are mostly one story buildings in Old Mamelodi. The research area is very spread because of the one story, low density dwellings. Most of the area looks like that.



Illustration 1.5.1 Current situation



Illustration 1.5.2 Current situation



Illustration 1.5.3 Current situation



Illustration 1.5.4 Current situation

The pictures below show there are some houses with more storeys. These houses are built for richer residents. The houses are multi-storeyed, more expansive materials having been used, such as roof tiles, plaster and bricks. See illustration 1.5.5 until 1.5.7.



Illustration 1.5.5 Multi-storeyed houses house



Illustration 1.5.6 Multi-storeyed

The building shown on the picture is a flat. The density of living units is great. The building is well occupied and inquiry by the experts shows they see this principle as a possible solution for high density aims.



Illustration 1.5.7 Multi-storeyed house house



Illustration 1.5.8 Multi-storeyed

The typical little shops people of Mamelodi work in made of old materials collected everywhere from. Wooden planks, steel cladding and rough building materials are used. See illustration 1.5.9.



Illustration 1.5.9 Little shops

The typical shacks residents of Mamelodi live in made of old materials collected everywhere from. Wooden planks, steel cladding and rough building materials are used. See. Illustration 1.5.10 and 1.5.11



Illustration 1.5.10 Shacks



Illustration 1.5.11 Shacks

The typical dwellings provided by the government residents of Mamelodi live in made of bricks and steel roofs. See illustration 1.5.12 till 1.5.15.



Illustration 1.5.12 RDP house



Illustration 1.5.13 RDP house

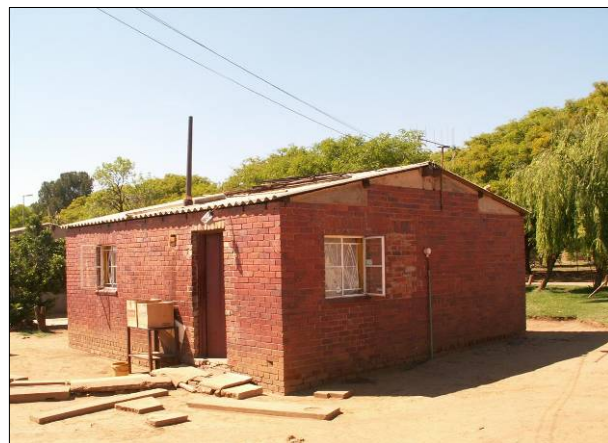


Illustration 1.5.14 Typical 51/9 house



Illustration 1.5.15 RDP house

1.6 Analysing demands of the resident

The demands of the residents are very important aspects which must be considered during the design. People don't want to live everywhere or in every type of house. The materials used to build the house are also aspects of consideration because the people don't want to live in a house made by some specific materials.

There is a great demand for houses. There are waiting lists for houses and it is hard for starters to find a house. Residents of Mamelodi can get a RDP house from the government. There are also large waiting lists for these.

The residents of Mamelodi are mostly poor and are a minority. Their living standard is low. Their goals are to get a higher living standard. The general living standard they aim for is the standard of the rich people.

They want to live in housing that has the same quality, charisma, applied materials and modern architecture as the richer residents in South Africa. Bricks, plaster and stone stand for high status. See Illustration 1.6.1.



Illustration 1.6.1 Expansive house in Mamelodi

Experimental projects have failed because of the above reason. Good options as earth blocks, rondavels type of houses (see Illustration 1.6.2) and other projects have failed because the people don't want to live in them. They interpreted it as generalizing.



Illustration 1.6.2 A experiment with rondavels failed

1.7 Analysing common architecture South Africa

The pictures below give an impression of the current modern architecture applied to building in South Africa at the moment.

The buildings have some similarities like they are all:

- Based on modern architecture tendency
- Multi-storeyed
- Applied materials and colours are modern (bricks, glass, steel cladding, steel)
- Modern overhangs and awnings



Illustration 1.7.1 Melrose Arch, Johannesburg

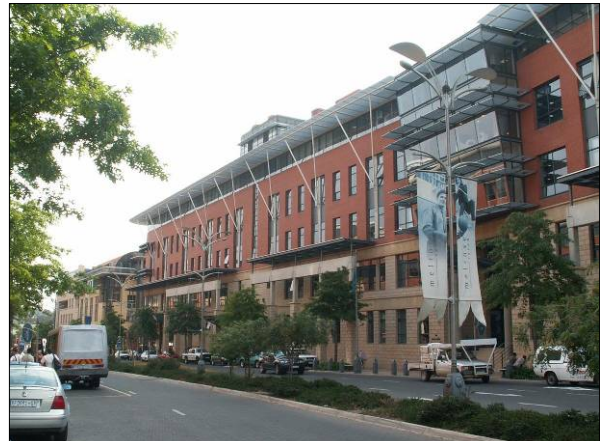


Illustration 1.7.2 Melrose Arch, Johannesburg



Illustration 1.7.3 Melrose Arch, Johannesburg



Illustration 1.7.4 Melrose Arch, Johannesburg

The area around the building has elements of woonerf principles applied in the urban plan. The shopping space is a non traffic area, but accessible in case of emergency.

The buildings shown in the pictures below are based on architecture from overseas. The buildings designed here look very similar to buildings in Holland. In cities like Amersfoort, Houten, Leidschenrijn en other vinex locations these buildings would easily fit in.



Illustration 1.7.5 Melrose Arch, Johannesburg

Library studies

The most of the books refer to buildings and architects all over the world but seldomly refer to domestic buildings and architects. The most of the literature is from abroad. Mostly from the United States of America. The influence of the USA is great.

1.8 Typology

The researchers of R.E.M.P. have recommended for future research about a typology. The typology is suitable for application in various situations because of their adaptability:

- Western developed area's like Melrose Arch, Johannesburg
- Townships like Mamelodi, Pretoria or Alexandria, Johannesburg
- South Africa
- Other countries of the continent with the same conditions as in South Africa.

R.E.M.P. recommends working out the typology of the living / working unit to a building which is suitable, useable, build able and applicable in the research area of Mamelodi.

2. Brief

2.1 Introduction

To make a building like this it is demanded to have a brief. In a brief the client's demands for the project must be recorded. This particularly brief is applied to the minor. Not every aspect is provided for in the project because the research is defined. The brief is not set up for legal use but is set up to give the designer direction and support during the project.

The most of the research and information necessary to make this brief is part of the REMP research.

The methods used to investigate the demands are:

- Interviewing the client
- Interviewing experts of Old Mamelodi
- Analyzing the current situation (fieldwork)

2.2 The outline of the project

The assignment is to design a building that is based on a typology and applicable in an urban design plan. The building must be a working / living unit and must demand on some criteria like, high density, sustainable and be suitable to application in Mamelodi.

This project is designed to solve a part of the housing problem in west-Mamelodi by integrating work, living and a higher density. Conformable to earlier research by students of the TUT in our research area there are some facts about the current density in Old Mamelodi.

The following facts are conclusions from research performed by Francois van der Walt and Andre Christensen (See Illustration 2.2.1)¹.

- 28 dwelling units per hectare
- 12m X 24m erf's – 300m²
- 14m road reserve
- 48m X 120m typical street block
- Typical additions from 24m² to 150m²
- Coverage up to 70%

There is no limit demanded about the wanted density in our research area. The quality of the design is not only comparable by figures about density.



Illustration 2.2.1 Density facts

¹ Rapport about "Housing policies about Mamelodi" by Francois van der Walt and Andre Christensen.

2.3 Budget

There is no specific budget in this stage of the research. In the chapter recommendations there will be a proposal for a future research where this subject will be an issue.

The costs will be an aspect during designing and will be based on experience, local sources and logical thinking.

2.4 The building site

The working / living unit must be placed in the research area of R.E.M.P.

The location of the building site will be decided in close consultation with the researchers of R.E.M.P. We decided to locate the building at the blue spot on the maps in Appendix A: The building site.

The location chosen for the working / living unit is a good place to erect the building because:

- The building is situated on a commercially attractive area.
 - North and west side of the building lie on main roads to the economy centre of the neighbourhood.
 - Much traffic and people walking by the centre.
 - Situated in a high density area.
- The building is situated on a well accessible place.
 - North and west side of the building lie on main roads. The road at the west side is connected with the highway.
 - Well occupied roads with a lot of traffic capacity.
- Not many houses will need to be demolished.
- The site lies in the planned high rise centre of old Mamelodi (Illustration 2.4.1²)

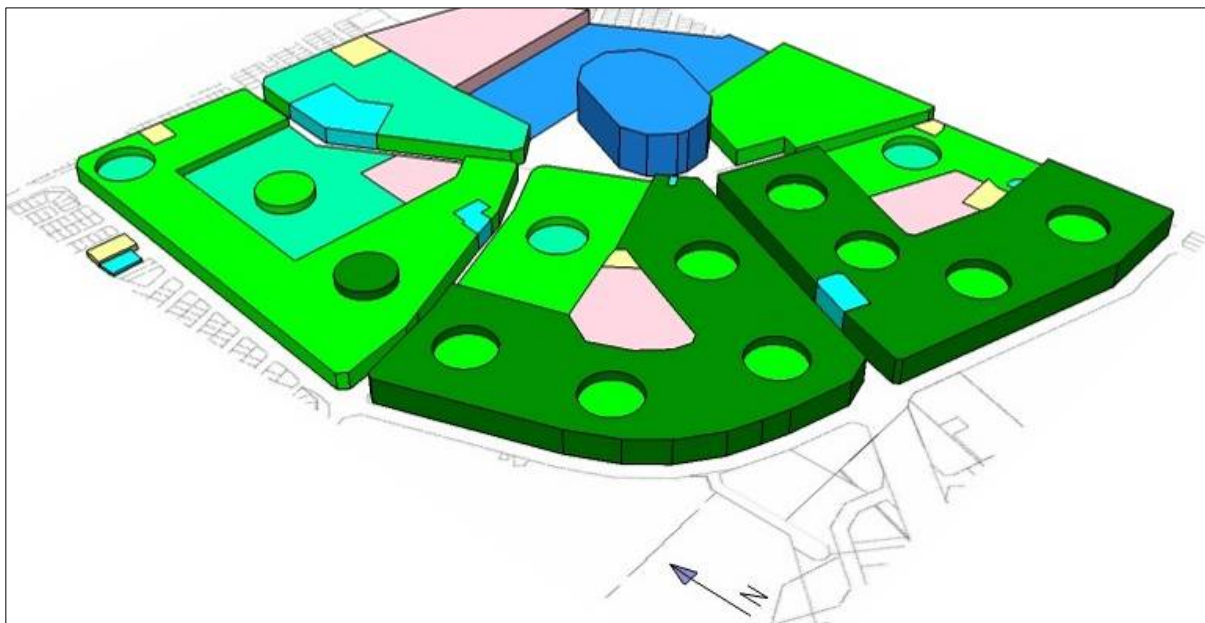


Illustration 2.4.1 Concept high rise center

² Graduation report The Neighborhood with lay-outs for subcultures made by R. van Heeringen

2.5 Typologies

The design must be based on the typologies designed in the previous research of REMP. REMP recommended to make a living / working unit based on their typologies. In close negotiation with the client is chosen for a typology (Illustration 2.5.1 and Appendix B: Typology³)

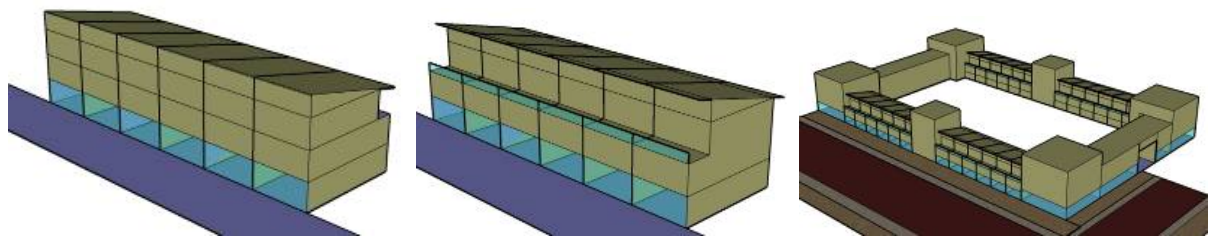


Illustration 2.5.1 Chosen typology

Illustration 2.5.1 shows that both chosen typologies for row houses are combined in a building complex by applying some additional structures which makes the building a closed complex. Because of the building is closed, the separation between public area and private area (the courtyard) is specified. The courtyard must be non accessible for people who do not belong there.

By making a closed complex the residents of the building should be comfortable and safe inside the building and in the area around. A place where the residents can socialize, the children can play and a place which will encourage them to participate in a community.

Participating in a community is a very important part of their culture and a way of surviving. Members of a community help each other when needed. They can share cars, help with day care, provide social control and nurse each other when needed.

2.6 Quality of the building

The quality on the level which is common in Mamelodi is far too low for the quality we aim for. We strive to upgrade the quality of building to a higher level.

The quality of the building must be a mix between these aspects:

- The quality on developed area level like in The Netherlands
- The quality on the level which is common in South-Africa

To give an indication of the priorities see Illustration 2.6.1

Time is not a priority in South-Africa.

Improving the quality of building is a topic but so is designing low costs buildings.

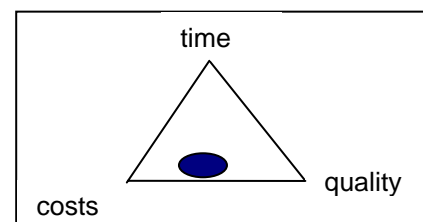


Illustration 2.6.1 Priorities

³ Research report Improving living quality in Old Mamelodi made by R.E.M.P.

2.7 Sustainability

Design is based on sustainable build. Great profit can be attained by little or simple interventions of the design. Aspects are:

- Orientation and passive solar design
- The use of solar energy (pv-cellen)
- Natural ways of ventilation
- Energy saving by improving the quality of the building (Shutting up cracks and applying insulation for example)
- Choice of materials and methods (durable, low-maintenance low-pollution)
- Flexible and changeable build.

2.8 Urban plan

Not only the building must be designed but also a part of an urban plan must be developed to achieve a good integration with the area surrounding the building. An aim is to strive for making a living environment with a lot of attention on cyclists and pedestrians and less for motorists.

In the lay-out of the area we can make adjustments to make the area safe, secure and liveable for the residents.

In the REMP research there are more specific solutions to solve that problem. In this research it is looked upon at a smaller scale. The building, the court yard and it's surrounding area.

2.9 Building regulations

The building must minimally meet the regulations set in the "National building regulations of South-Africa".

2.10 Changeable building

The building should not only be fit for use by the companies and settlements that will be present from the start, but the building must also be adaptable for future owner changes so the building can be used as effective and sustainable as possible. The lifespan of the first users is not the lifespan of the building. When there is no demand for a specific function, the building must be changeable for other purposes.

For the living units it is not desirable that the residents change a lot about the unit because of the total plan. Positions of outer elements like windows, doors etcetera are not supposed to change. Inner walls can be changed if needed.

2.11 Target group

The groups the living / working units are meant for are people who:

- Can afford to live in a unit like this
- Have a family size which fits into a four or five sleeping room apartment
- Are not handicapped
- Need space or have the opportunity to open a business

2.12 Car owning and parking

Buying cars, maintaining and driving them costs a lot of money. Cars are responsible for a lot of pollution, inconvenience for residents, unsafe situations and they require a lot of space and money. Instead of buying and maintaining a car the residents of Mamelodi may have a higher living standard. They can buy:

- Education
- Furniture
- Bicycles
- Go on holiday
- etcetera

Some residents need to own cars for different reasons:

- Amenities are not within walking distance.
- To get to work
- For business purposes.

The poor residents of Mamelodi also have desires. Generally the poor people desire to have the same living standard as the rich people do. Because the rich people own a car, the poor people wish to own one as well. Owning a car is a status symbol.

It's very hard to decrease the amount of cars. The governments of many European countries also try to bring down the amount of cars, but don't really succeed for now.

Locking out cars is unattainable but adaptations may be made during the design to discourage the use of cars.

Because totally locking out cars is unattainable, parking spaces are needed. About 15 % of the amount of residential families in Mamelodi owns a private car⁴. In close consideration with the client it has been decided that 50 % of the amount of residential families, occupying the building, need a parking space.

By providing that amount of parking space there will be enough place for visitors and residents to park their cars.

For the safety of the residents and the living environment we don't want cars inside the court yard. The cars must be parked outside the building. The cars must be parked on the street.

⁴ Bureau for statistics South Africa

3. Urban design

3.1 Introduction

In this chapter the urban designing aspects of the design will be discussed. Highly important is the way the building integrates with the urban plan. Streets, traffic, parking amenities and companies are very important factors. In this research is only looked at the direct surrounded area of the building. The urban plan of the whole neighbourhood and other bigger scales are not included in this research.

3.2 Traffic

The current streets are set up very width and take a lot of space. The streets are car friendly. The streets are dangerous. Cars are speeding, and there are no spaces for pedestrians and bicycles. Children can't play safely on the street. Most of the streets are all the same. Most of the streets have the same width, the same conditions for speeding and a lot of through traffic. See Illustration 3.2.1

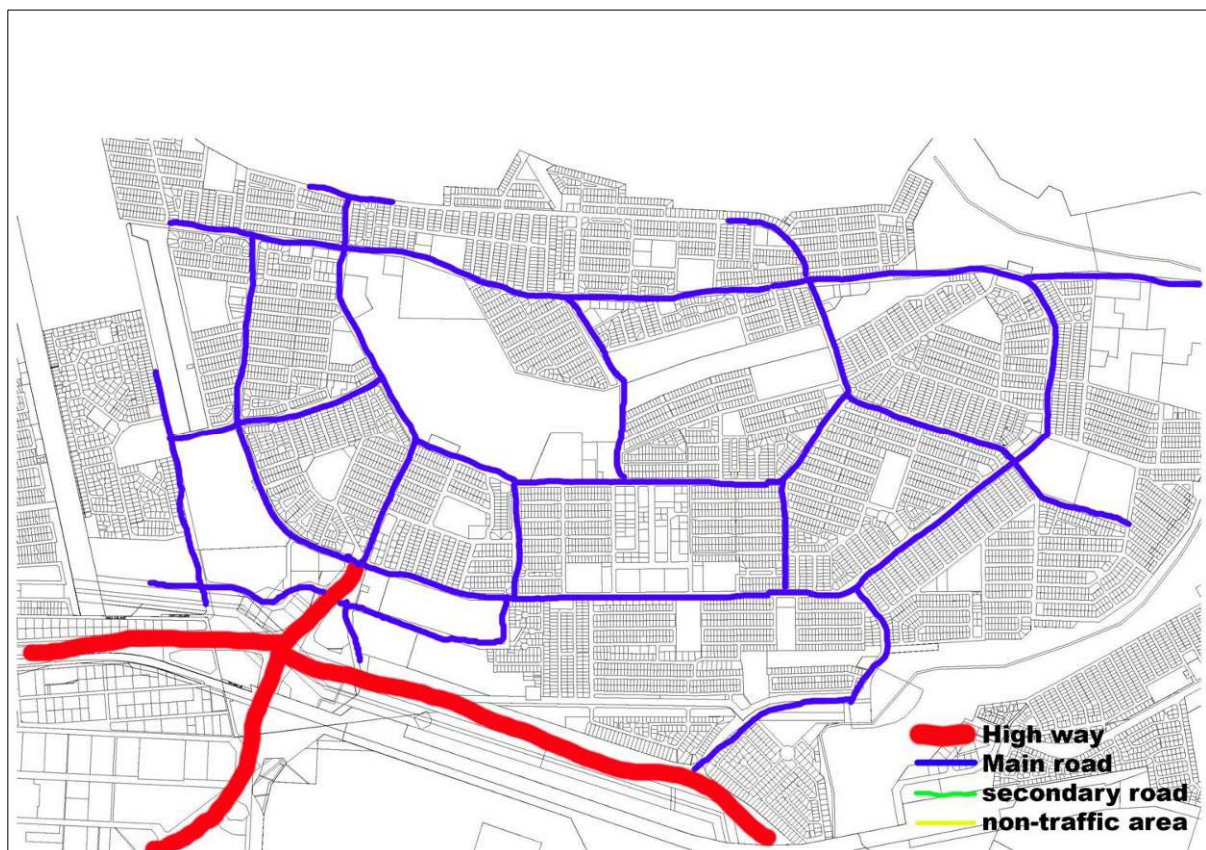


Illustration 3.2.1 Current traffic situation

The streets around the designed building can be distinguished in five different amounts of traffic and must provide space for some services. See Table 3.2.1

	High way	Main road	Secondary road	Woonerf	Non-traffic area
Small trucks	x	x			
Cars	x	x	x	x	
Taxi's	x	x	x	x	
Bicycle		x	x	x	x
Pedestrians			x	x	x

Table 3.2.1 Different amounts of traffic

In normal conditions public transport would be part of the table. The situation in South Africa about public transport is quite different from other parts of the world. The public transport is undeveloped and not sufficient enough for a well functioning transport system. There are trains and busses but on a small scale, a small reach and an irregular schedule. The trains are very unsafe and are generally used only by the poor residents. The busses are a bit safer.

The only service which looks like a form of public transport are the taxi busses. The mini vans drive through the whole of the city and stop whenever there is someone who signals to stop. The van picks them up and drives on. There are two signs for directions: Generally the drivers of the taxi busses drive very dangerously and cause a lot of accidents and hazardous situations in traffic.

It is unrealistic to say we can change all the streets in the whole area of Mamelodi.

Little changes to the streets could be of great benefit for the safety. Making all the streets the same width and conditions is unnecessary. Not every street has:

- the same traffic density
- needs the same width
- has the same priority
- has to be car accessible

Illustration 3.2.2 shows an alternative for the area. By changing some streets it is possible to create a safer and more live able environment. The changes made are:

- main routes changed in secondary routes
- the smaller streets changed in residential areas with restrictions to slow down traffic

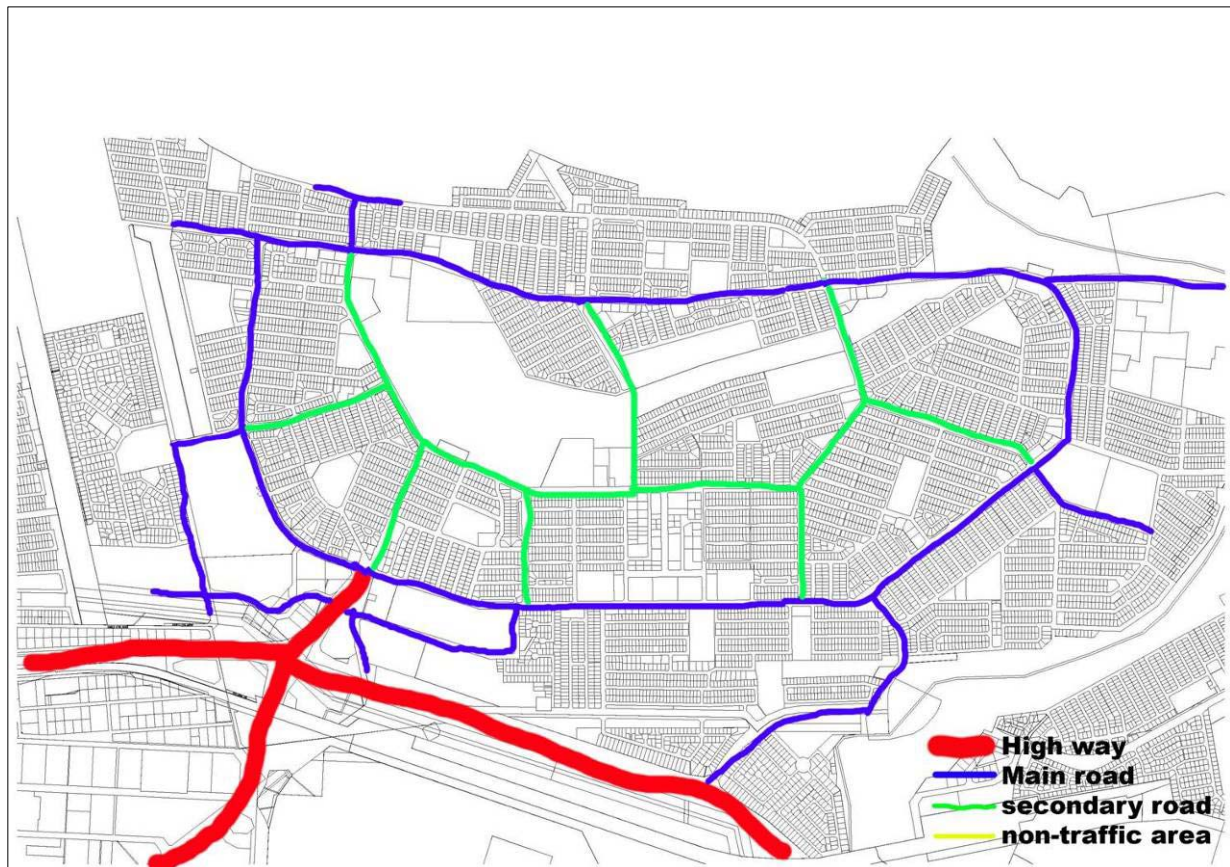


Illustration 3.2.2 Desired traffic situation

3.3 Parking vehicles

Aim is to bring down the ownership of cars by the residents of Mamelodi. If we bring down the need for cars the owning of it will be brought down too. Bringing down the need to own a car can be done by making:

- The facilities within walking distance
- Employability within reach
- Neighbourhoods self provided.
- Alternatives by providing an adequate public transport system⁵

The richer residents or the people that really need a car can drive them of course. The people who see the car as a status symbol and whose opinion can't be changed will still buy and own a car. Aim for that group is to bring down the inconvenience this causes for other residents and to improve the safety on street.

Research shows 15 % of the residents in Mamelodi own a car. In the brief is set down that the designed area must provide in parking spaces for 50 % of the amount of residential families that will be occupying the building.

⁵ A recommendation is made for research to public transport systems in chapter 7. Recommendations.

3.4 Different users streets

It is not preferable for residents to own cars. They must be transported by other means. Because of the bad public transport in Mamelodi, actually in the whole of South-Africa, this is not an option.

It is preferred to get transport:

- By foot
- By bicycle
- By taxi (only if necessary)

In the following subchapters the minimal widths are being described. The information used for this chapter is from the book “Building construction illustrated” and the drawings are made by the author of this report.

3.4.1 Vehicle lanes

Unless it is not preferred the people of Mamelodi have vehicles, there must be services for transportation for cars. Illustration 3.4.1 shows the minimal and preferred widths of vehicle lanes divided in one lane and two lanes.

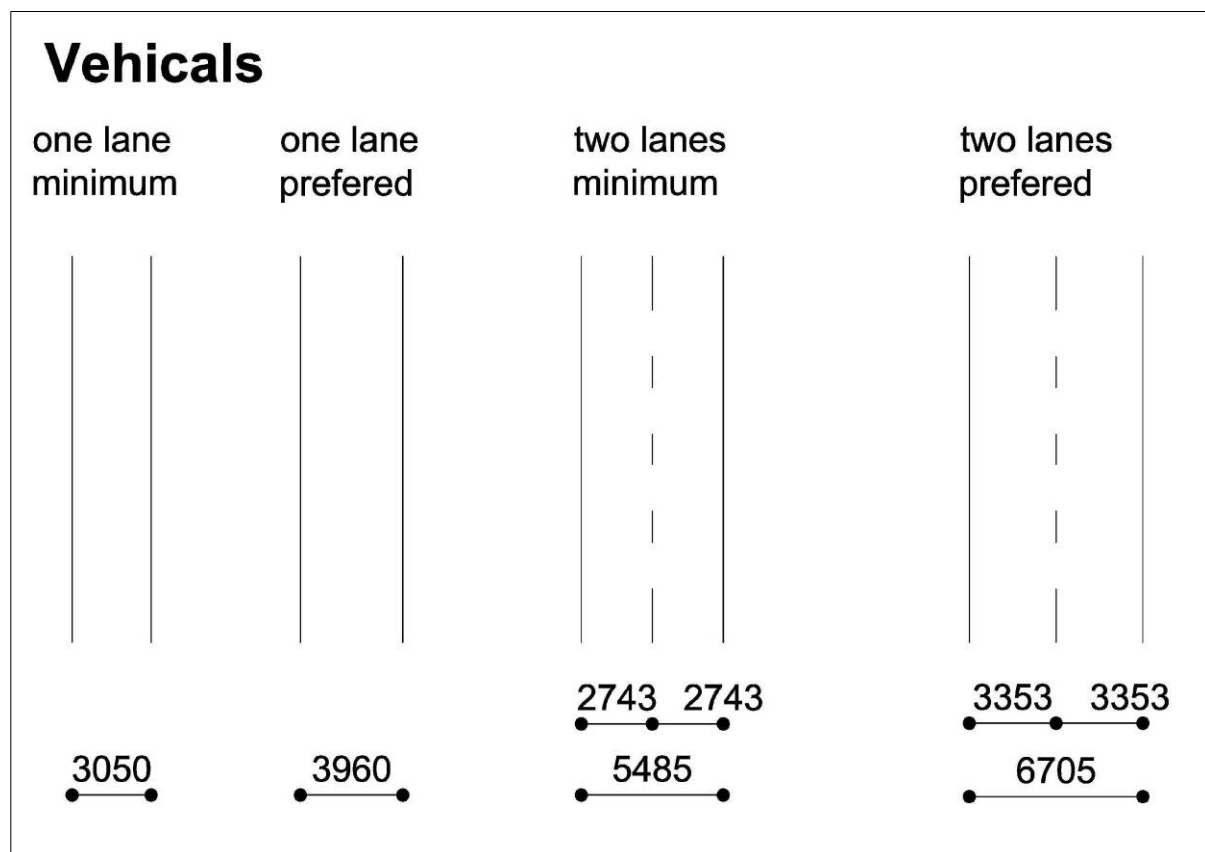


Illustration 3.4.1 Vehicle lanes

3.4.2 Bike paths

If the area around the building is designed against the use of cars, there must be other ways to get around. By bike is a preferred option. The paths are specific to transport next to main and secondary roads because of the higher risk. Illustration 3.4.2 shows the minimal and preferred widths of bike paths divided in paths for one and two persons cycling next to each other.

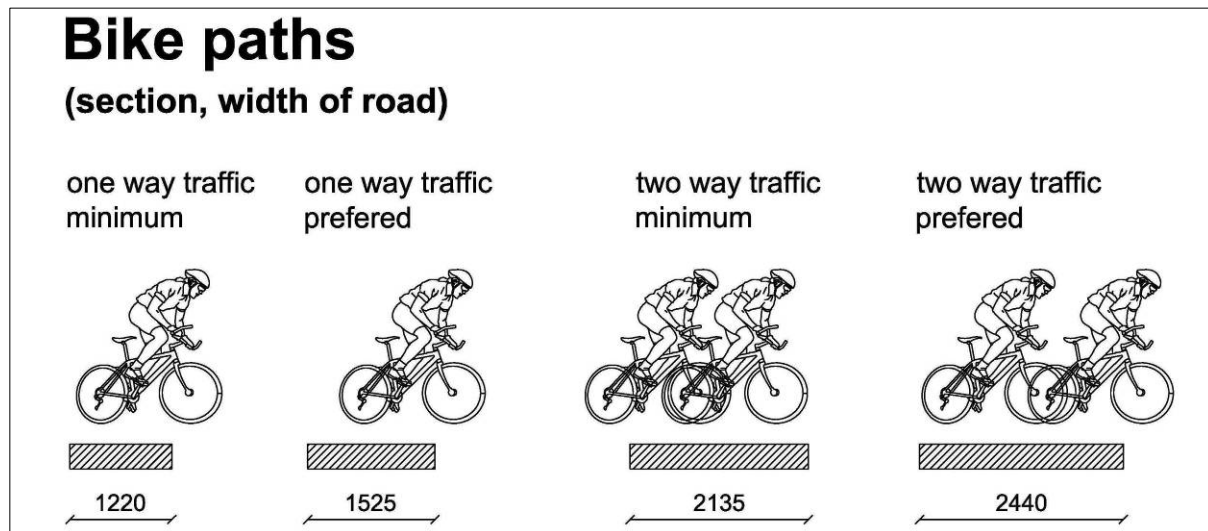


Illustration 3.4.2 Bike paths

3.4.3 Pedestrian Walks

Preferred is the making of a nice environment for pedestrians. The minimum and preferred width is described in Illustration 3.4.3. Pedestrian walks are needed if you want to have safe conditions for transportation by foot.

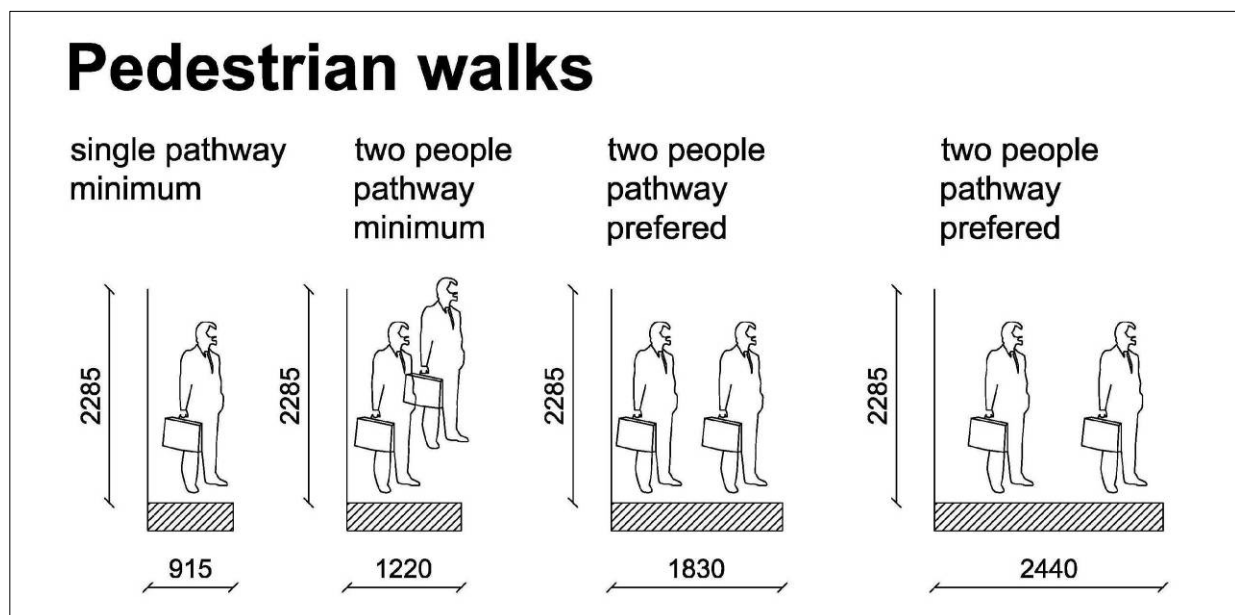


Illustration 3.4.3 Pedestrian walks

3.4.4 Woonerf

The principles described in this subchapter about a woonerf are based on the analyses and experiences which the author acquired in The Netherlands. Illustrations are made by author.

A woonerf is a way of making a safe and friendly environment for people to live in. Because of the traffic delaying services like bumps and obstacles the neighbourhood is a lot safer and more adjusted for children to play on the street and to encourage a community.

The principle of a woonerf is to discourage through traffic to use the streets in a woonerf, not even as a short cut for traffic jams. By doing so it becomes an area which is only being used for destination traffic, so less traffic.

By expanding the pedestrian walks over the entrance to the woonerf it is possible to delay the traffic because of the level difference with the high speed traffic street. By making the streets within the woonerf smaller and applying bumps, it is difficult to drive hard. The bike lanes are only applied on high traffic roads because in a woonerf the speed is low, so cars, cyclists and pedestrians can be safely using the same street. Even older children in the age of ten to twelve years old can use the street to play on.

Pedestrians, bikers and other road users on the side road have priority over the cars, and motorbikers who wish to enter the woonerf.

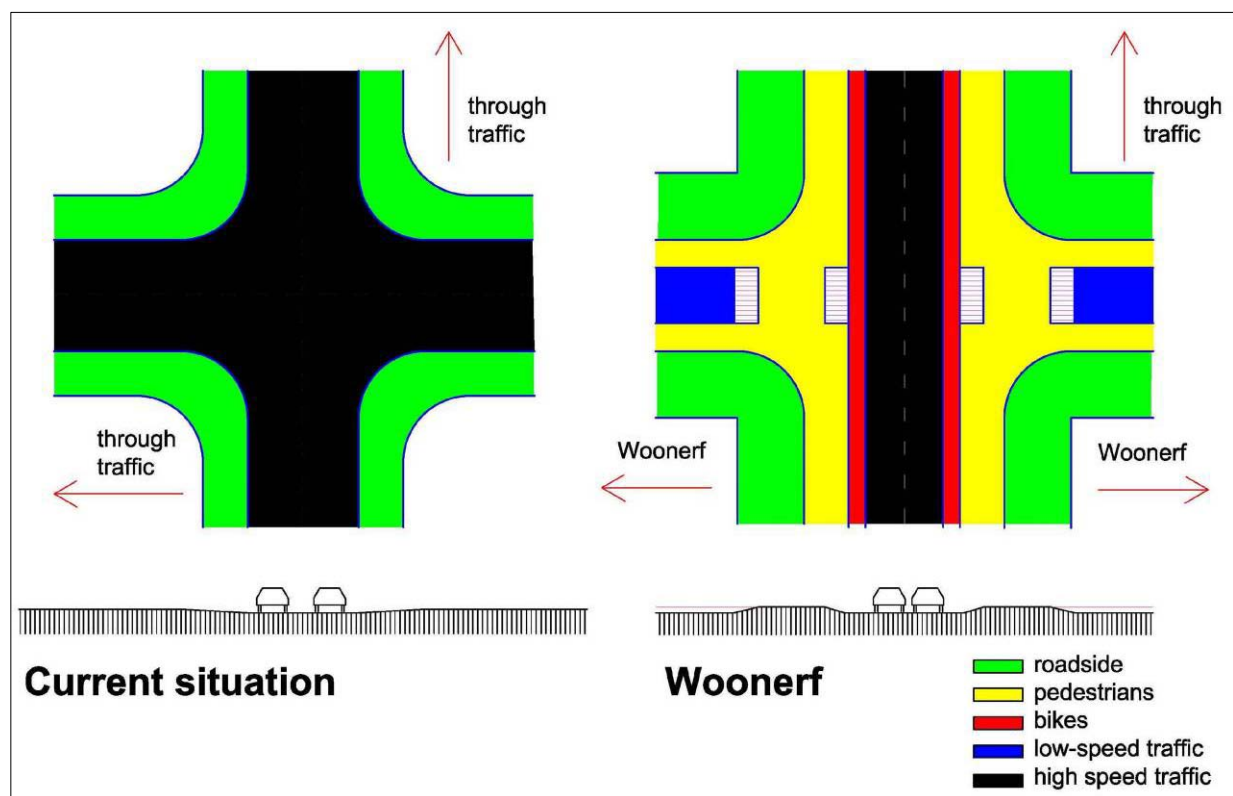


Illustration 3.4.4 Principle of a woonerf

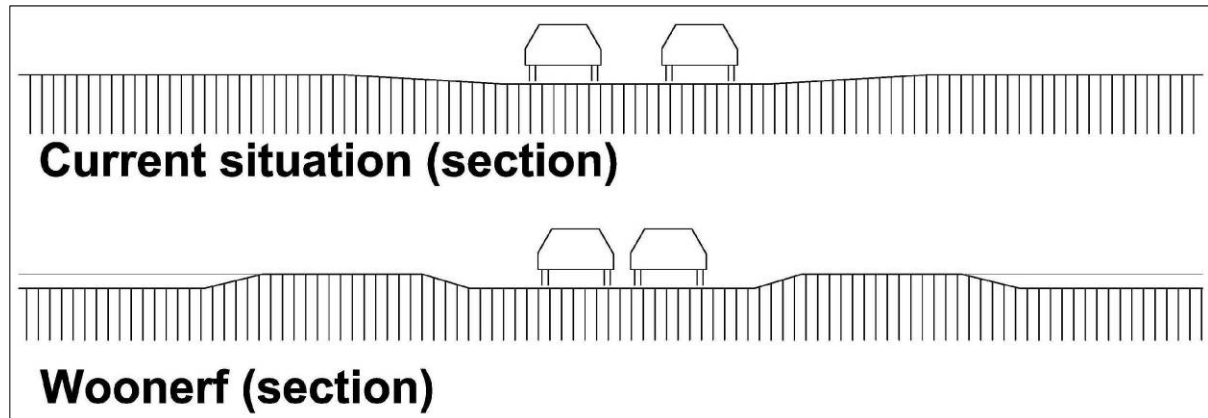


Illustration 3.4.5 Street sections

3.4.5 Traffic free area

To shop safely and comfortable it is desirable to walk without all difficult traffic situations, vehicles, bikes and other users using the same road. That way it is to be preferred to lock out certain users of the road. In a traffic free area only pedestrians belong. Bikers are allowed, but only on their own bike paths.

The traffic free area must be free of level differences because that may cause dangerous situations for the shopping public. The area must be well illuminated, because bad lighting can give an uncomfortable feeling and an unsafe situation.

It is important that the larger part of the area is not accessible to vehicles but must in certain situations be easily made available for some destination traffic. Ambulances, fire brigade and other services must be able to come close to all of the spots in the area. Also when building activities are necessary, it must be possible to reach every place with building equipment.

3.5 Situation build site

The current situation is shown in Illustration 3.5.1.

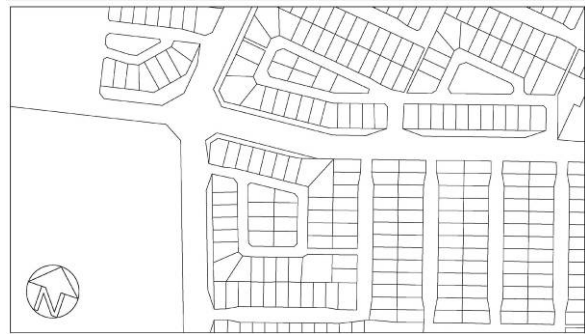


Illustration 3.5.1 Current situation

In Illustration 3.5.2 and Illustration 3.5.3 is a good place shown to build the living / working unit.

It is located at busy streets with much people passing by every day. It is located in the high rise centre of the area.

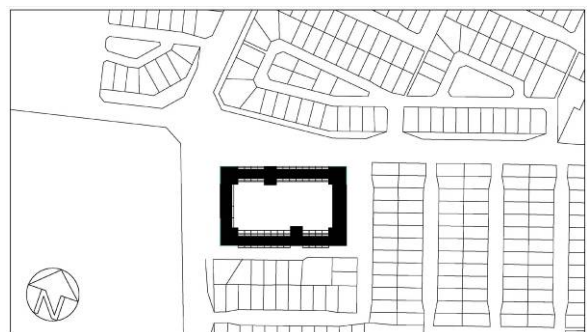


Illustration 3.5.2 Building site

The site chosen for the building is now occupied by RDP houses. Because an aim is to heighten the density, the building can't be located somewhere at an open space. There is no building ground available in the research area and spreading is no option.



Illustration 3.5.3 Building site air picture

The only solution is to relocate the residents who live there and demolish the current buildings (Illustration 3.5.4). It is hard to relocate residents in South-Africa. It is a social and political matter and costs a lot of money. Maybe it is an option to relocate the people to the new building. The residents can get a compensation for the inconvenience by giving them priority and the opportunity to rent or buy a unit in the building⁶.



Illustration 3.5.4 Houses needed to demolish

⁶ A recommendation is made for future research to the relocation problem of the residents from the houses that are planned for to get demolished in chapter 7. Recommendations.

3.6 Amenities

For the urban planning of the building it is important to know something about the amenities and facilities surrounding the building.

Illustration 3.6.1 shows where the amenities are in our research area.

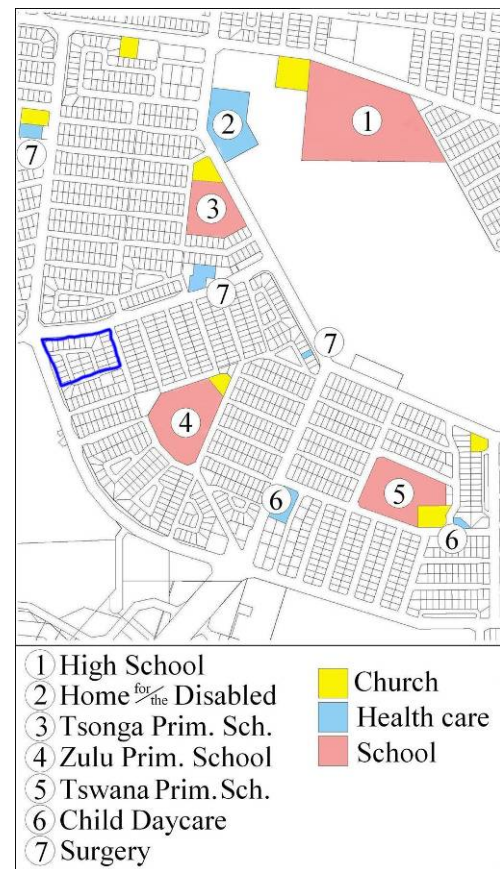


Illustration 3.6.1 Amenities

3.7 Employment

During the lifespan of the building there will be different users and owners of the building. If there is a change of function it must be possible to adapt the areas to a well functional room with little adjustments.

Because of the requirement above the companies and amenities planned in the building are just possible solutions. But there may be many alternatives.

A large variety of different branches combined in the building makes a very broad and diverse environment which is good for creating a sustainable community inside the building.

In the building it is not preferable to apply activities that may inconvenience the rest of the buildings' residents. For example: a bar is acceptable, but a dance hall is too loud and noisy.

The corner modules and the centre modules are important highlights of the building. Illustration 3.7.1 shows an option to assign companies to the building.

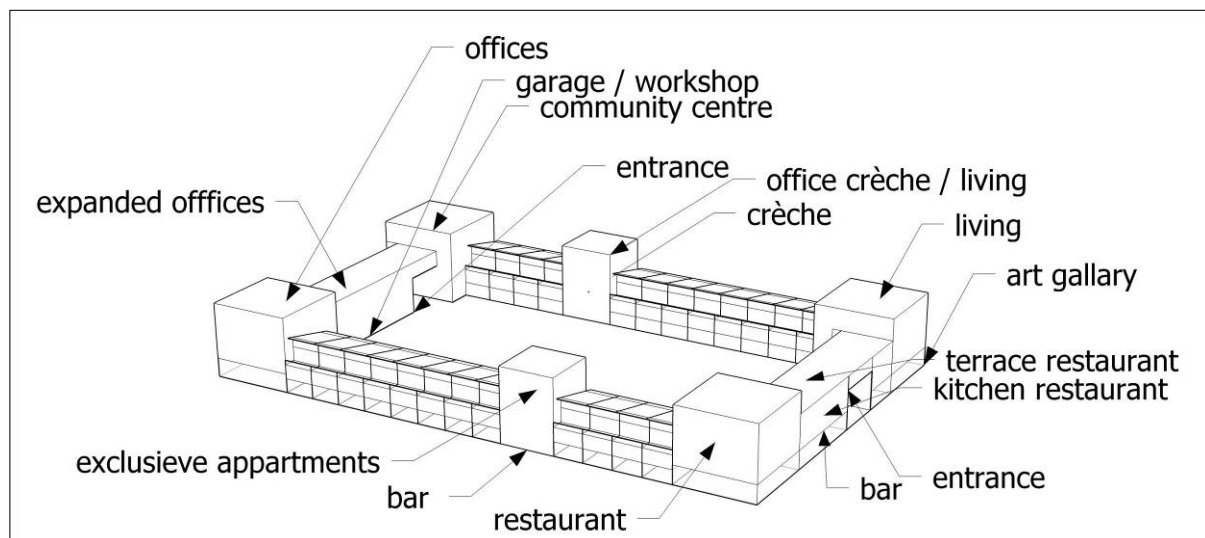


Illustration 3.7.1 Assigning the building

For the ground floor of the row houses there are plenty of possibilities:

- Bakery
- Butcher
- Groceries
- Internet café
- Bar
- Clothing
- Liquor store
- Pharmacy
- Hairdresser

3.8 Main entrance

The entrance to the court yard is a very important part of the building. It is important that the entrance is:

- Safe
- Accessible
- Recognizable
- Socially controllable

The east and west sides are the best places to plan the entrances. There they do not get in the way. It is in a main street and in a secondary street, but close to a clearly set out. There are ways to escape to the other side of the building if needed. There are plenty of opportunities to plan busy public places around the entrances for social control. See Illustration 3.8.1

The west and east side are less suitable orientations to plan your living spaces because of the sun and passive solar energy.

The exact position will be specified in a later stage.

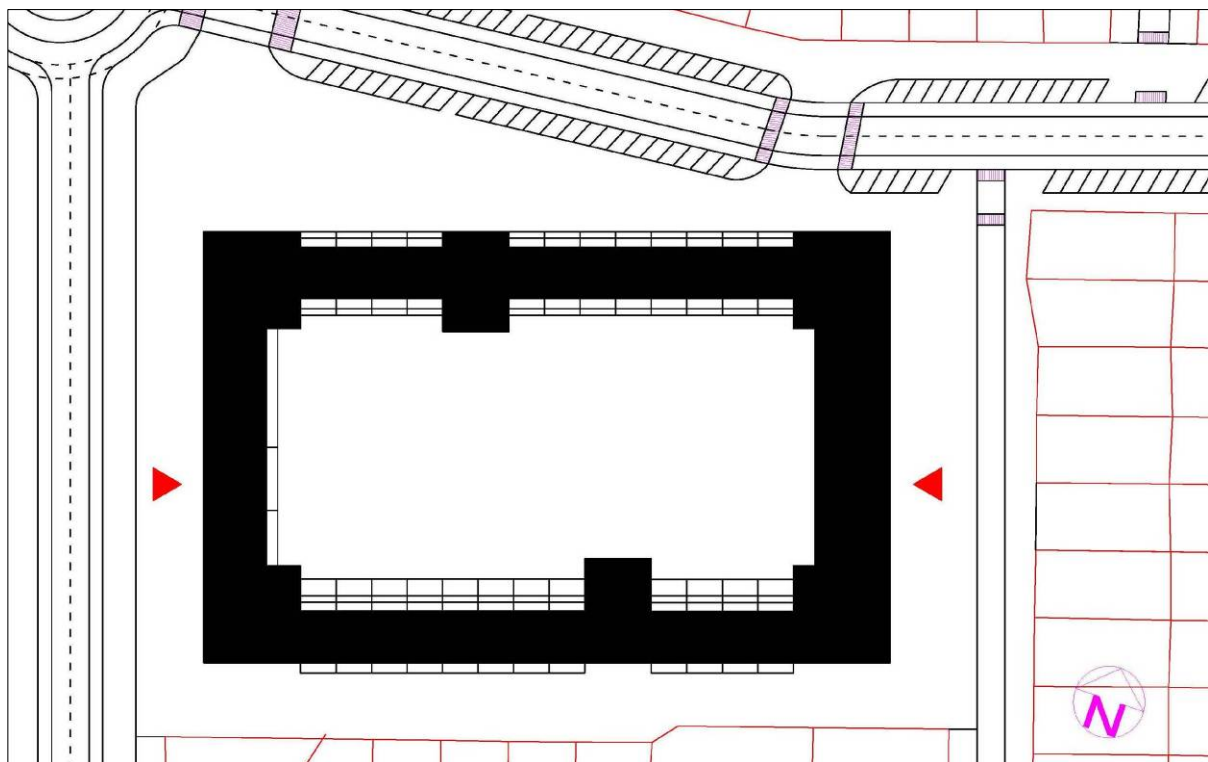


Illustration 3.8.1 Locations of the entrances

3.9 Courtyard

The courtyard is an important area. It is the area where the social community bonding takes place. The social control and the safety can be influenced by the design of the courtyard.

We want to create an area where the residents can socialize, the children can play and all the residents can form a community which not only takes care of its own family but also of the family and children of others. That is part of the culture of the residents of Mamelodi.

A good example of a courtyard which incorporates the most of the above demands is a mixed use development in Johannesburg made by Savage & Dodd Architects. See Illustration 3.9.1

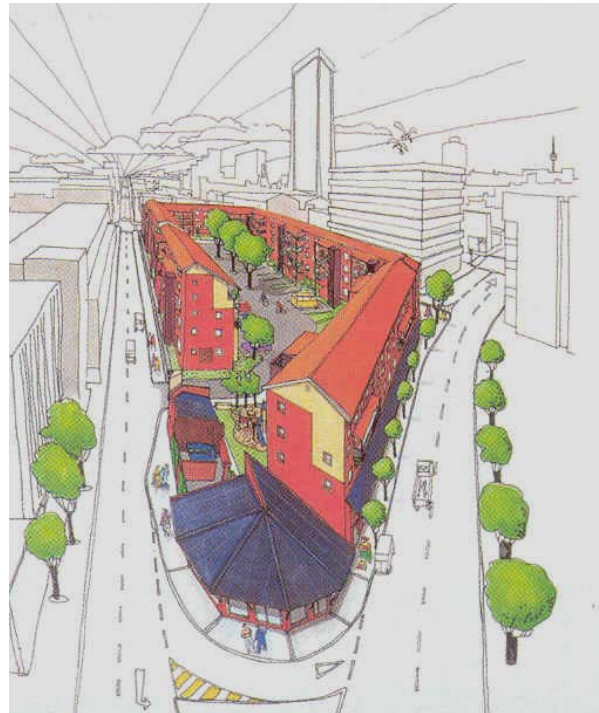


Illustration 3.9.1 Working / living unit in Johannesburg by Savage & Dodd Architects

The design shows an inner world inside of the building. There is:

- space to park
- space to play for children
- social control
- space to be social with other residents
- nice orientated design

There are some disadvantages also. The courtyard is not enclosed. It is easy accessible for everyone. Maybe with barriers, but that is not enough. The entrance is connected to a busy street. There are no facilities for traffic delaying. The courtyard has been paved, there is less green to recreate.

3.10 Plan urban design

In making a plan for a building this size, it is important to look at the surrounding area to adapt the building to that area if necessary. Sometimes one needs to adapt the surrounding area to the building. In this case it was necessary to apply the whole neighbourhood's infrastructure to optimize the environment for the residents and the buildings visitors. See Illustration 3.10.1 and Appendix C: Urban design. The numbers on the map correspond with the numbers in the text below.



Illustration 3.10.1 Urban plan surrounding area

When entering the area from the northward main road at the east (1), the traffic is forced into a low speed area (3). The different traffic situations are safely separated by a roundabout (2) and speed bumps (woonerf principle). Roundabouts are more safe than normal intersections and provide a more equal circulation.

The westward street at the north (1) has been changed from a main road to a secondary road. The traffic is slowed down because of the amenities installed in the road. It is important to create a safe, low speed area. In the secondary road (3) bike lanes have been added to create a safe area for travel by bike. Between the pedestrian walks and the bike lanes parking spaces have been applied.

The side roads (4 and 5) have been based on the woonerf principles. The pedestrian walks are extended over the vehicle lanes. The bikers and pedestrians have priority above the cars, motorcycles and bikes that want to enter the woonerf area. The woonerf roads are very narrow and have a lot of barriers to slow down the traffic and to create a safe area for everybody.

The non traffic area (7) is especially made for pedestrians. This is the area where the people can safely recreate, shop and socialize. To decrease the inconvenience from the main road, there is a natural barrier (6) planned next to the main road. The exact interpretation will be designed later on in the report.

Both entrances (8) are in the middle of the non traffic area on a safe and well lit area and in a central position to the surrounding area. The courtyard (9) is an important factor for the environment of the residents. It will be designed in a later stage of the research.

4. Sketches

The sketches made in this chapter are not on scale. The dimensions are based on proportions. The dimension will be notified in the following chapters.

4.1 Introduction

In this chapter the first sketches, ideas and the designer's vision are being represented. During the sketch phase the design gets its identity and during the design many alternatives are made to find the ideal form for the building.

4.2 Develop the typology

To make a good design the typology must be developed in a more realistic form. And it must be adapted to the situation of the local area.

4.2.1 Topics of the design

The typical way of building in South-Africa has a characteristic identity. Because of that the people of Mamelodi will not live everywhere. The design must be made such that the people want to live in a building like that.

Non technical provisions typical for a building in South-Africa are:

- Non-symmetrical form
- Informal
- Type of material
- Open space and outer space
- Variation

The first sketches are based on a typology developed by REMP. The changes made for the sketches are:

- Making the building asymmetrical
- Make every corner module and centre modules different
- Design the open space to a living environment described in 4.6 **Fout! Verwijzingsbron niet gevonden.**
- Make the entrance at the least demanding street so no traffic jams can develop. And because it is the least interesting part.

4.3 Rough sketch centre modules and row houses

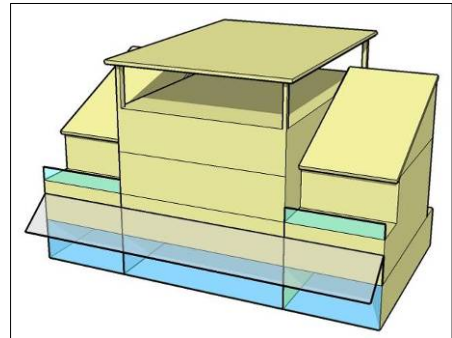
The centre module is about 10 by 12 meters and 4 storeys high. About 16 meters high.

The row houses are about 6 by 12 meters at ground floor and 6 by 10 meters at the storeys. They have 4 storeys and are about 15 meters high.

This design has a covered roof. It enables functions as terrace, outdoor living and recreation.

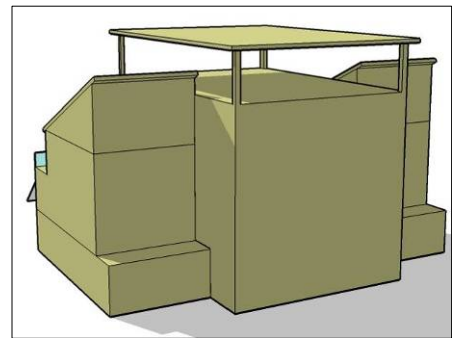
The roof is not well applied to heavy rain fall. It may rain very hard in South-Africa with litres per square meter.

The water must be transported very quickly to the sewer or be collected in special amenities for grey water use like sprinkling the garden etcetera.



The roof constructed as in this design is not a perfect situation for applying solar energy. The angle is 0 degrees and the ideal angle for solar energy in South Africa is between 20 and 25 degrees.

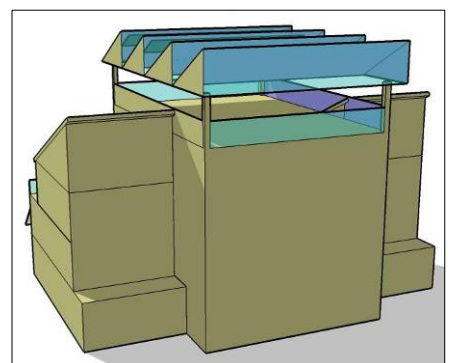
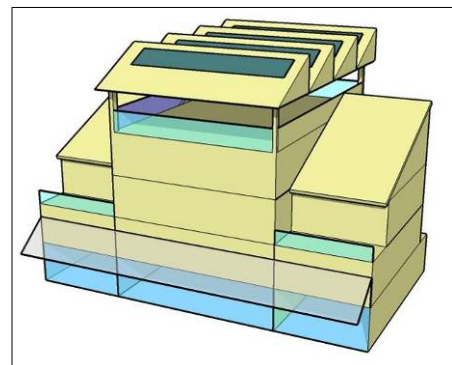
Using solar energy can be done, but the panels must be placed on a separate shelf, at the right angle.



This roof is more suited for transporting the rain-water and for the use of solar energy.

The natural northern sunlight will be let into the building by the windows in the roof.

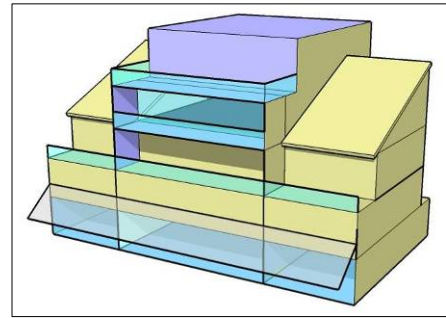
The principle of this roof is good for panels, rain water and for entering light. The shape is not desirable. Panels on shelves are a better solution.



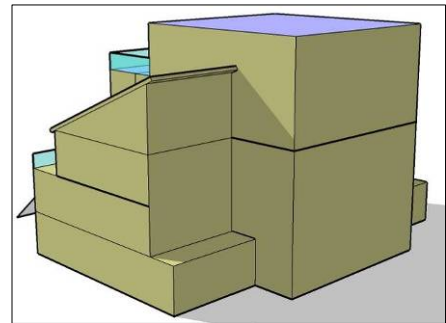
This adaptation will make a greater contrast and an interruption to the building.

The adaptations to the balcony make a professional use possible because the building is definitely different from the rest of the living units.

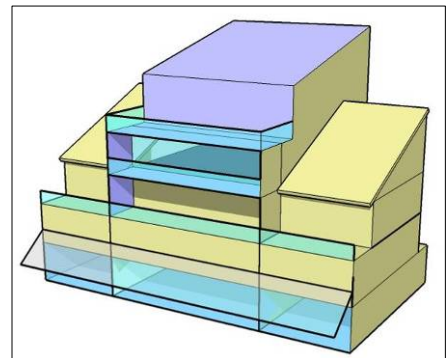
The roof is not ideal for efficient transport of water and for utilization of solar energy.



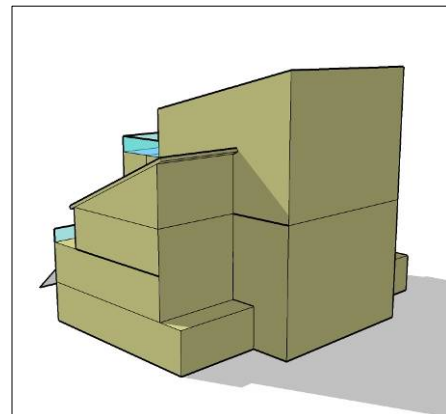
The building is deeper than the row houses. This will make an interruption into the inner garden.



The same design as above but with a different roof. It is better suited for transport of rainwater and the utilization of solar energy.

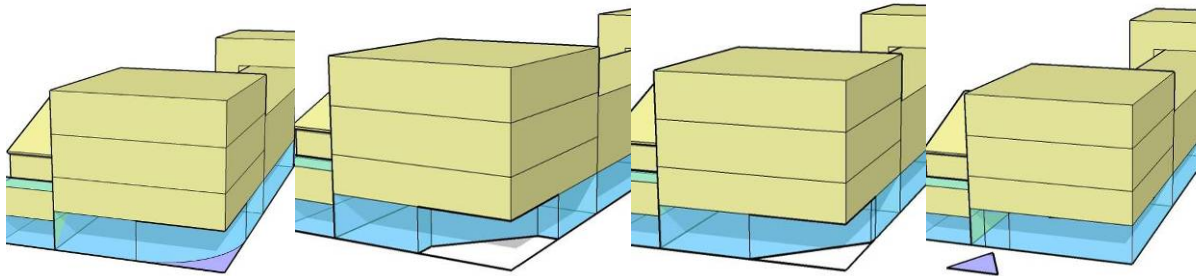


A disadvantage of this building is the high roof. Because of its slope the elevation gets very high. A lift would be officially needed.

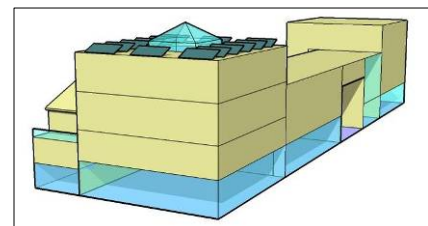


4.4 Rough sketch corner modules

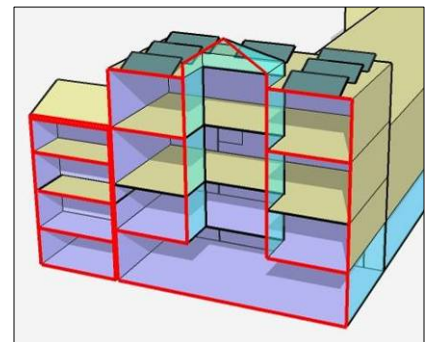
A study for the possible entrances. The illustrations below give some ideas.



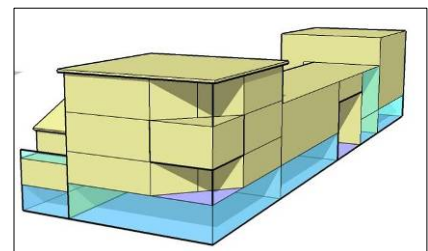
The design in the illustration on the facing place is made with an atrium. It is useful because “verblijfsruimtes” can be placed around the atrium and are provided with natural daylight.



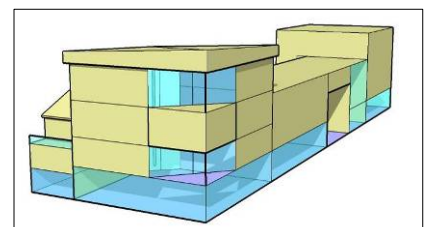
The corner modules are about 12 meters by 12 meters, four storeys and about 16 meters high.



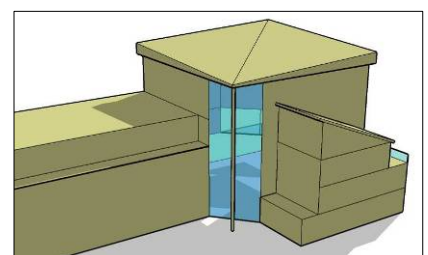
For this design, and the design above, it is hard to transport the rainwater and the solar panels must be placed on shelves. It is an expansive design and not the most effective design.



The problem with the rainwater is solved by the special shape of the roof. The rain water can be transported really fast, and be collected in amenities for water storage.

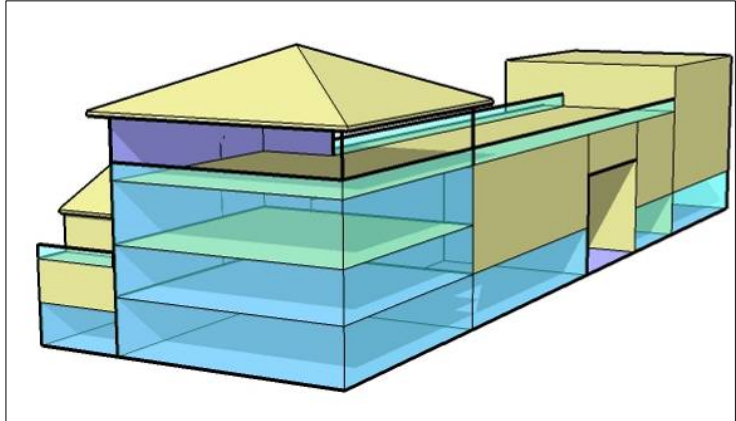


It depends on the orientation whether the solar panels can be implemented in this design.



This design for example can be used as a restaurant. At the corner there may be dinner tables, all facing the windows for the nice view.

In the top tables may be placed too, under the covered terrace. And in the section between the two corners the kitchen can be installed on the first floor and on the roof an uncovered terrace could be made.



The roof of the covered terrace can be used for solar energy but it is a small surface so maybe not profitable enough to invest in. Rainwater is no problem in this form.

4.5 Main entrance

The main entrances are situated in the east and west side of the building.

The entrance in Illustration 4.5.1 is much too small and out of proportion in comparison with the surrounding area like the courtyard and the building.

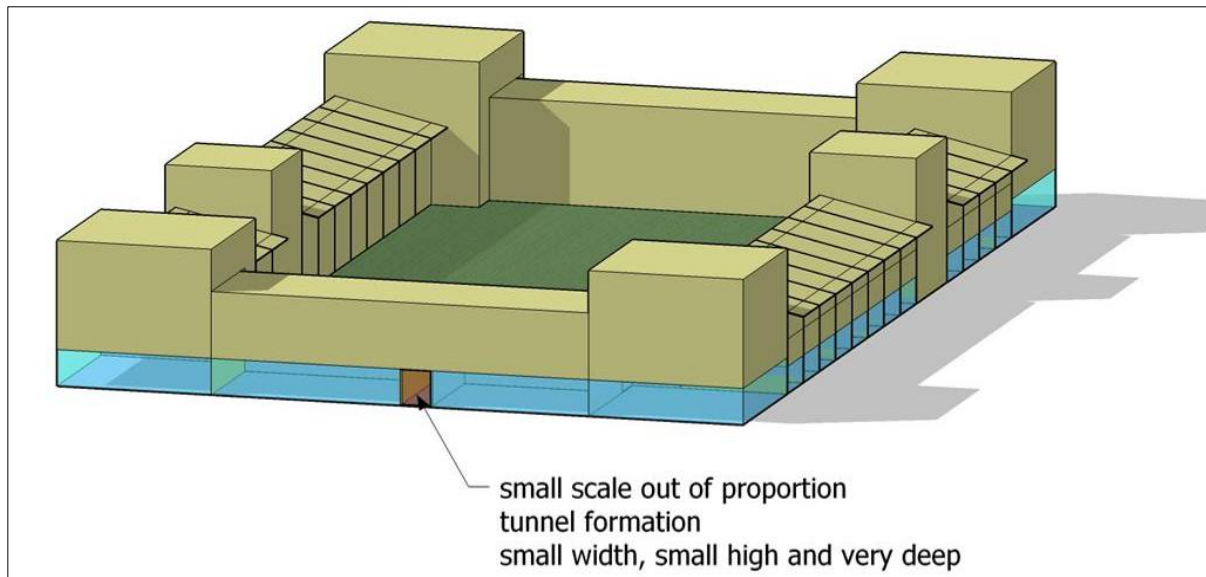


Illustration 4.5.1 Entrance sketch 1

By making the entrance wider (see Illustration 4.5.2) the proportions get better. The tunnel formation is nevertheless still present. The space above the entrance can well be used for commercial aims.

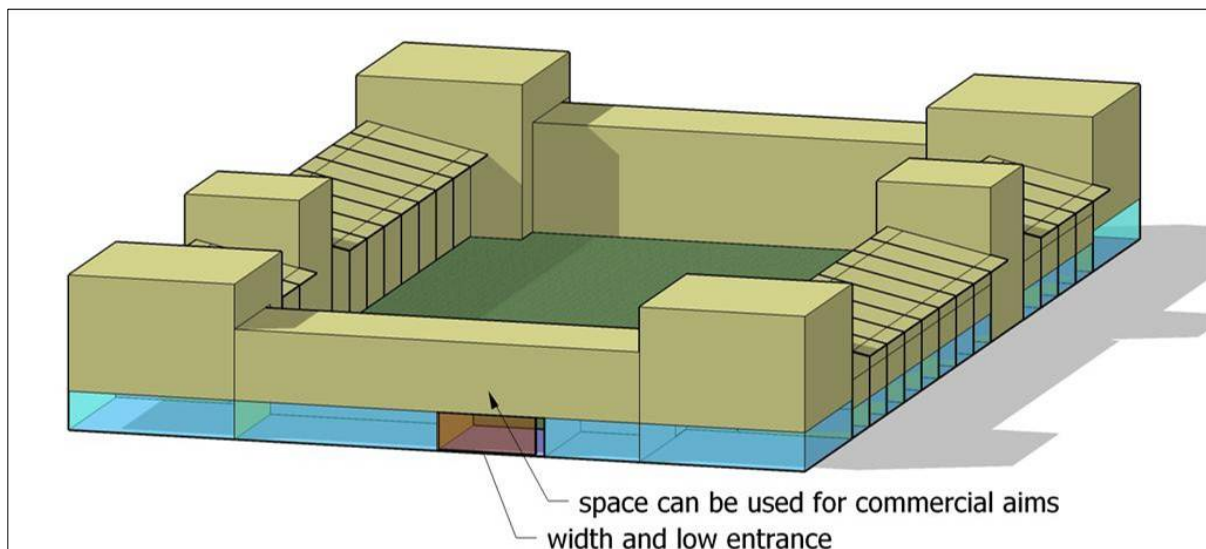


Illustration 4.5.2 Entrance sketch 2

By making the shape of the entrance as shown in Illustration 4.5.3 and Illustration 4.5.4 the proportions are well compared to the surrounding area. There is less tunnel formation. There are no overhangs, portals or porches where people can hang around, sleep, beg or commit any crimes.

By making the side wall of the planned facing bar transparent, social control is created. The gate is schematically presented. Exact form, shape and material are not important at this moment.

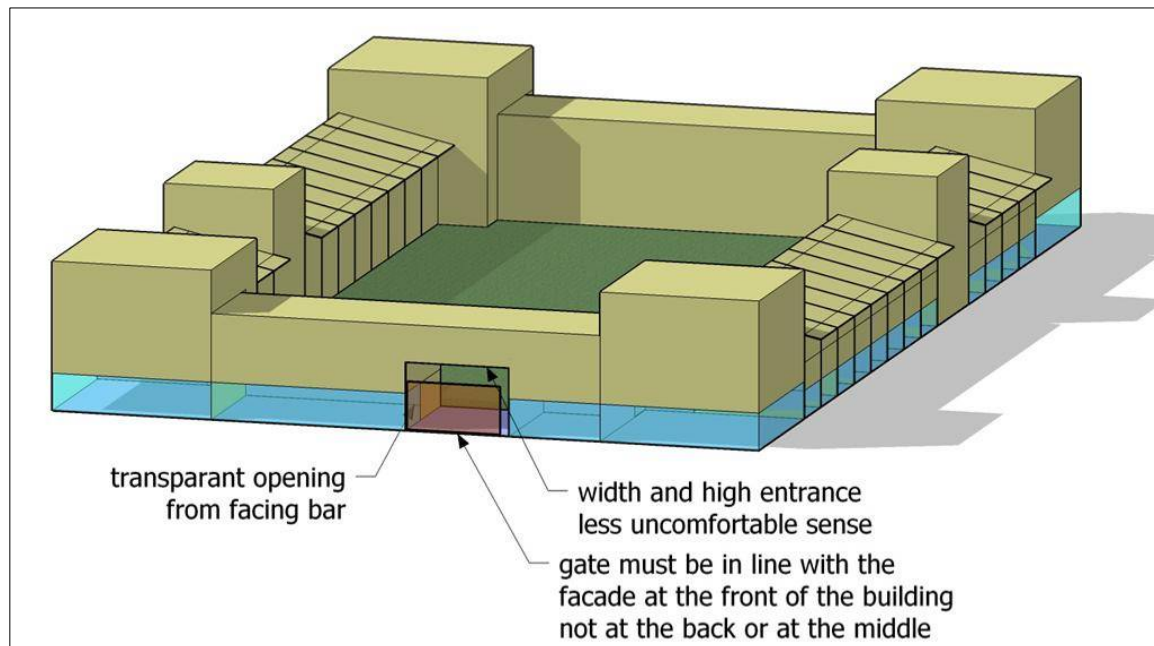


Illustration 4.5.3 Entrance sketch 3

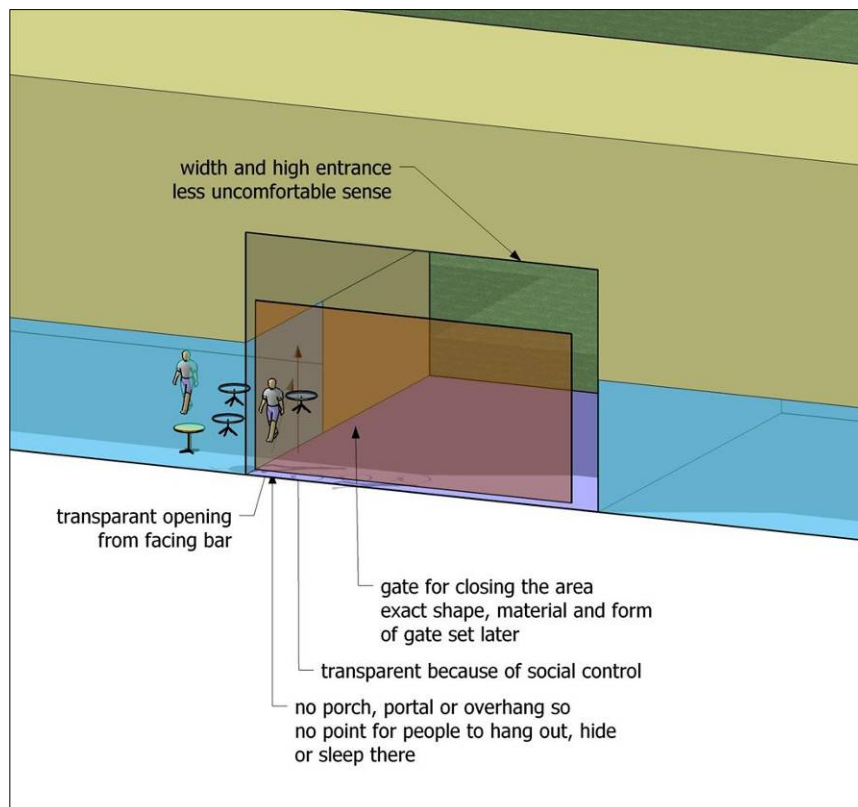


Illustration 4.5.4 Entrance zoomed

4.6 Courtyard

The residents of the building complex should be comfortable and safe in the building and in the area around. A place where the residents can socialize, the children can play and a place which encourages them to participate in a community.

The building is closed for everybody except:

- residents of the building,
- shop keepers
- stock up workers

See Illustration 4.6.1. The entrance is closed by a large gate. There are two entrances (1) because of the safety and usability. The footpaths (2) and roads for the stock up are paved with tiles. There is a lot of green area (3) where people can socialize, children can play and where there could be some practice of sports. A place to have a barbeque (braai) is very important because it is part of the culture of the people in Mamelodi. The circle is paved (4).

A lapa (5) is situated against the paved circle in the centre of the green area. A lapa is a covered area that can be used by the residents to socialize. Area 6 and 7 are grounds which could be bought by the owners of the centre modules. The owner can decide what to do with the ground. The owner can place his own fence. Area 7 can be used as outer living space for the planned crèche. It may have a child friendly fence and rubber tiles for safety. If the ownership of the centre modules changes, it must be possible to easily adapt the area's lay-out.

The residents of the living units have a box room (8). The entrances (9) to the gallery (11) are provided with stairs. The gallery leads to the entrances of the living units.

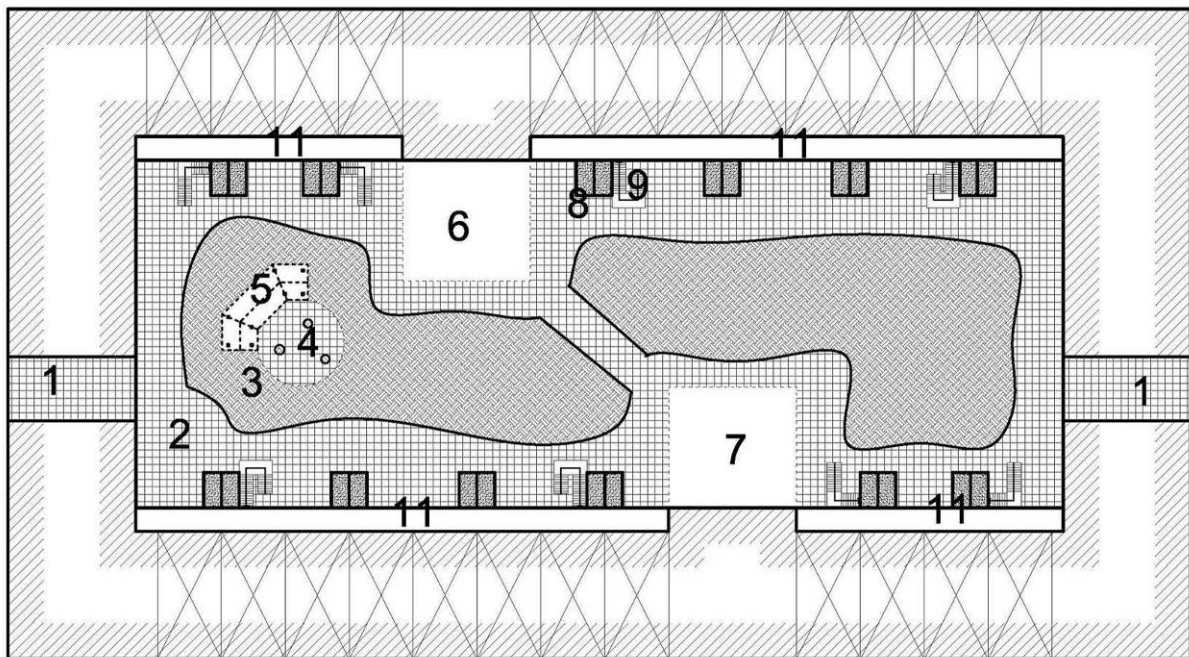


Illustration 4.6.1 Plan for the court yard

4.7 Entrance houses

The entries of the houses are only accessible from the court yard because of the safety, burglary, costs and because it's not preferable to have entries in shopping area's.

After entering the court yard by the main entrance the residents can go up with an outer staircase. They arrive at the storey and can go down a gallery to their front door. Every gallery must have two stairways for practical reasons and safety.

The gallery must be a well passable and friendly traffic area where people can socialize with their neighbours. The gallery must be part of the residents' living area:

- Surrounding area.
- Courtyard
- Gallery
- Living unit

See Illustration 4.7.1.

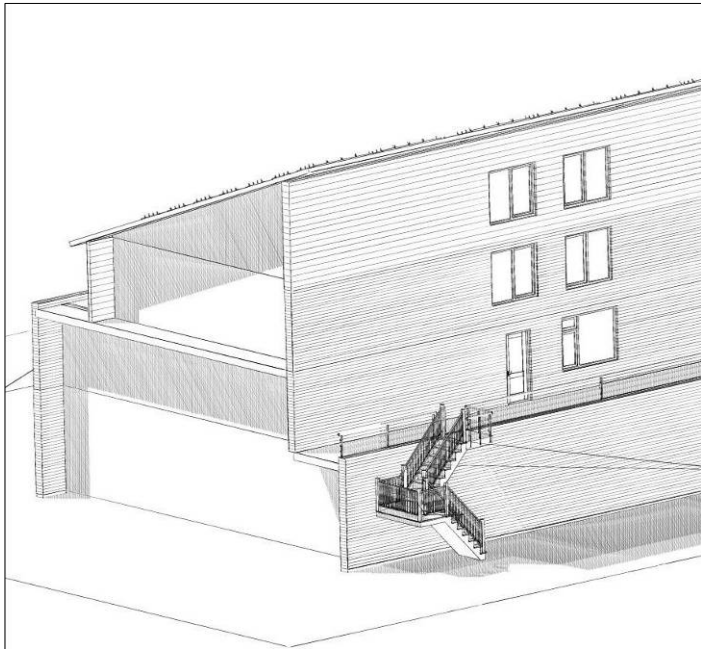


Illustration 4.7.1 Entrance houses

4.8 Façade

The façade is an important part of the building. The façade protects the inner life against influences from the outside. Also the esthetical aspects play a part. The lay-out of the windows, doors and roof are important in the charisma and aura of the building.

This design is just an indication of the author's vision of this report. The lay-out of the living units is not isolated from the rest of the building. The lay-out must be made in cooperation with the corners modules and centre modules. It's very important to consider the rest of the building.

The facade at the outside (Illustration 4.8.1) of the building has a terrace. This is made because the people in Mamelodi like to live outside, and they like to have contact with the people at the street. By making a terrace they have the opportunity to do that.

At the roof PV-cells for solar energy are applied. The exact materials of the façade will be indicated in a later chapter.

The facade at the courtyard (Illustration 4.8.2) doesn't have a terrace; because of the orientation of the sun it would have little use. There are double doors applied, with a fence against falling down.

For build ability and costs it is desirable to make all the facade lay-outs the same design. For the African way of building there can be more variation. The author's vision is that the build ability and costs are more important then the variation in lay-out.⁷

Future research is recommended for this issue.

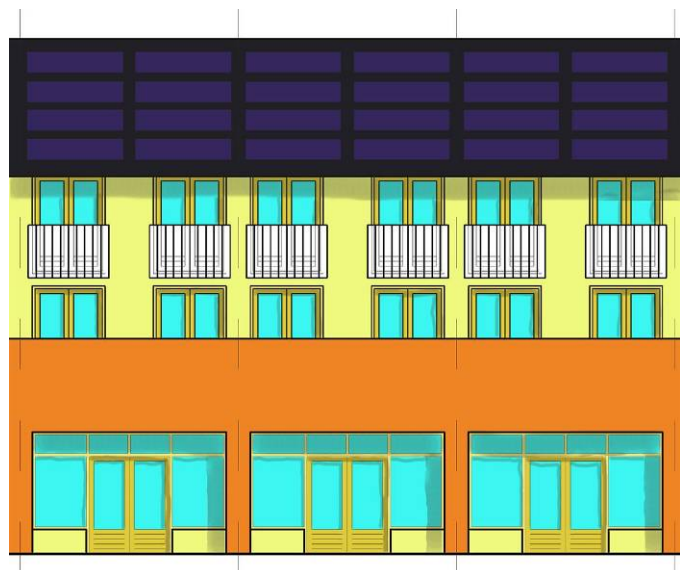


Illustration 4.8.1 Façade outside building



Illustration 4.8.2 Façade court yard side

⁷ A recommendation is made for future research about the lay-out for the living units in chapter 7. Recommendations.

5. Structural engineering aspects

5.1 Introduction

In this chapter the technical side of the plan is explained. Important highlights are described like the construction, the materials applied, the building methods and the lay-out of the houses.

Not the entire building is worked out in detail. There is no time for that and it's not the intention of this research. A recommendation for future research is made in chapter 7. Recommendations.

5.2 Structural system

The structural system of a building is designed to support and transmit applied gravity and lateral loads safely to the ground. The superstructure is the vertical extension of a building.

The exact construction isn't worked out. Calculations, drawings etcetera have not been made. Only the principles are indicated. A recommendation for future research about this subject is made in chapter 7. Recommendations.

5.2.1 Building method

The choice of building methods is based on some factors. The most prominent sources are:

- Literature studies
- Research performed by other students from the Hogeschool van Utrecht
- Analyses, experience and impressions by the author

The building method chosen to provide the super structure is a combined concrete one called a hybrid system. The concrete elements are partly prefabricated and partly poured in situation.

The advantages for using a hybrid concrete method are:

- The high structural mass of concrete can store heat well for climate control.
- The high structural mass of concrete complies with the regulations about sound, heat, moist and fire.
- The system is common in South Africa.
- The method is generally easy to perform for the workers on site.
- The experience and educational level from the executives to supervise the staff carrying out the work is available at the right level.
- The raw material to make concrete is available in the area. There is a concrete and cement factory around the building site.
- The material has a low demanded accurate accuracy level.
- With this method the possibility to build flexible is available.

The disadvantages of using a hybrid concrete method are:

- Large dimensions for width and height
- The building time is longer
- More labour needed on site

The time on site and the longer building time are disadvantages that are acceptable in this situation. The hourly wages for construction workers are not high. The workers can be selected among the residents of Mamelodi. Most of the labour is unskilled labour and can be performed by uneducated cheap workers. That way the building can be realized and Mamelodi has some extra employment.

5.2.2 Flexible building

The ground floor and the storeys of the row houses have a different structure. The ground floor is set up with concrete pillars and supports. The storeys are set up with concrete walls.

The pillars at the ground floor can be used for adaptations. It's possible for companies to rent or buy larger segments than one unit. By making pillars it is easy to change the limits of a working unit by changing the light walls. With this option it is easily possible to change a single working unit into a combined unit over several segments.

The walls used for separating the working units are required to meet the high regulations of noise, moist and fire demands.

It's unnecessary for living units to combine more units than one. It's unnecessary to leave the possibility open. Concrete walls meet all the regulations and don't need extra amenities.

5.2.3 Structural grid

The structural grid is very important in the design of the building. By making a well-thought-out structural grid it is possible to save money and to make the carrying out easier. By striving to make construction elements the same dimensions it's possible to repeat a lot of labour. That way it's possible to use the shuttering, the templates used in the factory and the preparations at the offices. That makes it easier and cheaper to build.

The width of a segment or unit must meet the demands of both living and working functions. The distance must be a multiple of 300 mm because it is designed using a modular system.

Chosen is for a heart by heart distance of 5400 mm. That is a usable distance for living units and it's a usable distance for working units. The distance enables the opportunity for flexible building, the heart by heart distance is possible with this type of building method and the proportion between distance and costs is reasonable.

For the corners modules and for the centre modules it's possible to choose another heart by heart distance. Because the functions in that area's and the brief don't demand a specified amount of space it is unnecessary to design a new heart by heart distance.

5.2.4 Structural principles

The substructure is the underlying structure forming the foundation of a building. The exact structure of the soil has not been tested for in the area. Conform earlier research the soil in Mamelodi is suitable for shallow foundations. Because of the height and weight of the building it is most likely that a shallow foundation will suffice. Assumed is that a piles foundation is needed.

The ground floor is constructed by a prefabricated concrete system floor. A crawl space is needed for pipes below the ground floor. With a crawl space it is easy to re-route the pipes and other provisions. With an in situ floor it's harder to adapt the piping. A prefabricated floor is easy to place by unskilled labourers.

It is possible to erect pillars in situ. The risk during the building is low. The beams are hybrid, partly prefabricated and the rest is poured in situation. To make a T-beam the construction height of the beam can be lower because the material of floor and beam are working together to resist the loads.

The elevation floor is prefabricated because it is difficult to make an elevation floor in situation. The workers must be skilled too, which gives a problem. The walls can be made in situation because the risk is lower.

5.2.5 Dilatation and stability

Because of the expansion by temperature changes the elements must have a dilatation seam. The maximum length of concrete elements without a dilatation seam is about 50 meters. It's important that every element in the entire building has a dilatation seam because through unequal settings great problems might appear like cracks.

Illustration 5.2.1 shows the dilatation plan for this building. Because of the dilatations the structural grid must be adapted because there are a couple of shifts in the design. Some extra structural grid lines are needed for systematic planning.

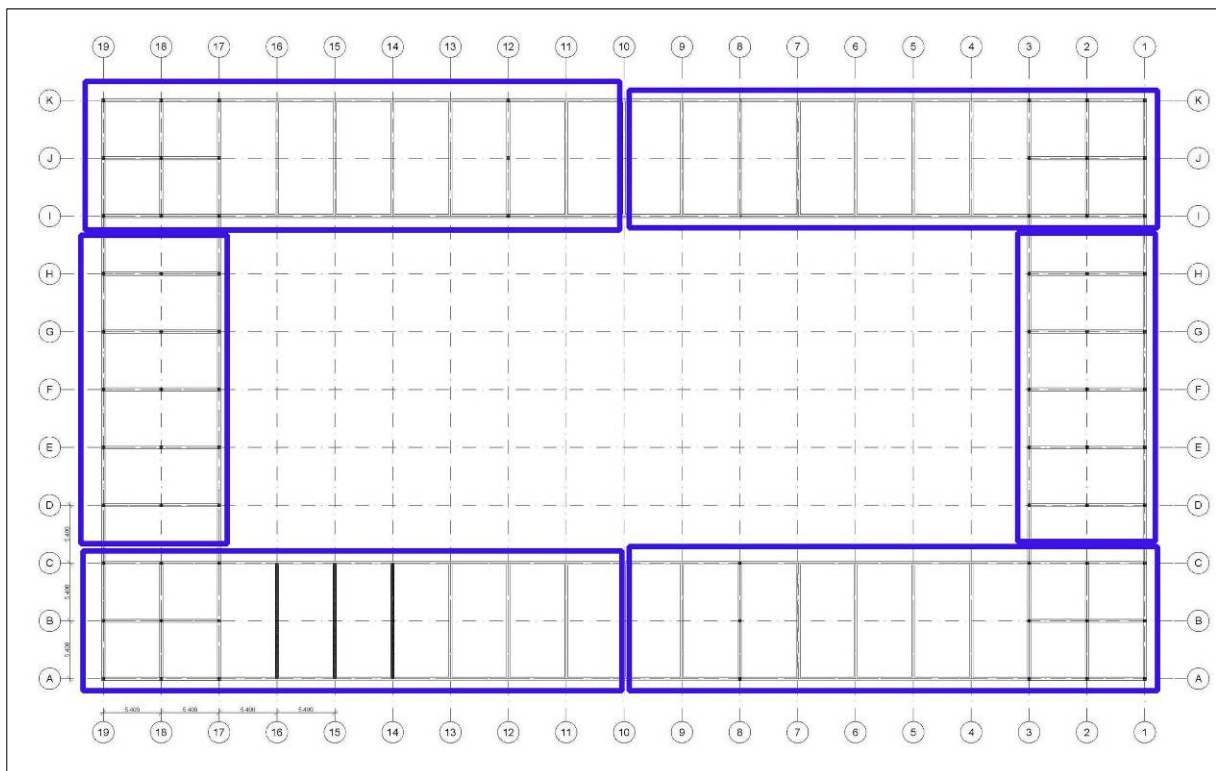


Illustration 5.2.1 Dilatation plan structural system

Stability and dilatation mostly conflict with one another. To create stability it's needed to make everything connected. Dilatations are made to make some parts loose from each other.

The stability of the building is made possible by making the corners modules into a stiff core. The rest of the blue parts are connected to the corner modules which gives them stability. These elements don't have any stiff core. That's why they have to be connected with a corner module. Because of the expansion caused by fluctuating temperatures special provisions must be made.

5.2.6 Plan for structural system

In the Isometric impression of the structural system (Illustration 5.2.2) the set up for the superstructure is shown. The drawings left and right are the floor plans of the storeys.

All the aspects described above are considered during the design of the superstructure. See Appendix D: Super structure for drawings.

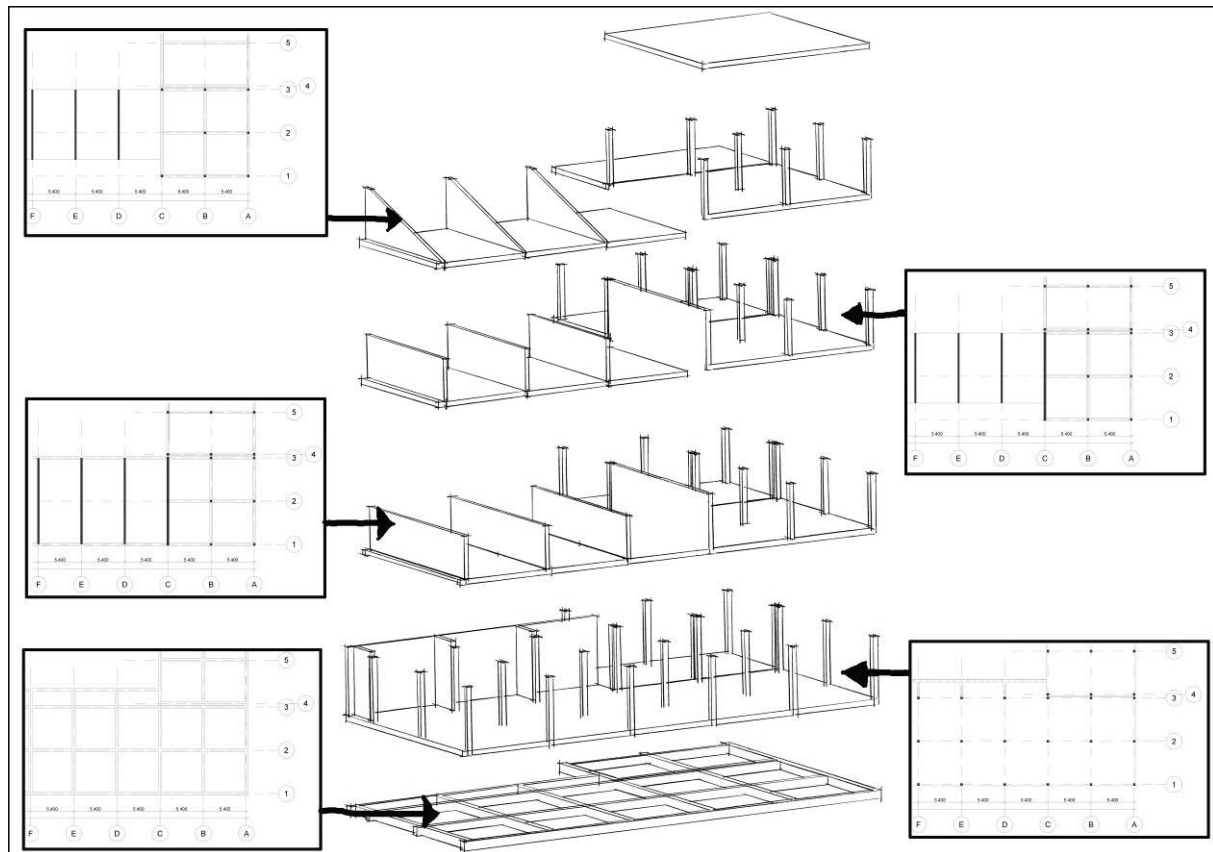
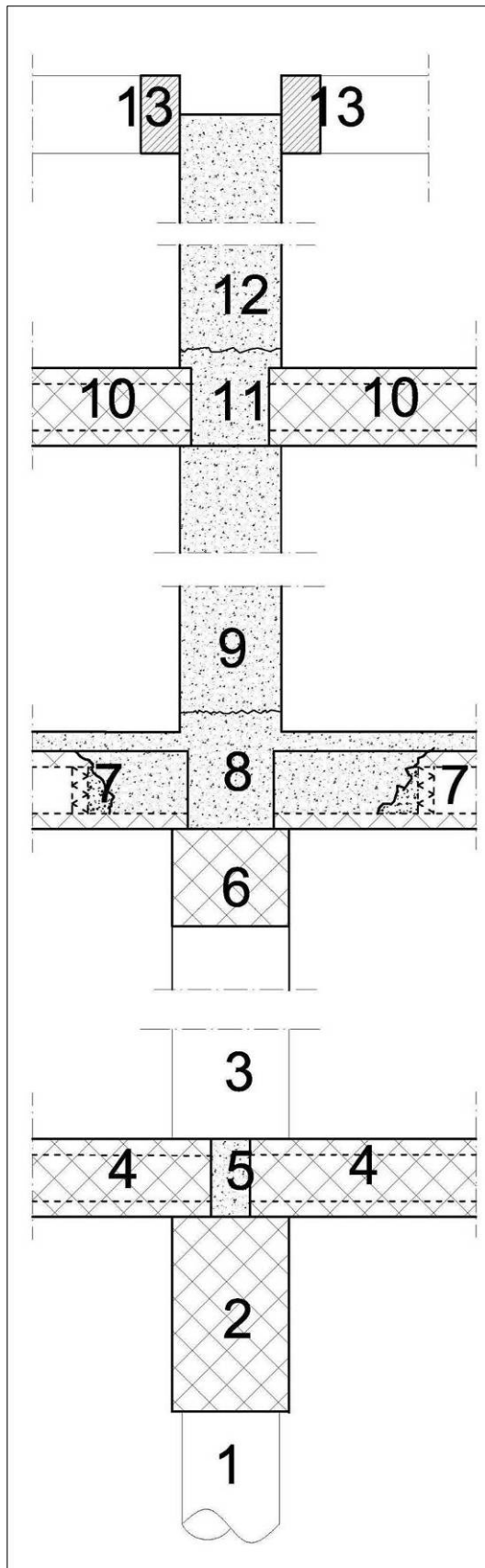


Illustration 5.2.2 Isometric impression structural system

The building can be executed in different phases, because the building will be divided into different segments by the dilatation seams. It is preferable to give the order to one contractor. The contractor is responsible for completing the entire building. If there are more contractors it's difficult to find the responsible contractors in case of problems. The contractors could shirk their responsibility to one another. If there is only one contractor that problem is less likely to happen.

If the one contractor doesn't have enough capacity for constructing the whole of the building in the time demanded, he can hire other companies or labourers to finish the work. But the responsibility stays with the main contractor.



Perform order structure system:

See Illustration 5.2.3

1. pile foundation prefab
2. beam foundation in situ
3. pillars in situ
4. floor prefab
5. fill with poured concrete
6. beam prefab supported
7. floor concrete partly chopped.
8. construction iron and poured concrete incl. provision for wall 9 for the sheltering.
9. wall in situ
10. floor concrete
11. Construction iron and poured concrete incl. provision for wall 12 for the sheltering.
12. wall in situ
13. provision for roof, timber trusts

The choice for a prefab beam (6) is because of the higher risk and the build ability of the construction.

The choice for prefab floors (7 and 10) is made because of the high risk of in situ made floors.

Illustration 5.2.3 Perform order for structure system

5.3 Enclosure system

The enclosure system is the shell of envelope of a building, consisting of the roof, exterior walls, windows and doors.

No research has been done about windows and doors. Most common in South Africa are steel windows and windows made of wood are also applied. Synthetic materials and aluminium are not commonly used.

5.3.1 Exterior walls

For the exterior walls ("buitenspouwblad") there are a lot of options. Because of the superstructure there must also be a provision for filling up the cavity between the exterior wall and the inner wall (interior wall, "binnenspouwblad"). A provision is needed for hanging the exterior material on to. There are some options for the interior wall:

- Bricks or light elements like gas concrete (Illustration 5.3.2 detail 1a)
- Wooden frame (Illustration 5.3.2 detail 1b)

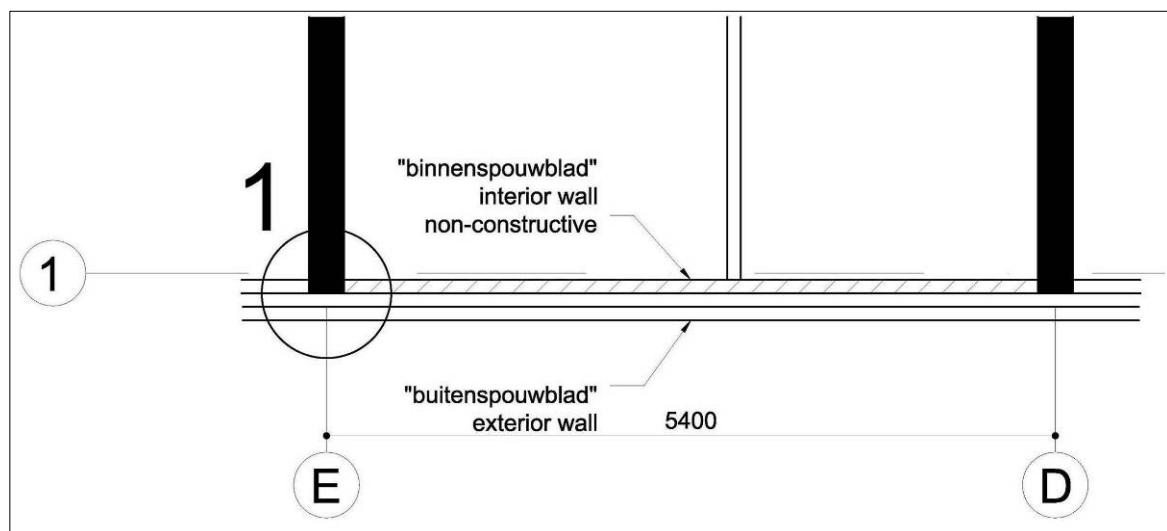


Illustration 5.3.1 Interior and exterior wall

The concrete superstructure is constructive. The interior wall doesn't have to be constructive only having to carry the external wall and its loads.

Detail 1a

Bricks are a common building material in South Africa. Disadvantages are the weight and the time needed to handle them. See Illustration 5.3.2 detail 1a.

Detail 1b

The wooden framework is much lighter. There is more skilled labour needed. The conditions are better for insulation because of better sealing. It is easier to connect to the concrete wall by using steel anchors. See Illustration 5.3.2 detail 1b.

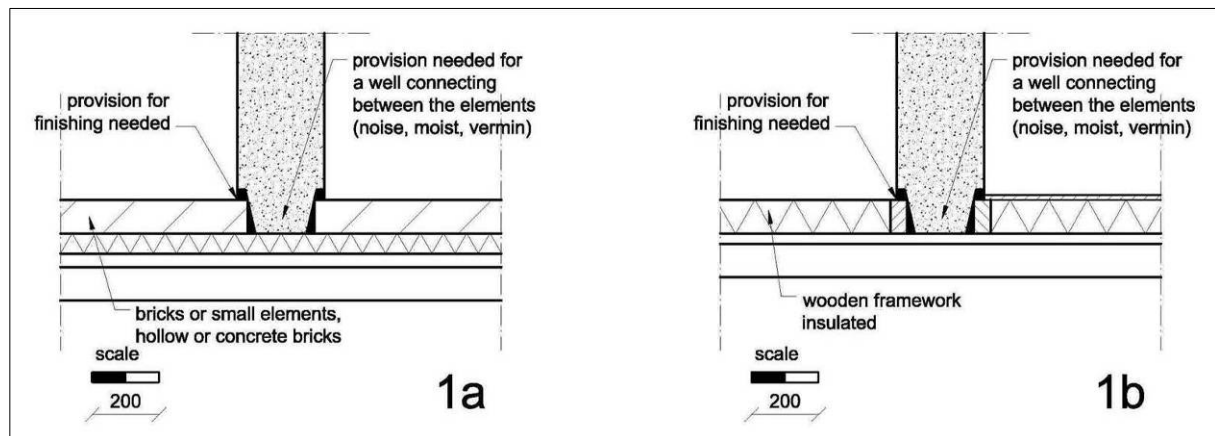


Illustration 5.3.2 Details interior wall

Method chosen:

The choice concerning the interior wall is for bricks. They must be hollow light bricks because of the weight and because the bricks don't have to be constructive. In an area with conditions like The Netherlands a wooden framework would probably have been decided upon. It's of better quality, there is less time needed to handle, it provides a better insulation and it is easier to process at the site.

Because of the low employment and the mostly cheap and unskilled workers, bricks are more profitable for contractor and residents of Mamelodi. This gives the advantage of low wages to the contractor and to the residents this method brings employment.

5.3.2 Exterior wall

There are a couple of options for the exterior walls:

- Plaster on insulation (Illustration 5.3.3 detail 2a)
- Bricks (Illustration 5.3.3 detail 2b)
- Wooden planking (Illustration 5.3.3 detail 2c)

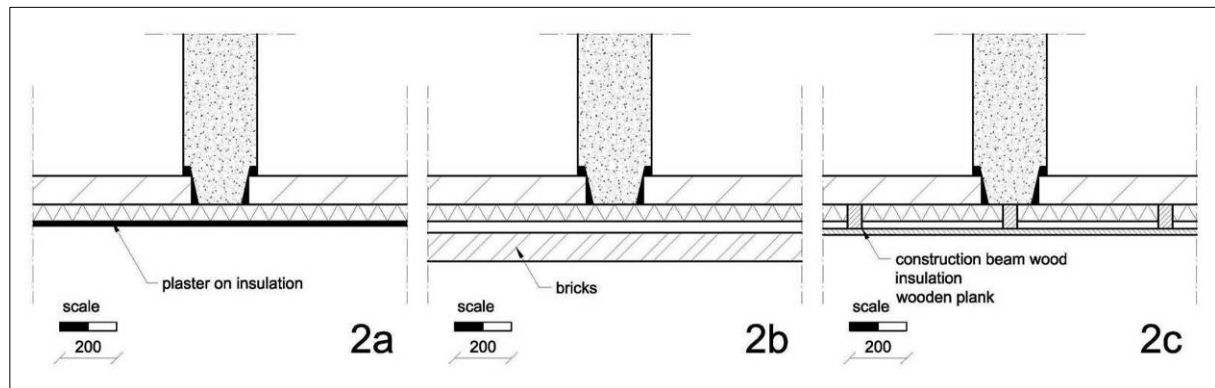


Illustration 5.3.3 Details exterior wall

Detail 2a

The insulation is mechanically fastened at the interior wall. Between those materials a layer of DPC is needed to stop the development of moisture and condensation. Then comes a layer of plaster. The construction described here gives a good quality, nice ethics, good insulation and is acceptable to the residents. The process needs skilled workers, but they can make use of additional assistance by unskilled workers. This option needs few maintenance.

Applying plaster on insulation at ground floor is not preferable. The plaster is vulnerable to vandalism. It's quite easy to kick or strike holes into the plaster.

Detail 2b

The insulation is mechanically fastened to the interior wall. The exterior wall made by bricks needs to be anchored onto the interior wall. The anchors are applied during the bricklaying. The cavity between the bricks and the insulation is needed for the transport of moisture out of the construction and to protect the insulation against weathering.

If the layer of air is not present a couple of problems might arise:

- Mildew on wall, floor, ceiling or other parts
- The air can become mildewed (very unhealthy)
- Moisture
- Shorter lifespan
- Insulation decay

The construction described has a good building quality, is easy to handle, can be done with a lot of unskilled work and is acceptable to the residents. This option needs

little maintenance. A disadvantage of this option is that there are two heavy and expensive layers of brick.

Detail 2c

The wooden planks are mechanically fastened to the interior wall by means of wooden beams. They could also be fastened with steel anchors, but these are more expensive. Between the beams the insulation is applied. The wooden parts of the construction need to be ventilated. The cavity has been designed to take care of the ventilation of the wooden parts.

One important factor is the question of the proposed residents wanting to live in wooden houses. The people see wooden superstructures as generalising and find them typical. They don't want to be remembered of their past. About exterior walls made by wooden parts the opinions are diverse. Because the houses designed by modern architects, that the rich people live in, often have wooden exterior walls it's therefore also possible to apply wooden walls to this building.

The correct building materials for wooden superstructures are not available in the area. The wood growing in South Africa grows too fast so the wood is not strong enough for use as construction material. Importing the building material is expensive.

The construction has a good quality, nice ethics, light weight building material, good insulation, easily adaptable and may mostly be done using unskilled labour.

Disadvantage is the needed maintenance and the sustainability of the material. A lot of the people don't have the money or the priority to maintain their houses. Wooden external building materials need to be maintained every two years and greater intervention every seven or eight years.

Exterior wall chosen:

Option 2c is not applicable to this building, in this area, under these conditions. Option 2a and 2b are applicable.

On the ground floor (working unit), option 2b is the best option. Option 2a can't be applied on the ground floor because of the vulnerability of the material.

On the first floor and the floors above that, the choice was made for option 2a.

The difference between ground floor and the upper storeys underlines the difference of activities within the building. Working unit at the ground floor and living units at the upper storeys.

5.3.3 Roof

The roof of a building must protect the inner life against the weather outside, close up the building and resist the powers of wind and rain.

There are some options for roofs:

- Concrete
- Wood
 - Prefabricated
 - In situ
- Steel

Because of the sloped roof it is not practical to use concrete roofs.

Steel roofs are an option but more for larger surfaces and for company's or low quality buildings. It's not common to apply steel roofs on houses.

Prefabricated wooden roofs are available in South Africa. They are not common because of the low employment. If the entire building branch would start working with prefabricated roofs, there would be even less jobs. Employment is already a problem in South Africa so that's why prefabricated building elements are not common.

An in situated timbered and isolated roof is also an option for the row houses. This is fit for unskilled labour, so provides for many jobs. But it is also dangerous, high risk labour.

Because of the repeating elements, and the high risk labour the choice was made for a prefabricated wooden roof.

See Illustration 5.3.4 for the details of roof and wall. The way of connecting is almost the same, but option 3a is riskier than option 3b because most of the work is done at the factory. Option 3b is more difficult and needs more expertise to install. The numbers in detail 3b is the perform order.

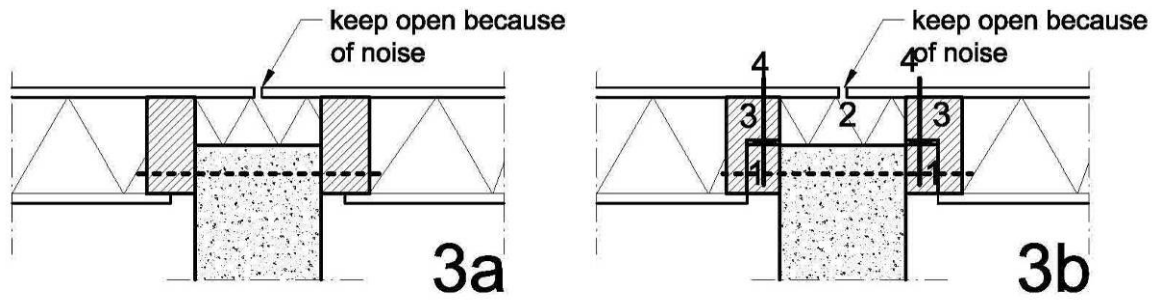


Illustration 5.3.4 Wooden roof construction in situ and prefabricated

At the corner modules and the centre modules (depending on the type of roof and its shape) could be chosen for concrete roofs or even steel roofs.

5.4 Lay-out living unit

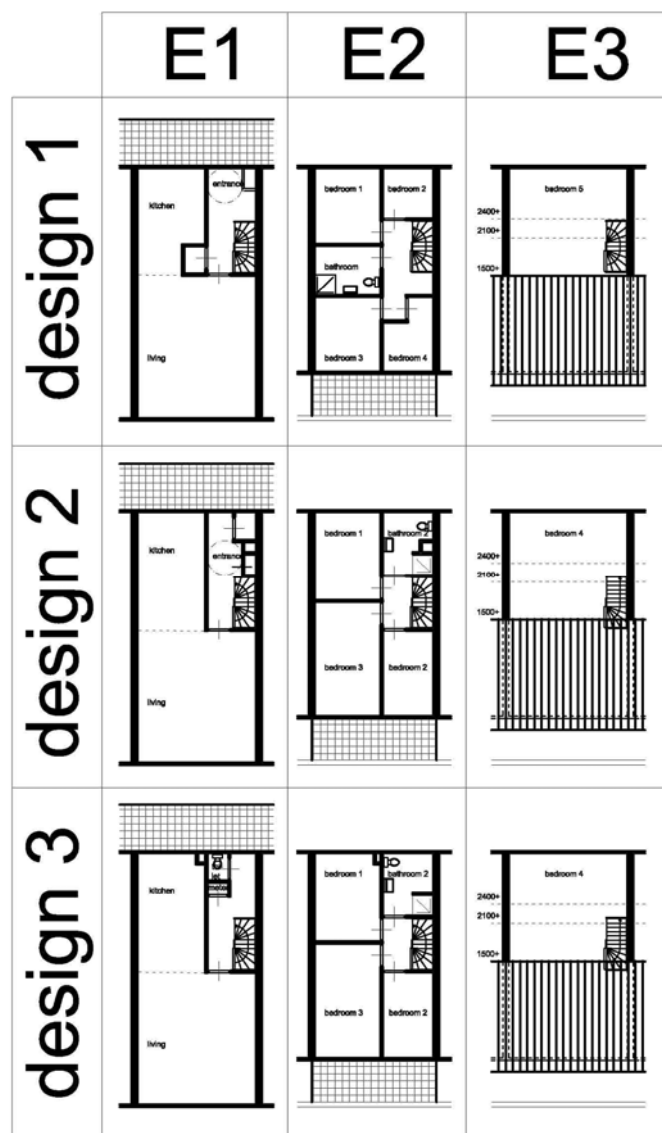


Illustration 5.4.1 Different alternatives for the lay-out of a living unit

The lay-out of a living unit is very important. The lay-out proves a unit is usable for the residents to live in.

The units are similar, so every lay-out is the same. A good design of the building can save money. Provisions for pipes, holes and assistance constructions can be expensive. Centre all those provisions at one point and it's cheaper and easier to build.

There are some alternatives made shown in Illustration 5.4.1. See also Appendix E: Lay-out living unit.

Generally, it is difficult to design the lay-out of these units because of the roof. There are few possibilities to place the stair because of the limited height. So the options in the design of the lay-out, are also limited.

In design 1 the lay-out at floor 2 (V2) has the most bedrooms. The traffic area is nevertheless inefficient. There is no provision for pipelines like a case. The toilet, the bathroom and the kitchen are spread over the whole of the lay-out.

Design 2 is a lot better. The wet cells are much closer to each other, the traffic area at floor 2 (v2) is more efficient. But there are only four bedrooms because the bathroom changed its position with a bedroom at the front. Because a bedroom needs daylight, it's impossible to plan a bedroom at the place of the bathroom. The kitchen at the ground floor can't reach the case for the pipelines. Extra provisions must be made, so more costs.

Design 3 fits all the aspects of a good and useable lay-out. All the wet cells can reach the case for pipelines. The rooms are well dimensioned, big enough and efficient. All the rooms offer natural ventilation. Traffic area is limited to a minimum.

6. Conclusions

6.1 Introduction

In this chapter the author of this report judges his own design, decisions, considerations, solutions and thoughts by looking back at the results. The author shows also the weaknesses in and the possible improvements to the subject.

This chapter will be the input for the chapter recommendations.

6.2 Research R.E.M.P.

- What can we use from the research made by R.E.M.P.?

The research executed by R.E.M.P. described a spread urban plan without many amenities. The residents live in shacks or houses provided by the government. The shops and dwellings have been built with old or recycled materials the people found or bought somewhere.

The people want to live in houses made of the same materials that the houses the rich people live in are made of, like bricks, stone, plaster, roof tiles and steel. People want to live in modern architecture buildings.

6.3 Brief

- What demands a working / living unit should meet?

A working living unit must be a build able, sustainable, affordable and changeable building. It must encourage the people to participate in a community and improve the safety in the building and its surroundings. The building complex must integrate working, living and amenities to reduce the travelling time between these functions.

6.4 Urban design

- How can the living / working unit be integrated in the urban design of the surrounding area?

The surrounding areas must be adapted to the building. By making a hierarchy in the streets the traffic will slow down. By applying a woonerf principle the area will be safer for children to play in and for residents to socialize in the street. The traffic situation is designed for the surrounding area of the building, but must be designed on a larger scale to form a correct plan.

The density of the living units per square meter has not really improved. The difference of this solution is that the people have more square meters of living area, more square meters of outer space, a closed courtyard, the ability to participate in a community and work, shop and amenities are close by.

There is no sufficient public transport system.

For the positioning of the plan people must be relocated to other dwellings because their houses are at the site of the proposed building. The houses must be demolished to create space for the building and its surrounding area.

6.5 Sketches

- What does the design of the working / living unit look like?

The design made for the working / living unit has a couple of highlights. Each corner module of the building is different. The designs of the building are based on the typical way of designing in South Africa. Informal, non symmetric and a lot of variation. Orientation towards the sun, solar energy, passive solar energy and natural ventilation are important considerations during the designing.

Most of the building must be worked out further. This chapter describes only concept plans for the most parts of the design. The lay-out of the facades is only an indication. The lay-out is repeating and standard. The lay-out of the corners and centre modules have not been designed. That's why there is no connection between the different lay-outs which is very important for the total aura of the building.

6.6 Build ability

- *How is the design of the working / living unit useable and build able?*

By drawing details and impressions from the construction the point of departure about the structure system is indicated.

The author chose for a hybrid system because it is safer, cheaper and creates more employment then other methods. The hybrid method needs more expertise from direction and workers. The connections (Illustration 5.2.3) between building elements are more difficult and need more expertise to make. Some acts need more labour than other methods would, and some need less labour. This are criteria why there is chosen for the hybrid system.

The gallery (Illustration 6.6.1) designed to provide the entrances to the front doors are hard to build. It is difficult to make a good connection with the other building elements. It is hard to close off for external influences like water, wind and rain. There is a difficult thermal connection between in and out that is hard to disconnect. Demands like fire, noise and moisture are hard to settle. Making the gallery is difficult, expensive and necessitates a lot of extra provisions like pile foundation, dilatations and insulation. It should be considered to try and find other solutions to provide the entrance to the front door.

Possible alternatives:

- One stairway for every front door
- Balcony instead of gallery
- One balcony per two doors

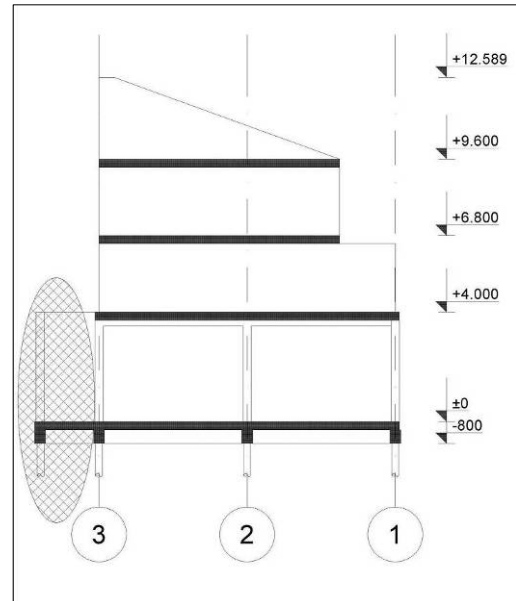


Illustration 6.6.1 Gallery hard to build

The adaptability of the lay-outs is limited by the demands of the building regulations. The building regulations demand daylight in every room used for living. Normally if residents of Mamelodi need more space, they build an extension to their shack or dwelling. This type is limited in its options to adapt. There can't be added extra rooms or storeys. The only option is to make the inner walls of an easily adaptable material. So the residents can change some inner walls if they want to. However there arises a serious problem if the lay-out gets changed by the residents. In that case the rooms don't meet the demands of the building regulation anymore.

The lay-out for the units is not suitable for every family size. If the family is too large the living unit in this design is not sufficient.

6.7 Main question

- *How can we make a design for a living / working which is suitable, useable and build able for the situation in Old Mamelodi?*

By analysing the current and the wanted situation, combined with the brief, it is possible to design a plan for a building complex based on a typology. By designing the urban plan of the surround area there is proven the design is suitable in that area. The sketches made of the building give an indication what the looks of the building are. By indicating the building principles for the super structure and the exterior walls the build ability of the design is proven.

The research is a good start but just a beginning. A great deal more research must be done and worked out to develop a realistic building at the end. The researches subjects are only worked out up to a certain level and need more depth.

7. Recommendations

7.1 Introduction

In this chapter the author gives recommendations for future research about the researched subjects and conclusions made in this report.

There are some recommendations for future research because there was no time to research everything. Some research was not of the specialty of the author and at the end of this research it has been concluded that some choices are not the right ones, creating the need for further research. The plan is now worked out considered from the point of view of an architect and urban planner. It's possible to work out the plan in detail. Broad differentiates and different fields can work on it like city planning, building and civil engineering.

7.2 Recommendations for future research

The urban plan of the surrounding area has been researched. The urban plan around the building could be researched on a larger scale to see if the adaptations in the surrounding area have any use.

There is in the current situation no sufficient public transport. Research might be done about how to improve the public transport.

The façade of the row houses has not been designed in cooperation with the rest of the building. The design of the rest of the building must be worked out to see if the lay-out of the façade fits in with the rest.

The gallery, which gives access to the front doors, is still under discussion. A couple of alternatives have been suggested. There could be future research done concerning the entrances to the living unit.

The building method is now worked out until the level of just principles. There could be research done by a construction specialist to work out the exact construction of the building.

The lay-out of the designed living units is not sufficient for big sized families. Future research can be done about the possibility to easily adapt the lay-out to that aim.

Epilogue

I signed up for this abroad experience in order to improve at personal, technical and social levels. I saw this assignment as an “once in a lifetime” opportunity. It has been a long desired wish to work abroad and I was curious if I could handle the challenge. I wish to help making the life conditions of the residents of Mamelodi a bit more human.

Those were my aims for this whole assignment. I think most of these aims have been fulfilled. The improvement at the personal level is the greatest. The experience of staying for four months at another country, with a different culture, seeing the other side of the medal is an experience that has changed me or even better, improved me. I now appreciate the life I live in The Netherlands more than ever after seeing what life people live in the townships of South Africa.

There was also (a bigger one than I expected) improvement at study related level. During the project I discovered that I never really worked structured. I was not able to get the researched material written down on paper. I was not used to substantiate my considerations and thoughts in advance. Normally, I made a product, a result, presented it and defended it orally. Always with good results.

I was not used to determining my own research, nor was I able to determine my own research. I demarcated at first a project that covered half of the results for the entire five year research. But I only had four months. The actual graduation report I finished in about six weeks. The remaining time was spent in research for R.E.M.P. and for general minor tasks.

During the process I improved myself at the study related field. Thanks to my coaches, some college students and hard work. The presence of especially the business engineer in the R.E.M.P. team was important for my improvement in this field.

There were also some social developments during these four months. To participate in a team of twelve people, work, live, party and travel with each other, without many serious incidents, is a big achievement and demands a lot off your (and your colleges) social ability.

The first weeks in South Africa I just had a great time. The weather was great, the people were friendly and we made nice trips to sights all over the country. We bought a car, we acclimatised to the new environment and we got to know each other. The cost of living here is lower than in The Netherlands, going out in Pretoria is nice and the pressure of work is still at a low level.

South Africa is a beautiful country with a great nature, mountains, sea and other sights. But, South Africa has enormous contrasts too. Between rich and poor, black and white, coloured and others. Between safe and in danger, working and unemployed, between beauty and ugliness. Between health and sickness.

There is in South Africa an official AIDS rate of 25 %. The unofficial rates are much higher because there is a taboo at AIDS. Even the president of the country denies the threat of AIDS to the inhabitants. Doctors are not allowed to write down AIDS as the cause of death. They must write down something else because they are not allowed any different.

The University of Pretoria is occupied mostly by people who are educated, the people with prospects the people who walk and party at Hatfield Square, the biggest place of entertainment for students. Two times a year, students can volunteer to give blood for charity. The blood is tested and one out of four students appears to have AIDS or is HIV infected.

If the AIDS figures for the educated rich people are that enormous how high will the real AIDS rate in the townships be?

That brings me back to the real essentials:

“This is not about graduation, a nice experience, personal development or about improving your curriculum vitae. This is about the life of thousands of people.”

One reason for me to sign up for this experience abroad was to try and make the living conditions of the people a bit more human. I think that was an unrealistic thought.

See Appendix F: Photo report

P.J. van Antwerpen

Bibliography

This chapter contains a summary of the bibliography that is used for this report. Institutes consulted for legal information are the South African bureau of standards and information about building materials at CSIR.

The books used for this report are:

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- "Kuijken Hilbrand, Hoogendoorn Elmar", Pretoria 2005, sustainable methods and materials
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- Schipper Mariecke, 2002, Handboek Communicatieve Vaardigheden, published by the study of Business Management, Hogeschool van Utrecht, Faculty Nature and Technology Utrecht
- "The Pioneers", Pretoria 2004, Baseline data collection
- "R.E.M.P.", Pretoria 2005, Mamelodi Project -Improving living quality in Old Mamelodi

The internet sites we used for this report are:

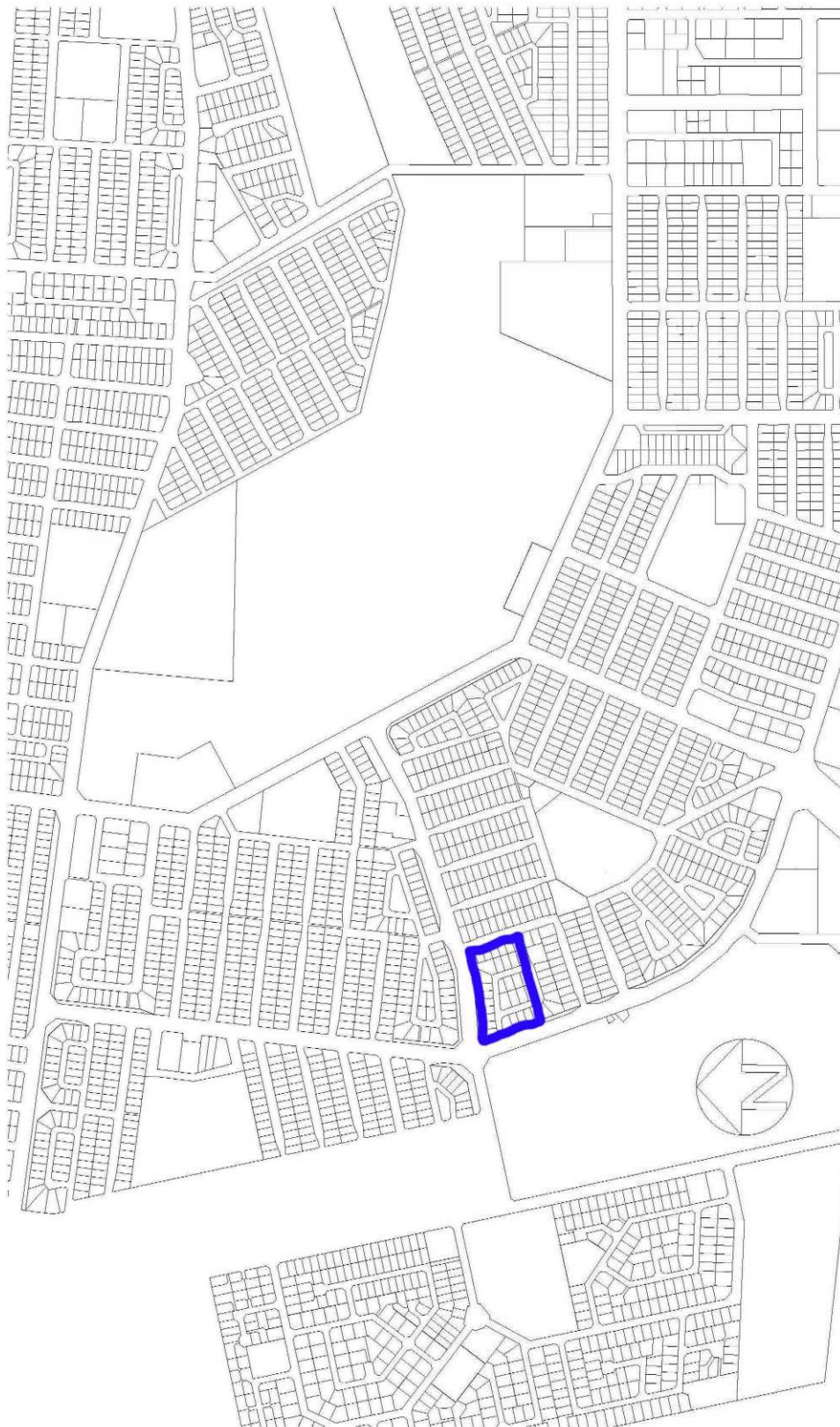
- www.google.nl
- www.sahistory.org.za
- www.socsci.kun.nl
- www.sustainablesettlement.co.za
- www.ruaf.org
- www.agrement.co.za
- www.dubo-centrum.nl

We used the sites on:

28-09-2004 until
15-12-2004
11-11-2004
10-11-2004
01-11-2004
04-11-2004
08-11-2004
18-11-2004

Appendix A: The building site

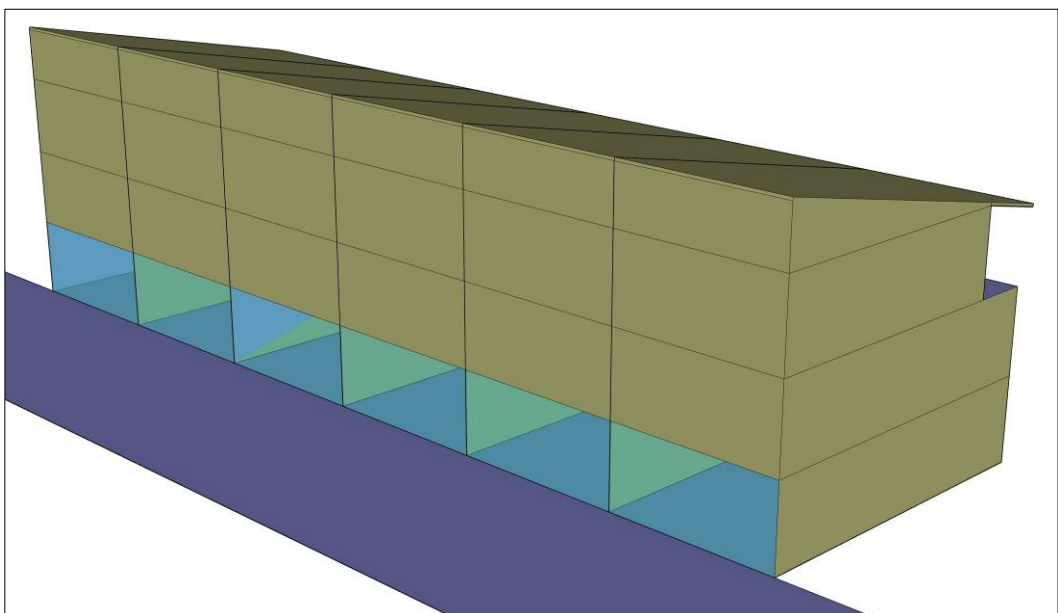
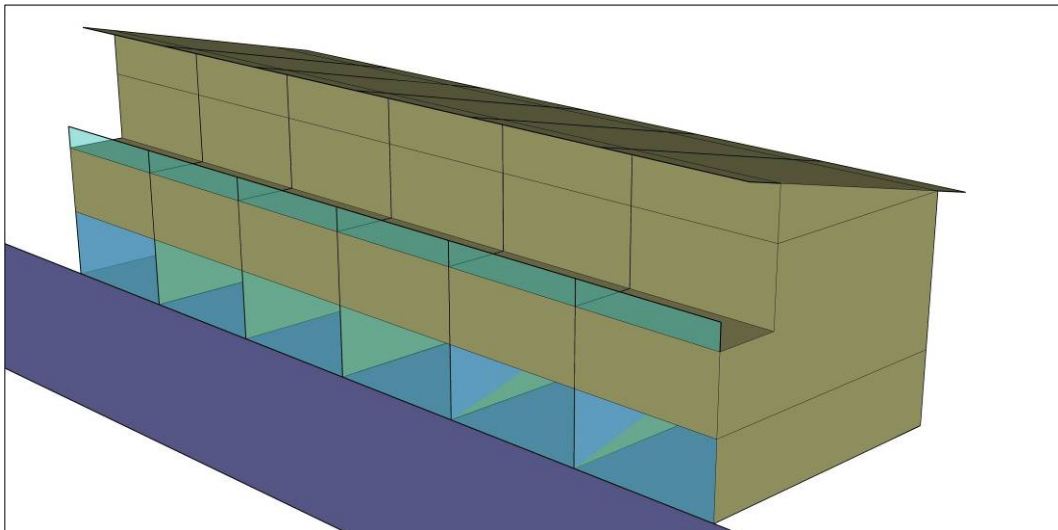
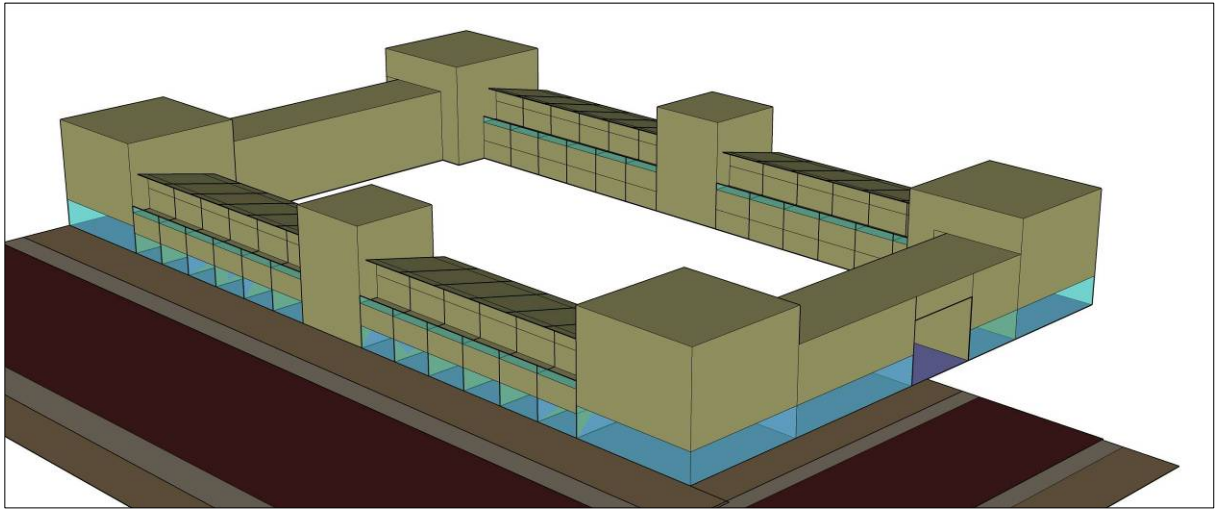
This appendix belongs by chapter 2.4 The building site.





Appendix B: Typology

This chapter belongs by 2.5 Typologies.



Appendix C: Urban design

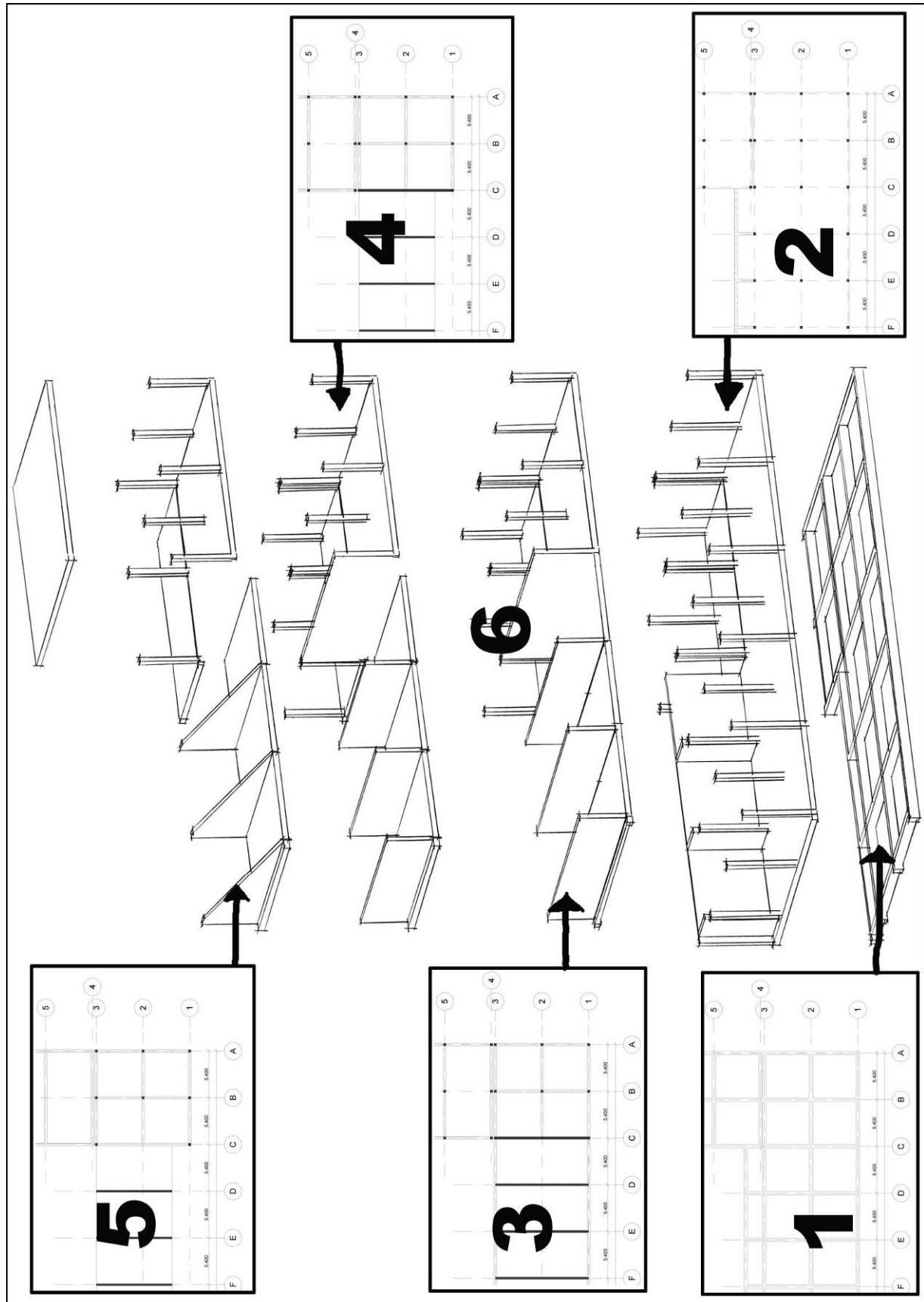
Plan for the urban design around the building.

This chapter belongs by chapter **Fout! Verwijzingsbron niet gevonden.Fout! Verwijzingsbron niet gevonden..**



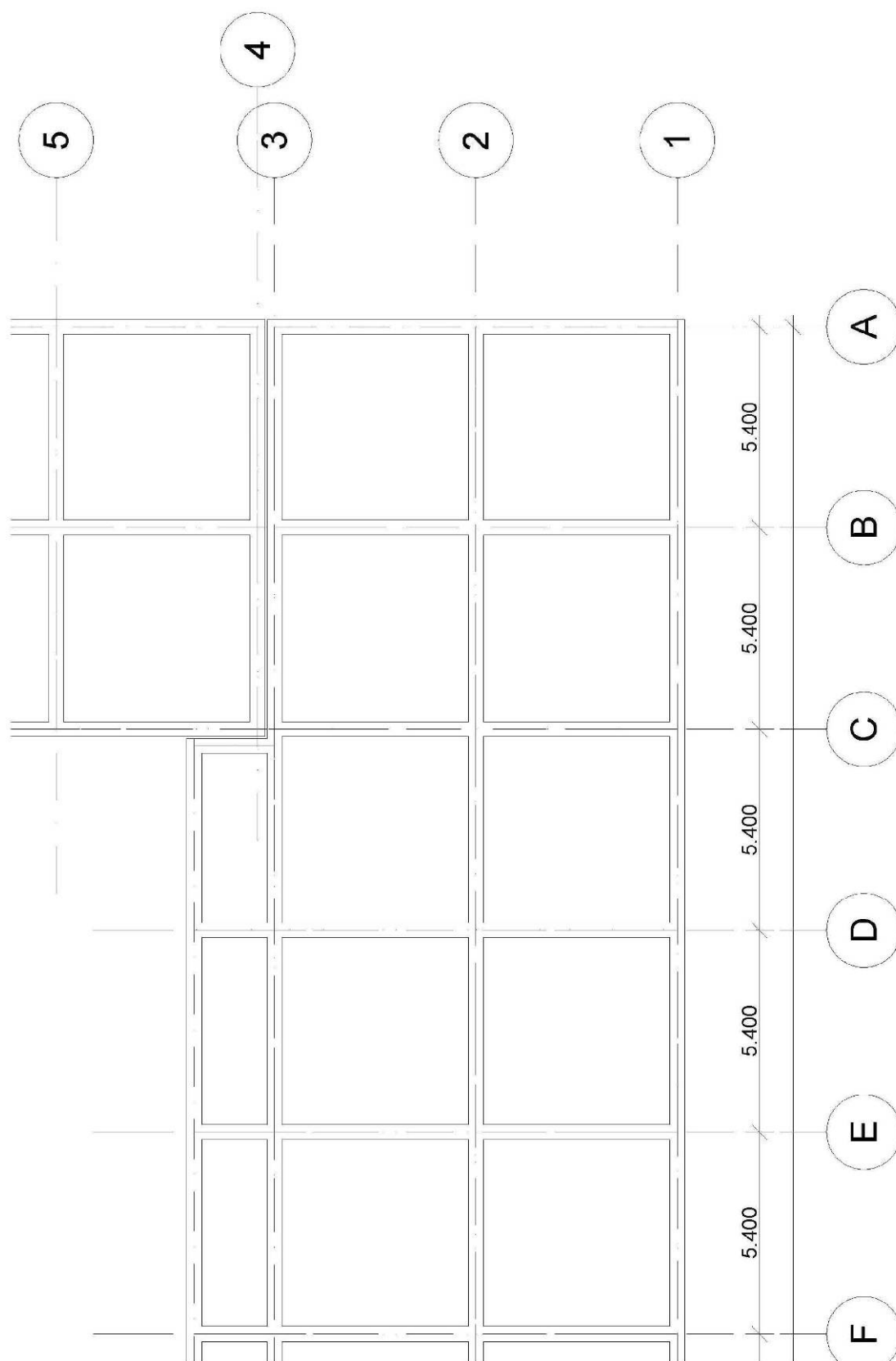
Appendix D: Super structure

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Verwijzingsbron niet gevonden..



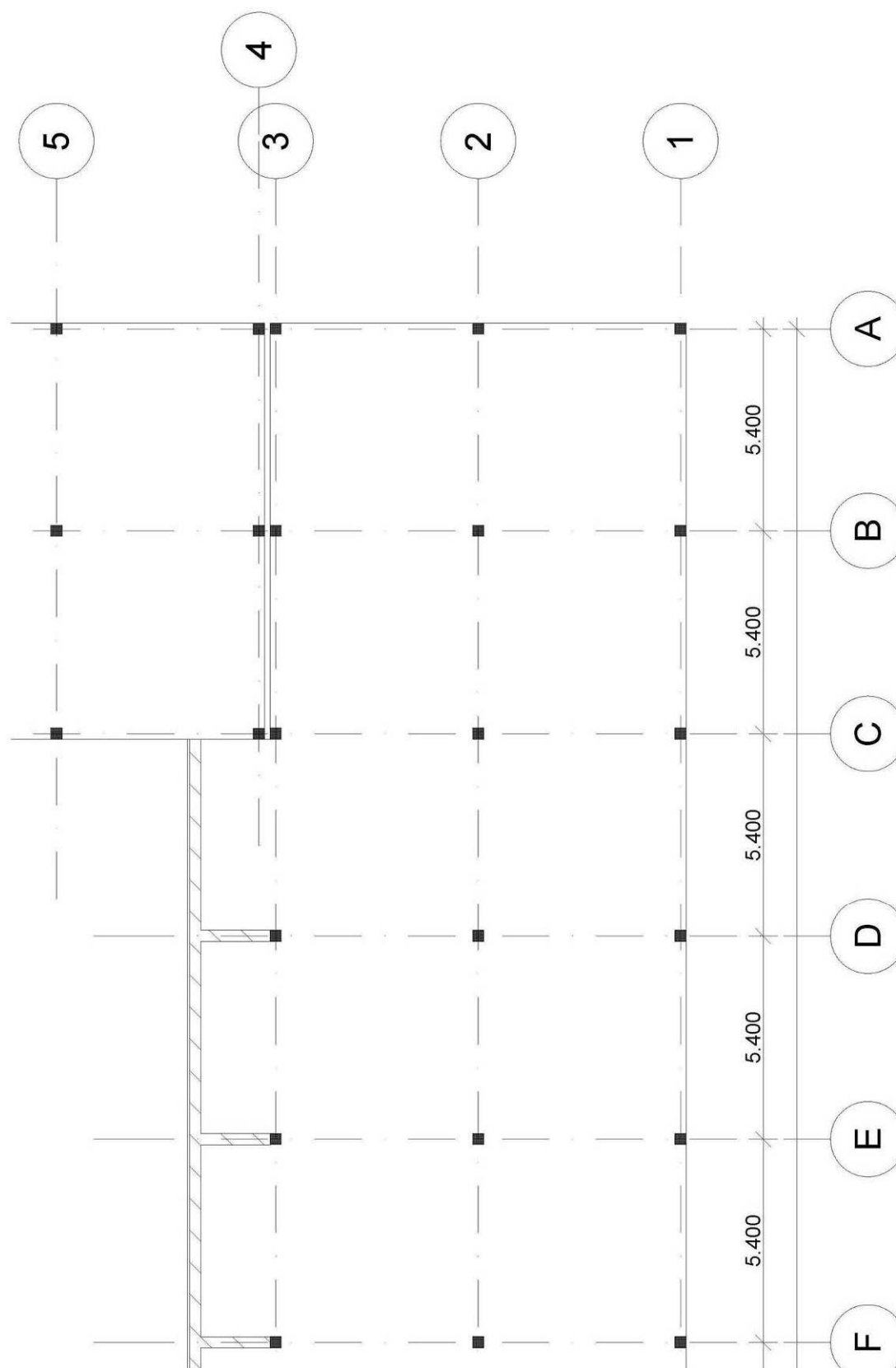
Appendix D1

Foundation plan story -01



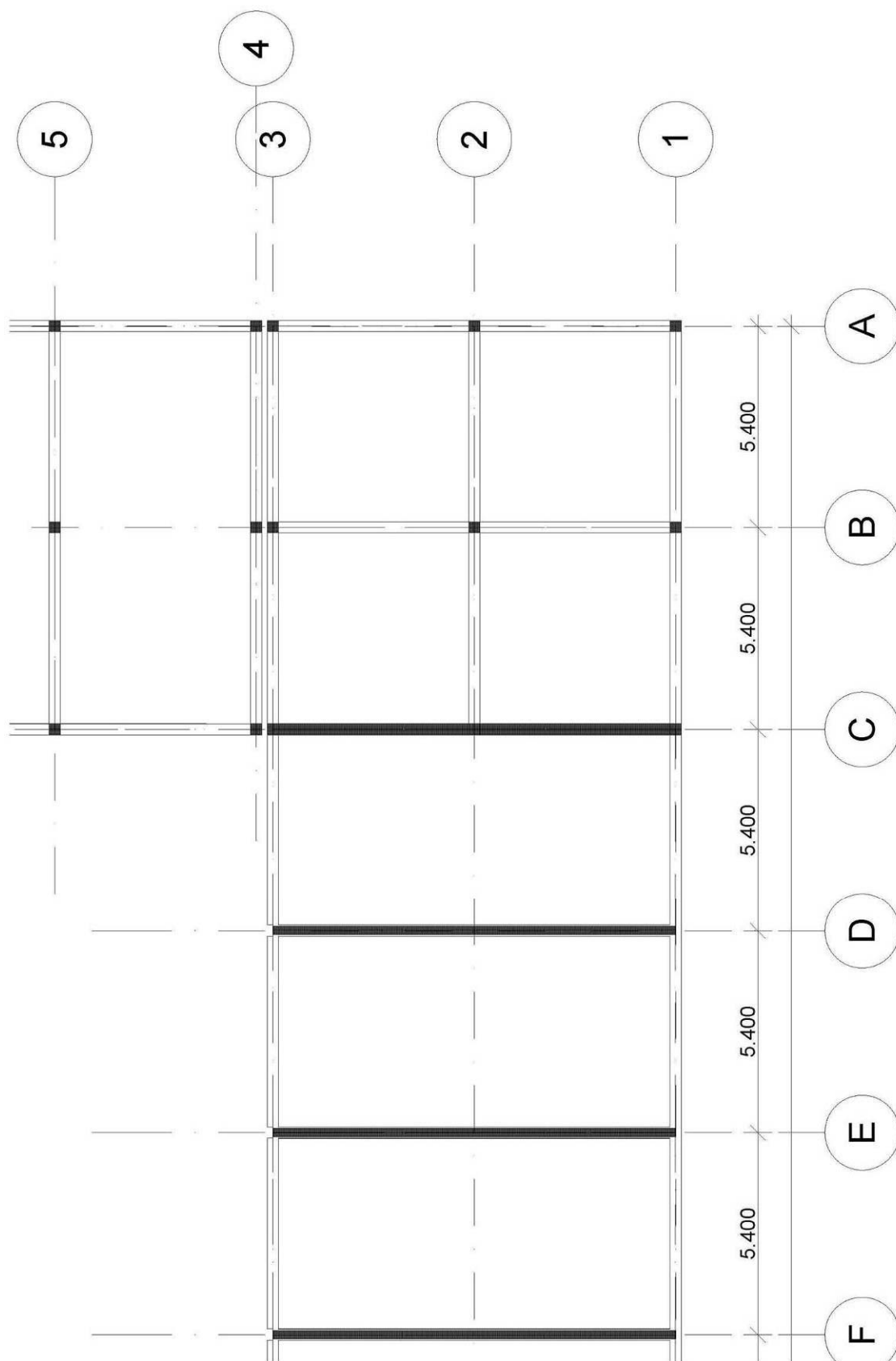
Appendix D2

Plan story 0



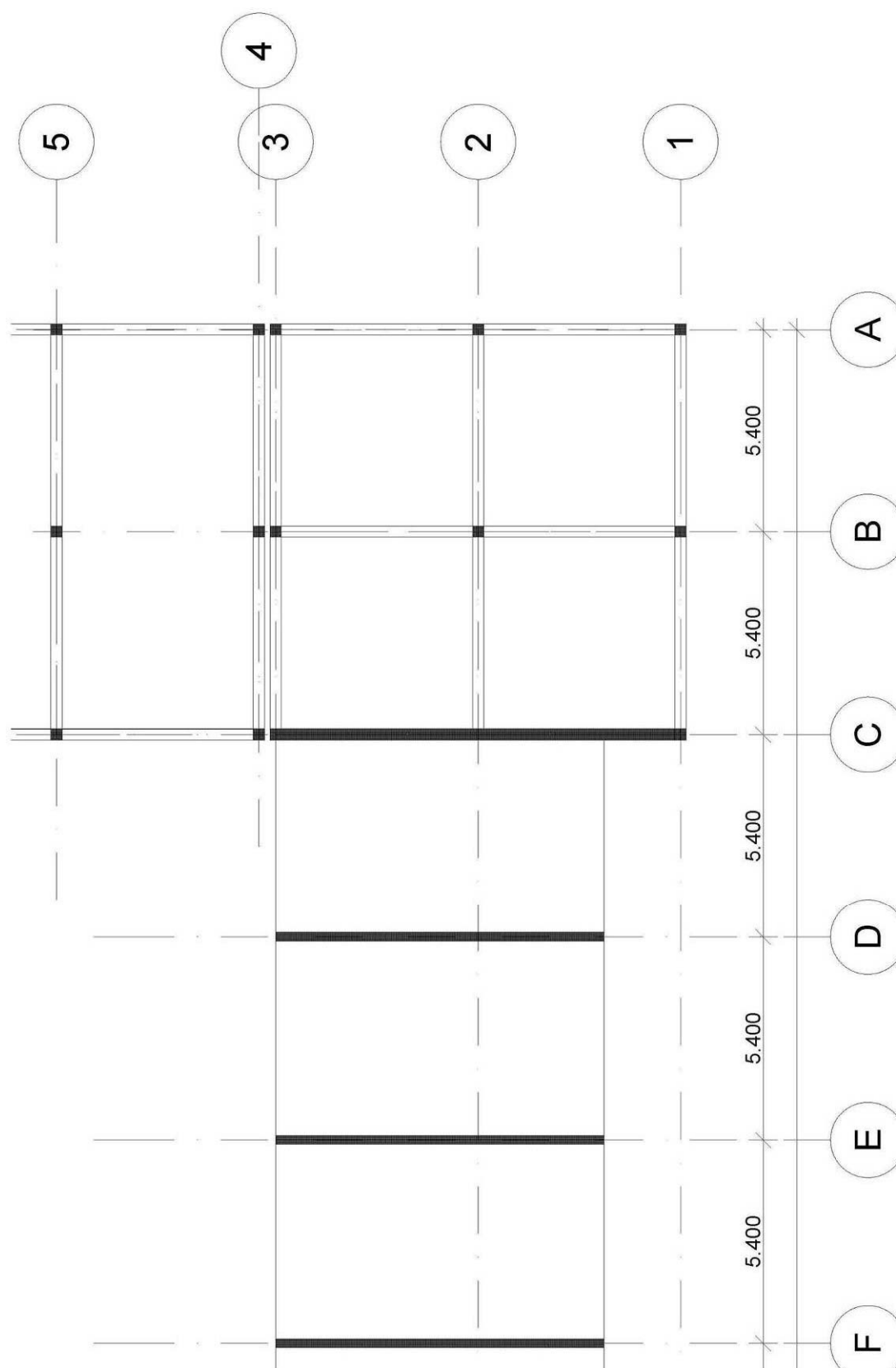
Appendix D3

Plan story 1



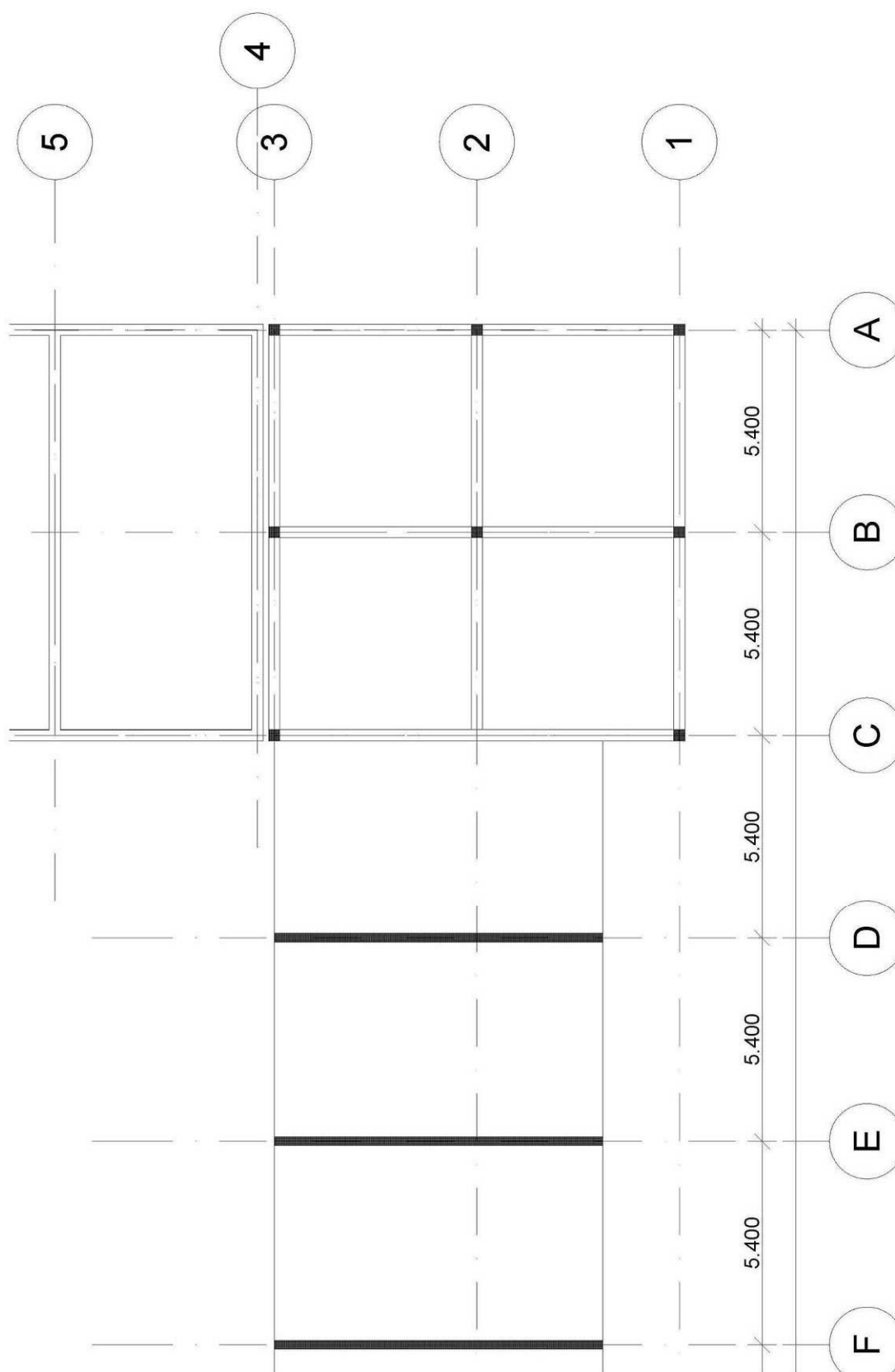
Appendix D4

Plan story 2



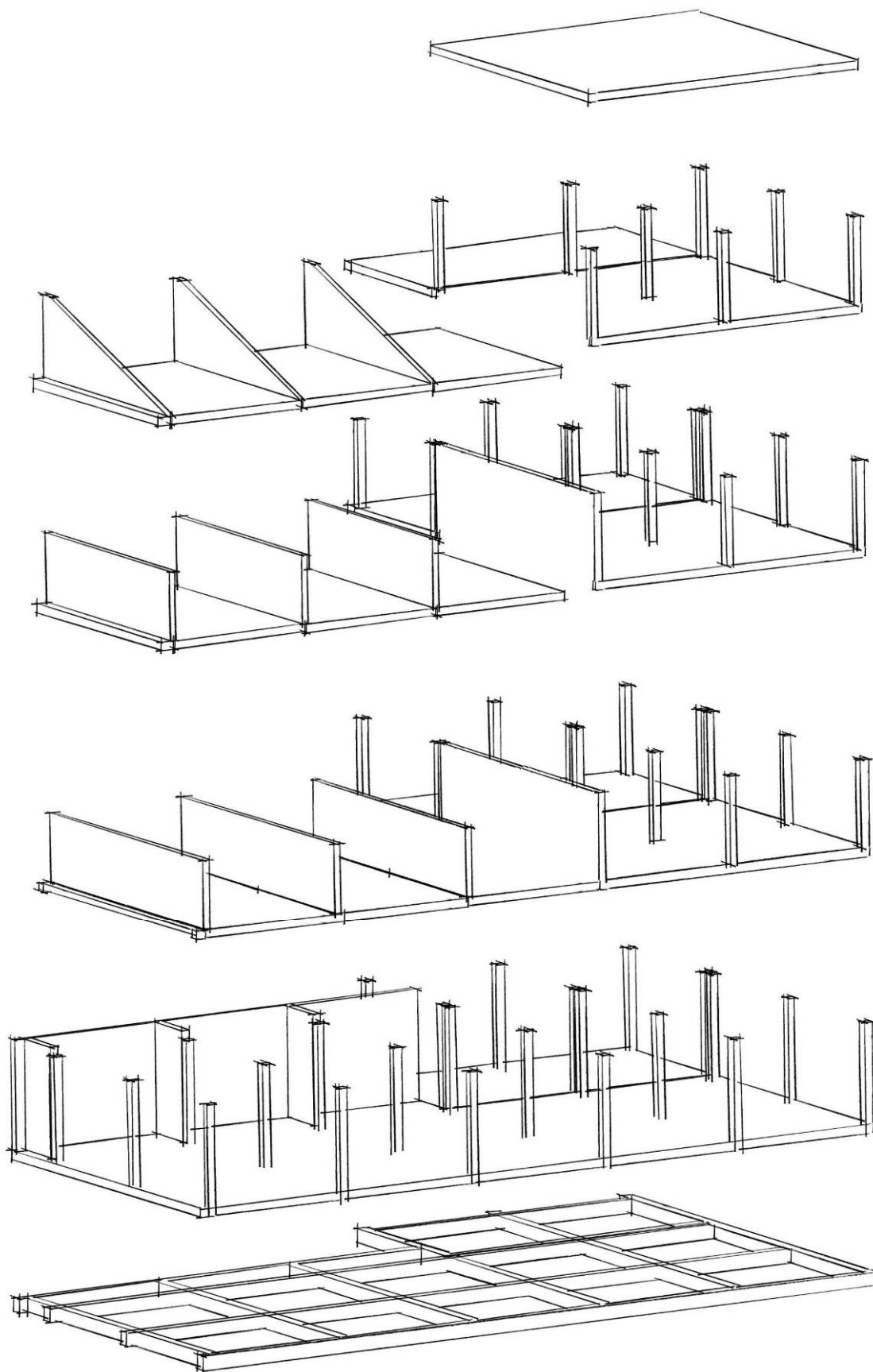
Appendix D5

Plan story 3



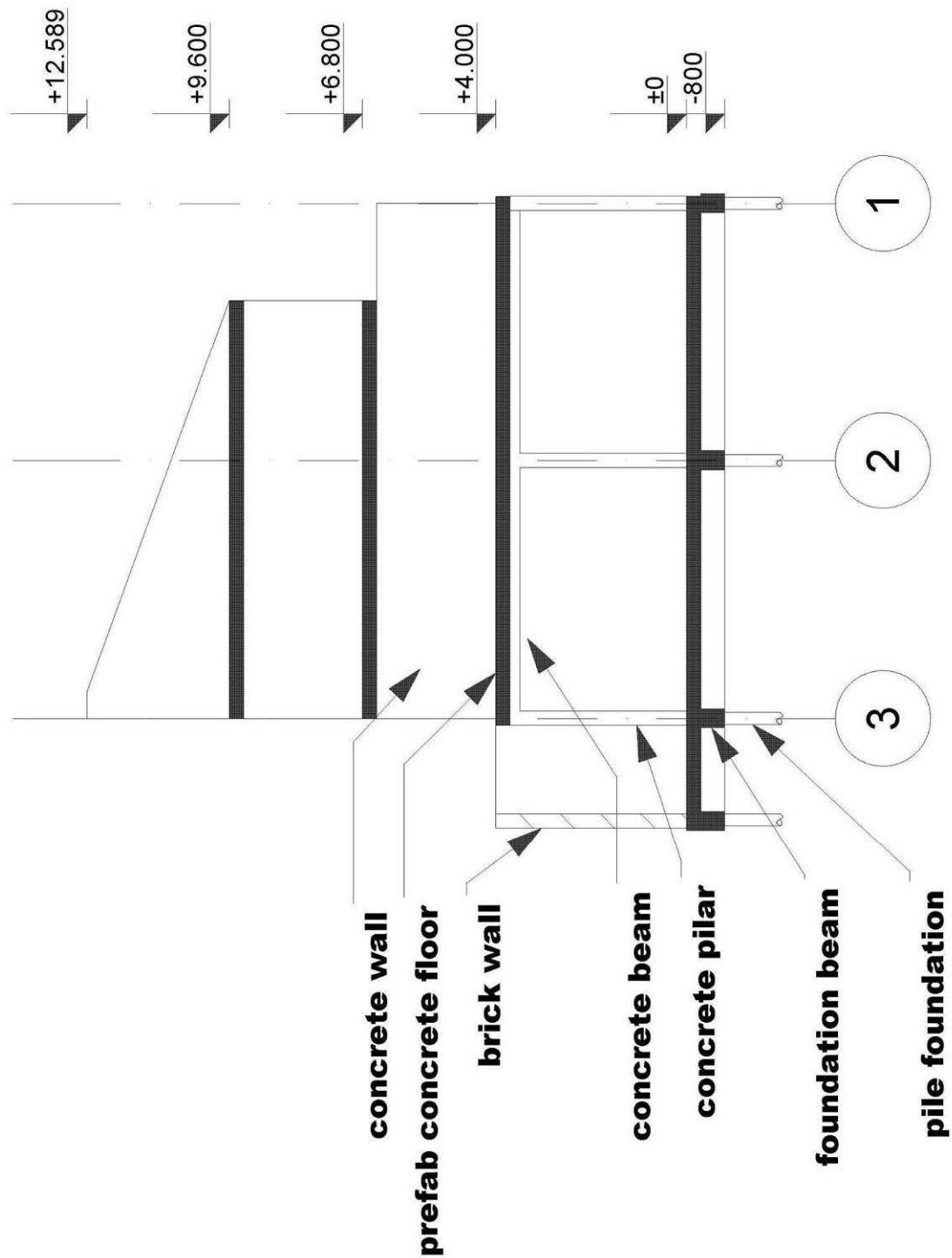
Appendix D6

Isometric impression of the structural system



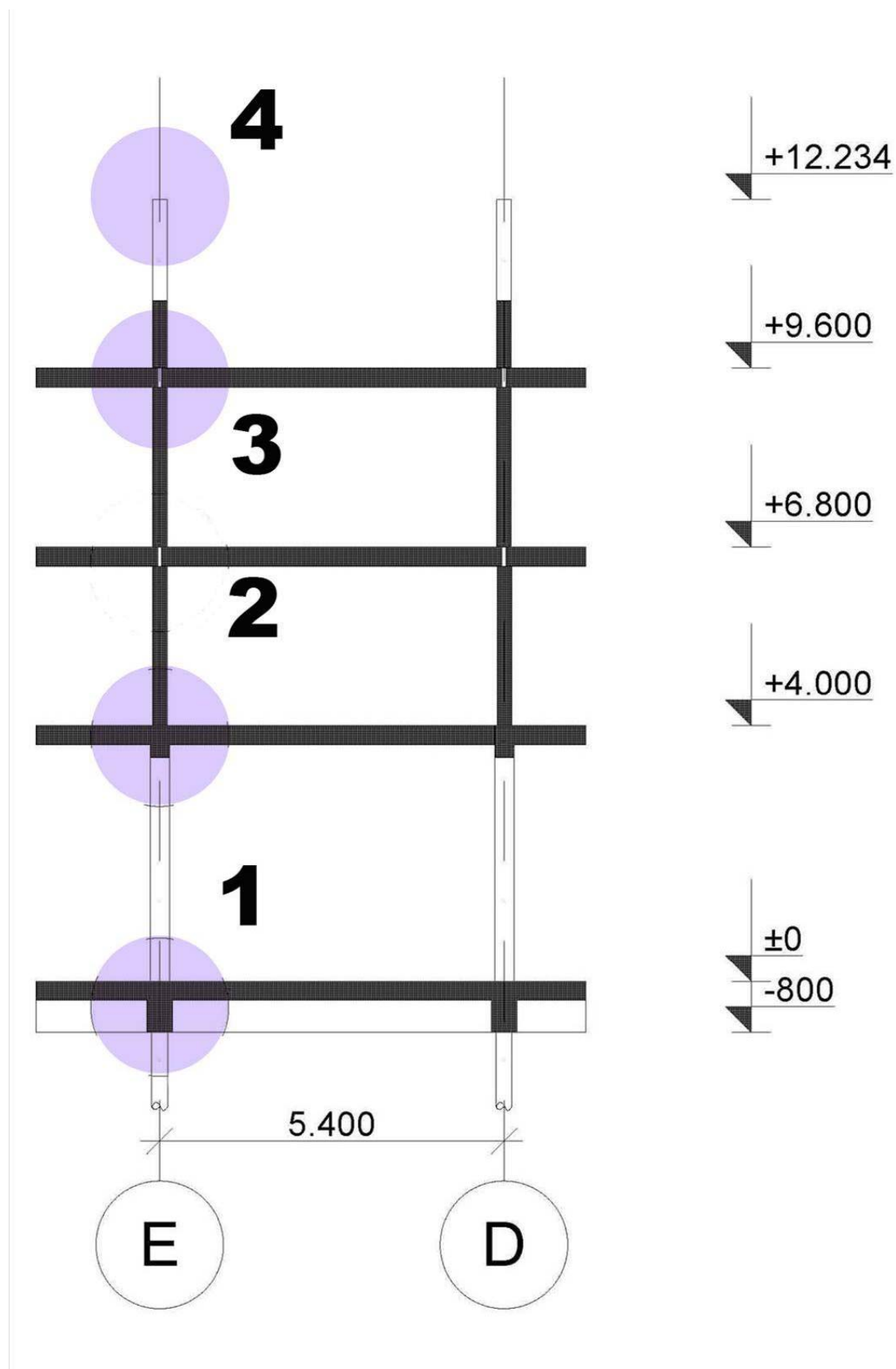
Appendix D7

Section about the construction of a working / living unit.



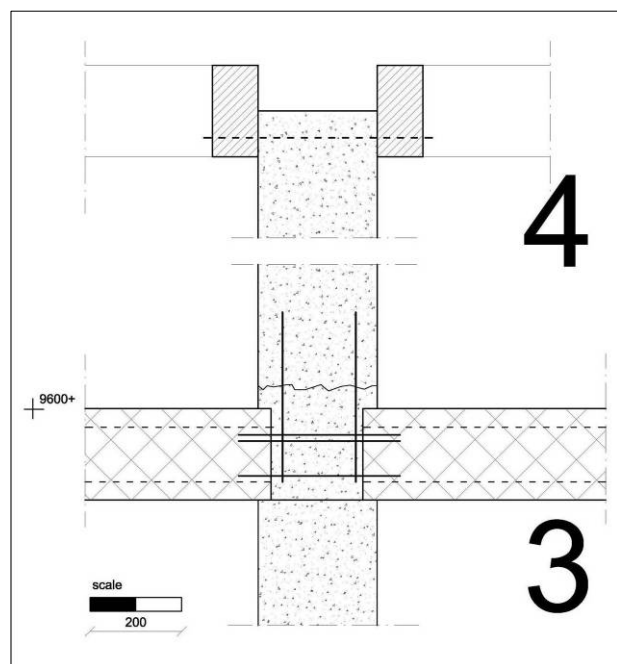
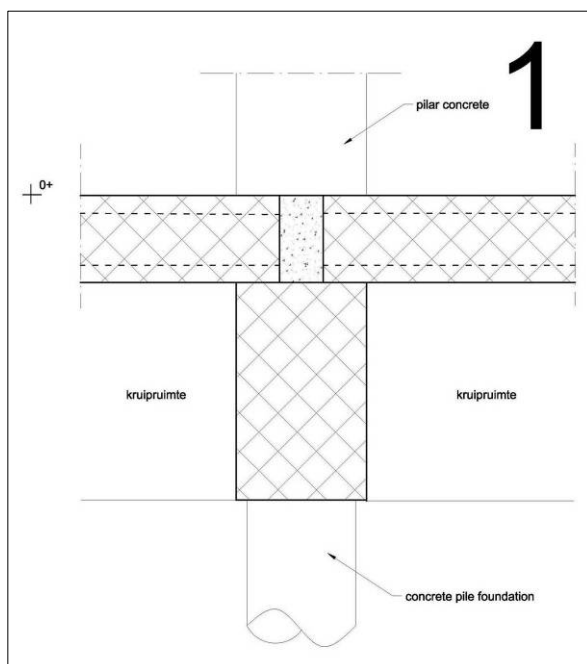
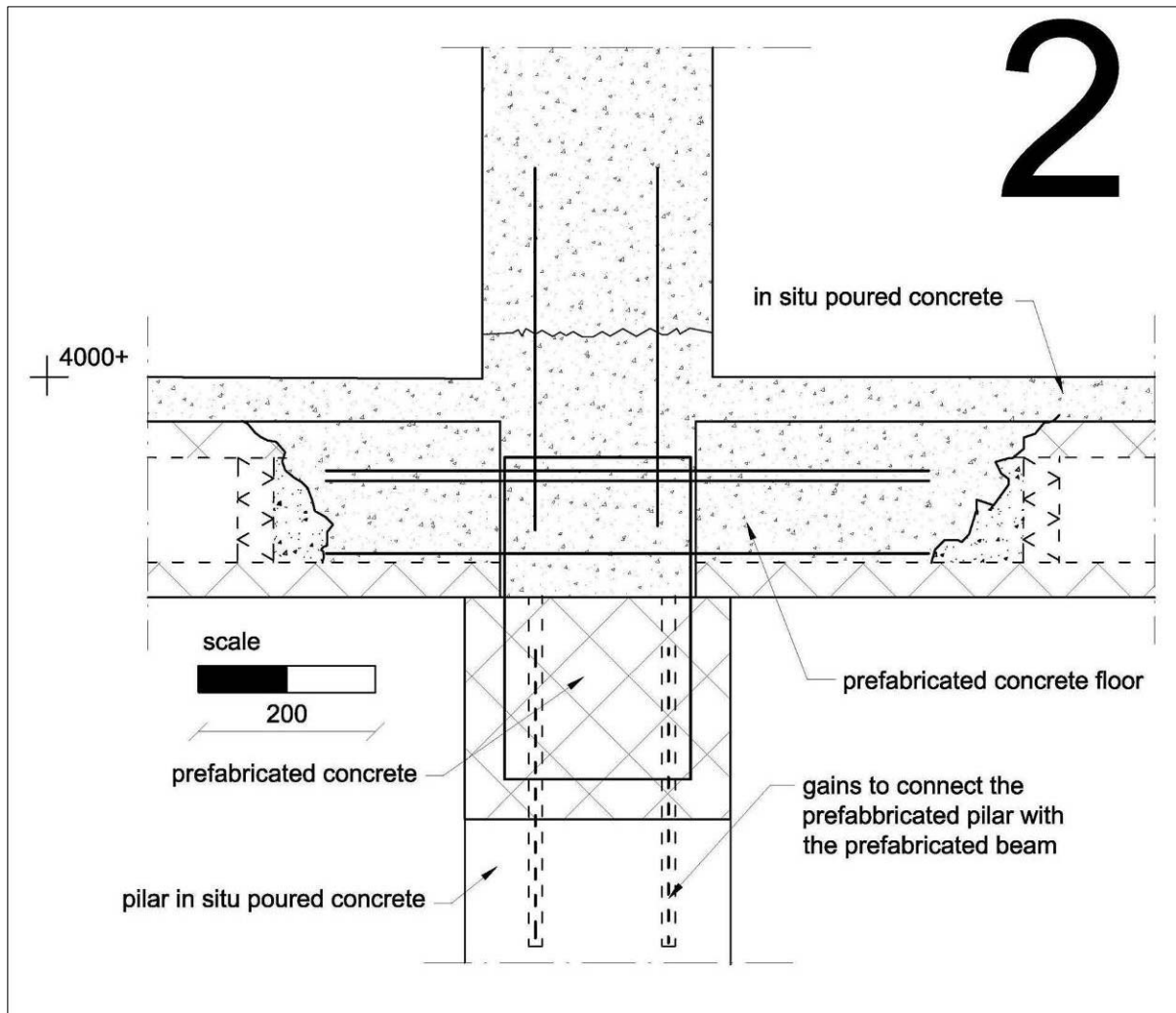
Appendix D8

Section about the construction of a working / living unit.



Appendix D9

Details

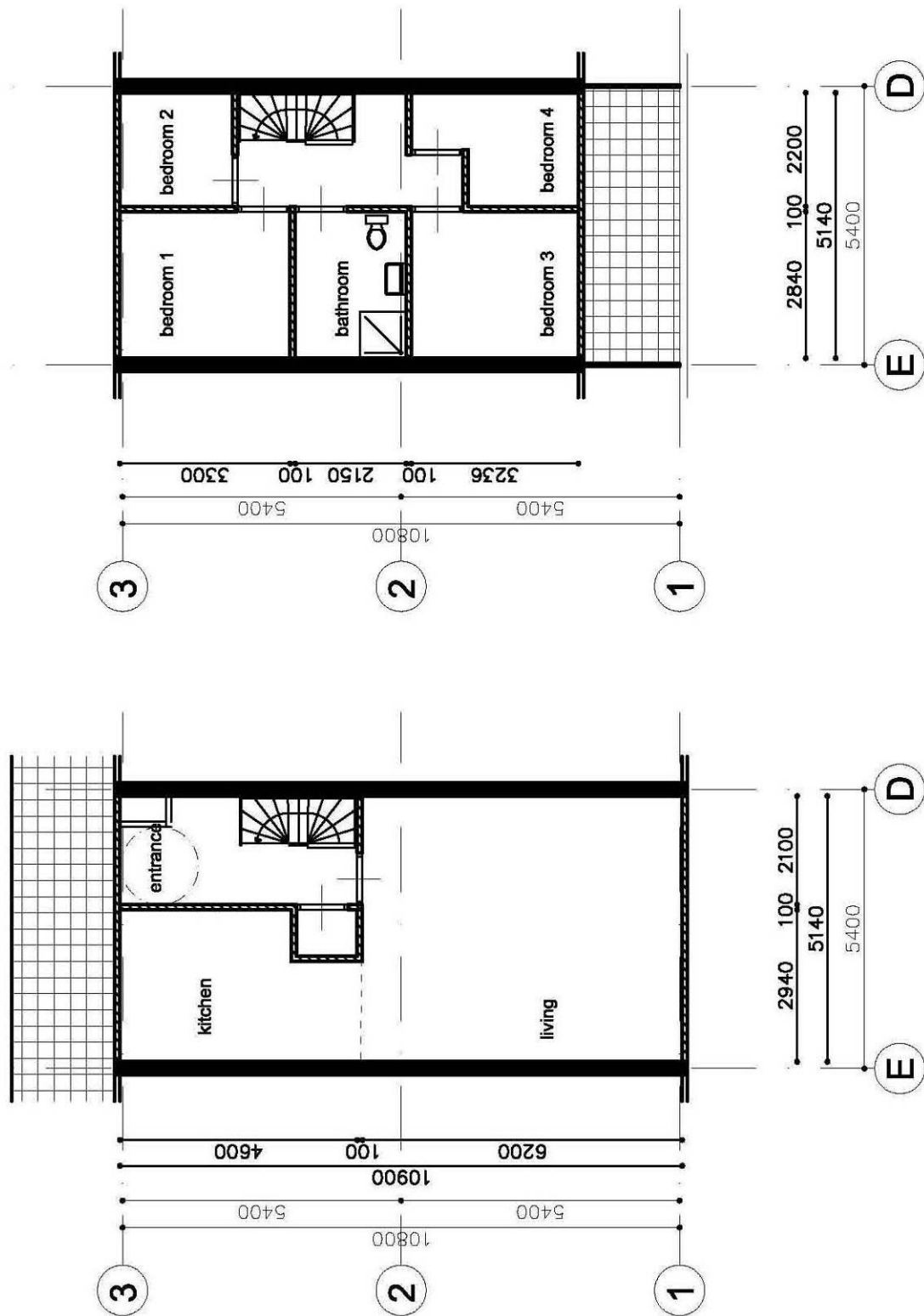


Appendix E: Lay-out living unit

Plan for the lay-out in the living unit.

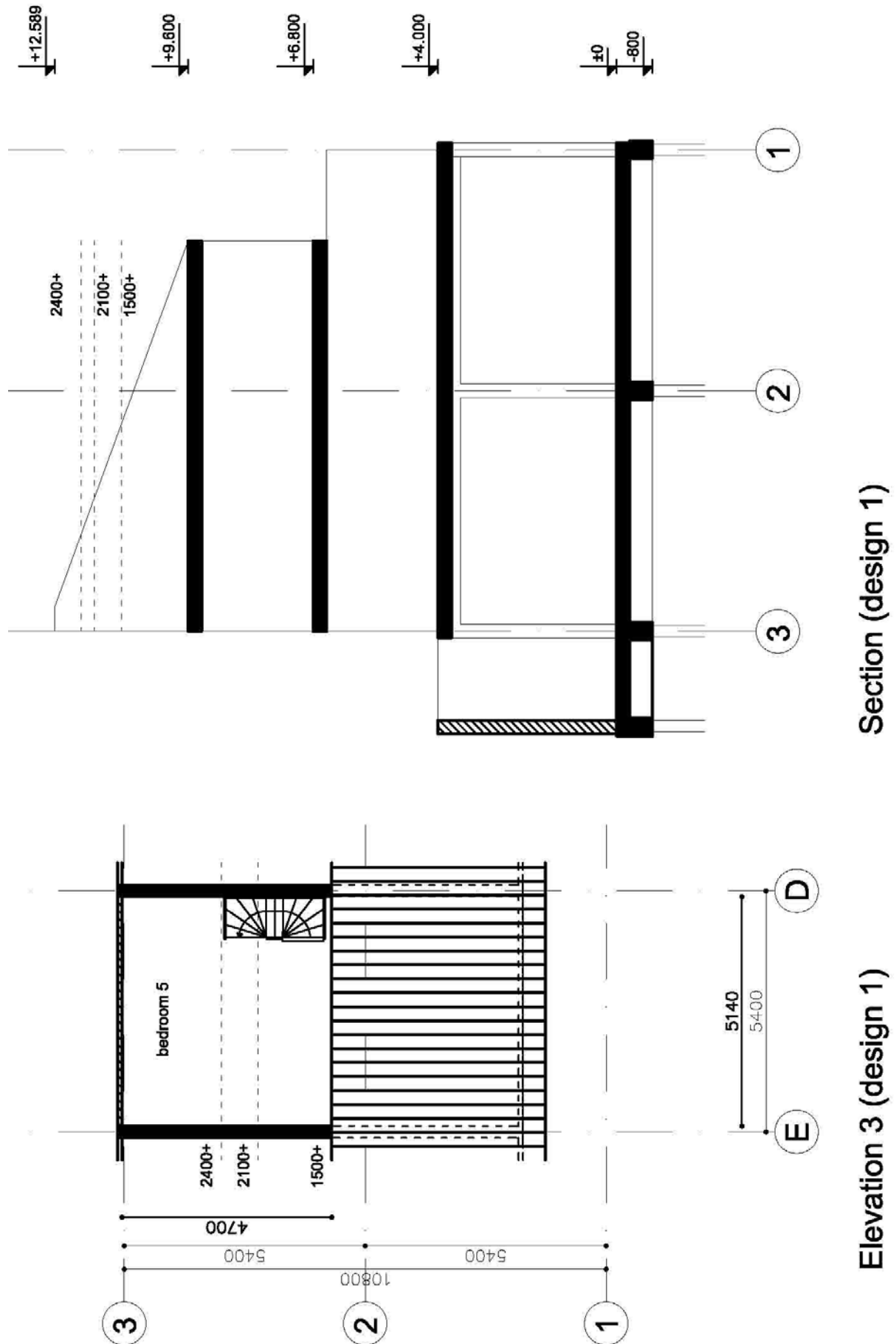
This chapter belongs by 5.4 Lay-out living unit.

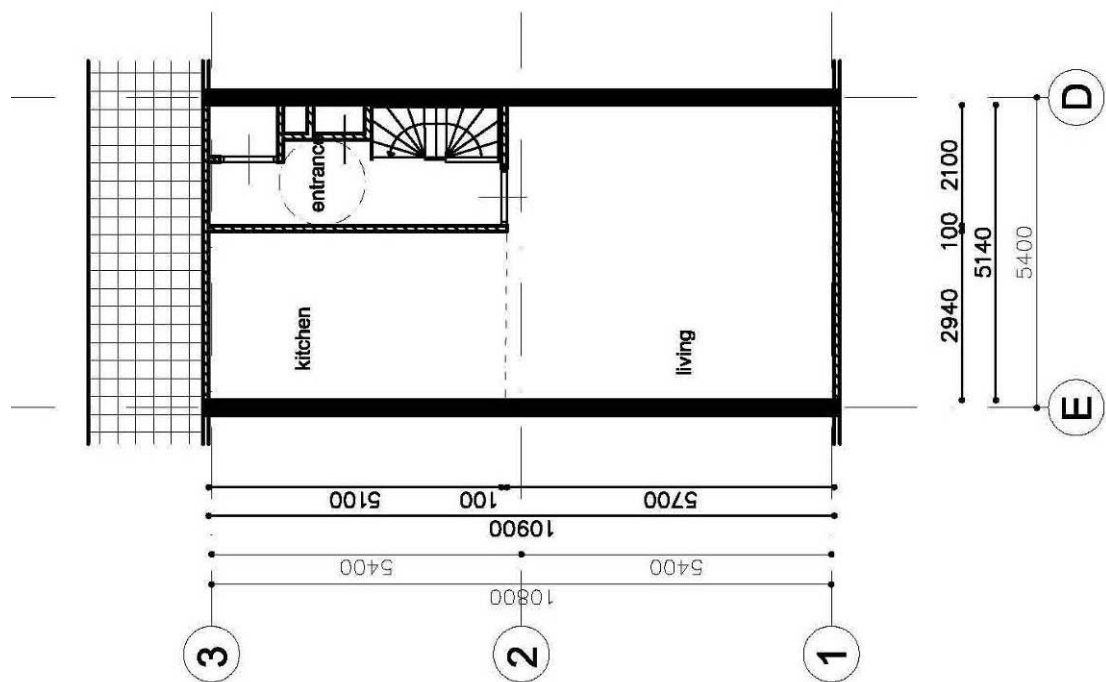
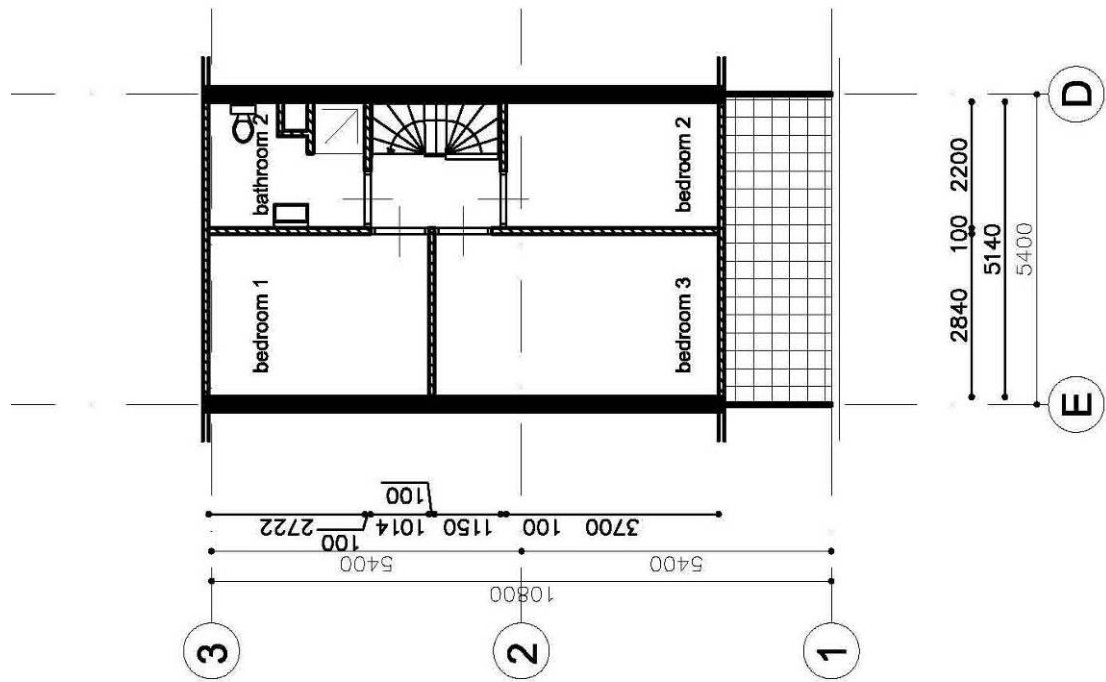
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design 1			
design 2			
design 3			

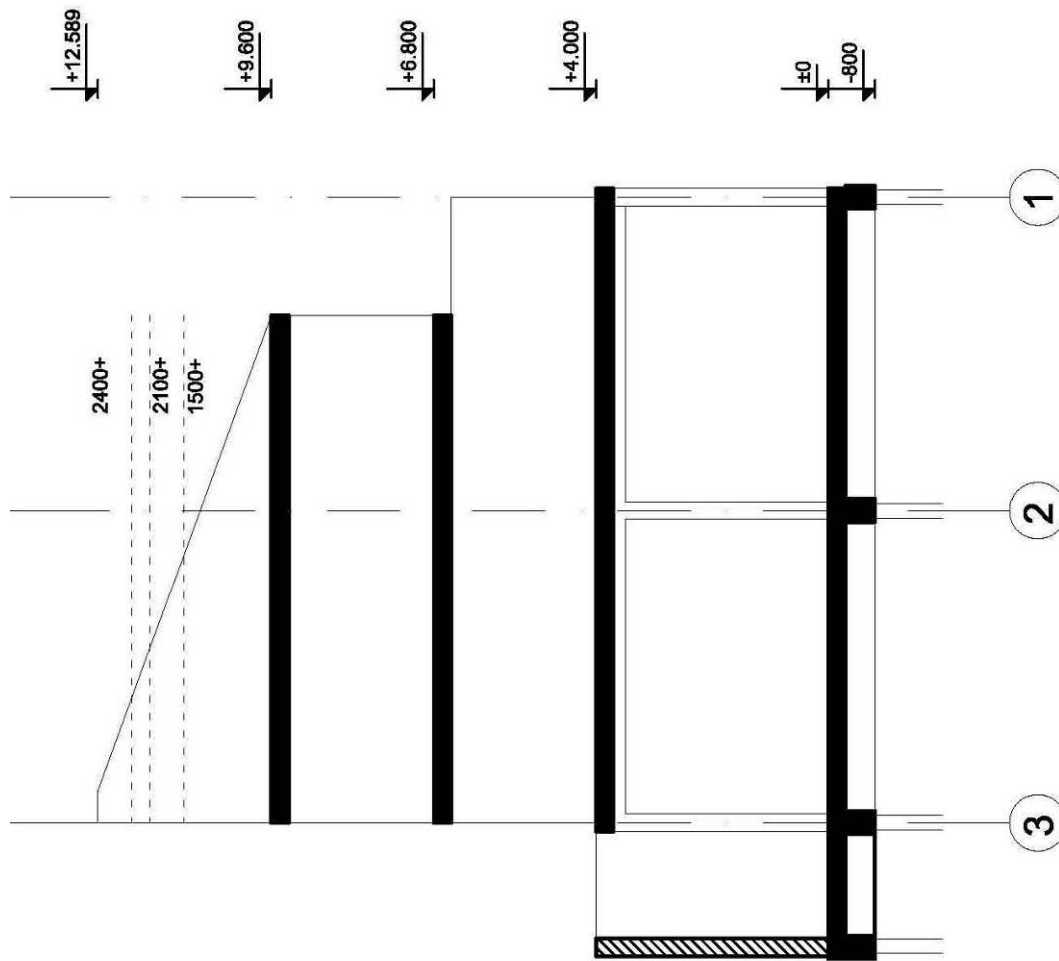


Elevation 2 (design 1)

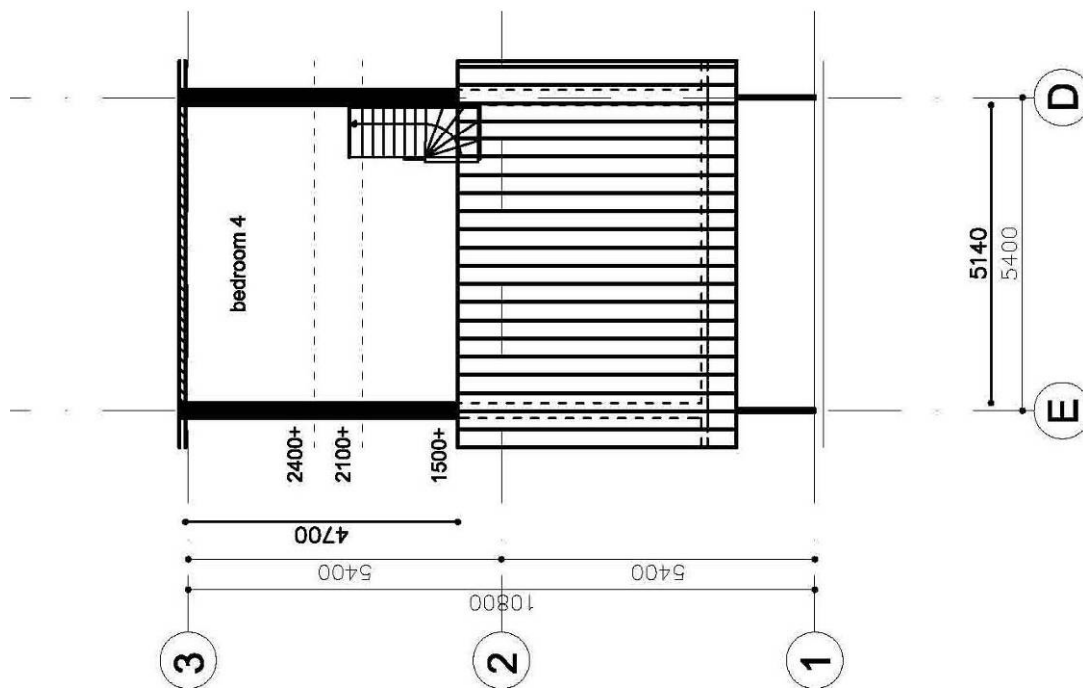
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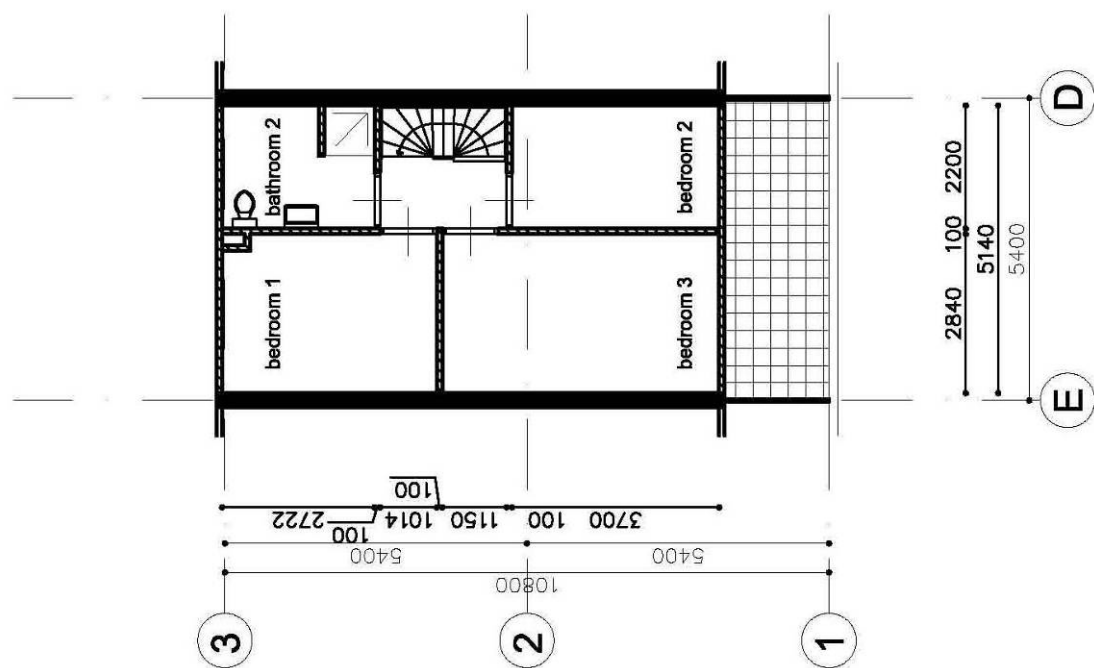




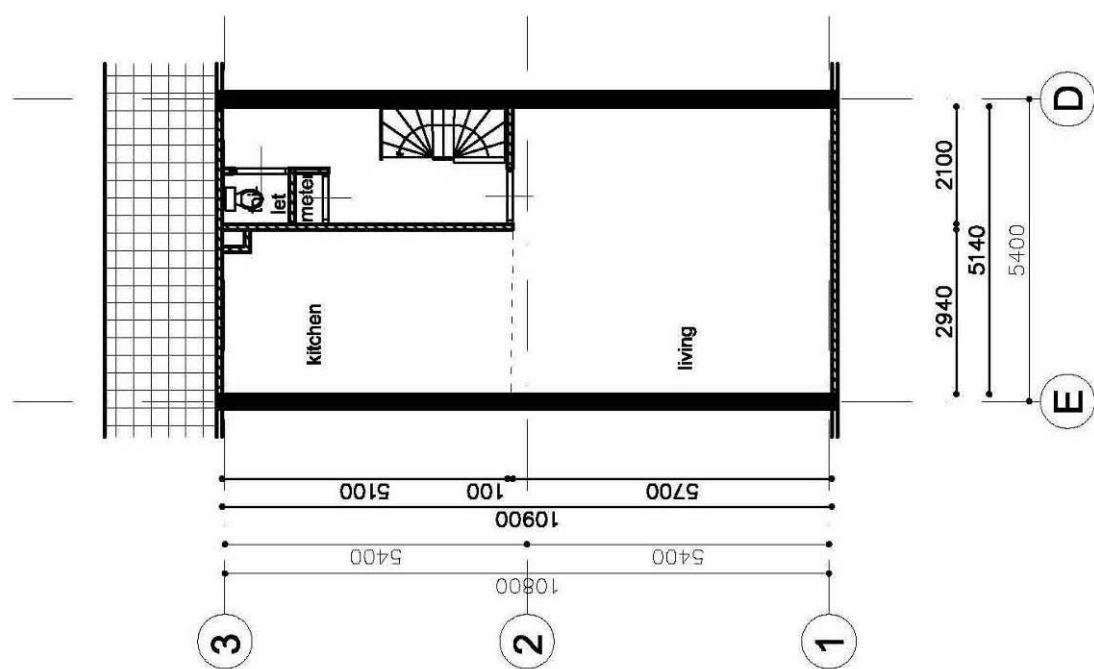
Section (design 2)



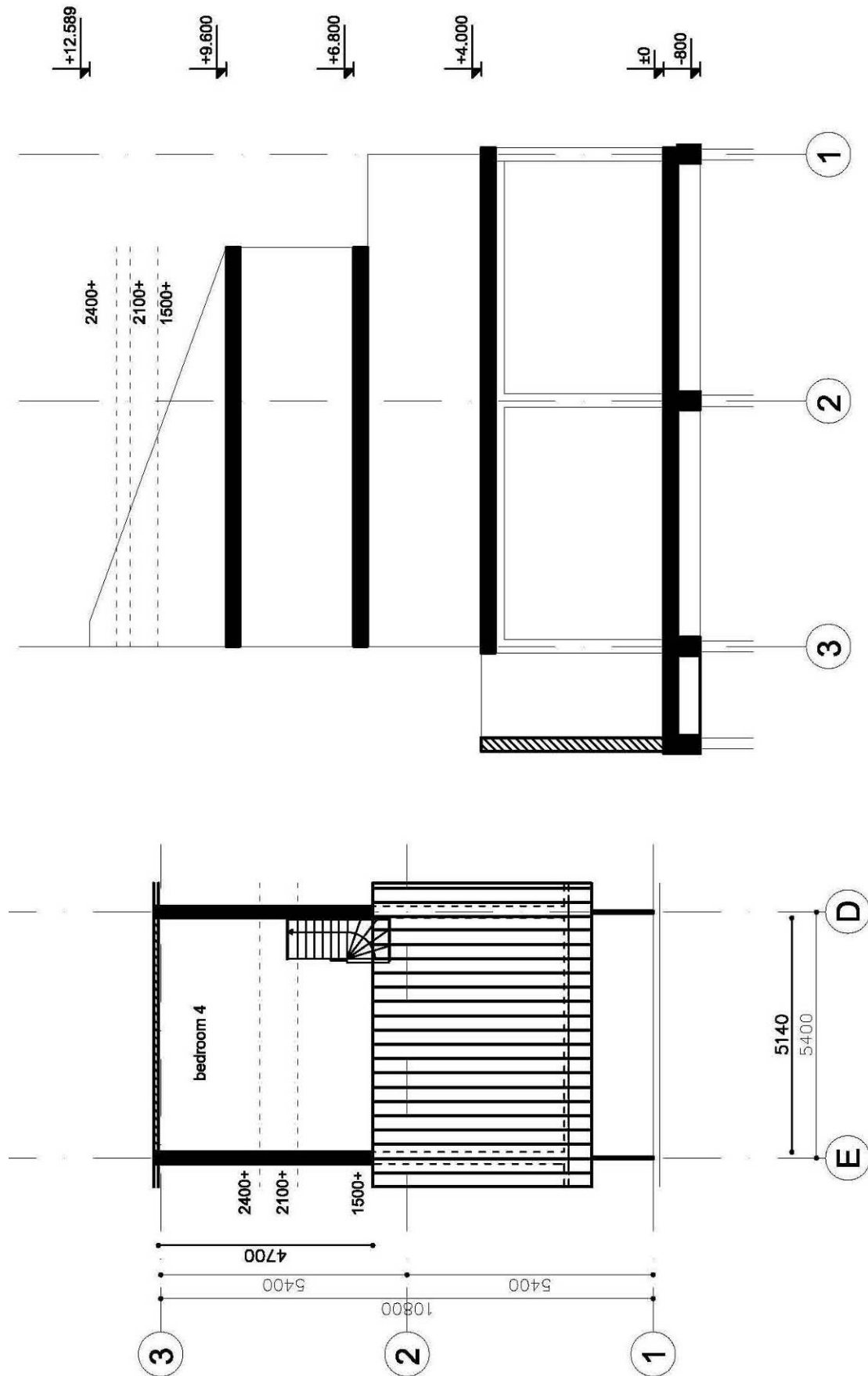
Elevation 3 (design 2)



Elevation 2 (design 3)



Elevation 1 (design 3)



Section (design 3)

Elevation 3 (design 3)

Appendix F: Photo report

A Photo report about the essentials in life what is really important.

