

Emergence in the self-organizing city
A multi-functional intervention

E. F. Britz

Emergence in the self-organizing city:
A multi-functional intervention

E. F. Britz 21095796

Mentor: P. Boer

Study leader: R. C. Fisher

Submitted in fulfillment of part of the requirements for the degree Magister in
Architecture (Professional) in the faculty of Engineering, Built Environment and
Information Technology, University of Pretoria, South Africa.

November 2007

04	Content
06	List of figures
11	Introduction
	Physical Context
15	Orientation
21	Mobility/activity mapping
27	Relationships
	Theoretical Context
34	Ants, humans and self-organizing systems
35	The city super-organism
39	Emergence
40	Genius loci
46	Feedback
47	Movement as feedback
50	Building as feedback
51	Building/moving
52	Community as feedback
55	Design tools and performance guidelines
	Design Development
59	Program
61	District development proposal
65	Site development - movement and form
71	Open space
83	Multi-purpose community hall
85	Day care centre
88	Residential development

	Technical Investigation	
	Skin	99
	Flora/Daylight	109
	Vendor stalls	112
	Intervention	
	From guidelines to intervention	116
	Conclusion	129
	Technical Documentation	130
	Bibliography	150

List of figures

Page 12:	Figure 001:	Ratanama butchery, cnr. of Bloed and Prinsloo Streets. (Author)			Figure 032:	Existing building canopies create roof for informal ranking in Brown Street (photo by author)
Page 14:	Figure 002:	View of the Tshwane CBD around 1960 (Academic Information Service Africana, University of Pretoria)		Page 42:	Figure 033:	Urban fabric along Struben Street (photo by author)
Page 16:	Figure 003:	The Tshwane CBD (University of Pretoria, Department of Geography)			Figure 034:	Fenced off sidewalk in Struben Street (photo by author)
Page 17:	Figure 004:	Boundaries (author)			Figure 035:	Kowloon City external façade. Photo by I. Lambot (Girard 1993: 172)
	Figure 005:	Movement arteries (author)			Figure 036:	A boundary of houses. The southern façade of Kowloon City. Photo by I. Lambot (Girard 1993: 77)
Page 18:	Figure 006:	Access points (author)			Figure 037:	Kowloon City on street parking. Photo by I. Lambot (Girard 1993: 12)
	Figure 007:	North-eastern quadrant of the Tshwane CBD (University of Pretoria, Department of Geography)		Page 43:	Figure 038:	Service distribution. Photo by I. Lambot (Girard 1993: 41)
Page 20:	Figure 008:	Figure ground study (author)		Page 44:	Figure 039 – 042:	Highlighting the edge. Interpretation by author
	Figure 009:	Traffic orientation (author)			Figure 043:	Kowloon Walled City, Kowloon Peninsula, Hong Kong. Photo by I. Lambot (Girard 1993: 10)
Page 22:	Figure 010:	Zoning and current land use (author)		Page 46:	Figure 044:	Movement and city shape (author)
	Figure 011:	Public transport nodes (University of Pretoria, Department of Geography)		Page 47:	Figure 045:	The growth of Athens around the Panathenaic Way (Bacon 1968: 52)
Page 24:	Figure 012:	Activity mapping of movement patterns in area under investigation (author)		Page 48:	Figure 046:	<i>Illuminated Leaf</i> by Paul Klee (Bacon 1968: 115)
Page 25:	Figure 013:	Simulated model of movement activity map over a 24 hour period in area under investigation (computer simulation by author)		Page 49:	Figure 047 & 048:	Diagram from <i>The Thinking Eye</i> by Paul Klee (Bacon 1968: 125)
Page 27:	Figure 014:	Du Toit Street informal kitchens (author)			Figure 049:	<i>Circular View of Rome</i> by Taddeo di Bartolo (Bacon 1968: 124)
Page 28:	Figure 015:	View down Du Toit Street sidewalk with the informal kitchens acting as barrier between pedestrian and vehicular movement (by author)		Page 56:	Figure 050:	<i>Veduta Schematica del Paino Stradale Ideato da Sisto V</i> by Giovanni Francesco Bordino (Bacon 1969: 124)
	Figure 016:	Bloed Street telephone box (photo by author)		Page 58:	Figure 051(top):	Façade design sketch by author
	Figure 017:	Corner of Bloed and Du Toit Streets (photo by author)		Page 60:	Figure 052 (bottom):	Façade design sketch by author
	Figure 018:	Du Toit Street with informal kitchens on sidewalk (photo by author)		Page 61:	Figure 053:	Fractional pattern growth. Concept sketch by author
	Figure 019:	Ratanama butchery sidewalk (Bloed Street) (photo by author)			Figure 054:	City block as neighbourhood. Concept sketch by author
	Figure 020:	Prinsloo Street with the corner shop in the background (photo by author)			Figure 055:	North-east district existing grid (author)
	Figure 021:	Prinsloo Street sidewalk (photo by author)			Figure 056:	New pedestrian grid (author)
Page 30:	Figure 022:	Ratanama butchery, Bloed Street. (photo by author)			Figure 057:	Location of new public squares (author)
	Figure 023:	Brown Street urban fabric (photo by author)		Page 62:	Figure 058:	The North-eastern district's city block neighbourhoods (author)
	Figure 024:	Brown Street informal taxi rank (photo by author)		Page 63:	Figure 059:	North-eastern district logo. Concept sketch by author
	Figure 025:	Existing building canopies create roof for informal ranking in Brown Street (photo by author)		Page 64:	Figure 060:	City block as neighbourhood development sketches (author)
	Figure 026:	View over parking terrain from Struben Street (photo by author)			Figure 061:	Volume model of existing structures on site (author)
	Figure 027:	Prinsloo Street informal trading under existing building canopy (photo by author)			Figure 062:	Boundary identification (author)
	Figure 028:	Soutpansperg road: exit route to the North-east (photo by author)			Figure 063:	Model of vehicular movement on and around site (author)
	Figure 029:	Existing building canopies create roof for informal ranking in Brown Street (photo by author)			Figure 064:	Model of pedestrian movement on and around site (author)
	Figure 030:	Urban fabric along Struben Street (photo by author)			Figure 065:	Model of pedestrian and vehicular movement translated into open space hierarchy (author)
	Figure 031:	Urban fabric along Struben Street (photo by author)			Figure 066:	Model of vertical movement (author)
					Figure 067:	Public skin vs. private skin (author)
				Page 65:	Figure 068:	Volume model derived from previous diagrams (author)
				Page 66:	Figure 069:	Initial movement diagram (author)
				Page 67:	Figure 070 - 074:	Perspective movement mapping over and around site (author)
				Page 68:	Figure 075 - 077:	Initial concept sketches (author)
					Figure 078 - 079:	Concept model no. 1 by author
					Figure 080 - 087:	Concept model no. 2 by author
					Figure 085 - 089:	Concept model no. 3 by author



Introduction

“The building of cities is one of man’s greatest achievements. The form of his city always has been and always will be a pitiless indicator of the state of his civilization. This form is determined by the multiplicity of decisions made by the people who live in it. In certain circumstances these decisions have interacted to produce a force of such clarity and form that a noble city has been born. It is my premise that a deeper understanding of the interactions of these decisions can give us the insight necessary to create noble cities in our own day.” (Bacon, E. N. 1968. *Design of Cities*. New York: Viking)

When first considering Bacon’s explanation on the origin of a city, it might seem that an accidental process or rather, product is implied. City form as the accidental conglomeration of space haphazardly grouped together to sustain the interaction between city inhabitants.

However what Bacon is describing in terms of city form and growth is an evolutionary process deeply embedded in the interactions of the inhabitants and consequent feedback of these interactions into the city as a whole. He illustrates city form as an emergent product of the inhabitant’s daily interactions. The city can then be understood in terms of a self-organizing system where the higher-level activity is more than the sum of the lower-level activities; where the city as a whole is the emergent product of social interaction. If it is possible to understand the form of the city as a product of these evolutionary processes then this insight can be utilized to formulate tools or guidelines with which emergence in a city can be guided in order to create a “noble city”.

page 12: figure 001
Ratanama butchery, cnr. of Bloed
and Prinsloo Streets. (Author)

However, in order to gain a deeper understanding of the lower-level activities within a certain urban context and the connection of these activities with the greater whole, an in-depth investigation of the social activities in the specific area is required. These activities not only include day-to-day interaction between city inhabitants, but also interaction between inhabitant and environment (feedback into the self-organizing system). On a human scale this feedback can be seen in the adaptation of specific environments and establishment of context sensitive activities in order to fulfill a certain need.

This study will look at these activities, their impact on the environment and the emergent products produced. This knowledge will be utilized to identify activities or strategies, based on the emergent quality of the city as self-organizing system, in order to guide or regulate an emergent design process.

physical
context



Orientation

The Central Business District (CBD) of Tshwane comprises of roughly nine city blocks in the east-west direction and eleven in the north-south direction. As indicated by figure 004 on page 17, the boundaries to the south and west are the southern railway line and D. F. Malan drive respectively. Boom Street acts as northern boundary and Nelson Mandela Drive as eastern edge (The eastern edge can also be seen as the Apies River).

Currently there exists seven major access points into and out of the Tshwane CBD. Nelson Mandela Drive and the Ben Schoeman Freeway enter the CBD from Centurion and Johannesburg in the south. The N4 toll road connects with Hartbeespoort dam and Rustenburg in the west as well as with Bronkhorstspuit and Witbank in the east. The other three access points connect to the north via D. F. Malan Drive in the north-west, Soutpansberg road/Dr. Savage road in the north-east, and Paul Kruger Street, originating in Church Square, directly north. Refer to figure 006 on page 17 for illustration.

Vehicular movement through the CBD is mainly focused in certain areas as illustrated by figure 005 on page 17. Main arteries for public transport north of Church Square include Boom and Struben streets in the east-west direction and Nelson Mandela Drive in the north-south direction. Soutpansberg/Dr. Savage Road access route is also extensively used.

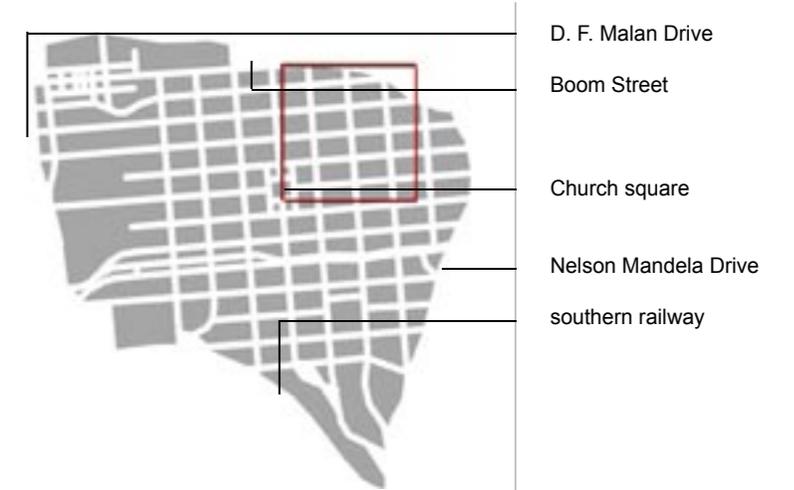
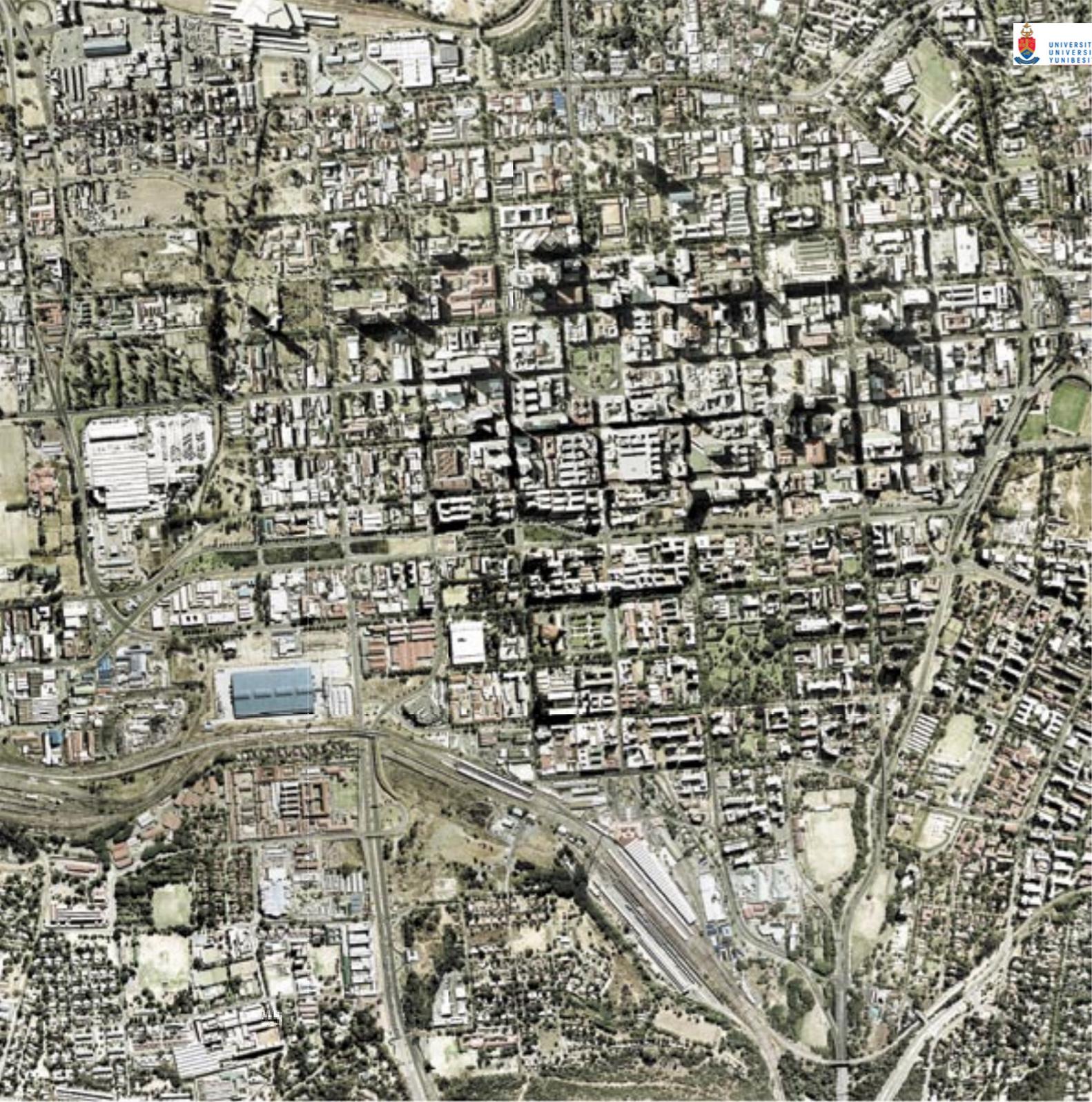
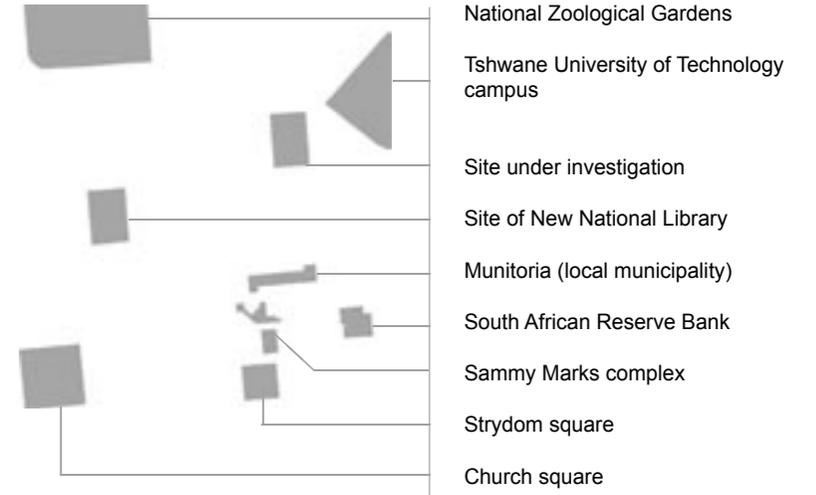


Figure 004: boundaries



Figure 005: movement arteries

Figure 006: access points



Located within the north-eastern quadrant of the CBD the area identified for further investigation forms an integral part of the workings of the Tshwane CBD: it is located along major arterial routes and forms part of the north-eastern gateway into the city. The area is mainly zoned for commercial use with some residential, institutional, governmental and light industrial land use. Figure 007 indicates areas of interest in the quadrant.

page 18: figure 007
North-eastern quadrant of the Tshwane CBD.



figure 008: figure ground study

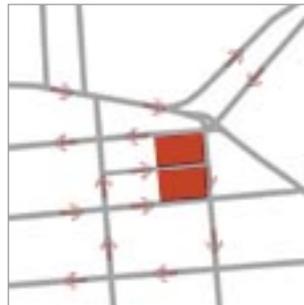


figure 009: traffic orientation

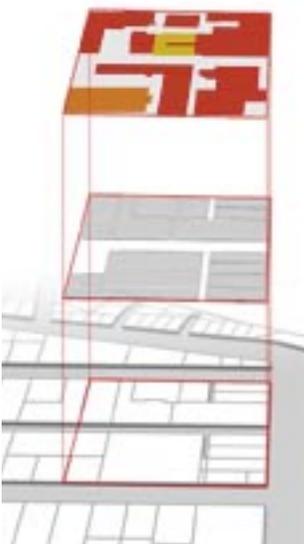


figure 010: zoning and current land use

The site under investigation lies at the corner of Bloed and Prinsloo Streets, with the southern edge defined by Struben Street (refer to figure 007 on page 18). As the figure ground study (figure 008) illustrates, the site lies at the end of the city grid. As described earlier, Boom Street acts as the northern edge of the CBD and Soutpansberg and Dr. Savage Roads constitutes one of the access points into the city from the north. Thus, the site can be seen as a gateway (entering the city via Dr. Savage road focus is directly on the north-eastern corner of the site). As shown by figure 009 most of the roads surrounding the site have been changed into one-way routes thus allowing for very specific viewpoints of and access points onto the site with regards to vehicular movement.

The site covers half a standard Tshwane city block (130m x 220), and is roughly 15 200m² (1.5ha). Brown Street cuts through the site in the east-west direction, decreasing the overall erf sizes but allowing for rear access. The site is divided into 13 erfs with usage zoned for general business. According to the official definition for this use zone, the following activities can be accommodated:

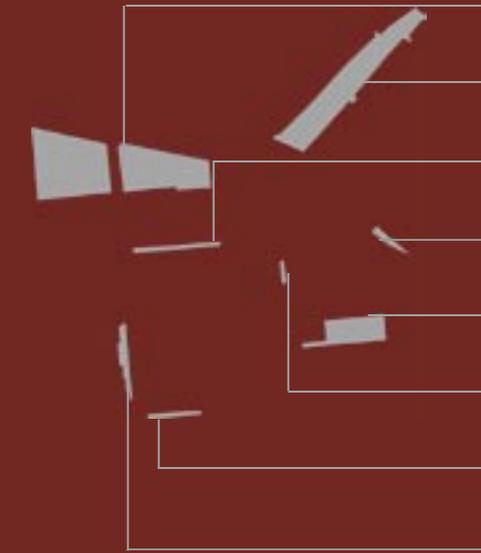
- Business buildings
- Government buildings
- Parking garages
- Places of institution
- Places of public worship
- Places of refreshment
- Residential buildings
- Restricted industries
- Shops
- Social Halls
- Vehicle sales marts.

Current land use is mainly commercial with isolated residential buildings (as per figure 010).

Mobility/activity mapping

Movement on and around the site can be divided into two categories: vehicular movement and pedestrian movement. With the Boom street taxi rank located just north of the site, public transport plays a vital role in the determination of pedestrian movement routes. The site acts as a route rather than a destination for most pedestrians: people move from the taxi rank into the city during the morning rush hours, which is mainly between 08:00 and 10:00, and out of the city toward the rank between 16:00 and 18:00.

There is also an increase of pedestrian movement between 12:00 and 14:00, when people buy lunch from the various food vendors. With zoning in the area mainly pertaining to offices and institutional usage, the need for street food vendors exists and makes out a major part of the social interaction.

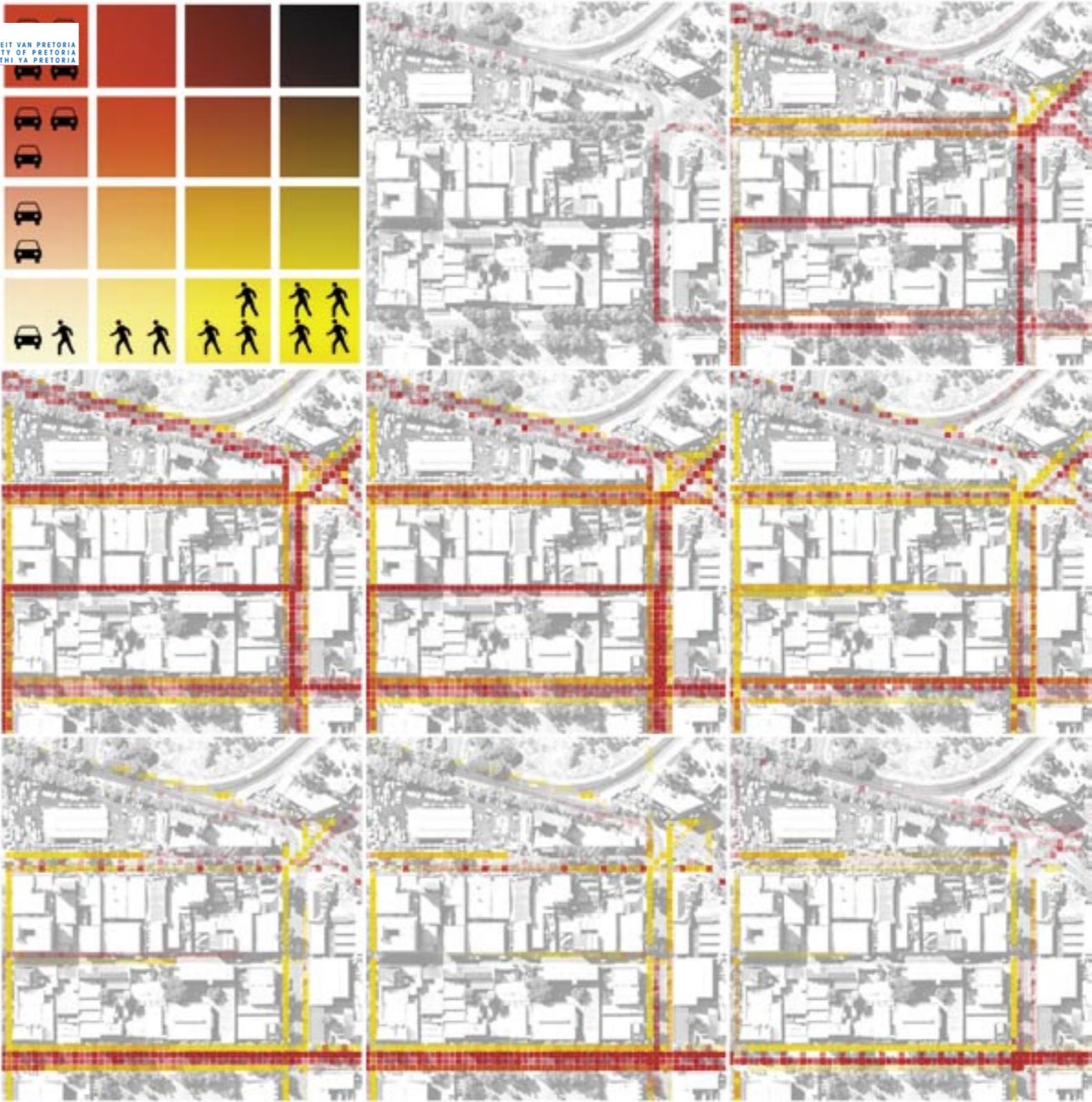


- Boom Street taxi rank (formal)
- Dr. Savage Road taxi rank (formal)
- Brown Street taxi waiting area (informal)
- Edward Street taxi rank (informal)
- Shepherd Street taxi rank (informal)
- Du Toit Street taxi rank (informal)
- Proes Street taxi rank (informal)
- Van Der Walt Street taxi drop-off zone (formal)

The Dr. Savage road taxi rank to the north-east of the site also contributes to pedestrian activity on and around the site. These two formalized ranks are not the only public transport interchanges in the area with Brown Street, Shepard Street and parts of Struben, Prinsloo and Du Toit streets housing informal taxi stops. These taxis enter the city in the mornings from various locations, including Bronkhortspruit and Mpumalanga. Drivers will wait until the evening and return with mostly the same commuters.

Private vehicles mainly move in the East-West direction down Bloed Street (into the city) and Boom Street (out of the city). Dr. Savage road also carries a fair amount of private vehicles as it connects to the north of the greater Tshwane via Soutpansberg road. Activity northbound mainly takes place between 16:00 and 18:00. An increase in vehicular movement southbound down Dr. Savage road and consequently Prinsloo Street take place between 07:00 and 09:00, with people moving into the city from the north.

page 22: figure 011
Public transport nodes



As can be seen from the activity mapping figures (012, page 24 and 013, page 25), some streets clearly separates vehicular and pedestrian movements. Sidewalks are wide and covered with informal trading stall creating a barrier between high speed traffic and more calm pedestrian movement.

However, there are some points where no clear distinction can be made between vehicular and pedestrian moving zones, thus the activity mapping indicating a chaotic activity scheme. One such area falls within the direct scope of this investigation. The junction directly north-east of the site under investigation, where Boom, Bloed, Dr. Savage, Edmond and Du Toit streets intersects, poses an interesting challenge in terms of movement and accessibility on both a pedestrian and vehicular scale.

Emergence in the self-organizing city

Relationships

The northern sidewalk of Du Toit Street is walled of from the Tshwane University of Technology campus, thus creating a less active street frontage. This, and the comfortably wide sidewalk, has created the opportunity for informal street kitchens to develop. These traders buy their stock from one of the local stores, Ratanama butchery, and the butchery in return stores their equipment there at night. These stalls consisting of steel tables and canopies are set up around 10:00 in the morning, prior to lunch when people will move out of the city to buy food. The stalls are disassembled around 18:00 as patrons buy food prior to embarking on the journey home. The mutual relationship between Ratanama butchery and the informal kitchens and its consequential influence on the environment and movement patterns have created a pedestrian link along the city edge as indicated on figure 014.



figure 014
Du Toit Street informal kitchens



Brown Street cuts through the site in the east-west direction. This allows for service entrance and loading zones for most of the buildings on the site. Orientated as a one way travelling east, this ally is used by taxis as an aid in navigating the one way streets surrounding the site. The proximity of buildings in this narrow street creates a shaded environment thus informal ranking takes place there during the day. Pedestrian activity is limited: the back side of buildings limit visibility and thus the area becomes unsafe; there are only two access points, thus movement is limited with only one possible escape route.

The corner of Bloed and Prinsloo Street is defined by a one storey building with a canopy covering the sidewalk held up by concrete columns. This building forms a landmark when accessing the city via Dr. Savage road with the focus on this corner. The building has a unique bazaar quality which adds greatly to the spirit of the area. The main uses located within the structure include a typical corner convenience store, a fitment centre and a doctor. The canopy and amount of pedestrian movement (to and from the Bloed Street Taxi Rank) allows for informal trade to take place, which also creates a barrier between pedestrian and vehicular movement. The stalls trade in food, snacks and traditional remedial products.

The pedestrian activity in Struben Street is in direct contrast to that of Bloed and Du Toit Street as there exists no relationship between the building frontages, the sidewalk or the street. Where Du Toit Street sidewalk allows for relaxing while having lunch, and Bloed Street sidewalk facilitates movement and trading, Struben Street sidewalk infrastructure creates an unpleasant, car and parking orientated zone. The building facades are set back with no canopy or overhang and some are fenced off for security reasons. The southern sidewalk is defined by a palisade fence overlooking a parking lot. There are no informal trading as pedestrian movement is almost non existing.

figure 015: View down Du Toit Street sidewalk with the informal kitchens acting as barrier between pedestrian and vehicular movement (by author)

figure 016: Bloed Street telephone box

figure 017: Corner of Bloed and Du Toit Streets. The corner is defined by the canopy held up by red columns. This building adds to the character of the area

figure 018: Du Toit Street with informal kitchens on sidewalk

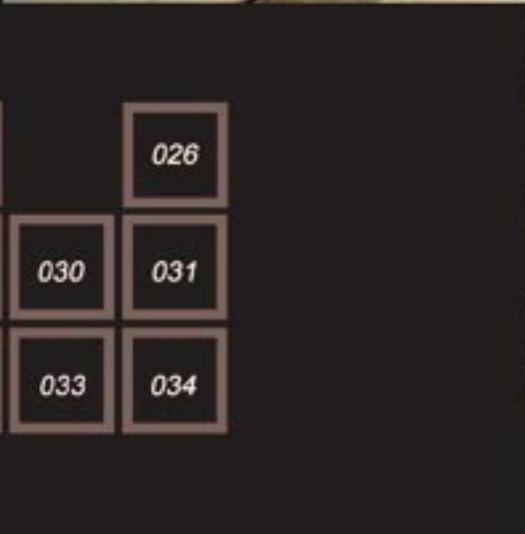
figure 019: Ratanama butchery sidewalk (Bloed Street)

figure 020: Prinsloo Street with the corner shop in the background.

figure 021: Prinsloo Street sidewalk. The edge of the sidewalk is used for trade of food and remedial products. This created a barrier between pedestrian and vehicular movement.

figure 022: Ratanama butchery, Bloed street.

015	016	017
018	019	020
021	022	



023	024	025	026
027	028	029	030
	031	032	033
		034	

Figure 023: Brown Street urban fabric (Author)

Figure 024: Brown Street informal taxi rank (Author)

Figure 025: Existing building canopies create roof for informal ranking in Brown Street (Autor)

Figure 026: View over parking terrain from Struben Street (author)

Figure 027: Prinsloo Street informal trading under existing building canopy (author)

Figure 028: Soutpansperg road: exit route to the North-east (author)

Figure 029: Existing building canopies create roof for informal ranking in Brown Street (Autor)

Figure 030: Urban fabric along Struben Street (author)

Figure 031: Urban fabric along Struben Street (author)

Figure 032: Existing building canopies create roof for informal ranking in Brown Street (Autor)

Figure 033: Urban fabric along Struben Street (author)

Figure 034: Fenced off sidewalk in Struben Street (author)

Page 70:	Figure 090:	Concept sketch of Prinsloo Street façade (author)	Page 100:	Figure 132:	Exploration of possible screen structure (author)
Page 72:	Figure 091:	Line diagrams showing boundary identification and open space size determination through the use of sun angles (author)		Figure 133:	Technical exploration sketch of possible structure for Eastern façade screen (author)
Page 74:	Figure 092:	Open public space identification. Concept sketch by author		Figure 134:	Technical exploration sketch of possible structure for Eastern façade screen (author)
	Figure 093:	Movement exploration through open public space	Page 102:	Figure 135 (top):	Concept model of Prinsloo Street screen structure (author)
Page 75:	Figure 094:	Exploration of the relationship between open and enclosed public space and movement possibilities. Concept sketch by author.		Figure 136 (bottom):	Skin investigation no.1 (author)
Page 76:	Figure 095:	Initial section through private open space. Sketch by author.	Page 103:	Figure 137:	Detail design sketch of building skin (author)
Page 77:	Figure 096:	Public foyer. Concept sketch by author	Page 104:	Figure 138 (top):	Skin investigation no. 2 (author)
	Figure 097:	Open space development sketch (author)		Figure 139 (middle):	Skin investigation no. 3 (author)
	Figure 098:	Private open space layout (author)		Figure 140 (bottom):	Skin investigation no.4 (author)
Page 78:	Figure 099:	Public skin/façade concept sketch (author)	Page 105:	Figure 141:	Design investigation sketch of possible skin material and structure (author)
	Figure 100:	Bloed Street façade development sketch (author)		Figure 142:	Euroslot stainless steel screen
Page 80:	Figure 101:	Public square trading stalls design sketch (author)	Page 106:	Figure 143:	Movable screen façade
Page 81:	Figure 102:	Public square interior façade (author)		Figure 144 (top):	Skin investigation no. 5 (author)
	Figure 103:	Bloed Street façade development sketch (author)		Figure 145 (middle):	Skin investigation no. 6 (author)
Page 82:	Figure 104 (top):	Community hall southern façade concept sketch (author)	Page 107:	Figure 146 (bottom):	Skin investigation no. 7 (author)
	Figure 105 (middle):	Community hall northern façade concept sketch (author)		Figure 147:	Design investigation sketch of possible skin material and structure (author)
	Figure 106 (bottom):	Community hall northern façade concept sketch (author)		Figure 148:	Patrick Blanc's living wall at Quai Branly, London. Photo by P. Blanc (Grant: 65)
Page 83:	Figure 107:	Initial section through community hall (author)		Figure 149:	Paviljoen Blackbox
Page 84:	Figure 108:	Concept sketch of day care centre (author)	Page 108:	Figure 150:	Design sketch showing section through day care centre classroom skylights (author)
Page 86:	Figure 109:	Initial layout sketch for day care centre (author)		Figure 151:	Design sketch showing section through day care centre classroom skylights (author)
Page 87:	Figure 110:	Sketch plan section through day care centre (author)		Figure 152:	Concept sketches for rain water spouts (author)
	Figure 111:	Perspective sketch of play area and the dining halls eastern façade (author)	Page 109:	Figure 153:	Isometric view of section model for residential block and day care centre (model by author)
Page 88:	Figure 112 - 115:	Initial models for housing development (author)		Figure 154:	Section showing structural considerations for day care centre and residential block connection (author)
Page 89:	Figures 116 & 117:	Movement diagrams for housing development (author)	Page 110:	Figure 155 - 157:	Concept model and final product of vendor stalls in Bradbury street, London (Hawkins\Brown: 80)
	Figures 118 - 120:	Initial residential unit layouts derived from movement diagrams (author)	Page 111:	Figure 158:	Design sketches for vendor stall by the author
Page 90:	Figure 121:	The city street as neighbourhood. Volume model of Brown Street with public and private open space identification (model by the author)	Page 112:	Figure 159:	Design sketches for vendor stall by the author
Page 92:	Figure 122:	Program for residential unit design by author	Page 119:	Figure 160:	Isometric view of the building components (author)
Page 93:	Figure 123:	Design sketches for residential units (author)	Page 121:	Figure 161:	Corner of Bloed and Prinsloo Street showing eastern façade screen and north facing offices (author)
Page 94:	Figure 124:	Design sketches for residential units (author)	Page 123:	Figure 162:	View of the public square showing the community hall's southern façade (author)
	Figure 125:	Conceptual layout of residential unit with service box (sketch by the author)	Page 125:	Figure 163:	The day care centre playground showing north facing classrooms and housing on top (author)
Page 95:	Figure 126:	Section through residential unit placed on top of day care centre classrooms (author)	Page 127:	Figure 164:	View of Brown Street showing entrance to the public square and the housing block's south western corner (author)
Page 96:	Figure 127:	Design sketches (author)			
Page 98:	Figure 128 (top left):	Diagram from <i>The Thinking Eye</i> by Paul Klee (Bacon 1968: 125)			
	Figure 129 (top right):	Concept study of screen surface no. 1 (model & photo by the author)			
	Figure 130 (bottom left):	Movement model over site (model & photo by the author)			
	Figure 131 (bottom right):	Concept study of screen surface no. 2 (model & photo by the author)			

“When very large numbers of people are concentrated in one place, the resources needed to maintain the environmental quality of public and private spaces increase exponentially. Social interaction is more complex and more intense, and this has to be ameliorated by spatial and infrastructural design that maximizes qualitative as well as quantitative factors.”

(Hensel, M., Menges, A., Weinstock, M. Emergence in
Architecture. *Architectural Design*. May/June 2006)

theor
etical
con
text

Ants, humans and self-organizing systems



Introduction

The theoretical context looks at the city as an emergent product of the lower-level activities of the city components. City components refer to the smaller elements which make up the fabric of a city like buildings, roads, inhabitants, cars etc. Lower-level activities refer to the interaction between these components, and will be investigated in order to define the consequential feedback into the city as a whole.

An understanding of these aspects of emergence will allow for the identification of tools and guidelines which will in turn be used as measuring criteria for design performance.

A “composite animal”, is how the South African Renaissance man Eugene Marais describes the nature of the termitary: “[it] is a separate composite animal at a certain stage of development, and lack of automobility alone differentiates it from other such animals” (Marais 1970: 63). Similarly Marais explains that “the human body is composed of a number of organs, each connected by a visible or invisible thread to the central point, the brain. Each organ is in constant activity and has a separate purpose – at least that purpose appears to be separate and independent; but on closer observation we find that all the organs are really working for a communal purpose” (Marais 1970: 61). Examining his comparison of the termite with the human body illustrates the universal nature of any bottom-up or self-organizing system. However, what ultimately cripples Marais study is his futile search for the pacemaker. According to him the queen ant controls the activities of every individual ant in the colony. Later studies in the field, specifically the work of Deborah Gordon, Behavioural Ecologist at Stanford University, indicate that this is not the case. There is no pacemaker. The colony self-organizes out of millions of individual ants into an entity of which the qualities are far more than the sum of that of the individual ants.

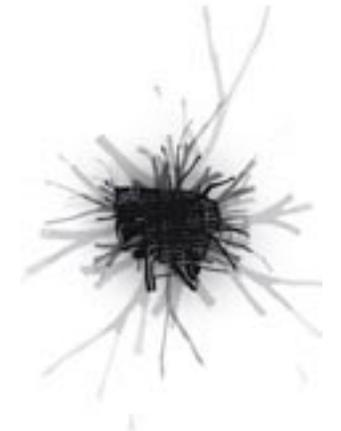
Steven Johnson, author of *Emergence: the connected lives of ants, brains, cities and software*, explains that “in these systems, agents residing on one scale start producing behaviour that lies one scale above them: ants create colonies; urbanites create neighbourhoods; simple pattern–recognition software learns how to recommend new books” (2001: 18). Thus it would seem that we are surrounded, or rather integrally part of these self-organizing systems. In order to define a self-organizing system, four universal truths apply:

The city super-organism

Cities comprise of smaller systems or components which are self-organizing systems within themselves. Included in this list of city organs, which are all vastly different in character and function but act toward the successful functionality of the city as whole, are roads, cars, busses, taxis, parks, inhabitants, commuters, neighbourhoods and buildings etc. Buildings for example are also self-organizing within themselves. Like the human body which comprises of organs acting diversely but toward a common goal; structural systems, ventilation systems, movement systems, etc are all different in nature and function yet they contribute to the successful functionality of the building as a whole.

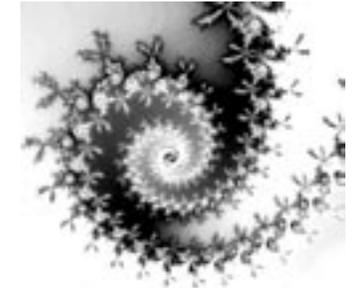
It is thus possible to classify the nature of a city as a self-organizing system. The higher-level activities of a city is a product of the lower-level activities, or as stated by Johnson: “The city is complex because it overwhelms, yes, but also because it has a coherent personality, a personality that self-organizes out of millions of individual decisions, a global order built out of local interactions” (2001: 39).

As stated earlier, one of the defining aspects, and the source of evolution within any self-organizing system, is the constant feedback from the lower-level activities into the whole. An individual forager ant will, based on the amount of other forager ants encountered during the day, either keep on searching for food or change its behaviour. This is an instinctive “decision”, based on the success of the colony as a whole. According to Gordon, “Ants can sense the difference between encountering ten foraging ants in an hour and encountering a hundred.” She continues that “this particular skill is critical to the colony’s formidable ability to adjust task allocation according to colony size or food supply – a local talent, in other words, that engenders global behaviour” (Johnson 2001: 76).



1. Self-organizing systems comprises of **smaller entities** with a variation of functions, yet acting towards a united goal. The system as a whole defines an environment for these smaller entities (the human body for example, acting as environment for the different organs).
2. The definition or character of the **smaller components is vastly different from that of the system as a whole** and in most cases can be defined as self-organizing systems within themselves (like ants within a termitary).
3. The system as a whole, as well as the smaller components, is subject to **external influences**, correlating to the respective scales.
4. The system as a whole is subject to **feedback** from the smaller parts, which is the driving mechanism behind changes within the smaller part’s environment and evolution of the system as a whole.

Emergence



“Emergence is a classical concept in systems theory, where it denotes the principle that the global properties defining higher order systems or ‘wholes’ ... can in general not be reduced to the properties of the lower order systems or ‘parts’.”

Heylighen: Self-organization: Emergence and
the Architecture of complexity

“We are everywhere confronted with emergence in complex adaptive systems – ant colonies, networks of neurons, the immune system, the internet, and the global economy, to name a view – where the behaviour of the whole is much more complex than the behaviour of the parts.”

Holland: Emergence from chaos to order

It is within this constant process of feedback that we find the evolutionary power within any self-organizing systems. In the case of a territory, this is an instinctive process. Yet, with a city, feedback becomes much more reflective and thus increasingly complex. City inhabitants are aware of decisions made which changes their environment like a vendor setting up a stall or a corporation building new offices. There are, however, some decisions of which the feedback into, and change of the city environment is not so obvious. Johnson explains that this is because lower-level activity falls within a different time scale than that of the emergent higher-level product. He explains that: “Driving a car has short-term and long-term consequences. The short term influences whether we make it to soccer practice on time; the long term alters the shape of the city itself” (Johnson 2001: 98). He goes on by saying that if “perceived at that [the millennium time scale], the success of the urban super-organism might well be the single most momentous global event of the past few centuries” (2001: 98). This statement is backed up by the fact that urbanization has displaced half the population of the planet into cities and that “until the modern era less than 3 percent of the world’s population lived in communities of more than five thousand people ...” (Johnson 2001: 98). The success of the city super-organism is due to its emergent nature.

In his essay *Morphogenesis and the Mathematics of Emergence*, Michael Weinstock, director of the Emergent Technologies program at the Architectural Association School, explains that “living organisms can be regarded as systems, and these systems acquire their complex forms and patterns of behaviour through the interaction, in space and time, of their components.” He further states that “the form of an organism affects its behaviour in the environment, and particular behaviour will produce different results in different environments, or if performed by different forms in the same environment” (Weinstock 2004: 12).



Genius loci

We find the same elements in a small town or village as we find in a city, yet there is a distinct difference in the character of a city compared to that of a village. Thus, the character of city or town cannot be deduced by the mere sum of the parts. The character is an emergent product of the interaction of these parts. The number of interactions between elements seems to increase as the system increase in complexity: A building in a city relates to a magnitude of other buildings in terms of proximity and scale; a city dweller's options of travel, housing and work are much more than that of a village inhabitant.

This emergent product of the interaction of components is the spirit of a place or the *Genius loci*: it is the product of interaction between the magnitude of city components (the lower-level activities) and the consequential feedback into the city as a whole. However, it is not a quality that can be attributed to the city inhabitants, buildings, roads or any other city component in isolation.

Chrisian Norberg-Schulz, in his book *Genius loci: Towards a Phenomenology of Architecture*, states that “from the beginning of time man has recognized that to create a place means to express the essence of being. The man-made environment where he lives is not a mere practical tool or the result of arbitrary happenings; it has structure and embodies meaning” (1980: 50). He goes on by explaining that any man-made environment, be it a house or a city, can structurally be defined in terms of built boundaries, which defines “enclosure” (1980: 58). The character of these boundaries comprises of the permeability or axis (be it physical or visual) through them. Furthermore, an enclosure has a three dimensional quality, with boundaries extending not only horizontally, but vertically as well.

“The main urban elements are centres and paths. A square



viously functions as a centre and a street as a path. As such they are enclosures; their spatial identity in fact depends upon the presence relatively continuous lateral boundaries” (1980: 59).

Norberg-Schulz explains the structure of the urban *genius loci* in terms of scale, dividing the city environment into urban districts, which, according to him, falls within the same category as a centre. He states that “a district, thus, is either defined by conspicuous edges of some kind, or at least by a change in urban texture which implies a boundary.” (1980: 59) The fact that boundary and enclosure plays an eminent role in the structure of man-made places, the “character of man-made places is to a high extent determined by its degree of ‘openness’” (1980: 63). This openness refers to communication between structure and user, as well as relationship between structure and structure, in other words, lower-level activities.

A prime example of *genius loci* in terms of closure and openness is the Kowloon walled city on the Kowloon peninsula in Hong Kong. Greg Girard, author of *City of Darkness: Life in Kowloon walled city* describes it as follows: “six-and-a-half acres of solid building, home to 33,000 people, the biggest slum in the world,” (1993: 9). In 1993, under agreement of both Chinese and British governments, the Kowloon walled city was demolished. Despite valid arguments for and against the existence of the city (dirty, unhygienic slum life vs. the existence of a self-governing, self-maintaining environment with a strong spirit), the city clearly illustrates some guiding principles pertaining to a positive *genius loci*. The origins and evolution of form and performance of the city as a whole lie in the political history of Hong Kong. However, the *genius loci*, although influenced by these external, political forces, was mainly shaped by the fact that this was, in the word of Peter Popham, journalist specializing in architecture, “arguably the closest thing to a truly self-regulating, self-sufficient, self-determining

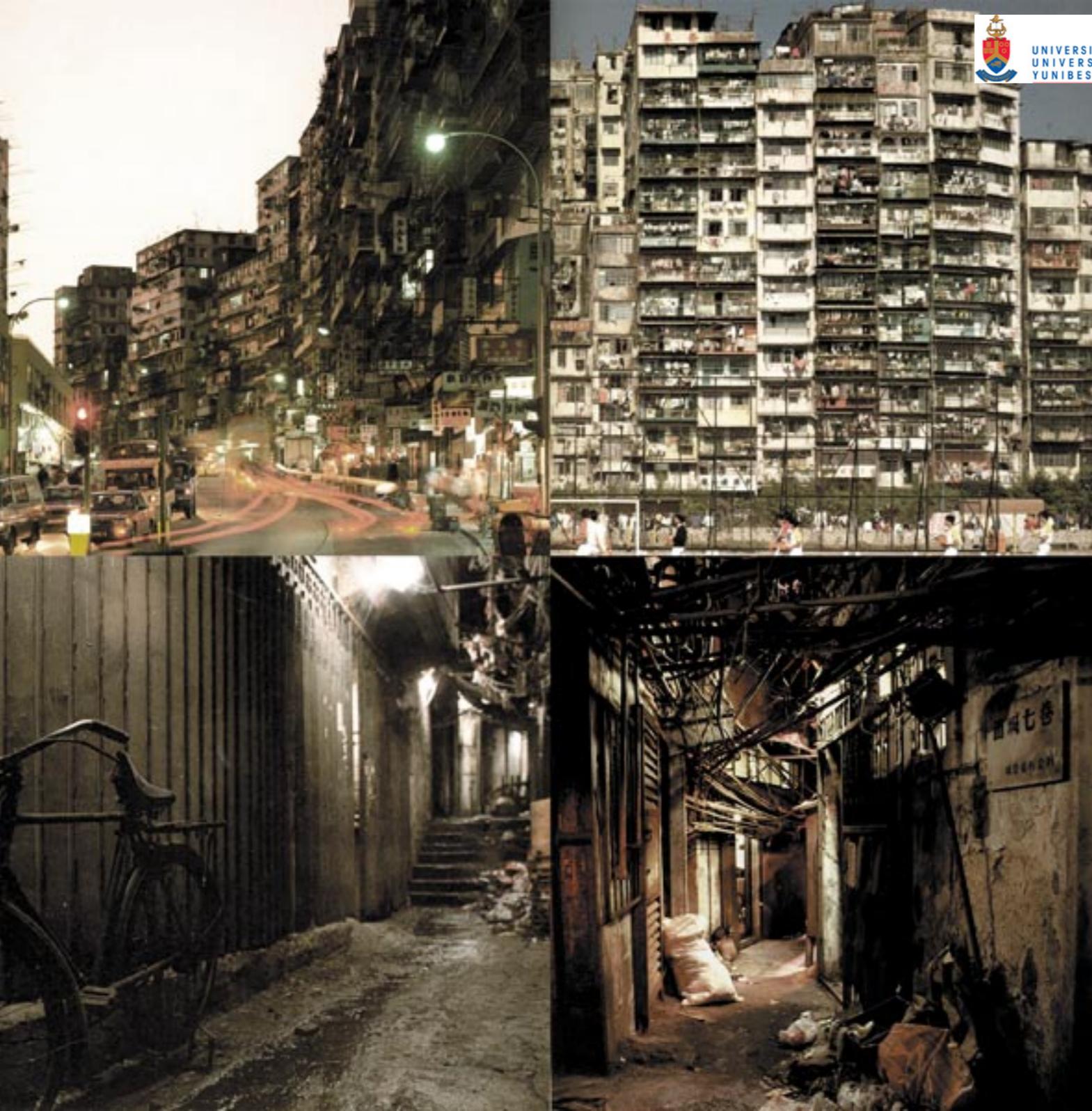
Page 42: figure 035 (top left): Kowloon City external façade.

Figure 036 (Top right): A boundary of houses. The southern façade of Kowloon City.

Figure 037 (Bottom left): Kowloon City on street parking.

Figure 038 (Bottom right): Service distribution.

Page 44: Figure 043: Kowloon Walled City, Kowloon Peninsula, Hong Kong



modern city that has ever been built” (Girard 1993: 9). It was within this self-organizing system that the full potential of emergence can be seen: a solid and well-defined spirit of place.

As mentioned earlier, the barrier or edge, and movement through the edge constitutes one of the main structures in the creation of man-made environments. Referring to figures 039 to 042, the edge of the outer wall of Kowloon defines it as a separate entity within its surroundings. Restricted movement through this barrier ensured the safety and unity of the community within the city. This enhanced the emergence of a very distinct spirit for the entire city.

When viewed in terms of a solid structure, the entire city becomes a block with movement patterns carving away the fabric, and daily activities carving space for living in. Like water forming a canyon over centuries of erosion, movement within a city defines form and creates possibilities for appropriation by the city inhabitants. Yet in order for this to happen, boundaries need to exist, albeit between different functions in a city or the city as a whole. This form of evolution is graphically explained in figure 044 on page 46.

Thus, it is within the way enclosure and openness, edge and access communicate with one another that we find an aspect of the spirit of a place. As derived from the above argument, the language for this communication consists of visual as well as physical access and openness. Yet in order to achieve such interaction, an enclosure is required, a distinct boundary to act as mediator between structure and structure, and structure and user.



Figure 039

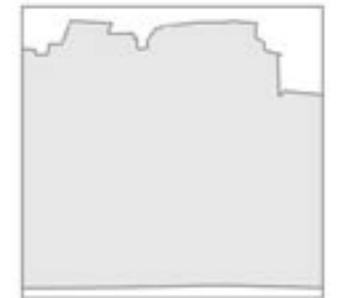


Figure 040

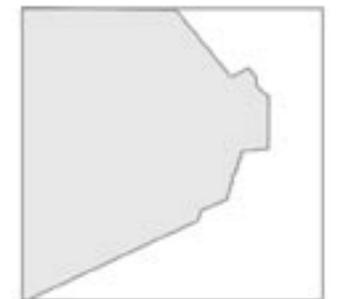
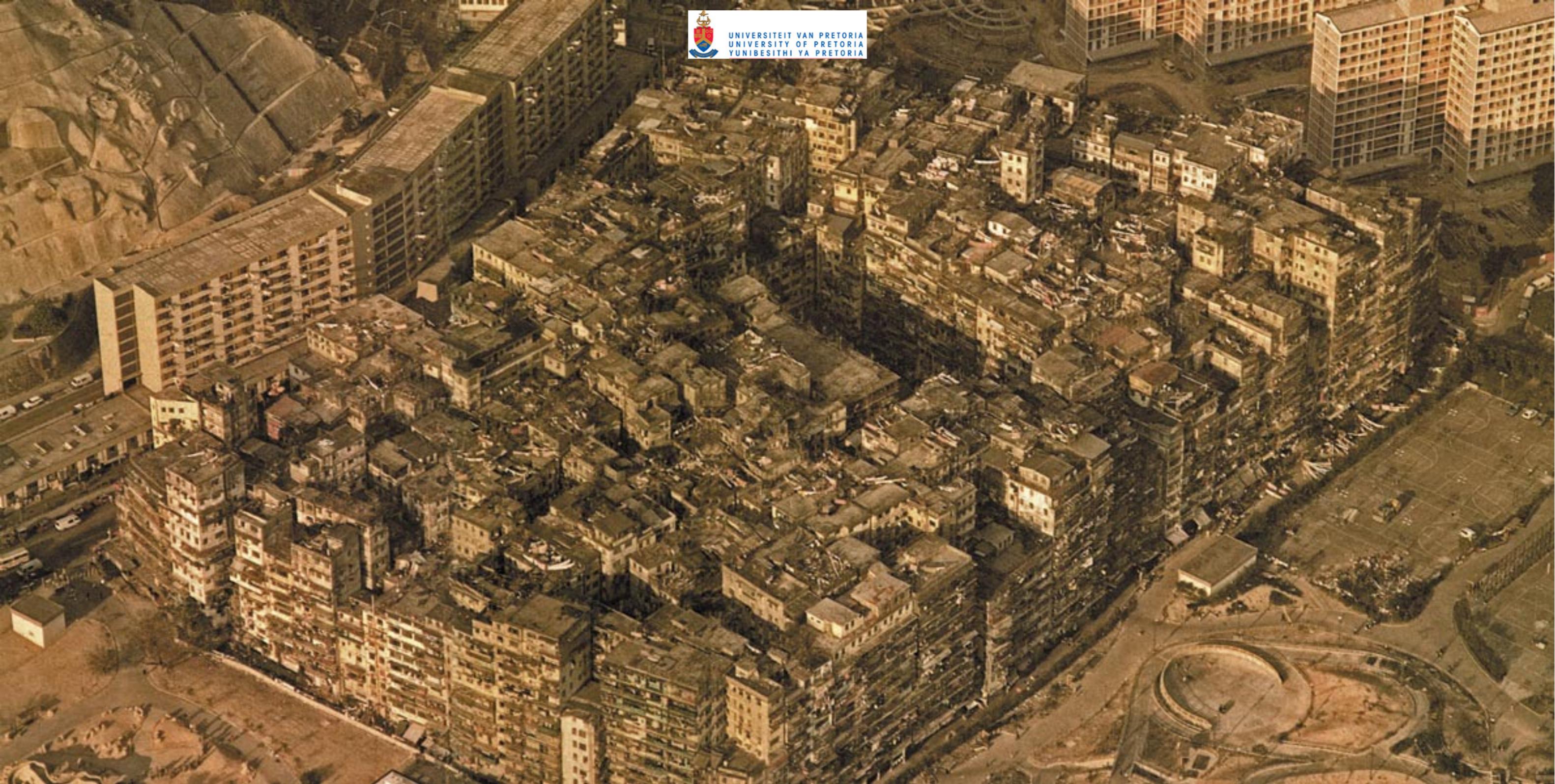


Figure 041



Figure 042



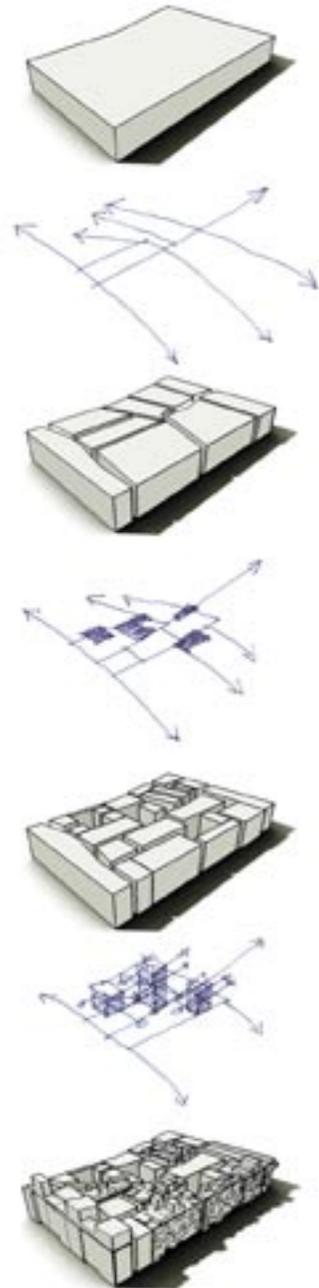


Figure 44: Movement and city shape

Feedback

Feedback is a defining characteristic of any self-organizing system and is the main driving force behind the creation of complexity. It can broadly be defined as the parts interacting with the whole. As explained earlier, we find this quality brilliantly demonstrated by the individuals in an ant colony, where a number of encounters between foraging ants will determine the next action of the individual ants.

“A foraging ant might expect to meet three other foragers per minute – if she encounters more than three, she might follow a rule that has her return to the nest. Because larger, older colonies produce more foragers, ants may behave differently in larger colonies because they are more likely to encounter other ants.

This local feedback may well prove to be the secret to the ant world’s decentralized planning” (Johnson 2001: 8).

The ultimate aim of any feedback into a system is to ensure the continual improvement of performance of such a system. In order to “learn”, the lower-level activities obviously feed information back into the higher-level activities. This, likened to the process we find in the natural selection theory, is to ensure the ultimate survival of the system as a whole.

Movement as feedback

Movement can be considered as a ground level activity within the urban environment. Examining the structure and layout of our cities, it is by far the dominant determinant of how a city is planned. The reason for this is that it forms the primal feedback line from city elements to the city as a whole.

The growth of Athens from 600 B.C. to 287 A.D. illustrates this point. Referring to figure 045, it is clear that the growth of the city was determined by the movement of users along the Panathenaic Way, which stretched from the Dipylon Gate, up the slopes of the Acropolis and terminated at the foot of the statue of Athena. According to Edmund Bacon, “it served both as sacred way and as the main street of Athens. It was the central spine along which occurred the principle mercantile, industrial, and political activities which made up the life of the city. Indeed the position and size of the Parthenon are comprehensible only when it is viewed in relation to the entire Panathenaic sequence” (Bacon 1968: 53).

In redesigning the master layout for Rome, Sixtus V, ..., saw the need to use movement as a basic organizational tool. He used nodal points (refer figures 049 and 050, page 49) to connect certain vital districts of the city. Between these points embodied by obelisks erected in open “squares”, movement paths were created. Consequently, Baroque Rome emerged from these points and around these paths. The two diagrams by Paul Klee (figures 047 and 048, page 49) illustrate the principle of nodal point orientation using movement.

Another diagram, a water-colour painting (figure 046, page 048), also by Klee, further develops the idea of movement systems. This shows simultaneous movement systems with the intersecting areas highlighted. The suggestion here is that the form and performance of a city is, in general, determined by the systems of movement.

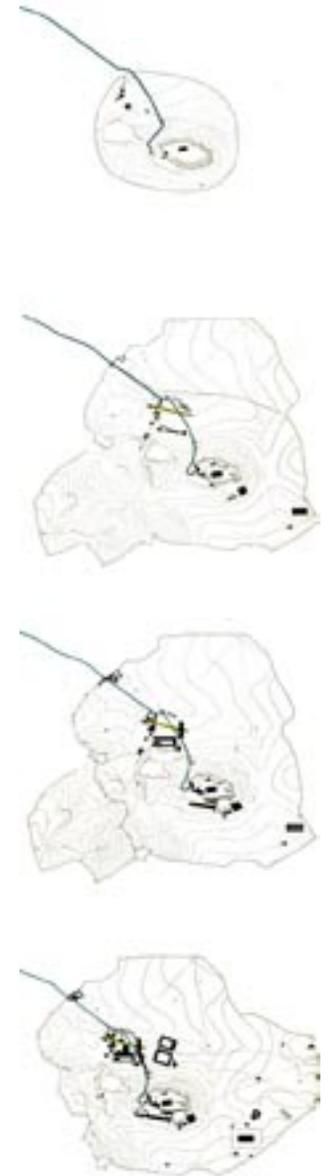
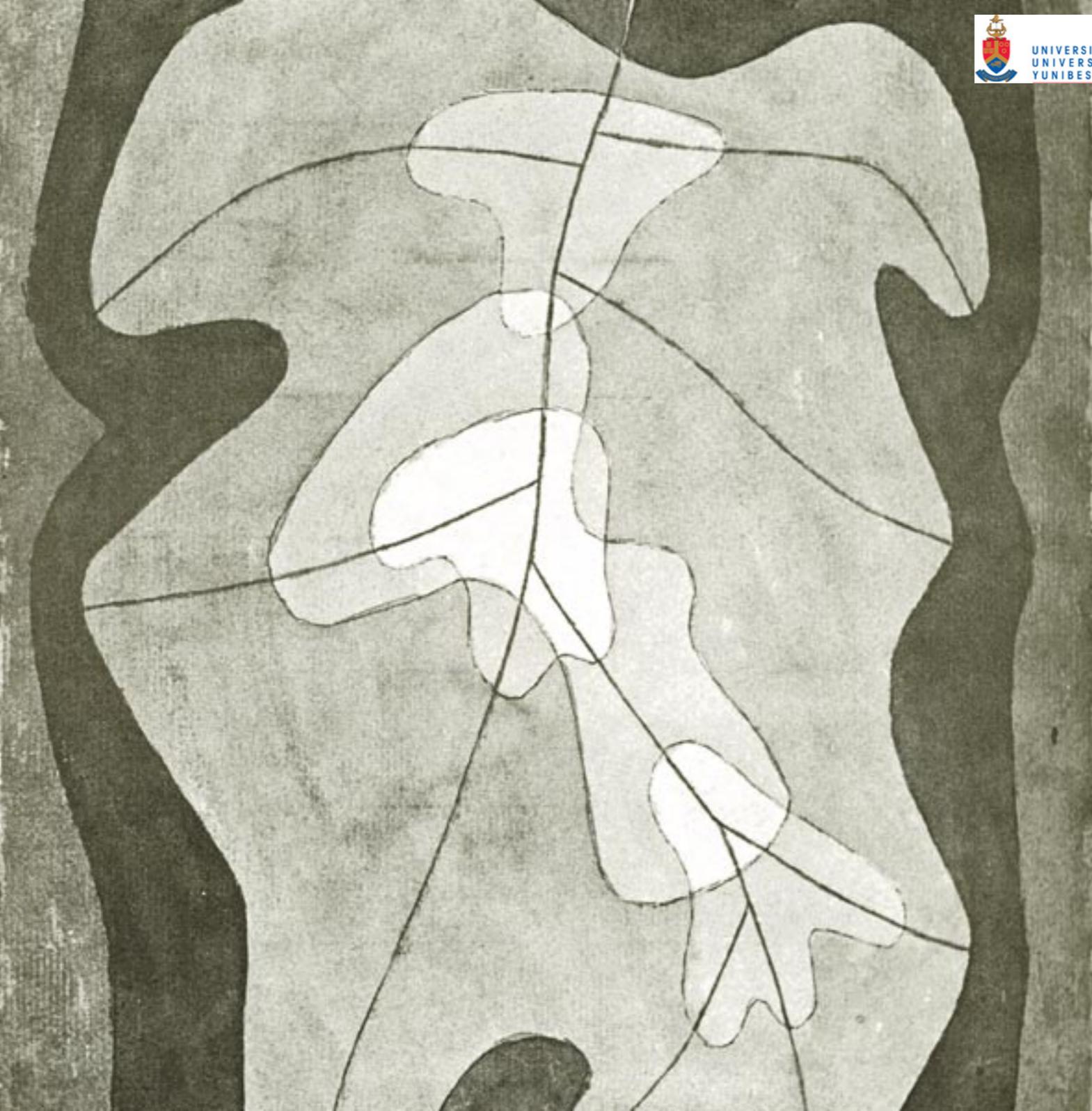
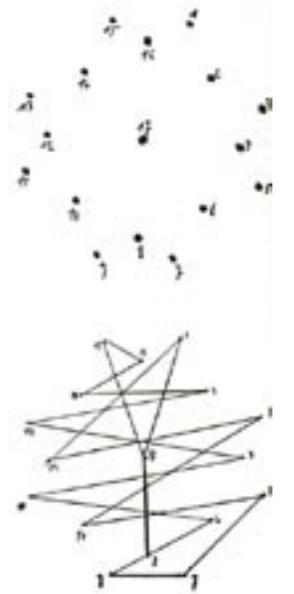


Figure 045: The growth of Athens around the Panathenaic Way.

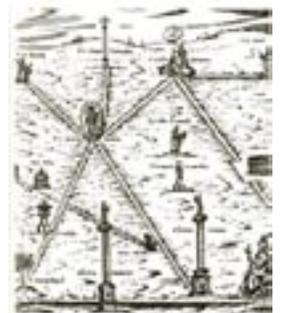


“Since the veins of a leaf or the branches of a tree are comparable to the channels of movement of people and goods within a city, we see the parallel between organic structural form and the city movement system, their sequential effect on the sensibilities of the people who move over them, and the resulting effect on the appearance and character of the city adjacent to them” (Bacon. 1968: 114).

According to Bacon, there are three concepts which need to be taken into consideration when investigating simultaneous movement systems. These are the relationship of mass and space, the continuity of experience, and simultaneous continuities. Where mass and space can be understood as physical entities, and the relationship between them as a tool for design, continuity of experience and simultaneous continuities refer to a qualitative aspect of movement. Bacon states that “if one can establish a track through space which becomes the actual path of movement of large numbers of people, or participators, and can design the area adjacent to it to produce a continues flow of harmonic experience as one moves over that track in space, successful designs in cities will be created” (1968: 34). This establishes the simultaneous movement systems in a city as the primary feedback line, determining the form and performance of a city.



Top: Figure 47 and 48
Bottom: Figure 49 and 50



Building as feedback

As was mentioned earlier, one of the defining elements of the spirit of an urban environment is boundary. The creation of boundary defines space. The wall of a room indicates a certain relationship between the user and a space. This is however not limited to built space: The circle of light around a fire, or the canopy of a tree indicates just as clearly the notions of "inside" vs. "outside". We find this perception of space not only on the individual room or building, but also on the urban scale: either 'inside' or 'outside' the city.

The relationship between user and space is defined in terms of scale, proximity, opportunity for movement and view, and need. The act of place making, or rather, the adaptation of space in terms of abovementioned factors, is defined as building, and is mainly informed by the need of the user. Need causes the changing of the environment through the creation of boundary. Thus boundary is the product of adaptation according to need. It is boundary that defines space, which in turn is made into place by the need of the inhabitant. Conclusively, the difference between the creation of space and place is that of time: Space is the initial product of boundary creation, where place requires user adaptation of that space. This adaptation will in turn create a new space, as the act of building includes the creation of boundary. Thus building falls within the scope of a feedback system: need creates boundary; boundary defines space; over time space becomes place; place making is informed by need, and need creates boundary.

This iterative process varies in scale: adapting a city block to the need of the community requires a more complex approach to boundary creation and a more public focused place making, compared to the more private place making and subtle boundaries in the adaptation of a residential unit. Thus the same is true for the creation of neighbourhoods, suburbs and city districts.

Building/moving

Since building constitutes the creation of boundary or edge, moving to or from a place will always be through these boundaries: walking to work requires moving through the semi-private house/street boundary, through the magnitude of neighbourhood/city block/city district boundaries, through the public street/foyer boundary, and finally through the semi-public foyer/office boundary. Clearly these boundaries of different scale and accessibility (semi-public boundaries are more accessible than semi-private or private boundaries) exists simultaneously on different layers within the urban environment.

It is this multi-level nature which gives the urban environment its complexity and can be the cause of disorientation. However, the initial division of cities into districts, suburbs and neighbourhoods attempts to orientate the user and guide movement. As Johnson states: "A city is a kind of pattern amplifying machine: its neighbourhoods are a way of measuring and expressing the repeated behaviour of larger collectives – capturing information about group behaviour, and sharing that information with the group" (2001: 40). Thus the clear definition of barriers, the knowledge of leaving and entering space, constitutes a vital orientation tool when moving through an urban environment.

It is this awareness of ones location in place, the knowledge of position (inside this place, outside that place) along a movement system, which constitutes as continuity of experience, one of the principle considerations of movement systems. However continuity does not refer to repetition or rhythmically structured space. It describes clearly identifiable boundaries between places, and the awareness of location.

Community as feedback

The Oxford English Dictionary describes a community as (1) “a group of people living together in one place”, (2) “the people of an area as a group” or (3) “a group of people sharing a religion, race, or profession” (2006). Considering the diversification of communities not only in a urban environment (commuters moving through the area daily etc.), but also on the internet with Facebook and mySPACE communities growing daily, the above mentioned definitions seems outdated and does not adequately describe the multi faceted nature of a community.

Consequently the arguments for movement and building as feedback highlighted some aspects of the urban community. A person moving through a space is as an important role player in the adaptation to place as someone working there or living there. Thus the urban community will consist of a multitude of role players on different scales of involvement and the following breakdown will be used as client profile for the design:

- 1 **The daily commuter** does not work or live in the community district, yet contributes significantly. Place making along movement routes and through boundaries play a vital role in the open public landscape of the district or area. The need of public facilities and the opportunities for retail are determined by the amount of commuters along a movement route. This falls under the scope of place making, which, as described earlier, is a feedback system. Thus the amount of commuters influences the making of place, which in turn influences the amount of commuters.

- 2 **The patron** mostly visits the area over lunch hours. These users are more related to retail and dining opportunities and as such contributes to the community financially.
- 3 **The employee** forms an integral part of the urban community during office hours, establishing the area as a destination. They also contribute financially as most employees fall under the patron definition. In establishing the area as a destination, movement to and from work influences the movement systems.
- 4 **The vendor** can be seen as a unique employee, contributing to the daily street level activity of the urban community. They ensure an influx of patrons during lunch hours and play a vital role in the quality of experience of a space since the nature of street venting includes the adaptation of space to place according to need.
- 5 **The resident** is the only role-player described by the initial definition of a community. However, residing in one place might be a better description. This includes homeowners, home-renters and the homeless. They form the after hour custodians of the community and contribute to the more personalized place making activities. The homeless is in most urban areas the only true 24hour inhabitants of an area, with place making limited and nomadic, yet with a contribution to spirit and character.

“Cities have no central planning commissions that solve the problem of purchasing and distributing supplies... How do these cities avoid devastating swings between shortages and glut, year after year, decade after decade? The mystery deepens when we observe the kaleidoscopic nature of large cities. Buyers, sellers, administration, streets, bridges, and buildings are always changing, so that a city’s coherence is somehow imposed on a perpetual flux of people and structures. Like the standing wave in front of a rock in a fast-moving stream, a city is a pattern in time.”

John Holland (Johson 2001)

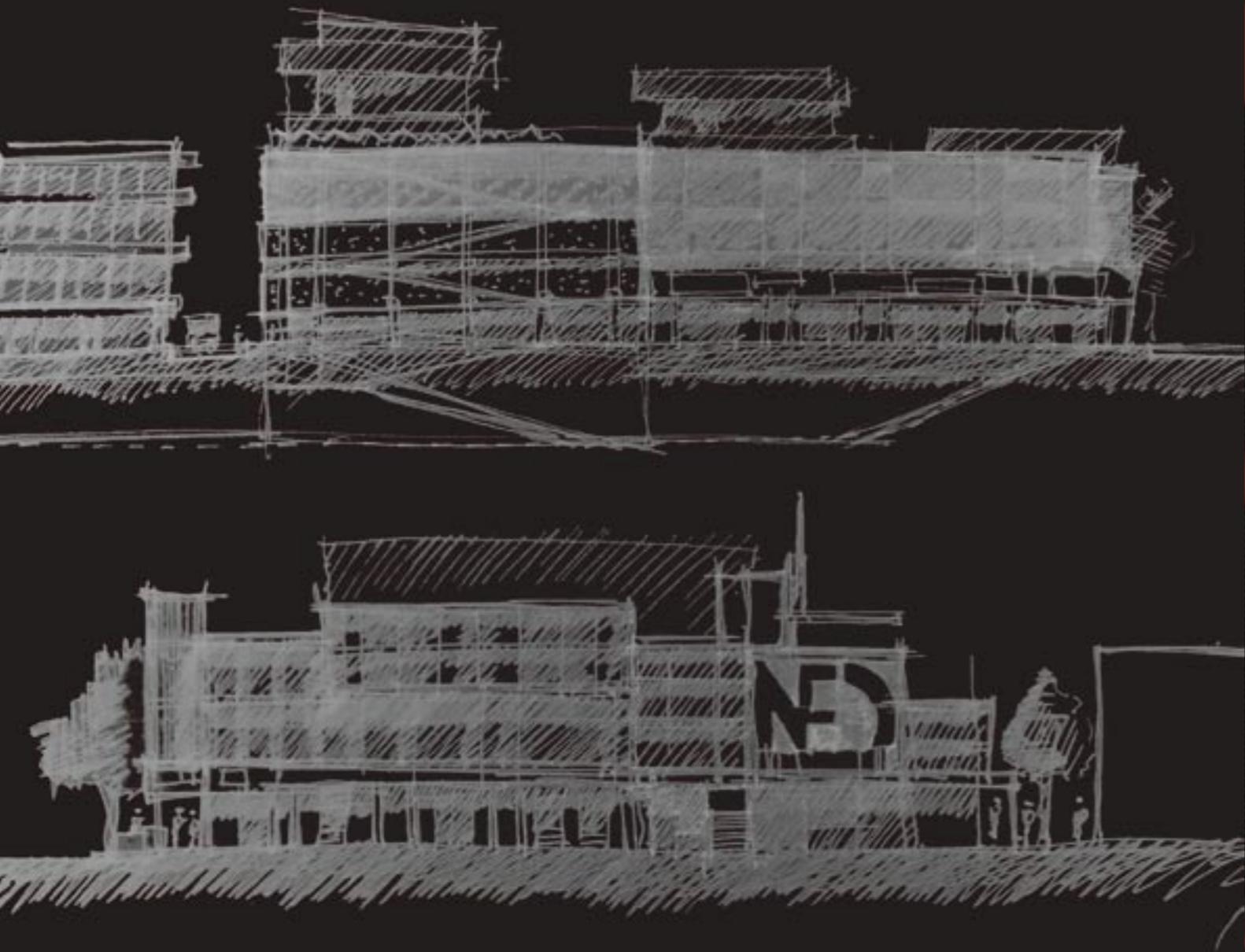
Design tools and performance guidelines

Understanding a city as a self-organizing system complicates the identification of measurement criteria for performance or even tools for design. Even when considering Holland’s statement, it becomes clear that there are no right or wrong interventions within the urban environment. The identification of tools for emergence within the city super-organism seems futile as this organism, per definition, is self-regulating its growth and evolution. However, from the argument for movement and building as feedback, certain guidelines can be highlighted to guide the iterative process of emergence within the urban landscape.

The first guideline is the **creation of boundary** in order to define space. The quality of a boundary should correspond to the classification of space it encloses yet still allow for juxtaposing of other boundaries (possibly of different qualities) on it. For example, a street level entrance might give access to a foyer which is used for both office and residential space.

Secondly, the possibility of adaptation of the boundary in order to **transform space into place**: where creation of space is determined by boundary, place making emerges from space over time. This adaptation must be possible in all the layers of an urban environment.

As illustrated by Sixtus V’s master plan for Rome, movement takes place from or to a place. The **continuity of experience** between places can be seen as the third guideline. As described earlier, this continuity deals with movement through boundaries and the knowledge of orientation. It also describes the movement through the city districts, suburbs and neighbourhoods.



*design
development*

The theoretical discussion concluded with the identification of three principle guidelines with the aim of guiding emergence within the city super-organism: The **creation of boundaries** in order to define space; the creation of possibilities for adaptation in order to **transform space into place**; and finally, **the continuity of experience** or the knowledge of orientation when moving through the boundaries.

The creation of boundaries takes place on different scales: defining the boundaries of the CBD of Tshwane; identifying the boundaries of the North-eastern district of the CBD; placing boundaries on the site informed by movement and activity patterns; Allocating open space hierarchy based on optimal movement and activity on the site; translating these theoretical boundaries into building skin, the quality of which is determined by the program of the building it forms part of.

The transformation of space into place occurs when residents or users adapts space according to need. The creation of a skeleton structure with the possibility of physical adaptation prior to use, is however, not conducive to the creation of complex, multi-faceted societies. With these so called open buildings, adaptation becomes limited by economy and/or scale and becomes exclusive. The intervention aims at adaptation as a reaction to something existing rather than the creation of something new. In order for this to succeed, a magnitude of different users is required, as with each user the possibility of adaptation increases. Therefore a multi-functional intervention will create the most opportunities for adaptation and the consequential transformation of space into place. For this reason the intervention accommodates a variety of old and new functions: restaurants and retail on the ground floor lining the outside of the block, existing and new commercial space on top of the restaurants, a multi-purpose community hall, day care centre and a residential block.

Emergence in the self-organizing city



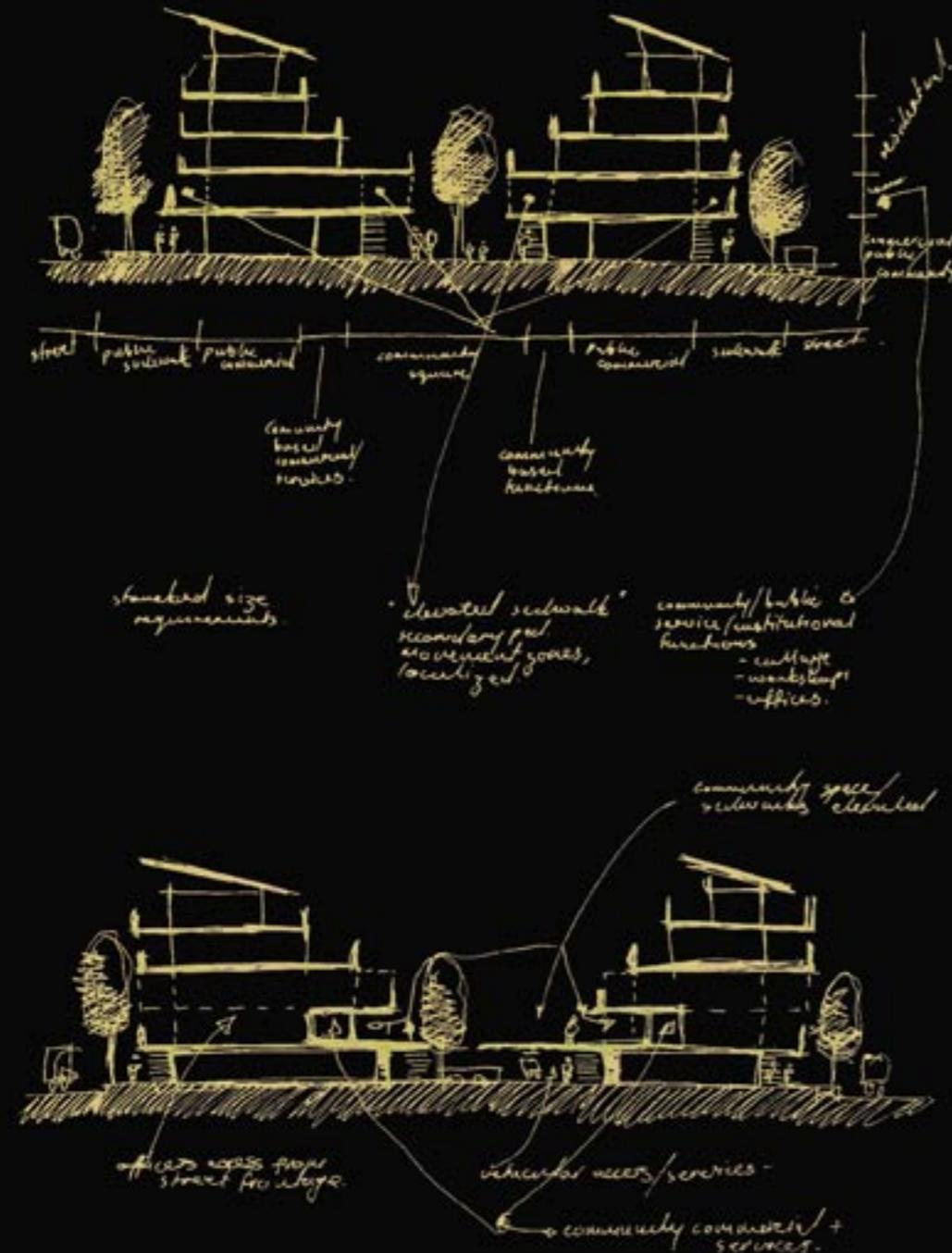
Page 56: Figure 051 (top):
Façade design sketch
by author

Figure 052 (bottom):
Façade design sketch
by author

Page 58: Figure 053: Fractional
pattern growth.
Concept sketch by
author

Page 60: Figure 054: City block
as neighbourhood

District development proposal



Previous frameworks concerning the regeneration of Tshwane ignored the north-eastern corner of the CBD. Visual axis across the city from the Union Buildings and Freedom Park, and the regeneration of the Apies River were set out as primary design focuses. Furthermore, the identification of districts according to usage and zoning, as some of these frameworks suggests, contributes to the regularity and monotonous nature of the CBD. Additionally, it contributes to the degeneration of the north-eastern corner, as it is totally ignored.

In contrast to the grouping of uses, the framework proposed will allow for multi-use development in all areas. The CBD is viewed as a single, un-zoned entity from which the city can emerge out of smaller activities.

Following the theoretical investigation, the first consideration regarding an intervention within a self-organizing system subject to emergence, is the identification or creation of boundaries. Considering the layout of the CBD, with Church Square as anchor, the logical identification of districts will be the four quadrants – these will each be roughly four city blocks by four city blocks big.

On a smaller scale, and informed by movement as a feedback system and the CBD's history of arcades and promenades, every city block is divided into four quadrants, creating pedestrian movement arcades through the blocks and establishing each quadrant as a manageable "neighbourhood". Public squares and open green areas are then placed where these pedestrian arcades intersect one another.

As illustrated by figure 054, each quadrant forms a city neighbourhood: On the ground floor around the edge of the block, public activity will take place (larger convenience stores, restaurants, markets etc.),

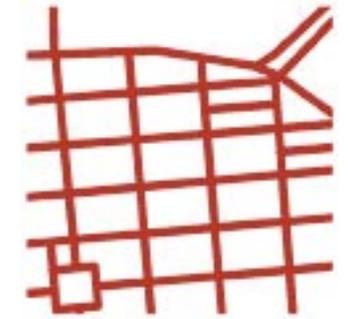


Figure 055



Figure 056



Figure 057

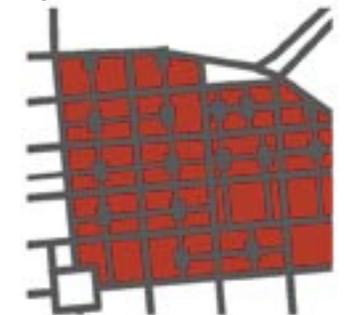
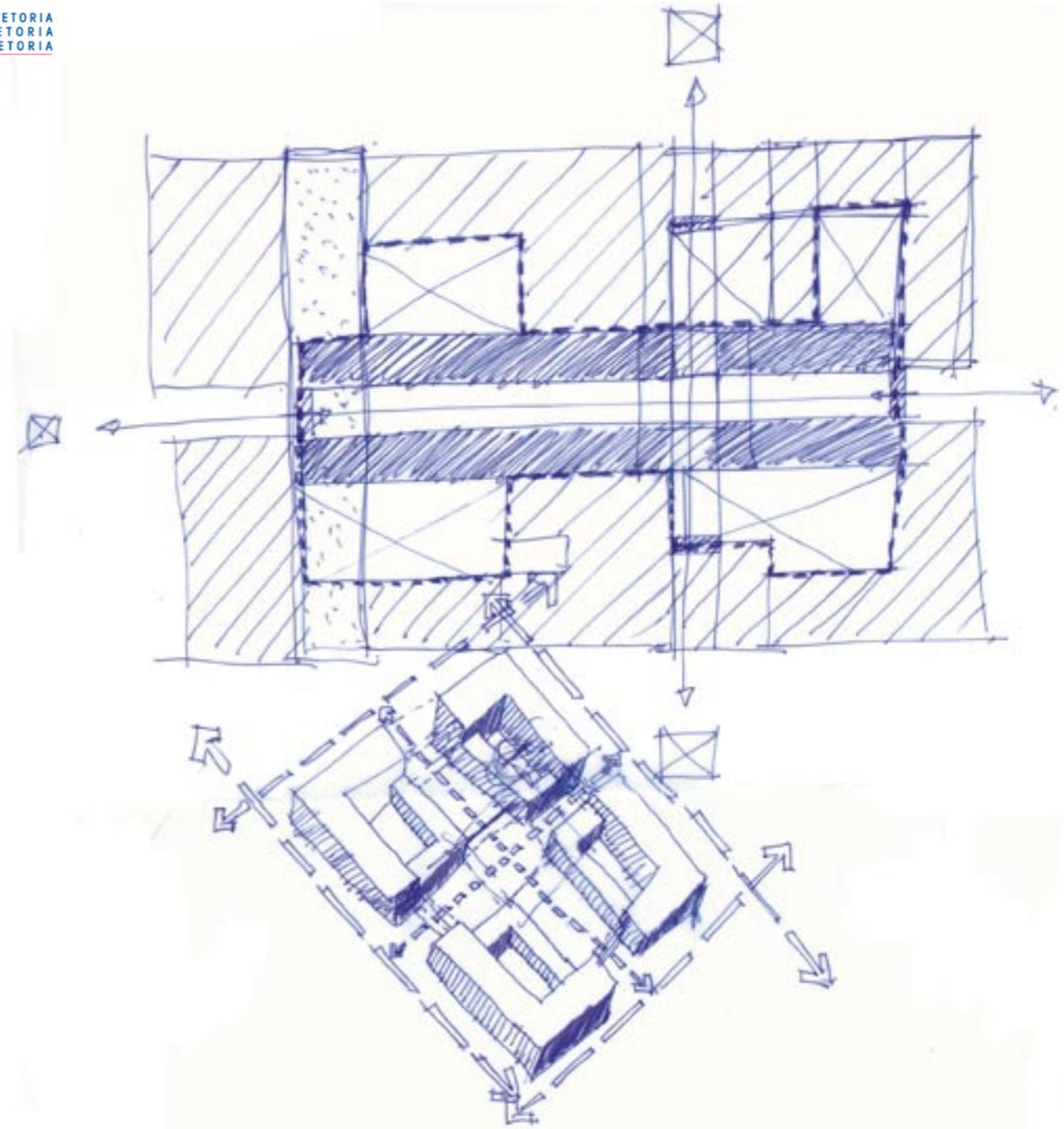
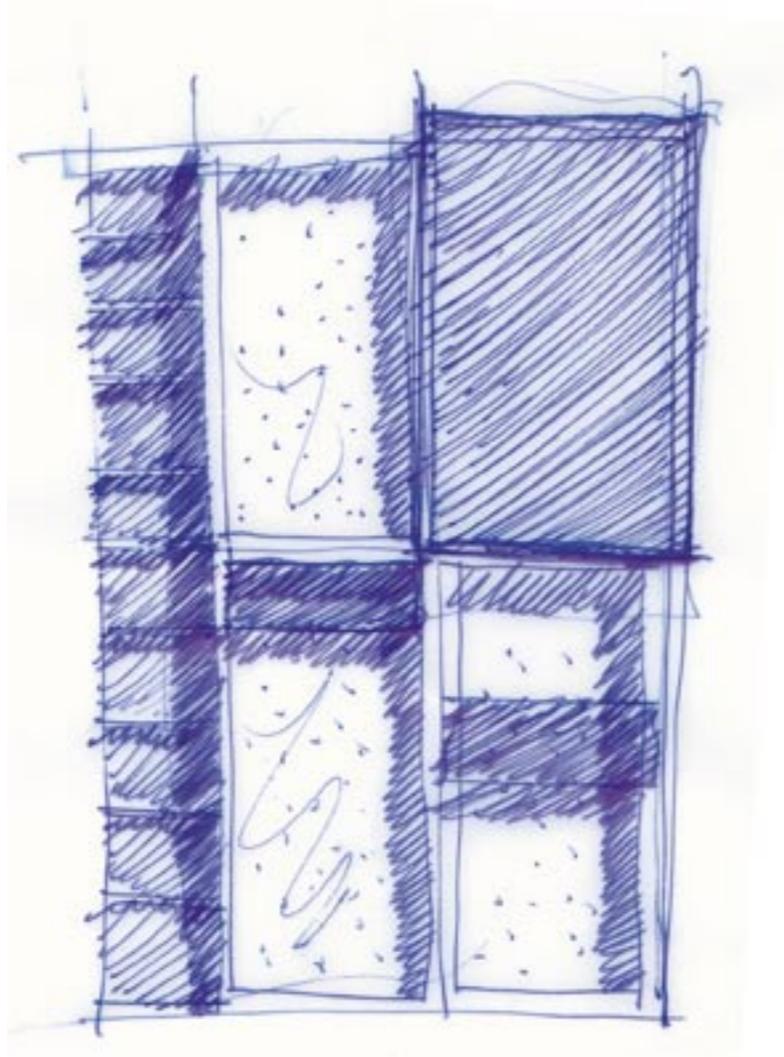


Figure 058



while the inner ground floor will house more community based retail (small trading stalls, internet cafés and laundries). The first and second floor will house commercial usages on different scales: corporate offices on the edge and community workshops looking inward. The floors on top will be residentially orientated and location within the block will determine type of housing.

Figure 059: North-eastern district logo

Page 63: Figure 060: City block as neighbourhood development sketches

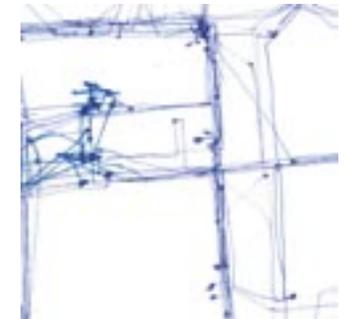


Site Development - movement and form

Primarily informed by the **continuity of experience** and the need to create **boundary** as main space definer, the initial site development included a mapping of horizontal pedestrian and vehicular movement around and on the site. Mapping pedestrian movement proved to be much more complex than mapping vehicular movement: in the urban environment every point can be the point of origin or destination of a pedestrian; pedestrian movement, as apposed to vehicular movement, does not follow a linear path on a bigger grid, movement is random and in any direction. Thus the attempt to map this seemingly chaotic process produces a variety of methods and maps. (figures 061 to 068)

From these movement diagrams boundaries were identified which could be graded in terms of permeability: the amount of pedestrian and vehicular movement through a boundary informed the openness of that boundary. This developed the hierarchy of open space. Depending on movement and accessibility, public open space and private open space could be identified and further links between these two could be drawn in.

Vertical movement within the site was placed depending on open space classification and prominence of the façade. The extrusion of space classification defined each façade as either public or private building skin, thus informing the placement of correlating interior space. From these diagrams developed the bulk of the development and it informed the placement of functions.



Page 64: Figure 062: Boundary identification

Figure 063: Model of vehicular movement on and around site

Figure 064: Model of pedestrian movement on and around site

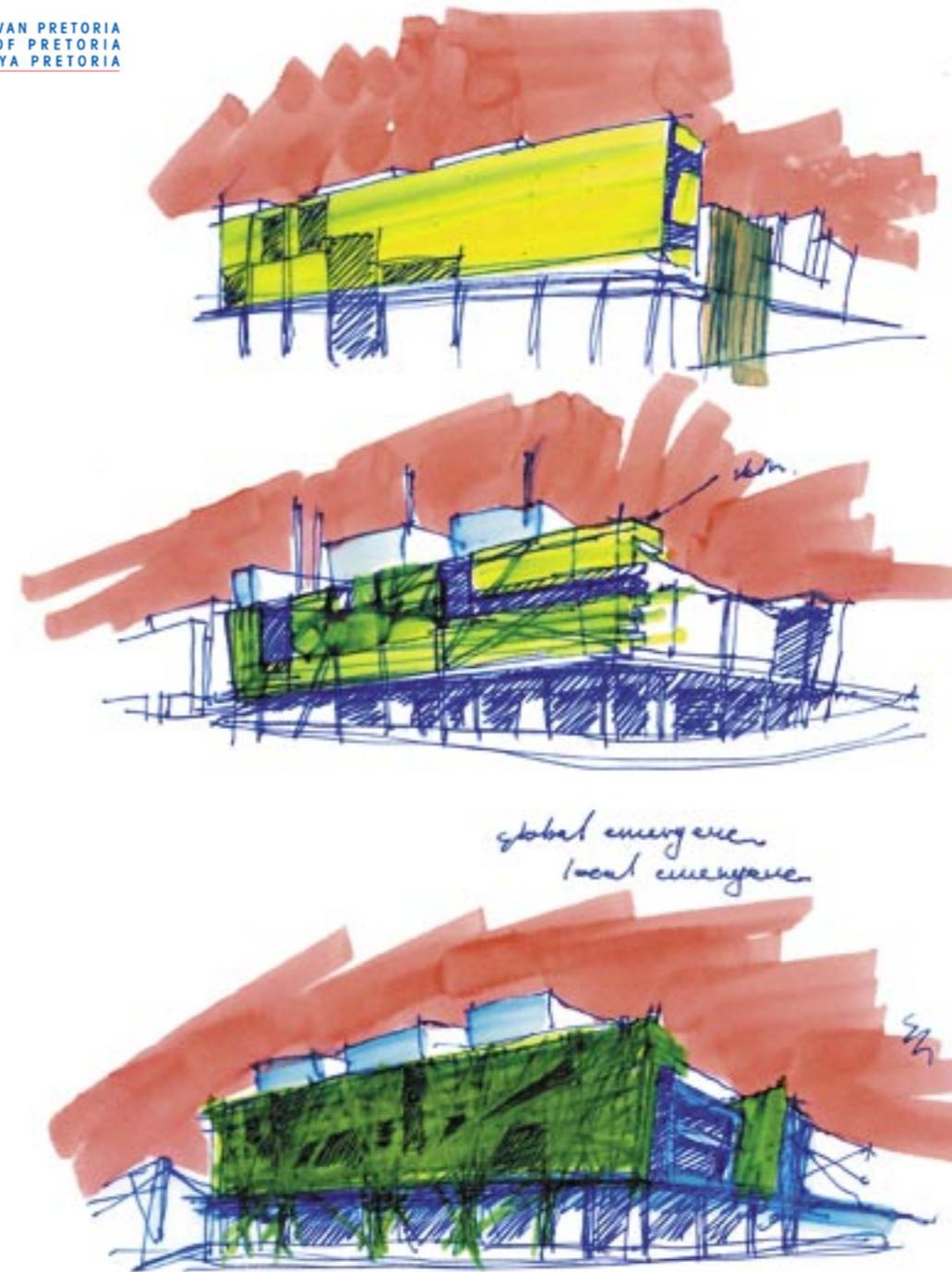
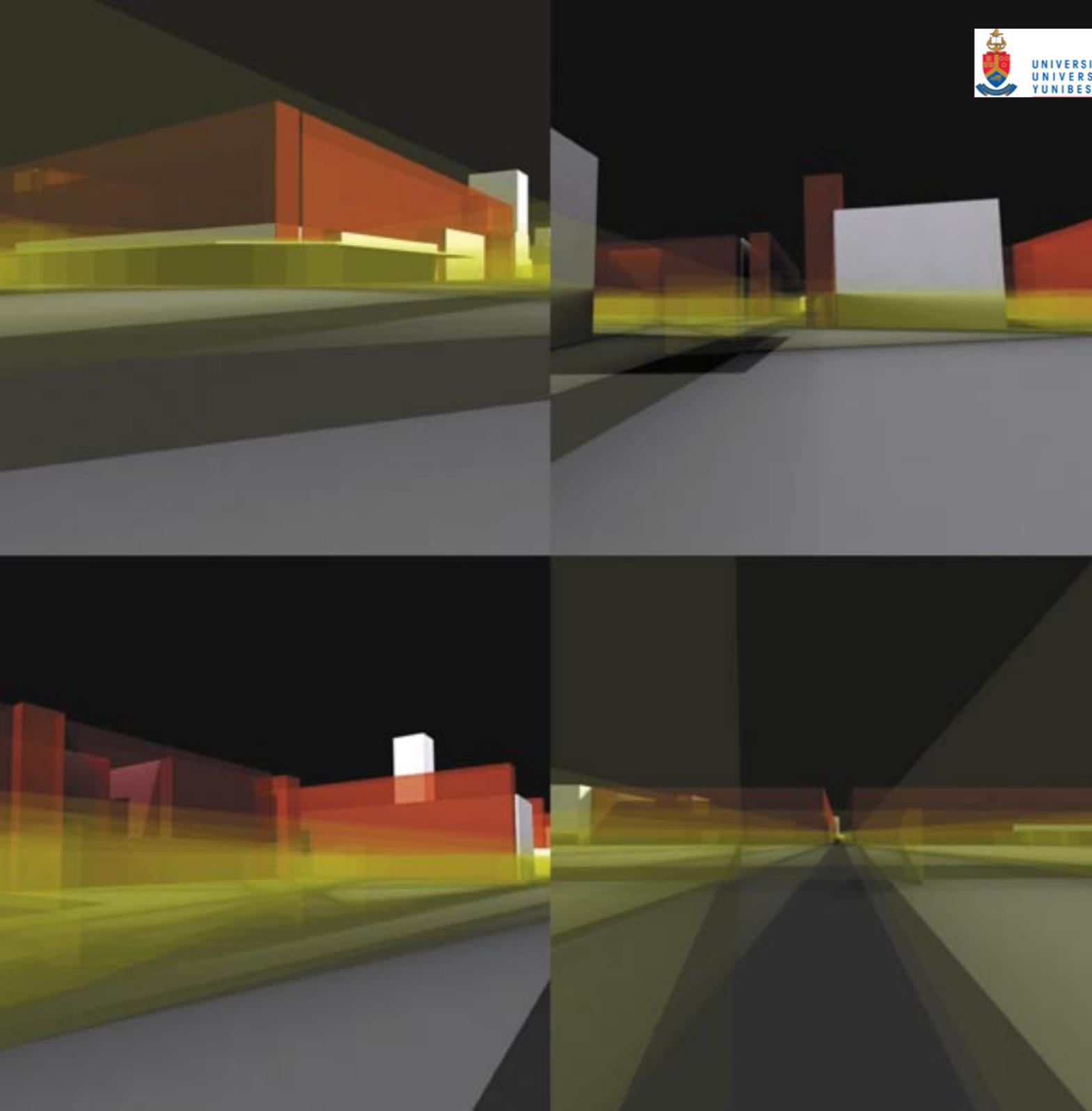
Figure 065: Model of pedestrian and vehicular movement translated into open space hierarchy

Figure 066: Model of vertical movement

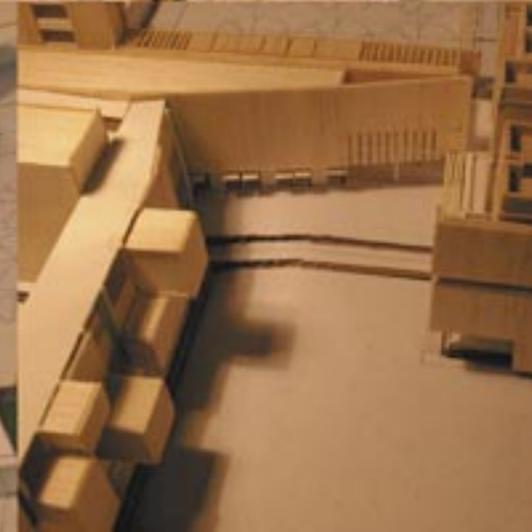
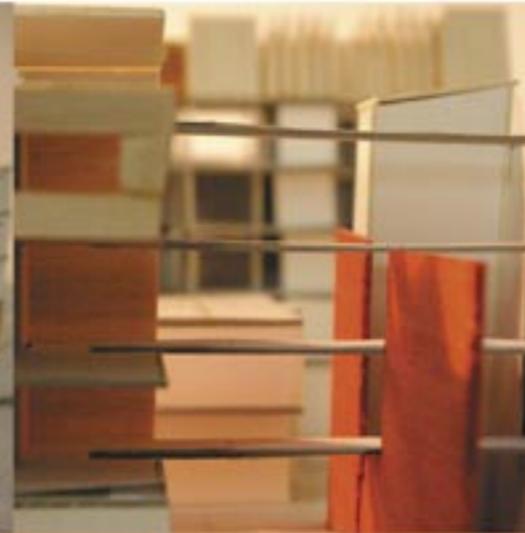
Figure 067: Public skin vs. Private skin

Figure 068: Volume model derived from previous diagrams

Figure 69 (above): Initial movement diagram



078	079				
080	081		082	083	084
085		086	087	088	089



Open space

Grading the open space as either public, semi-public, semi-private and private (figure 091 page 72) directly influenced the bulk of the development. A distinction was made between public and private building skin. This informed not only the design for the open space, but also directed the design as to the placement of public and private functions.

Public building skin must relate to the public movement outside while fully accommodating adaptation of use on the inside. The public building façade will be treaded by a skin of screens. These screens will be context specific and material and flexibility will be related to both the public and private activities around them.

The screen on the eastern façade will form an integral part of the developments identity, as it will be fully visible when entering the city from the North-east along Dr. Savage road. It will guide the vehicular movement into the city and frame the view of the University of South Africa (UNISA) to the south. The façade across the road consists of studio boxes, establishing a rhythm into the city.

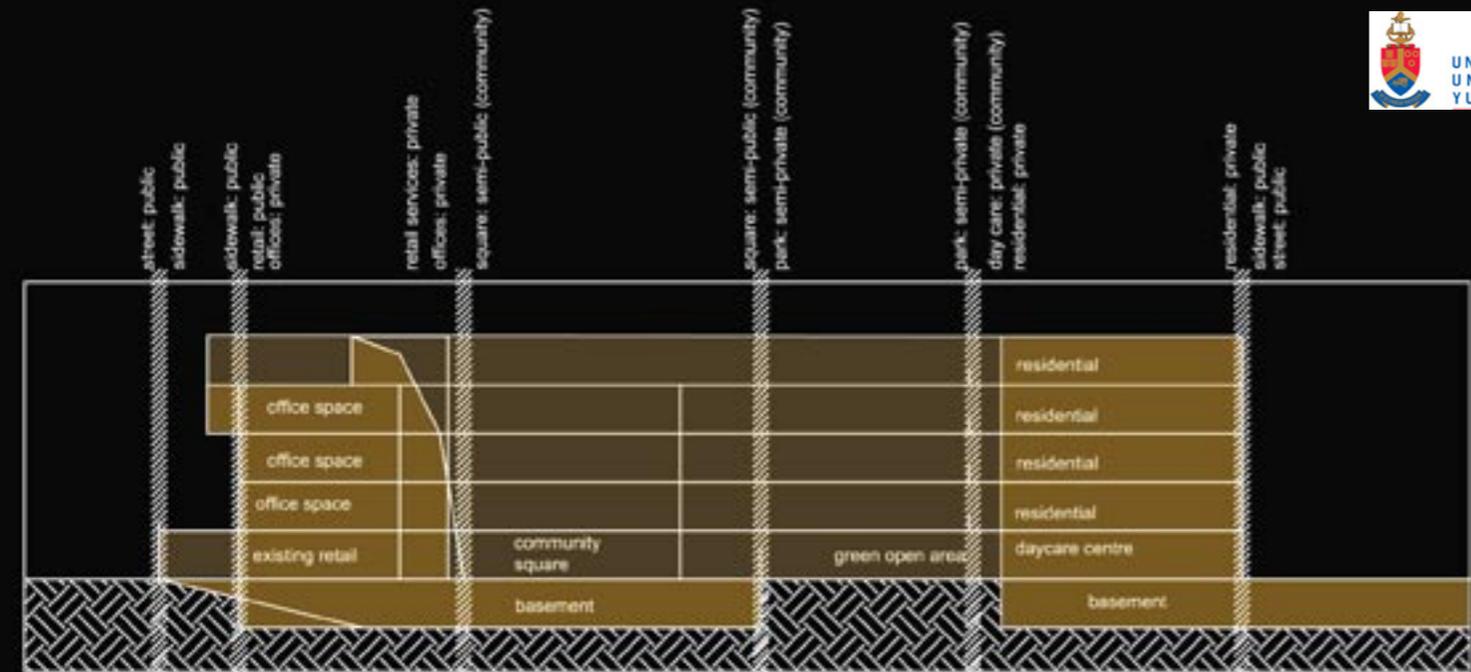
The Eastern façade screen's structure will vary according to it's location on the building: separated from the existing corner building and handled as a floating object above it while manifesting as the ramp which connects the elevated sidewalk with the street floor towards the south. (Figure 090 page 70)

Scale proportions between physical structure and open space is determined by orientation and sun angles (Figure 091 page 72)



Page 70: Figure 90: Concept sketch of Prinsloo Street façade

Page 72: Figure 91: Line diagrams showing boundary identification and open space size determination through the use of sun angles



barrier defined by overhang canopy and columns - existing to remain and intervention based on existing

barrier defined by building skin - ground floor to communicate with sidewalk

barrier defined by sloping screen - solid at ground floor to hide retail service area - fence or wall - visual connection through barrier important

barrier defined by change in fabric (bavement to grass) - physical barrier needed for security - fence or wall - visual connection through barrier important

barrier defined by building skin - ground floor to be an extension of the park into the daycare centre

barrier defined by building skin - this barrier is a potential problem as it forms the rear of the residential units - parking on ground floor perhaps be replaced with retail to create a more vibrant sidewalk

25m height limit

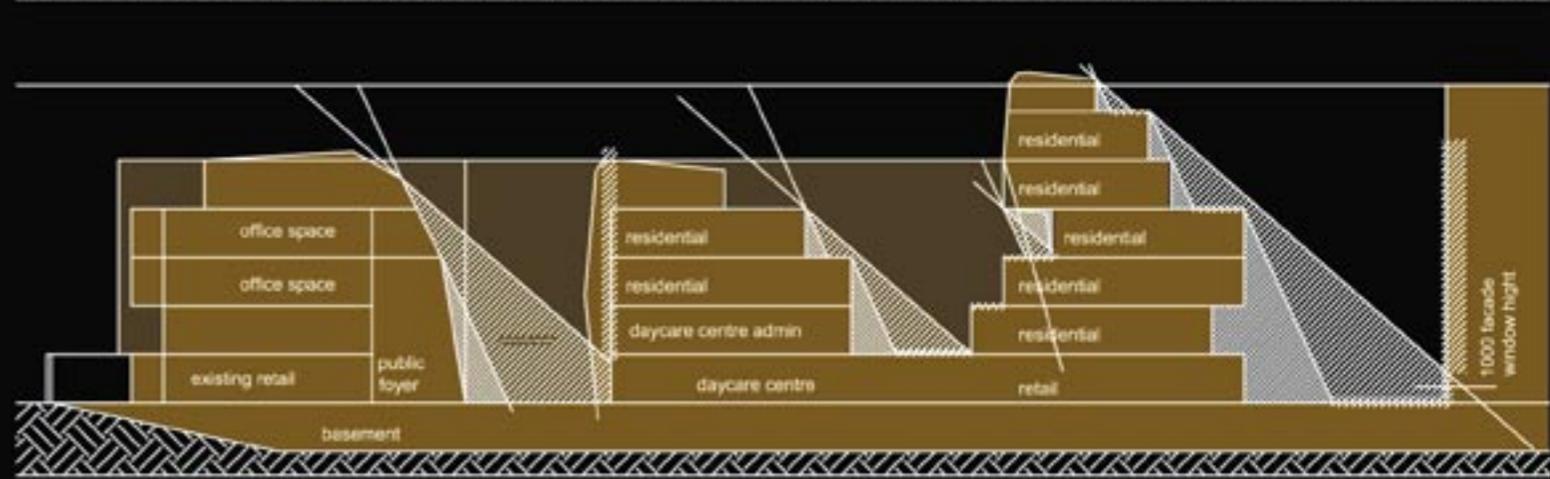
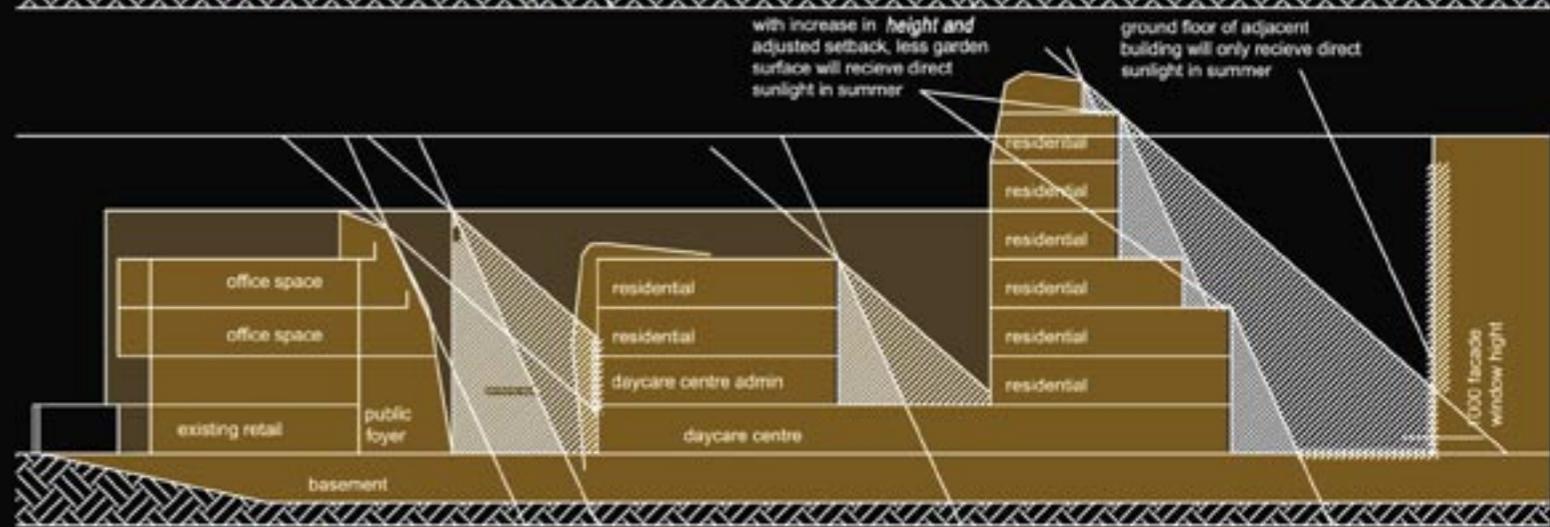
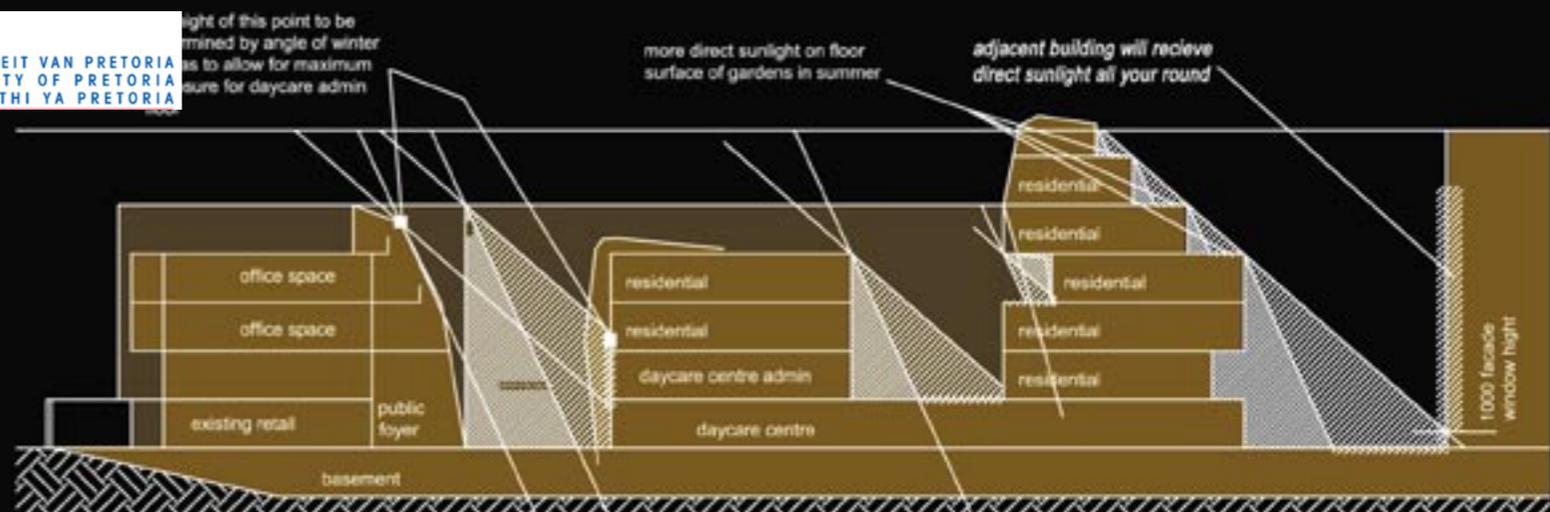
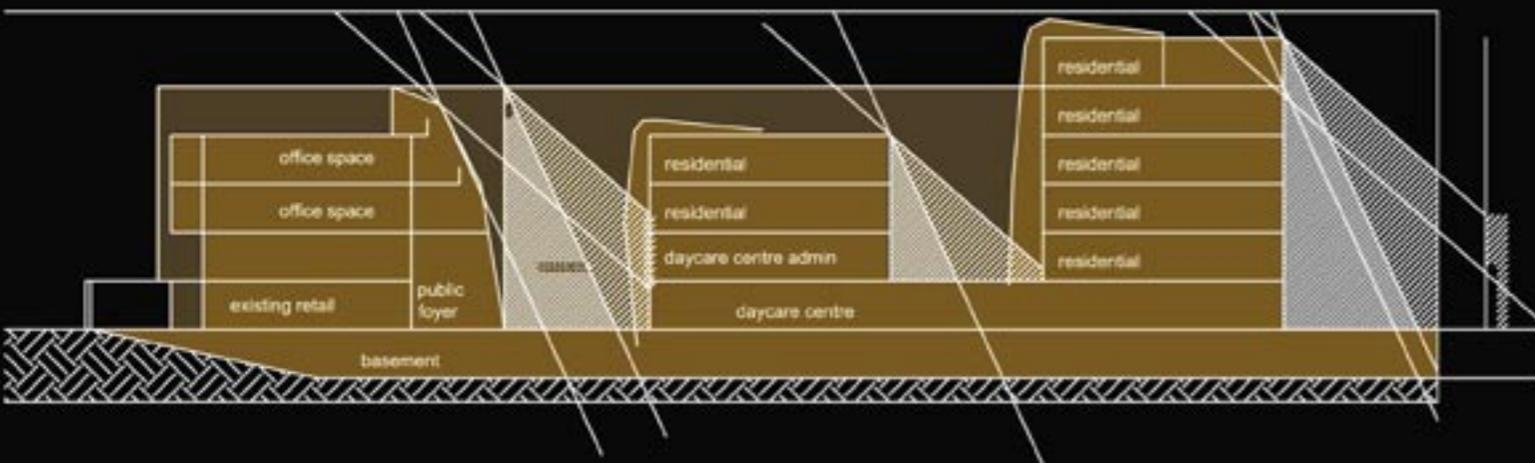




Figure 92

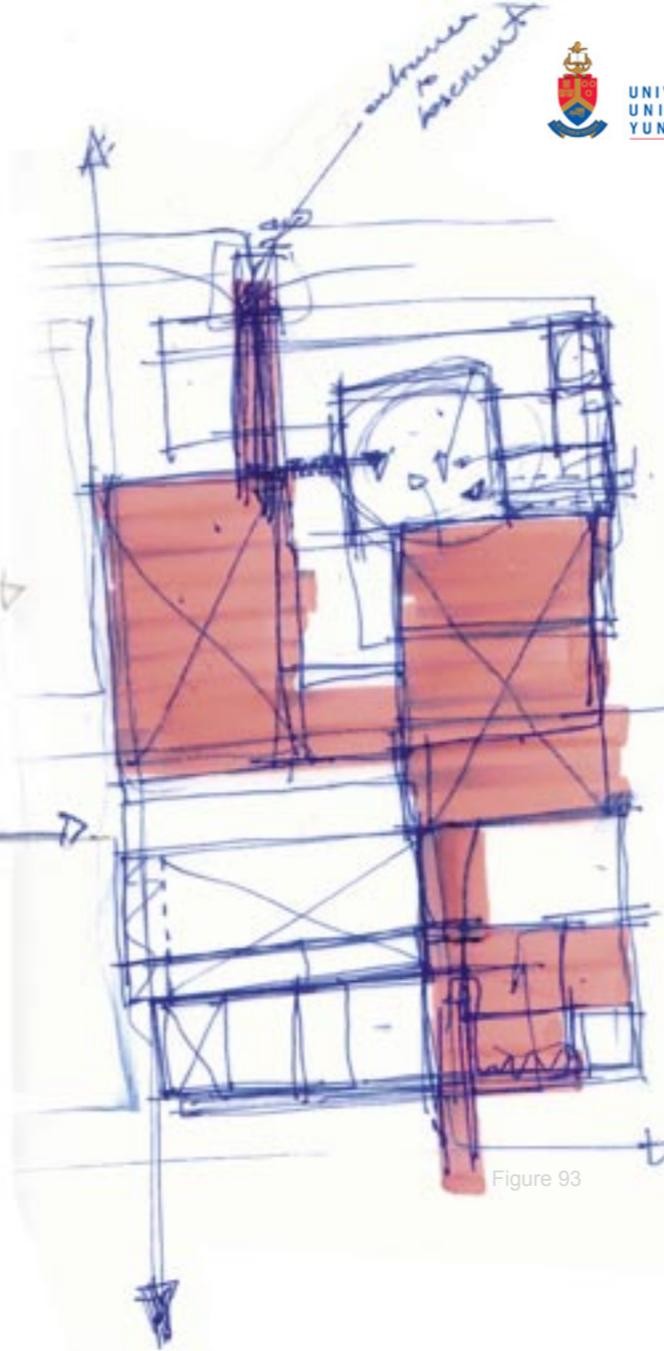


Figure 93

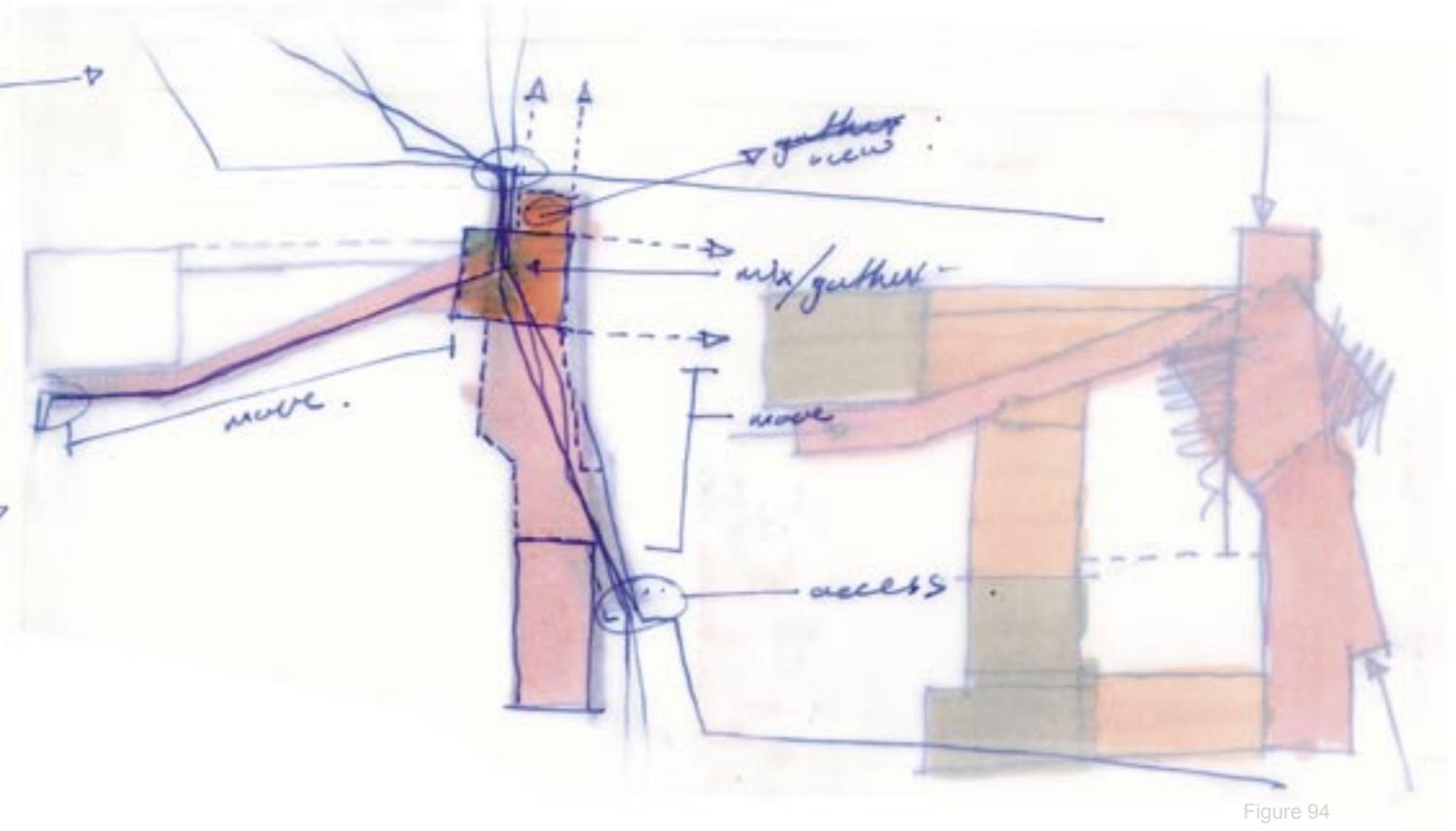


Figure 94

Using public space must allow movement through the boundaries which define the hierarchical quality of the space while maintaining continuity of experience. Thus the user must at all times know where he/she is within the public space system. The process of movement/activity mapping informs the main design decisions for the public space on and around the site.



Figure 96

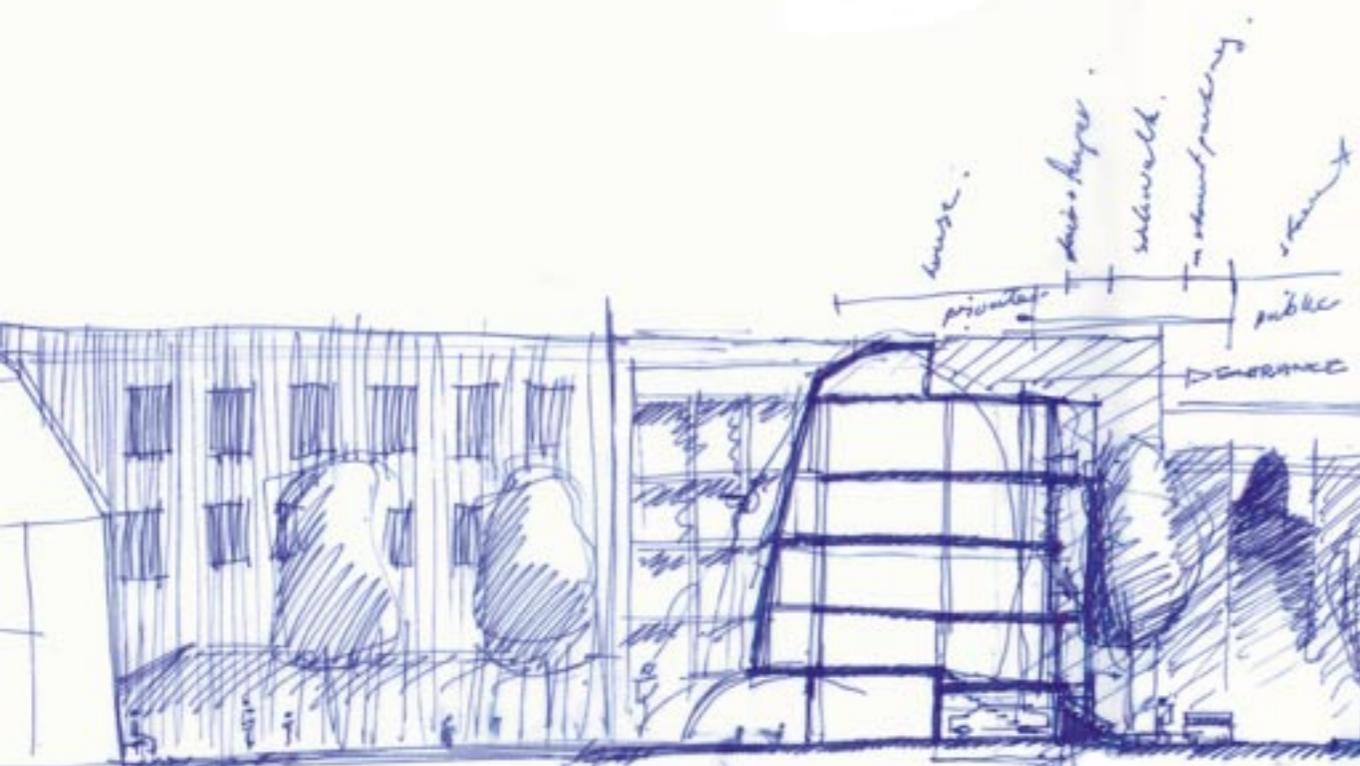


Figure 95

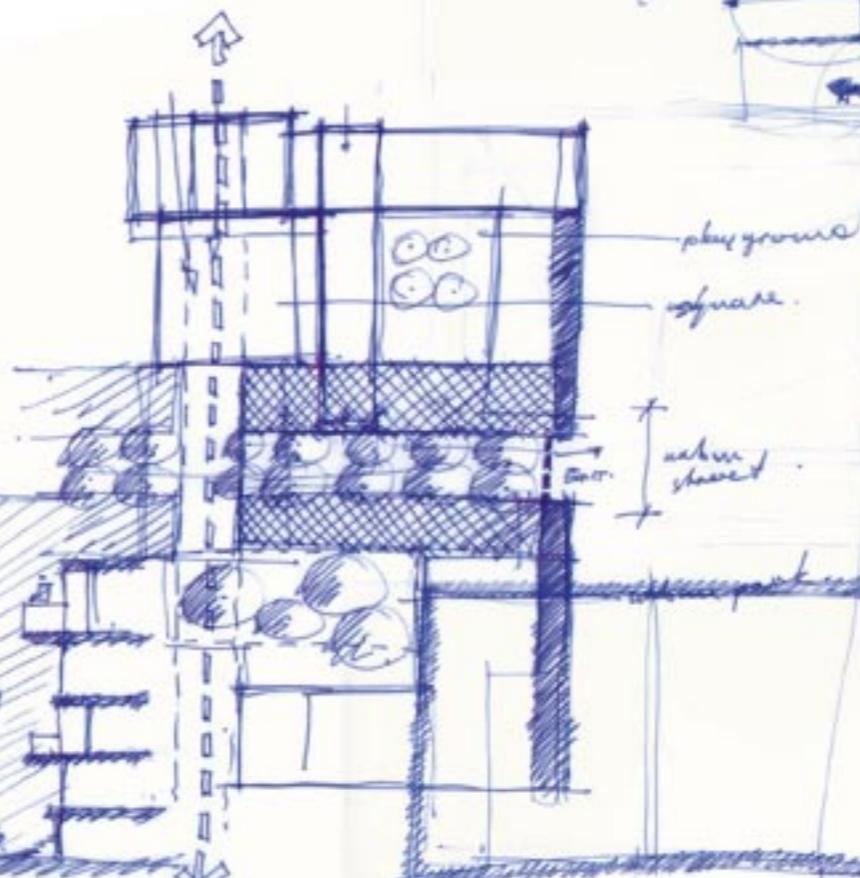


Figure 97

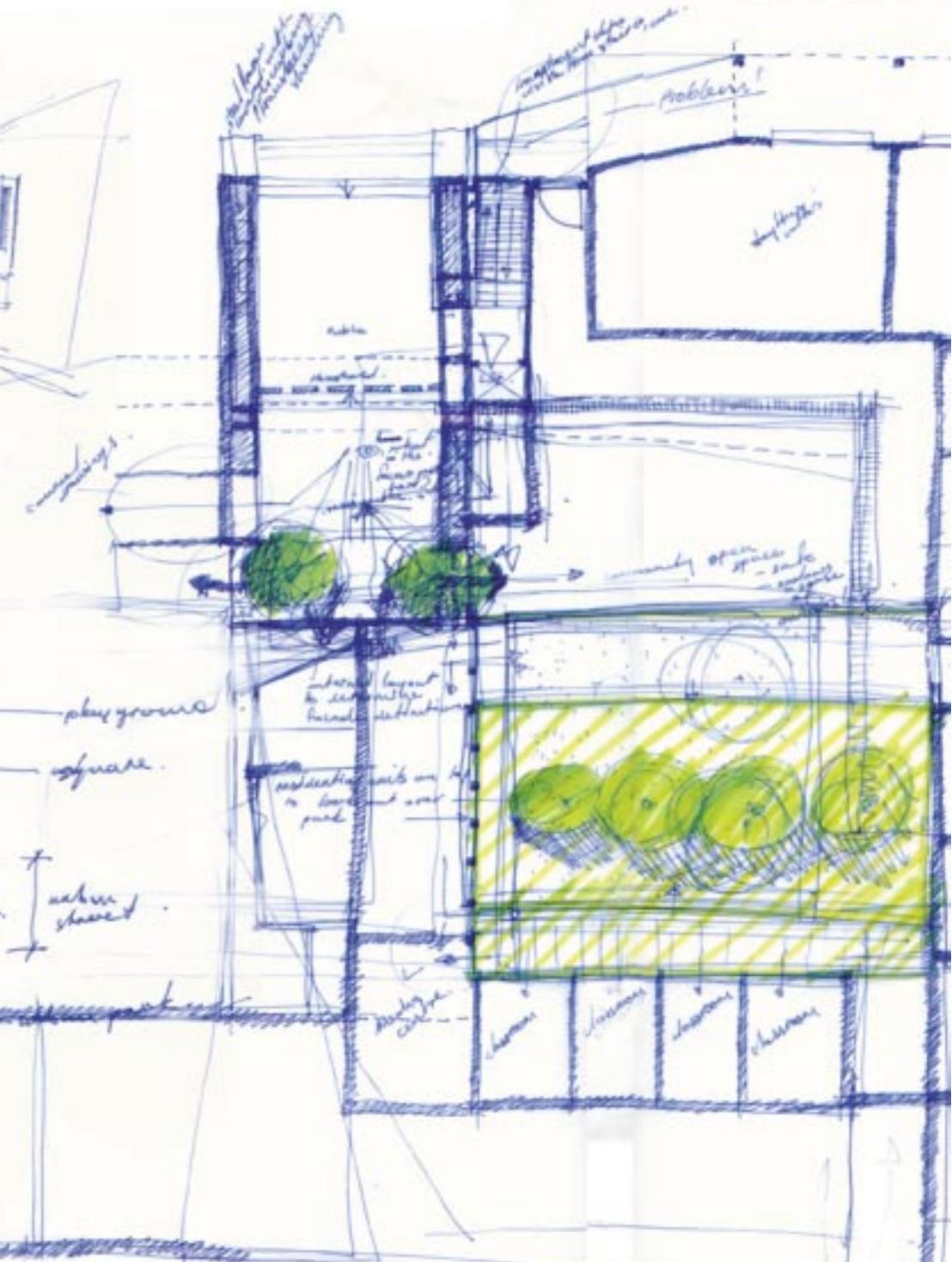


Figure 98



main entrance
- offices
- community hall
- daycare.

sculptural
monument
building.

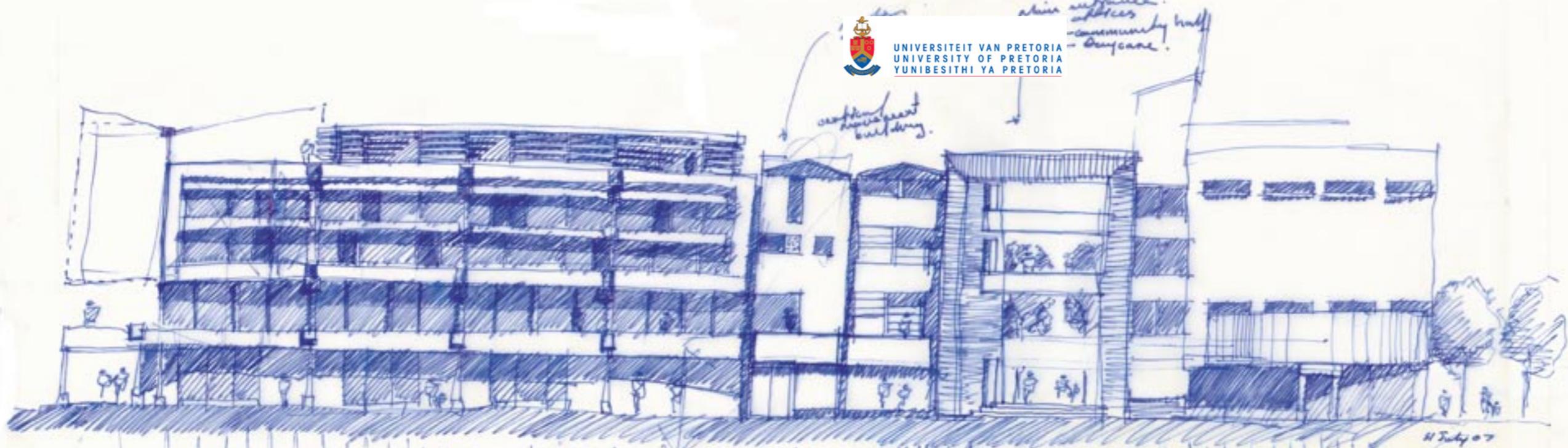


Figure 99

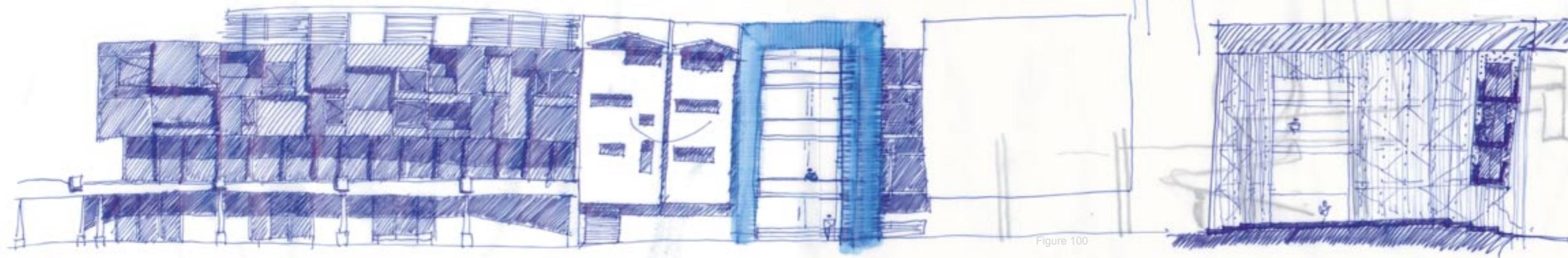


Figure 100

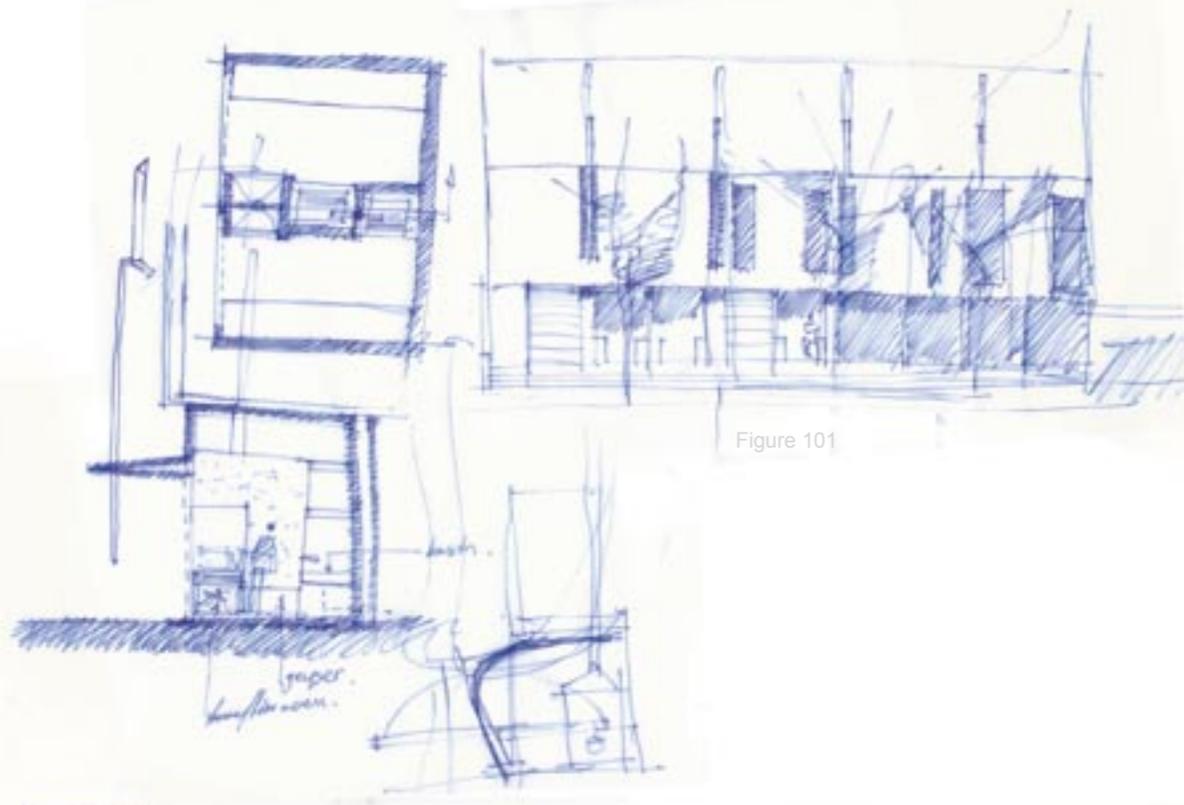


Figure 101

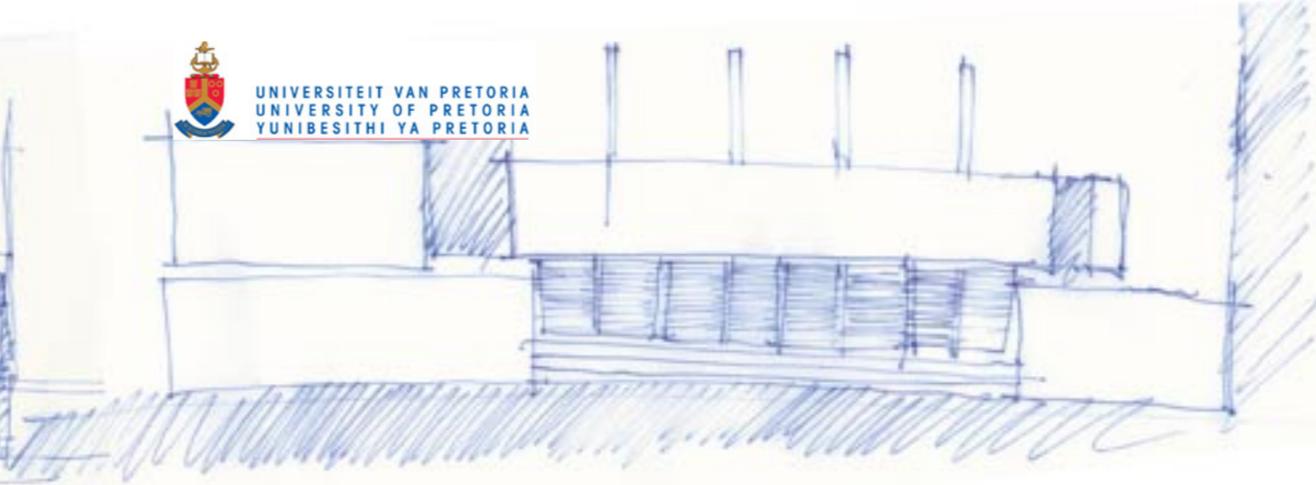


Figure 102

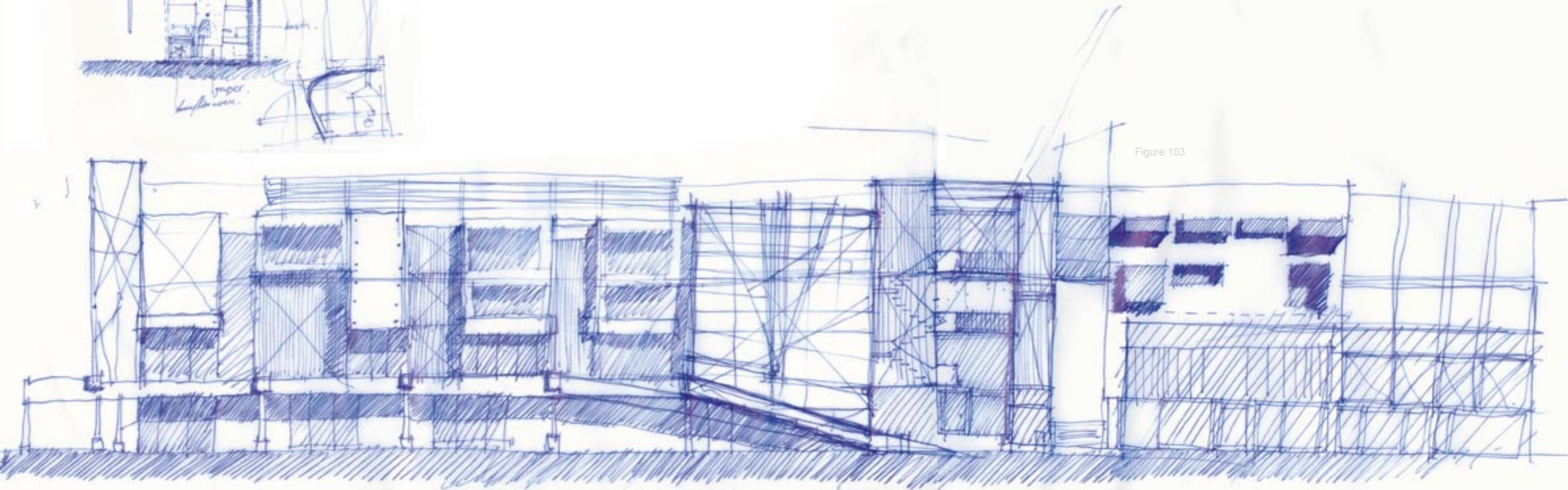
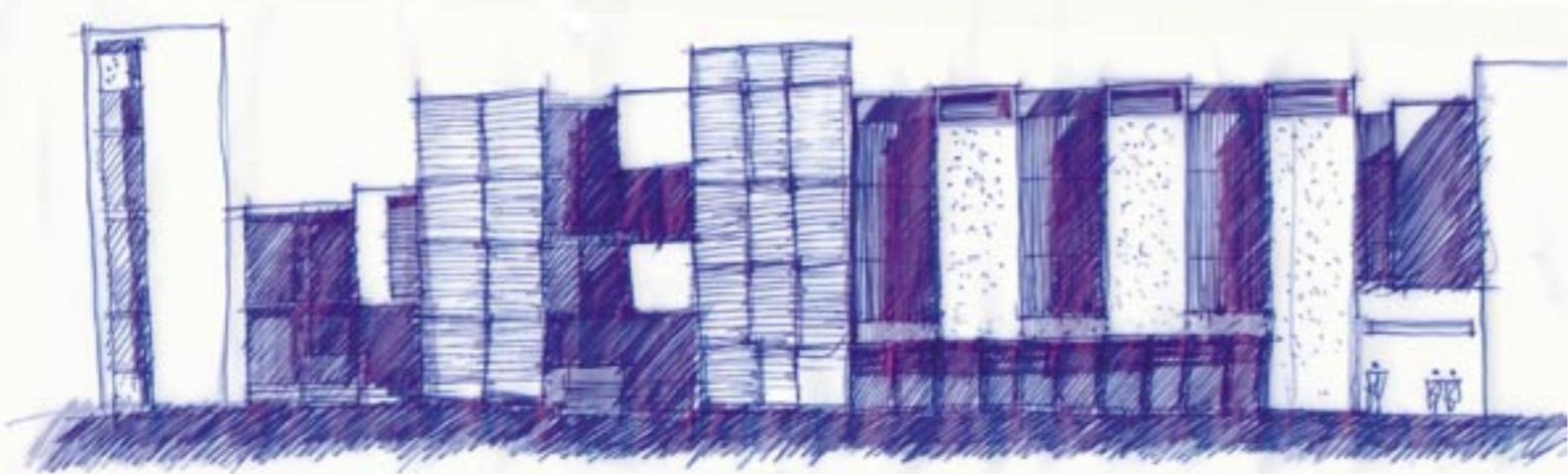
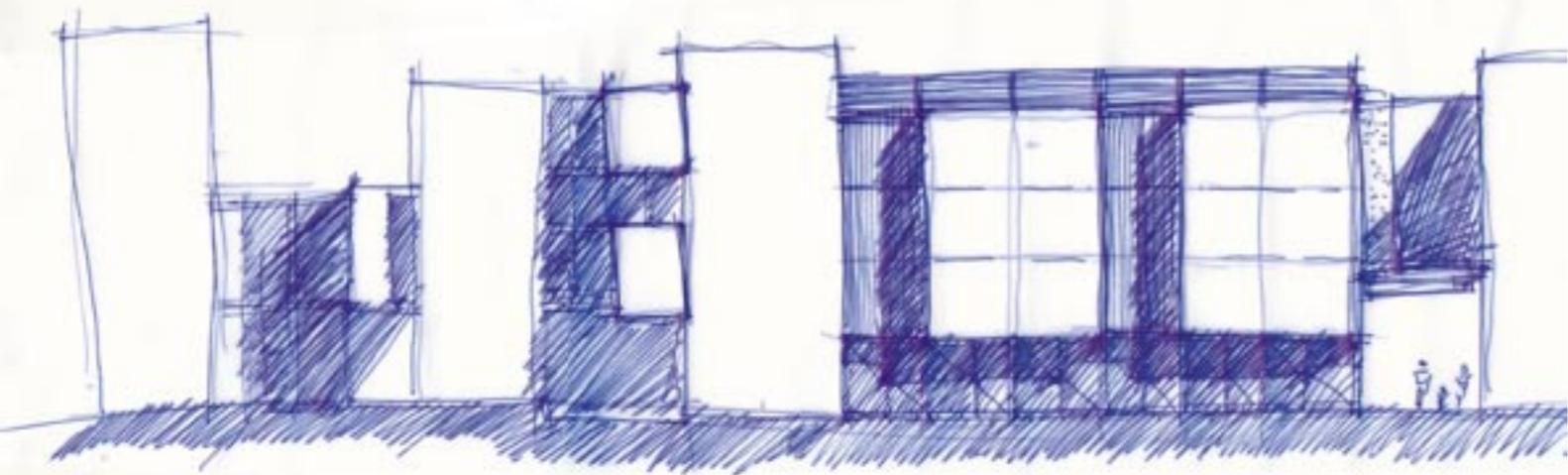
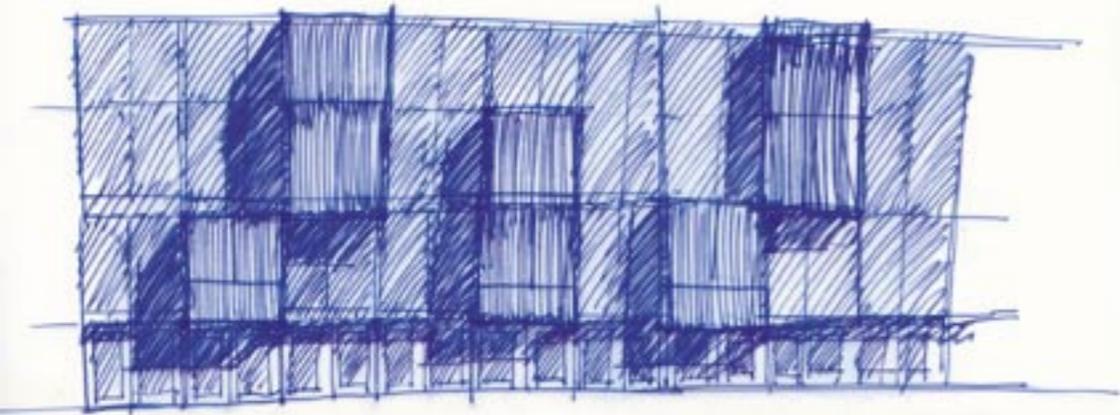


Figure 103

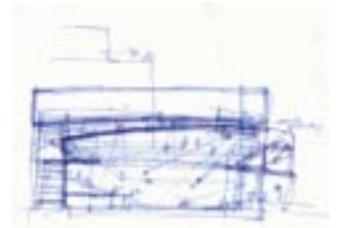


Multi-purpose Community Hall

The primary public space consists of a multi-purpose community hall (indoor sports hall and auditorium) which connects Bloed street with a public square. The placement of the square was derived from the district development proposal and the activity/movement mapping of pedestrians over the site. Variable permeability through the hall onto the square allows for adjustable privacy in the hall and on the square, creating the opportunity for various uses and adaptation.

The community hall acts as a civic building and should project an initial identity for the North-eastern district community: it is a hub of activity during the day and night. The public square south of the hall allows for the building to become an icon within the community while the northern façade identifies it as a city wide icon for the North-eastern district.

Offices for a local newspaper are located within the community hall. Printed media will contribute greatly to the community's identity and ensure daily activity in the complex even when performances and sport events are limited.

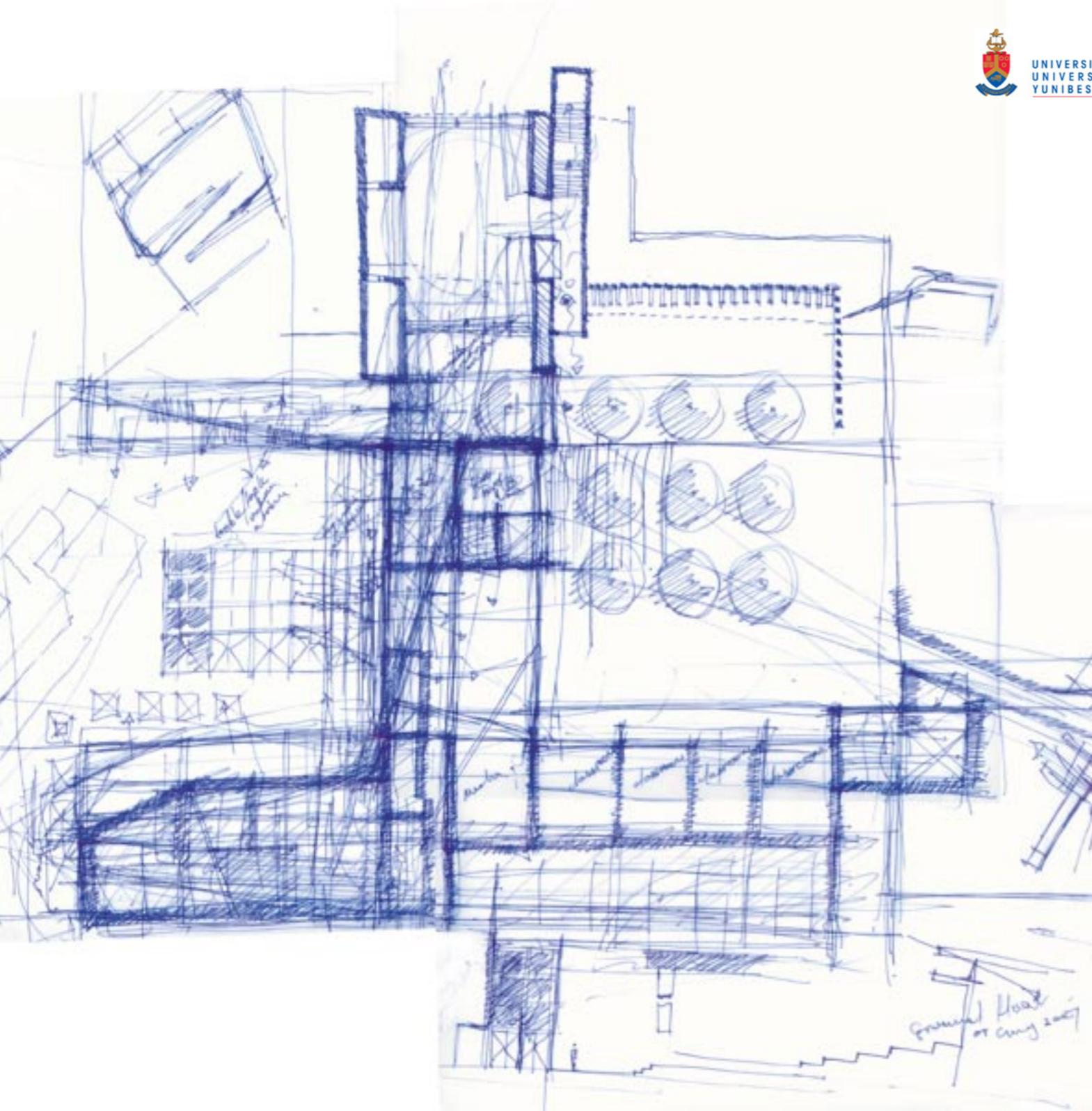


Page 82: Figure 104 (top):
Community hall
southern façade
concept sketch

Figure 105 (middle):
Community hall
northern façade
concept sketch

Figure 106: (bottom):
Community hall
northern façade
concept sketch

Figure 107 (this page): Initial
section through community hall



Day care Centre

The day care centre is situated within the middle of the block, allowing for enhanced security and limiting access. The playground forms the major planted area on the site, although a magnitude of surfaces will be used to create a fun and educational private open space.

Access to the day care centre is from the public foyer in Bloed Street. This foyer also houses the lobby for the offices and a security desk. The main entrance for the day care centre is visually connected to Bloed Street, allowing for a safe drop of zone: parents can stay in their vehicles and watch their children walk through the foyer directly into the day care centre.

The classrooms are situated on the southern side of the playground allowing for maximum natural light to enter. Natural light in the classrooms is also enhanced by the use of skylights.

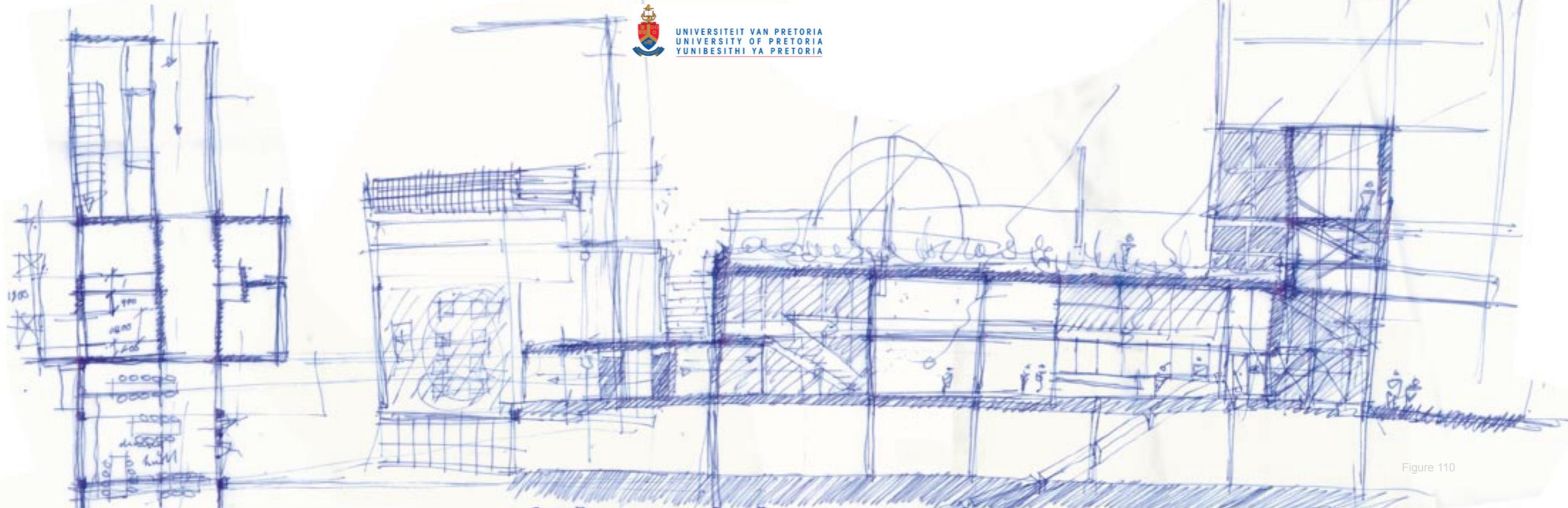


Figure 110

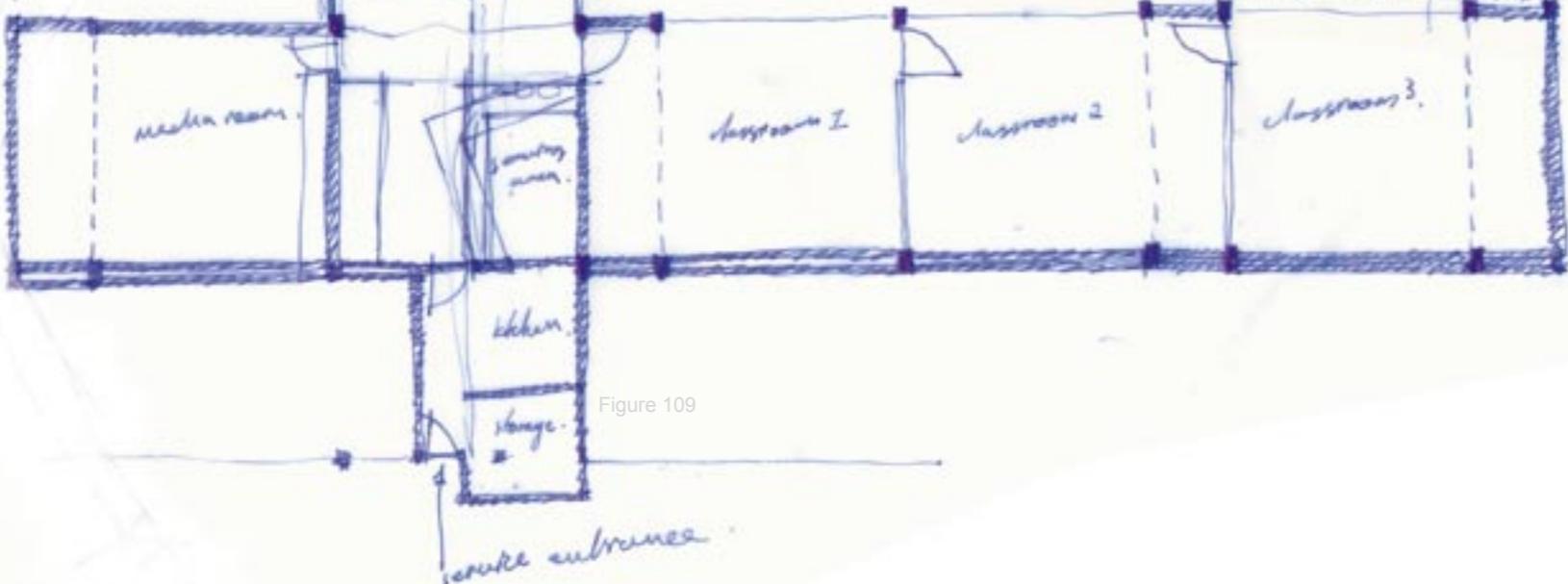


Figure 109

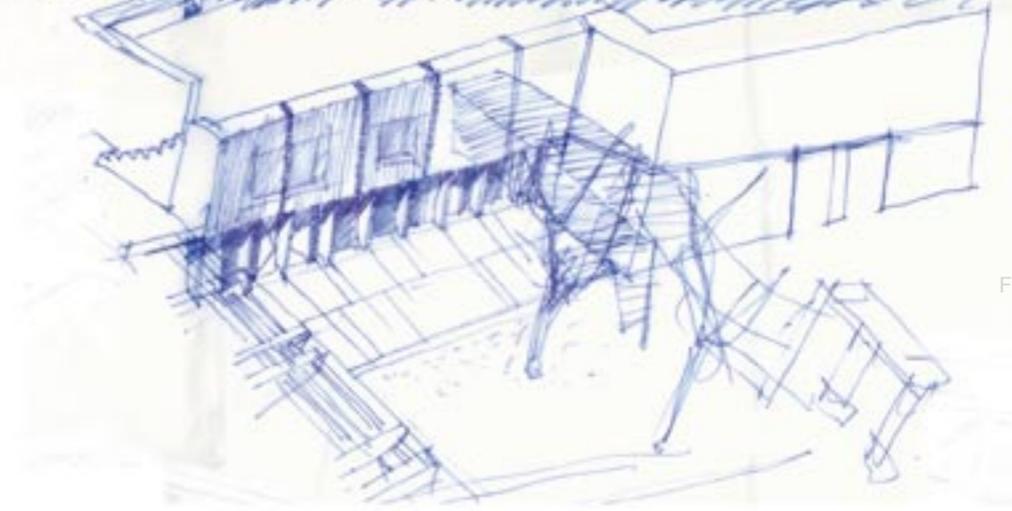


Figure 111



Residential development

Primarily informed by the theoretical context, the concept for each living unity is based on the movement through boundaries (Figure 116 and 117 page 89). After deriving an initial layout from these movement diagrams, the exploration of light penetration into the units became important. Thus, quality of light is the main informant of the spacial quality within each unit.

The residential block's form is derived from the sun angle diagrams (Figure 91 page 72), and the placement of individual units to allow maximum sun penetration. The block is placed on top of the day care centre classrooms and lock up garages, accessing from Brown Street. This allows for more privacy, as none of the units open directly onto the street, yet overlooks the green playground of the day care centre.

Considering the District Development Proposal of a city block as neighbourhood it is imperative that the residential units function more as houses than flats. Thus every four units have a separate entrance from street level, eliminating hallways at the back of the block. Furthermore, every unit has access to a private garden and a back door, creating a more livable environment.

Brown Street function as the backbone for this new neighbourhood (Figure 60 page 63) and has clear boundaries through which users enters and exits. This is to ensure a sense of ownership and enhance security. Figure 121 on page 90 explains the concept of the city street and the usage of open space around it. Also shown is a volume model for the housing block with garages and entry foyers accessing directly from Brown Street.



Figure 122 on page 92 indicates the main design program for each residential unit type. Separating services from the living and sleeping area allows for the creation of boxes as per the volume model (Figure 121 page 90). This also solves problems regarding sewage down pipes, storm water down pipes and fire escapes as these functions are all accommodated within open service courtyards.

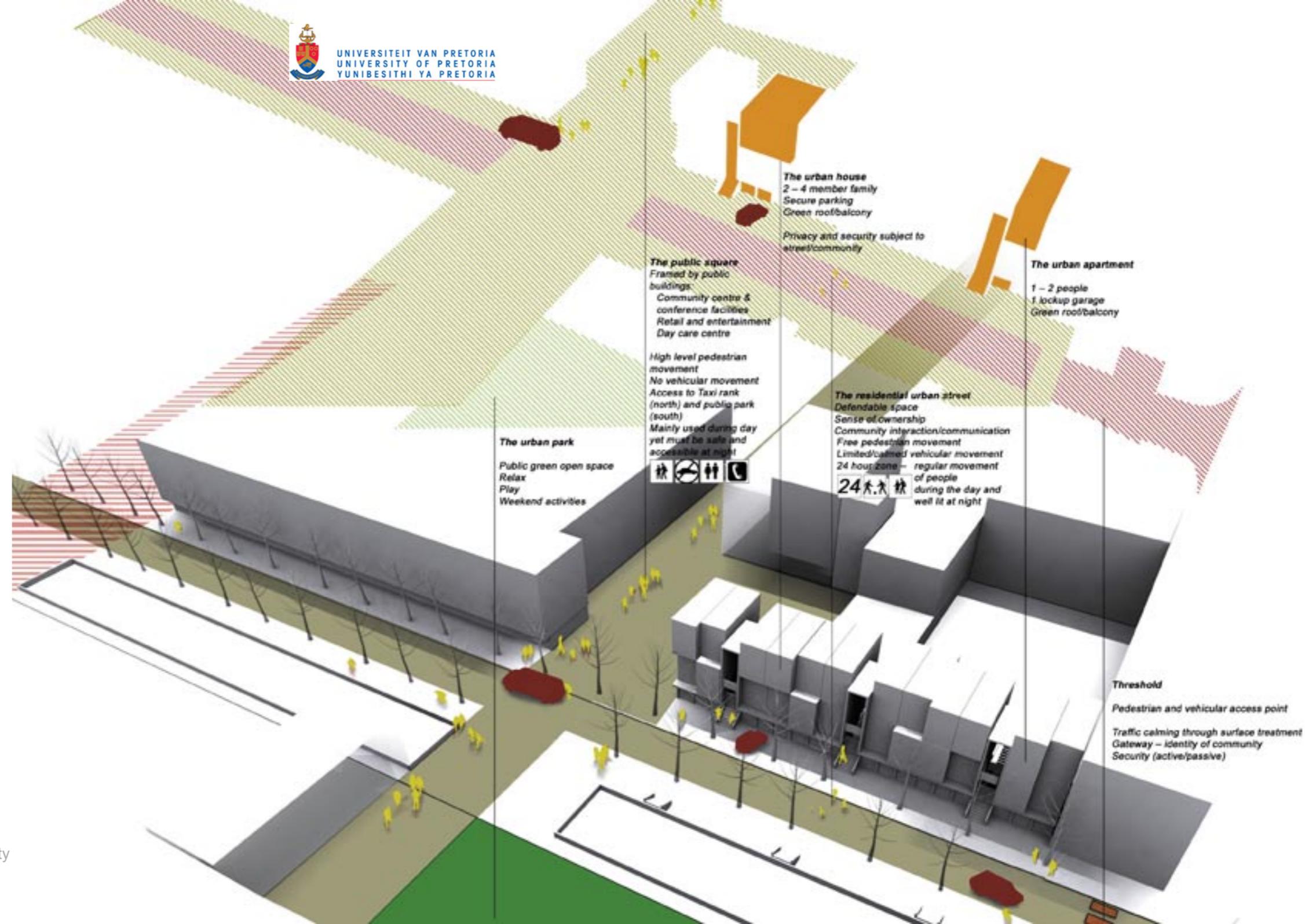
To ensure inclusiveness, the residential block consists of four different unit types: A two/three bedroom unit, a two bedroom unit, a one bedroom unit and units for disabled people or the elderly.

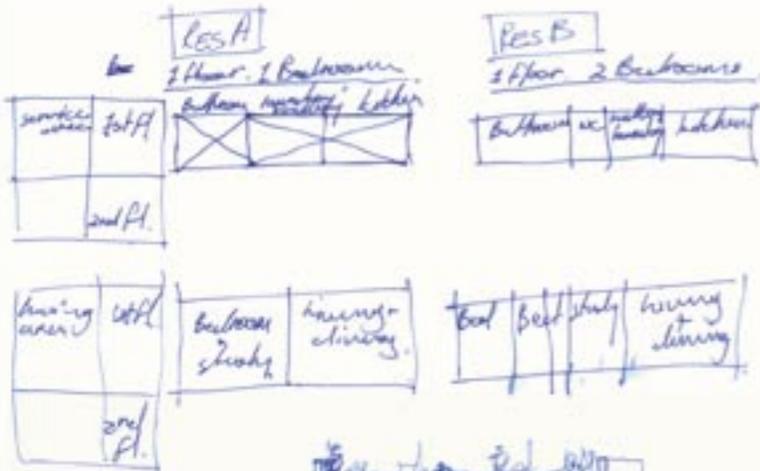
Page 88: Figure 112 to Figure 115: Initial models for housing development

Page 89: Figures 116 and 117: (top) Movement diagrams for housing development

Page 89: Figures 118 to 120: (bottom) Initial residential unit layouts derived from movement diagrams

Figure 121 (page 90): The city street as neighbourhood. Volume model of Brown Street with public and private open space identification (model by author)





study area on all three 1st/2nd floor.

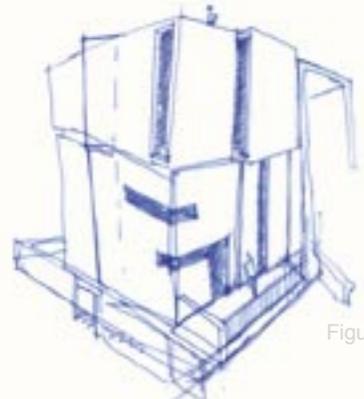


Figure 123

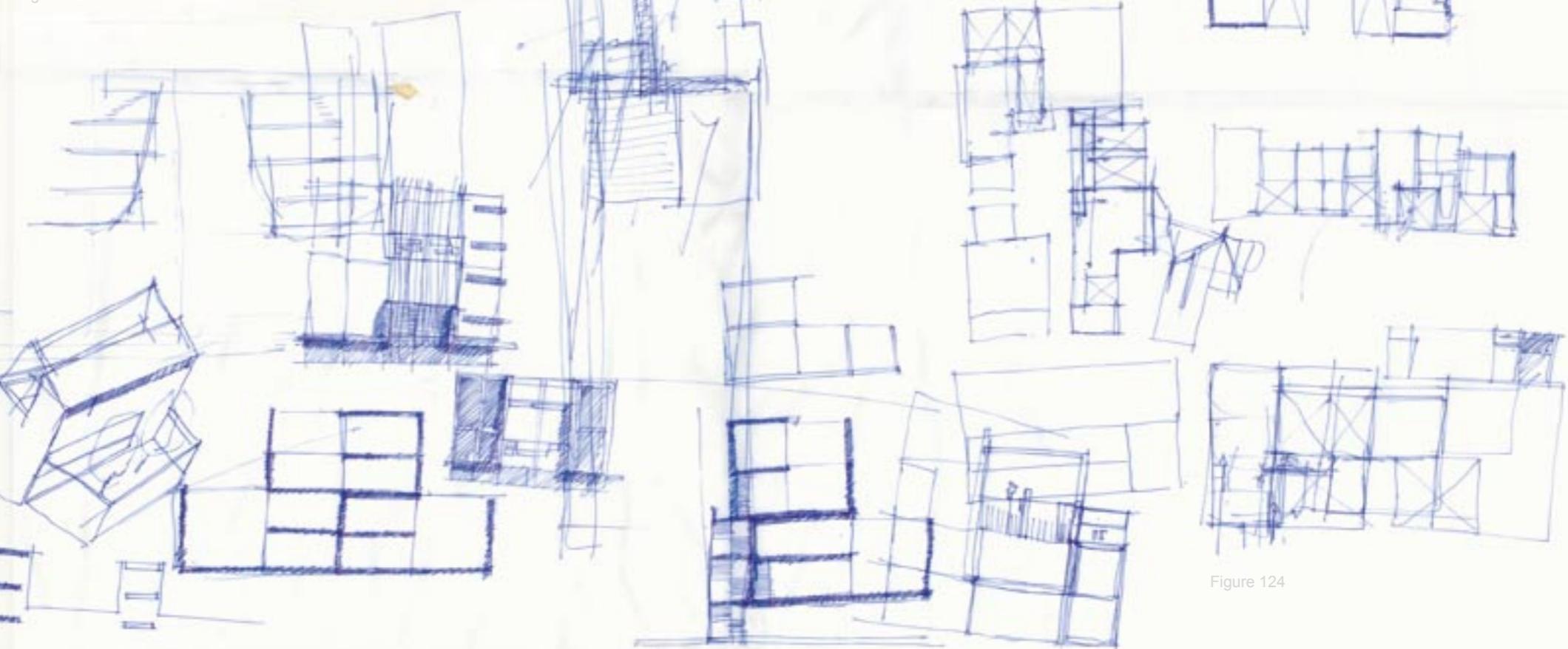
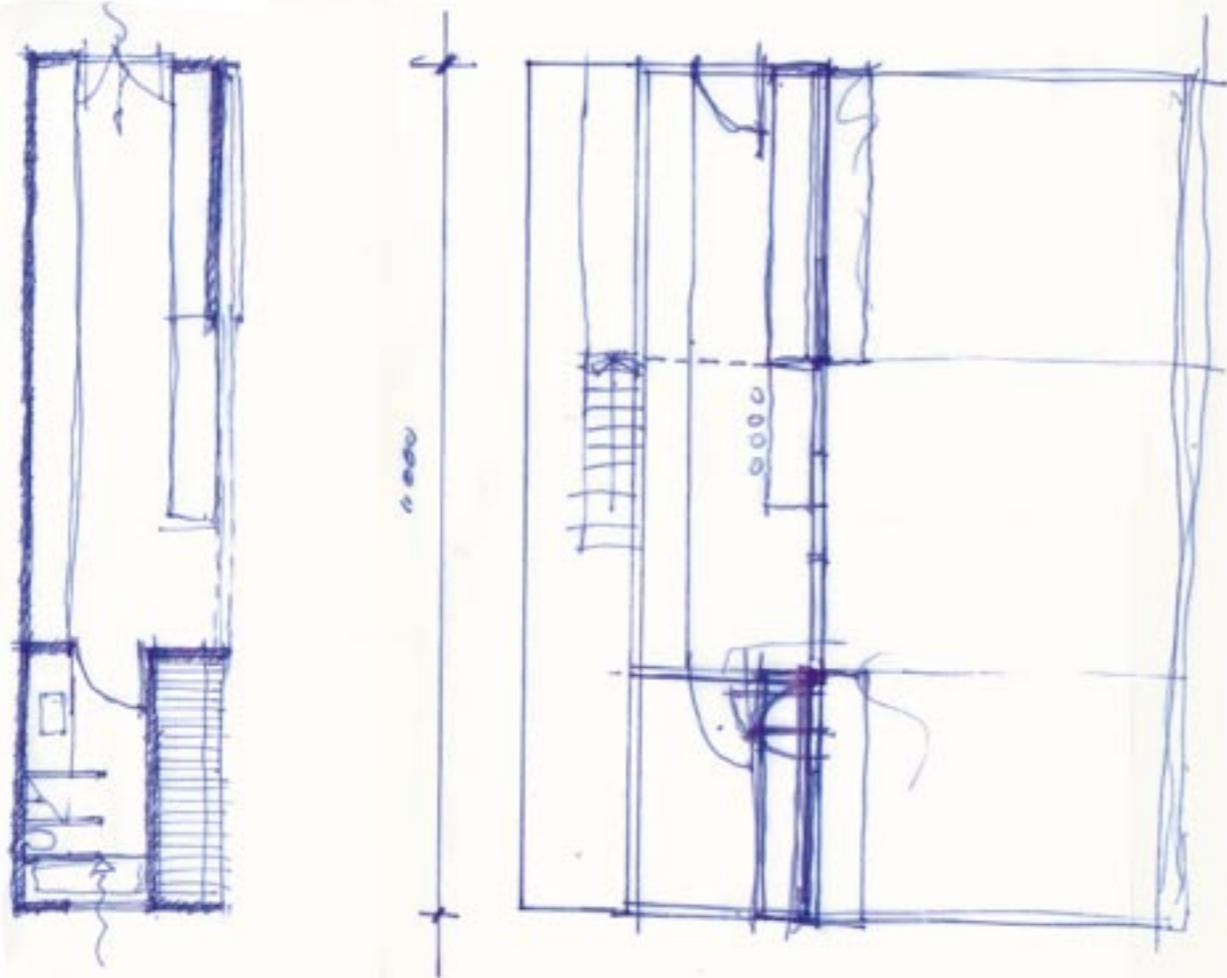


Figure 124



rest service
core base plan

Figure 125

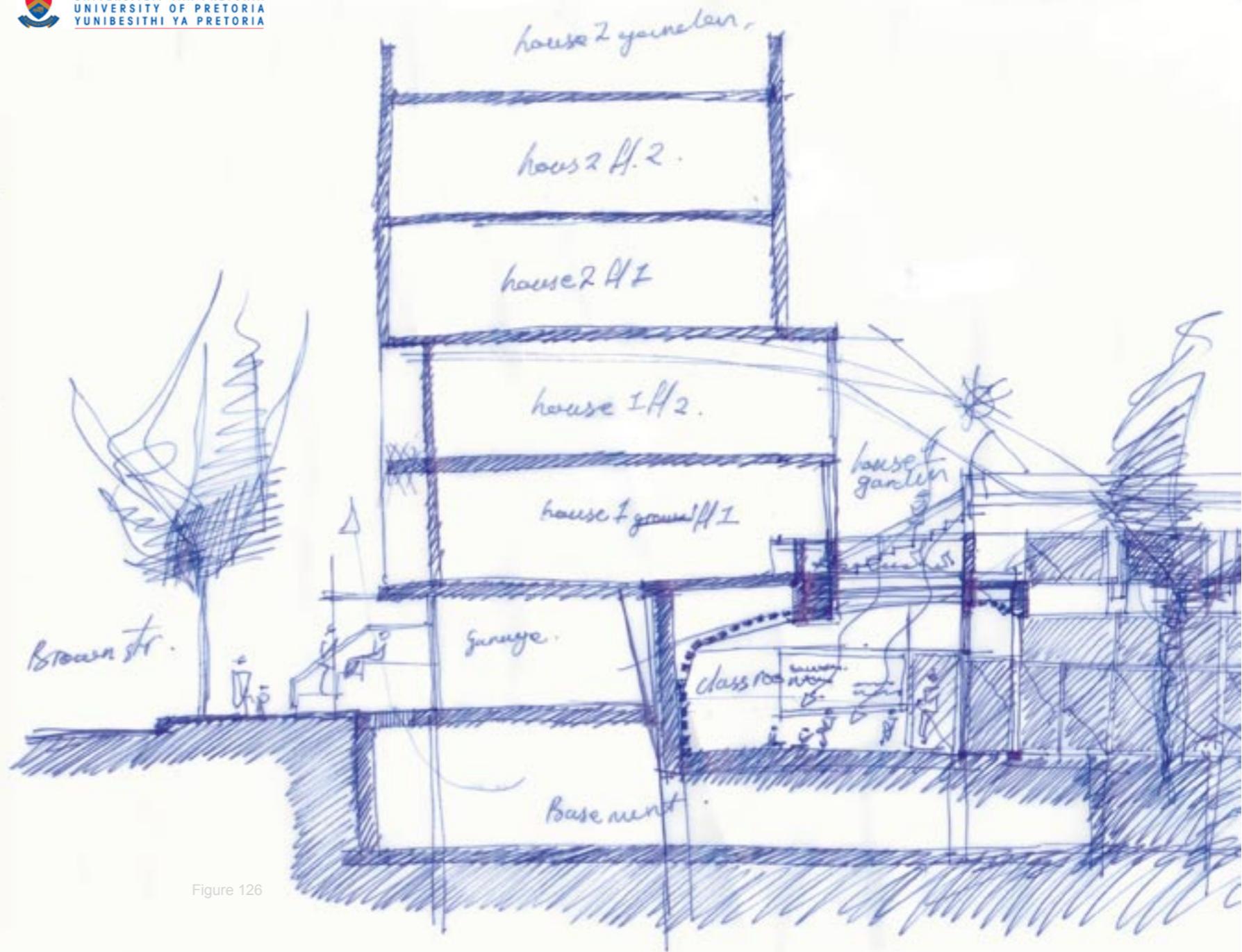
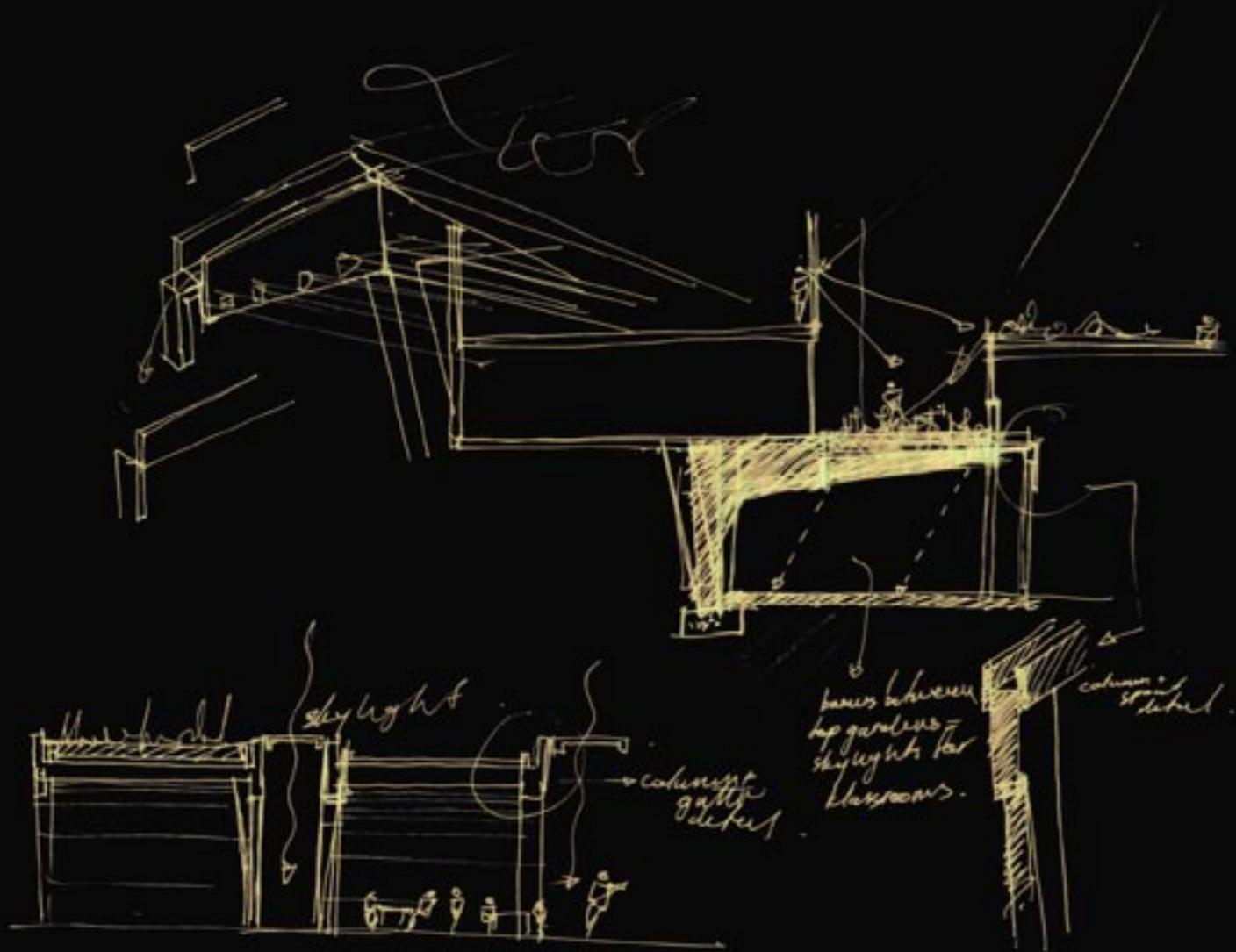
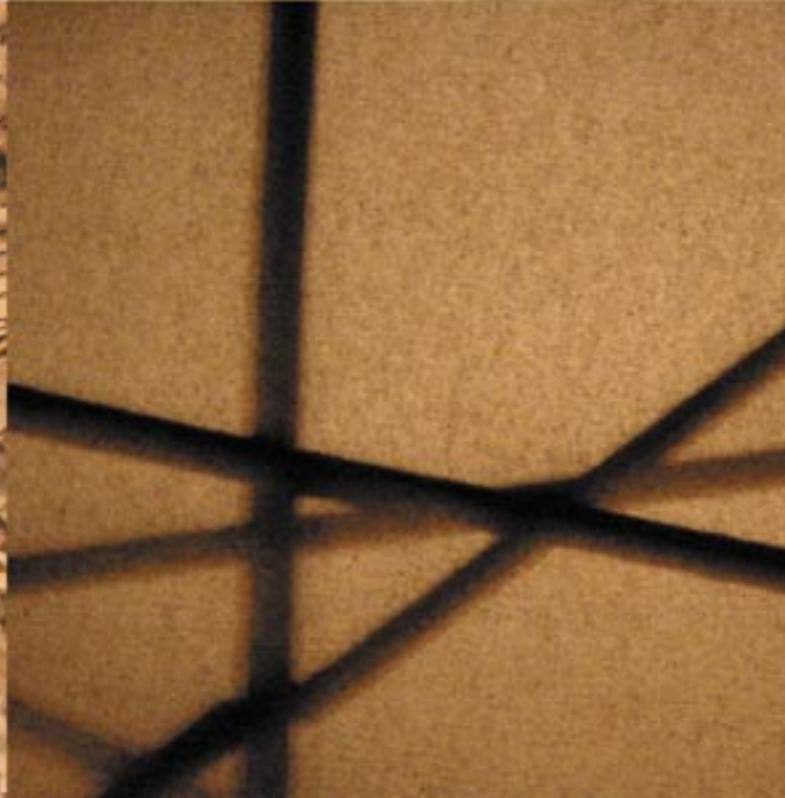
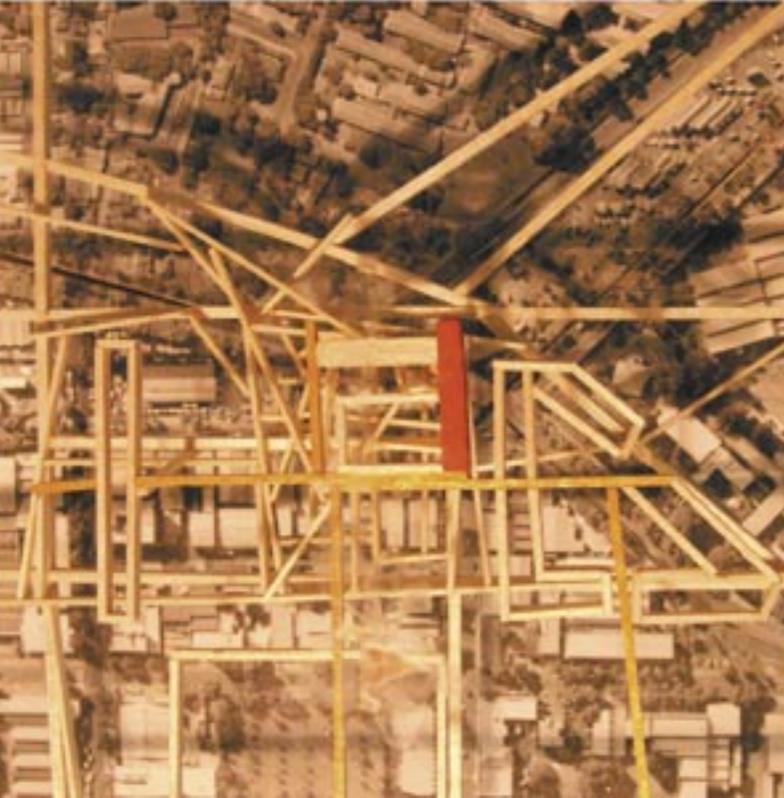
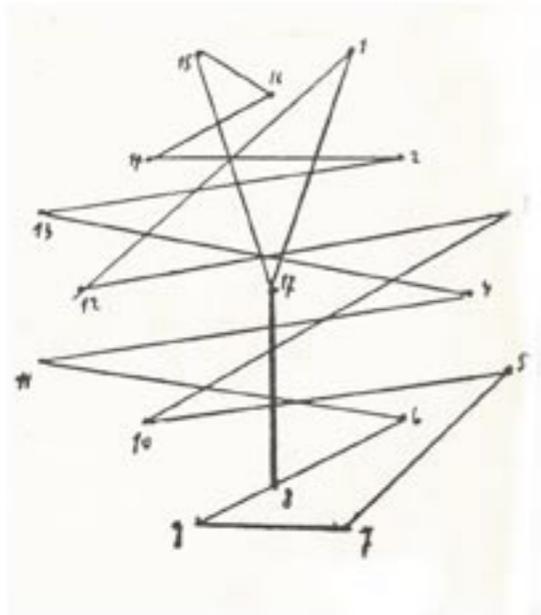


Figure 126



technical
analysis
investi
gation



Page 96: Figure 127: Design sketches (author)

Page 98: Figure 128 (top left): Diagram from *The Thinking Eye* by Paul Klee

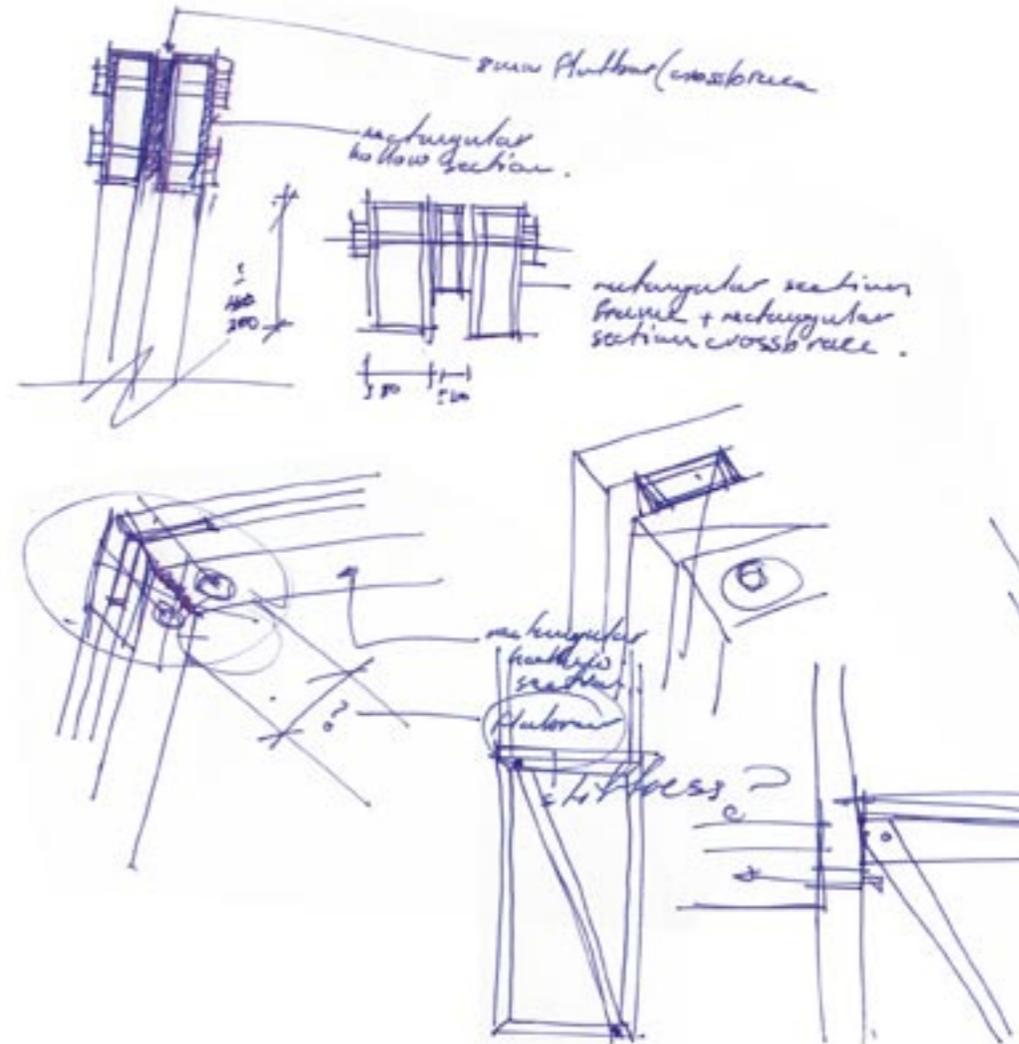
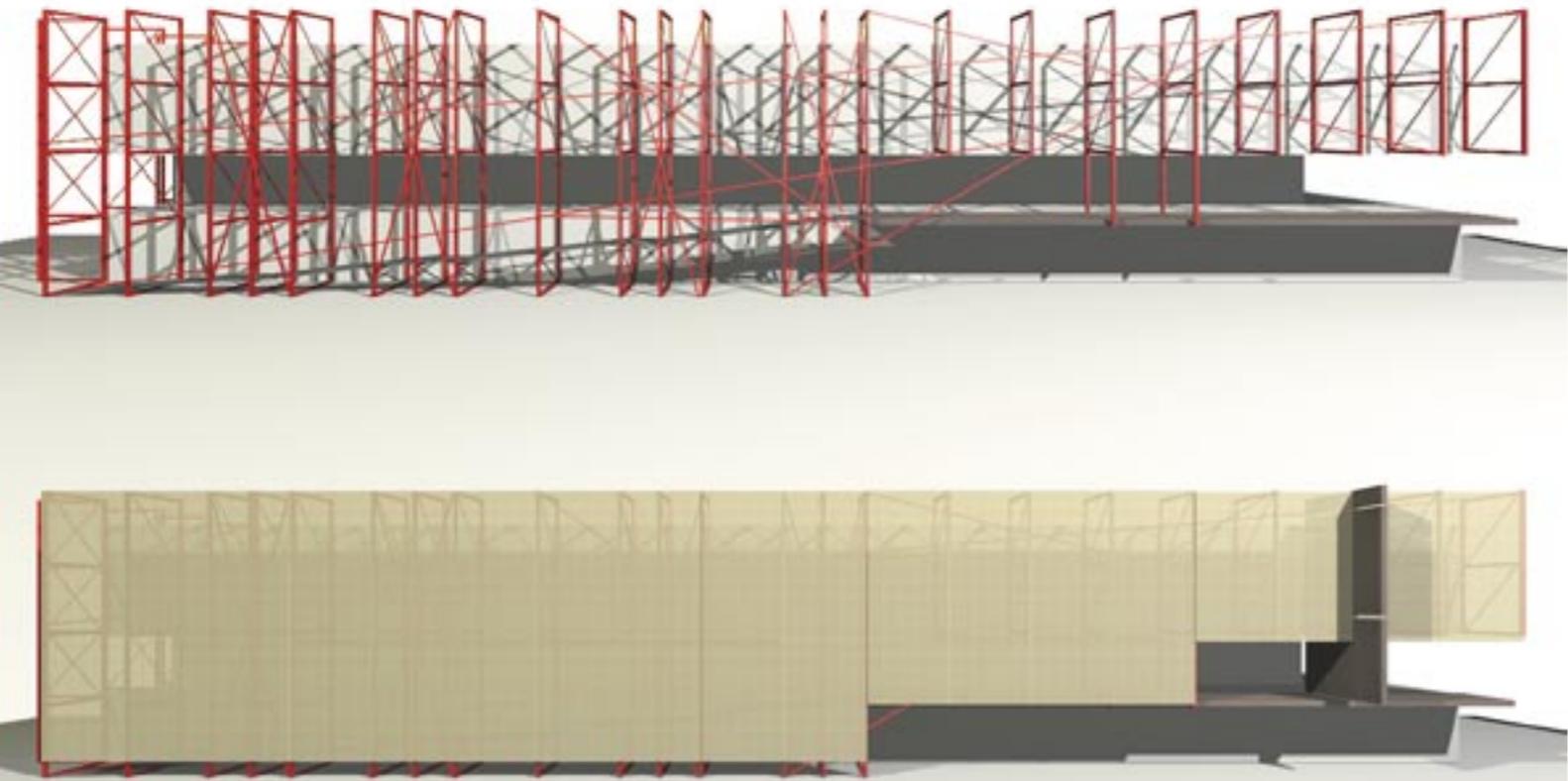
Figure 129 (top right): Concept study of screen surface no. 1

Figure 130 (bottom left): Movement model over site

Figure 131 (bottom right): Concept study of screen surface no. 2

Skin

Since the building consists of a basic concrete column and slab structure with brick and concrete infill, the technical investigation looks at the possibilities regarding the building skin. Large parts of the building is covered with screens which, as explained earlier, either forms part of the façade or is place in front of it. The nature of every screen is determined by the interior or exterior space it defines. This investigation explores possible materials and relating connection details.



Page 102: Figure 135 (top):
concept model of
Eastern façade screen
structure

Figure 136 (bottom):
Skin investigation no.1

Page 103: Figure 137: Detail
design sketches of
building skin

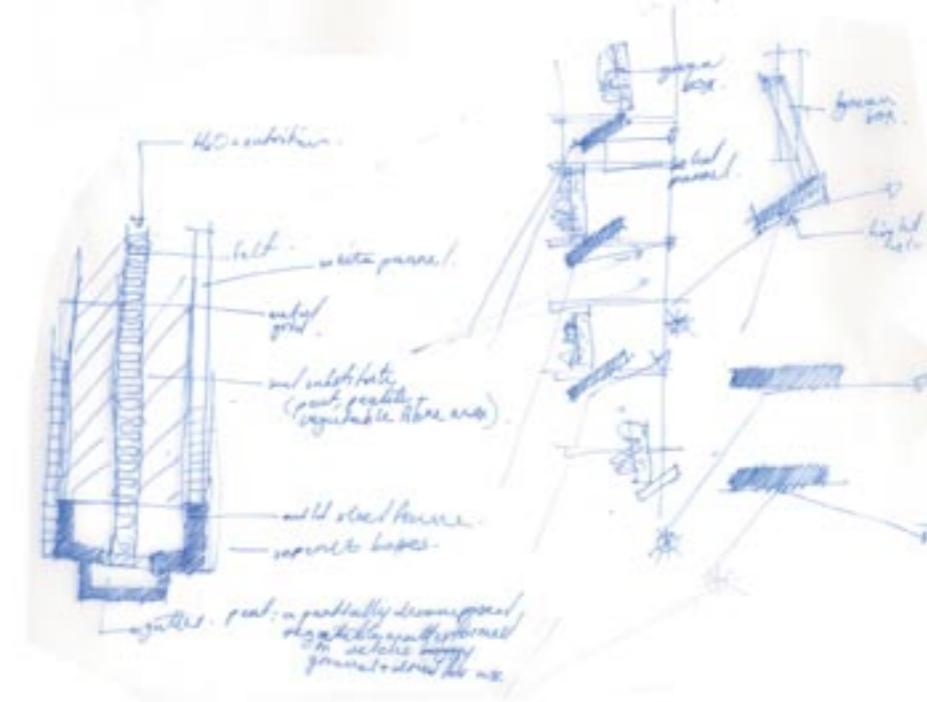
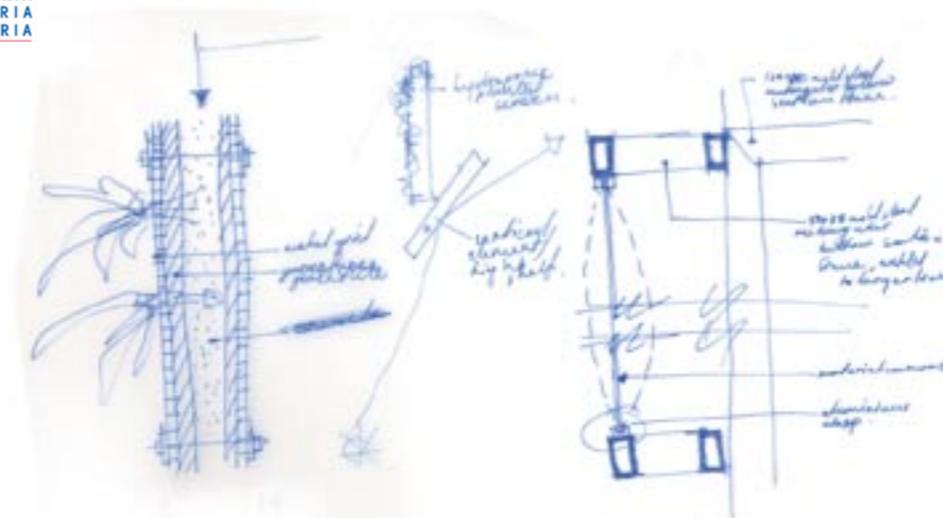
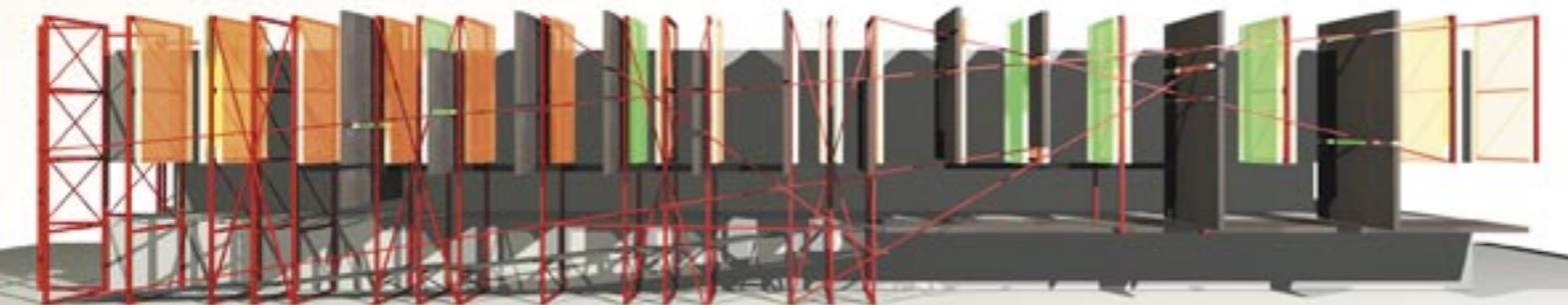
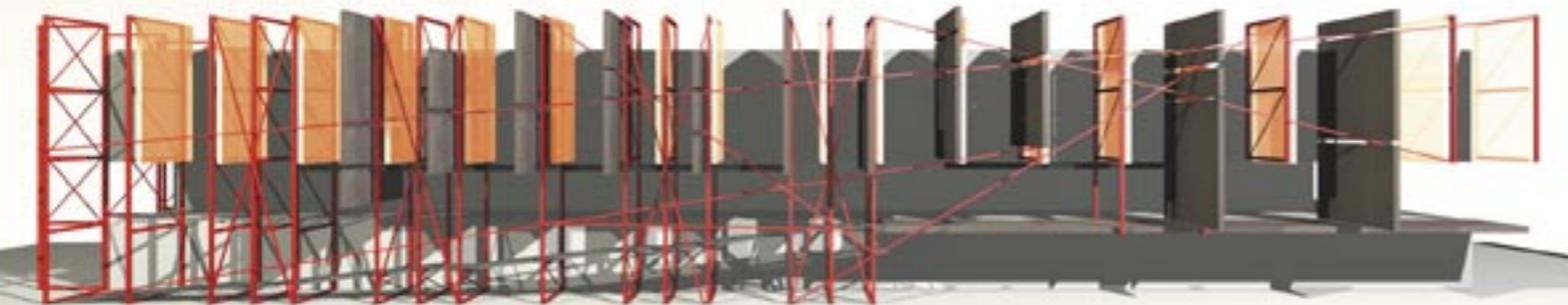


Figure 148: Patrick Blanc's living wall at Quai Branly, London

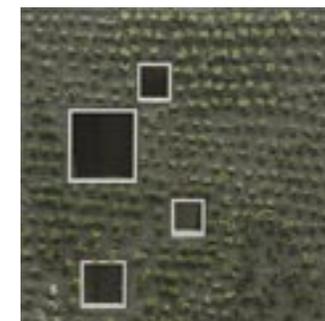


Figure 149: Paviljoen Blackbox

Page 107: Figure 147: Design investigation sketches of possible skin materials and structure

Page 108: Figure 144 (top): Skin investigation no. 5

Figure 145 (middle): Skin investigation no. 6

Figure 146 (bottom): Skin investigation no. 7

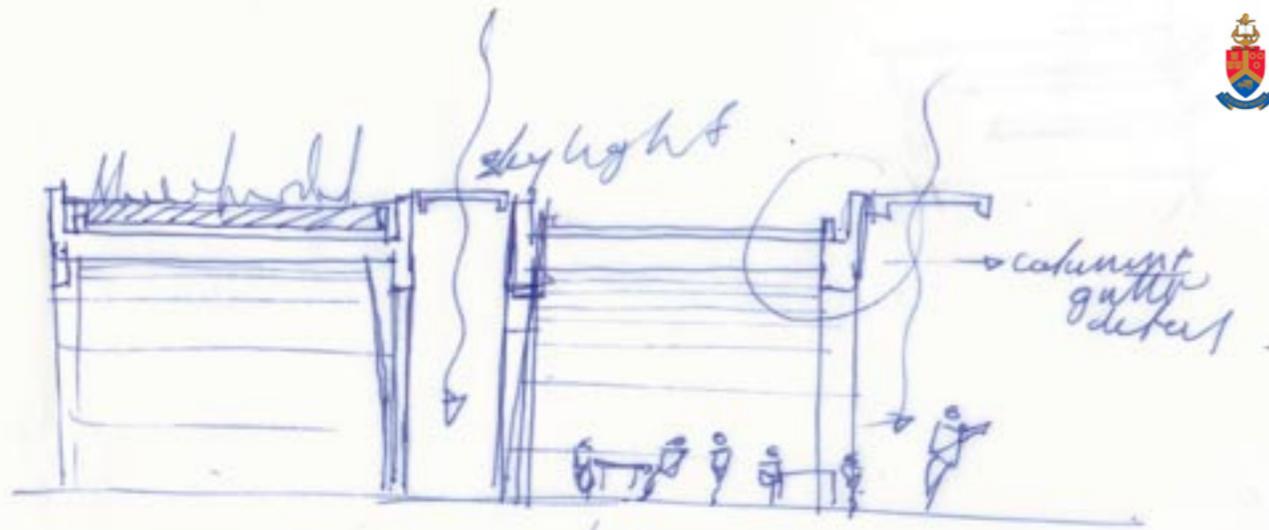


Figure 150

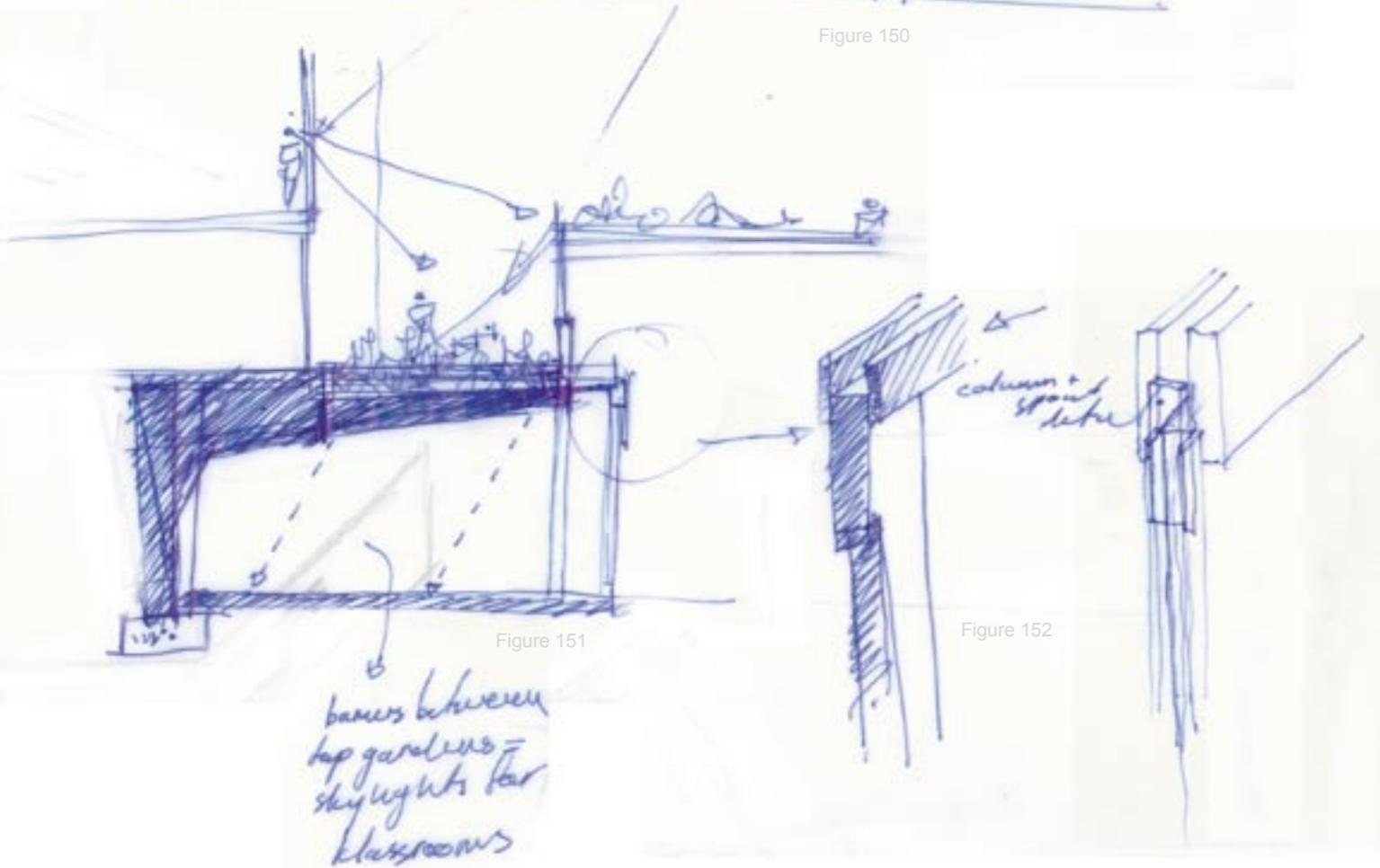


Figure 151

Figure 152



Figure 153: Isometric view of section model for residential block and day care centre

Flora/Daylight

In order to create a livable urban neighbourhood each residential unit has its own garden. These are located either on top of the day care centre classrooms for the lower units or on top of the residential block for the top units. The day care centre playground consists of a multitude of surfaces which includes grass and trees. Furthermore, the roof of the day care centre admin building consists of a vegetable garden which is maintained by the day care centre and used for education on nutrition and small scale agriculture. The following investigation looks at possibilities regarding the detail design of these gardens.

In both the residential units and the day care centre classrooms, the infiltration of natural light plays a vital role in the quality of space. Although each classroom faces north, considering that these rooms are seven meters deep, a skylight is used to allow for the maximum amount of sunlight to enter the space.

The residential block is covered with screens which defuses the light which enters each unit. The investigation explores the quality of some of these spaces regarding light entry.



Figure 154: Section showing structural considerations for day care centre and residential block connection



Figure 155: Model of vendor stalls in Bradbury St. London.



Figure 156: Installation of Bradbury St. vendor stalls.

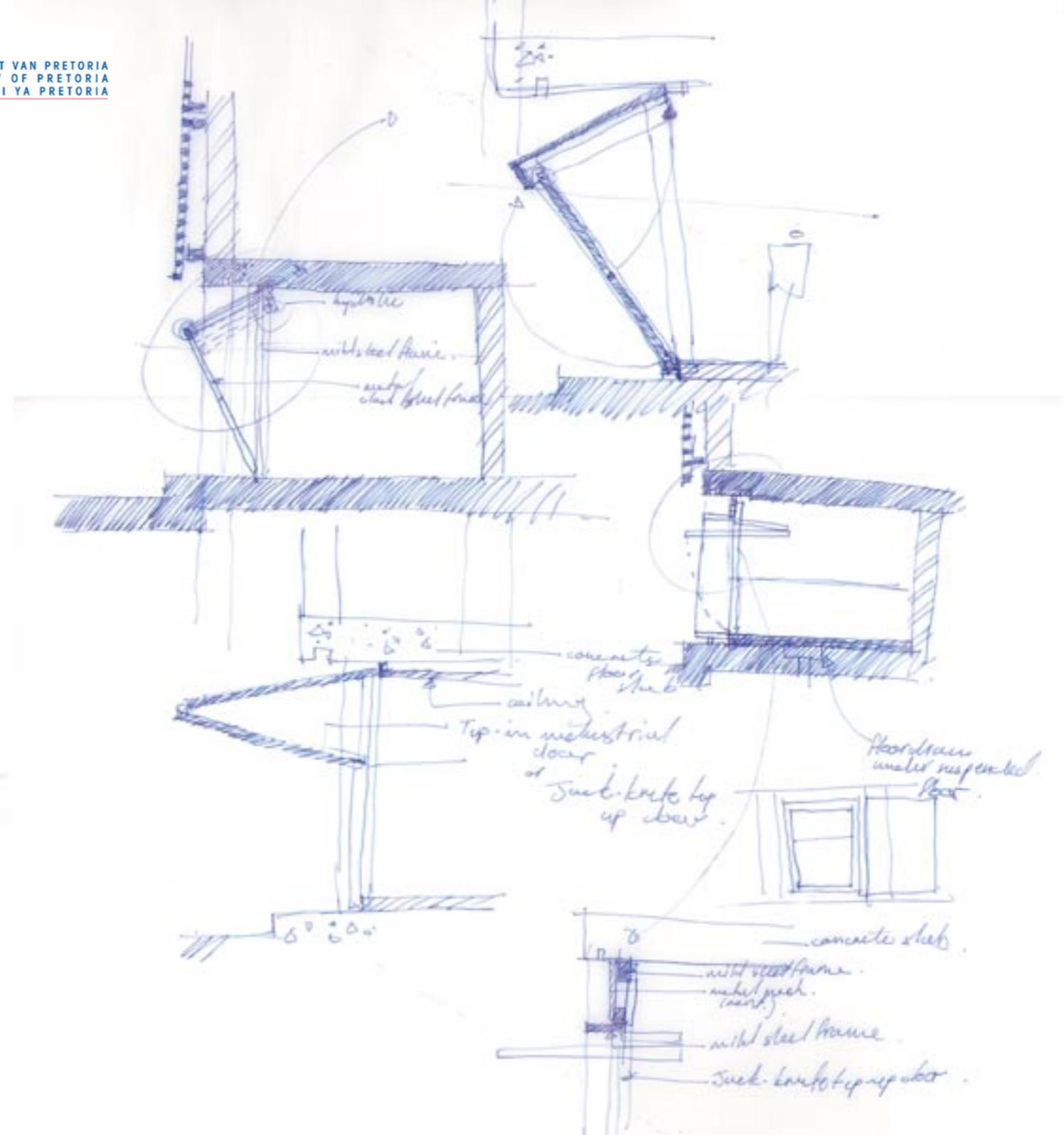


Figure 157: Operational vendor stalls.

Page 111: Figure 158; Design sketches for vendor stalls

Vendor stalls

In order to activate the main public square and establish it as the vibrant heart of the community, vendor stalls are introduced next to the community hall. These stalls are mainly used for the preparation of food. The following investigation looks at a precedent and possible design options.



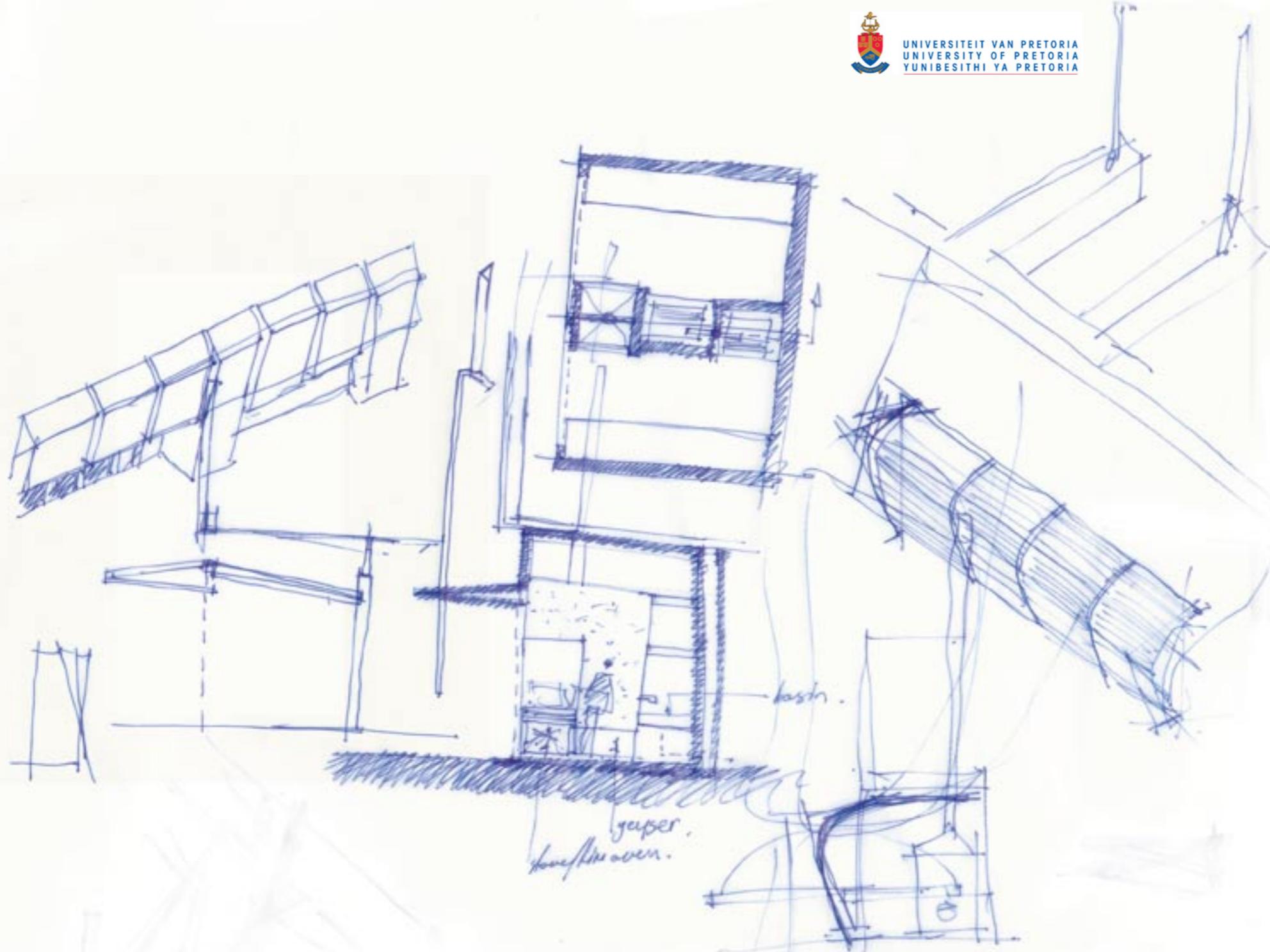


Figure 159: Design sketches for vendor stall in Public Square

inter vention tion

From guidelines to intervention

The theoretical argument identified three principles to guide design within a self-organizing system. These guidelines were used not only to set up an initial site development proposal, but extended throughout the design up to detail design level. However, the evolution of a self-organizing system is based on feedback, which is an iterative process. On a city scale, this process can span hundreds of years. Thus, the proposed intervention must be seen as a single step within this evolutionary process and the identified guidelines as the product of the history of city evolution.

Higher-level activity is the emergent product of lower-level activity, context specific and iterative in nature. Thus, these guidelines will most probably be different depending on place and time. For this specific place and time, the successful implementation of the three identified guidelines are as follows:

1. The creation of boundaries in order to define space:

Using boundary as the main informant for space definition produced a site model based on pedestrian and vehicular movement. These movement studies are context specific and directly derived from the existing urban fabric and activities. Grading this model in terms of privacy levels programmed the initial layout according to optimum usage and thus a program and client profile was identified.

Furthermore, these boundaries informed not only surface treatment, but also building skin design considerations. Both these elements are subject to the grading of space according to privacy and relates directly to quality of space.

2. The adaptation of boundary to transform space into place:

The proposed intervention does not suggest an open building

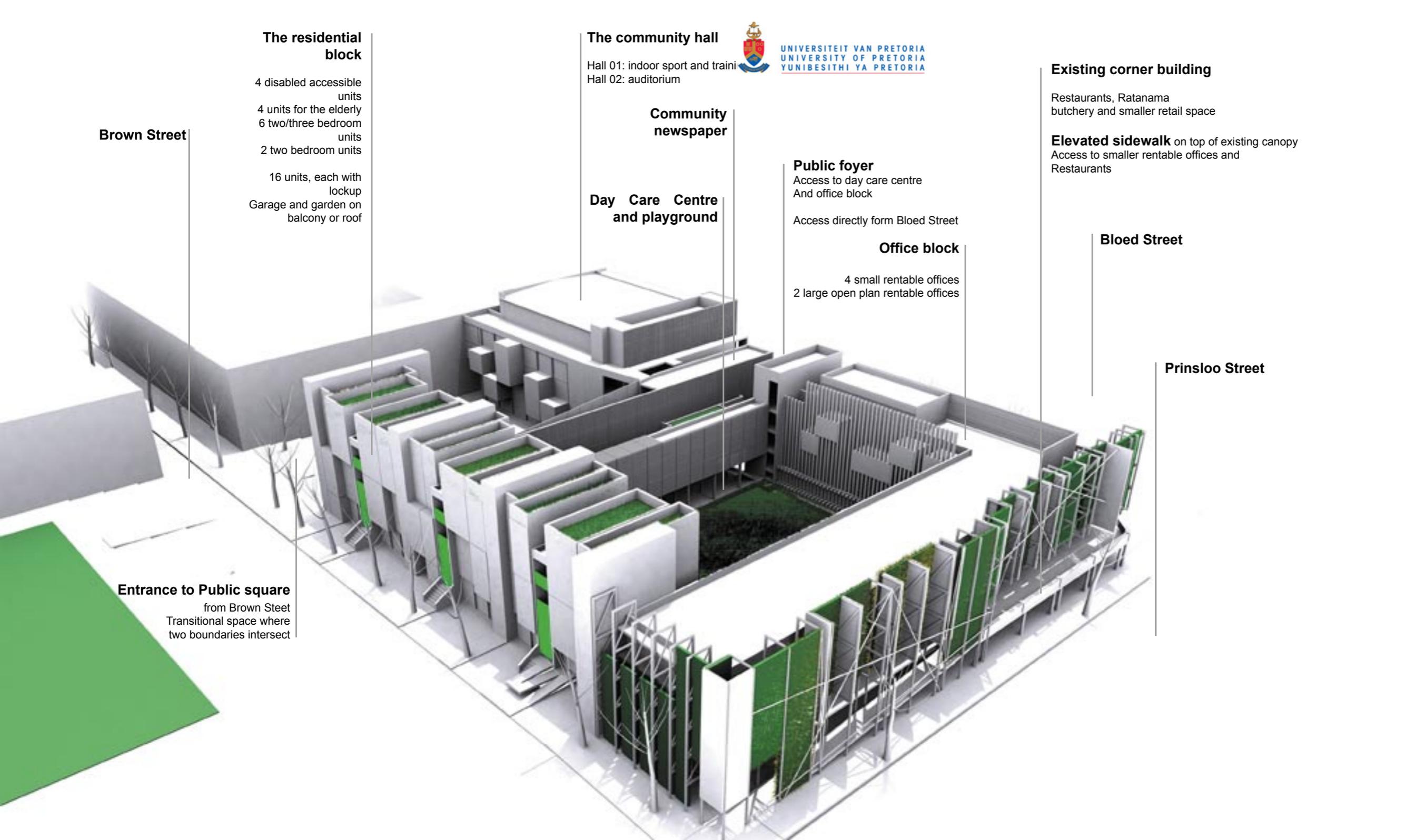
system where individualized physical adaptation can take place on a daily or weekly basis. It acknowledges the city evolutionary time scale and accepts the fact that any building has a limited lifespan. What it aims at is the adaptation of space as a reaction to the existing. Within the complex urban environment, adaptation of space is an inevitable product of emergence and thus to try and quantify any intervention according to adaptation as successful or not is irrelevant.

Thus, the proposed intervention steers away from direct adaptation as a design consideration. The transformation of space into place, whether on urban or residential scale, will inevitably take place.

3. The continuity of experience:

The intersection points of the juxtaposed barriers create opportunities for orientation while moving through the proposed intervention. These points of intersection were used to define spaces of transition between the different scales of privacy. Viewing these points as part of the movement over the site, they identify places where different types of movement intersect. Thus, these points become nodes of orientation not only for the immediate area, but on a city scale.

Like Klee's diagram explains (Figure 046 page 48), these points of simultaneous movement forms the prime catalyst for the opportunity of growth. As the starting point of evolution, they constitute the main orientation points within the dynamic urban fabric. The proposed intervention sees these points as foyer areas and places where the direction and mode of movement changes.



The residential block

- 4 disabled accessible units
- 4 units for the elderly
- 6 two/three bedroom units
- 2 two bedroom units

16 units, each with lockup
Garage and garden on balcony or roof

Brown Street

The community hall

Hall 01: indoor sport and training
Hall 02: auditorium



UNIVERSITEIT VAN PRETORIA
UNIVERSITY OF PRETORIA
YUNIBESITHI YA PRETORIA

Community newspaper

Day Care Centre and playground

Public foyer

Access to day care centre
And office block

Access directly from Bloed Street

Office block

4 small rentable offices
2 large open plan rentable offices

Existing corner building

Restaurants, Ratanama
butchery and smaller retail space

Elevated sidewalk on top of existing canopy

Access to smaller rentable offices and
Restaurants

Bloed Street

Prinsloo Street

Entrance to Public square

from Brown Street
Transitional space where
two boundaries intersect

Figure 160: Isometric view of proposed intervention (showing south-eastern corner)



Figure 161: Corner of Bloed and Prinsloo Street showing eastern façade screen and north facing offices.



Figure 162: View of the public square showing the community hall's southern façade

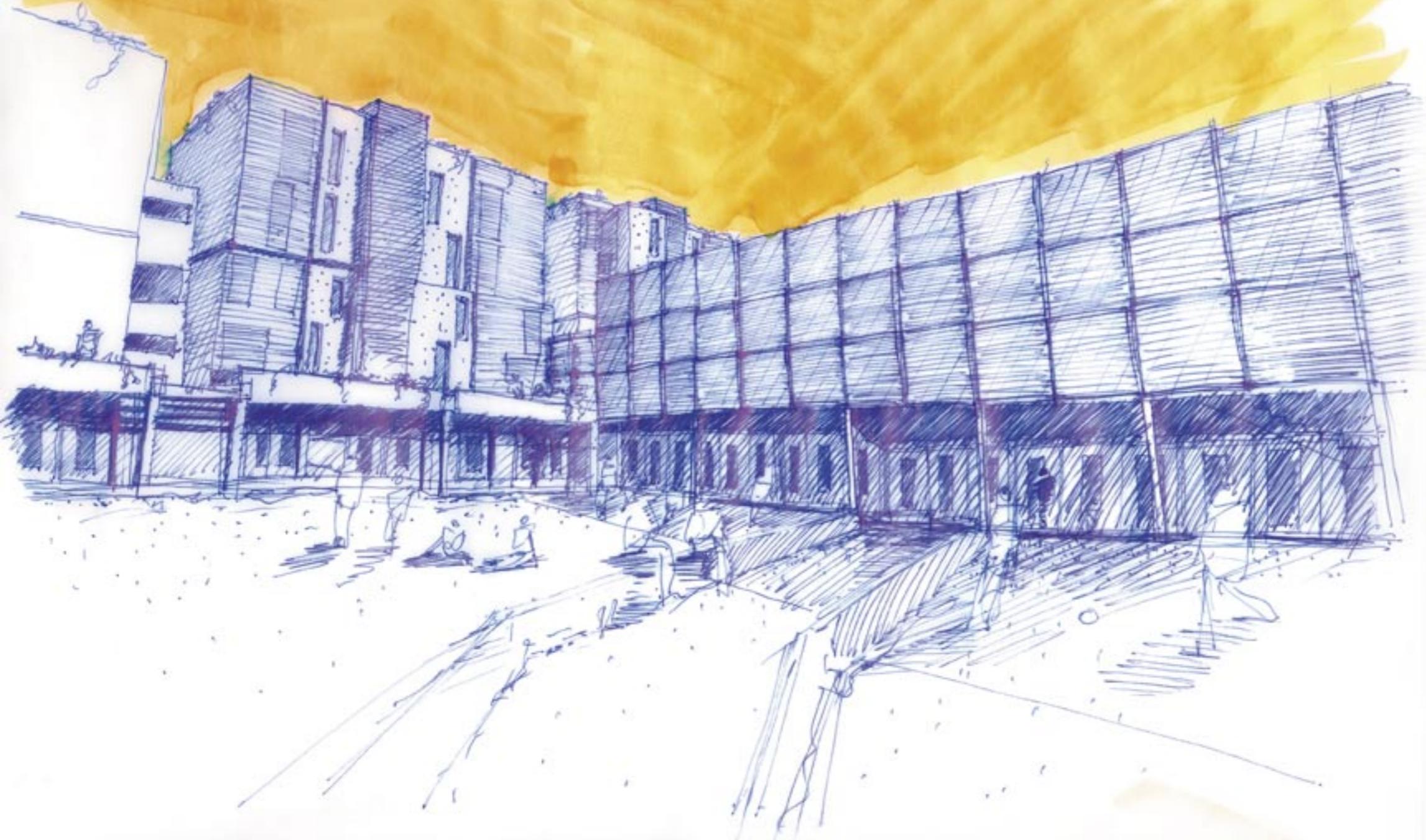


Figure 163: The day care centre playground showing north facing classrooms and housing on top

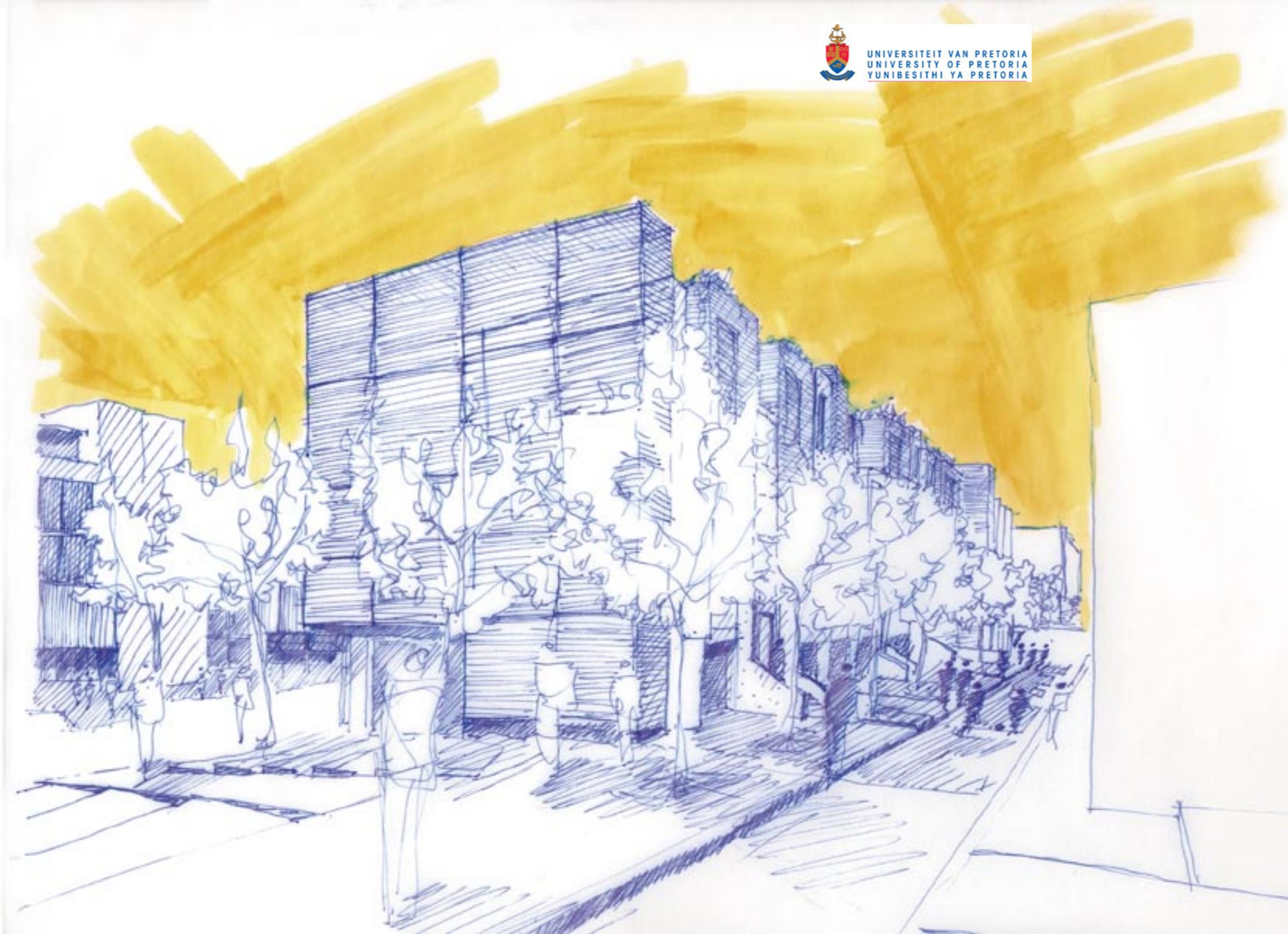


Figure 164: View of Brown Street showing entrance to the public square and the housing block's south western corner

Conclusion

City form and growth is an evolutionary process deeply imbedded in the interactions between city elements and guided by feedback of these elements into the city as a whole. This defines the city as a self-organizing system, the quality of which cannot be deduced from the sum of the lower-level activities.

Understanding the city as a self-regulating super-organism allowed for the identification of three guidelines, among possible other. These principles were used to guide an emergent design process, which had the multi-functional intervention as product. As illustrated by the proposed intervention, these guidelines are independent of scale and can be implemented in all levels of design.

However, the iterative feedback system of the city will determine the outcome of any urban intervention which, in turn forms part of the lower-level activities of the city. Thus, on the city scale, form and growth is determined by only one entity: the city as a whole.

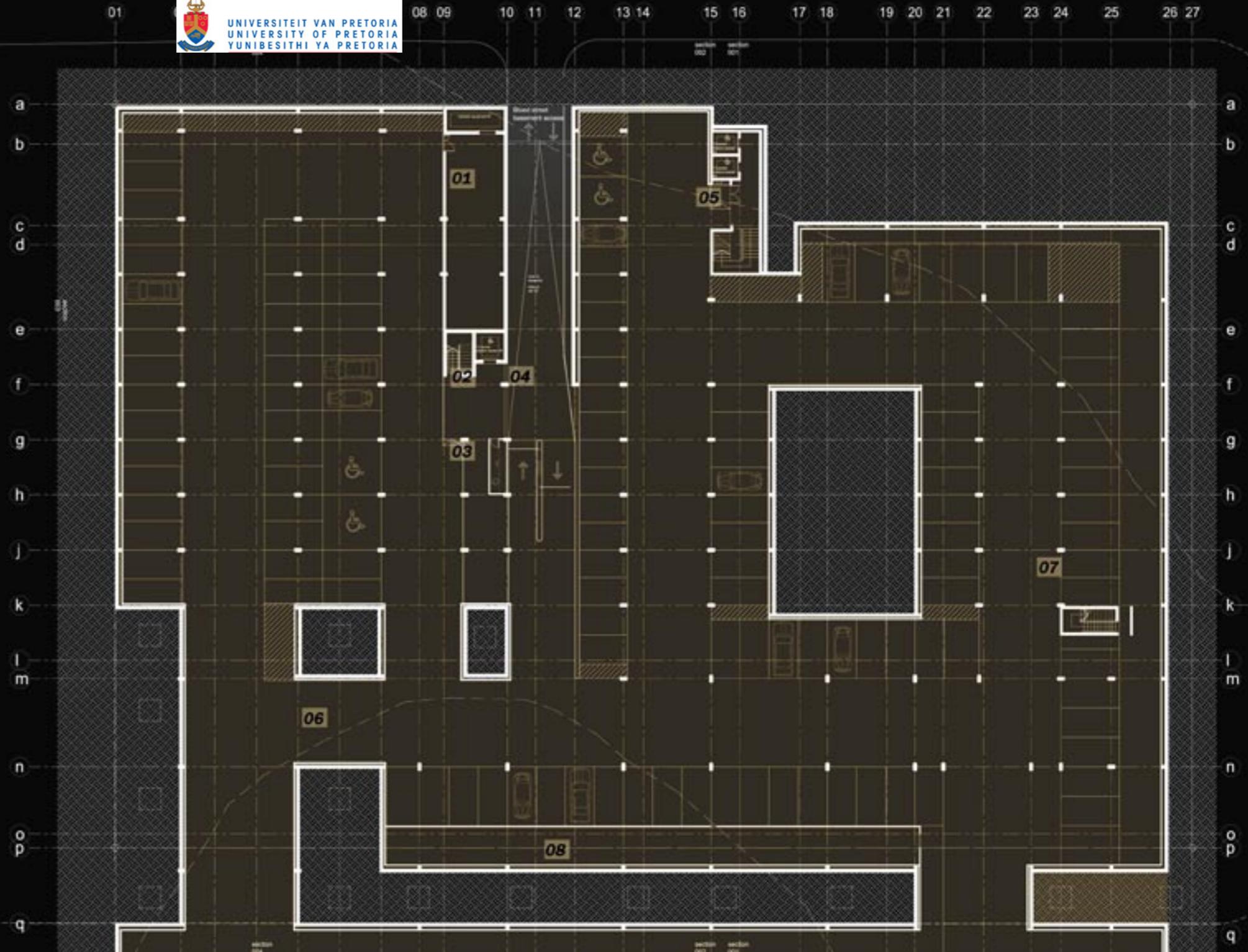
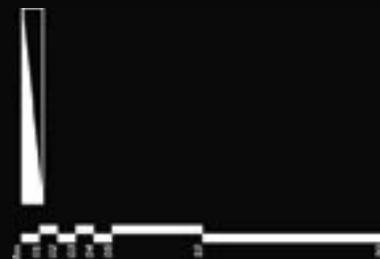
technical docum entation

Level -01: Basement

Notes

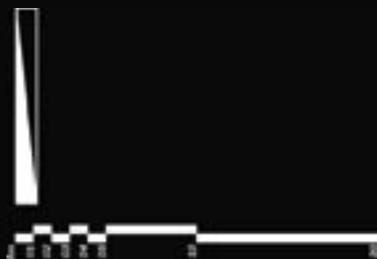
1. The basement continues towards the south with another access point in Struben Street.

- 01. Community hall equipment store
- 02. Foyer A: Community hall
- 03. Basement security office
- 04. Vehicular ramp: Bloed Street access
- 05. Foyer B: Office block
- 06. Planter boxes
- 07. Fire stair to level 00
- 08. Basement AC plant and grey water storage tanks



Level 00: Ground floor

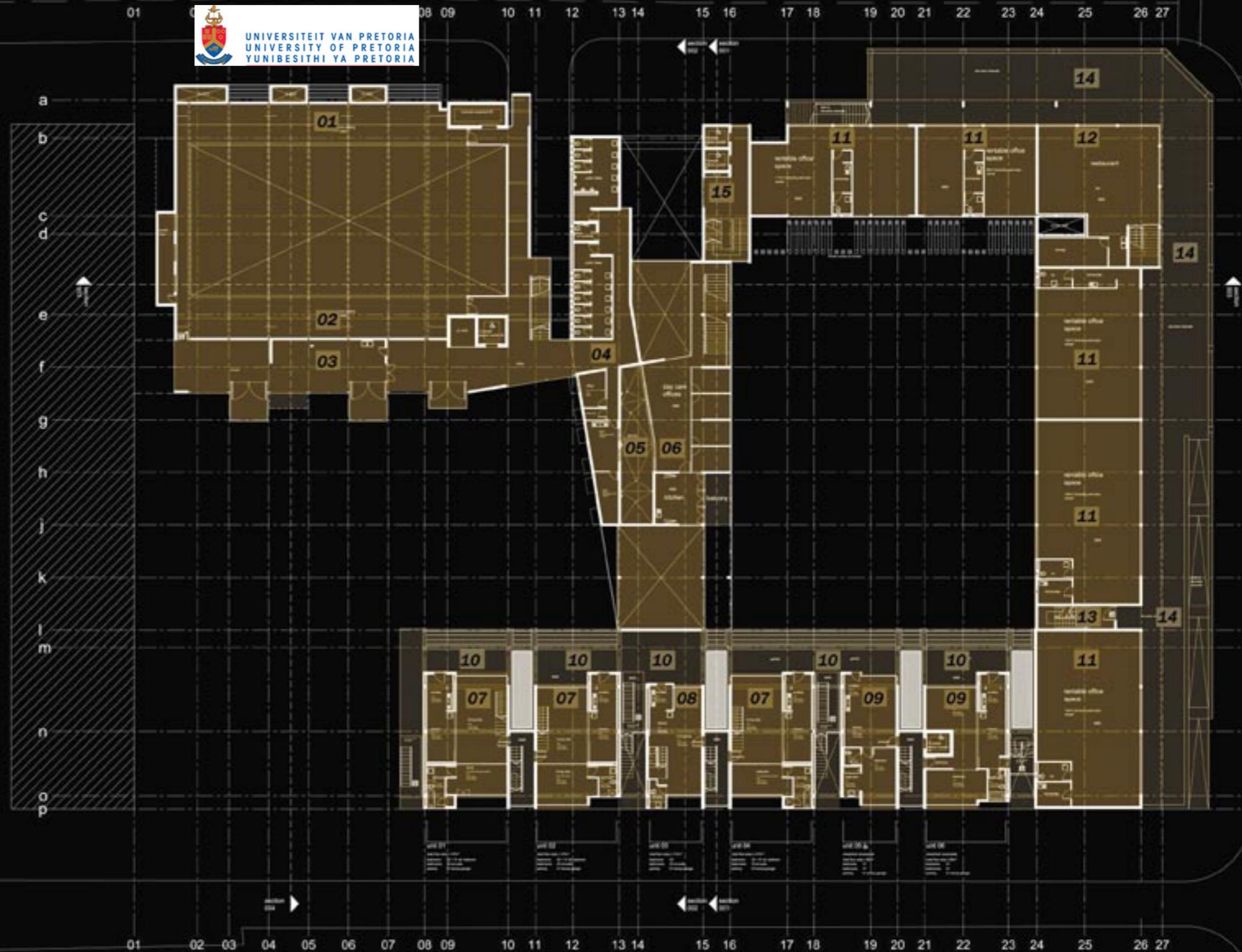
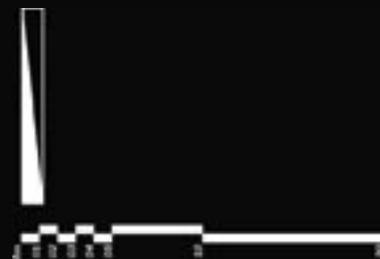
- 01. Community hall 01
- 02. Community hall foyer
- 03. Main Public foyer
- 04. ATM control room
- 05. Security office
- 06. Day care centre entrance
- 07. Children's toilets
- 08. Dining hall
- 09. Serving area
- 10. Kitchen
- 11. Media room
- 12. Classroom
- 13. Lockup garage
- 14. Retail
- 15. Restaurant
- 16. Fire stair and escape passage
- 17. Retail
- 18. Ratanama butchery
- 19. Service and delivery yard
- 20. Access to offices
- 21. Playground (Private open space)
- 22. Restaurant external seating area
- 23. Vendor stalls
- 24. Public square



Level 01: First floor



- 01. Community hall 01 gallery seating
- 02. Community hall 01 gallery seating
- 03. Bar and lounge
- 04. Community hall public toilets, prep. Kitchen and office
- 05. Open service area
- 06. Day care centre offices
- 07. Two/three bedroom residential unit ground floor
- 08. Two bedroom residential unit ground floor
- 09. One bedroom residential unit
- 10. Garden
- 11. Rentable office space
- 12. Restaurant first floor
- 13. Fire stair to ground floor
- 14. Elevated sidewalk
- 15. Access to offices



Level 02: Second floor



- 01. Community hall 02: Auditorium
- 02. Auditorium backstage
- 03. Community Newspaper reception and board room
- 04. Day care centre vegetable garden
- 05. Two/three bedroom residential unit first floor
- 06. Two bedroom residential unit first floor
- 07. One bedroom residential unit
- 08. Open plan office space
- 09. Access to offices



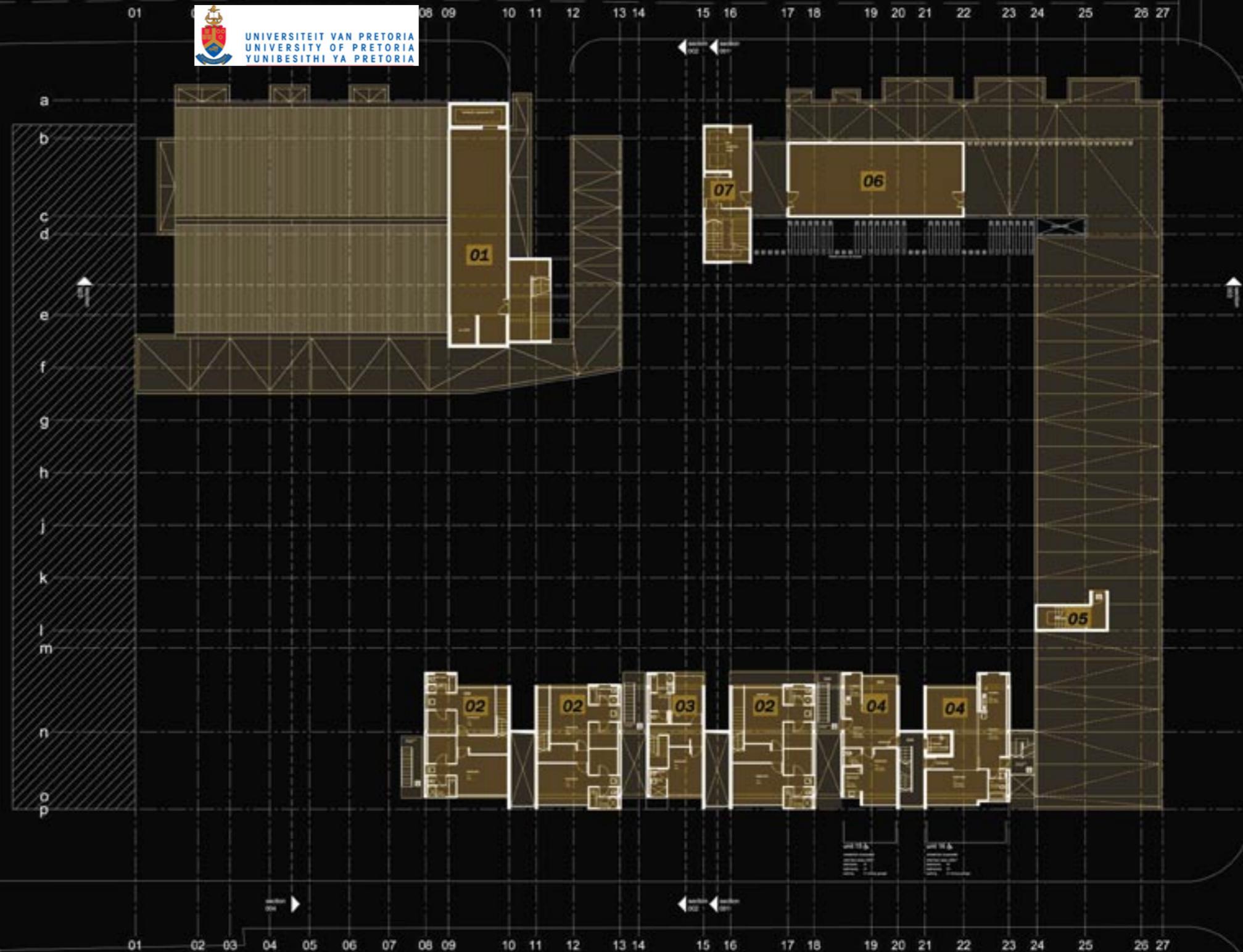
Level 03: Third floor



- 01. Community hall 02: auditorium
- 02. Community Newspaper office
- 03. Two/three bedroom residential unit level 01
- 04. Two bedroom residential unit level 01
- 05. One bedroom residential unit
- 06. Open plan office space
- 07. Access to offices

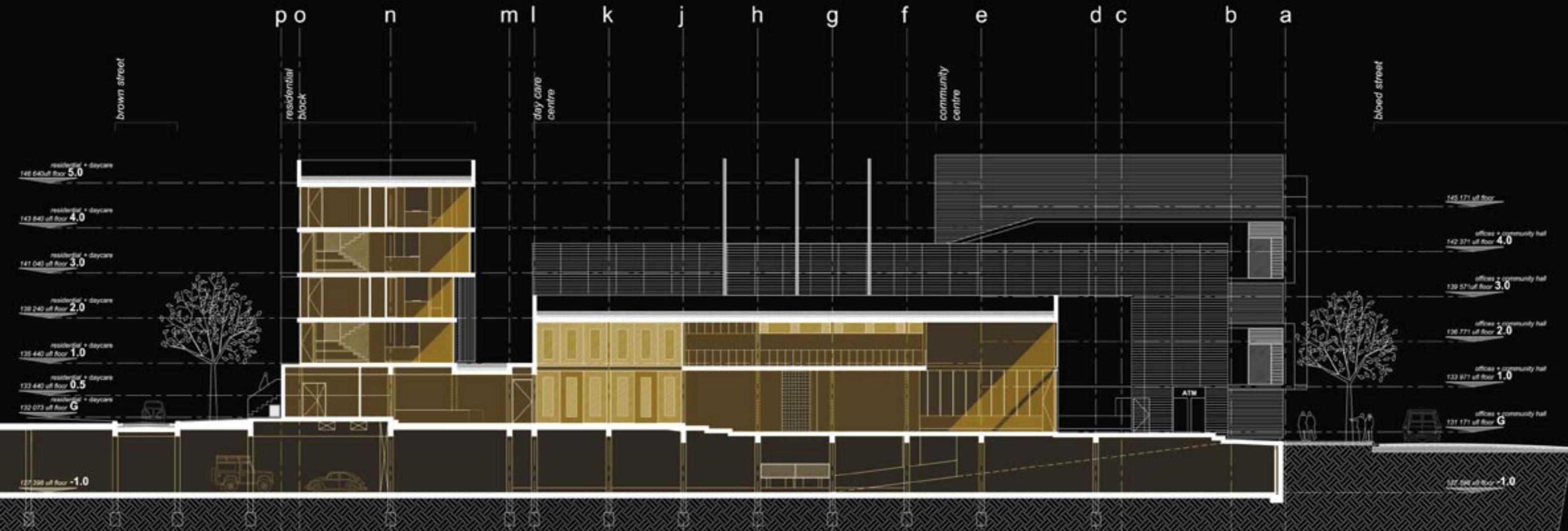


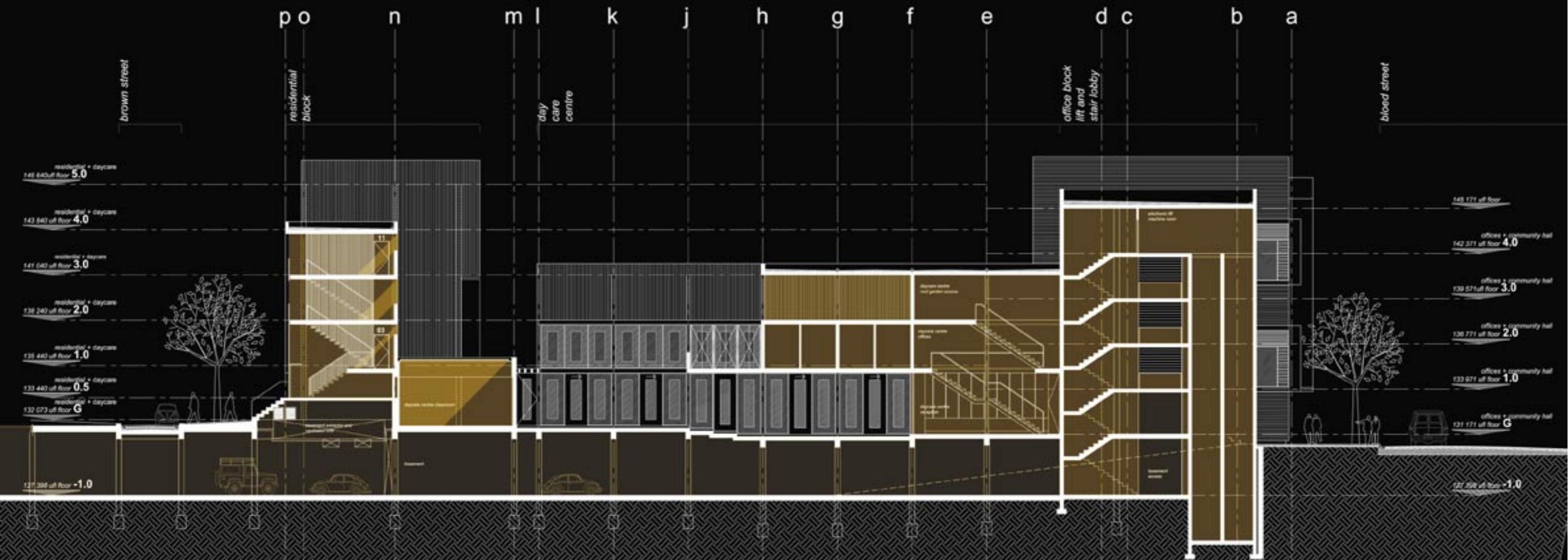
Level 04: Fourth floor



- 01. Community hall plant room
- 02. Two/three bedroom residential unit level 02
- 03. Two bedroom residential unit level 02
- 04. One bedroom residential unit
- 05. Fire stair roof access
- 06. Office plant room
- 07. Access to elevator machine room

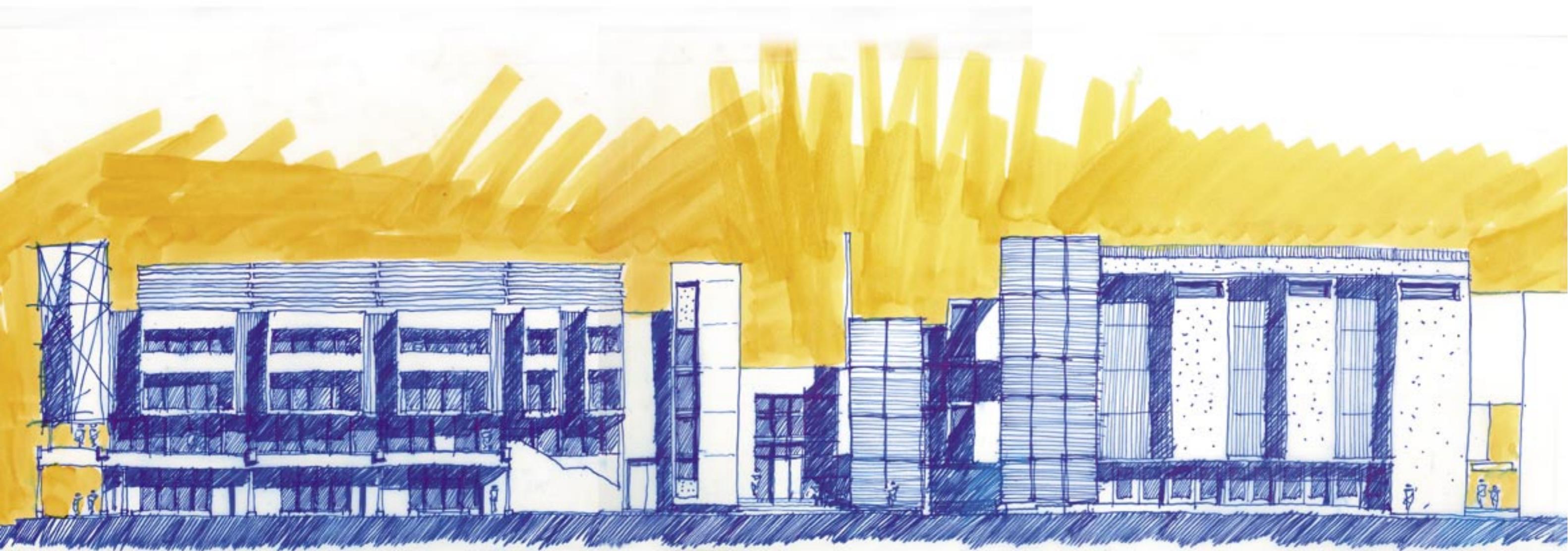








UNIVERSITEIT VAN PRETORIA
UNIVERSITY OF PRETORIA
YUNIBESITHI YA PRETORIA



NORTHERN ELEVATION 1:100

Bibliography

1. Bacon, E. N. 1968. *Design of Cities*. New York: Viking Press.
2. Billings, K. 1993. *Master Planning for Architecture: Theory and practice of designing building complexes as development frameworks*. New York: Van Nostrand Reinhold.
3. *Drawing / Building / Text: essays on architectural theory*. Edited by A. Kahn. 1991. Princeton: Architectural Press.
4. Gibson, M. S. & Langstaff, J. M. 1982. *An Introduction to Urban Renewal*. London: Hutchinson.
5. Girard, G. 1993. *City of Darkness: Life in Kowloon walled city*. UK: Watermark.
6. Grant, G. Extensive Green Roofs in London. *Urban Habitats*, vol. 4, no. 1.
7. Hawkins\Brown. 2003. *&/also*. UK: Black Dog
8. Hensel, M., Menges, A., Weinstock, M. 2004. Emergence in Architecture. *Architectural Design*, May/June 2004, vol. 74, no. 3 p. 6.
9. Hensel, M. 2004. Frei Otto: In Conversation with the Emergence and Design *Architectural Design*, May/June 2004, vol. 74, no. 3 p. 18.
10. Hookway, B., Perry, C. Responsive Systems/Appliance Architecture. *Architectural Design*, September/October 2006, p74.
11. Johnson, S. 2001. *Emergence: The connected lives of ants, brains, cities and software*. London: Penguin.
12. *Landscapes of Memory and Experience*. Edited by J. Birksted. 2000. New York: Spon Press.
13. Marais, E. N. 1970. *The soul of the white ant: the psyche of ants, their inherited memory of instinct*. Cape Town: Human & Rousseau.
14. Norberg-Schulz, C. 1980. *Genius loci: Towards a Phenomenology of Architecture*. London: Academy Editions.
15. *Paviljoen Blackbox: The pavilion that grows on you*. <http://www.stylos.tudelft.nl> (05 October 2007)
16. Richards, B. 1976. *Moving in Cities*. New York: Cassel & Collier Macmillan.
17. Weinstock, M. 2004. Morphogenesis and the Mathematics of Emergence. *Architectural Design*, May/June 2004, vol. 74, no. 3 p. 10.



UNIVERSITEIT VAN PRETORIA
UNIVERSITY OF PRETORIA
YUNIBESITHI YA PRETORIA

