NEGOTIATING THE EDGE

Resolving the conflicts and potentials between endogenous and exogenous environments in a peri-urban settlement by creating a condition for a narrative between the two extremes

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“A city, however perfect in its initial shape, is never complete, never at rest... more cities come about without benefit of designers or once designed, set about instantly to adapt themselves to the rituals of everyday life”

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Spiro Kostof (1999; pp13)

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For guidance, inspiration and patience
Neels van Rooyen, Dr. Arthur Barker

For support and map-pin-expertise:

My family

programme:	industrial apprenticeship workshop as catalyst for informal (endogenous) activities
site description:	open lot adjacent to back-of-house of Central City Mall
site location:	Mabopane, City of Tshwane
address:	Corner 18th Street and M17
coordinates:	25^{0}29'39.06" S ; 28^{0}5'12.09" E ; elev 1221m
research field:	Human Settlements and Urbanism
client(s) & end-user	SA Cares, Lesedi Traning Centre, SA Artisan Training Institute
Keywords:	Architecture after architects, seeding opportunity, informal settlements, resilient and adaptable space, civic space

Architectural Theoretical premise:
Architecture should encourage informal (endogenous) development and create opportunities for negotiation and narrative between the exogenous (externally generated as formal) and endogenous (internally generated as informal) activities

Architectural Approach
The exploration of architecture to act as a mediator between the exogenous (formal) and endogenous (informal) activities and built form. This could be created by establishing a socio-spatial dialect between what is provided by exogenous initiatives and what is interpreted by the endogenous activities.

ABSTRACT

In Mabopane's core, designers have, in an idealistic, static and utopian fashion, created environments for a society that does not exist, which has resulted in a tension between formal environments and informal activities. Because of the nature of formal institutions, informality (which is the backbone of identity of place) is suffering and being encroached upon by formal developments.

In reality, in all formality lies some informality, and vice versa. The intention is not to formalise the informal or informalise the formal, but rather to create a hybrid space where the two extremes (which are dependent on each other for survival) can co-exist and form a symbiotic relationship.

How does one create this landscape of co-dependence? The answer is firstly sought in a programmatic approach . An apprenticeship workshop inherits current site activities and forges a new relationship between the two extremes by sourcing the by-products of retail from the formal structure (i.e. the shopping centre) and utilising the evident resource efficiency of the community in order to solve a series of urban problems. The programme consists of two branches: the larger product manufacturing (where a current modular housing system with added recycled insulation is produced); and the smaller workshops (where finer crafts are practised, such as sewing and mending). These spaces are aimed at creating social, economic and knowledge-exchange environments.

The programme is used as a vessel to illustrate the concept that three types of spaces are required: the necessary, the optional and the spontaneous. The programme is designed in such a way that it compliments existing activities, introduces new ones where necessary and capitalises on established networks.

The built form is thus required to create a hybrid landscape of exchange. In order to create this landscape, a visual language is extracted from the context, deciphered and applied to the proposed site and activities. The designer is only capable of creating the formal and not in control of the informal, but one can learn from the fabric by deciphering some of the visible patterns on how to create successful space. This understanding of "anonymous architecture" aims to stimulate the narrative between the two extremes.

By examining the context, understanding what works and why it works in that specific way, a decision on what formal intervention is needed, could be supported to compliment and reflect the dynamic properties of the context. This familiarity of form is used to create an architecture that is region specific in its message and use.

ABSTRAK

In die hart van Mabopane het ontwerpers op 'n idealistiese, statiese en utopiese wyse, omgewings geskep vir n gemeenskap wat nie bestaan nie. Dit het gelei tot spanning tussen die formele omgewings en informele aktiwiteite. As gevolg van die aard van formele instellings het die informele daaronder gely deurdat formele ontwikkelings op die informele inbreuk gemaak het.

In werklikheid bevat die formele elemente van die informele en omgekeerd. Die bedoeling is nie om die informele te formaliseer of die formele te informaliseer nie, maar eerder om n kruis-omgewing tussen die twee uiterstes (wat van mekaar afhanklink is) te skep, sodat hulle saam in n simbiotiese verwantskap kan bestaan.

Hoe word hierdie landskap van interafhanklikheid geskep? Die antwoord word eerstens gesoek in n programmatiese benadering. 'n Nywerheidsvakleerlingwerkswinkel spruit uit die huidige aktiwiteite op die terrein en tree in n nuwe verhouding tot die formele toe deur newe-produkte van die kleinhandelaar te benut om 'n reeks van munisipale en maatskaplike probleme aan te spreek. Die program is gebaseer op die effektiewe aanwending van hulpbronne deur die gemeenskap. Die program bestaan uit twee vertakkings: die groter vervaardigingseenheid van modulêre boumateriaal en die kleiner werkswinkels waar handvaardighede soos naaldwerk beoefen word. Hierdie areas fokus daarop om maatskaplike en ekonomiese omgewings te skep waar kennis uitgeruil word.

Daar word van die tasbare omgewing vereis om 'n kruis-landskap van wisselwerking te skep. Om dit suksesvol te bereik moet die konteks as 'n visuele kommunikasie middel bestudeer en ontsyfer word sodat dit aangewend kan word as 'n as n positiewe ingryping in die terreinaktiwiteite. Die ontwerper kan die formele omgewing skep maar kan nie die informele beheer nie. Deur egter die omgewing te bestudeer kan patrone waargeneem en aangewend word om n suksesvolle omgewing vir wisselwerking te skep. 'n Begrip van 'Anonieme Argitektuur" kan die kommunikasie tussen formeel en informeel stimuleer.

Deur die omgewing te ondersoek en te verstaan, beïnvloed die besluit tot watter soort formele ingryping toepaslik sal wees om die dinamiese eienskappe van die omgewing te reflekteer en te ondersteun. Hierdie bekendheid van vorm word gebruik om 'n argitektuur te skep wat eiesoortig aan die omgewing is deur die wyse waarop dit gebuik en waargeneem word.

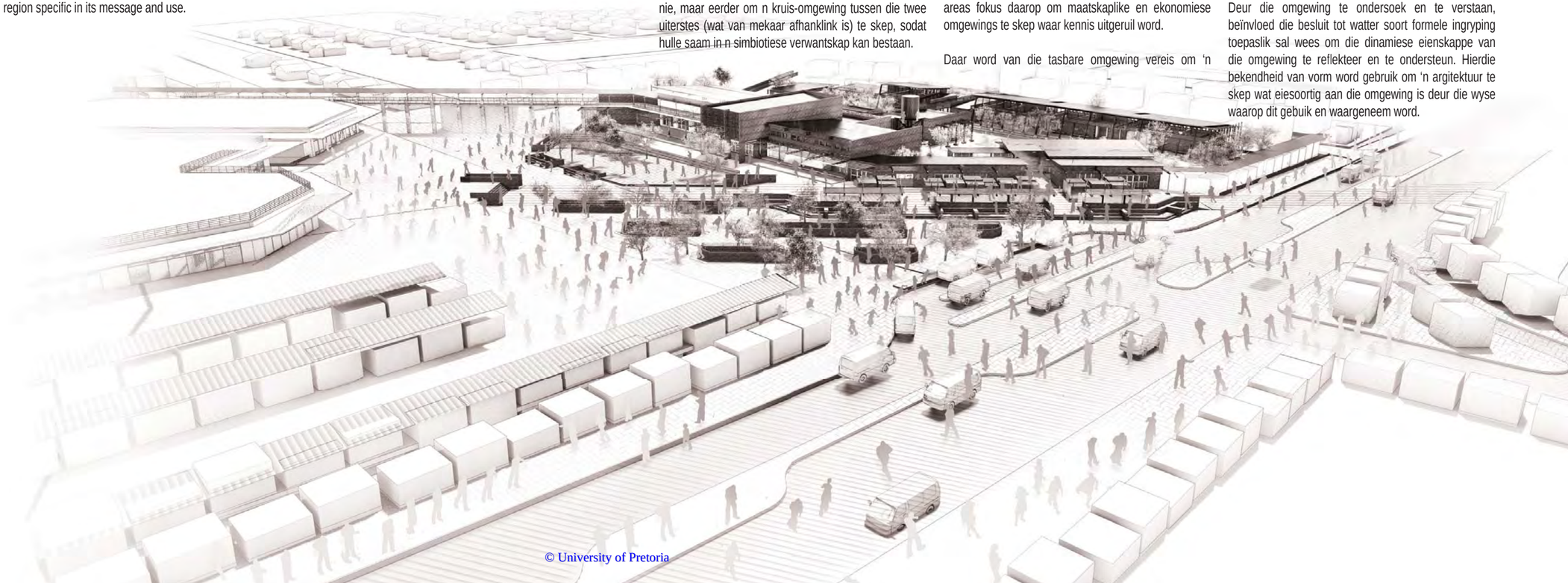

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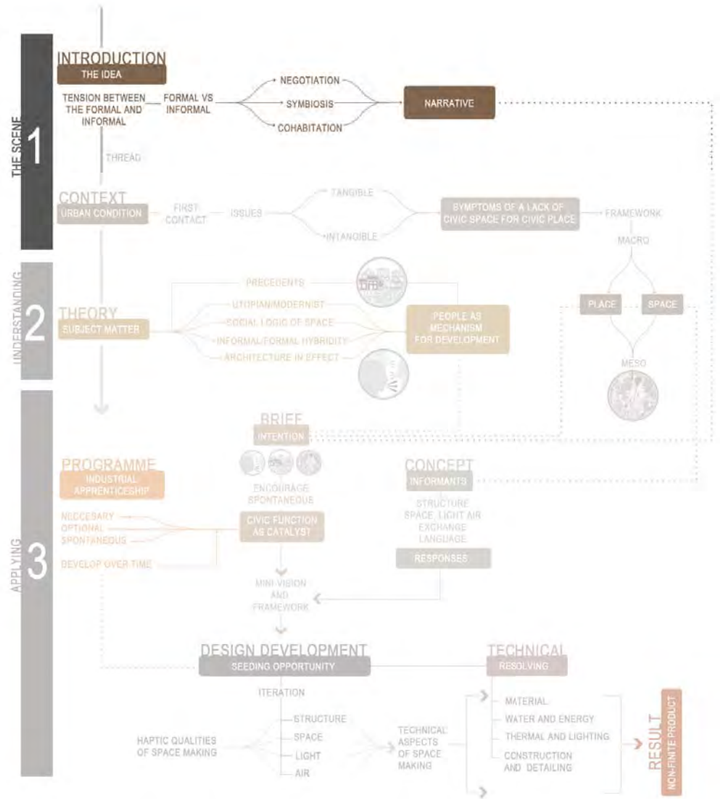
Fig 09-7n perspective of the interior of cognitive learning facilities (Author, 2014)
Fig 09-7o section and details relating to the interior of cognitive learning facilities (Author, 2014)
Fig 09-7p perspective of the entrance foyer(Author, 2014)
Fig 09-7q section and details relating to the entrance foyer (Author, 2014)
Fig 09-7r technical resoltion devolved from the design intention (Author, 2014)
Fig 09-7s sectional development from design intentions to a technical resolution (Author, 2014)
Fig 09-7t perspective of the condition created for a narrative (Author, 2014)



01 INTRODUCTION

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01 BACKGROUND

"Edge cities" are a common phenomenon in the South African landscape (Pekelharing 2005). Once situated in the homelands, enforced by the Apartheid government, they are found on the fringes of the urban core. These "edge cities" are separated from the urban core by an industrial buffer zone, and foster the migratory labour system (Davies 1981). At the heart of most of these settlements lies an inter-modal transport node, aimed at creating a conveyor belt between the urban core and the peri-urban landscape.

These areas are characterised by informal solutions to the problems formal architecture cannot and does not attempt to address. The physical fabric of these informal solutions displays the inhabitants' resource efficiency (Simone 2004) and ability to manipulate an environment that does not welcome "non-pedigreed" architecture (Kellet & Napier 1995).

Mabopane (Fig 01-1) is an edge city located north of Pretoria and is connected to the urban core by the Metro rail. Mabopane is characterised by the tension between the formality of that which is provided by external initiatives (the professionals) and the community initiatives of reclaiming and re-organising space (the experts). This tension results in a display of the community's ability to survive in a world that is concerned with "quick fixes", driven by Eurocentric ideas and a need to build a new Utopia (Hamdi 2010). This community's survival, however, does not mean that it is functioning in an optimal manner (Simone 2004); the reliance on external imports of knowledge, goods and employment makes this a fragile system that is not resilient and does not display the characteristics of longevity.

The physical environment is a result of this frantic attempt to survive, as public life becomes no more than a struggle to find a place between the formal elements. Civic space is then often neglected, as the gradual privatisation of space occurs and the encroaching formal fabric destroys opportunities for informality to thrive.

"Cities are not the static and stable entities that we have always imagined cities to be – physical constructs where stable meanings are contained in architecture that then becomes the spectacle of the city – where the memory of the city is encoded and contained."

- Mehrotra (2013)

Fig 01-1 Aerial view of Mabopane station (Courtesy Holm and Jordaan Architects 2008)

02 NORMATIVE POSITION

The argument in this document finds itself in the roots of an observed tension between the formal and informal environments and the ability of an informal environment to create space more efficiently than the planned or exogenous initiatives.

Tension between the formal and informal

Formal buildings act as islands in the landscape, having little interaction with the informal activities that they are submerged in and dependent on (Fig 1-02). This devotion to utopian principles has caused a tension between the formal and informal where the informal seeks to adapt while the formal remain static. The formal creates spaces of resistance and inhibits the cohabitation and negotiation of space (Cardosi 2011). Shadow activities – the informal – struggle to find a place between the imposed formal activities.

Architecture happens without designers

"[A] city, however perfect in its initial shape, is never complete, never at rest... more cities come about without benefit of designers or once designed, set about instantly to adapt themselves to the rituals of everyday life" - Kostof (1999, pp. 13). From this observation of the tension between the formal and informal environments comes the notion that design often happens after architects have left the site. This is where the true meaning and use of space emerges as the provided space is inhabited.

The spaces created by the internal energies (the spontaneous or endogenous) between the formalised elements reflect a better sense of public life . More successful architecture is often a result of what happens when the designers leave the site. The community has managed to create space with "non-pedigreed" architecture more successfully than external initiatives (exogenous activities) – they (the community) are the experts, as well as the often disregarded sources of information (Hamdi 2010).

The term "informal" often has a negative connotation, as it is seen as something that hinders development and progress and is temporary in nature, when in fact the informal is what promotes development (Anderson & Jenkins 2011). This common misconception has lead to designers believing that formalising the built environment in its entirety is what constitutes true progress. The built environment in informal settlements is characterised by the isolation of two extremes: the formal and the informal practices (Anderson & Jenkins 2011). Fringe or edge cities are often described as "challenges", as if they are problematic, because of the informal qualities they display. This document aims to show that the problem might be rooted in the inability of designers to accept the presence of informality and the value of these activities.

When designing a city, a seemingly finite rigid layout for the city (Fig 01-3) is provided by planners. Once inhabited, the city is quickly adapted and shaped by informal activities to address the true needs of the community and to reflect the ritual use of space. This adaptation in itself has limits and reaches a point of distress where the formal fabric becomes too dominant for the informal fabric to thrive. This document meets the selected site (Mabopane) at this point of panic, where options for the informal inhabitation of space are saturated due to the overpowering nature of the formal elements.

> **"They (informal settlements) are constantly emerging through a dynamic, flexible process, moving from "need to need, opportunity to opportunity, in a series of adaptations."**
>
> - Mills (2012)

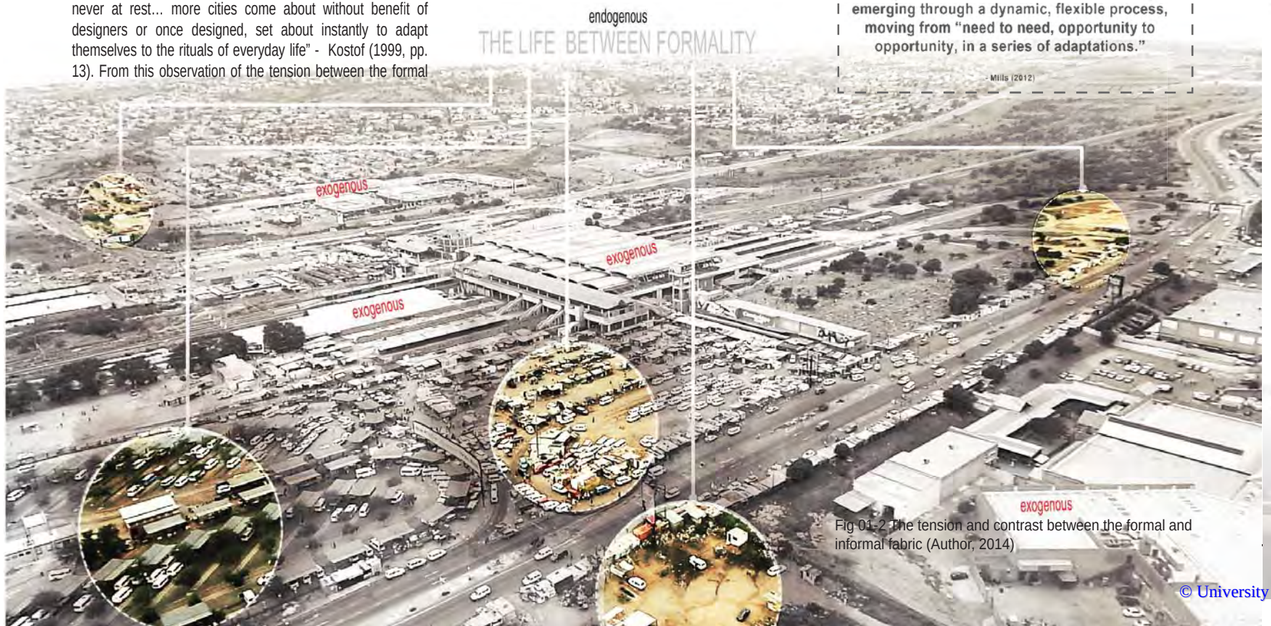


Fig 01-2 The tension and contrast between the formal and informal fabric (Author, 2014)

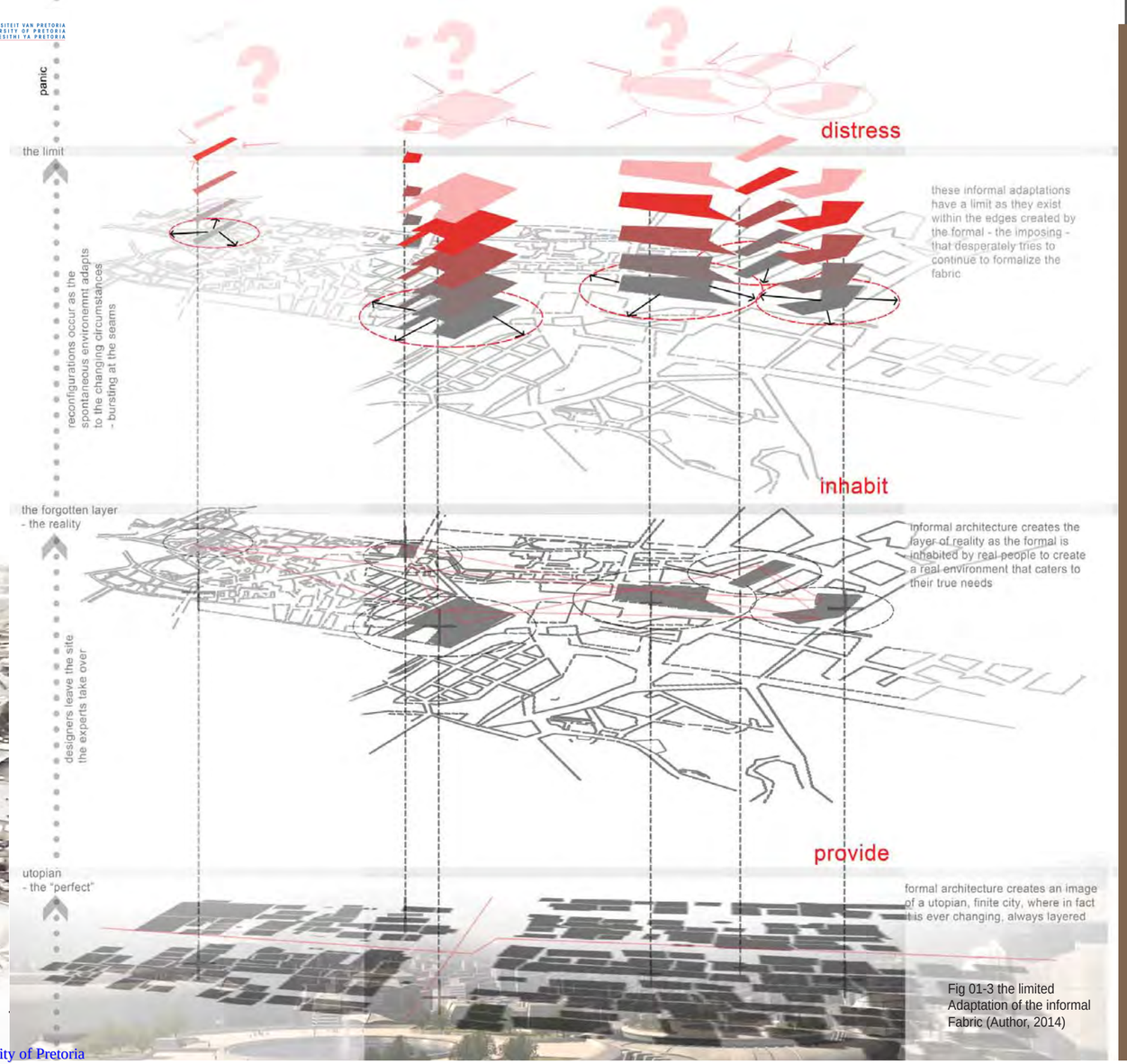


Fig 01-3 the limited Adaptation of the informal Fabric (Author, 2014)

03 INTENTION

These notions described in this document have funnelled down to the idea that architecture in peri-urban settlements needs to address the disconnect and tension between the formal and informal environments. A negotiation and narrative needs to occur in order for the cohabitation of the two extremes to be successful and beneficial to both parties. In other words, people should be the driving force behind development, not engineers or planners .

(In)formal settlements have a rich layer of social infrastructure informing the built form (Hamdi, 2010). The opportunity for designers to work in these areas requires the urban and architectural approach to be of a well-informed, humanistic nature – which is often neglected by an industry concerned with pleasing the "client" in the form of external investors and the government. Projects are often driven by external investors aiming to "make a quick buck", thus privatising land use. There is, however, an opportunity to find the balance between what is provided as formal architecture and what is adapted by informal architecture to create civic space.

The aim of this document and its research is to understand region-specific architecture, as well as the specific use and edges of spaces and building materials, and the ritual of use. Research will involve taking cues from existing strata to understand the architectural language of place-making.

Several leads will be followed as the area of opportunity is presented as lying between the formal and informal built environment (Fig 01-4). The intention is to provide a catalyst intervention that capitalises on existing industry, strengthens established networks and defines public space in the celebration of identity. The design must be informed by the strengths and potentials within the rich urban fabric by identifying missed catalyst opportunities that would result in a long-term effect of incremental design (longevity). An interdependency between natural, built and social (public) environment needs to be established as part of a holistic approach to finding a solution to the existing tension.

There is a need to anticipate future development and problems, and to find architectural solutions that are resilient and able to adapt to the changing economic, social and environmental atmosphere.

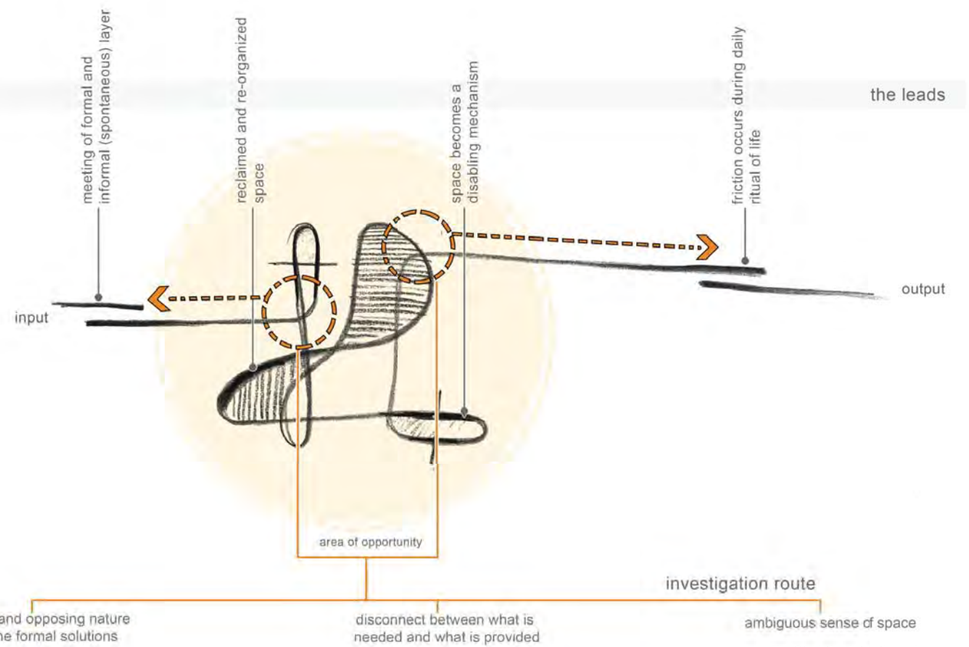


Fig 01-4 the intention of research (Author, 2014)

04 THE QUESTION

This dissertation is guided by the overarching issue of the negative attitude towards informal or "non-pedigreed" architecture, resulting in a tension between the formal and informal environment. It aims to address the value of this kind of architecture and the role it plays not only in socio-economic landscapes, but also in the importance of identity.

Urban issue

Although many generic issues, found in most peri-urban settlements, are present, ranging from inadequate infrastructure to poor waste management, the site consisting of central Mabopnae suffers from a deeper layer of intangible issues, namely:

•The "islandification" of built structures is a result of the gradual privatisation of land parcels. This leads to a limited amount of public space and a place to have a voice.

•A study of the urban condition has led to the conclusion that there is a reliance on external industry and knowledge, and the lack of transfer of knowledge between existing systems.

•The mono-functionality of space creates harsh edges between spaces.

•External initiatives are designed to exist in a specific time of day, disregarding the daily rituals of the users.

•Fragmentation occurs and the missing links are often filled up quickly by the "informal" or spontaneous as the need is most understandable and clearest to the people who live there (Anderson & Jenkins 2011).

These are all symptoms of a lack of public space for civic life. The fabric does not serve the community's true needs, but rather serves an external client.

Architectural issue

The architectural issue derives from a synthesis between the main issue of tension between the formal and informal and the inability of the fabric to serve the community. The formal and informal environments are not accepting of each other in their built form and yet they require each other to survive.

Edges do not only exist between the settlement and the urban core (physical), but also within the settlement itself as tension between the formal and informal is creating disabling circumstances for spontaneous growth and resilient solutions to public space issues.

The research question now arises:

The main research question that this dissertation aims to address is what formal catalyst intervention is required to create the condition for the narrative and negotiation between the spontaneous (the informal environment) and the formal environment?

Sub-questions

• How can formal solutions become part of an evolutionary process of space making instead of a finite solution to a series of needs?

• How can formal architectural solutions reflect the dynamic properties of the context and communicate the use of space through a visual language?

• How can formal architecture in a peri-urban settlement create the opportunity for and accommodate the spontaneous nature of the informal to allow for a constant negotiation and narrative between them?

• How can the creation of public/ civic space be used to activate the relationship between the formal and informal built environment?

05 THE INFORMANTS

How does one address this disconnect between the formal and informal? The answer might lie in the study of relevant informants. Three informants (each with their own sub-informants) were identified in order to generate a possible solution: first, that which has been said (by notable authors in the field) grouped together in a theory investigation ; second, that which has been done in the form of precedent studies; and third, what the fabric has to offer by investigating the urban condition and setting the scene for development (urban framework).

Fig 01-5 the informants (Author, 2014)

06 LIMITATIONS

The aim of this document and its constituent practical project is not to create a new architecture, but rather to understand and illustrate the symbiosis and value of a negotiated edge. The aim is not to informalise the formal or formalise the informal, but to understand that a constant narrative and negotiation needs to occur between the two. One needs to support and encourage the other in the rapidly changing political, economic and social environments so as to allow the other to adapt to these circumstances.

The author is not an expert on the social behaviour connected to space-making, but can simply predict a series of adaptations and variable use and aim to facilitate a range of activities. The informal cannot be constructed by the professionals, but the circumstances required for it to grow and flourish within the formal and for it to adapt further can be provided (by architects) armed with a knowledge of precedents and an ethnographic study. The scope of this document and its constituent practical work cannot prove an absolute certainty of use over time, but rather is limited to creating opportunities for the negotiation and creation of a narrative between the formal and informal.

The research is limited to understanding the social logic of place-making, urban identity, region-specific urban fabric and what the designer's role could be in creating the area for possible symbiosis of the formal and informal (Fig 01-6).

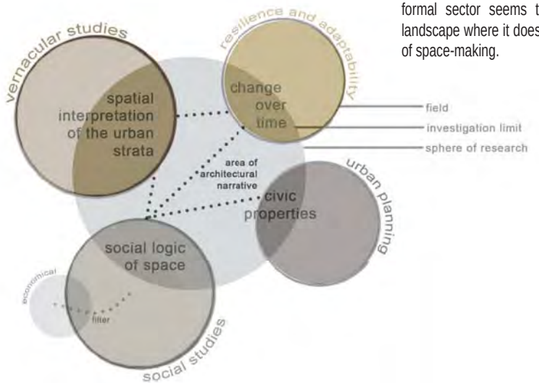


Fig 01-6 the limits of the investigation (Author, 2014)

07 ASSUMPTIONS

According to the Metropolitan Spatial Development Framework (City of Tshwane 2008), plans to extend the rail to the North of the existing rail road station are underway (Fig 1-07). This will have a profound effect on the Mabopane region as smaller settlements further North would now have quick access to Mabopane and its limited spatial resources. This might result in the current pressures and spatial limitations increasing and causing distress in the fabric.

08 HYPOTHESIS

It is hypothesised by the Author that architecture should serve as a mediator between the formal and informal environment, while promoting opportunities for the informal to develop and expand by introducing a catalyst intervention.

As previously stated, this document does not aim to promote formalising the informal or informalising the formal; rather, it is about finding the common ground and language with which the two can communicate and negotiate space in a setting where the socio-economic climate is ever changing on a linear and cyclical time scale .

Architecture should be an instrument for socio-economic opportunity (Low 2005). The shift from provision to enablement has been present since the late 1970s (Low 2005), but the formal sector seems to provide a disabling element in a landscape where it does not understand the community's ritual of space-making.

Fig 01-7
The extension of the rail to the north (Author, 2014) adapathed from The MSDF (City of Tshwane, 2008)

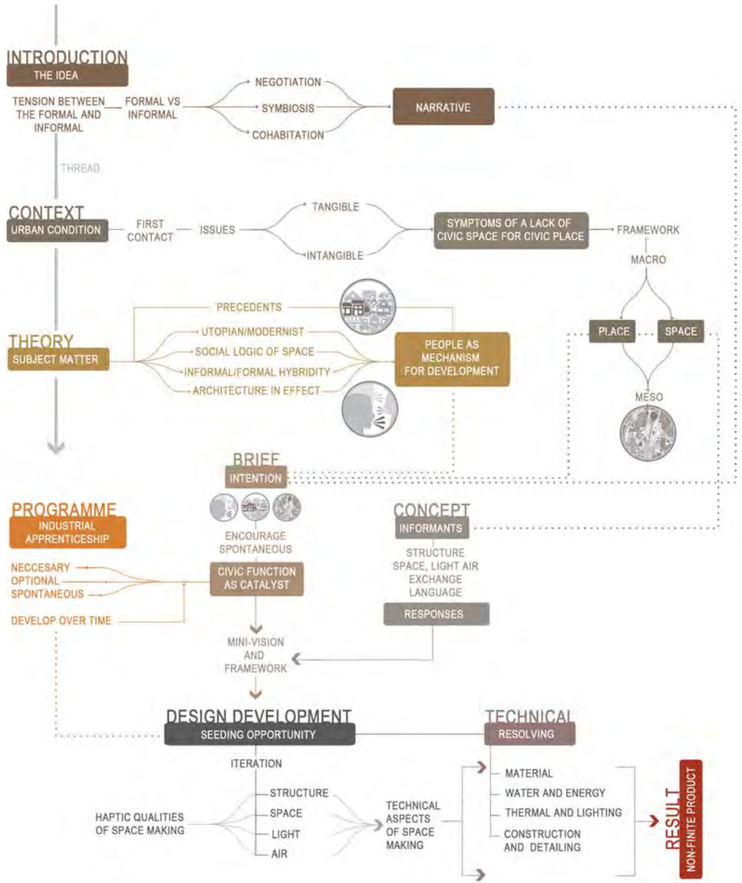


Fig 01-8 research methodology expressed as a linear process (Author, 2014)

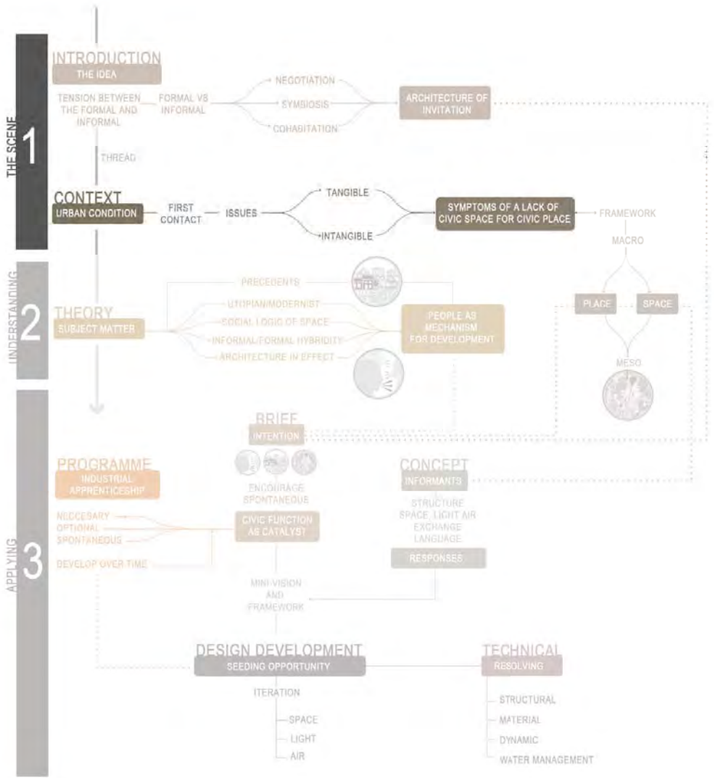
09 METHODS AND METHODOLOGY

The research process for this project developed from discovering the site, Mabopane. On first contact with the site, an idea was generated, and was later investigated and explored. The method of investigation is based on the presentation of research leads. Discovering the site conditions lead to a synthesis of an architectural issue and an urban issue to provide the clues necessary for an architectural brief and, in turn, for a programme, concept and solution to be generated. The design solution in itself is not finite and should anticipate multiple interpretations for the co-habitation of formal and informal elements.

Both primary and secondary sources will be investigated during the course of this project. Primary sources include the investigation of the edge condition of the physical fabric of the site and its contingent intangible elements. The focus will be on understanding space-making abilities (successes and failures) by both the external and internal forces and their effect on the daily life of the user. Secondary sources for data collection will be critiqued and made relevant (due to the site-specific investigation) to the specific area. Precedent studies will also form a part of the investigation so that calculated/ informed risks can be taken during the design process.

PART 1_THE SETTING

CHAPTER 02_THE URBAN CONDITION
CHAPTER 03_URBAN FRAMEWORK



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01 INTRODUCTION

Mabopane developed as a settlement, adjacent to Soshanguve, to house migratory labourers during the apartheid years. Times have changed, but the approach to the fabric has not. The need to control, formalise and limit social interaction is evident in the formal fabric that aims to suppress the informal and spontaneous nature of the settlement's inhabitants. The introduction of internalised malls and attempts to formalise taxi ranks have caused the fabric to become a hybrid of formal and informal, where the informal develops around the energy provided by the formal. This cohabitation of formal and informal, on an urban scale, is reaching its breaking point as the Municipal Spatial Development Framework (MSDF) proposes an extension of the rail to include settlements to the north of the city of Mabopane (City of Tshwane 2008) – a growing node with nowhere to go. The invasion of more formal elements into the landscape is inevitable, possibly resulting in the further suppression of the spontaneous.

Fig 02-1 First contact (Author, 2014)

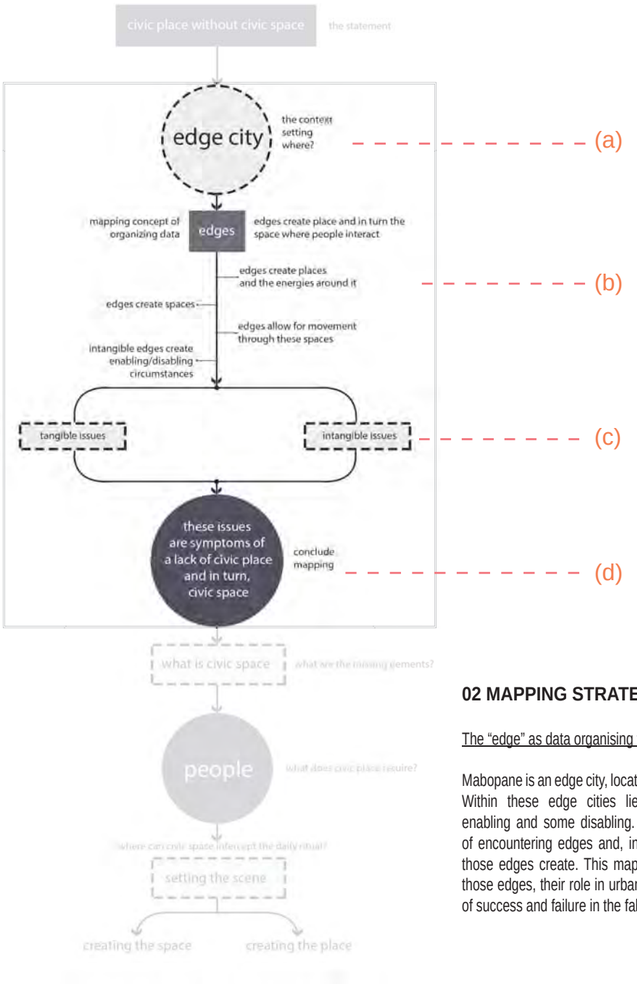


Fig 02-2 The Devolution (Author, 2014)

02 MAPPING STRATEGY

<u>The "edge" as data organising tool</u>

Mabopane is an edge city, located on the fringe of development. Within these edge cities lie even more edges – some enabling and some disabling. The inhabitants live in a state of encountering edges and, in turn, experiencing the spaces those edges create. This mapping exercise aims to discover those edges, their role in urban space-making and the causes of success and failure in the fabric's ability to serve its users.

03 THE CONTEXT

Mabopane is a peri-urban settlement located north of Pretoria, connected to the urban core by the Metro rail and subsequently fed through this life line. Once situated within a homeland (Bophuthatswana), enforced by the Apartheid government, the settlement is separated from the urban core by an industrial buffer zone and fosters the migratory labour system (Davies 1981). At the heart of the settlement lies an inter-modal transport node, aimed at creating a conveyor belt between the urban core and the peri-urban landscape.

Mabopane is currently the north most point of the Metro-rail system, but future plans include an extension that will reach and include settlements further north. The presence of the rail has shaped the daily ritual of Mabopane's inhabitants and, in turn, both the formal and informal fabric that house these rituals.

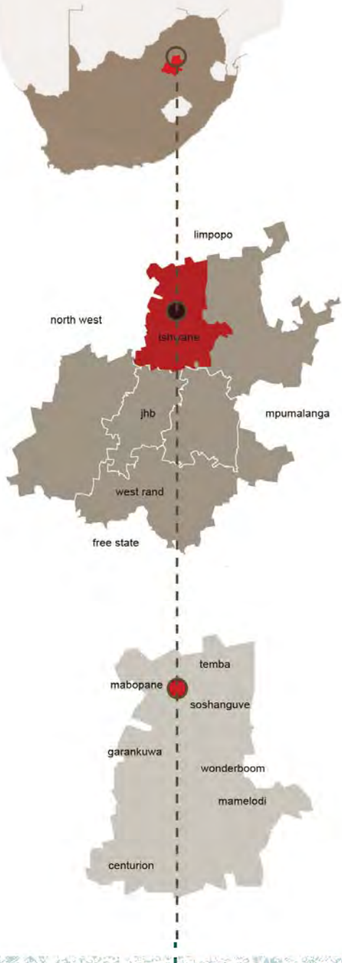
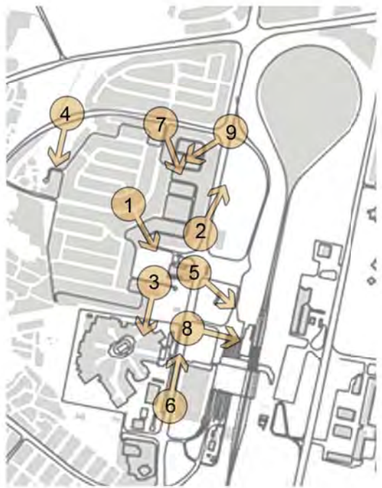
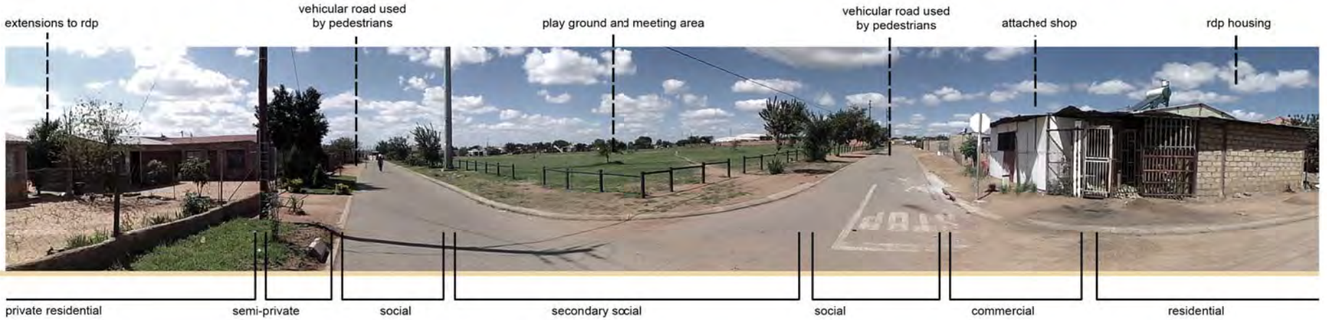


Fig 02-3 locality and infrastructure (Author, 2014)

The fabric is characterised by a collection of formal and informal solutions to housing, production, retail and infrastructure. This layering of the two different strata is what gives the community its identity.





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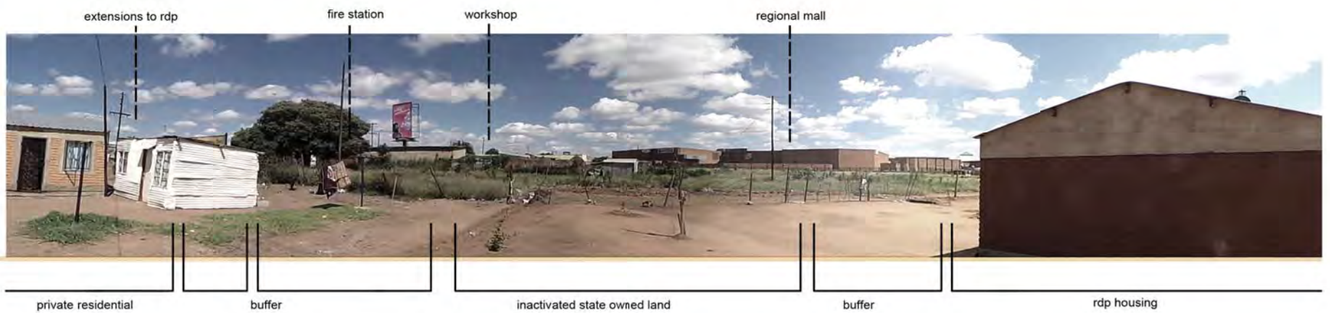

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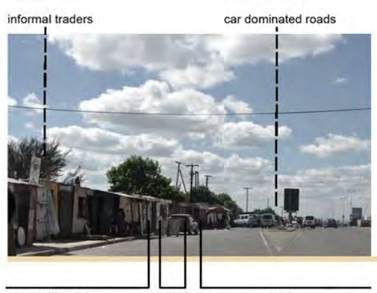

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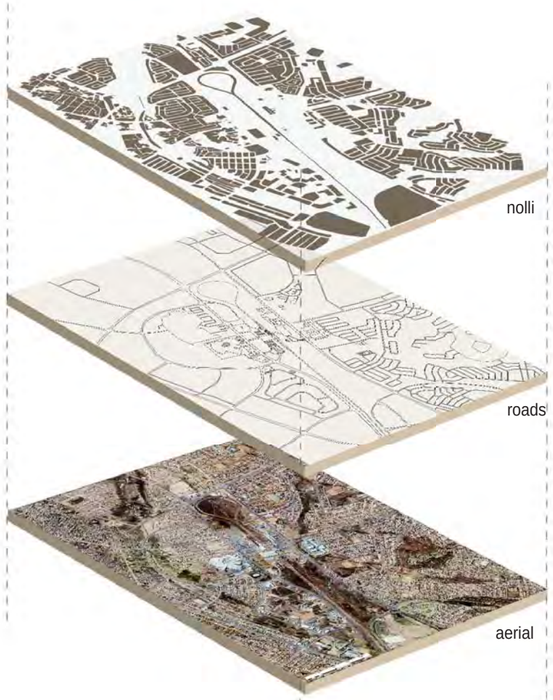
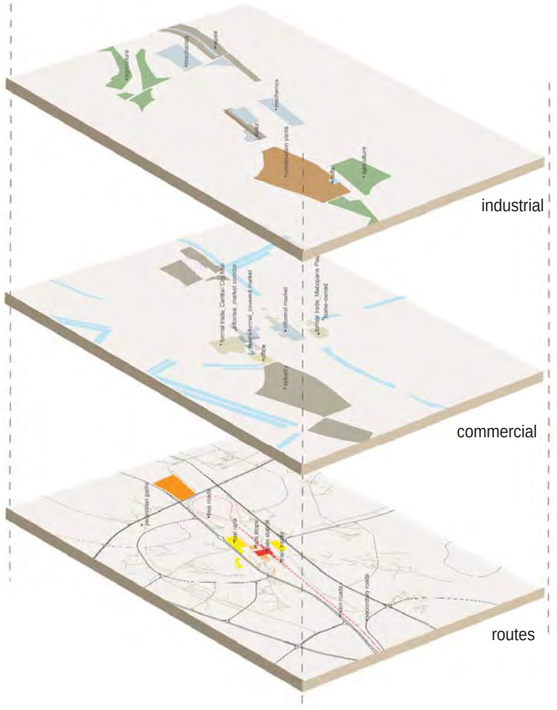
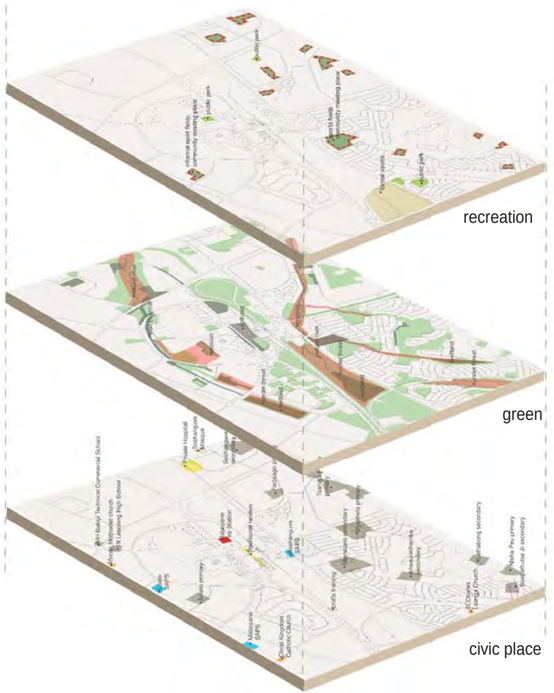
Fig 02-4 The fabric (Author, 2014)

04 CREATING THE EDGE

Edges are created by both activities and physical structures. Various layers of activities that aid in the community's survival exist within the Mabopane-Soshanguve region.







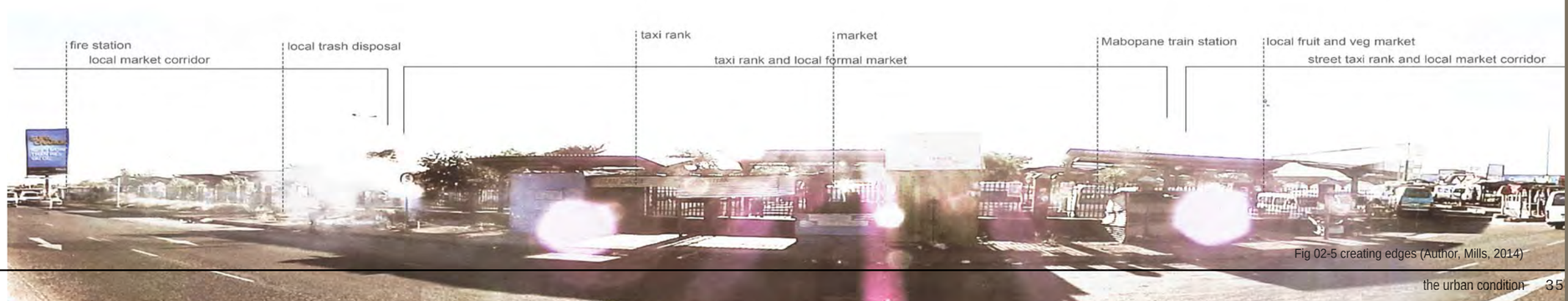
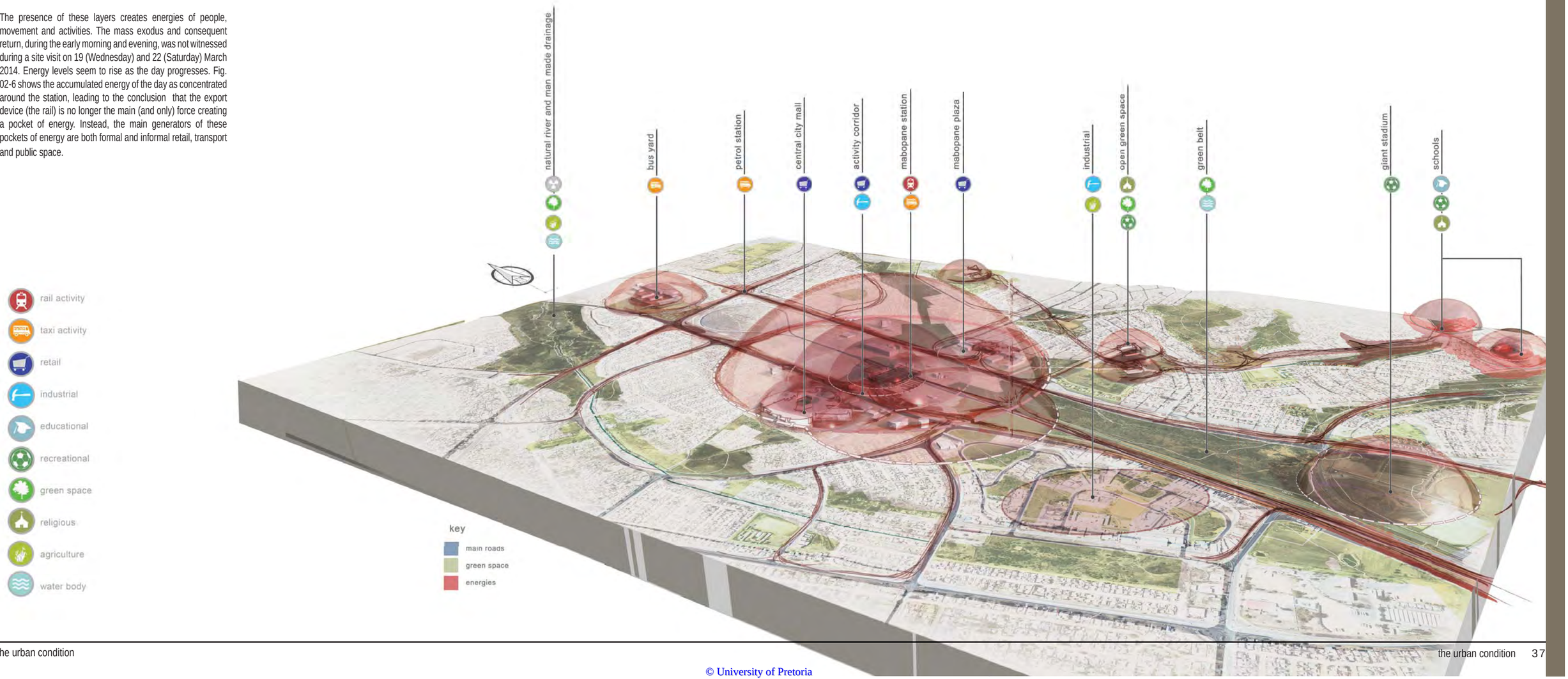


Fig 02-5 creating edges (Author, Mills, 2014)

05 THE RESULTING EDGE

The presence of these layers creates energies of people, movement and activities. The mass exodus and consequent return, during the early morning and evening, was not witnessed during a site visit on 19 (Wednesday) and 22 (Saturday) March 2014. Energy levels seem to rise as the day progresses. Fig. 02-6 shows the accumulated energy of the day as concentrated around the station, leading to the conclusion that the export device (the rail) is no longer the main (and only) force creating a pocket of energy. Instead, the main generators of these pockets of energy are both formal and informal retail, transport and public space.



These pockets of energy exist within boundaries created by the built form. The built form enables or disables the energies to grow and stretch beyond their initial boundaries, due to harsh edges. The formal built structure seems to dictate these boundaries and create the space in which the informal energies exist (Fig. 02-7). The opposite is also true, as the energies created by people mould and shape the physical environment into what it is today (Hillier & Hanson 1984).

Fig 02-7 the edge condition (Author, Mills, 2014)

The community lives in a state of experiencing edges in public life. As one moves through these edges, pockets of activity are created (Fig. 02-8). Some edges are permeable, others are harsh. Edges are space-making elements, as they dictate the use and boundaries of the spaces they enclose. The composition of edges and the rhythm of density are what create enabling or disabling environments.

Fig 02-8 movement through edges (Author, 2014)

As movement between the formal and informal environment occurs, the inhabitant experiences intangible edges. Networks of survival are formed and informed by the physical edges (Fig. 02-9). The physical edges intercept the daily ritual of these networks and encourage or discourage their diversity and strength. The networks are incomplete as edges creating disabling circumstances or a lack of appropriate space for these activities to occur. Networks are spontaneous activities which increase in intensity and strength when the space provided for them is of high quality (Gehl 2010).

Fig 02-9 intangible edges (Author, 2014)

06 MAPPING CONCLUSION - THE TANGIBLE AND INTANGIBLE

Analysis of the edge conditions has led to the identification of a series of tangible and intangible issues (discussed in more detail below), including mono-functionality, islandification, emphasis on the destination rather than the journey, and limited green space. In addition, the tangible fabric has resulted in intangible edges, namely disconnection between internal and external knowledge; reliance on external industry and training; lack of community identity; and separation between suburbs .

The tangible issues:

Mono-functionality
"Mono-functionality" refers to the idea that external initiatives are designed to exist in a specific time of day, disregarding the daily rituals of the users. Zoning has led to strict demarcations of residential, industrial and commercial development. The informal/ interior initiatives try to bridge these gaps and introduce a variety of functions in a single area. The scaling between the formal and informal activities seems to be out of equilibrium, as external initiatives aim to trump spontaneous development.

Islandification
Due to the security risks of an informal settlement, external initiatives rely on introverted structures to limit access. In the process, the built form exists as an island on its own and an object in the landscape instead of as an interacting element ("islandification"). The industrial sector is thus isolated from the rest of the settlement by hard edges, which might limit the transfer of knowledge between workers and prospective students of the trade (that includes auto repairmen, carpenters, welders etc.).

Emphasis on the destination, not the journey
Where emphasis is placed on the destination rather than the journey, the route to the destination seems undefined, which causes friction between the walker and the environment he or she experiences: a place is present, but lacking in space around it.

Limited green space
Accessible public green space plays an important role in social and religious gatherings. However, the encroaching residential development is limiting the existing green space or making it hard to access, and thus threatening what little green space remains, as well as the fragile drainage system for these green spaces.

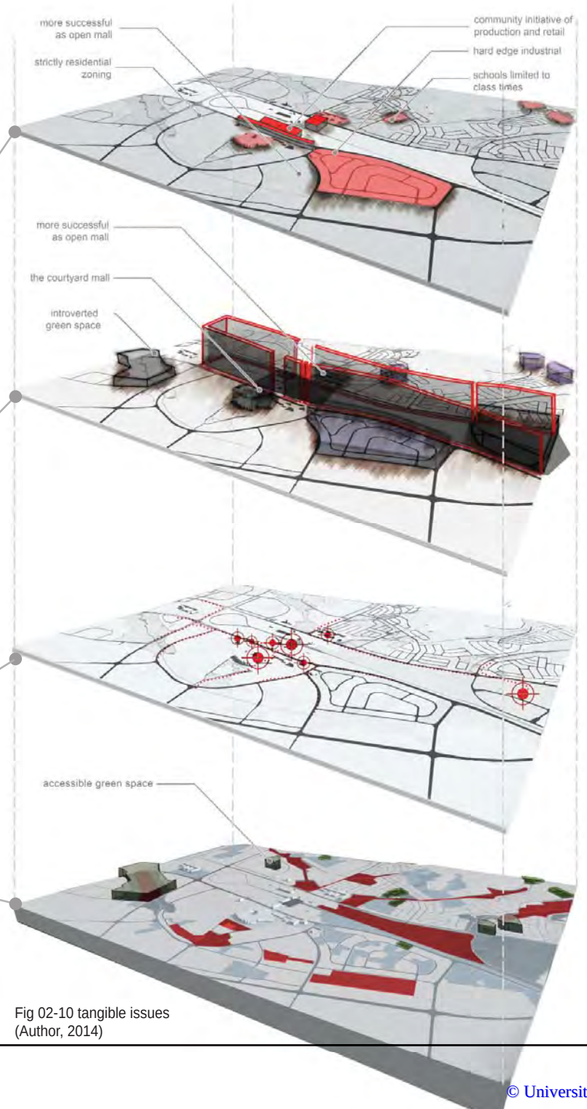


Fig 02-10 tangible issues
(Author, 2014)

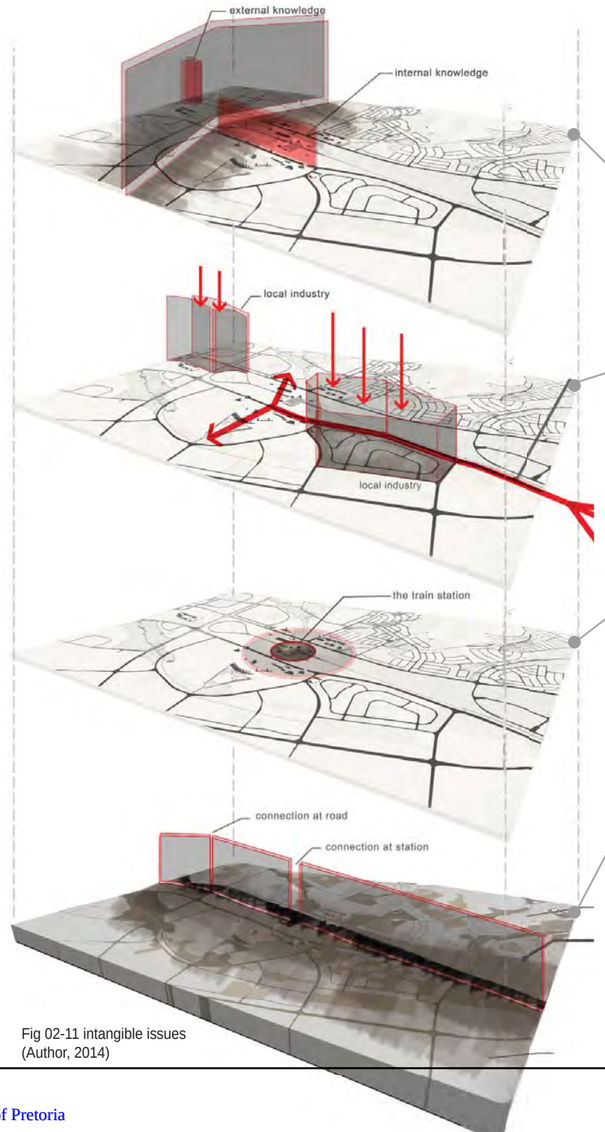


Fig 02-11 intangible issues
(Author, 2014)

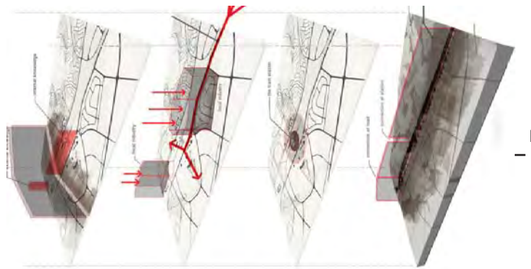
The intangible issues:

Disconnection between internal and external knowledge
There is a limited understanding of – and transfer between – internal and external knowledge by both western and traditional professionals.

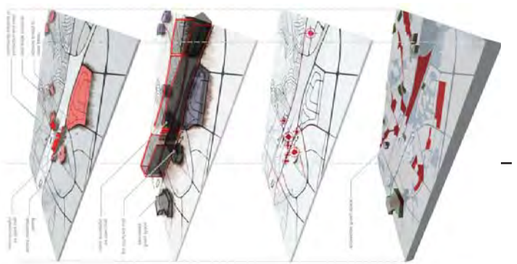
Reliance on external industry, training
Locally-owned industry is limited, which results in the community relying predominantly on external industry for goods and services. This reliance on external sources means that funds are channelled out of the settlement rather than benefitting the existing economic networks. The community relies on training and education from external sources, which leads to traditional and survival skills not being shared or taught by and within the community.

Lack of community identity
The community's survival is defined by the station itself, the activity within the station houses and the edges the station creates. The fabric of Mabopane does not provide the community with a place where they can define their own survival and, consequently, their identity.

Separation between suburbs
Fragmented patterns within the landscape leads to a separation of adjacent communities. The limited connection between communities results in limited transfer and sharing of networks of survival, resources, skills and knowledge.



INTANGIBLE ISSUES



TANGIBLE ISSUES

These tangible and intangible issues are merely symptoms of a larger issue: the lack of civic place and civic space.

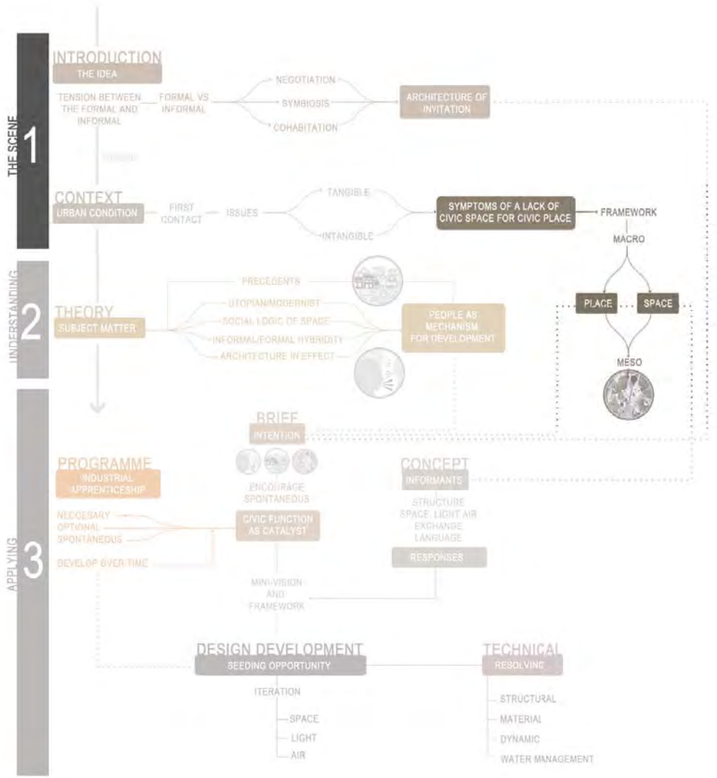
“Civic spaces are the foundations for great cities. Apart from distributing a level of stewardship among diverse groups, civic spaces provide neighborhood identity, support local economies, help the environment, provide settings for cultural and social activities, and connect communities”

- Arroyo 2010

URBAN ISSUE

civic place without civic space

Fig 02-12 intangible and intangible issues as a symptom of a lack of civic elements(Author, 2014)



03 URBAN FRAMEWORK

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- the route to promote life
- setting the scene
- building_the public servant

06 CONCLUSION 67

WHAT THE SCENE HAS TO OFFER

urban vision

adjusting the fabric to be an agora

01 INTRODUCTION

Before the framework can commence, some further investigation is required to understand the meaning and purpose of civic elements and the space leading up to them (a), and to discover what energies and elements are required to create functional civic space (b). Once the toolbox for civic space has been identified, a strategy must be developed to set the scene for the creation of these places (c) incorporating both the destination (place) and the route (space).

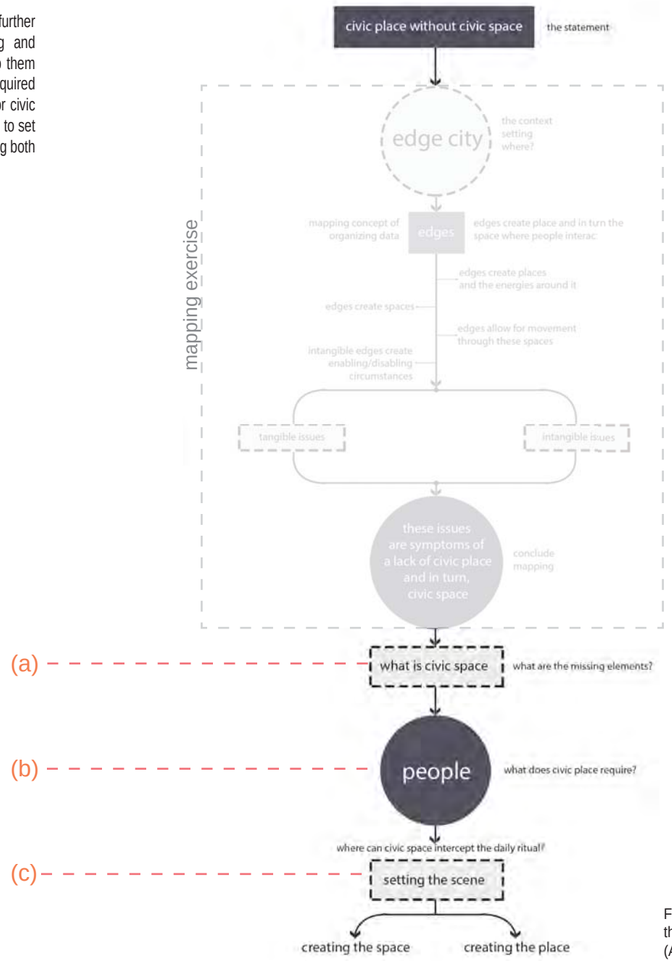


Fig 03-1 the devolution of the framework development (Author, 2014)

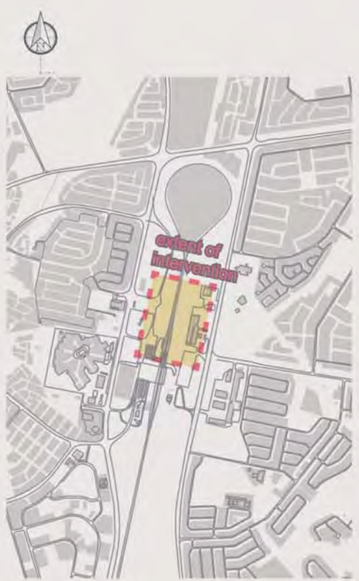
02 EXISTING FRAMEWORK CRITIQUE

Two proposals for the Mabopane-Centurion Development Corridor were produced for the Mabopane precinct. Both proposals failed to address the main urban issue: a lack of civic space. This document applied three lenses when analysing the proposals commissioned, based on the theories put forward in the following works:

1. *Pattern Language* (Christopher Alexander, 1977)
2. *The City Shaped* (Spiro Kostof, 1999)
3. *Image of the City* (Kevin Lynch, 1960)

The first proposal was put forward by Alexander Designs CC, which proposed a framework concept for the Mabopane station precinct in 2004. Criticism of the proposal focused on the fact that it was:

- Limited to the precinct;
- Finite in nature as growth is limited;
- Insensitive towards existing activities and fabric; and
- Formal in nature – i.e. an island of buildings



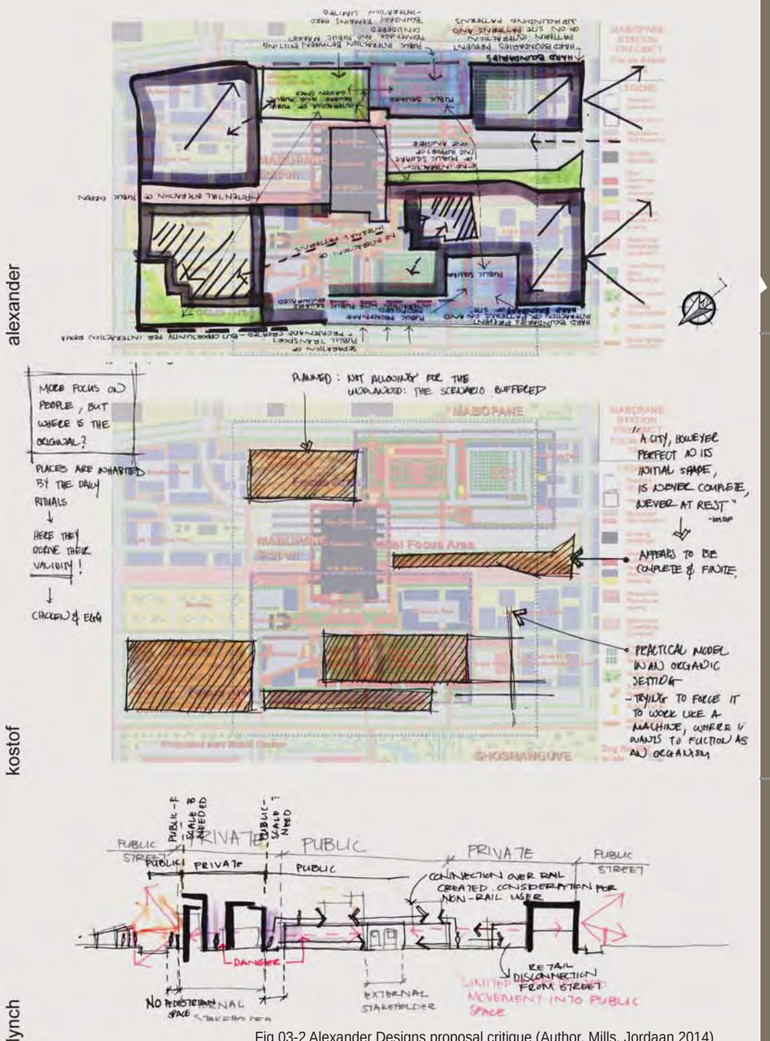
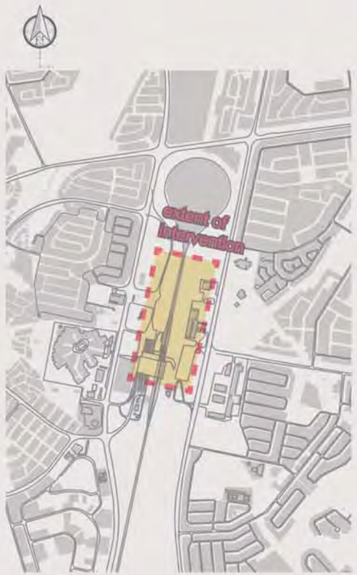


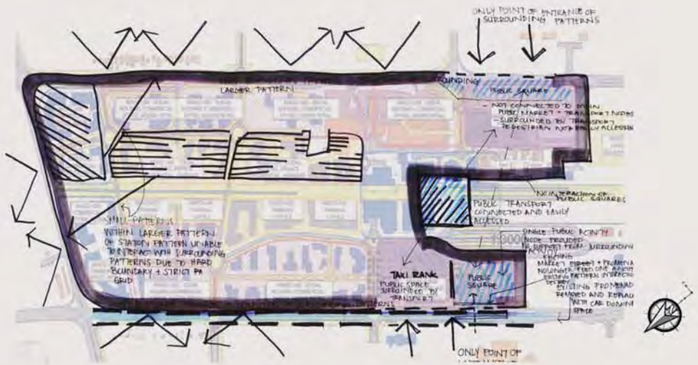
Fig 03-2 Alexander Designs proposal critique (Author, Mills, Jordaan 2014)

The second proposal was by Holm and Jordaan Architects, who proposed an intervention in 2008 after a proper brief had been provided by the City of Tshwane Municipality. However, the brief was vague, not site-specific and overly broad in its intension. Criticism of the proposal focused on the following:

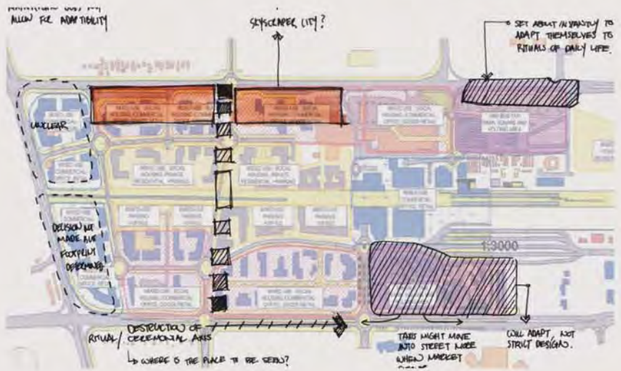
- Although somewhat more extensive than Alexander Design's proposal, itwas nevertheless still limited to four boundaries;
- The proposal contained the harsh thresholds and uninviting boundaries of an elitist precinct;
- Patterns were not allowed to interact with the surrounding fabric; and
- It was a finite solution with site-inappropriate elements.



alexander



kostof



lynch

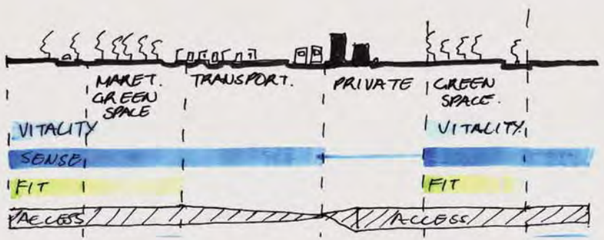


Fig 03-3 Holm and Jordaan's proposal critique (Author, Mills, Jordaan 2014)

physical location and physical fabric of the civic service

civic place without civic space

people's movement to the place and their interaction with each other and the place.

03 FRAMEWORK CONCEPT

From the mapping exercise it can be concluded that the tangible and intangible issues are symptoms of the larger problem of a lack of space for civic life. The framework (from macro to micro) is concerned both with creating the civic place and providing the missing civic space around these existing civic places.

Why create civic space?
Civic space and place act as an extension of a community, serve the community, act as a stage for public lives and are the "front porch" of public institutions. Civic space also contributes to community health (Project for Public Spaces 2013):

- socially,
- economically,
- culturally, and
- environmentally

Civic space and civic place are interdependent: civic space provides the setting for civic place to function. They go hand-in-hand with public space that acts as a facilitator of the two. This stands in strong contrast to the modernist idea of buildings that exist as islands in the landscape (Fig. 03-4a) and that reject the value of the urban life between buildings (Gehl 2010 p.4)

Currently, while there is civic place in the form of the station, the surrounding malls, etc., the space around these civic elements is poorly (if at all) defined and largely unsuitable for civic life (Fig. 03-4b).

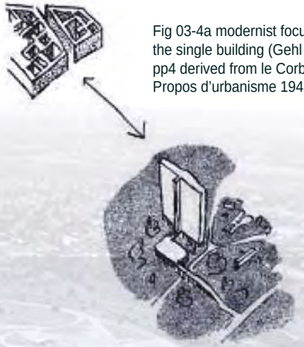


Fig 03-4a modernist focus on the single building (Gehl 2010 pp4 derived from le Corbusier Propos d'urbanisme 1946)

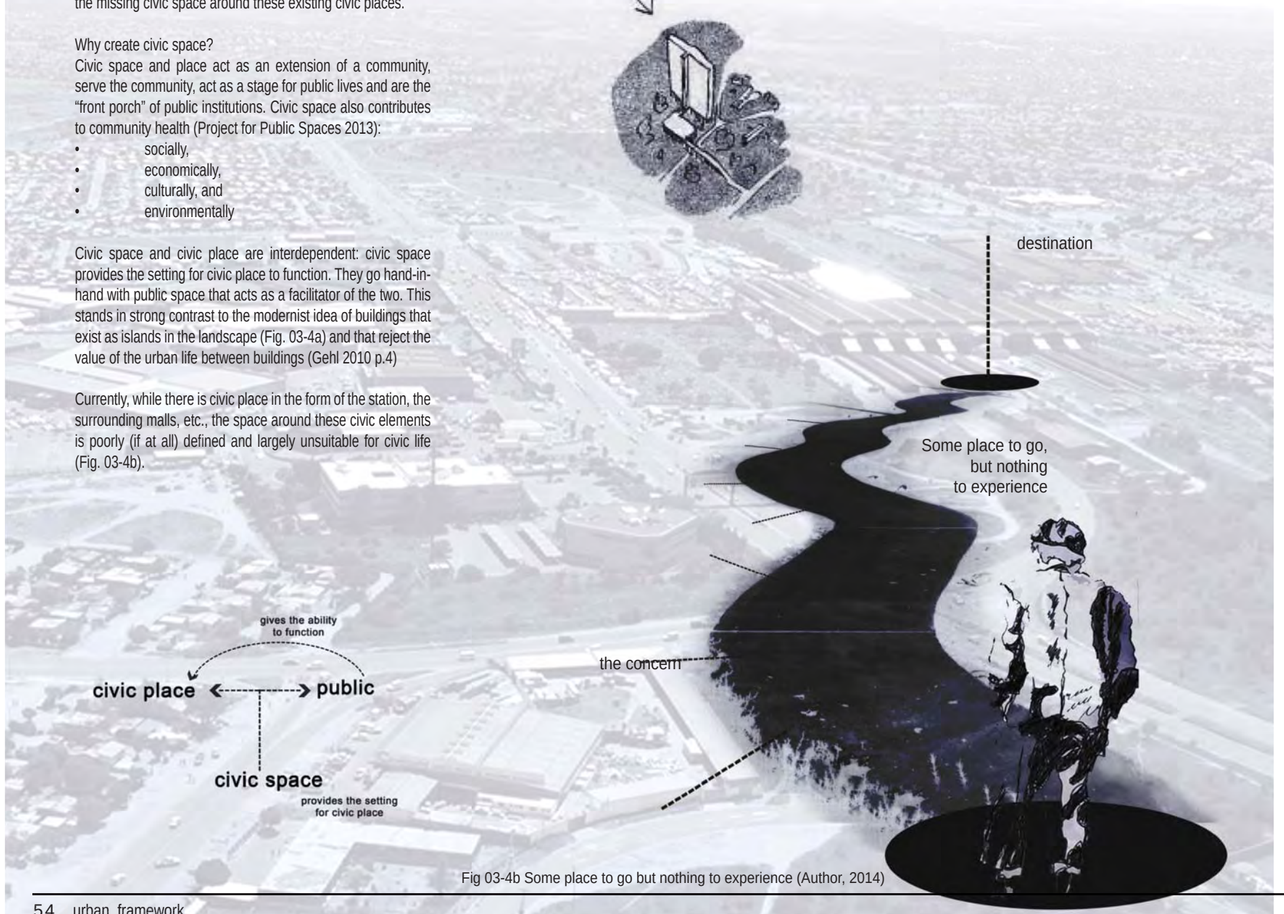


Fig 03-4b Some place to go but nothing to experience (Author, 2014)

A basic civic toolkit was created in order to understand the hierarchy and connection between civic spaces (Fig 03-5). These civic spaces and places have the potential to anchor the community (Gehl 2010).This is what the community requires to function as a thriving city instead of a settlement in limbo on the fringes of development

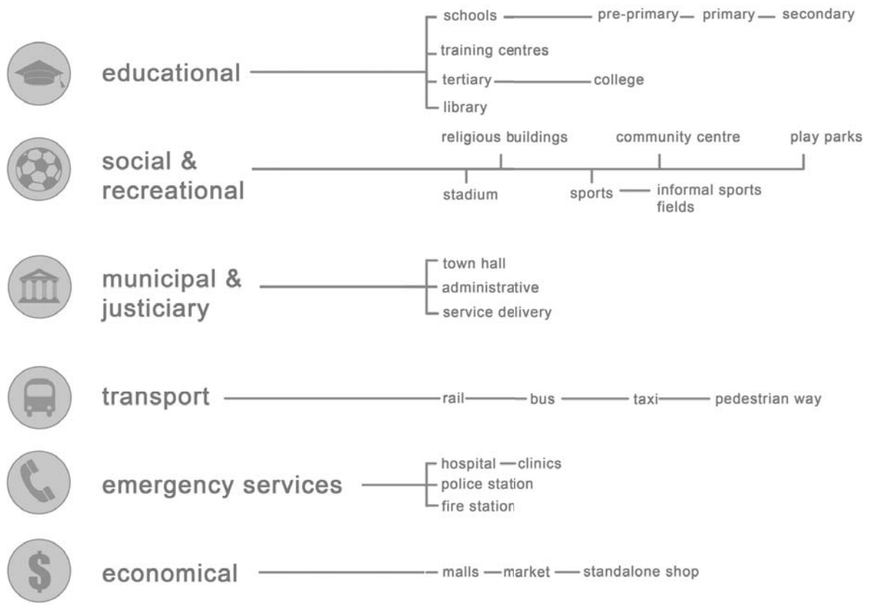


Fig 03-5 The civic elements (Author, 2014)

04 MACRO SOLUTION

The macro solution (Fig. 03-6) allows the existing node (the station precinct) to grow and mature into an “agora” that serves the surrounding community. Future plans for the sports stadium to the south aim to use the healthy, growing node and the energy of the “agora” to heal and support a node that might otherwise be problematic and unactivated . A promenade has suggested as a way to connect the two nodes in order for them to feed off each other’s energies over time. The incremental design aims to layer space (as zoned) between the two nodes and allow activities to grow, merge and exchange between the two over time to create an integrated whole.

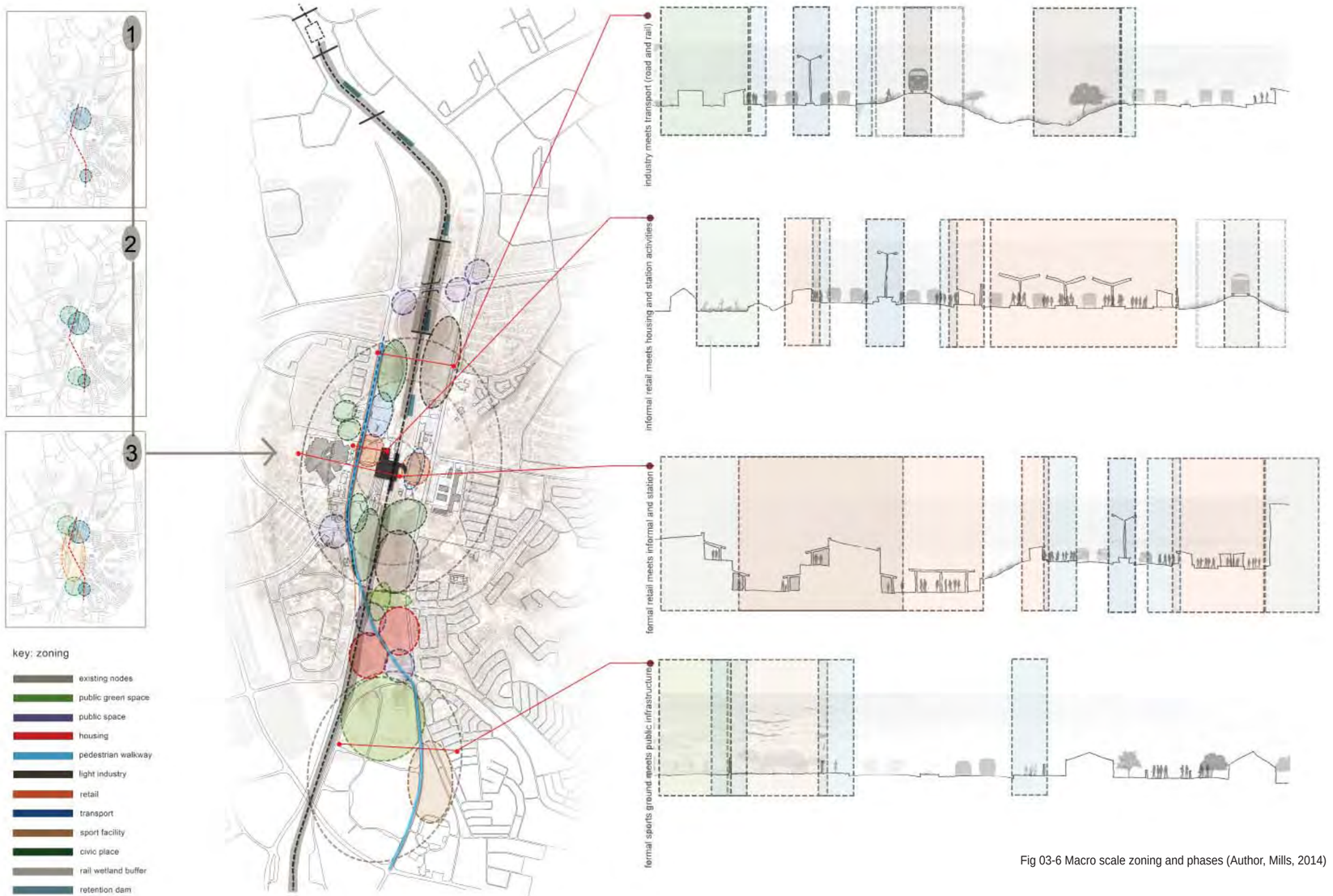


Fig 03-6 Macro scale zoning and phases (Author, Mills, 2014)

05 MESO SOLUTION

Modernist principles have often ignored the life between buildings (Gehl 2010), the part that is public and less programmed to serve a specific function. Gehl proposes in his publication Life Between Buildings (2011) that designers must first design for life, then for space and only then buildings, as “the other way around never works”.

Within Mabopane, life has been identified as the movement of people through their daily rituals. Here, tension exists between the three main modes of transport – pedestrian, train and taxi – since the physical environment creates disruptions and dangerous contact points between these three transport modes.

The space to practise social activities is lacking because of the saturated nature of the precinct and the conveyor belt-like system of movement. The opportunity for people to be static and engage with each other on a meaningful level is limited.

As is the case with most informal settlements, the civic buildings that are present in Mabopane are there to help the community survive. They are intended only to provide basic civic services, and do not move beyond administrative, transport and emergency services in function.

Fig 03-7 Life, space and building according to Gehl 2010 (Author, 2014)

In order for the civic setting (the space) to be created effectively, the missing civic functions need to be identified.
Within the toolkit (Fig. 03-5), a series of elements were identified and questioned regarding their relevance to Mabopane. The existing civic elements were eliminated in order to summarise the need (Fig. 03-8). The elements were arranged from high to low importance order elements.

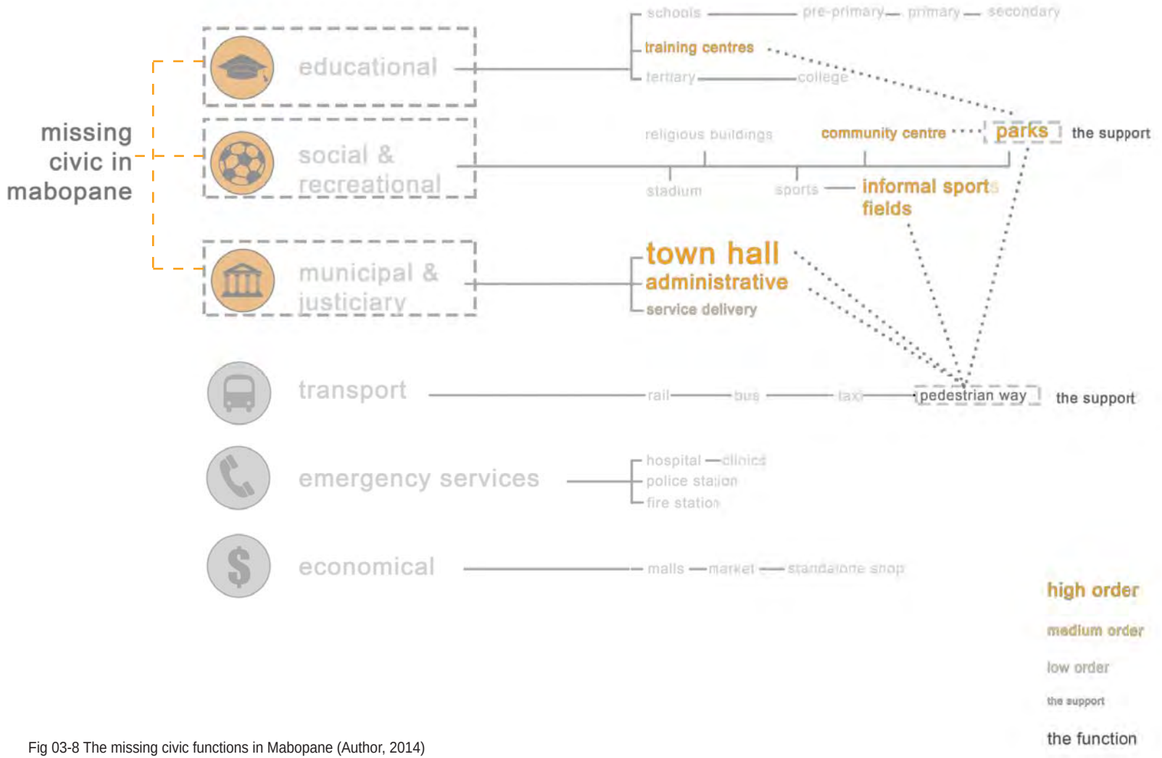


Fig 03-8 The missing civic functions in Mabopane (Author, 2014)

The route to promote “life”

Life in Mabopane depends on the movement of people. The route pedestrians and taxis need to follow towards the existing civic elements becomes important as there is conflict between the three modes of transport– pedestrian, taxi and rail. However, since both the pedestrian and taxi systems are dependent on the rail system, the majority of conflict occurs between the pedestrian and taxi modes.

“There has been a movement trying to win back public space for people activities in many cities. In our modern society we have to accept the cars and trucks in cities, but the challenge is to create a balanced city environment where people in cars, people on bikes and people walking can coexist” (Søholt 2004).

Taxis and pedestrians

Despite the interdependency between the pedestrian and taxi systems (taxis go where the people are and vice versa), there is constant conflict between the two, due primarily to the taxi-oriented nature of the road. While taxis can pick up more people in the formalised taxi rank, taxis tend to try and get as close as possible to the drop-off points for their passengers, which turns the taxi rank into a parking/ waiting zone, while the road becomes the drop-off zone, obstructing traffic and making it unsafe for pedestrians attempting to cross the roads or walk along the islands.

By pulling off from the road onto the island separating the two (or more) lanes of traffic, the taxi is situating the pedestrians halfway to their destination, insofar as the pedestrians are let off on a safe island, which gives them time to orientate themselves and means that they only have to look out for cars from one direction. The raised surface and texture of the roads change in taxi-orientated areas in an attempt to slow down traffic.

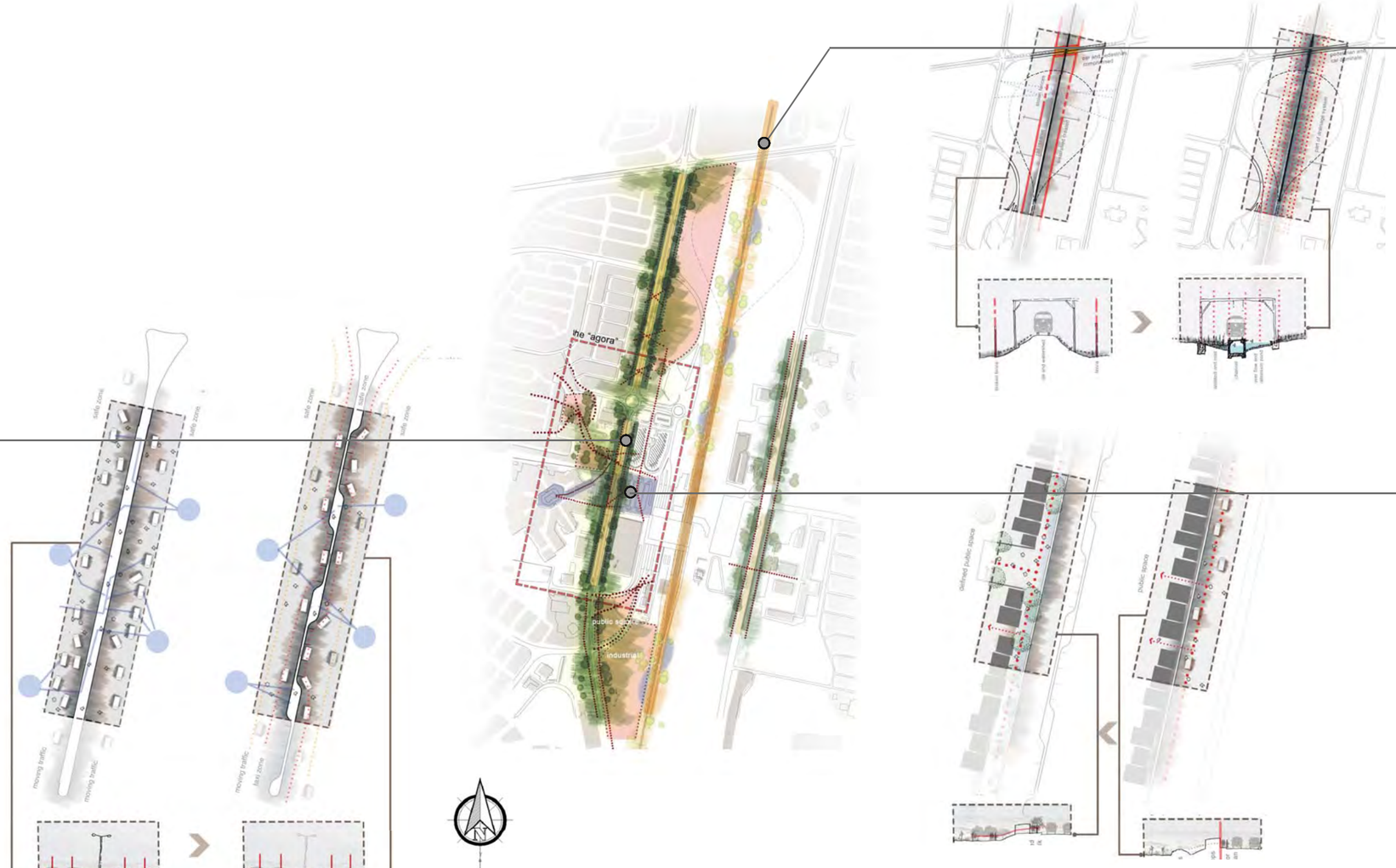


Fig 03-9 parameters of spatial treatment (Author, 2014)

The extending rail – a divide

Currently, the rail acts as a dividing element between suburbs. However, this does not mean that it is an ineffective system in certain areas; rather, the limited access to the opposite side near the market allows for the duplication of retail services on either side (which results in more income).

Further away from the station, however, this division of suburbs does become a problem as people cross the rail in an unsafe manner in order to shorten their journeys. Pedestrian crossings are then introduced to aid in the flow of people.

The extending rail also has an effect on the drainage system, since railways are often raised to allow water to run off the tracks as quickly as possible. The rail can become part of the drainage system through the introduction of wetlands, retention ponds and a canal to form a natural barrier preventing pedestrians from crossing the rails unsafely.

The sidewalk – a place where walking is dangerous

The existing system does not allow for pedestrians to move alongside the road in a safe manner. Informal shops have been erected on the edge of the streets, forcing pedestrians to come into direct contact with the taxi-dominated road.

Since moving the (in)formal shops is not an option, the aim of this project was to look for space elsewhere. Because a portion of the roads are set aside for taxi drop-offs, it is no longer necessary for the road to be so wide. Thus, the sidewalk can be widened to accommodate pedestrian space.

A form of channel-and-release is applied as the shops are set back at certain places to accommodate public resting areas. Defining these areas with street furniture will create permeability to spaces behind the wall of shops.

The human dimension – life between buildings

The core of the settlement is converted from a space where the pedestrian and vehicle are in constant conflict with each other, to a space that encourages and invites pedestrian movement. The pedestrian experiences various qualities of space, ranging from a channelling of movement to a release into larger public spaces. People attract other people (Gehl 2011). This variability in space is set out by coding a density of space that will encourage and aid ritualistic behaviour around and through civic space. This rhythm of space is informed by the pockets of civic place that form along the development spine.

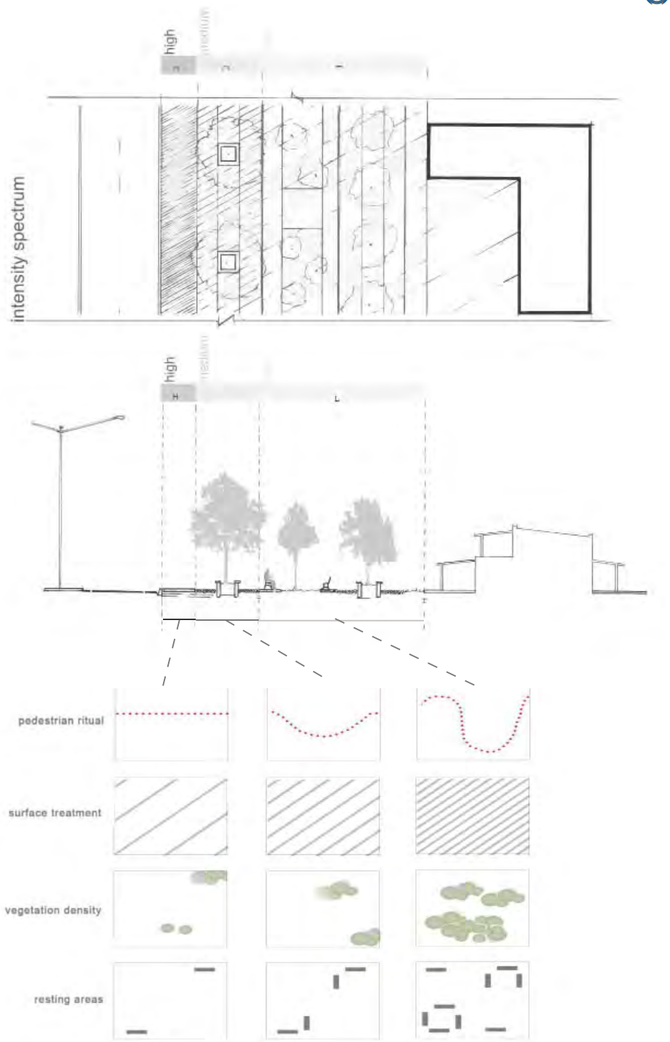


Fig 03-10a the intensity spectrum (Author, Jordaan 2014)

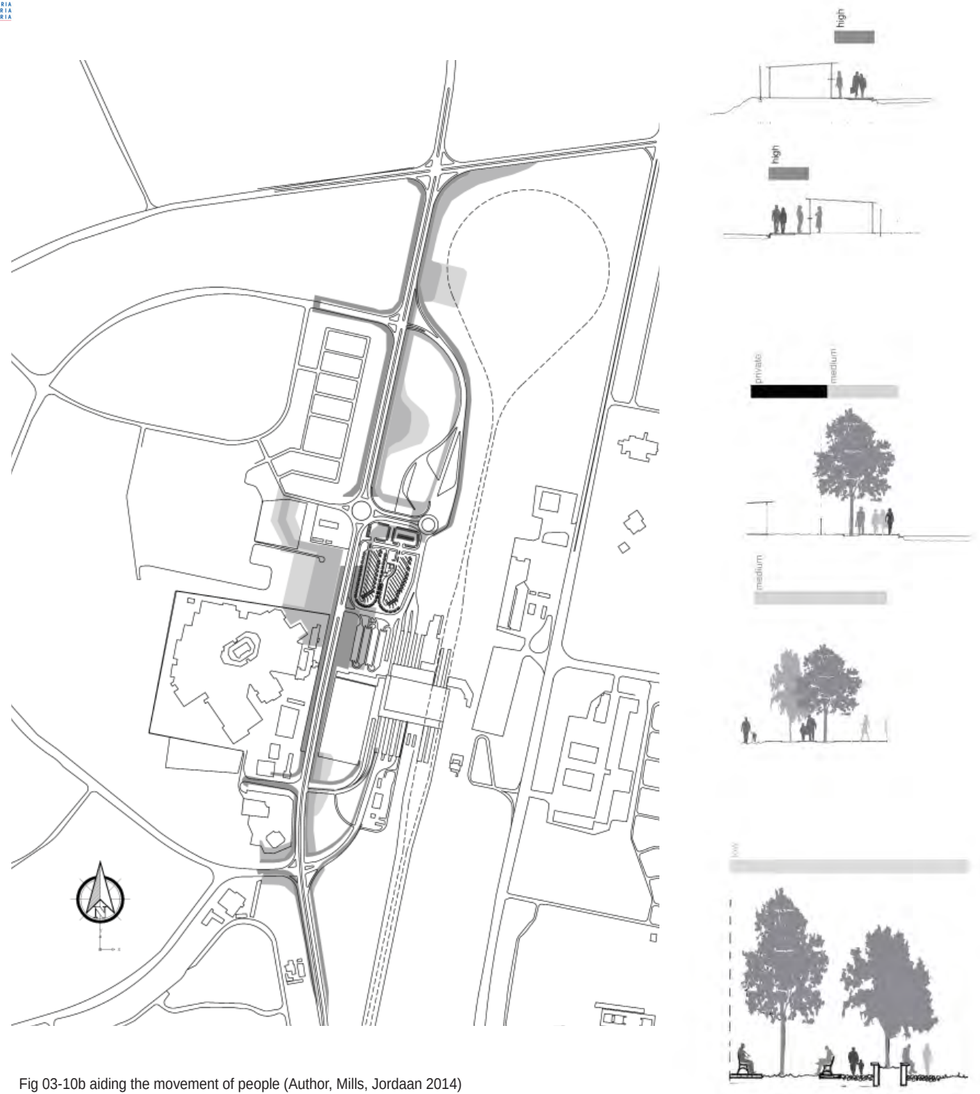
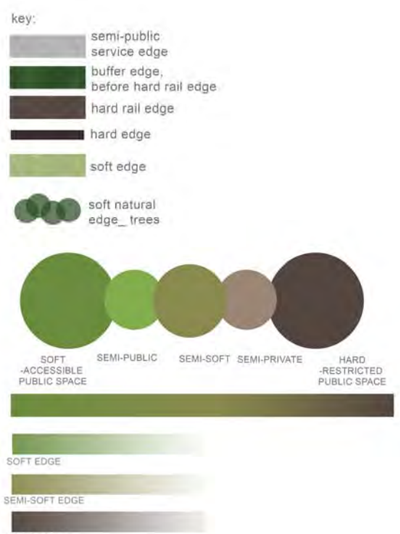


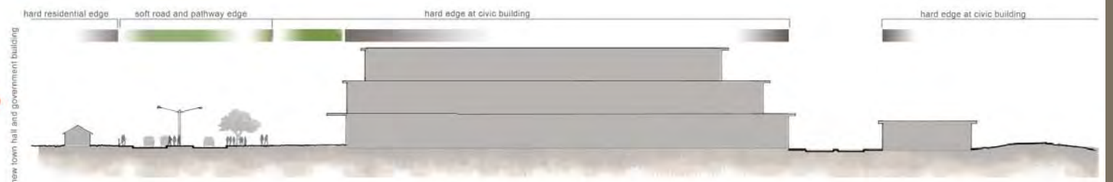
Fig 03-10b aiding the movement of people (Author, Mills, Jordaan 2014)

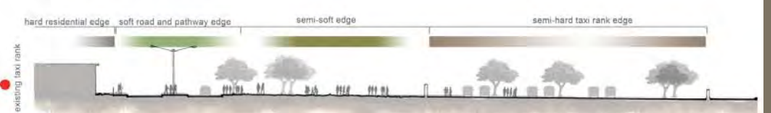
Setting the scene:

Pockets of space for social interaction are created to relieve the stress the fabric experiences during the daily ritual. Something to experience on the route is required . These spaces are created by edges, both hard and soft, and form the route to the civic place and define the boundary of the public realm.

Concept of organisation:
Edges can create both public and very private space. When considering civic space it is important to remember that public space is fully accessible and highly populated, while semi-private space belongs to the public, but access is restricted and the space is thus less populated. Semi-soft edges are the transitions between public and private spaces.







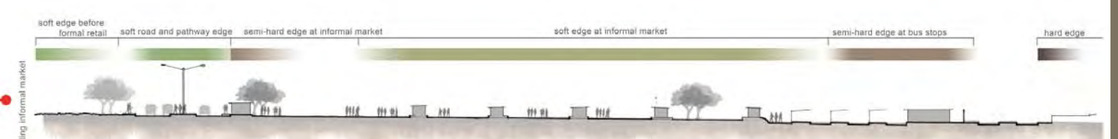


Fig 03-11 edge treatment to create a setting (Author, Jordaan & Mills, 2014)

Building - the public servant

The missing civic buildings are identified and a placement strategy is developed. Civic elements are placed using an ordering system where high order civic spaces are surrounded by medium order spaces that feed off the energy of the high order spaces. The same principle applies when placing medium order spaces: low order spaces must then feed off these medium order energies. The existing civic elements are also added to in order for architectural interventions to capitalise and expand on the existing energies.

Ordering system and height restriction:

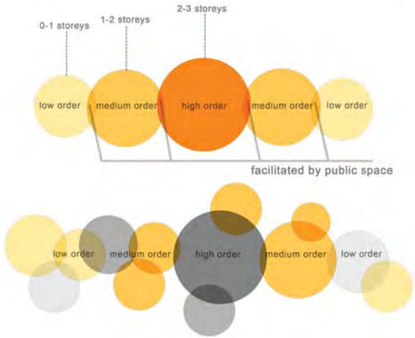


Fig 03-12 civic elements and ordering (Author, 2014)

06 CONCLUSION

The framework has now set the scene for a micro solution that will enable the generation of the brief and then a programme to illustrate the possibilities of resolving the general issue.

WHAT THE SCENE HAS TO OFFER

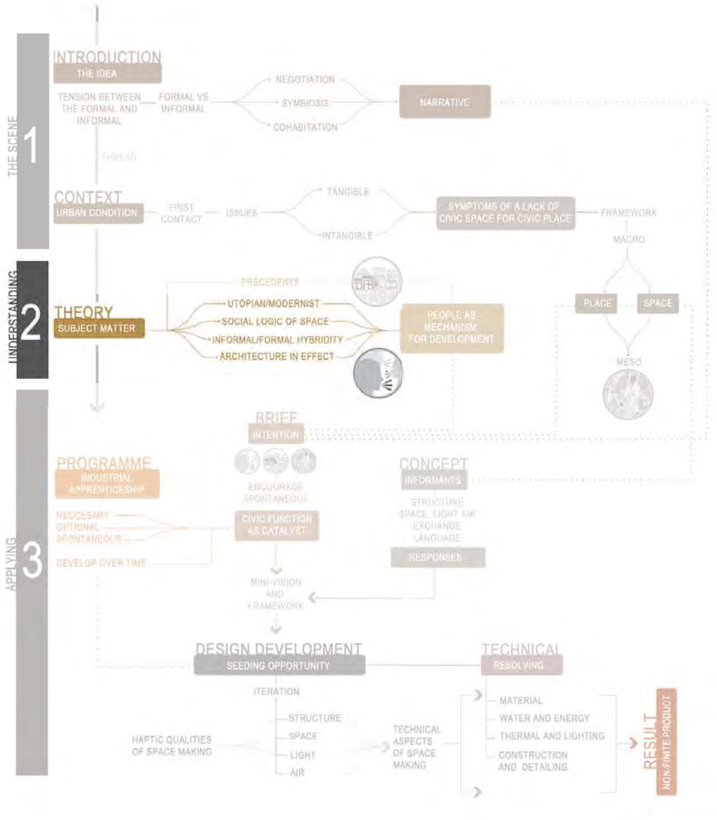
urban vision

adjusting the fabric to be an agora

Fig 03-13 perspective drawing of the urban vision (Author, 2014)

PART 2_THE SUBJECT MATTER

CHAPTER 04_THEORETICAL BACKGROUND
CHAPTER 05_PRECEDENT STUDIES



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WHAT HAS BEEN SAID
the leading lights in theory conversations on the subject matter

01 INTRODUCTION

From a synthesis of the proposed idea and analysis of the urban condition, supporting theory is selected in order to understand the subject matter more clearly. The aim is to provide background for the theoretical statements that will be used later in the document. The theory revolves around understanding the role and importance of the formal/ informal relationship, how space is informed by social rituals, what the role of the architect is, and the after effect of interventions, in order to inform a sensitive design solution.

02 HYBRID – THE IN-BETWEEN

The word "informal" was initially applied in the economic sector in the 1970s to deal with issues of legality, quantification and regulation (Meyers 2011). Since then, it has spilled over into the development sectors, particularly the urban development environment (Anderson & Jenkins 2011). According to Anderson and Jenkins (2011), the term "informal" as it is used today is often connected to "illegal", "unregulated" and "sub-standard".

In the built environment the informal is often seen as something that should be formalised or upgraded and is usually the target of informal settlement upgrade schemes. Anderson and Jenkins (2011) suggest that in all formal elements, there is a level of informality that cannot be avoided. For that reason, a sliding scale is suggested where two extremes are placed at separate ends and levels of the in-between exist (Fig. 04-1). Therefore the terms "formal" and "informal" are increasingly being queried for their usefulness in the industry (AlSayaad & Roy 2004).

"Formal" and "informal" are not two separate aspects of the environment; rather, they co-exist in complex systems of interdependency (Anderson & Jenkins 2011). This dichotomy of the formal-informal binary needs to be resolved, and Anderson and Jenkins (2011) suggest that designers need to come to terms with this interconnectedness and not try to substitute the endogenous informal environment for the exogenous formal environment.

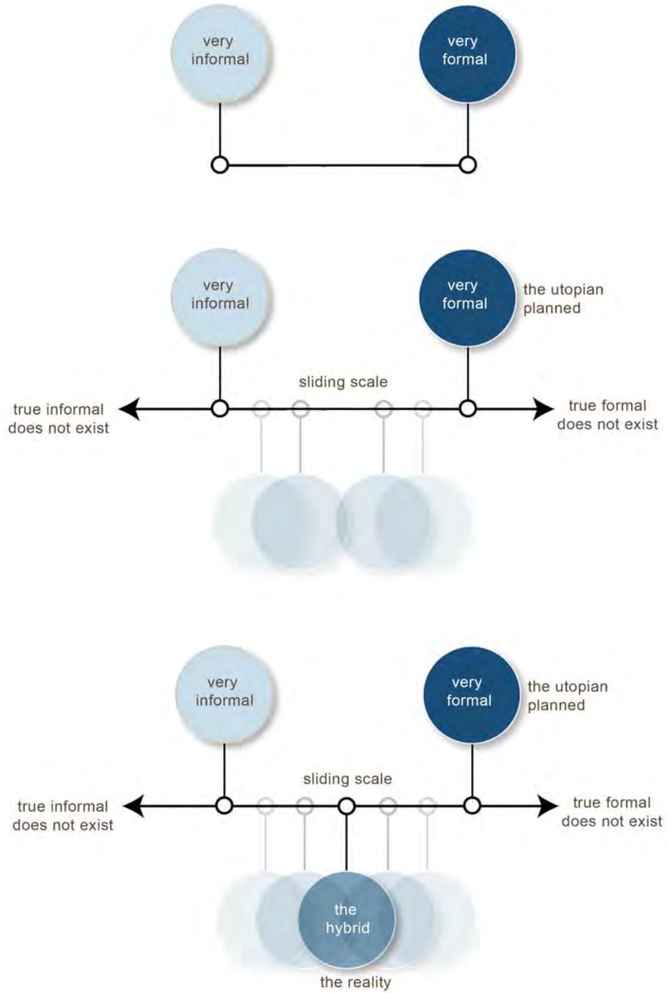


Fig 04-1 The formal and informal sliding scale (Author 2014)

Fig 04-2a Anonymous architecture inhabiting spaces around the planned in Mabopane - retail typology (Author 2014)

03 SHADOW ARCHITECTURE

Informal (endogenous) activities (driven by socio-economic opportunities) often result in the display of non-pedigreed architecture in the form of hawker's stalls, informal meeting places and sport fields, etc. According to Rudofsky (1964), these solutions to spatial shortcomings in the formal environment, created by exogenous forces, have their roots in the vernacular designs and are coined as "anonymous" architecture (Fig. 04-2a). In essence endogenous architecture in peri-urban settlements have become the new vernacular and give the community their identity in the form of typologies responding to environmental, social and economic conditions (Fig. 04-2b). Architecture of the informal is disregarded in history because of its non-pedigreed nature, and is often overlooked by the industry as a source of information (Rudofsky 1964 pp3). The result is that these informal activities attach themselves to the pedigreed and "planned" structures that arise because of exogenous initiatives. Tovivich (2009) suggests that a new "professionalism" is required to include these types of activities and built forms, and Mills (2012) advocates that architects learn from the informal processes that shape the environment.

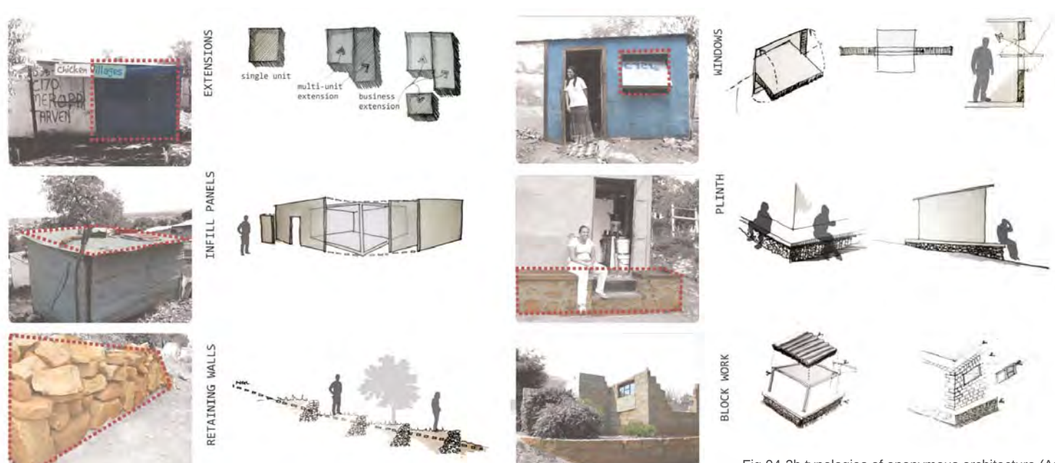


Fig 04-2b typologies of anonymous architecture (Author 2013)

04 THE LAYER OF IDENTITY

In partial agreement with authors and designers like Joubert (2009), Noble (2011) and de la Porte (Epilogue in Joubert 2009 pp442-444) , a search for a post-apartheid identity is required after the sterilised post-1994 design solutions (stripped of a social agenda), but designers seem to be contradicting their initial intentions with the end-result designs that they produce. Identity is looked for in elements that are not recognisable to the present day man; for instance, copying the aesthetic of a Ndebele hut or even the way of holding court under a tree (ex. Fig. 04-3c–3e) is in itself idealistic. These symbols are rarely understood because they represent a society that might no longer exist. The profession is in limbo, experimenting with hybrid typologies of the far past and international trends, which has led to a plethora of architectural flagships for the post-apartheid design field. By introducing too many inverse narratives into a built solution so as to accommodate multiculturalism, the essence of the contributing narratives is lost.

This document aims to question the relevance of these kinds projects and to show that there might be more visible and recent architectural languages present in the laboratory of informal development (which form part of an identity capital) that could be explored – the identity found in the current fabric, not the fabricated collective past. These images might not be as visible and iconic, but represent a reality that is found in settlements today and could be used to generate a region-sensitive design solution. The drivers of successful design might lie in achieving an understanding of the making of space and filtering that understanding through an architectural lens, rather than in the copying of a particular aesthetic

" ...There cannot be a single South African architecture –- only region-specific expression" (Fisher in Joubert 2009 pp 24)

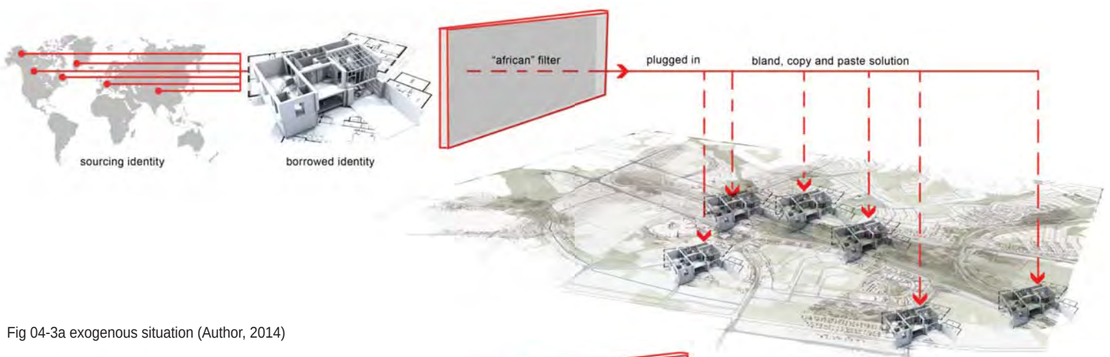


Fig 04-3a exogenous situation (Author, 2014)

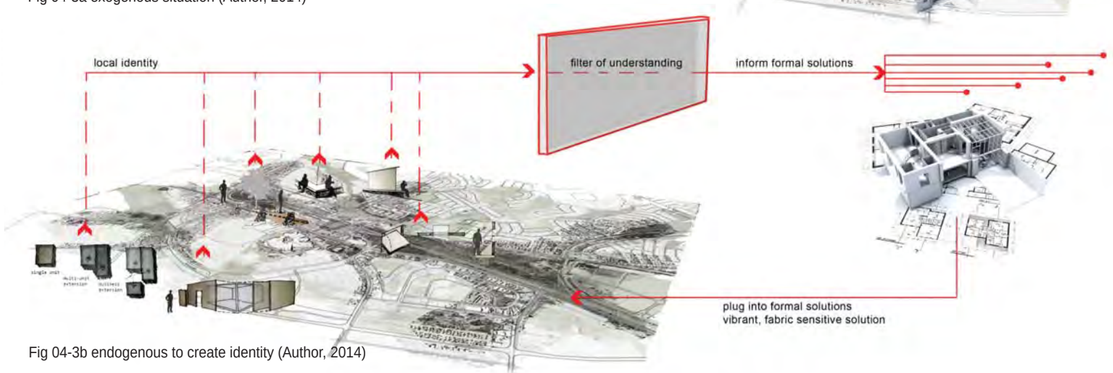


Fig 04-3b endogenous to create identity (Author, 2014)

From top down

Fig 04-3c Constitutional court (designworkshop sa with urban studios 2004)

Fig 04-3d Northern Cape Legislature (Ferreira Da Silva nd Johnston Architects 2002)

Fig 04-3e Mpumalanga Legislature Court (Meyer and Pienaar Architects 2001)

05 CHICKEN AND EGG

The question now arises: spaces for people, or by people? In informal settlements a hybrid typology is present, often obscuring which came first, the formal or the informal. The answer might be that the two developed parallel to each other. People go where other people are (Lockton, Harrison & Stanton 2009) and the built form follows this pattern.

The book *The social logic of space* (Hillier & Hanson 1984) describes a theory referred to as "Space Syntax" that is grounded in the observations of meetings and social exchanges that occur in urban spaces. The theory states that the intensity of connections at certain locations is a result of, and can be explained by, the physical features of space. The opposite is also true as social processes in turn create and lead to the creation of physical features of space. The physical environment becomes a footprint of the social processes that are layered over it (Hillier & Hanson 1984). This relationship between abstract social relations and the physical space they inhabit becomes a chicken-and-egg situation where either one could have followed or led to the other.

Space syntax theory aims to discover the intensity of social meetings/ exchanges by examining the number of "paths" or "routes" that lead to them. The inhabitant is presented with a series of choices and a mathematical system is applied to understand the most likely choice of route and meeting points. Hillier and Hanson (1984) propose that the "spatial layout in itself generates a field of probabilistic encounter, with structural properties that vary with the syntax of the layout". Lockton, Harrison and Stanton (2009) agree with this and state that design could influence behaviour, by directing people to strategic locations or providing a particular experience by influencing their social interactions. The arrangement of space-making elements (walls, windows, roofs, floors etc.) could hinder or encourage these social interactions and chance meetings, making the designer now the driver that decides on the points of contact.

Mills (2012) suggests that informality is what drives the shaping of a city and that it quickly becomes permanent and, over time, moves towards the formal side of the sliding scale. It is these meetings and social exchanges that encourage the informal to develop along the lines of maximum energy. The most basic form of informality is the hawker. The hawker aims to intercept the movement of the client, and thus situates himself on the route with the highest intensity of movement (Mills 2012), applying the concept of an architecture of opportunity. If the informal is to be invited and encouraged, a place of social meeting should be created and built in such a way that it forms a narrative with the informal activities.

> **"Something happens because something happens because something happens"**
>
> - Gehl (2011 ; pp24)

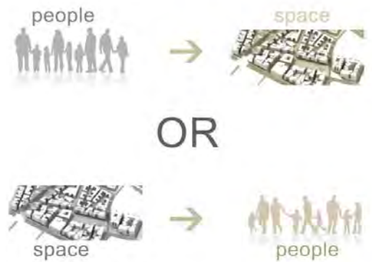


Fig 04-4 the chicken and egg situation (Author, 2014)

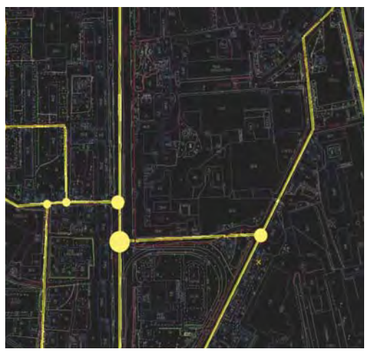


Fig 04-5 The mathematical result of the space syntax analysis (Hillier et al 2014)

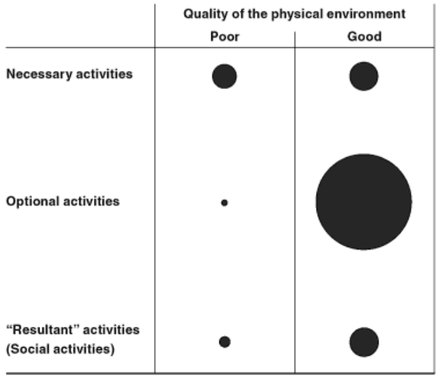


Fig 04-6 Relationship between the neccesary, optional and spontaneous activities to public space quality (Gehl 2012)

06 PUBLIC SPACE AS A FACILITATOR OF POINTS OF CONTACT

Public space could be the facilitator of the activities that encourage spontaneous development and informal solutions, as this is where the highest level of social interaction takes place. Sanchez (2011) argues that public space is the central factor of life and is where the community engages with each other and life is physically represented. The life between buildings is what creates these points of contact.

According to Gehl (2012), there are three types of activities that take place in the public realm. The first is necessary activities that drive the public space's efficiency as a servant to the community (ablutions, seating etc). The second is optional activities that arise from the provision of these necessities, and that have a higher level of informality and a lower level of planning. The third is resultant activities (social activities) that are provided for but not planned or regulated, and that incorporate the lowest level of planning. These resultant activities could be planned to some degree depending on the provided or necessary activities. Through a process of elimination the field of what the space could become is narrowed down to a few options by creating strategic spaces of resistance to unwanted activities (Cardosi 2011). Gehl (2012) created a graphic representation of the relationship between the quality of outdoor spaces and the occurrence of these activities (Fig. 04-5). When the quality of the space is good, the optional activities occur with increasing frequency and, in turn, aid in the seeding of opportunity (Fig. 04-6). Mabopane currently experiences poor quality outdoor space, and thus only those activites that are necessary for survival (informal trade) take place, and contact is limited to a modest level.

Fig 04-7 urban revitalization plan for Elda (Ecosystema Urbano 2014)

07 POSSIBILITIES OF SPACE - THE IDEA OF ACTIVITY

In de Boeck's *Kinshasa: Tales of the invisible city* (2004) the author argues that "what one needs to operate a garage is not a building named 'garage', but rather the idea of a garage". De Boeck (2004:235) goes on to say that the only material element needed to make this 'garage' was a car tyre on which the owner wrote the name of a well-known garage owner (Fig. 04-5). The presence of something – even in small or insufficient quantities (logic of paucity) – could generate activities where spaces are defined more efficiently by material absence than by its presence. Koolhaas (2002) refers to these spaces as "flex-scapes " where a flexible environment is created to accommodate what is needed at any given moment.

Space is a form of communication, a language (Lawson 2001). Certain rules and activities are expressed by the composition of a space or by what it could become. In this way a series of options is presented to the interpreter (the viewer) and the designer could effectively provide the necessary tools for the majority of options. Lawson (2001) describes space as being like "...a musical instrument that suggests how it is to be played but does not predict all the wonderful music that can be made by its owner".

Bremner (2010) published a series of essays about Johannesburg aimed at understanding the way city space is made. The author argues that spaces should incorporate both the planned and the contingent. What is expected and what is not need to constantly reassess what is possible. Bremner (2010) proposes that architectural projects need to work through human relations and with informal networks, instead of working against them.

According to Brand (1994), buildings comprise six layers, ranging from the slowest to the fastest to adapt to change: site, structure, skin, services, space plan and stuff (furnishings etc.). In order for a building to adapt efficiently over time, slippage between these layers must be made possible. Schmidt, Eguchi, Austin and Gibb (2009) add two more concepts (Fig. 04-9): social interactions and surroundings. These layers are quick to change and adapt, and are the pacemakers for the rest of the building blocks.

Brand (1994, p. 170) describes two methods of approaching a building: the first is programme based and has a finite and definite use over time that is difficult to adapt; the second is a scenario-buffered building that allows for more than one use over time without simply designing an "open building". Brand also advocates for the allowance and accommodation of the unexpected, but suggests a strategy of finding the focal use, designing for that activity and allowing for activities to attach themselves to it over time. In order to assure the longevity of a building, a tight fit must be avoided (Schmidt et al. 2009). Fig. 04-10 and Fig. 04-11 show that adaptability is manifested by balancing human, spatial and physical agency. A very loose fit will result in a building with just as problematic a relationship to adaptation as one with a tight fit.

> "All buildings are predictions. All predictions are wrong",
>
> - Brand (1984; 170)

Fig 04-8 Illustrating de Boeck's concept of the idea of space (Authorl 2014)

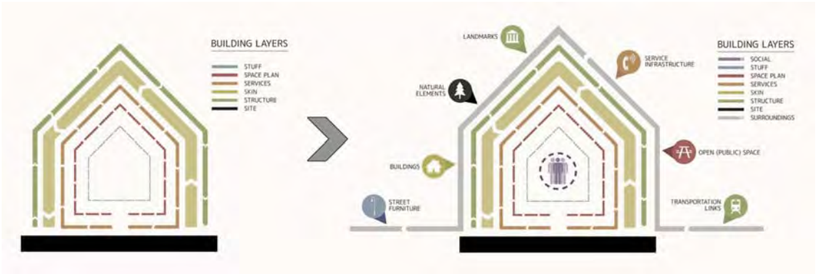


Fig 04-9 Schmidt et al. building on Brand's concept of shearing layers (Schmidt et al 2009)

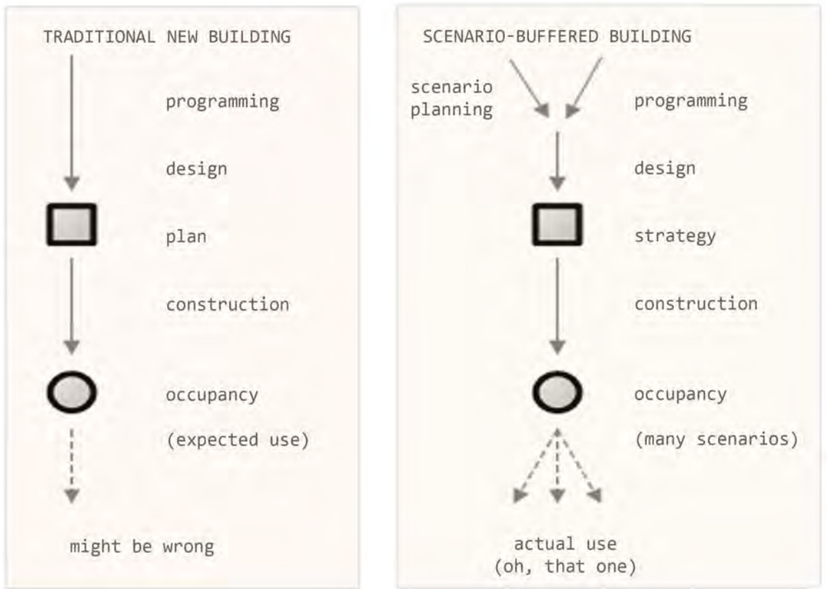


Fig 04-10 Scenario buffered vs programmed building (Brand 1994)

> " No place exists in a void and all places are inextricably a part of the relation of all sites.
> Foucault, 1986

08 POST-PLANNING : ARCHITECTURE IN EFFECT

"A city however perfect in its initial shape will never be complete, never at rest," Kostof (1999; pp13). As is the case with a city, buildings are often designed with a finite purpose in mind. However, the true purpose of the design often only emerges after the architects have left the site (Mills 2012). This is where the adaptations and re-appropriations of space take place and the true success of the project is determined. Identity is created in these processes as a layer of ownership is added to the space to reflect and communicate who the user is (Despres 1991). It is here where architecture can encourage or discourage this layering of meaning and be coined as successful or not in the informal settlement environment (Fig. 04-11).

> "Resolving the conflicts and potentials between top down and bottom up processes of urban change"
> Campbell, 2011

09 EVOLUTIONISE NOT REVOLUTIONISE

The ways in which space is used cannot necessarily be controlled, as they mutate and evolve socially over time; however, the building blocks of space remain in the form, elements, materials, details and colours of the space (Campbell 2011). Space should be dependent on both human agency and building agency as it evolves over time. Campbell (2011) advocates for the plan-design-deliver mindset to shift towards an understanding that development happens regardless of planning, thus drawing from the "chaos" of which develops spontaneously should inform solutions where human agency plays the largest role.

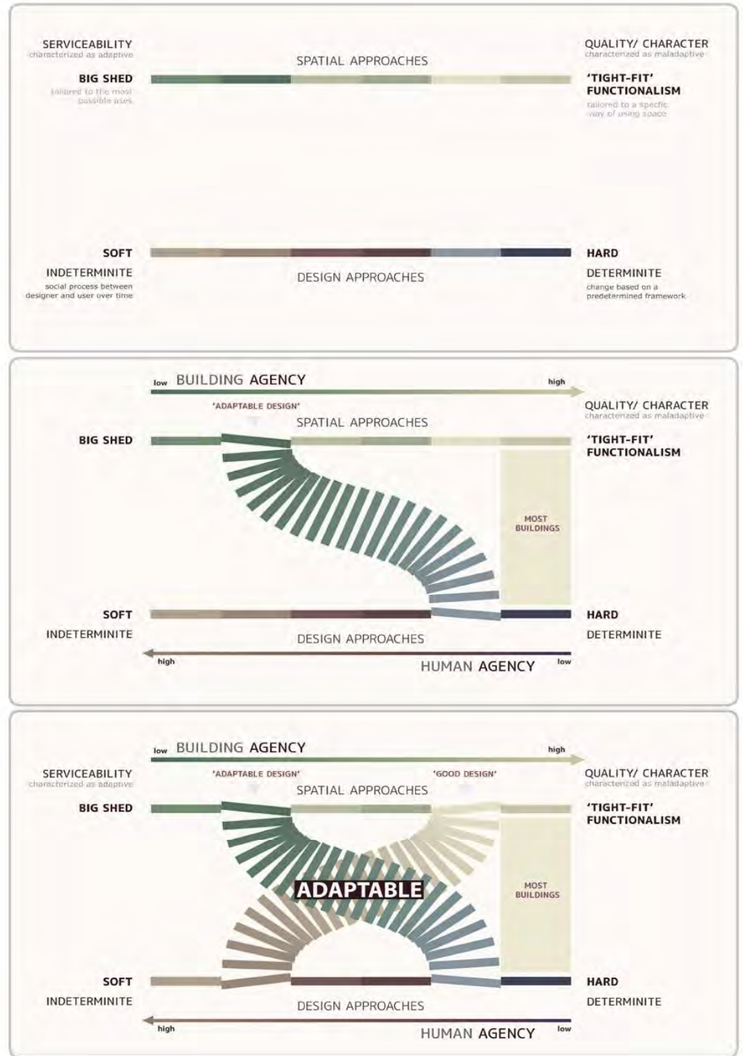


Fig 04-11 The balance between programmed and human agency driven buildings (Schmidt et al 2009)

10 THE UTOPIAN MYTH

Modernist principles and devotion to the utopian ideal have been criticised and radically challenged, especially in the late modernist period. Yet Metropolitan Spatial Development Frameworks (MSDFs) still seem to advocate these principles. The idea that a building is a machine implies that it is finite and performs a finite function, whereas (especially in informal settlements) the building actually wants to be an organism that grows, adapts and evolves over time to fit in with its surroundings (Mehrotra 2013).

According to Gehl (2012), the modernist principles of design ignore the space between buildings, as each building is situated as an island in the landscape rather than as a participatory element in a series of buildings (Fig. 04-12). The idea of a finite programme needs to be challenged as this is not the case in reality. The modernist principle of control has lost some of its relevance (Gehl 2012), especially in the context of informal settlements, where spaces attempt to adapt to activities the designer did not anticipate. This creates spaces of resistance where the natural impulse of the environment the space occupies is rejected (Cardosi 2011). This is where informal activities come under fire, as they are often evicted or moved due to urban development policies of "cleanliness". The informal relates to notions outside of the official rules set out during the modernist era. The "superiority" of modernism is the flawed utopian ideal that governs urban planning schemes (Cardosi 2011).

> "First life, then spaces, then buildings – the other way around never works."
>
> - Gehl (2012)

One criticism of the physical form of the utopian ideal is that crime is a reality. The main solution to the problem of crime that is most often applied to buildings in an informal settlement is to erect a fence, which is quickly broken down or even appropriated by others. Two strategies for creating defensible space could be applied as an alternative to erecting a fence. The first strategy is to foster an intangible connection among the community to the site. Through cultivating ownership of the site with the community as a primary stakeholder, the community is more likely to defend the space against unwanted activity within the complex social networks (Hamdi 2010, pp. 179). The second, tangible method implies an intangible message where the layering of thresholds is applied to announce the privacy level of a space. This system is advocated by Newman (1973), who suggests using a series of spatial territories that provide subtle thresholds to private spaces and that encourage surveillance as a defence mechanism.

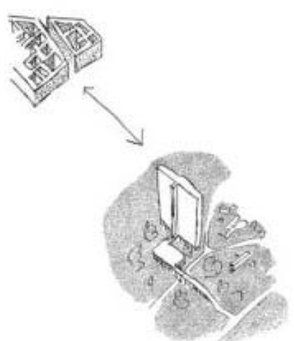


Fig 04-12 modernist focus on the single building (Gehl 2010 pp4 derived from le Corbusier Propos d'urbanisme 1946)

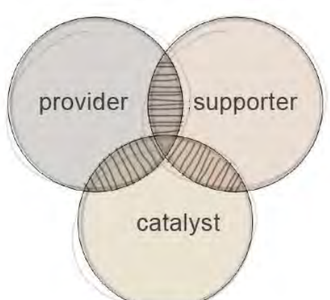


Fig 04-13 the three roles of the architect (Mehrotra 2013)

11 THE ROLE OF THE ARCHITECT

The architect needs to take on three separate roles when working for and with informal settlement communities: provider, supporter and catalyst (Mehrotra 2013). The architect must be able to slip between and cross the boundaries of these roles efficiently as he or she aims to strengthen existing networks (Fig. 04-13). Hamdi (2010) proposes that the architect bear in mind the concept of PEAS: **P**rovide, **E**nable, **A**dapt and **S**ustain (Fig. 04-14). The amount (of built environment as a "formal intervention") that is provided is project specific and will determine the success of the enablement, adaptation and sustainability. Architects must realise that they simply provide the instrument of transformation and act as a mediator between the "now" and the "possible"(Cardosi 2011). Thus, architecture is a material agent (not a provider of) for social transformative change.

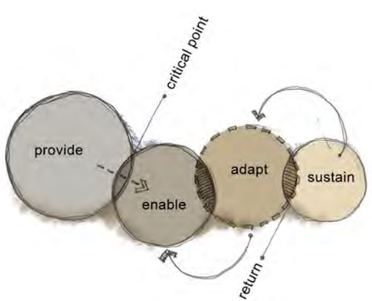


Fig 04-14 PEAS (Author, 2014) adapted from Hamdi (2010)

12 CONCLUSION

Due to their speedy development, informal settlements are laboratories for testing change. They are meant to be studied and their informal components invited to participate in and engage with formal activities. The environment created for the informal activities needs to encourage the development of informal settlements and their evolution over time as they must be considered within a selected framework.

Designers need to be acquainted with the reality of informality and, in the process, should expect the unexpected and the spontaneous, and not force it to survive in a world created for a society that does not exist (Fig. 04-14). Architecture needs to be defined not as an "it", but as an in-between stage of development, a process that is constantly undergoing change, and where a condition rather than a product is created.

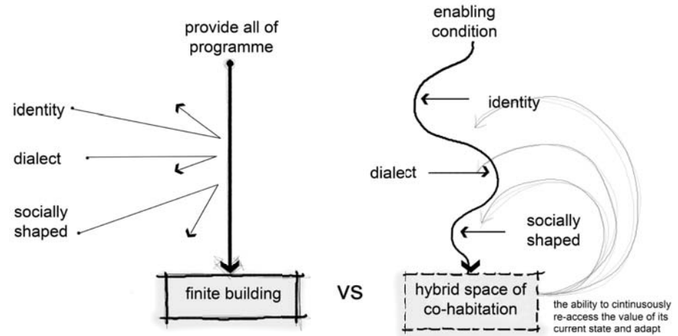
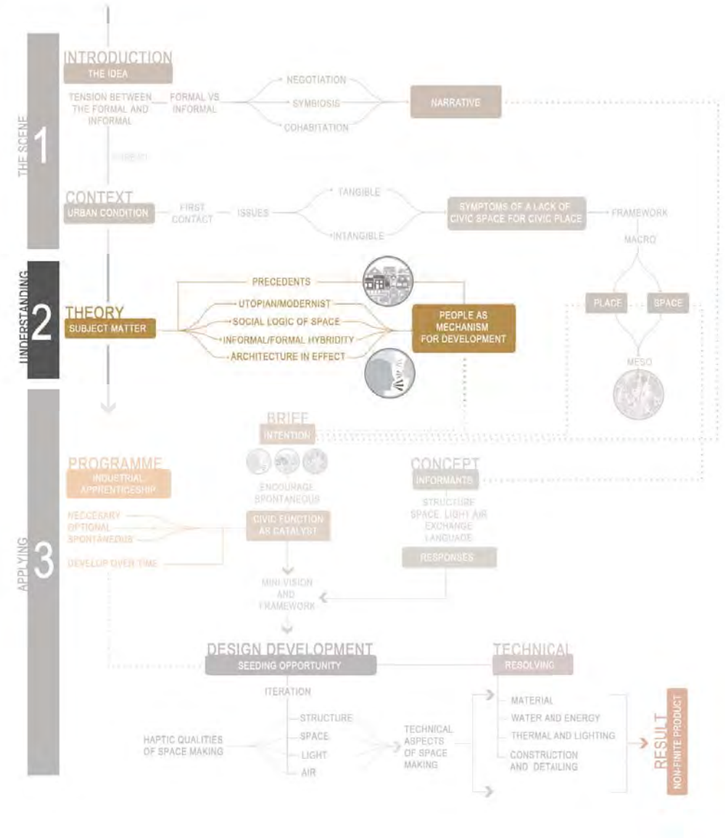


Fig 04-15 The informal is forced to live in a world that tries to contain it, a utopian idea for a society that does not exist (Author 2014)



05 PRECEDENT STUDIES

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01 INTRODUCTION

The precedent studies examined in this chapter were selected because they display characteristics similar to the ideas of the author. These studies are used as visual and functional inspiration, and serve as tools for generating an architectural solution.

02 THOHOYANDOU TAXI TERMINAL

Location: Thumela Municipality, Limpopo

The precedent study is not focused on the design or aesthetic level of the project, but rather on the intangible value it has added to the community. The main focus of the project is the re-governing of the space since none of the informal activities were designed, but rather happened spontaneously. The hawkers and the Spar supermarket across the way have an agreement with the informal traders to not sell the same produce. There is also an agreement between the two regarding the price of those products that do overlap (Vorley, Fern & Ray 2007). In this way, the formal and informal activities are dependent on each other rather than competing with each other. Both retail activities also rely on the taxi rank and the energy produced by the movement of people for their existence, and both intercept the movement of bodies through the space from the taxi terminal to the bus stop, creating the opportunity for trade.

This system was not designed by architects; it arose spontaneously as a result of a series of adaptations made in order to survive, and is driven by the existence of the taxi terminal and the mall across the way.

Fig 05-1a Thohoyandou location (Author 2014)

Fig 05-1b Thohoyandou corridor (Vorley et al 2007)

Fig 05-1c Thohoyandou taxi rank (Vorley et al 2007)

Fig 05-2a Kuyasha transport interchange urban framework (Meyer and Vorster 2007)

Fig 05-2b Kuyasha trader stalls (Meyer and Vorster 2007)

Fig 05-2c Kuyasha precinct (Meyer and Vorster 2007)

03 KUYASA TRANSPORT INTERCHANGE

Designers: MEYER+VORSTER Architects
Location: Khayelitsha , Cape Town
Client: City of Cape Town
Date of completion: 2009

The aim of the project was to emphasise the importance of the new urban node as a transport interchange site and to create a catalyst intervention for development around the station node (Archdaily 2014).

According to Meyer and Vorster (2008), pedestrian traffic was to take precedence, as the project was structured around a series of public spaces (Fig. 05-2a). This, in turn, provided the conceptual layout and informed the detail design of the project. The existing fabric (community centre and school) was integrated into the precinct. Further commercial and social spaces were to function as ancillary activities (Fig. 04-2b) to the transport interchange facility. The project was designed as a public investment opportunity that does not function as a completed environment but encourages incremental growth over time.

As a high order public facility, the human scale of the design (down to detail) was emphasised. Public space is clearly defined by a colonnade (Fig. 04-2c). Elements are used to layer spaces from very public squares to the more private domains of the trading units.

04 PHILIPPI PUBLIC TRANSPORT INTERCHANGE

Designers: NM and Associates
Location: Phillippi-North, Cape Town
Client: City of Cape Town
Date of completion: 2001

The peripheral context and historical quality of Philippi was used as a design generator. The designers responded to the ability of citizens to shape their own public and private space. The project aimed to use the transport interchange facility to construct the opportunity for diverse encounters, public realms and formal and informal trade.

The station creates a large amount of energy that has resulted in the local citizens defining the station forecourt with dense informal trade. This demarcation resulted in the users defining an urban living room where social exchanges take place and public life is sustained. These defined spaces were used to create a conceptual plan where facilities support the spatial rhythms. The existing space was added to by introducing vegetation, seating and formal trade areas, and incorporating the shebeen culture.

NM and Associates (2001) describe a large red band stretching along an "urban veranda". This band was intended to accommodate informal trade signage since it is seen as more than its basic function – as a display of status and identity.

The design is focused on areas where the possibility for social interaction is at its maximum. The essential forms of architecture are applied (seats, paving, etc.) in a robust form to allow for change over time, and for individual interpretation (urban legibility) and expression. The space is only claimed and activated once the designers have left the site – the unpredictable (for which provisions were made) happens.

Fig 05-3a Aerial view of Philippi station precinct (NM and Associates 2001)

Fig 05-3b informal trade (NM and Associates 2001)

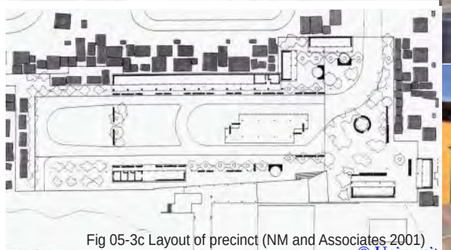


Fig 05-3c Layout of precinct (NM and Associates 2001)

Fig 05-4a public Bathhouse (SA Architect, 2002)

Fig 05-4b-d public Bath-house (SA Architect, 2002)

Fig 05-4e framework for sithandatu avenue (SA Architect, 2002)

05 SITHANDATU AVENUE PUBLIC SPACE NYANGA BATH HOUSE

Designers: Piet Louw
Location: Cape Town
Date of completion: 2001

The project was part of a larger precinct of a hierarchal "family" of public facilities stretching into the settlement with a visual or movement link between the elements (Phaidon 2004, p. 640). The public facilities are used as the highest order structuring elements and form part of the social infrastructure since they are part of the community's daily ritual.

According to the Phaidon (2004, p. 640), the project represents a typological approach to (not a specific use of) space that allows for flexibility over time as different spatial arrangements arise, and for adaptability to aid in various possible activities. The building reflects modesty out of respect for the surrounding environment (critical regionalism) and is integrated with the natural environment (the topography).

The bathhouse, regardless of how appropriate the typology might really be for the surrounding area, becomes more than just a place for cleansing. It becomes a playground, a place for meeting, a public stage for the display of everyday life. The projects are driven by the concern that architecture has a public responsibility and that each of the public places created should contribute to the public realm (Piet Louw Architects 2014).

06 KHAYELITSHA SERVICE CENTRES AND PAY POINTS

Designers: Piet Low, Anton Roux
Location: Khayelitsha
Client: City of Cape Town
Date of completion: 2002

The Dignified Public Spaces project launched a number of sensitive civic interventions in 1999, one of which was the pay points that were placed at strategic and sometimes even historic locations (Joubert 2009).

The nature of the buildings is administrative, including pay halls and offices. The designers decided not to use the internalised typology that these functions require, but rather to optimise public opportunities by working carefully with the edge conditions (Phaidon 2004). According to Joubert (2009), these facilities are combined with public forecourts and seating to encourage the meeting and social gathering of people. The aesthetic approach was again one that resonates with the surrounding fabric and aims to be inviting rather than intimidating. The sensitive design demonstrates that the utilitarian brief can be translated into one that can benefit an entire community (Joubert 2009).

Fig 05-5a government facility khayelitsha (Joubert 2009)

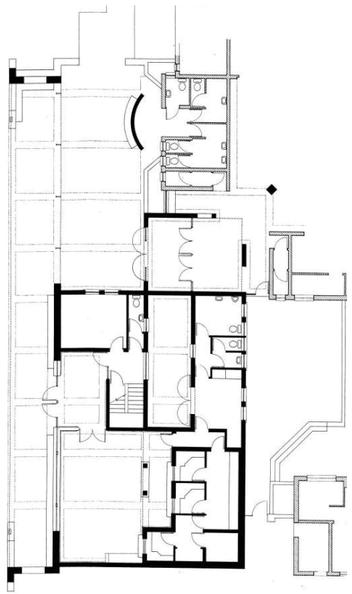


Fig 05-5b plan showing the extension and public interface (Phaidon 2004:640)

Fig 05-5c-d paypoint public interface (Phaidon 2004:640)

Fig 05-6a aerial view of current conditions (Author 2014)

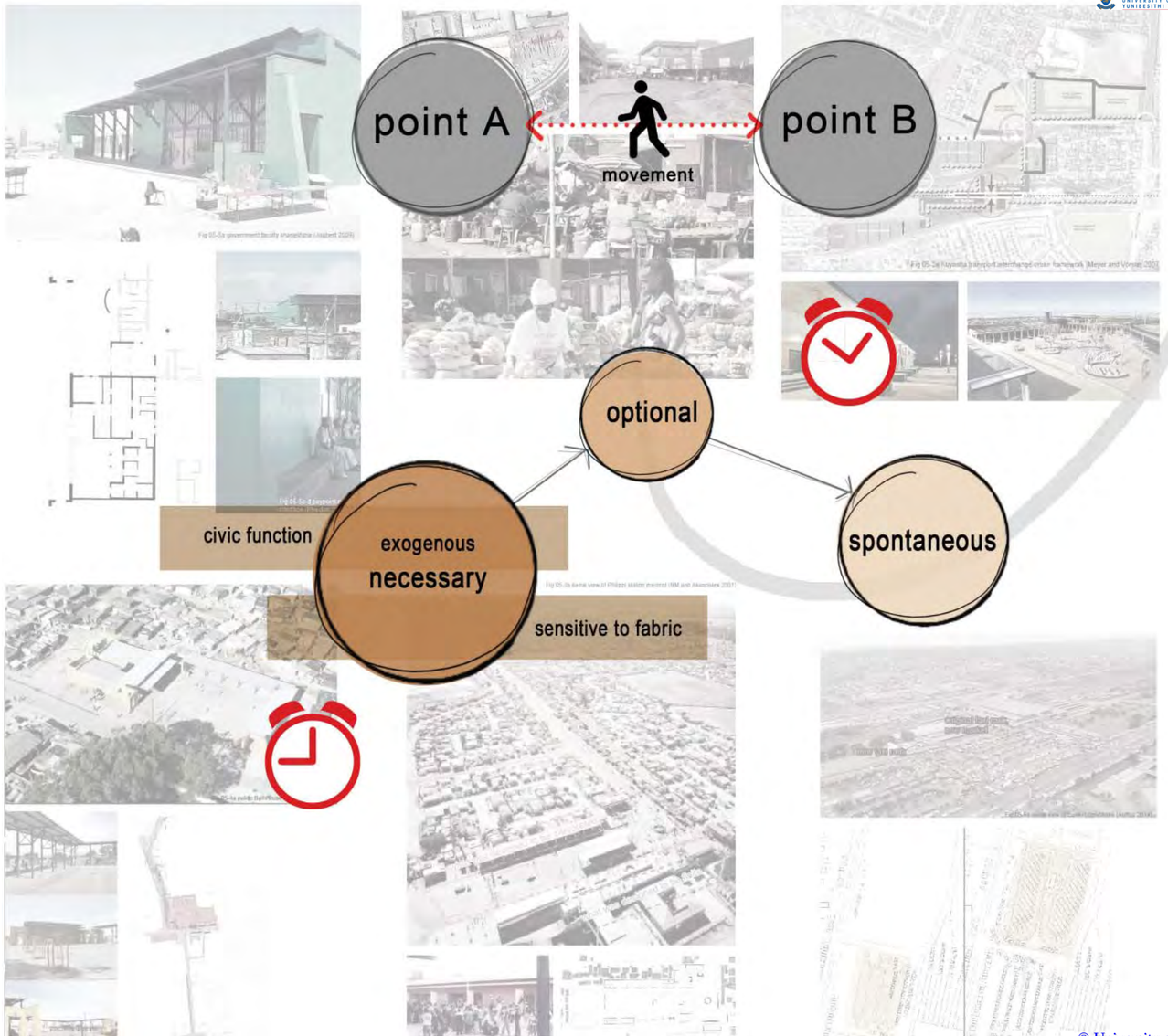
Fig 05-6b plan of development over time (Author 2014)

07 MABOPANE (IN)FORMAL MARKET THE SIGNIFICANCE OF FAILURE

- The on-site precedent

The current form of the station precinct is due to a series of layers that are initiated by a chain-reaction of events.

The station typology in this setting required a taxi rank over time. This was provided, but quickly informal traders aimed to intercept the movement of their clients from the taxi to the station's front door. This ability of informal traders to quickly move and adapt to the clients' movement has led to the entire taxi rank being populated by informal trade. From there, plans were made to yet again provide taxis with a drop-off and pick-up facility, and a new taxi rank was built to the north of the original site. This increased the distance the client has to walk from the taxi to the station, generating more possibility for trade. Soon the streets around the precinct were also taken over by informal trade. Traders position themselves on the raised islands intended to create taxi lanes. This organising device is effective in the sense that it creates a platform for the traders where they are protected from run-off. This on-site example of an architectural "failure" not only shows that spatial use predictions within these settlements are often flawed, but also that a space (if designed even with partial components) could be taken over and re-appropriated as needed. This might not be a success story for the designers, but within the settlement fabric it is one of the most successful spaces.



08 CONCLUSION

The precedents all have a common thread: the movement from point A to point B and the art of inviting development and informal activities around the formal programmed space. The optional and spontaneous activities attach themselves to the energies created by the necessary or formal activities. The initiator of the energies steps into the background over time as the focus shifts to the spontaneous activities that developed from it. We can conclude that management of these sites plays an important role in the acceptance of informal activities.

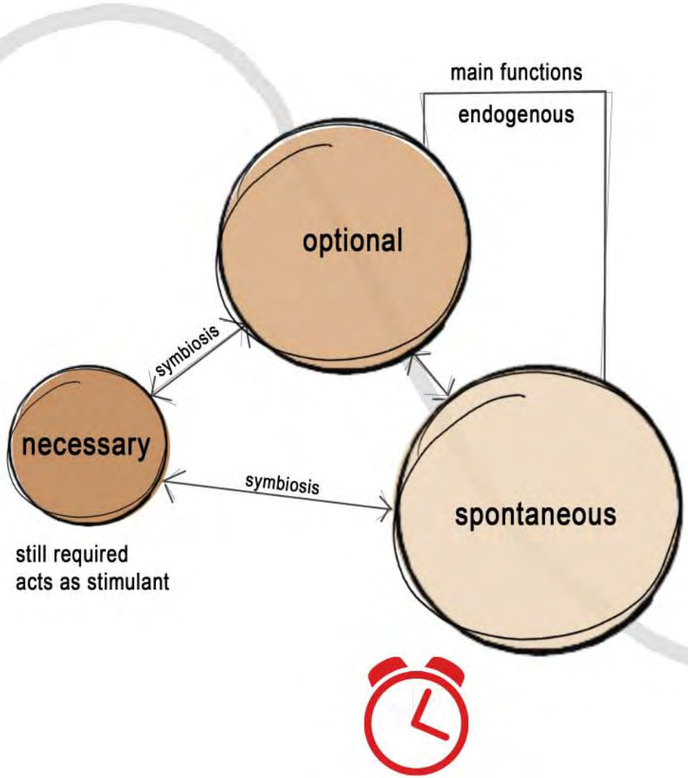
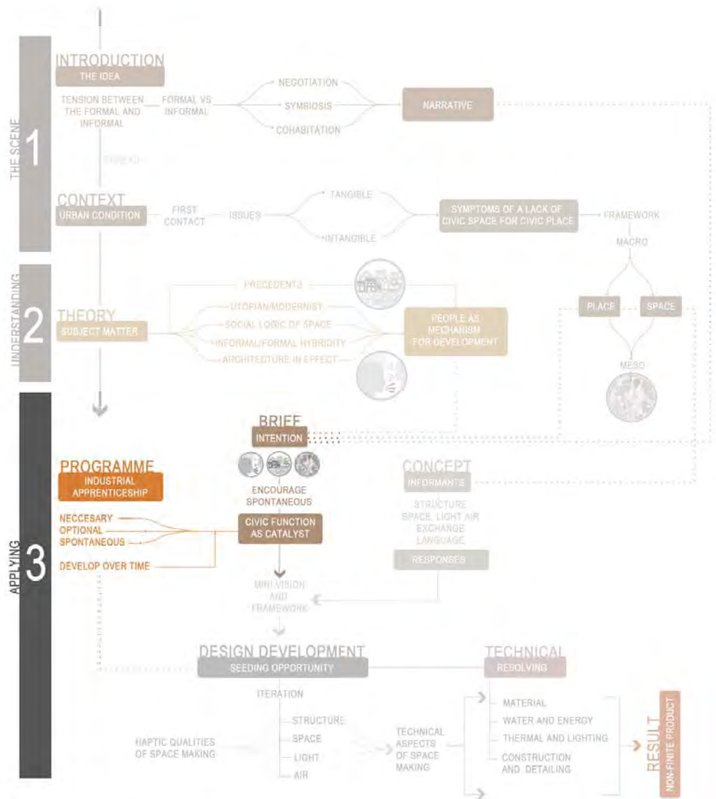


Fig 05-7 Conclusion of precedents (Author 2014)

PART 3_APPLYING

CHAPTER 06_GENERATING A BRIEF
CHAPTER 07_THE CONCEPT
CHAPTER 08_DESIGN DEVELOPMENT
CHAPTER 09_TECHNICAL RESOLUTION



06 GENERATING A BRIEF

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01 INTRODUCTION

The notion that a negotiation and narrative need to be established between the exogenous and endogenous activities has been filtered through three lenses. This enables design decisions to be made based on what the programme needs to be, where the ideal location in the fabric is and how one should go about creating this architecture of invitation. This chapter is concerned with the "what" and "where" in order to generate a brief.

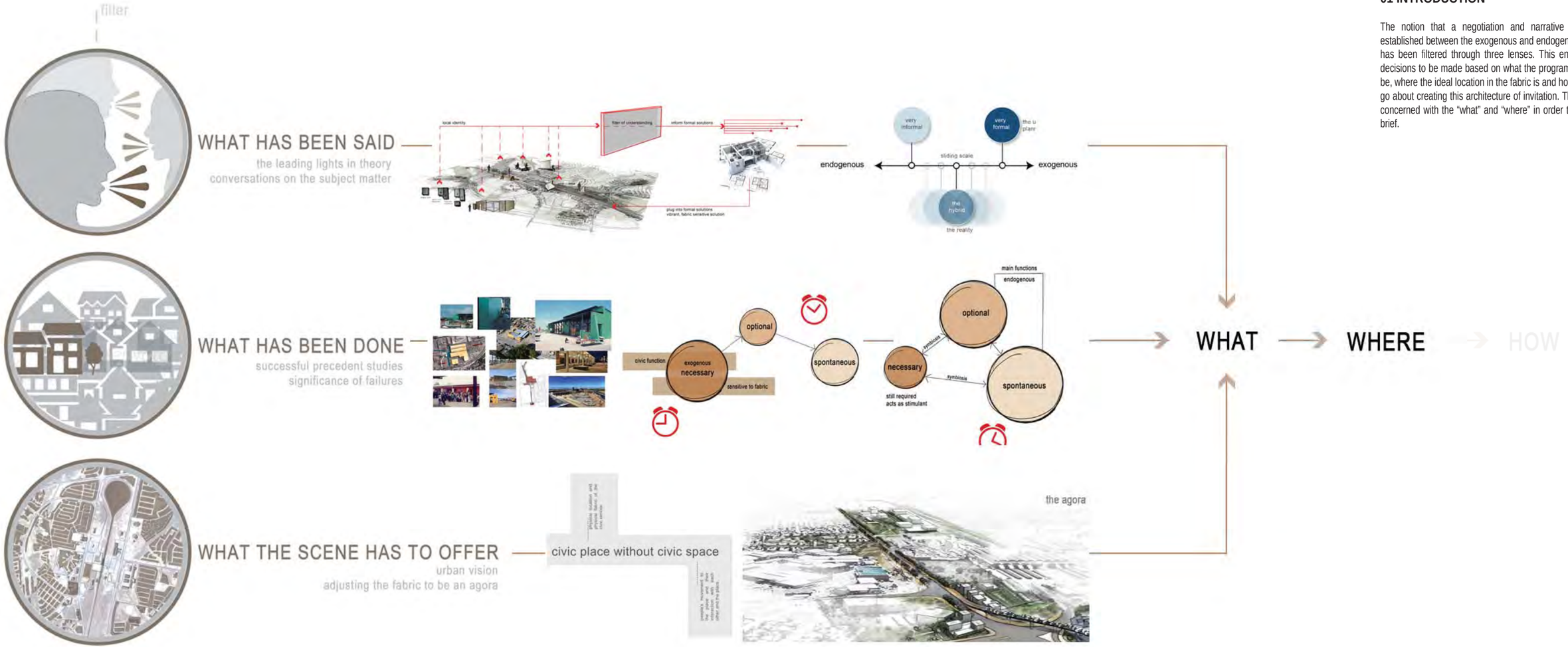


Fig 06-1 The investigation route to generating a brief (Author 2014)

symptoms

sources

overreaching solutions

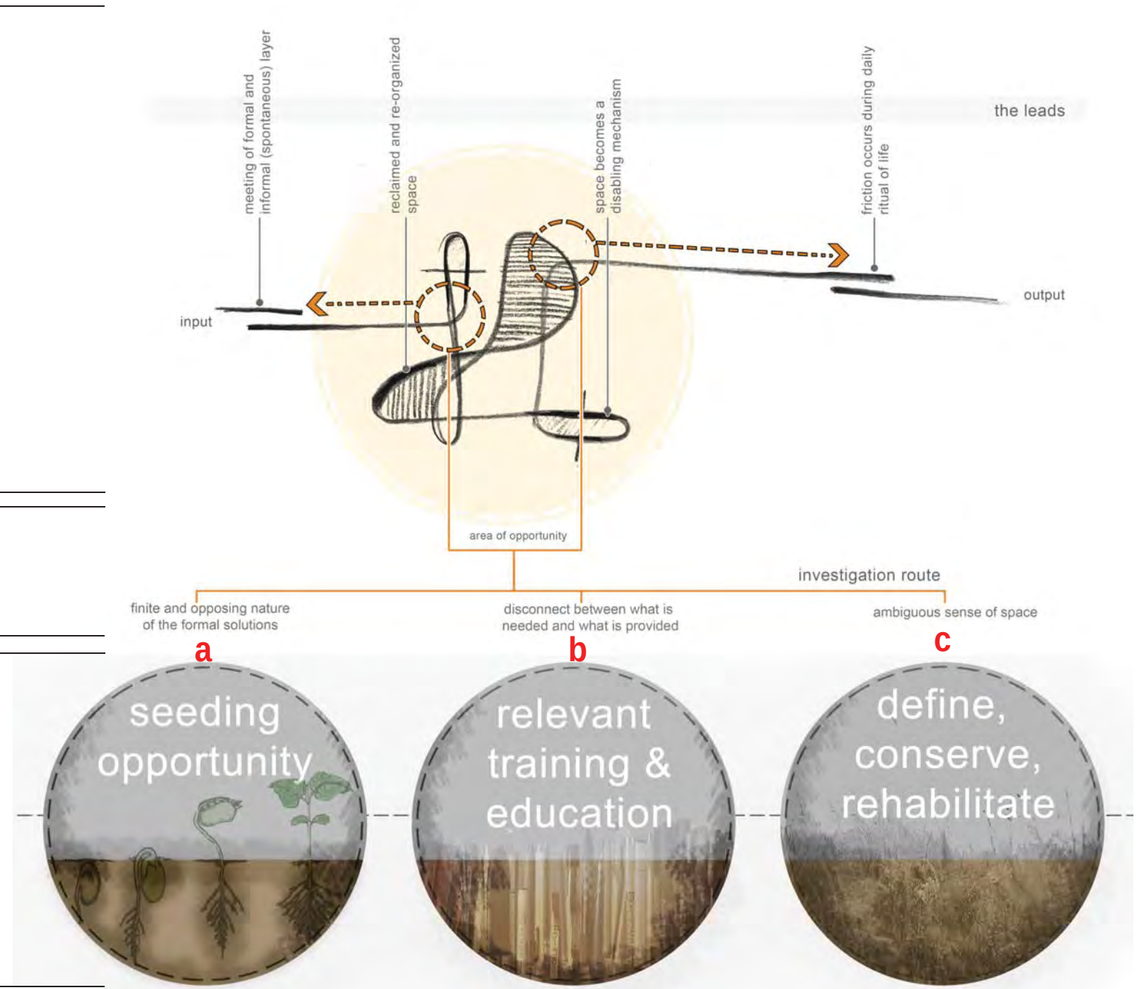


Fig 06-2 The overarching design approaches (Author 2014)

02 THE LEADS

The investigation into the fabric and issues on site has led to a series of overarching problems (Fig. 06-2). An understanding of these problems has led the investigator to believe that three approaches to design needs to be followed.

The first approach (a) refers to social spaces that seed opportunity, strengthen existing relationships and forge new relationships between activities. The second approach (b) is the need for training and education as a civic function. The third approach (c) is an environmental aspect that includes resource management and landscape rehabilitation. These overarching ideas aid the intervention to create the condition for a narrative between the formal and informal activities to form.

03 BRIEF VISION

From an understanding of theory, precedents and the urban framework requirements, the brief vision (Fig. 06-3) was formulated to understand that three types of spaces and activities that need to be designed for: the necessary (as a civic function), the optional and the spontaneous, which relies on endogenous initiatives. The exogenous civic function and the space designed around it is what determines the nature of the endogenous activities.

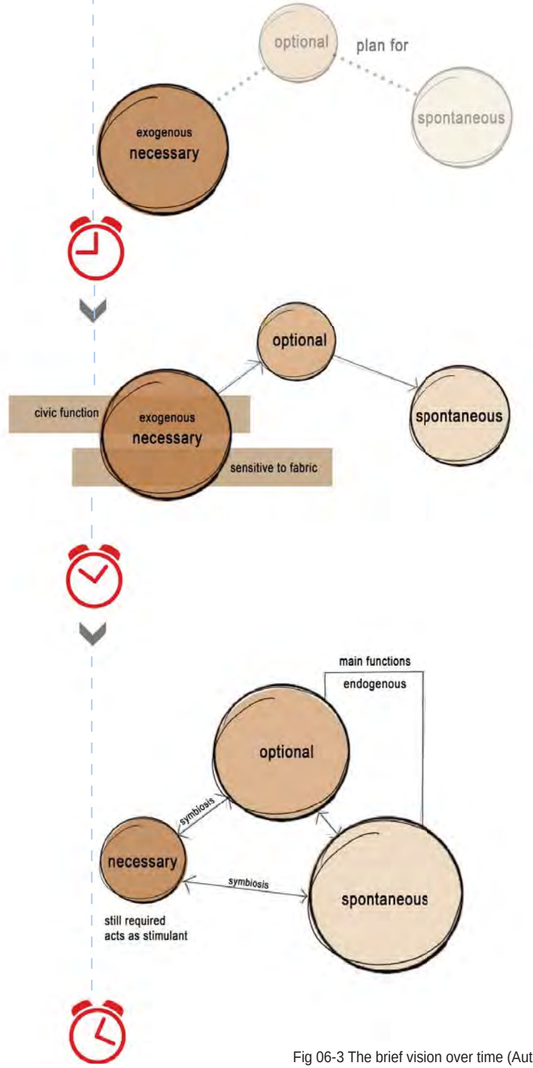


Fig 06-3 The brief vision over time (Author 2014)

04 BRIEF CONCEPT

Understanding the issues in the fabric resulted in the building of the knowledge base of Mabopane. When this knowledge base is overlaid with the brief's concept of three spaces, the programme outline and possibility become clearer (Fig. 06-4).

The necessary activities consist of the existing formal (that requires an intervention) and the stimulant activity that has a civic function and a supporting network. That which is adapted and spontaneous over time becomes less predictable but more manageable and anticipated by the nature of the stimulant activity.

The exogenous (existing formal and stimulant) has a high predeterminacy, and function change over time can, to a large extent, be predicted. The spontaneous (endogenous) is scenario buffered and relies on human agency to generate a physical form from the activity.

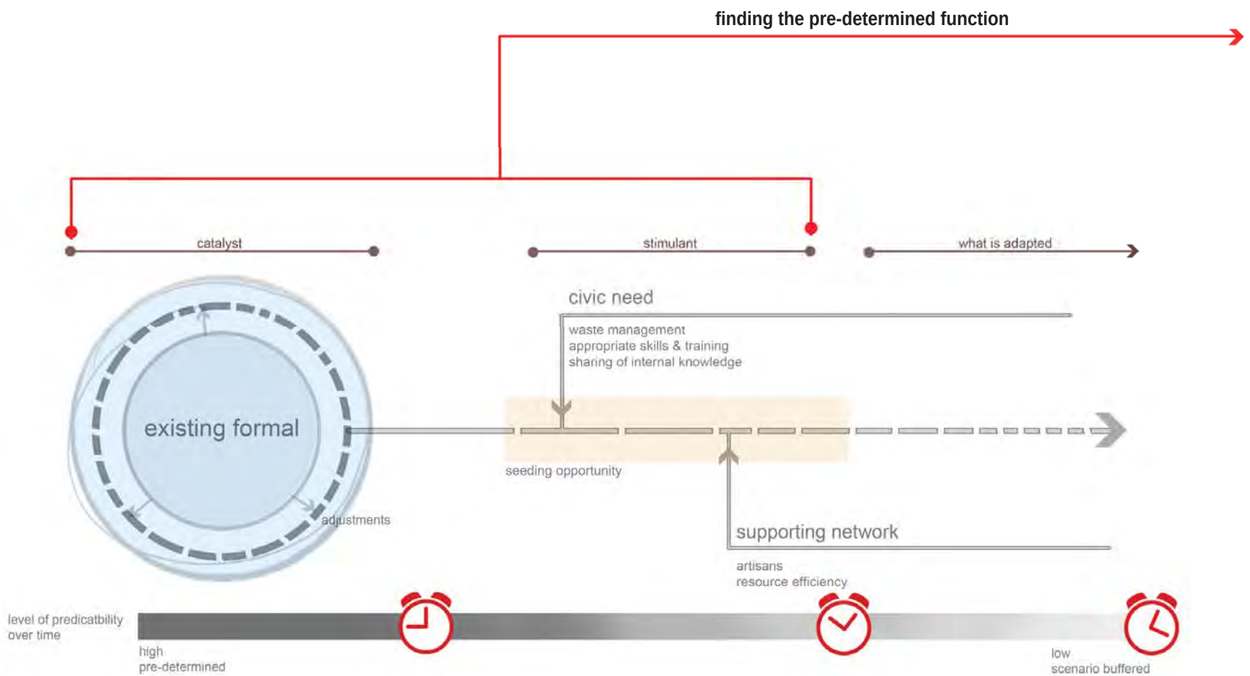


Fig 06-4 The brief concept (Author 2014)

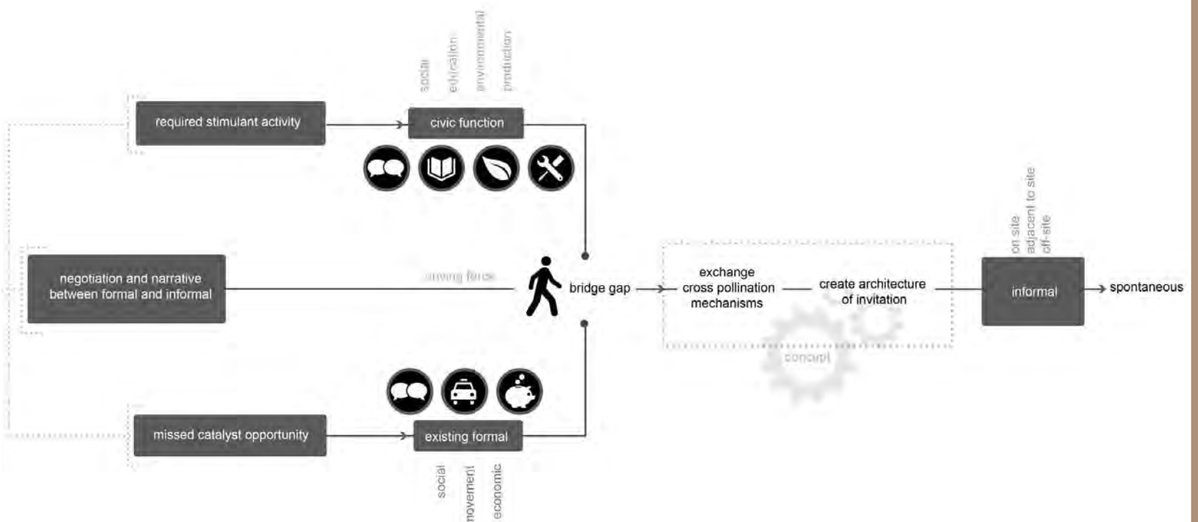


Fig 06-5 programme vision (Author 2014)

05 PROGRAMME VISION

Since the endogenous cannot be constructed by designers (the author etc.), the programme vision relies on determining the required exogenous activity that will stimulate and determine the endogenous activities that come from it (Fig. 06-5).

From a mapping perspective, some of the tangible and intangible issues in Mabopane are: (a) a lack of social interaction on a meaningful level, (b) the lack of educational opportunities outside of academia, (c) environmental neglect and (d) limited endogenous production of goods. The civic function needs to address all or at least some of these aspects.

The existing formal fabric within Mabopane acts as islands in the landscape, with little to no interaction with the surrounding fabric that led to its existence. Reprogramming such sites to have a social connection as well as a more inviting nature relative to the surrounding community could enable them to become part of the fabric instead of separate objects in the landscape.

Based on theory, it was determined that these new activities (or adjustments to existing activities) require people as a resource in order to survive. The driving force behind civic spaces is the presence of people. This gives a clue as to where this intervention needs to be placed within the fabric.

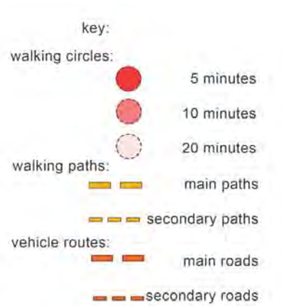
The gap between the formal (exogenous) and the informal (endogenous) needs to be bridged in order for a negotiation and narrative to form between the two. In order for interaction to occur between them, a hybrid landscape needs to be created that will encourage endogenous activities.

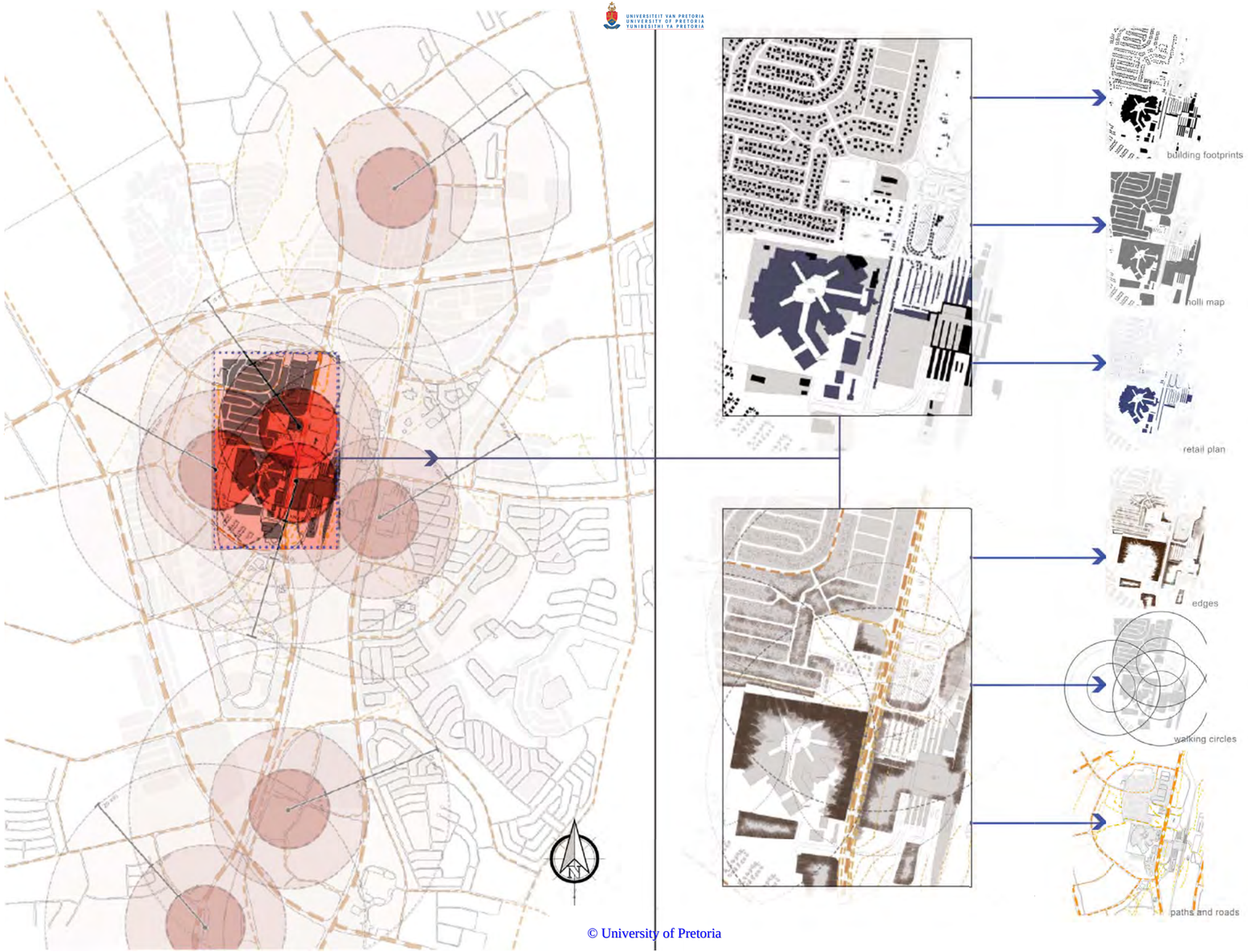
Three types of encouragement of endogenous activities are suggested, as the intervention needs to stretch beyond the site boundary in its effect. The first is the direct invitation on site, second is the effect adjacent to the site as movement is encouraged, and third is the production and sharing of knowledge, which needs to stretch further than the site's perimeter.

06 SITE JUSTIFICATION - where?

> "Wherever there are people - in buildings, in neighborhoods, in city centers, in recreational areas, and so on - it is generally true that people and human activities attract other people. People are attracted to other people. They gather with and move about with others and seek to place themselves near others. New activities begin in the vicinity of events that are already in progress"
> - Gehl 2011

Successful civic space requires the presence of people as a resource. Further investigation into the movement of bodies through the settlement indicates that the most energy is created within the station precinct. Thus the placement of civic elements and the arrangement of civic space would be most beneficial in this area.





People as a resource

In order to identify a site for intervention on a micro scale, the edges, routes/ paths, points of interest, walking distances and footprints of the meso framework were investigated (Fig. 06-6).

With the station precinct being overdeveloped and saturated with informal trade, the site across the road from this activity becomes important, since it presents itself as a missed opportunity.

Two sites north of the Mall and west of the market have not been developed but seem to have a large amount of pedestrian movement. According to Gehl (2010), the presence of people is the driving force behind civic space (and vice versa) making these two sites particularly interesting areas of opportunity.

Fig 06-6 identifying the movement of people (Mills, Author 2014)

The sites are surrounded by civic elements ranging from high to low orders and yet they are not populated by architectural solutions but simply activated by movement. They become corridors to something larger and more important. This is seen as a missed catalyst opportunity where the built form could possibly activate these spaces to become more than corridors, forming part of a series of experiences.

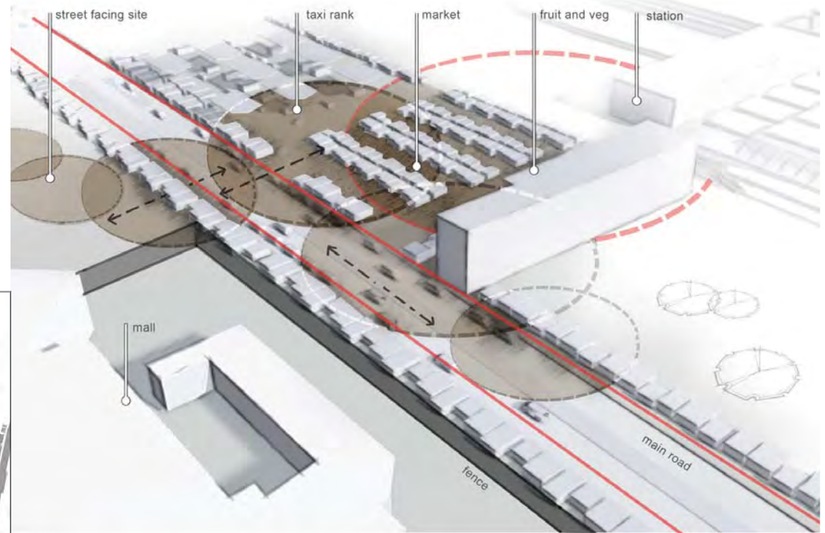


Fig 06-7 the existing conditions of the possible sites, view from South-West (Author, 2014)

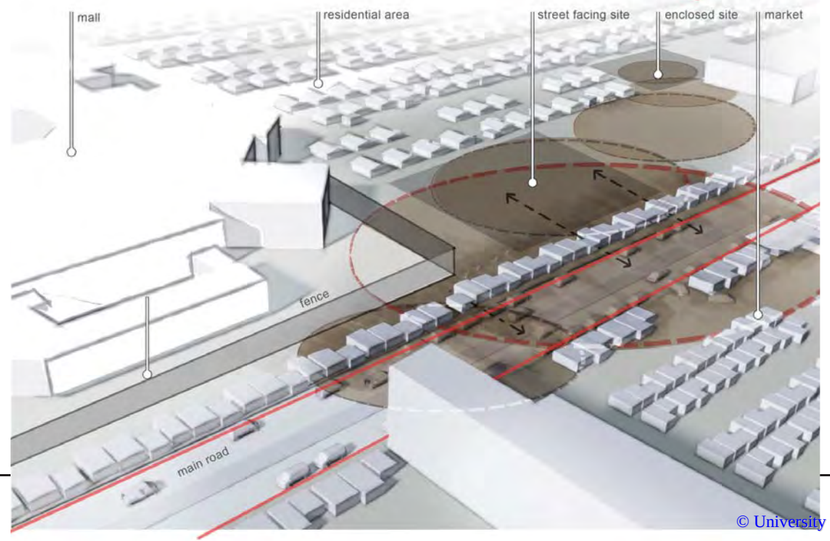


Fig 06-8 the existing conditions of the possible sites, view from South-East (Author, 2014)

Space syntax

Science based but human focused, space syntax is a concept advocated by Hillier and Hanson in The social logic of space (1984). The concept relies on the idea that spaces are broken down into components, then analysed as a series of choices and represented in a physical form that planners can use to make calculated decisions regarding the connectivity of space. The aim is to predict the most likely movement of people through and towards a space, highlighting the density and probability of use. Software (Advanced Spatial Analysis) developed by the Bartlet University College in London has made this prediction of intersection, nodes and paths possible.

Using this method of pedestrian movement prediction, the observed energy around the market, station and taxi rank is confirmed. The result of the analysis is in agreement with what was observed on site. The main north-south axis is most dominant with the largest junctions forming near the station precinct entrance.

Unfortunately, very few spaces for further development exist within the precinct. Experimenting with the intersections and axial lines created by movement, new opportunities for development might already be present on site. This catalyst opportunity is currently not in its ideal shape and therefore limits development.

a large junction forms on the edge of the site in question

main axial lines of movement

junction formation

intensity of movement

Fig 06-9 existing junctions (Author, 2014)

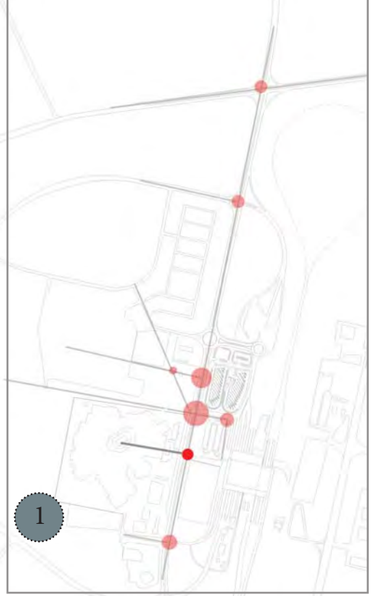
Fig 06-10 movement intensity (Author, 2014)

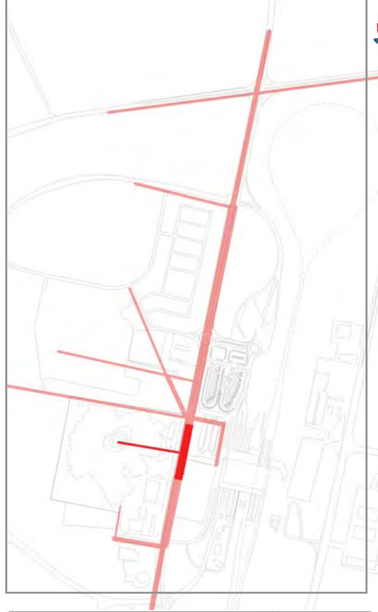
The experiment

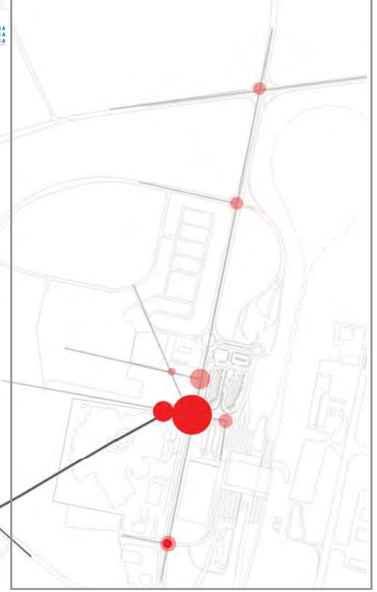
A junction forms on the edge of the site in question. The spatial analysis programme works on the understanding that in order to increase this junction (node), more axial lines need to intersect or lead to it. A series of experiments was conducted to analyse the different possibilities for junction (node) increase. Some of the most drastic changes in energy include:

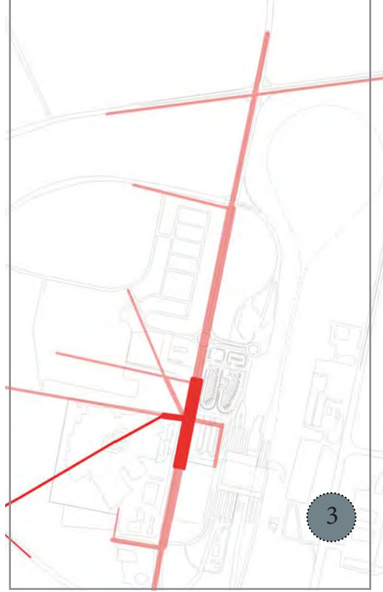
Applying the original plan (evident in the layout of the shopping centre) of a walkover from the shopping centre area, through a formal market and into an informal market.
Result: A saturated area is affected by an increase in the junction size. Very little elbow room exists to expand and create new opportunity here.

Opening the introverted shopping centre (possible catalyst element) into the civic realm to a public square. The axial line provides a larger junction and in turn more opportunity for development.
Result: The junction grows as more routes feed into it. The energy in the main street also increases.









Transforming the shopping centre into a walkover from the open field to the south west to the station precinct.
Result: More junctions are formed and nodes around these junctions increase. The junction to the south, however, decreases, since its feeding line is now intercepted.

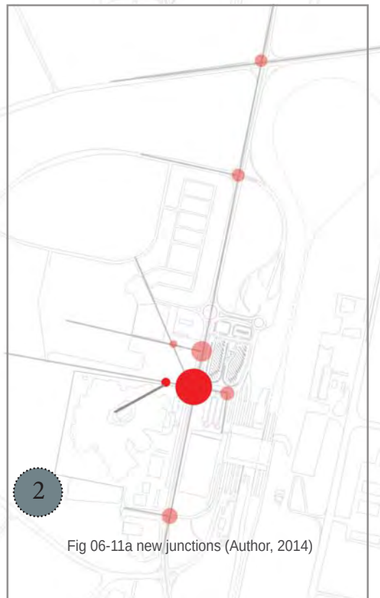


Fig 06-11a new junctions (Author, 2014)

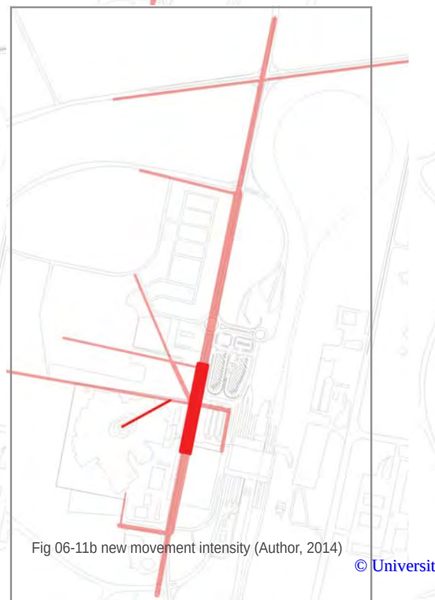


Fig 06-11b new movement intensity (Author, 2014)

Fig 06-12a new junctions (Author, 2014)

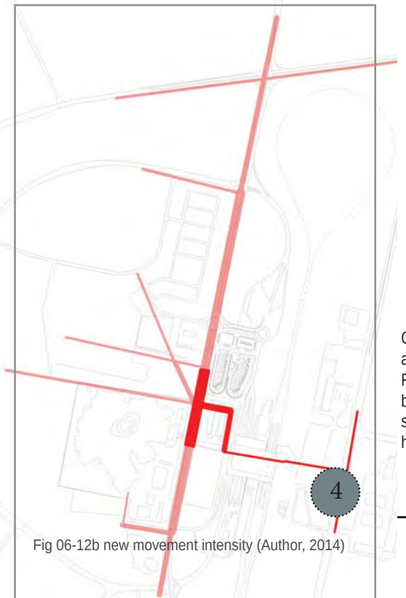


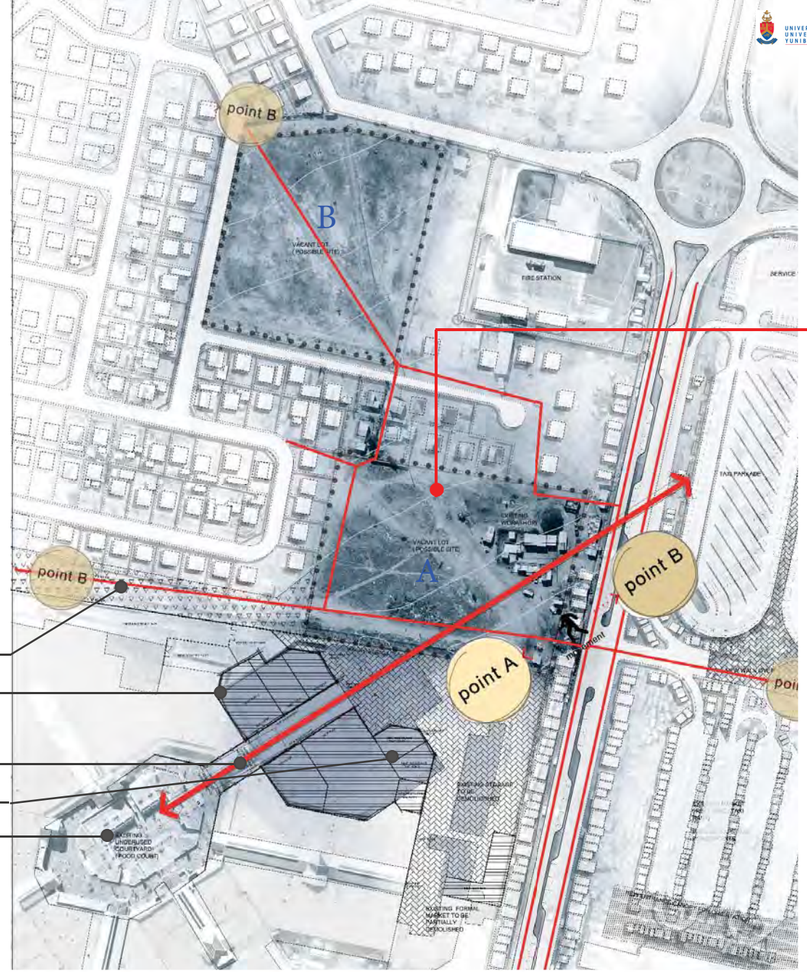
Fig 06-12b new movement intensity (Author, 2014)

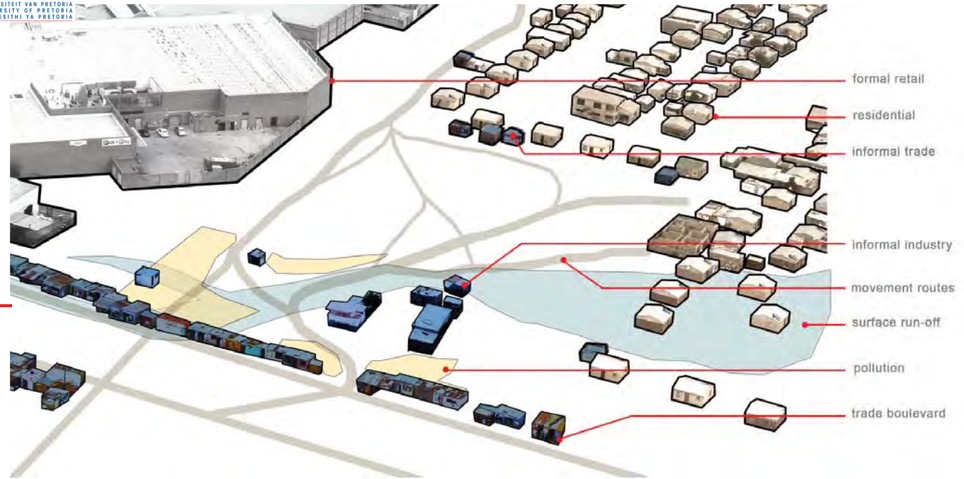
Creating a walkover towards the eastern side of the rail, allowing two sets of movement systems to merge.
Result: The station precinct's node increases significantly but this might have a negative effect on the informal retail system since opportunity and diversity is in effect cut in half due to easy access.

The catalyst

In order for an architectural intervention to act as a stimulant for the interaction between the formal and informal built environments, the movement of people is required. Creating a new space that this energy can spill into sets the scene for a possible negotiation between the two extremes.

The micro-vision concludes that new points of interest are created. This is achieved by creating a more successful entrance to the enclosed mall space. The courtyard of the mall is able to spill out into the public realm more successfully. The anchor store is broken up into smaller units. These shops are zoned as formal food shops to entice movement into the space; they do not compete with a possible intervention but rather complement it. The physical form of the mall steps down to a human scale in order to be more sensitive to the surrounding fabric.





Site Informants

Site A was selected because of the high movement of people and more public characteristics. Site B is of a more intimate nature due to the residential elements surrounding it. With the identification of a site of intervention, a new series of informants is identified (Fig. 06-14). These informants are hierarchised to develop and respond to them.

Fig 06-13 The formal as catalyst (Author 2014)

Fig 06-14 on-site informants (Author 2014)

07 PROBLEMS AND OPPORTUNITIES

"That which we throw-away, we fail to value." In his *Design for the real world* (1971), Papanek discusses how society regards things as being disposable. "[We] haven't run out of water, we have run out of new streams to pollute," Papanek states, arguing that most of the problems designers are faced with today are actually created by ourselves. Air, water and earth pollution and disfigurement are man-made and usually by so called "benign" intentions that have gone wrong. Finding the source of these disfigurements and treating that disease first might be a possible solution.

The source of the pollution in Mabopane can be traced back to the selling and buying of goods. Plastic bags and cardboard boxes all disposed of because they seemingly no longer have value. They end up in dumping sites scattered all over the area. The author encourages designers to make a shift from this mindset of "band aiding" the problem to actually starting with the source.

Papanek (1971) uses a pen he received as a gift as an example. As he unwraps the layers of paper, plastic and packaging to reveal a small pen nestled in a tiny box, he questions the true meaning of this aesthetic. The packaging is thrown away and makes its way to the garbage dump. Why is it that something that has made its way half way around the world is simply disposed of? Why is it not responsibly designed to be used again in some way?

The community has shown in its own capacity that it is able to reuse and recycle (even if it is simply down cycling) objects. A prominent opportunity is to tap into this resource efficiency in order to solve a need within the community. This ability of the community can be used as a first stage mechanism to bridge the gap between the formal and informal activities.

Fig 06-15a Papaneck's (1971) argument on throw-away culture (Author 2014)

Fig 06-15b re-using objects as they are constantly re-appropriated and repaired (Author 2014)

Fig 06-15c pollution in the residential area and make-shift incinerators (Author 2014)

why can't the lifespan and usefullness be extended and used to solve other problems beyond this?

A civic function that will respond to the current site and new framework needs to be selected. The problems (three research leads) are broken down into their essence and further opportunities are identified. Possible solutions are proposed and these leads are organised to allow for cross-programming and for an interdependency between the required activities (Fig. 06-15d).

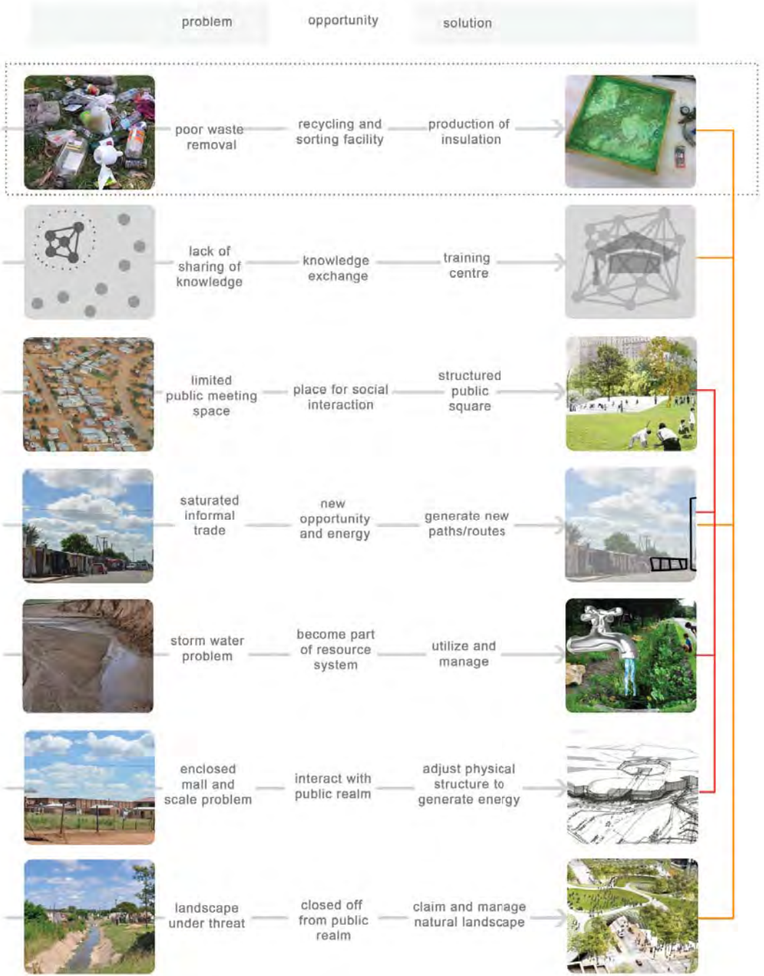
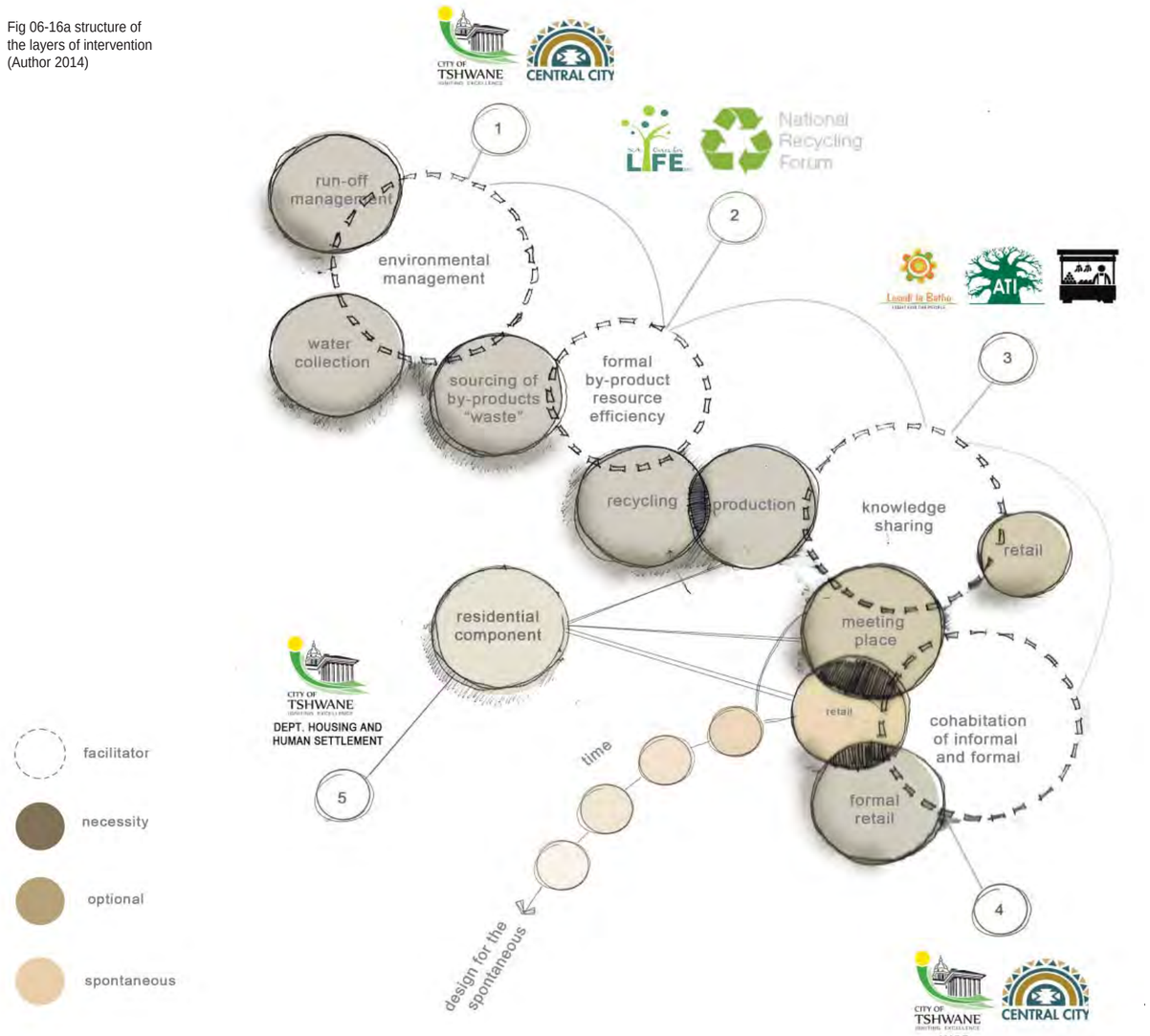


Fig 06-15d problems and opportunities (Author 2014)

Fig 06-16a structure of the layers of intervention (Author 2014)



08 RESULTING PROGRAMME

An understanding of the site conditions and the brief concept has lead to the development of a programme. At the centre of this programme is an industrial apprenticeship facility (Fig. 06-16a). The aim of the programme is not just to produce a physical product, but also (and more importantly) to create a non-finite situation, a gateway or scenario that will lead to the enablement and evolution of both the tangible and intangible fabric and resources.

Gehl (2011) suggests that there are three types of activities in a public setting: necessary activities, optional activities and spontaneous activities. This was applied in the programmatic solution as certain activities are more finite and necessary to support the community, some are adaptable and open to interpretation, and some involve inviting the spontaneous to the site (unpredictable).

The functions aim to cross-pollinate and be interdependent of each other. They exist in a series of layers that intersect and exchange resources – not only physical but also social and knowledge based – as various spaces come into contact with each other (Fig. 06-16b).

09 AGENTS OF OWNERSHIP, CONTROL AND PARTICIPATION

The nature of the project requires multiple agents of ownership, control and participation. The boundaries between the layers of intervention are blurred due to their interdependency and the nature of exchange between them (Fig. 06-16).

1. City of Tshwane with the combined efforts of the owners of the Formal retail (mall)
2. National recycling forum with the aid of SA Cares for Life Lesedi Training centre
3. Lesedi la Batho skills and training division with the local network of informal retailers and craftsman, SA Artisan Training Institute.
4. The owners of the Formal retail in association with the City of Tshwane's initiative for the Mabopane-Centurion Development Corridor Project aided by the local network of traders
5. The residential programme forms part of the skills developement unit, promoted by the South African Artisan Training Institute and is managed by the Department of Human Settlements as part of the current upgrade plan.

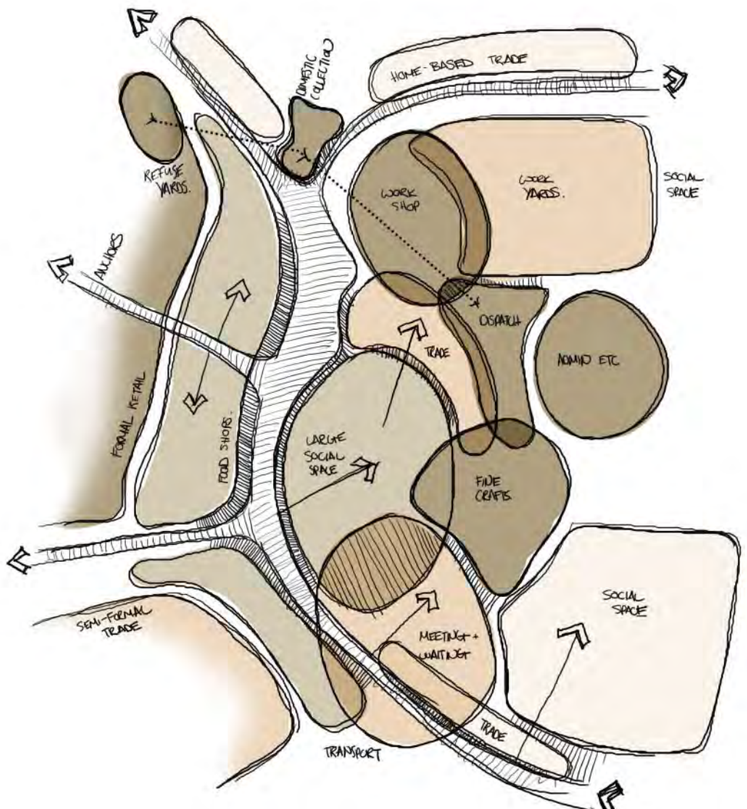


Fig 06-16b spatial connection of programme (Author 2014)

The production programme associated with the necessary components of the building will create a condition for the narrative and stimulate the optional and spontaneous use of space (Fig. 06-16c). The production line taps into the community's display of resource efficiency (where formal retail lacks this) and combines it with the existing industry and training facility potential.

These industrial processes are inspired by the existing training facility at the Lesedi la Batho Centre (in Block B), the existing crafting skills and activities present in the market space, and the synthesis of problems and opportunities witnessed in the community. They are not strictly programmed into the building, but the building anticipates industrial processes of the same nature and therefore caters for two types:
- "heavy" industry, requiring power tools and large amounts of material (transport via machine), and
- "light" industry, requiring detailed work with smaller products relating to crafting.

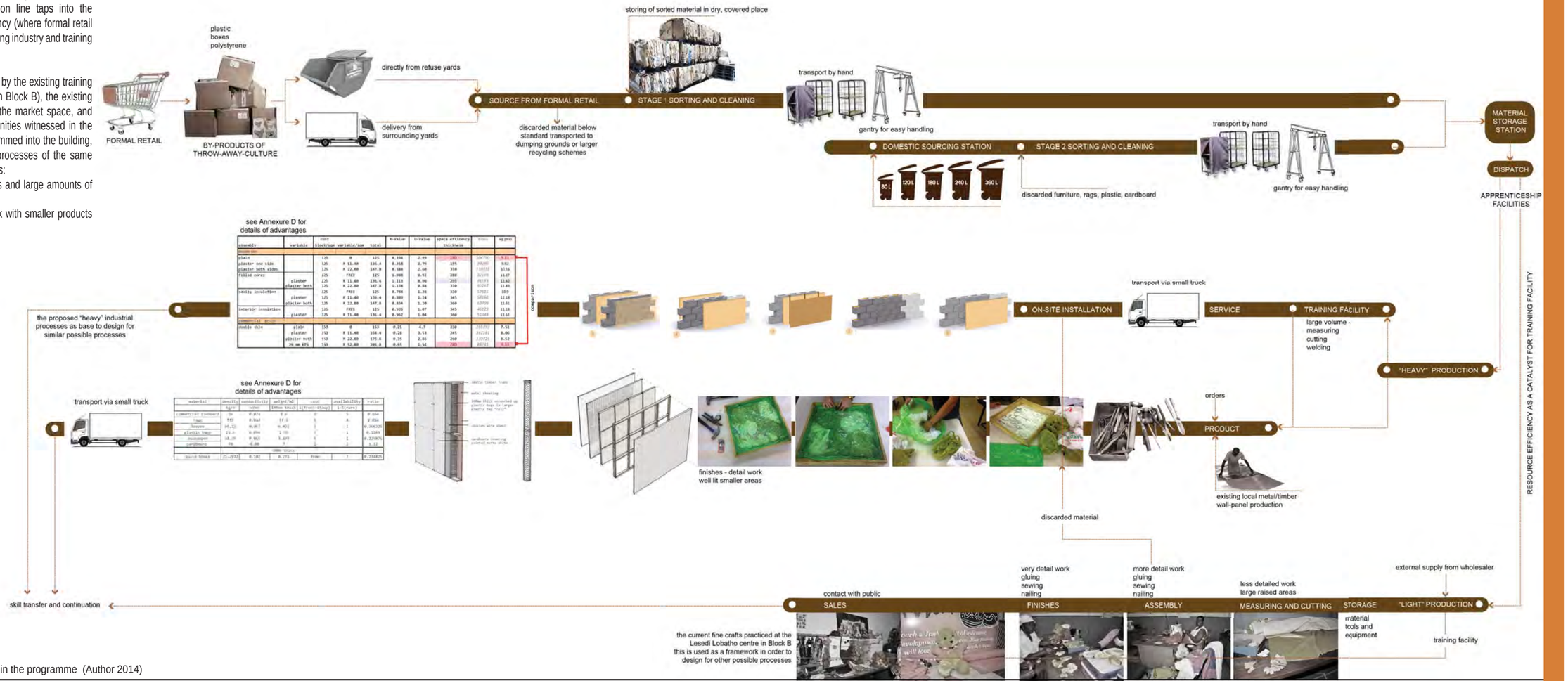


Fig 06-16c the necessary processes in the programme (Author 2014)

10 PROGRAMME JUSTIFICATION

Drivers for the programme selection:

The programme for the necessary spaces needs to be a vehicle for the opportunity of a negotiation and invitation of exogenous and endogenous activities. Therefore, the necessary space design for the programme needs to address a civic need, capitalise on an existing activity/ network and unlock an inherent skill (mainly resource efficiency) in order to stimulate evolutionary use and interpretation. The arrangement and ethereal qualities of these spaces will invite and allow for the narrative with the endogenous activities.

1. Urban framework

The urban framework is concerned with creating civic space and, in turn, a place that serves the community. Starting from an understanding of this, the location of the possible site requires a medium to low order civic function.

2. Economic driver

The settlement is driven by economic opportunities as the market and formal retail become the agora of the settlement. Since people are already motivated to move across the site to these activities, the intervention can capitalise on and tap into existing energies. The community displays resource efficiency as products are used over and over again in different ways until their use runs out completely.

3. Education

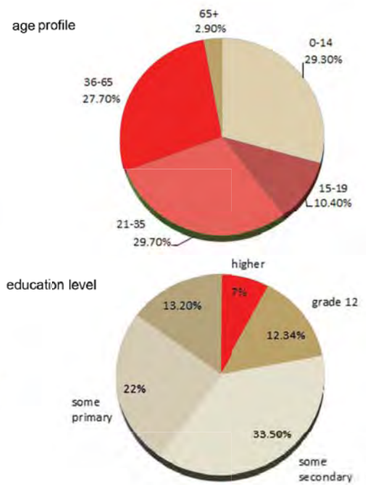
Many schools are provided and dispersed throughout the settlement, but there is only one college and one skills and training centre available, making opportunities for jobs after school very limited and creating a finite system. An isolated system of knowledge transfer exists, but the sharing of endogenous knowledge is inhibited since the space in which to practice this transfer is limited or has not been exposed to the wider public. The introduction of an apprenticeship facility will position trainees within an established network where that can practise and sell the goods that are made (geographically, there is already a market for such goods).

4. Demographics

A large part of the population is not only unemployed but also consists mostly of young people , making the influx of young unemployed people an even larger threat. By creating a gateway as an apprenticeship for industrial work, opportunities for self-employment are increased (see Appendix C).

5. External reliance

Jobs and income are reliant on external initiatives and organisations. Reliance on the external import of goods has caused a bottleneck in the diversity of available products. By decentralising the suppliers, a wider range of products will be made available. Currently, the Lesedi centre has an agreement with Beares (a furniture company) to produce stuffed teddy bears on a small scale. This relationship has value for both parties as it creates jobs for the endogenous and decentralises supply for the exogenous, creating cheaper, less transport-intensive products. Relationships between exogenous initiatives penetrating the settlement and endogenous activities could be forged by placing them in close geographical proximity to each other.



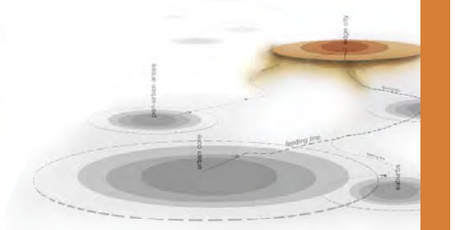


Fig 06-17 unpacking the programme justification (Author 2014)

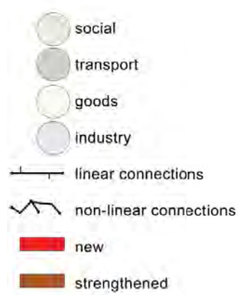
Fig 06-18 geographical disconnect between networks (Author 2014)

11 SUPPORTING NETWORK

In order to achieve a high level of social capital, the existing neighbourhood networks need to be invited into the space (Hamdi 2010). Some networks are well-integrated geographically with others (recreational, transport and retail), but some are isolated because of their geographical position in the fabric (skills and training). The Lesedi la Batho skills and training centre is the only one of its kind in Mabopane, making it an asset to the community. By merging these networks with each other geographically, new meetings can occur and new relationships between networks can be forged, making them more resilient.

This has led the investigation to believe that, as a possible civic space, a skills and training aspect of a resource management Centre might tap into the programmatically adjacent networks to form a resilient system.

The solutions need to be integrated into the existing networks and form stronger bonds between the established connections (Fig. 06-18). The core of the settlement's spatial formation (as a pacemaker for development) is based on economic gain in the form of informal retail. All the activities filter down to the retailer, making this the focus of the new supporting activities.



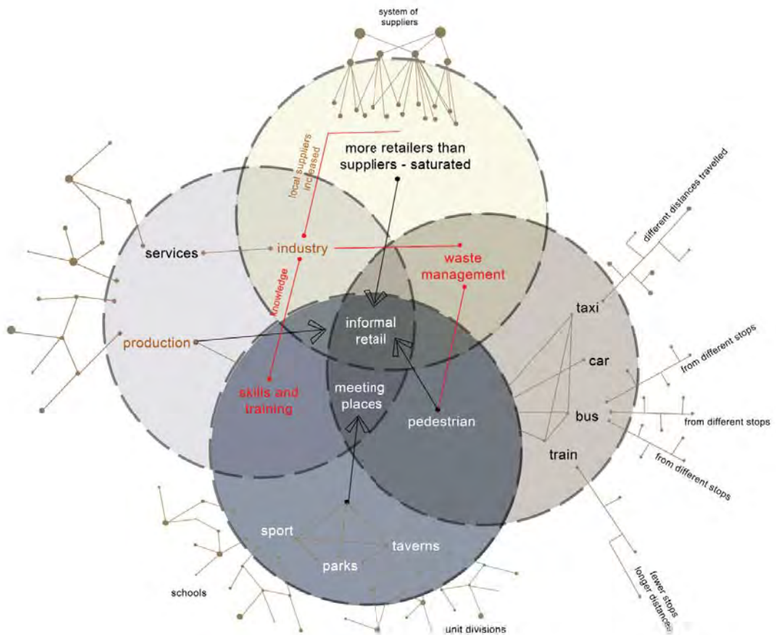


Fig 06-19 integrating the networks (Author 2014)

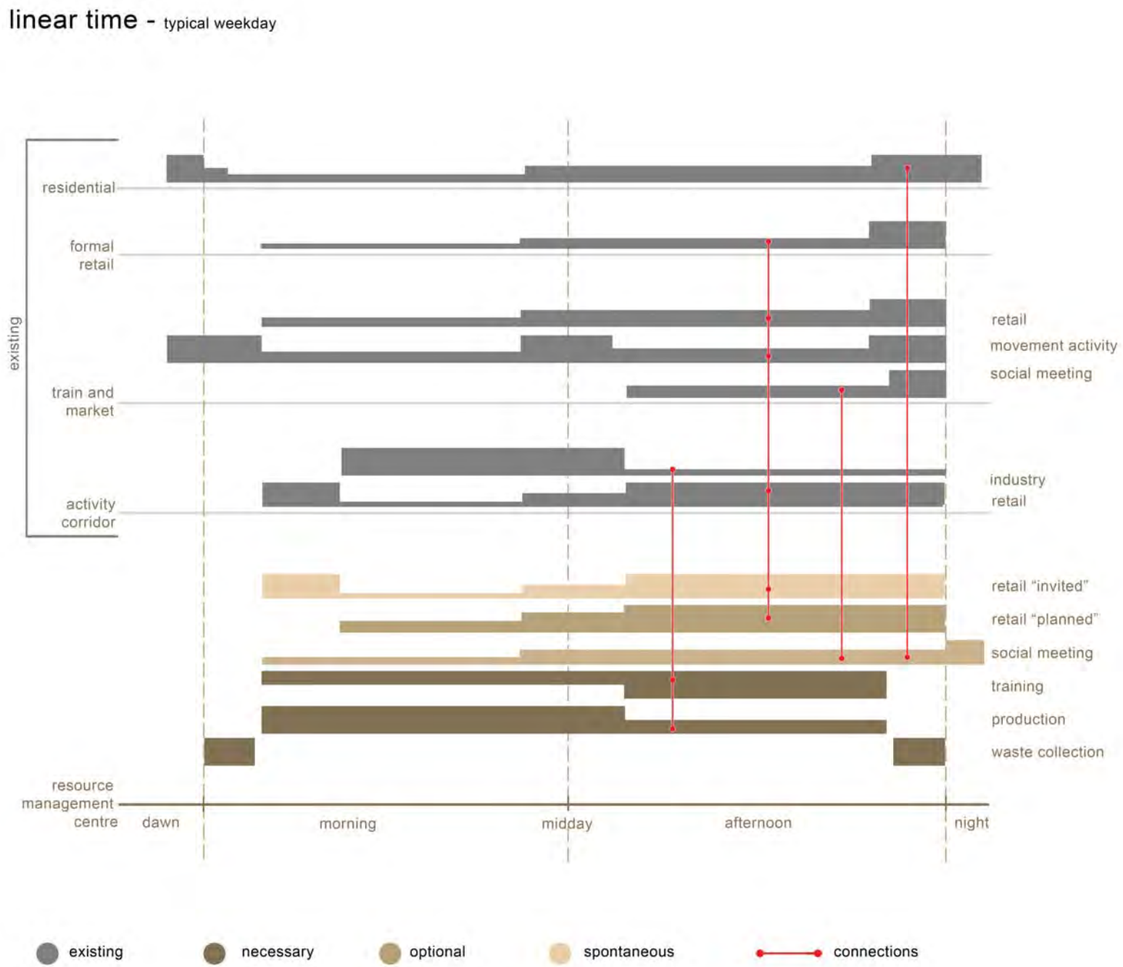


Fig 06-20 linear time changes of activity (Author 2014)

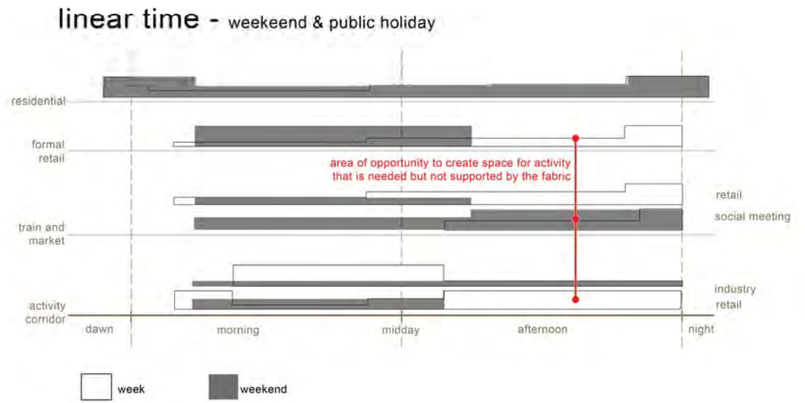


Fig 06-21 linear time changes of activity for weekends and holidays (Author 2014)

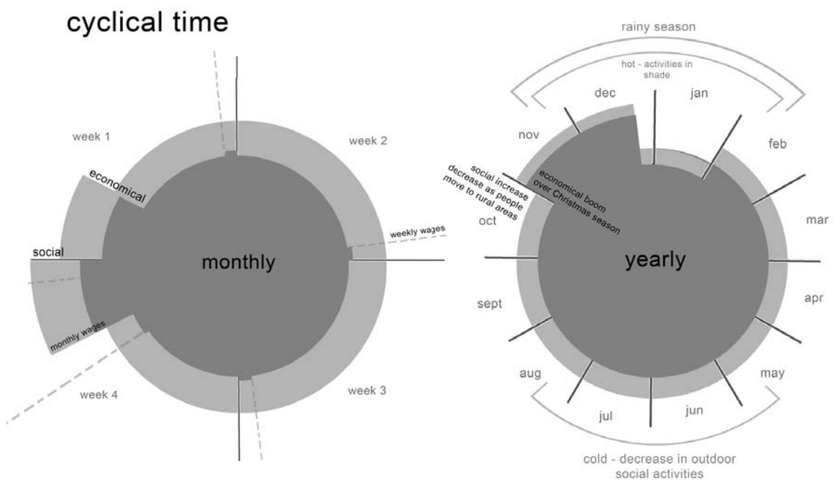
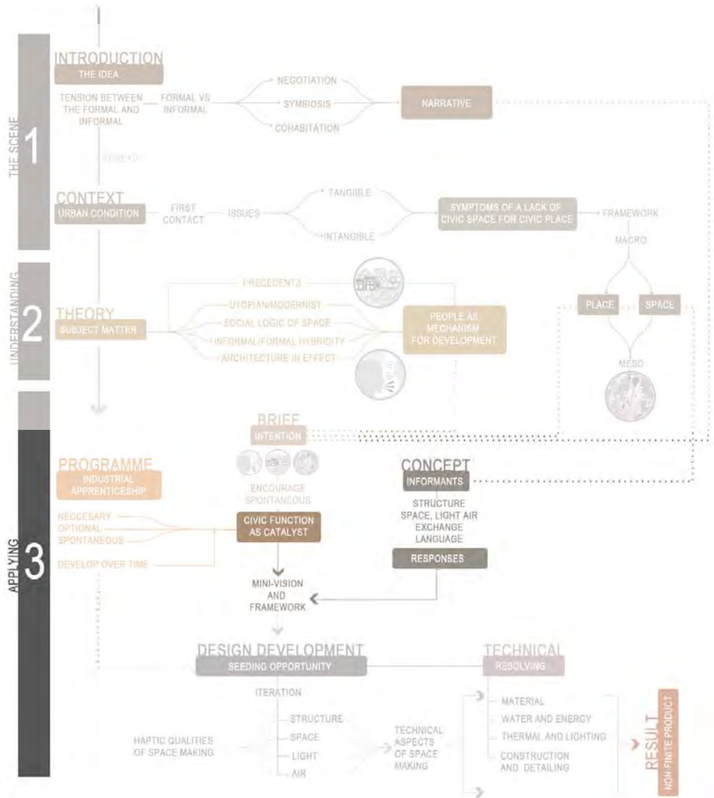


Fig 06-22 cyclical time changes (Author 2014)

12 LINEAR AND CYCLICAL TIME

Schmidt et al. (2009) suggest that for buildings to be truly adaptable they need to consider both linear and cyclical time changes. The linear and cyclical changes in the ritual of the community were thus analysed. The program aims to fill the gaps in activity in the linear time line by discovering movement and rituals that are not supported by the built form (Fig. 06-19). In this way the space is activated, protected and surveyed by the presence of people. The programme attaches itself to existing activities in order to increase the energy they create.

The cyclical time analysis (Fig. 06-21) has shown certain areas of opportunity where the current fabric and built structures fall short of the community's needs (seasonal changes). Social activity is guided by environmental and economic changes. The project aims to find other ways in which social activities could be accommodated, ways that are not necessarily driven by the economy. For example, over school holidays children have very few places to go. They might be accommodated and, in turn, activate the space.



07 CONCEPT

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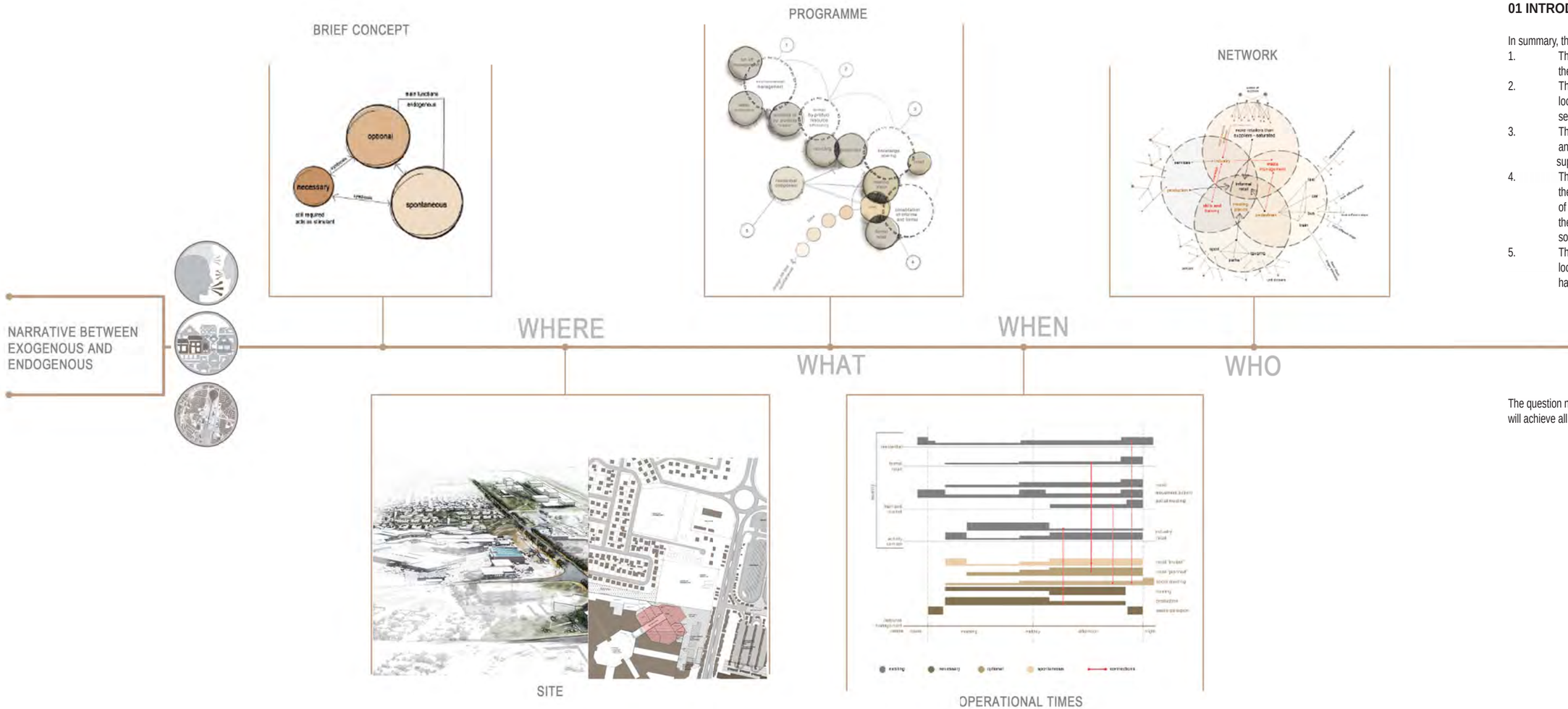


01 INTRODUCTION

In summary, the brief states that:

1. There are three spaces that must be designed for: the necessary, the optional and the spontaneous
2. The site that would support such a concept is located behind a formal retail centre and adds a series of informants to respond to.
3. The programme find its essence in a skills and training centre with attached activities that support the formation of the informal (endogenous).
4. The intervention needs to support and enhance the current activities and also address the lack of activities during the day in order to ensure that the space remains an active one that parties can socially invest in.
5. The intervention needs to support and strengthen local networks but also heal sick networks that have links that are missing.

The question now is: How does one create an architecture that will achieve all of the above?

Fig 07-1 introduction on how to find the “how?”(Author 2014)

02 ADJACENT SITE INTRODUCTION

The adjacent site programme is, in essence, an early learning centre named "Surviving the Edge", as it deals with the survival of children in Mabopane. The conceptual approach deals with the ritual of daily life and the manner in which the child's physical and mental health is the key channel to connecting with the family.

Fig 07-2 perspective of Mabopane framework (Author, Mills 2014)

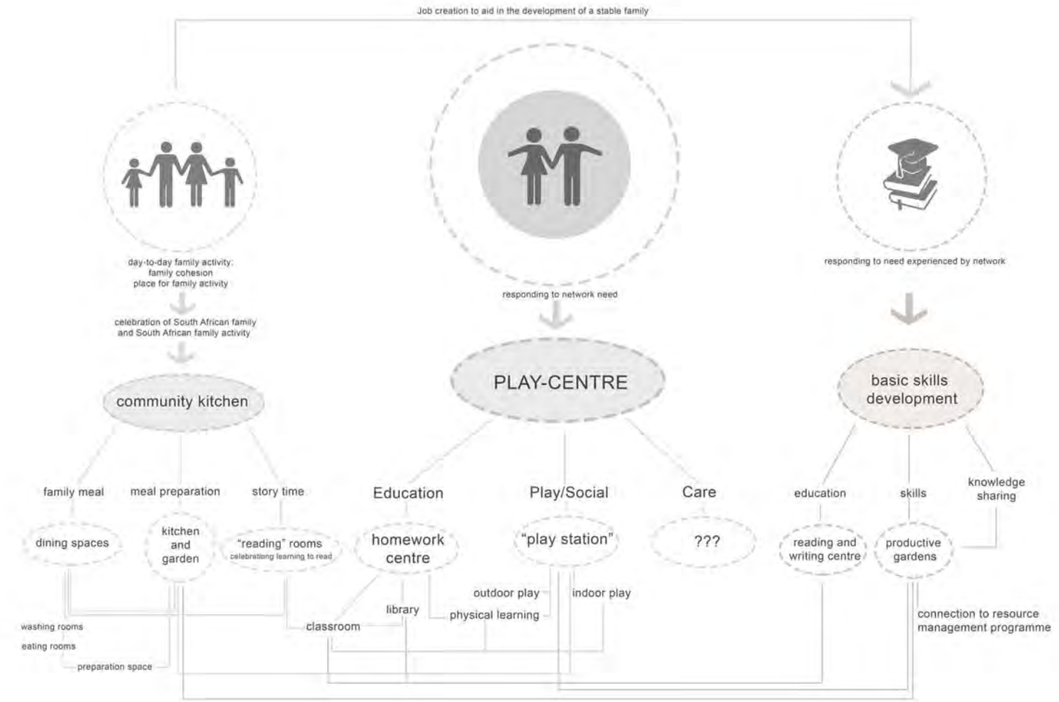


Fig 07-3 Surviving the edge programmatic response (Mills 2014)

03 MICRO-FRAMEWORK EFFECT_ STAKEHOLDERS AND AFFECTED PARTIES

Both direct and indirect parties will be affected by the intervention. In order for the choice of intervention to be accepted (and thus successful), these parties must gain something from the altered fabric.

Taxis
Going with the assumption that an increase in energies (especially the use of the shopping centre) will occur, more business opportunities might arise. The creation of more taxi-friendly stops at strategic points will streamline the process of client-taxi interaction.

Formal retail
By sacrificing rentable space to the new walkover, a new flow of energy is introduced, creating easier access and more feet for the shopping centre. Clients have indicated a need for more food shops through a survey conducted with the possible expansion of the mall in mind (see Appendix C). The parasitic nature of the residential component introduced into the northern façade (back of house) increases activity and provides visibility and security to a once dead space.

Shopping centre tenants
Although tenants of the shopping centre are more exposed to the surrounding fabric, more opportunities for business arise as visibility and access to stores is increased.

Existing residential fabric
The inherent creativity of the resident lies in transforming the front portion of the yard into a business, as the anticipated movement of people in front of the houses increases. An upgrade to the surroundings and increased opportunity for informal trade exists as public spaces are introduced.

Relocation of residents
Certain residential units will be removed in order to articulate the edges of the site more clearly. In return, these residents will be relocated to the phase one residential units that are clinging to the northern façade of the mall structure. By pooling the government grant for housing, a higher standard of living could be introduced, since the design dictates that social activities (food, recreation, living spaces) be shared.

Fire station
By dissolving the boundaries of a finite civic function, the next generation of civil servants are exposed to the processes and duties of the fire station, which can act as a gateway to life after primary and secondary phase education. In return for this extended civic service, the fire station receives increased land use, social space for existing firemen and a physical contribution of nonpotable water suitable for putting out fires, where in the past potable water was used.

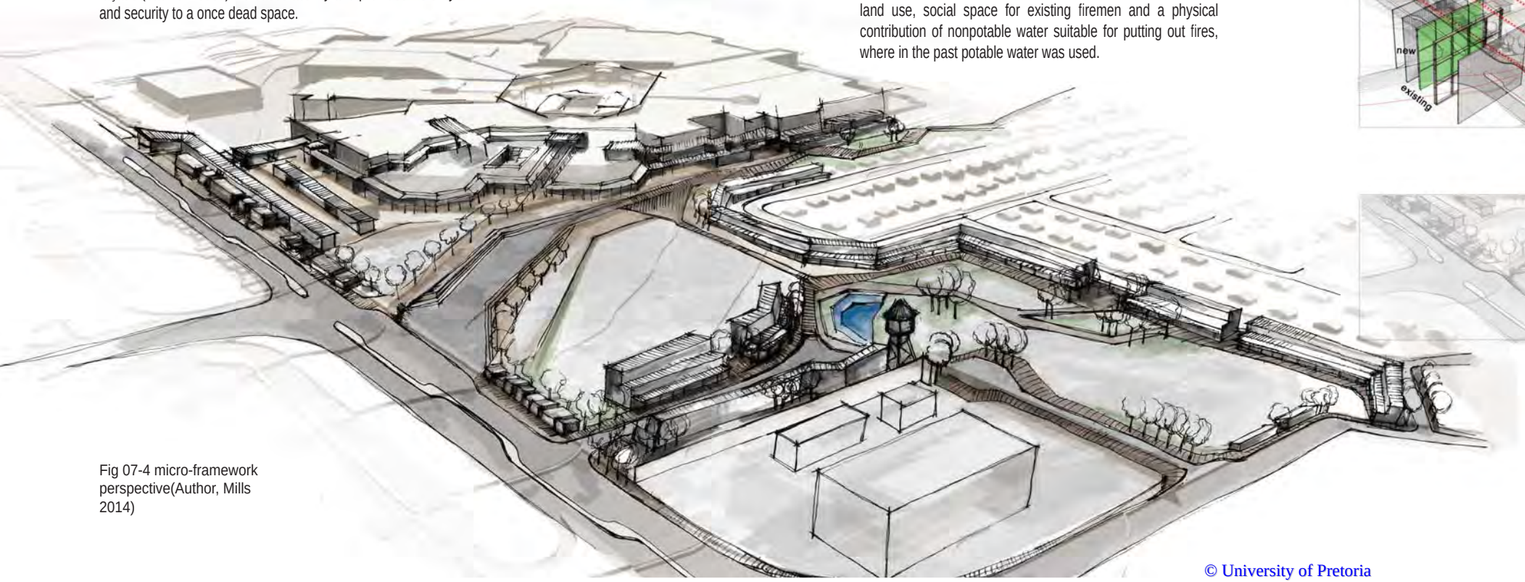


Fig 07-4 micro-framework perspective(Author, Mills 2014)

04 SUPPORTING THE ENDOGENOUS_A CATALYST FOR GROWTH

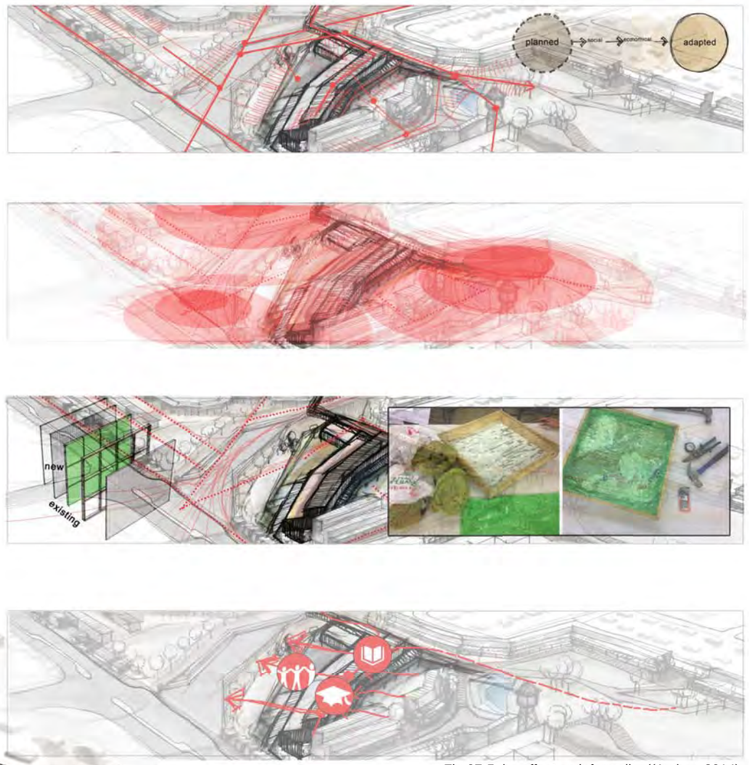


Fig 07-5 the effect on informality ((Author 2014)

1. Direct
By allowing and designing for optional and spontaneous activities to populate the site parallel to the necessary programmed space, a direct effect on informal activities and structures is encouraged. These activities consist of social meeting, as well as informal trade and industry developing from the necessary programmed activities.

2. Indirect
New or heightened energies and strengthened networks have an effect on the adjacent fabric of the site. A study of how the fabric evolves over time may result in a possible increase in home-run businesses and taxi activity.

3. Off-site
The production of building material that is equal in thermal performance to that of “pedigreed” materials supports the direct physical fabric of the endogenous activities. Recycled material will increase industry, decrease pollution and make for comfortable interior environments of the informal physical fabric (see Appendix D).

4. Intangible
The larger scope of the project increases the knowledge transfer between residents, and has an effect on the wider fabric. The programme of an apprenticeship workshop acts as a gateway by providing training that will increase both the retail opportunities and the livelihood of the community. The meeting spaces provide for social experiences and contact with the physical product the building produces as a recreational experience.

05 CONCEPTUAL APPROACH

The approach is to create a hybrid landscape that will encourage the narrative between the endogenous and exogenous activities. This is done through a series of conceptual ideas and informants. The points of interaction and exchange between these informants could generate the circumstances for the endogenous to step into a narrative with the provided exogenous space.

Three types of tangible and intangible encouragement of the endogenous activities occur:

1. Firstly, direct contact will be established as the endogenous activities (optional activities) are invited onto the site to inhabit spaces designed for them.
2. Secondly, the adjacent fabric will display qualities of endogenous activities being heightened as the energy created by the intervention spills beyond its boundaries.
3. Thirdly, the knowledge sharing and production of insulation material as a pedigreed addition to the built form will increase the ease with which endogenous activities occur, stretching far beyond the site boundaries.

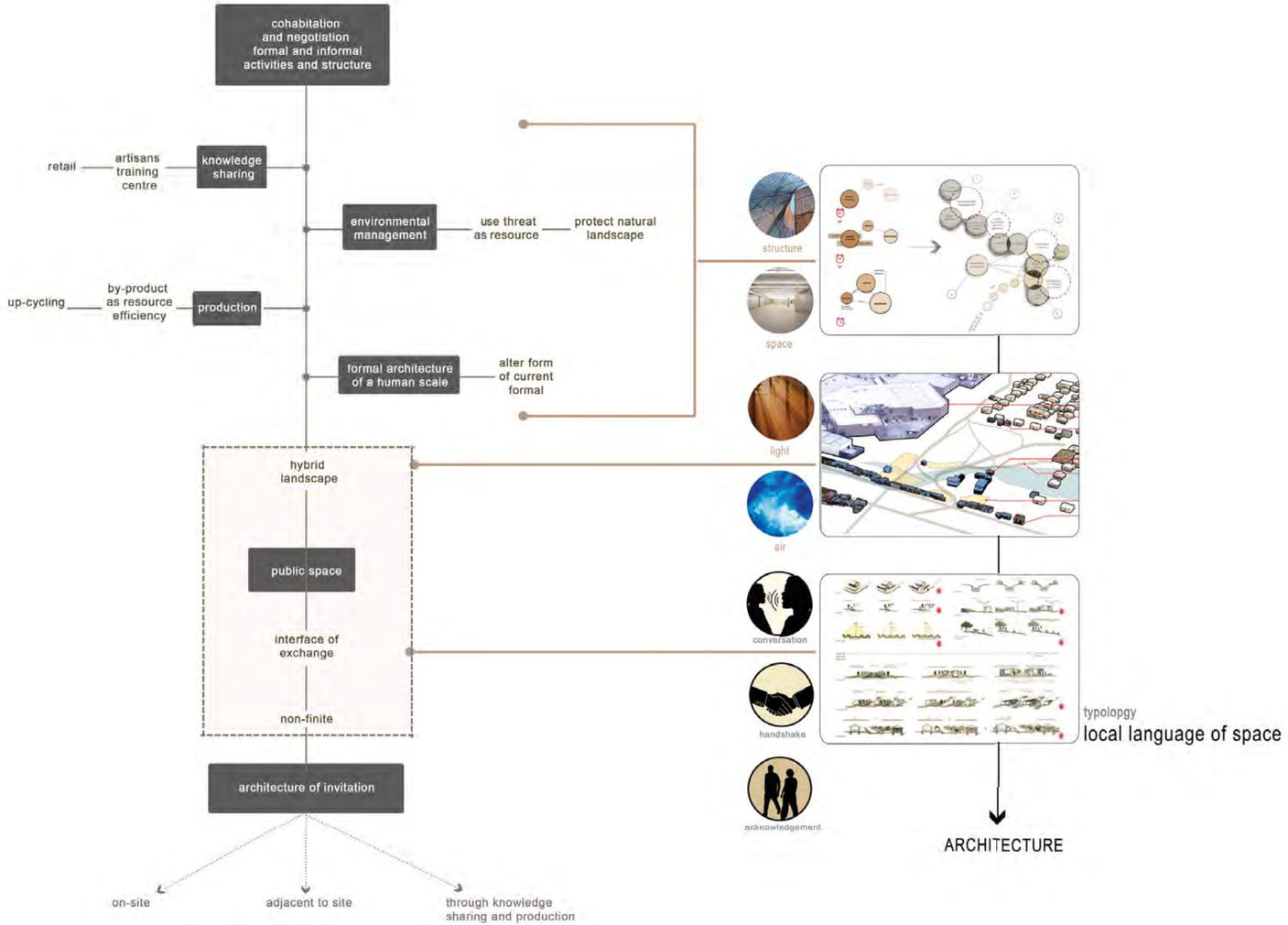


Fig 07-6 conceptual approach to a hybrid landscape (Author 2014)

06 HIERARCHY OF INFORMANTS

Informants were selected to use as tools in order to create architecture. These were hierarchised in order to enable an appropriate response.

The top order informant is that which is generated by the framework and then programme. The ethereal qualities of space are divided into structure, space, light and air. According to Louw (in Phaidon 2004), the logical, legible arrangement of these qualities is what creates architecture and enables it to communicate intent to a user.

The second set of informants is that of the site conditions. The identification of a possible site has led to a series of site conditions that can be studied and used as informants in space making, whether they are to be responded to sensitively or disrupted.

These two sets of informants need to create the last set – that of the local typology and language of space and the vernacular language. This method of interpreting and re-appropriating space must be studied and applied within the intervention to communicate what the space could become.

The informants are used as filters for the main idea (creating an invitation for the endogenous), from the micro-framework, to the programme, to the site in order to determine what architecture needs to be created.

The purpose of this section is to gain an intuitive understanding of the informants and develop a base design and layout to be iterated and moulded during design development.

Fig 07-7 hierarchy of informants (Author 2014)

07 STRUCTURE

Micro-framework

Layering of space should occur from the very public realm (the front porch) to the more private and intimate spaces (behind the front door) on a micro-framework scale when the programmes of the site are considered. The sites now stretch beyond their initial boundaries, making the adjacent spaces part of their territory.

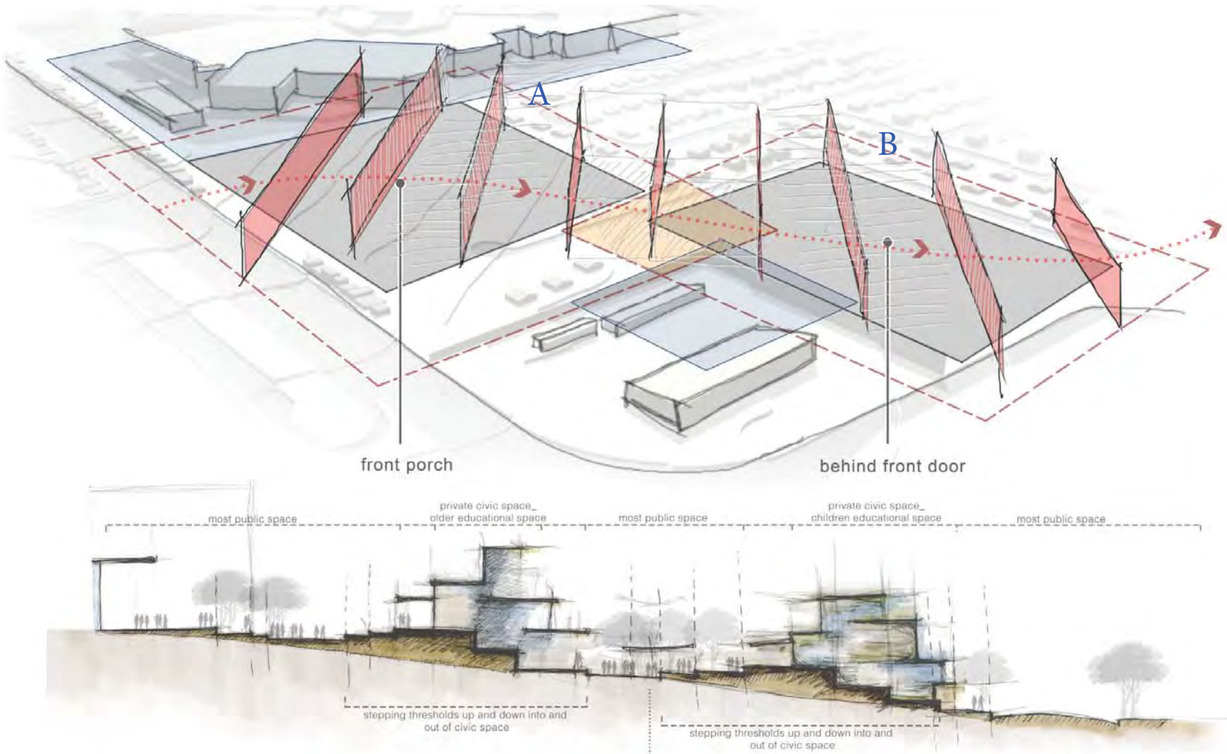


Fig 07-8 Layering from one site to the other (Author, Mills 2014)

Structure is created by defining edges and blurring boundaries. Within the micro-framework, the nature of the surrounding fabric indicated that a residential typology might be beneficial to creating these edges. By removing some existing residential units, the two sites are now more clearly interlinked.

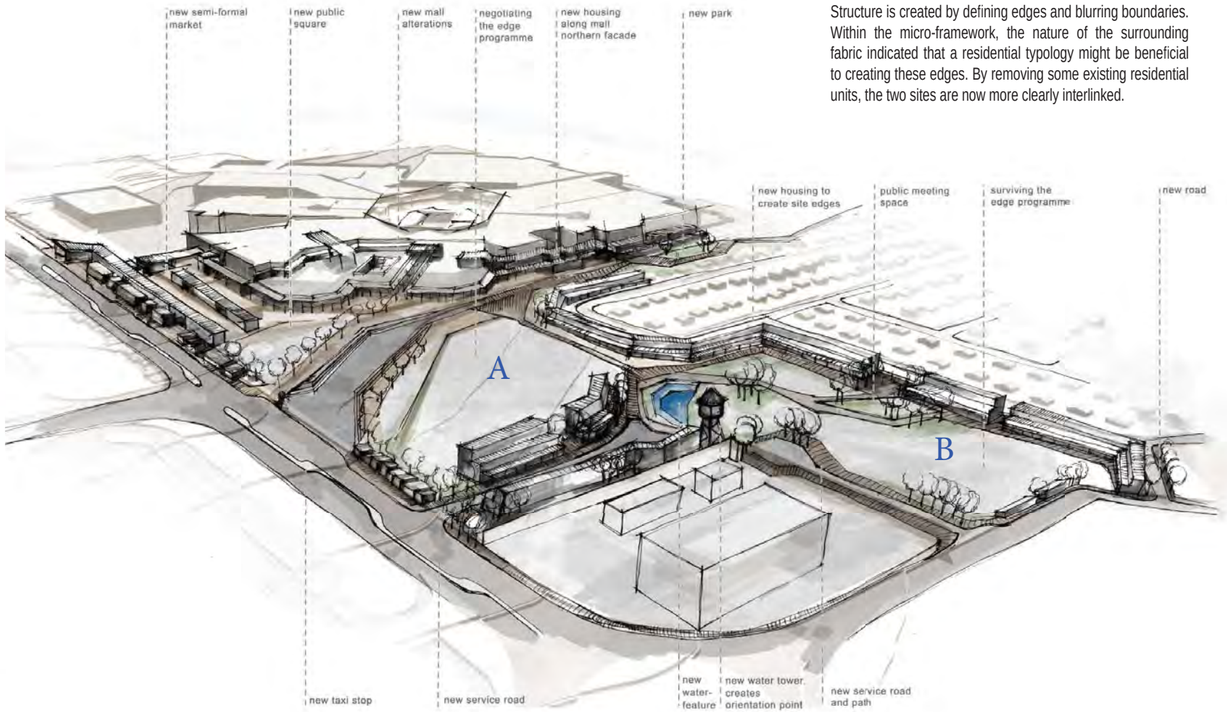
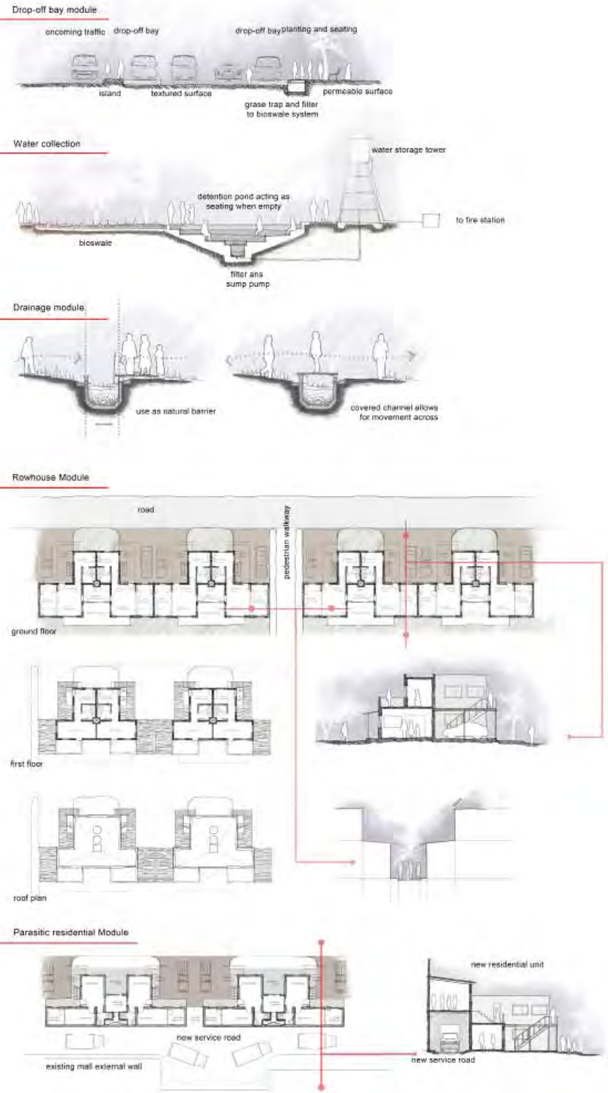


Fig 07-9 new edges and boundaries (Author, Mills 2014)

The type of public space required individually and collectively by the two programmes is defined. Significant routes and required connections to the adjacent built structures is determined.

Fig 07-10 plan view of framework structure (Author, Mills 2014)



A series of modules was set up to determine the structures that create edges and define boundaries. These modules include the drop-off bays, detention pond, bioswale and channel, row-house and parasitic house concept.

Fig 07-11 series of modules applied to the framework (Author, Mills 2014)

Three conditions determine the success of inviting the spontaneous and optional activities onto the site (Fig. 07-12). Learning from the on-site precedent and precedents elsewhere, it was determined that the spontaneous endogenous activities occur because of three basic principles:

1. Firstly, the nature of the surrounding activities – the drawing forces of energies (the mall, the station, the taxi rank, the residential development).
2. Secondly, the movement of people between these activities (respecting the existing movement while also taking into account the newly created paths).
3. Thirdly, the nature of what is provided in that in-between space as a catalyst (junctions form because of this).

The introduction of new activities (manipulating the existing as a catalyst) creates a new range of paths and intersections that give rise to a new area of opportunity in which the optional and spontaneous can exist (Fig. 13). This is where the architectural effort will be focused.

This area was selected because of its increased movement of people and new junctions forming within it. The programme requires the "rubbing against" and movement through of people for the spontaneous to claim this space, therefore special care must be taken when designing this area. The essence of the intervention (Fig 14) can be captured in providing a workable surface and a structural device that will communicate the organization of activity to the user.

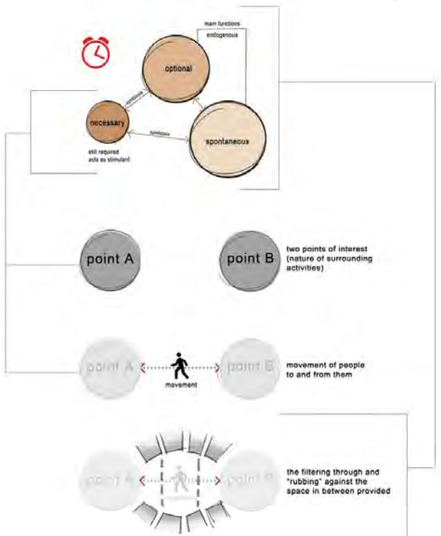


Fig 07-12 the three conditions for the spontaneous(Author, 2014)

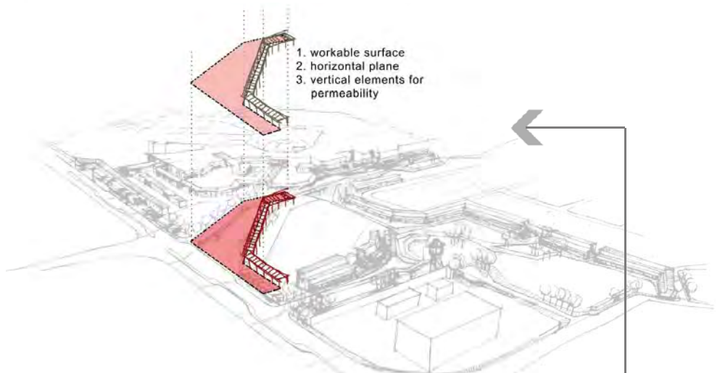
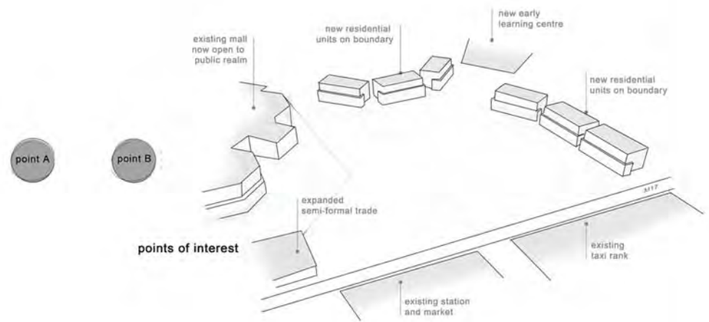
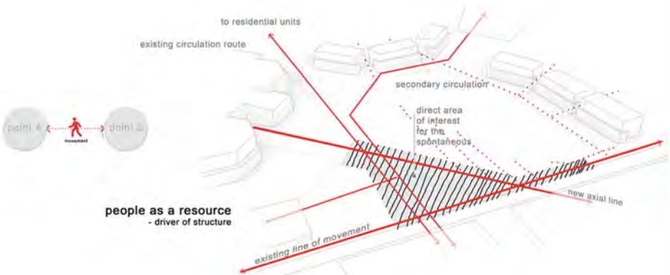


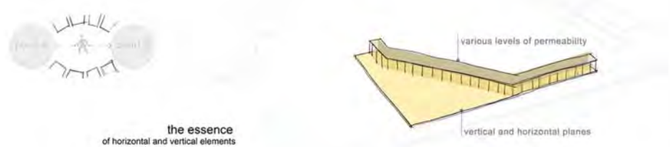
Fig 07-14 the essence of the structure (Author, 2014)

Fig 07-13 new nodes and paths (Author, 2014)

existing nodes and points of interest | exisitng paths and routes to junctions | new points of interest | new paths and routes







Conclusion

Starting from an understanding of the edges and points of interest, new and old paths can be identified. From here, the most valuable area is selected and its structure distilled to an understanding of vertical and horizontal elements (varying in thickness) that frame this space.

Fig 07-15 structure conclusion (Author, 2014)

08 SPACE

Programme

The necessary programme can now accompany the space set out for the optional and spontaneous, and can develop even more opportunities. The programme for site A is analysed in terms of the programmatic requirements of structure, both tangible and intangible. Tangible structure relates to the robust, finite structure as well as the adaptable, changeable structure, while intangible structure is compared to the composition or structuring of a house, where "thick structure" refers to very private, less permeable spaces and "thin structure" refers to public, very permeable space.

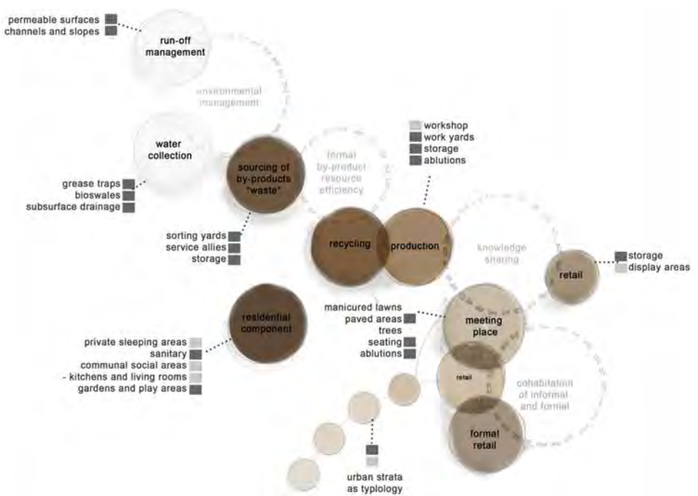


Fig 07-16a structure and space expressed in programme (Author 2014)

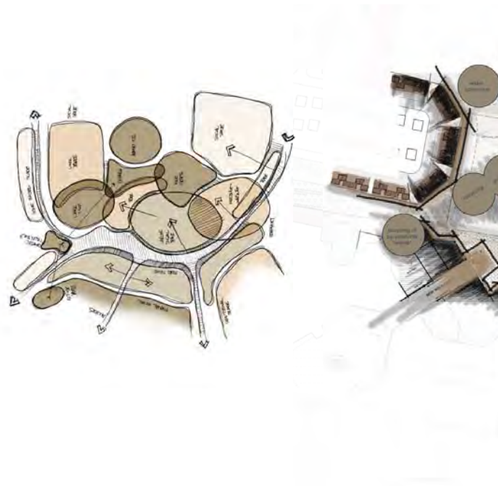
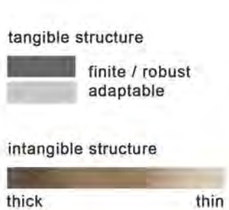


Fig 07-16b space of the programme expressed on site as an intuitive process (Author 2014)



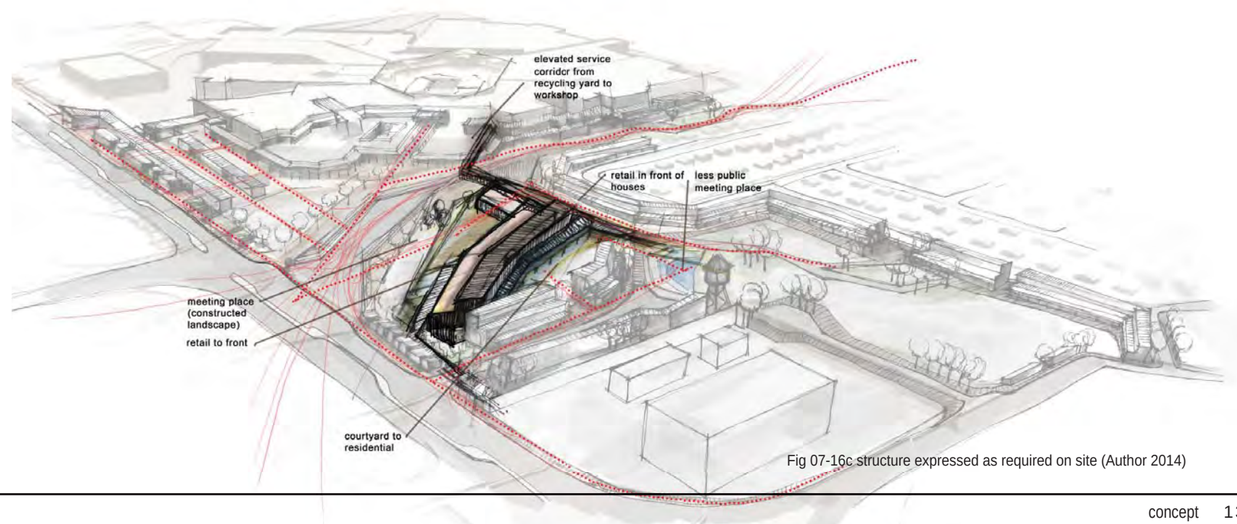


Fig 07-16c structure expressed as required on site (Author 2014)

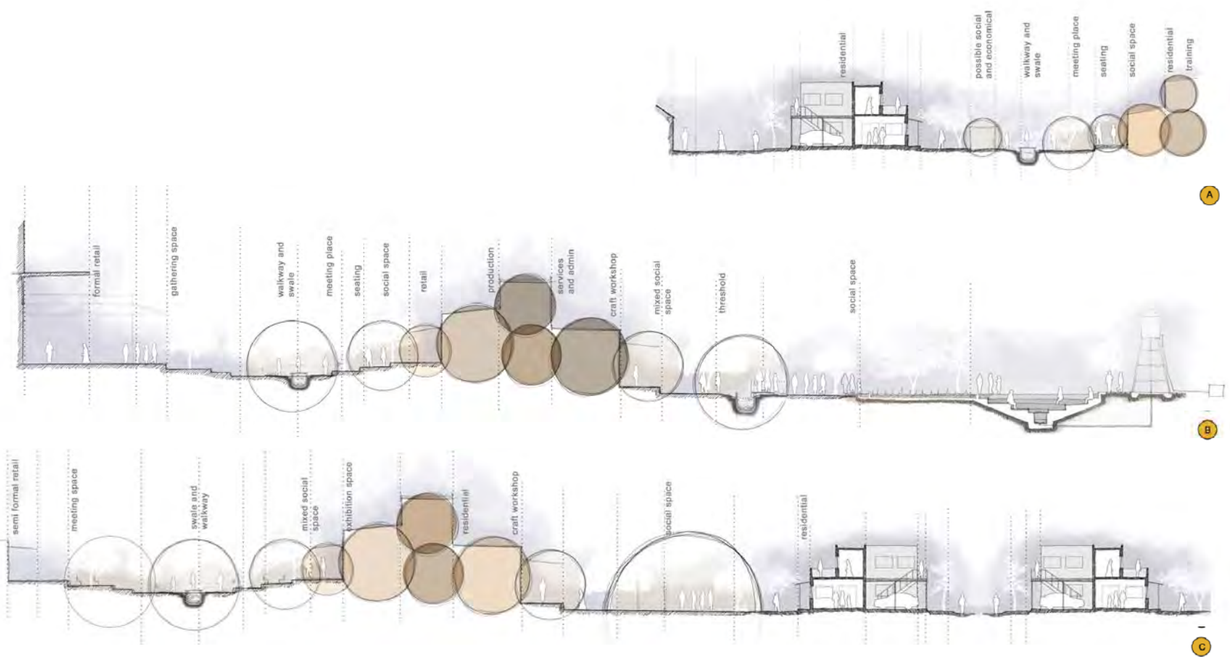
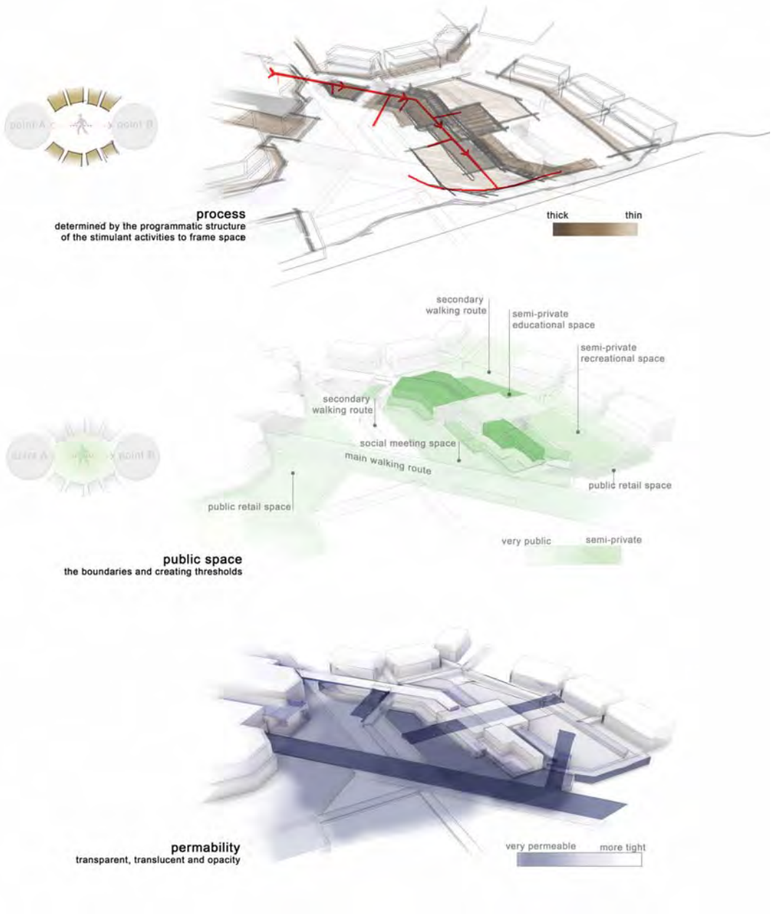


Fig 07-16d the programme filtered through and carved by the existing and new rituals on site of the site (Author 2014)



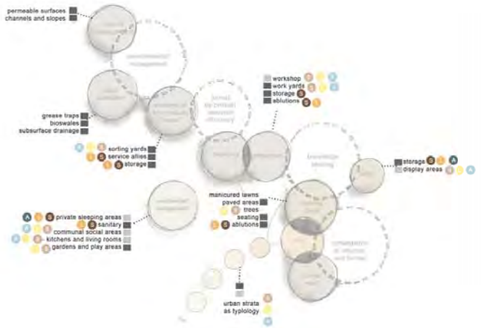
Conclusion

The structure provided the frame for space to be understood and arranged around. From an understanding of the processes in the building, the spaces for various aspects of civic life are identified. The building responds by being thin and permeable on its edges with selective filters and bands that lead to more intimate spaces within.

Fig 07-16e space conclusion (Author 2014)

09 ETHEREAL QUALITIES_LIGHT AND AIR

The ethereal qualities of the programme are analysed to discover the requirements for each predetermined (necessary), expected (optional) and promoted (spontaneous) activity.



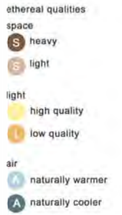


Fig 07-17 ethereal qualities of the programme (Author 2014)

The physical characteristics of the site, such as slope and water run-off patterns, were used to carve the programme and rearrange it on site.

Spaces located on the northern facade often tend to have better access to direct sunlight and are inherently warmer spaces. Now the programme is starting to re-organise itself on the site.

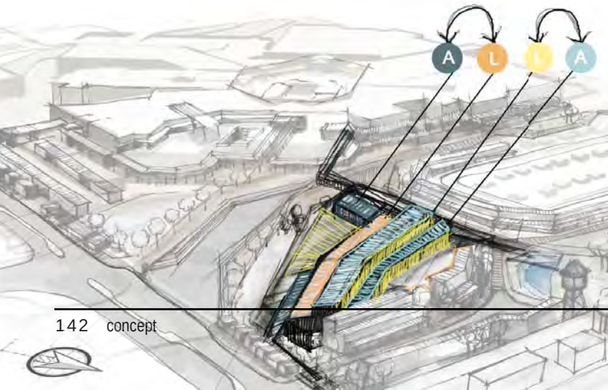
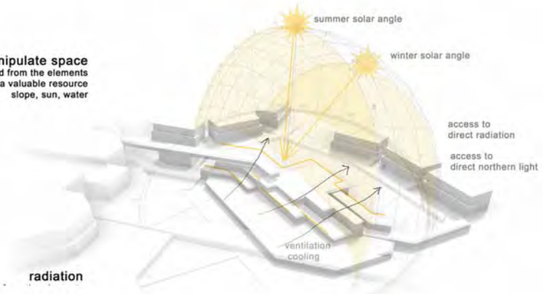
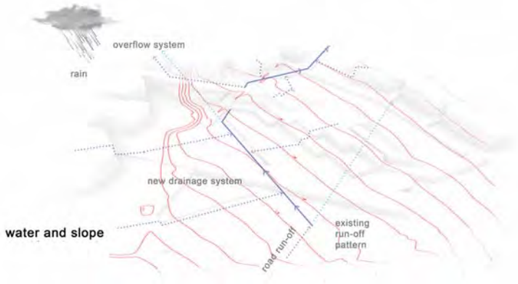


Fig 07-18 ethereal qualities of the programme's effect on site (Author 2014)

site conditions that manipulate space
user needs to be protected from the elements and capitalize on what is a valuable resource
slope, sun, water





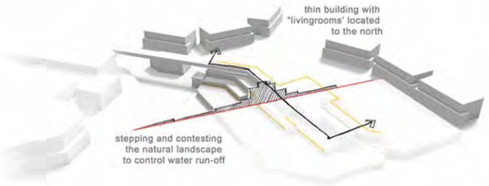


Fig 07-18b light and air conclusion (Author 2014)

Conclusion

Light (radiation both visible as light and invisible as heat) and air (ventilation) reshuffle the programme. Site conditions such as the slope (effect on light) and water management (result of air) can now manipulate or be manipulated by the building. The result is a thin building with "livingroom" spaces that receive direct (northern) light and benefit from cross-ventilation opportunities.

10 RESULTING POINTS OF EXCHANGE

The understanding of how structure, space, light and air qualities mould the site leads to a hybrid landscape of exchanges. The programme consists of a series of resource exchanges between functions and groups of activity. Overlaying the movement of people with these exchanges creates points of contact between them. Possibility and energy exist at these points of contact where social activities are encouraged. From there, the intangible points of resource exchanges are determined.

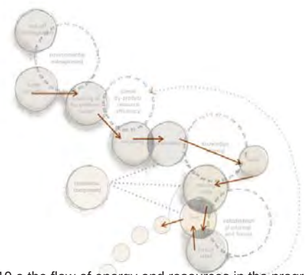


Fig 07-19 a the flow of energy and resources in the programme (Author 2014)

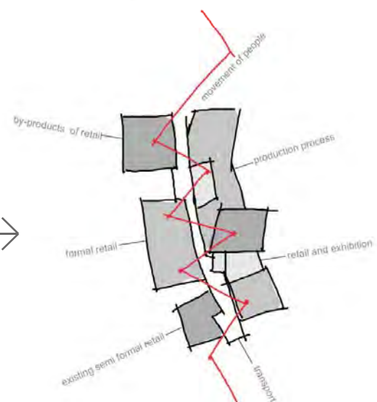


Fig 07-19 b the intersections of people and programme (Author 2014)

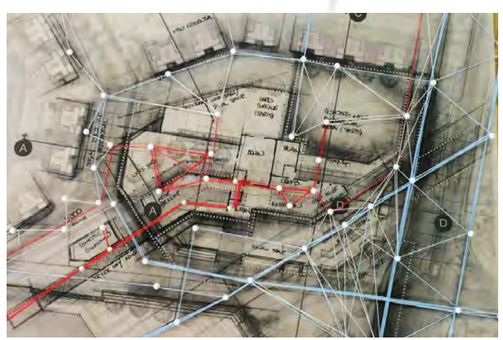


Fig 07-19 c intersection of people as a resource and the physical resources

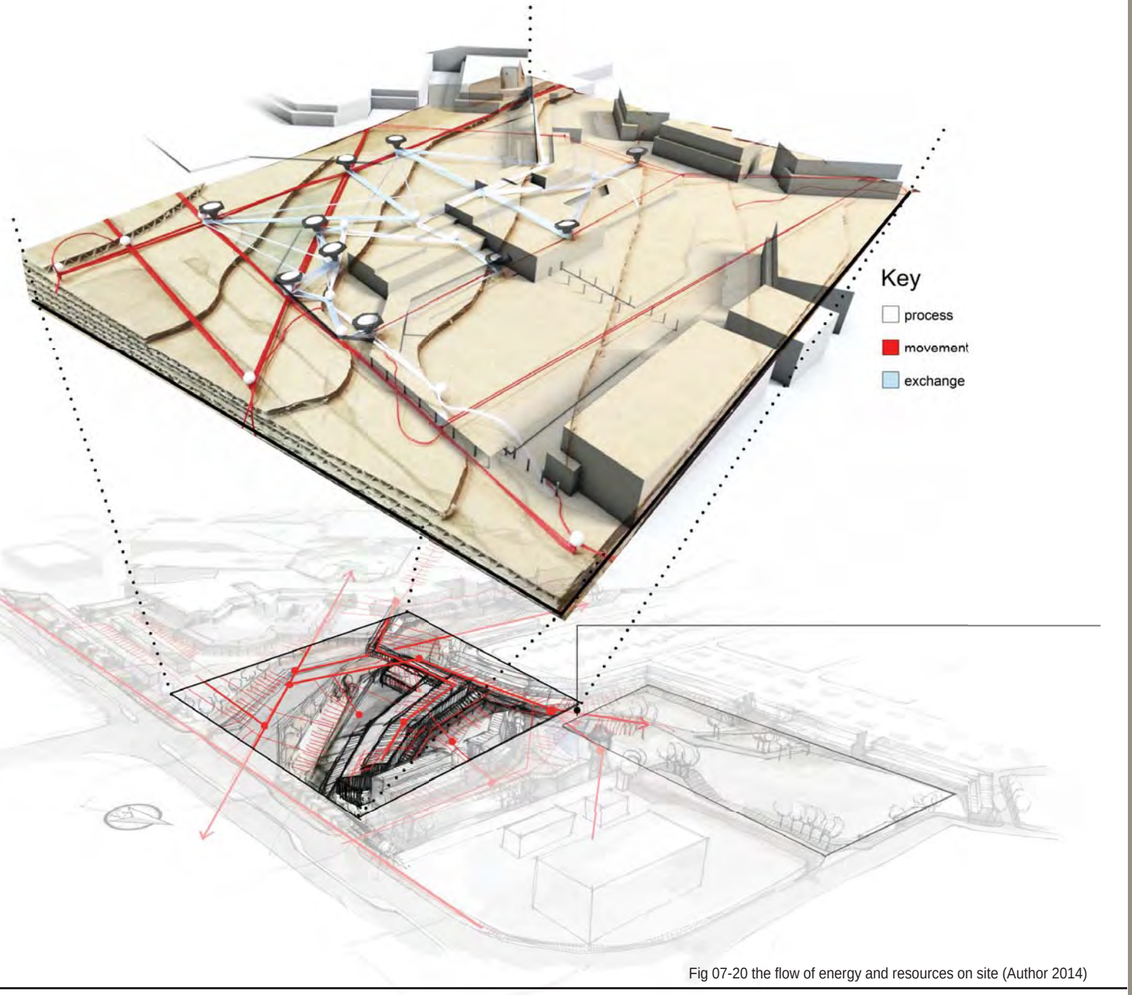
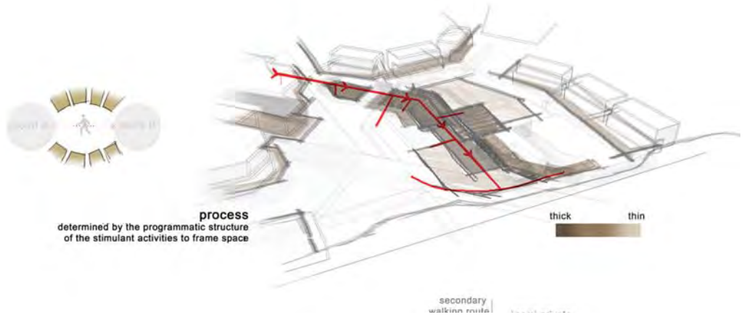
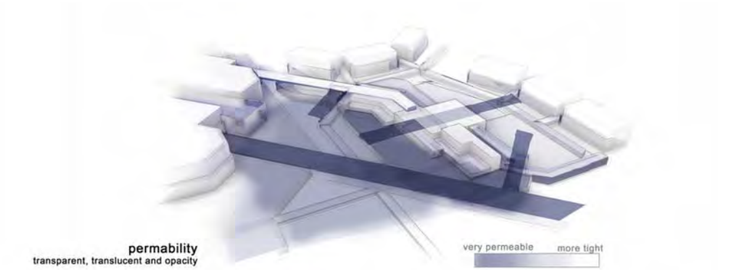
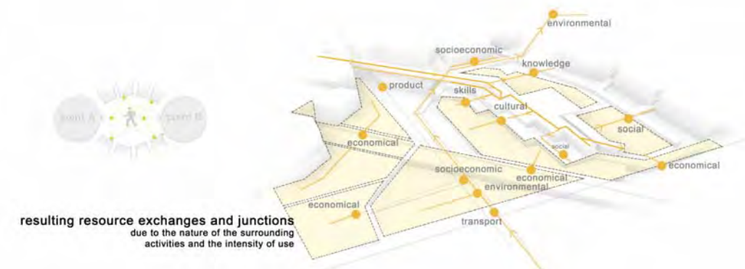


Fig 07-20 the flow of energy and resources on site (Author 2014)







Conclusion

From an understanding of movement, public space and the processes occurring within the site, a series of exchanges occur as people come into contact with processes. This landscape of opportunity creates energies that will result in tangible and intangible exchanges.

Fig 07-21 points of exchange (Author 2014)

11 METHODS OF CREATING A HYBRID

Establishing a socio-spatial dialect

Three methods of approaching the hybrid typology could be explored. As the designer is only in control of the formal, an ethnographic study was performed to understand the way in which the existing fabric functions, changes and responds to formal solutions.

Through the creation of a "dictionary" that is understood by the user, thresholds could be maintained, movement directed and space allowed to evolve into what it needs to become. The visual language is extracted from the fabric, deciphered and applied to the proposed site and activities. This understanding of "anonymous architecture" aims to stimulate the narrative between the two extremes. (see Chapter 2 and Appendix E).

Mimic

Understanding the structures and compositions of space within the given context allowed the design to impersonate these structures and compositions in order to function as a whole with the existing and proposed formal and informal environments.

Invitation

The design learns from the context how space is ritualistically formed and anticipates these changes over a linear time basis.

The idea of multiplicity

The design should embrace the context's ability to have more than one use for an element as space changes (expands and contracts) on a cyclical time basis.

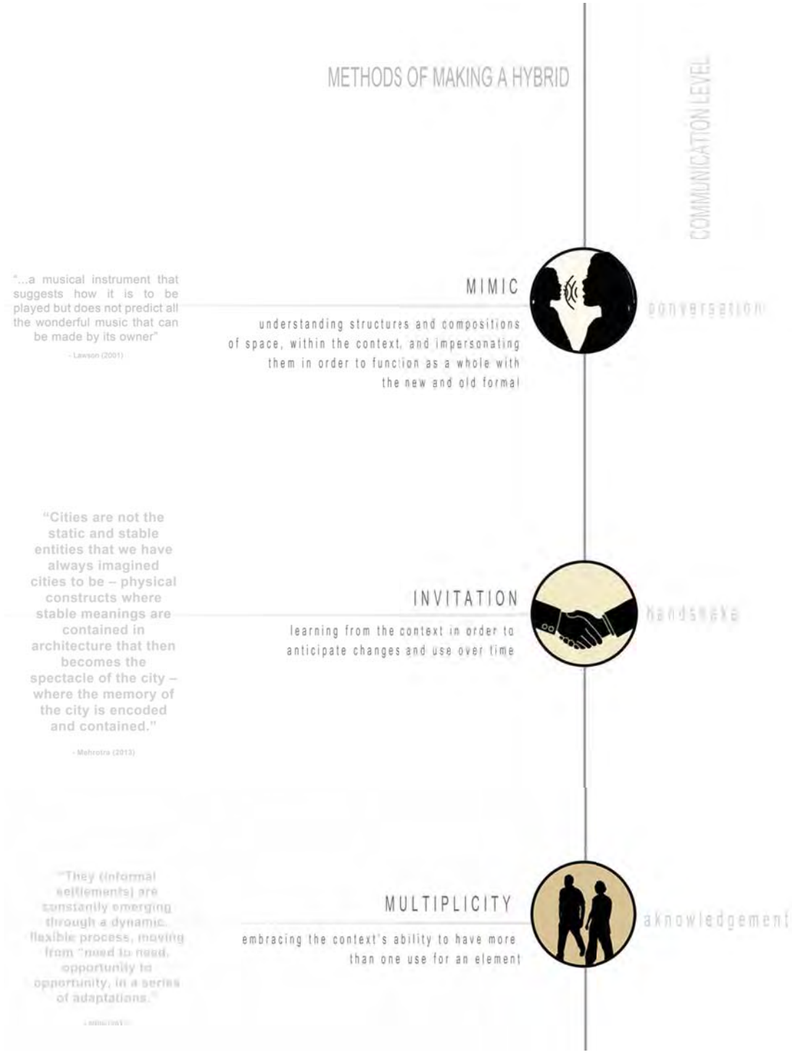
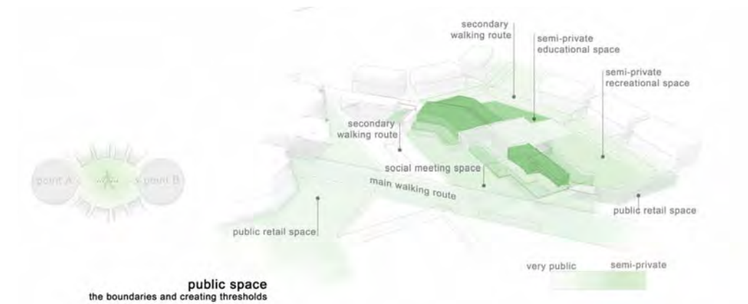
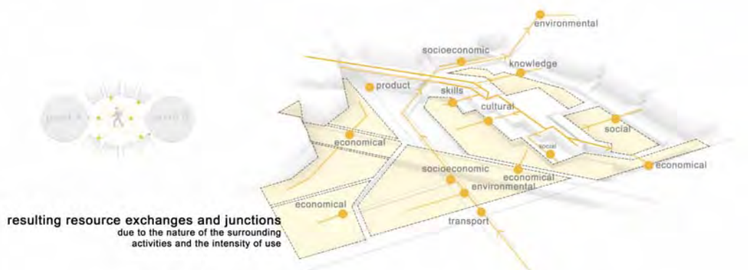
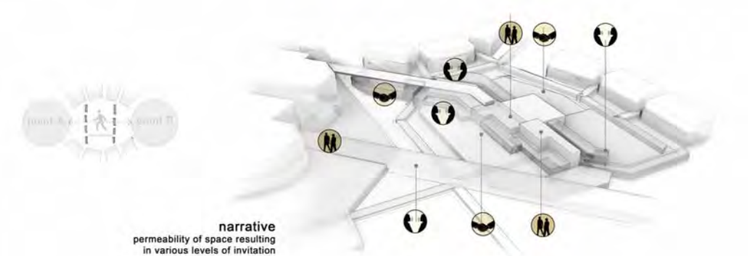
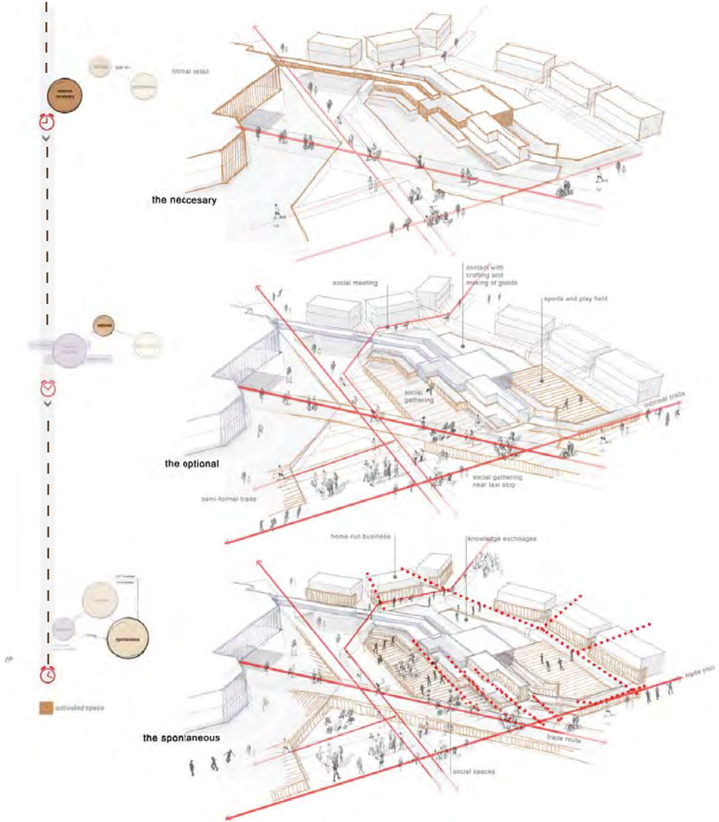


Fig 07-22 the optional and spontaneous spaces as determined by the programme (Author 2014)









Conclusion

Examining the context and understanding what works and why it works in that specific way, allows for a decision to be made as to what formal intervention is needed – and could be supported – to complement and reflect the dynamic properties of the context. This familiarity of form is used to create an architecture that is region specific in its message and use.

Fig 07-23 the hybrid landscape (Author 2014)

Fig 07-24 growth over time (Author 2014)

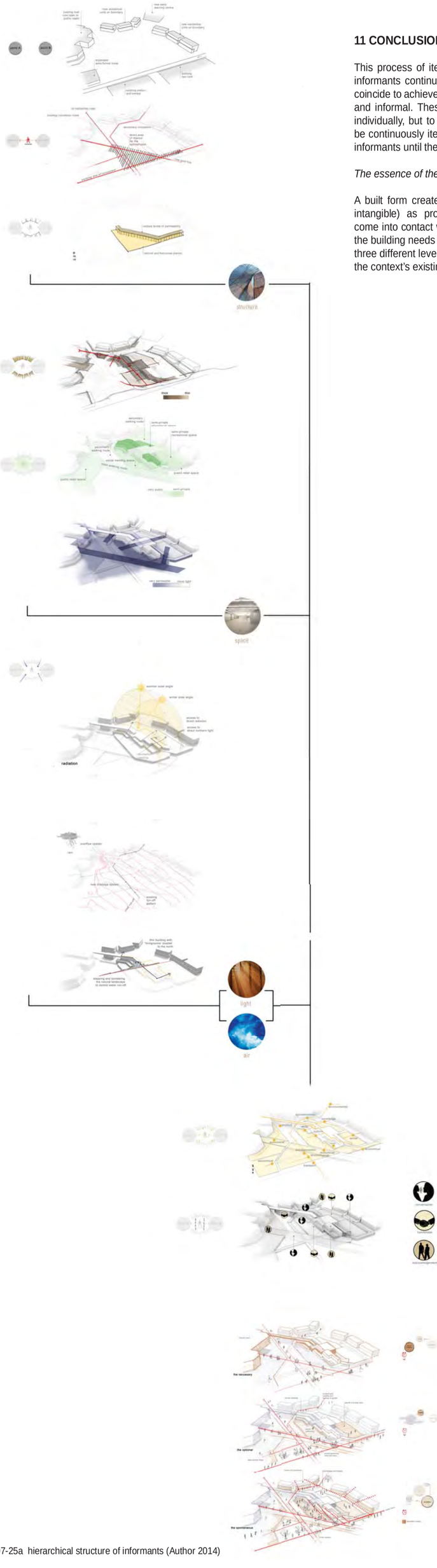


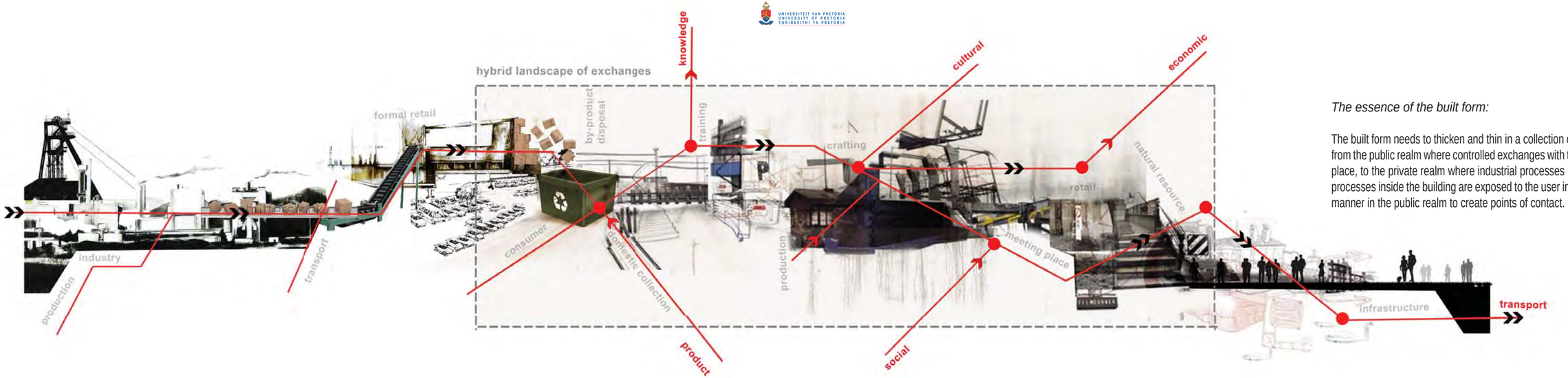
Fig 07-25a hierarchical structure of informants (Author 2014)

11 CONCLUSION

This process of iterating the proposal by filtering it through informants continues until the various layers of intervention coincide to achieve the goal of a narrative between the formal and informal. These layers do not aim to influence the site individually, but to build up to a possible solution that could be continuously iterated through the hierarchical structure of informants until the essence of the project is satisfied.

The essence of the function

A built form creates points of exchange (both tangible and intangible) as processes (man-made and environmental) come into contact with the user. At these points of exchange the building needs to speak a visual language to the user (on three different levels) by creating layers of space informed by the context's existing structure.



The essence of the built form:

The built form needs to thicken and thin in a collection of thresholds from the public realm where controlled exchanges with the user take place, to the private realm where industrial processes happen. The processes inside the building are exposed to the user in a controlled manner in the public realm to create points of contact.

Fig 07-25b concept diagram of hybrid landscape of exchanges (Author 2014)

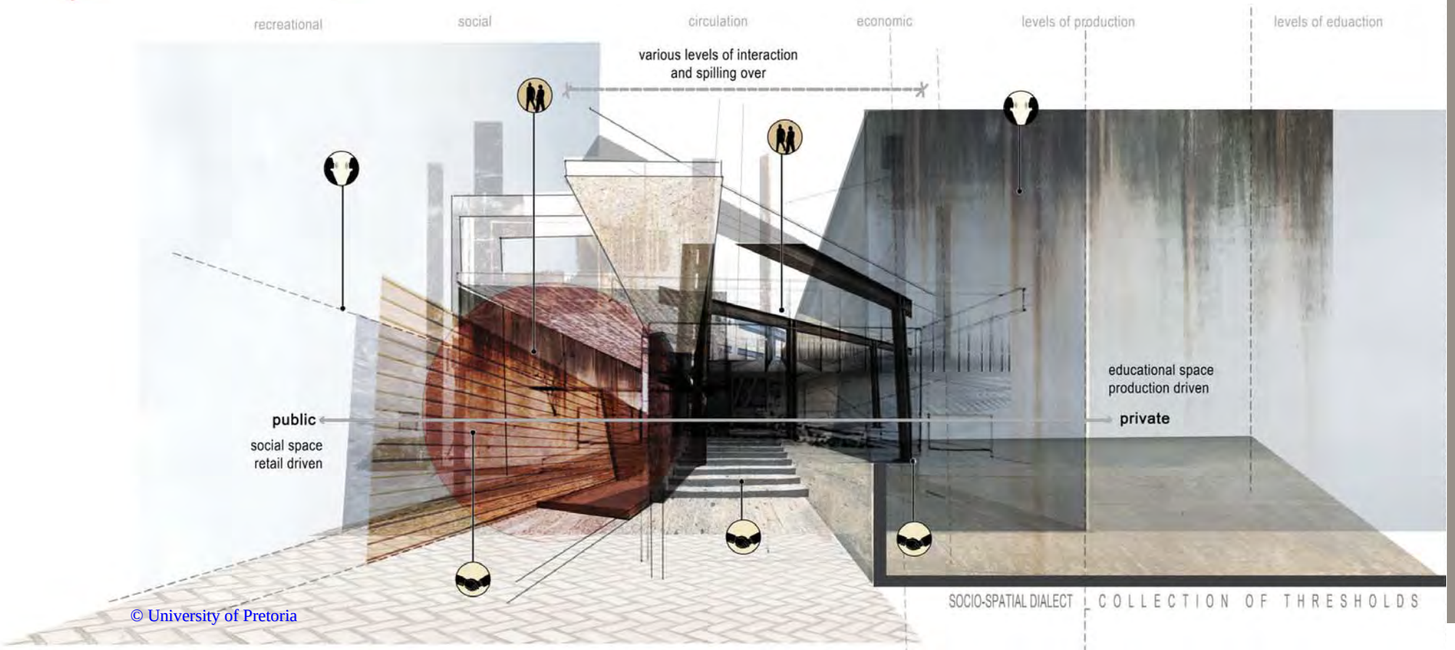
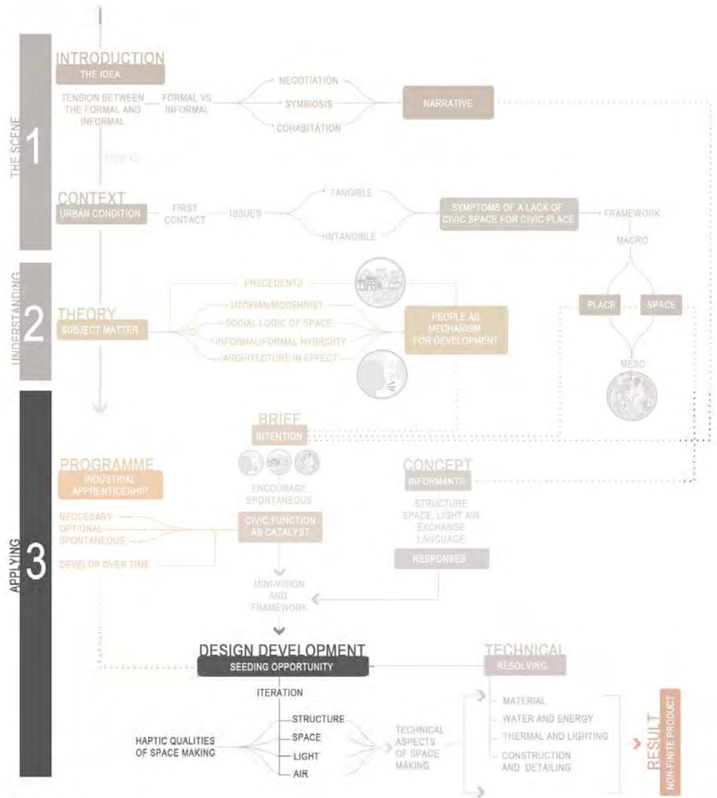


Fig 07-25c concept drawing of the collectior



08 DESIGN DEVELOPMENT

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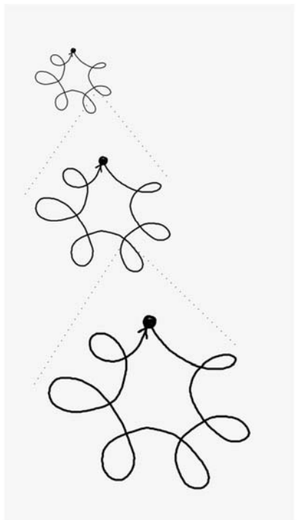
what it really looks like



return processes within return processes

how it can be expressed "linearly"

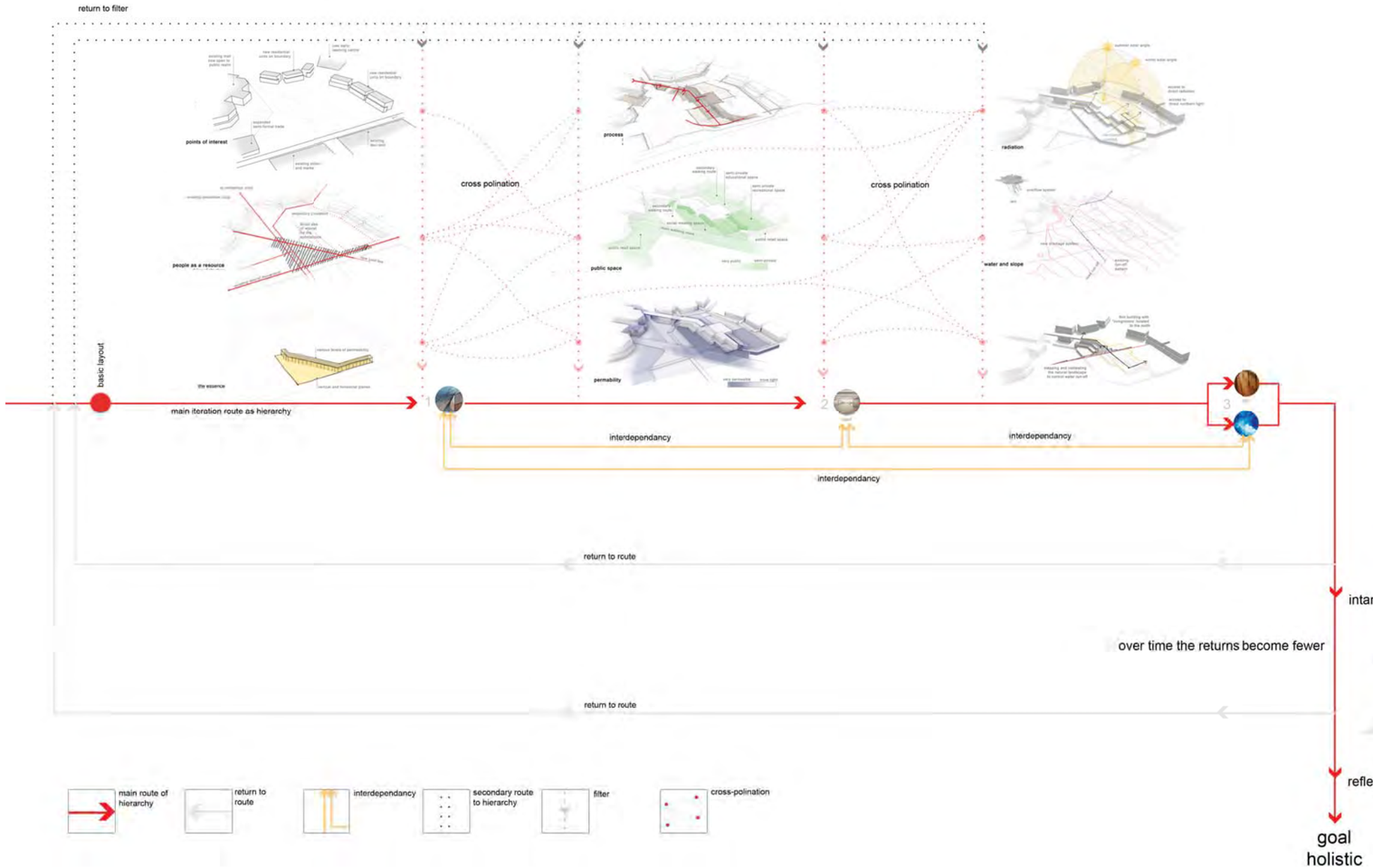


Fig 08-01 The iteration process (Author 2014)

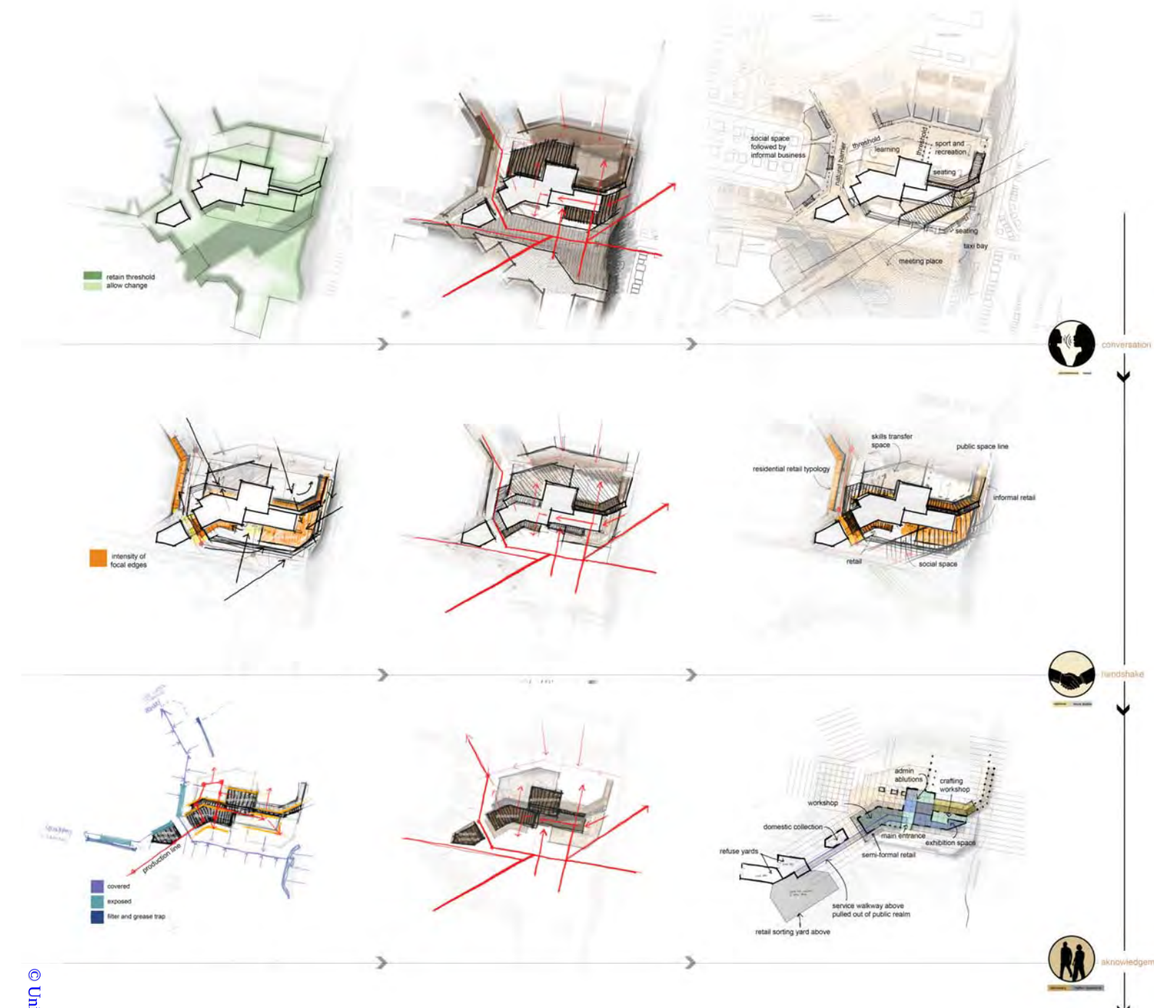
01 INTRODUCTION

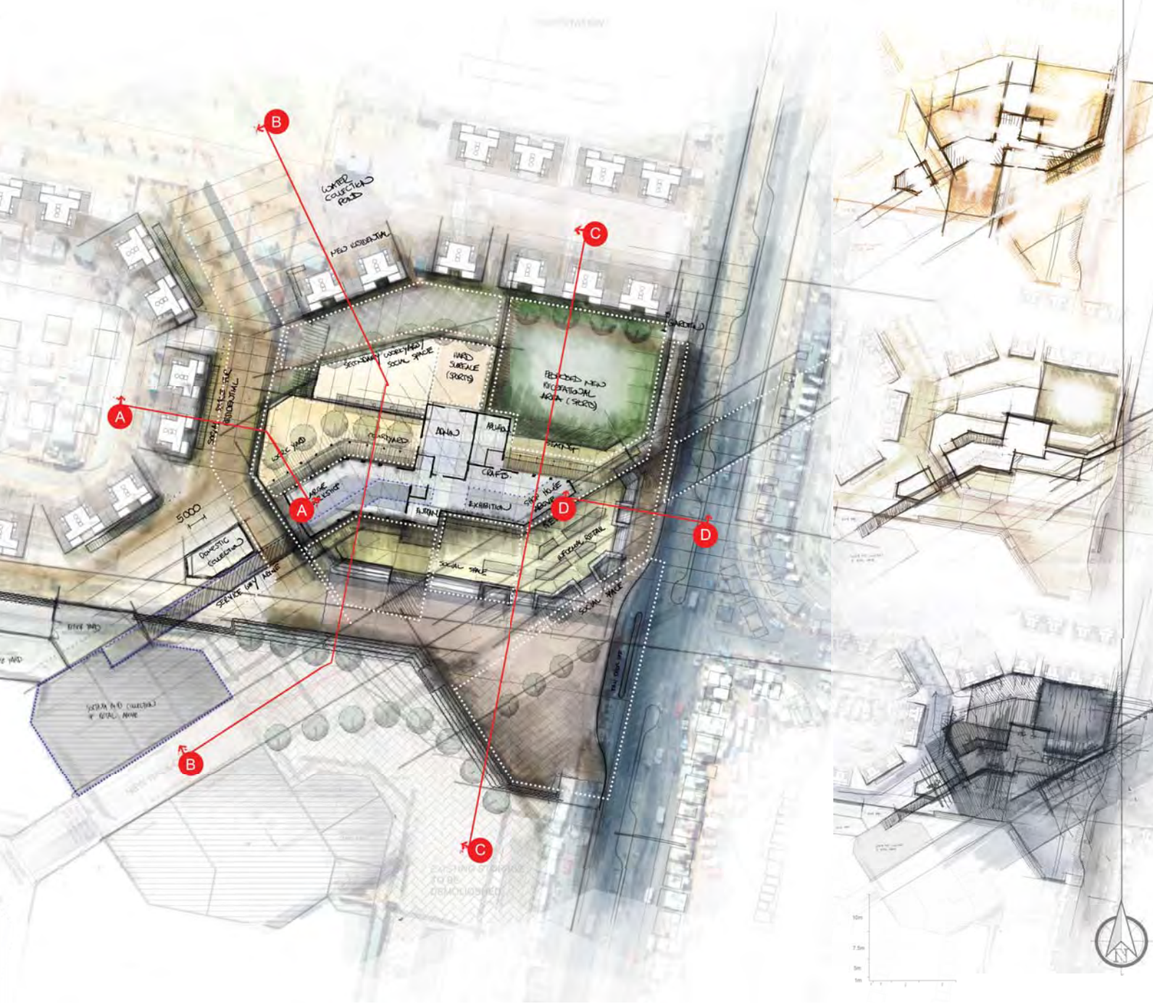
The basic conceptual design is iterated through the informants, starting with the movement and filtering down to the site conditions (Fig. 08-1). This filtering process is not linear and the filters affect each other as they change. Constant synthesis needs to occur with the essence of the design, as one needs to "touch-base" with the original intentions and question their validity.

The most closely related informants are iterated together and plugged back into the hierarchical system to be compared to the essence of the project. Some of the informants directly influence each other and are grouped together in the iteration process. Others lightly "touch" each other or filter down into each other. These are brought together in a single thought in the synthesis section.

02 ORGANISATIONAL STARTING POINT

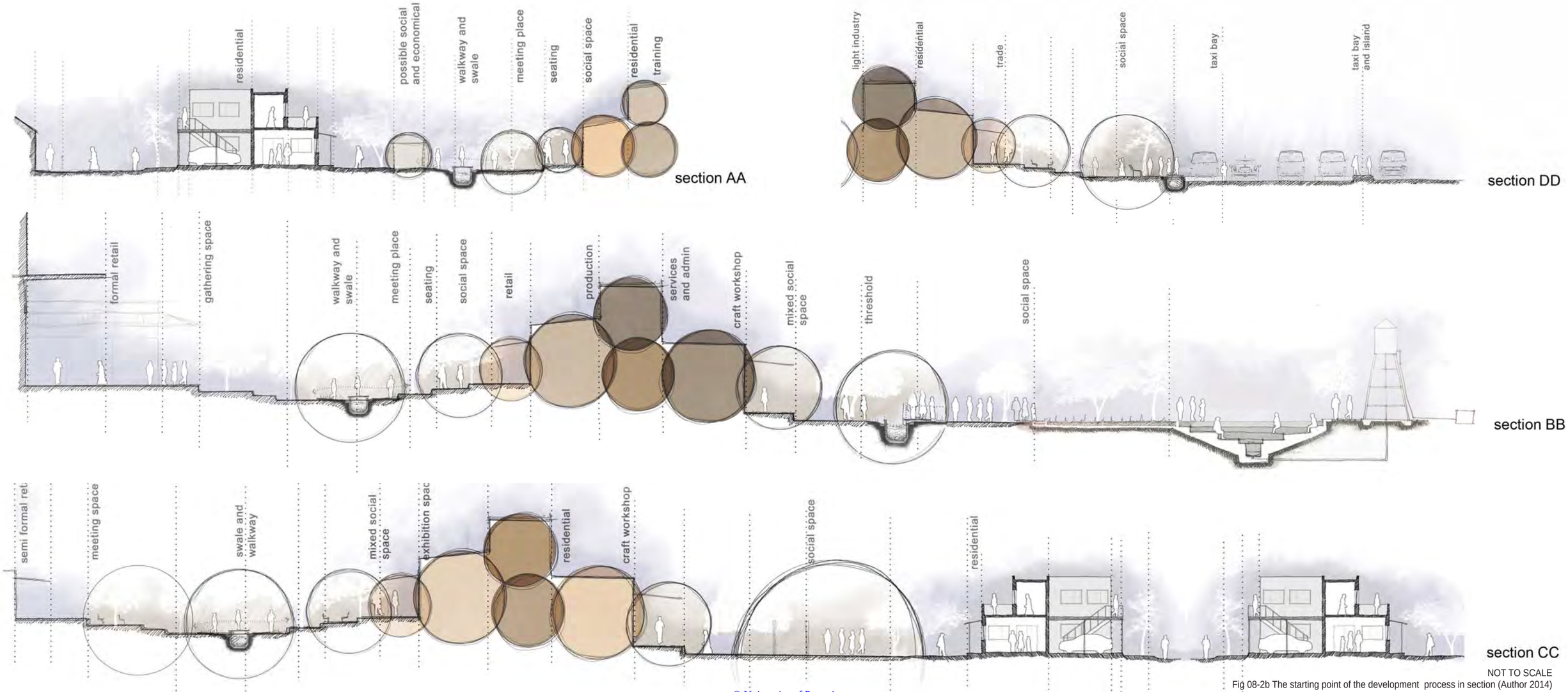
The basic sketch plan was intuitively derived from an understanding of both the informants and the requirements for the three types of narratives that need to occur as it relates to the essence of the project. The layout has not yet investigated the landscapes of exchange and the resulting edges and narratives, but instead illustrates one possibility for spatial layout.





NOT TO SCALE

Fig 08-2a The zoning starting point of the development process (Author 2014)



NOT TO SCALE

Fig 08-2b The starting point of the development process in section (Author 2014)

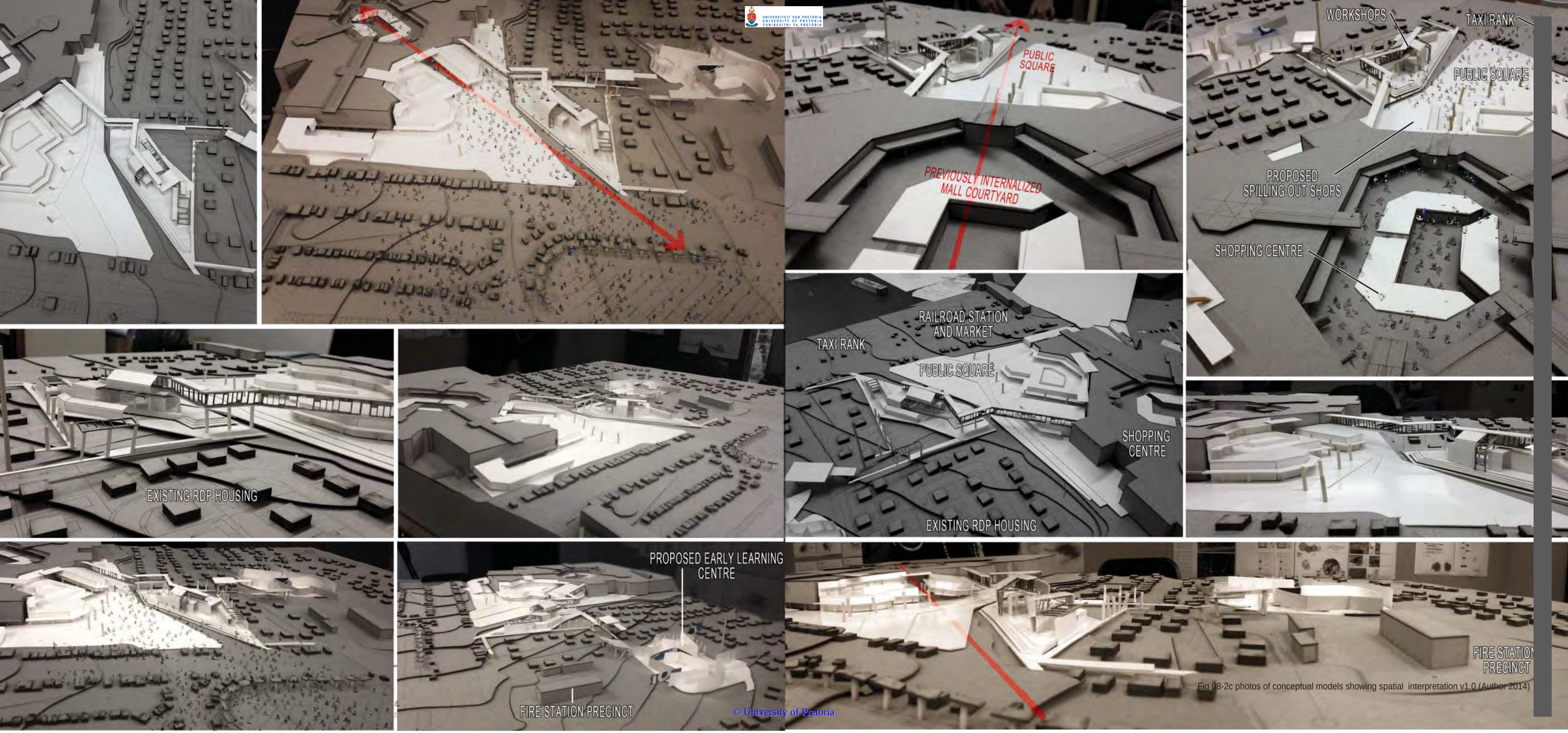
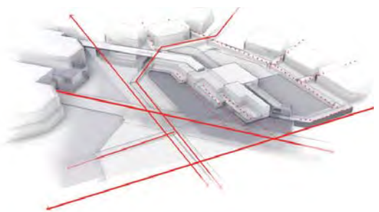
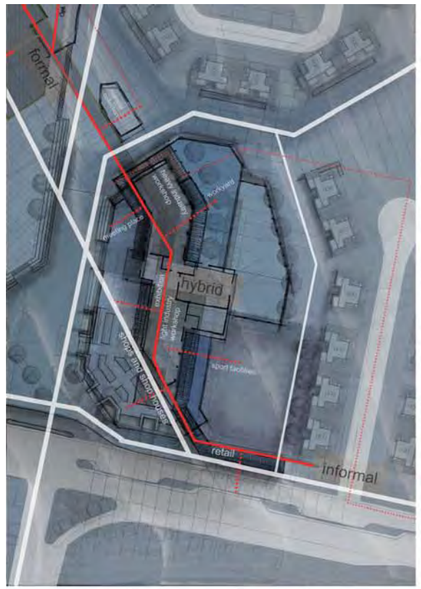
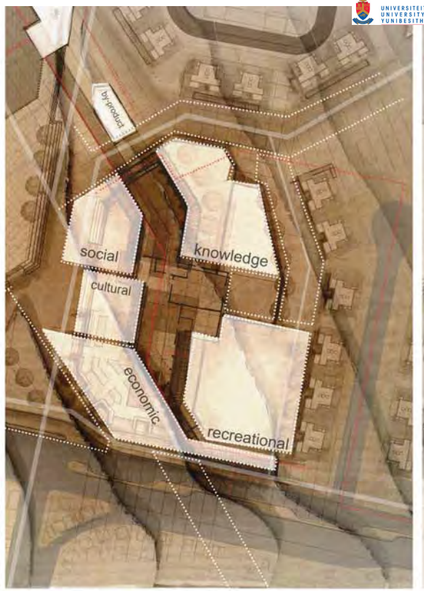


Fig 08-2c photos of conceptual models showing spatial interpretation v1.0 (Author 2014)

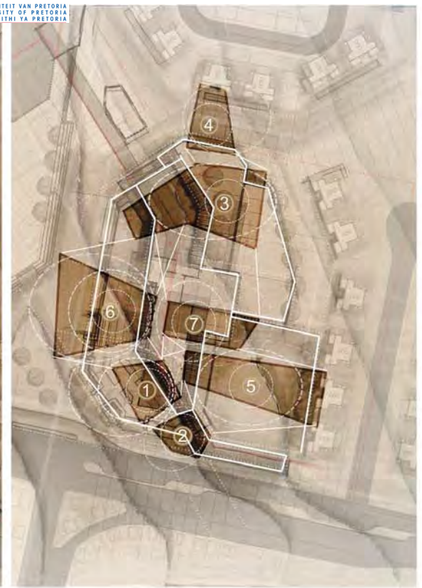




MOVEMENT OF PEOPLE AND PROCESS



CONNECTION AND LANDSCAPES OF EXCHANGE



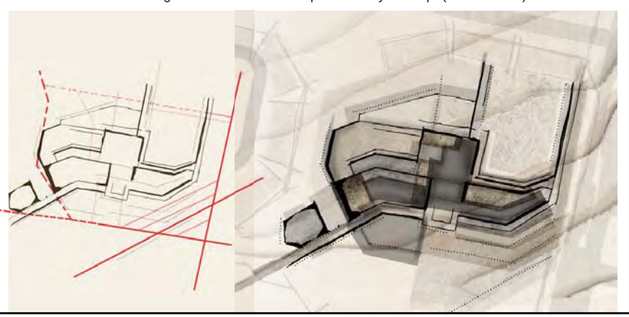
SOCIO-SPATIAL DIALECT

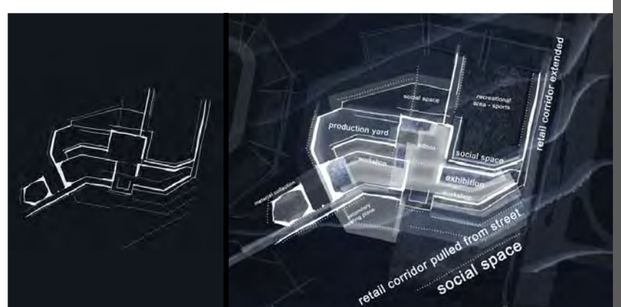
LAYERS OF EXCHANGE
VERY PUBLIC - LESS PUBLIC

SPATIAL FLUIDITY AND CONNECTION

Fig 08-3b conceptual layout (Author 2014)

Fig 08-3a movement and permeability concept (Author 2014)





03 RESPONSE 1

This section is concerned with refining the movement and access to and from space as kinetic energy moves through the collection of thresholds (Fig. 08-3a). Movement is guided, intercepted and blocked by an architectural form that communicates visually to the user what it needs to become, who can enter the space and where territories are formed.

The desired movement is hierarchised, showing fast, slow and filtered movement lines (Fig. 08-3b). The movement creates edges that are thick and permeable, but also in-between where sifting and funnelling need to occur. This results in space that is both thick and thin, depending on the function it houses.

The drawing is inverted to show that space (in some instances) could be the absence of edge. By inverting the base drawing, a hierarchy of space could be set up and architectural effort could be focused on these spaces.

In order to respond to a civic need for social space, the retail corridor is pulled from the street (Fig. 08-03c) and into the complex, lining up with the formal retail axis. The space that would have been used as an extension of the trade corridor is now social space. This "pulling" is informed by a new axial line of movement, but also by the provision of a more appropriate space for retail activities. Traders follow the path of least resistance, and thus the social space acts as a space of resistance to trade.

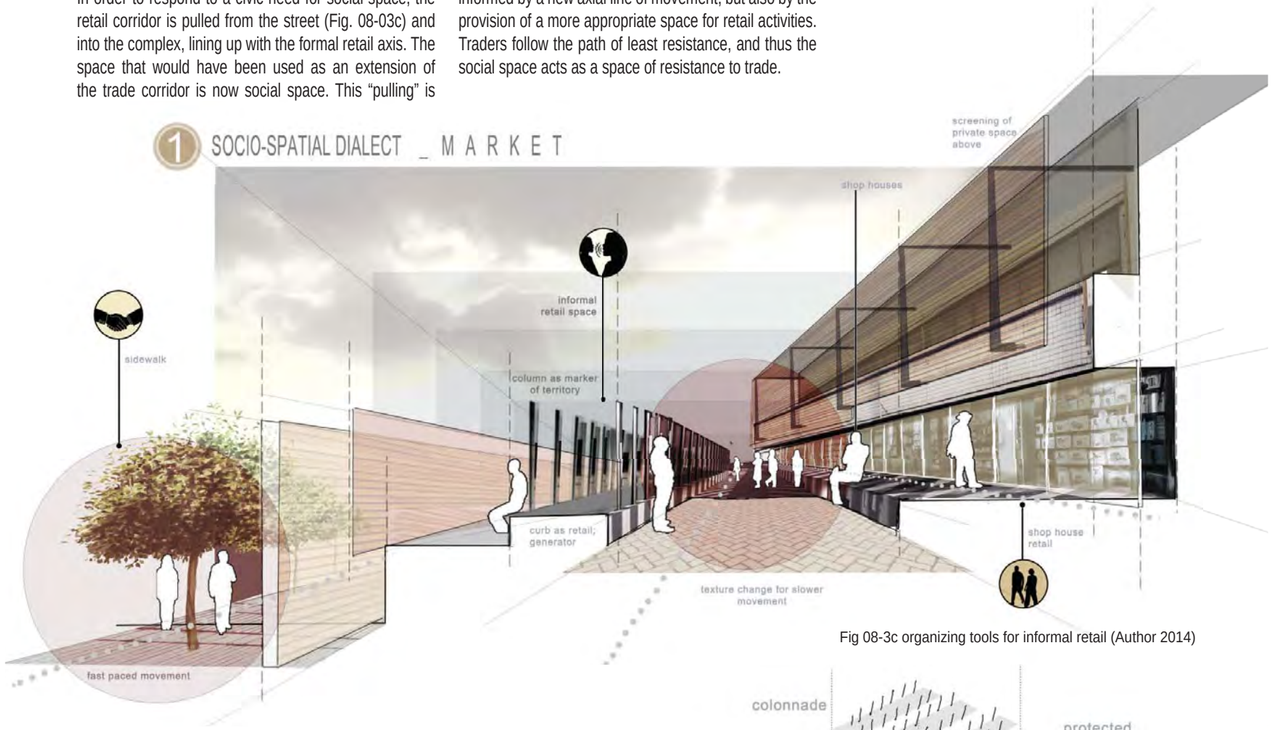


Fig 08-3c organizing tools for informal retail (Author 2014)

From the earlier study of spatial evolution (the taxi rank/ market), a traffic regulating island was selected to act as a generator and organisational device for the informal retail to come. The raised area could be paired with a colonnade to hint towards possible vertical (wall) and horizontal (roof) planes developing over time. This is a space that illustrates little resistance by using a known device found in the settlement as a visual communicator.

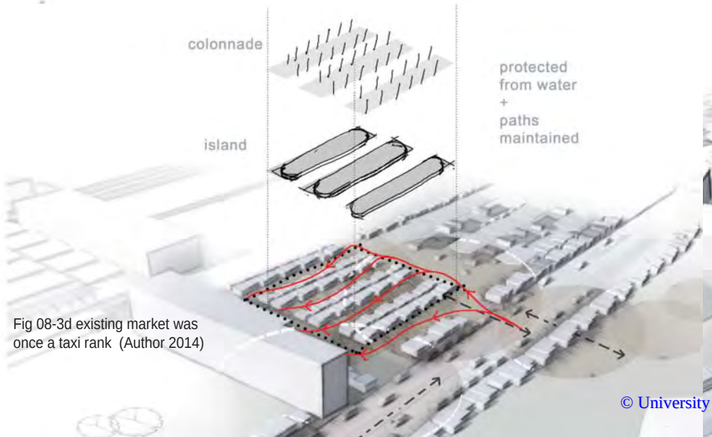


Fig 08-3d existing market was once a taxi rank (Author 2014)

Movement through and around the built structure is programmed to be either "fast" (stairs, hoist and lifts) or slow (large tread stairs and ramps). These accelerators or retarders of movement are paired with vertical and horizontal planes to create territories and pockets of space (Fig. 08-3e).

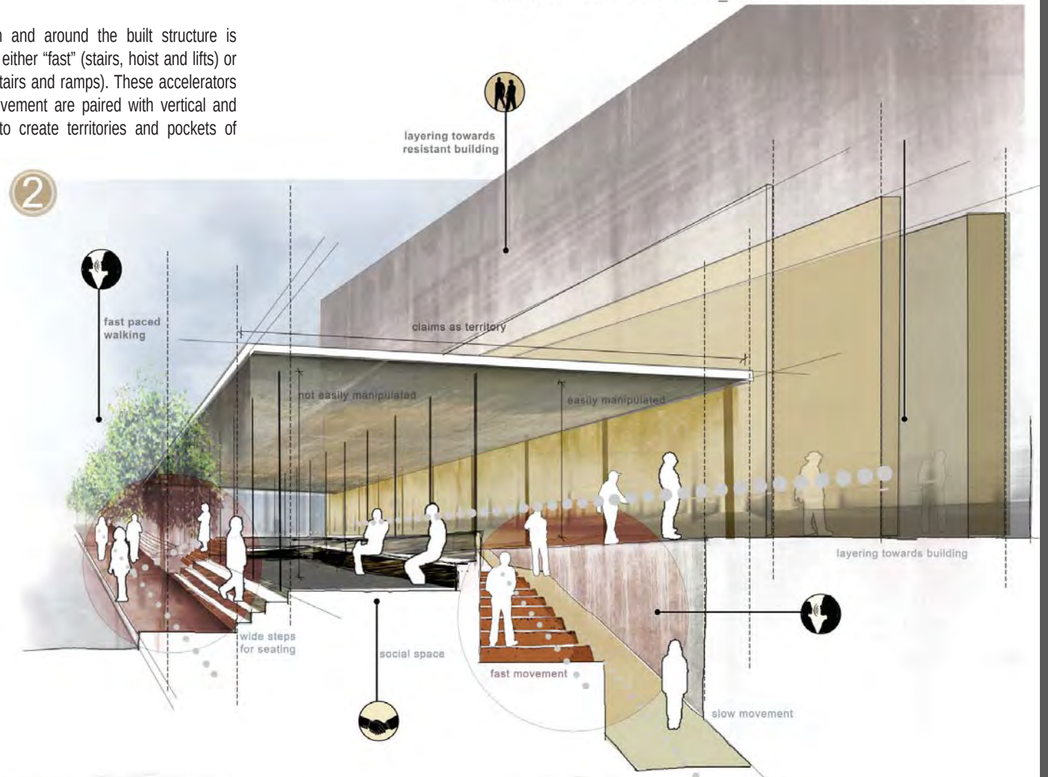


Fig 08-3f creating a market space and social space territory (Author 2014)

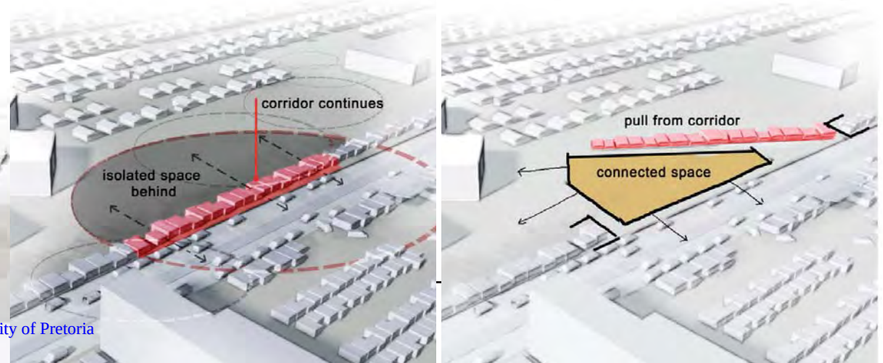
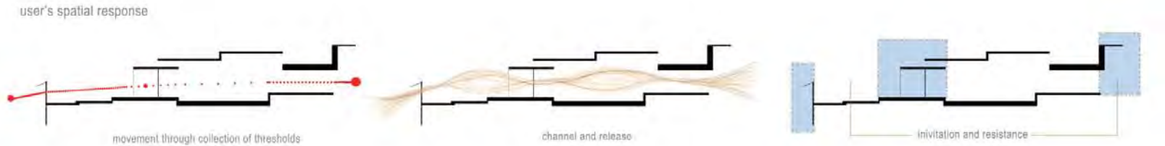


Fig 08-3e pulling the corridor into the site (Author 2014)

Spaces that require privacy are layered more intensely with thicker thresholds. The workshop requires multiple layers and thresholds as visual cues for a visitor from the outside to understand the privacy of space. Thresholds and spatial cues (height, volume, etc.) dictate what stage of the industrial process needs to take place in a given space.



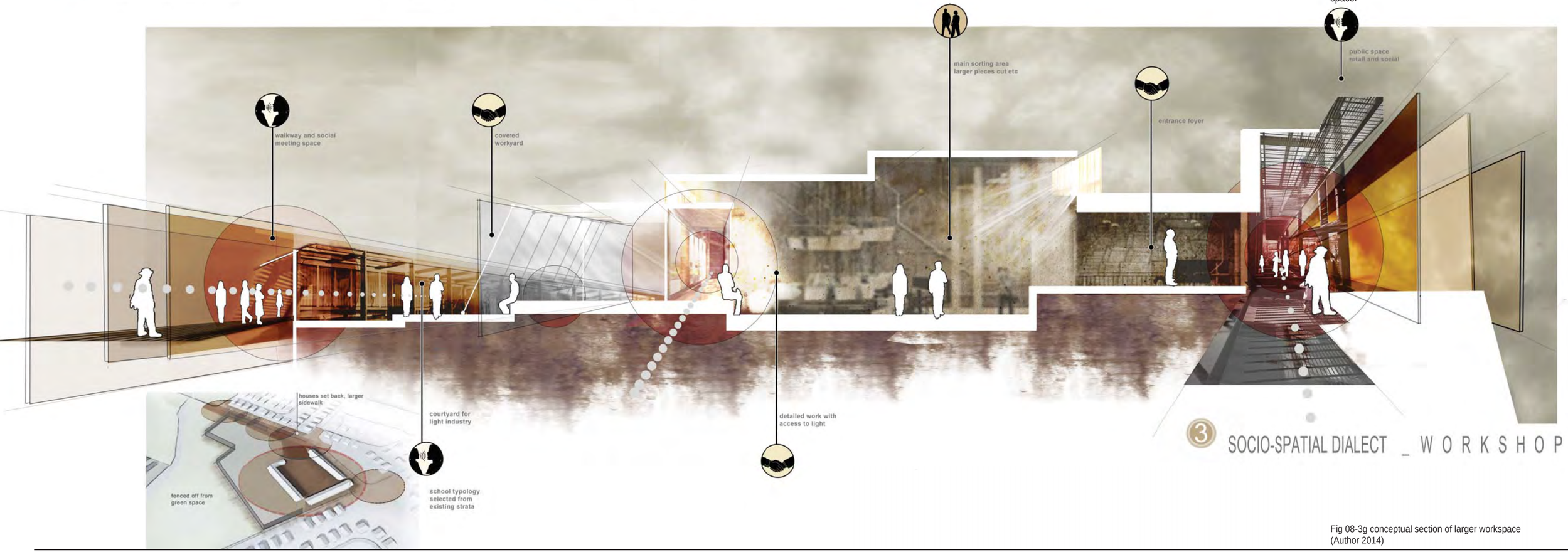


Fig 08-3g conceptual section of larger workspace (Author 2014)

4 SOCIO-SPATIAL DIALECT _ WORKSHOP/RESIDENTIAL

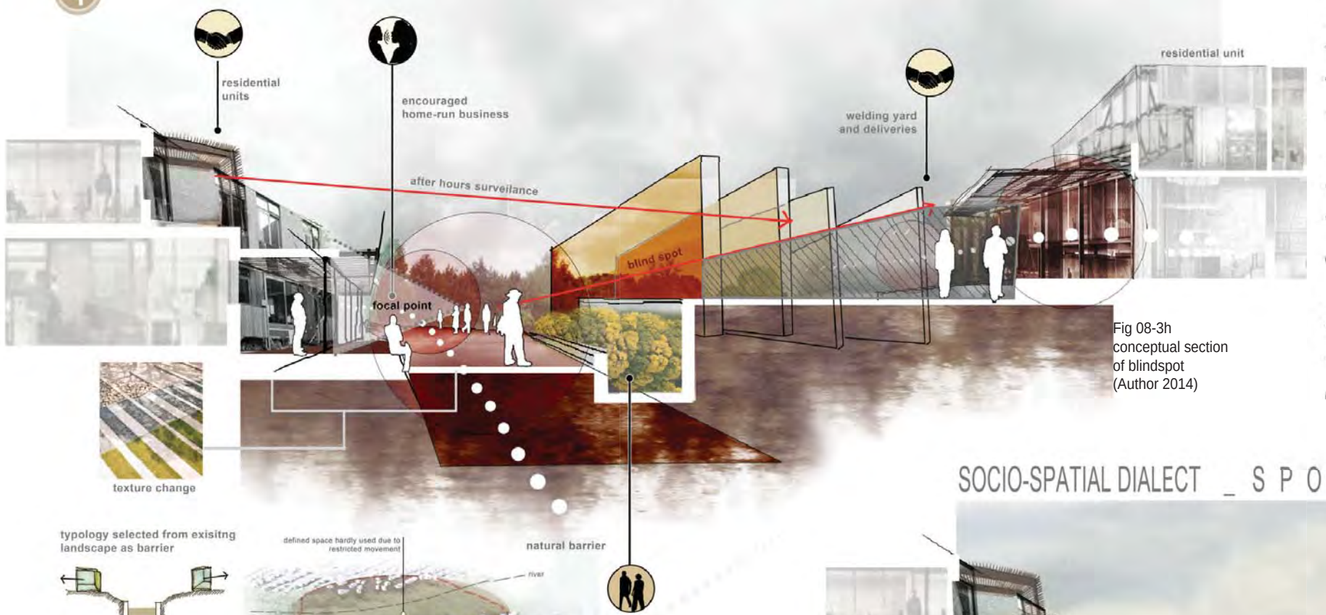
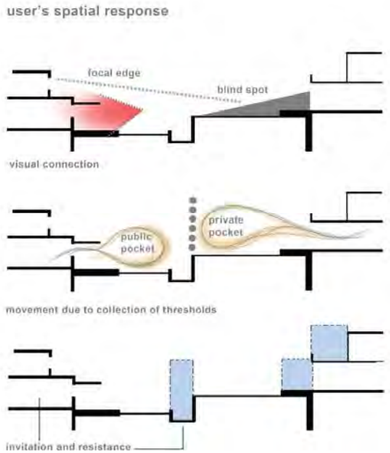


Fig 08-3h
conceptual section
of blindspot
(Author 2014)



The "garden" (back of new residential units) and the programmed optional sports and recreational fields require a filtered movement from the public realm to the "back yard".

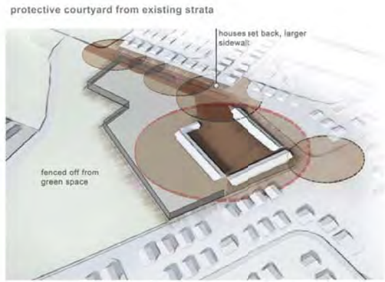
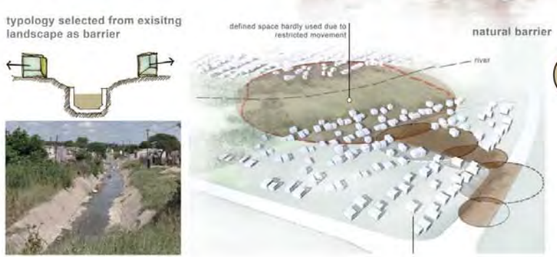
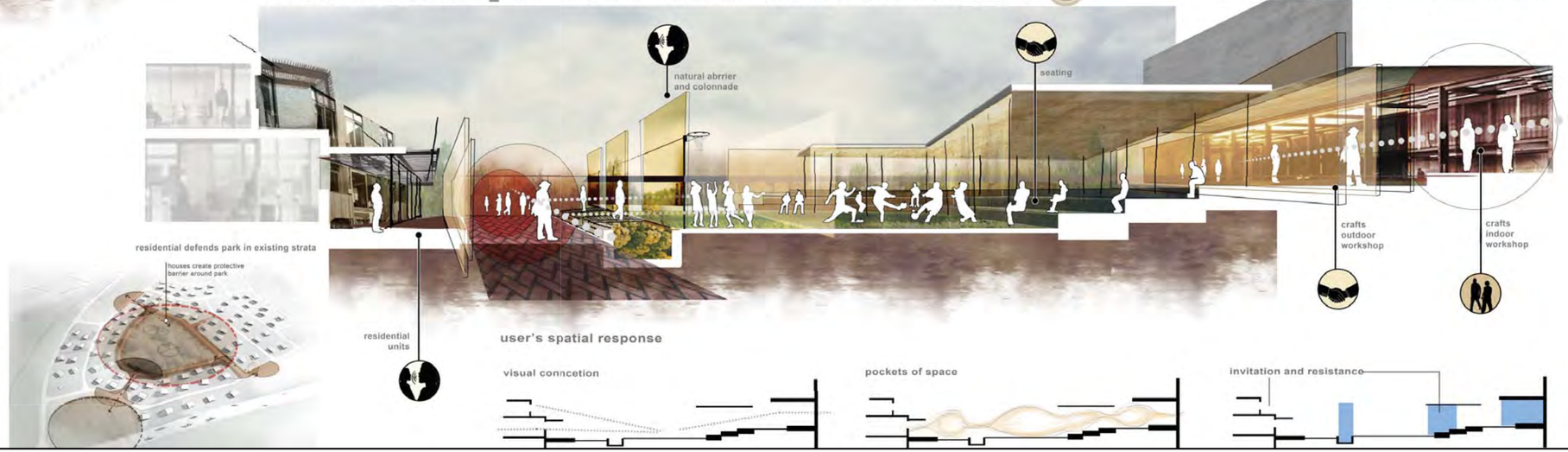


Fig 08-3i
conceptual section
recreational area
(Author 2014)



In some instances the space requires visual privacy, and an alternative to a wall was thus experimented with. A natural barrier (typology selected from the existing urban fabric) was paired with level changes to create blind spots while still considering defensible space characteristics when the site is not active.

5 SOCIO-SPATIAL DIALECT _ SPORTS AND RECREATIONAL



Social spaces connect to the processes inside the building, requiring visual connection and thinner thresholds. The layout pulls users from a fast moving walking route into an intimate courtyard with a visual connection to the dynamic spaces around it. People place themselves where other people are, thus a circulation mechanism (steps) is widened to act as seating when needed.

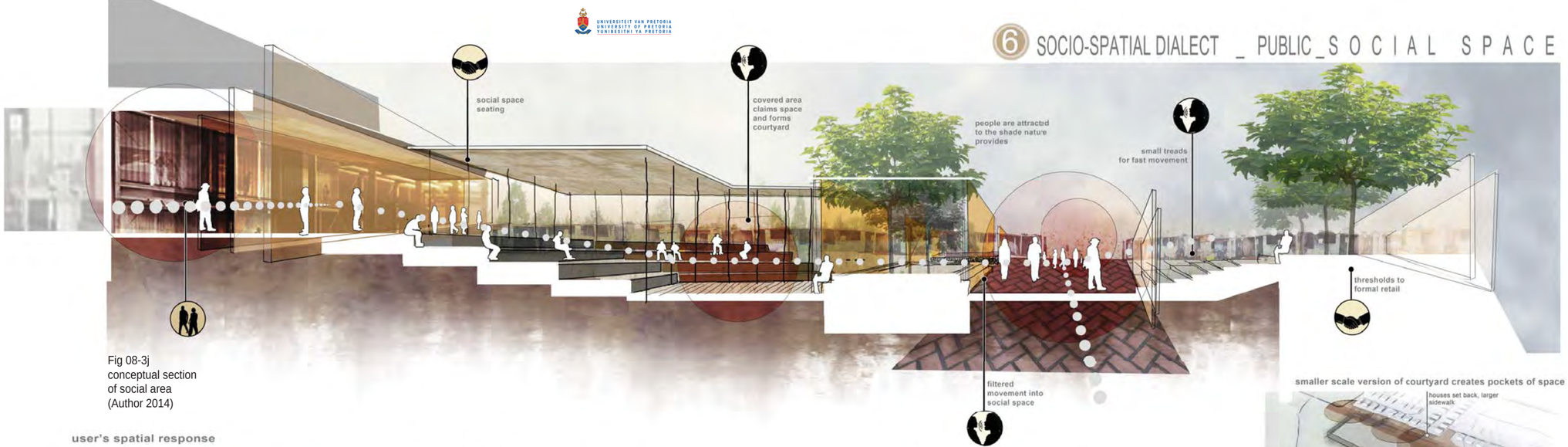


Fig 08-3j
conceptual section
of social area
(Author 2014)

The "fine" or delicate crafts workshop attaches to a shop house component, but production faces the garden space as children and residents are exposed to the making of products as a learning experience.

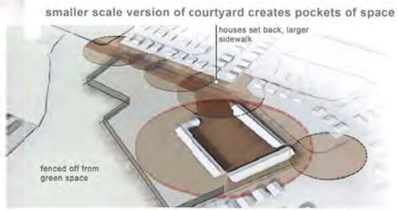
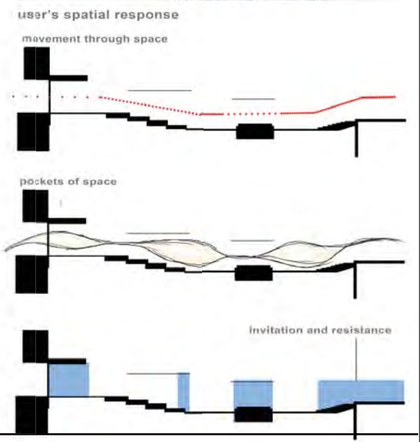


Fig 08-3k
conceptual
section of smaller
workshop
(Author 2014)



04 RESPONSE 2

This section is concerned with resolving problems in the landscape and creating a synthetic landscape that would support both the continuous movement and the static state of people (focal edges) as it contributes to a socio-spatial dialect.

Fig. 08-4a demonstrates that certain focal edges need to be formed while allowing for water movement to occur in a controlled manner across the site. The sections through the site (Fig. 08-4b) indicates that these focal edges could be formed by raising or lowering the ground level. By contesting the natural slope and creating a synthetic landscape water could be effectively channeled and managed through the site.

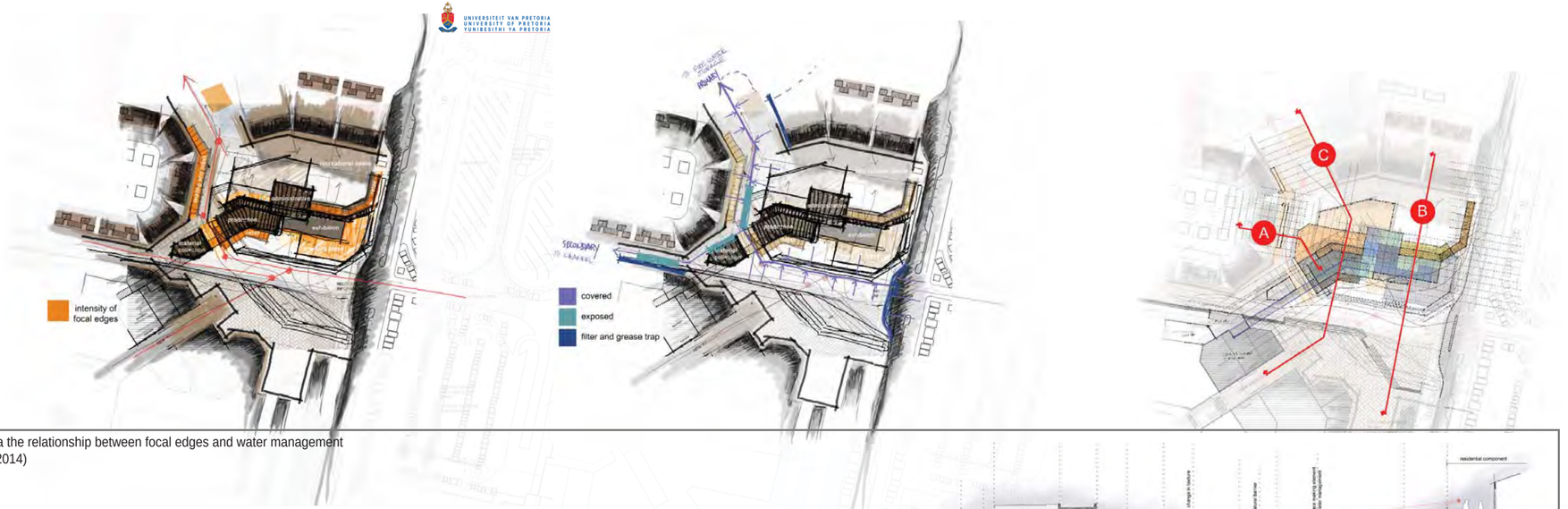


Fig 08-4a the relationship between focal edges and water management (Author 2014)

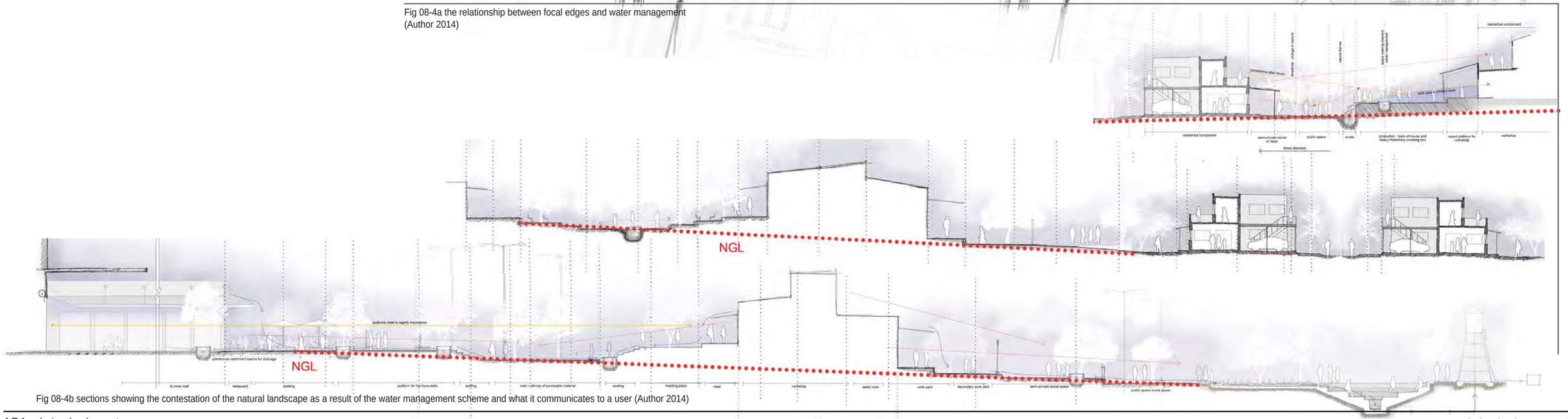


Fig 08-4b sections showing the contestation of the natural landscape as a result of the water management scheme and what it communicates to a user (Author 2014)

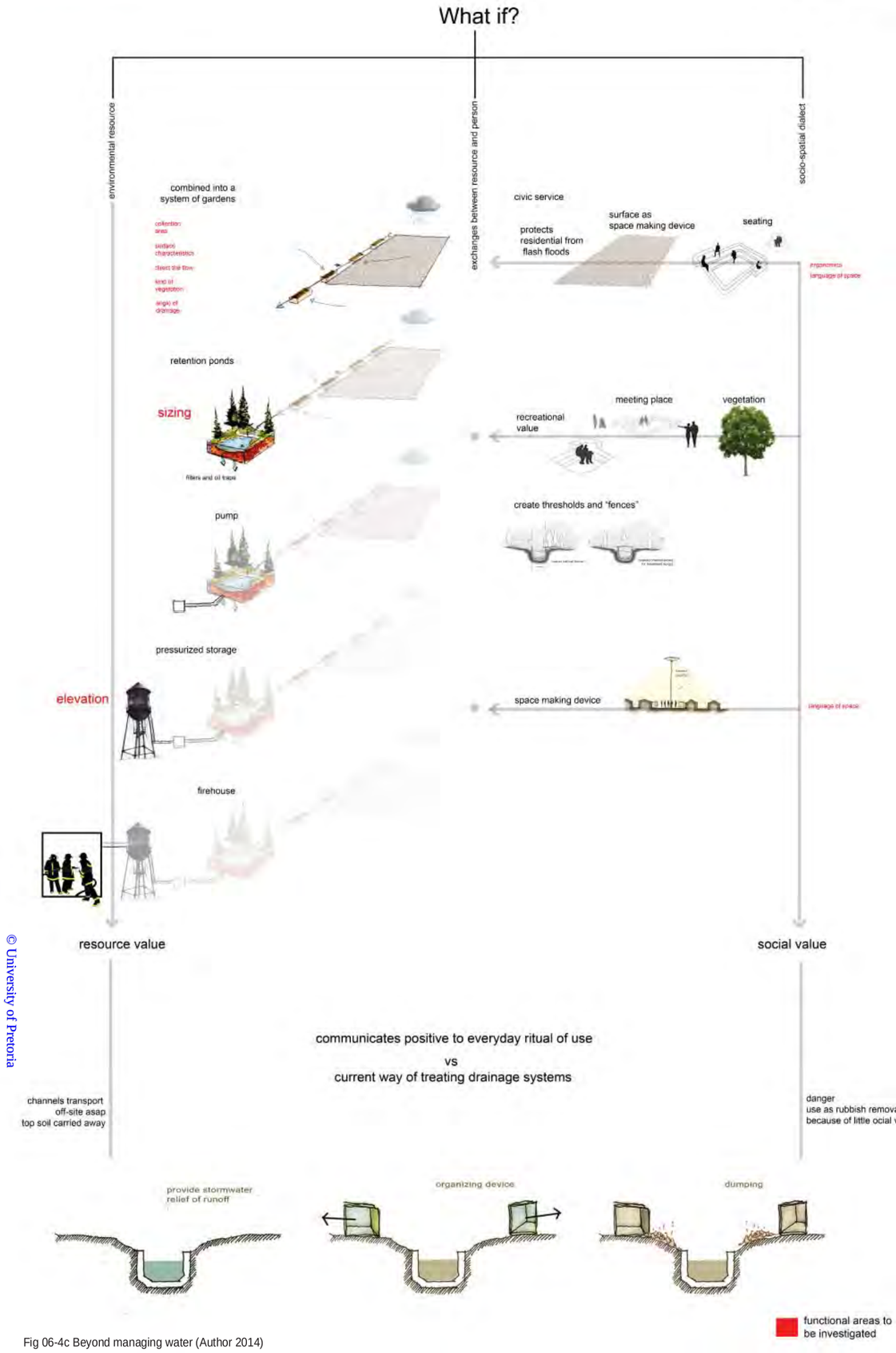
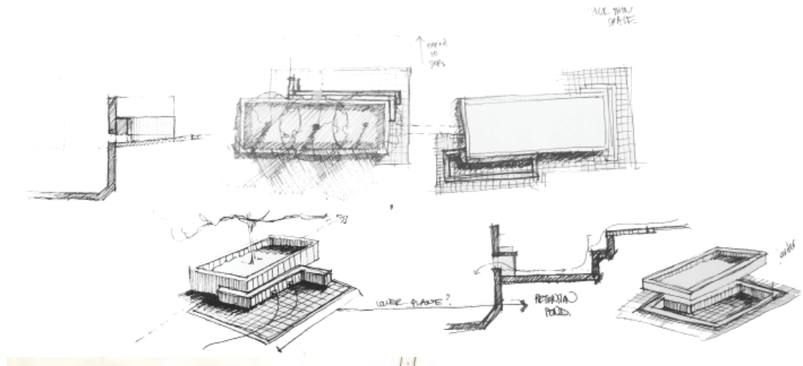
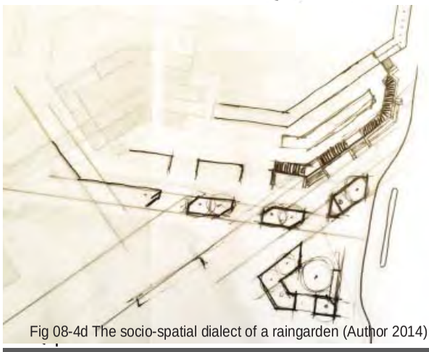


Fig 06-4c Beyond managing water (Author 2014)





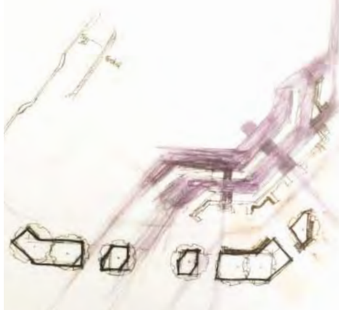


Fig 08-4d The socio-spatial dialect of a raingarden (Author 2014)

Beyond merely managing water

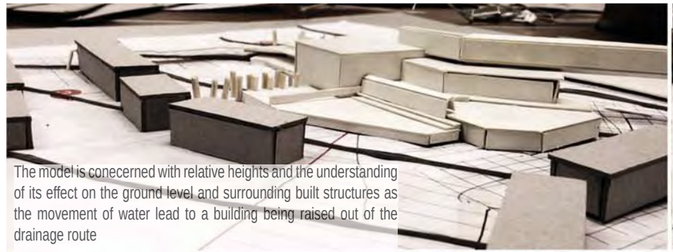
Why should functional elements be that and only that? Why can't they contribute to a language of space and become a positive contribution to the psychological experience?

Something as functional and engineered as a drainage system scheme has in the past been associated with rubbish dumping because it had little social value. Seeing water as a resource and utilising the process of collection as a feature in the landscape could change the view and experience of this resource (from a threat to a resource).

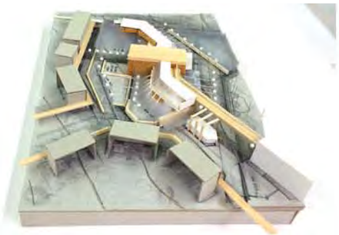
Experimentation with the social value of a drainage system (Fig. 08-4c) took place as the texture, level changes and vertical planes communicate a use of space (socio-spatial dialect takes place)

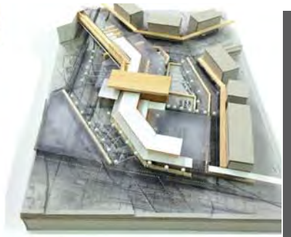
The building developed from an understanding of the public and private space it creates on either side. The process was based on working from the outside-inwards and then returning to the landscape. This layering continues until the public front and the more private space behind the building is contained and satisfies the requirements of the brief.

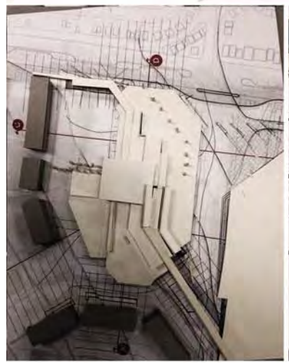
Fig 08-4e section development (Author 2014)

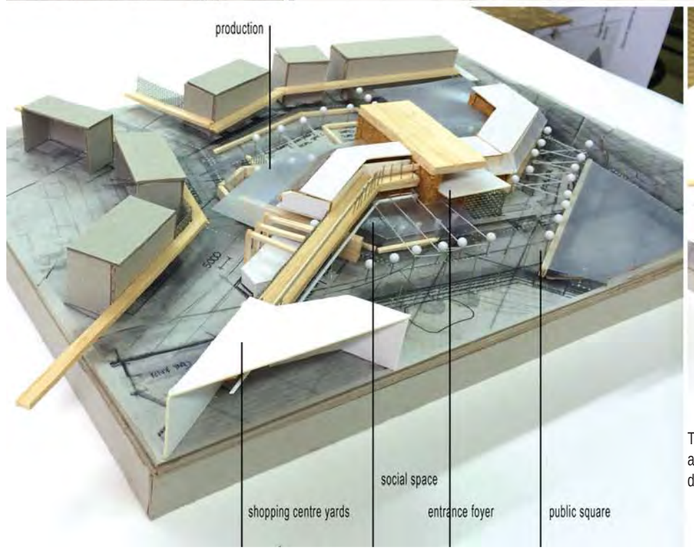


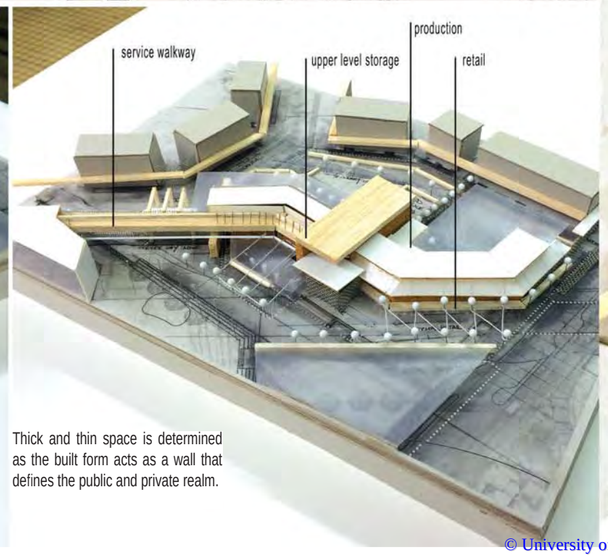
The model is concerned with relative heights and the understanding of its effect on the ground level and surrounding built structures as the movement of water lead to a building being raised out of the drainage route











Thick and thin space is determined as the built form acts as a wall that defines the public and private realm.

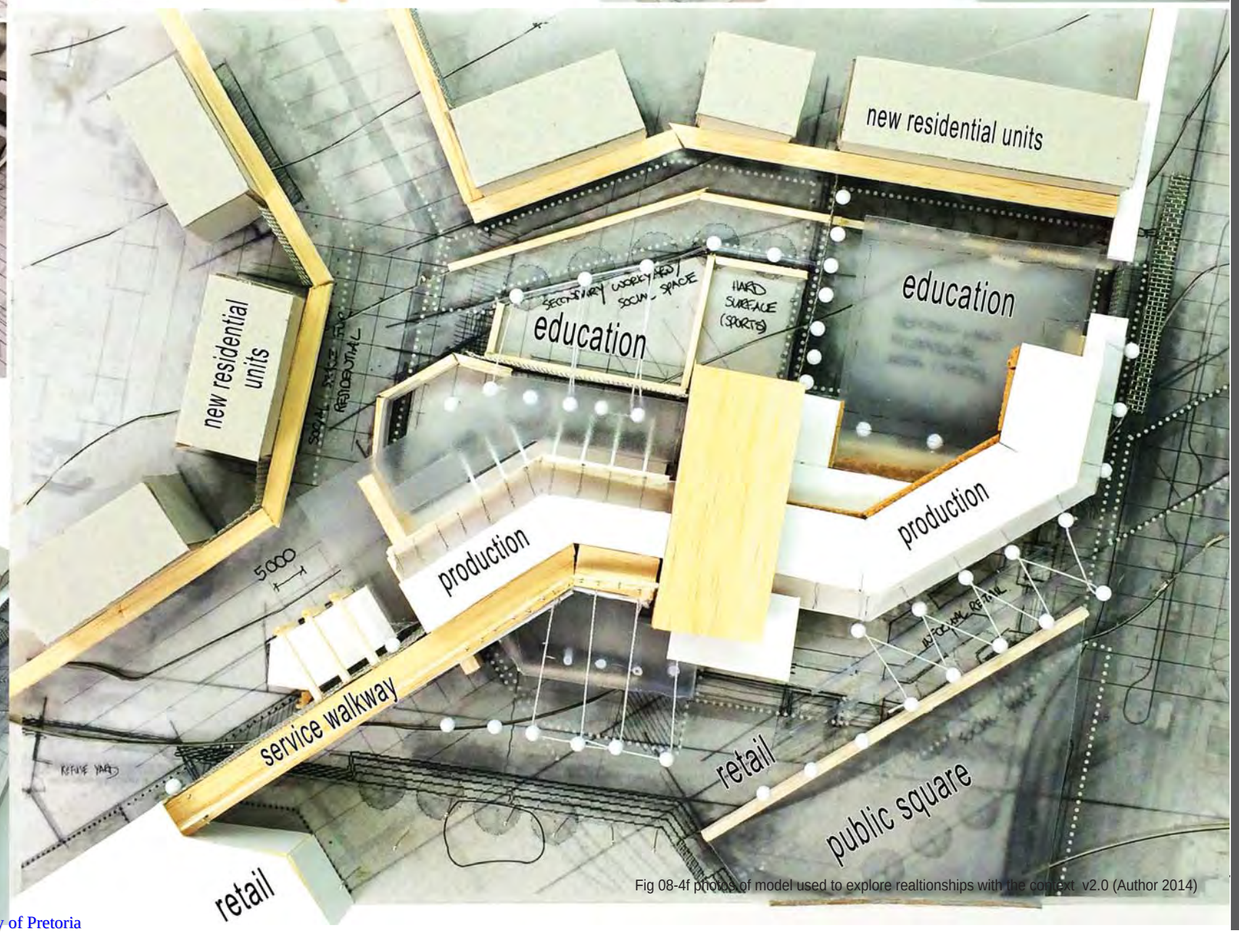
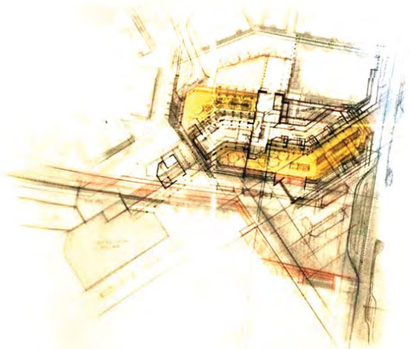


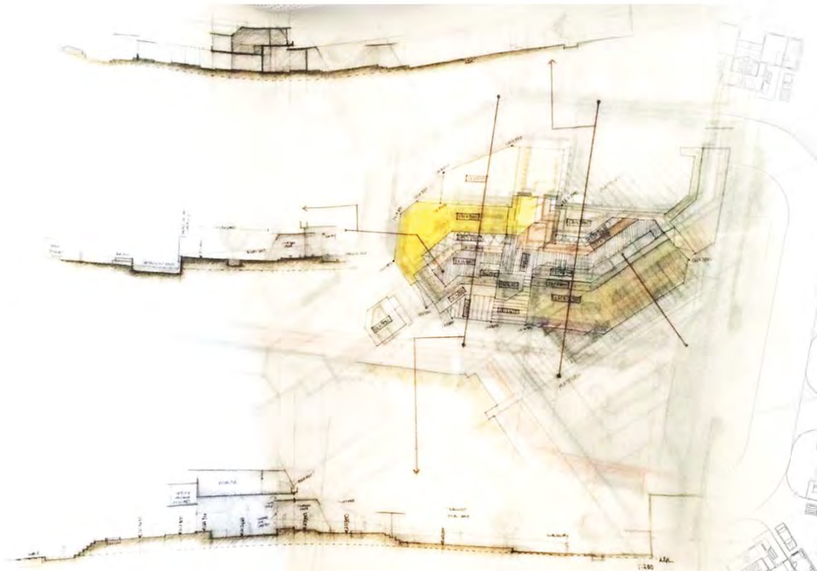
Fig 08-4f photos of model used to explore realtionships with the context v2.0 (Author 2014)

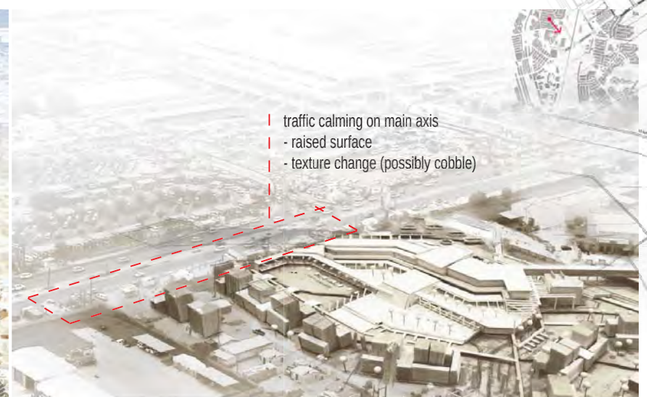
05 RESPONSE 3

The third response aimed to create a built form where the principles discussed in the second response take on the form of a building that could be iterated and developed.

The built form was based on understanding the movement through the landscape and everyday rituals that formed because of it (as the plan suggests). Traffic calming techniques were applied and the nature of the taxi was embraced. Seating and activities were placed along the main axis of movement. Care was taken to understand how this building sits in its context and relationship with the adjacent sites.







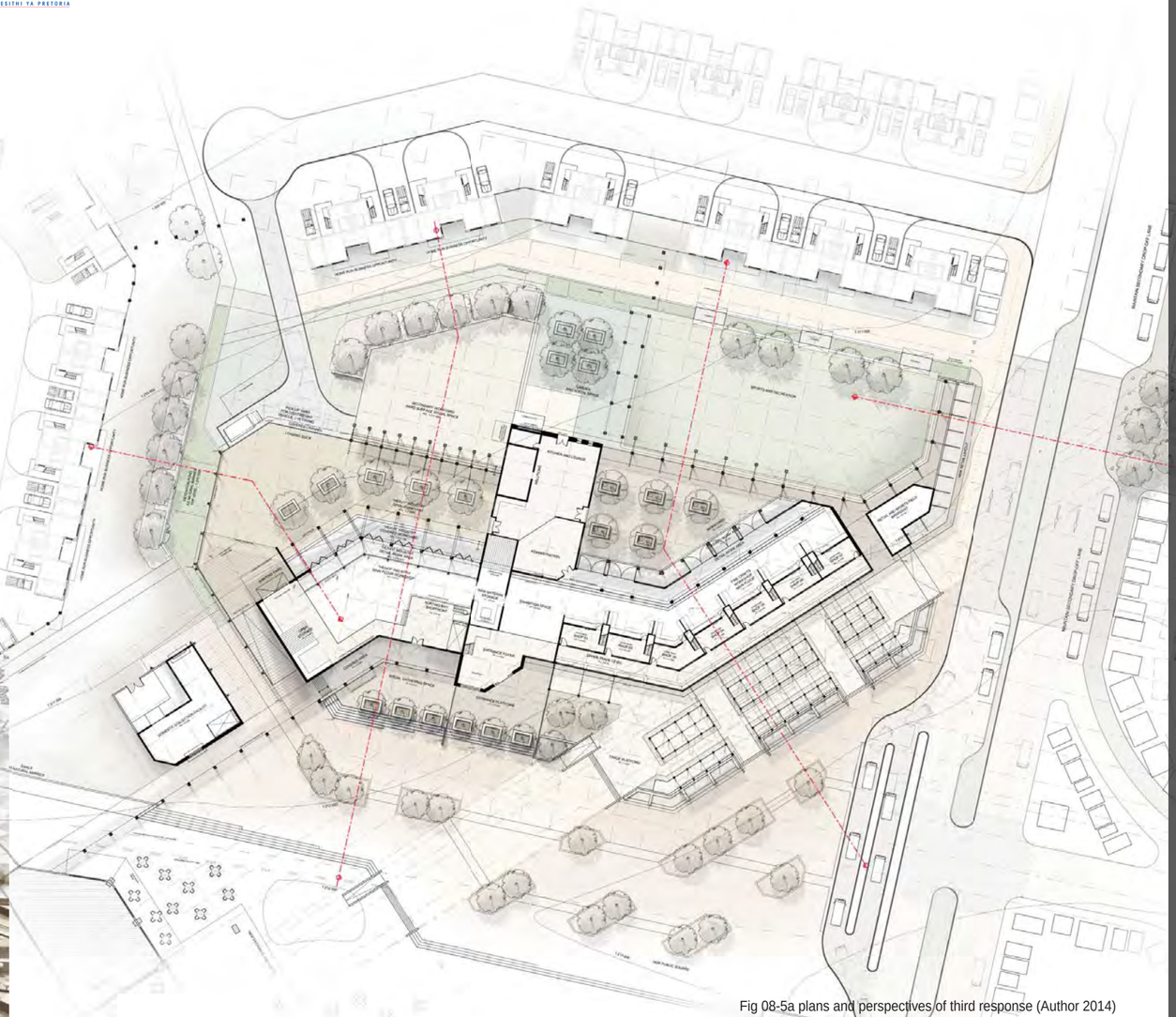


Fig 08-5a plans and perspectives of third response (Author 2014)

SPATIAL INTELLIGENCE _ DISTRACTION

SPATIAL INTELLIGENCE _ PORTICO AND VESTIBULE

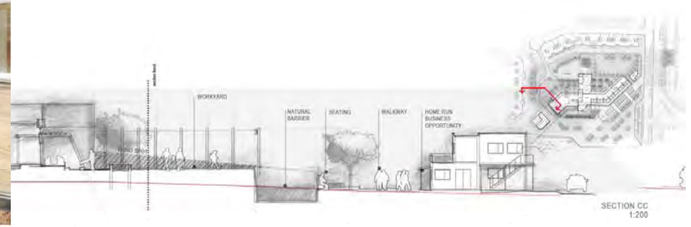
SPATIAL INTELLIGENCE _ FILTERING

SPATIAL INTELLIGENCE _ FOYER

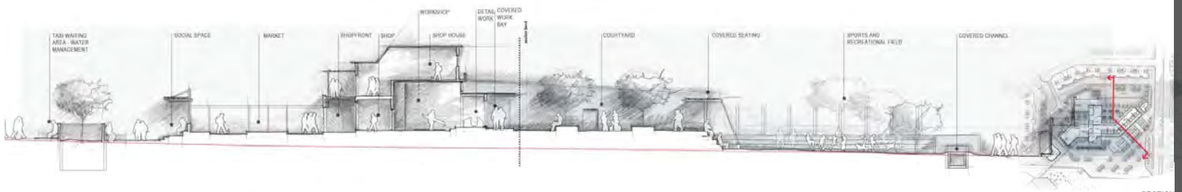
SPATIAL INTELLIGENCE _ PASSAGE

An investigation into the way space is perceived was undertaken. The building aims to create spaces that act as “distraction”, “filtering” mechanisms, “foyers” and “passages”, as learnt from studying the context. The sections aimed to create the filtering and layering between the public social realm and the production educational realm.

The perspectives indicate how functional elements in the constructed landscape could become more than what their primary function indicates. For example, the raised service walkway becomes an imposing filter to the residential spaces at the back, and the water management scheme serves as a natural barrier between the public and dangerous production processes.



SECTION CC
1:200



SECTION BB

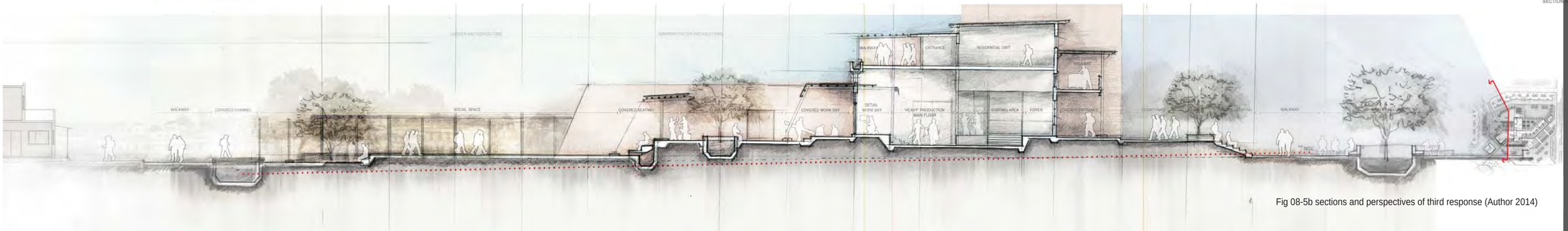


Fig 08-5b sections and perspectives of third response (Author 2014)

The model indicates the various levels of public, semi-private and private spaces that form due to the division of space by the built form.

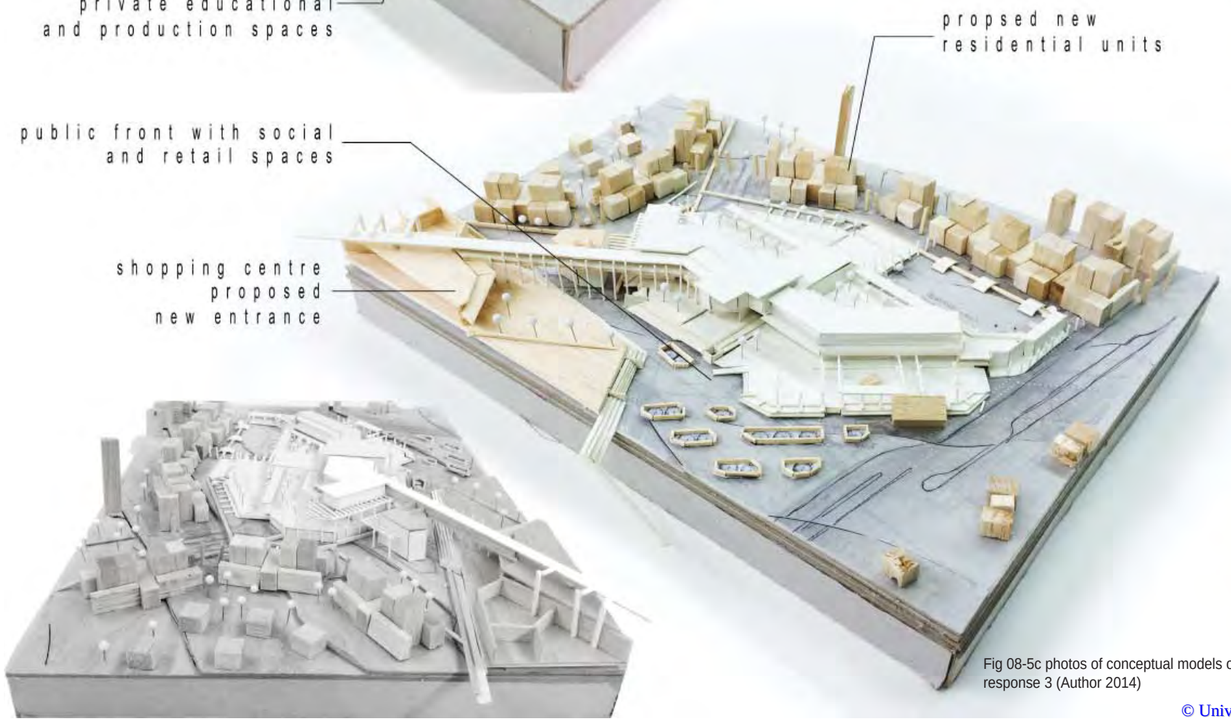
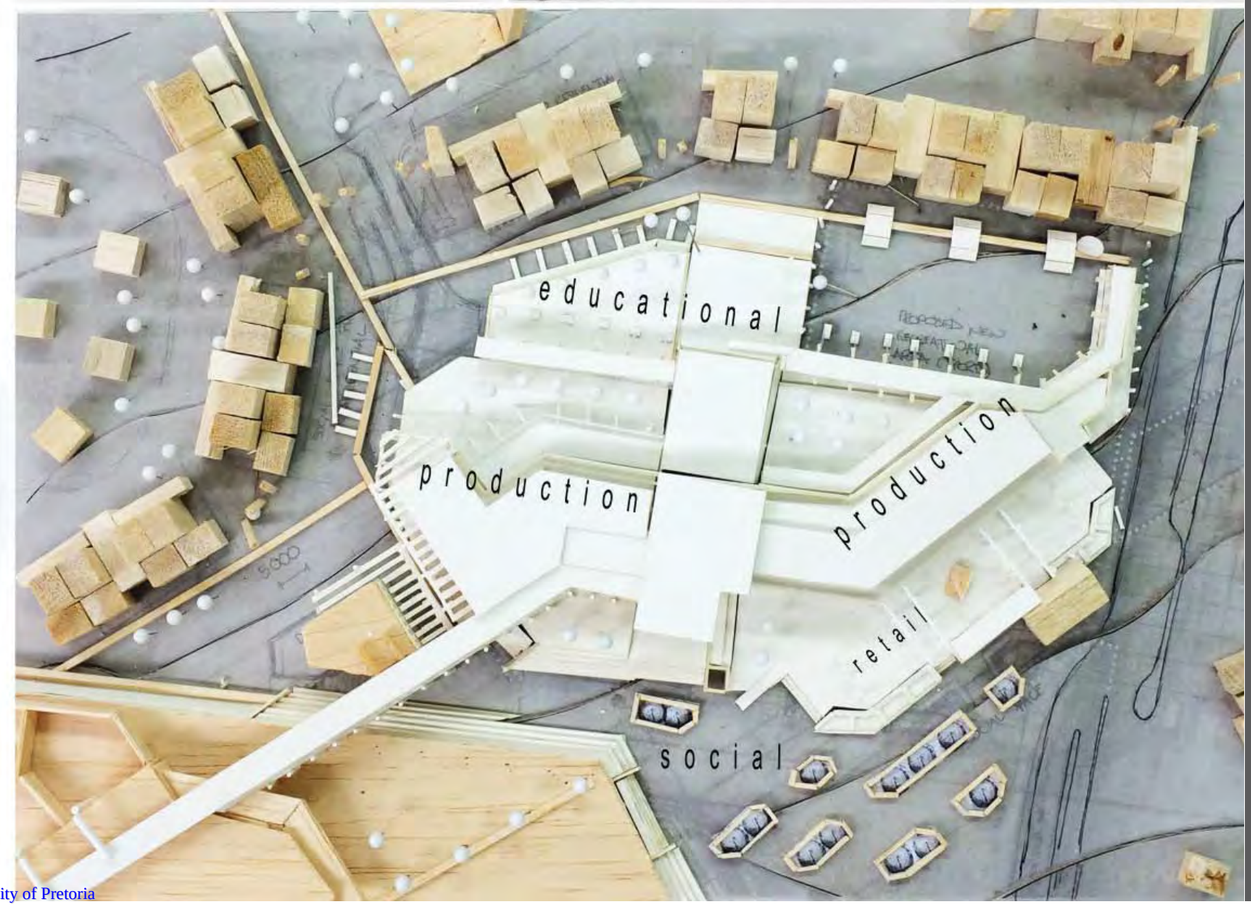


Fig 08-5c photos of conceptual models of response 3 (Author 2014)

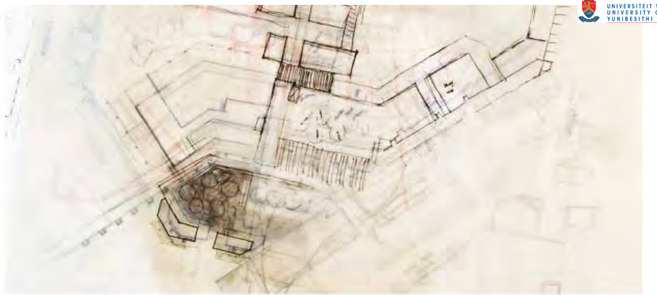


Response

A conflict exists between production, retail and education. The hierarchy of drivers needs to be established. The rear courtyard spaces are confused – are they backs or fronts or both? The clear and potent idea of the relationship between the formal and the informal is being lost in the 'planning'.

The way forward

A clearer understanding of the framing of space to the north (work yards and educational spaces) needs to be developed. The educational component should not be neglected.



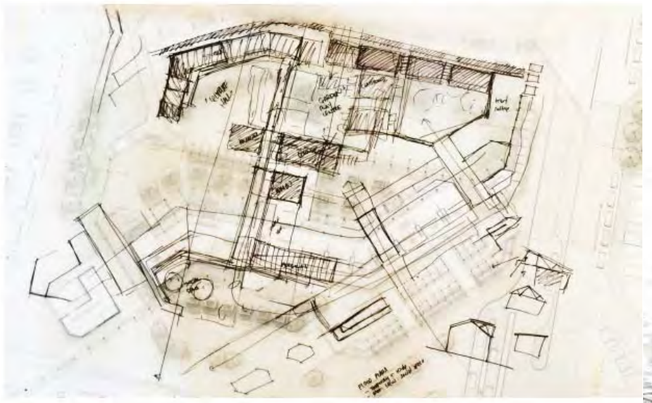
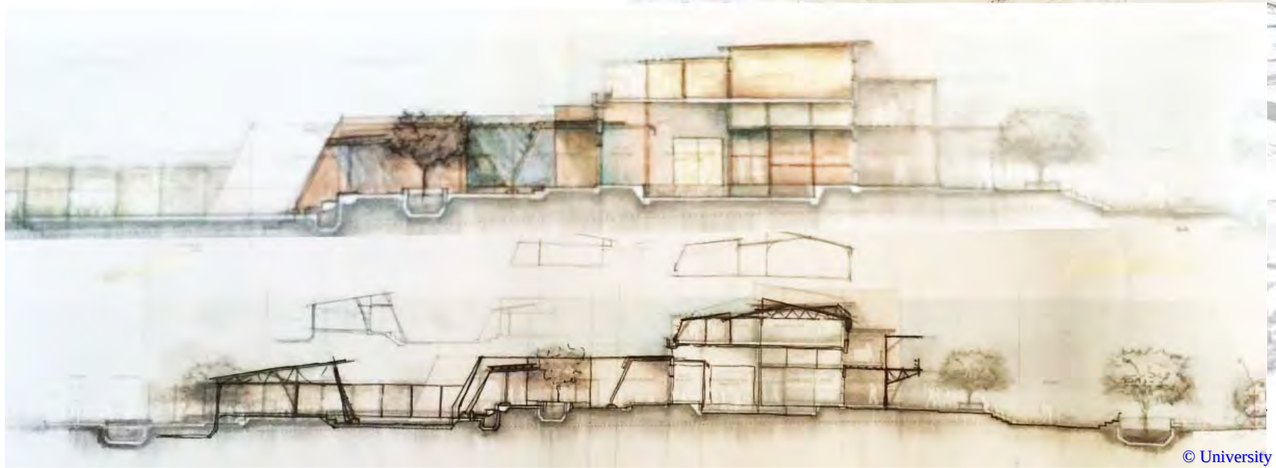


Fig 08-5d the way forward (Author 2014)



06 RESPONSE 4

The fourth response aims to deal with undefined or "confused" spaces to the north and attempts to define the boundaries more clearly. In context, the heights of the existing RDP houses and the new residential units were used to determine the scale of the intervention. Contextually, the project will focus more on strengthening the new axial line and the filtering belts to the less public spaces at the back.

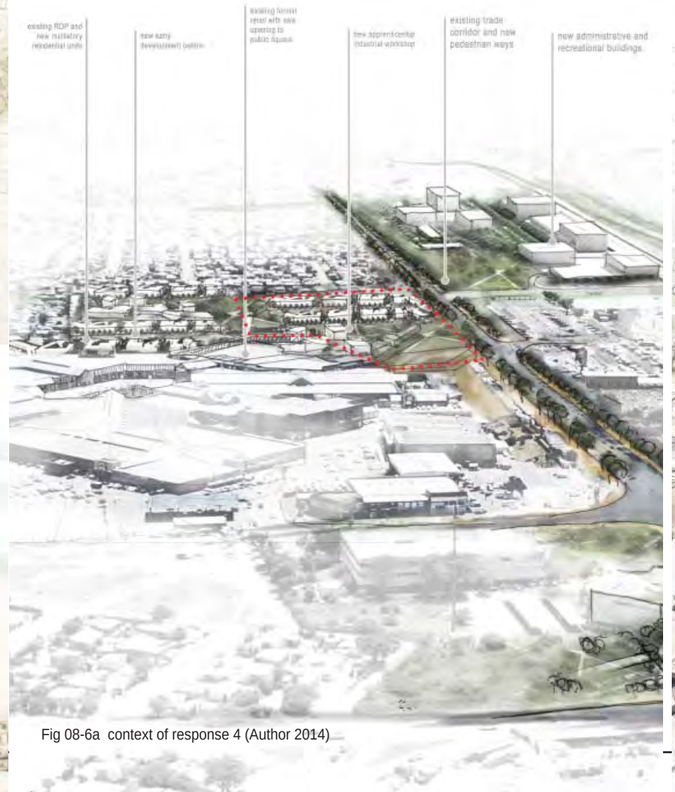


Fig 08-6a context of response 4 (Author 2014)

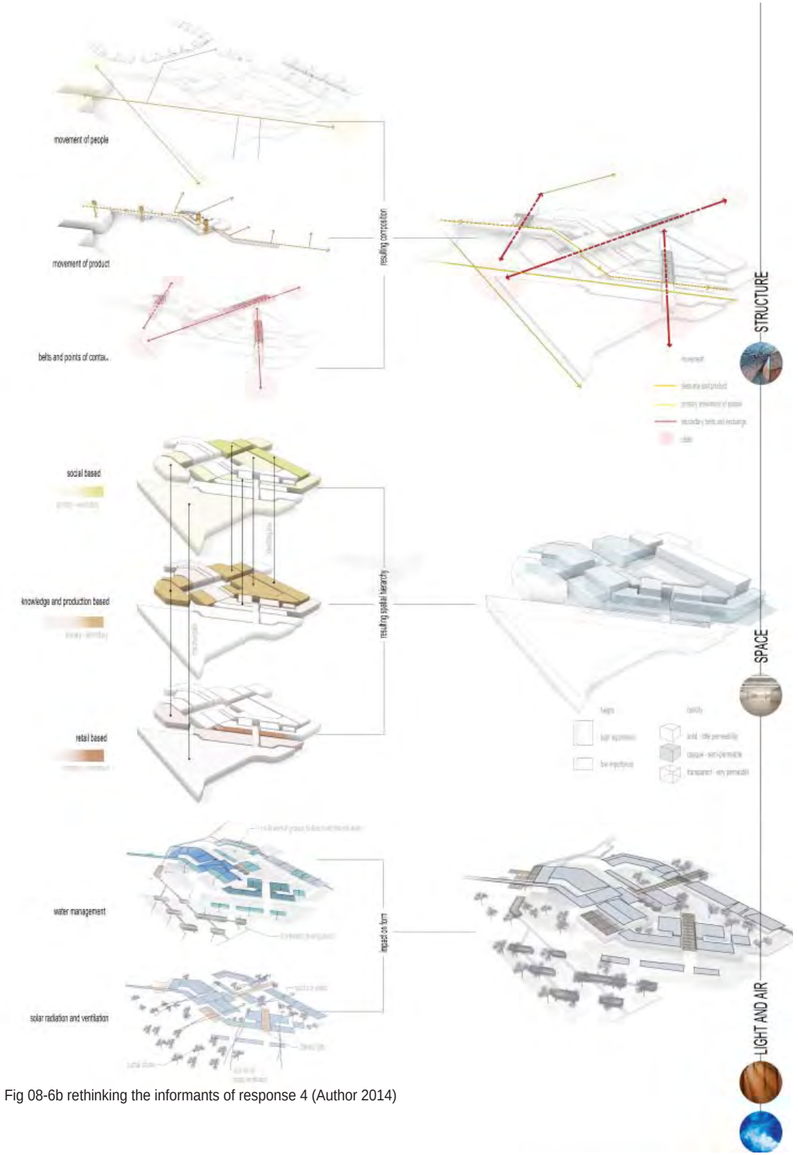


Fig 08-6b rethinking the informants of response 4 (Author 2014)

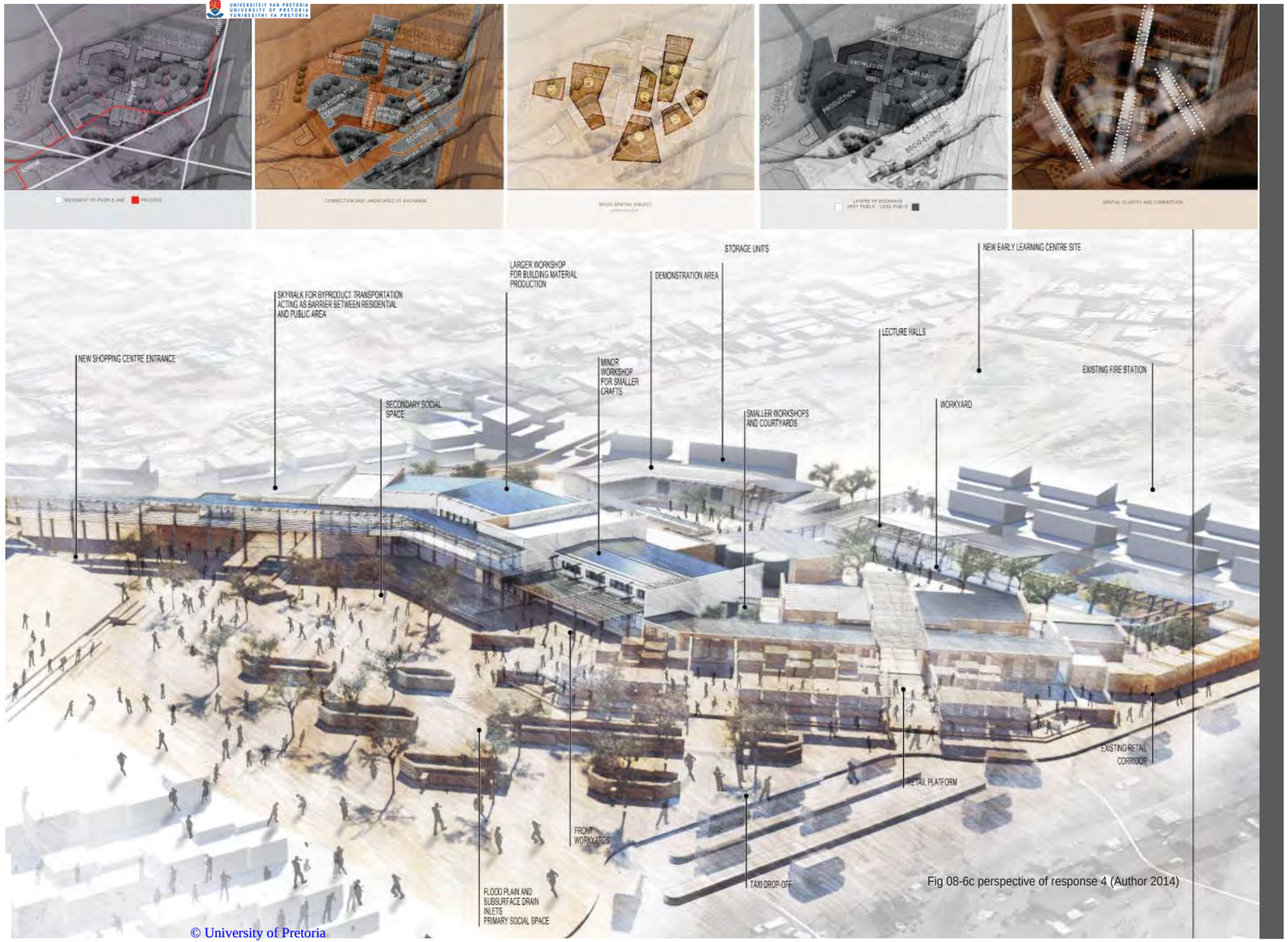


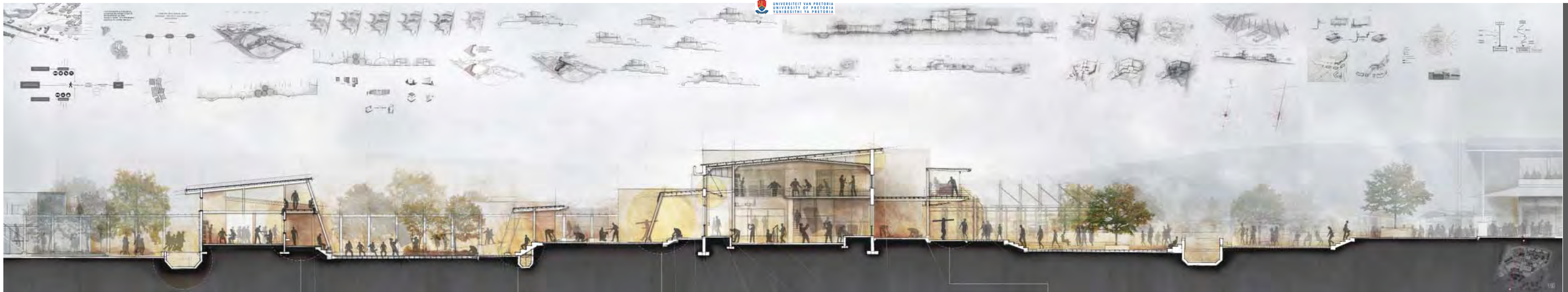
Fig 08-6c perspective of response 4 (Author 2014)

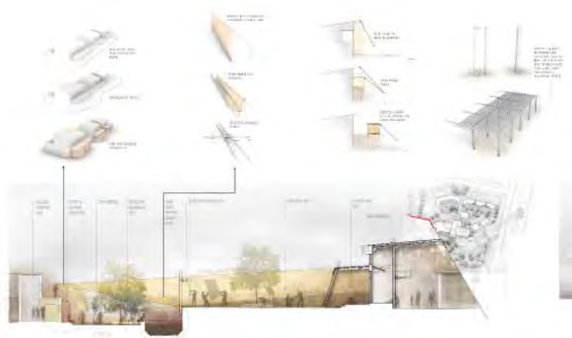
SITE _ PLAN

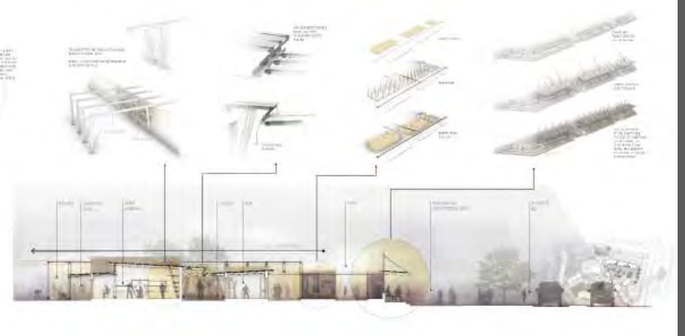
UPPER LEVEL _ PLAN

A clearer definition of “design structure” was provided to define the northern work yard spaces (Fig. 08-06b and Fig. 08-06c). The yards are defined by educational buildings resembling classrooms, and storage buildings that enclose the space (Fig. 08-6d).

Fig 08-6d plans of response 4 (Author 2014)







To embrace the multiplicity and multi-functionality of the context, spaces are designed to expand and contract in order to satisfy various needs at different times of the day, week, month, etc. Since the context is characterised by this multi-functionality, the construction of the built form cannot be limited to one purpose either. Structural beams are pulled into the building, forming part of other structural systems and connecting the interior function with the exterior function. Slanting elements limits the possibility of manipulation of the built form (thresholds could be maintained in order for the space to function properly) and an array of thresholds to a space is formed. Eliminating a structural component and finding other ways of holding a roof up once again eliminates a column to which something could be fixed so as to enclose the space, creating a space that is resistant to change. Through this, energy is focused on spaces of invitation (the market) where the height and span is better suited for manipulation and infill.

Fig 08-6e sections and conceptual drawings of response 4 (Author 2014)

From the ethnographic study it is clear that linear time changes occur in the landscape once altered by an exogenous intervention. This "laboratory" that is an informal landscape responds almost overnight to such changes. The study of the landscape's changes over time has led to a design response that predicts and accommodates possible changes.

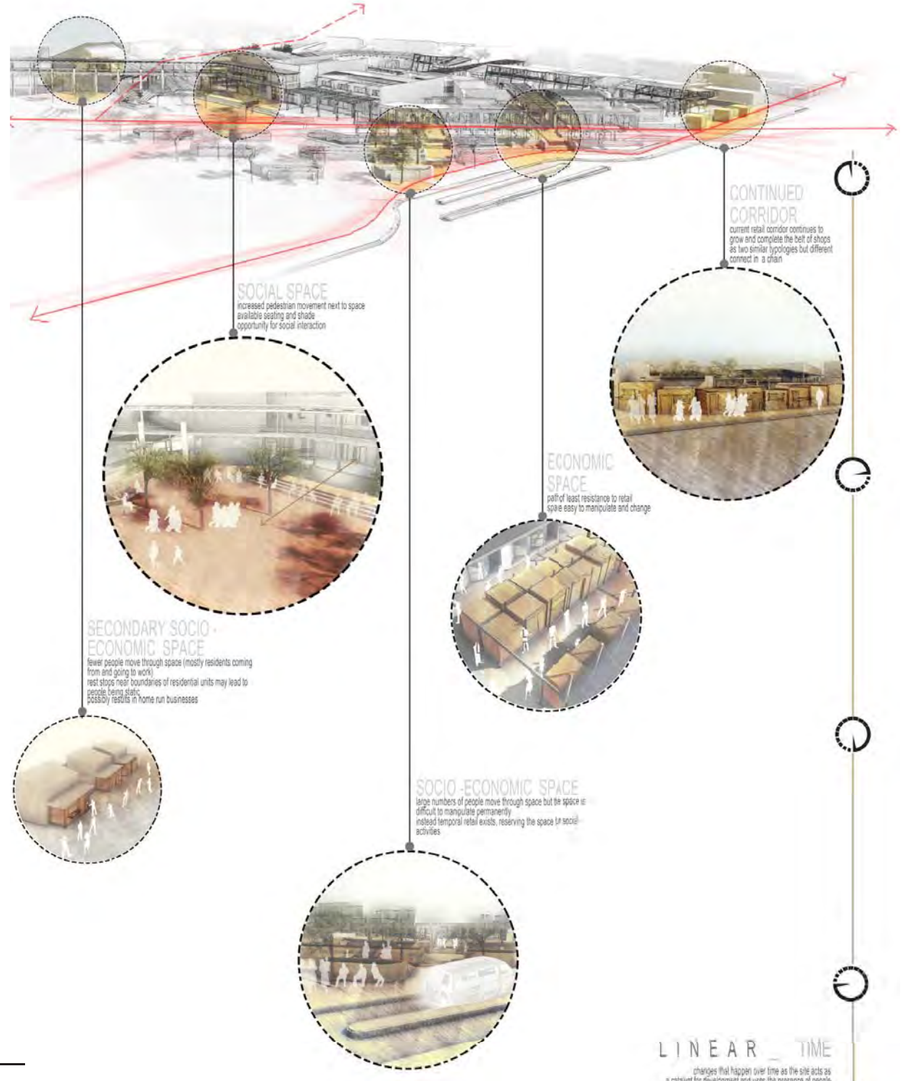
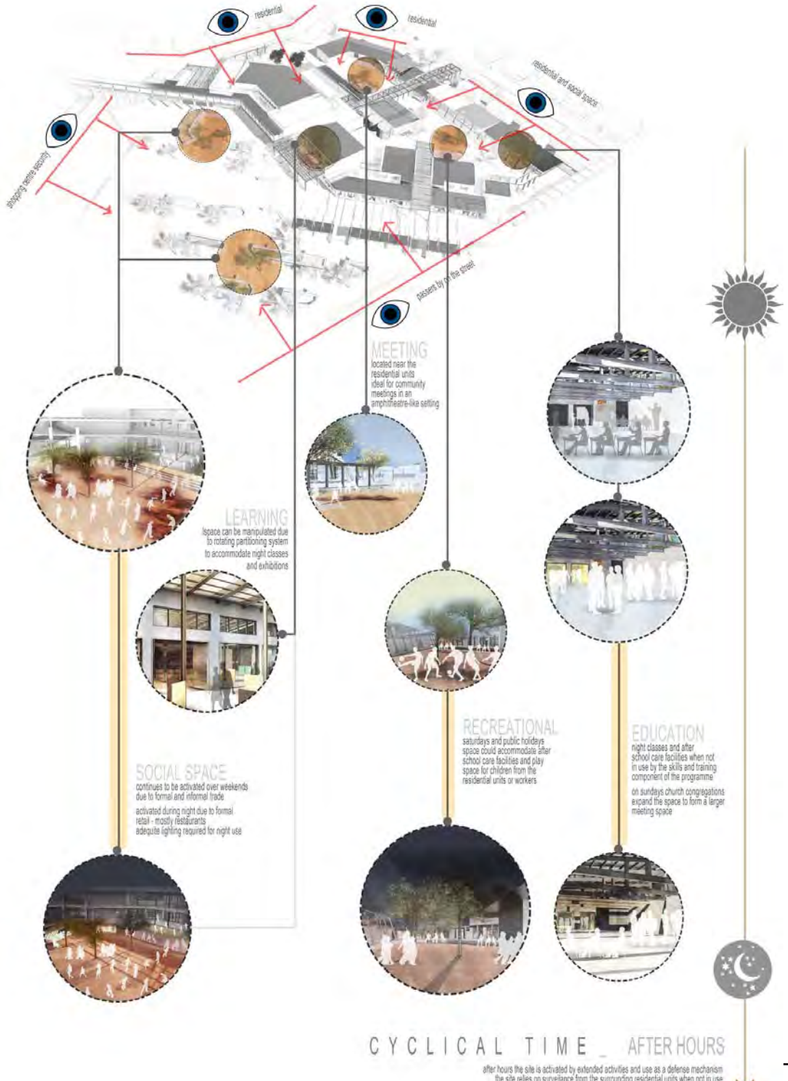


Fig 08-6f linear time changes (Author 2014)



The built form is designed in such a way that it does not function only on weekdays from 09:00 to 17:00. The context does not stop being active after this time period, and neither should an intervention that aims to understand and reflect its context.

The building could capitalise on this constant activity by using it as a defence mechanism (defensible space is discussed in the theory chapter), as it invites the existing activities and rituals to participate in the use of the intervention. Spaces are crafted to be manipulated and changed on a daily basis to suit the needs of a particular time, whether they be educational, social or even administrative (community meeting spaces).

Fig 08-6g cyclical time changes (Author 2014)

The perspectives reflect this same vibrancy that is found in the context. Spaces are changeable and adaptable to suit the needs at any given time. Rotating work stations allow the user to manipulate the composition of space.

The building creates a series of thresholds to spaces that house more dangerous activities. This is done by pulling elements from the building into the public realm so as to increase the threshold count and the distance between the two different activities, while maintaining a visual link.

Educational spaces that need to be introverted use top lighting strategies to maintain the enclosed nature of the function. A gallery is added to capitalise on this new space that forms to create vantage points and clear views to the demonstration that occurs on the interior.

The built form starts to replace furniture as height differences are not only meant to indicate spatial divisions but also act as work surfaces. By pushing the main work surface into the ground, it becomes possible to easily move large material around without creating a massive structure that seems imposing and out of place from the exterior.

The water management scheme is used to create space and smaller pockets of space in a large social area. Seating is placed around the inlets that are created for storm water management.

The service walkway is used to create an imposing structure that frames space and acts as a filter to the residential units at the back. The structure gradually changes as it meets the new workshop to act as a canopy for work yards to the front that come into contact with social spaces.

The smaller workshop expands and contracts via an operable panel to allow for the selective spilling out of function into the front social spaces.

Fig 08-6h perspectives (Author 2014)

The model aimed to integrate itself more clearly into the context and highlight the hierrchy and framing of space clearer

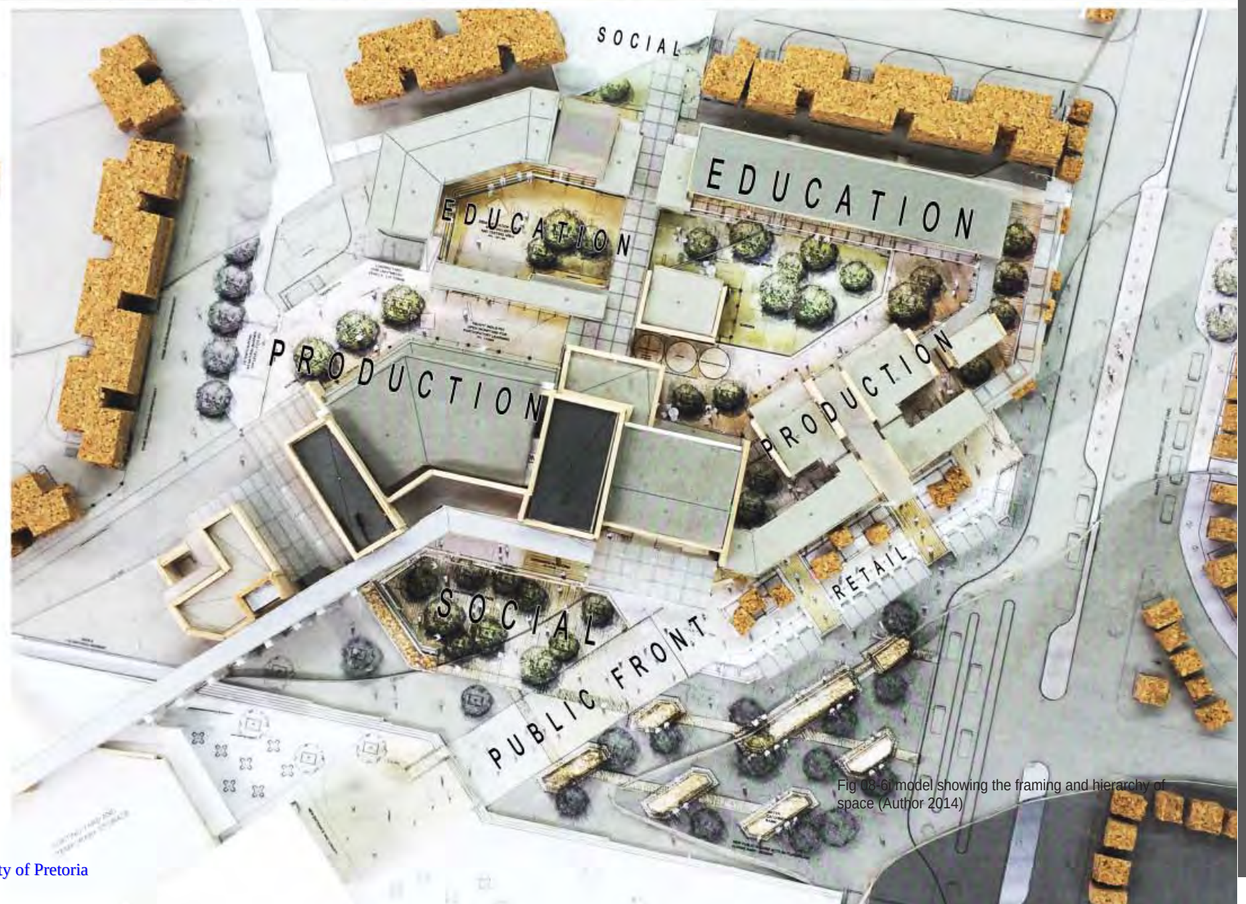
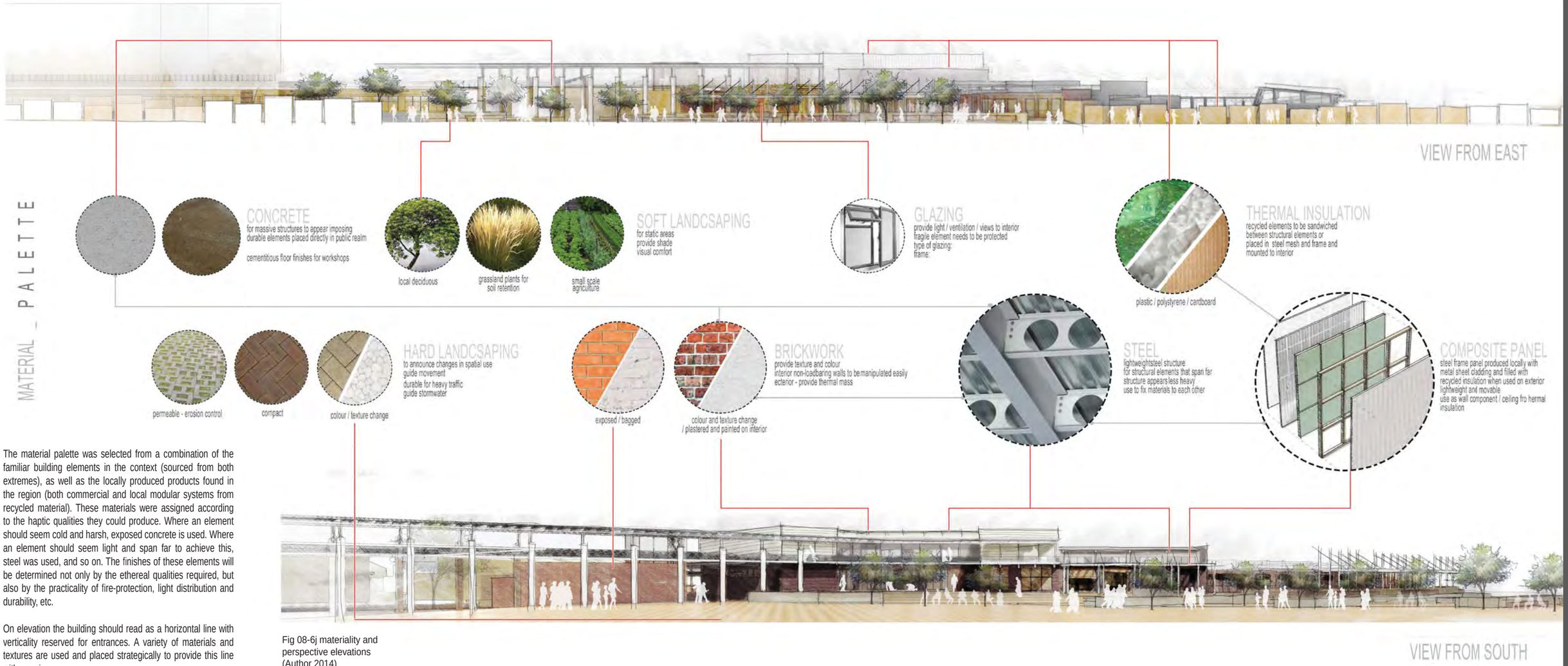


Fig 03-6 model showing the framing and hierarchy of space (Author 2014)



The material palette was selected from a combination of the familiar building elements in the context (sourced from both extremes), as well as the locally produced products found in the region (both commercial and local modular systems from recycled material). These materials were assigned according to the haptic qualities they could produce. Where an element should seem cold and harsh, exposed concrete is used. Where an element should seem light and span far to achieve this, steel was used, and so on. The finishes of these elements will be determined not only by the ethereal qualities required, but also by the practicality of fire-protection, light distribution and durability, etc.

On elevation the building should read as a horizontal line with verticality reserved for entrances. A variety of materials and textures are used and placed strategically to provide this line with prominence.

Fig 08-6j materiality and perspective elevations (Author 2014)

Response

Control over the sectional and plan development seems to be lost and undefined. There are too many variables in the roof structure – one language needs to be found and used. The rear courtyards are better defined, but some still lead to "dead" or "unactivated" space facing the residential units.

The way forward

Control over the built form needs to be established and certain conditions need to form at various edges to create internal divisions of space. The roof structure needs to be investigated, as uniformity must be maintained but manipulated to accommodate the various activities.

07 RESPONSE 5

The fifth response (Fig. 08-05b) aims to resolve the unactivated space created by the framing of the courtyards. The space that seems "left over" from the building results in awkward corners and soft landscaping elements that fragment the space.

A revised diagram of how the spaces are formed (Fig. 08-07a) demonstrates how the movement (existing and new) of people creates various landscapes of exchange and pockets of static space.

The building is pushed and shoved by the movement of people, stabilised by the movement of products within the building, and moulded by the geometry of the surrounding structures.

1. The built form arranges itself along the new axis to capitalise on the presence of people.
2. The building steps back to create social spaces along the movement routes.
3. The building opens up and allows for connection between southern and northern public spaces.
4. The building frames the courtyards and educational spaces.
5. Edge conditions are manipulated to respond to the existing fabric and activities.
6. Public edge conditions vary due to programmatic or functional requirements.

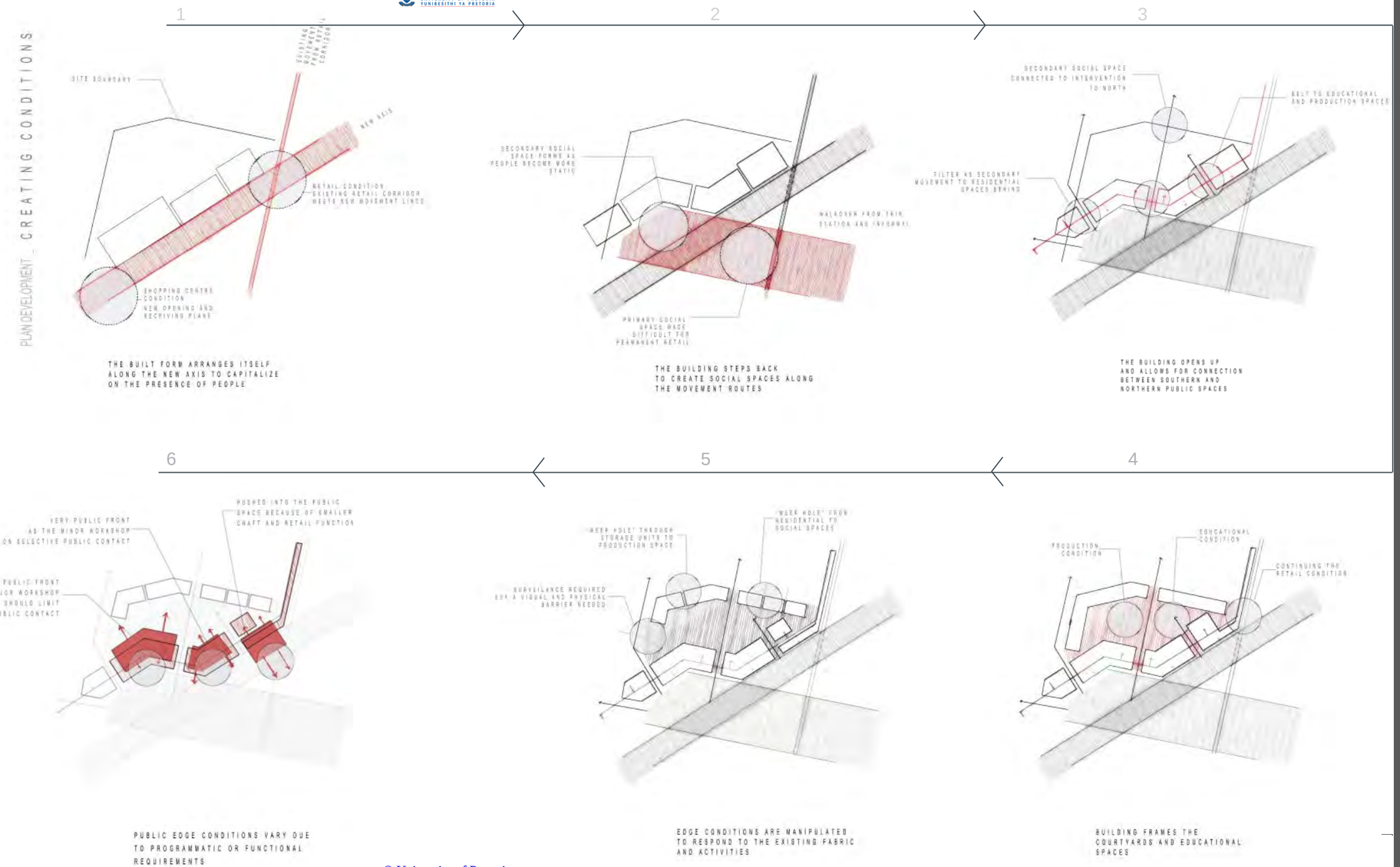


Fig 08-07a revised structure of the landscape resulting in certain conditions forming (Author, 2014)

The revised plan aims to overcome the perceived “flatness” of space as the facade is broken up and materials are placed strategically to create a defined sense of depth.

Awkward corners are starting to be resolved as the built form is manipulated to treat not only the interior spaces but also the exterior spaces that are often a result of “left over space”. By assigning more clear functions to these spaces, they could now be designed with a clear goal in mind.

Soft landscaping elements are now used to create and define space more clearly. A tree’s trunk is treated like a column and the canopy is treated as an umbrella that could provide shade during the overheated period and allow solar radiation through during the underheated period.

Fig 08-7 b revised plan for response 5 (Author 2014)

Fig 08-7 b.1 revised plan for response 5 (Author 2014)

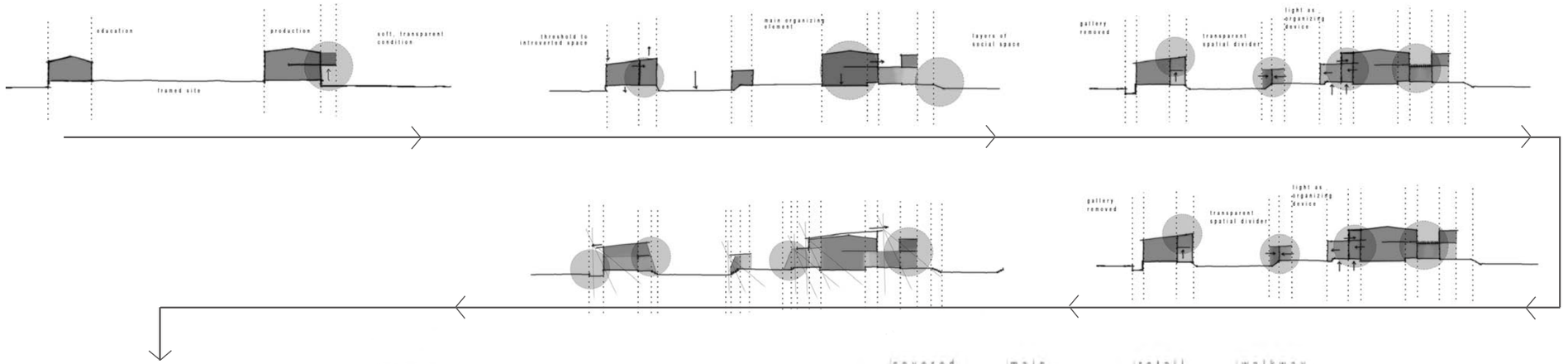


Fig 08-7 c various conditions created (Author 2014)

The base sectional drawing is revised to gain more control over the elements placed in the landscape.

The basic composition (as found in the context) requires a division between public and private space (Fig 08-07c). Elements are pushed out of and into the basic structure to create edge conditions suitable to the activity. Pushing the floor surface into the ground or raising the building onto a podium that becomes part of the building, creates a whole new series of conditions. The practicality of doing this (creates work surfaces and the building reaches the height of the raised walkway height determined by the shopping centre yard levels) is exceeded by the haptic qualities it produces in creating subtle thresholds and spatial divisions. The amount of thresholds increase as the process continues until the built form (both interior and exterior) displays a hierarchy of space (Fig 08-07d).

The sectional drawing shows how this spatial division is achieved by elements like light, surface change, walkways and routes and the boundary between the exterior and interior is challenged as elements puncture and stretch beyond the enclosed building while still maintaining clear security boundaries (Fig 08-07e).

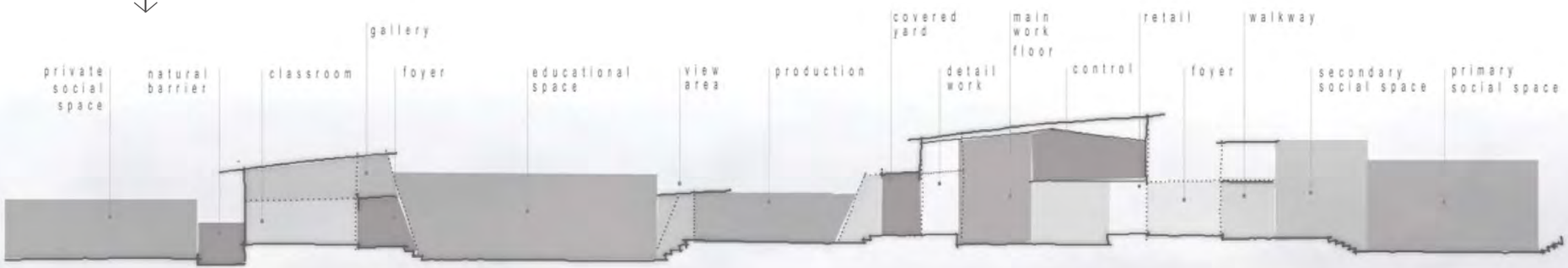


Fig 08-7 d the resulting spatial division (Author 2014)

Fig 08-7 e Resulting sectional drawing (Author 2014)

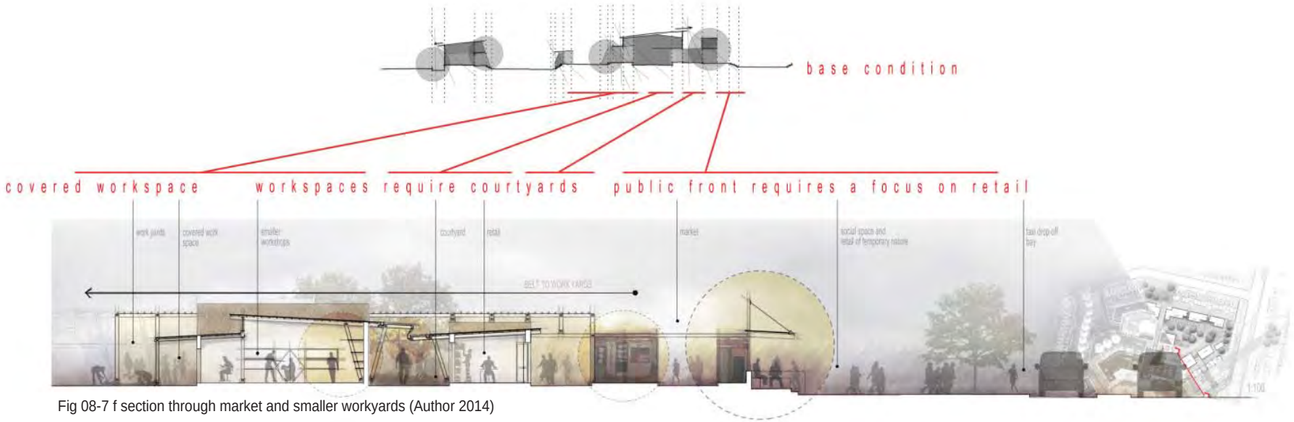


Fig 08-7 f section through market and smaller workyards (Author 2014)

The same conceptual drawing of the required conditions (Fig. 08-07f) is applied to other sections of the building. Here the structure uses other ways (determined by the function it houses) to achieve these conditions.

The composition of the market to smaller work yard spaces (Fig. 08-7f) requires that the workspace be partially covered but relies mostly on courtyards for production. The focus of the retail front is more evident and more effort is placed on the socio-economic area facing the main street.

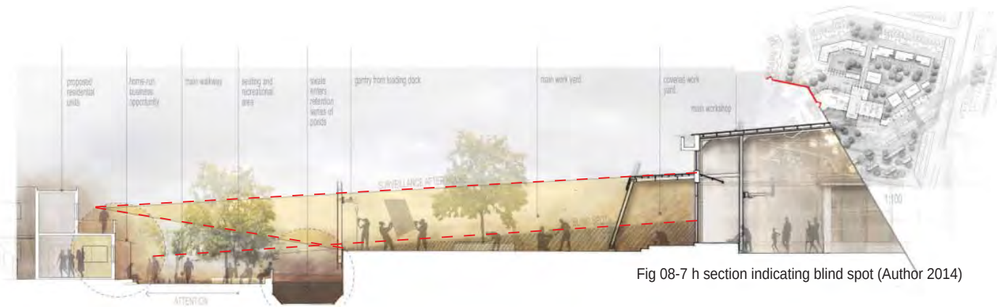


Fig 08-7 h section indicating blind spot (Author 2014)

The minor workshop manipulates the drawing by increasing the public front since activities inside the workshop are less dangerous and could capitalise on more public contact (Fig. 08-7g). The volume of the building is smaller and ceiling heights are lower (products are not as massive), and spatial division does not need to rely on floor surface changes but rather on adaptable workstations.

The back-of house is treated without the use of walls and fences (in response to the dead space the shopping centre creates by doing this). The space is defined by pushing the floor surface out of the ground to create a blind spot during the day and focus towards the residential units (Fig. 08-7 h). To create defensible space the natural barrier prohibits crossing to the yard, but during non-operational hours the space is protected by surveillance from the residential unit.

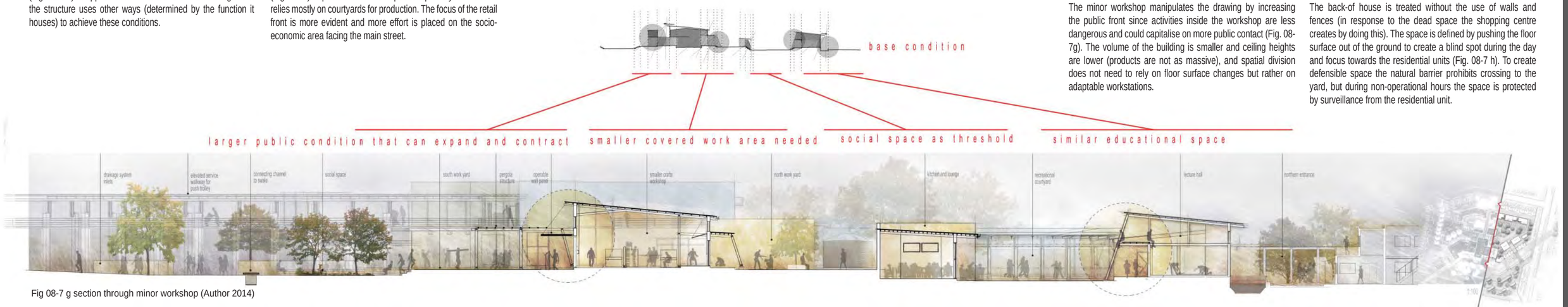


Fig 08-7 g section through minor workshop (Author 2014)

The main workshop (Fig. 08-7j) aims to create a continuity between the interior and exterior workspaces by pushing and pulling elements from the interior to exterior. These elements become useful on both sides, serving as a canopy structure as well as a secondary structural system bracing the roof structure. The extending member serves as a fixing place for a light shelf that can be operated to direct light into the deep space. .

The canopy (Fig. 08-7k), defining work yards and separating them from the educational spaces, uses a compression and tension system. By doing this the area underneath the canopy is liberated on the work yard side. The tension member is placed at an angle to lower the force required, but it creates a multitude of thresholds while maintaining a visual connection.

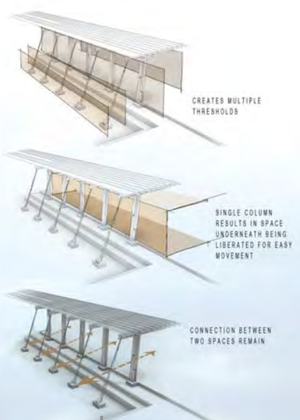
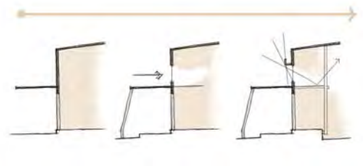
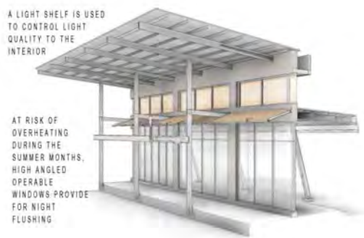


Fig 08-7k workyard canopy (Author 2014)





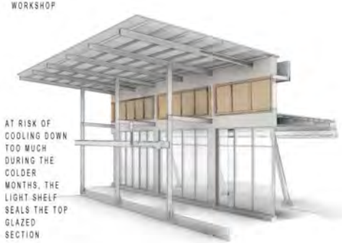


Fig 08-7j main workshop (Author 2014)

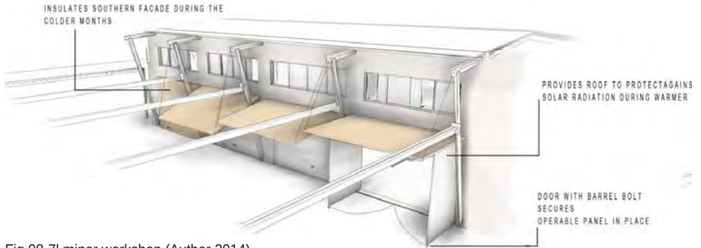


Fig 08-7l minor workshop (Author 2014)

The minor workshop is designed to expand and contract with use (Fig. 08-7l). An operable wall panel is introduced in order to achieve this. By using a pulley system placed at an angle, the initial force required by the person operating the wall is lower. The panel is stabilised by opening the door underneath and hooking the structure into place using a floor-mounted barrel bolt. The structure supporting the pulley system is supported by the pergola structure latching onto the building. Here various elements work together to support the system, again reflecting the complexity and interconnectedness of the context.

Educational buildings (Fig. 08-7m) are designed to increase in size as they connect to each other to form a continuous space. A similar operable wall panel is used to create a canopy as the spaces become one.

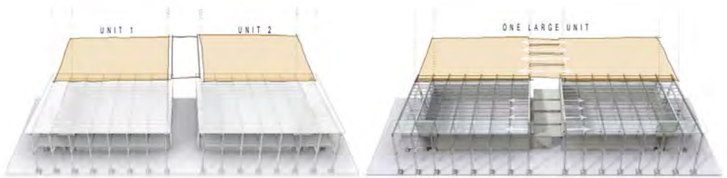
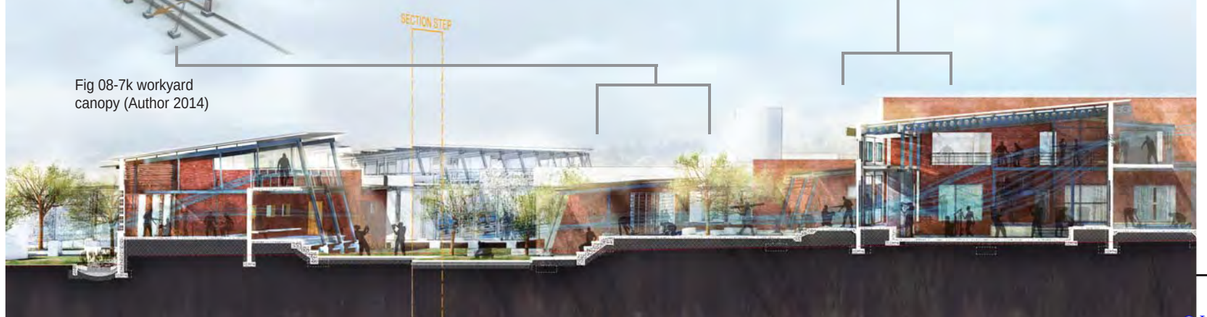


Fig 08-7m educational buildings (Author 2014)



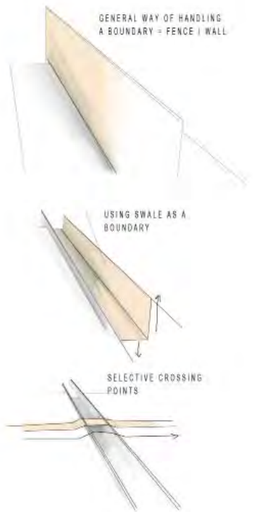


Fig 08-7o residential units (Author 2014)

Instead of using built walls or fences, a natural barrier in the form of a raingarden or bioswale is utilised to create distance between secondary movement routes and work yards (Fig. 08-7o). A height difference on either side of the wetland creates blinds spots ideal for welding areas to which the public should not be exposed.

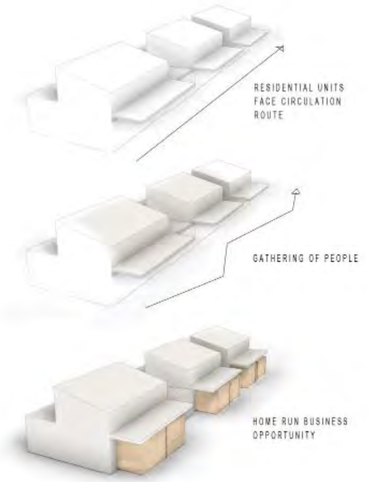


Fig 08-7n residential units (Author 2014)

The residential units, with secondary movement routes running in front of them, are designed to face these social spaces (Fig. 08-7n). The aim is to stimulate smaller home-run businesses, as witnessed in the fabric.

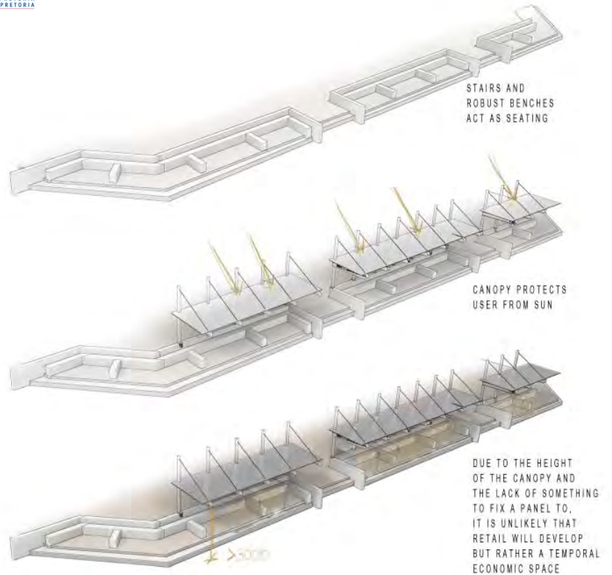


Fig 08-7q The social space (Author 2014)

In order to reserve the southern square for social spaces and prohibit permanent retail forming, a flood plane is introduced to encourage temporal activities (social and temporary economic functions). Seating is created to serve as temporary taxi waiting areas (Fig. 08-7q). The canopies creating shade for these spaces are placed high up, making them hard to manipulate and subject to infill over time. A tension cable is used to support the cantilever – in this way one of the elements (a column) to which the components of a shop are fixed is once again eliminated. This space is resistant to physical adaptation.

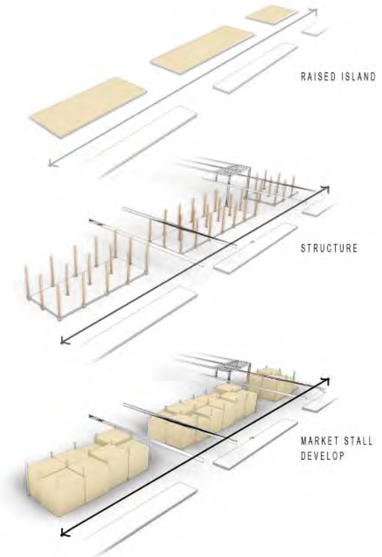
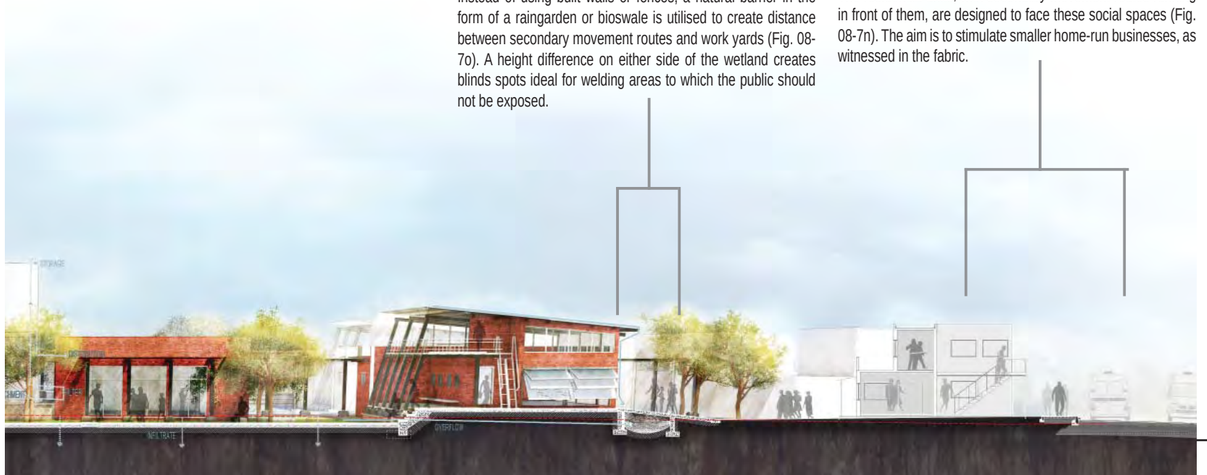
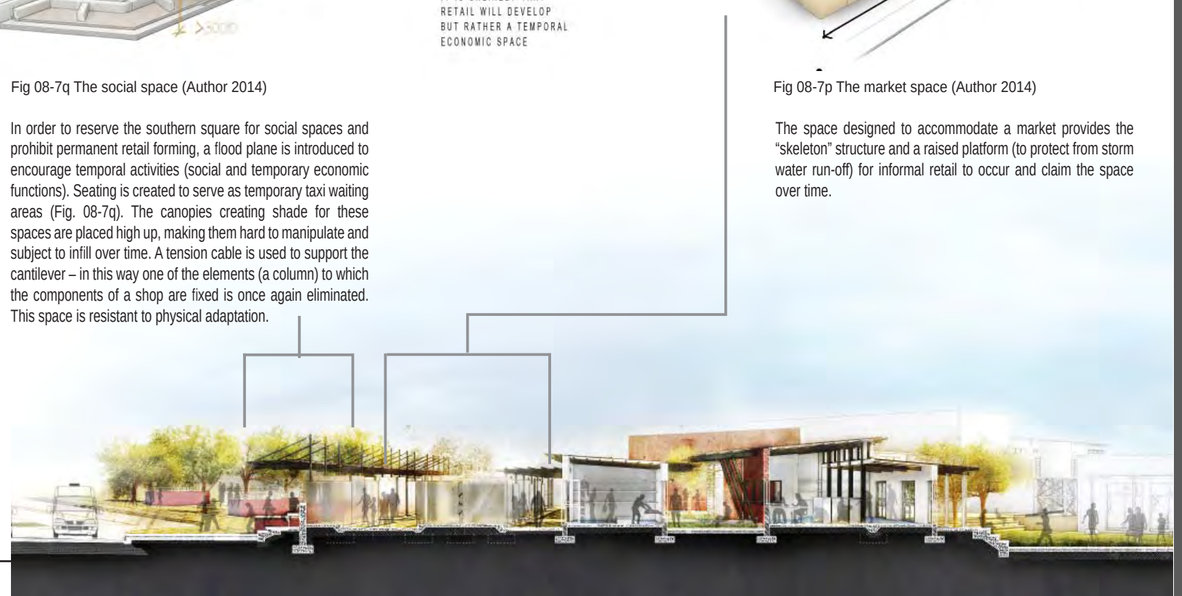


Fig 08-7p The market space (Author 2014)

The space designed to accommodate a market provides the “skeleton” structure and a raised platform (to protect from storm water run-off) for informal retail to occur and claim the space over time.





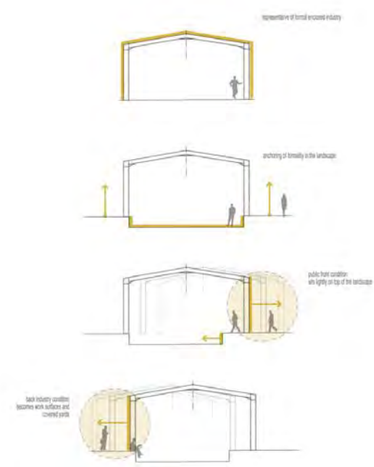
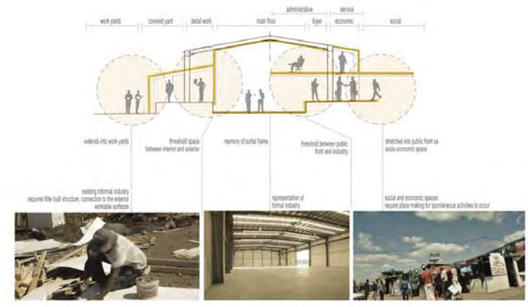
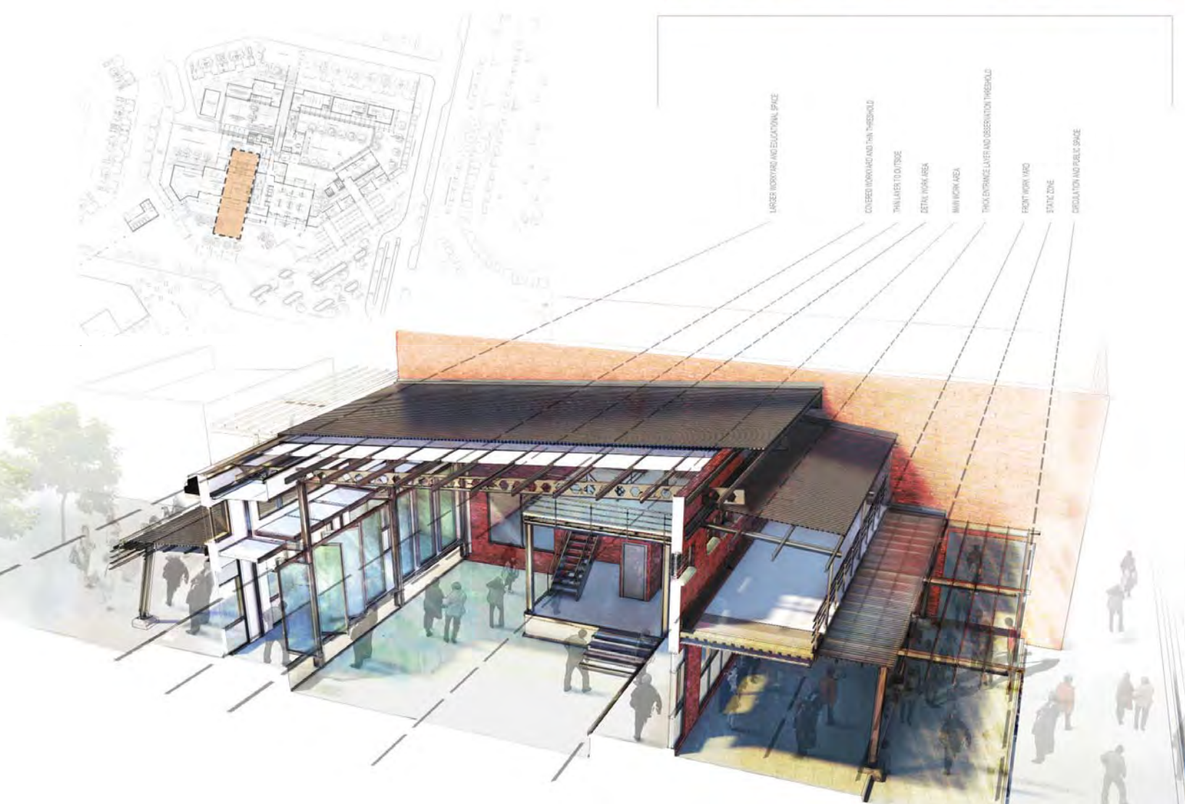


Fig 08-7r layering and programme
over the detail section (Author 2014)





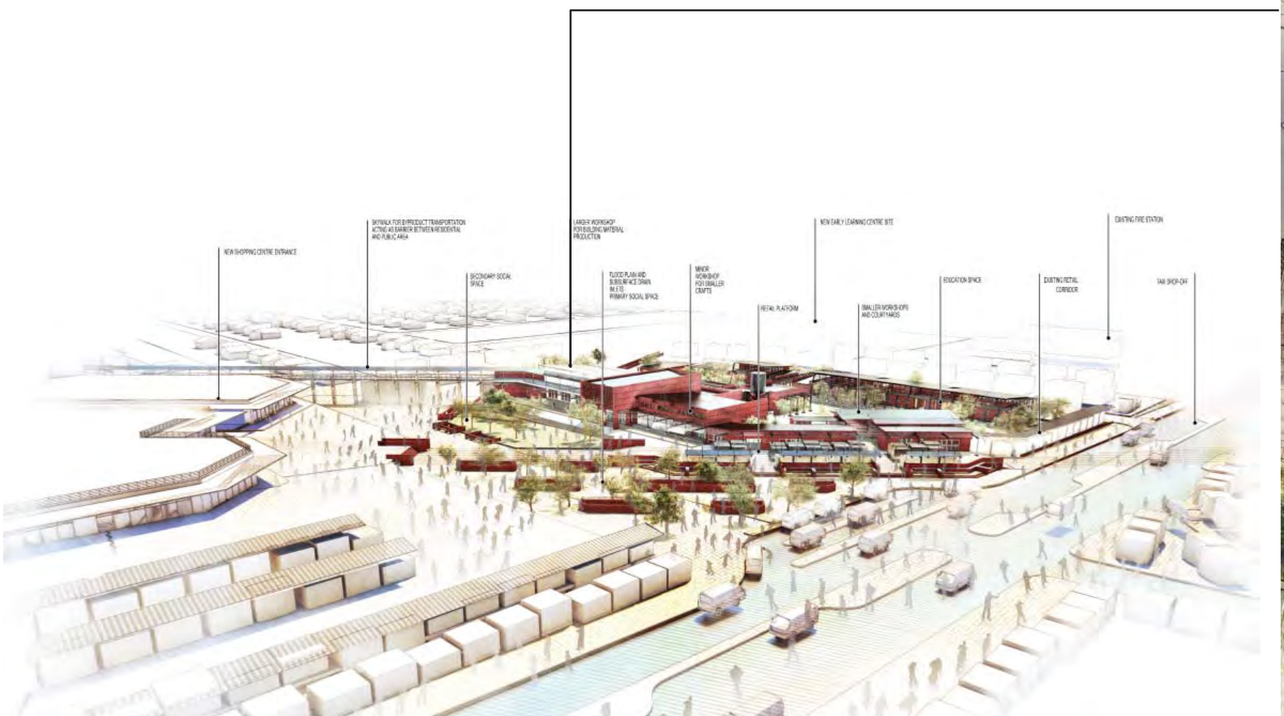
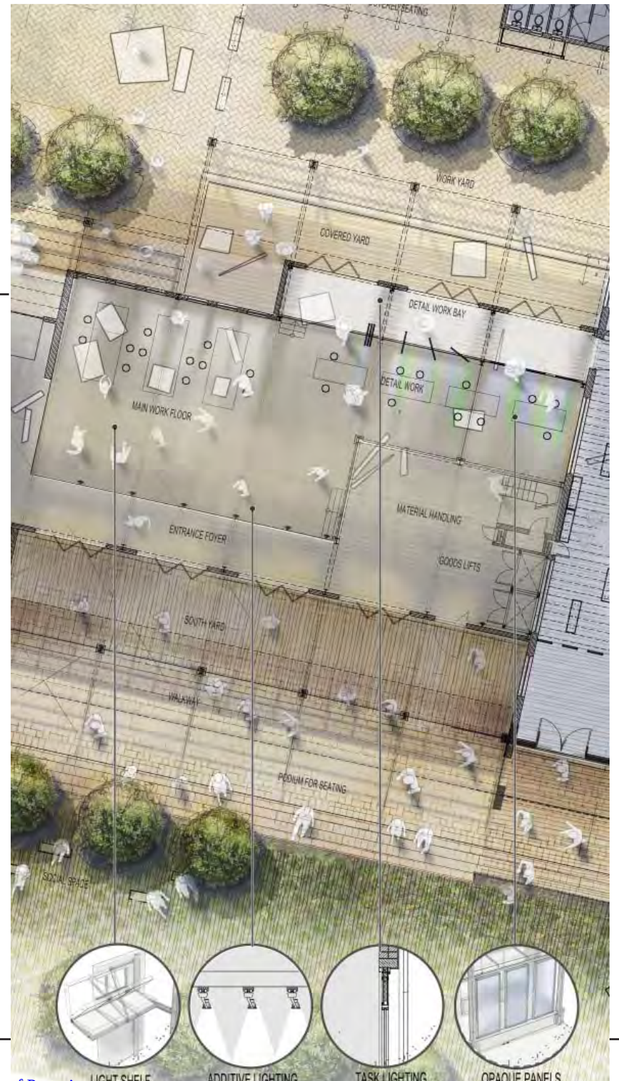
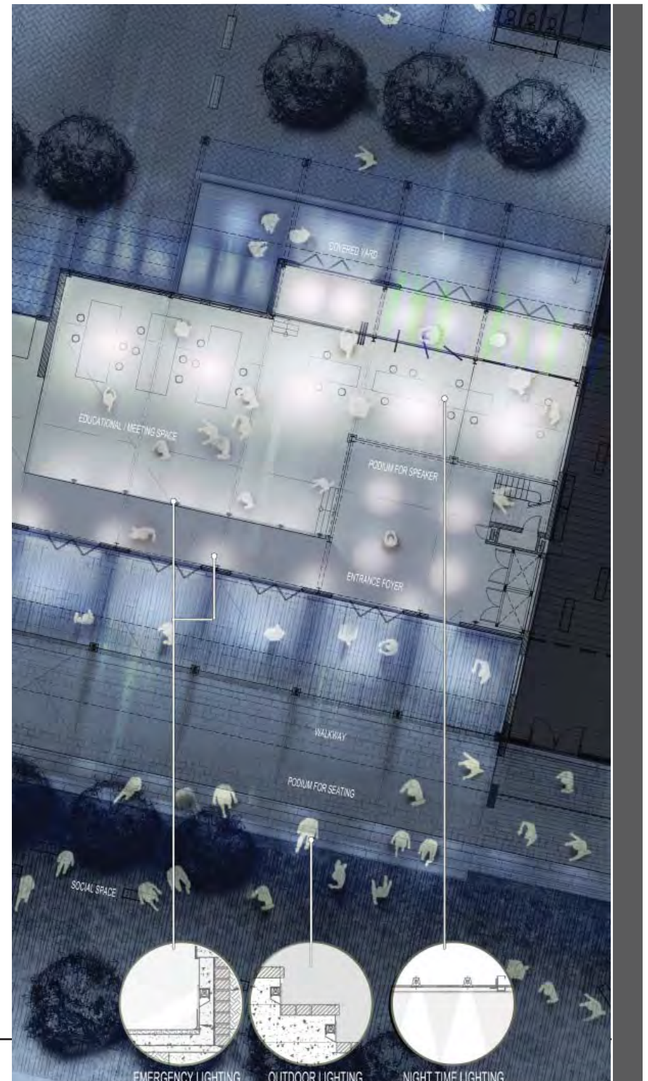


Fig 08-7s perspective and plans showing transitions between night and day (Author 2014)





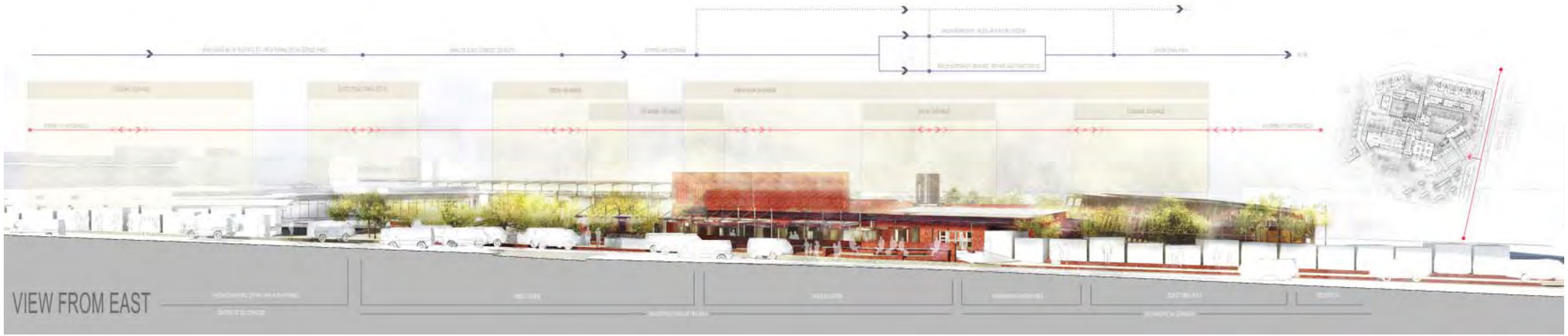


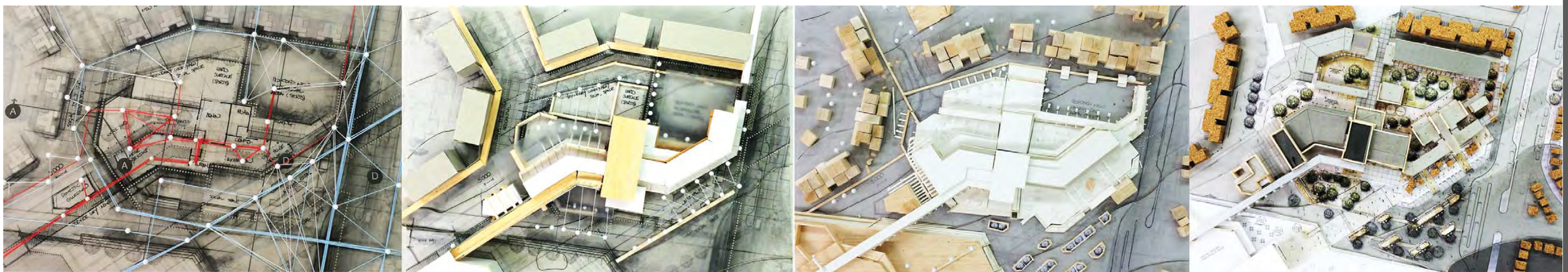
Fig 08-7t view from east (Author 2014)

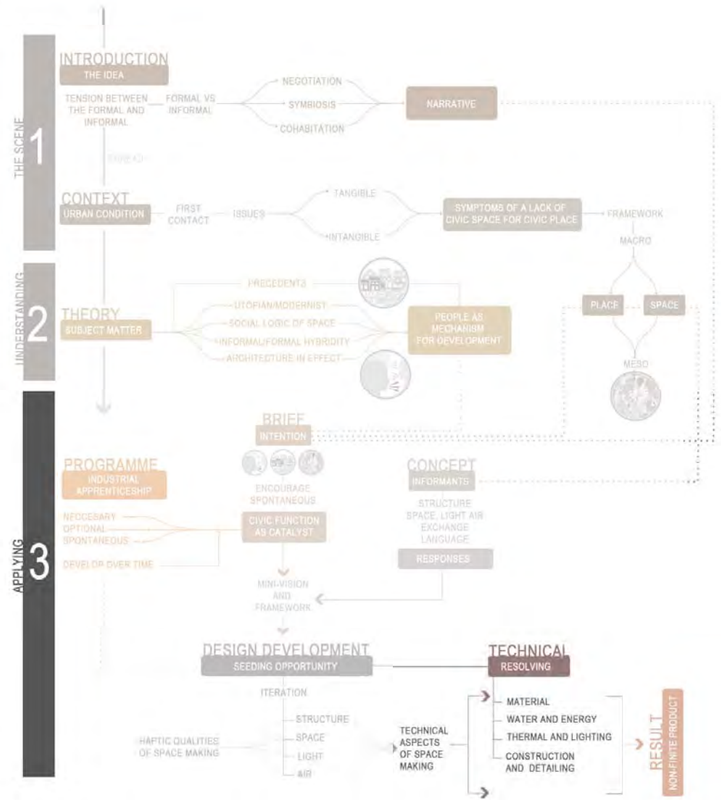
Fig 08-7u view from south (Author 2014)

08 CONCLUSION

Now that the informants for structure, space light and air are satisfied on a design level, a technical investigation could commence. However, the design is in no way complete. The technical investigation will determine changes that need to be synthesised with the original design intentions.

Fig 08-7v model development (Author 2014)





09 TECHNICAL RESOLUTION

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01 INTRODUCTION

The design iteration continues as the technical aspect of each of the informants is explored, scrutinised and iterated.

As with the design strategy, four components make up the iteration process: structure, space, light and air. In this section the technical influences will be investigated (Fig. 09-1b). This relates to structural solutions, ventilation, thermal properties, lighting analysis and water management technical resolutions. A strategy and view is developed for each component and iterated separately and as a whole. The components are interdependent not only with each other, but also with the design strategy as a whole, and require a synthesis and balance with the design intentions. The methodology of this iteration is based on investigating structure, light and air (and all their components) as they cross-pollinate, interweave and touch base with the design intentions (space).

02 TECHNICAL STRATEGY

Since the design generator finds its roots in the context, each informant requires a sensitivity and analysis of its effect on the context. Technology, assemblies and construction require a low-tech, high durability and low maintenance solution in order to function as a whole with the fabric.

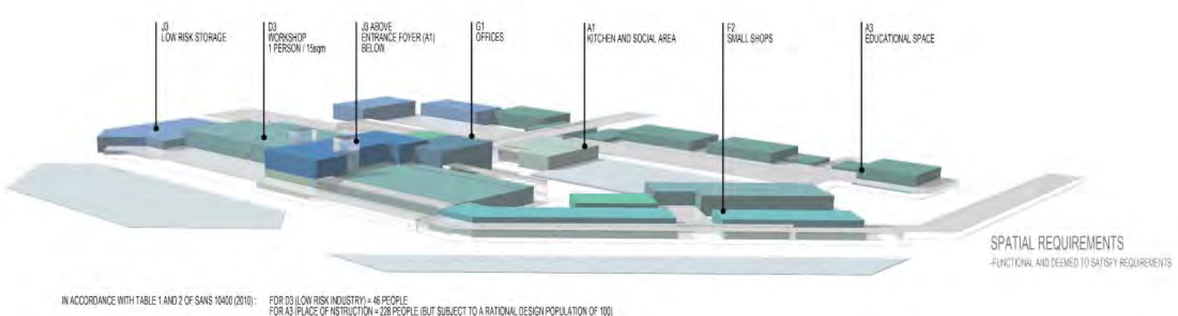


Fig 09-1a classification of spaces and design population (Author 2014)

The structure is the first component to stimulate the narrative between formality and informality, as local building techniques and structures are fused with the expected formal responses to the programme. Structures becomes more than a roof, walls and a floor as it serves other practical and ethereal functions beyond the requirements of construction.

Space is seen as the “touch base” point in the iteration as the design principles need to be reflected in the technical investigation. Structure, light and air make up the components of a spatial intervention.

Light is used as a design element to form, divide and communicate space to the user. Now light could be iterated to validate the idea that the natural light design will provide adequate lighting as required by the light zoning. The electrical lighting principle will be added to the investigation in order to reduce reliance on the municipal electrical supply. Light also includes solar radiation (that which is not visible) and directly influences the thermal behaviour of the building. In order to be resource efficient, the building needs to rely on passive systems to achieve thermal comfort during use.

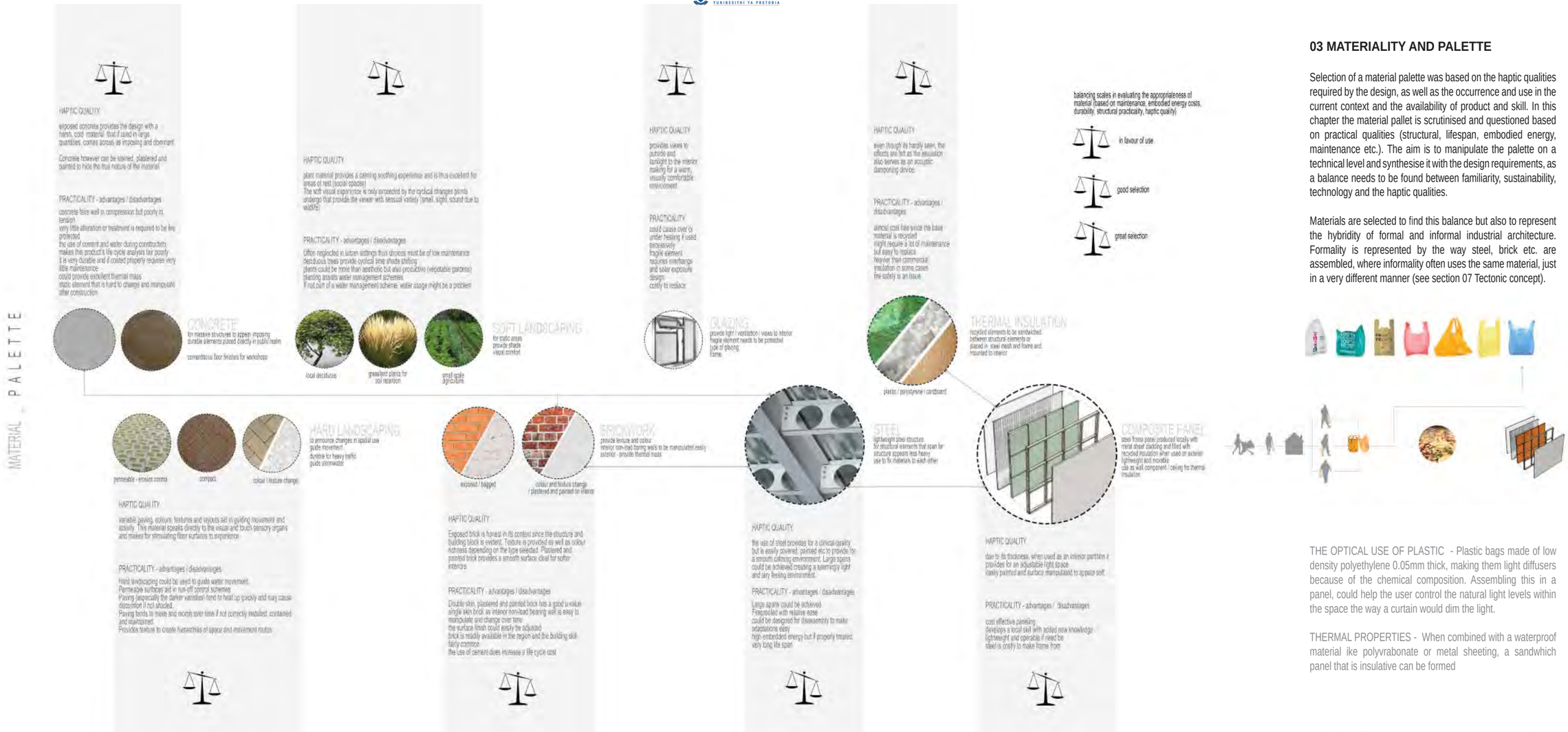
The air component is multifaceted. It relates to what air produces in terms of water. Water is used as a design element to turn a threat into a resource and should be iterated as a system. Air also relates back to the thermal properties of the building, as it could aid or prevent environmental comfort.

Fig 09-1b Technical methodology (Author 2014)

03 MATERIALITY AND PALETTE

Selection of a material palette was based on the haptic qualities required by the design, as well as the occurrence and use in the current context and the availability of product and skill. In this chapter the material pallet is scrutinised and questioned based on practical qualities (structural, lifespan, embodied energy, maintenance etc.). The aim is to manipulate the palette on a technical level and synthesise it with the design requirements, as a balance needs to be found between familiarity, sustainability, technology and the haptic qualities.

Materials are selected to find this balance but also to represent the hybridity of formal and informal industrial architecture. Formality is represented by the way steel, brick etc. are assembled, where informality often uses the same material, just in a very different manner (see section 07 Tectonic concept).



THE OPTICAL USE OF PLASTIC - Plastic bags made of low density polyethylene 0.05mm thick, making them light diffusers because of the chemical composition. Assembling this in a panel, could help the user control the natural light levels within the space the way a curtain would dim the light.

THERMAL PROPERTIES - When combined with a waterproof material ike polyvrabonate or metal sheeting, a sandwhich panel that is insulative can be formed

Fig 09-2a The technical material palette (Author 2014)

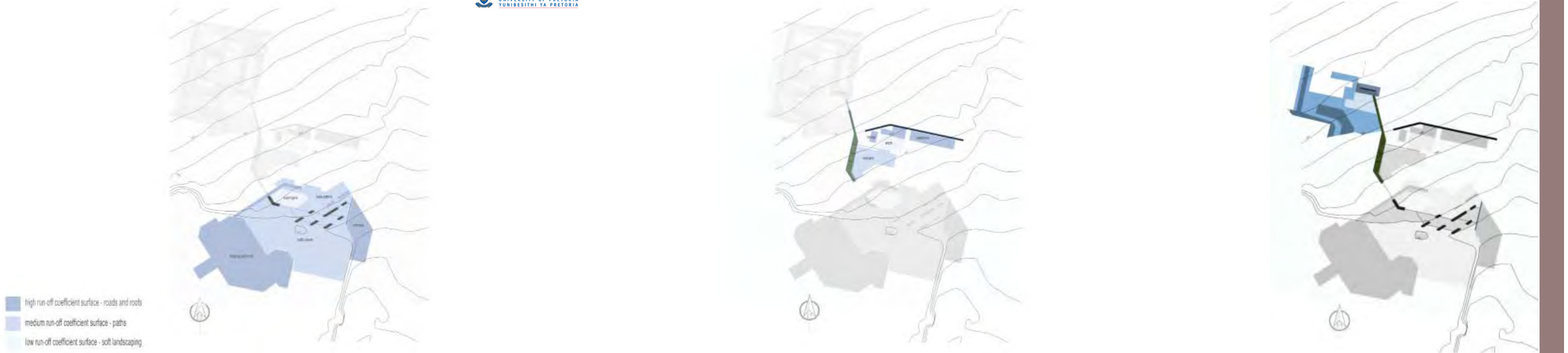
Fig 09-2b The technical material palette and south elevation (Author 2014)

04 WATER CONCEPT

The water methodology is divided into two sections: storm water management and building use .

04-01
THE MICROFRAMEWORK WATER CONCEPT

Here, water is used as both a resource and a design element to define a natural barrier (Fig. 09-3).



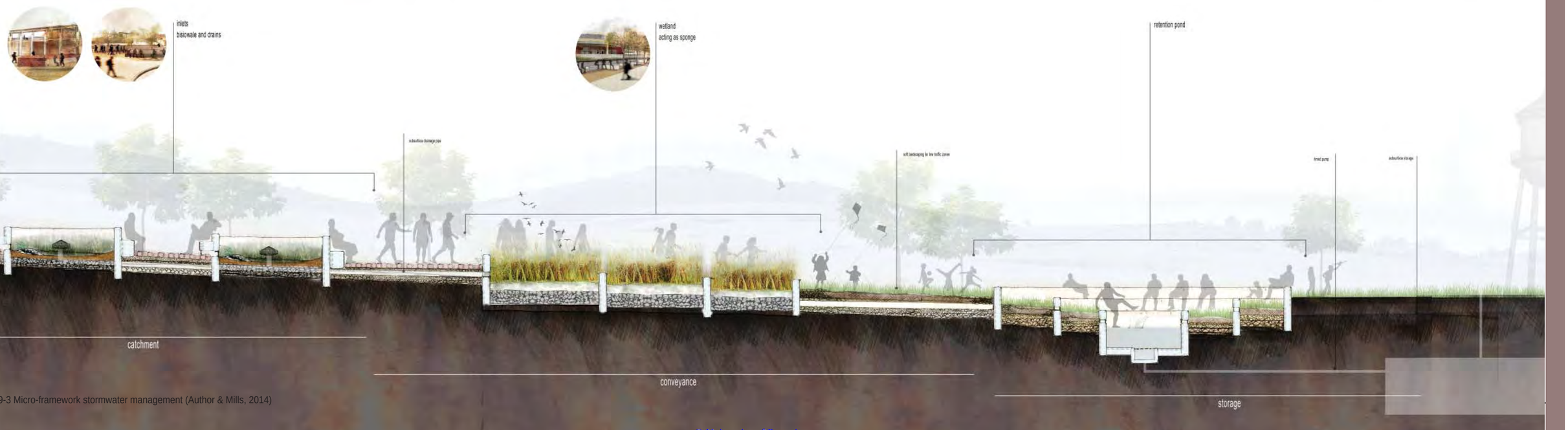


Fig 09-3 Micro-framework stormwater management (Author & Mills, 2014)

PRIMARY YIELD

Yeild= P x A x C (precipitation x area x coefficient)

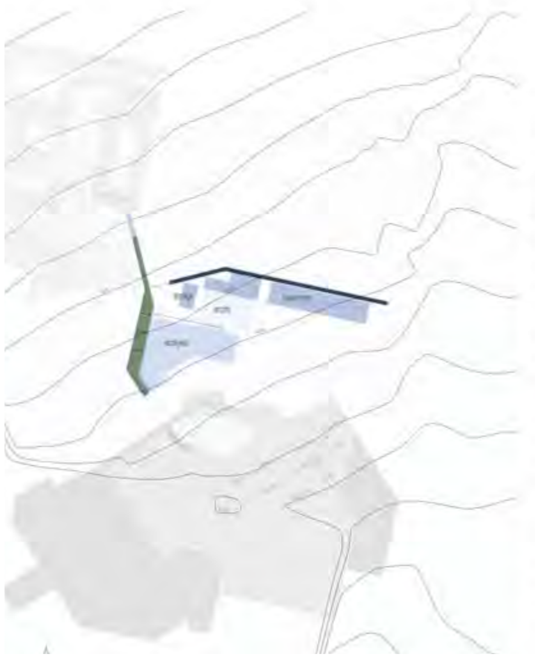
Month	monthly precipitation (m)	area m squared	coefficient	NEW ROOFS m³	coefficient	PAVING m³	coefficient	ROADS m³
January	0.136	6930	0.9	848.232	0.7	630.224	0.8	272
February	0.076	6930	0.9	474.012	0.7	352.184	0.8	152
March	0.082	6930	0.9	511.434	0.7	379.988	0.8	164
April	0.051	6930	0.9	318.087	0.7	236.334	0.8	102
May	0.013	6930	0.9	81.081	0.7	60.242	0.8	26
June	0.007	6930	0.9	43.659	0.7	32.438	0.8	14
July	0.003	6930	0.9	18.711	0.7	13.902	0.8	6
August	0.006	6930	0.9	37.422	0.7	27.804	0.8	12
September	0.022	6930	0.9	137.214	0.7	101.948	0.8	44
October	0.071	6930	0.9	442.827	0.7	329.014	0.8	142
November	0.098	6930	0.9	611.226	0.7	454.132	0.8	196
December	0.11	6930	0.9	686.07	0.7	509.74	0.8	220
				4209.975		3127.95		1350

TOTAL YIELD RUNNING INTO BIOSWALES 8687.925

Fig 09-4a Primary yield (Author 2014)

Concept

The primary system utilises hard surfaces to guide the water towards inlets situated in the public square. A sub-surface system conveys the water towards a wetland system acting as a natural barrier. The bioswale empties into a retention pond used for interaction between the user and harvested water.



SECONDARY YIELD

WETLAND (SECONDARY RUNOFF)

Month	monthly precipitation (m)	area m squared	coefficient	PAVING m³	coefficient	ROOF m³
January	0.136	672	0.7	63.9744	0.9	15.0552
February	0.076	672	0.7	35.7504	0.9	8.4132
March	0.082	672	0.7	38.5728	0.9	9.0774
April	0.051	672	0.7	23.9904	0.9	5.6457
May	0.013	672	0.7	6.1152	0.9	1.4391
June	0.007	672	0.7	3.2928	0.9	0.7749
July	0.003	672	0.7	1.4112	0.9	0.3321
August	0.006	672	0.7	2.8224	0.9	0.6642
September	0.022	672	0.7	10.3488	0.9	2.4354
October	0.071	672	0.7	33.3984	0.9	7.8597
November	0.098	672	0.7	46.0992	0.9	10.8486
December	0.11	672	0.7	51.744	0.9	12.177
				317.52		74.7225

TOTAL SECONDARY YIELD 392.2425

TOTAL RUNNING INTO WETLAND CONVEYING WATER TO THE POND 9080.1675

Fig 09-4b Secondary yield (Author 2014)

Concept

By angling the hard raised surfaces of work yards towards the edge of the wetland, water produced by the work yards enters the wetland. Storm water drains convey water from non-adjacent areas towards the wetland. A bioswale catches run-off from the educational space roofs and conveys it via a subsurface pipe towards the wetland system.

TERTIARY YIELD

YIELD SURROUNDING WETLAND (Tertiary runoff)

Month	YIELD HARD SURFACES	Yield Roads	TOTAL YIELD m³
January	1165.91	410.27	1576.18
February	651.61	229.5	881.11
March	702.1	247.64	949.74
April	437.16	154.02	591.18
May	111.38	39.26	150.64
June	59.99	21.14	81.13
July	25.41	9.06	34.47
August	50.62	18.12	68.74
September	168.52	66.4	254.92
October	608.88	214.42	823.3
November	840.28	295.96	1136.24
December	943.04	332.5	1275.54
	[illegible]	[illegible]	[illegible]

Secondary tank sizing:

Month	YEILD m³	DEMAND	Water in tank
January	2851.18	509.99	2341.19
February	1593.62	509.99	3424.82
March	1718.5	509.99	4633.33
April	1069.31	509.99	5192.65
May	272.518	509.99	4955.178
June	146.03	509.99	4591.218
July	62.591	509.99	4143.819
August	124.61	509.99	3758.439
September	461.17	509.99	3700.619
October	1183.47	509.99	4383.099
November	2055.052	509.99	5929.161
December	2306.832	509.99	7725.003
	13844.883	6119.88	

WETLAND SIZING

Month	YEILD m³	DEMAND	water left for tank
January	2851.18	424.95	2426.23
February	1593.62	424.95	3594.9
March	1718.5	424.95	4888.45
April	1069.31	424.95	5532.81
May	272.518	424.95	5380.378
June	146.03	424.95	5101.458
July	62.591	424.95	4739.099
August	124.61	424.95	4438.759
September	461.17	424.95	4474.979
October	1183.47	424.95	5233.499
November	2055.052	424.95	6863.601
December	2306.832	424.95	6745.483

therefore wetland pond size = 16 x 16 x 2

	left in tank	yield	demand	in Tank
August	526	124.61	509.99	140.62
September		461.17	509.99	91.8
October		1183.47	509.99	765.28
November		2055.052	509.99	2310.342
December		2306.832	509.99	4107.184
January		2851.18	509.99	6448.374
February		1593.62	509.99	7532.004
March		1718.5	509.99	8740.514
April		1069.31	509.99	9299.834

Fire Station will use water continuously through the year, but most fires occur in during the dry season, April to August, and during these months all the water within the tank will be used.
The tank will always have enough water in to fill all the stations trucks and supply the wetland used by the school with water.
Therefore the tank needs to be able to hold the amount of water harvested at the start of April each year= 9299.834
Therefore tank size = 46 x 51 x 4

Fig 09-4c Tertiary yield (Mills 2014)

Concept

Serve and protect:

The water collected on the sites adjacent to the wetland accumulates in a public meeting space, acting as a transition between the neighbouring programs. This collected water brings social energy into this public meeting space. The concept for the use of this collected water and the energies it brings, is one of service and protection. The collected water is to be used to serve both the children-focused spaces and the adjacent civic function, the fire station. The wetland system will serve the children-focused spaces as a source of educational energies and will protect the children-only spaces by acting as a natural barrier between public and private civic spaces. The water collected and cleaned in the wetland system will serve as a source of water for the children-focused spaces, to be used in the ablution facilities and the community kitchen.

The excess water collected will be cleaned through the wetland system and stored in a secondary tank. The water stored in this tank will be used by the fire station. The collected water will serve the fire station in order for the fire station to serve and protect the community. The water used by the fire station includes that used for daily functioning and water used to extinguish fires. Most fires occur during the dry season and the fire station will use up all the water stored in the tank by the end of August, leaving only enough water to serve the children's spaces and the fire station's monthly demands in the tank.

04-02
THE SITE
Only the primary and secondary yield systems are located on the site. These systems are responded to on a technical level as they are used as design elements in the artificial landscape.

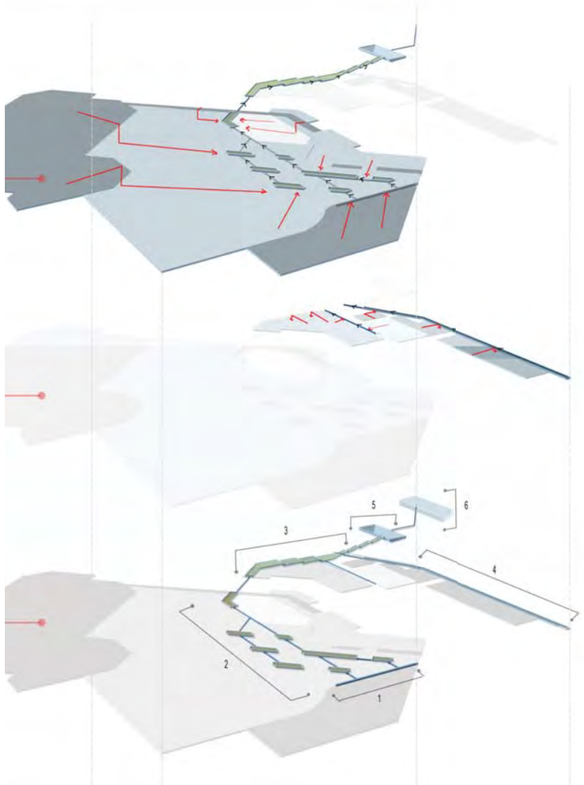


Fig 09-4d Storm water management on site (Author 2014)

Primary system
The primary system utilises hard surfaces to guide the water towards inlets situated in the public square. A subsurface system conveys the water towards a wetland system, which acts as a natural barrier. The bioswale system empties into a retention pond and wetland system used for interaction between the user and harvested water.

Secondary system
Water produced by work yards enters the wetland through the angling of the hard, raised surfaces towards the edge of the wetland. Storm water drains convey water from non-adjacent areas towards the wetland, and a bioswale catches run-off from the roofs of the educational space and conveys it via a subsurface pipe towards the wetland system.

The whole
1. Run-off from the raised road system (for traffic calming) enters a storm water drain equipped with a grease trap and filter.

2. Rain gardens enclosed by seating are equipped with inlets and floating debris filters.

3. The wetland system slowly releases water downstream and acts as a natural barrier between spaces.

4. A bioswale collects water from roofs as new hard surfaces are introduced, and might aggravate an existing problem.

5. A retention pond stores water until it is pumped up to a water tower for storage.

6. Water is stored in an underground storage facility to prevent loss due to evaporation. The fire trucks use on-board pumps to fill up their tanks from the underground storage facility.

The threat
Water is viewed as a threat on the site. Evidence of flash flooding is visible as water rushes from the road and existing building over the site into the residential area. Movement paths have compacted the ground over time, aggravating the situation and gradually causing a loss of vegetation. Creating a raised platform for the building to sit on will allow the platform to act as a barrier for storm water.

A drainage plain is introduced to act as inlets to a subsurface system. The surfaces around these inlets require hard landscaping (high traffic zones) and could thus guide water towards the inlets. These sponges transport the water to a wetland system that acts as a natural barrier between the work yards and the semi-public zone in front of the proposed residential units. The water is slowed down and filtered towards a social gathering space (retention pond) where, during the rainy season, interaction of the user with water is important. From here it is pumped up into an elevated storage tank to provide the necessary water pressure.

The resource
Now that water is being managed it can be translated from a threat to a resource. The harvested storm water can now be used by the fire station to clean and service the site, instead of potable water.

The design element
The harvesting and storage of water becomes a design element. The inlets are framed and protected by seating that acts as a space-making device in a relatively large new public square.

The wetland acts as a natural barrier between the residential and workshop zones, eliminating the need for a conventional fence.

The retention pond encourages interaction with water during the wetter months. During the dry months where water is not present in the pond, the space becomes seating, adding yet another social component.

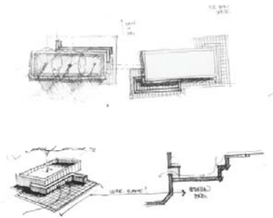


Fig 09-4e Threats due to erosion and possible social opportunities of a management system (Author 2014)

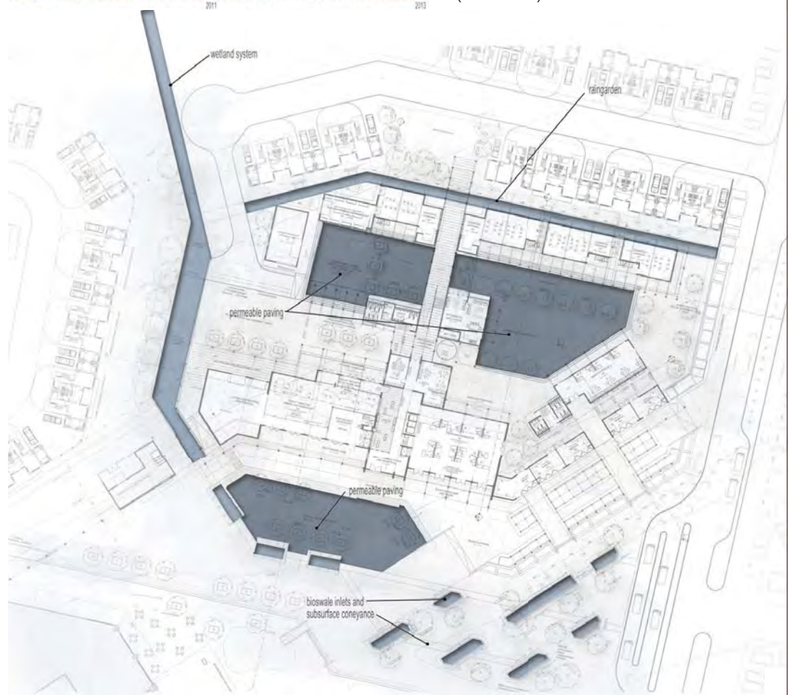
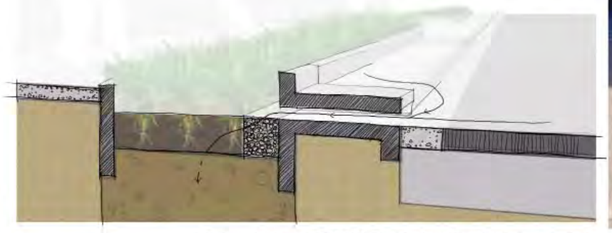


Fig 09-4f Storm water management surface properties (Author 2014)

Fig 09-4g The raingarden system assembly and process (Freno systems 2014)



Technological precedents

In order to understand water management schemes, a few precedents were selected.

Freno systems (based in the USA) developed a pre-cast modular rain garden system (Fig. 09-4g) that can be assembled in situ. This system aims to capture run-off from the surrounding hard surfaces in the downtown district of St Louis, Missouri. The water is retained in the structure and slowly released into the groundwater system (Freno Systems 2014).


View A: Intersection of 9th Street and Pacific Ave


View B: View of Entertainment District

An extensive water management scheme was proposed for the Tacoma Business District in Washington by Olson Kundig Architects and Charles Anderson Landscape Architecture (Fig. 09-4h). The project used a series of rain gardens connected through subsurface pipes to move water slowly from the collection points to the main underground drainage system (Karnes 2014). Various surfaces (permeable and hard) were used to direct the run-off to the collection points, which become green features along the city streets and have a function beyond the engineering requirements.

Fig 09-4h Tacoma business district (Olson Kundig Architects 2014)

04-03
BUILDING USE

The second part of the water concept revolves around harvesting water for building use. Here water is harvested from the roof since it contains the least pollutants and is easier to process for building use.

The principle

The system does not aim to be independent of the grid, but rather to reduce municipal supply use – to be resource efficient. Fittings, toilets and urinals are designed to use less water. Grey water is recycled and used to flush toilets and urinals. Primary grey water (directly from the roof) is used as a substitute for municipal water wherever non-potable water can be used, for example, as cleaning water and for flushing toilets, etc.

Fire water strategy

Since 600kPa is required to achieve the necessary water pressure exiting the hose of the fire hose reel (FHR), it is unlikely that the building will be able to produce this capacity without using pumps, elevated storage tanks (60 metres above the point of use) and generators. The municipal supply is used as a primary source during emergencies, with a reserve left in the grey water tank to be used as a back-up during extremely unlikely cases (municipal water supply is switched off etc.). Because of the size of the building, fire sprinklers are not required, but the FHR must be accompanied by two 4.5 kg fire extinguishers. In accordance with SANS 543, the distribution of these FHR and fire extinguishers must be such that the FHR can protect an entire floor when obstructions are considered.
In accordance with SANS 10400 Section T, a Fire hose reel needs to be provided for any building exceeding 250sqm, with intervals of 500sqm per hose.

Fig 09-4i Building usage of water (Author, 2014)

The design element

Angling of roofs makes for large imposing structures on the public condition side. Structures are inserted to hide the massiveness of the structure. Gutters are used to block sunlight from reaching glazed elements during the overheated period. Down pipes are used as elements to create and strengthen uniformity in the formal design.

The storage system is displayed to the visitor as one passes along the main axial line running through the building, adding to the educational component of the site. Once a threat, water now becomes a resource.

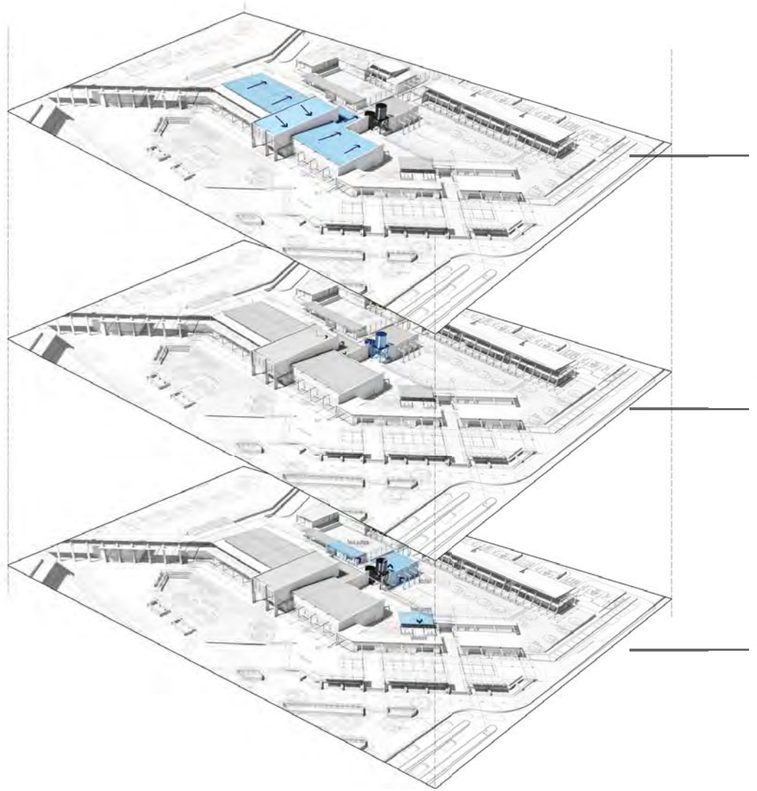


Fig 09-4j Collection, conveyance and distribution of water (Author, 2014)

Collection and conveyance

The largest roofs are angled towards the collection facility, with continuous gutters aimed towards the central collection roof. From here water enters the primary storage tank, situated as high up as possible.

The Dept. of Public Work's Guide for architects concerning drainage water supply and storm water drainage (2000), specifies that for the maximum roof size of 280sqm, a 200x150mm gutter is required, with downpipes not more than 15 metres apart. Since the gutter needs to travel 30 metres and the roof area is 514sqm, the size of the gutter was doubled, to 500x240mm.

Storage and cleaning

Before entering the catchment tank, water is filtered by a screen that was added to prevent floating debris from entering the gutter conveyance system. A second, finer filter is situated at the mouth of the primary water tank to trap further, finer debris. The primary storage tank (for incoming run-off collection) can overflow into a garden space if need be.

A UV filter will not be feasible since the demand for water is much higher than the harvested amount. However, the demand for grey water is slightly less than the amount of harvested grey water. Thus the municipal supply will feed the potable water outlets while the harvested supply is limited to use of grey water.

Building Use
Potable use:

The municipal supply will serve the potable outlets. All taps are fitted with aeration valves to reduce water use. If located in a toilet space, an integrated system is used to recycle grey water exiting WHB and redirect it into urinal and toilet holding bowls.

Grey water use:

As grey water from the WHB enters the urinal or toilet, it replaces the grey water supply from primary catchment and storage (or the municipal supply when grey water is depleted). The primary tank is always left at a certain level in order to supply the building with water for cleaning and possible back-up water should a fire break out. Since the fire station is situated next door, the building is subject to rational design and should, by law, have a certain number of FHRs, although it is unlikely to use them over time.

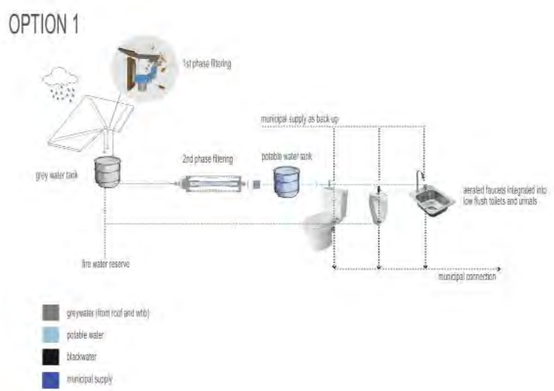


Fig 09-4k option 1 with UV filter (Author, 2014)

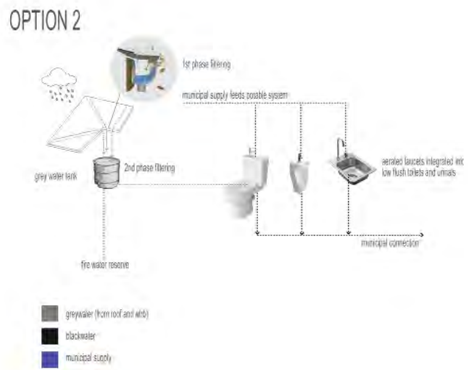


Fig 09-4l option 2 without UV filter (Author, 2014)

Month	monthly precipitation (m)	area m squared	coefficient	ROOFS m³
January	0.136	1140	0.9	139.536
February	0.076	1140	0.9	77.976
March	0.082	1140	0.9	84.132
April	0.051	1140	0.9	52.326
May	0.013	1140	0.9	13.338
June	0.007	1140	0.9	7.182
July	0.003	1140	0.9	3.078
August	0.006	1140	0.9	6.156
September	0.022	1140	0.9	22.572
October	0.071	1140	0.9	72.846
November	0.098	1140	0.9	100.548
December	0.11	1140	0.9	112.86
				692.55

In accordance with SANS 10400-A the design population (Table 2)

type of space	Area	design population
D3 (low risk industrial)	700sqm	46
A3 (places of instruction)	1139sqm	227.8
F2 (small shops)	385 sqm	39

According to SANS 10400-P (Table 6) the total required sanitary facilities:

Male			Female	
U	WC	WHB	WC	WHB
8	5	7	13	7

Considering a UV filter to convert greywater harvested from the roof into potable water

toilets and urinals	usage pp/pd	population	total usage (l)
	4	313	1252

urinal flush	% of facilities provided	flushes	liters used / d	liters / year
0.5l	34%	425	212.84l	55330.6

toilet flush	% of facilities provided	flushes	liters used / d	liters / year
2.5l	66%	827	2067.5	537550

WHB usage per day	population	duration	liters / minute	total usage per day (l)	usage per year
4	313	20s	5	2003.2	520832

WHB greywater substitution

	flush	saved	percentage of use	saved
urinal	0.5l	1.6l	34	100%
wc	2.5l	1.6l	66	64%

Total water required from greywater harvesting tank / day

	liters used	liters recycled	additional needed from harvested greywater supply
urinal	212.84l	212.84l	0l
WC	2067.5l	1323.2l	744l

Ablutions water budget	day	year
grey water requirements	744	193440
potable water requirements	2003.2	1105766.4

Potable water for kitchen etc		
population	liter / day	liter / year
313	1878	488280

Fire water			
amount of FHR	liters / min	30 minutes	total
4	30	900l	3600l

Total potable water required	1594046.4
Total grey water required	193440
Total water always in tank (fire water)	3600
	1791086

Water harvested m3	Harvested l	water required l	municipal supply
692.55	692550	1791086	1098536

Question feasibility of UV filter costs

Without UV filter to make greywater harvested from roof potable

Harvested (l)	greywater (l)	potable water requirements	FHR requirements
692550	592880.5	1009112	3600

The harvested amount is less than the required potable amount
The harvested amount is however greater than the greywater demand
When applying a safety factor, it seems more feasible not to have a costly UV filter, but rather rely on a municipal supply of potable water and rely on the harvested water for greywater usage

Tank sizing

Demand per year - 592.8805 m3 demand per month - 49.4067

		DEMAND			
Month	YIELD m³	m³	EXTRA	WATER IN RESERVOIR m3	
January	139.536	49.4067	90.1293	90.1293	
February	77.976	49.4067	28.5693	118.6986	
March	84.132	49.4067	34.7253	153.4239	
April	52.326	49.4067	2.9193	156.3432	
May	13.338	49.4067	-36.0687	120.2745	
June	7.182	49.4067	-42.2247	78.0498	
July	3.078	49.4067	-46.3287	31.7211	
August	6.156	49.4067	-43.2507	-11.5296	
September	22.572	49.4067	-26.8347	-38.3643	
October	72.846	49.4067	23.4393	-14.925	
November	100.548	49.4067	51.1413	36.2163	
December	112.86	49.4067	63.4533	99.6696	

The most water will be harvested in January but the largest amount must be contained in April - requiring a tank that can hold more than 157 m3

The lowest level the water should reach is 3600l (or 3.6 m3)
Since this level is not reached during the months of August to October, either a municipal reliance for fire water must occur or the tank must be filled up to that level since grasses are still dry from winter and fires are a danger

Fig 09-4m Water collection and tank sizing calculations (Author, 2014)

05 THERMAL CONCEPT

Conceptual approach

The context and nature of the use of the building has led the project to favour a low-tech, highly durable and low maintenance approach to thermal comfort. The building should thus rely on natural systems to create coolness and warmth where needed.

Fig. 09-5a illustrates the selected building that will be investigated in this section. This building was chosen for its wide variety of function and volume that will illustrate clearly how the thermal comfort band could be reached (readings are often clearer in larger volume spaces than in smaller areas that are more sensitive to internal gains). Using Autodesk Ecotect Analysis and Autodesk Flow Design software, the author aims to determine whether the space could produce ambient air temperatures between 18 and 26 degrees (lower range in winter and higher range in summer) to the user for their thermal comfort.

Design population and usage

The selected space consists of a D3 occupancy (low-risk industry), according to SANS 10400-A:2010. The design population for this kind of occupancy is one person per 15sqm according to SANS 10400-A Table 2.

The total floor area for this section is 479sqm (of the total GLA 2 224sqm), leading to a design population of 32 people.

From a study of the current context, it can be assumed that the workshop will be used from 07:00 to 17:00 on workdays during the week, and from 17:00 to 20:00 for after-hours training, and on the weekends from 09:00 to 13:00.

Base materials and assembly

Intuitively, massive materials create the northern façade (shaded during the overheated period) and insulation panels make up the southern facade. Windows and doors opening to the exterior comprise of aluminium frames and single glazing. The roof is insulated to reach the minimum requirements as stipulated by SANS 204:2011 Table 10. Floors consist of concrete slabs on the ground with various finishes determined by function. Cross ventilation opportunities exist as users open and close windows for individual environmental comfort control.

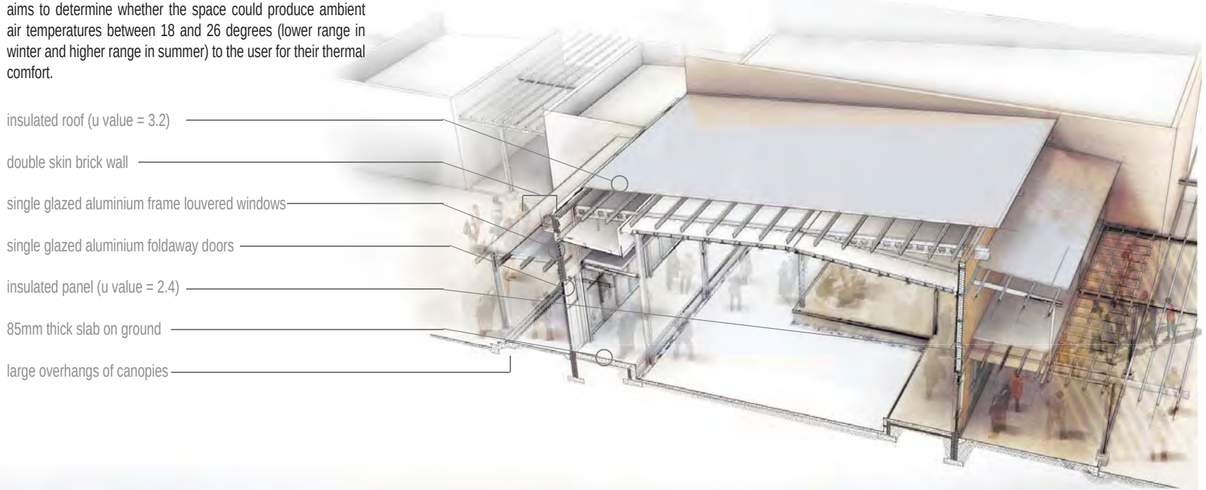
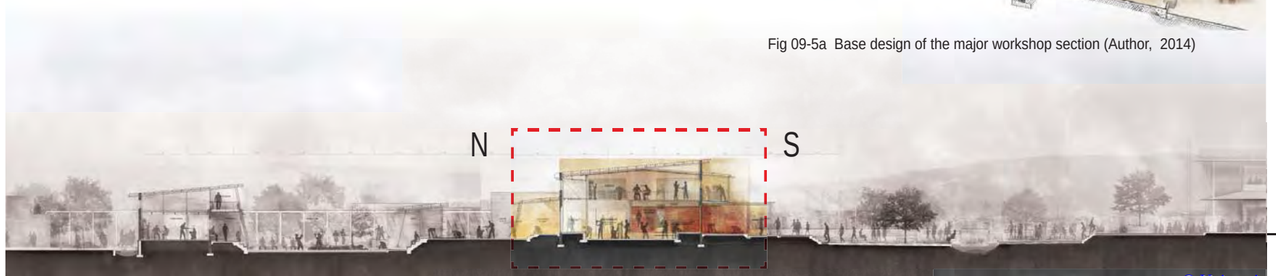


Fig 09-5a Base design of the major workshop section (Author, 2014)



Activity and equipment zoning

Within this space various activities are performed in specific places (Fig. 09-5b):
1. Administration, circulation and collection: Here activity varies but can be classified as low; population = 153sqm/ 5 people.
2. Detail work: people are mostly stationary and located at high natural light levels; little equipment is used, mostly hand tools and some electrical drills; population = 100sqm/ 12 people (rational design).
3. Major work: people are performing rigorous exercise and are located where light levels are lower but adequate; power tools such as drills and saws are used (welding etc. occurs outside); population = 226sqm/ 15 people.

Base analysis results

The building's users experience temperatures within the comfort range (18-26 degrees Celsius) for 82.6% of the year (Fig. 09-5c). This high comfort level is probably driven by the large overhangs as well as the availability of natural cross ventilation. Various activity (design driven) and material (technical driven) changes could be made to increase this to the ideal of 85-95% of the year.

Major problem areas (Fig. 09-5d)

Ventilation losses need to be limited without compromising the air exchange rate. Conduction needs to be limited by insulating properly and minimising glazed surfaces.

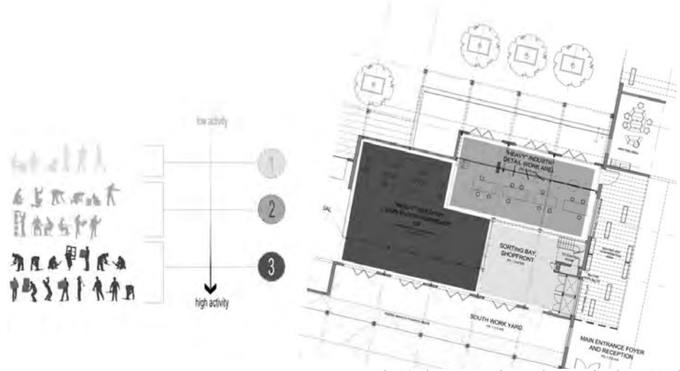


Fig 09-5b Base zoning and usage (Author, 2014)

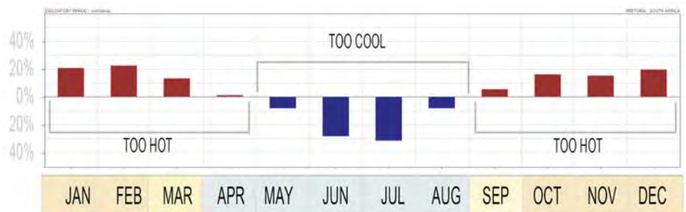


Fig 09-5bc Base analysis discomfort percentage (Author, 2014)

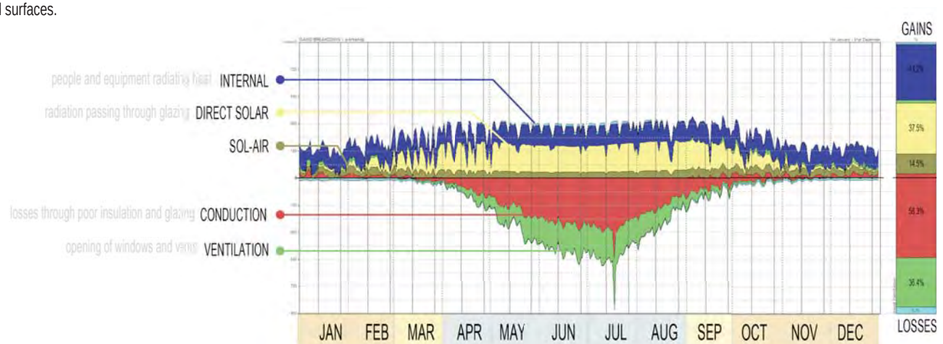


Fig 09-5d Base analysis gains and losses (Author, 2014)

Successful areas

Direct solar gains occur mostly during the underheated period. Indirect solar gains are concentrated during the cooler months but do occur during some warmer months (Fig. 09-5e).

Room for improvement

The thermal mass absorbing the heat within the building requires a longer lag period (Fig. 09-5f) in order to re-radiate heat during the night that can possibly be removed by night purging (summer) or serve as a pre-heating mechanism (winter).
Glazed surfaces need to be limited and/or more insulation is required for roofs. Air that is too warm or too cool entering the building must be limited.

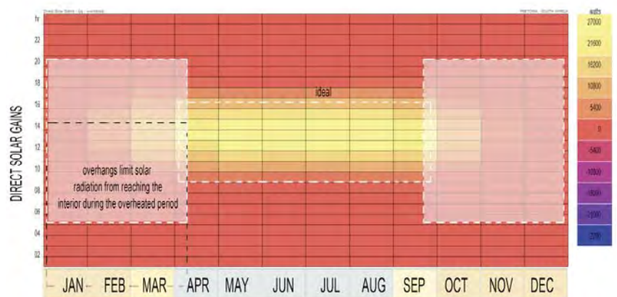


Fig 09-5e Base analysis direct gains (Author, 2014)

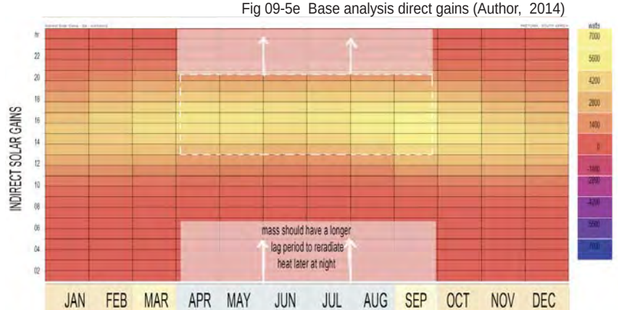


Fig 09-5f Base analysis indirect gains (Author, 2014)

The main drivers

Two drivers aid in the heating of space. The first is internal gains which can be manipulated by organising people and machinery correctly in order to moderate temperature differences within the space. This could be manipulated later as a last resort. The second is solar radiation, which drives the production of heat. It is transferred to the interior through conduction, radiation and convection. In order to understand these principles more clearly, the direct source's effect must be studied for both the overheated (Fig. 09-5g) and underheated (Fig. 09-5h) periods.

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Fig 09-5g solar study and insolation study for over heated period (Author, 2014)

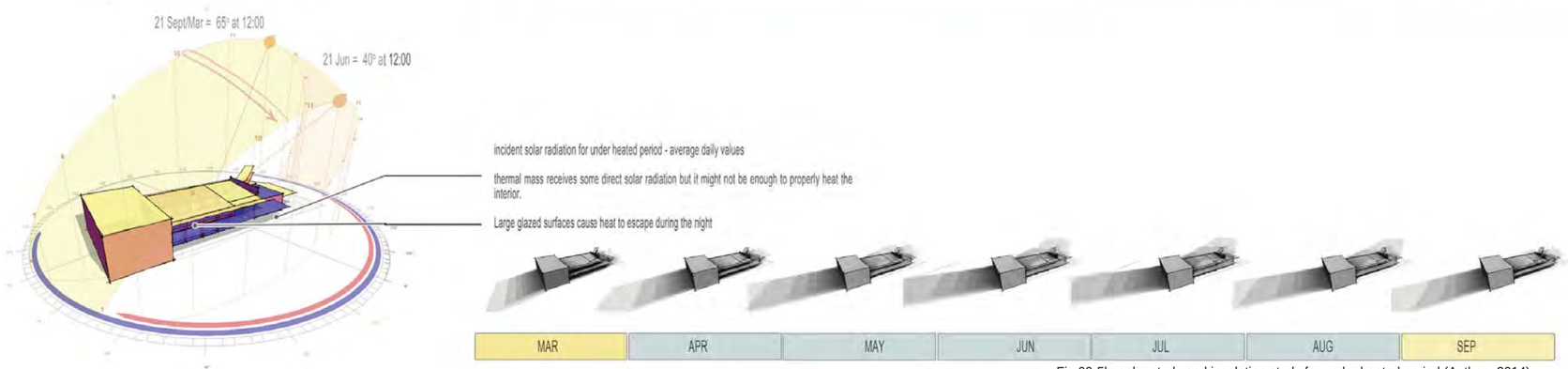
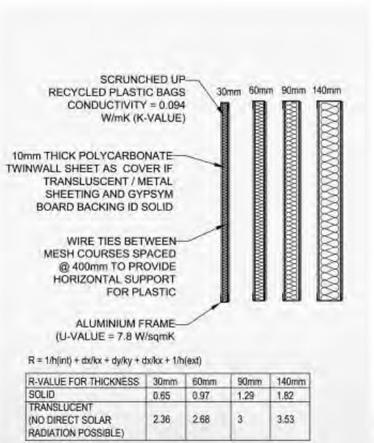


Fig 09-5h solar study and insolation study for under heated period (Author, 2014)

Material properties

Activities within the building and building behaviour play a large role in the thermal behaviour of spaces, but the largest factor that determines thermal comfort is the material's ability to conduct, absorb and transmit heat through the envelope. Fig. 09-5i to 09-5m illustrate the ways in which materials or assemblies of materials could possibly be improved.



R-VALUE FOR THICKNESS	30mm	60mm	90mm	140mm
SOLID	0.65	0.97	1.29	1.82
TRANSLUCENT (NO DIRECT SOLAR RADIATION POSSIBLE)	2.36	2.68	3	3.53

Fig 09-5i opportunities for insulation panels (Author, 2014)

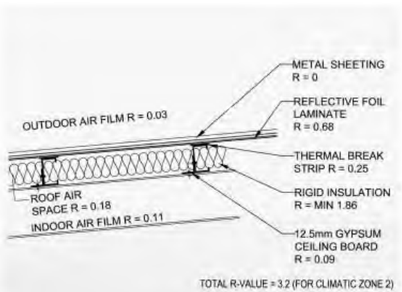


Fig 09-5j opportunities for roof insulation (Author, 2014)

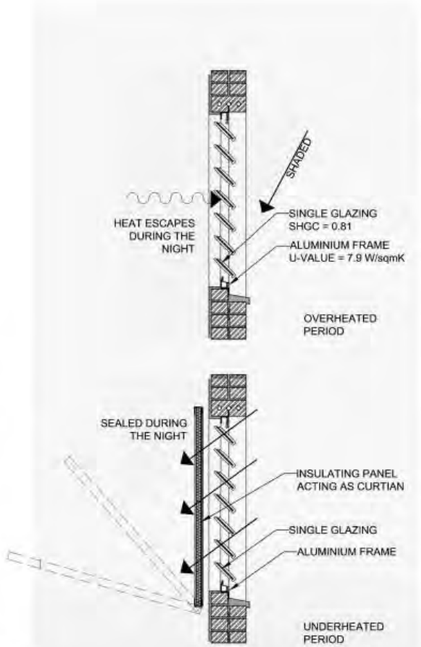


Fig 09-5k opportunities for glazed elements (Author, 2014)

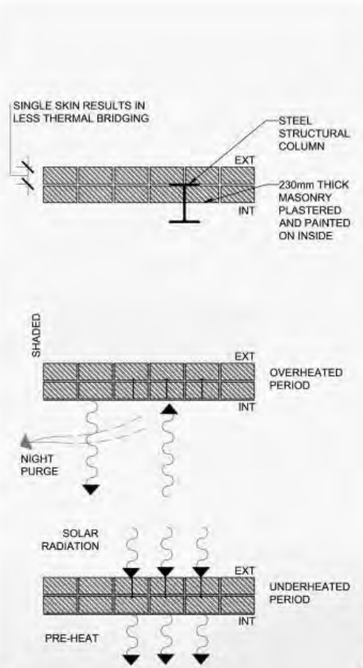


Fig 09-5l opportunities for wall and columns (Author, 2014)

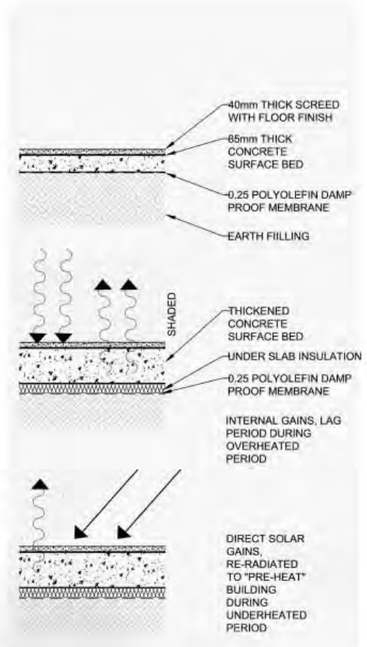
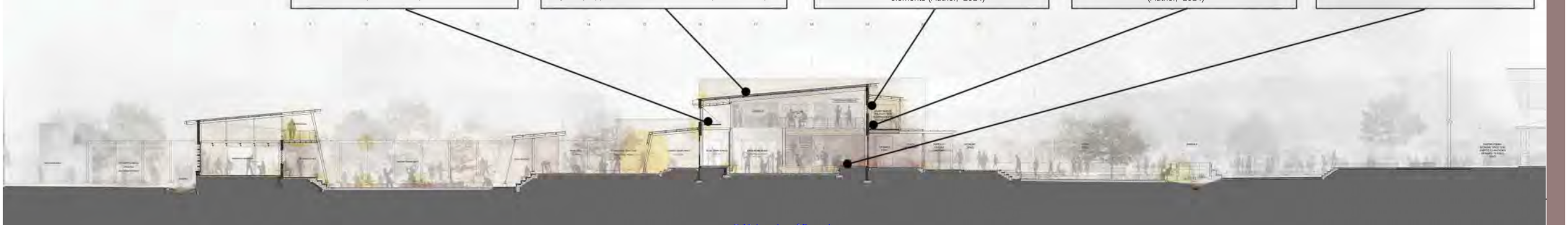


Fig 09-5m opportunities for floors (Author, 2014)



OVERHEATED PERIOD

The psychrometric chart (Fig. 09-5n) suggests that natural ventilation could increase thermal comfort, to an extent. The largest influence on the comfort period is adding exposed thermal mass and night purge ventilation.

Strategy for cooling

The methodology consists of making sure that exposed elements like the thermal mass are properly shaded and the roof is properly insulated. Night purging is also investigated. A natural ventilation strategy will be evolved to make sure that warm air does not enter the building unnecessarily.
These strategies are investigated as a buildup method.

Shading

Using the Ecotect Shading design wizard, the shading devices are optimised to block solar radiation from reaching fragile elements like glazed surfaces (Fig. 09-5o).Thermal mass is shaded during the overheated period in order to optimise absorption potential for internal gains.

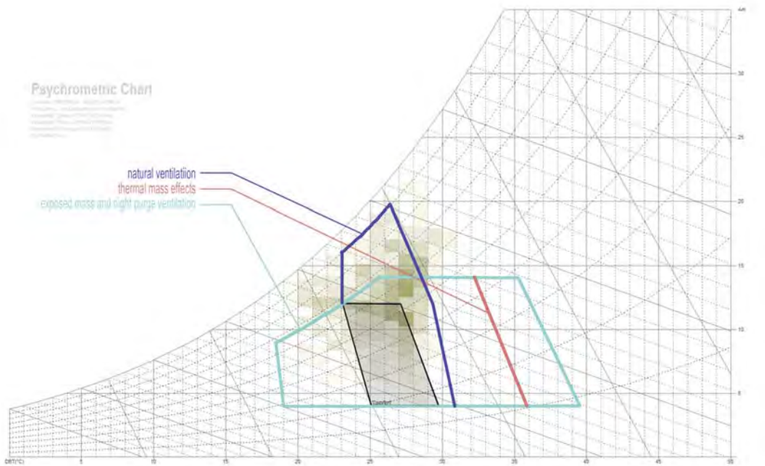


Fig 09-5n psychrometric chart showing opportunities for cooling (Author, 2014)

shading coefficients:

Month	Avg.SC	Max.SC	Min.SC
January	89.5%	100.0%	73.0%
February	73.6%	100.0%	26.0%
March	59.2%	100.0%	0.0%
April	50.0%	87.0%	0.0%
May	39.5%	70.0%	0.0%
June	35.1%	57.0%	0.0%
July	40.7%	72.0%	0.0%
August	59.1%	100.0%	0.0%
September	61.2%	100.0%	0.0%
October	80.6%	100.0%	48.0%
November	90.8%	100.0%	73.0%
December	93.8%	100.0%	83.0%
Summer	**85.6%**	**100.0%**	**60.7%**
Winter	**38.4%**	**66.3%**	**0.0%**
Annual	**64.4%**	**90.5%**	**25.2%**

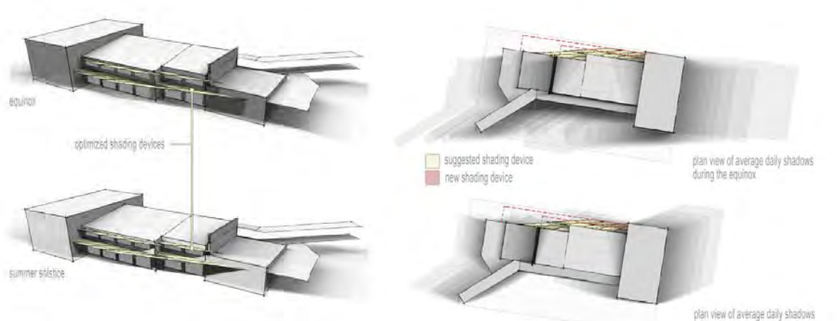


Fig 09-5o shading coefficients and adjustments (Author, 2014)

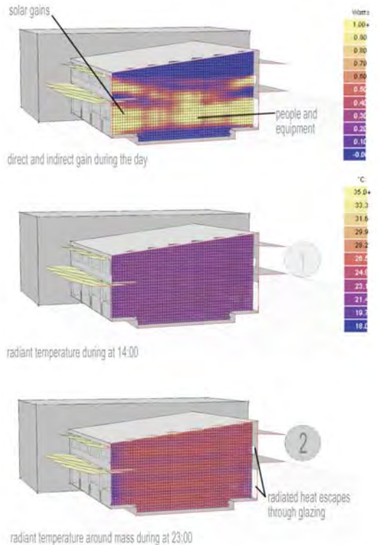


Fig 09-5p radiant temperatures during different times of the day (Author, 2014)

Thermal mass

Thermal mass is advantageous for cooling a building by absorbing the heat generated by equipment and people during the active period. It is then re-radiated during non-active periods.

Mass is exposed to the interior spaces; insulating coverings like carpets etc. are removed to expose a layer of plaster and paint and a cement floor that is ready to absorb the internal heat. The slab on the ground is thickened and the south wall panels are replaced with brickwork. The thermal lag is increased and a shift occurs as heat is re-radiated during the night (Fig. 09-5q). Now that the southern wall is made up of a massive element and not the insulating panels produced by the building, other methods of showcasing the building's product need to be explored (see section 6, pp. 252).

Heat is absorbed by the mass but also removed by human agency (opening a window etc.). Heat is re-radiated into the space but escapes via conduction through the glazed elements (thus the temperature profile shows a lower temperature).

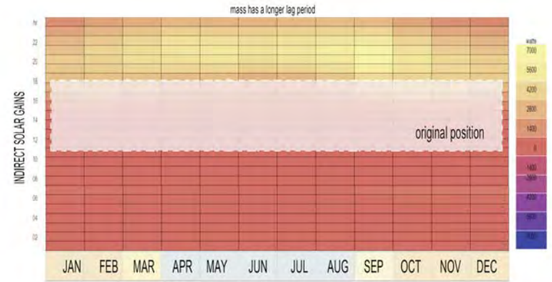


Fig 09-5q the effect of adding thermal mass to the indirect gains graph (Author, 2014)

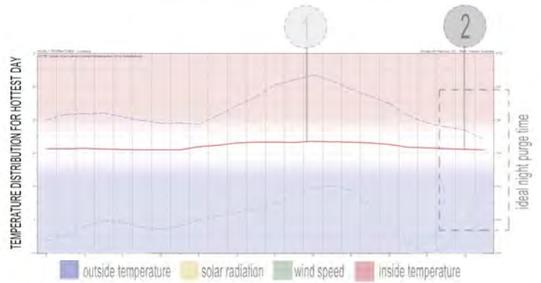


Fig 09-5r 24h temperature profile of the average hottest day (Author, 2014)

Fig 09-5s Massing the building (Author, 2014)

Refining the ventilation strategy

Two forces are at work when removing heat from a building. The first is that of a heat difference. Hot air rises and needs to escape from the building's highest point as quickly as possible. Second, prevailing winds could drive this and aid in the removal of hot air.

The base computed fluid dynamics (CFD) analysis, performed with Autodesk Flow Design software, has shown that the positions of the inlets are problematic (Fig. 09-5t). Prevailing winds are working against the internal system where hot air rises and needs to be removed. Hot air rises and is pushed back into the building, and suction created by the shape of the roof is not taken advantage of.

After some iterations (Fig. 09-5u) were performed to try and understand pressure zones and ideal mixing and removal of air, it was determined that the roof angle was correct but the inlets where positioned inversely. The ceiling is prohibiting the air flow from effectively removing hot air. It was determined that a mono pitch with an equally pitched ceiling would aid in the ventilation strategy.

The optimised model (Fig. 09-5v) shows that low pressure points (suction) on the south façade are taken advantage of. Cool air enters an inlet that is placed at a low angle, adequate mixing occurs and hot air exits at a high angle as it is aided by the prevailing wind direction. Zoning now becomes important as activities with little heat production qualities are placed to the north (likely to heat up more) and activities with high heat production properties are placed to the south to moderate the internal temperatures. Very low activity is placed at high points, since static people do not feel discomfort due to overheating as quickly as people doing rigorous exercise (hot air rises).

Fig 09-5t the base analysis of air movement (Author, 2014)

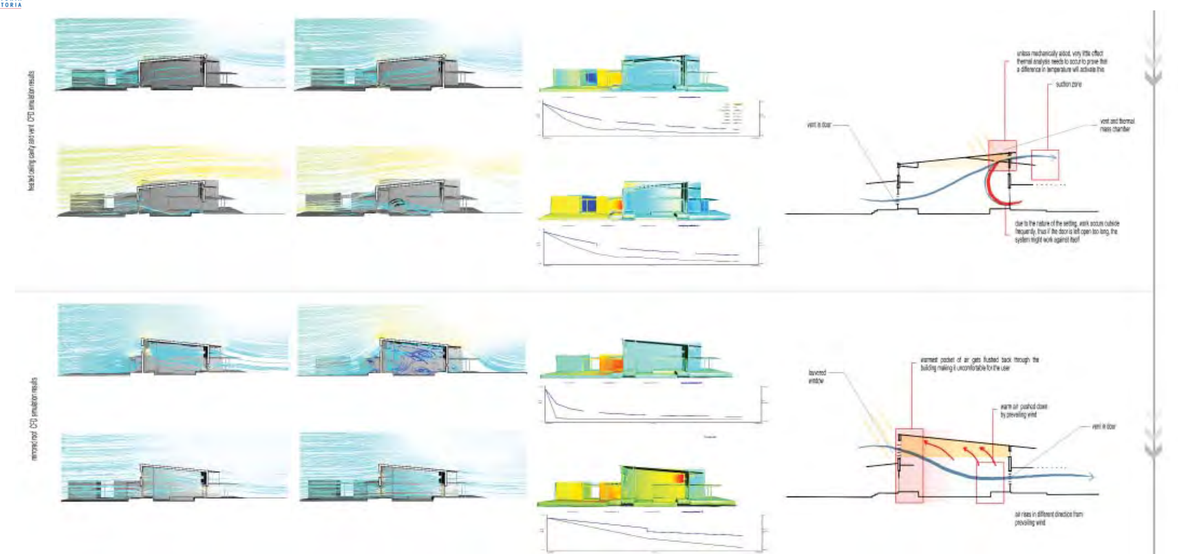


Fig 09-5u iterations to understand pressure zones and mixing (Author, 2014)

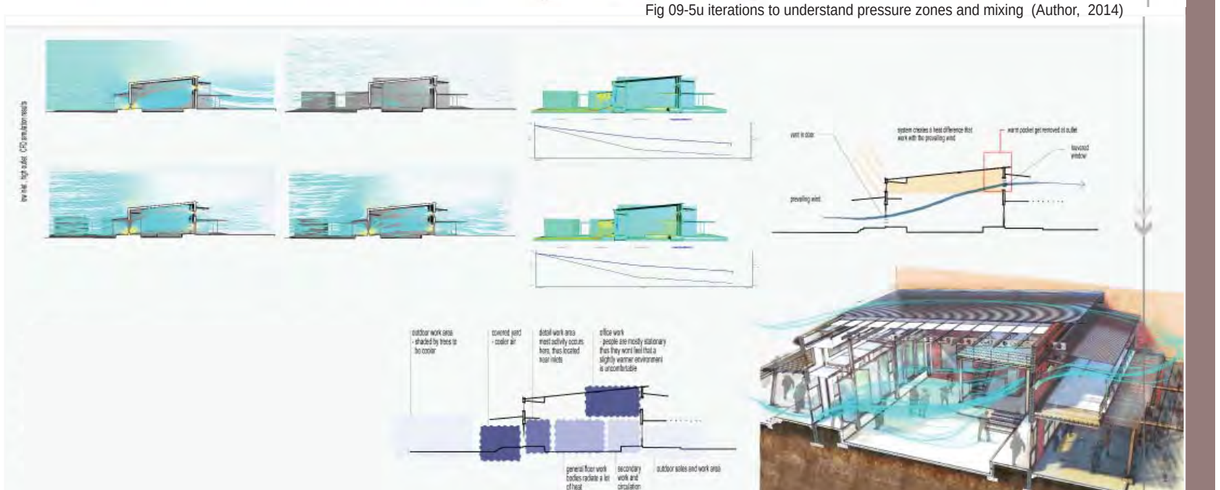


Fig 09-5v refined air flow and zoning (Author, 2014)

Night purge ventilation

During the night in the warmer months, air temperatures drop. By flushing the building with cool air at this time, the re-radiated heat from the thermal mass is removed and the building is "pre-cooled" for use during the day (Fig. 09-5w). Ventilation losses during the hotter months increase and less discomfort is felt by the occupants (Fig. 09-5x and Fig. 09-5y).

Resulting building behaviour (Fig. 09-5z)

A well-insulated roof, together with large overhangs (to shade mass and glazed elements), limits direct solar gains. The mass absorbs heat from the internal sources (people and equipment) during the day. At night the heat difference, as well as the prevailing winds, remove the re-radiated heat in order to pre-cool the building for the next day.

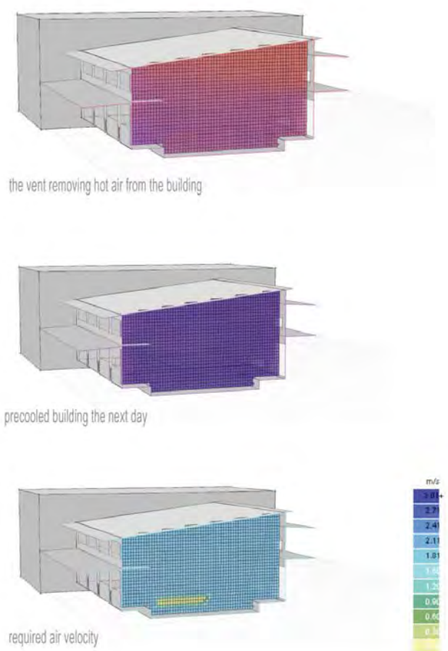


Fig 09-5w radiant temperatures during and after night purging (Author, 2014)

Fig 09-5x resulting thermal discomfort bands for the over heated period (Author, 2014)

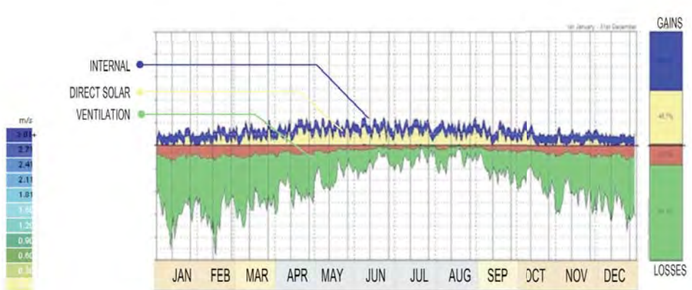
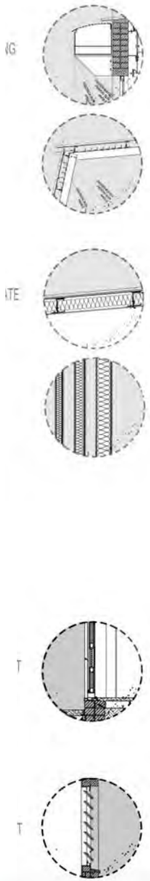


Fig 09-5y the increased ventilation losses due to nigh ventilation (Author, 2014)



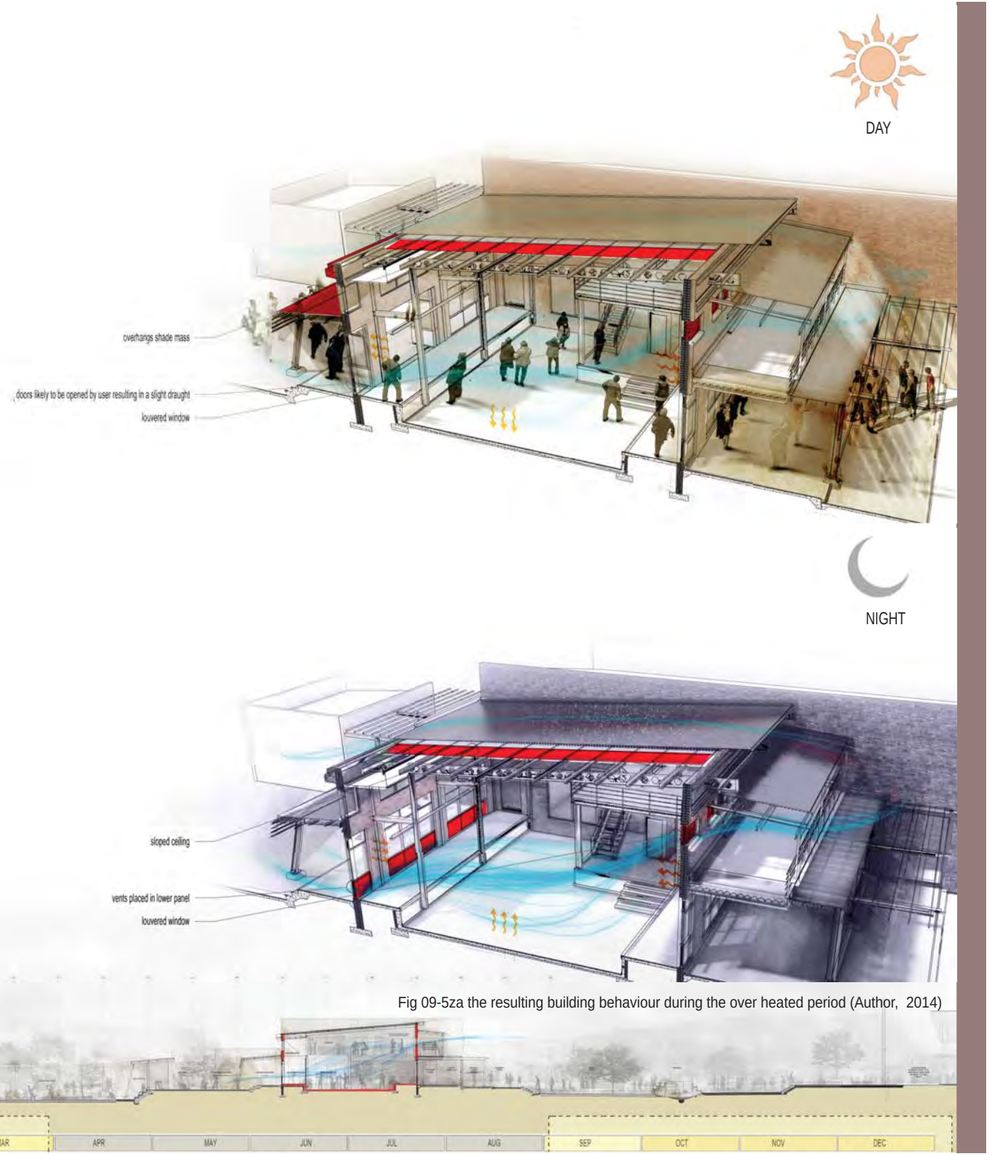
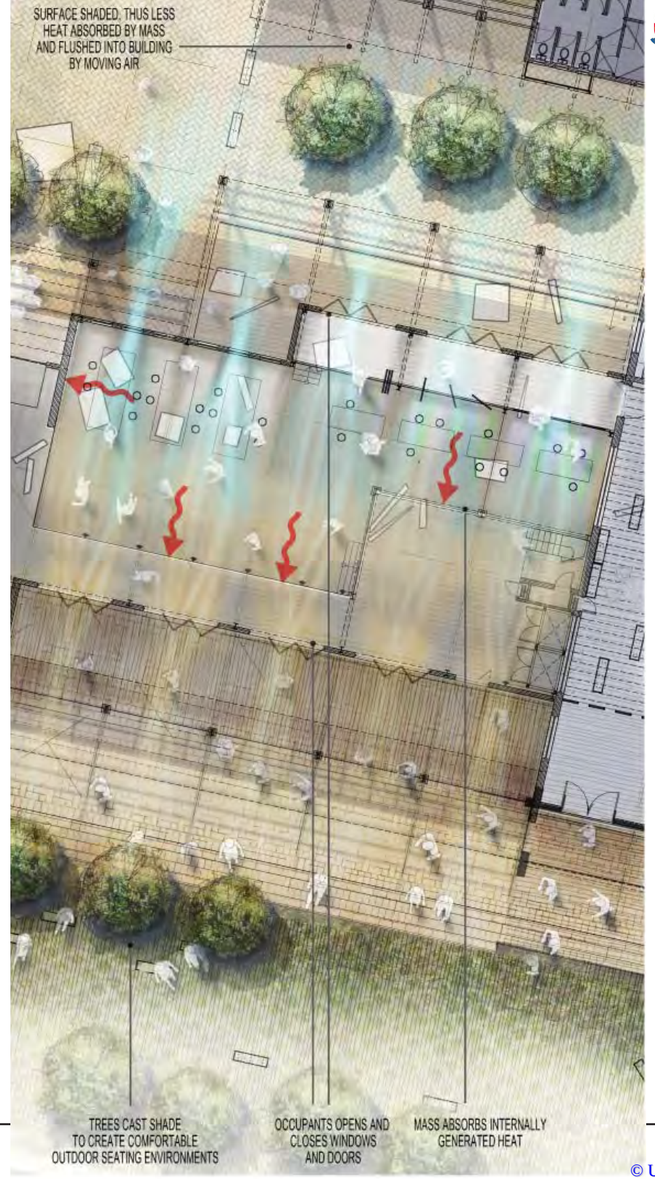


Fig 09-5za the resulting building behaviour during the over heated period (Author, 2014)



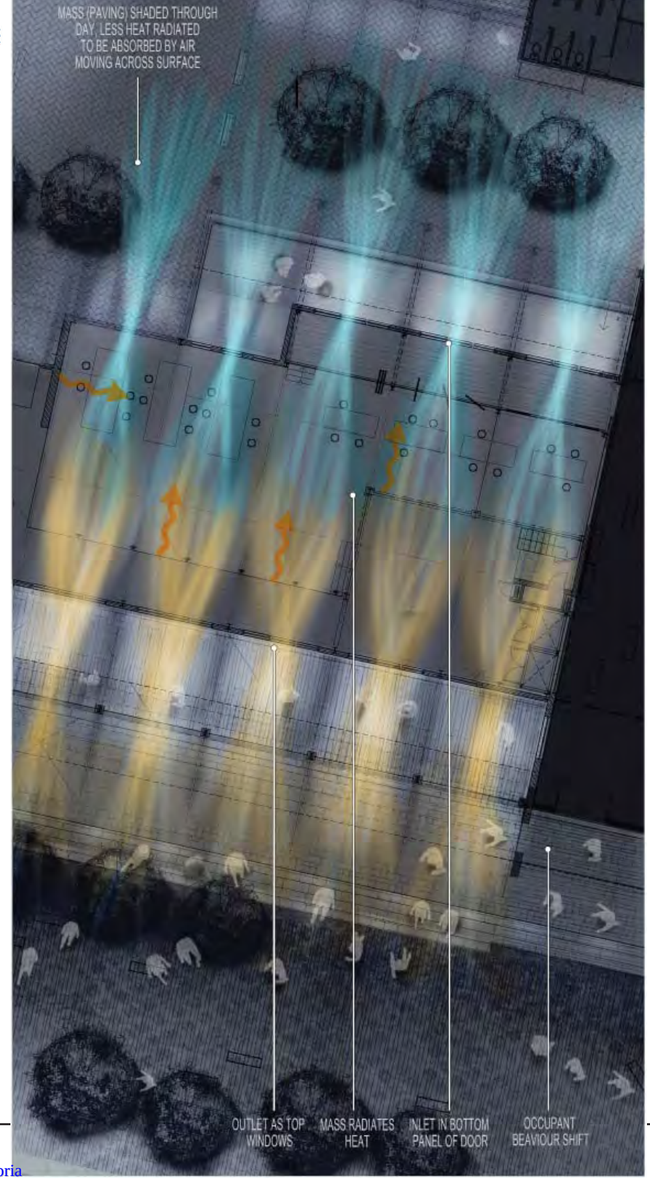


Fig 09-5zb the resulting building behaviour on plan during the over heated period (Author, 2014)

UNDERHEATED PERIOD

From the chart (Fig. 09-5aa), it is clear that the interior temperatures experienced by the user should fall within the comfort band by adapting the thermal mass and allowing for direct solar radiation to reach the interior during the cooler months.

Strategy for heating

Thermal comfort could be achieved by using more thermal mass that could "pre-heat" the building for use the next morning. Thermal mass requires exposure to direct solar radiation as well as internal heat sources (people and equipment radiating heat) during the day. Glazed elements might need to be reduced in order to create a tighter seal to prevent heat escaping during the night.

It is important to note that internal gains still play a role and the people working in these spaces are likely to wear warmer clothes to compensate for the cold, thus the comfort band required moves to the lower end of the 18-26 degree Celsius scale. People exercising do not feel cold as quickly as people who are stationary.

Solar exposure (Fig. 09-5bb)

During the cooler months, solar radiation needs to reach the interior through glazed surfaces, thus overhangs cannot be too large. Thermal mass needs to be exposed in order to absorb solar radiation and re-radiate it to the interior.

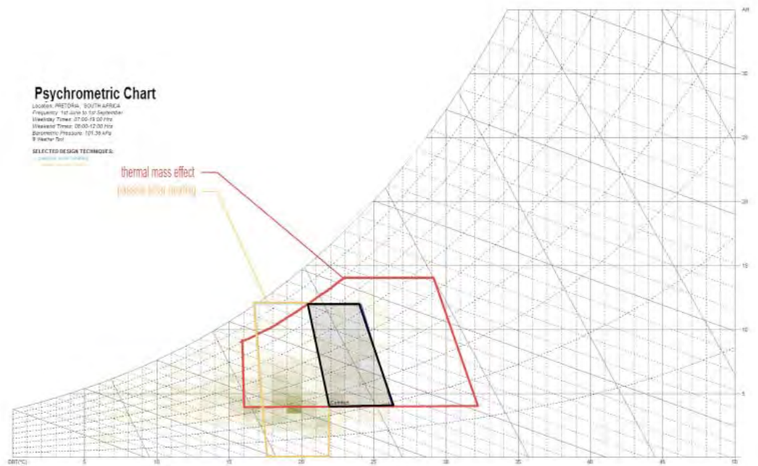


Fig 09-5aa psychrometric chart showing opportunities for heating (Author, 2014)

Solar access:

Month	Avg.SC	Max.SC	Min.SC
January	89.5%	100.0%	73.0%
February	73.6%	100.0%	26.0%
March	59.2%	100.0%	0.0%
April	50.0%	87.0%	0.0%
May	39.5%	70.0%	0.0%
June	35.1%	57.0%	0.0%
July	40.7%	72.0%	0.0%
August	59.1%	100.0%	0.0%
September	81.2%	100.0%	0.0%
October	80.6%	100.0%	48.0%
November	90.9%	100.0%	73.0%
December	93.8%	100.0%	83.0%
Summer	85.6%	100.0%	60.7%
Winter	38.4%	66.3%	0.0%
Annual	64.4%	90.5%	25.2%

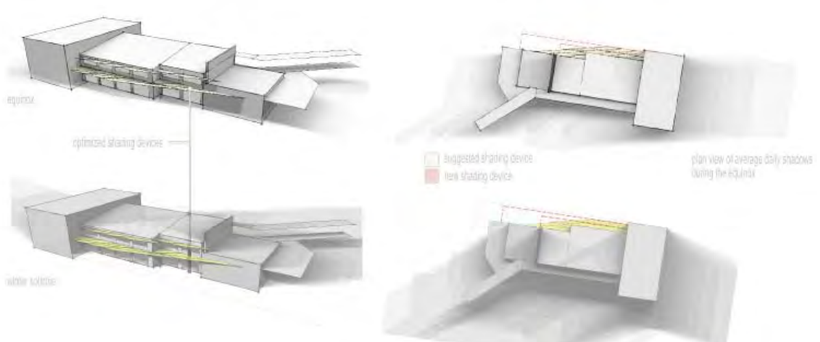
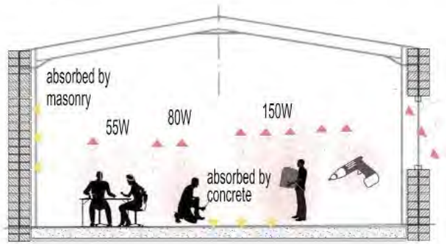


Fig 09-5bb solar exposure coefficients and adjustments (Author, 2014)

Insulate

Heat is being lost and gained through elements such as the roof and glazed surfaces. The roof is properly insulated to prevent heat escaping. Due to the need for large openings to move material in and out the building, heat is being lost through conduction (glazed elements etc.). This can be solved by replacing some of the glazed surfaces with insulating panels.

Large glazed surfaces are needed to reflect light into the building and for direct solar radiation. During the night this becomes problematic as heat escapes just as quickly as it entered. By creating an industrial "curtain" system, some of the glazed openings can be partially sealed off to prevent these losses (Fig. 09-5cc).



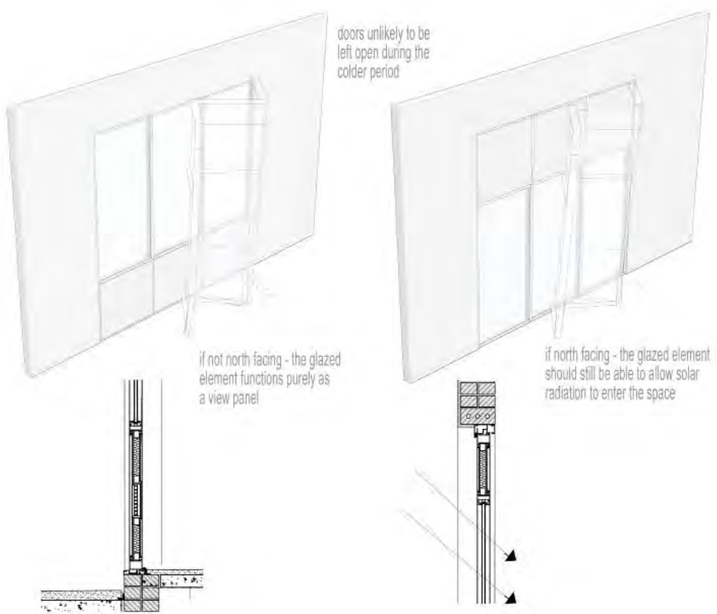


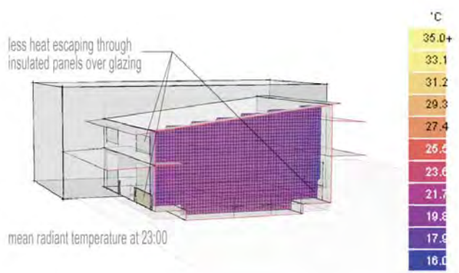
Fig 09-5cc opportunities for reducing the heat loss (Author, 2014)

Thermal mass as heating mechanism

Thermal mass is exposed to direct solar radiation as well as the internal gains. During the cooler months, the envelope is sealed and less heat is allowed to escape into the much cooler night air. This results in heat radiating to the interior spaces to pre-heat the building (Fig. 09-5dd) during the night, due to the increased thermal lag of the exposed mass (Fig. 09-5ee). The effect could clearly be seen when studying the average coldest day temperature profile (Fig. 09-5ff). The discomfort period experienced by the user is significantly decreased due to this pre-heating, combined with insulation (Fig. 09-5gg).

Building behaviour during the under heated period (Fig. 09-5ii)

During the day the mass absorbs direct solar radiation and receives internal gains (people and equipment). During the night re-radiation occurs from the thermal mass and some glazed surfaces are sealed by an operable panel acting as a curtain. The next morning, when work commences, the building feels warmer.



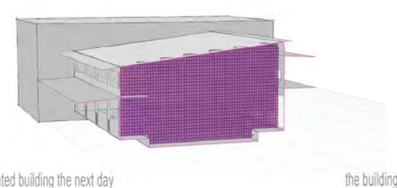


Fig 09-5dd re-radiating thermal mass (Author, 2014)

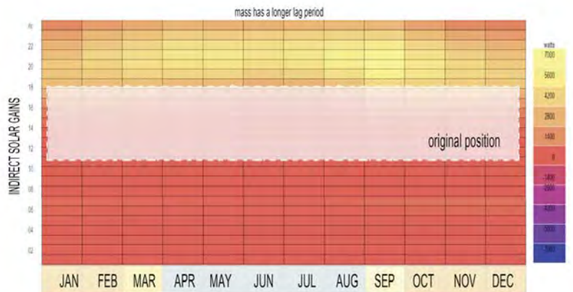


Fig 09-5ee thermal mass lag period improved (Author, 2014)

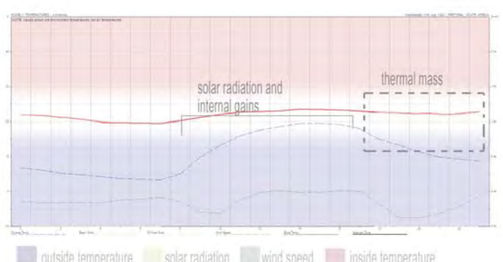


Fig 09-5ff the effect on the average coldest day temperatures (Author, 2014)

Fig 09-5gg the reduced thermal discomfort period during the cooler months (Author, 2014)

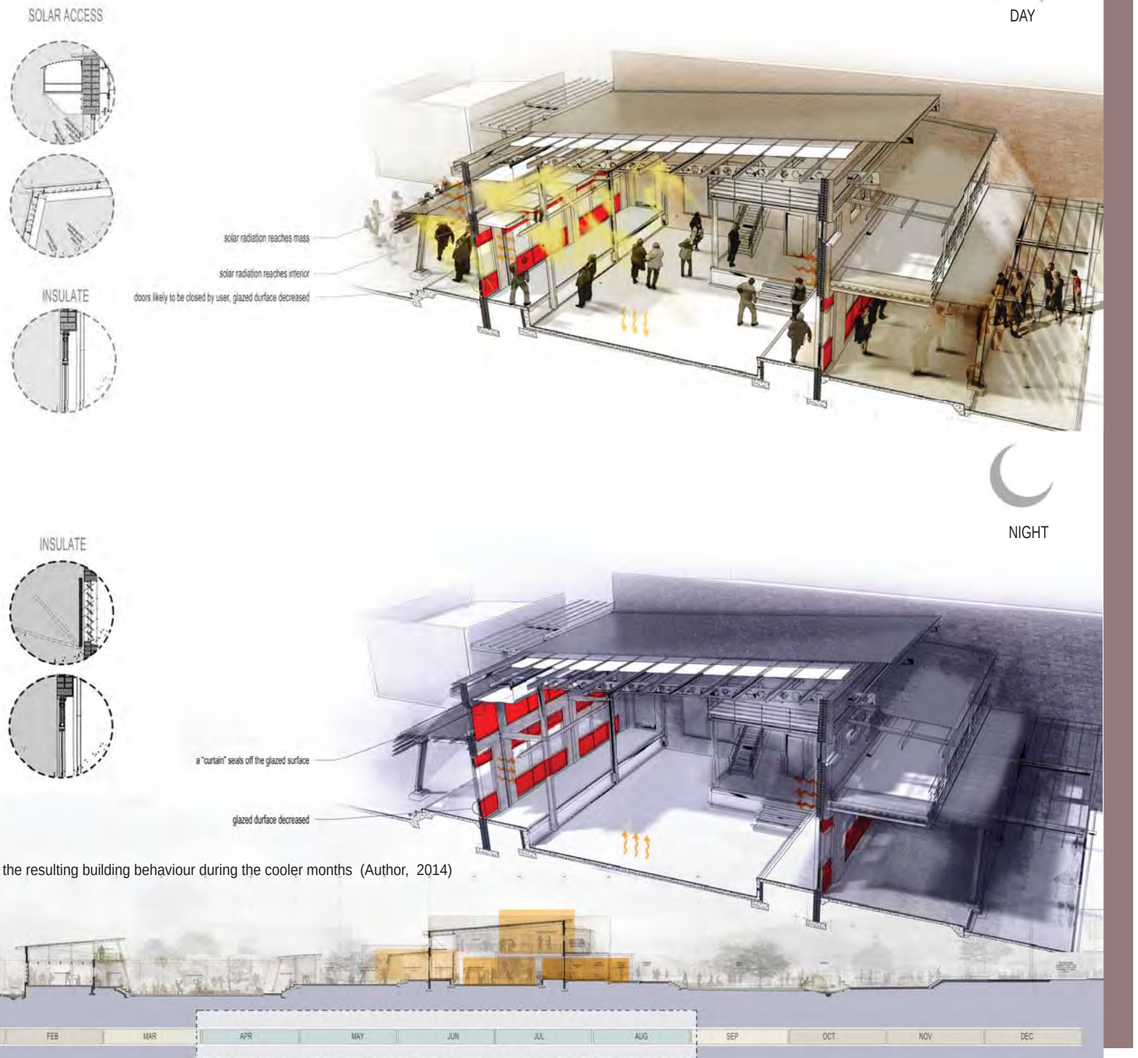


Fig 09-5ii the resulting building behaviour during the cooler months (Author, 2014)

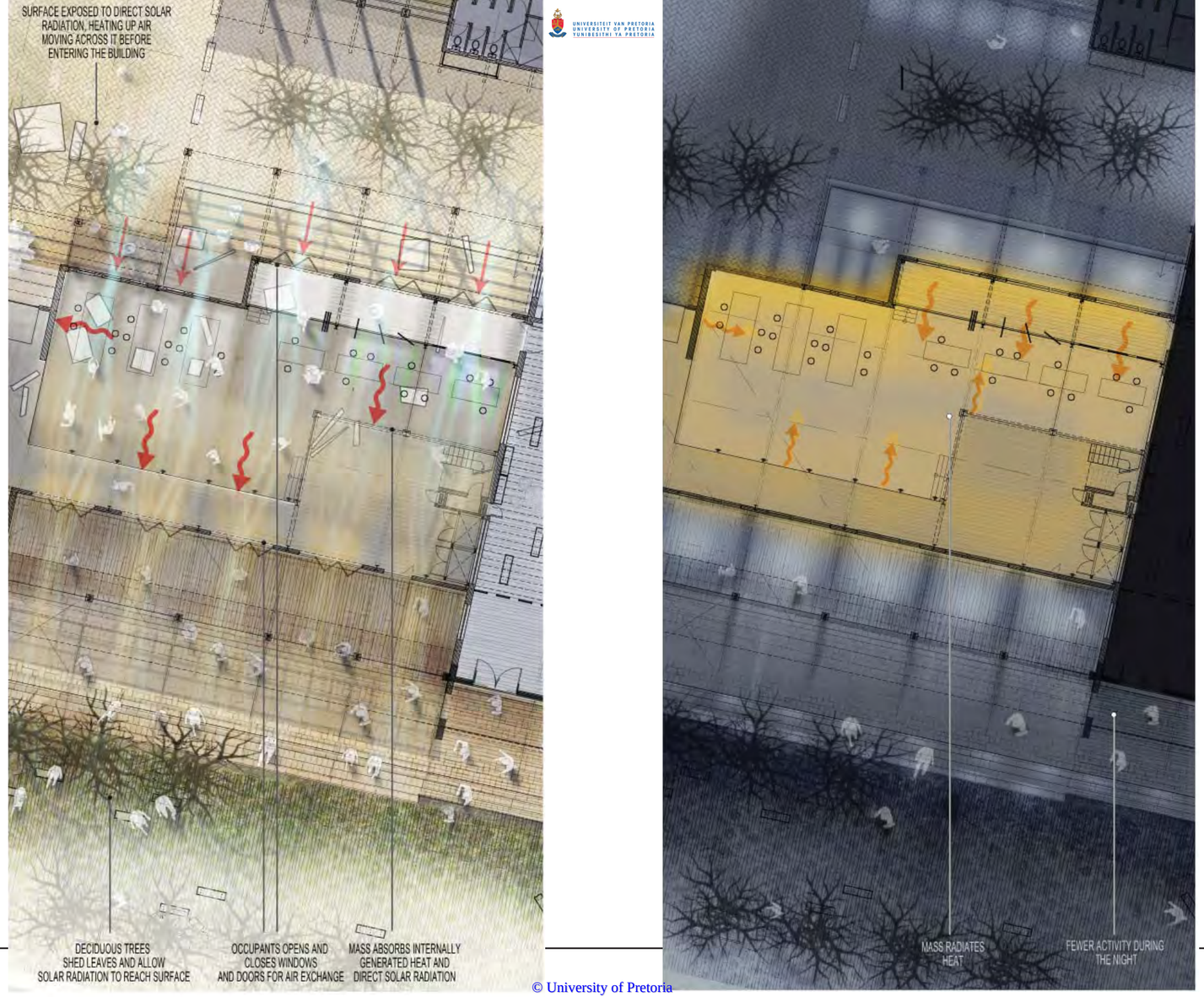


Fig 09-5ii the resulting building behaviour on plan during the cooler months (Author, 2014)

06 LIGHTING CONCEPT

Strategy and zoning (Fig. 09-6a)

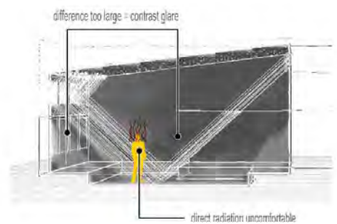
The aim is to rely on as much natural light as possible to achieve the required internal lux levels. Artificial lighting will be combined with natural lighting where the levels cannot be reached. A change to the building envelope will result in over- or underheating occurring, thus changes must bear in mind this effect. The thermal analysis stream has placed certain functions in certain places within the building. The lighting analysis stream needs to determine if this placement is successful for adequate day lighting and, if not, an alternative or addition is needed.

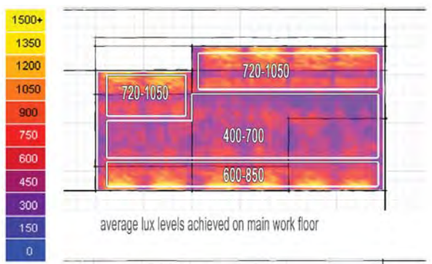
1. Detail work: finishes and detailing occurs here (900 - 1000 lux)
2. Main material work: little detail but handling of product (500 - 750 lux)
3. Receiving of goods and circulation: basic admin and walkways (150 -250 lux)

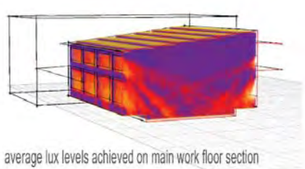
Base analysis (Fig. 09-6b)

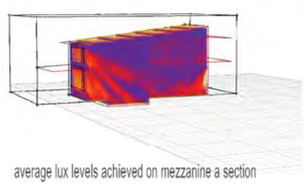
The natural lighting levels are calculated with Ecotect building analysis software. Here, the sky factor is 8 500 Lux (typical overcast sky) and the window cleanliness is an average 0.9.

The base analysis has shown that on an overcast day throughout the year adequate lighting will be achieved. The problem comes in where the contrast between spaces is too high, causing discomfort for the user. Direct radiation reaching a user is perfect for lighting (might be too bright), but it is uncomfortable even in the winter to be constantly in the sun.









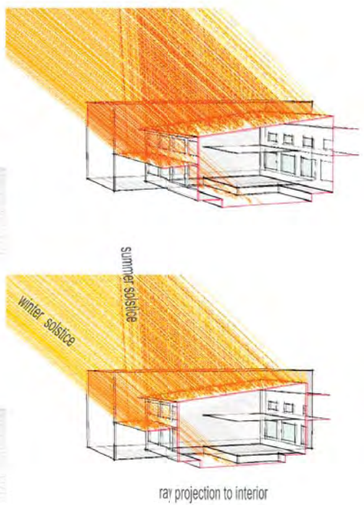


Fig 09-6b natural lighting base analysis (Author, 2014)

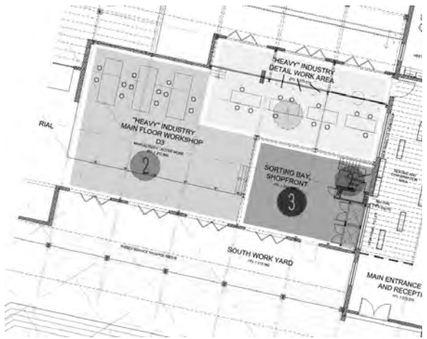
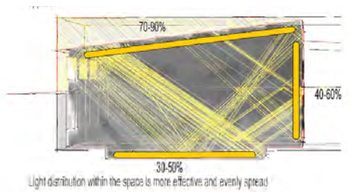
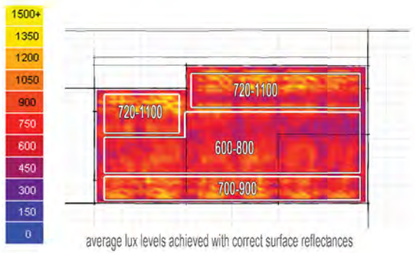


Fig 09-6a lighting and use zoning (Author, 2014)

Internal colours and reflectances

The first exploration into trying to create an optically comfortable space is to study the surface properties of materials as they reflect and diffuse light. Reflectances were increased, but not so much as to cause indirect glare. The ideal (or rule of thumb) was applied (Fig. 09-6c) to improve the light distribution within the space.





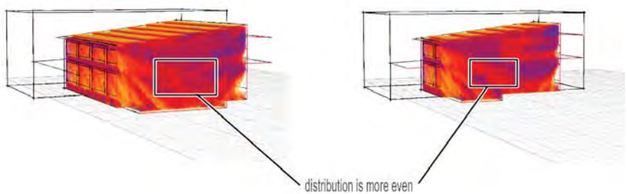
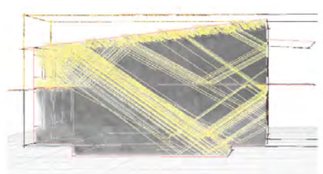
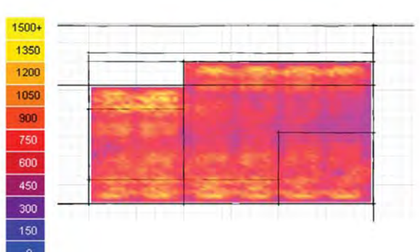


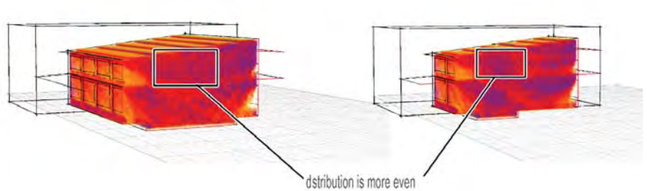
Fig 09-6c adjusting the internal colours and reflectances (Author, 2014)

Light distribution

It is uncomfortable to the user to be exposed to direct radiation (even in winter) for lighting purposes, for long periods of time, thus reflected light makes more sense. A light shelf (Fig. 09-6d) distributes light deeper into the space, creating an evenly distributed natural lighting system and more comfortable levels of light to perform activities in.







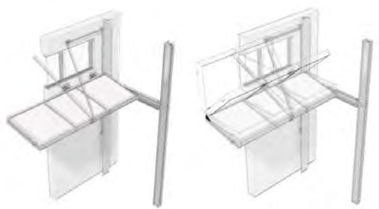


Fig 09-6d the effects of a reflective light shelf (Author, 2014)

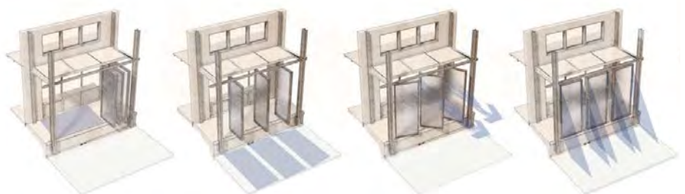
The optical use of plastic

Since the use of the building's main product (a modular insulating panel building system) is reduced (from the thermal analysis), other methods of showcasing the product are explored, relating to the light-diffusing possibilities of low-density polyethyline (LDPE).

The production of one kilogram of LDPE requires the equivalent of two kilograms of oil to produce (raw material and energy). Because LDPE is not biodegradable, it poses a pollution and environmental hazard. It can be recycled by melting, but this requires a lot of energy and there is a loss in quality. Why not upcycle, which requires little adjustment other than cleaning?

Plastic bags are made of LDPE that is 0.05mm thick, making them light diffusers because of their chemical composition. Assembling this in a panel could help the user control the natural light levels within the space the way a translucent curtain would dim and diffuse the light (Fig. 09-6e).

thickness of infill (mm)	30	50	90
amount of sheets	3	5	9
thickness of plastic	0.3	0.5	0.9
light transmittance %			
white 85	61	44	23
yellow 63	25	9	3
red 44	8	2	0
green 74	40	22	7
blue 73	39	20	5
orange 59	20	7	2



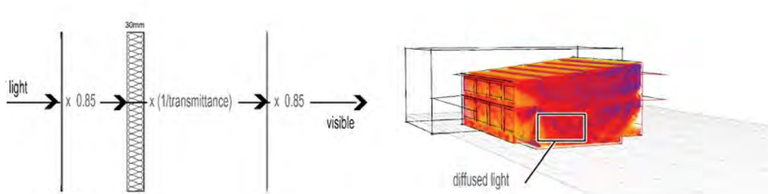


Fig 09-6e pattern making and individual control over light quality (Author, 2014)

Artificial lighting

Where day lighting levels drop below the comfortable lux level for the zone activities, during the worst case scenario of a completely overcast sky (thunderstorms, etc.), sets of artificial lights are introduced (Fig. 09-6f). Sets of lights are grouped according to the lighting requirements so as to not waste energy on dimming the light fixtures. Each set of lights serves a specific zone and is switched on individually to conserve energy. Once again, it is not about being off-grid, but rather minimising the demand on the municipal supply.

Zone A : 8 x 680 lumens LED lighting
Zone B : 4 x 490 lumens LED lighting
Zone C : 4 x 490 lumens LED lighting
Zone D : 4 x 490 lumens LED lighting

Emergency escape route lighting

Low angle lighting is combined with zone D to provide an illuminated floor surface for an escape route. These lights automatically switch on during an emergency situation to guide a user to the nearest exit to the public open space of safety. The lighting must remain on for a minimum of 60 minutes at 0.3 lux, according to SANS 10114 Part 2.

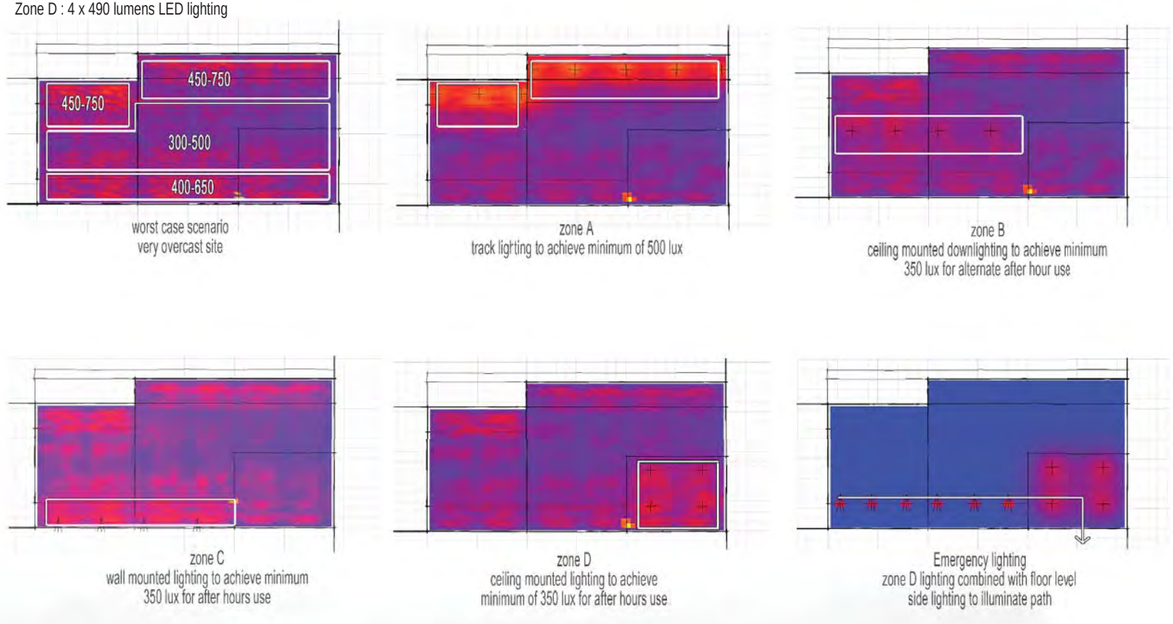


Fig 09-6f artificial lighting strategies and zones (Author, 2014)

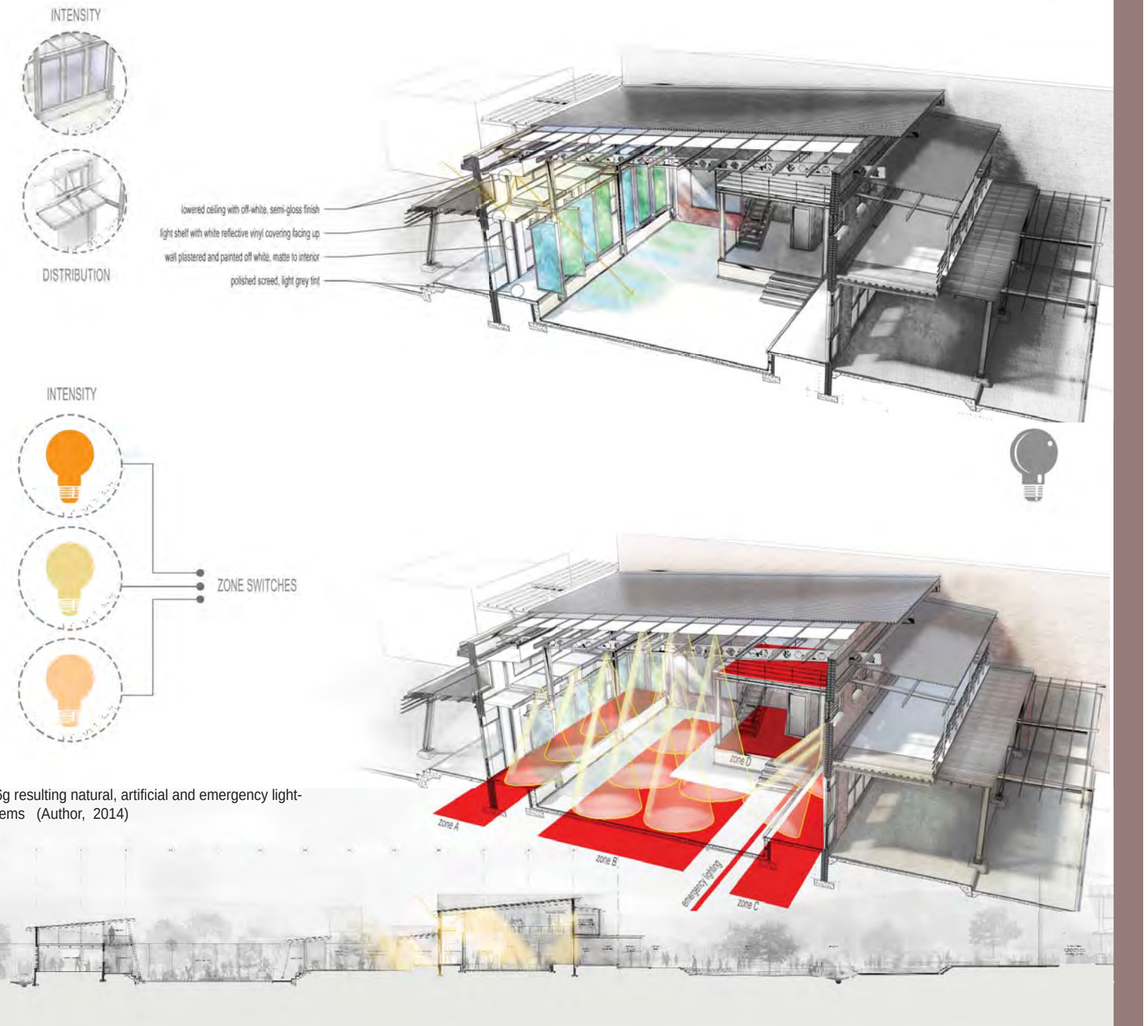
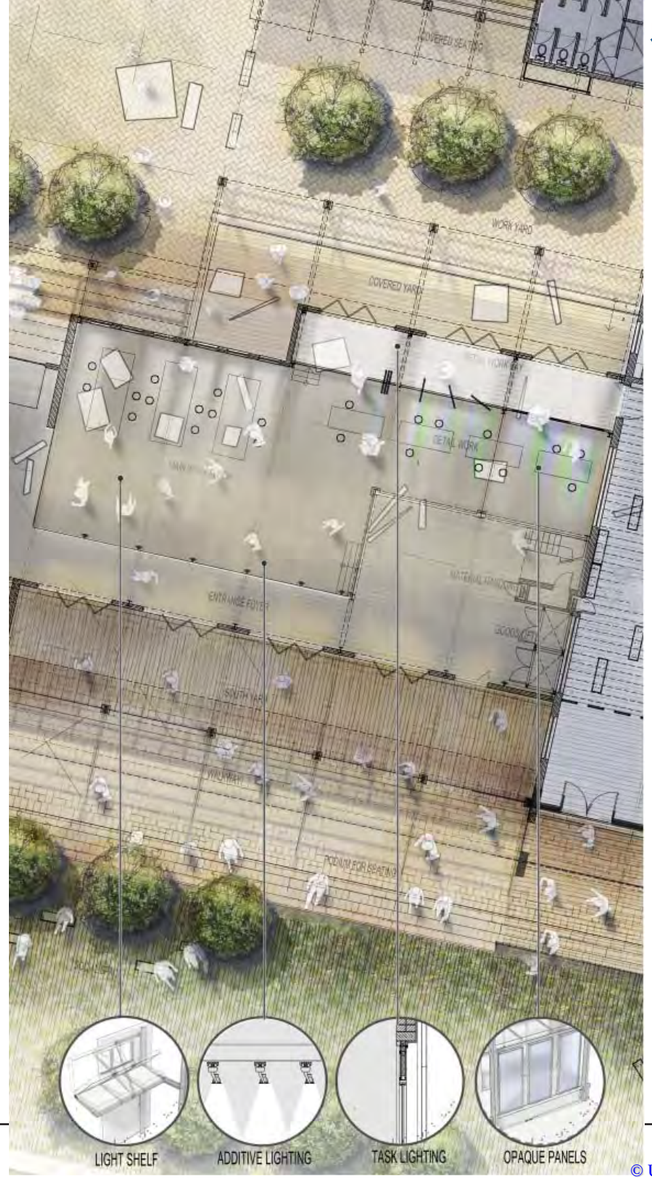


Fig 09-6g resulting natural, artificial and emergency lighting systems (Author, 2014)



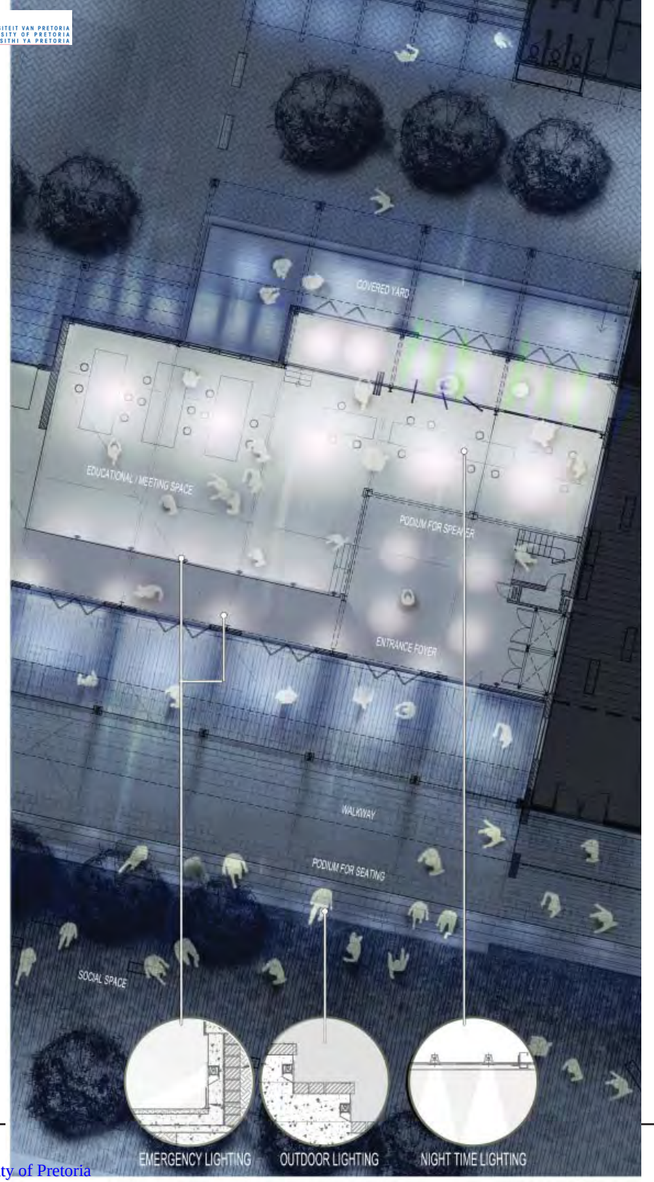


Fig 09-6h lighting strategy (Author, 2014)

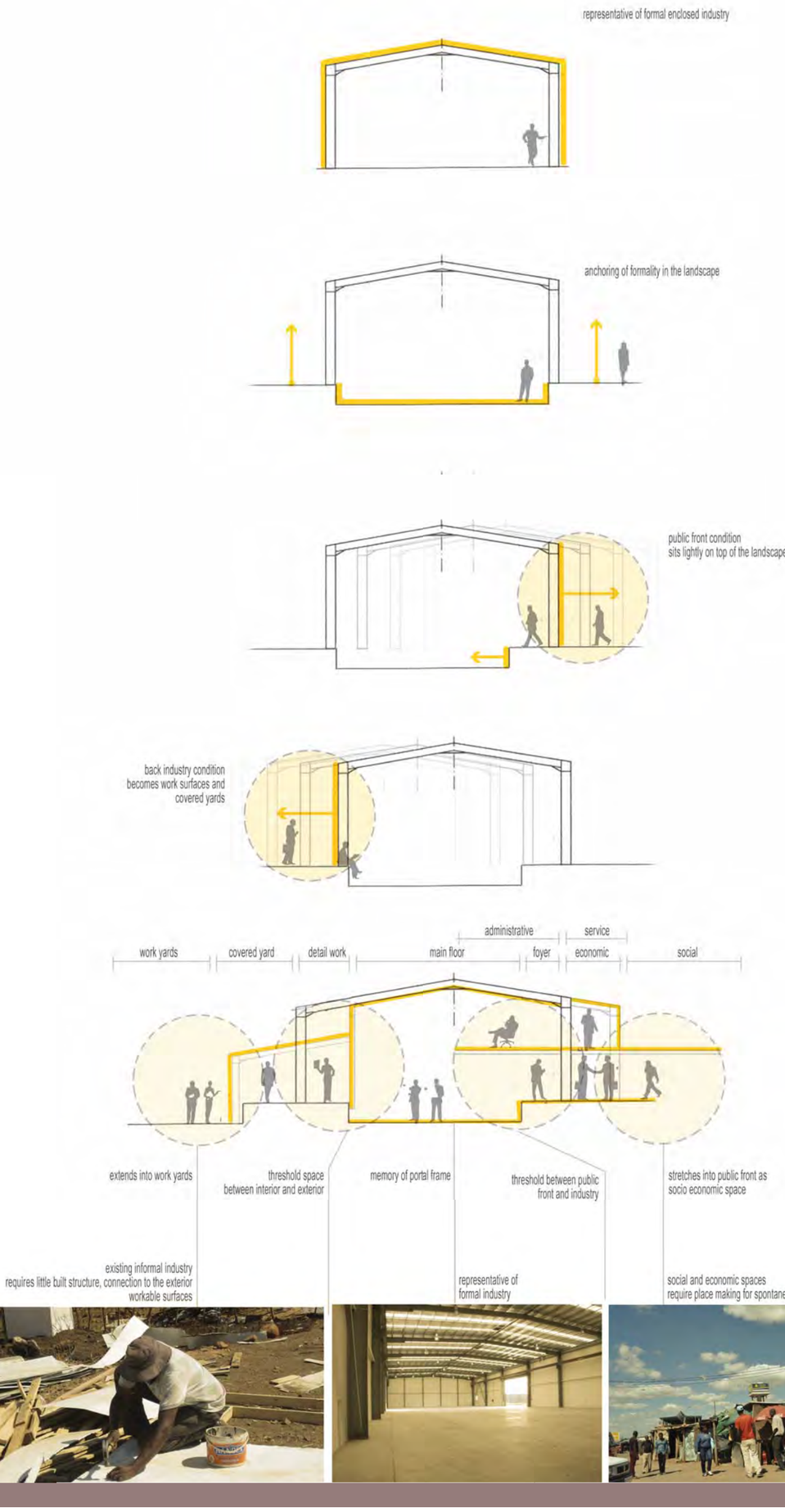
07 TECTONIC CONCEPT

The portal frame structure is used to represent formality and the way designers (creating formal or exogenous structures) build in Mabopane when approaching an industrial scheme. This structure is adapted, expanded and morphed into what the context requires it to be. The portal frame construction is highlighted in the interior expression, but is almost unrecognisable from the exterior as it is absorbed by its context and the workings thereof. Using infill material yet again expresses the context's way of assembling built form from a framed construction method. The frame remains the constant and the infill can be manipulated to become what it needs to over time.

Two conditions

The front condition to the public realm calls for expressing a lightness that thickens towards the main structure.
The back conditions towards the work yards call for a practical solution to spaces and sizes required to handle material, produce products and teach skills.
The two conditions stand in contrast to each other as the public realm requires a sensitive dialogue with the user of public space and the work yard conditions require a robust approach to an industrial educational typology.

Fig 09-7a the tectonic concept diagram (Author, 2014)



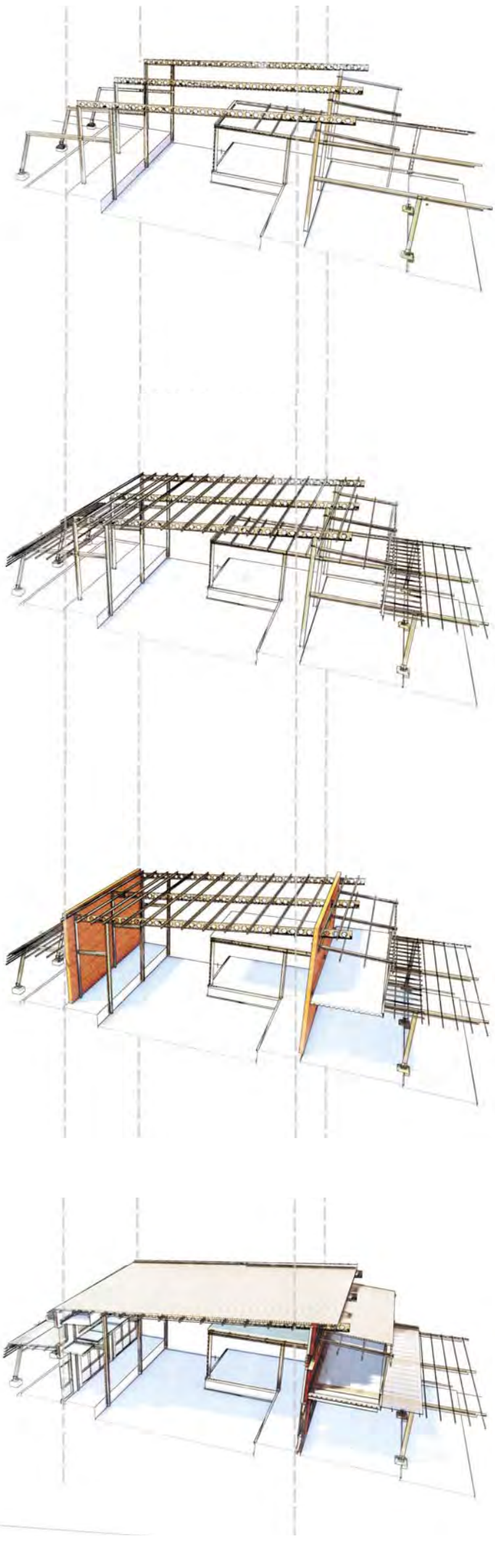
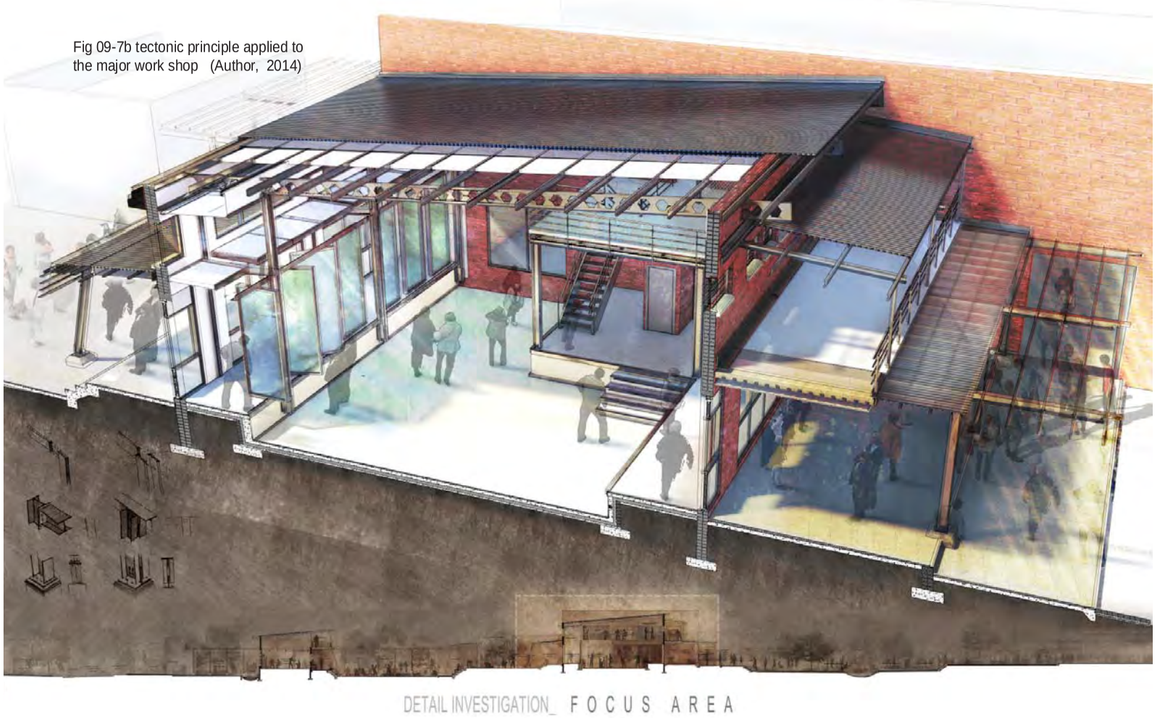


Fig 09-7b tectonic principle applied to the major work shop (Author, 2014)



The section through the public social space, main workshop and educational areas was selected to be subjected to the technical resolution process (Fig. 09-7c). A theory or approach to the way building elements are assembled and used was developed to guide and aid this process (Fig. 09-7d).

1. Beams – Horizontal supports
Even though the beams do not cut through the portal frame's columns, they are attached on either side and exposed to create the idea of a continuous space that draws the user into or out of the space.

2. Junctions – Contrast
The portal frame structure requires hard perpendicular junctions as a practical solution, but also to serve as a reminder of the rigidness of the industrial building. The junctions that extend from this building should contrast and read as lighter, less rigid construction that can be dismantled and unbolted if needed.

3. Walls
Walls are now used as infill between columns as the step away from the column to highlight the structural system. Elements stand away from the walls, as if not to touch them.

4. Roofs – Extending past boundaries
The roof edge seems light and extends past the column. The supporting rafters and beams extend past the column holding the roof in place so as to communicate a sense of a dynamic structure, as if they do not sit on top of the column but rather hang in between (in contrast with conventional portal frame construction).

5. Floors – continuity and thresholds
Floor texture change occurs as the building is approached from the public realm. This adds to the layering towards the processes inside the building. Moving from the building interior to the work yards, floor surfaces continue from the interior to the exterior to highlight the connection to the outdoor spaces. Floors are raised above or lowered into the ground to reflect an understanding of the production process where tables are hardly used. Now the floor becomes work surfaces and acts as furniture.

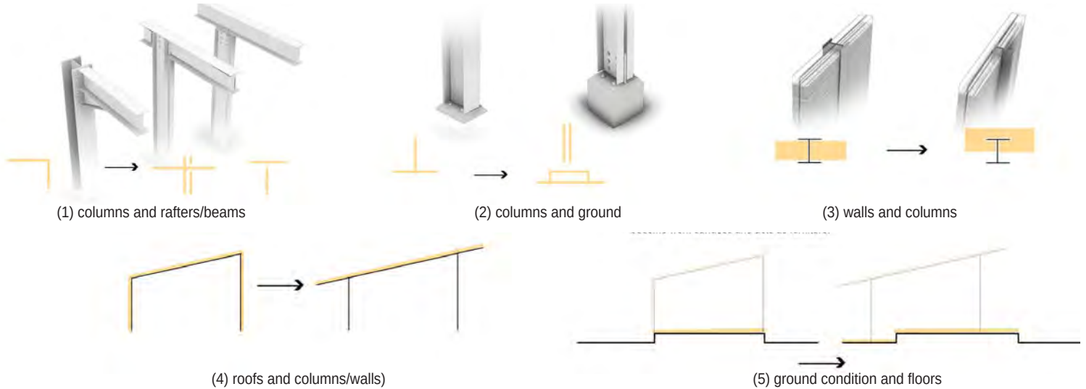


Fig 09-7d theory on how to treat connections and building elements (Author, 2014)

Fig 09-7c the principle section and programme investigated (Author, 2014)

Thresholds

The entrance to the educational buildings serves as a series of thresholds to the interior. The buildings steps up, the podium becomes seating and is layered towards the entrances. The social space in front serves as a play area, meeting place and gateway to the work yards. This “optional” space becomes flexible and is able to serve a wide variety of functions, even after the main activity of the site has stopped running. The green space utilises both soft and more durable hard landscaping to not only provide visual comfort, but also restore a natural habitat that has been removed over time by human agency.

Gallery and amphitheatre

The roof of the building extends past the boundary of the walls and portal frame to create a gallery space where functions inside the building can be observed from a bird’s eye point of view. This is reversible as the walkway is open to the exterior and the gallery can serve the social space and amphitheatre-like structure in front of the building, too. Here, community meetings, performances and outdoor demonstrations could be held.

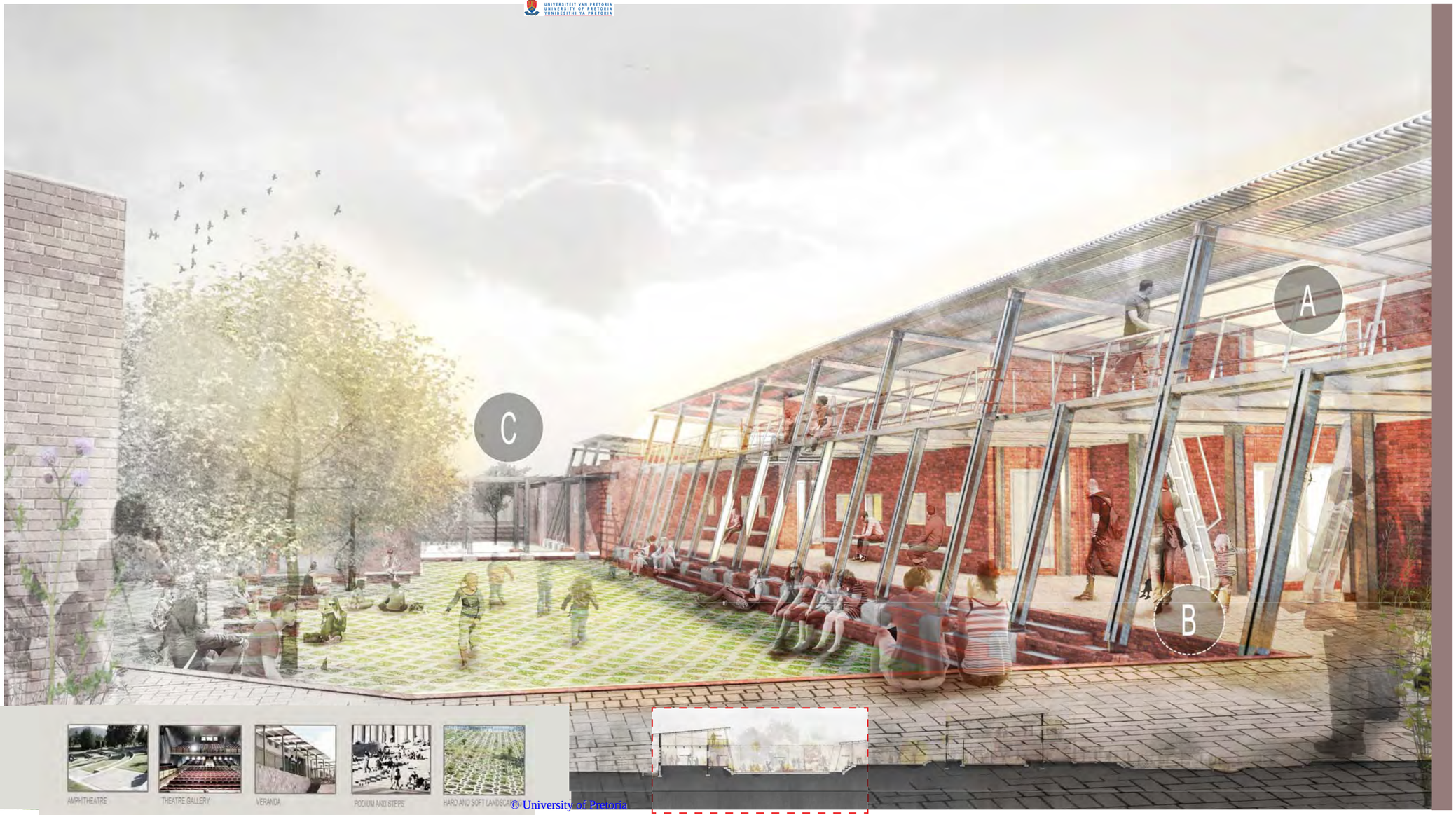
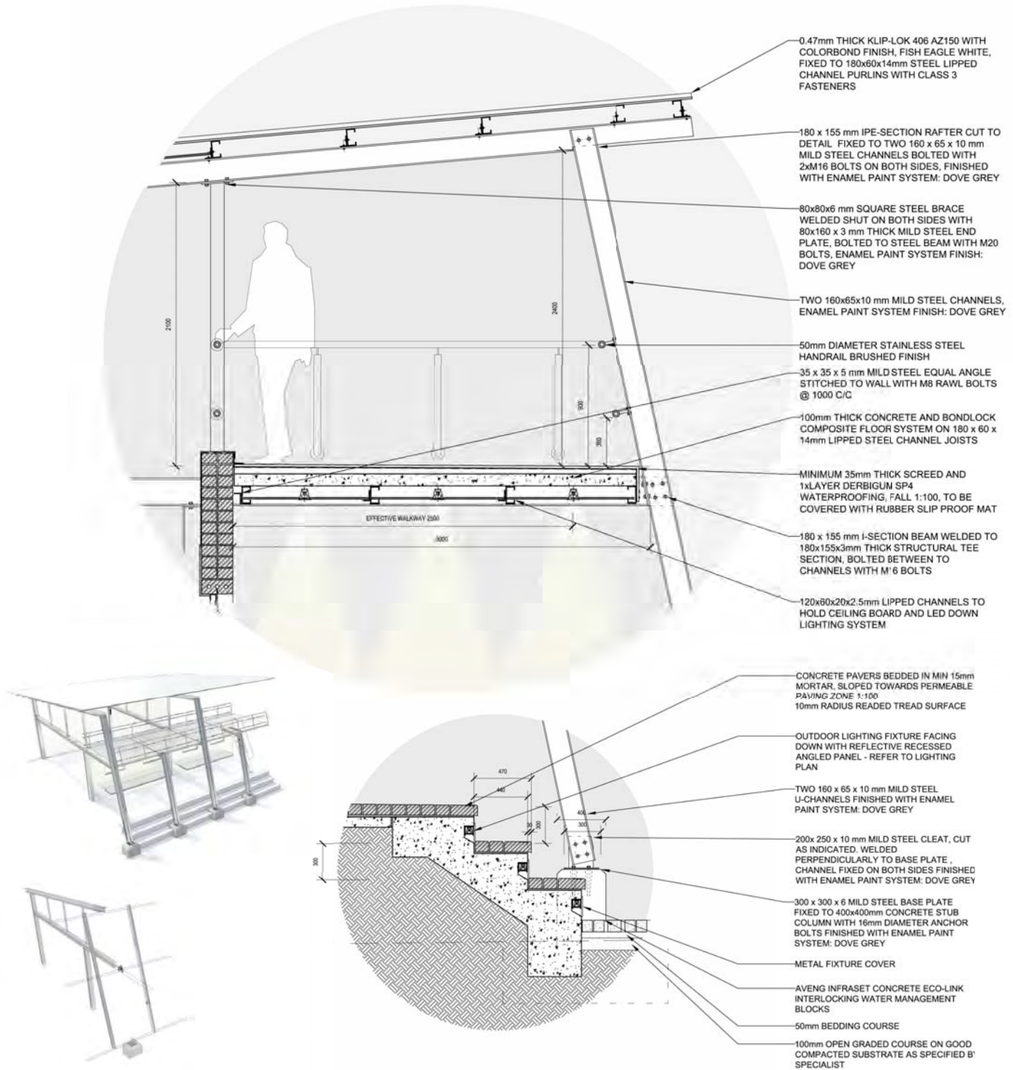


Fig 09-7e perspective of educational facilities (Author, 2014)

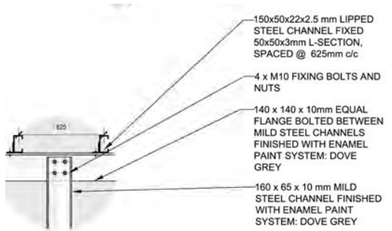


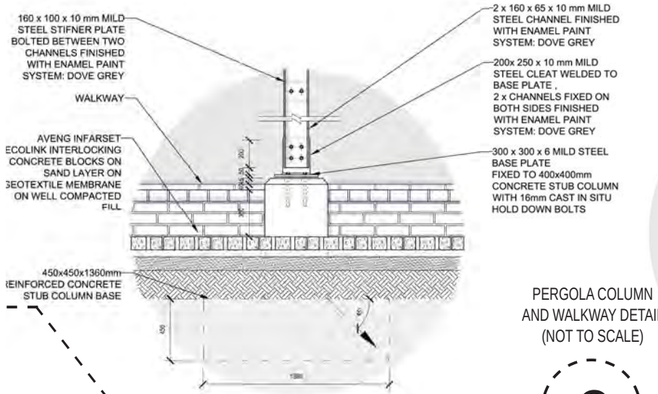
A

WALKWAY AND VIEWING DECK (NOT TO SCALE)

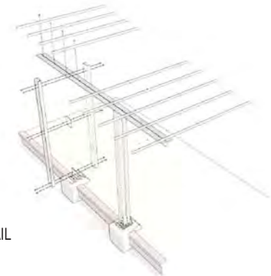
FOOTING AND OUTDOOR LIGHTING SYSTEM (NOT TO SCALE)

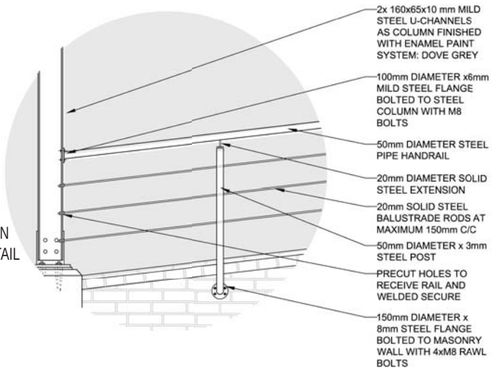
B





HANDRAIL ALTERNATIVE DETAIL (NOT TO SCALE)





PERGOLA COLUMN AND WALKWAY DETAIL (NOT TO SCALE)

C

Fig 09-7f section and details A-C related to educational areas (Author, 2014)

Merging the indoors with the outdoors

The large canopy extends from the inside to the outside space and the adjacent floor finish is uniform to connect the indoor workstations with the outdoor work space. The canopy “disappears” as it becomes thinner towards the ends and is anchored by a column extending past the floor boundary. Deciduous trees frame the courtyard space and create pockets of work areas that will be exposed to direct solar radiation during the cooler months and partially shaded during the warmer months.

Organising space

The covered work yard steps down from the interior space into the larger work yard, creating a series of thin thresholds as one moves from the interior space to the exterior. Ceiling boards run parallel to the line of movement, further extending the interior to the exterior. Framed on both sides by overhead planes, the courtyard is subdivided by soft landscaping, creating smaller pockets of work space.

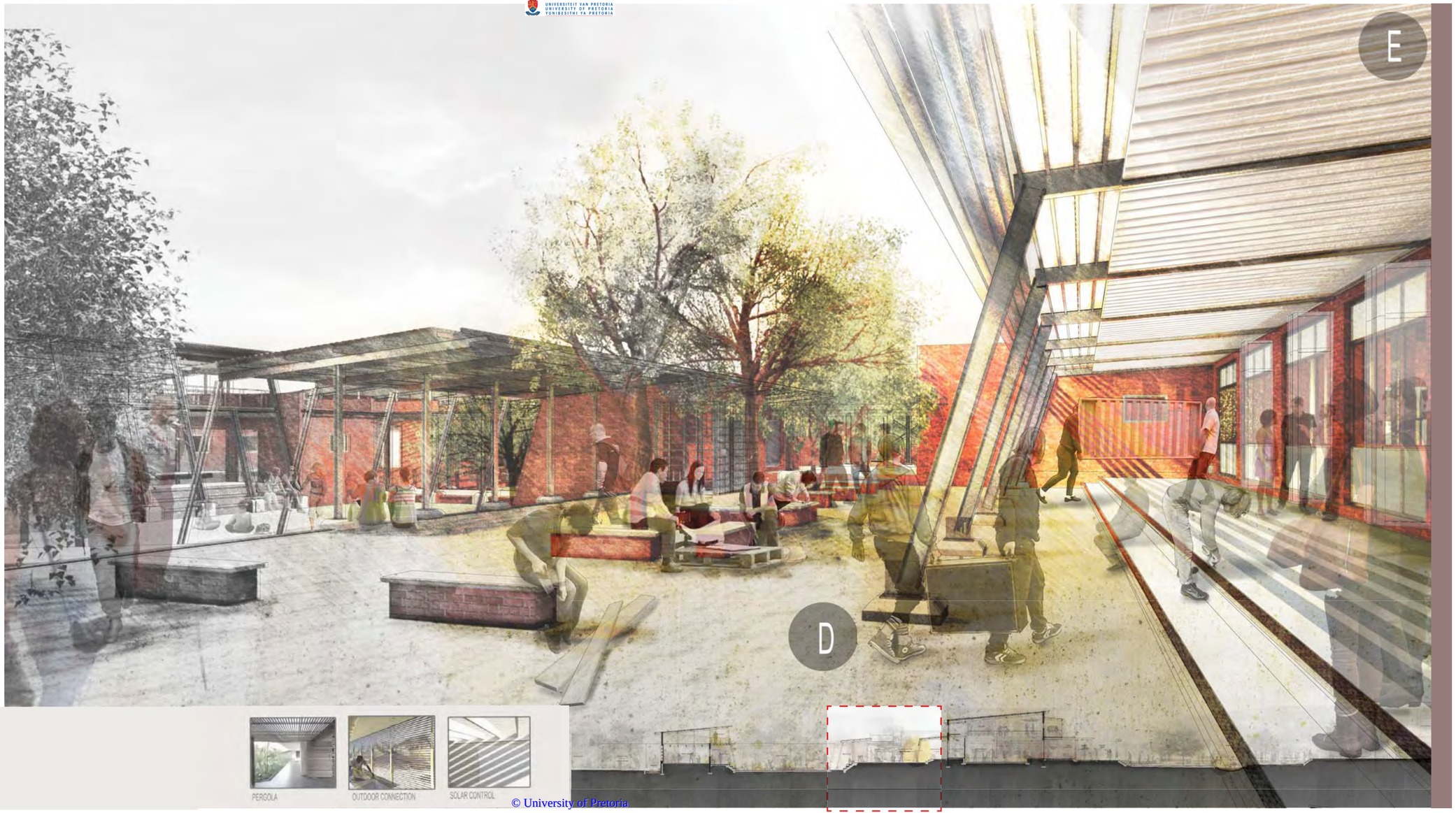
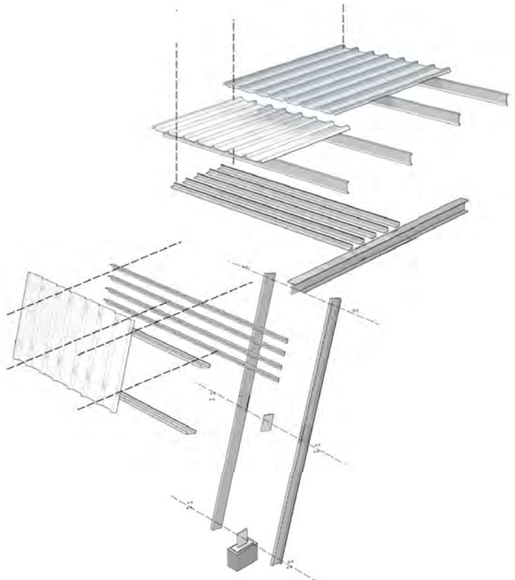
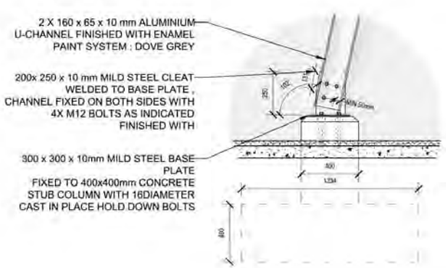
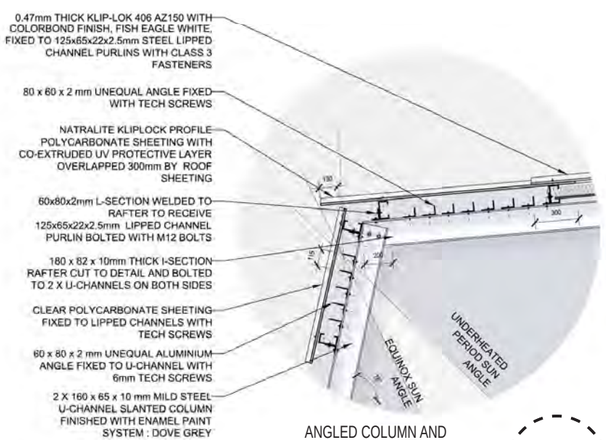


Fig 09-7g perspective of production facilities located outdoors (Author, 2014)



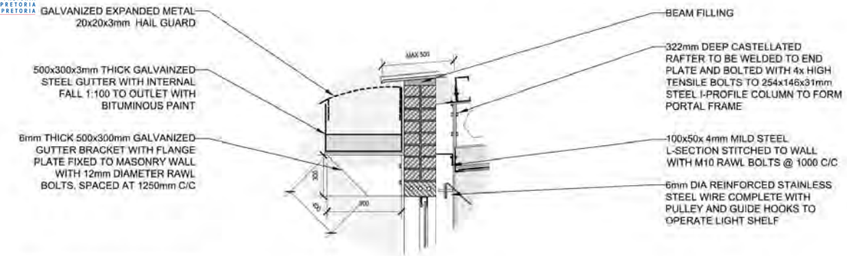


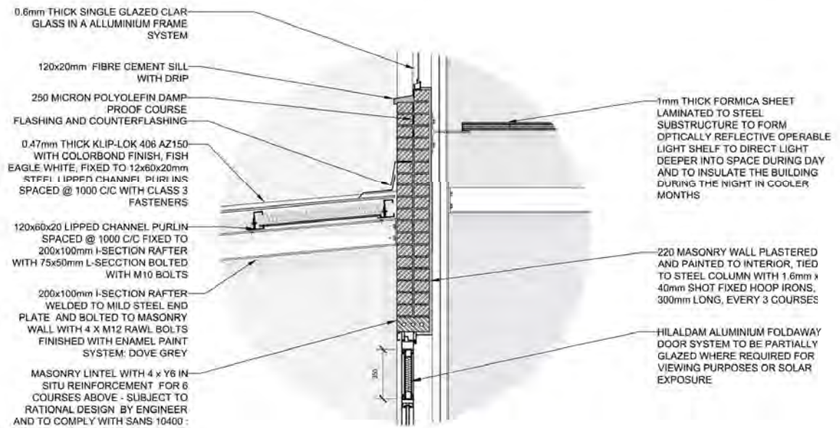
ANGLED COLUMN
FOORING DETAIL
(NOT TO SCALE)



ANGLED COLUMN AND
RAFTER CONNECTION
(NOT TO SCALE)

D





E

FLOOR WALL AND
ROOF JUNCTIONS
(NOT TO SCALE)

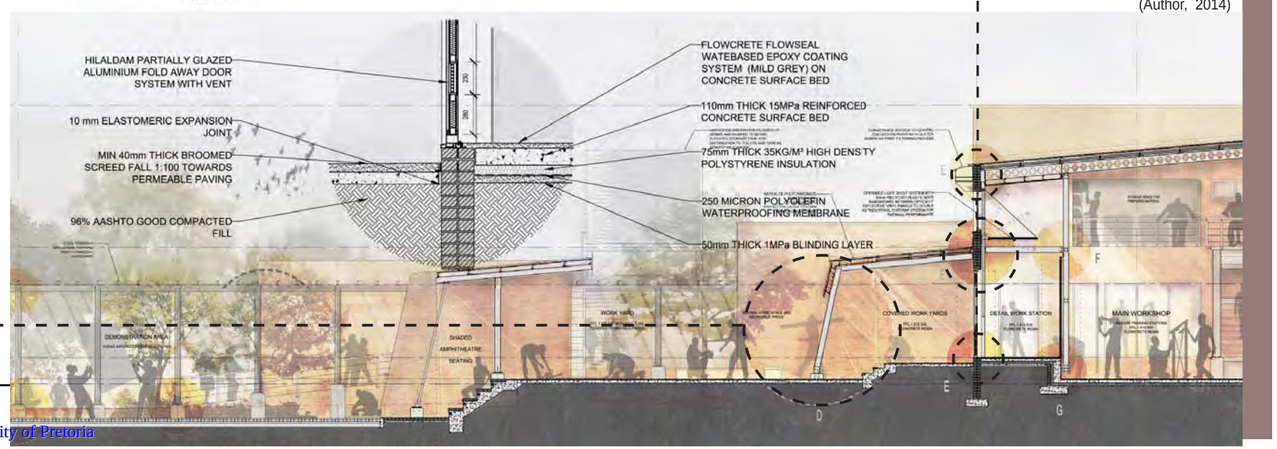


Fig 09-7g section and details D-E related to outdoor production areas (Author, 2014)

Organising space

The pivoting partitions aid in a self-organisation of the activities. They can divide, screen or connect space as required. Stacked away they provide large work surfaces on work level with the best light quality (detail work).

Floors on higher levels act as work surfaces and seats, as the building becomes furniture instead of just housing loose pieces.

Light quality (direct and diffused) varying in lux levels create opportunities for different activities to occur in different spaces.

Individual control

The system allows for the user to control the light quality, colour and air speed (as it acts as a permeable screen due to the gaps between partitions) to provide the user with environmental comfort that suits his/her needs at that time.

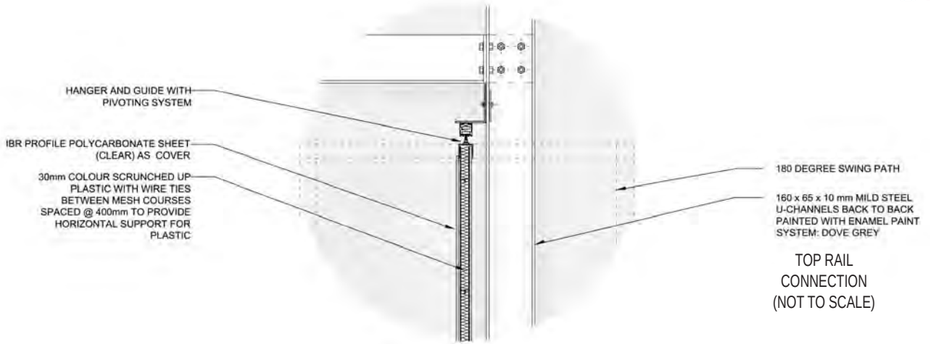
The user is now in control of his or her own spatial quality and can change, adjust and move elements as needed.

Two major elements are the light shelves and the pivoting partitions that affect the quality of space the worker experiences.

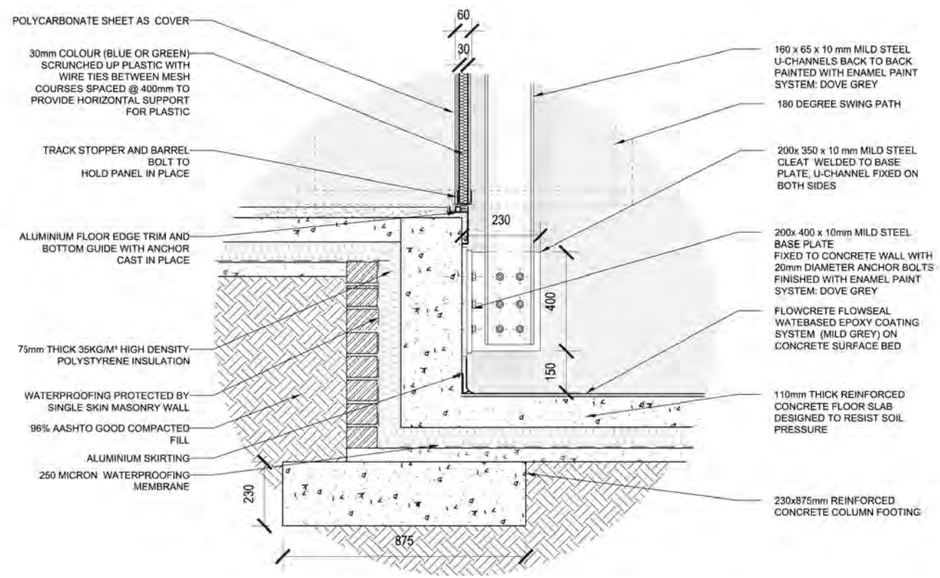
Thermal and lighting performance

Light to the interior must be evenly distributed or at least not high contrast, as that will cause uncomfortable glare. A light shelf along with light interior colours could provide a much more comfortable diffused light to the interior spaces. The operable light shelf directs light deeper into the space, but due to its insulation properties it also acts as a curtain. The panel is placed in the upright position during the night in the underheated period to prevent warmth radiating from the thermal mass from escaping through the glazed surfaces.

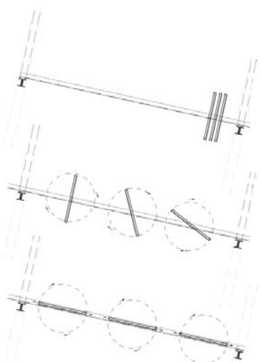
Fig 09-7h perspective of production facilities located indoors, the major work shop (Author, 2014)



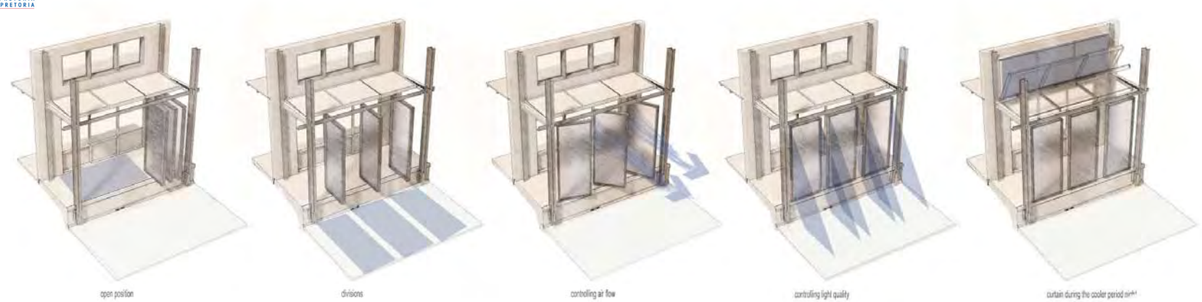
TOP RAIL CONNECTION (NOT TO SCALE)

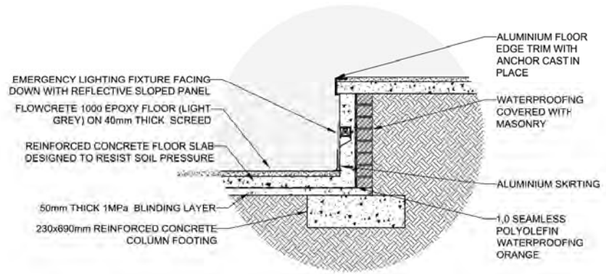


LEVEL CHANGE, COLUMN AND PIVOTING PANEL (NOT TO SCALE)

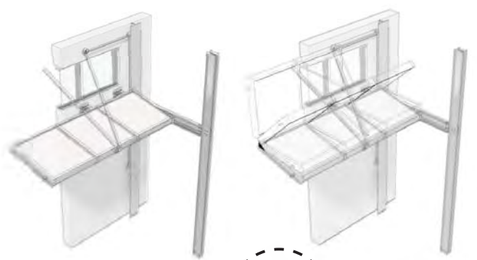


PLAN OF PANEL POSITIONS (NOT TO SCALE)





H EMERGENCY LIGHTING DETAIL (NOT TO SCALE)



F OPERABLE LIGHT SHELF AND CURTAIN

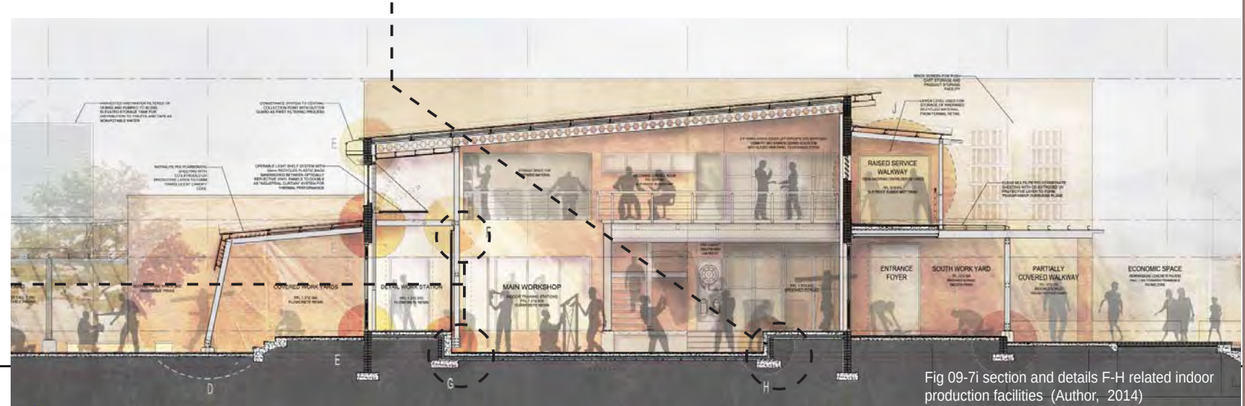
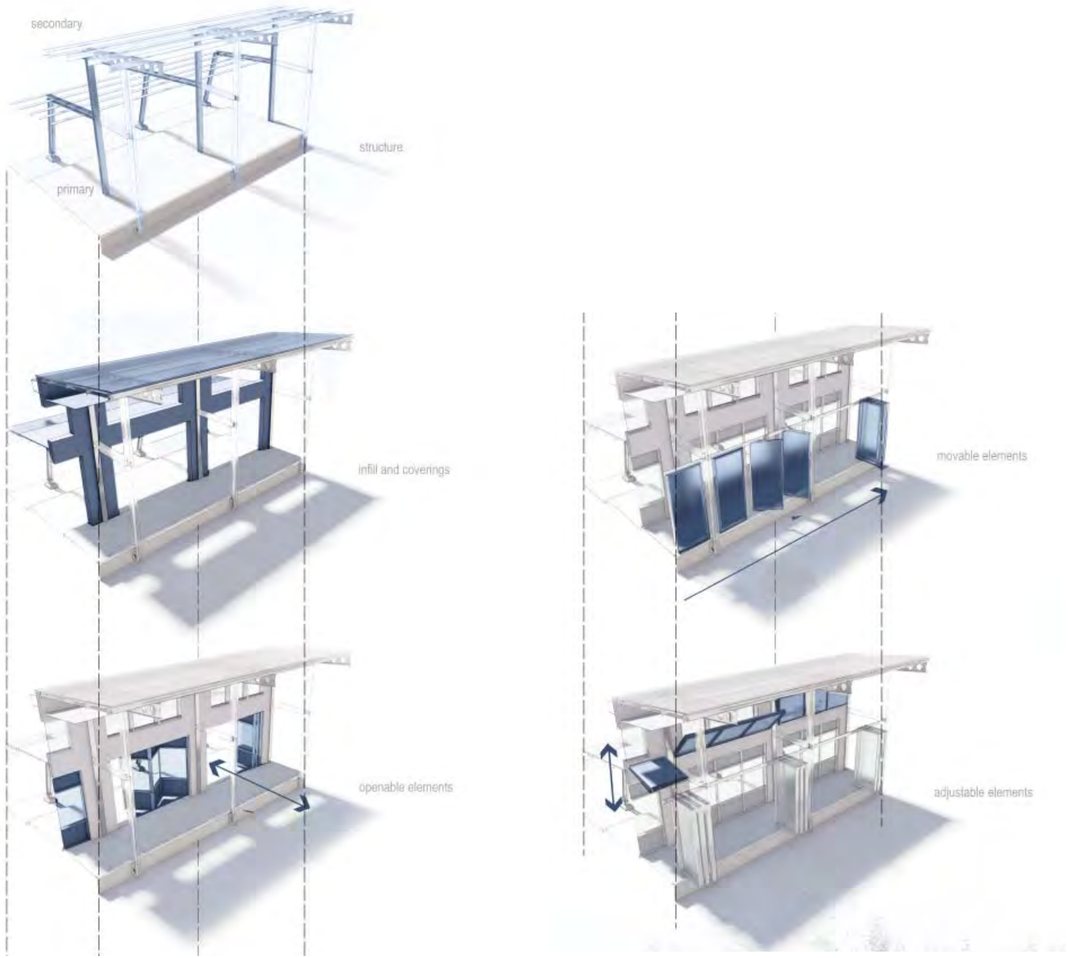


Fig 09-7i section and details F-H related indoor production facilities (Author, 2014)



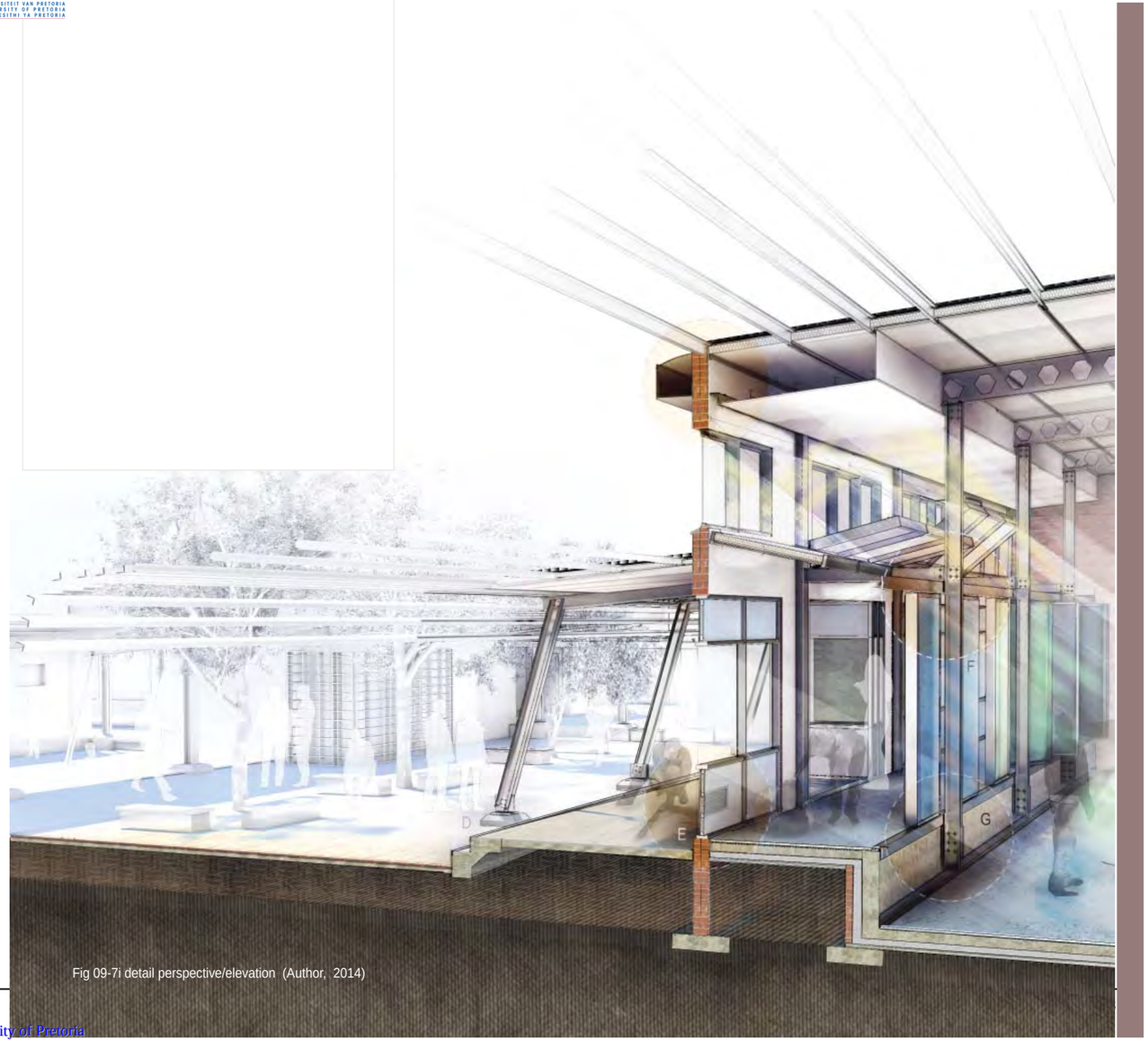


Fig 09-7i detail perspective/elevation (Author, 2014)

Organising space

The pergola and floor system create multiple thresholds towards the workspaces as the structure thickens towards the building's entrances. The walkway runs perpendicular to these thresholds, allowing the visitor to view the processes, but warns against coming to close to the workspace territory. The landscape steps up to the building, forming a podium that becomes a seating area.

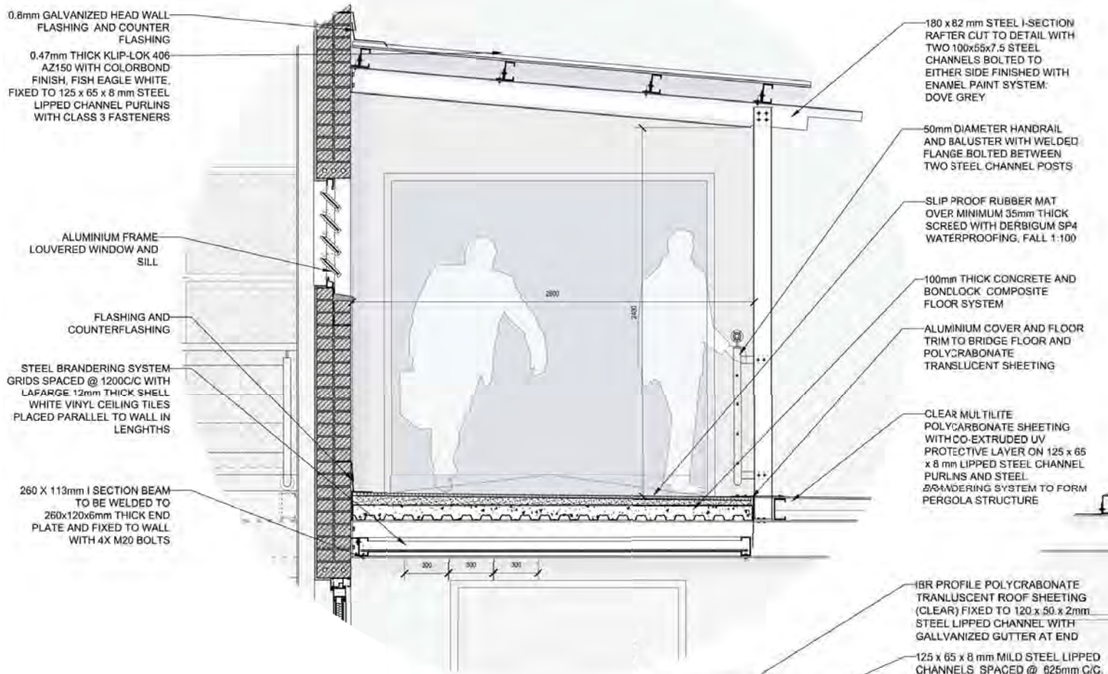
Landscape

The landscape becomes softer as the user moves from hard landscaped high-traffic zones towards more static, lower traffic social spaces. Soft landscaping elements include deciduous trees to provide shade in summer and allow for sun to reach the user in winter.

Water management

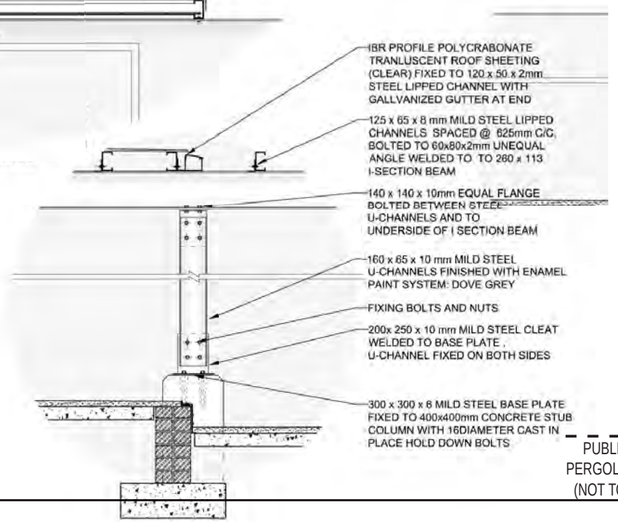
The water management system consists of a series of rain gardens connected by subsurface coverts in the public zones. Hard surfaces are sloped towards these inlets and social spaces utilise permeable surfaces to create infiltration zones. The water management system moves from being an engineering object to an architectural element as it forms part of a social space and seating opportunity.

Fig 09-7j perspective of public space concerned with socio-economic issues (Author, 2014)

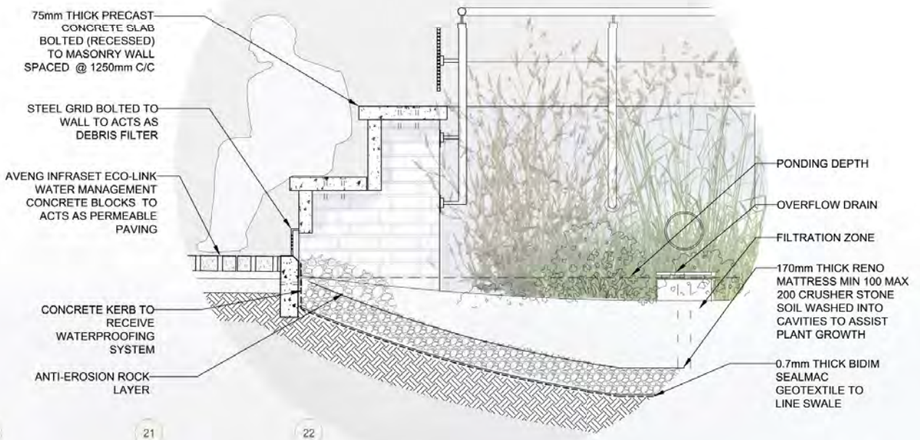


J

RAISED SERVICE WALKWAY (NOT TO SCALE)



PUBLIC AREA PERGOLA SYSTEM (NOT TO SCALE)



K

BIOSWALE AND SEATING (NOT TO SCALE)

Fig 09-7k section and detail J-K of public space concerned with socio-economic issues (Author, 2014)

MINOR WORKSHOP
The smaller workshop deals in the production of smaller finer crafts like sewing, smaller product repairs and classes.

Expand and contract
The minor workshop expands and contracts as needed. The operable wall sections create a canopy under which users can work when the panels are open. When closed, the exterior space becomes an ideal location for temporary retail to form when the main function of the building is not active.

Rearrange and divide
The rotating partitions revolve around the columns to create works paces that can be rearranged and reshuffled as functions change. They lock into place at certain positions, using a barrel bolt system. Due to their height, they do not obstruct airflow through the building.

Diffuse and insulate
When the operable wall sections are closed, they insulate the building to heat losses and gains during off-peak times. The cut-outs covered by polycarbonate sheeting provide diffused light to the interior, exposing the internal qualities of the wall.

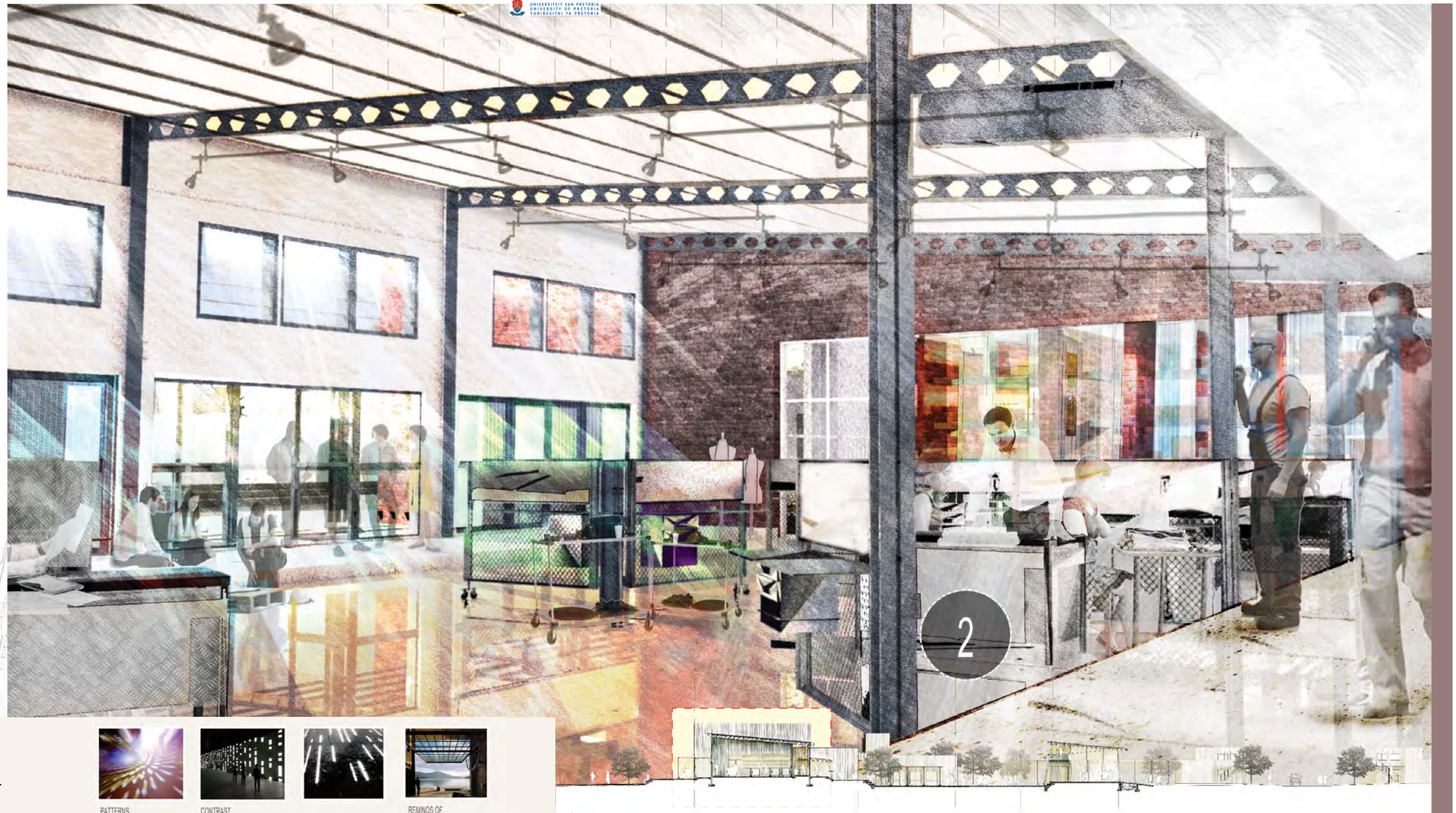
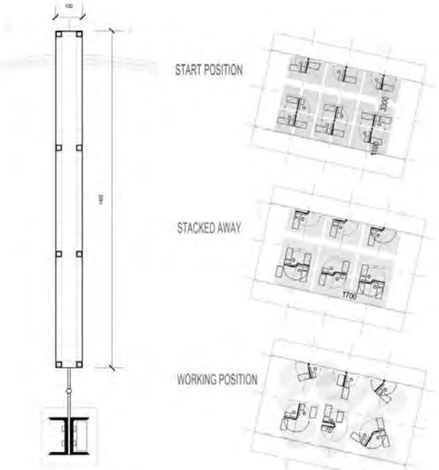


Fig 09-7l perspective of the minor workshop area (Author, 2014)

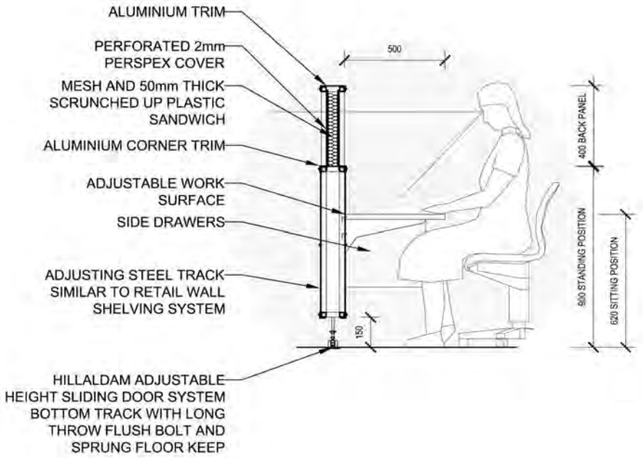
OPERABLE PANEL
CLOSED CONDITION
(CONTRACT)

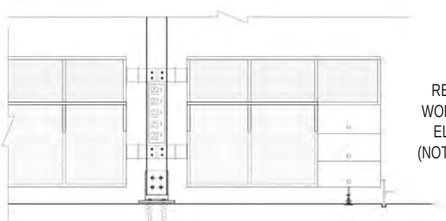
OPERABLE PANEL
OPEN CONDITION
(EXPAND)

1



REVOLVING
WORKSTATION PLAN
(NOT TO SCALE)





REVOLVING
WORKSTATION
ELEVATION
(NOT TO SCALE)

2

REVOLVING
WORKSTATION
CROSS SECTION
(NOT TO SCALE)

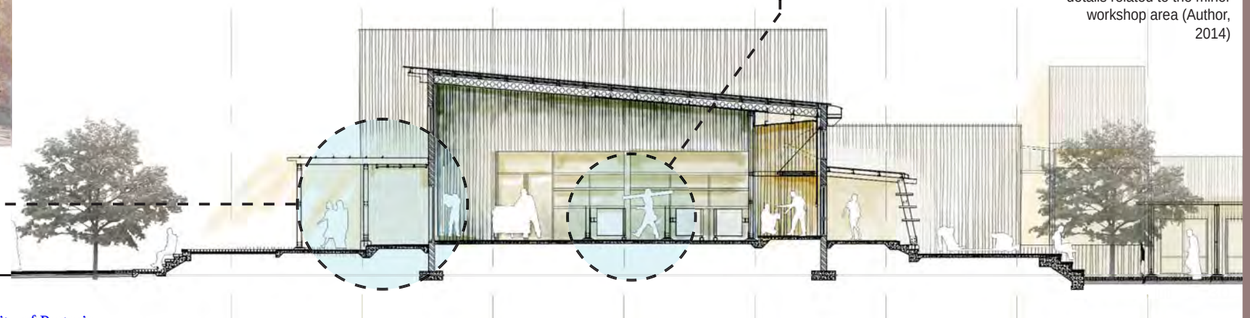


Fig 09-7m section and details related to the minor workshop area (Author, 2014)

COGNITIVE LEARNING AREAS

Classrooms are assembled to function as industrial educational spaces. These buildings are designed to be used for a variety of functions as they open up to each other and utilise the volume created by the truss system as seating (viewing deck). These spaces understand not only the volume required for moving and rotating products, but also the importance of an internalised function. This internalisation does not mean that the interior requires complete separation from the exterior, as appropriate connections to the exterior are explored.

Expand and contract

The classrooms open into each other to create one large space when required. This encourages multiple uses, as the spaces can expand and contract to suit larger groups of people and a variety of activities. The sliding panels open the interior up to the elements when needed. During over- or underheated periods, the panels slide in front of the openings in the brick wall to seal the building off from the hot or cold air entering due to prevailing winds.

Light and lightness

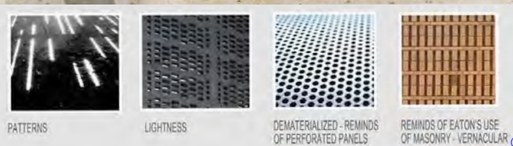
This weaving of brick results in a building that is not completely enclosed but merely protected from the elements. Cold prevailing winds can be avoided by moving the partitioning system in front of the openings between the bricks. Since the underheated period is characterised by a lower sun angle, light (radiation) would pass through the openings and light up the interior partitioning light diffusing system. When the lux levels are higher inside (night activities), diffused and tinted light is visible to the residential side.

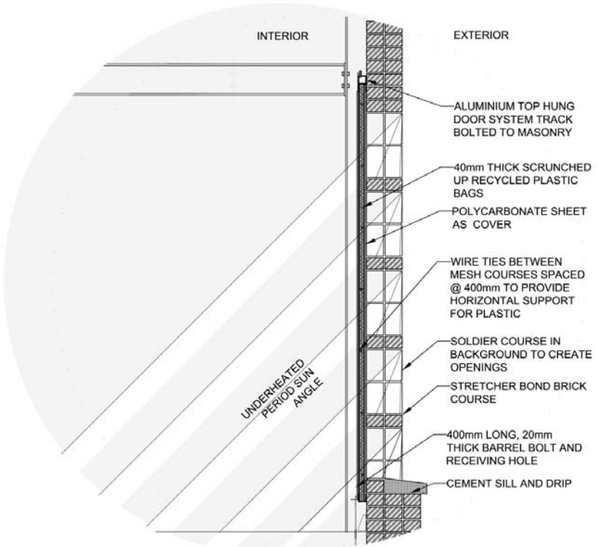
Views

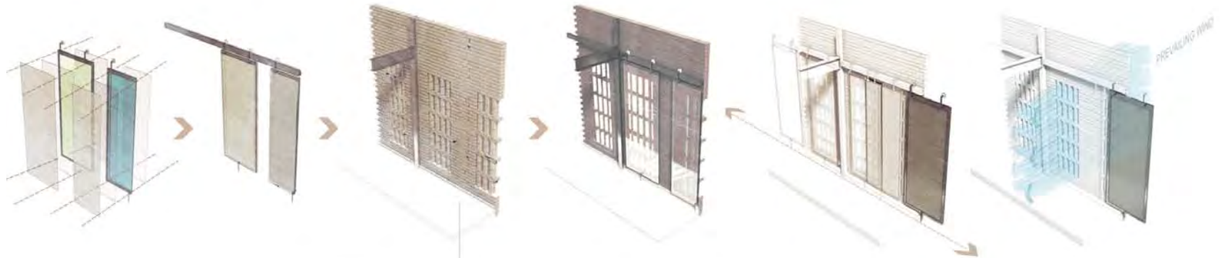
The extending of the portal frame beyond its initial boundaries creates an opportunity for a viewing gallery to form. Here students can view the demonstration from a bird's eye point of view. Precast concrete panels attached to the brick wall create seating, organising the viewing space.

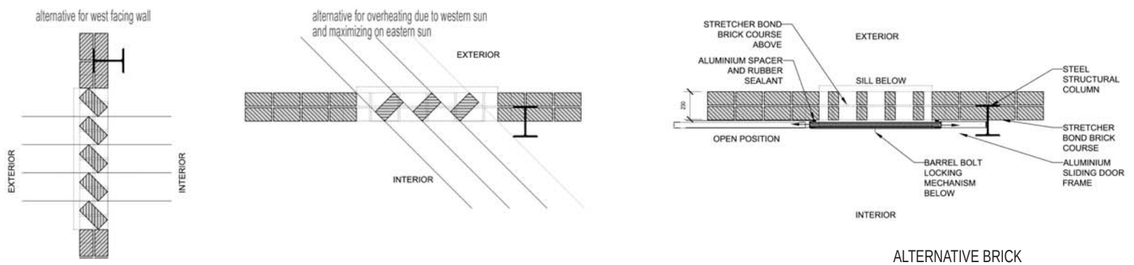
From the residential point of view, the wall becomes activated as the patterns provide an aesthetic quality.

Fig 09-7n perspective of the interior of cognitive learning facilities (Author, 2014)

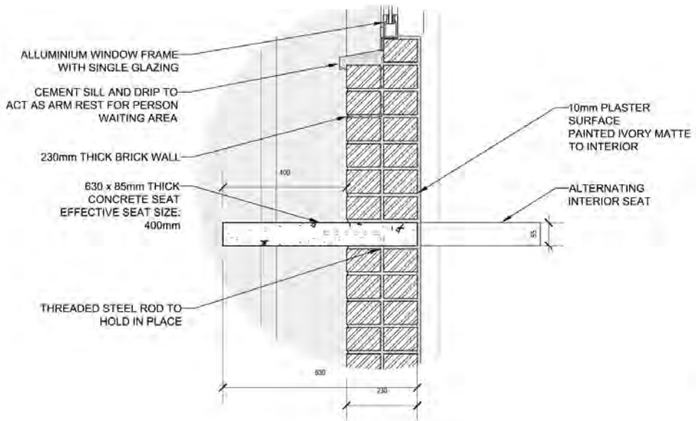








ALTERNATIVE BRICK WALLS
(NOT TO SCALE)



2

WOVEN BRICK AND HANGING PANEL SECTION
(NOT TO SCALE)

1

PRECAST SEAT DETAIL
(NOT TO SCALE)

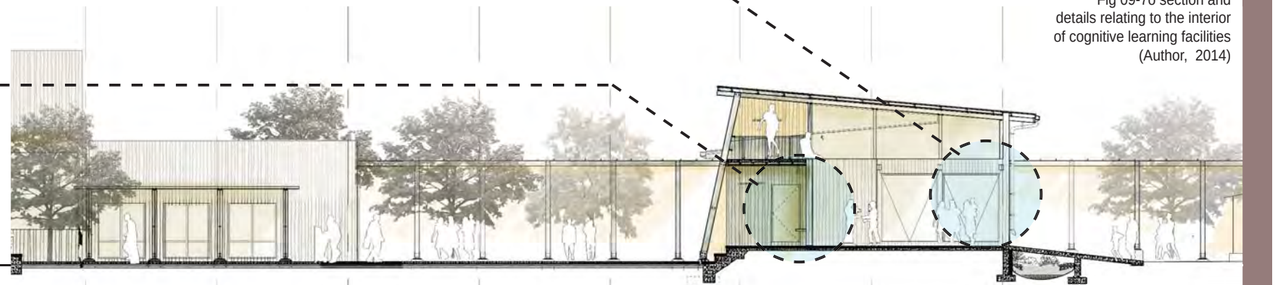


Fig 09-7o section and details relating to the interior of cognitive learning facilities (Author, 2014)

ENTRANCE FOYER

The entrance foyer aims to introduce the visitor (in a safe, controlled manner) to the functions and products of the building.

First contact on the route

The visitor is exposed to the first stage of production that of sourcing and preparing the raw recycled product. The entrance foyer aims to showcase the use and product of the building. The user is exposed to visual contact to the two extremes (heavy industry and light industry) on both sides of the route. This part of the route serves as an introduction to the possibilities of the site.

Spatial properties

Shelving is placed between strips of load bearing walls to create a screen between the user entering the building and the smaller workshop. A glazed panel is placed between the user and the larger workshop for safety reason – contact must be limited but visual connections are important. The goods lifts are on display and the user can witness material moving from the storage area above into the workshop areas. Seating is placed in the entrance foyer to stimulate cognitive learning and conversation. Here, a lowered vertical ceiling system is used for acoustic comfort. The movement route is highlighted by a different material use, ceiling height and a strong horizontal line of elements.

Light (optical properties when passing through a medium other than air)

Deriving from the building material that is produced in the larger workshop, translucent panels are used to create spatial dividers. Depending on the colours of the plastic wedged between the panels, coloured light filters through to create a pattern on the ground. The vertical slats, creating a more intimate space for conversation, house lighting above. Between every third or fourth slat a translucent panel is placed to create diffused light on the other side.

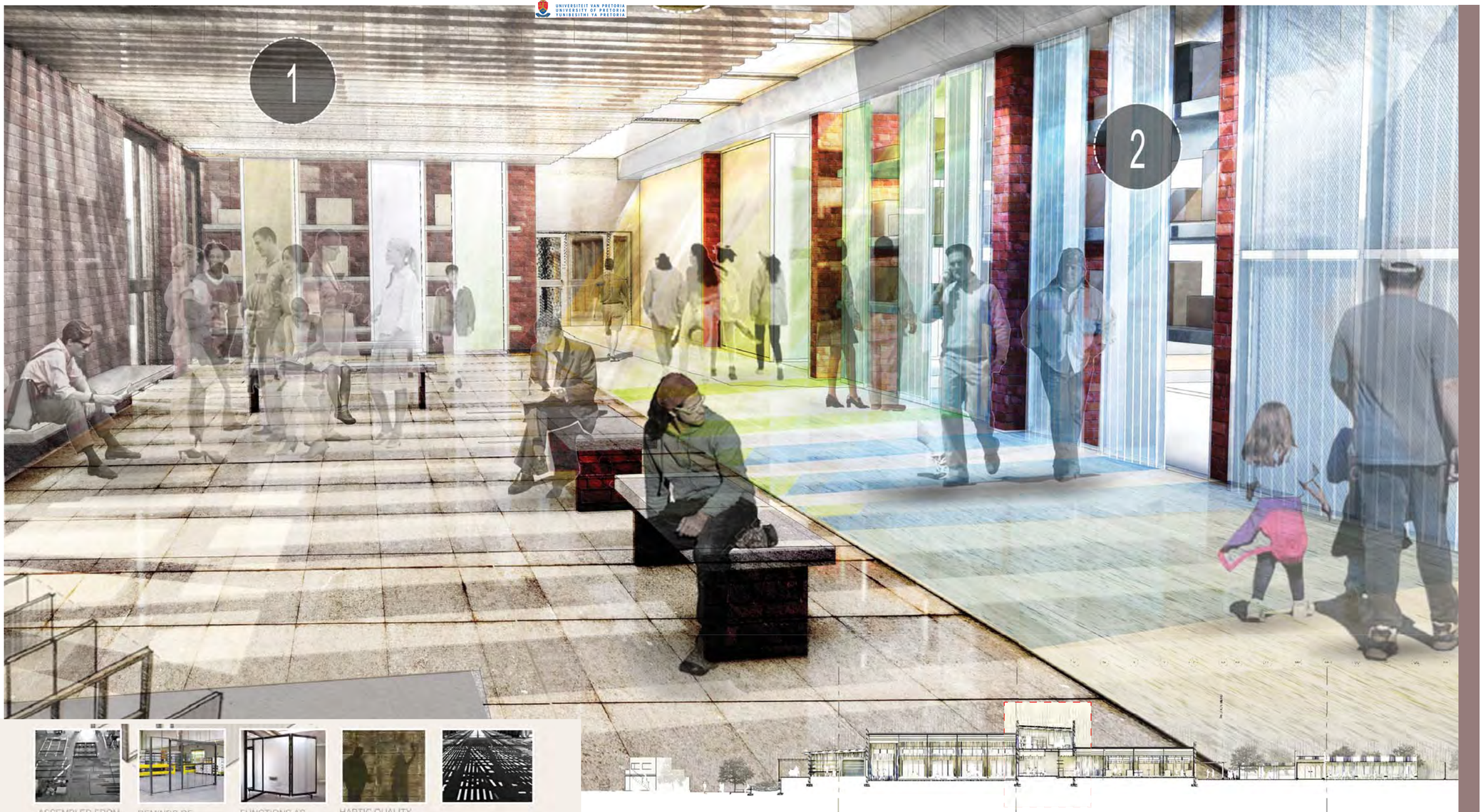
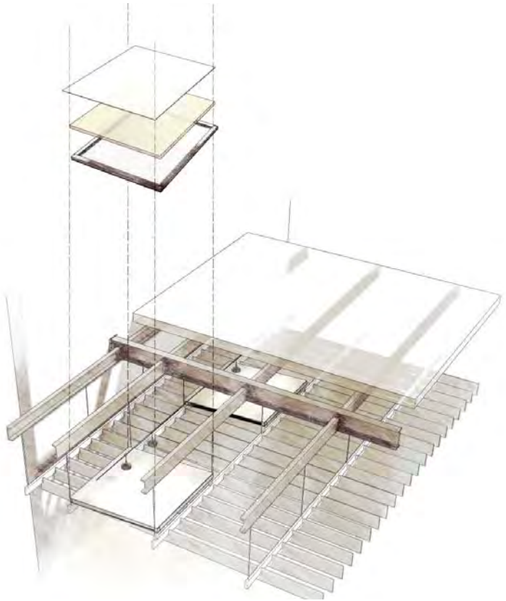
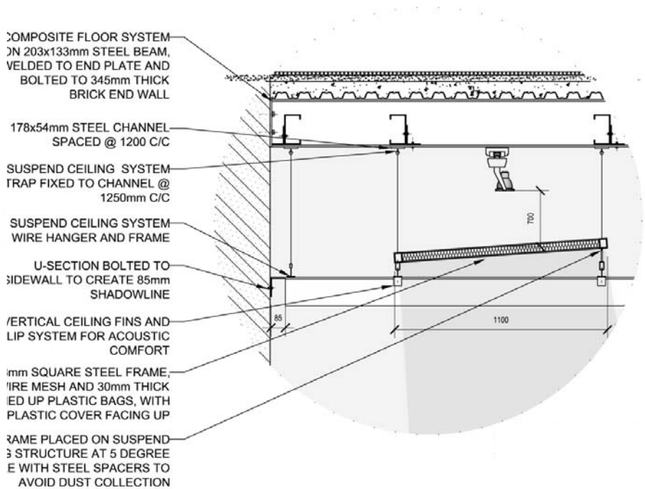
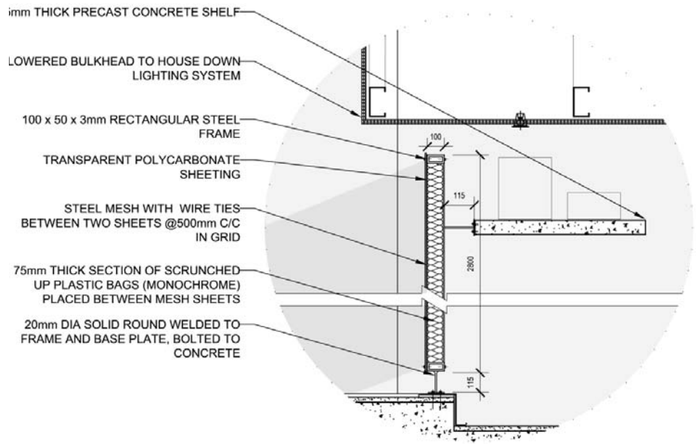


Fig 09-7p perspective of the entrance foyer(Author, 2014)







1

VERTICAL CEILING
SYSTEM AND
ARTIFICIAL LIGHTING
(NOT TO SCALE)

2

FREE STANDING
PANEL DETAIL
(NOT TO SCALE)

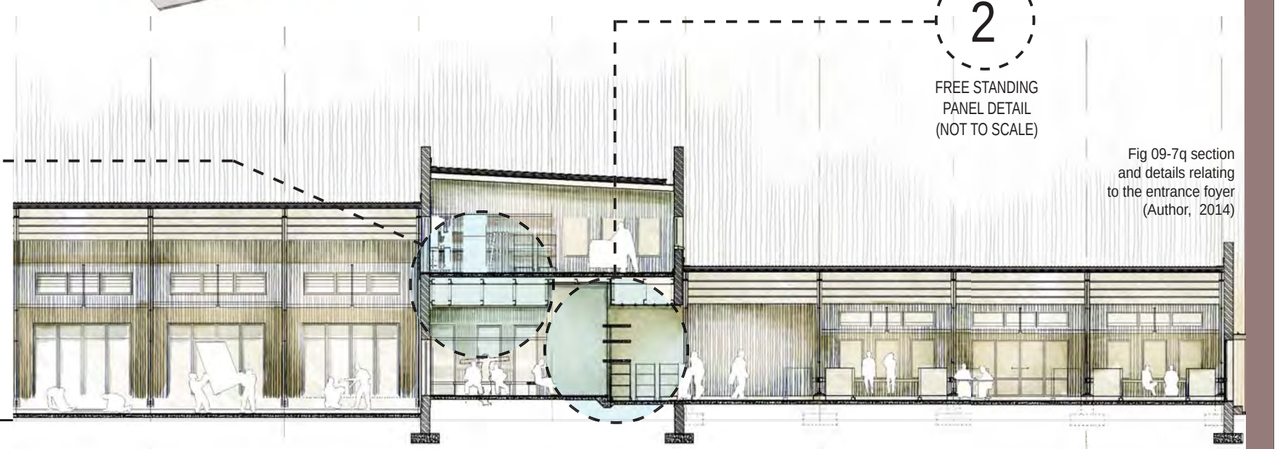
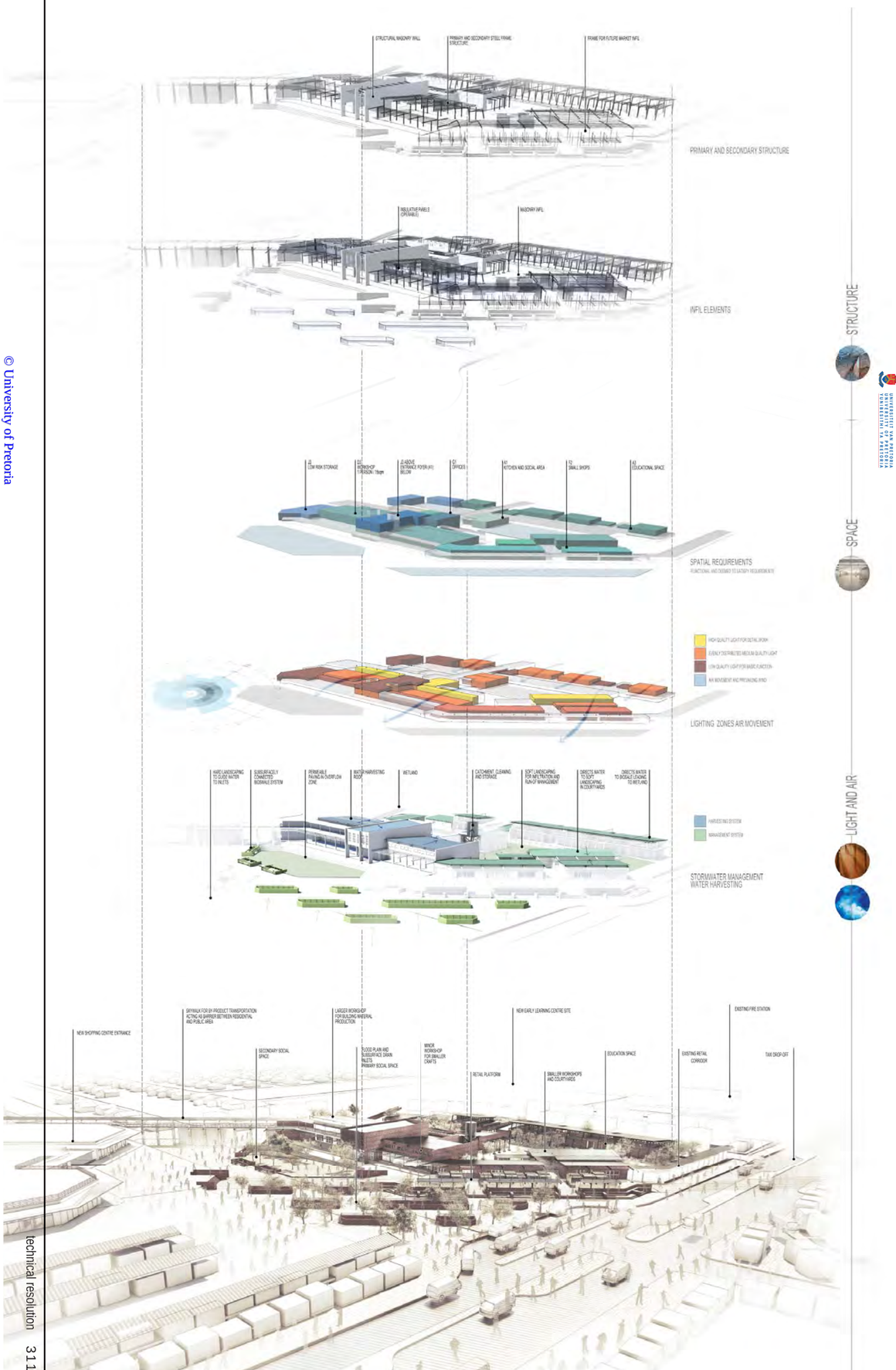


Fig 09-7q section
and details relating
to the entrance foyer
(Author, 2014)

08 CONCLUSION

Prof. Roger Fischer (2009:24) states that “Regional variations are reflected in different use of material, detailing and moderating climatic devices in accordance with resources, skills and labour, resulting in an architecture appropriate to locale.” The technical resolution of the design intentions conclude that a region specific architecture grounded in the social and economic structure of the context, could be resolved on a technical level to reflect these design intentions and aspirations. Fischer goes on to say that architecture will “always be emergent, generated at the threshold of the possibilities of locale”.

Fig 09-7r technical resoltion devolved from the design intention (Author, 2014)



DESIGN INTENTIONS

TECHNICAL RESOLUTION

Fig 09-7s sectional development from design intentions to a technical resolution (Author, 2014)

CONCLUSION

By utilising a hybrid typology that understands the vibrancy, workings and multiplicity of the context of Peri-urban settlements, the conflicts and potentials between formal and informal environments could be resolved and used to stimulate and create the condition for a narrative between the two extremes. One method of achieving this hybrid typology is to conduct ethnographic studies on the region's specific making and use of space over time, specifically the shaping of public and/or civic space. It is concluded that a narrative between formal and informal environments needs to occur for a formal solution to be holistic and inclusive of its setting. This narrative does not need to be a grand one, but simply one that takes queues from the existing strata, as no place exists in a void, but is inextricably part of the relation of the fabric it situates itself in.

" ...there cannot be a single South African architecture - only region-specific expression"
(Fisher 2009:9)

Fig 09-7t perspective of the condition created for a narrative (Author, 2014)

REFERENCES

AlSayaad, N., Roy, A. 2004. Urban informality: Transnational perspectives from the Middle East, Latin America and South Asia, Lexington Books, Lanham.

Anderson, JE., Jenkins P. 2011. Developing Cities in between the Formal and Informal. ECAS 2011 - 4th European Conference on African Studies African Engagements: On Whose Terms? Sweden

Brand, S. 1994. How Buildings learn: What happens after they are built? Penguin Books, USA

Bremner, L. 2010. Writing the City into Being, Essays on Johannesburg : 1998-2008. Fourthwall Books, Johannesburg

Campbell, K. 2011. Massive Small: The operating programme for smart urbanism. Urban Exchange

Cardosi, G. 2011. Habitat between norms, impulse and utopia toward the integration of informal settlements. Department of Urban Planning. McGill University, Montreal, Canada.

City Planning, Development and Regional Services Dept, City of Tshwane, 2008. Urban Framework for Mabopane Region. pp. 181-195 [online] http://www.tshwane.gov.za/Services/CityandRegionalDevelopment/CityMabopane%20Station.pdf [accessed 03 Feb 2014]

Davies, RJ. 1981. The spatial formation of the South African city, GeoJournal 2: 59-72

Demacon Market Studies. 2010. Impact of Township Shopping Centres. Urban Landmark, [online] http://www.urbanlandmark.org.za/downloads/retail_in_townships_2011_07.pdf [accessed 1 May 2014]

Despres, C. (1991). The meaning of home: Literature review and directions for furtherresearch and theoretical development. Journal of Architecture and Planning Research 8(2), 96-115.

de Boeck, F. 2004. Kinshasa: Tales of the invisible City. Ludion Ghent, Amsterdam

Foucault, M. 1986 "Of Other Spaces," Diacritics 16.1, pp22-27.

Freno Systems (2014). The pre-cast raingarden system, product information. [online] http://www.frenosystems.com/pages/TheProduct.html [acessed 22 May 2014]

Gehl, J. 2010. Cities for people. Island Press, Washington

Gehl, J. 2011. Life Between Buildings. Island press, Washington

Joubert, O. ed. 2009. 10+ Years 100 Buildings: Architecture in a Democratic South Africa. Bell-roberts Publishing, Cape Town. pp 264-265

Hamdi, N. 2010. Placemaker's Guide to Building A community. Routledge

Hanson, J. & Hillier, B. 1984. The social logic of space. Cambridge University press, Cambridge

Housing development Agency. 2011. South Africa: Informal settlement status. Housing development Agency, Johannesburg

Kellet, P. & Napier, M. 1995. Squatter Architecture? A critical examination of vernacular theory and spontaneous settlement with reference to South America and South Africa. TDSR vol VI no. II pp. 7-24

Kostof, S. 1999. The City Shaped: Urban Patterns and Meanings Through History. Thames & Hudson, New York

Lawson, B. 2001. The language of space. Reed Educational And Professional Publishing, Great Britian.

Lockton, D., Harrison, D.J., Stanton, N.A. 2009. Design for Behaviour Change: The Design with Intent Toolkit v.0.9, Brunel University Press, Uxbridge:

Low, I. 2005. Design as instrument in transformation : settlement as empowerment opportunity for socio-economic development. XXXIII IAHS World Congress on Housing Transforming Housing Environments through Design September 27-30, 2005, Pretoria, South Africa

Mehrotra, R. 2013. Mumbai: Planning Challenges for the Compact City. Holcim Foundation. [online] http://src.holcimfoundation.org/dnl/238630ef-399c-4479-9fa7-5d6abe54c6cb/F13_Green_03_Mumbai_Planning_Challenges_for_the_Compact_City.pdf [viewed 09 March 2014]

Meyer and Vorster. 2009. Kuyasa Transport Interchange. [online] http://www.meyervorster.co.za/home.asp?m=7&idkey=542 [accessed 23 March 2014]

Meyers, G. 2011. African Cities: Alternative Visions of Urban Theory and Practice. Zed Books, London

Mills, G. 2012. Informal Settlements could be our cities of the future. [online] www.urbanlandmark.org.za

Newman, O. 1973. Defensible Space: Crime prevention through urban planning. Macmillan Publishing Co.

NM and Associates. 2001. Philippi Transport Interchange. [online] http://www.nmassociates.co.za/projects/selected/philippi-public-transport-interchange [accessed 23 March 2014]

Noble, J. 2011. African Identity in Post-Apartheid Public Architecture: White Skin, Black Masks. Ashgate Publishing UK.

Papanek, V. 1971. Design for the real world; human ecology and social change.New York: Pantheon Books.

Pekelharing, E.J. 2005. The phenomenon of the urban edge as a planning tool for compact cities : an international and local comparison. North-West University, Potchefstroom.

Phaidon (2004) Phaidon Atlas of contemporary world architecture: Khayelitsha services centres. Sithandatu avenue public space. Phaidon, London

Piet Louw Architects. 2014. Sithandatu avenue public space [online] http://www.nmassociates.co.za/about-us/partners/piet-louw-architects [accessed 29 March 2014]

Project for Public Space. 2013. What is a Great Civic Space? [online] http://www.pps.org/reference/benefits_public_spaces/ [accessed 22 March 2014]

Rudofsky, B. 1964. Architecture Without Architects. University of New MExico Press, Albuquerque

Sanchez, F. 2011. Significance of Public Space in the Fragmented City: Designing Strategies for Urban Opportunities in Informal Settlements of Buenos Aires City. Working Paper, World Institute for development and Economics Research

Schmidt, R., Eguchi, T., Austin, S. and Gibb, A. 2009. Adaptable futures: A 21st century challenge, In proceedings of the CIB Changing Roles: New Roles; New Challenges conference, Noordwijk, The Netherlands [online] http://adaptablefutures.com/wp-content/uploads/2011/11/Schmidt-et-al.-2009b.pdf [accessed 3 April 2014]

Simone, A. 2004. For the City yet to come: Changing life in four African Cities. Duke University Press, London

Søholt, H. 2004. Life, spaces and buildings – turning the traditional planning process upside down. Paper presented to Walk21-V Cities for People, The Fifth International Conference on Walking in the 21st Century, June 9-11 2004, Copenhagen, Denmark [online] http://www.walk21.com/papers/Copenhagen%2004%20Soholt%20Life%20spaces%20and%20buildings%20turning%20the%20t.pdf [accessed 18 April 2014]

Tovivich, S. 2009. Learning from informal practice: teh new professionalism for architectural practice. CEBE Transactions, Vol 6, Issue1, April 2009 pp 62-85

Vorley, B., Fearne, A., Ray, D. 2007. Regoverning Markets: A place for small scale producers in moder agrifood chains? Gower Publishing Ltd, England. pp. 77-80

Yegenoglu , H. 2004. The Power of informality. Paper presented at the International Research Conference 'Adequate and Affordable Housing for All' , Toronto [online] http://www.yegenoglu.com/Atricles/Paper%20Toronto%20def+images%20website.pdf [accessed 30 March 2014]

In accordance with Regulation 4(e) of the General Regulations(G.57) for dissertations and theses, I declare that this thesis, which i hereby submit for the degree Master of Architecture (Professional) at the University of Pretoria, is my own work and has not previously been submitted by me for a degree at this or any other tertiary institution.

I further state that no part of my thesis has already been or is currently being submitted for any such degree, diploma or other qualification.

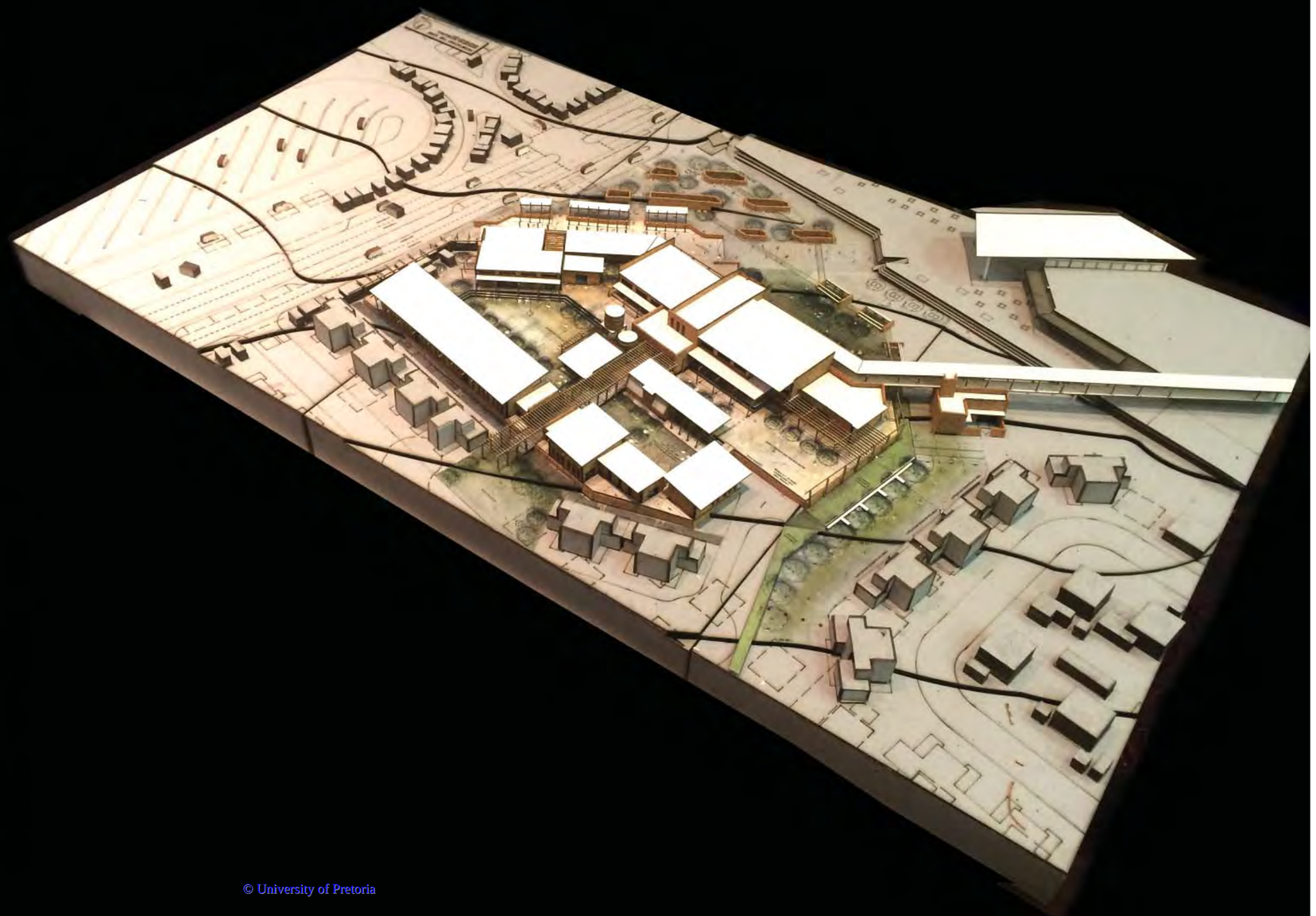
I further declare that this thesis is substantially my own work. Where reference is made to work of others, the extent to which that work has been used is indicated and fully acknowledged in the text and list of references,

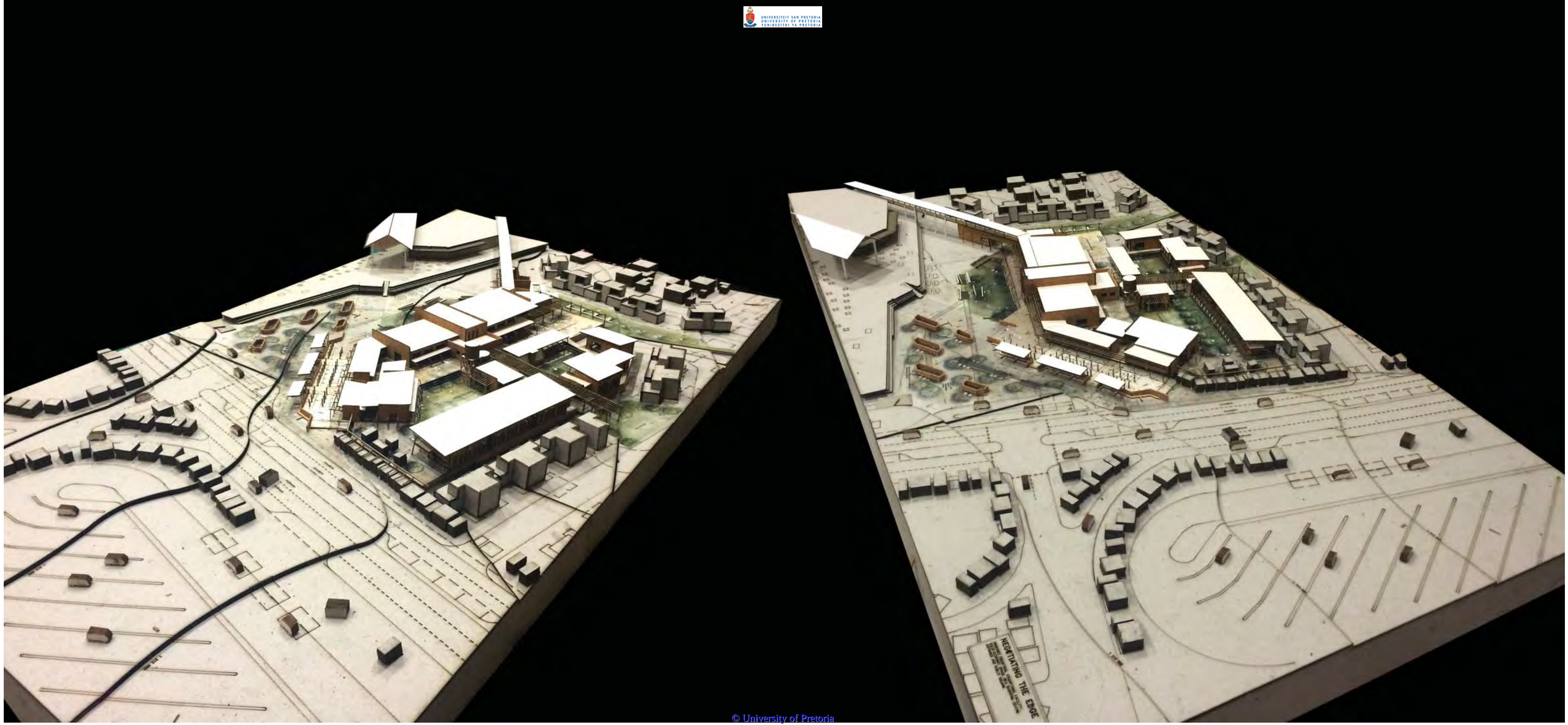
Eilunid Farmer
November 2014

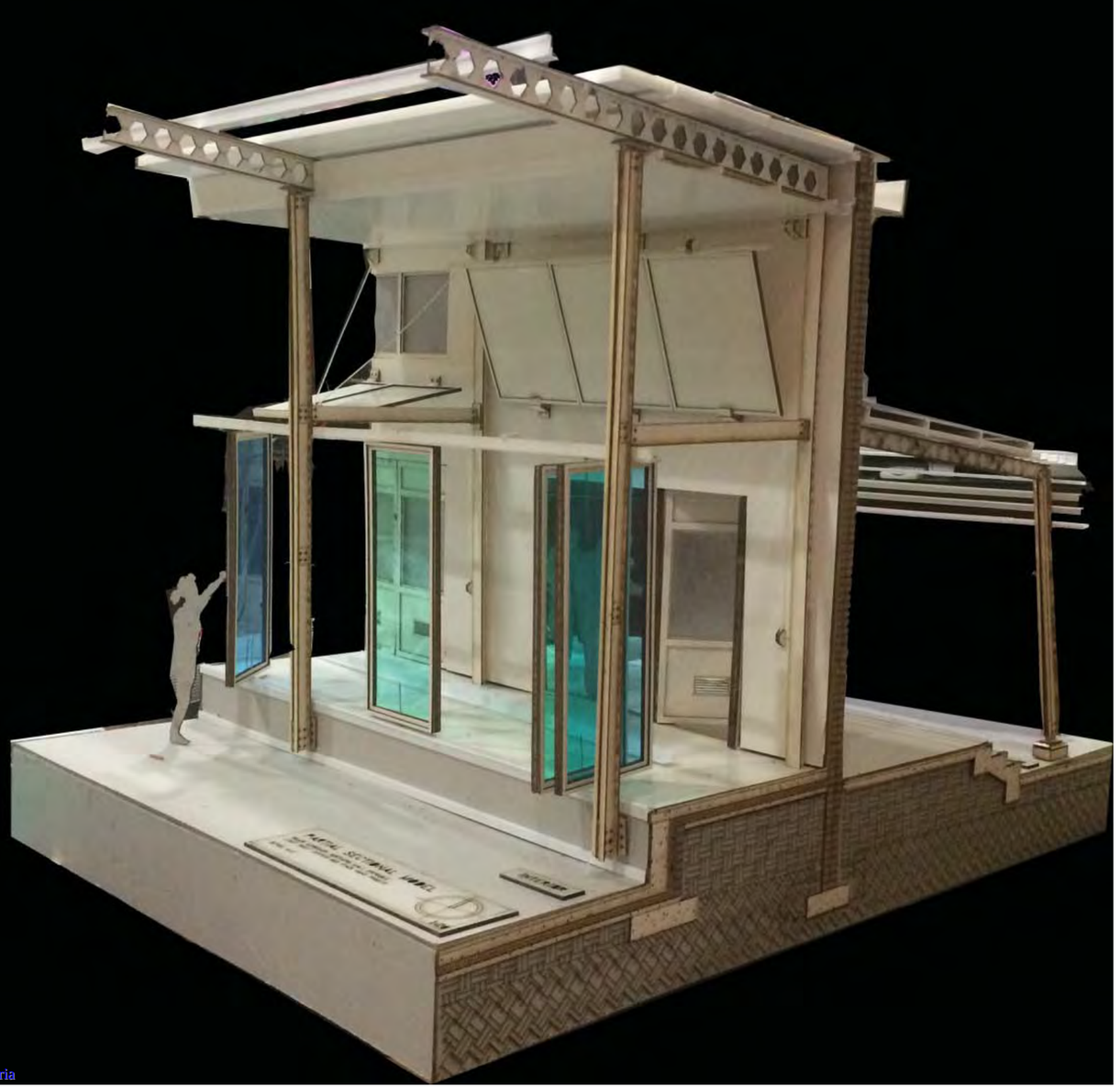
APPENDICES

APPENDIX A: FINAL MODELS
APPENDIX B: URBAN FRAMEWORK FOR MABOPANE AS PROPOSED BY THE MSDF
APPENDIX C: FEASIBILITY STUDY OF CENTRAL CITY MALL
APPENDIX D: THERMAL PROPERTIES OF RECYCLED MATERIALS AS INSULATION
APPENDIX E: FURTHER THERMAL INVESTIGATIONS
APPENDIX F: ETHNOGRAPHIC STUDY

A







B

City Planning and Regional Services Department of the Municipality of Tshwane proposed guidelines for the Mabopane region Urban Design Framework in June 2008. The relevant pages were extracted and can be foundin this appendix

Source: City Planning, Development and Regional Services Dept, City of Tshwane, 2008, pp. 181-184; 187-192

PD 17/16/2/1
André Du Plessis (012 358 9081)
MAYORAL COMMITTEE: 18 June 2008

8. CITY PLANNING, DEVELOPMENT AND REGIONAL SERVICES DEPARTMENT
(CITY PLANNING AND DEVELOPMENT DIVISION)
URBAN DESIGN FRAMEWORK FOR THE MABOPANE STATION
(From the Mayoral Committee Cluster: Infrastructure Development: 22 May 2008 and the Portfolio Committee: City Planning Development: 10 June 2008)

1. PURPOSE

The purpose of this report is to approve the Urban Design Framework for the area surrounding the Mabopane Station as to develop the station and surrounding areas into a sustainable, functional and accessible urban core. The Framework will also guide the development of the area towards an environment responsive to current needs and pressures. (Urban Design Framework attached as Annexure "D"). The framework was presented to the Mayoral Committee Cluster : Infrastructure Development on 28 November 2007 and it was decided that the report does not have to serve at the abovementioned committee but that it can directly serve at the Portfolio Committee : City Planning, Development and Regional Services.

2. STRATEGIC OBJECTIVES

Strategic objective 1: Provide quality basic services and infrastructure.
Contributions towards the upgrading of infrastructure will be payable by the developers of the various erven. The total area will be serviced as plans is made available for development.

Strategic objective 2: Accelerate higher and shared economic growth and development.
More business development will ensure more economic growth within the area.

Strategic objective 3: Fight poverty, build clean, healthy, safe and sustainable communities.
The proposed development will comply with all building and safety regulations. The development will create more job opportunities.

Strategic objective 4: Ensure good governance, financial viability and optimal institutional transformation with capacity to execute it's mandate.
The proposed development makes effective use of existing land and existing infrastructure.

3. BACKGROUND

In terms of the COT City Strategy Mabopane Station has been identified as one of the "Urban Cores" that needs to be developed into real city centres.

In terms of the City Strategy and the Metropolitan Spatial Development Framework, Urban Cores have been identified in mostly previously disadvantaged areas. Urban Cores have been identified as the strategic areas where the City should concentrate capital expenditure.

Due to funds being approved on the capital budget for public transport- and informal trade facilities at stations, the Department of Economic Development has played a leading role in the development of these nodes over the past two years. With the implementation of the MFMA from 2004/05 it is however not possible to proceed with most of these capital projects as no feasibility studies, transport studies, economic studies or EIA's can be done and paid for out of a specific transport project's capital budget. It is also not possible to appoint consultants to lodge township applications , draft service reports and conduct geological surveys necessary for township applications out of capital budgets. This is also not Economic Development's core business and should probably be done by other departments. The end result is that only limited amounts of the annual budget is being spent within the urban cores on inter modal facilities.

Urban cores in previously disadvantaged areas are not developing as planned, and not because of a lack of capital funds, but because of red tape and inadequate structures to ensure co-ordination between the various departments in Council dealing with large multidisciplinary capital projects.

Holm Jordaan Group was appointed by Intersite as Urban Designers on this project with a threefold task, to look at the area in a broader perspective and identify the issues as previously noted in other surveys and reports (in other words, to set the contextual framework) to create a vision in line with all of the strategies for Mabopane to develop into an Urban Core; and to kick start the development by designing a first phase for the proposed development. These three tasks correspond with the outcomes expected from this report: a contextual framework for Mabopane, a development framework and a Spatial Development Plan (for the informal trade area on the northwestern side).

Applicable Policies Or Plans

The City Development Strategy

One of the main focus areas of the City Development Strategy, as approved by Council in 2004, is the "Development of the North". The "North" is defined as the area within Tshwane that lies north of the Magaliesberg including the Mabopane area.

Metropolitan Spatial Development Framework

The MSDF, which in essence serves the manifestation of the City Vision and City Development Stategy through spatial representation, has two major focus areas namely, restructuring of the city and economic development and growth.

The purpose of the MSDF for the city is to provide a tool to integrate all aspects of spatial planning such as:

- Land use planning
- Planning of pedestrian, vehicular and other movement patterns
- Planning regarding buildings and built-up areas
- Planning of open plan systems
- Planning of roads and other service infrastructure such as public transport systems

Another objective is to guide all decision making processes regarding (physical) development.

In terms of the Metropolitan Spatial Development Framework, Urban Cores have been identified where activity nodes of metropolitan significance should be developed. The following cores were identified in previously disadvantaged areas:

- the area around the Eerste Fabrieke station between Mamelodi and Nellmapius;
- the area around the Saulsville station in Atteridgeville;
- the area around the Klip-Kruisfontein station;
- the area around the Mabopane station; and
- the area around the Hammanskraal Station.

In terms of the approved City Strategy and the Tshwane Spatial Development Strategy, these areas were also identified as Urban Cores. Urban Cores are activity nodes of metropolitan significance aimed at providing economic, social and residential opportunities in an integrated, vibrant, high-intensity, mixed-use and pedestrian friendly environment linked to public transport facilities and the highest level of accessibility.

The five urban core's role in the future is to be the focus and highest concentration of residential, commercial, social, cultural and other urban activities. Higher density residential development should be encouraged specifically in and around the Urban Cores. All three urban nodes as mentioned above have been developed to a certain extent.

Of the five Cores' the Mabopane / Soshanguve Core has been developed the furthest, mostly in terms of formal retail development. Existing infrastructure includes a large station, retail facilities of 45 000 m² which are currently being upgraded, a bus rank and a taxi rank. Major upgrading is however required in terms of the station, public transport-, informal trade-, recreation-, ablution-, and other communal facilities such as offices for Metro Police, Customer Care etc.

4. DISCUSSION/APPLICATION

4.1 Vision

The vision for the Mabopane Station development is to develop the station and surrounding areas into a sustainable, functional and accessible urban core that will:

- enable a commercial and community facility which will be
- integrated with current public transport, road infrastructure and
- pedestrian movement as well as
- the upgrade of the Mabopane Station Concourse and surrounding areas
- to function optimally as an intermodal facility,
- creating a development thrust that will support a mixed use of development,
- take the demands of the commuters into consideration,
- create an recognizable and celebrated African urban space for the area,
- ensure a safe and economically viable environment that

will realize the ideal for Mabopane as a world class Urban Core.

4.2 Scope

The scope of the report can be divided into three areas:

The contextual framework is concerned with:

- the greater area of the station,
- the status quo of the physical, socio-economic and institutional context.
- This part forms the basis for all the decisions and vision for the rest of the report.

The development framework is concerned with:

- Creating a vision for Mabopane as an Urban Core,
- identifying the issues and objectives that need to be addressed when developing Mabopane,
- making recommendations from an urban design point of view for the overall development of this area.
- This part will refine a development vision for the immediate station precinct.

The proposed site development plan is concerned with:

- implementing the objectives of the development vision,
- focusing on a specific area of the station itself, and
- showing on a more detailed level the first phase of the development vision,
- solving the most urgent needs and requirements for the station to function properly,
- making sure that the station can fulfill its role on the short term as well.

4.3 Locality (Annexure "A")

Mabopane Station is located approximately 40km north of the Pretoria CBD on the boundary between Mabopane and Soshanguve in the north-west area of COT. The station serves as the main transport link between Pretoria CBD, Mamelodi and Johannesburg and is one of the busiest stations in the country. According to CTMM between 120 000 and 150 000 commuters use the station on a daily basis.

5. ISSUES AND OBJECTIVES FOR FUTURE LANDUSES (Annexure "C")

5.1 Making Linkages

The success of a new development depends on how well the connections work. This is not only the functional performance thereof, but also how well they contribute to the quality and character of the urban area. In the case of Mabopane it is very important to create new linkages that will 'stitch together' the two residential areas of Soshanguve and Mabopane. This can only be done if the new linkages allow for easy and safe linkages from the eastern side to the west, and vice versa.

The way that these linkages are integrated into the greater area, must be well planned and coordinated with the greater development of this area. New linkages will help to develop the station into a true destination, and not a thoroughfare as it is currently used. The necessity of developing a new link outside of the station can also be used as an opportunity: the bridge can be used to accommodate some of the hawkers and thus create new trading opportunities.

Objectives:

- Create additional pedestrian linkages between eastern and western sides
- Use pedestrian and vehicle desire lines to structure routes
- Use linkages to connect eastern and western sides into one community
- Improve ease of pedestrian movement between different modes of transport
- Incorporate movement to and from retail centers in routes
- Make movement routes accessible to all users, including the handicapped

5.2 Improving Movement and Circulation

Circulation routes should give people the maximum choice in how to make their journeys, and be in favour of walking and public transport. The provision of a road networking this area should open up more land for development, but should still give the pedestrian preference. These roads should form part of the greater fabric of the surrounding residential area. Service roads and routes should be set out from the beginning to form the structure of future development.

Objectives:

- Provide pedestrian bridge to open up concourse for commuters
- Split pedestrian movement from vehicle movement

- Create pedestrian walkways with good ground surface for walking
- Make the subway connecting the concourse to shopping centre free of hawkers and safe for pedestrians.
- Provide safe routes over railway from east to west
- Provide traffic circle on K-route to enable easy entrance to new taxi ranks

- Relax 60m building line next to new taxi rank to 10m to open up more area for development
- Reduce road reserve dimension to discourage informal trading in this area
- Provide barriers so that dangerous pedestrian movement over the roads are discouraged

5.3 Ensuring Accessibility

The raison d'etre of the urban core is its function as a modal interchange, thus a destination and thoroughfare. It should be the place of highest accessibility, specifically via public transport, the place where a variety of transport systems converge: rail, taxis, buses and private vehicles. Through this function, it will attract masses of people and thus holds potential for intense development. This can only be achieved if the area is accessible for all users, including the handicapped.

Objectives:

- Make station accessible for handicapped users
- Provide alternative entrances into concourse
- Clear concourse of informal traders
- Provide infrastructure to support all modes of transport
- Provide more than one route over the roads to connect eastern and western sides
- Ensure that future development keep the pedestrian routes as structuring element

5.4 Creating Mixed Uses and Activities (Annexure "C")

Because of its accessibility, Mabopane Station is ideally suited to fulfill a number of needs through concentration o f activities. It should thus serve as a commercial hub by concentrating a variety of commercial functions and creating an economy of scale. It should also function as a service centre, addressing a number of social needs. In order to fully capitalize on the accessibility advantage of an urban core, it should contain a sizable high-density housing component in an appropriate location to achieve a 24 hour city activity patterns.

Objectives:

- Provide areas where formalized urban activities can take place (events, concerts)
- Provide enough lighting to encourage 24hour use
- Provide play areas for children
- Provide areas for activities relating to businesses (eating areas, waiting areas)
- Develop areas for housing (high density)
- Provide opportunities for private investment
- Provide social service facilities
- Formalize activities by providing sufficient infrastructure

5.5 Introducing Place Making Elements

A sense of place is created by a hierarchical system of hard public spaces and responding to the cultural and natural contexts of the site. The sense of place of an area should strengthen the local identity, and create an area that is recognizably distinct. The vision of developing Mabopane Station into an Urban Core is closely linked to the idea of creating a distinct sense of place, and this is exactly what place making elements should introduce. The area should become highly recognizable, and the 'new face' of this area.

Objectives:

- Develop Mabopane as public face of the area
- Create an exciting place with place making elements
- Place 'iconic' objects in open areas to establish identity
- Put objects at visible places to create vistas and sightlines
- Create places of arrival and departure
- Use and create civic identity of broader area

5.6 Conserving the Natural Environment

The natural environment at Mabopane is not very good. In response to this situation there must be consideration in the development to re-create such a condition. These areas must be accessible to the community and multifunctional. Involvement from the community itself must form part of the design and development of these areas, and the community must accept 'responsibility' for these areas. The design of these areas must be done in such a way that it can be self-sufficient, and do not require high maintenance.

Objectives:

- Stakeout the public places and facilitate development to support and sustain these spaces
- Create an open green network of spaces in the over all development
- Re-introduce natural elements in open space development
- Use tree grid to soften impact of open spaces
- Use green elements to integrate and differentiate between spaces and uses
- Leave areas open where users can interact with nature
- Make provision for natural environment in all development packages

5.7 Developing Land Parcels

Large developments often limit pedestrian connectivity through an area. Irrespective of the size of the development, regular pedestrian through routes should be created to a similar scale as the surrounding street network. These land parcels should include certain community services that the future developer must provide. All retail above 4000m² must submit a retail study. The phasing of the development of these parcels as well the interface between different areas should be receiving careful consideration.

Objectives:

- Land parcels should have mixed uses
- Appropriate land release strategy
- Create different sizes and uses of land parcels
- Make sure that social structure is part of future development

5.8 Creating Partnership Opportunities

In opening up the area for development, care must be given to design it in such a way as to create opportunities for partnerships. This can be done in phasing the development and identifying partners that would be interested in being part of the process right from the start.

Objectives:

- Create development phases to facilitate new development
- Make investment opportunities attractive for investors
- Use movement routes to open up land for partnership developments
- Provide infrastructure to attract partnership development opportunities

5.9 Creating Private Sector Investment Opportunities

Part of the partnership opportunities should focus on private sector investment opportunities. This will help to make the development as (financially) independent as possible. Private investors should partake in the greater contribution to the community as well, and provision should be made for certain public contributions (either in terms of infrastructure of facilities). The overall 'beautification' and the creation of a safer environment will also attract more investors.

Objectives:

- Create areas for private sector investment that will supplement the urban fabric of Mabopane Station
- Design the mixed uses areas to attract private investments
- Advertisements should also be used as place making elements
- Providing public amenities must form part of investment of the public sector

5.10 Ensuring Sustainable Development

As described in the Urban Cores, sustainability refers to economic viability and adaptability and protection of natural systems. In order to achieve sustainability high density residential must be placed within walking distance from the core. This will allow more people easy access to facilities and public transport. Slightly higher densities can be achieved through a rich mixture of housing types from single family homes to duplexes, bungalows to row houses, townhouses to apartments.

Objectives:

- Create high density housing in vicinity of Mabopane Station
- Development should cater for the movement of pedestrians
- Development must be adaptable for future changes in demand
- Provision must be made for densification over time

5.11 Planning for Future Extensions

The development should allow for extension, and should be designed in such a way that the phasing is logical. The correct phasing of the future development is very important. Future extensions should not only take the existing development into consideration, but be visionary for possible changes that may occur in the demand of development.

Objectives:

- Development should allow for densification over time
- Development should be adaptable over time
- Each extension should be part of greater area, and not an 'island' onto itself
- Development should be in line with greater vision for area

5.12 Creating Opportunities For Growth

On the level of the urban core, public transport facilities act as magnets, thereby generating activity and movement which stimulates economic activities. This additional function of public transport should be used to structure the urban core to increase the economic potential of the area and thereby adding to its sustainability. Furthermore, in order to achieve sustainability facilities should be designed to accommodate different users and functions, and must be able to adapt to future changes in transport modes.

Objectives:

- Create infrastructure that will support current uses and help to develop informal economy into formal economy
- Make use of pedestrian routes to stimulate growth, and not hinder it
- Develop area in such a way as to have a big effect, but small impact

5.13 Planning for Community Development

Social facilities form part of the public infrastructure and can be used to create a certain image for an area. They should be designed as a 'capital web' and as such are guiding elements for future development. Their strategic and prominent placing is thus crucial. Social facilities should be placed according to their locational needs with regards to visibility, accessibility via public transport and by foot and privacy. Special attention should be given to the old, the young and the handicapped as these groups are frequent users of social facilities.

Objectives:

- Expose public facilities by placing them in strategic positions
- Access for handicapped Right-sizing
- Coherent design features
- Arrange social facilities around public spaces
- Must form part of investment parcels of private developments

5.14 Ensuring a Safe Environment

Safety can be improved through land use management by ensuring that an area is used all hours of the day, the so-called 24 hour city and that surveillance is possible. Natural surveillance deals with users of a space observing possible crimes. It is achieved by activities and entrances that are placed on the street. Provide sufficient lighting to make area safe in the night.

Objectives:

- Territoriality
- Natural surveillance
- Activity support
- Lighting

6. COMMUNITY PARTICIPATION

It needs to be reported that the Mabopane Development Forum had been scheduled to take place quarterly during the year 2007. The quarterly meeting dates are as follows:

25-04-2007 / 18-07-2007 / 10-10-2007 / 05-12-2007
The critical points contained in the Agenda at each of these meetings were

- Informal Traders issues,
- Safety and Security,
- Progress with regard to the construction projects within Mabopane.

Informal traders, taxi association and delay in Taxi construction project

At the Development Forum meeting of 18-07-2007, a technical report on the Mabopane taxi rank construction was presented There were concerns raised by the Forum that the taxi association and informal traders need to cooperate to enable the contractor to work on the taxi construction project. Special meetings were convened with the Informal Traders and taxi associations and the two bodies eventually cooperated to vacate their respective sites to enable the contractor to operate.

The taxi rank construction project and access road engaged the Community Liaison Officers from wards number 19 and 12 respectively. The critical areas of concern raised against the taxi rank contractors were that there should be specific statistics reported on labour forecast. The slow progress on the taxi construction prompted the

C

A study was conducted by Demacon in 2010 to determine the feasibility of the extension of Central City Mall and the possible effect on the settlement of Mabopane. Relevant information was extracted and can be found in this appendix.

Source: Demacon Market Studies, 2010, pp. 121-128

Table 7.2: Existing Supply Within 10km from Central City

Centre	Location	Size (m^2GLA)	Classification	Developed	Shops	Anchors
Central City Shopping Centre	Mabopane	49 175.0	Minor regional centre	1986	96	Shoprite, Score Supermarket, Clicks
Mabopane Sun Plaza	Mabopane	3 000.0	Local convenience centre	1999	15	Spar, Medical Centre
Soshanguve Plaza	Soshanguve	19 161.8	Community centre	2006	57	Shoprite
Total		71 336.8				

Source: Demacon Ex. SACSC, 2010

- ✓ There are two other retail centres within a 10km radius of Central City.
- ✓ One is located in Johannesburg and the other in Soshanguve.
- ✓ These represent one community and one local convenience centre.
- ✓ The sizes of the centres vary between 3 000m^2 retail GLA and 19 161.8m^2 retail GLA.
- ✓ The centres excluding Central City constitute a total of 22 161.8m^2 of retail GLA.
- ✓ Only one of these centres was developed post 2000.
- ✓ Anchors include Shoprite, Score Supermarket and Clicks.

Three other centres are located within 15km of Central City. Two of these centres are located in Ga-Rankuwa (a community and neighbourhood centre) and one in Rosslyn (neighbourhood centre).

Overall, Central City is located in a market area characterised by low levels of supply, with no direct effective competitive supply of similar scale or nature.

7.3 CONSUMER MARKET PROFILE

In order to understand the consumer market profile of Central City, a 10km trade area was delineated – Refer to Map 7.2. Subsequent paragraphs highlight the dominant characteristics of the primary trade area population, in terms of:

- ✓ Population size;
- ✓ Racial profile;
- ✓ Age profile;
- ✓ Level of education;
- ✓ Employment status;
- ✓ Occupation profile and manner of employment;
- ✓ Average annual household income;
- ✓ Mode of transport;
- ✓ Dwelling type.

Map 7.2: Central City Primary Trade Area Delineation, 10km Radius

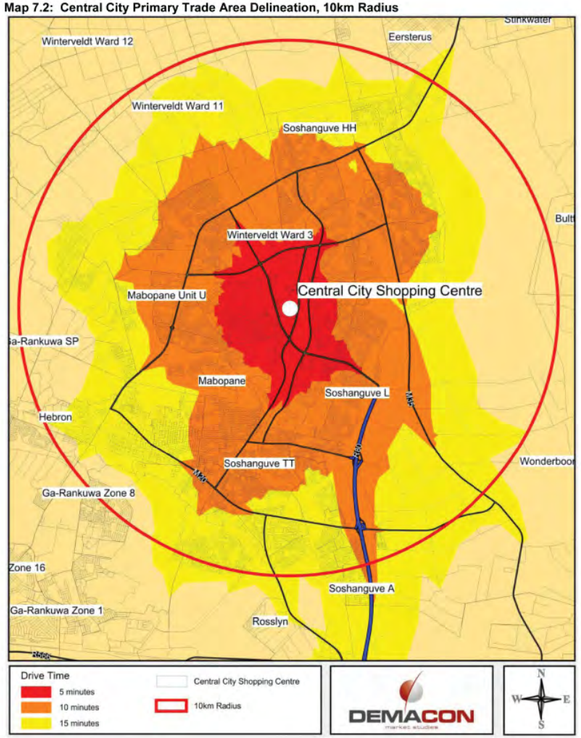


Table 7.3: Consumer Market Profile, 2010 Estimates

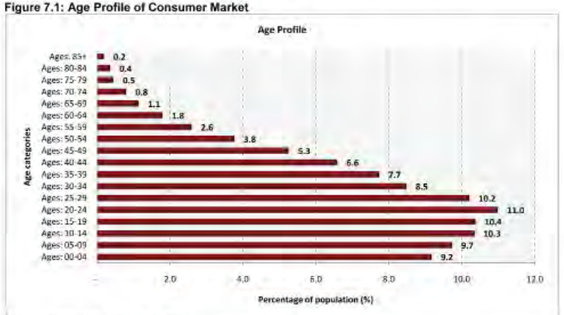
Variable	Primary Source Market Characteristics
Number of people	✓ 657 096
Number of households	✓ 184 979
Household size	✓ 3.5
Household density	✓ 1 182.9 households/km^2
Racial distribution	✓ African blacks – 98.9% ✓ White – 0.9% ✓ Coloureds – 0.2% ✓ Asian – 0.0%
Age profile	✓ 0-14: 29.3% ✓ 15-19: 10.4% ✓ 21-35: 29.7% ✓ 36-65: 27.7% ✓ 65+: 2.9%
Educational attendance (aged 5 to 24 years)	✓ School: 62.6% ✓ None: 27.7% ✓ Pre-school: 3.6% ✓ Technikon: 3.2% ✓ Other: 2.9%
Highest level of education (aged 20 and older)	✓ Higher: 7.0% ✓ Grade 12: 24.3% ✓ Some secondary: 33.5% ✓ Some primary and primary: 22.0% ✓ None: 13.2%
Level of employment	✓ EAP: 64.3% ✓ Employed: 53.5% ✓ Unemployed: 46.5%
Manner of employment	✓ Paid employees: 90.6% ✓ Self-employed: 8.3% ✓ Family worker: 0.7% ✓ Employer: 0.3%
Occupation profile	✓ Elementary occupations: 26.8% ✓ Craft and related trade: 17.0% ✓ Service workers: 13.9% ✓ Clerks: 12.5% ✓ Plant and machine operators and assemblers: 11.1% ✓ Technicians and associate professionals: 10.0% ✓ Professionals: 4.5% ✓ Legislators, senior officials and managers: 3.2%
Weighted average[67] household income	Total market earning an income: ✓ R68 408.2/annum ✓ R5 700.7/month LSM 4 to 10+: ✓ R89 855.8/annum ✓ R7 488.0/month
LSM profile	✓ LSM 1-3: 43.8% ✓ LSM 4-10+: 56.2%
Mode of transport	✓ On Foot: 47.2% ✓ Bus: 16.0% ✓ Mini-bus: 15.6% ✓ Train: 11.9% ✓ Private vehicle: 8.3%
Dwelling type	✓ House on separate stand: 54.5% ✓ Informal dwelling on separate stands: 31.0% ✓ Informal dwelling in backyard: 4.6% ✓ Living quarters: 4.3% ✓ House/flat/room in backyard: 2.5%

Source: Demacon Ex. Quantec, 2010

[67] Note: Weighted average is an average of multiple values produced by assigning a weight to each value, multiplying each value by its weight, and then adding the results.

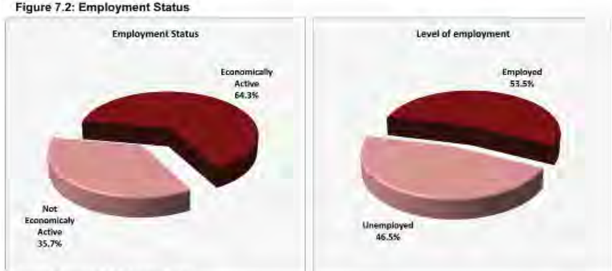
Subsequent figures highlight some of the salient features of the consumer market.

Figure 7.1: Age Profile of Consumer Market



Source: Demacon Ex. Quantec, 2010

Figure 7.2: Employment Status



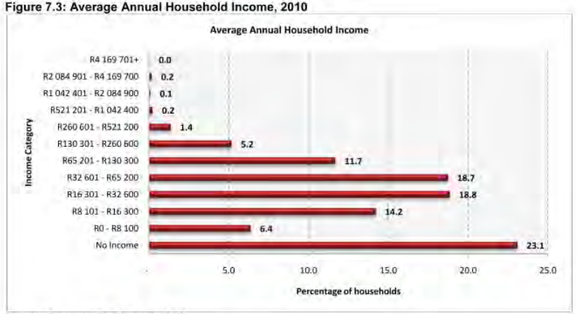
Source: Demacon Ex. Quantec, 2010

Table 7.4: Living Standard Measurement Indicator, 2010

Income category (R/month)	LSM Status	Market Area
Super A income	LSM 10+	1.3
A Income	LSM 10	0.5
B Income	LSM 9	3.6
C Income high	LSM 8	1.6
C Income low	LSM 7	9.3
D Income	LSM 6	13.6
D Lower top	LSM 4 to 5	26.3
D lower end	LSM 1 to 3	43.6

Source: Demacon Ex. Quantec, 2010

Figure 7.3: Average Annual Household Income, 2010



Source: Demacon Ex. Quantec, 2010

Overall the primary consumer market profile reveals the following pertinent characteristics:

- ✓ At least **184 979** households (2010);
- ✓ Largely an African black consumer market;
- ✓ Relatively large young and upcoming market segment, supported by more mature adult segment and large youth component;
- ✓ Less sophisticated consumer market characterised by relatively low levels of education;
- ✓ Relatively large economically active market segment, characterised by moderate levels of employment – reflecting moderately high dependency ratios;
- ✓ Occupation profile reflects a dominance of blue collar occupations – serving as a proxy for a lower to middle income consumer market characterised by pockets of wealth and poverty;
- ✓ Weighted average monthly household income of target market (LSM 4 to 10+) approximately **R7 488.0** (2010);
- ✓ Moderate living standard levels – **LSM 1 to 3 (43.8%); LSM 4 to 10+ (56.2%)**;
- ✓ A number of factors contribute to the general property development climate in a specific geographical area. Thesocio-economic factors that provide an initial indication of market potential are levels of education, level of employment, income and standards of living. These factors combined reflect a consumer market with a demand predominantly focused towards the middle to lower end of the upper spectrum of commercial products and services.

In order to examine the impact that the development of Central City had on the local community, proportionally stratified household surveys were conducted within the 10km radius. Subsequent paragraphs highlight the findings of these surveys.

7.4 IMPACT OF THE DEVELOPMENT OF CENTRAL CITY

Household surveys were conducted within the 10km trade radius in order to assess past and current consumer behaviour using the development of Central City as reference point. They also look at current levels of satisfaction, perceived demands pertaining to future extensions and preferences pertaining thereto. Overall, these findings show the overall impact that the centre had on the local community and their consumer behaviour.

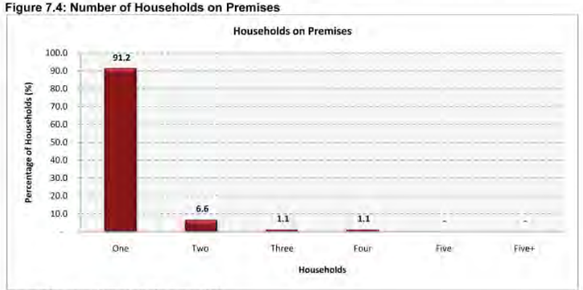
The findings of these surveys are addressed under the subsequent main headings:

- ✓ Household information;
- ✓ Past consumer behaviour;
- ✓ Current consumer behaviour;
- ✓ Frequency of visits and dwell time;
- ✓ Level of satisfaction;
- ✓ Need to expand Central City;
- ✓ Overall impact of the development of Central City;
- ✓ Living standard and average annual income.

7.4.1 HOUSEHOLD INFORMATION

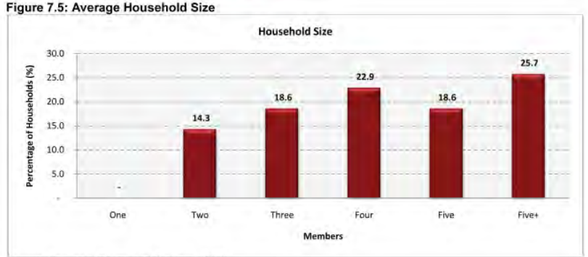
In terms of household information the following were addressed: number of households on premises, average household size, current life stage, age profile of household members, family member mainly responsible for conducting retail purchases, mode of transport, number of breadwinners and suburb of employment.

Figure 7.4: Number of Households on Premises



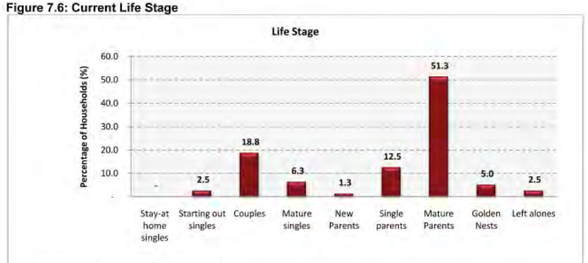
Source: Demacon Household Surveys, 2009

Figure 7.5: Average Household Size



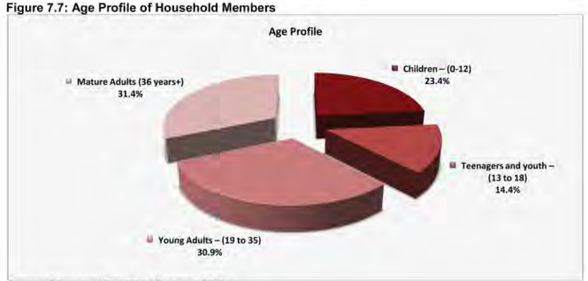
Source: Demacon Household Surveys, 2009

Figure 7.6: Current Life Stage



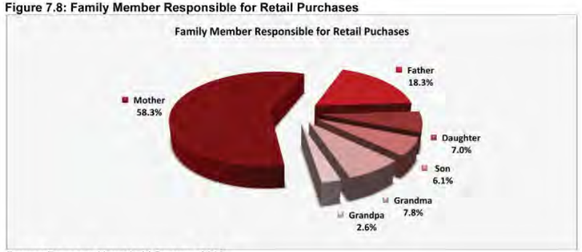
Source: Demacon Household Surveys, 2009

Figure 7.7: Age Profile of Household Members



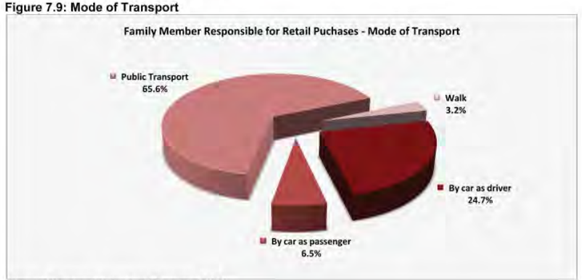
Source: Demacon Household Surveys, 2009

Figure 7.8: Family Member Responsible for Retail Purchases



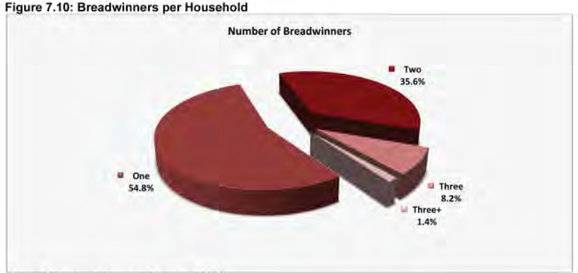
Source: Demacon Household Surveys, 2009

Figure 7.9: Mode of Transport



Source: Demacon Household Surveys, 2009

Figure 7.10: Breadwinners per Household



Source: Demacon Household Surveys, 2009

D

Reserach during the Honours Programme at the University of Pretoria conducted by the Author in 2013 (Module : RFS 704) on improving the current wall system (timber-metal and concrete block) used in informal settlements.

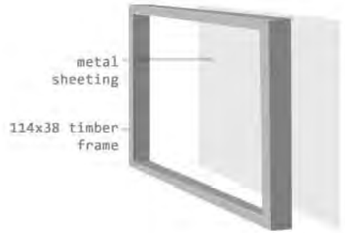
The relevant information was extracted and can be found in this appendix. The main source of thermal properties of the recycled material as a unit was conducted by Clarke (2005).

TIMBER PANELS

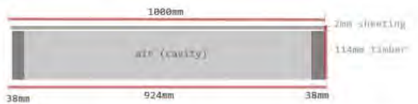
produced on site

a minimum R-value for external non-masonry walls
must be 1.9 (SANS 204 Table 3)

current building standard in community
114x38mm timber frame (20.8kg/m @ 1m spacing) 0.14W/mK
2mm thick metal sheeting (6.5kg/sqm) 0.03W/mK
cost: R50/sqm (Alaska manufacturer)



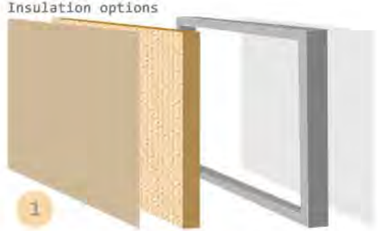
R value of entire frame:



$$R = R_{i\,(\text{interior air film})} + R_{S\,(\text{sheeting})} + \left[\frac{A_C\,(\text{area of air})}{R_D\,(\text{air width/conductivity})} + \frac{A_W\,(\text{timber area})}{R_W\,(\text{timber width/conductivity})}\right]^{-1} + R_{O\,(\text{outside air film})}$$

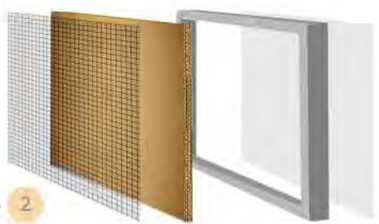
$= 0.216 \ \text{m}^2\text{K/W}$

Insulation options



1

100mm commercial extruded polystyrene
- isoboard
Total R-Value = 3.69 m²K/W



2

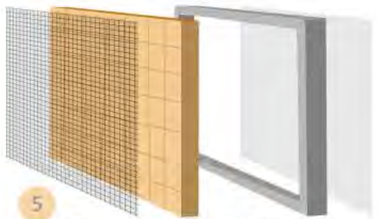
100 mm cardboard with interior layer
painted white
Total R-Value = 1.564 m²K/W

3

100 mm scrunched up plastic bags
with wire mesh covering
Total R-Value = 1.93 m²K/W

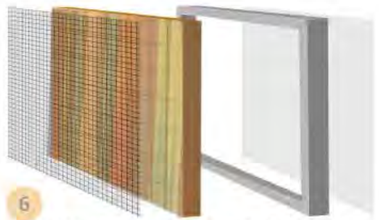
4

100mm scrunched up newspaper
with wire mesh coverinig
Total R-Value = 1.96 m²K/W



5

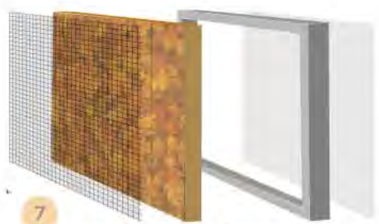
60mm cardboard based packaging
(juice.milk containers etc) with
wire mesh covering
Total R-Value = 1.243 m²K/W



6

100 mm rags with wire mesh covering
as support
Total R-Value = 2.438 m²K/W

possible problems to consider:
fire hazard
decomposition of insulation
inappropriate use of resource
inability to secure in vertical position



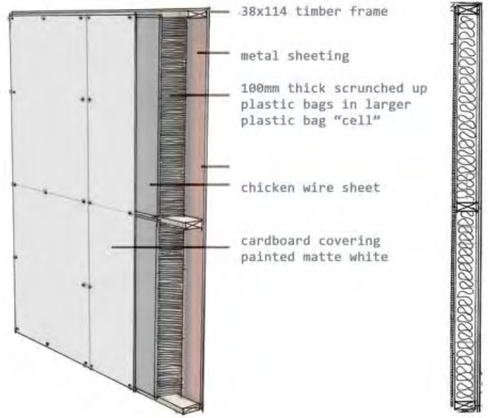
7

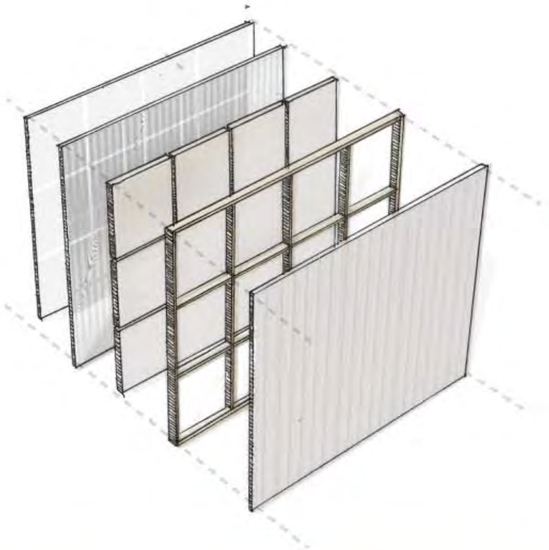
100 mm leaves in layers covered
with wire mesh

material	density	conductivity	weight/m2	cost	availability	ratio
	kg/m	W/mK	100mm thick	1(free)-2(buy)	1-5(rare)	
commercial isoboard	36	0.024	3.6	2	5	0.864
rags	115	0.044	11.5	1	4	2.024
leaves	64.25	0.057	6.425	1	1	0.366225
plastic bags	13.5	0.094	1.35	1	1	0.1269
newspaper	34.75	0.065	3.475	1	1	0.225875
cardboard	70	0.08	7	1	2	1.12
	60mm thick					
juice boxes	32.2972	0.101	0.775	free	3	0.234825

setting up parameters
lowest cost, lowest
U-value, most readily
available

the ratio was achieved
by multiplying the
conductivity, weight,
cost scale and
availability scale





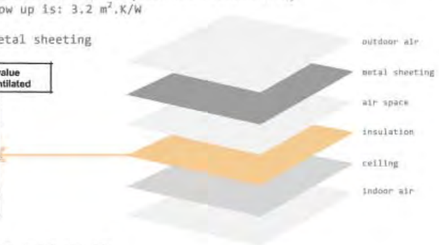
ROOF STRUCTURE

commercial materials available

current building practices in the area do not allow for insulated roofs, is the largest building area exposed to the elements, puting it at risk for heat gain and loss
- minimum R-values of roof assemblies for zone 2 (SANS 204 Ection 4.3.6)
  with the direction of heat flow up is: 3.2 m^2.K/W

typical r-values of roof with metal sheeting
table 3

Component	*R*-value unventilated
	Up
Outdoor air film (7 m/s)	0,03
Metal cladding	0
Roof air space (non-reflective)	0,18
Plasterboard, gypsum (10 mm, 880 kg/m^3)	0,06
Indoor air film (still air)	0,11
Total *R*-value	0,38



requires insulation material that would provide
R-Value of 2.82 or more
From the analysis of alternative insulation it was determined that plastic have the lowest weight-u-value ratio making it a more suitable roof insulation material.
Rtotal > 3.2
R > 0.03 + 0 + (dx/0.094) + 0.06 + 0.11
3 > dx/0.094
dx > 95.75
Thus 100mm of plastic bags is required

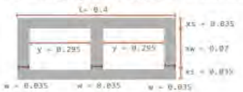
plastic

paper

CONCRETE BLOCK WALL SYSTEM

external masonry walls must achieve a minimum U-Value of 0.35

Determining the R-Value of a concrete block



$$R_b = R_{si} + R_{se} + \left[\frac{A_c}{R_{ic}} + \frac{A_w}{R_{iw}}\right]^{-1} + R_{si} + R_{se}$$

where A_c = percentage of cross sectional area not taken by webs expressed as a decimal number $2\,y/L$

A_w = percentage of web cross sectional area expressed as a decimal number $1 - (2\,y/L)$

The thermal resistance terms are obtained or calculated as follows:

R_{si} and R_{se} are literature values

$R_{ic} = \frac{X_{fs}}{\lambda_c}$

where X_{fs} = thickness of face shell

λ_c = apparent thermal conductivity of concrete

$R_{iw} = \frac{X_w}{\lambda_c}$

where X_w = thickness of core-web

λ_c = apparent thermal conductivity

$R_w = \frac{X_w}{\lambda_c}$

Cost: R5 per block = R62.50 / sqm

current building practice = single skin, unisulated, rarelyplastered, sometimes painted

according to the amount of cement and aggregate used, it could be determined that the resulatnt concrete mix is less than 15MPa in strength with a known R-value of 1.1 m.K/W

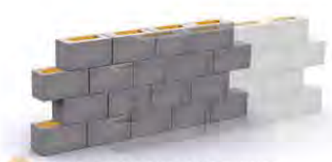
Rbody = Rblock + di/ki
= 0.051 + 0
= 0.051 m²K/W

Rtotal = Ri(air film) + Rbody + Ro(air film)
= 0.12 + 0.051 + 0.03
= 0.201 m²K/W

U = 1/R = 1/0.201 = 4.13 W/m²K

Options for improvement:

1 single / double skin wall, plaster and paint on one side



2 single / double skin wall insulation in block cores (plastic)

3 single / double skin wall insulation on inside (50mm plastic + 15mm cardboard)

4 single/ double skin wall, plaster painted on both sides

5 cavity wall, 50mm plastic bag insulation in cavity

6 commercial cavity brick wall with 20mm EPS

setting up parameters lowest cost, lowest U-value, provide for light interior, durability, thinnest construction (space efficient)

The ratio was found by multiplying the cost, U-Value and thickness.the assembly with the lowest score (R-value above 0.35) is the most appropriate

results

assembly	variable	cost block/sqm	cost variable/sqm	cost total	R-Value	U-Value	space efficency thickness	*Ratio*	lag (hrs)
single skin									
plain		62.5	0	62.5	0.201	4.98	140	*43532*	3.6
plaster one side		62.5	R 11.40	73.9	0.226	4.42	155	*50684*	4.27
plaster both sides		62.5	R 22.80	85.3	0.251	3.98	170	*57773*	4.91
filled cores		62.5	FREE	62.5	0.619	1.62	140	*14136*	5.57
	plaster	62.5	R 11.40	73.9	0.644	1.55	155	*17786*	5.82
	plaster both	62.5	R 22.80	85.3	0.669	1.49	170	*21676*	6.24
interior insulation		62.5	FREE	62.5	0.804	1.24	205	*15936*	5.57
	plaster	62.5	R 11.40	73.9	0.829	1.21	215	*19166*	6
double skin									
plain		125	0	125	0.334	2.99	280	*104790*	9.31
plaster one side		125	R 11.40	136.4	0.358	2.79	195	*74296*	9.92
plaster both sides		125	R 22.80	147.8	0.384	2.60	310	*119318*	10.55
filled cores		125	FREE	125	1.088	0.92	280	*32169*	11.17
	plaster	125	R 11.40	136.4	1.113	0.90	295	*36153*	11.42
	plaster both	125	R 22.80	147.8	1.138	0.88	310	*40262*	11.83
cavity insulation		125	FREE	125	0.784	1.28	330	*52615*	10.9
	plaster	125	R 11.40	136.4	0.809	1.24	345	*58168*	11.18
	plaster both	125	R 22.80	147.8	0.834	1.20	360	*63799*	11.61
interior insulation		125	FREE	125	0.935	1.07	345	*46123*	11.18
	plaster	125	R 11.40	136.4	0.962	1.04	360	*51044*	11.61
commercial brick									
double skin	plain	153	0	153	0.21	4.7	230	*165393*	7.51
	plaster	153	R 11.40	164.4	0.28	3.53	245	*142181*	8.06
	plaster both	153	R 22.80	175.8	0.35	2.86	260	*130725*	8.52
	20 mm EPS	153	R 52.80	205.8	0.65	1.54	280	*88741*	9.33

comparison

E

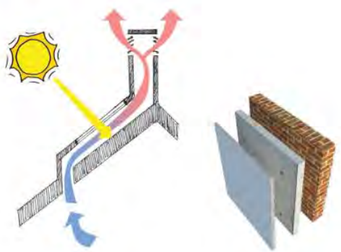
Further thermal investigations were conducted to explore various options available to effectively heat and cool the space.

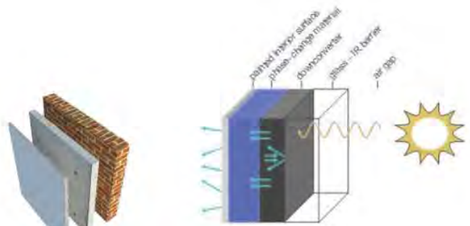
(Author, 2014)

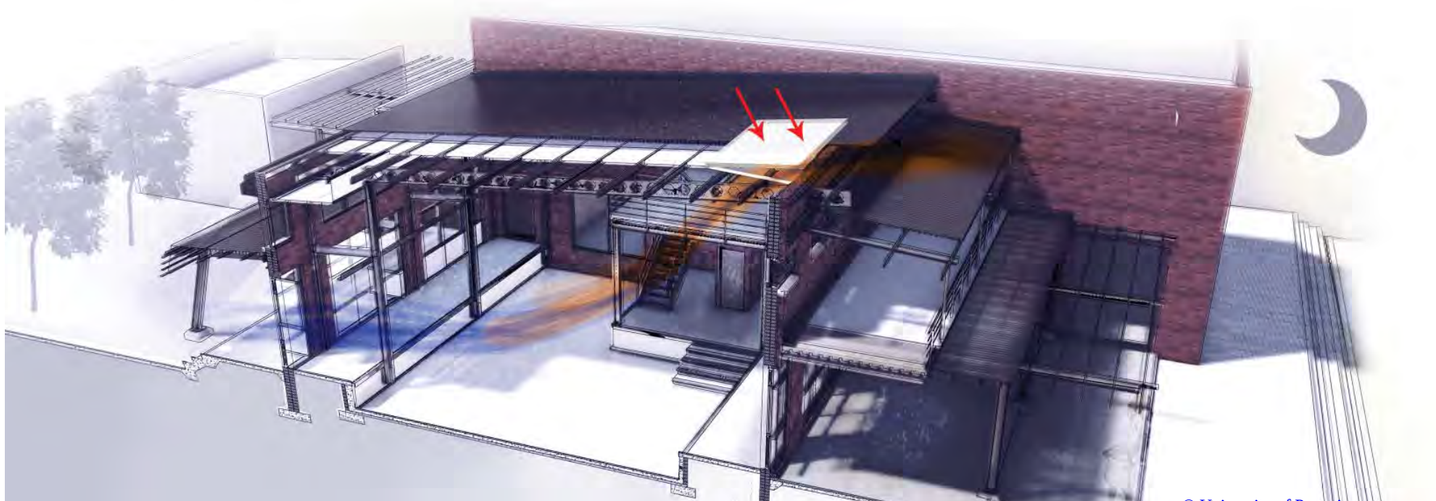
placement strategy

Bernoulli's principle, uses wind speed differences to move air. It is a general principle of fluid dynamics, saying that the faster air moves, the lower its pressure. Architecturally speaking, outdoor air farther from the ground is less obstructed, so it moves faster than lower air, and thus has lower pressure. This lower pressure can help suck fresh air through the building. A building's surroundings can greatly affect this strategy, by causing more or less obstruction.

The advantage of Bernoulli's principle over the stack effect is that it multiplies the effectiveness of wind ventilation. The advantage of stack ventilation over Bernoulli's principle is that it does not need wind: it works just as well on still, breezeless days when it may be most needed. In many cases, designing for one effectively designs for both, but some strategies can be employed to emphasize one or the other. For instance, a simple chimney optimizes for the stack effect, while wind scoops optimize for Bernoulli's principle.







assembly

the addition of a phase change material

feasibility

The advantage of using this system is evident, but only effective when the window below is kept closed (system might short circuit).

The impact on the interior comfort levels is so small when simulated, but the system has an advantage: if the building does not function as expected, it could be retrofitted to assist in moderating the interior climate from the cooler months to the hotter months.

intention

Thermal mass radiates heat during the night time and using natural ventilation as a driver, the heat is removed from the building.
During winds till nights, this becomes less effective, thus a trombe wall could assist in this movement

Active time: night, since the phase change material delays the time at which the heat is reradiated into the space and aids in night ventilation.

TROMBE WALL

sizing

Site Information and Constants		
Installation Address:	Pretoria: Mabopane	
P_a	Barometric air pressure in millibar (mb) at height above sea level of installation site.	1213.00
	Millibar converted to Hectopascal (N/m^2): x 102	123726
R_g	Specific gas constant for air (J/Kg˚K)	287.00
T	0˚ Celcius in Kelvin: 0 + 273 = 273 (˚ K)	273.00
μ_a	Viscosity of air at 25 ˚C (Ns/m^2)	0.00001862
ρ_a	Density of air in Kg/m^3	1.579124708

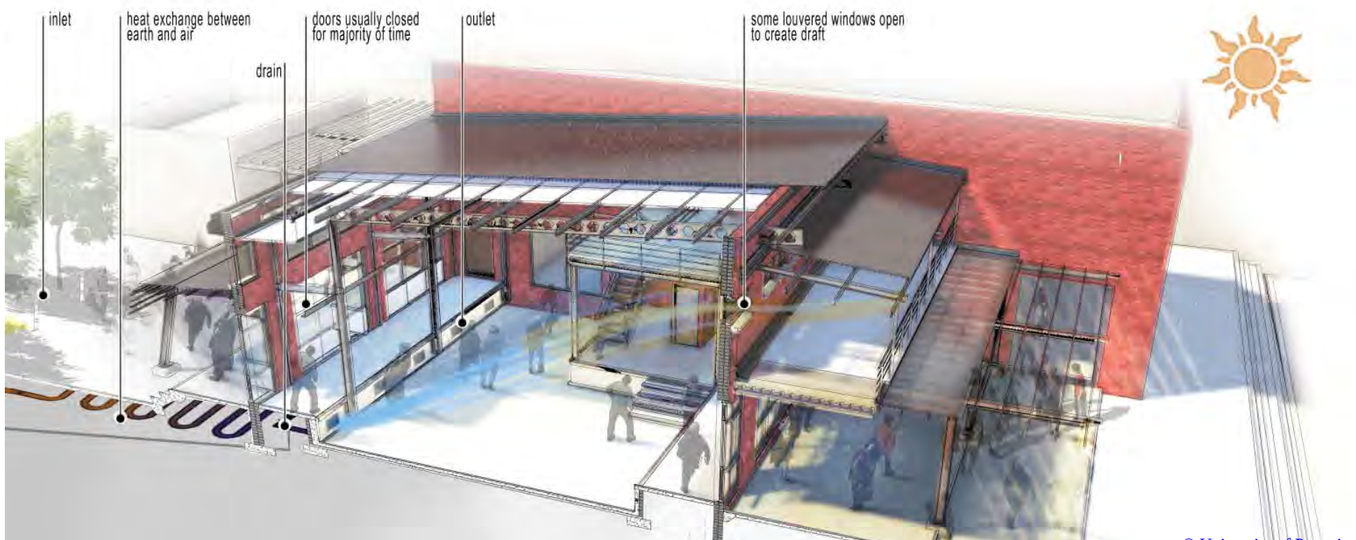
Temperatures		
e	Constant	2.71828
T_a	Ambient air temperature outside tube. (˚C)	35
T_g	Ground temperature at 3 metres depth (˚C)	19
T_x	Air tempurature (˚C) in tube at a distance x from inlet. *(This is the desired indoor air temperature)*	25
Tnr	Temperature number. (Dimensionless number)	0.375

Required Air Change Rate Calculations		
$Q_R = n \times V$		
n	Air Change Rates	15
V	Volume to be ventilated in m^3	2041.25
Q_R	Air Flow Rate Required in m^3	30618.75

No.	D_h metres	x: pipe length metres
10	0.1	842.08
20	0.2	421.04
30	0.3	280.69
40	0.4	210.52
50	0.5	168.42
60	0.6	140.35
70	0.7	120.30

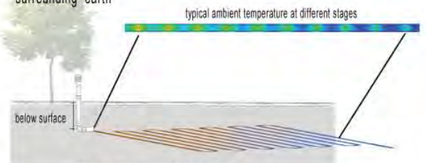
No.	D_h metres	x: pipe length metres
80	0.8	105.26
90	0.9	93.56
100	1	84.21
110	1.1	76.55
120	1.2	70.17
130	1.3	64.78

No.	D_h metres	x: pipe length metres
140	1.4	60.15
150	1.5	56.14
160	1.6	52.63
170	1.7	49.53
180	1.8	46.78
190	1.9	44.32
200	2	42.10



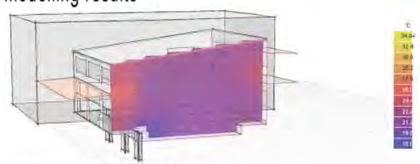
placement strategy

The inlet is placed under tree to prohibit direct solar radiation reaching air around it and causing a rise in the ambient air temperature. A serpentine layout with 2% fall towards pump was chosen since it is space effective and provides a large surface area exposed to the surrounding earth



50 diameter pipe provides 5m/s air speed

modelling results



percentage within comfort band: 92%
only 5% improvement

rarely an effect on cooler months
slight effect during the summer months - might be so low due to the opening and closing of doors as product is moved around

modelling strategy

Since Autodesk Ecotect software does not have a function or built in method of determining the effect of an earth tube, manual calculations where used to determine the air speed and temperature existing the tube into the building.
From here independent zones where created to represent the effect of an earth tube emptying cool air into the space

feasibility

A balance between energy invested into construction, funds and long term maintenance must be found.
It was determined that earth tubes (taking into account the space available to lay the tubes, pumps and drains required etc) it might not be feasible compared to how small of a difference in the spatial comfort percentage it makes.

Secondly the tubes cannot be installed after construction and due to the nature of the building, might not be serviceable if required.

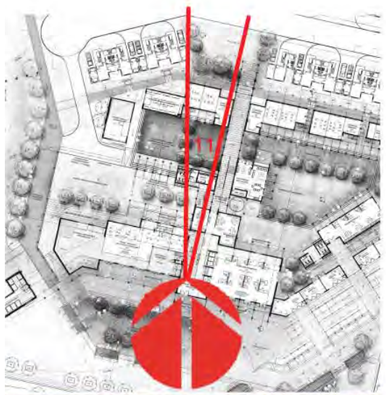
Thirdly, doors are opened and closed continuously during the day in order to move product. In order for the earth tube system to be effective, the building envelope requires to be sealed. The earth tubes (like an AC system) is not as effective as it could be, thus the cost and initial investment could not be justified.

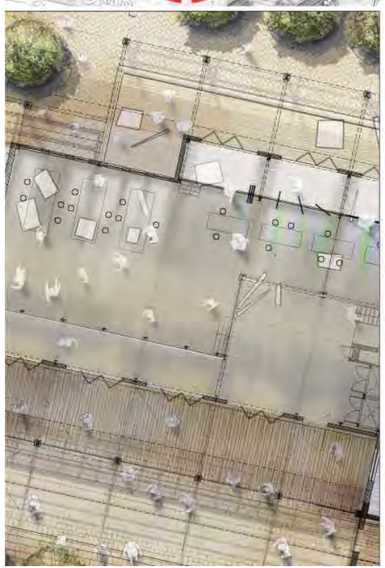
intention

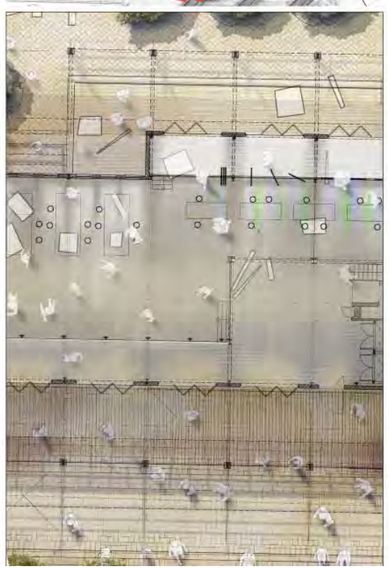
Earth reaches a moderate soil temperature at a certain level. By running a pipe at an downward angle through the soil at this level, air moving through the pipe could gain or loose heat to the soil. Using a pump, air entering the building from the system is cooler than air outside

Optimum time of use: day, since air temperatures outside are at its highest. During the night, night purge ventilation is active.

EARTH TUBES







modelling strategy

An analysis into the comfort period experienced by the user if the design remains as is, but is orientated directly north was undertaken. The results is compared to the original orientation results.

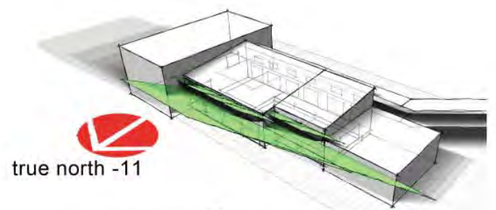
Secondly, the shading devices are optimized in order to achieve a similar result as the original design in order to compare the size of and effort put into creating these overhangs

modelling results

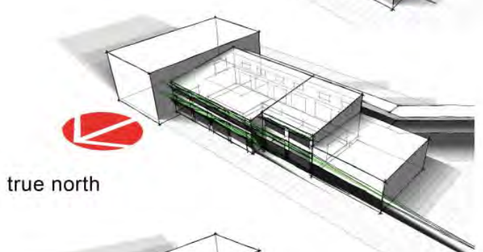
simply retaining the building correctly

Percentage within comfort band: 91%
Only 4% improvement.
No change is witnessed during the over heated period, but a change is noted during the underheated period. Shading devices from the original design most probably shield well in summer, but do not allow for optimum solar exposure during winter.

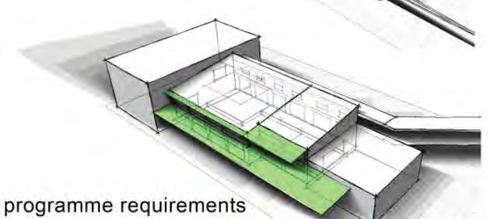
adjusting the shading devices to achieve a similar value than the original design



true north -11



true north



programme requirements

impact on context and geometry

Design intentions now contradict the required overhangs and shading devices. It is important to note that shading devices such as canopies have many functions other than shielding the interior from solar radiation. In some cases it provides and overhead plane that contributes to a haptic quality, in other cases it shield the user from rain. By decreasing these sizes due to an orientation change, these qualities are lost even though it is more economic and less material and labour intensive

intention

As a result of applying the design principles, the building is oriented 11 degrees east of North. Ideally the built form should face directly towards geographic North to minimize the size of overhangs as well as the need for shading devices to the South

ORIENTATION

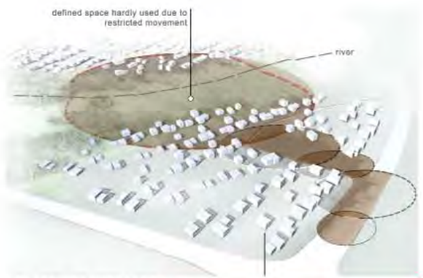
F

In order to understand the existing fabric and how the context operates, an ethnographic study was performed, decipehered and used to create a visual language that would stimulate the narrative between the new and existing formal and informal environments.

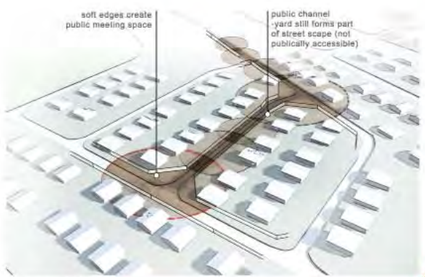
(Author, 2014)

ETHNOGRAPHIC STUDY

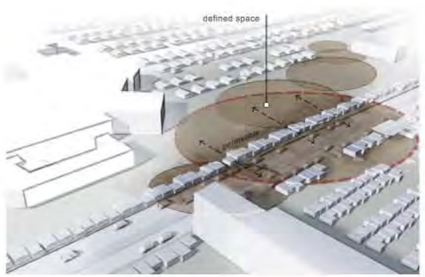
DEFINING SPACE AND BOUNDARIES



residential and green space

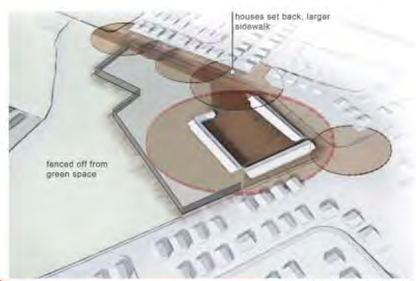


residential (RDP)

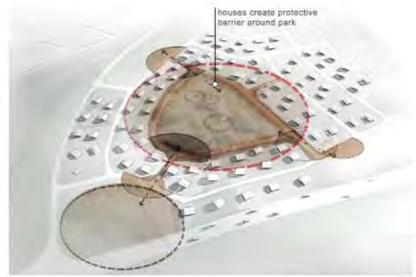


informal trade and public space

informal trade and the station precinct



education and residential



park and residential

sketch key

- main focus
- defined space

map key

- public space
- not public

space defined by edges

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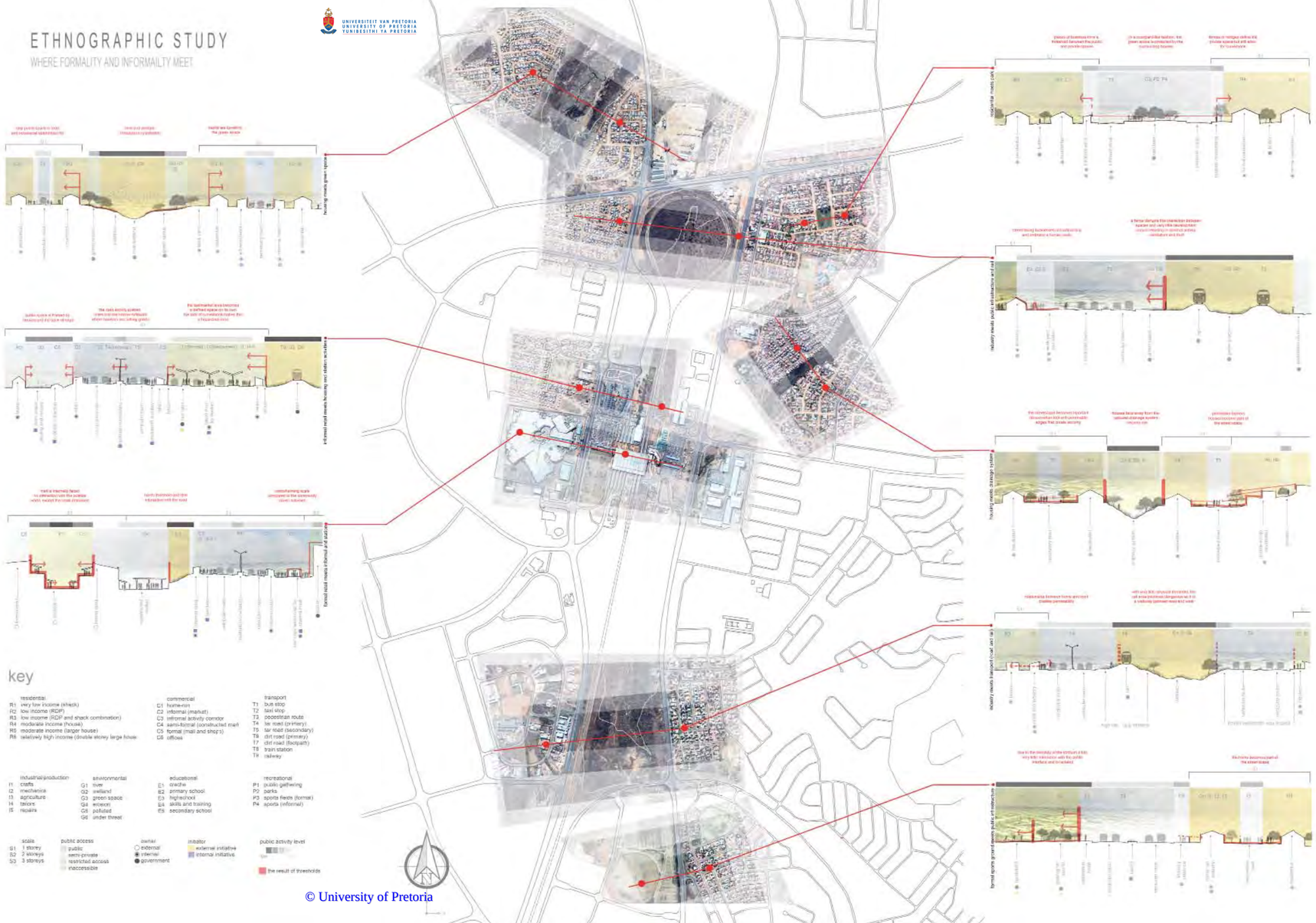
ETHNOGRAPHIC STUDY

WHERE FORMALITY AND INFORMALITY MEET



key

residential
R1 very low income (shack)
R2 low income (RDP)
R3 low income (RDP and shack combination)
R4 moderate income (house)
R5 moderate income (larger house)
R6 relatively high income (double storey large house

commercial
C1 home-run
C2 informal (market)
C3 informal activity corridor
C4 semi-formal (constructed mark
C5 formal (mall and shops)
C6 offices

transport
T1 bus stop
T2 taxi stop
T3 pedestrian route
T4 tar road (primary)
T5 tar road (secondary)
T6 dirt road (primary)
T7 dirt road (footpath)
T8 train station
T9 railway

industrial/production
I1 crafts
I2 mechanics
I3 agriculture
I4 tailors
I5 repairs

environmental
G1 river
G2 wetland
G3 green space
G4 erosion
G5 polluted
G6 under threat

educational
E1 creche
E2 primary school
E3 highschool
E4 skills and training
E5 secondary school

recreational
P1 public gathering
P2 parks
P3 sports fields (formal)
P4 sports (informal)

scale
S1 1 storey
S2 2 storeys
S3 3 storeys

public access
public
semi-private
restricted access
inaccessible

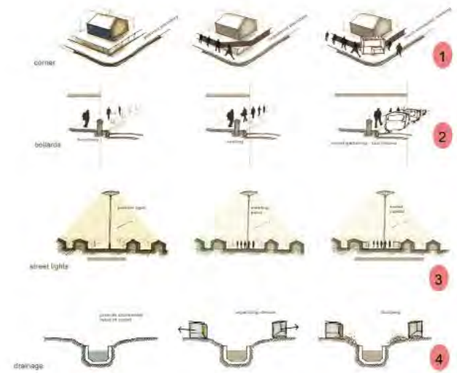
owner
external
internal
government

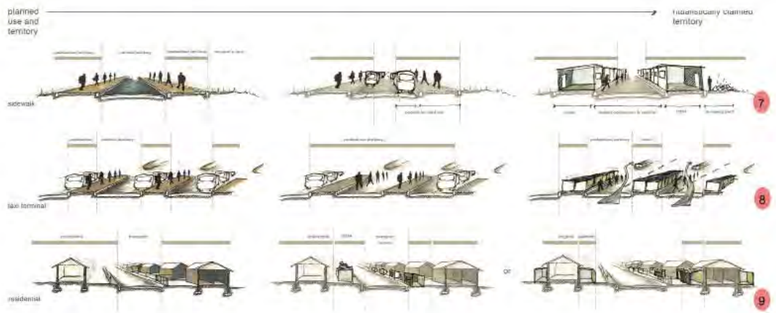
initiator
external initiative
internal initiative

public activity level
the result of thresholds

ETHNOGRAPHIC STUDY

RITUALISTIC SHAPING AND MOULDING OF SPACE





A series of elements was selected to guide an experiment of form and space that informs movement. The aim to have a "library" or "catalogue" to work from. These elements find their roots in the study of the local strata's evolutionary space making abilities. These "precedents" are learnt from and analyzed in order to apply them in the architectural solution.

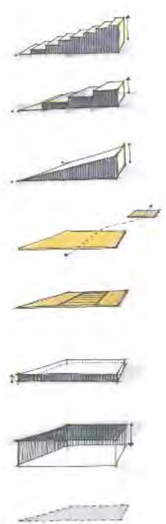
A mentioned in Chapter 3, in order for space to be read as a "garage" it does not require a plan labelled garage but only hint towards the spatial use. This "labelling" and fencing is the method exogenous activities use to try and communicate spatial intent, instead of using a palette (sometimes already present in the local fabric) of a visual language to form "sentences" of what the space needs to be and how it needs to be used. The familiarity of form and assimilating patterns already existing in the landscape, is used to create a socio-spatial dialect between the user and the built form.

A plan of movement routes is not required to inform a user on where to go and how (slow, filtered entry etc) but a visual cue could be designed to communicate this. Architecture is not as much about what tou see anymore, but how it makes you feel and in turn respond to it.

The essence of building elements (vertical and horizontal planes) is extracted and analyzed. These elements can be manipulated to form thresholds and in turn territories that guide movement through and around the built form. These visual cues speed up movement or slow is down (even block it) where needed.

ETHNOGRAPHIC STUDY

ELEMENTS THAT MAKE UP SPACE



Smaller steps
fastest way of changing levels as it speeds up traffic

large steps
If long periods of time is spent here, may result in seating

angled plane/ramp
slow movement as it is uncomfortable

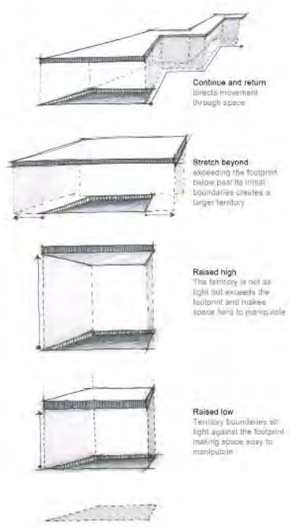
Dislocated planes
two areas with same surface characteristics tend to be connected and encourage movement from one to the other

Texture as path
texture changes guide movement over surface

Island
raising the surface slightly creates a territory close to the boundaries

Subsurface
pushing the plane into the ground creates an uncomfortable area to walk near. the boundaries stretch past the footprint

horizontal plane on ground



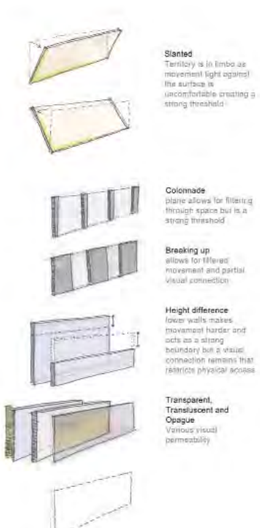
Continue and return
directs movement through space

Stretch beyond
extending the footprint below past its initial boundaries creates a larger territory

Raised high
This territory is not as light but exceeds the footprint and makes space hard to manipulate

Raised low
Territory boundaries sit light against the footprint making space easy to manipulate

horizontal plane raised



Slanted
Territory is in limbo as movement light against the surface is uncomfortable creating a strong threshold

Colonnade
plane allows for filtering through space but is a strong threshold

Breaking up
allows for filtered movement and partial visual connection

Height difference
lower walls makes movement harder and acts as a strong boundary but a visual connection remains that restricts physical access

Transparent, Translucent and Opaque
Various visual permeability

vertical plane