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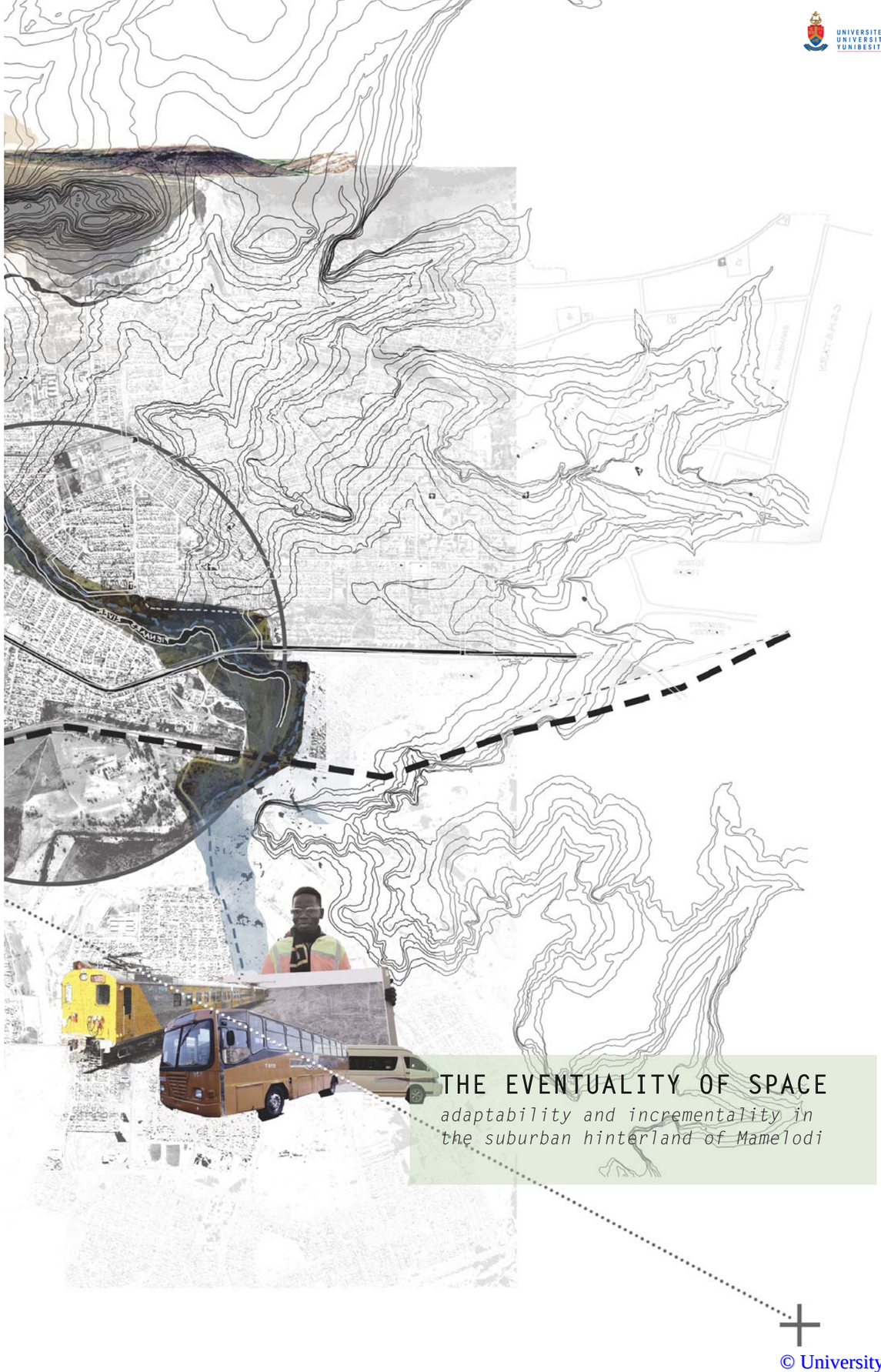

THE EVENTUALITY OF SPACE

adaptability and incrementality in the suburban hinterland of Mamelodi

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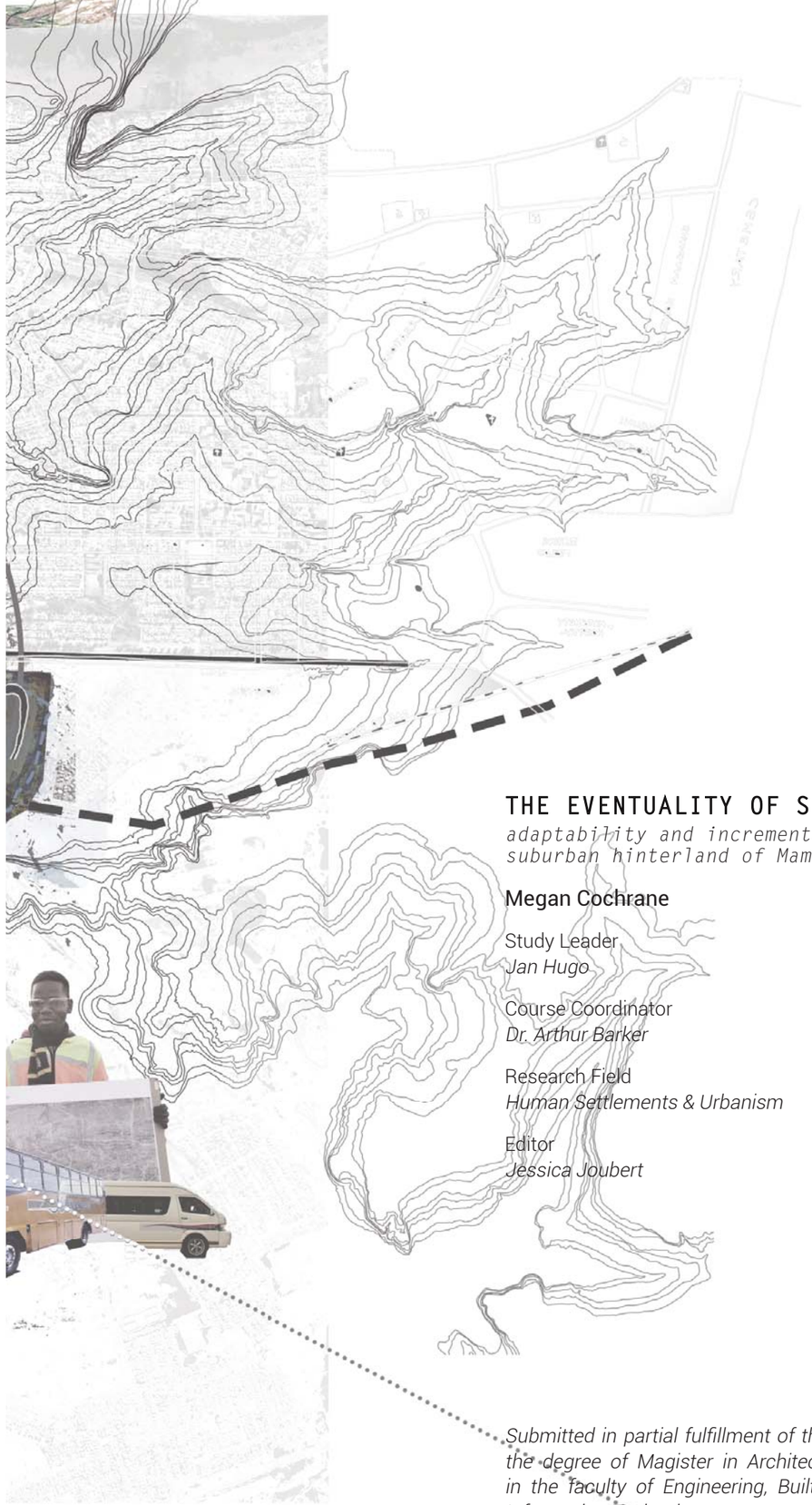

THE EVENTUALITY OF SPACE

adaptability and incrementality in the suburban hinterland of Mamelodi

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Research Field
Human Settlements & Urbanism

Editor
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Submitted in partial fulfillment of the requirements for the degree of Magister in Architecture (Professional) in the faculty of Engineering, Built Environment, and Information Technology.

University of Pretoria, 2017

In accordance with Regulation 4(e) of the General Regulations (G.57) for dissertations and theses, I declare that this dissertation which I hereby submit for the degree Master of Architecture (Professional) at the University of Pretoria, is my own work and has not been previously by me for a degree at this or any other institution. I futher state that no part of my dissertation has already been, or is currently being, submitted for any such degree, diploma or other qualification.

I futher declare that this dissertation is substantially my own work. Where reference is made to the works of others, the extent to which the work has been used is indicated and fully acknowledged inthe text and list of references.

Megan Cochrane
2017

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SAMEVATTING

Die aanpasbare gebruik van oop ruimte is 'n algemene en organiese proses wat voortdurend in die kontemporêre Suid-Afrikaanse stad plaasvind.

Die tabula rasa-benadering van Apartheid en modernistiese beplanning het min ag gelet op hierdie natuurlike ruimtelike patrone. Hierdie skripsie stel die saak vir 'n demokratiese benadering tot argitektuur en die skep van ruimtes in die kontemporêre Suid-Afrikaanse stad, een wat diversiteit, multifunksionaliteit en die moontlikheid van inkrementele ontwikkeling verwelkom.

Die navorsing ondersoek moontlikhede aangaande die ontwerp van ontluikende en aanpasbare ruimte as hulpmiddel vir bemagtiging in die konteks van Mamelodi, soos ondersoek in teorieë soos *Control of Complexity* (Habraken 1987), *Space as Ritual* (Van Rensburg en da Costa 2008) en *Safe-to-Fail* (Ahern 2011).

Die nalatenskap van die Apartheid ruimtelike kondisie in Mamelodi het gelei tot die voorkoms van mono-funksionele, medium-digtheid ontwikkeling wat beperkte ekonomiese geleenthede bied en daalikse migrasie van mense op soek na indiensneming aangemoedig het.

Die geleentheid word dus gebied om nuwe skale van stedelikheid aan die konteks voor te stel, wat steeds sensitief is en bestaande ruimtelike funksies en patrone aanmoedig.

Sleutelwoorde:

Aanpasbaarheid, inkrementele ontwikkeling, kontekstuele, veerkragtigheid

Site:

60 Hinterland Avenue, Phumulamcashi Buffer Zone, Mamelodi.

25°43'06.0"S 28°22'34.8"E

Stakeholders:

Local craftsmen, The Open Architecture Collaborative, TVET College

Programme:

Community design hub and workshops

ABSTRACT

The appropriation of open space is a common and organic process that is constantly taking place in the contemporary South African city.

The *tabula rasa* approach of Apartheid and modernist planning had little consideration for these natural spatial patterns. This dissertation argues for a democratic approach to architecture and space-making in the contemporary South African city, one that embraces diversity, multifunctionality, and the eventuality of incremental development.

Drawing from theories such as *Control of Complexity* (Habraken 1987), *Space as Ritual* (van Rensburg & da Costa 2008), and *Safe-to-Fail* (Ahern 2011), the research explores the possibilities of designing for emergent and adaptable space as a tool for enablement in the context of Mamelodi.

The inherited Apartheid spatial legacy of Mamelodi has led to the prevalence of mono-functional, medium density development that has limited economic opportunity and encouraged pendulum migration in search of employment.

This presents the opportunity to introduce new scales of urbanity to the context, whilst still being sensitive and encouraging existing spatial functions and patterns.

Keywords:

Adaptability, incremental, contextual, resilience

A revolution that does not produce a new space has not realised its full potential.

(Lefebrve, 1991:54).

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THANK YOU

My heavenly Father for being a constant source of strength, inspiration and rest.

Dad, Mum, Jess and JP for your constant prayers, and support in every way possible.

Gareth for always being encouraging, strong, and by my side.

Steph and Wilmé for being the best friends, classmates, and roommates I could ask for.

Jan Hugo and Dr. Arthur Barker for your constant guidance and motivation.

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INTRODUCTION

issues and intentions

Choices and opportunities are limited because notions of necessity instead of social richness dominate the urban fabric (Van Rensburg & Da Costa 2008:32)

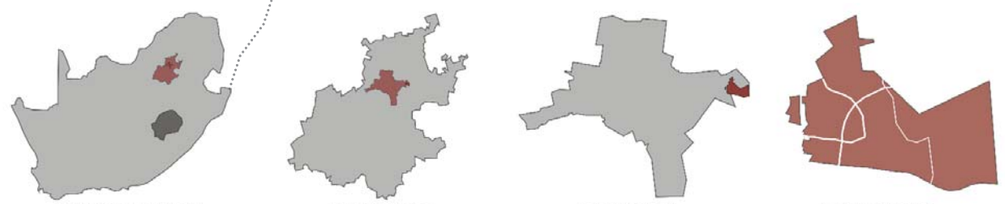

Figure 1.1 *Above: Macro locality (Hofman 2017).*

The scars of South Africa's past are etched into the very fabric of its cities. The fragmentation of spatial, cultural, and economic opportunities has resulted in the continuation of the disconnection of communities and a slow move towards spatial transformation in democratic South Africa. The Apartheid-driven rational underpinning of the formation of South Africa's cities has led to the marginalisation and hindrance of the development of socially rich and resilient communities.

ISSUES

General Issue

The very underpinning of Mamelodi, is the notion of the hinterland – the area that exists but is out of view and out of mind. This inherited spatial legacy of Apartheid provides the opportunity to "inclusively repair and integrate the gaps left in the urban fabric" (Peres et al. 2013).

The Western ideals of rationality and inflexibility in planning fostered oppression under the Apartheid regime. Spaces and places that encouraged separation and animosity rather than unity and communality have given rise to the need for the revival of the African City, through new, authentically African and democratic methods.

Urban Issue

Mamelodi was founded with the intention of being a predominantly residential and industrial area (van der Waal, 2000), resulting in a crippling mono-functional, medium density fabric. This leaves little room for public spaces, formal economic nodes, and cultural hubs. The suburban typology that is prevalent in Mamelodi has cultivated a spirit of multi-functionality within the homes, occupying the streetscape and negotiating the threshold between public and private space.

The inherited Apartheid spatial legacy of Mamelodi is still evident in the continued disconnection from the city, unreliable service delivery, and undeveloped buffer zones. Any undeveloped or open spaces give rise to the influx of informal settlements, which raises security concerns for the more established Mamelodi residents.

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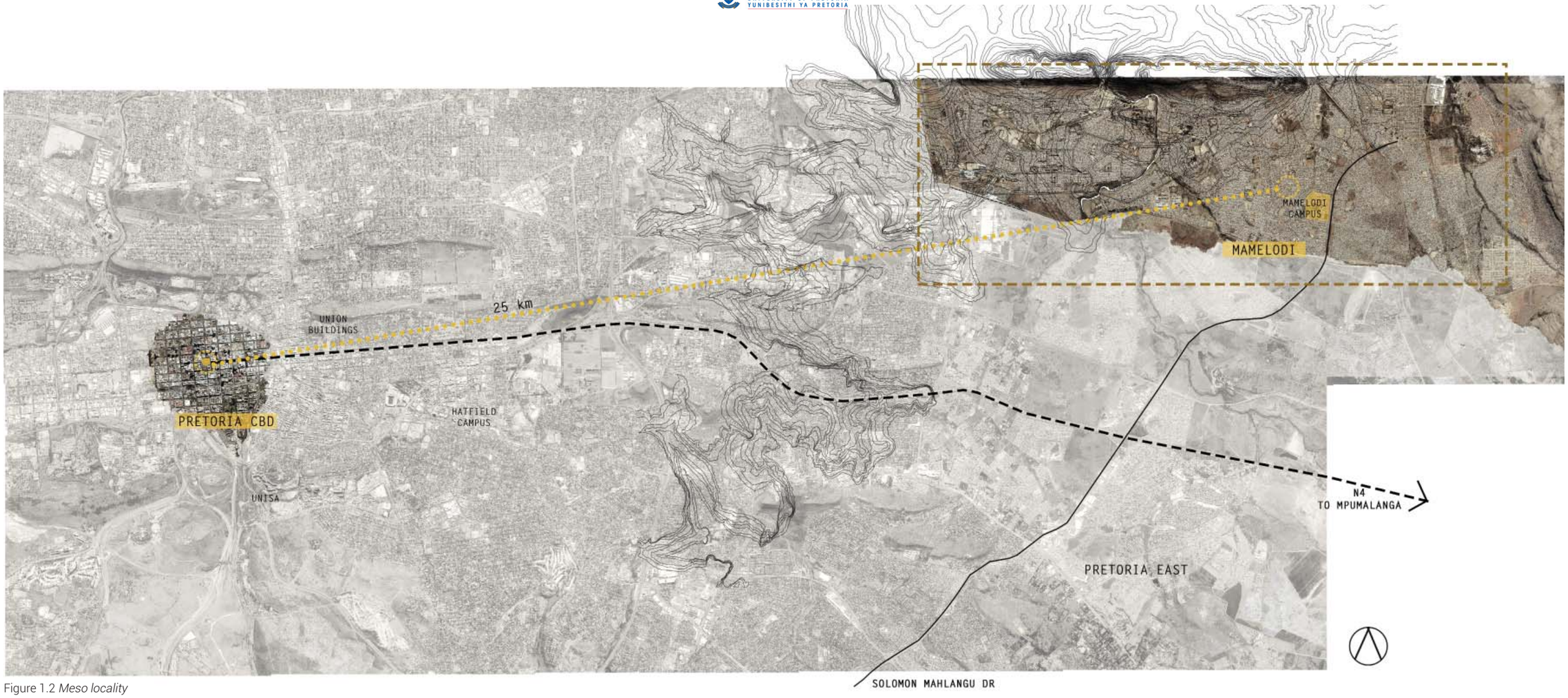

Figure 1.2 *Meso locality*

Architectural Issue

Mamelodi's mono-functional background has resulted in a dilution of public architecture, where public buildings or institutions are closed to the community and create street conditions in which only informality can operate. Although architecture in itself cannot fix or change a society, it can form the platform for this transformation to take place. By creating an inclusive, practical and beautiful place for communities to operate, ownership and pride can grow within a community and architecture can come alive through the people who use it.

In a context where opportunities have been thwarted and schools of thought marginalised, there is a necessity for architecture and planning to become a tool for upliftment and reconciliation. Especially where it had previously been used as an instrument of separation (Low, 2002).

Research Questions

How can architecture create a platform for discourse and place-making in previously-separated contexts such as Mamelodi?

How can architecture facilitate the multiplicity of Mamelodi's incremental spatiality to build resilient and diverse communities?

Sub Questions:
How can spaces of separation, such as buffer zones, be used as a site of unification and reconciliation?

How can the existing context be respected but reimagined for future development?

[1]*Abstract space refers to Lefebvre's* Production of Space (1991) *and is defined as space that relates negatively to historical, religious and political spheres. Abstract space functions objectally, formally and quantitatively, and dominates the current architectural context.*

[2]*Lefebvre's Differential space refers to notions of a new typology; space that restores unity to what Abstract space breaks up, celebrates differeces and dissolves boundaries.*

INTENTIONS

The intention of this dissertation is to research and investigate the architectural opportunities relating to the formation of spaces of authentic thought and transformation within the context of the fragmented city of Pretoria. This research intends to understand the possibilities for creating places of valued differences and unity in the Phumulamcashi Buffer Zone of Mamelodi. This research should build a precedent that can be applied to other fragmented contexts of South Africa.

The aim is to investigate the process of making contemporary South African architecture,to move away from the domination of abstract space[1], and towards an affinity to differential space[2] in the architectural practice.

The architectural outcome of this research will be embedded in the understanding of the "symbiosis of existing conditions, philosophies and thought processes," conceptualised through "new inventive strategies" in order to "[transform] it into an authentic place-specific expression" (Van Rensburg & Da Costa 2008:36) or space and architecture.

Programmatic Intentions

The appropriate program for the site will be developed and refined through the contextual exploration. An understanding of the existing users, networks, and programs on the site will determine the functionality that is necessary for the expression and exploration of the theoretical notions of space-making in the context of contemporary Mamelodi.

RESEARCH METHODOLOGY

An investigation into the context is done through qualitative research, conducted through experiential and observational studies of the site; through photographs, conversations and sketches.

The result of the contextual understanding and mapping is expressed in the form of the group urban vision and is discussed in the academic article in chapter two.

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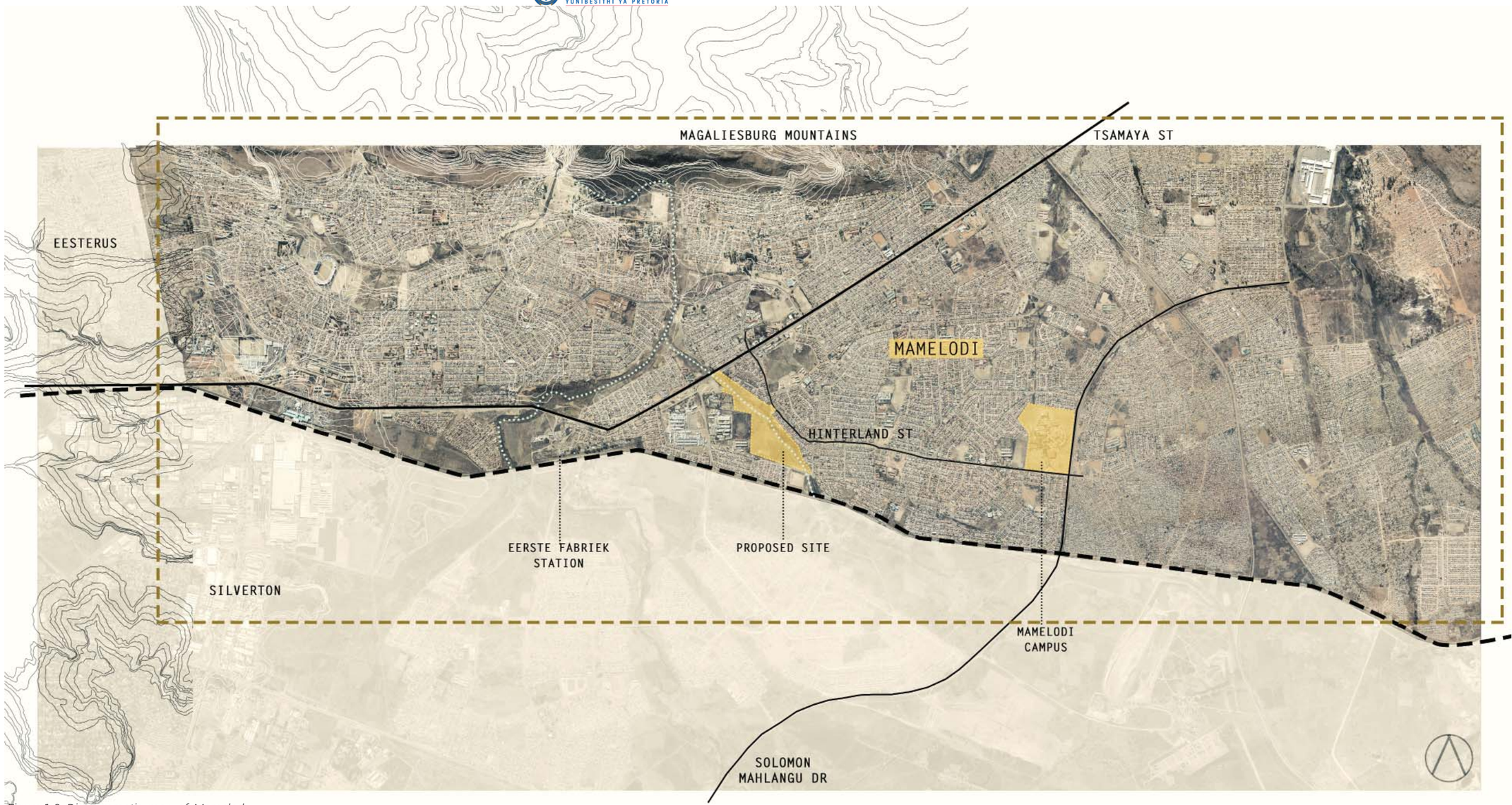

Figure 1.3 *Diagrammatic map of Mamelod (author 2017).*

Literature Review

A literature review has been conducted and integrated into the investigation. The theoretical investigation ranges from international writings to local influences, creating a broad scope of knowledge.

Through the synthesis of both local and international theories, this theoretical approach aims to find the overlaps between a wide range of subjects in order to develop an appropriate architectural response to the eventualities of Mamelodi's spatiality.

Precedent Studies

Similar to the literature review, the precedent studies integrated into this research, range from local to international examples.

DOCUMENT STRUCTURE

This document is structured into three main sections:

1. Introduction: setting the scene through the understanding of the context, issues and intentions of the project.
2. Article: representing the core theoretical, contextual, and programmatic ideas that contribute to the fulfillment of the project.
3. Architectural expression: the concept, design development, and technical development that forms the outworking of the ideas discussed in the article.

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Figure 1.4 *Above: Precinct locality*

Figure 1.5 *Right: Aerial view of site, northward view*

Figure 1.6 *Right: Aerial view of site, southward view*

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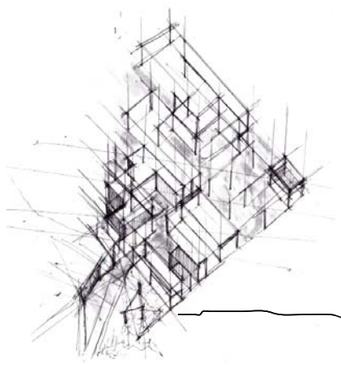

ARTICLE: CONTRIBUTION

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Megan Cochrane

The Eventuality of Space

Designing for adaptable and emergent space in the suburban hinterland of Mamelodi

The scars of South Africa's past are etched into the very fabric of its cities. The fragmentation of spatial, cultural, and economic opportunities has resulted in the continued disconnection of communities and slow spatial transformation in democratic South Africa. Consequently, the Apartheid-driven rational underpinning of the formation of South Africa's cities has led to the hindrance of the development of socially rich and resilient communities. This marginalisation has led to an attitude of spatial adaptability, which needs to be harnessed and embraced in designing for the future of resilient communities.

Apartheid's segregation of people and opportunities suppressed the freedom of cultural expression and the celebration of multiple identities. According to Low (2002:34), "space is the construct that most effectively realised and maintained Apartheid's grand plan and continues to ensure the endurance of its legacy". The Western ideals of rationality and inflexibility in planning fostered oppression under the Apartheid regime. Spaces and places that encouraged separation and animosity rather than unity and communality have given rise to the need for the revival of the African City, using new, contextual and democratic methods.

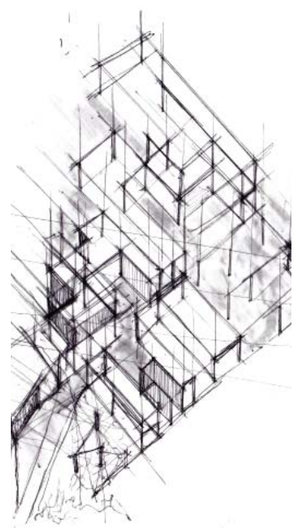

Figure 2.1; Conceptual sketch (Author, 2017)

Issues

The very underpinning of Mamelodi, is the notion of the hinterland – the area that exists but is out of view and out of mind. This inherited spatial legacy of Apartheid provides the opportunity to "inclusively repair and integrate the gaps left in the urban fabric" (Peres et al. 2013)

Mamelodi was founded with the intention of being a predominantly residential and industrial area (van der Waal, 2000), resulting a crippling mono-functional, medium density fabric. This leaves little room for public spaces, formal economic nodes, and cultural hubs. However, the suburban typology that is prevalent in Mamelodi has cultivated a spirit of multi-functionality within the homes, occupying the streetscape and negotiating the threshold between public and private realms.

The inherited Apartheid spatial legacy of Mamelodi is still evident in the continued

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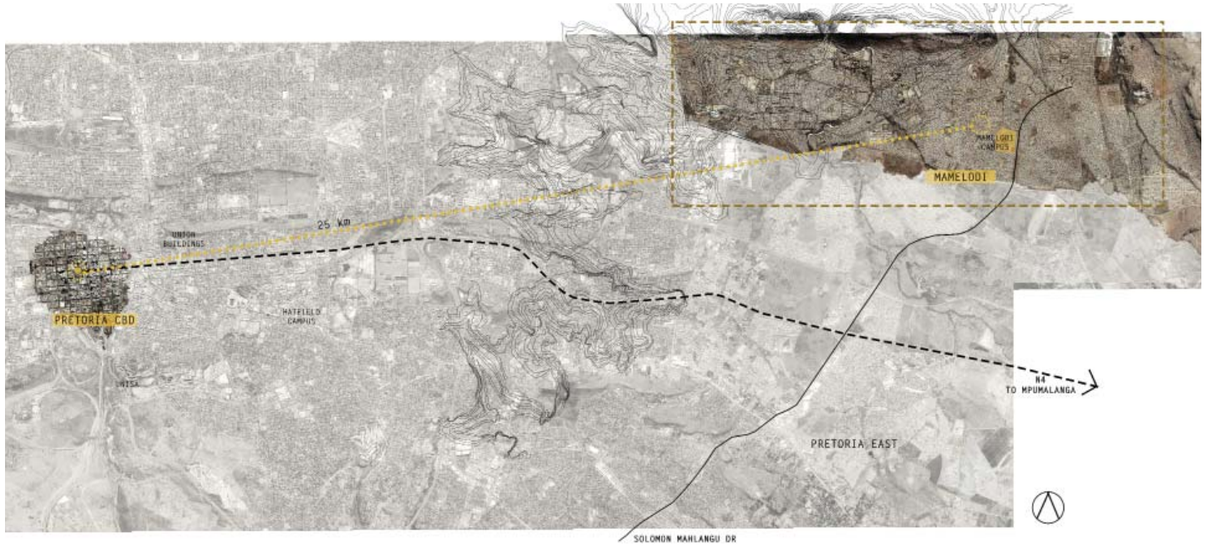

Figure 2.2; Locality map (Author, 2017)

Figure 2.3; Collage depicting consequences of spatial planning (Author, 2017)

disconnection from the city, unreliable service delivery, and undeveloped buffer zones. Any undeveloped or open spaces give rise to the influx of informal settlements, which raises security concerns for the more established Mamelodi Residents.

Mamelodi's mono-functional background has resulted in a dilution of public architecture, where public buildings or institutions are closed to the community and has created street conditions in which only informality can operate.

In a context where opportunities have been thwarted and marginalised, there is a necessity for architecture and planning to become a tool for upliftment and reconciliation where it had previously been used as an instrument of separation (Low 2002).

The intention of this dissertation is to research and investigate the architectural opportunities relating to the formation of spaces of authentic thought and transformation within the context of the fragmented city of Pretoria. This research intends to understand the possibilities of creating places of valued differences and unity in the Phumulamcashi Buffer Zone of Mamelodi in order to build a precedent that can be applied to other fragmented contexts of South Africa.

The context is the primary driver of this investigation, embedded in the understanding of the "symbiosis of existing conditions, philosophies and thought processes," (Van Rensburg & Da Costa 2008:36) through space and architecture.

The appropriate program for the site is developed and refined through contextual exploration. An understanding of the existing users, networks, and programs on the site determines the functionality that is necessary for the expression and exploration of the theoretical notions of space-making in the context of contemporary Mamelodi.

Historical Development

The vast township of Mamelodi is located 20km east of Pretoria's city centre. It sits wedged between the mountains, known as Thabo tsa Mogale (the Magaliesberg), and is fenced in by railways and roads (Van der Waal 2000). The railway line, which was built in 1890 under Paul Kruger, linked Pretoria to Maputo's harbour. The line was intended as an alternative to British controlled trade routes and its first stop was located at Eerste Fabrieke, which remains today as Mamelodi's metrorail station (Van der Waal 2000).

Mamelodi saw its first residents settle on Vlakfontein farm in 1945, as Pretoria attracted African communities in search of work. Under the Group Areas Act of 1950 the township's population grew tremendously. The forced removals that dominated the Apartheid era saw multitudes of people forcibly relocated to the area. It was formally declared a township in 1953 (Matooane 1999).

The South African environment has been severely morphed as a result of the racial segregation that was enforced on society, by the National Party government (Morejele et al. 2006). Mamelodi is an example of this, and its current form is deeply rooted in the Apartheid spatial planning strategy. Non-white people were deliberately removed from cities and placed into neighbourhoods that were separated from the urban centre by large distances, industrial areas or natural features (buffer zones). Informal settlements formed due to the rapid influx of migrants from rural areas, who were looking for work in the city, and the refusal by government to accommodate for them in formal planning.

Mamelodi, together with the city of Pretoria, is experiencing rapid urbanisation in the context of pervasive poverty and inequality (Du Plessis and Peres 2013:1). This rapid growth and influx of people is a reaction to the forced removals from the city during Apartheid, but results in the growth of unserviced informal settlements and the perpetuation of poor living conditions.

Consequences of Spatial Planning

For many years Mamelodi has been evolving within its inherited spatial legacy, which still influences how the city functions. Through the mapping of the region, certain observations were made:

Mamelodi was designed to be easily controlled as a self-contained area, thus it has limited accessibility to the city, causing it to function separately from it.

The availability of affordable housing in Mamelodi results in the pendulum migration of the urban poor, commuting extensive hours for work at a great cost.

The current single-use zoned residential typology is not only causing urban sprawl due to the lack of economic diversity, but also spatial, social and economic fragmentation (Steyn, 2005:1).

The mono-functional nature of Mamelodi's fabric has caused the street to become the primary public space where ceremonies are held, public gatherings emerge, pedestrians walk, *spaza* shops appear and where cars are serviced.

The urban vision focusses on the aspect of the emerging city. Mamelodi is reaching its spatial capacity in terms of topographical and residential boundaries limiting its expansion. This creates an important threshold in the future of Mamelodi for its opportunity to become a sustainable and resilient city of its own.

Urban Vision

The proposed urban vision could be used as a precedent to explore new ways of how informal settlements and townships are dealt with in the context of South African cities that still operate within the apartheid spatial legacy. The study focuses its attention on the uniqueness of character found in the street culture. This urban vision aims to

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Figure 2.4 Opposite Top; Different scales observed on site (Author, 2017)

Figure 2.5 Opposite Bottom; Mapping of activities present on site (Author, 2017)

restructure the township typology into a good, sustainable neighbourhood through interventions placed along the negotiated street edge. The urban vision focusses on the strengths found through the mapping to pre-empt new nodes of development that could increase accessibility and offer economic choice. This urban vision offers an adaptable, dynamic approach to urban planning. It is not a linear, top-down process, but rather an interrelated framework of processes that collectively and slowly would regenerate the urban condition.

Four urban vision principles were established through an understanding of the site for the future development of Mamelodi:

1. Strengthen Networks

Strengthening existing economic, environmental, and social networks. Relying on locally-based networks will create complete communities of resilience and accessibility. These networks need to become complete and integrated, realising the connections between economic, environmental, and social well-being.

2. Celebrate Uniqueness

The unique street-culture and vibrancy of Mamelodi can begin to inform methods of place-making and identity on an urban scale. The day-to-day character of Mamelodi can contribute to the engagement of communities and the ownership of the urban fabric as a collective and individual.

3. Densify and Diversify

The densifying of nodes within the urban fabric will contribute to the resilience of neighbourhoods. Bringing economic choice and diversity through mixed-use precincts will combat the mono-functional nature of suburban Mamelodi, allowing for effective use of space and nodes of economic, social and cultural activity.

4. Infrastructure Upgrade

Upgrading existing and unused infrastructure to become durable and reliable. Infrastructure and service delivery are pertinent to the development of emerging cities. The economic, social and cultural health of communities rely on the efficiency and sustainability of infrastructural systems.

Spaces of Separation

From the urban-scale of Mamelodi, the focus now shifts to the smaller scale site under investigation through this research.

The site within the Phumulamcashi Buffer Zone exists as an open and formally unprogrammed space in the suburban hinterland of Mamelodi east. The vastness of the space allows for a multitude of rituals to take place, from daily pedestrian and economic activity to weekly church gatherings, weddings or funerals. Situated on Hinterland Avenue, it acts as a hiatus between Mamelodi West, the older suburbs, and Mamelodi East, the more recent developments. The site of investigation is the open green space within the buffer zone that remains unbuilt.

Triangulated by educational institutions to the west and residences to the north and south, the site has small connections to the busy Tsamaya Road and Hinterland Avenue, and the quieter Serapeng Avenue to the south. It is interrupted by a small tributary of the Pienaar's River made traversable by two small pedestrian bridges, while the rest of the site is criss-crossed by a network of footpaths (see Figure 2.5).

Site Surroundings

The green space is bordered by an institutional belt on the western side, consisting of the Walter Sisulu Conservation Centre, TVET College, and Phateng Secondary School.

The conservation centre aims to educate residents and school children on the importance of sustainable living. It consists of a training facility as well as a nursery intended to supply the community with plants and skills training. The Technical Vocational Education and Training (TVET) College is a public college that aims to educate scholars of 16 years and older in marketable skills such as engineering, administration and accounting. Phateng Secondary School takes learners from grade 8 to grade 12 and specialises in ordinary and technical education.

These institutions have no relationship to the green space and the hard boundaries create negative conditions on both the street edge and the hinterland. The remainder of the surrounding fabric is residential, with the exception of three churches, also making use of solid boundary walls, creating hard boundaries to separate from the open space due to security concerns.

Transience and Permanence

Due to the nature of the site as an open green space, it facilitates many informal and transient activities. Used daily as a thoroughfare space for pedestrians, footpaths weave along the surface of the grassland creating permanent reminders of impermanent motions. In the afternoons, school children use parts of the field for soccer practice led by a local community member. On a weekly basis, between two and five groups of people meet in the landscape to hold church services.

Only one group has designated an area with two colourful flags, whereas there is no evidence of any other groups claiming ownership of spaces on the site. According to a local resident the churches that meet in the fields are foreigners, which adds to the xenophobic tension existing in Mamelodi. However the religious groups hold a deep respect for, and connection to, the landscape in which they practice their faith.

Due to the pollution in the river, it is not used for any religious rituals. The indigenous plants that grow in the riverbed are used by a traditional healer who operates from its northern edge. Similarly, the river water is used by three brickmakers situated on different corners of the site.

The open space is also frequently used to hold events such as weddings and funerals, which supports the micro-economy of rentable portable toilets that are stored on-site. Some of the bordering houses have also built toilets that are accessible from the site for a small fee.

Although this is considered a public space, there are already groups utilising the council's adopt-a-spot program leading to the gradual occupation of portions of the site which could result in the further fragmentation of a diversely-

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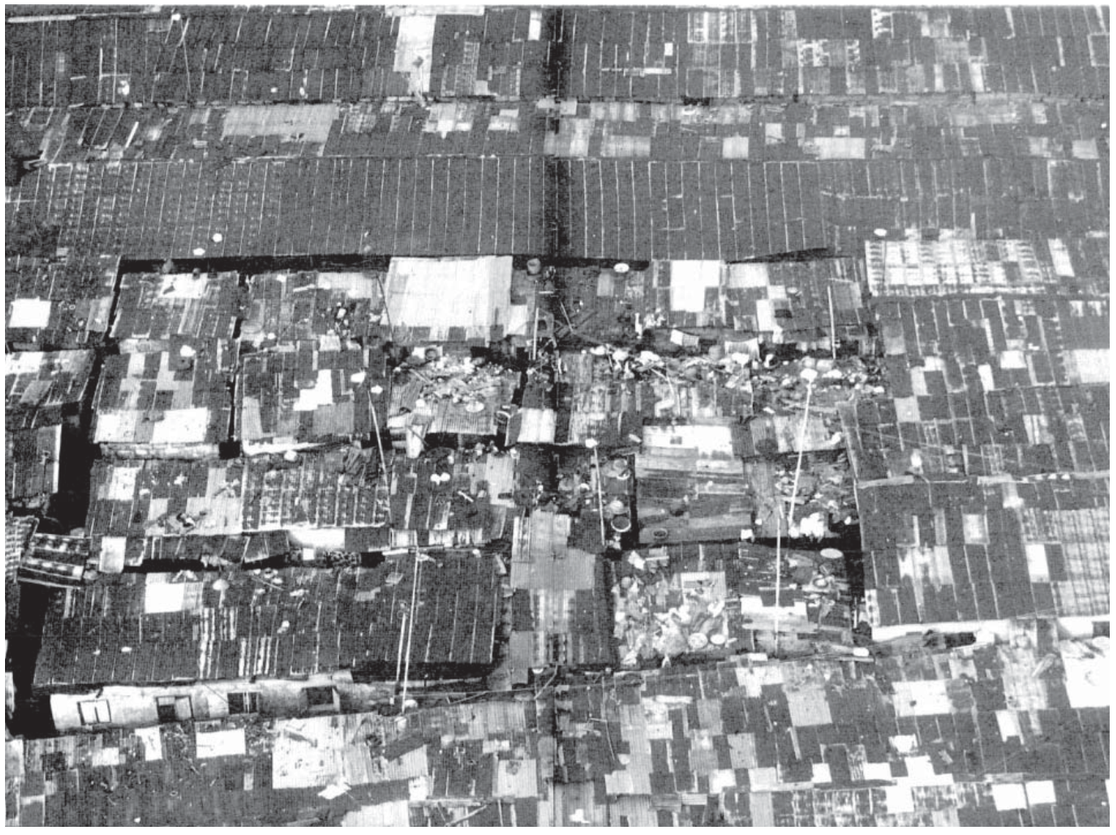

Figure 2.6 Left; Warwick junction (Allen, 2014)

Figure 2.7 Opposite Top; Compound typology, Lagos (Koolhaas et. al, 2000:666-667)

Figure 2.8 Opposite Bottom; Negotiated street edge, Lagos (Koolhaas et. al, 2000:716-717)

used space.

Site Vision

The uniqueness lies in the multi-faceted nature of the site, which provides many informants for the creation of architecture, but also requires sensitivity in terms of the architectural programming.

The transient and ephemeral activities flourish in the unprogrammed landscape and allow for flexibility and communality. The possibility of the site lies in harnessing its transient energy and application of it to new programs that can either facilitate or complement the current networks as "the role of architecture in the African urban condition should be to provide for multiple identities in the creation of a reconsidered urban condition" (Van Rensburg & Da Costa 2008:35). The uniqueness of the site needs to be encouraged through architecture and not undermined, progressing towards the transformation of public space in the post-Apartheid South African city.

Urban Flexibility: Lagos

The city of Lagos, Nigeria, provides an extreme case of post-colonial African urbanisation. Home to over 15 million people and "rapidly expanding, transforming, and perfecting," Lagos has become an "icon of West African urbanity" (Koolhaas et al. 2000:652). The infrastructural shortcomings of such a megacity has led to the development of ingenious, improvised, and unconventional systems that accommodate the growing population.

Lagos operates on a level of complexity that is rarely seen in any other city in the world and "forces the reconceptualization of the city itself" (Koolhaas et al. 2000:652) through its truly 'African' methods of modernisation and globalisation (ibid. 2000).

Communality and incrementality are notions that dominate the urban fabric of Lagos. Made up of a series of 'compounds' (see Figure 2.7), the city contains spaces "wherein a group of interests coexist side by side and in agreement" (Koolhaas et al. 2000:661). These compounds operate as multifunctional spaces; small-scale businesses support the incremental additions to the residential sections, which also become rental income. This incremental growth and challenging of conventional boundary conditions is similarly seen in the life of South African cities, albeit on a lower density to that of Lagos.

These spatial contingencies result in "heterogeneity of use and function" at compound-scale, but "homogenous and porous space" (Koolhaas et al. 2000:662) at neighbourhood scale. One could argue that this spatial homogeneity is not as evident in the South African context due to the much lower density of the peri-urban settlement condition, such as Mamelodi. However, through continued urbanisation and growth this could become a probable urban form.

Lagos represents an interesting urban understanding of the potential of post-colonial African urbanisation. While South Africa's "spatial legacy is embedded within a planned 'brick and mortar' urban fabric, secured by buffers and tenure patterns" (Low 2010:37), the integration of culturally and environmentally sustainable urban principles has the possibility to ensure the urbanisation of its cities celebrates the "improvisational nature of the African city" (ibid. 2010:48), as seen in the extreme case of Lagos, but in a resilient manner.

Urban Contribution

The value of this research lies in the understanding and rethinking of the urban condition for similarly separated contexts.

If spatial transformation is to take place in South African cities, the unique contexts need to be understood in order

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to design appropriate responses to their growth.

The case of Mamelodi acts as a case study that can be applied to similar contexts, implementing principles that guide the decision making for the benefit of the uniqueness of the context. This approach does not aim to provide a blanket method that can be applied to any environment, but rather a way of thinking systemically in order to avoid being victims of the same urban issues, of segregation and monofunctionality, that still afflict South Africa's urban fabric.

Theoretical Approach

The theoretical approach stems from the understanding of the context and its relevance in the larger context of post-Apartheid South African urban development.

Through the synthesis of both local and international theories, this theoretical approach aims to find the overlaps between a wide range of subjects in order to develop an appropriate architectural response to the eventualities of Mamelodi's spatiality.

Facilitating Multiplicity

The extensive rationality of the Apartheid spatial planning scheme imposed western and colonial typologies onto the African context. The widespread application of rigid and homogenous spaces attempted to force an inflexibility that was "unfit for human habitation" (Low 2010:39). The undermining of diverse cultures and expressions continues to be reflected through the fragmented urban fabric and uniform housing typologies that dominate the peri-urban settlements of the country.

In response, additions to government-built housing for economic use have become commonplace in most households of Mamelodi, starting with backyard additions, garages and eventually occupying the street-frontage for economic purposes. This very Apartheid intention of mono-functionality and inflexibility has fostered a culture of informality and incrementality.

This nature of incrementality, observed through mapping and site visits, cultivates ownership of the street edges and negotiated the boundaries between public and private realms as seen in the urban analysis of Mamelodi. This presents the opportunity for architecture to draw on these activities that are already taking place and encourage growth and ingenuity.

Asiye eTafuleni

This approach is seen in the works of *Asiye eTafuleni*, a non-governmental organisation based in Durban. Focussing on the informal sector, *Asiye eTafuleni* aims to build capacity and livelihoods through the uplifting and education of existing informal economies. The NGO acts as a mediator between traders and city officials, finding solutions to urban and spatial issues. This is seen in the Warwick Junction project where better infrastructure and spatial upgrades were designed for the benefit of the informal traders that already operated in Durban's central transport node.

The upgrade not only improved the condition of the precinct, but introduced multi-scalar stakeholders by incorporating the junction into Durban's tourist experience (Dobson & Skinner 2009). This in-situ upgrade demonstrates a simple way of dealing with urban complexity. This very low-tech intervention has a large impact in allowing for a multitude of identities to operate within one space.

An Appropriate Urban Condition

Van Rensburg and Da Costa (2008:39) argue that the role of architecture is to ensure that the city is not "reduced to a homogenous state that alienates its users, paralyses their imagination, and deprives them of sensory engagement".

With regards to spatiality in the city, both globally and in South Africa, Borden (2001:4), and van Rensburg and da Costa (2008:39) argue three important points. Firstly; scale. The city needs to be considered on scales other than that of the building. The city is a complex network of scales and interactions that operate from the large to the intricate, from the "wordly to the intimate" (Borden 2001:4). The second issue is that of form; the city cannot be reduced to merely a representation of identity through form and "object-buildings" (ibid. 2001:4). Lastly, the city is not merely a product of the planners and architects that design them, but they are shaped and changed by a much larger network of social, economic and political influences. This can often be rendered insignificant by planners and architects that create spaces that "[ignore] social relations and [render] people passive" (ibid. 2001:4).

So, what is the use of architecture if it is only a static representation of human activity?

It is argued by Borden et. al that;
"architecture is no object. At an interdisciplinary nexus, as an intrinsic element of everyday life, architecture is not composed of isolated and monumental object. Architecture is ambient and atmospheric, and architecture allows us to tell stories it is both backdrop to and inspiration for theoretical and poetic musings of all kinds, from love to philosophy, theology to Marxism" (Borden et al. 2001:3).

Architecture can easily be thought of as insignificant if it fails to adapt and change to suit the needs and networks of the context it is a part of. It can be argued that the aesthetic emphasis of architecture is not relevant in the context of present-day South Africa if it continues to encourage the creation of inflexible, 'abstract space', which has dominated the past planning of South African cities and buildings.

Abstract space, as termed by Henri Lefebrve in *The Production of Space,* is the "dominant form of space[...] and it seeks to mould the space it dominates" (1991:49), with little regard for qualitative, social and historical aspects of the context and people. Abstract space dominated the approach to spatial planning during Apartheid, strengthening barriers and the quantitative aspect of human settlement with little regard for social richness and diversity.

On the contrary, Lefebvre's notion of 'differential space' aims to "restore unity to what abstract space breaks up" (ibid. 1991:52). Differential space seeks to celebrate the differences that abstract space attempts to homogenise. Van Rensburg and Da Costa argue for differential space as an appropriate alternative to the inflexibility and homogeneity of abstract space, allowing for a multiplicity of social uses and the "weaving of spatial experience into the cultural continuum" (Van Rensburg & Da Costa 2008: 40). Space becomes informed and moulded by the everyday rituals that inhabit it, it is produced and reproduced in multiple manners depending on the nature of the needs and inhabitants.

This flexibility and adaptability is necessary in the production of space in the African metropolitan context. For generations, colonial and westernised constructs of abstract, quantitative, and fixed space have dominated the urban fabric, attempting to constrict transient and evolving spatial rituals.

This constrictive spatial approach has resulted in the thriving of informality, which provides a better spatial adaptability for the changing economic and social networks present in the African city. In a context where open space is constantly being appropriated to suit everyday needs, architecture and architects have a role to play in terms of ensuring that this spatial appropriation can take place in a sustainable manner in order to stimulate resilient networks and communities. If this shift towards adaptable architecture does not take place, informality and incrementality will still thrive, and static architecture will become a helpless bystander; losing out on the opportunity to design and engage with these processes.

According to Low (2002:37), "contingency is often the source of a productive transformation", and thus it is valid to argue for design that celebrates and encourages the adaptation of space rather than attempt to eradicate it.

Safe-to-Fail

In the context of the constantly evolving and growing nature of Mamelodi, its densification and urbanisation needs to be intentionally designed to celebrate its uniqueness and ensure resilient development. Resilience is defined as "the capacity of a system to respond to change or disturbance without changing its basic state" (Walker & Salt 2006 in Ahern 2011:342). Resilience in urban planning requires the building of "adaptive capacity" (Ahern 2011:342) that is able to react to changes or disturbances in the environmental, ecological, social and economic networks on which the planning should be based.

Ahern (2011) proposes five strategies for building urban resilience which link to how architects and planners should be thinking about space in the context of the contemporary African city according to da Costa and van Rensburg.

1. Multifunctionality

The increasing density of urban conditions requires the designing of layered and multi-functional spaces. This is done through "intertwining/ combining functions, stacking or time-shifting" (Ahern 2011:342). Multifunctionality does not only cater for the multiplicity of spatial identities suggested by da Costa and van Rensburg (2008), it is also characteristically spatially and economically efficient. Multifunctionality is already very present in the urban condition of Mamelodi; sidewalks are used as transition spaces and retail areas, fences exist as a barrier as well as a support for informal structures, streets are used as a means of movement as well as an event space.

2. Redundancy and Modularisation

In order to achieve redundancy and modularisation, Ahern argues that "multiple elements or components provide the same, similar, or backup functions" (2011:342) and are needed in planning. Centralising infrastructure or services increases the vulnerability of the failure of systems. In the same sense, architecture and planning that ignores socio-spatial relationships and focusses on aesthetics and image is not resilient or sustainable and will inevitably lead to failure if there are no systems and functions in place to support it.

3. Bio(and social) Diversity

Similarly to redundancy and modularisation, biodiversity is necessary to include elements that have different responses to changes and disturbances. This is necessary in social and economic situations in order to have a more complex and adaptable response to changing environments. This bio and social complexity is already present in South African cities, which are defined by "social, cultural, political and economic contrasts" (Van Rensburg & Da Costa 2008:37), but not necessarily celebrated spatially.

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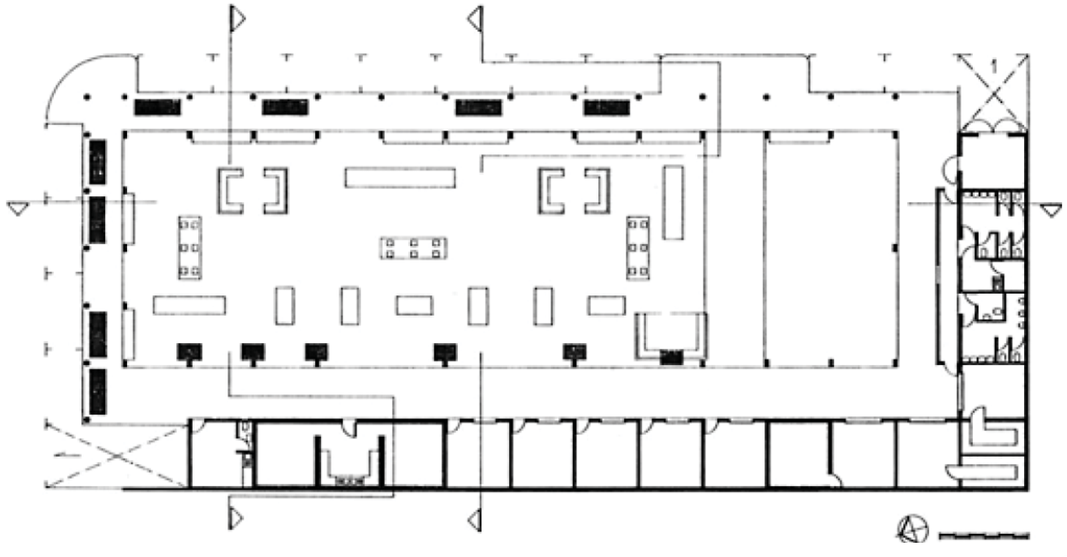
4. Multi-Scale Networks and Connectivity

According to Ahern, "connectivity is arguably a primary generator of sustainable urban form" (2011:343), and is necessary to repair the isolation of natural and social systems in the urban environment. These networks need to support the bio and social diversity in order to create holistic urban systems. Borden (2001:4) and da Costa and van Rensburg (2008:39) agree that the city is a "multi-scalar landscape" and thus space and architecture needs to be considered not from the urban scale down to grass-roots level but rather as a bottom-up process.

Figure 2.9 Below; Gugulethu Central Meat Market street view (Smuts, 1998)

Figure 2.10 Bottom; Gugulethu Central Meat Market ground floor plan (Smuts, 1998:2)



5. Adaptive planning and design

Although adaptive planning in resource management is common practice, Ahern proposes it be incorporated into urban planning and design. Adaptive planning aims to see the opportunity, at a governmental level, in change and uncertainty for the development of pilot projects and reduce the potential to fail through the use of 'safe-to-fail' design experiments. Similarly, da Costa and van Rensburg argue that the need for non-rigid space exists, and spatial planning "as an elastic entity should accommodate the unpredictable" (2011:36).

Control and Complexity

Designing for elastic spaces and programs leads to the exploration of the open building concept discussed in *The Control of Complexity* by N. John Habraken (1987). Similar to Ahern's *Safe-to-Fail* approach, Habraken argues for the multi-functionality of space and the built environment as a product of an ongoing and adaptable design process.

The Open Building Concept argues that "variety and adaptability yield a better match between the built environment and the life it shelters" (Habraken 1987:3), allowing the architecture to constantly reinvent itself through those that inhabit it. Like Van Rensburg and Da Costa (2008), Habraken argues against the "uniformity and rigidity" (Habraken 1987:3) of large built projects and embraces the spatial complexities of the urban environment.

Finding form in the Open Building method relies on the understanding of the surrounding forms and "may result from a process of transformation" (Habraken 1987:4). The development of an architectural vocabulary relies on the transformative nature of the design process. It becomes necessary to make a first move in order to allow for a multitude of possible 'next moves' to be made by the users. This approach to the built environment allows for ownership to be cultivated through an "architecture of weak boundaries" (Van Rensburg & Da Costa 2008:35) where the "improvisional nature of the African city" (Low 2014:48) is embraced and architecture becomes responsive to changing needs and environments.

Architectural Response and Contribution

The appropriate architectural response is deeply embedded in the context of the intervention. In the setting of the South African metropolis, architecture needs to "address both the legacy of the past as well as possibilities presented by a developing future" (Low 2002:37). Due to the entrenchment of separation and oppression in the urban fabric of South African cities, contemporary architecture and architects have the responsibility to create space for new design approaches; where image-driven monuments are less celebrated than the catalytic interventions that stimulate innovative and incremental space-making.

By designing for adaptive spaces, architecture can take the higher ground and ensure that it takes place in an environmentally, socially and economically resilient manner through employing the strategies presented by Ahern for creating 'safe-to-fail' spaces. Da Costa and van Rensburg argue for spaces that can "intersect and connect in an exploration of cross-pollination and exchange" (2008:35) of skills, cultures, resources, and ideas.

Designing for a multiplicity of identities and activities decreases the possibility of the failure of a space. Creating a complexity that becomes resilient on different scales, from the larger urban scale to grass roots level. South African architecture should aim to create space of ownership through "interventions that contribute to social inclusion and recognition of the citizenship and creative practices of the previously disenfranchised" (Mbembe in Morejele et al. 2006:2).

Precedent: Gugulethu Central Meat Market

The Central Meat Market by CS Studio Architects is located in the township of Gugulethu, Cape Town. The aim of the project was to respond to the immediate need for a covered market area for meat vendors, but included multiple capacity building strategies through workshops done by external funders to equip the local traders with financial and business skills.

The inclusive process taken by the architects ensured that not only was the immediate problem solved, but the community benefitted other skills necessary for personal upliftment. The design itself was a simple solution to the site's issues. Surrounded by informal housing and hostels, the site also became a "central gathering point" and an "important public space" (Smuts 1998:1) leading to the importance of accommodating multiple possible spatial functions over the structure's lifetime.

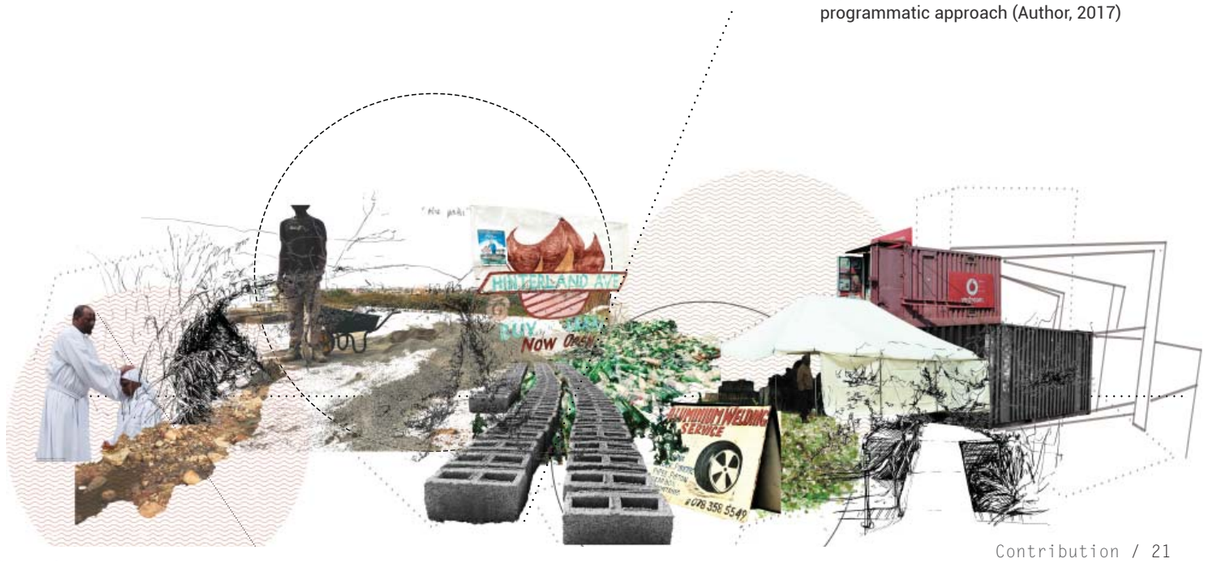
The formal elements of the structure, such as offices, public toilets, and serviced *spaza* shops, are arranged in an L-shape on the southern and western sides. This not only creates a thickened boundary wall which defines the interior open space, but becomes a barrier to block the prevailing winds. The northern and eastern edges are defined by a more tectonic steel structure that supports a large undulating roof, which demarcates the market space beneath it.

The control of solid and void allows the open market space to be adapted according to the vendors' needs whilst still defining an important urban space. This in-situ intervention becomes an "appropriate local and culturally expressive solution" (Smuts 1998:1) and a vibrant urban space.

Programmatic Approach

According to Van Rensburg and Da Costa, "the need for a non-prescriptive space exists" (2008:36), honouring the complexity of views and identities

Figure 2.11 Below; Collage depicting programmatic approach (Author, 2017)



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that exist within the African city. Assigning a fixed program in a complex environment such as Mamelodi will result in unresponsive and unnecessary space. Van Rensburg, Da Costa (2008), Low (2002), Ahern (2011) and Habraken (1987) argue for the inclusion of connected and multi-scalar activities in the built environment.

Operating in a culture in which "one justifies one's architecture functionally" (Habraken 1987:4) encourages the independence of form from function. However, this does not mean that architecture should exist as homogenous unprogrammed space. Within this context, certain thematic decisions are made that start to inform the architectural vocabulary, although the function of spaces does not become the primary driver of the design process. Drawing from programs and processes already existing on the site allows for the pre-empting of spatial needs and design informants.

With an approach very embedded in the nature of the context, the programming of architecture needs to be sensitive to the existing networks on the site. As discussed in the previous chapter, adaptation of spaces and incremental development are eventualities of the context of the South African city. Thus the intended program does not aim to limit these processes, but celebrate them.

Working with the Existing

Through site visits and mapping of the context, it became evident that, similarly to the compound typology seen in Lagos, trades and functions that complement each other are grouped in close proximity. For example, a car mechanic, a welder, and a car wash are often seen occupying similar, if not the same, spaces on the street edge. Food vendors are predominantly located close to schools, transport stops, or pedestrian pathways. This pattern is valuable to understand in order to develop a relevant approach to programming architectural interventions in this context.

Considering this, the functions existing on the site of intervention are maintained and considered before introducing new programs that may hinder their development.

The existing site programs include the cement brick maker, glass recycler, food vendor and car wash. These programs have the potential to be reorganised and incorporated into the design in order to contribute to a larger site system, where these separated activities will be able to be interdependent rather than independent (see Figure 2.11).

Finding cohesion and relationships between these different functions stems from the systemic approach of Ahern's safe-to-fail principles. In the current condition, the programs operate independently from each other, merely occupying the same site. These programs have the opportunity to feed off each other. For example; the food vendor is supported by customers waiting for their cars to be washed, and vice versa, as well as those working on-site at the car wash and the brickyard. The glass bottles from the food vendor can then be used by the glass recycler to be crushed, which can then be sold to the brick maker as an alternative to quarried aggregate.

The value in this contextual and systemic approach to programming lies in the building of communality amoungst the stakeholders as there is now a common interest in the success of the other.

Needless to say, in this particular study, these four programs do not provide enough opportunity for architectural exploration in the context of Mamelodi as an emerging city. The introduction of other programs to the site creates greater spatial and functional diversity while also creating a larger architectural vocabulary with which to create form.

Incremental Interventions

Similarly to Habraken (1987), Low argues that "form and use are in disjuncture" (Low 2010:48), but that design presents the opportunity to "configure worlds as opening up or closing down opportunity for interaction" (ibid. 2010:48). With this in mind, a new program is proposed to bring an element of unity to a fragmented site; that of a community design centre. As mentioned above by Low (2010), design can either open or close chances for effective spatial interaction. A community design hub offers the opportunity for community members to have a point of contact with professionals such as architects or engineers in order to solve spatial and design issues in a more resilient and sustainable manner.

It is proposed that the architectural intervention in such a context takes place in an incremental manner as a continuation of the existing spatial character. Making a 'first move' on the site aims to create a catalytic reaction and "leads to a number of alternative next moves" (Habraken 1987:4). Initiating the catalyst with the community design hub allows for the subsequent interventions to happen in a manner that aligns with the theoretical principles laid out.

As a thematic approach to the program, the presence of a construction and design bias on the site invites the growth of local craftsmen to establish themselves on the site and become part of the construction of the building itself, as well as projects implemented by the design hub in the community.

Architectural Contribution

The value of embracing the incremental nature of Mamelodi's spatiality allows such interventions to occur in a more organic manner in contrast to large-scale projects that create little interaction between the user and the design process.

This approach also allows for adaptive planning to take place – as the project develops in stages, it allows time for the users to interact with the spaces in order to understand what should be adapted for the next phase of the project.

Similarly, integrating the programmatic theme into the nature of the technology or construction allows for the users to be closely involved with the process which will, as previously mentioned, "contribute to social inclusion and recognition of the citizenship and creative practices of the previously disenfranchised" (Mbembe in Morejele et al. 2006:2).

This approach further aims to contribute to the multi-scalar approach of the project; incorporating programs from the site-scale; the existing programs, with those on a precinct-scale; the surrounding educational institutions, and a global scale; the community design centre.

Significance lies in viewing the built environment as the product of an ongoing and reiterative design process, allowing buildings to have multiple uses and lives. In a changing environment such as Mamelodi, it becomes important to design buildings that can respond to the needs of the user rather than the contrary.

Conclusion

Working in previously-separated contexts such as Mamelodi provides great opportunity for the implementation of resilient and democratic urban planning methods.

At the threshold of densification and urbanisation, Mamelodi has the opportunity to develop architecture and urban conditions, which celebrate its unique spatial character, rather than attempt to implement changes that would be alien to the context.

The celebration of a multiplicity of identities and functions is necessary for the transient and changing nature of Mamelodi's spatial character. Using the built environment as a method to embrace this changing nature will use what was previously used as an instrument of separation, as a tool of reconciliation and upliftment.

Through theoretical and contextual investigation, it becomes clear that the functionality of architecture does not take priority in this approach, as it develops incrementally from a grass-roots level in order to work with what has developed naturally in the context and catalyse it.

Thus the architecture does not exist for itself, but as a growing, responsive tool for the upliftment and betterment of the people that use it. Growth is an eventuality that needs to be designed for, in the situation of developing post-Apartheid cities. Facilitating the natural spatiality encourages the ingenuity and initiative of the users, the expert-citizens.

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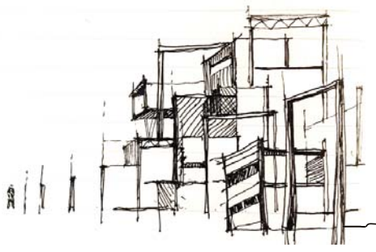

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6

CONCEPT

design intentions and informants

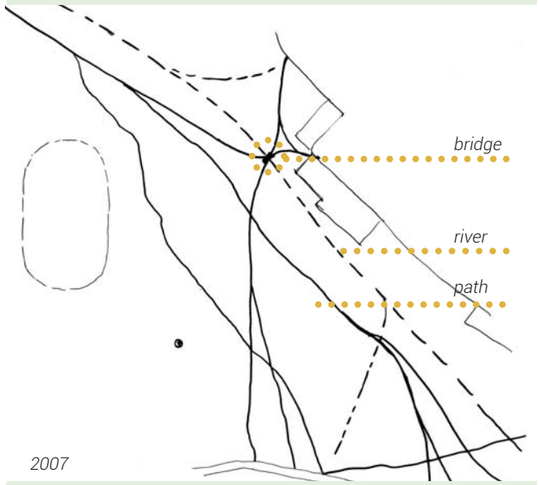
the appropriation of open spaces is a process that is prevalent in many South African cities and is seen in the evolution of this site. The intention is to design architecture and spaces that facilitate this adaptability of space and provide the infrastructure (knowledge/ materials) to support it

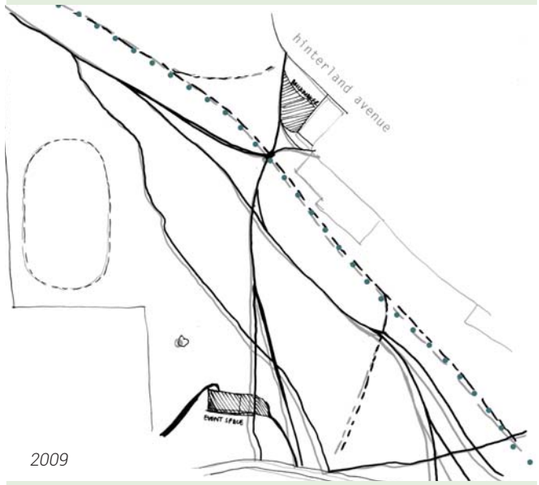
CONCEPTUAL GENERATORS

Drawing from the understanding of the precinct through the urban vision, it became apparent that the most appropriate approach to developing an architectural concept would be through the understanding of the context and theories that support the celebration of its uniqueness. Thus, the appropriation of open space and the negotiation of the street edge become important elements in designing for Mamelodi.
The development of conceptual approaches that are rooted in the urban vision, but uniquely derived from the individual sites, are necessary for the holistic implementation of the vision, without a homogenous development strategy. As the main informant of the argument is the site and the context it sits in, the mapping and understanding of the processes and spatial development of the site and the buffer zone as a whole have informed the decision making with regards to architectural concept. This understanding is then supported by theories such as *Space as Ritual* (2008) which, as discussed in previous chapters, informs the conceptual basis before exploring other theories in conjunction with the design development.

SPATIAL DEVELOPMENT

The appropriation of open space has taken place on this site over time, for activities ranging from permanent to impermanent and sacred to profane.





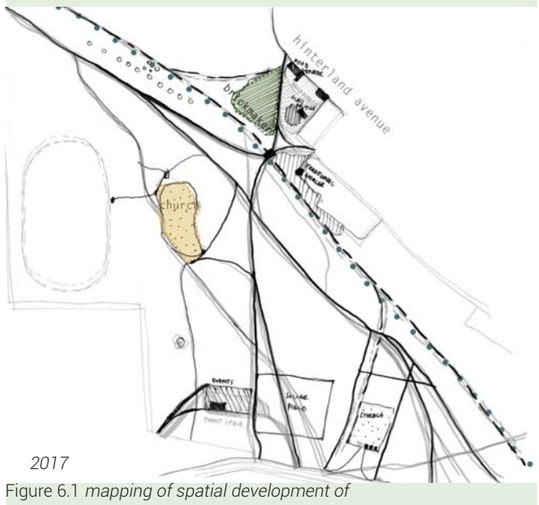


Figure 6.1 *mapping of spatial development of site from 2007-2017 (Author 2017)*

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As seen in Figure 6.1, the predominance of the flood plain on the site has limited development to temporary activities closer to the river, with more permanent structures taking developing closer to the street edges and away from the floodline.
This mapping of the changes of the bufferzone has revealed three main constant elements; the river, the path and the bridge. Understanding this hierarchy of spatial appropriation has led to the development of conceptual approaches to inform the design all the way through to technical resolution.
These three consistent elements of the site start to become important informants for the development of the architectural concept.

The River

The river represents what is natural and inherent to the site. Not only to the physical tributary itself, but all of the natural components that contribute to the character of the site. Understanding the natural conditions such as; floodlines, vegetation, natural systems and topography, are important elements for the designing of a contextually responsive architecture.
As these elements are what first existed on site, it is important that they are also the processes that are first considered in the design and planning of the site intervention.

The Paths

The next phase of site development is the path. These are developed out of necessity and as a means of traversing through the site. The paths represent the necessary practicalities for the workings of space; such as services and circulation. Pathways not only create links between destinations, they can surround and frame spaces in which other activities take place.

The Bridge

The bridge represents the infrastructure that allows the previous two elements to function with each other. As a higher level of human intervention, the bridge allows the river to flow and the path to continue over it.
The bridge is necessary for the future development of the site as it allows for greater and easier accessibility. Although the physical bridge on the site is small, it is effective for its purpose. Similarly to the architectural approach, sensitive but effective interventions are necessary for the catalysing of development without overshadowing the successful processes already existing on the site.
These three elements not only exhibit a hierachy over time, but also different scales of human intervention, from none to infrastructural.

CONCEPTUAL DEVELOPMENT

Studio conceptual workshops also contributed to the conceptual development of the project. Different lenses and methods (see Figure 6.8 to Figure 6.8) are explored to consider holistic understanding and intuitive decision making. Although this intuitive diagramming takes place over the whole bufferzone site, it leads to the decision to concentrate on the street edge as per the urban vision, and the 'hot' spaces of the site (see Figure 6.3).

Figure 6.2 *Opposite: Site sketches; the river, the pathway and the bridge (Author 2017).*

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Figure 6.3 *Hot and cold spaces of the site (Author 2017).*

1. HOT + COLD
Conceptual representation of 'hot and cold' spaces on the site.
This resulted in the understanding of the relationship between urban and environmental - the hard boundaries create 'cold' and dangerous spaces. The areas of movement and activity create hot spaces but pathways through the site only provide transient moments of heat.

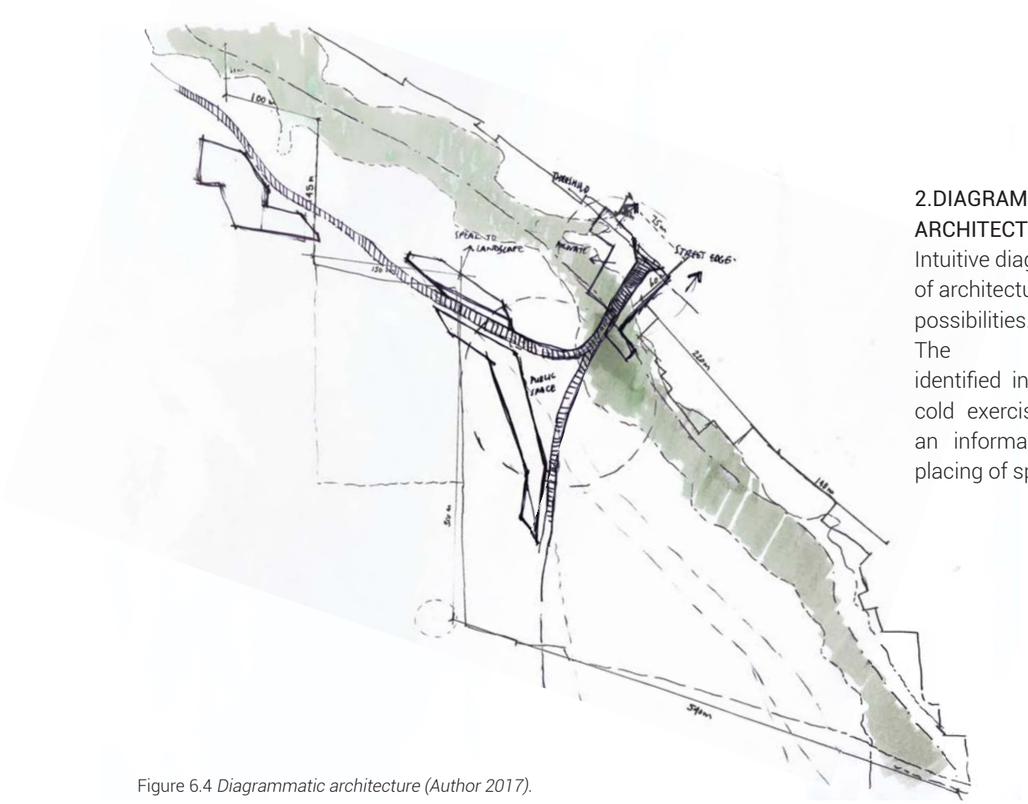
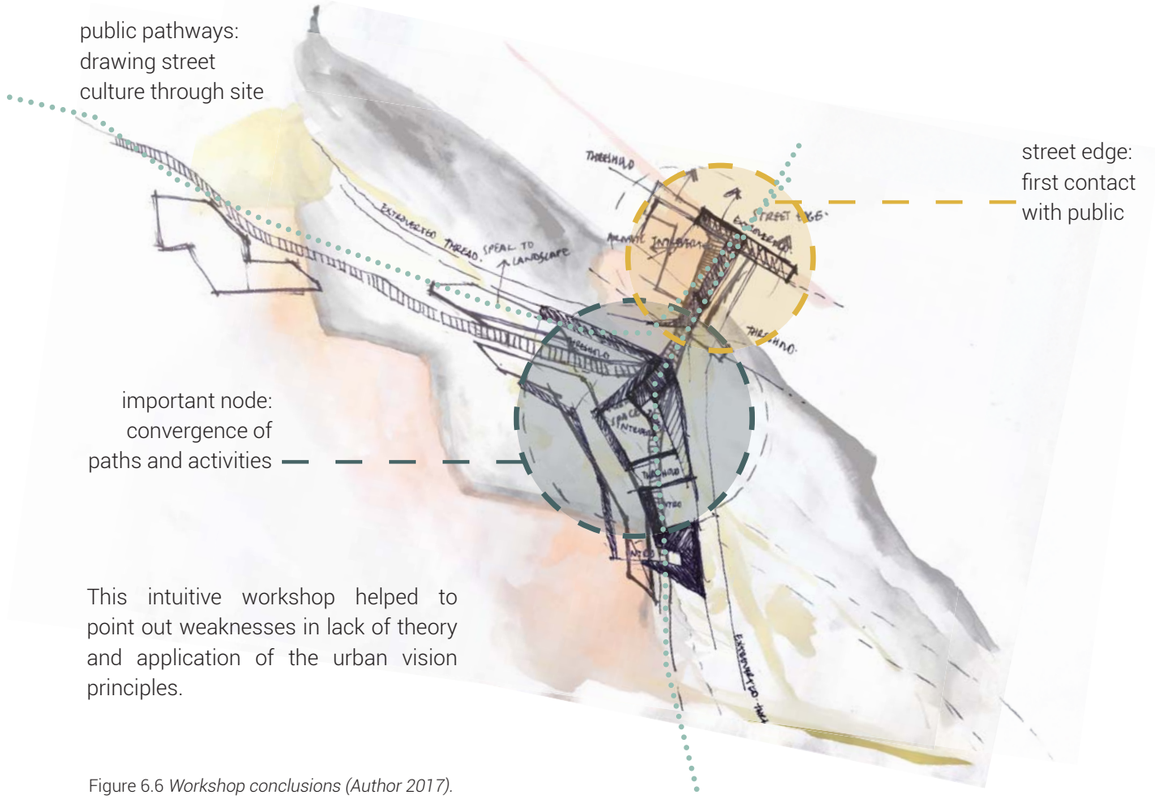


Figure 6.4 *Diagrammatic architecture (Author 2017).*

2.DIAGRAM OF ARCHITECTURE
Intuitive diagramming of architectural possibilities.
The pathways identified in the hot + cold exercise become an informant for the placing of spaces.

Figure 6.5 *Introverted and extroverted spaces of the program (Author 2017).*

3. INTROVERTED/ EXTROVERTED
Excercise in diagramming introverted and extroverted components of the program. Although the program was not difinitive, it led to an understanding of where introverted or extroverted spaces could begin to take place on the site.



This intuitive workshop helped to point out weaknesses in lack of theory and application of the urban vision principles.

Figure 6.6 *Workshop conclusions (Author 2017).*

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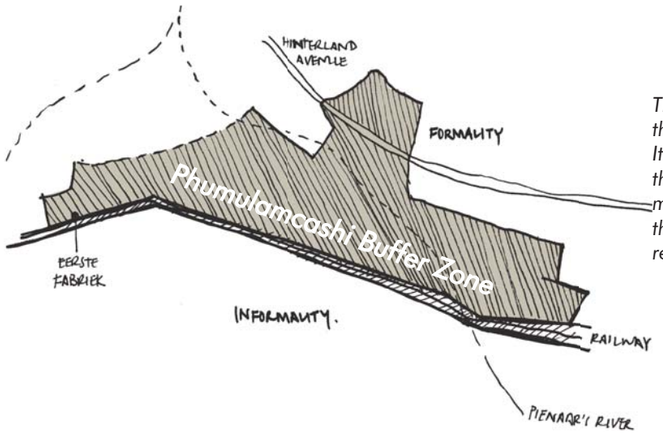

The existing condition of the site as a buffer zone. It is a physical divider that also separates the metaphysical but holds the potential as a point of reconciliation.

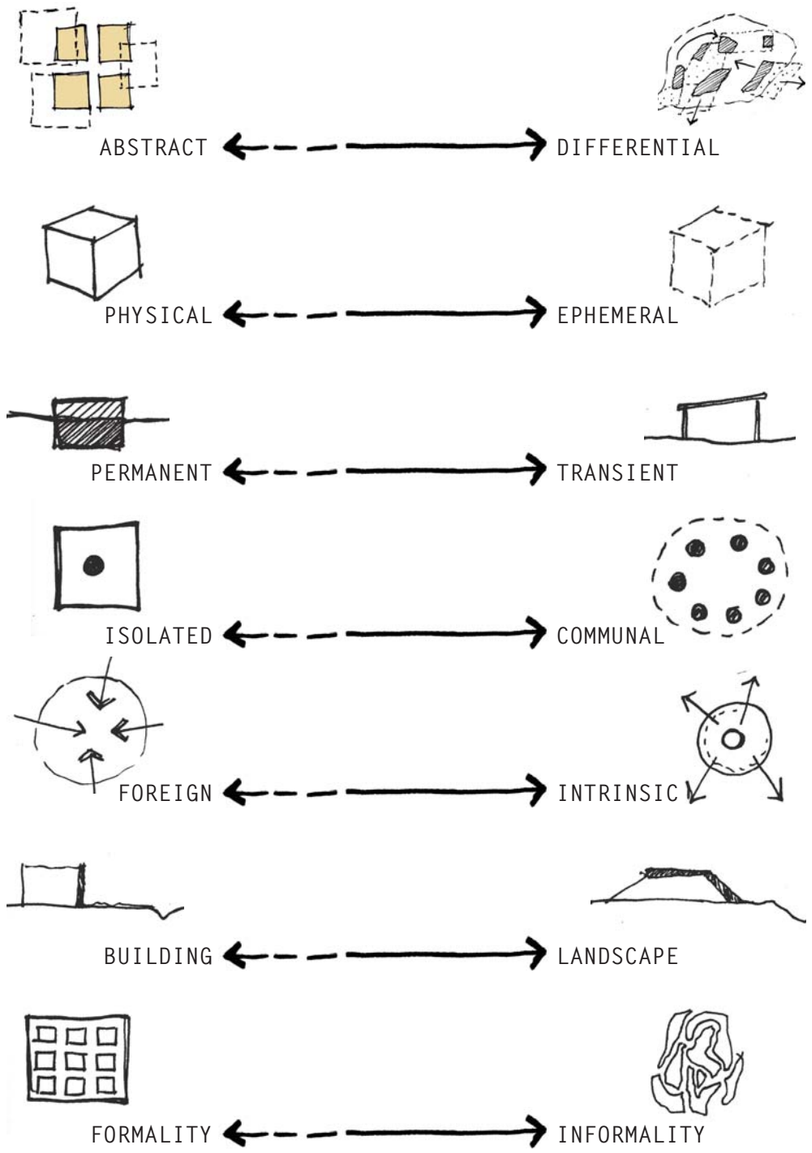

Figure 6.7 *Contrasts observed on site informing concept (Author 2017).*

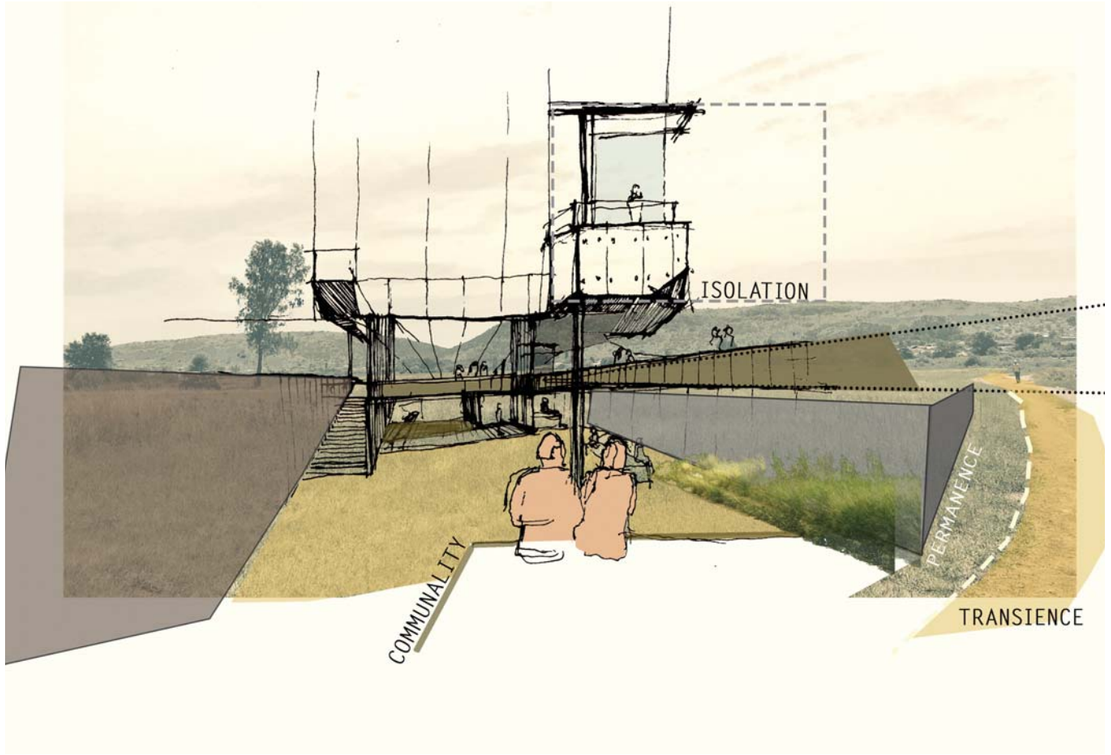

Figure 6.8 *Conceptual architectural diagramming of contrasting spaces (Author 2017).*

CONCEPTUAL APPROACH:

Scales of Separation

The architectural concept is rooted in the nature of the site as a buffer zone. Exhibiting many transient and permanent qualities, the context is constantly negotiating between these differences. The eventuality of new programs forming and spaces being appropriated to suit them leads to the need for a flexible approach to space-making in contemporary Mamelodi.

Scales of separation intends to negotiate the tension between the polarities seen on the site; transient and permanent, sacred and profane, formal and informal, solid and void, in order to create an architecture that is responsive to these scales and can adjust accordingly. Working with these contrasts aims to progress towards the multiplicity of spatial identity encouraged by Van Rensburg and Da Costa (2008) rather than a homogenous development approach. Lefebrve's notions of differential space also support the celebration of these contrasts in order to restore unity and understanding through space.

This concept deals with a non-homogenous approach to space making as “an appropriate South African urban expression begins with honouring the significance of the diverse perceptions and viewpoints of its society” (Van Rensburg & Da Costa 2008:36) towards a new era of space.

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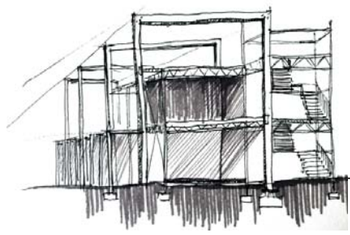

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7

DESIGN DEVELOPMENT

design process and iterations

design iterations are developed through an increased understanding of the site, program and theoretical influences

DESIGN INFORMANTS

The initial design intentions are developed through the understanding of site constraints - being ecological, social, and cadastral.
The acknowledgement of these elements results in many interpretations and responses to these through the architecture.
This approach develops and changes throughout the process as consideration of program, materiality, adaptability and incrementality become more prevalent through the project.

DESIGN PROCESS

The design process is a constantly reiterative one. Researching, designing, critiquing, and responding has led to the development of the creation of this intervention.
The exploration of technology also becomes an integral part of the design process, especially when dealing with modular and flexible spaces. This exploration of materiality results in multiple responses to the site and eventually to the development of technical resolution.
Although this process is reiterative, there are elements that become more consistent with each iteration, creating a stronger base for the further resolution of the architecture.

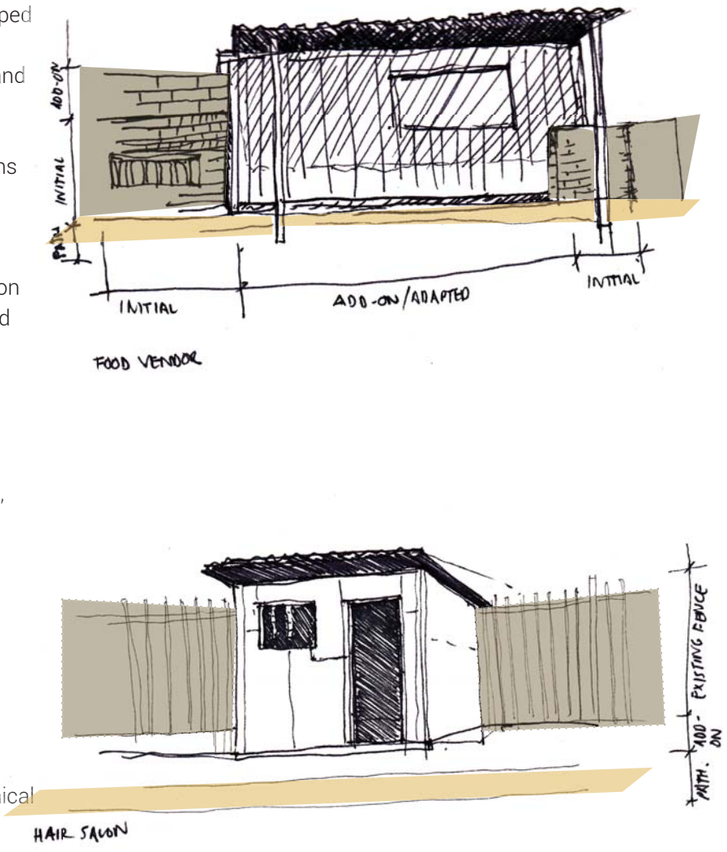

Figure 7.1 *Contextual spatial development observation sketches (author 2017).*

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Figure 7.2 *Activity mapping of the site (author 2017).*

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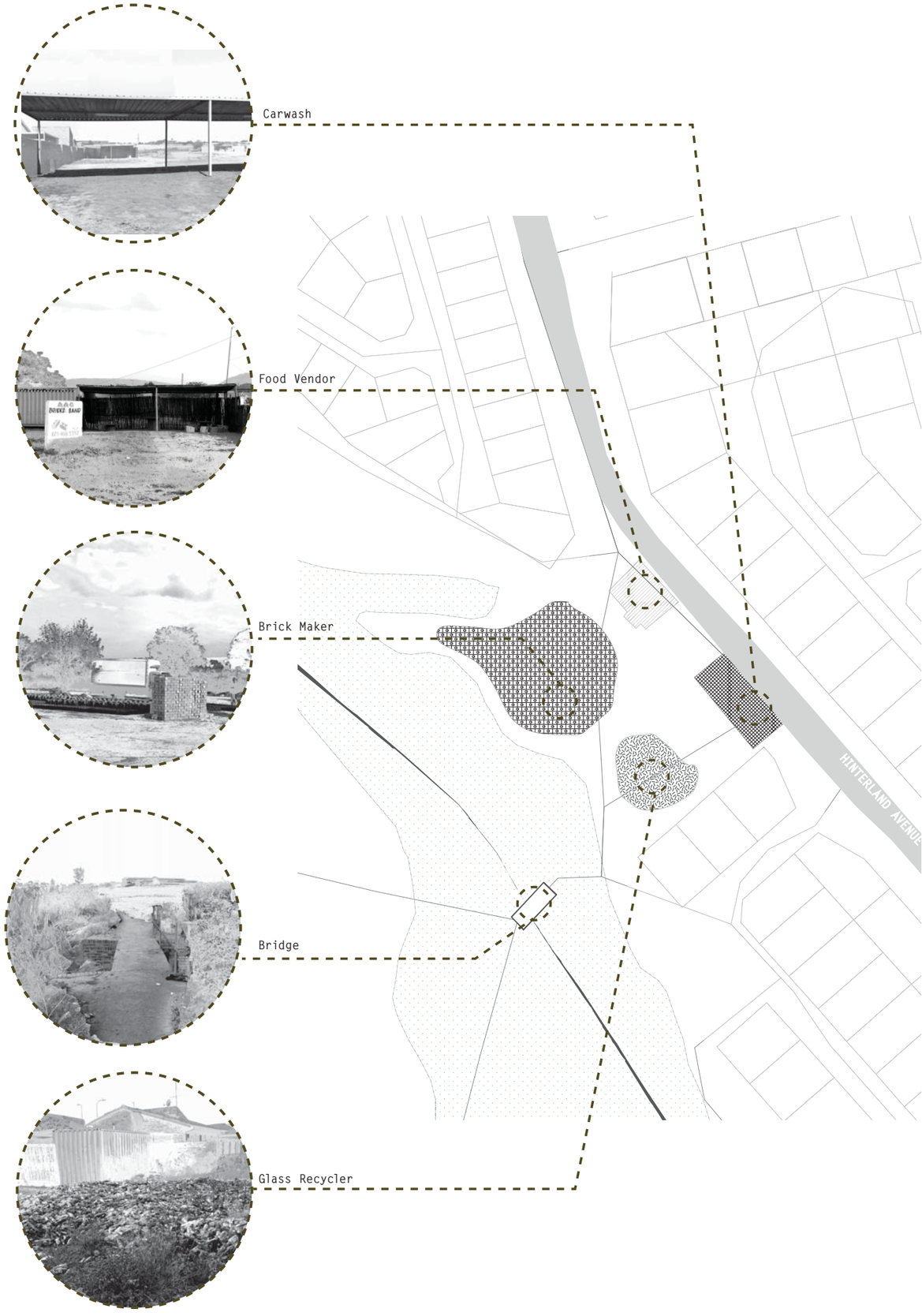

Figure 7.3 *Opposite: Diagram of existing programs on the site (author 2017).*

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> ITERATION ONE

The first iteration responds to the residential scale of the surrounding context, aiming not to overpower the surrounding scale but to complement it.
This results in a low-scale development covering most of the site.
This iteration further aims to maintain the existing movement patterns through the site, resulting in the public pathways cutting through the buildings and forming a large public space in the centre.
The grid of the site is rotated to maximise the access to northern light, creating a staggered facade on the street edge.

Critique

This iteration failed to address the urban issue of density Mamelodi's sprawling low-density spaces have led to an inefficient use of space ad limitation on vertical density.
This iteration mimics that nature of spatiality rather than proposing new ways of public space development as suggested by the writings of Van Rensburg and Da Costa (2008).
Although this iteration creates interesting combinations of spatial experiences, the direct rotation of the grid becomes unresponsive to the important street edge. The rigidity of this grid also becomes homogenous in its treatment of this edge and lacks the hierarchy necessary for a public building.

Figure 7.4 *First iteration plan, not to scale (author 2017).*

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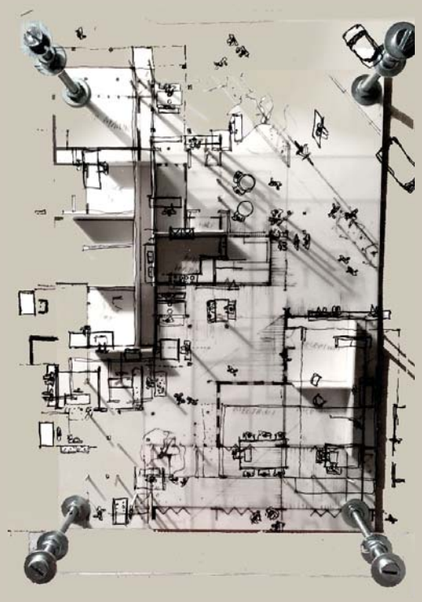


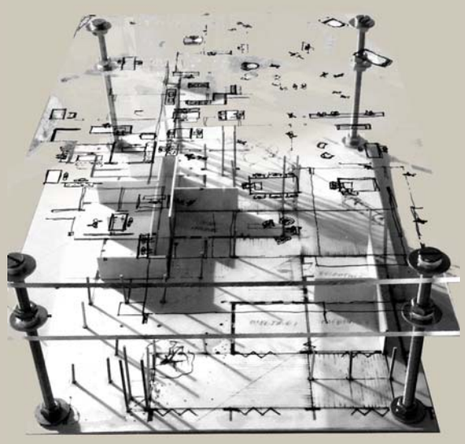
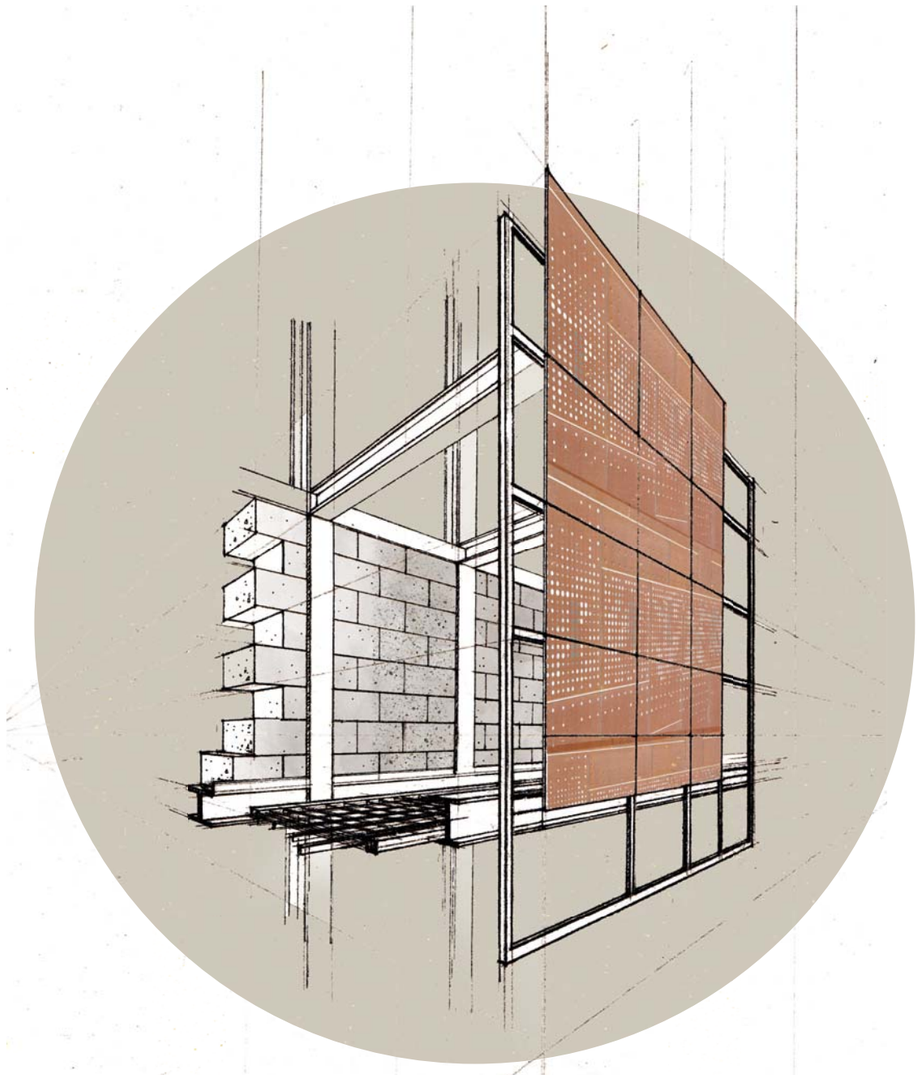
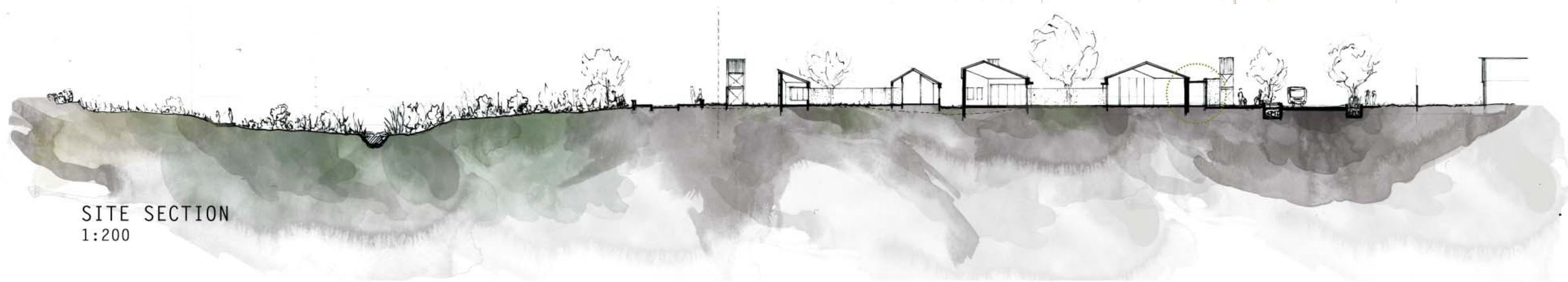


Figure 7.5 *Left: conceptual layered model representing the different stages of development, from initial structure, to adapted spaces, to people populating the spaces. (Author 2017).*

Figure 7.6 *Below: Section through site depicts low-scale intervention, drawing not to scale (Author 2017).*

Figure 7.7 *Opposite: diagram representing tectonic intentions. The materiality is informed by the concept of 'scales of separation' discussed in the previous chapter. Ranging from cement bricks made on-site to a heavy steel structure to a lighter steel screen, the materiality represents a transition from stereotomic to tectonic, allowing for future extension both horizontally and vertically. Diagram not to scale (Author 2017).*





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> ITERATION TWO

The second iteration responds to the lack of density of the first iteration. As an explorative exercise, the maquette becomes an intuitive response to space-making on the site.
Similarly to iteration one, the existing diagonal movement through the site is maintained as a design informant. However in response to the first iteration, a greater density of space and program is focussed along the street edge, maintaining the western section of the site for the for the rehabilitation of the natural landscape.
Diagrammatic plans (see Figure 7.11 and Figure 7.12) are developed from the maquette in order to inform the spatial planning of programmed spaces.

Critique

This iteration is more of a spatial exploration of scale and complexity of spaces. Although it is not developed into a resolved design, it becomes an important informant for elements that are carried through the design process.
This exploration begins to explore the possibilities of holding the corner of the site, defining the public space towards the interior of the site.
Although this iteration explores more complexity in hierarchy and scale, the structure becomes too dense towards the street edge and too dominant over the neighbouring houses. This iteration also begins to respond more to the river edge by pulling away from it creating a sensitivity to the natural landscape.
Designing spaces of this density also begins to limit the adaptability of spaces, leading to the introduction of more generous space to allow for growth over time.

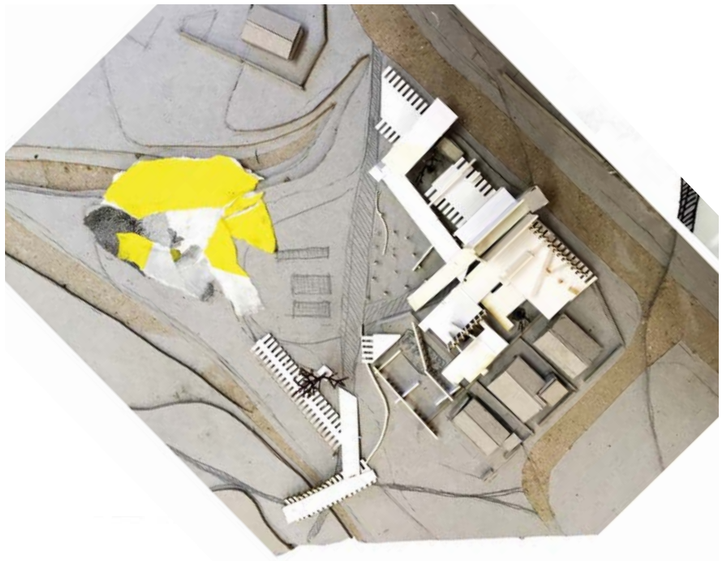

Figure 7.8 *Above: explorative maquette, top view (author 2017).*

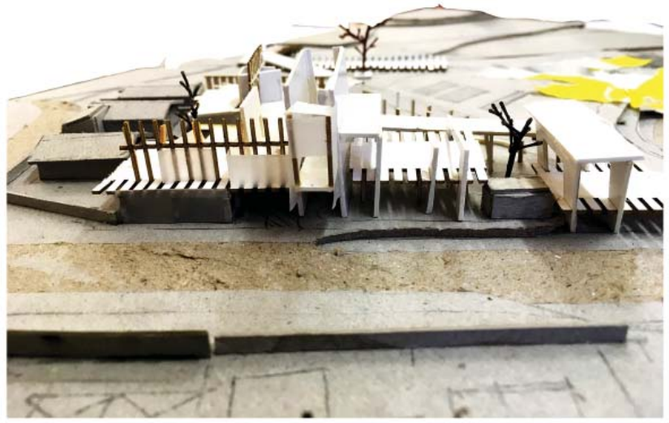

Figure 7.9 *Above: explorative maquette, street elevation (author 2017).*

Figure 7.10 *Below: explorative maquette, street view (author 2017).*

Figure 7.11 *Above: second iteration ground floor plan diagram (author 2017).*

Figure 7.12 *Below: second iteration first floor plan diagram (author 2017).*

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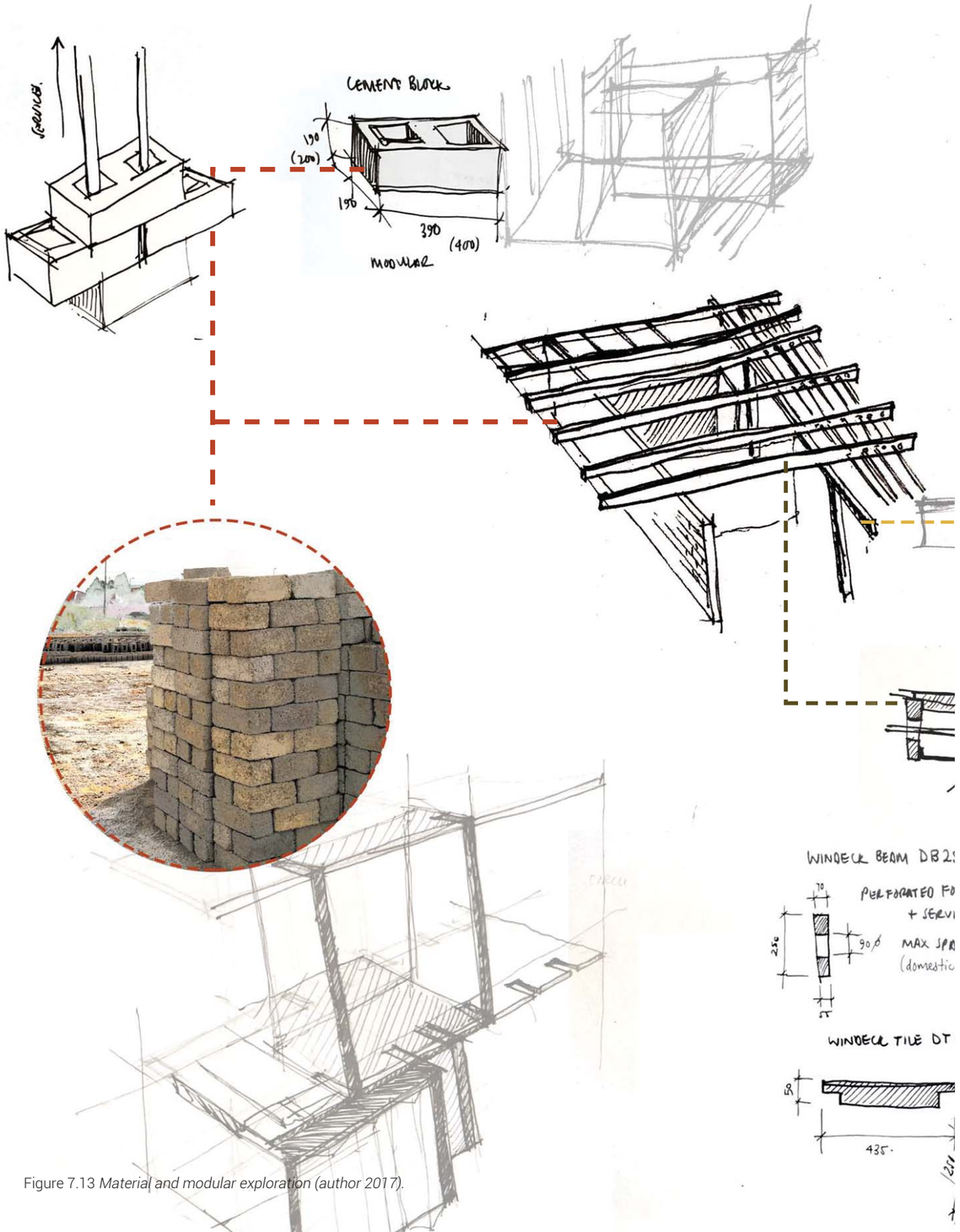
> ITERATION THREE

The mid-year design crit sees the development of tectonic and material intentions.



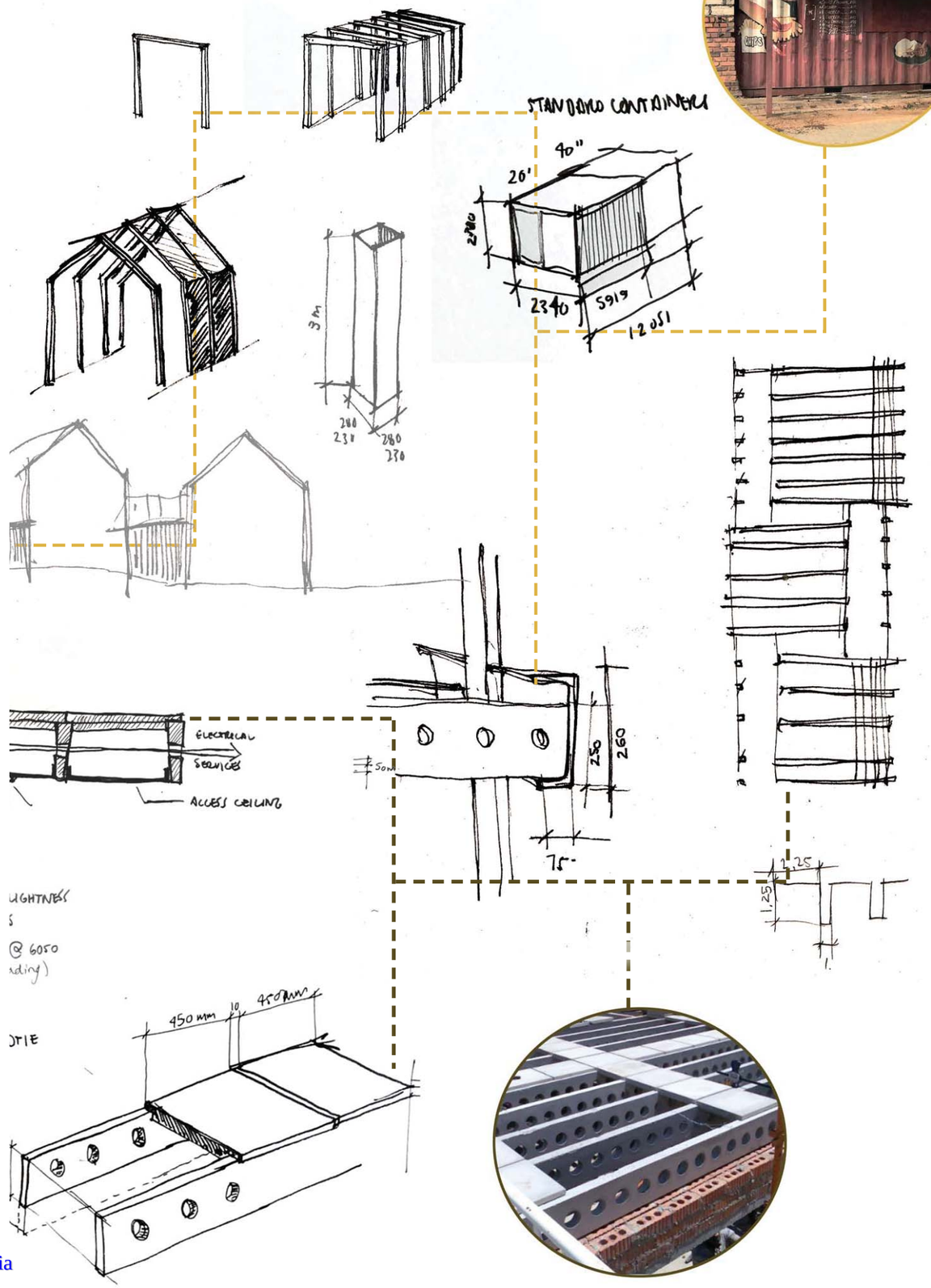


Figure 7.13 *Material and modular exploration (author 2017).*

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> ITERATION THREE

In pursuit of spatial flexibility through architecture, the theory explored in this process suggests the use of modularity for easy expansion, subtraction and replacing of spatial elements.

In order to achieve the adaptability of the Open Building concept, this iteration begins to explore the materiality that can contribute to this character. Along with the contextual nature of this project, the materiality aims to make use of the resources available on-site, namely the concrete blocks that are currently manufactured on the site.

The program begins to form a narrative in the architecture, exhibiting the possibilities of the programs to move around the site, changing and developing over time according to their spatial needs. The brick yard moves from the western corner of the site to the south eastern edge, allowing for the former space to be rehabilitated to the natural landscape, and 'land-banked' for future development. The south eastern edge of the site also allows for easier vehicular access, limiting it from the rest of the pedestrianised site (see Figure 7.14).

This iteration exists as a very sensitive intervention on the site, aiming not to over-power and over-plan the open area. The intention is for the project to develop incrementally, always allowing space for it to grow over time (see Figure 7.22). As put forward by Habraken in *The Control of Complexity*, any first architectural move "leads to a number of alternative next moves" (1987:4) and thus resulting in a multitude of architectural possibilities.

The development of the project is represented in Figure 7.22 as an exploration through the model process. The first move is to establish the first phase of the design hub on the most public corner of the site, creating a landmark to signify the coming development. The design hub will then oversee the future development of the site, working with the local community and stakeholders for greater social sustainability.

The next move would be the development of the pedestrian pathway through the site and the street edge condition. In order to provide for the introduction of new programs, the service blocks will be established to act as cores from which the workshops can extend. As the craftsmanship spaces develop along the ground plane street edge, the training and meeting spaces of the design hub will develop on the first floor plane.

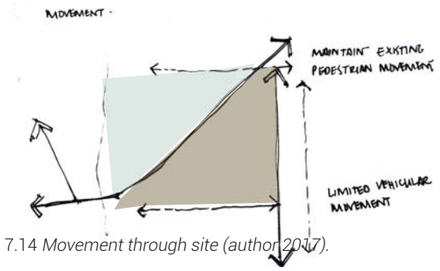

Figure 7.14 *Movement through site (author 2017).*

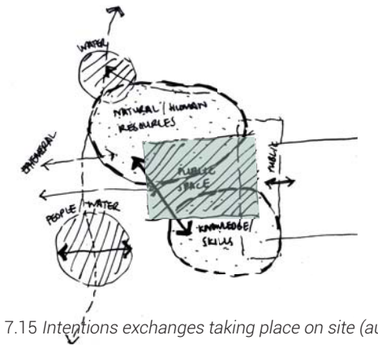

Figure 7.15 *Intentions exchanges taking place on site (author 2017).*

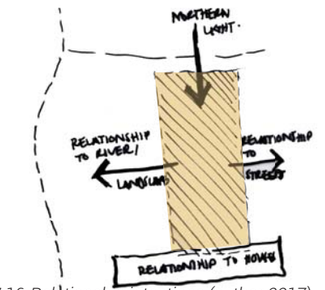

Figure 7.16 *Relationship intentions (author 2017).*

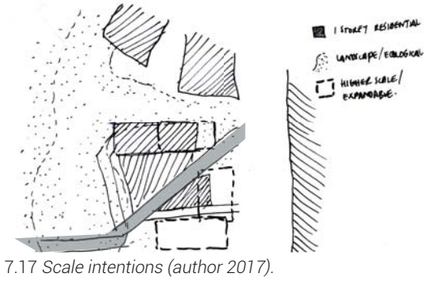

Figure 7.17 *Scale intentions (author 2017).*

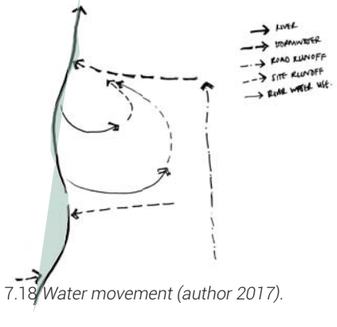

Figure 7.18 *Water movement (author 2017).*

Figure 7.19 *Above: third iteration ground floor plan, not to scale (author 2017).*

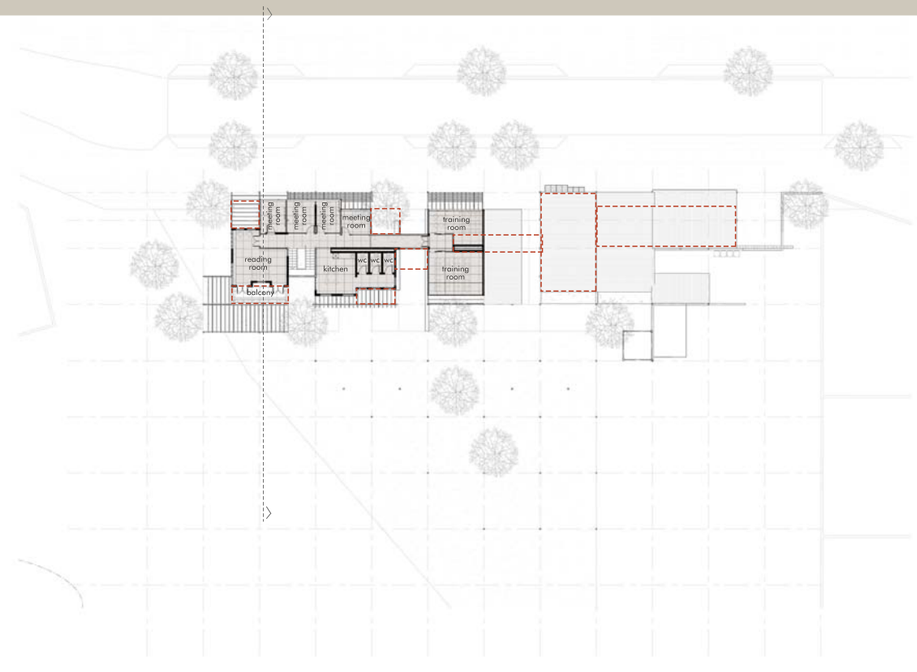

Figure 7.20 *Below: third iteration first floor plan, not to scale (author 2017).*

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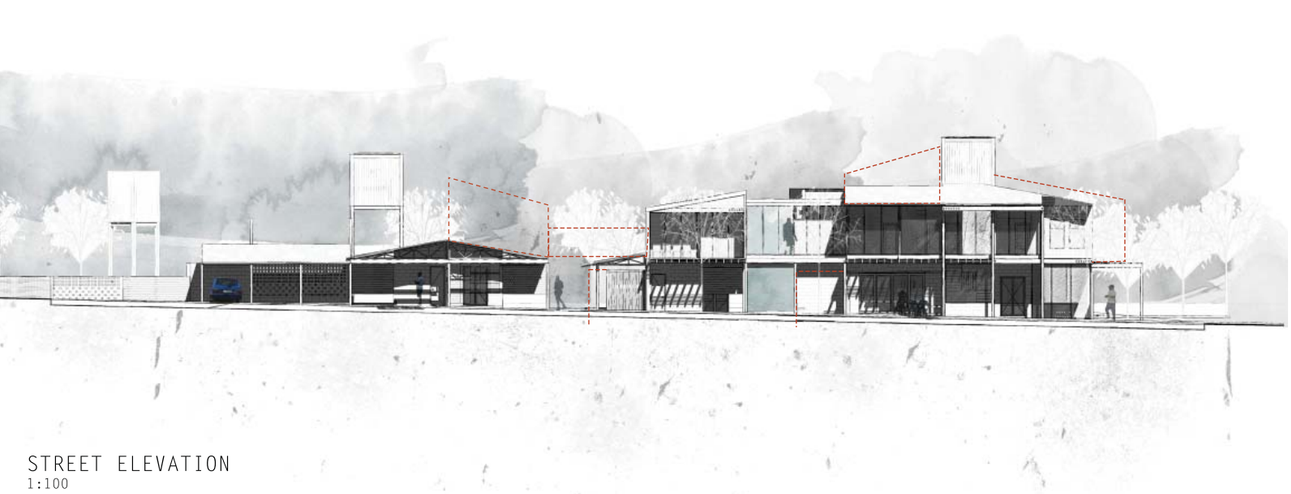


Figure 7.21 *Street elevation indicating possibility of future expansion, not to scale (author 2017).*

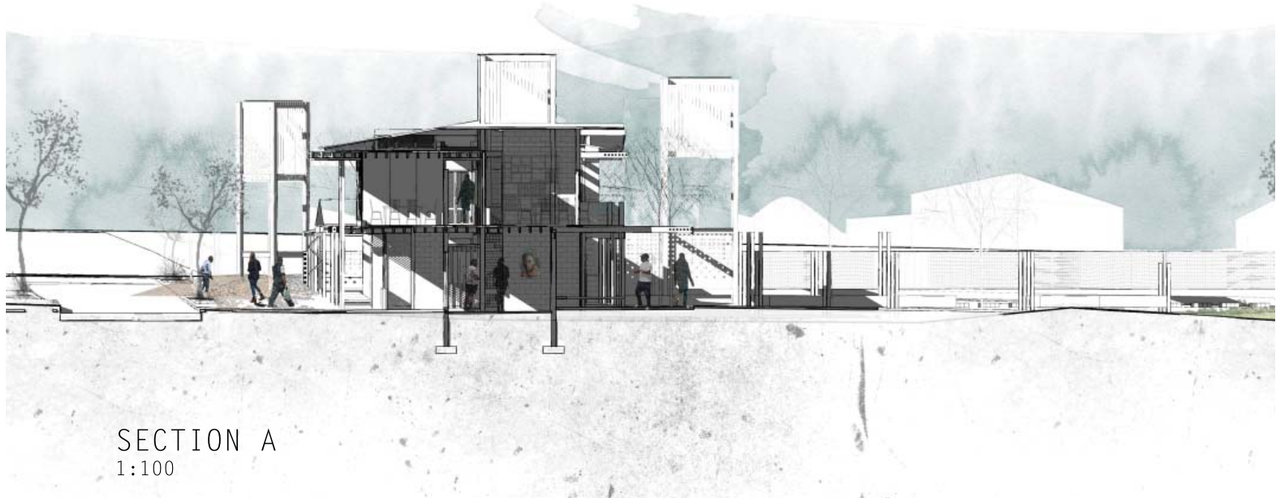


Figure 7.23 *Section displaying response to street edge and public space, with tectonic intentions. Drawing not to scale (author 2017).*

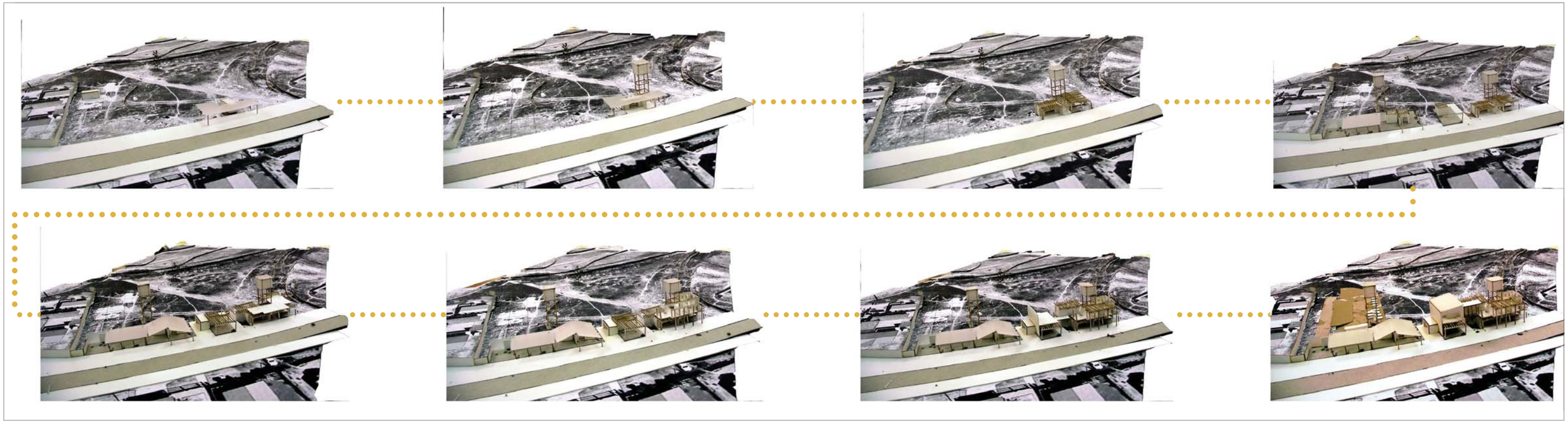
Critique

The architecture begins to form interesting spatial experiences, but the material proves to still be limiting in terms of flexibility and adaptability. Because of the heaviness of the structure, it becomes very rigid.

There needs to be a clearer distinction of the logic in structure, less haphazard and more articulated in terms of the elements of the design such as the infill panels and the supporting structure.

The materiality also gives an impression of domesticity which responds to the surrounding context, but may not be appropriate for the design of a building with civic intentions. There exhibits an opportunity to introduce a new scale to the precinct, not only spatially but also in terms of use of materials. The response to this is to investigate how to incorporate the materiality of the context with other technologies that could provide the most "alternative next moves" (ibid. 1987:4).

Figure 7.22 *Incremental development of project over time represented through model photos (author 2017).*



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> ITERATION FOUR

Tectonic development for the technical interim crit leads to design changes in pursuit of greater flexibility of space and implementation of the tectonic concept.

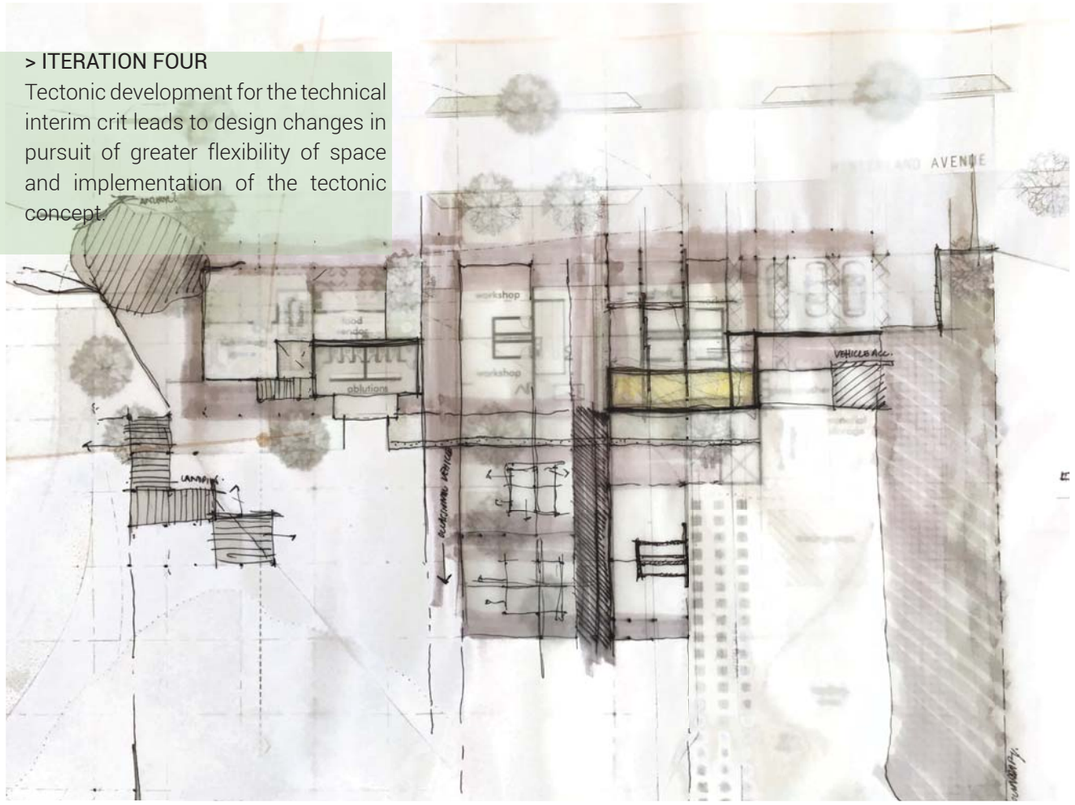

Figure 7.24 *Above: Design development process work, not to scale (author 2017).*

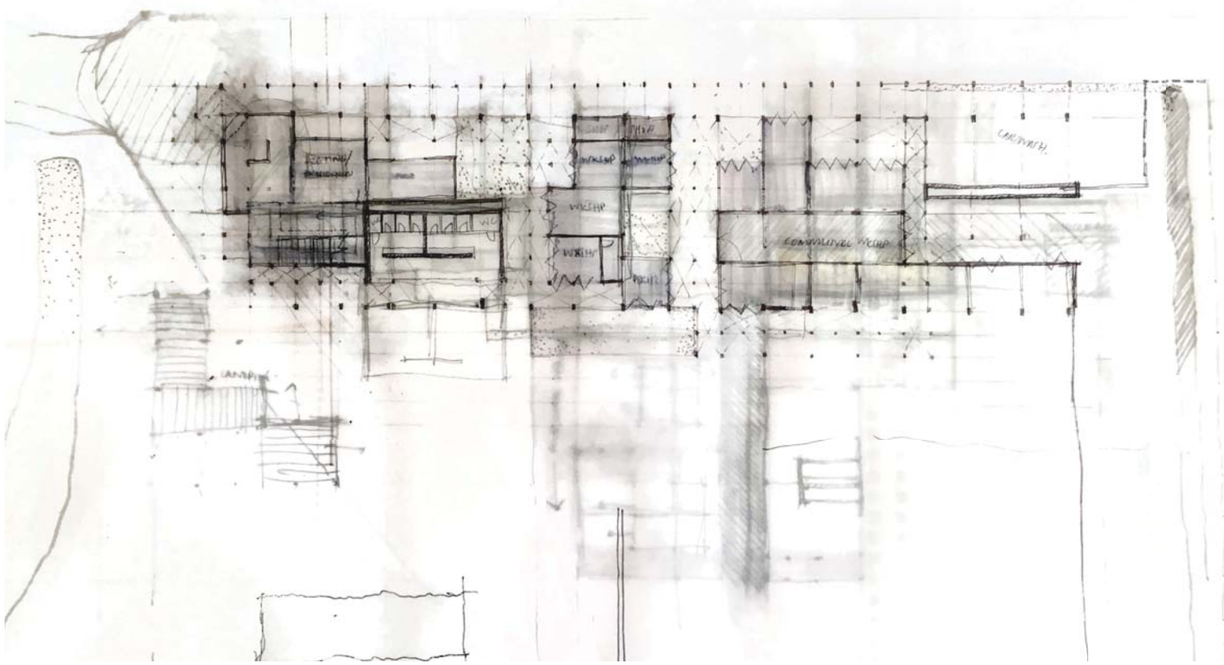

Figure 7.25 *Below: Ground floor design development process, not to scale (author 2017).*

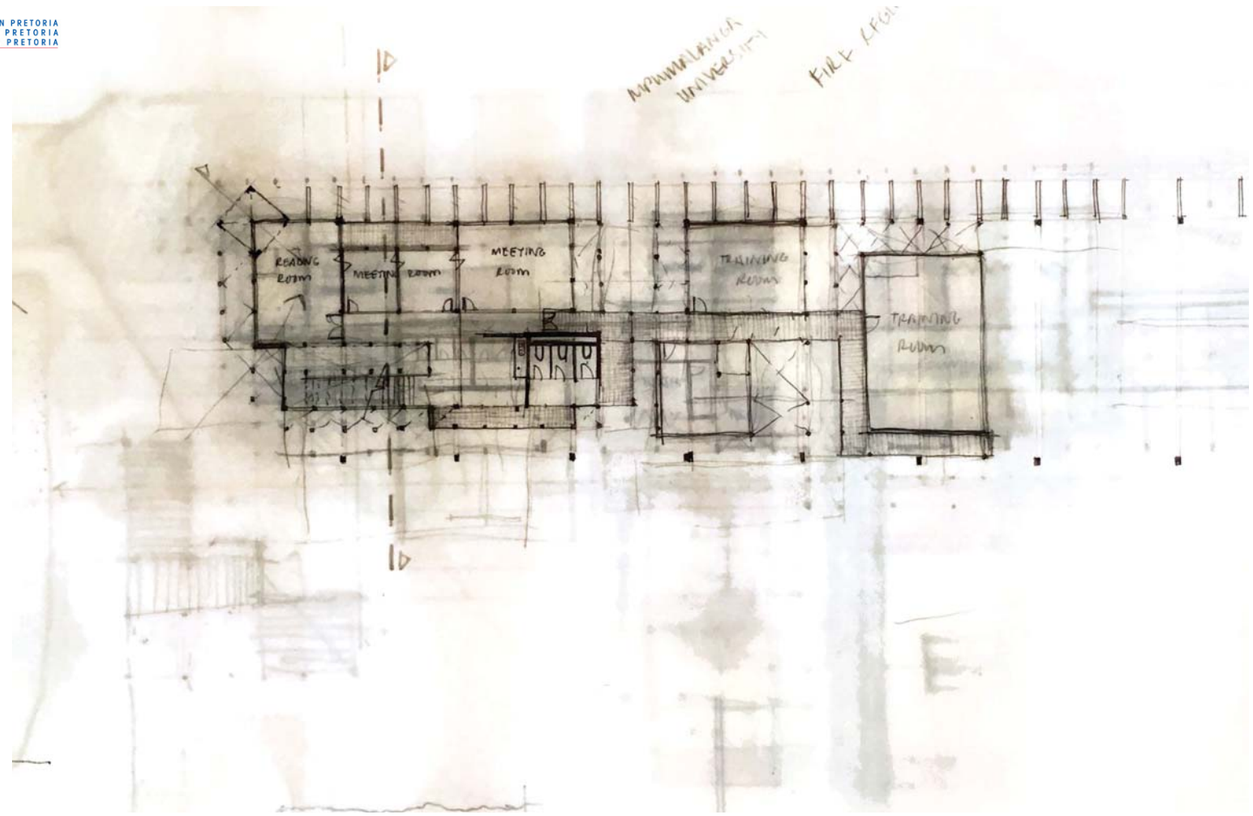

Figure 7.27 *Above: First floor design development process, not to scale (author 2017).*

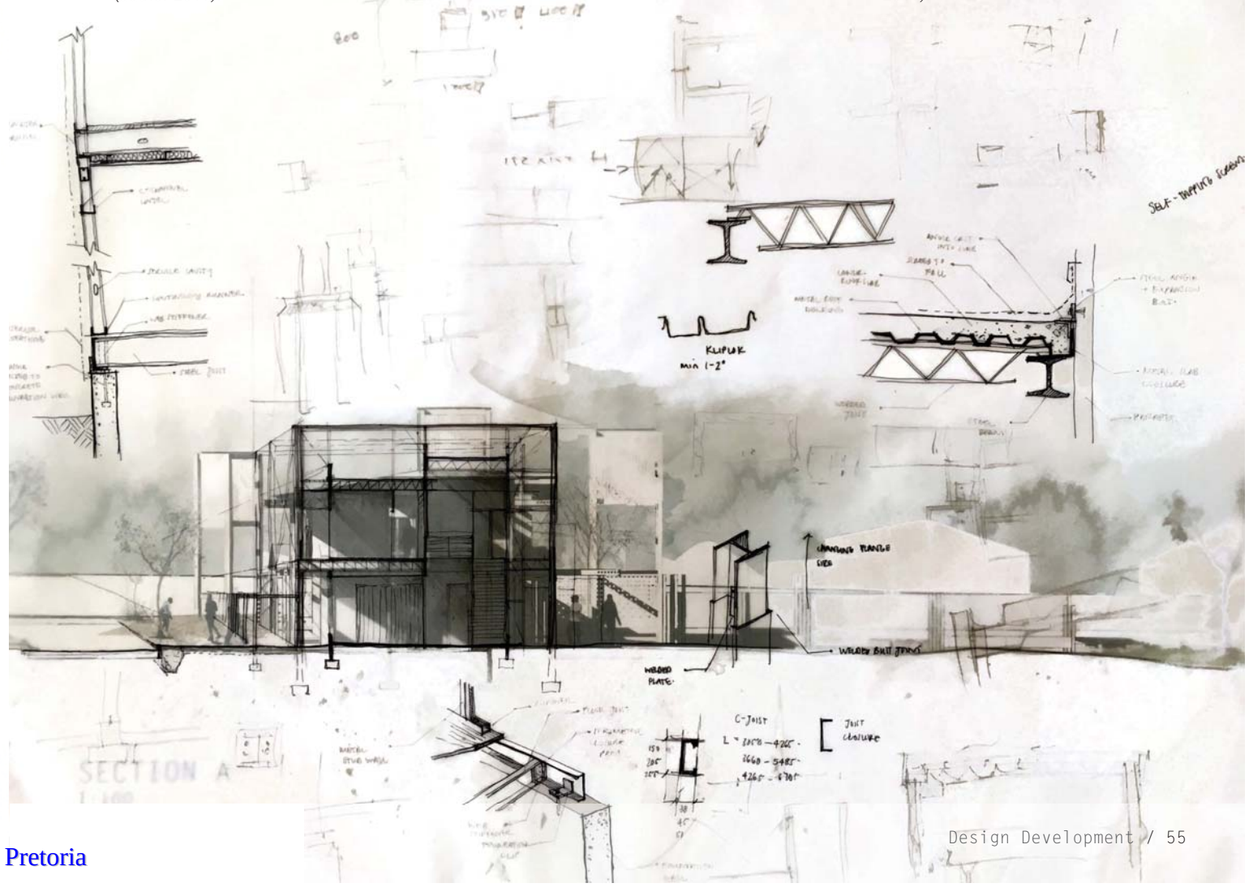

Figure 7.26 *Below: Technical section development, not to scale (author 2017).*

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> ITERATION FOUR

As a response to the material and technical limitations of iteration three, this iteration stems from the tectonic concept, which then affects the materiality and design of the structures.

In this iteration, the primary material used is steel. Steel allows for quick construction, adaptability, longevity, lower water use during construction, and less material waste. This iteration explores the possible structural hierachy of a steel structure and light-gauge steel infill.

Although the spatial planning remains very similar to the previous iteration, the negotiation between permanent and temporary, or fixed and flexible, is extended through the use of three different service cores (see Figure 7.28). These cores become more permanent structures, making use of the bricks made on-site, with each aiming to serve a different type of user.

The separation of the types of uses and users allows for different scales of systems and the implementation of safe-to-fail principles (Ahern 2011). By decentralising these service systems according to use-type, it allows for failure to occur without jeopardising the system as a whole.

This principle is also applied to the structure. In order to facilitate the future adaptability of spaces, a larger steel portal structure is constructed in which the light-gauge steel framing can sit and be able to grow over time with the main structure holding it in place (see Figure 7.30 and Figure 7.31). This allows for greater freedom of movement of the interior spaces and layers of structural elements to contribute to the redundancy and modularisation of the building.

These multiple layers act as 'buffer zones' within the architecture, allowing room for the spaces to grow and fill-in over time.

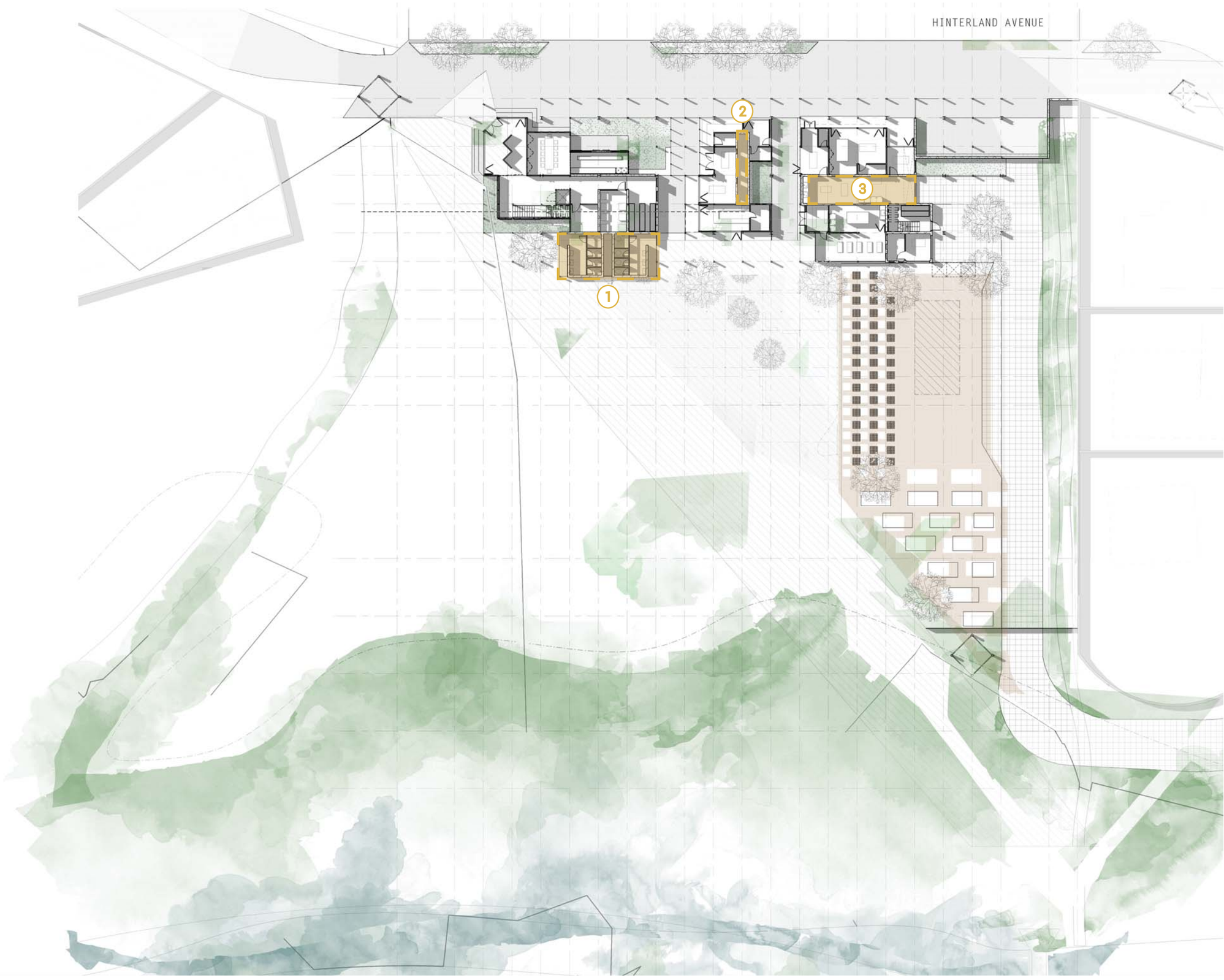

Figure 7.28 *Iteration four ground floor plan, not to scale (author 2017).*

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Critique

In order to develop a more economical structural solution, the elements need to be more sensitive to the surrounding context and responsive to the immediate need with possibility for the future expansion, rather than creating a dominating structure that becomes very heavy and expensive.

Working on a solid planar element, such as the floor plane, may create more opportunity for the flexibility of spaces rather than the individual, independent structures.

Although this iteration shows much more control over structural organisation, it is not the most appropriate solution for the site and also requires more continuity between internal and external structure.

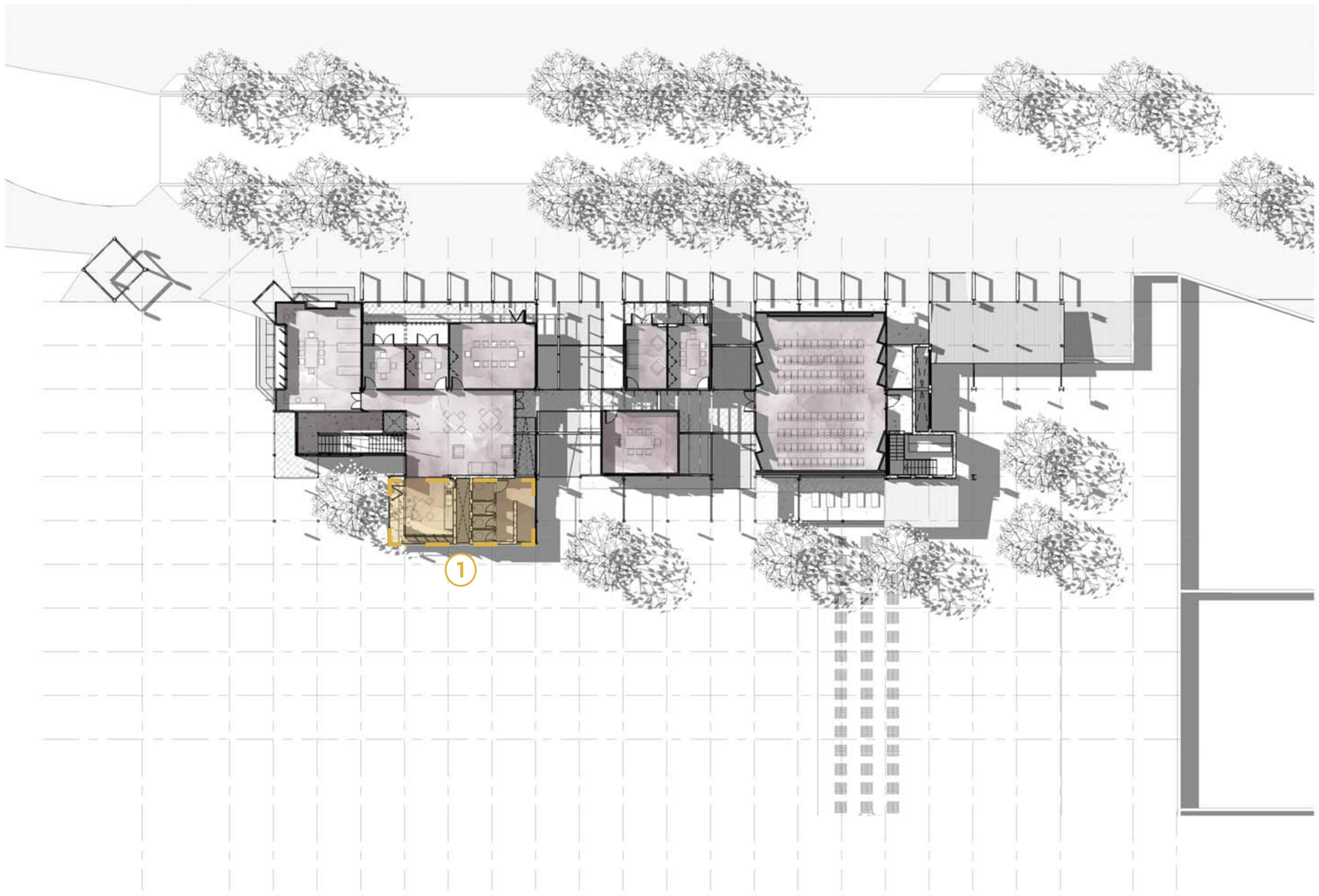
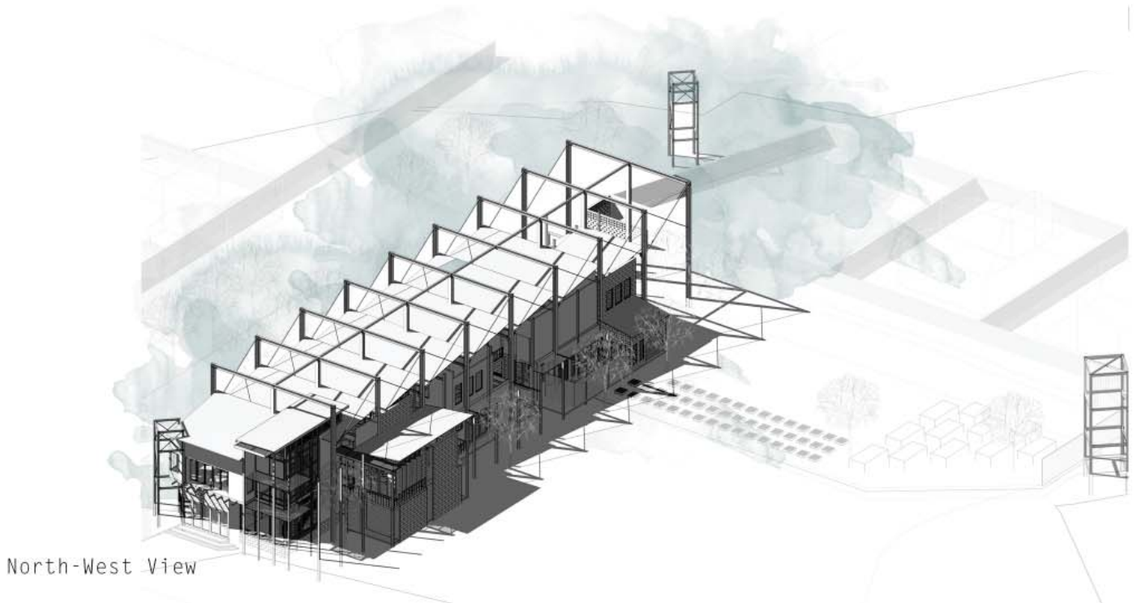


Figure 7.29 *Right: Iteration four first floor plan, not to scale (author 2017).*

Figure 7.30 *Opposite bottom: Iteration four axonometric view (author 2017).*

Figure 7.31 *Below: Iteration four axonometric view (author 2017).*



North-West View

North-East View

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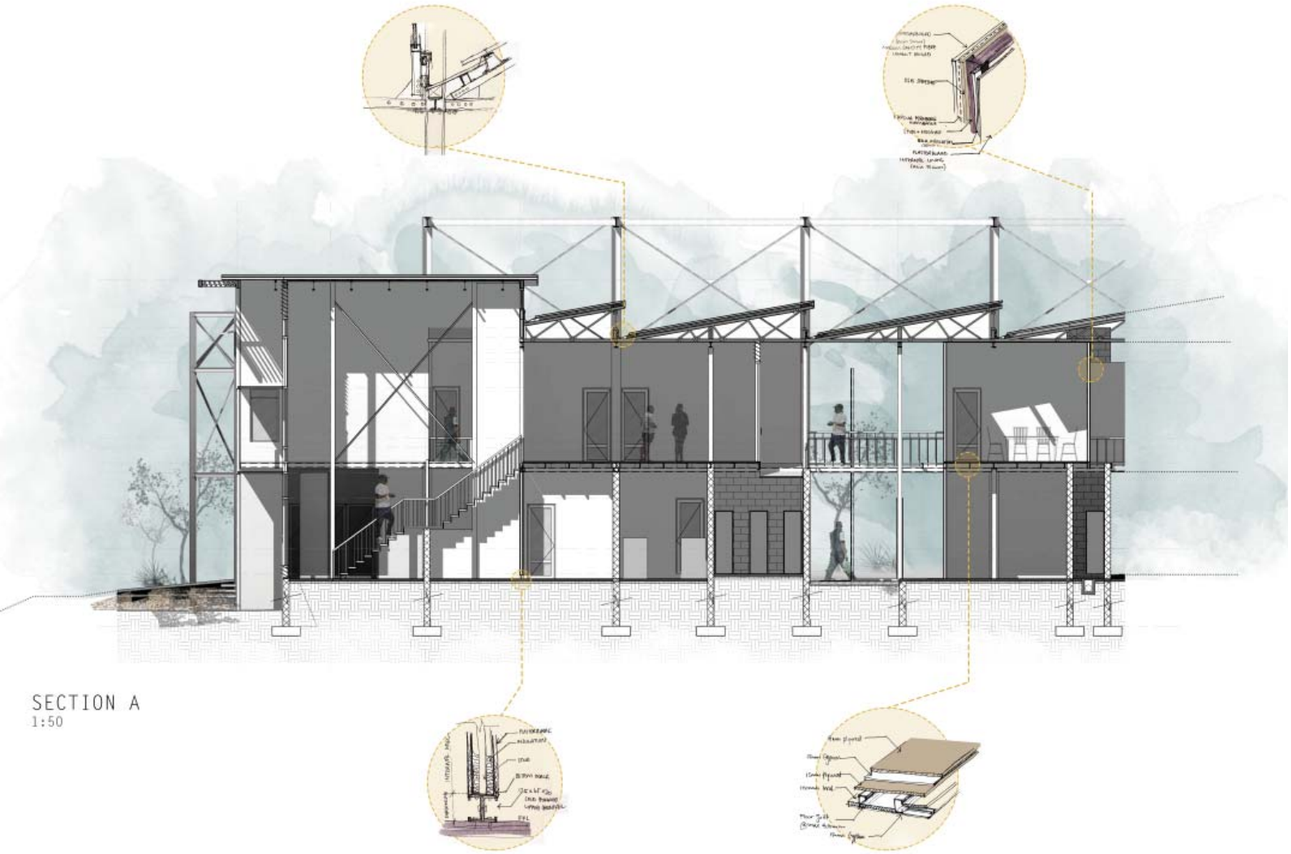
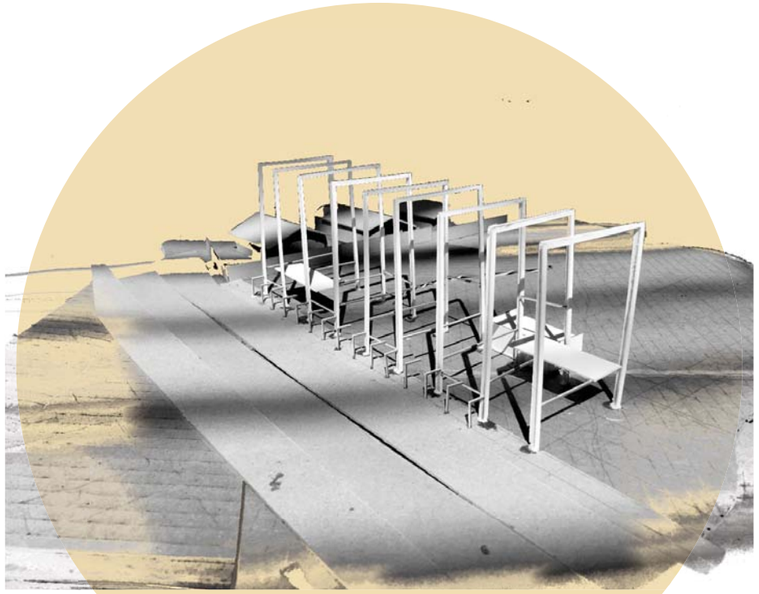


Figure 7.32 *Above: Section exploring tectonic intentions and details (Author 2017)*



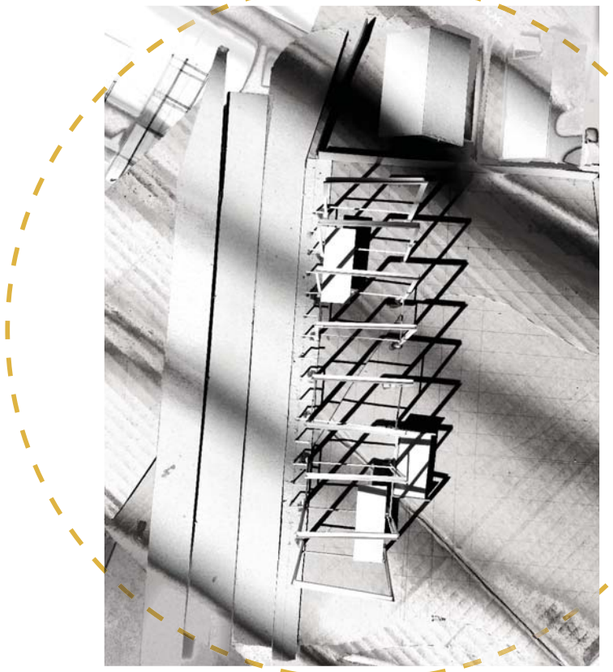


Figure 7.33 *Opposite top: Exploration of structure through maquette (Author 2017).*

Figure 7.34 *Opposite bottom: Exploration of structure through maquette, top view (Author 2017).*

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8

TECHNE

tectonic concept and development

the development and implementation of technical concepts and intentions which aim to facilitate the incremental nature of Mamelodi's spatiality

TECHNICAL CONCEPT:

Unfinished Architecture

With theoretical influences of Space as Ritual (2008), Safe-to-Fail (2014), and the writings of N. John Habraken (1987, 2014), the development of the tectonic concept relates to the design of multifunctional and adaptable spaces.

The incremental nature of spatial development in Mamelodi becomes a driving informant for the tectonic quality of this intervention. Situated in a context that is constantly growing and changing according to spatial needs, the architecture aims to encourage the identity that "the built environment as a living organism renewed by never-ending series of partial transformations" (Habraken et. al 2014:10).

The notion of architecture as a never-ending design process leads to the idea of scaffolding as a structural informant (Figure 8.1). Scaffolding can either be a temporary measure used to aid the development of the built environment, or it can become a more permanent element of the structure.

Scaffolding not only facilitates the growth of other strutures, it is designed in itself to grow and extend as the need arises. The idea of scaffolding also informs the structural hierachy in that the vertical elements are the most important, allowing the horizontal and planar elements to be added and adjusted where necessary.

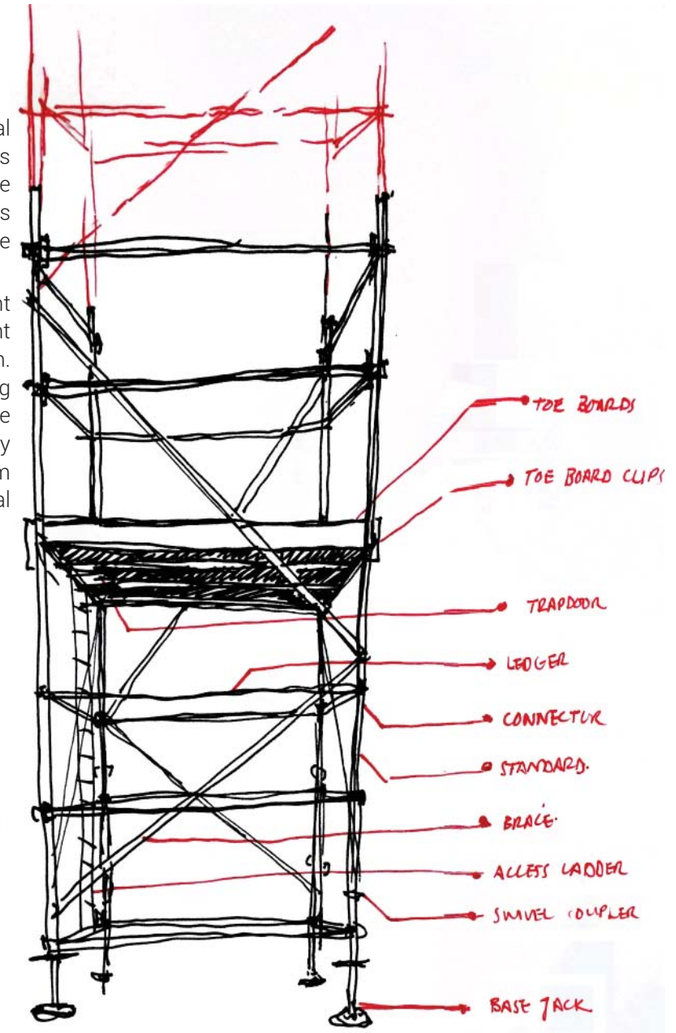

Figure 8.1 *Scaffolding as structural informant (author 2017).*

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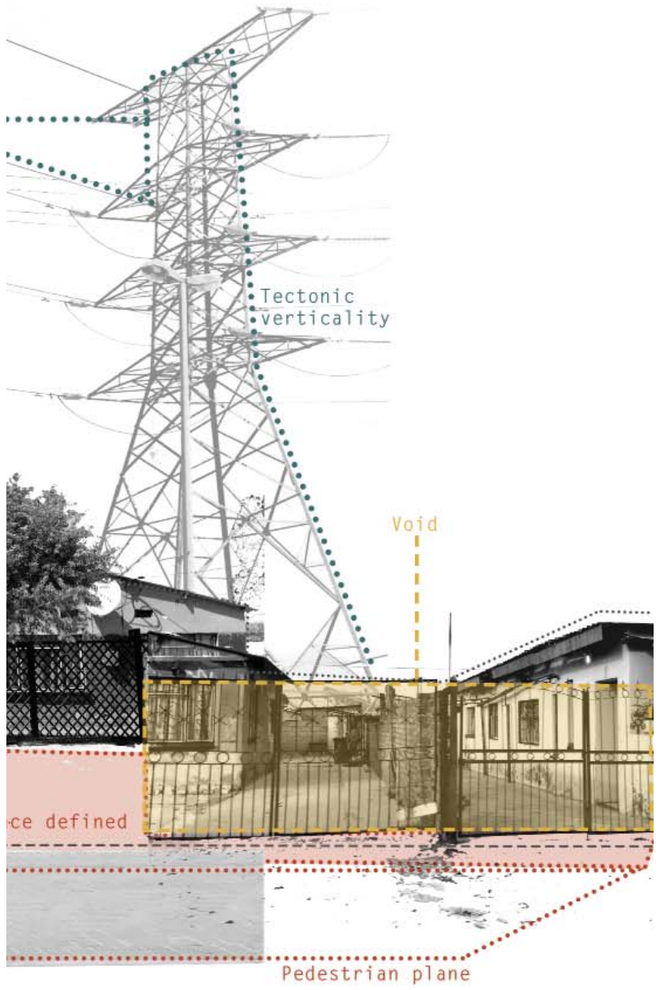
Figure 8.2 *Collage depicting contextual informants for tectonics and spatiality (author 2017).*



Tectonic Spatiality

The tectonic quality is derived from the contextual influences. There are two main patterns that are seen in the spatial nature:

1. The ground plane and roof plane are dominant in the demarcation of space.

2. A framework is established in order to facilitate infill over time, creating the tension between solid and void within the streetscape.

Structural Intentions

In order to facilitate this changing, adaptable spatiality through architecture, the structure intends to create the framework in which this tension between solid and void can form. Using the theoretical background of multiplicity, modularisation and multi-scalarity, the structural hierachy is designed as a series of structural layers.

From the larger steel framing, to defining the ground plane, to the light gauge steel infill, the tectonics aim to cater for the future development of space through an understanding of the existing contextual spatial patterns.

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PROGRAMMATIC PROCESSES

As discussed in chapter two, the program intends to make use of the processes existing on site, and contribute new programs that will encourage the development of the site and surrounding context.

Figure 8.3 depicts a conceptual collage of the programmatic development of the project. Maintaining the mixed-use quality of the site, the scheme develops into a design hub which facilitates this continued incremental development.

The design hub becomes a public interface for the development of creative spatial solutions and the encouragement of craftsmanship and apprenticeship in the context of Mamelodi.

Figure 8.4 represents a diagram of the exchanges that take place in the development of the programs. The design hub acts as an exchange of issues, knowledge, and solutions, creating the interface between the public and TVET students, University of Pretoria Students, and built environment professionals.

The ideas and solutions exchanged within the design hub are then transferred to the craftsmen and workshops on-site to implement these ideas.

Integrating the workshops with the design hub allows for apprenticeship and craftsmanship to grow in a sustainable manner. Allowing the exchange between artisans and apprentices allows for the equipping of new generations of craftsmen and creatives.

Maintaining the existing food vendor on the site encourages the social aspect of the scheme, also allowing for the diurnal and nocturnal use of the site and increasing the safety of the precinct by having eyes on the street. The food vendor then also contributes to the glass collection which is crushed on-site to be used as aggregate in the cement brick-making process.

Timber waste from the carpentry workshops are compressed into briquettes to be sold to the public. These briquettes can also be used for fuel for the food vendor's fires.

Figure 8.3 *Conceptual programmatic collage (author 2017).*

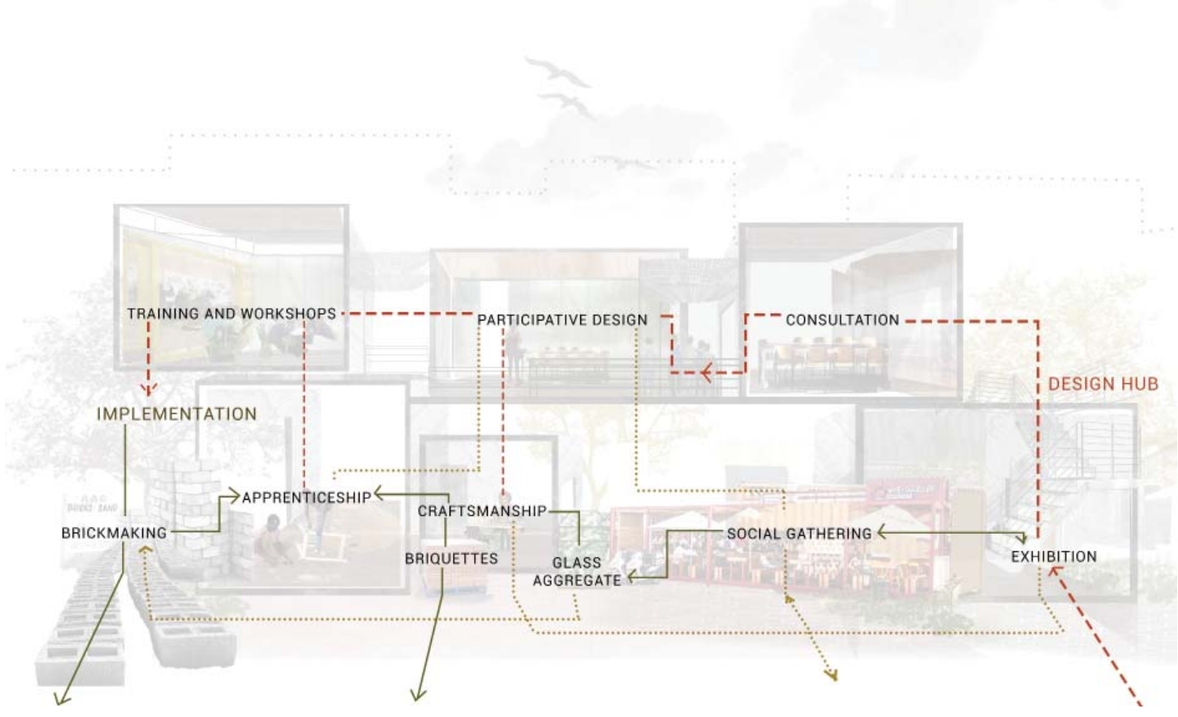

Figure 8.4 *Diagram of programmatic relationships (author 2017).*

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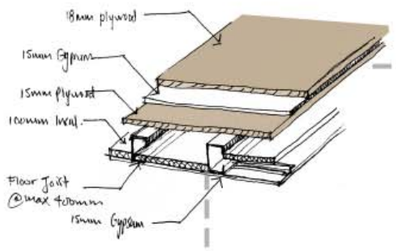
7

Roof:
Metal sheeting @ 20degrees, fixed to 100x75x20 light-gauge steel purlins with 90mm flexible fibre glass insulation
Min R-value: 3.20m²K/W

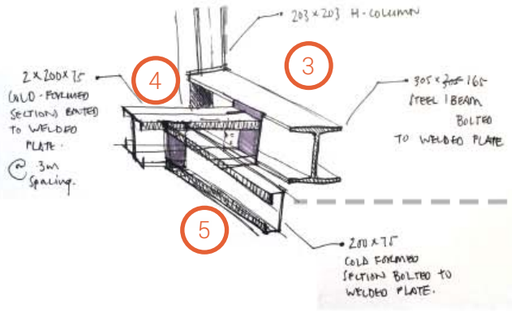


6

Floor:
Suspended 38mm plywood timber floor with 100mm rigid expanded polystyrene insulation

5

Joists:
200x75x20 cold formed lipped channels fixed to bearers @max 900mm spacing

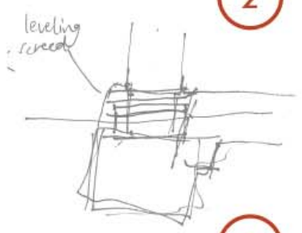


4

Bearers:
2x200x75x20 cold formed lipped channels fixed to beams @max 3000mm spacing

3

Beams:
305x165x40 galvanised steel I-beams fixed to steel columns @ 6000mm spacing

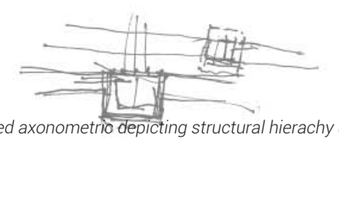


2

Columns:
203x203x60 galvanised steel H-section fixed to steel base plate and concrete footing columns @ 6000mm spacing (see Figure 8.17)

1

Ground floor:
Reinforced concrete raft foundation with 50mm self-levelling EcoScreed with recycled glass aggregate.



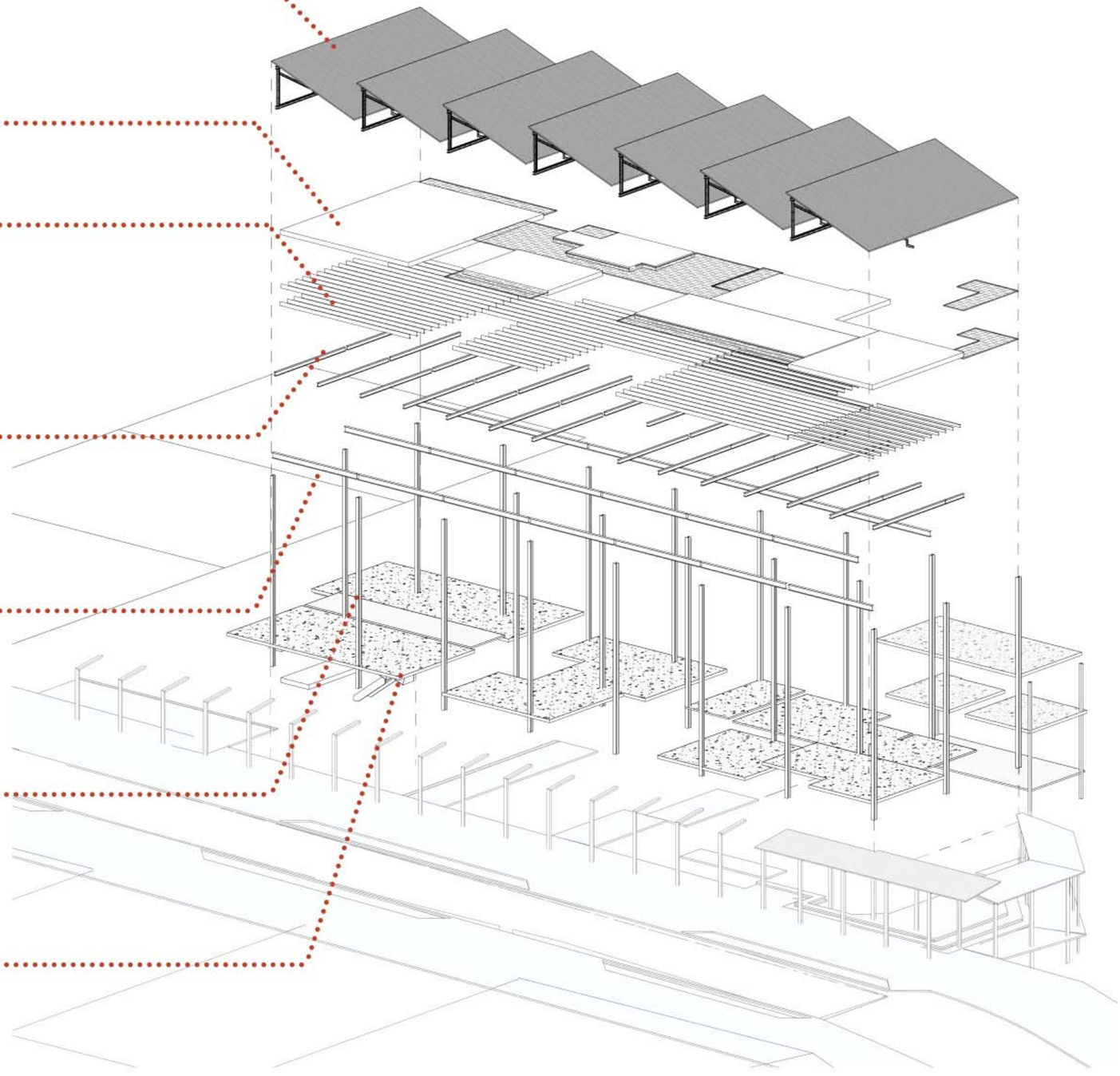


Figure 8.5 *Exploded axonometric depicting structural hierachy (author 2017).*

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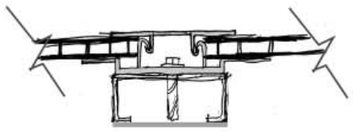
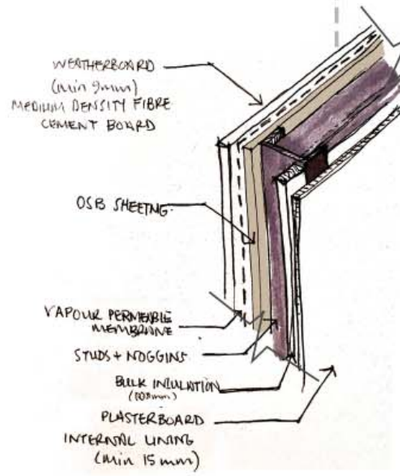
3

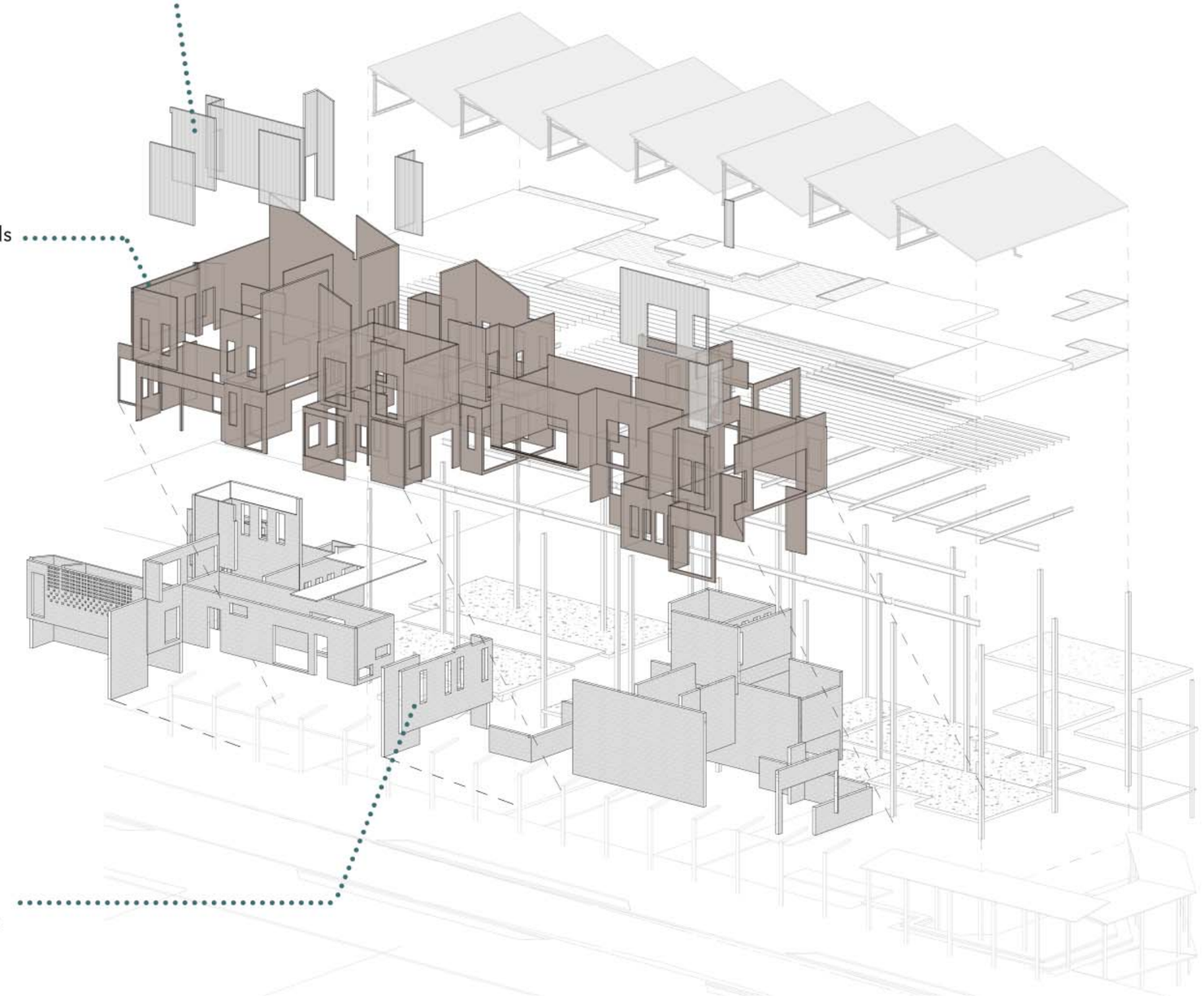
Adaptable infill:
25mm Polygal Thermogal translucent infill panels as adaptable room dividers and roof closure panels fixed to glavanised light steel framing with galvanised steel self-tapping screws.
R-Value: 0.58m²K/W



2

Adaptable infill:
133mm thick light-gauge steel frame wall panels with magnesium oxide board cladding and plaster & paint finish.
R-Value: 3.69m²K/W
Fire Rating: 60 min
Sound Insulation: 52dB





1

Permanent:
200mm thick concrete block walls with 12mm interior plaster and paint, manufactured on-site
R-Value: 1.04²K/W

Figure 8.6 *Exploded axonometric depicting skin infill (author 2017).*

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Tectonic Development

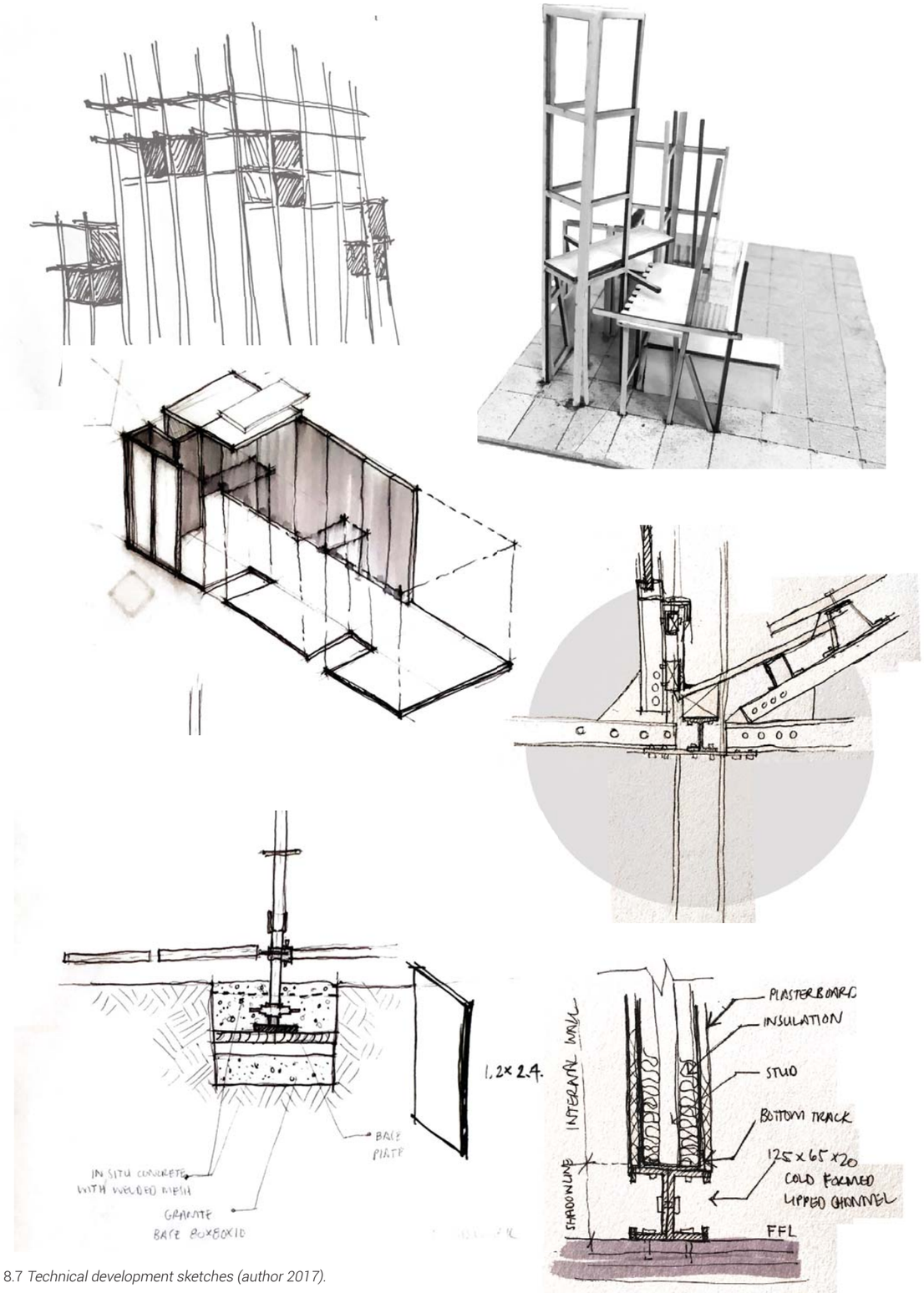


Figure 8.7 *Technical development sketches (author 2017).*

Materiality

The materiality is derived from a range of sources - from the cement bricks manufactured on-site, to light gauge steel framing that is constructed off-site and erected on site.

>Cement Bricks

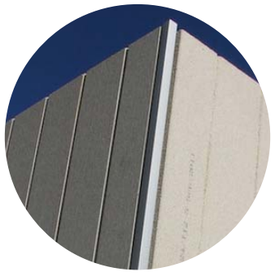
As mentioned in the previous chapters, the use of programs existing on-site are important for the conceptual underpinning of this project.

The intention is for the brick making process to be integrated with the glass recycling, allowing for the production of more sustainable cement blocks with up to 40% recycled glass aggregate.

>Light Steel Framing

Light steel framing is used as the wall infill panels due its spatial flexibility, accuracy, and is non-combustible. Light steel framing is also 100% recyclable and has a significantly lower water use in construction due to less wet trades (Futurecon, 2016).

Use of this method would also introduce a new set of trade skills to the craftsmen of Mamelodi, encouraging future employment and the use of light steel framing as a construction method.



>Magnesium Oxide Board

External cladding for the light steel frame walls will be Magnesium Oxide board as a cost effective alternative to fibre cement panels.

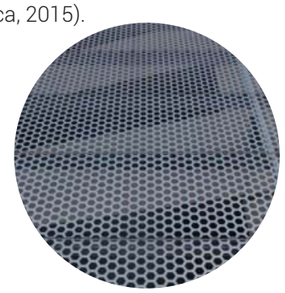
MgO board is made of 50% recycled timber, Magenesium Oxide, and fibreglass mesh. It is durable, cost effective, sound insulating, and fire and water resistant (Habitech, 2013).

>Multiwall Polycarbonate

Multiwall Polycarbonate can be used either for roof panels or wall panels. As an alternative to the MgO cladded walls, polcarbonate will allow the transmission of light while still providing thermal and sound insulation. It also boasts durability, a wide range of colours or finishes and fire retardant properties (Perspex South Africa, 2015).

>Plywood Panels

Plywood panels will be used for internal wall cladding and floor panels on the first floor. It provides versatility in terms of replacement of panels, ability to be plastered or painted and changing of internal spatial conditions.



>Perforated Steel Sheeting

Perforated steel sheeting is used for solar shading panels as well as floor panels for the suspended open walkways. This allows for movement of air, light penetration, and increased visibility between levels of the architecture.

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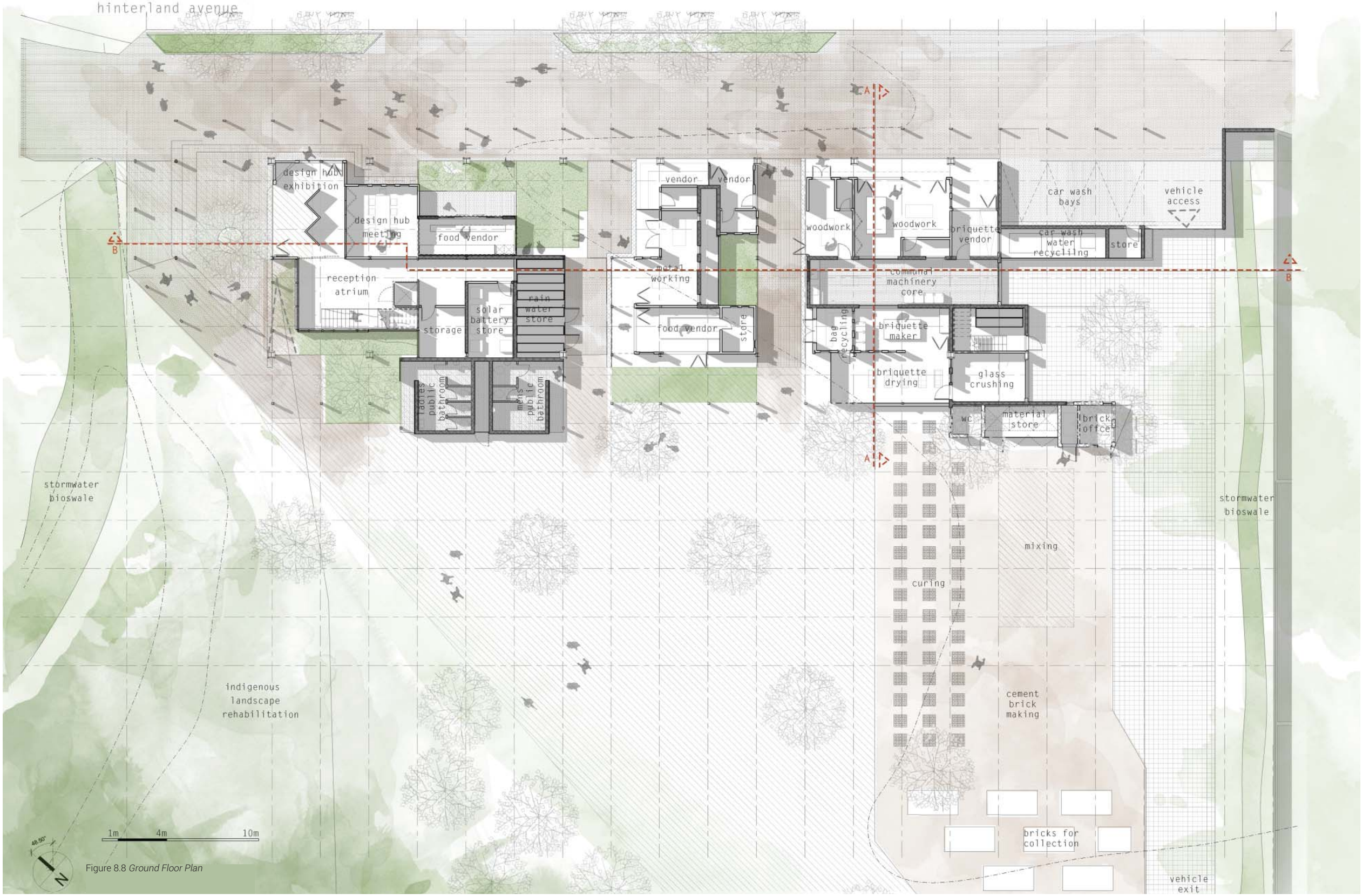

Figure 8.8 *Ground Floor Plan*

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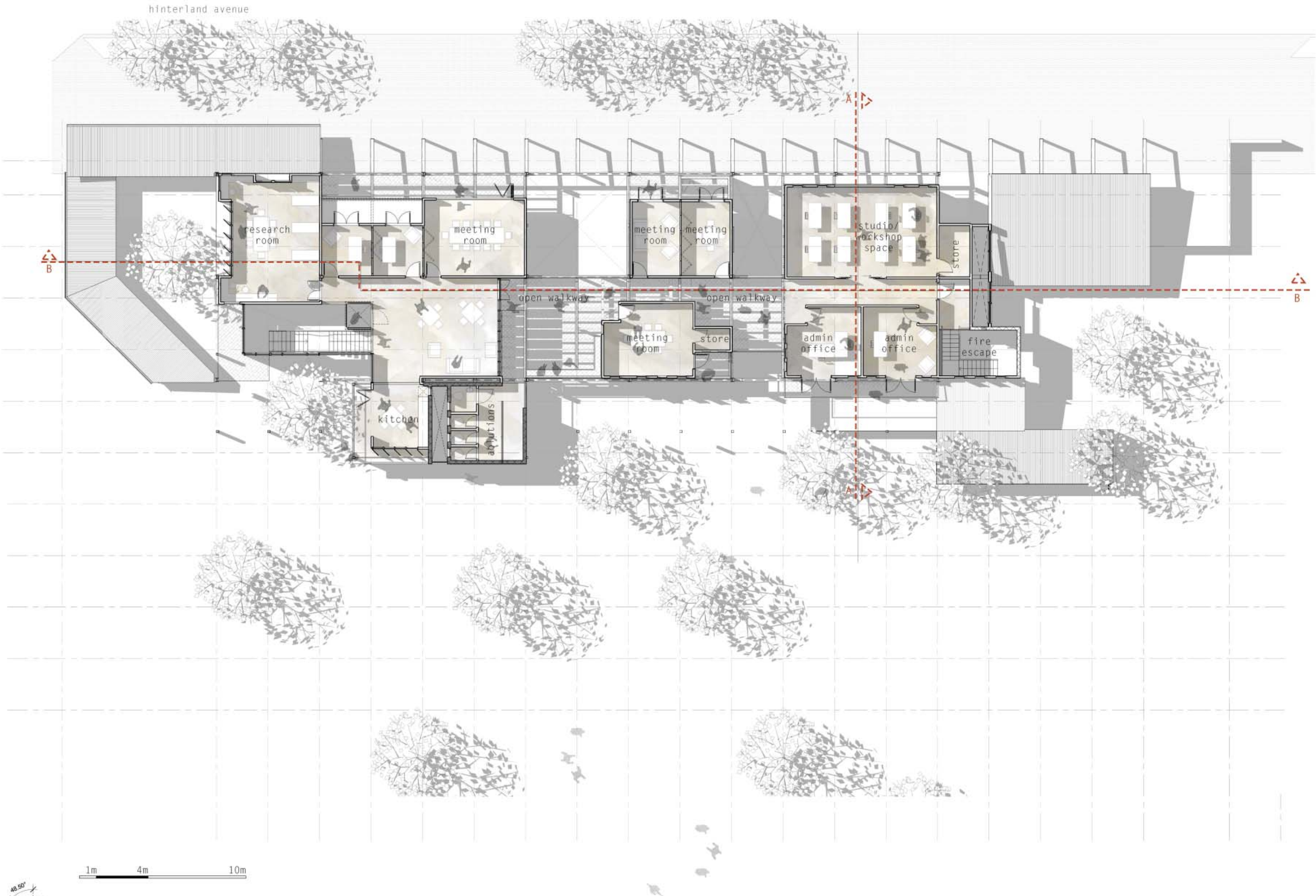

Figure 8.9 *First Floor Plan*

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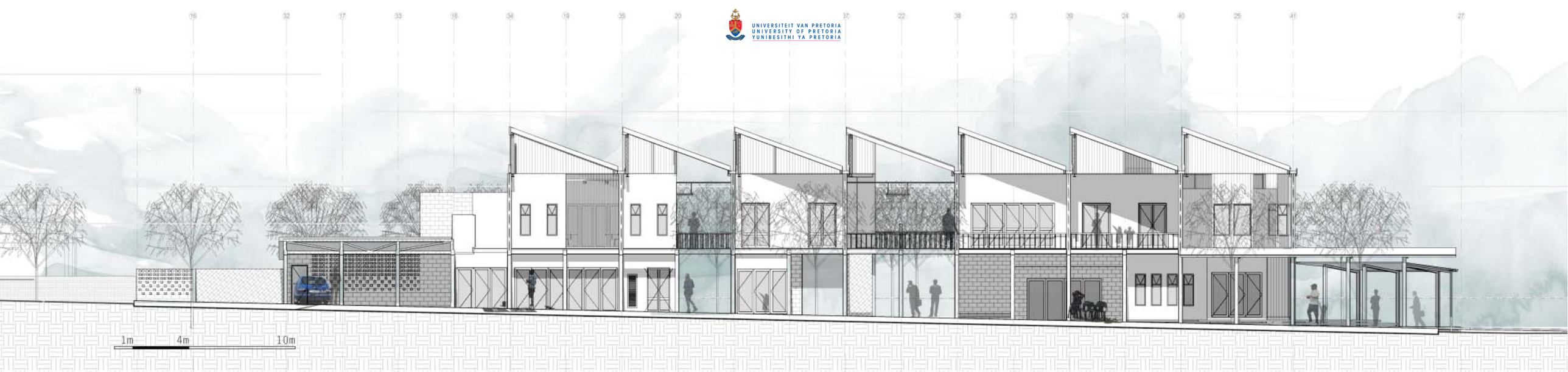

Figure 8.10 *East Elevation development.*

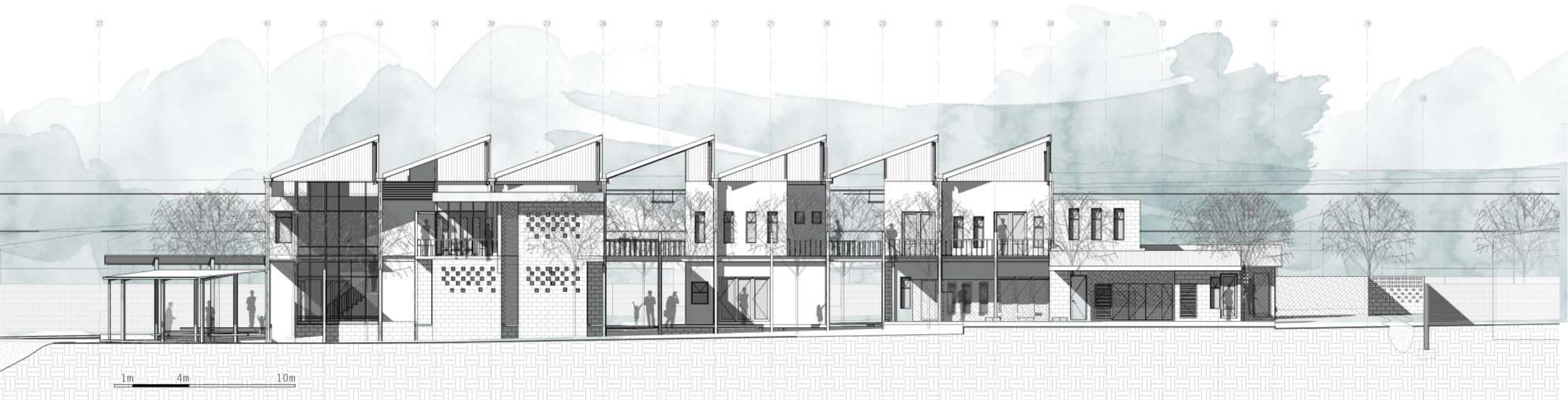

Figure 8.11 *West Elevation development.*

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Figure 8.12 *Section A-A*

Figure 8.13 *Section B-B*

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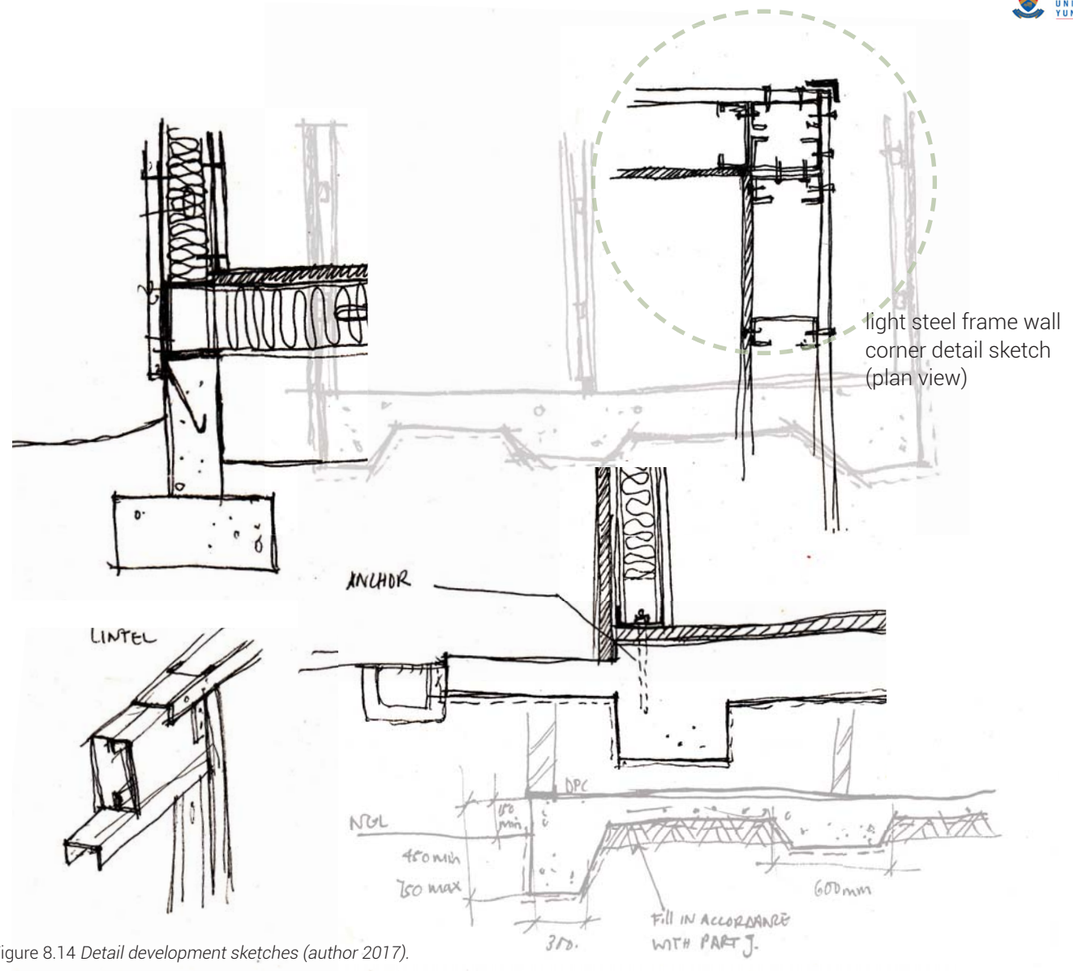

Figure 8.14 *Detail development sketches (author 2017).*

Figure 8.15 *Model development (author 2017).*

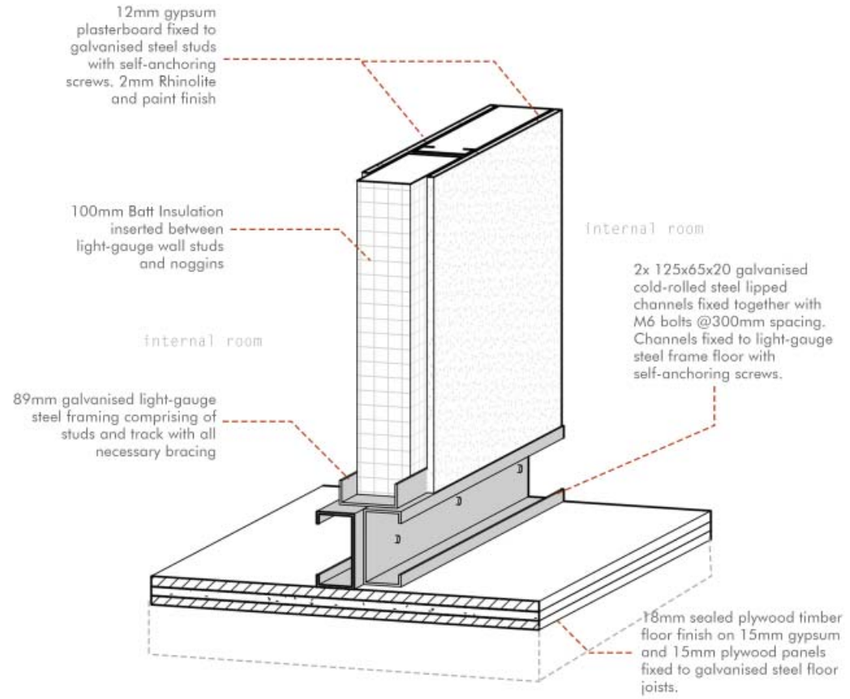

Figure 8.16 *Interior wall detail development scale 1:10 (author 2017).*

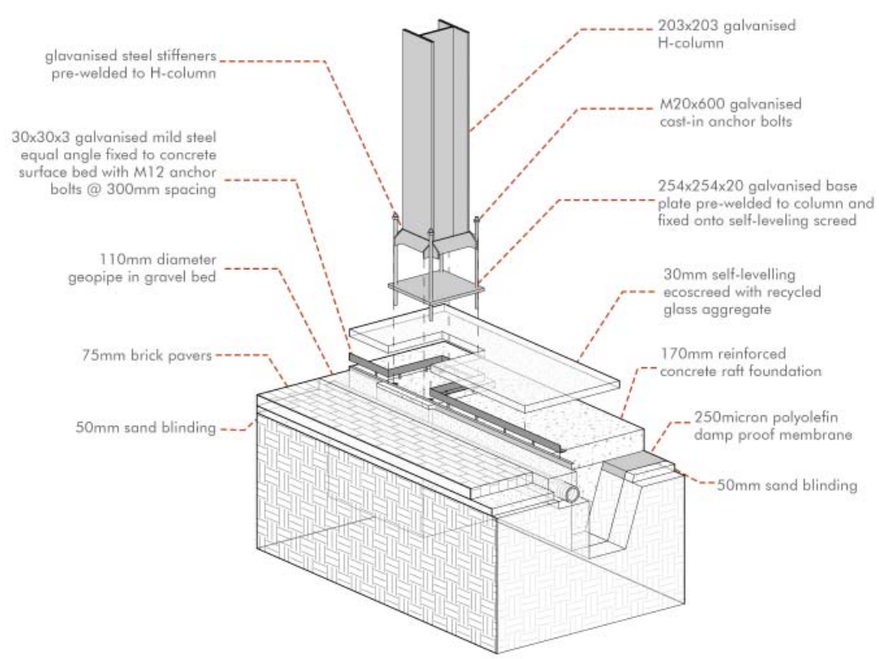

Figure 8.17 *Column base and slab edge detail, development scale 1:20 (author 2017).*

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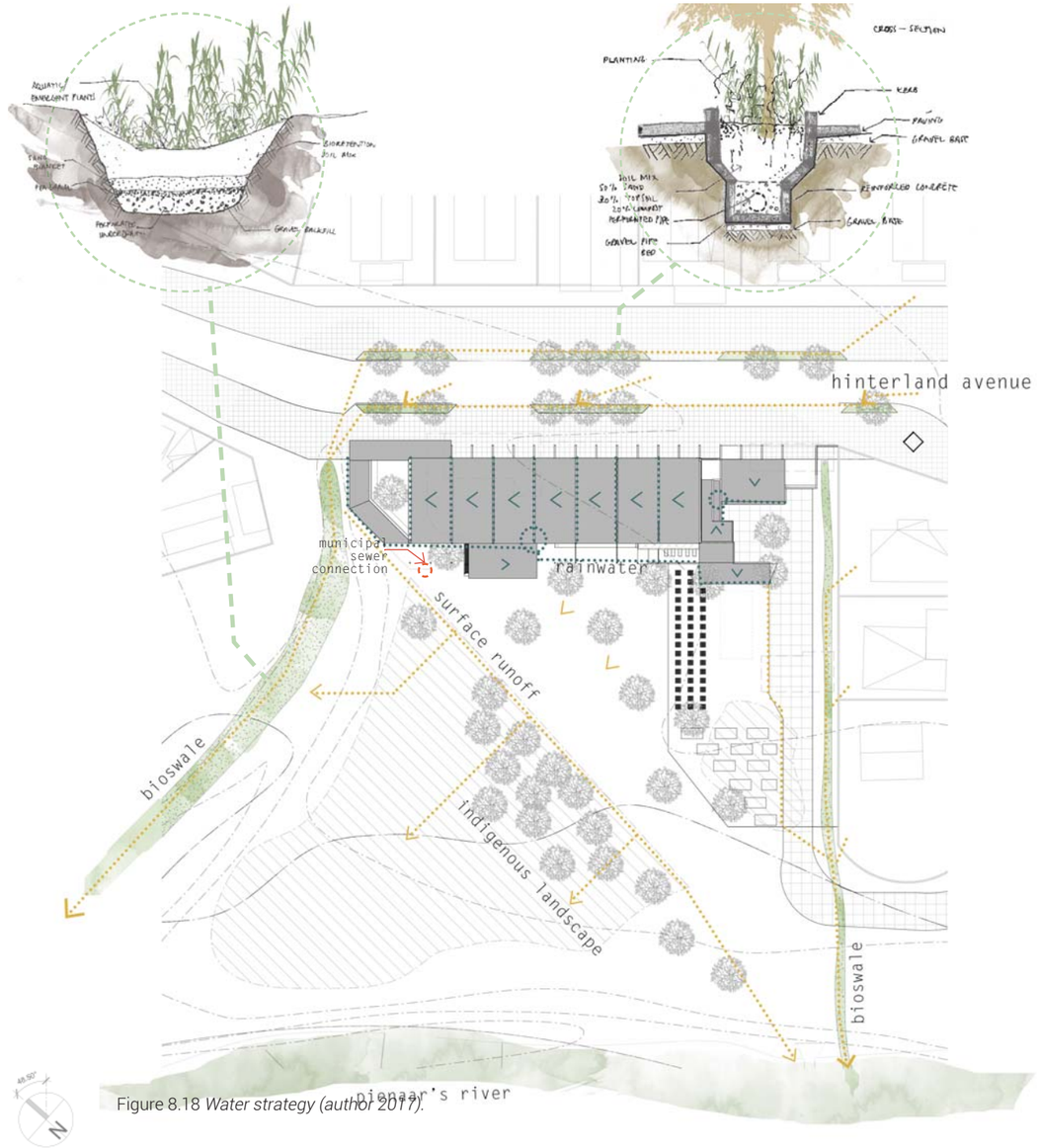

Figure 8.18 *Water strategy (author 2017).*

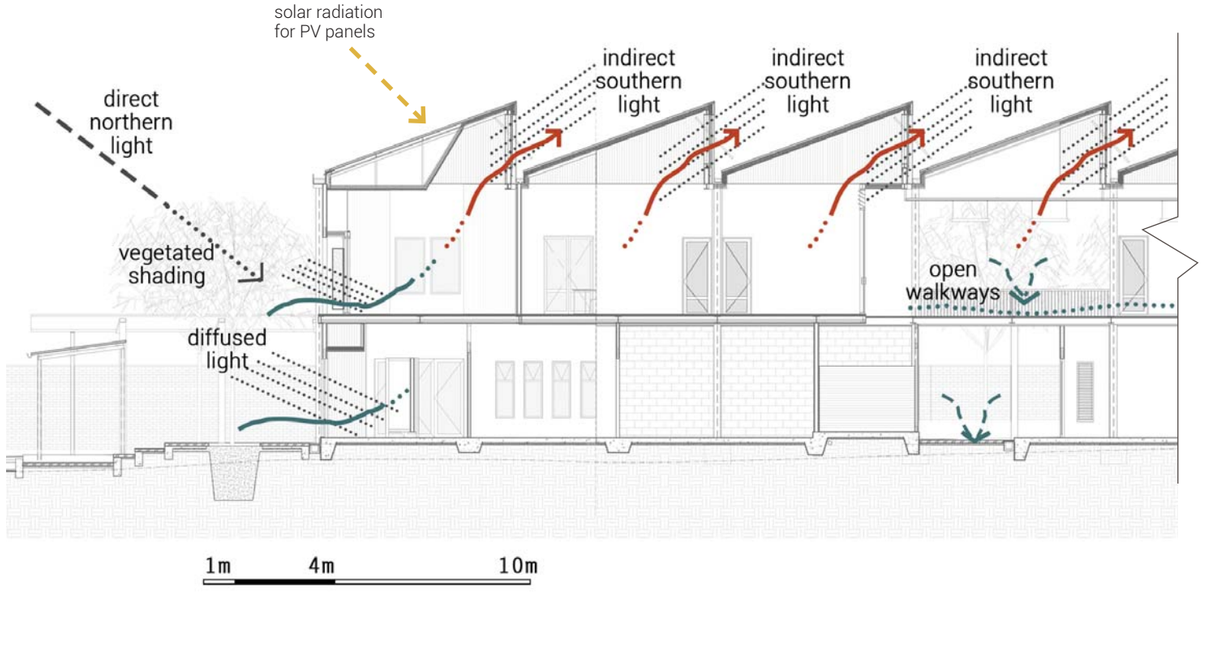

Figure 8.19 *Energy strategy (author 2017).*

Services

>Stormwater Runoff

Stormwater runoff from the street is collected in bioswales along the street edge which, then feeds into the larger bioswale on the northern edge of the site. This will clean the water before depositing it into the Pienaar's river. There is also a bioswale located along the southern edge of the site to collect stormwater runoff from the neighbouring residences while also acting as a threshold between the different scales of architecture.

>Rainwater Harvesting

Rainwater is collected from the main roof structure through the internal gutters and downpipes concealed in the columns of the primary structure. The water is stored in tanks on the ground floor for easy access and maintenance, then pumped with a solar pump to smaller distribution tanks on top of the bathroom and kitchen core. From here, the water can be gravity-fed to cistern toilets below, and to the brick yard for mixing. These processes do not require extensive water pressure thus the height of tanks will not need to be raised higher than the roof level.

>Grey Water

Grey water from the basins and car wash will be collected and cleaned through solids removal, an oil trap, a membrane bioreactor, then stored for use in toilets, brick making, and landscape irrigation.

>Black Water

Sewerage effluent is dealt with through the existing municipal sewerage line on site.

>Solar Energy

Photovoltaic panels fixed to the north-facing roofs can provide up to 210 397kWh/year (see Appendix A). The panels will be fixed securely to roof tracks in order to reduce possibility of theft or breakage.

The installation of PV panels also requires the inclusion of battery storage space in a well-ventilated but secure space within the building.

>Thermal Comfort and Ventilation

Thermal comfort in the habitable spaces is achieved through the insulated wall and floor panels (see Figure 8.7 for R-values), solar shading and natural ventilation.

The open walkways and corridors allow for air to flow through the structure with rooms shallow enough to allow for cross-ventilation of spaces. Clerestory windows in the overall roof structure allow for warm air to escape the interior spaces. The bioswales along the street edge allow for cooling of hard surfaces and chances of evaporative cooling through the prevailing wind.

>Daylighting

Adequate daylighting is achieved through the use of translucent wall panels, door and window openings, and south-facing clerestories.

The open walkways also allow for more diffused natural light to penetrate the interior spaces.

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Figure 8.20 *Neighbourhood considered within a two kilometre radius of the site (author 2017).*

SBAT RATING

The Sustainable Building Assessment Tool (SBAT) was developed with the intention of creating an integrated approach to sustainability in the built environment.

The SBAT tool takes into account the neighbourhood (considered a two kilometre radius) surrounding the site as a more holistic apporach to assessment, rather than an isolated element of architecture. Considering the social sustainability of the built environment is very important in the context of Mamelodi as it is necessary for the architecture to exist for more than itself.

This tool is used because of this holistic apporach to sustainability, and provides clues on what should be iterated and developed to create an architecture that is not only responsive to resource and energy use, but also social cohesion and upliftment.

SBAT Report

The graph shown in Figure 8.21 represents the results of the assessment.

Achieving a score of 3.9 out of 5 exhibits the opportunity for many iterations and improvements to be made.

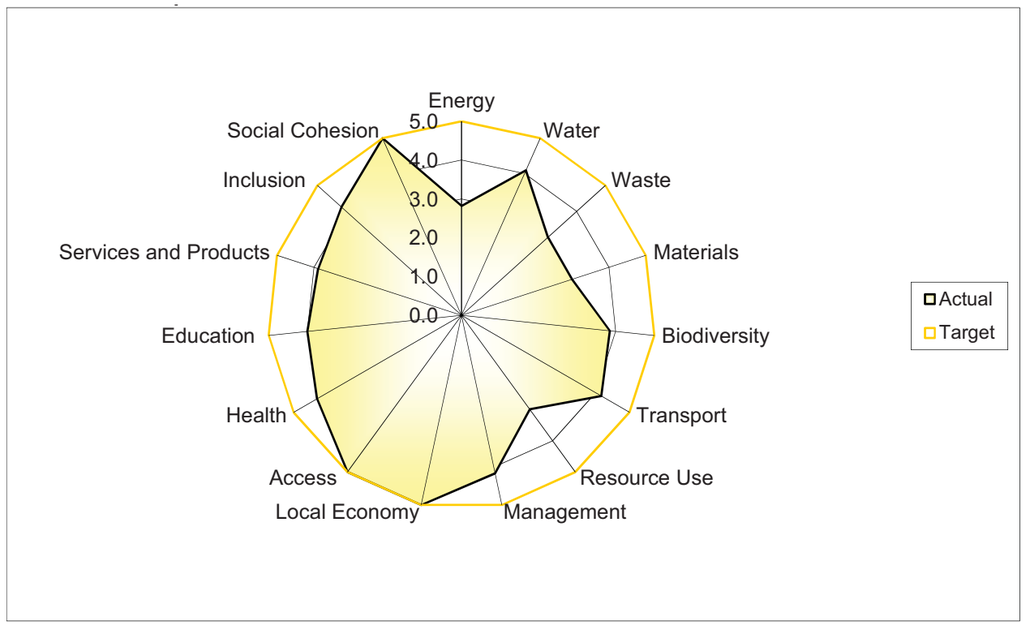
The informal nature of the context contributes to the neighbourhood's sustainability, as the prevalence of spaza shops, taxis and other small enterprises. increases the access to services and encouragement of the local economy.

There still exhibits much opportunity for the development of the use of renewable energy sources, waste management and sustainable materials.

Refer to Appendix B for report values.

SBAT REPORT

achieved	target
3.9	5.0



SB4 Environmental, Social and Economic Performance	Score
Environmental	3.4
Economic	4.3
Social	4.3
SBAT Rating	4.0

SB5 EF and HDI Factors	Score
EF Factor	3.4
HDI Factor	4.4

SB6 Targets	Percentage
Environmental	67
Economic	85
Social	85

Figure 8.21 *SBAT report (Gauge, 2017).*

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PRECEDENT:

Arizona State University Polytechnic Academic District

Client:
Arizona State University

Size:
22700m²

Location:
Arizona, USA

Architects:
Lake | Flato Architects

Date:
2008

Project type:
Education/Campus

Figure 8.22 *Exterior view (Tillerman, 2012)*

Figure 8.23 *Courtyard (Tillerman, 2012)*

Overview

Located on a brownfield site, the new campus for the ASU Polytecnic aimed to repurpose the existing airforce base buildings to create a pedestrianised environment that engages the students with the surrounding landscape.

Design

The campus is designed as a response to the desert climate and context, making use of a collection of linear buildings that are connected by a system of arcades, atria, courtyards and open walkways. These external circulation routes contribute to the climatic design strategies; minimising the artificially lit and airconditioned area of the campus.

The materials were chosen for their locality and durability in the desert climate, contributing to the overall contextual approach of the architecture.

Systems

Thermal comfort and daylighting strategies were acheived through the design of the narrow buildings, orientation, and strategic shading.

The heat island effect is reduced through the minimisation of hardscapes and the introduction of indigenous landscapes. Stormwater treatment becomes a part of the user experience through the integration of bioswales, seeps and water furrows into the public space.

Conclusion

This project represents a well-rounded approach to bioclimatic design, achieving a gold LEED rating.

The reduction of thermal and lighting loads through passive design decisions have a large impact on reducing the energy usage of the building.

Although this scheme is of a much larger scale and completely different context to that which is being investigated in this dissertation, it represents similar approaches in the use of external circulation, atria and sensitivity to the landscape.

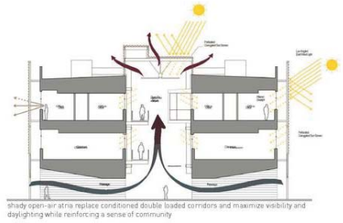

Figure 8.25 *Atriums (AIA, 2012)*

Figure 8.24 *Solar screening (Tillerman, 2012)*

PRECEDENT:

Arena do Morro

Client:
Ameropa Foundation, Centro Sócio Pastoral Nossa Senhora de Conceição

Size:
1964m²

Architects:
Herzog & de Meuron

Project type:
Gymnasium

Location:
Mãe Luíza, Natal, Brazil

Date:
2014

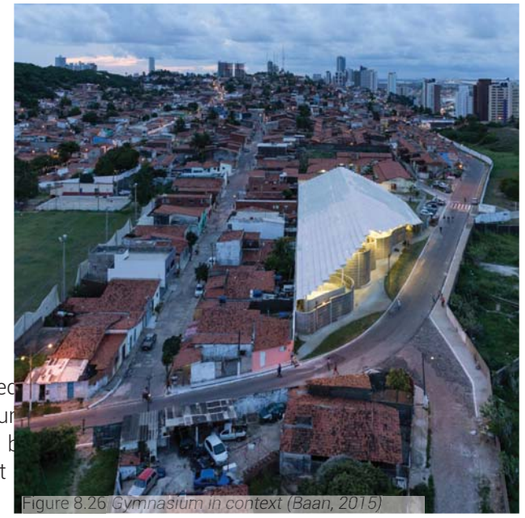
Figure 8.26 *Gymnasium in context (Baan, 2015)*

Overview

Arena do Morro is the first project to be completed as part of the larger vision for Mãe Luíza developed by Herzog & de Meuron and Centro Sócio Pastoral Nossa Senhora de Conceição.

The urban study identified open spaces in the dense fabric of the neighbourhood and aimed to create a spine of new buildings and activities that would contribute to the community life. As seen in Figure 8.26, the gymnasium aims to introduce a new scale to the dense residential fabric, initiating a the step towards a new urban scale to facilitate the future groth of the neighbourhood.

Design

Making use of the preexisting gymnasium, the geometry of Arena do Morro encapsulated the whole space through its over-arching roof whose edges respond to the boundaries of the site. The generous roof become the demarcating element of the public space, taken from traditional Brazilian spatial practices.

The large roof structure allows more freedom for the internal walls and spaces, creating the large indoor sports area and smaller communal rooms such as dance studios and locker rooms.

Materiality

The lightness in colour and structure of the gymnasium creates a stark contrast to the surrounding colourful urban fabric.

The roof is constructed standard insulated alu panels which overlap b not touch, allowing light keeping water out.

The undulating wall is cons from locally-made c blocks. Both the roof a walls act as transluscent s allowing for natural vetilati for engagement with the p

Conclusion

The gymnasium creates a landmark and public fea the region of Mãe Luíza.

Making use of construction and locally-av skills, the architecture faci multiplicity of public fu with minimal maintenanc management requirement

Located in a similar su fabric to Mamelodi, gymnasium represents effective way to introd larger scale to the precin make use of simple const principles.

Figure 8.27 *Street facade (Finotti, 2015)*

Figure 8.28 *Design model (Herzog & de Meuron, 2015).*

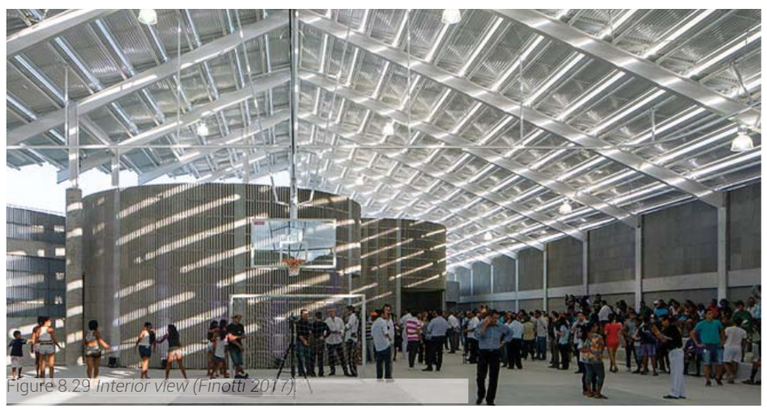
Figure 8.29 *Interior view (Finotti 2017)*

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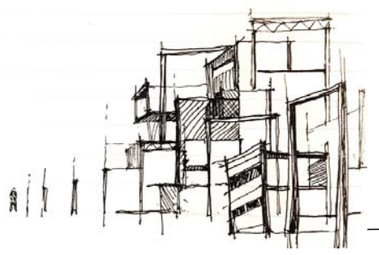

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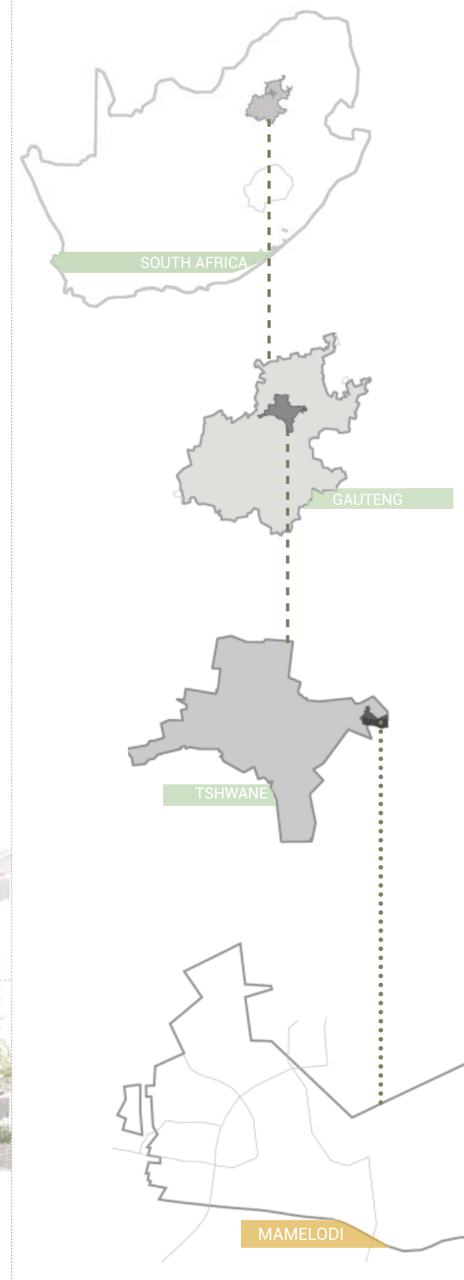
9

DESIGN RESOLUTION

final presentation



THE EVENTUALITY OF SPACE
adaptability and incrementality in the suburban hinterland of Mamelodi

Figure 9.1*: Title page and locality*

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Figure 9.2*: Site plan*

Figure 9.3*: Model top view*

Figure 9.4*: Northern street view*

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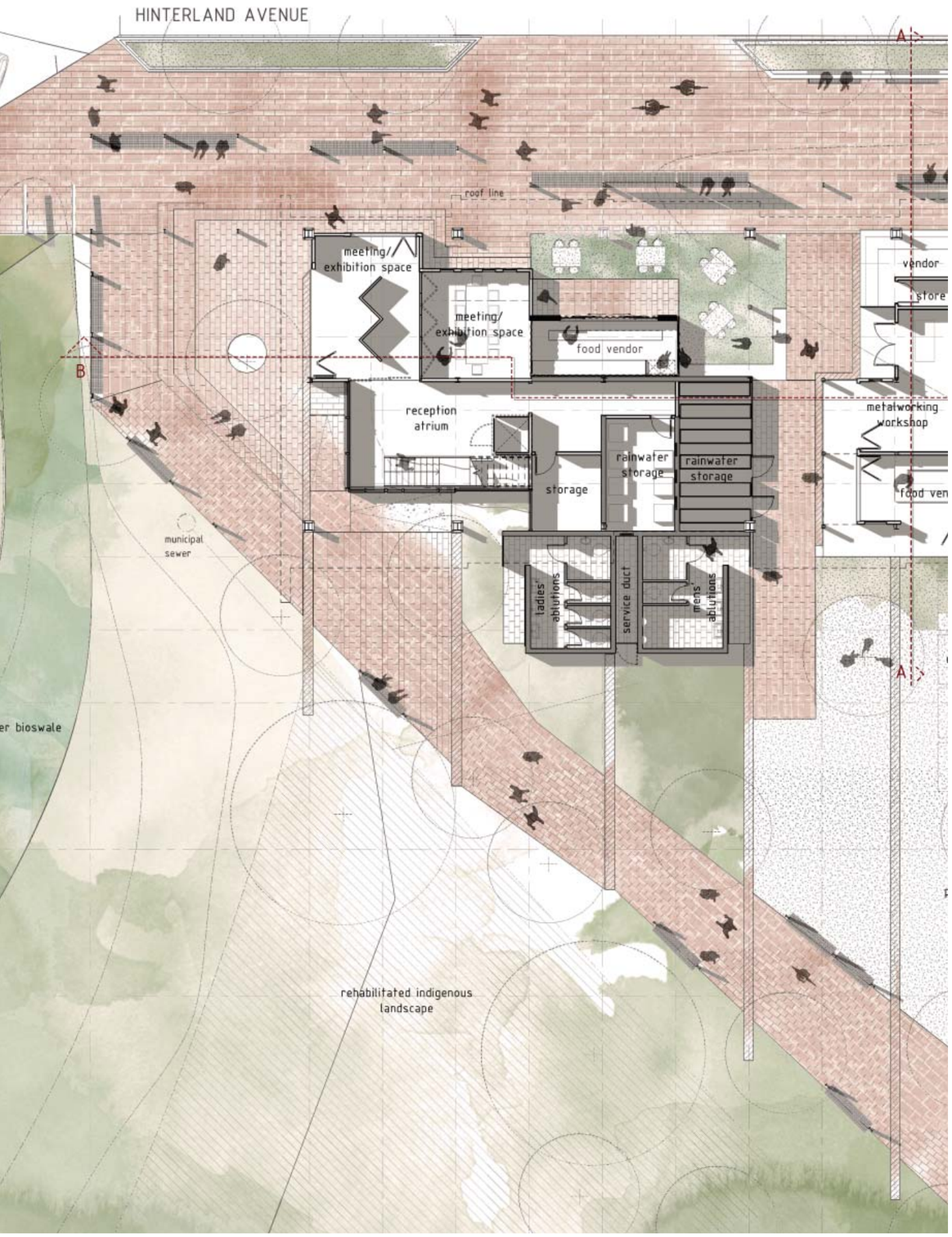

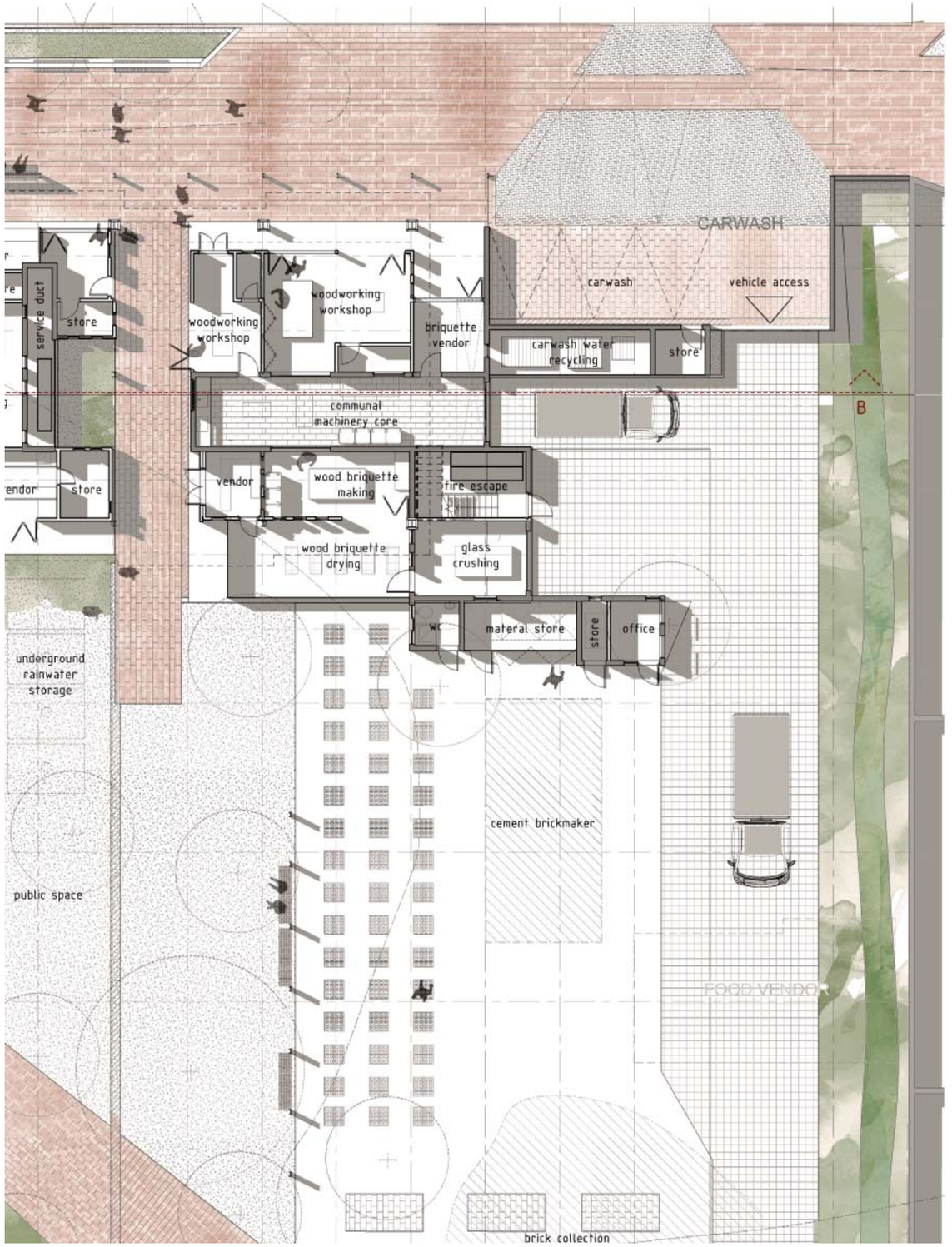

Figure 9.5: *Ground floor plan*

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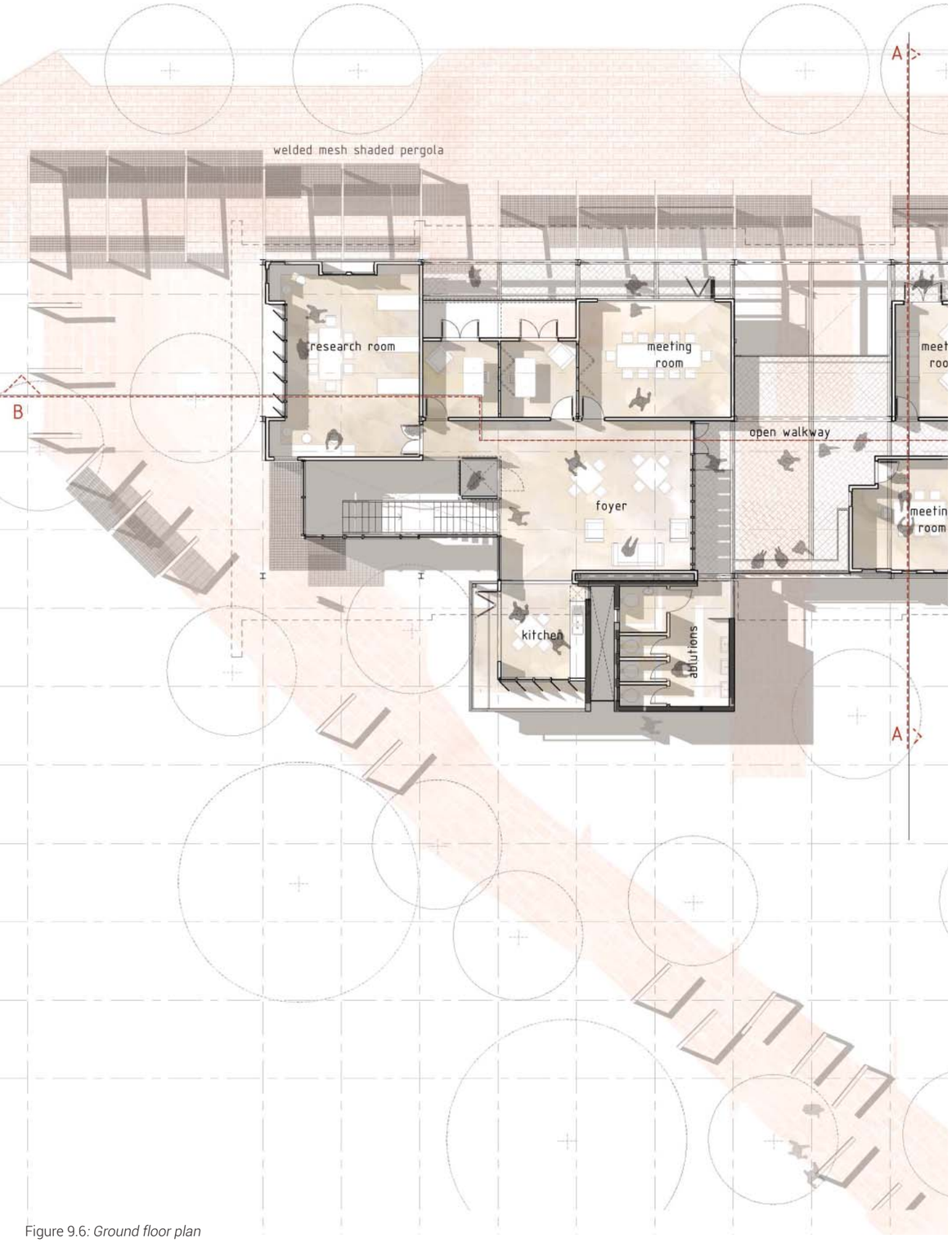

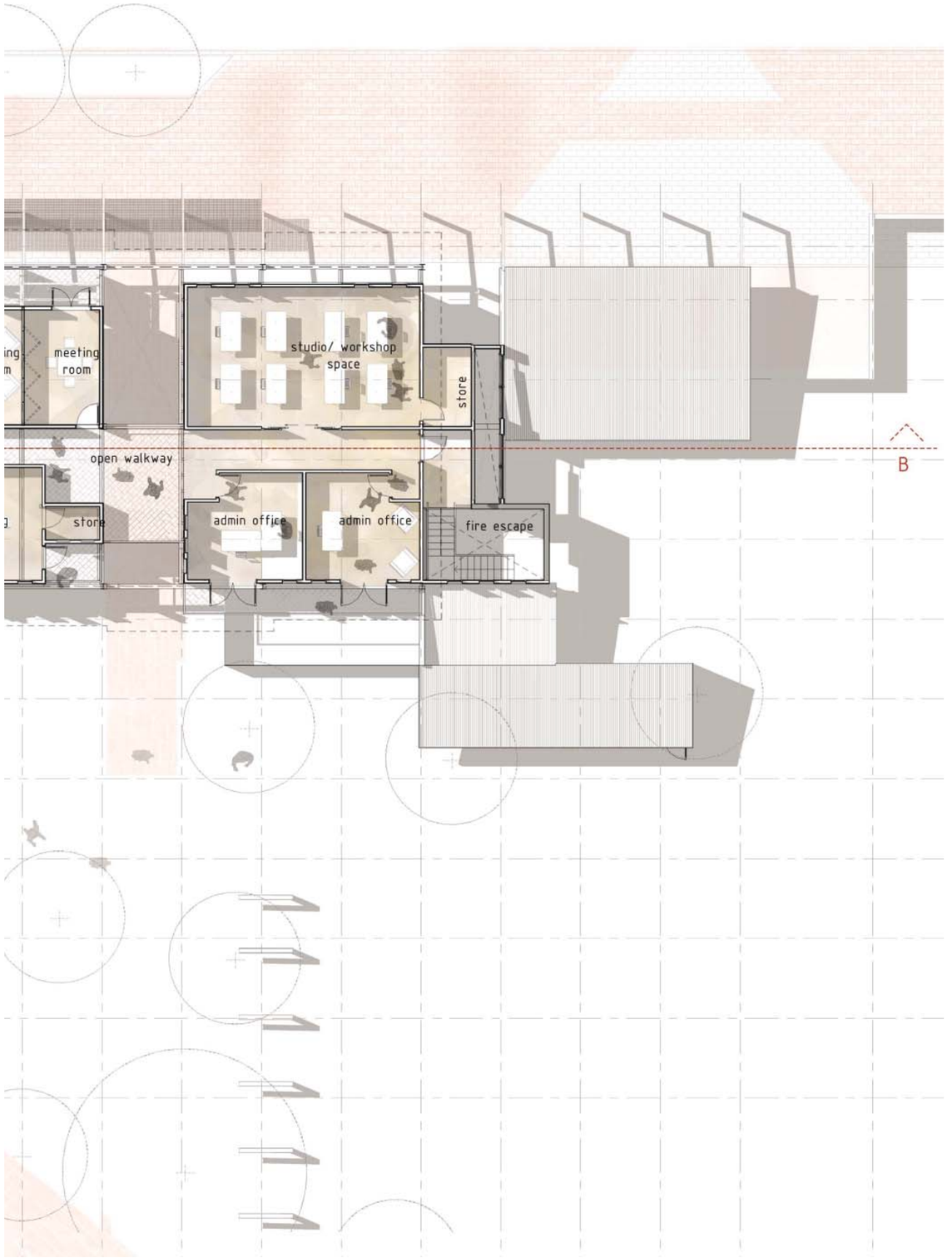

Figure 9.6*: Ground floor plan*

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Figure 9.7: *First floor open walkway view*

Figure 9.8: *Axonometric section*

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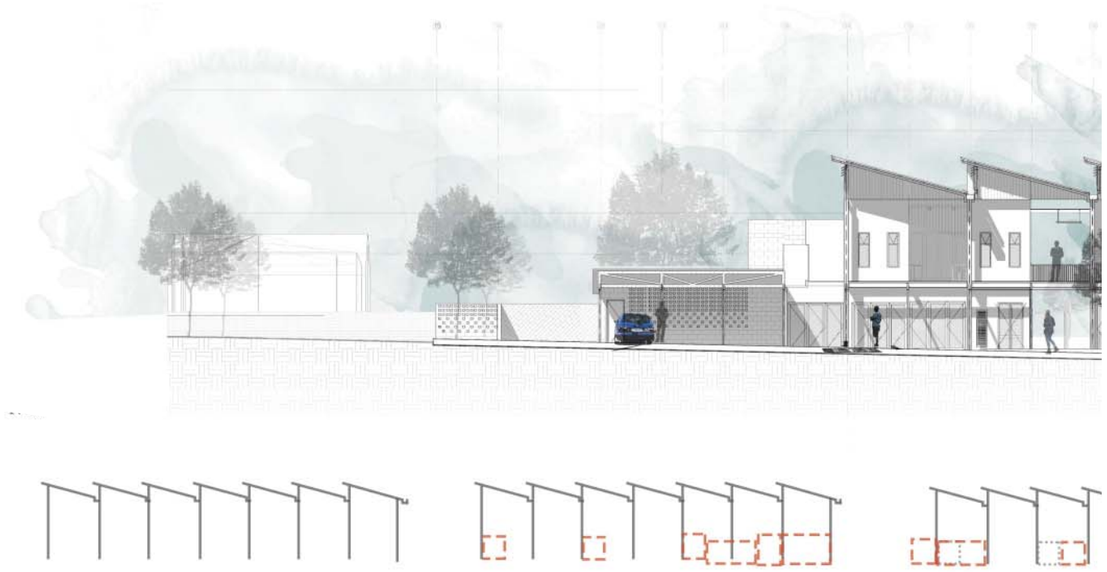

Figure 9.9: *East elevation*

Figure 9.10: *East elevation*

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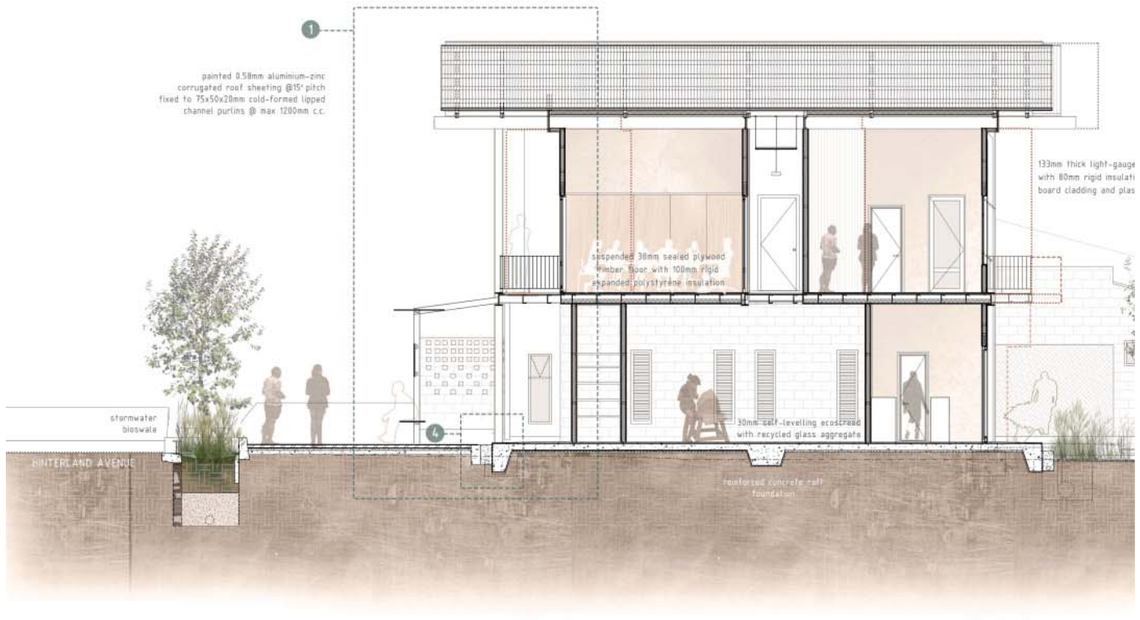

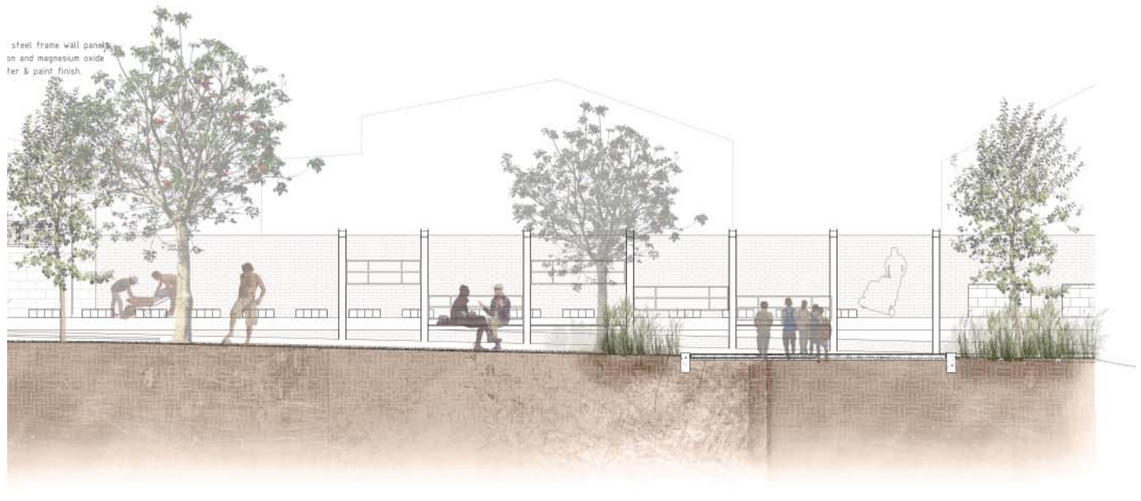

Figure 9.11: *Section A-A*

Figure 9.12: *Section B-B*

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Figure 9.13: *Wall section*

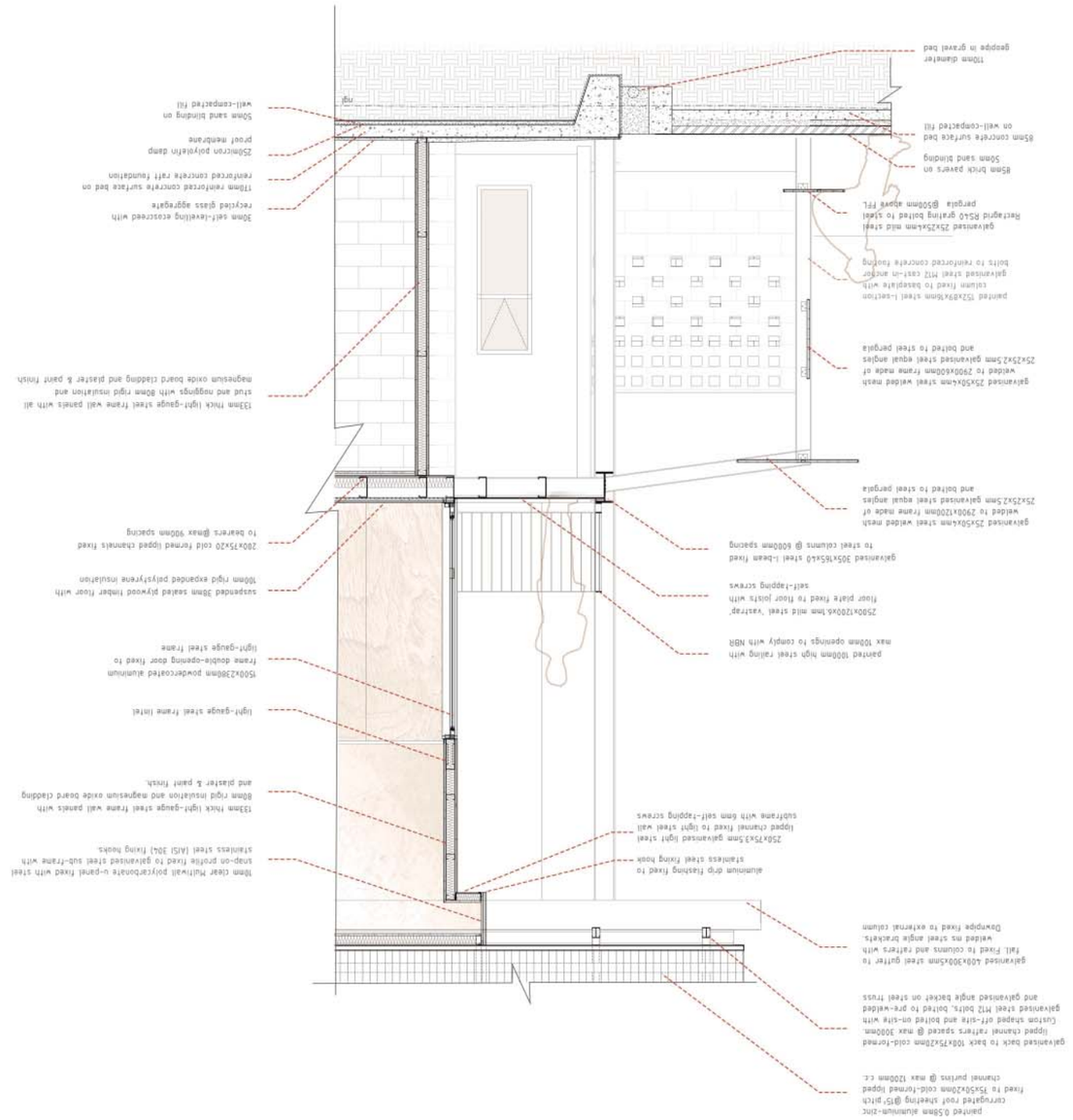

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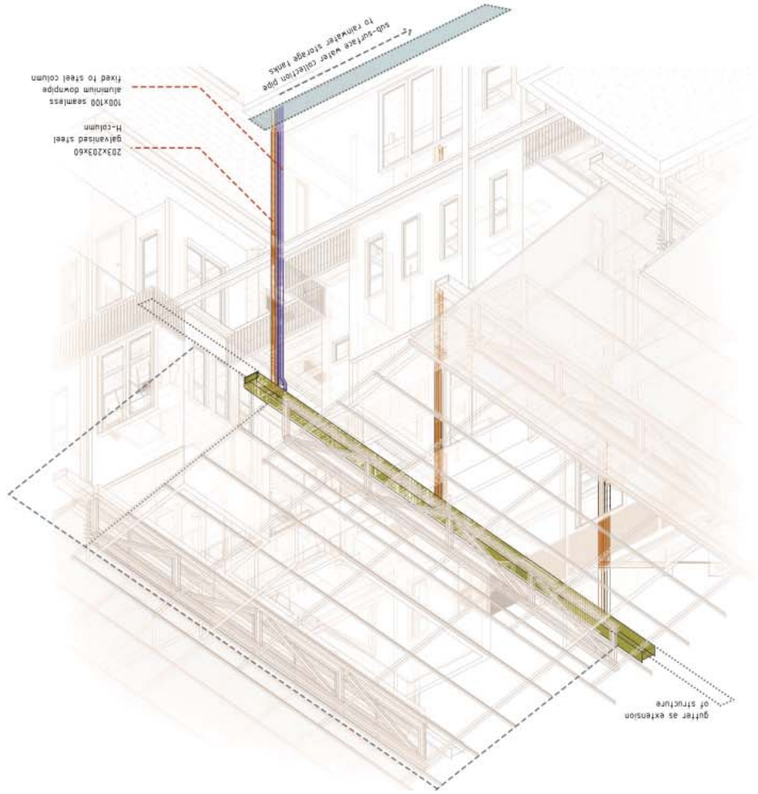
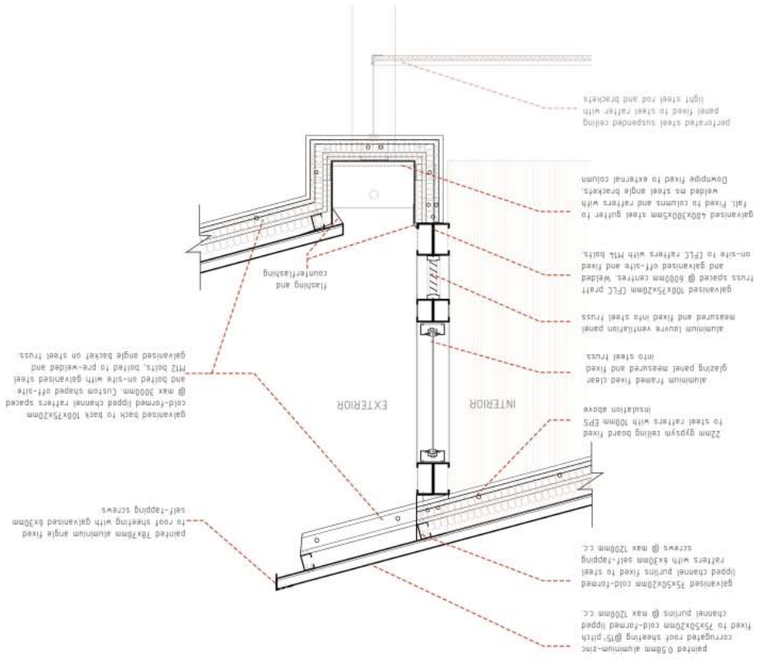
Figure 9.14: *Box gutter detail*





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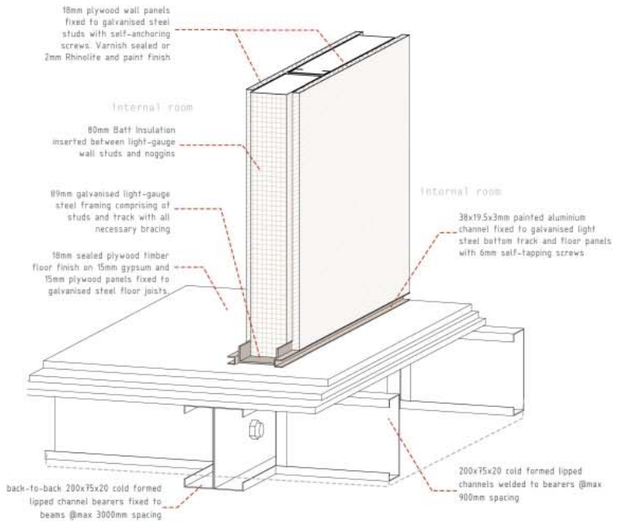


Figure 9.15: *Internal wall detail*

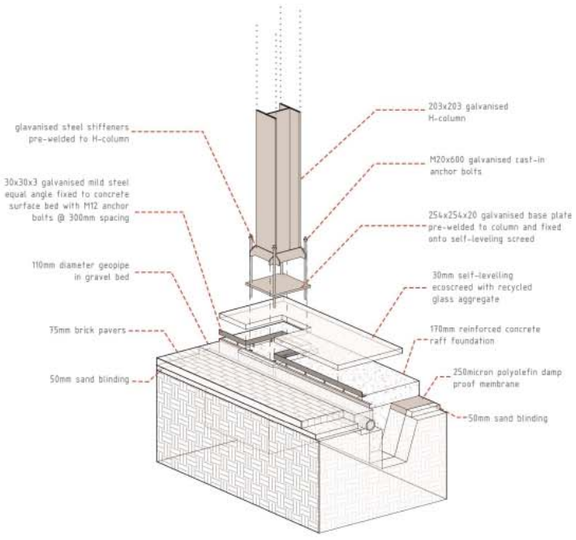
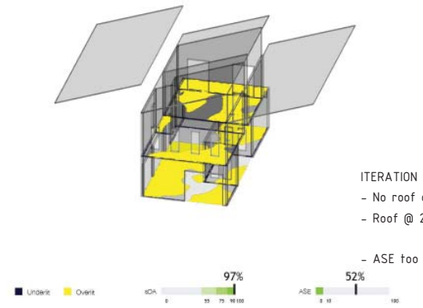


Figure 9.16: *Ground floor slab detail*

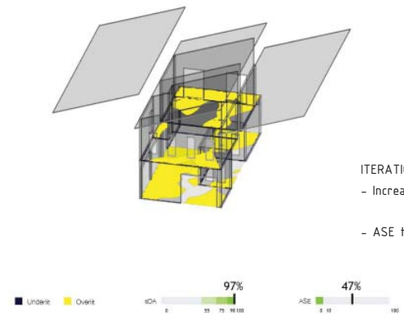
DAYLIGHTING
sefaira iterations

Manipulating of roof overhangs and pitch to assess adequate daylighting. Due to the nature of the software, the whole building cannot be analysed and thus a portion of it is used as an indication of the differences in daylighting.



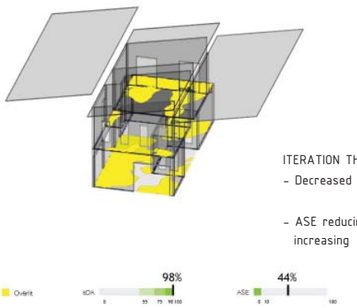
ITERATION ONE
- No roof overhang
- Roof @ 20°

- ASE too high



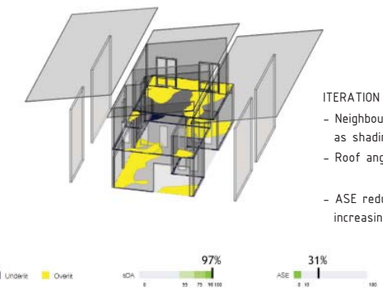
ITERATION TWO
- Increased roof overhang

- ASE too high



ITERATION THREE
- Decreased roof pitch to 20°

- ASE reducing and SDA increasing

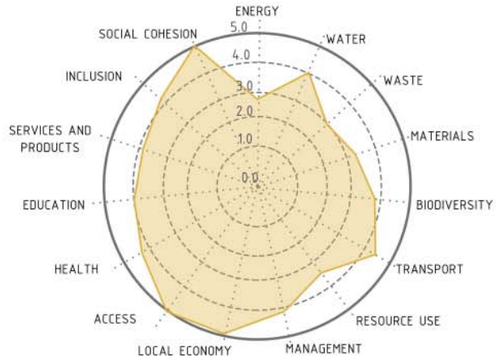


ITERATION FOUR
- Neighbouring walls included as shading
- Roof angle increased to 15°

- ASE reducing and SDA increasing

Figure 9.17: *Daylighting and sustainability assessment*

SBAT ASSESSMENT
neighbourhood sustainability



SBAT RATING: **4.0**/5.0

		PERFORMANCE			
ENVIRONMENTAL	3.5	ECONOMIC	4.3	SOCIAL	
2.7 Energy		4.2 Transport		3.5 Health	
4.1 Water		5.0 Resource Use		3.9 Education	
3.0 Waste		4.2 Management		4.3 Access	
3.0 Materials		3.0 Local Economy		4.2 Inclusion	
3.8 Biodiversity		5.0 Services and Products		5.0 Social Cohesion	

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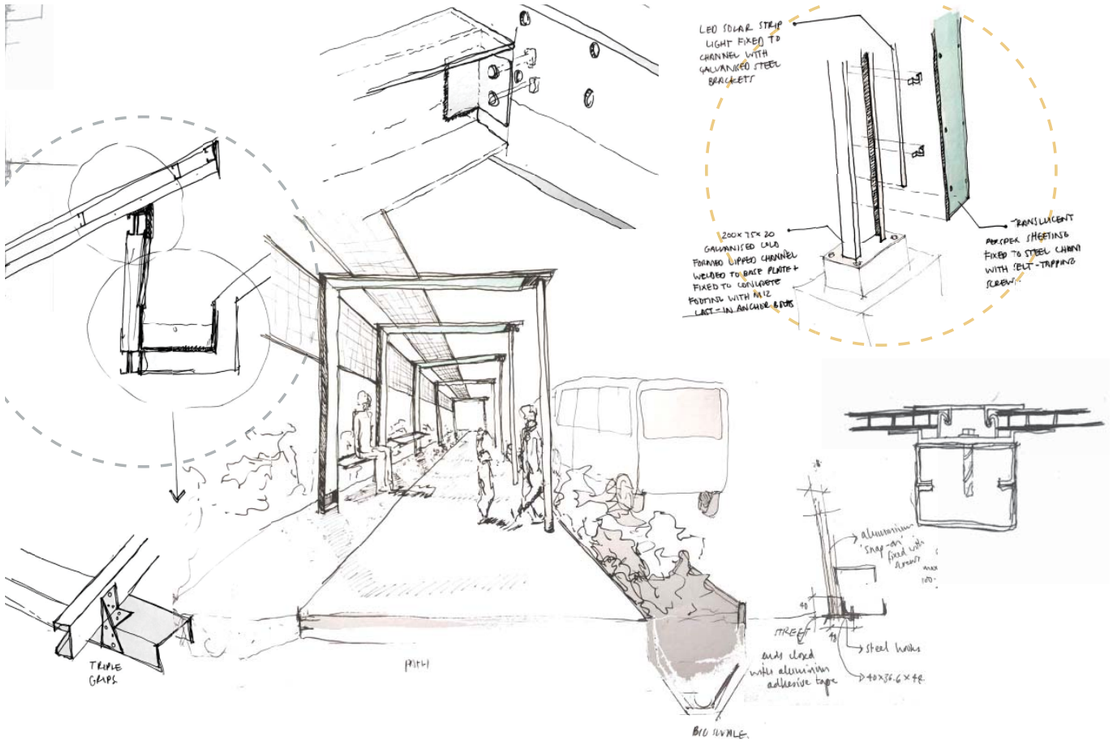

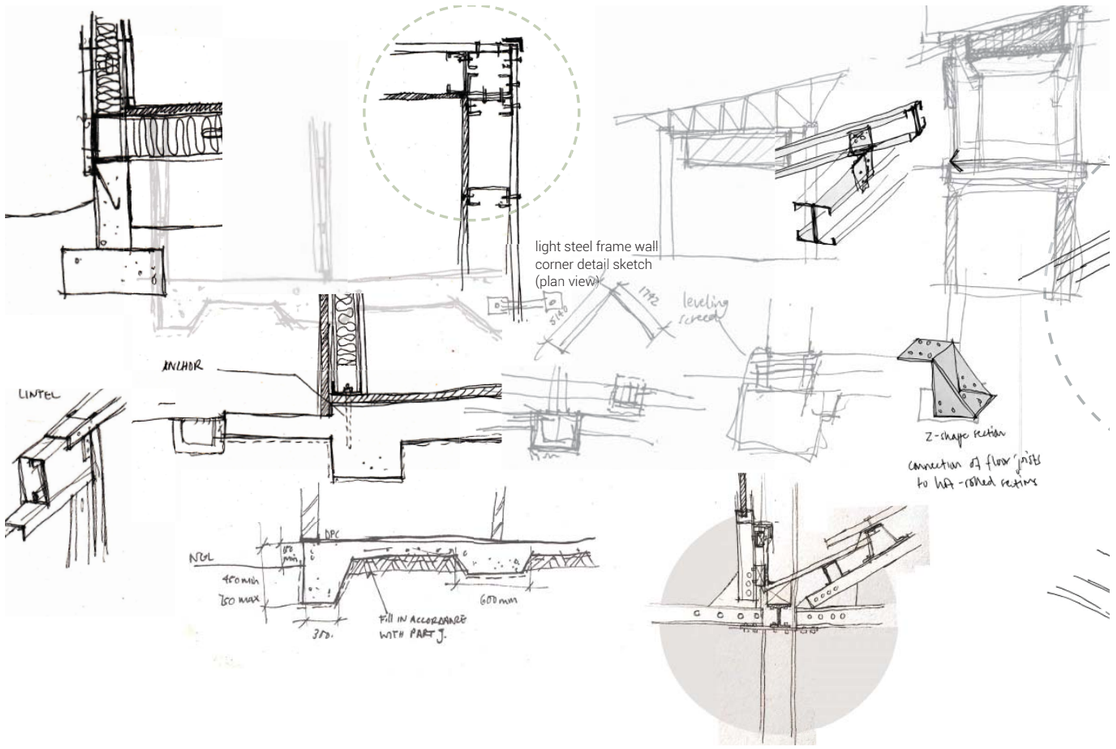

Figure 9.18: *Final model landscape elevation*

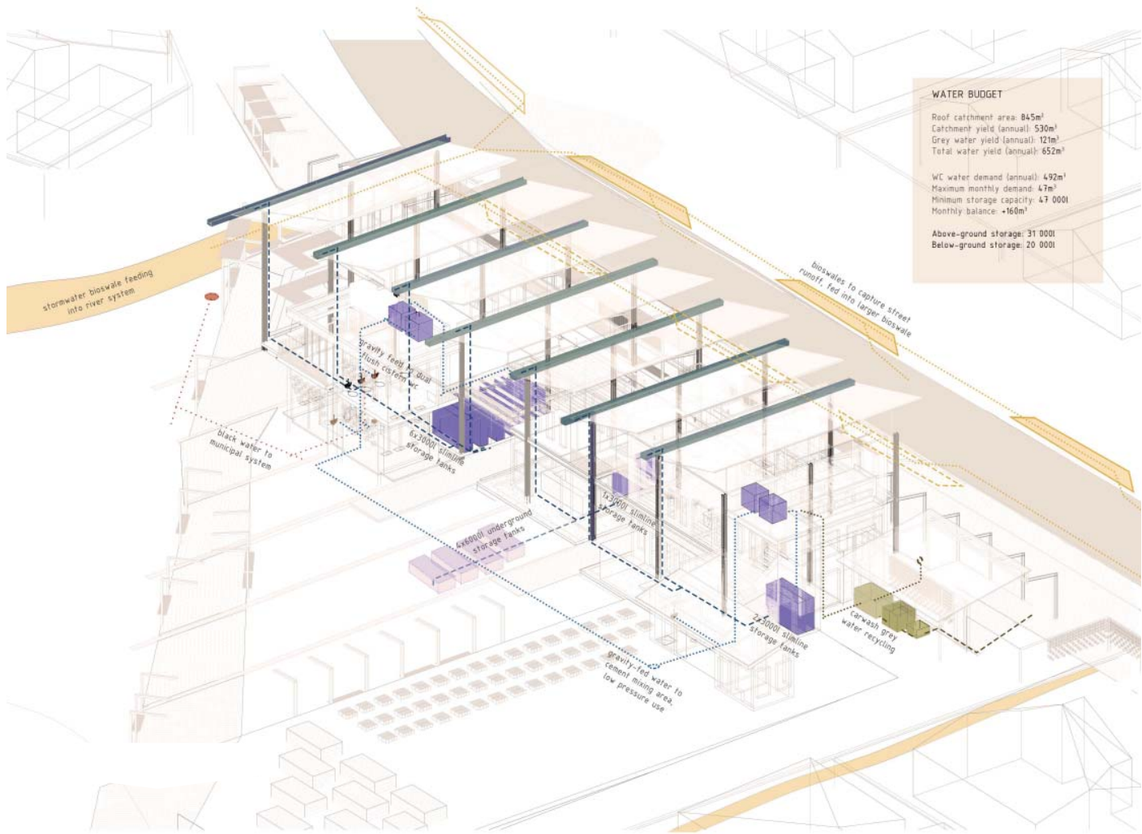

Figure 9.19: *Water strategy diagram*

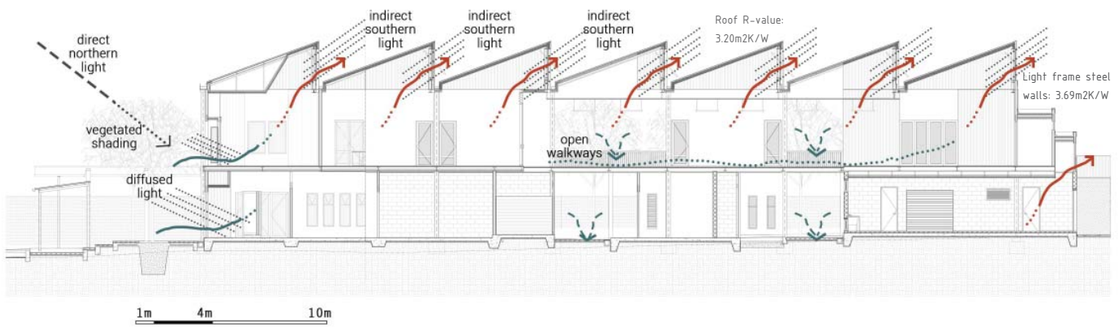

Figure 9.20: *Light and ventilation strategy diagram*

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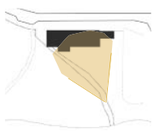
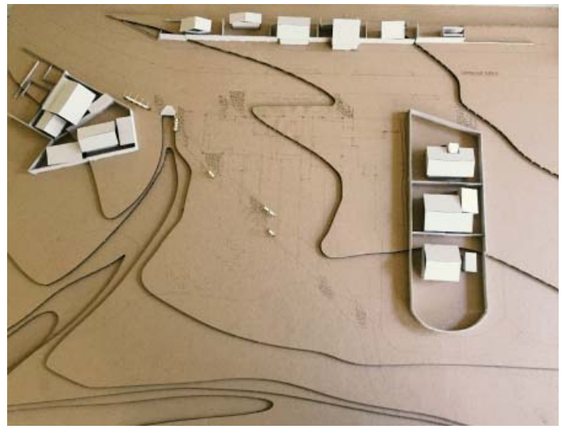
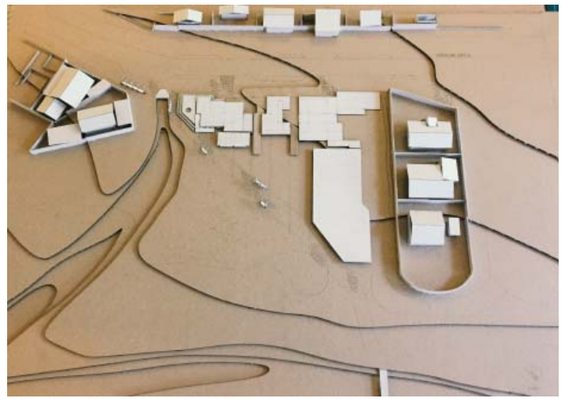


Figure 9.21: *Southern landscape view*





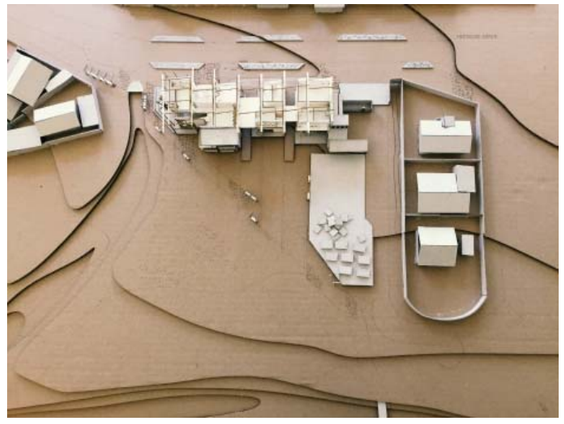


Figure 9.22: *Model develoment*

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Figure 9.23: *Exam pinup*

Figure 9.24: *Layered model showing incrementality*

Figure 9.25: *Final exam*

Figure 9.26: *Final exam pinup*

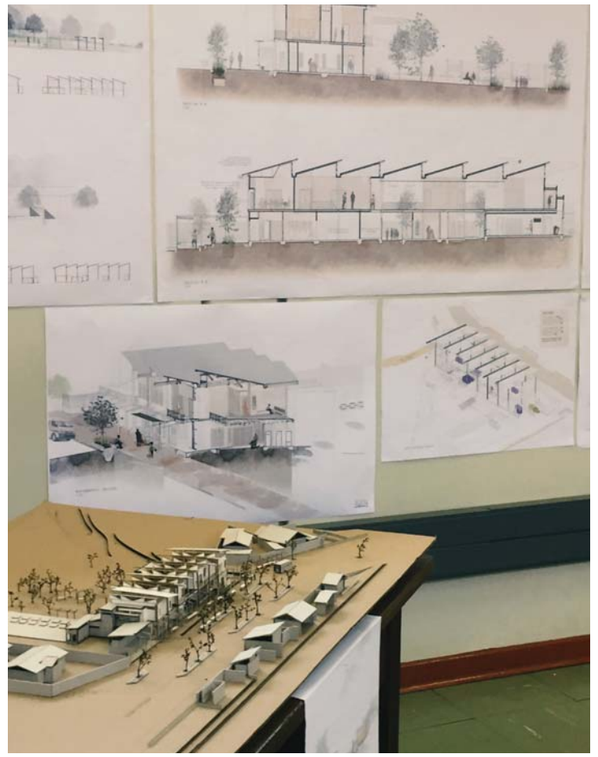

Figure 9.27: *Final exam pinup*

Figure 9.28: *Final exam pinup*

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Figure 9.29*: Final model*

Figure 9.30*: Final model process*

Figure 9.31*: Final model street elevation*

Figure 9.32*: Final model landscape elevation*

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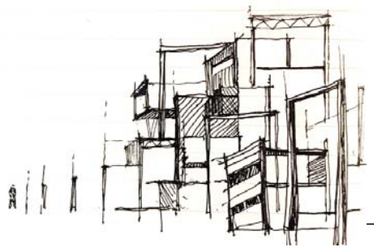

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10

CONCLUSION

aims, outcomes, and future research

When approaching a project, it is vital that the intentions of the design be evaluated – why do we design? Here, the initial intentions of this research were to investigate the tensions between formal and informal, permanent and temporary, and the creation of architecture in this environment of plurality.

Situated in the mono-functional context of suburban Mamelodi, this project aimed to introduce multi-functionality of neighbourhoods that can operate not only in the informal sector.

It was here proposed that architecture can be used as a tool of development, where it had previously been used as an instrument of separation (Low, 2002). This can be achieved through the use of contextual solutions and methods of space-making.

This research considered the possibility for creating places of valued differences and unity in Mamelodi's Phumulamcashi Buffer Zone. In doing this, it aimed to build a precedent of process that can be applied to other fragmented settings of South Africa.

Lessons Learned

Due to the eventuality, informality, and adaptability in Mamelodi, it becomes clear that it is difficult to predict outcomes for how spaces will develop organically over time; one can only rely on how it has unfolded in the past.

This makes it challenging to assess methods for unleashing the desired new era of spatiality, but it is clear that the process of development and design needs to be as adaptable as the space it aims to create.

Community involvement and participation also become imperative for the success of this nature of project to create an environment of shared interest and progression towards sustanainable neighbourhoods.

Working with the concept of incrementality and adaptability presents the possibility of an infinite "number of alternative next moves" (Habraken 1987:4), thus the design iterations explored in this dissertation are only a fraction of the possibilities of how the project could develop over time, providing the opportunity for endless further exploration.

Contribution

This study contributes to the complexity surrounding spatial transformation in South Africa.

This research has stressed the importance of designing for a multiplicity of identities and activities, because in doing so we reduce the possibility of the failure of a space. This approach prepares architecture for a complexity that becomes resilient on different scales, from the larger urban scale to grass roots level. South African architecture should aim to create spaces of ownership through "interventions that contribute to social inclusion and recognition of the citizenship and creative practices of the previously disenfranchised" (Mbembe in Morejele et al. 2006:2).

This dissertation has explored the idea of transforming a buffer zone, which was previously used for separation, into a space that is a tribute to unity and the incrementality of everyday life in Mamelodi. By exploring both practical and symbolic realizations of these values, the work compiled here has attempted to honour the lives and livelihoods of the residents of Mamelodi, as it is for people that spaces should be designed.

As discussed throughout this research, "contingency is often the source of a productive transformation" (Low 2002:37), and thus it is valid to argue for design that celebrates and encourages

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the adaptation of space rather than attempting to eradicate it. As a nation seeking transformation, it is fitting that our designed spaces are also transformative, and adaptable.

Suggestions for Future Research

There is still much work to be done in the realm of spatial transformation in democratic South Africa. With new technologies and methods constantly being established, research into the application of these in different contexts is imperative for the benefit of future generations.

If this shift towards adaptable architecture and planning does not take place, informality and incrementality will still thrive, and static architecture will become a helpless bystander; losing out on the opportunity to design and engage with these processes to create better cities and better livelihoods.

Figure 10.1: *Conceptual programmatic collage*

The role of architecture in the African urban condition should be to provide for multiple identities in the creation of a reconsidered urban condition.

(Van Rensburg & Da Costa 2008:35)

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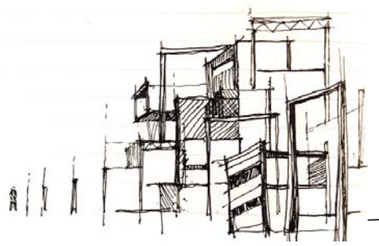

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APPENDIX A

PV Panel collection calculations.

Source: NREL, 2017. PVWatts Calculator. Available at: http://pvwatts.nrel.gov/pvwatts.php [Accessed September 29, 2017].

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The expected range is based on 30 years of actual weather data at the given location and is intended to provide an indication of the variation you might see. For more information, please refer to this NREL report: The Error Report.

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The energy output range is based on analysis of 30 years of historical weather data for nearby , and is intended to provide an indication of the possible interannual variability in generation for a Fixed (open rack) PV system at this location.

RESULTS

210,397 kWh/Year*

Month	Solar Radiation (kWh / m^2 / day)	AC Energy (kWh)	Energy Value ($)
January	6.24	18,584	N/A
February	5.97	16,311	N/A
March	5.98	17,949	N/A
April	5.51	16,558	N/A
May	5.32	16,288	N/A
June	4.97	15,171	N/A
July	5.22	16,477	N/A
August	5.74	18,024	N/A
September	6.02	17,864	N/A
October	6.21	19,178	N/A
November	6.11	18,269	N/A
December	6.45	19,725	N/A
Annual	5.81	210,398	0

Location and Station Identification

Requested Location	hinterland avenue, mamelodi	
Weather Data Source	(INTL) JOHANNESBURG, SOUTH AFRICA	30 mi
Latitude	26.13° S	
Longitude	28.23° E	

PV System Specifications *(Commercial)*

DC System Size	129.6 kW
Module Type	Standard
Array Type	Fixed (roof mount)
Array Tilt	20°
Array Azimuth	40°
System Losses	14%
Inverter Efficiency	96%
DC to AC Size Ratio	1.1

Economics

Average Cost of Electricity Purchased from Utility	No utility data available

Performance Metrics

Capacity Factor	18.5%

APPENDIX B

SBAT assessment results.

		Target	Achieved
BI	**Building Information**	**5.0**	**3.9**

BI 1	Building Targets	Target	Achieved
EN	Energy	5.0	2.7
WA	Water	5.0	4.1
WE	Waste	5.0	3.0
MA	Materials	5.0	3.0
BI	Biodiversity	5.0	3.8
TR	Transport	5.0	4.2
LE	Local Economy	5.0	3.0
MN	Management	5.0	4.2
RE	Resources	5.0	5.0
SP	Services and Products	5.0	5.0
AC	Access	5.0	4.3
HE	Health	5.0	3.5
ED	Education	5.0	3.9
IN	Inclusion	5.0	4.2
SC	Social Cohesion	5.0	5.0

BI 2	Priority Key (Not Performance Key)		
VH	Very High	5.0	
HI	High	4.0	
ME	Medium	3.0	
LO	Low	2.0	
VL	Very Low	1.0	
NA	None / Not Applicable	0.0	

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