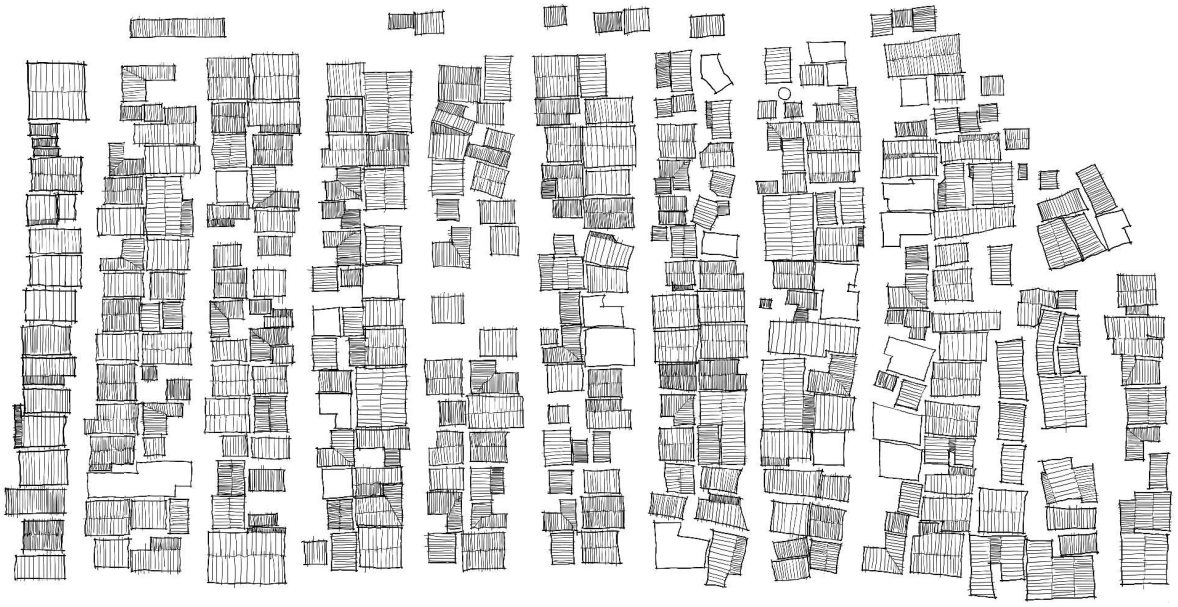
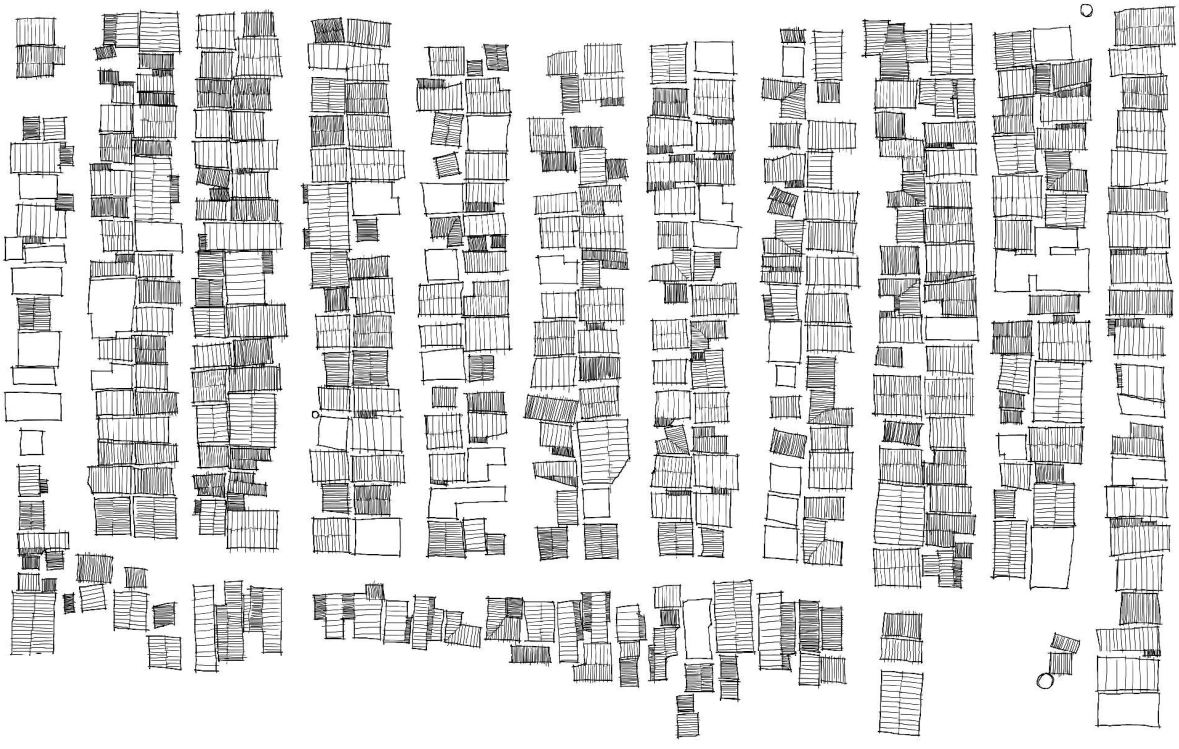


ANTICIPATED INFORMALITY

The incremental development of resilience in the marginalized community of Plastic View

Nicholas Ramsey



PROJECT SUMMARY

Name	Nicholas Ramsey
Student number	16148356
Dissertation title	Anticipated informality: The incremental development of resilience in the marginalised community of Plastic View
Degree	Master of Architecture (Professional)
Study leader	Dr. Jan Hugo
Co-supervisor	Dr. Carin Combrinck
Year coordinator	Dr. Arthur Barker
Research field	Unit for urban citizenship
Site	Plastic View informal settlement Pretorius Park, Pretoria Gauteng 0042
GPS coordinates	25°83'06.1"S 28°30'85.5"E
Programme	Waste management hub, marketplace and housing
Client	Residents of Plastic View, Dept. of environment & agriculture management, Dept. of housing and human settlement, Private waste management sector
Theoretical premise	Urban resilience within informal settlements
Keywords	Resilience, informal settlement, Plastic View, infrastructure, adaptation, appropriation, vulnerability

DECLARATION

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 of Masters of Architecture
(Professional) at the University of Pretoria, is my own work and has not previously been submitted by me for a degree at this or any other tertiary institution.

I further state that no part of my dissertation has already been, or is currently being, submitted
for any such degree, diploma or other qualification.

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

Nicholas Ramsey
2021

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

University of Pretoria. 2021

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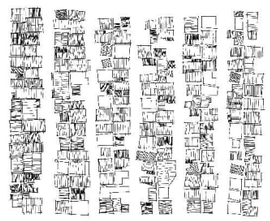


CHAPTER 00

PREFACE

ACKNOWLEDGEMENTS

Dr. Jan Hugo, thank you so much for the constant guidance and advice you provided this year. I could not have asked for a better supervisor. I couldn't even give a definition of resilience before your help.

Dr. Carin Combrinck, I am so grateful for you opening the door for us to explore the field of urban citizenship. Your enthusiasm within this field will most certainly be continued by many of us.

Mom and dad, you both always supported my studies, put a roof over my head, drove back and forth to Pretoria countless times over the years, and most importantly, forked out the cash for this one. Maybe I can pay it back one day, who knows, Corvettes and flights to Croatia don't go cheap.

Alex and Dale, what a ride this one has been. Working together was pretty great, but everything in between that; the drives to campus, the jolling, Uncle Faozi, roadtrips, festivals, mandatory brunches, I could go on forever. Those are the memories I'm most stoked to have.

Everyone else along the journey, through school, res, Tuks and the sesh, you all know who you are. Thank you for all the good times.

ABSTRACT

The informal settlements of South Africa are commonly marginalised urban systems existing within larger formal urban landscapes. Due to their marginalisation, informal settlements often lack formal infrastructure, socio-economic opportunities and a sense of permanence, which in turn challenges their resilience. Focusing on the Plastic View informal settlement in Moreleta Park, the dissertation investigates architecture's ability to contribute towards the settlement's capacity to adapt or transform to desirable states when disturbed. The "safe-to-fail" system approach (Ahern 2011) is used to develop an architectural response that caters for continuous appropriation and adaptation by the local community. In order to understand and reinterpret Plastic View's innate socio-spatial organisation and construction knowledge, a pattern language of the settlement is documented. This framework informs the design process from initial explorations through to technical and material resolution. The investigation into Plastic View's internal resilience and prevailing vulnerabilities leads to a multifunctional intervention along the settlement's emerging high street. The architecture addresses the settlement's critical infrastructural deficit, whilst proposing diverse responses to housing and public space demands. The various avenues discussed in the dissertation, including community engagement, transformative participation, incremental upgrading and anticipated settlement growth, collectively assist with the improvement of Plastic View's resilience and local living conditions.

GLOSSARY

Adaptive capacity The extent to which a system can handle and respond to a shock after it occurs, either by avoiding shifting into an undesirable state or successfully shifting into an improved state (Walker & Salt 2012:213).

Adaptive cycle A framework that breaks down the continuous evolution of a social-ecological system into four phases of operation; rapid growth, conservation, release and reorganisation (Walker & Salt 2012:213).

High street The communal hub of a neighbourhood (or settlement in this context) that fosters social interaction, pedestrian accessibility and small businesses, whilst often expressing the local identity of the community (Griffiths, Vaughan, Haklay and Jones 2008:1155).

Open building An economical, user-dependent approach to design and construction that separates the architecture into two levels; the 'support' level, consisting of the load-bearing structure; and the infill level, consisting of walls, services and fixtures (Habraken 1988:12).

Resilience The capacity of a system to maintain a quality of life and functional integrity in spite of disturbances, whether that is in a return to original condition or transformation to a new equilibrium (Peres, du Plessis & Landman 2017:692; Walker & Salt 2012:215).

Sustainability The state of a system in which its function and integrity can persist without the depletion of resources and ecological subsystems (Peres, du Plessis & Landman 2017:692).

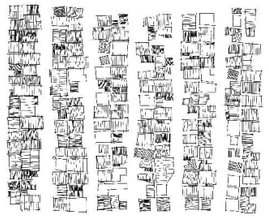
Social-ecological system Complex living structures comprising human beings and nature (Peres & du Plessis 2013:3).

Third space The public area between the home and the workplace where people gather and interact (Oldenburg & Brissett 1982:269).

Transformative participation An approach to community engagement that recognises the imbalances of power and knowledge between architects (experts) and end-users (non-experts), and responds with transparency, inclusion and two-way knowledge sharing (Till 2005:4).

Urban resilience A branch of resilience that specifically addresses attributes of systems that make up cities, to improve the resilience of the city as a whole (Peres & du Plessis 2014:1).

Vulnerability The measure of a system's exposure, prevention and response capacity to cope with shocks and disturbances (Weichselgartner & Bertens 2000:6).



CHAPTER 01

INTRODUCTION

Figure 1.1. Entrance to Plastic View (Author 2021)

1.1 RESILIENCE IN THE BUILT ENVIRONMENT

In the 1973 paper “Resilience and stability of ecological systems”, Holling propagated the concept of resilience as a factor of systems thinking (Davoudi 2012:300). He defined resilience according to the magnitude of a disturbance that a system can take in, and the speed at which the system can return to a stable condition after the disturbance (Davoudi 2012:300). The understanding of resilience has since been applied to various fields, including architecture (Peres & du Plessis 2014:3). Unfortunately, because of the extensive range of resilience theory, built environment professionals often confuse it for a solution to urbanization-related problems, when instead it is a characteristic of the problematic system itself (Peres & du Plessis 2014:4). Within the urban development sphere, the term resilience has become a widespread substitution for sustainability; as an overarching goal for city planning (Peres, du Plessis & Landman 2017:691). Resilience and sustainability should instead be considered as having a complementary relationship. Sustainability can be considered the normative position for urban development, as it determines the desired functional characteristics of a system to be restored or upheld (Peres *et al*. 2017:692). Thus, the resilience of a sustainable social-ecological system is its capacity to maintain a quality of life and functional integrity in spite of disturbances, whether that is in a return to original condition or transformation to a new equilibrium (Peres *et al*. 2017:692; Walker & Salt 2012:215).

Urban resilience practice is based on the understanding that cities are made up of systems that interact on different scales following a hierarchical structure (Allen, Angeler, Garmestani, Gunderson & Holling 2014:578). From this perspective, urban resilience practice is concerned with the enhancing of positive attributes of individual systems that collectively build the general resilience of the city (Peres & du Plessis 2014:1). Within South African cities, rapid urbanisation has led to an influx of migrants establishing informal settlements on municipal and private-owned land (Peres *et al*. 2017:690; Soggot & Amupadhi 1997). Informal settlements are inherently city systems within larger formal urban landscapes, however their marginalisation causes greater disturbance across systems of different scales, consequently challenging their respective cities’ urban resilience (Peres & Du Plessis 2013:7). Understanding and improving the conditions of informal settlements, specifically in their capacity to absorb shocks or transform to more desirable states, can not only create a higher quality of life within settlements but also improve their multi-scale relationships with larger systems in cities (Peres *et al*. 2017:692; Peres & Du Plessis 2013:4).

1.2 INTRODUCING PLASTIC VIEW

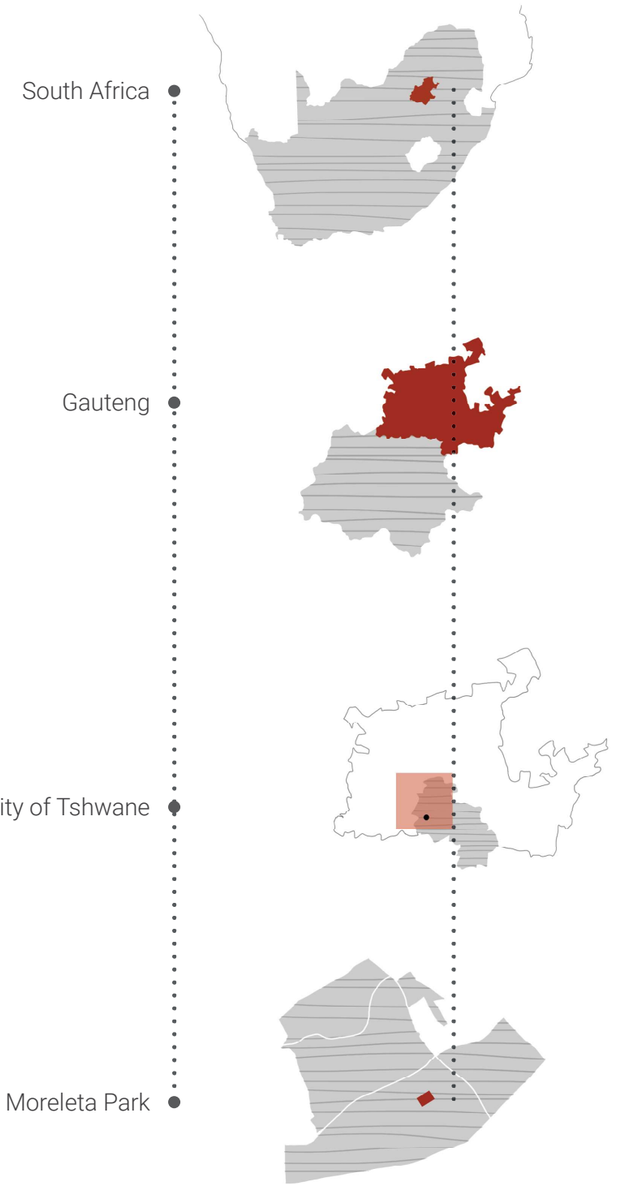


Figure 1.2. Locality diagram (Author 2021)

This dissertation follows a site-specific approach for the improvement of Plastic View informal settlement. The settlement, formally named Woodlane Village, began as small clusters of informal dwellings in an open, municipality-owned portion of land in the Moreleta Park suburb of Pretoria, adjacent to the Moreleta Park Gemeente church. In 2009, it became partially formalised by the City of Tshwane municipality in an effort to control its rapid growth. In an expression of the settlement’s resilience, Plastic View has developed and transformed to its present state, with over 900 dwellings and an estimated 9000 residents. The growth continues unabated despite continuous disturbances, including evictions, fire outbreaks and relocation court cases. The highly dense settlement, of approximately eight hectares, starkly contrasts the surrounding gated communities, with individual plot sizes up to a

hectare each. In addition to density, the disparity is equally evident in household incomes, expenditure and amenities. Within a two-kilometre radius of the temporary dwellings and spaza shops of Plastic View lies the Woodlands Boulevard Mall, Parkview Shopping Centre, Pretoria East (private) Hospital, and several gated communities, whilst within Plastic View, there are spaza shops and temporary dwellings. The formalisation in 2009 resulted in a consolidation of the informal dwellings into organised streets contained within a semi-defined boundary (where there was once fencing, the boundary is currently enforced by the outermost dwellings and the church's boundary fence). Since then, the general layout has remained relatively stable; however, in the past three years, the density has steadily increased in the southern and eastern corners and north-eastern boundary of the settlement. The municipal water and sanitation supply to Plastic View consists of 9 water tanks (maximum 180 000 litres per day) and 87 portable toilets (Ebersohn, Goga, Haese, Hudson, Meij, Mojaphoko, Schmutz & Swart 2021:33). Other municipal infrastructure, such as paved roads, stormwater management, street lighting and waste management, is non-existent in the settlement.

Like all informal settlements, Plastic View is a spontaneous act of self-organisation and appropriation against the spatially-restrictive city of Pretoria (Lutzoni 2016:2; Peres & du Plessis 2014:8). As informal settlements in the global South continue to grow, so too does a lack of government-issue, resilience-building infrastructure and services for those living in the settlements (Revi & Satterthwaite 2014:546). The issues being investigated in Plastic View are not specific to a single informal settlement but rather part of greater observable urbanisation patterns in South Africa. Plastic View was identified for this dissertation, not only for its exemplification of these patterns but also because of its existing relationship with the University of Pretoria's department of architecture. Research conducted on informal settlements frequently requires on-site data gathering, and the presence of a research team in Plastic View is generally met with comfort by the community as they are familiar with such data gathering processes.

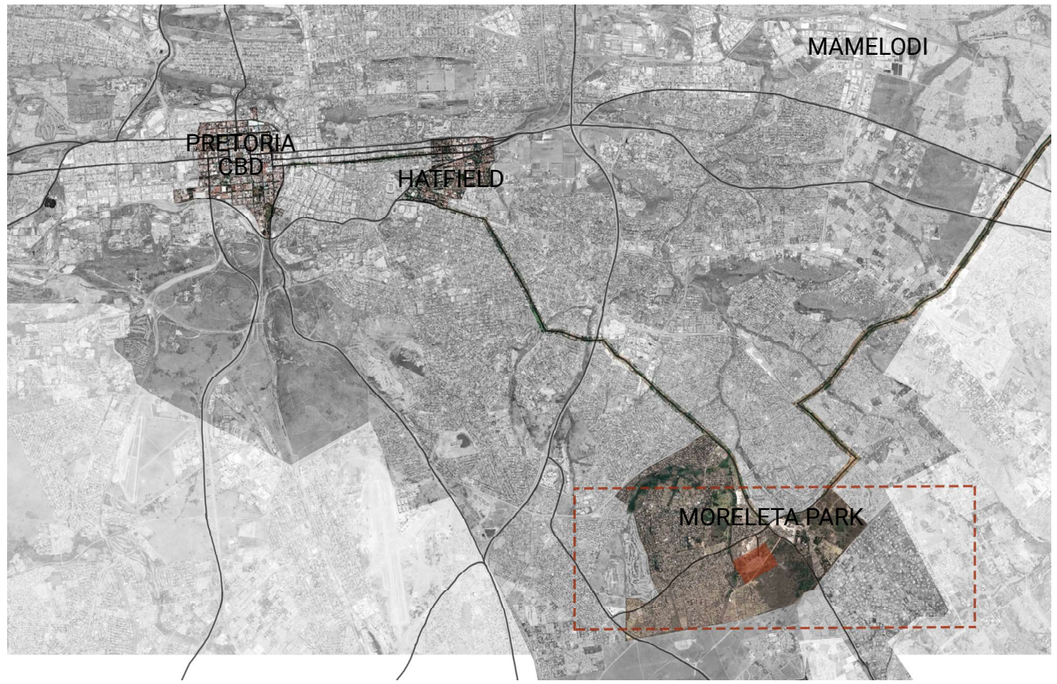


Figure 1.3. Locality map (Author 2021)

Figure 1.4. Suburb map (Author 2021)

1.3
PROBLEM STATEMENT

Figure 1.5. Plastic View aerial view (Author 2021)

General issue

The South African apartheid-era urban planning displayed a deliberate approach to spatial separation that provided white, suburban areas with accessible facilities and job opportunities (Landman 2006:3). Close to thirty years after the ending of apartheid, spatial segregation remains evident in the low-density sprawl, socio-economic inequity, and growth of gated communities (Osman 2015; Peres et al. 2017:691; Peres & du Plessis 2013:4). Seeking social and economic opportunities, the urban poor follows the development sprawl of the wealthy. The centralised availability of work opportunities is the primary driver of the growth of informal settlements within high-income, developed areas (Dovey 2015:6; Kellett & Napier 1995:8). Whilst servicing the formal city through cheap, readily available labour, the communities of informal settlements are generally excluded from social capital and municipal service provision (Dovey 2015:6; Peres & du Plessis 2013:3).

Due to assumed criminal activity, informal status and unsightly conditions in settlements (Peres & Du Plessis 2013:5), they are perceived with contempt and distrust by the formal communities surrounding them (Combrinck, Vosloo & Osman 2017:44). Despite providing valuable service to the surrounding communities, informal settlements continue to be misunderstood and resultantly excluded from formal enablement.

Urban issue

The increasing presence of gated communities in ‘new business districts’ like Moreleta Park has enforced a privatisation of public space that heavily restricts the residents of Plastic View access to socio-economic opportunities and public facilities (Landman 2006:7). The exclusion from formal infrastructure and negative public perception has created a more significant threat of slow and fast disturbances upon the settlement (Peres & du Plessis 2013:8). These disturbances, aided by the lack of land tenure, continues to challenge Plastic View’s existence. Plastic View, however, displays an internal resilience as residents create informal methods to mitigate and resolve disturbances (such as fires, job scarcity, and food scarcity). The financial and political limitations faced by the community (particularly in the lack of municipal support) impedes the improvement of such resilience. The social and economic differences between Plastic View and the surrounding neighbourhoods create multi-scale pressures that cause disturbances like evictions and pollution (Peres & du Plessis 2013:7). Ultimately, Plastic View’s lack of municipal assistance diminishes the quality

of life in the settlement and creates greater conflict with the surrounding neighbourhoods of Moreleta Park, which in turn hinders the city of Tshwane's urban resilience.

Architectural issue

When considering the role architecture can play in improving the existing resilience of Plastic View, its potential contribution towards returning or transforming to a desired condition arises. The non-equilibrium theory recognises that built environments, such as Plastic View, are inherently prone to unexpected change (Wu & Loucks 1995:443). The appropriate response to this theory is to develop architecture that is "safe-to-fail", whereby it can maintain an adaptive capacity against disturbance or failure (Ahern 2011:342). Informal settlements exist in highly transient states of existence; thus, static, formulaic interventions can be seen as ignorant in the context of a settlement's unpredictable threats and fluctuating needs (Ahern 2011:342). The informal development in Plastic View, as residents build and adapt their homes with cheap, often found materials, exemplifies the "safe-to-fail" mentality. Formal development, in its adherence to design and planning regulations, often answers to a specific problem or opportunity, failing to recognise that informal settlements rely on incremental adaptation as a mode of supporting livelihoods (Kamalipour & Dovey 2020:1). The permanent nature of formal construction tends to limit the adaptability and capacity for reuse (Kamalipour & Dovey 2020:1), because it doesn't often conceive designing to cater for unexpected disturbances as an opportunity to reduce the risk of failure (Ahern 2011:343). In the context of informal settlements, formal intervention must ultimately have the capacity to be continuously appropriated by the community in response to their changing needs.

Figure 1.6. Plastic View dwelling (Author 2021)

Figure 1.7. Woodhill Golf Estate dwelling (Moreleta Park Integration Project 2021)

1.4
RESEARCH QUESTIONS

Primary question

How can architecture facilitate the improvement of the internal resilience of Plastic View?

Sub-questions

a. What existing infrastructure and systems actively contribute to the resilience of Plastic View?
b. How can the interconnection of multi-scale networks, hosted by an architectural intervention, contribute to the settlement's internal resilience?
c. How can one expand on the existing conditions to build further resilience in Plastic View?

Figure 1.8. Plastic View street (Author 2021)

CHAPTER 02

RESEARCH FRAMEWORK

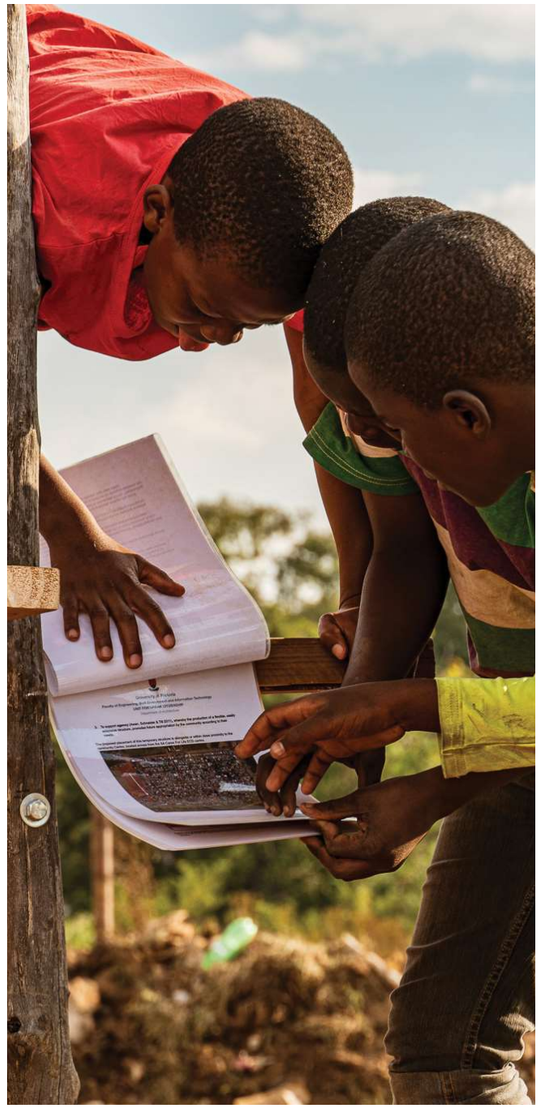


Figure 2.1. Live-build knowledge exchange (Zorn 2021)

2.1 RESILIENCE & VULNERABILITY

The intention of the research is to investigate the existing resilience practices within Plastic View that contribute towards its sustainability. In the interest of the identified issues, the physical indications of these practices will be investigated, primarily through the community's material choices, spatial planning, and micro-infrastructure. According to Usamah, Handmer, Mitchell & Ahmed (2014:178), to understand the resilience of an informal settlement and its degree of social capital and internal networks, the vulnerabilities must also be understood. This is because vulnerability is a measure of the settlement's exposure to hazards (Weichselgartner & Bertens 2000:6), hence a measure of that which threatens its resilience. Investigating the vulnerability of Plastic View, through factors of geography, economy, housing and land tenure (Usamah et al. 2014:181), provides an understanding of the degree to which the community can be affected by disturbances (Weichselgartner & Bertens 2000:6). Understanding resilience practices within such an environment can contribute to building adaptive capacity and reducing vulnerability (Peres & du Plessis 2013:2). Thus, the intended research consists of explorations into the existing resilience of the Plastic View community, the vulnerabilities and potential threats it may face, and the adaptive and transformative capacity it holds in the face of such threats.

2.2 INCREMENTAL SERVICING

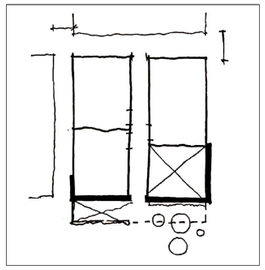
While Kihato & Napier (2013:91) characterise informal settlements as poverty-stricken, overcrowded, and lacking in municipal servicing, these characteristics can be considered temporary in the same way the informal dwellings are temporary (Kellett & Napier 1995:22). Plastic View is transient by nature, and the support for its existence comes in the form of incremental upgrading that lends to a transition and reintegration into formal operations of urban life. It is evident that the residents of informal settlements have the capacity to provide themselves with basic forms of shelter; however, the vulnerability of the settlements largely stems from a lack of basic infrastructure and services (Satterthwaite, Huq, Pelling, Reid & Lankao 2007:2). According to Bertaud (2018:260), services such as water provision and sanitation have greater potential to improve a community's livelihood than the quality of their dwellings. Considering that small-scale adaptation of dwellings prevails in informal conditions (Dovey 2015:7), so should the provision of infrastructure through an incremental process.

This comes from a pragmatic stance to settlement upgrading, which, according to Combrinck, Vosloo and Osman (2017:46), sees a context like Plastic View to be in a state of transition and reintegration into formal society. The argument for incrementalism recognises a necessary balance between provision and enablement that can develop the agency of the community (Combrinck, Vosloo & Osman 2017:34). It can thus be said that upgrading Plastic View, through the development of basic infrastructure, has the potential to improve living conditions, reduce vulnerability against long term disturbances and contribute to the settlement's agency.

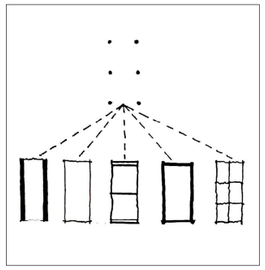
2.3 ANTICIPATED REUSE

In response to the architectural issue of static, formal provision, a “safe-to-fail” intervention will be designed to take advantage of the strong social cohesion and internal networks present in Plastic View. It is necessary that the system anticipates a degree of appropriation and adaptation of built forms by the community itself. According to Wakely and Riley (2010:1), this is highly pertinent to facilitating incremental upgrading of informal settlements, as the architecture is positioned to enable the community to elicit their desired socio-spatial evolution (Combrinck et al. 2017:34). Designing to cater for appropriation requires an understanding of socio-spatial organisation within Plastic View. A pattern language of the settlement as a whole, its grid structure, the individual streets, third spaces, and finer details of construction material choice and methods shall inform the design process. This can inform how an intervention may be incrementally adapted and how it may influence a future expansion of the settlement. As a “safe-to-fail” system, the intervention should be designed so that if the proposed use of the building becomes obsolete, a reuse of the structure, or the construction materials, is possible.

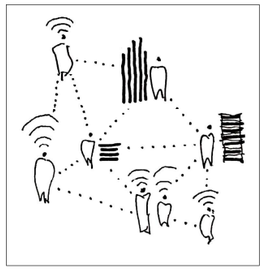
Multifunctionality



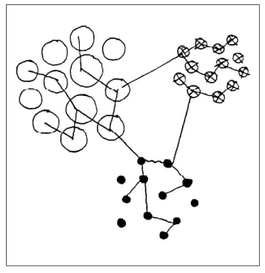
Redundancy & modularisation



Diversity



Multi-scale networks & connectivity



Adaptive planning & design

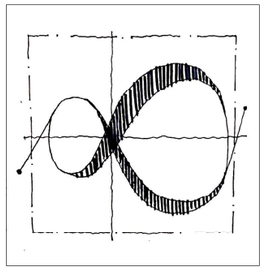


Figure 2.2. Safe-to-fail principles (Author 2021)

2.4 POSTULATION OF PROGRAMME

The resolution of the programme is heavily rooted in the contextual understanding and physical engagement with the Plastic View community. As stated above, the development of infrastructure has the greatest potential to respond to the outlined issues. Understanding the evolving living conditions and transient built forms in the settlement will inform the appropriate programmes to expand on. Basic infrastructure is crucial for the livelihoods of all communities (Bertaud 2018:260); however, a clarification of the specific disturbances and vulnerabilities of Plastic View will delineate the necessary services that will actively build capacity against such threats. The proposal of a programmed intervention is a cautious act for informal settlements due to their inherent changing needs; however, having it rooted in existing functions and conditions on site creates a stronger opportunity for successful unity and appropriation. A responsive, incremental architecture, according to Habraken (1987:4), can be catalytic to subsequent spatial - potentially parasitic - activation. Thus, the incremental development of basic infrastructure, through architecture, will respect the vital role of providing services whilst allowing continuous appropriation by the community in response to their changing needs.

2.5 RESEARCH METHODOLOGY

Reality studio

The research for this dissertation exists in conjunction with Chalmers University of Technology under the 2021 Reality Studio, with the intention of engaging with the complex mode of urbanism that is spontaneous urban settlements. A group of nine architecture masters students, myself included, form the Moreleta Park Integration Project that specifically addresses Plastic View. Our collective goal was to "uncover deeper layers of intricacies of Plastic View and draw legitimate conclusions from these analyses" (Creighton, de Bruin, Herbst, Katranas, Kriek, Lindqvist, Mbedzi, Ramsey & Zachrisson 2021). By dividing into three rapid data collection groups, a broader range of specified data was gathered. I positioned myself within the group focused on the circularity and resilience of Plastic View.

Approach

The methodology is based on qualitative research being conducted for a deeper understanding of Plastic View and the residents. This entails direct contact with the community to investigate and interpret the social and economic occupation of their lived space (Groat & Wang 2002:222). Through an interpretivist approach, explication and reasoning can be made to understand the resilience practices operating in Plastic View that contribute towards or otherwise mitigate its vulnerabilities. The objective of this investigation is exploratory and interactive due to the transfer and construction of knowledge on the specific topics of interest (Kivunja & Kuyini 2017:33). Whilst broad documentation has been conducted in the past, primarily in 2020, the subject of resilience requires a more detailed investigation. The data gathering process consists of collecting contextual information that, through interpretation, can be used within the chosen context and subsequently related to others (Kivunja & Kuyini 2017:34). The interpretivist approach was identified as it lends to the intention of addressing specific areas of vulnerabilities in the community of Plastic View.

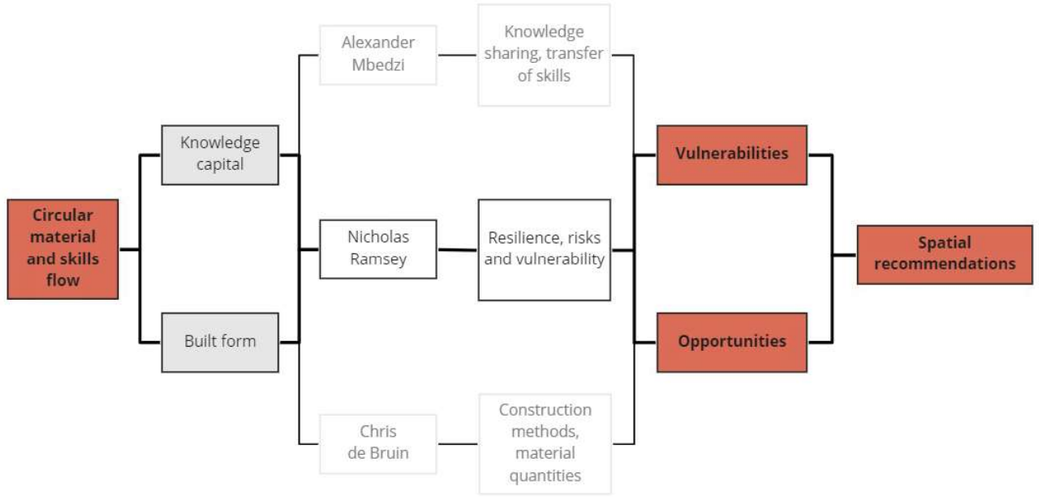


Figure 2.3. Group research framework (Author 2021)

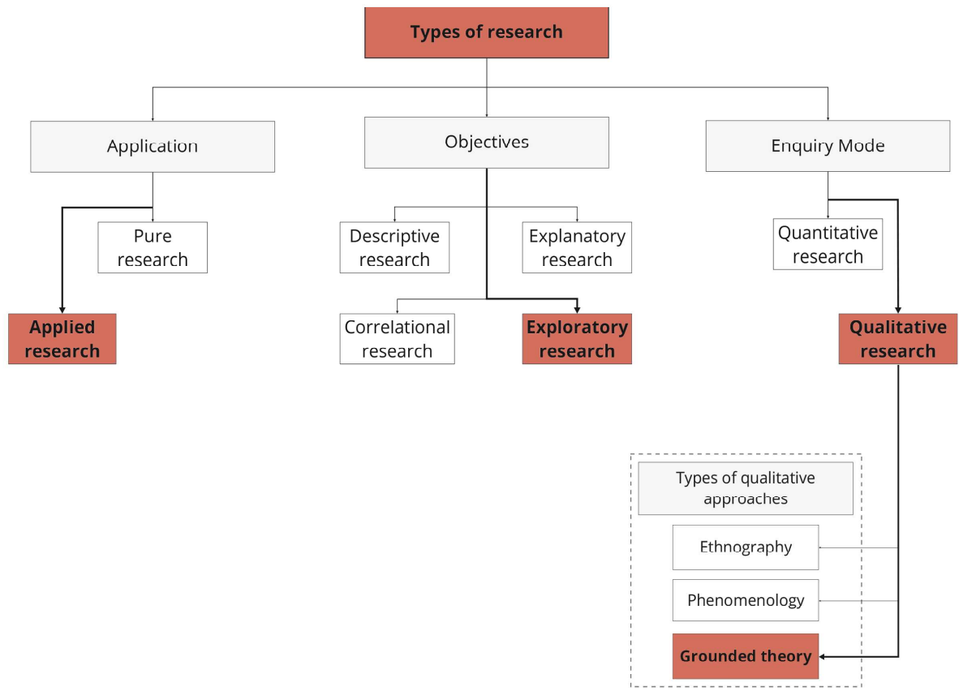


Figure 2.4. Methodology diagram (Author 2021)

Data collection

A reintroduction of the Moreleta Park Integration Project group to the community members was required to make our planned presence and intentions aware. Through photography, the documentation of recent development in the community was accomplished with the recreation of geolocated photos to allow a side-by-side comparison of dwellings. The data gathering process specifically explored the knowledge capital and built forms present in Plastic View. The investigation consisted of structured interviews with residents of Plastic View. Understanding the local construction skills provided a foundation for transformative participation. According to Till (2005:4), the architect offers technical knowledge and is also afforded the opportunity to have their understanding transformed by the participants. Examining the material life cycles and household adaptation and maintenance indicated the expected resource requirements of possible future developments. Elementary floor plans of households were created through brief sketching exercises; in some cases done by the research participants and otherwise after granting verbal permission for researchers to view the inside of their homes. This provided a greater understanding of lived spaces that contributes to the pattern language of Plastic View.

Finally, a prototype live-build was conducted in collaboration with the 2021 University of Pretoria BArch(Honours) students. The objective was to respond to contextual conditions, explore design ideas through open dialogue with the community, and produce a flexible, adaptable structure that promotes future appropriation (Unit for Urban Citizenship 2021:1). During in situ assembly, unstructured interviews and demonstrations were conducted to receive initial feedback regarding construction techniques and speculated use, in the interest of transformative participation.

Investigation — Immersion and understanding of systems and dynamics in Plastic View

Speculation — Identifying growth trends and vulnerabilities

Participation — Live-build exercise with transformative interaction and two-way knowledge sharing

Coding — Analyzing data to formulate a pattern language of Plastic View

Explanation — Developing theories, speculation and principles as a reflection on investigation

Figure 2.5. Methodology timeline (Author 2021)

2.6 LIMITATIONS & ASSUMPTIONS

As discussed in chapter one, Plastic View constantly undergoes changes to its structures, residents and municipal involvement. Thus, the data presented in the dissertation is accurate to the time of collection. The information is, however, likely to have changed since this time as the settlement has evolved.

“Permanent” construction within Plastic View has historically been met with severe criticism by the surrounding communities. Numerous structures, generally outside of the defined boundary of the settlement, have been removed by the municipality in the past.

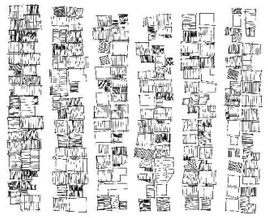
Whilst this reaction to new development is changing as the neighbourhood becomes accustomed to the upgrading within Plastic View, it is assumed that the surrounding communities and municipality would approve of the architectural intervention presented in this dissertation.

Figure 2.6. Prototype structure (Author 2021)

2.7 CONCLUSION

The theoretical framework and conducted data gathering provide insight into various principles and informants that can be used for the project’s concept and design development. As it is clear that Plastic View is currently undergoing incremental growth, the construction knowledge, material life cycles, and local socio-spatial organisation that informs this growth will also inform the “safe-to-fail” architecture from this dissertation. In addition to these contextual informants, Ahern (2011:342) proposes five principles for building urban resilience; multifunctionality, redundancy and modularisation, diversity, multi-scale networks and connectivity, and adaptive planning and design. These will be unpacked and assessed in the context of basic infrastructure in Plastic View to identify shortfalls and opportunities for intervention.

Designing to cater for appropriation was earlier identified as an intention of the dissertation. To respond to the intention, the pattern language of Plastic View will be interpreted to provide an understanding of the settlement’s construction and operations of living. The act of respecting and fostering these conditions will create a greater chance of successful appropriation and longevity of the project and ultimately improve the internal resilience of Plastic View. The site selection and scale of intervention will be informed by an analysis of existing activity and systems in Plastic View. Finally, the speculation of the eventual large-scale growth of the settlement, within a revised urban framework, will further contribute to the design approach for this dissertation.



CHAPTER 03

CONTEXT

Figure 3.1. Plastic View drone image (MPIP 2021)

3.1
INTRODUCTION

Having discussed the research intentions and data collection process in chapter one, the following chapter will discuss the findings of the data collection, chosen site conditions and their implications on viewing Plastic View's resilience. From the earlier explanation of the settlement's deficit of basic infrastructure, the intended programme is unpacked to express the intention of improving internal resilience and enabling the community. The argument is built towards speculation of the rapid growth of Plastic View in response to nearby urban development, with a resultant site vision. The concept expands on spatial and programmatic drivers whilst introducing the typology layers that make up Plastic View's pattern language. The patterns, registered through the diverse methods of desktop studies, photography, interviews and observations, inform the design explorations. This process respects the existing conditions and language of Plastic View. The initial design explorations are critiqued to guide the development towards a refined intervention.

3.2
RESEARCH FINDINGS

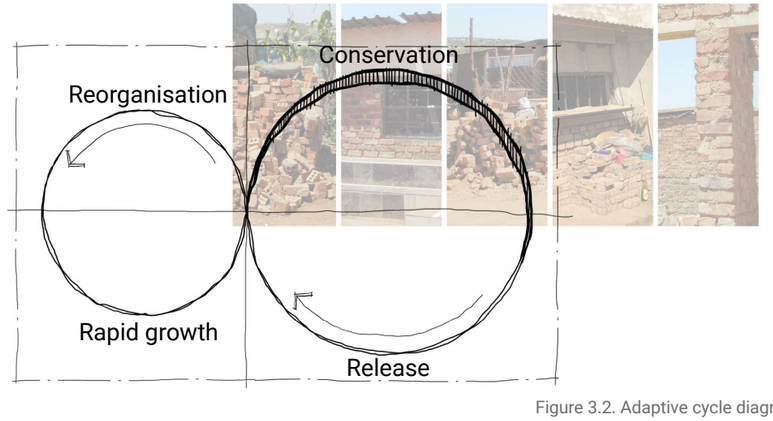


Figure 3.2. Adaptive cycle diagram (Author 2021)

The conservation phase

The early observation of Plastic View's ongoing dwelling upgrades provides insight into the dynamics of its adaptive cycle. The adaptive cycle of a system, in this case, Plastic View, provides a framework to understand the internal operating connections and how they dictate a potential change in the system (Walker & Salt 2006:75). A system generally proceeds through four phases of an adaptive cycle; rapid growth, conservation, release, and reorganisation (Holling 1986:95).

The upgrades in Plastic View primarily consist of the transition from perishable plastic sheeting and timber boards to clay bricks as the primary cladding materials of dwellings. The number of brick dwellings has increased significantly in the past year, from scarcely any to thirty four as of April 2021 (Ebersohn et al. 2021:42). In addition to this, several stacks of bricks were observed in front of and adjacent to dwellings. Interviews confirmed that the homeowners were collecting a sufficient number of bricks to eventually reconstruct their homes with the more permanent material. This gradual process of upgrading points to Plastic View being in a conservation phase of its adaptive cycle. According to Walker and Salt (2006:76), the conservation phase consists of the accumulation and storage of resources for eventual efficient use. A sense of stability increases with a dependency on the favoured structures and networks (Walker & Salt 2006:77), as seen in Plastic View's favouring for brick dwellings. The dependency also, however, makes Plastic View increasingly vulnerable to disturbance (Walker & Salt 2006:77), due to the restricted network that exists for sourcing the favoured bricks.

Figure 3.3. Dwelling upgrade observations (Author 2021)

Material sourcing

The acquisition of bricks to use in construction in Plastic View is currently a slow, inconsistent process. The residents primarily rely on the formal construction industry to supply used and excess bricks. The bricks are usually sourced from construction sites in the area (often using their jobs in the construction industry as a connection) or found in the immediate proximity of Plastic View. Bricks from construction sites are often dumped in the fields adjacent to the settlement or on the road leading to its main entrance. Hence, the process of collecting the bricks is slow and unpredictable as they rely on an external source. It became evident that many residents have to store their bricks at their existing homes as they build up enough stock to begin upgrading, or save up enough money to buy cement and other materials. In reference to Plastic View's phase of conservation, there is little redundancy in the process of brick collecting. Not only is the process of acquisition narrowed to a single mode, but it is also highly dependent on external systems. According to Ahern (2011:342), when a service is provided by a single operation, it is more vulnerable to failure, whereas a decentralised system, with multiple internal and external operations, is more resilient. To aid the process of incremental upgrading in Plastic View, which will, in turn, improve living conditions and capacity to respond to disturbance, the settlement requires an expansion of networks that provides quality construction materials for more permanent dwellings.

Mitigation and adaptation

The conducted interviews (29 March - 31 March) and observations provided an understanding of the different ways dwellings continue to be upgraded over time. By analysing the changes as either reducing impact of disturbance or responding to the impact of disturbance, there is a better understanding of Plastic View's internal resilience. The shift to more permanent materials like brick and corrugated iron and the addition of one metre wide passages between dwellings that double as firebreaks indicates the mitigation of disturbance impact. Through the conducted interviews, it is understood that residents have recognised that these changes can prevent flooding, sun and fire damage and improve levels of comfort, and resultantly express the capacity to realise the changes. The process of maintenance due to material degradation, and rebuilding due to disturbances such as fires and evictions, shows the adaptive capacity for disaster response. Ideally, the settlement can progress to a state of mitigating disturbance rather than

responding to it, which furthers the argument for upgrading to brick dwellings. The transition from perishable plastic sheeting and timber boards to permanent brick and concrete not only increases resilience against fire and weather conditions, but also shifts the dynamics around settlement longevity (Kamalipour & Dovey 2020:4). The longevity can subsequently create opportunities for broader permanence, with de facto tenure and connection to formal servicing (Kamalipour & Dovey 2020:4).

The incremental upgrading in Plastic View is already being conducted by the residents themselves, with the continuous reconstruction of their dwellings. The opportunity for architectural intervention is grounded in the need for an improved operation of material acquisition; however, the process of upgrading is

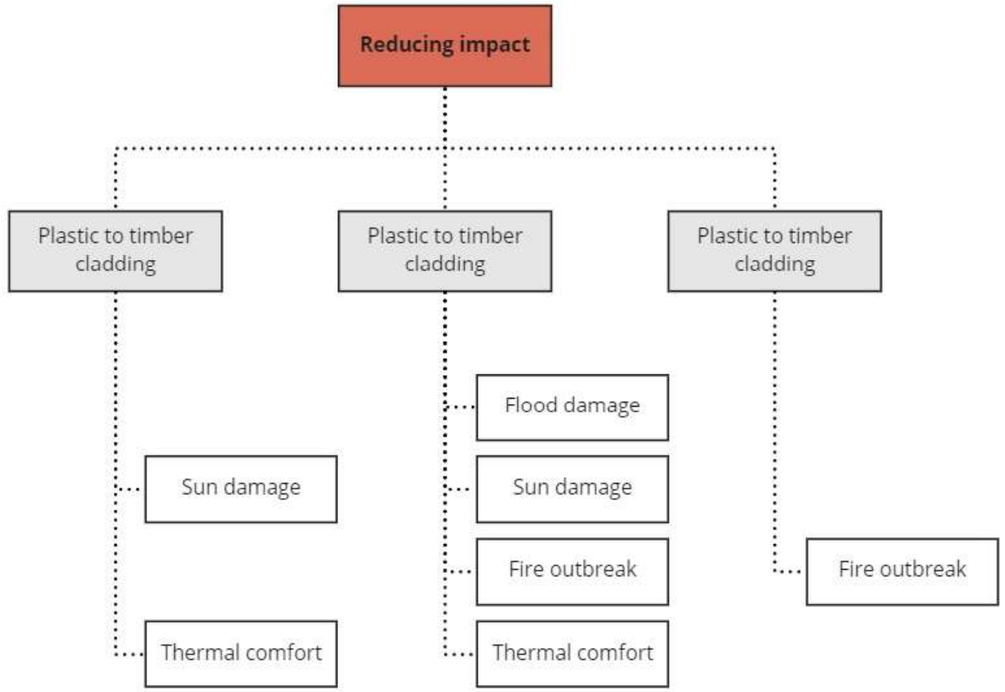


Figure 3.4. Pre-emptive upgrading diagram (Author 2021)

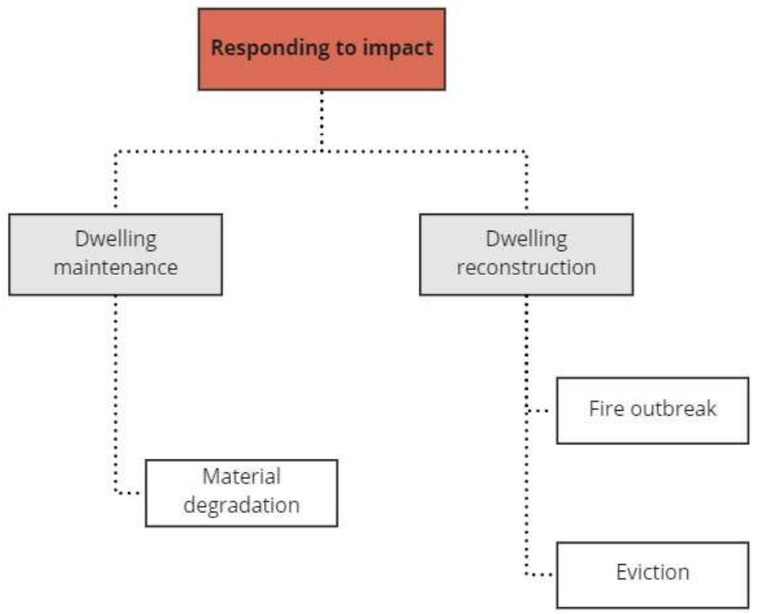


Figure 3.5 Responsive upgrading diagram (Author 2021)

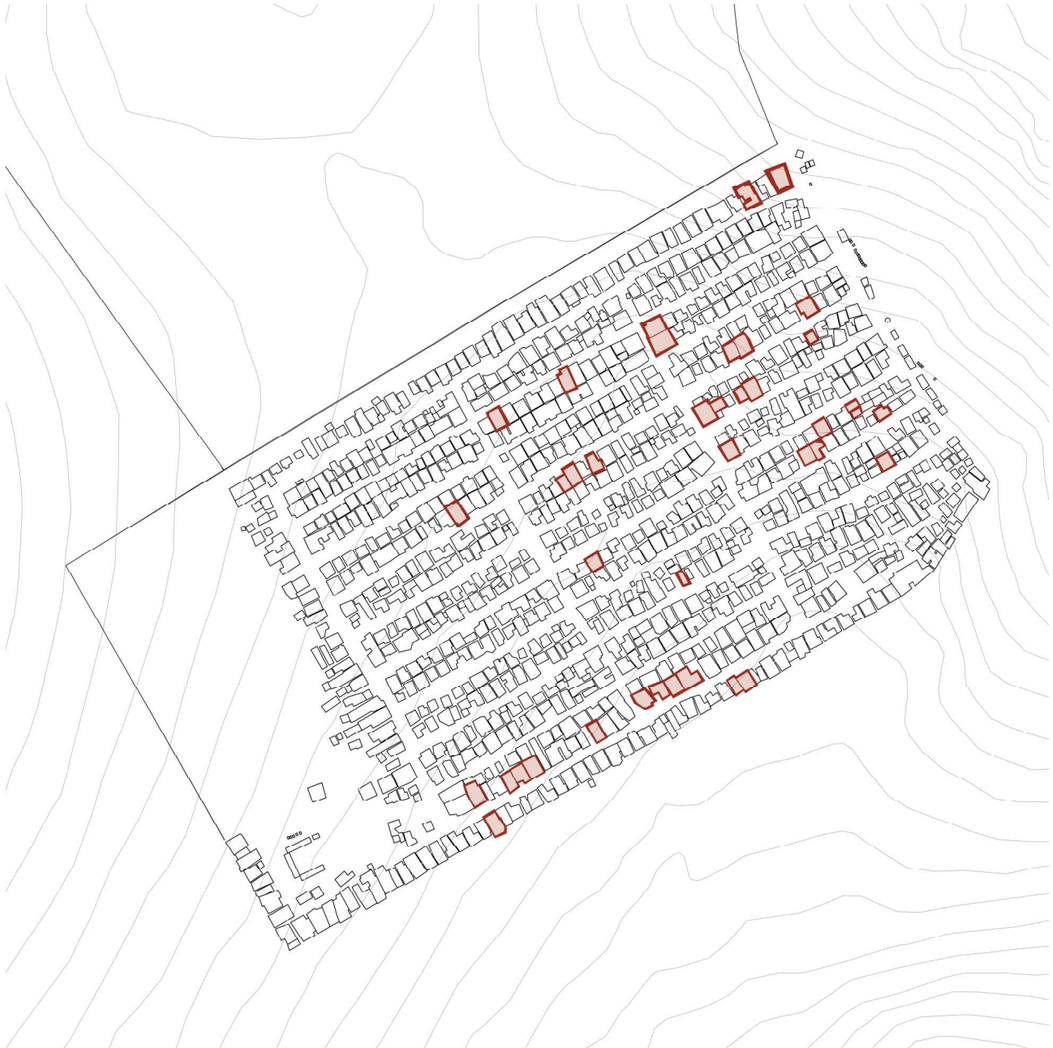


Figure 3.6. Brick dwelling map (MPIP 2021)

Low quality dwelling

Brick stockpiling

High quality dwelling

Figure 3.7. Upgrading process (Author 2021)

not confined to dwelling construction alone. It creates additional avenues for formalisation within the settlement, including necessary infrastructure, sanitation and public space. Such avenues are desired within Plastic View, as expressed in the conducted interviews; however, the community has not expressed a capacity to realise this degree of upgrading without assistance from external parties. The development and upgrading discussed in this dissertation has the potential to shift Plastic View into the rapid growth phase of its adaptive cycle, because of its creation of new opportunities and resources (Walker & Salt 2006:76). Guiding the settlement out of its resilience-decreasing conservation phase, whilst avoiding a disturbance-driven release phase, will be more conducive to its longevity and progression towards formality (Walker & Salt 2006:76). The full scope of upgrading, to be addressed through architectural intervention, will be unpacked in the following section as the identified site and programme is discussed.

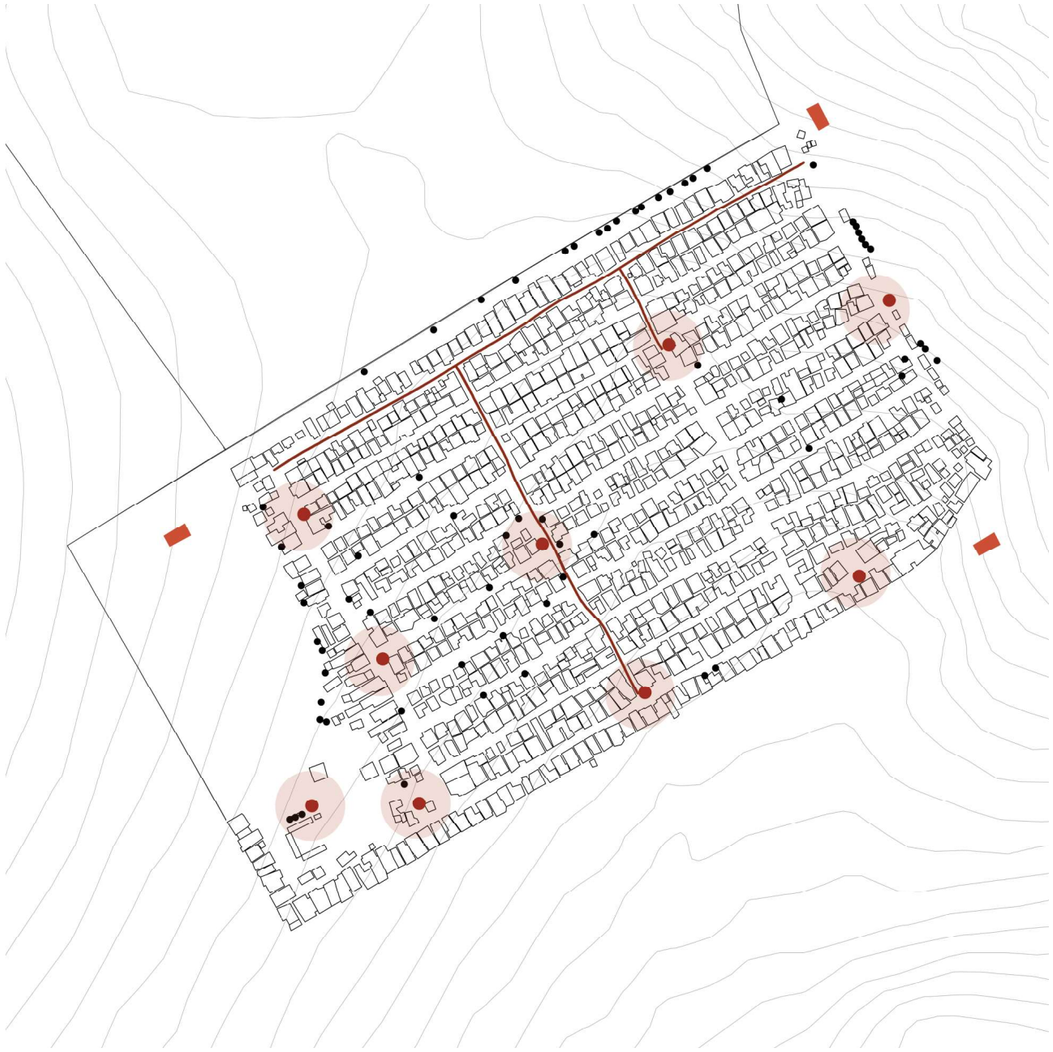


Figure 3.8. Meso infrastructure map (MPIP 2021)

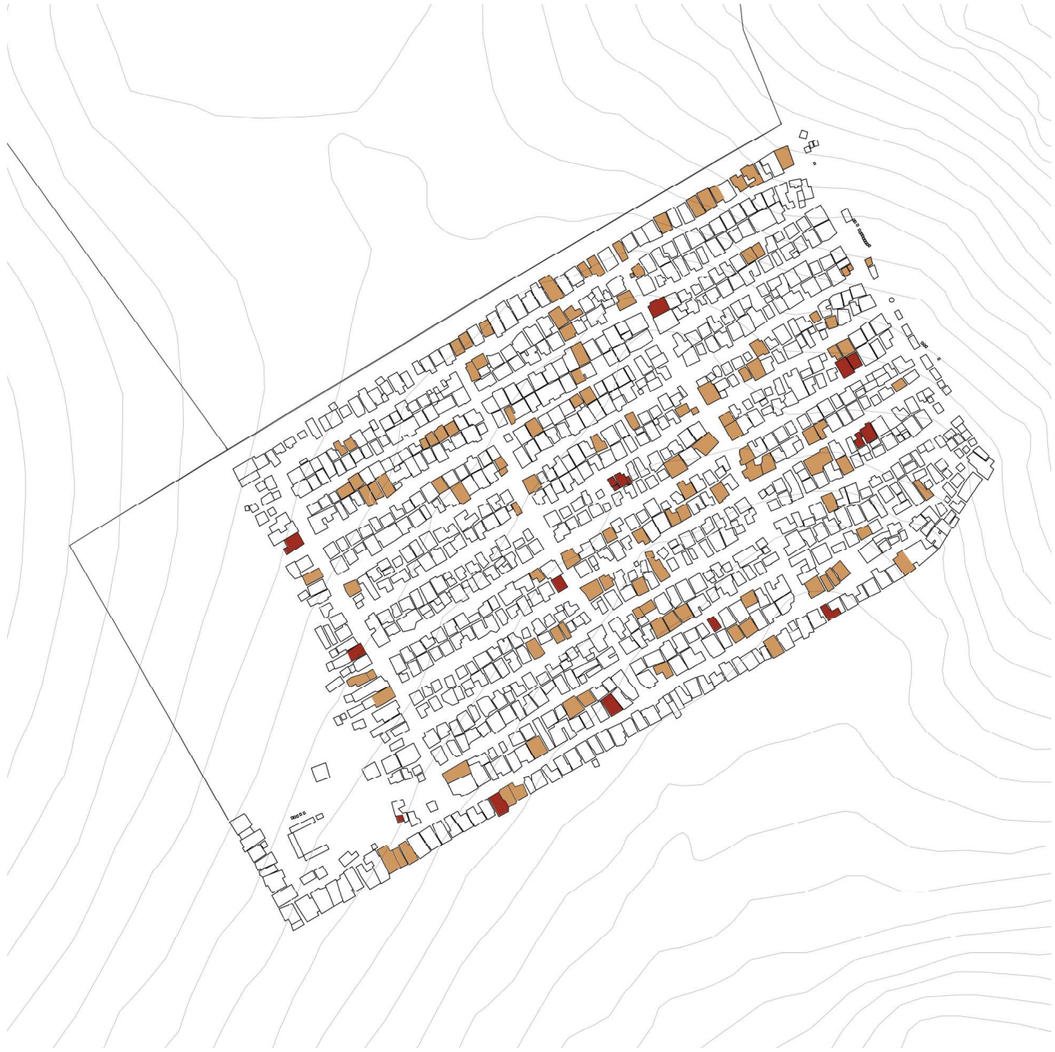


Figure 3.9. Meso economy map (MPIP 2021)

Figure 3.10. Macro waste map (Author 2021)

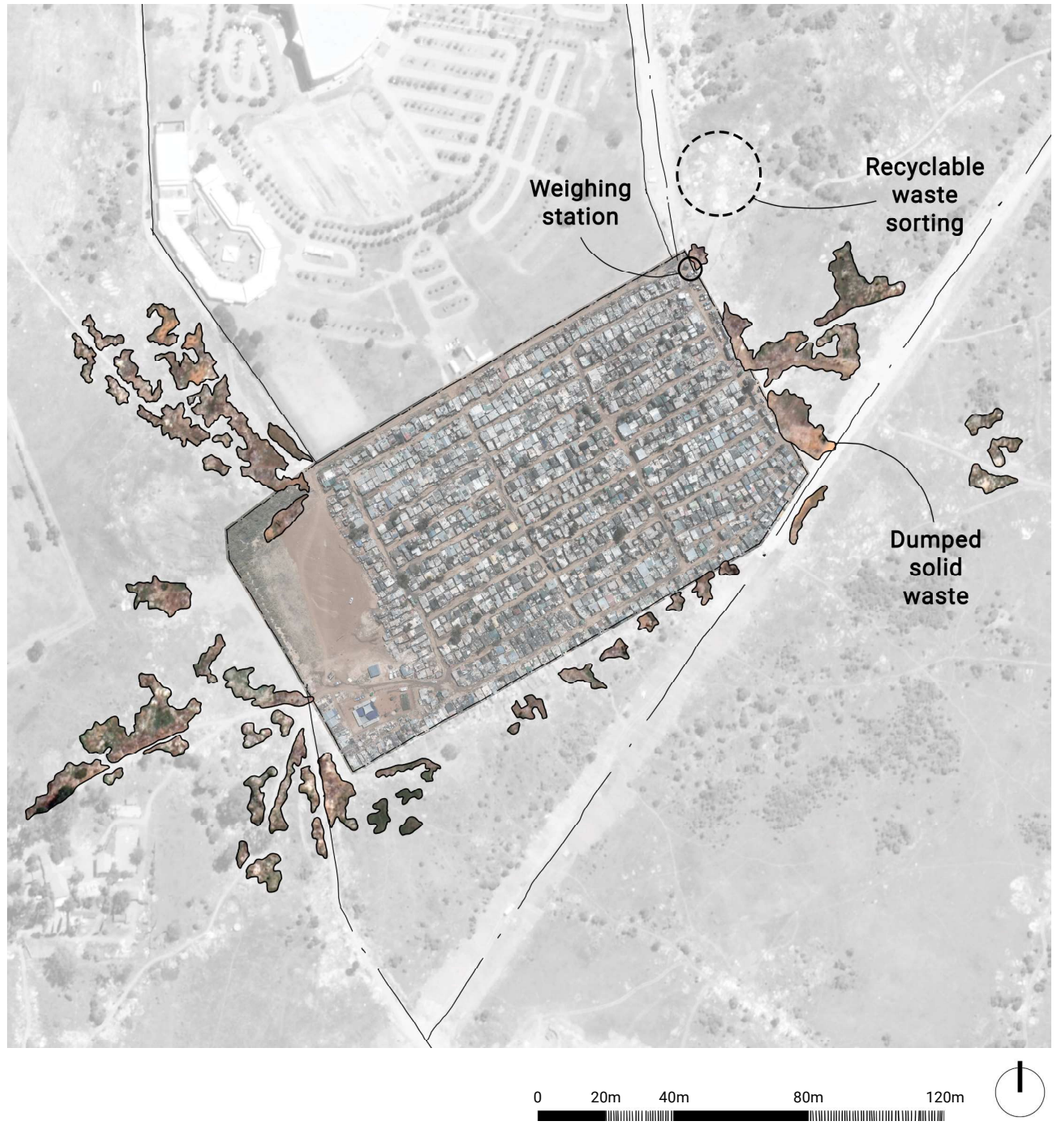


Figure 3.11. Meso waste map (Author 2021)

3.3
SELECTED SITE

The identified site for intervention within Plastic View exemplifies the current and speculated growth occurring in the settlement. Positioned along the north-eastern boundary of Plastic View (see figure 2.3), it consists primarily of the wide street, running the 200 metre width of the settlement, that connects the main entrance with eight of the ten internal streets. The majority of residents with formal employment move along the street, both early morning and late afternoon, as they come to and from work. As a result, the site can be considered an emerging high street due to the growing presence of small businesses capitalising on the substantial foot traffic along the street.

Since 2018, twelve new structures have been built along the street, of which more than half are occupied by small businesses, including spaza shops and barbers. The dwellings on the corners of the internal streets have also, in recent years, opened shops and kitchens onto the wider high street. The same dwellings are also actively being upgraded with more permanent materials, showing a stronger investment in the site's longevity. In response to the activity on the site, several porta-loos have been gathered along the street for a more centralised, efficient use.

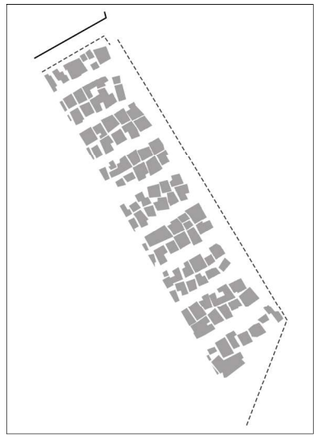
The site is host to various informal recycling practices. Positioned at the main entrance of Plastic View lies a material resale station that sources construction materials, primarily steel, to buy and sell to residents in the settlement. In the field adjacent to the main entrance, waste pickers offload their collected waste to sort and store until trucks arrive to transfer the plastics to larger recycling centres. Unfortunately, the waste built up by the pickers, combined with the solid waste and food waste (that which isn't regarded as usable by the community) discarded in the field behind the high street, has led to an alarming level of pollution on the site. The pollution has gradually damaged and pushed back the line of vegetation that frames Plastic View, leaving both unsightly conditions and a threat to the health of residents.

Legend

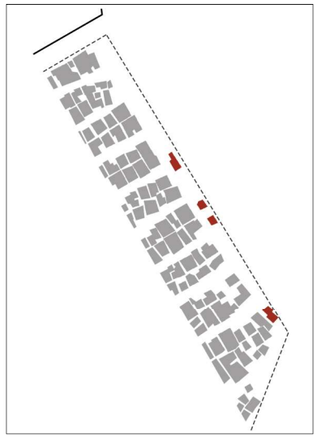
01. Waste sorting area
02. Main entrance
03. Material resale station
04. Porta-loos
05. Small business (Spaza shop/barber)
06. Water tank
07. Dumped solid waste

Figure 3.12. Selected site map (Author 2021)

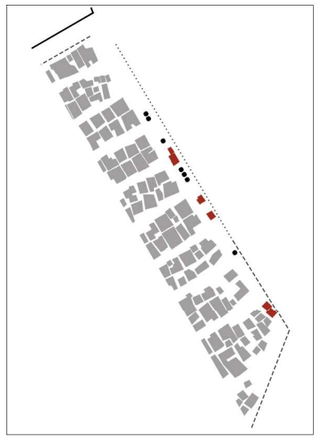
2018



2019



2020



2021

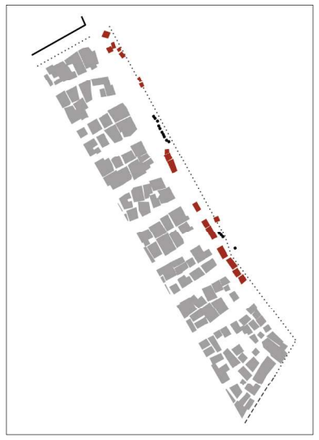


Figure 3.13. Selected site growth (Author 2021)

Waste sorting area

Small business

Main entrance

Water tank

Porta-loos

Pollution

Figure 3.14. Selected site photos (Author 2021)

3.4
URBAN FRAMEWORKS

The growth conditions of the selected site provide a new perspective on how Plastic View may continue to expand in the future, should they not be forcibly relocated by the municipality. Plastic View's surrounding neighbourhoods continue to develop through numerous plans for estate housing projects and infrastructural installations. Most notably, the Mooikloof Mega City project is looking to develop approximately 50,000 apartment units, which will create an estimated 115,000 direct and indirect jobs (Ndlazi 2020). Development such as this will continue the existing pattern of the urban poor following formal work opportunities, particularly in the large-scale construction operation of gated communities.

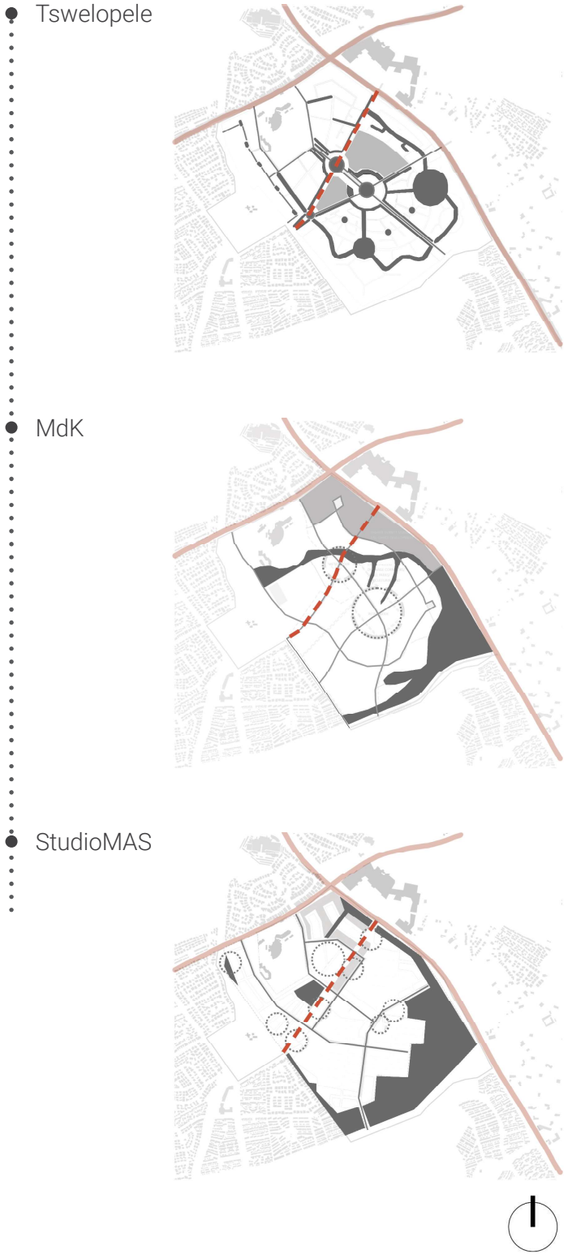


Figure 3.15. Urban framework maps (MPIP 2021)

Figure 3.16. Consolidated framework map (Author 2021)

3.5
SITE VISION

Thus, the speculation is that Plastic View will expand, likely doubling in size, in unison with the sprawl of gated communities in the area. This expansion will possibly occur outwards from the existing north-eastern boundary. The main entrance, currently at the corner of Plastic View, would become a central access point for the settlement. When the municipality partially formalised the settlement in 2009, the dwellings were organised into a grid structure with the street system visible to this day. It is reasonable to assume that a similar grid structure would be implemented for the expansion if the municipality intervened once again. This, however, will only exacerbate the problems associated with the current density of dwellings in Plastic View, including fire outbreaks and poor health conditions. The intervention within the chosen site will thus require a reconsideration of the settlement's density, which would serve as an informant for the organisation of future extensions of Plastic View.

In response to the speculated growth, the chosen site becomes increasingly important as a central, dynamic high street for a larger settlement. The speculation furthers the argument to implemented a "safe-to-fail" system on the chosen site (Ahern 2011). Future expansion would likely bring about changes in Plastic View's adaptive cycle due to an increased population, greater health and public service demands. The dynamic within the settlement will shift according to needs and threats, and so too should the capacity for public architecture and infrastructure to respond to such a dynamic. An adaptable intervention can respond to the existing activity and networks in Plastic View whilst also catering for anticipated growth. Thus, despite proposing structures to house specific initial programmes, the structures may be reappropriated for different purposes and functions.

Legend

1. Central access point
2. Existing settlement
3. Speculated expansion (municipal planning)

Figure 3.17. Growth speculation map (Author 2021)

3.6 PROGRAMME

Plastic View's growing pollution exposes the settlement's exclusion from essential services, specifically municipality-led waste management. The recycling efforts by waste pickers and those that construct their homes highlights informal practices towards managing waste; however, municipal involvement is necessary for a comprehensive waste management system. The existing processes of sorting, selling and dumping waste within the site, provide a foundation for waste management operations with expanded internal and external networks. However, in the interest of improving the adaptive capacity of Plastic View, the existing informal practices need to be leveraged to create a system that can actively mitigate the disturbances identified in the research process. As discussed, the current manner of collecting bricks is a tedious, inconsistent process. By forming new networks through which residents can acquire building materials, the system can increase its redundancy and become less vulnerable to failure (Ahern 2011:342). Currently, plastic waste is only sorted on site before being sold and removed by recycling organisations; however, with the introduction of an upcycling factory, the plastic waste can be reused in situ to generate a constant supply of building materials for the upgrading of Plastic View. These plastic bricks will supplement the existing materials sourced through construction industry dumping and the resale station. The upcycling operation further expands the business of selling materials, provides a further financial incentive for collecting and sorting waste, and reduces the harmful pollution brought on by dumping. As it requires employees, the factory creates local revenue streams and introduces new skills to be learned.

As the intention is to develop the high street and enable the community through incremental upgrading, responding to the other small businesses and functions operating along the street will help with the growth of the site in conjunction with the proposed waste sorting and upcycling operation. Thus, the introduction of market spaces, live/work units and ablution facilities are included in the design development. Combrinck, Vosloo and Osman (2017:34) argue that it is the architect's obligation to favour enablement over provision; thus the intervention, in responding to the existing activity, will follow this approach. Services along the high street, including sanitation, electricity and water provision, should contribute to the longevity of the street by continuously operating in favour of the user regardless of the functions on site.

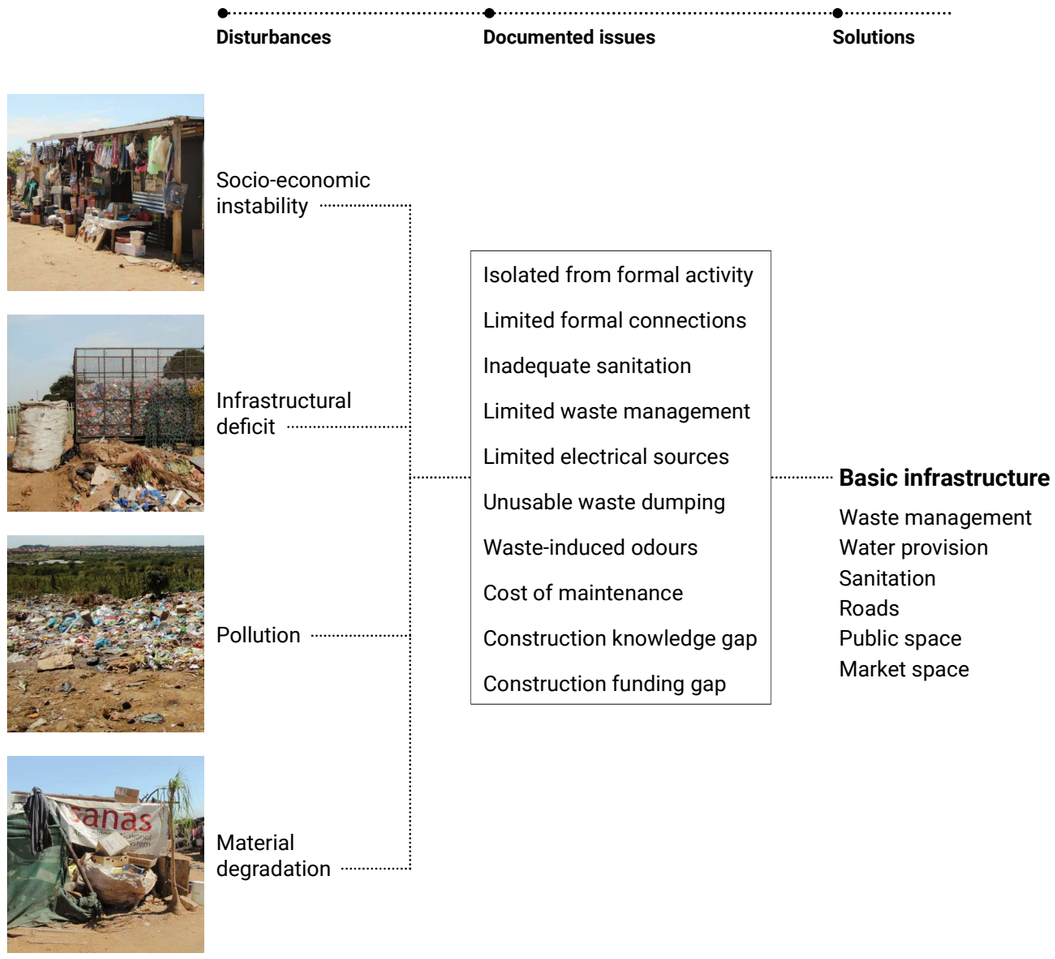
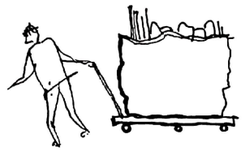
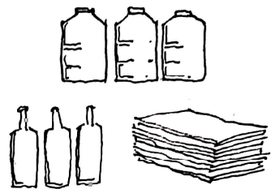


Figure 3.18. Unpacked site disturbances (Author 2021)

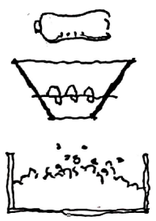
- Collecting



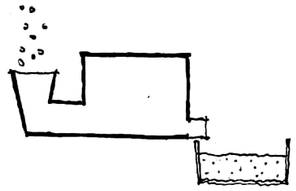
- Sorting



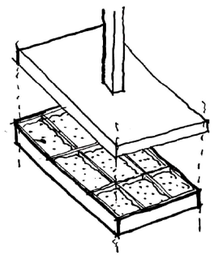
- Shredding



- Melting



- Molding



- Distributing

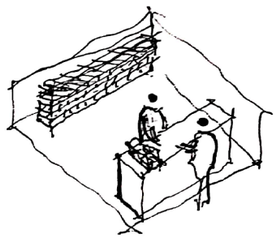
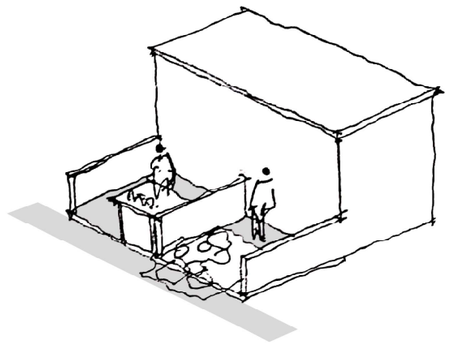
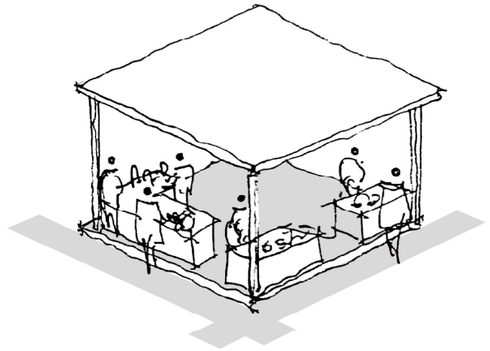


Figure 3.19. Brick manufacturing process (Author 2021)

- Trading space



- Market stalls



- Lockup units

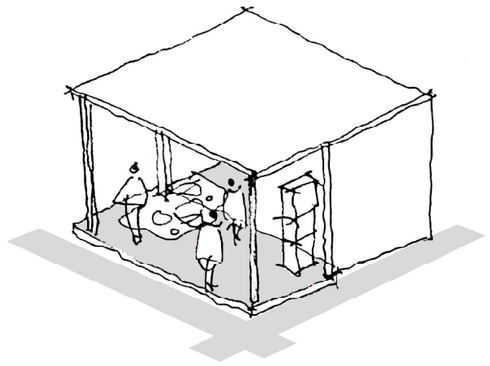


Figure 3.20. Market diversity (Author 2021)

3.7 PRECEDENT STUDY

Project: Silindokuhle upgrading project
Architect: Collectif Saga & Indalo
Location: Joe Slovo West
Port Elizabeth
South Africa
Completion: 2015

The Silindokuhle social development project, by Collectif Saga and Indalo, is located in the informal area of Joe Slovo West, Port Elizabeth. The project was conceived as having four phases, with the first phase being a community hall and the second phase a preschool (Galland, Guérin, Guitard, Rohaut & Sablé 2016). The aim of the project was to design a building that can accommodate a local, informal crèche started by a community member whilst creating an environment of transformative participation with the community throughout the construction process (Galland et al. 2016). A crucial part of the construction of both the hall and preschool was the use of locally sourced, recycled materials, such as glass bottles, pallet wood and tyres (Galland et al. 2016). This was done in the interest of keeping to a small budget, and to respect the maintenance capabilities of the community, as replacements for the original materials used in construction could be sourced with ease in the local area.

The phased planning of the project aligns with the principles of Ahern's "safe-to-fail" system (2011). The community hall was designed to be a temporary creche until the preschool completed construction, after which it would host a workshop for community members that work with timber and metal (Galland, Guérin, Guitard, Rohaut & Sablé 2015). It was thus designed with a degree of multifunctionality and flexibility to meet the changing needs of the growing community. According to Ahern (2011:343), adaptive planning recognises the value in designs being experiments that may face change that couldn't be catered for initially. The incremental approach taken for the Silindokuhle project embodies this notion in its creation of adaptable structures, and the two-way exchange of knowledge that can be carried forward by the community as they continue to upgrade their dwellings and respond to disturbances (Galland et al. 2015).

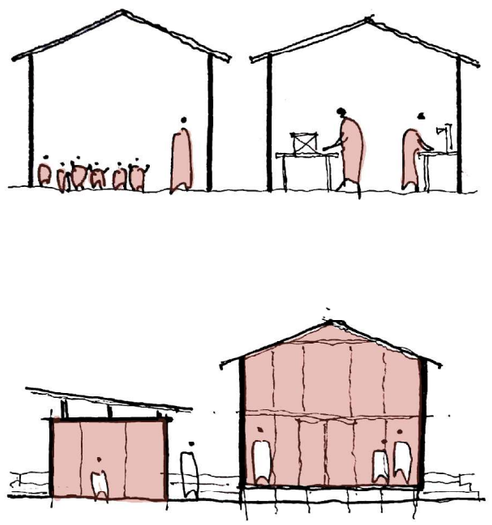


Figure 3.21. Multifunctional hall sketches (Author 2021)

Figure 3.22. Silindokuhle community hall (Loots 2015)

Figure 3.23. Adjacent ablutions (Loots 2015)

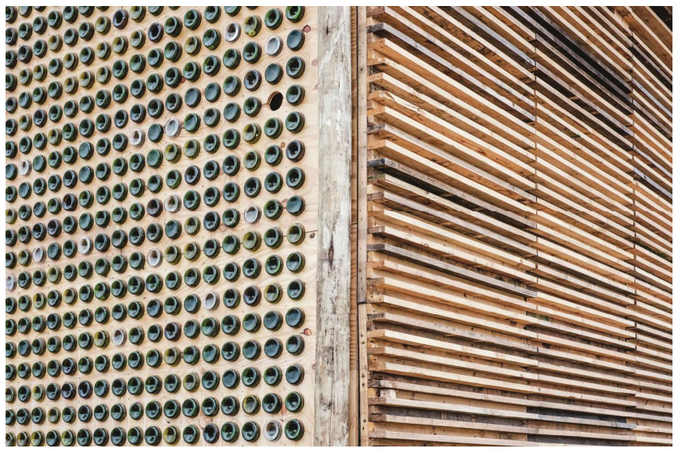


Figure 3.24. Upcycled construction materials (Loots 2015)

Project: Philippi public transport interchange
Architect: NM & Associates
Location: Philippi North station
Cape Town
South Africa
Completion: 2001

The Philippi public transport interchange, by NM & Associates, is positioned at the Philippi North station, Cape Town. The surrounding township, consisting of both formal and informal housing, is undergoing transformation with a focus on improving public spaces (NM & Associates n.d.). Prior to the intervention, the site existed as an urban living room preserved by the surrounding community. Thus the intention was to provide a degree of legibility to the public space (NM & Associates n.d.). The project was successful in that, whilst providing formal services and accommodating public transport, it didn't take away from the existing social activity and informal trade occurring on site. The public space was upgraded with seating areas, vegetation and formal trading units; however, it withheld from excessive provision (NM & Associates n.d.). The formal intervention acted as a catalyst for further informal socio-economic activity, as the community continued to occupy space for informal trading, thus highlighting the project's capacity for reappropriation post-construction.

The trading units provide diversity through a scaled response to the observed informal trading. By offering both formal units and space for informal traders, there are levels of response to the specific function of trade. The diversity creates contingency plans that allow a continuation of the activity should one of the scales fail or fall to disuse (Peres & du Plessis 2014:9). The units themselves are unfitted and lined with a covered walkway with seating (NM & Associates n.d.). The design continues the project's thread of appropriation in the treatment of the unit thresholds as shop owners extend their trading space out onto the walkway to capitalise on the active edge. Unfitted units allow for a greater adaptation and prevent limitations on the types of trade that can occur on-site. The adaptability and enablement that the design provides is the primary contributor to the appropriation and longevity of the site.

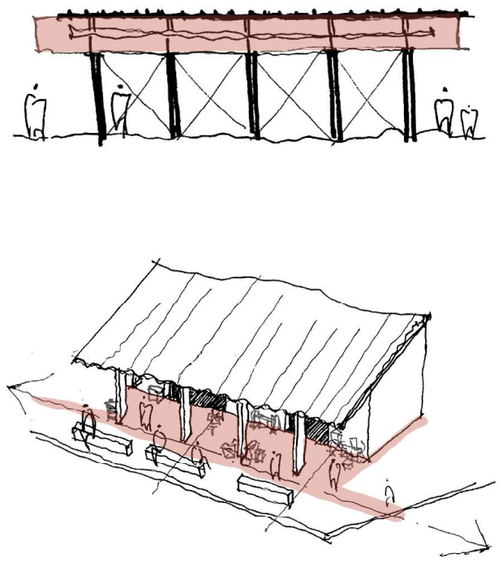


Figure 3.25. Marketplace sketches (Author 2021)

Figure 3.26. Philippi North Station (Google Earth 2021)

Figure 3.27. Phillipi station public square (NM & Associates n.d.)

Figure 3.28. Trading units (Google Maps 2017)

Project: Upcycle Centrum Almere
Architect: Ronald Olthof
Location: Almere
Netherlands
Completion: 2015

The upcycling centre, designed by Ronald Olthof, is located in Almere, Netherlands. The aim of the project was to facilitate processes of waste sorting, upcycling, education and trade, to bring awareness to the field of recycling and circular economy (LKSVDD Architects 2019). The building itself is a model for the possibilities of upcycling, as it was largely constructed and furnished from upcycled materials, including repurposed timber and car tyres (LKSVDD Architects 2019). The building works as a self-contained laboratory that takes waste materials brought in by the public, sorts and distributes them to workshops below the sheltered, public drop-off platform. Upcycling entrepreneurs then transform the materials into new products that are sold back to the public or used to furnish the building (LKSVDD Architects 2019).

According to LKSVDD Architects (2019), the building itself is flexible in that its parts are joined with demountable screws. This lends itself to the notion that adaptable planning was considered for the project. In a waste management centre, the architecture exists as an experiment for the processing and marketing of upcycled materials, which allows for changes in cladding, furnishing and internal organisation. However, the drop off system's design, which uses a ramp to access elevated platforms (LKSVDD Architects 2019), may limit the multifunctionality of the architecture over a longer time period. The unique layout limits the possibilities for functional experimentation and reuse of the internal space, thus challenging the resilience of the project (Ahern 2011:343). While this design decision may be feasible and worthwhile in its given context, Plastic View presents a more critical urban condition that requires greater consideration of a multifunctional architecture.

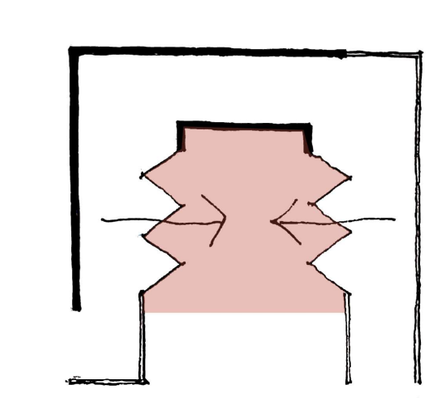


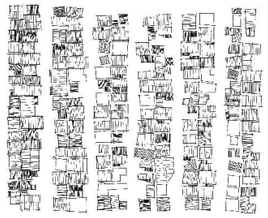
Figure 3.29. Internal organisation sketches (Author 2021)

Figure 3.30. Warehouse exterior (Knipscheer n.d.)

Figure 3.31. Adjacent ablutions (Modulo n.d.)

Conclusion

The three precedents discussed individually embody principles of the "safe-to-fail" system that will be threaded into the design exploration process. The Silindokuhle project and the upcycling centre both express adaptive planning, with the former anticipating function changes and the latter changes of cladding and furnishing. The Silindokuhle project, due to the sensitivity of its context, presents a stronger case for resilience and appropriation. The Philippi project shows how formal intervention can co-exist with the informal activity that preceded it. This understanding of response diversity, particularly within the realm of trading and market activity, is highly pertinent to the dissertation and will reflect in the development of the site.



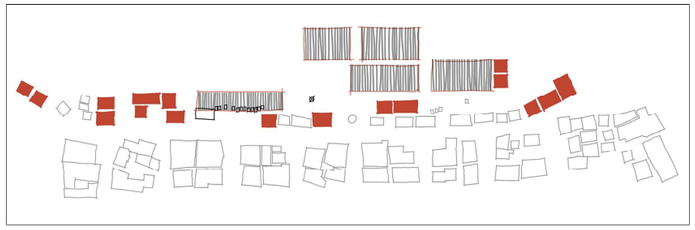
CHAPTER 04

DESIGN DEVELOPMENT

Figure 4.1. Design process sketch (Author 2021)

4.1 INTRODUCTION

This chapter discusses the development of an architectural response to chapter one's issues and intentions and chapter three's site conditions and vision. The design process is guided by the research framework of chapter two and the concept and informants discussed below. The process itself consisted of multiple intuitive and critical workshops, maquette explorations and sketch plan revisions. The iterations arrive at a point from which a deeper technical and material exploration and further design resolution is required.



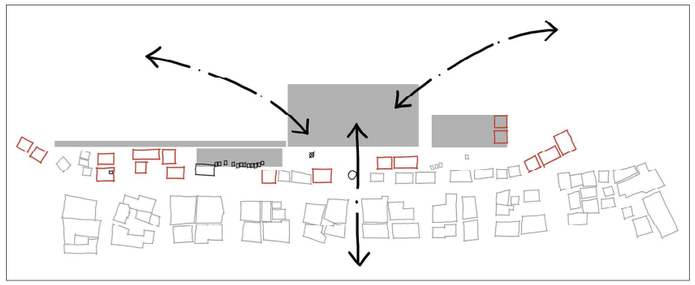


Figure 4.2. Concept diagrams (Author 2021)

4.2 CONCEPTUAL APPROACH

The concept draws from the established theoretical and contextual investigations, as well as the anticipated growth stipulated in the site vision. Despite its endurance through forced removals, fire outbreaks and infrastructural deficits, the resilience of Plastic View is impeded by social, financial and political limitations. In overcoming such limitations, the architectural response seeks to facilitate informal upgrading initiatives, promote socio-economic opportunities, and advance current informal trade practices.

The current incremental development of the chosen site can be considered sporadic and cautionary, as new structures attempt to respect the right of way of the street whilst capitalising on open space. Issues become evident in the consumption of already limited open space, as threats of eviction simultaneously put the structures of Plastic View at risk, particularly those that challenge the 'designated' settlement boundary.

The approach responds to the three critical aspects of infrastructure deficit, incremental upgrading and community isolation. As an anchor, the architecture exists along the emerging high street as a core for basic infrastructure otherwise unprovided by the municipality. As a catalyst, the architecture contributes to the activation of the high street through the invitation of social gathering, spatial appropriation and informal construction. In addition to this, the upcycling programme, in providing alternate construction initiatives, acts as a catalyst for settlement upgrades. Finally, architecture as a connector suggests its ability to counteract the isolation faced by Plastic View through the formation of new networks outside of the settlement. The introduction of the waste management facility extends the network of informal waste collection, whilst connecting Plastic View with the greater, formal construction industry. Responding to the discussed transient nature and speculated expansion of Plastic View, the three aspects must be handled with an abiding consideration for adaptability in the architecture and public spaces.

4.3
DESIGN INFORMANTS

The dissertation looks to the pattern language of Plastic View to inform the architectural intervention by critically observing the settlement's scale, spatial organisation, and visual and structural articulation. According to Alexander (1979:54), the qualities including 'beauty', 'comfort', and 'freedom' can exist not only in environments but also in their inhabitants. It is a relationship where one evokes the qualities in the other, and because of that, environments can be continuously shaped by their users even through expansions and interventions (Dawes & Ostwald 2017:3).

In the context of Plastic View, the environment is defined by the identities of the residents as they continuously occupy the space. Thus, looking to the patterns within the environment as informants for the intervention will aid in the continuation of qualities desired by the residents. The critique of the patterns and the proposal of new patterns in structure and space can bring about new qualities that residents may adopt and carry forward (Dawes & Ostwald 2017:3). The patterns are formatted into six layers that range in scale from settlement-wide planning through to material joining. The layers consist of; settlement blocks, to understand plot sizes and growth patterns; streets, to understand their widths and functions; third spaces, to observe rituals, activities and other means of gathering; thresholds, to understand the transitions between public and private, and external and internal spaces; private spaces, in the organisation and division within dwellings; and construction, to understand local material preferences, methods and other architectural reasonings. The layer of construction becomes a larger informant in the eventual technical resolutions of the dissertation.

The architectural approach stems from the thorough understanding of Plastic View's complex issues and socio-spatial dynamics, hence the integration and reinterpretation of existing patterns. Various patterns within the layers of settlement blocks, streets and third spaces are unpacked throughout the design process as elements including pedestrian streets, courtyards, and public space are addressed. The discussed concept, regarding both the approach of the anchor, catalyst and connector, and the pattern language informant, are ingrained in the design exploration process.

Figure 4.3. Plastic View pattern language (Author 2021)

4.4
DESIGN EXPLORATION

Site organisation

Whilst the “string of beads” concept is generally used for city-scale corridors (Warnich & Verster 2005:344), it provided a lens to explore activating the high street by means of developing nodes. Two primary node opportunities were identified; firstly, the main entrance currently occupied by a material trader, barber, kitchen and occasional food traders; and secondly, the area around a water tank rapidly being occupied by new structures. The proposed programmes are organised in relation to the nodes; the marketplace is positioned at the main entrance, responding to the existing trading activity; and the waste management facility is adjacent to the water tank, suggesting a new north-eastern boundary to Plastic View. As incremental growth and infill occurs, additional structures and services along the high street begin to connect the two developed nodes. Public ablutions and live/work units would be distributed in relation to the two nodes along the street.

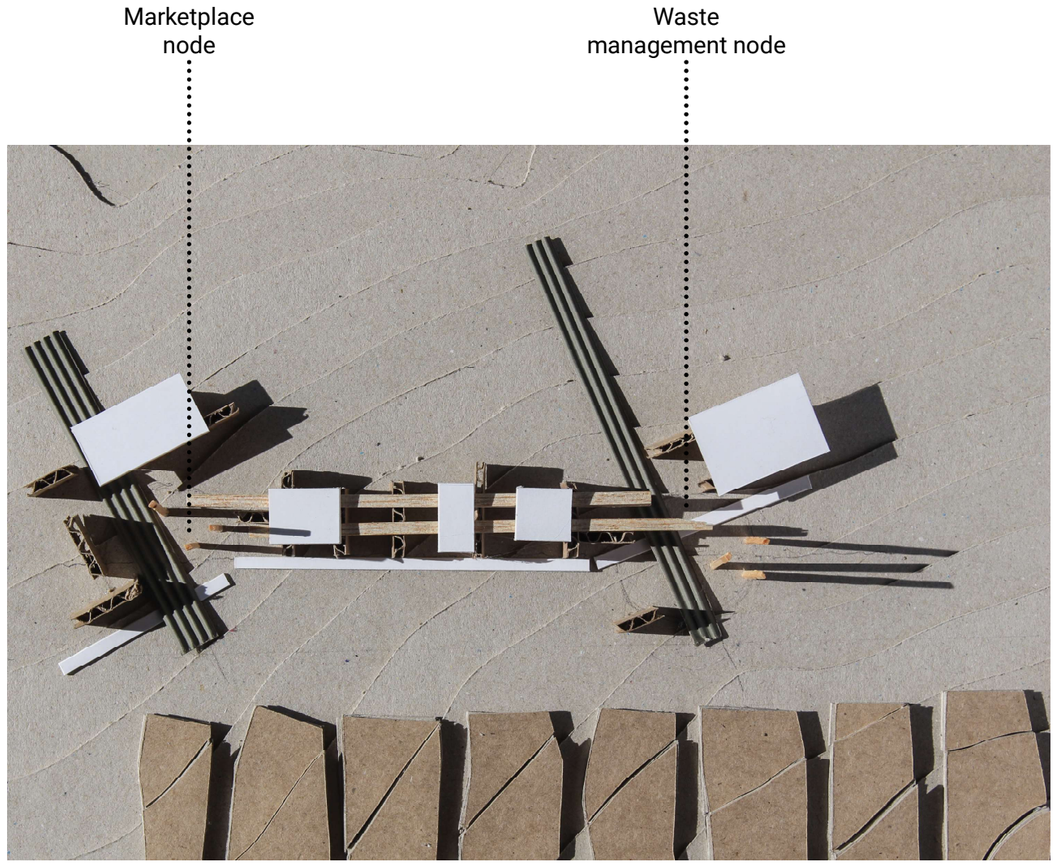


Figure 4.4. Site organisation maquette (Author 2021)

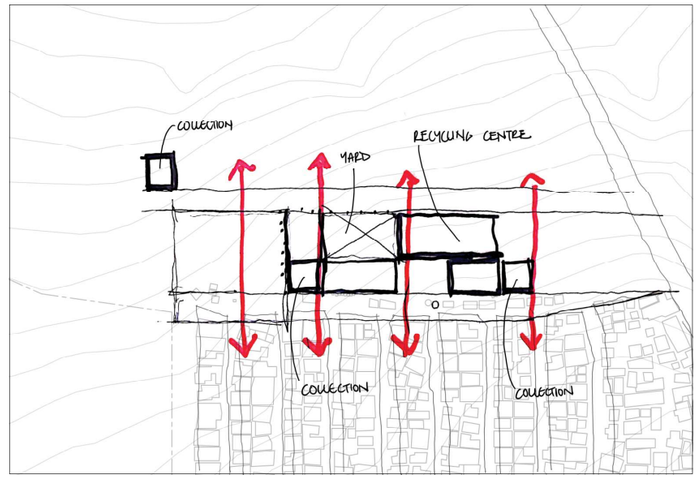
Massing explorations

The explorations began with responding to the speculated growth of Plastic View.
With the expansion of the settlement to the north-east, the road that currently leads to the main entrance of Plastic View should be extended through the settlement parallel to the identified high street. The existing widths of dwelling blocks (10m - 15m) and streets (3m - 5m) highlight an efficient ordering of space. However, the existing occupation of land created the various density issues discussed earlier. These patterns must thus be reinterpreted. The scale of the existing streets in Plastic View allows pedestrian movement to thrive and is therefore maintained in the site development. The scale and proximity of structures however, is reconsidered, with larger structures to accommodate the more complex functions and greater provision of public space to limit the settlement's density.

The inclusion of the formal thoroughfare lends itself to the intention of forming networks between formal and informal operations, whilst also providing adequate road access currently absent for Plastic View. The formal road, defining the longitudinal edge of the site opposite the high street, also serves as a buffer zone between the existing portion of the settlement and the land upon which the speculated expansion.

Initial drawings failed to respond to the angle at which the settlement is thought to expand. Shifting the structures towards this angle (approximately 25° east of north) simultaneously responds to the angle of expansion and respects the angles of the contours on site. This orientation opens up public spaces along the high street, with courtyards forming at both identified nodes. Patterns were observed in the presence of courtyards within Plastic View. When positioned internally between dwellings, they allow for private gathering, and when made as extensions from the spatially-limited streets, they encourage social and functional gathering.

Despite the intention of creating architecture that plays a catalytic role in incremental development and upgrading, a challenge was noted in the introduction of public space. Public space, at a scale greater than the intimate thresholds along streets, is scarce in Plastic View as dwellings are conceived as more beneficial uses of the limited land available. In light of this pattern of occupation, the public space of the intervention will require an articulation of public furniture, vegetation and functional use that shows the community the value such spaces can provide. This, in turn, will prevent residents from erecting additional structures in the open spaces to the extent that it would overload the density of the site and incite fire hazards, movement restrictions and other threats to public health.



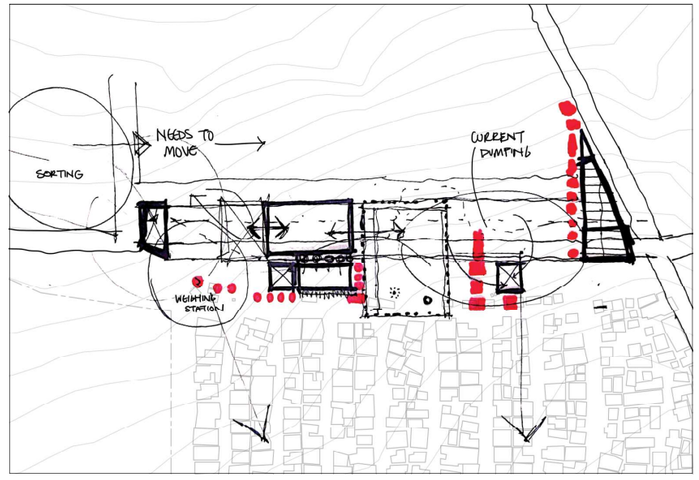
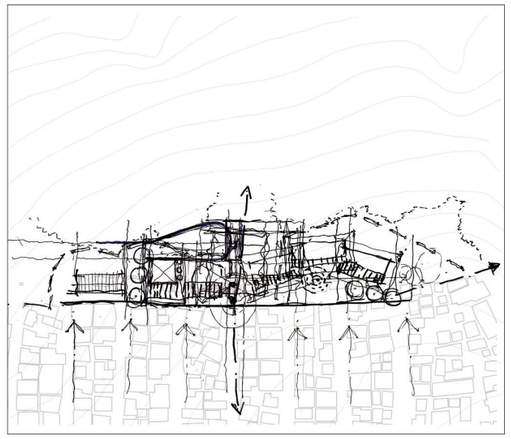
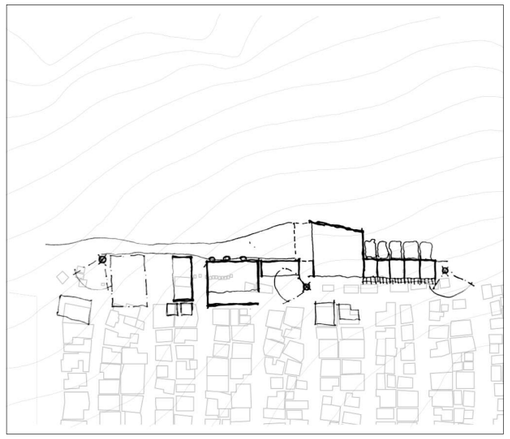
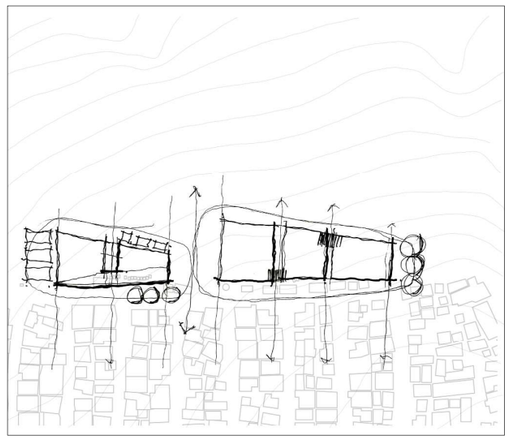
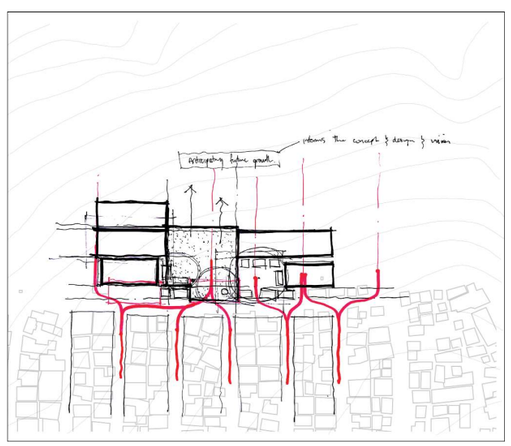


Figure 4.5. Site explorations (Author 2021)



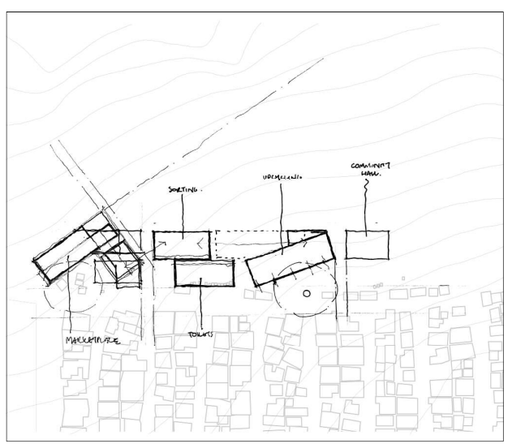
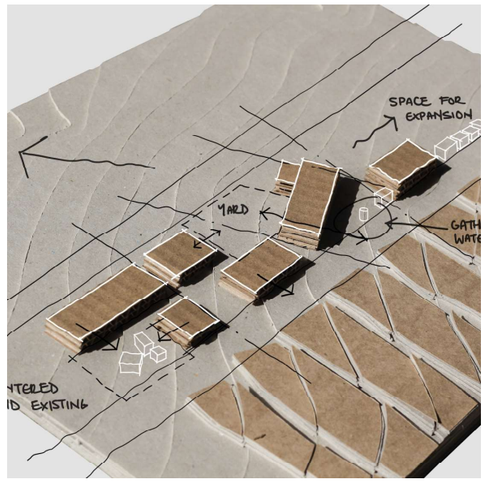
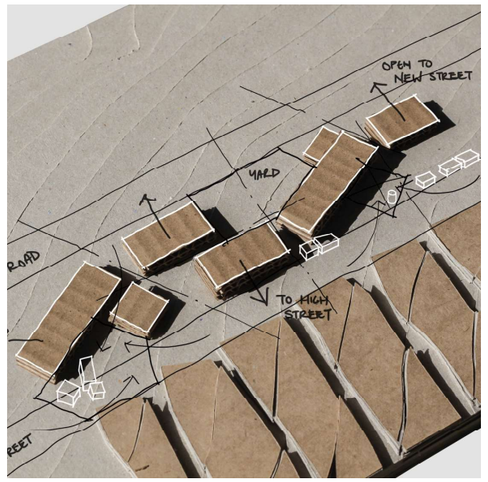


Figure 4.6. Site explorations (Author 2021)



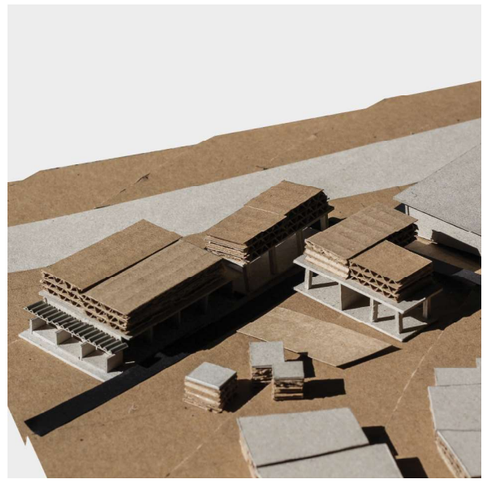
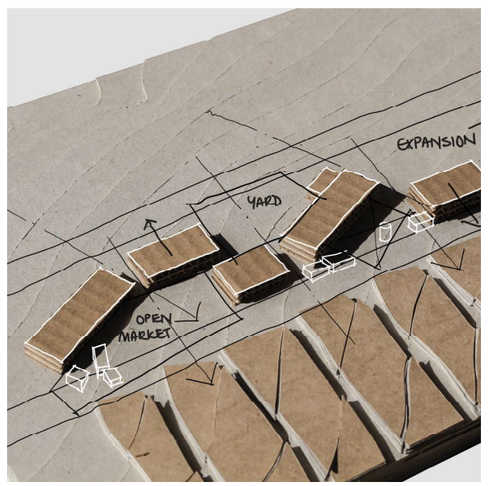



Figure 4.7. Maquette explorations (Author 2021)

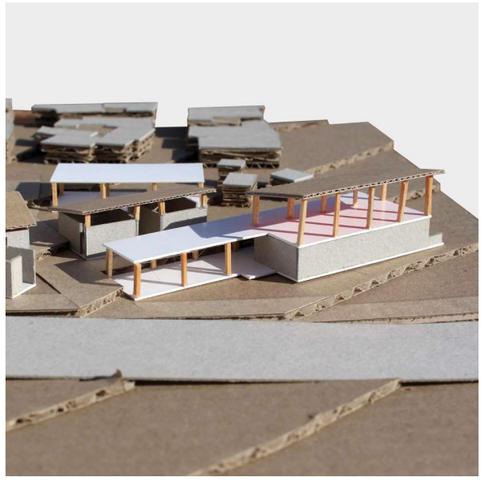


Figure 4.8. Maquette explorations (Author 2021)

The explorations appropriately respond to the speculated large-scale expansion of Plastic View; however, it still needs to address the changes in community dynamics that will come with the expansion. As discussed in the site vision, consideration must be given to the changing needs and desires of the Plastic View community, be that in the reinvention of spaces for different functions or the physical adaptation of the architectural elements that define those spaces. There is value in exploring how a shift in the settlement's adaptive cycle may affect the site and create opportunities for further growth and service provision through municipal involvement.

Whilst analysing the pattern language of Plastic View has led to a reinterpreted, appropriate scaling of the site, as the design iterations continue, further response to the language at its various levels is needed. The threshold typologies of the settlement will inform the complexity of design along the high street, and the use of critically limited space will inform the multifunctionality of structures. As the design of more intimate spaces like internal rooms and courtyards hasn't been articulated yet, the massing scale seems to overpower that of the existing dwellings; however, through the iterative process they will be appropriately distributed around the nodes.

4.5 DESIGN ITERATION

The design explorations discussed in chapter two were limited to investigating the programmatic requirements, massing and pedestrian movement of the intended development, in response to the outlined programmes and concept. Drawing from the "string of beads" concept (Warnich & Verster 2005:344) and "safe-to-fail" systems thinking (Ahern 2011), the explorations culminated in a grounded understanding of a proposed organisation and hierarchy of the selected site. The design iterations build on the research intentions discussed in chapter one, specifically addressing the various branches of infrastructure and the elements that contribute towards the "safe-to-fail" system. The public realm within the site development will be informed by the literature of Jan Gehl, particularly the book "Life between buildings: Using public space" (Gehl 2011). From this comes a thorough exploration of public space, thresholds and services, as well as themes of incrementality and the balance between existing informality and the proposed formal construction. The iterations, however, highlight a greater acknowledgement of public space, incrementality and the thresholds between the existing informality and the proposed formal construction.

Iteration one

The first iteration explored the spatial implications that came with organising programmes around the two identified nodes along the street. Responding to the existing business practices at the entrance to the site, the proposed market hub is positioned at this entrance, capturing the heavy foot traffic of this area of Plastic View. The market consists of lock-up units that provide more permanent occupation for trade and an open marketplace that caters for the transient nature of informal trading. This response diversity is similar to that of the Philippi public transport interchange, lending to a notion of a “safe-to-fail” system (Ahern 2011:342). Further up the street, the waste management hub is stepped back from the existing path to define a courtyard space between it and the existing water tank. The iteration proposed a formal road that, together with the existing street running parallel, defines the longitudinal boundaries of the site. Consideration was made for movement between the existing street and the proposed road, which aided in decreasing the scale of masses and distributing them along the site.

Critique

Iteration one failed to successfully occupy the selected site in two manners. Firstly, there is a disconnect between the proposed structures and the high street. Instead of opening up directly onto the street, the structures are stepped back, forcing pedestrians to move off the street into the isolated hubs. This ignored the conceptual approach of architecture as a catalyst for third space activity along the high street and instead created an internal organisation rather than an external one. Photographic documentation in Plastic View, as outlined in the research intentions of chapter one, shows patterns of social interactions and activities occurring primarily on the streets, where the streets become third spaces extending out from the privacy of dwellings. This understanding must be reflected in the treatment of the edge condition along the high street. Secondly, whilst the plan speaks to two nodes along the street with multiple structures defining the nodes, there lies an issue in the linking of the market hub and waste management hub. The “string of beads” approach to development not only necessitates nodes along a corridor, but also structure and opportunity for activity between such nodes (Warnich & Verster 2005:344). Both nodes express concern for internal movement along pathways; however,, there lacks exploration between the two in how they connect and how they might read as a holistic development along the site.

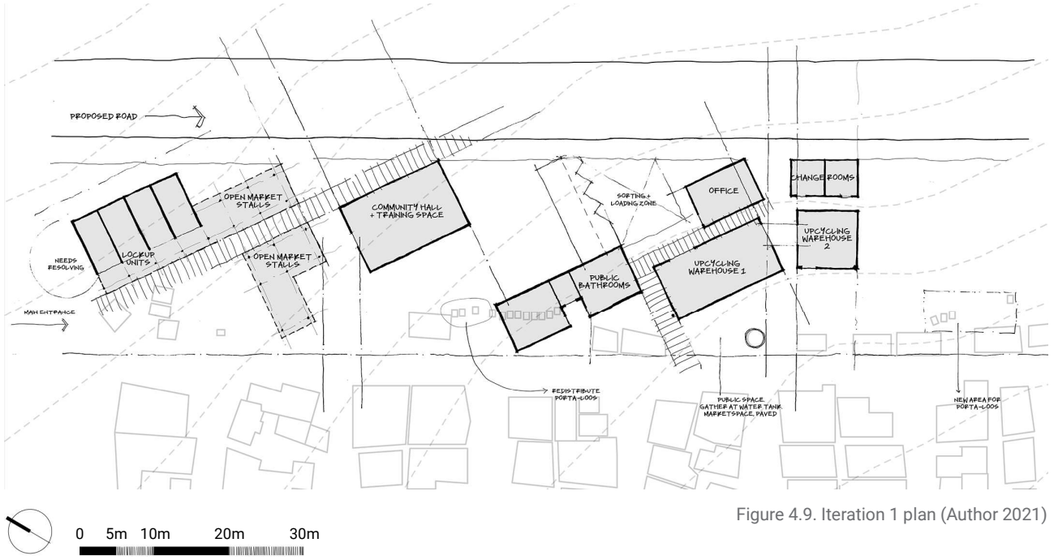


Figure 4.9. Iteration 1 plan (Author 2021)

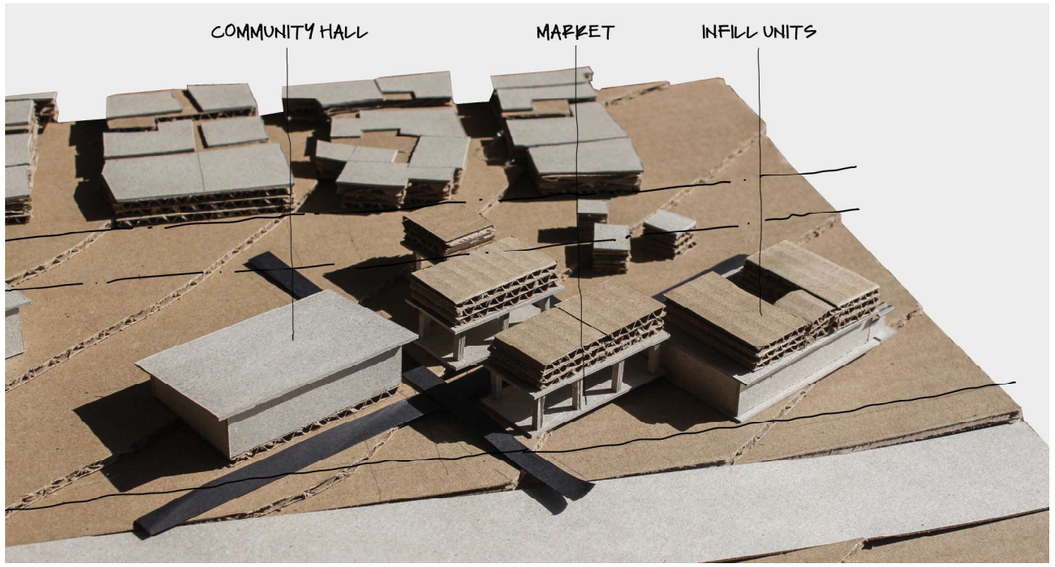


Figure 4.10. Iteration 1 maquette (Author 2021)

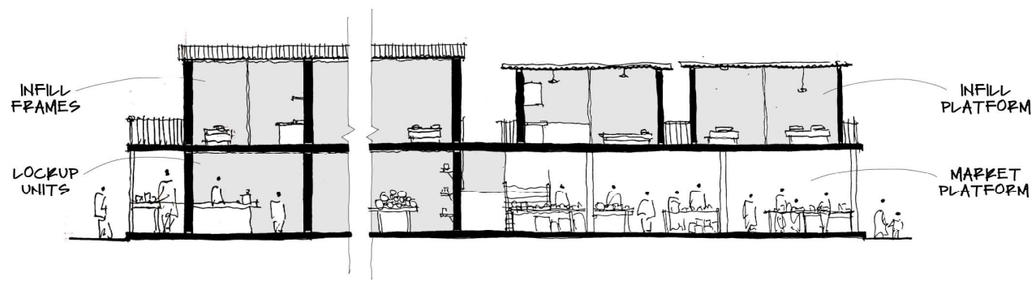


Figure 4.11. Iteration 1 market section (Author 2021)

Iteration two

The second iteration responded to the critiques made for iteration one, particularly concerning the edge condition of the high street. Live/work units were conceived along the street edge as a solution to both previous critiques. The units open onto the street in service of the present informal economy, and as a result of their central positioning, begin to stitch the two identified nodes together. In addition to the live/work units, residential space was introduced above the marketplace and factory structures in the form of open building systems. According to Walker and Salt (2006:121), a greater variety of responses to threats creates a stronger internal resilience against disturbance. Hence the decision to design a diverse set of economic platforms, with lock-up stores, the marketplace and live/work units, and a diverse range of residential opportunities for Plastic View. The collected data on household floor plans showed that residents continuously alter and repurpose rooms within their dwellings to suit their financial needs and family dynamics. As expressed in iteration two, open building systems imply an incremental infill construction process that caters for the financial instability and alternating needs of the Plastic View community. This begins to articulate the notion, discussed in chapter one, of enablement over provision as part of the architectural service (Combrinck et al. 2017:34). Positioning the residential spaces above other functions was a response to the concern of density within Plastic View. The design and construction of multi-storey dwellings is a critical facet of technical knowledge that is transferred during the development. This sharing of knowledge is ideally reflected in the incremental upgrading of the settlement, as residents see the formal construction methods as guidance and inspiration for informal construction.

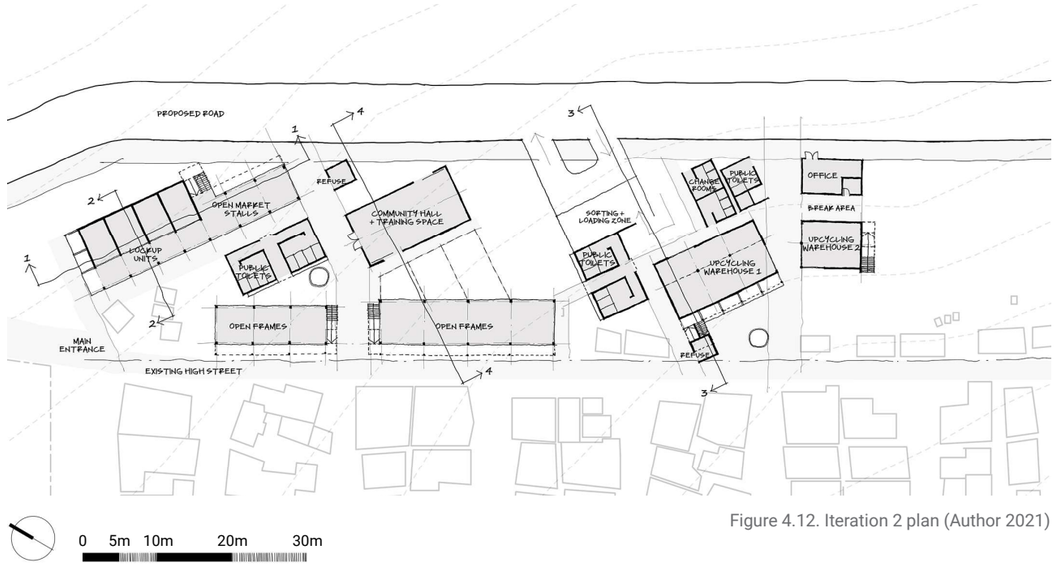


Figure 4.12. Iteration 2 plan (Author 2021)

Critique

The iteration brought forward important design considerations, such as the open building system; however, it was not spatially and technically resolved. The resolution of this system will come in the technical development of the dissertation as the structures and materials are deeper explored. Iteration two included a distribution of public ablutions (as opposed to a centralised ablution facility) that aligns with Ahern's (2011:342) argument that a system with decentralised entities creates a redundancy that mitigates the risk of failure. However, the ablutions within the market hub block a potential public courtyard from forming, so their position should be reconsidered. The other concern with the iteration is the orientation of the structures, which was primarily dependent on the angle at which the speculated expansion of Plastic View was to occur. At an angle of 25° east of north, the structures would face a more harsh morning sun as opposed to ideal midday sun that comes with north-facing structures. The design required a reconsideration of orientation that would make a more favourable balance between climate-informed and context-informed orientation.

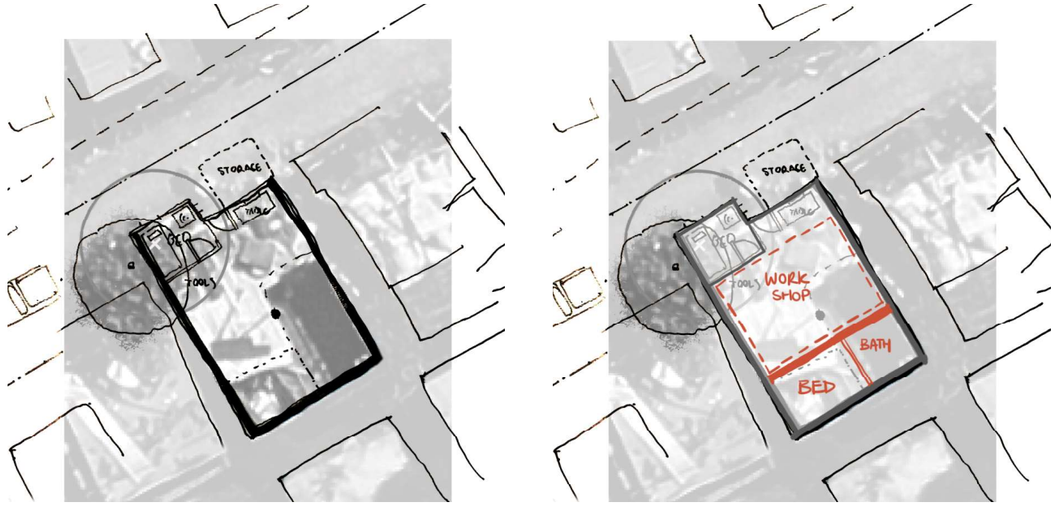


Figure 4.13. Speculated household interior changes (MPIP 2021)

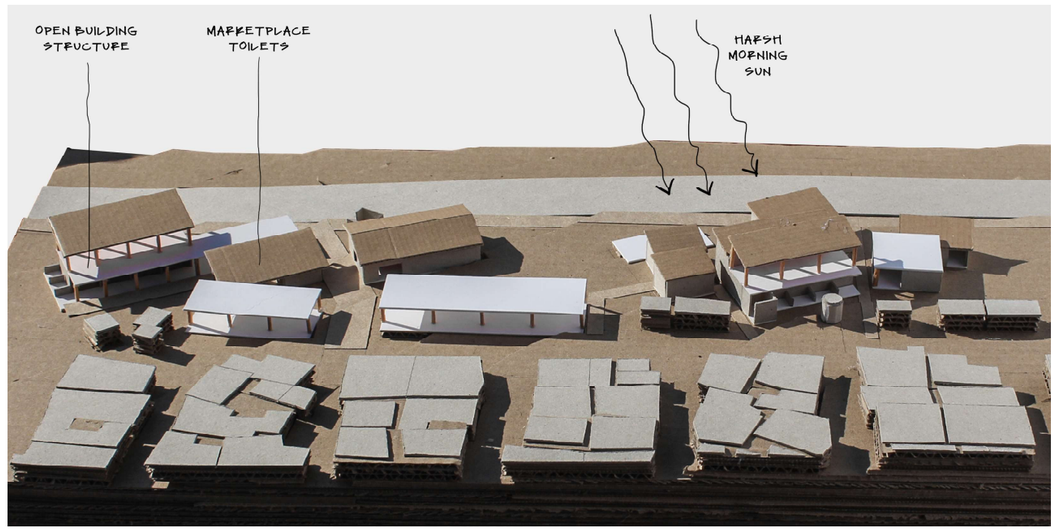


Figure 4.14. Iteration 2 maquette (Author 2021)

Iteration three

The third iteration sought to rethink the orientation issues of iteration two by rotating to a north-facing design. This had spatial implications on the movement between structures, their threshold conditions and the framing of public spaces along the site. Pathways subdivide both nodes, creating opportunities for the third space interactions observed within the settlement, as structures can open up to the internal pathways and external public spaces.

The marketplace and community hall were positioned to frame a public square extending from the street. The square provided a flexible space for large outdoor community gatherings, an additional safe playing area for children and an extension of the marketplace for increased trading activity and events. In this sense, it aligns with Gehl's understanding of catering for three types of outdoor activities (Gehl 2011:9).

A large public area was created between the two nodes as a green space within the site development with this iteration. Currently, Plastic View has one large field on the opposite end of the settlement at which children and adults convene to play sports. Whilst providing the settlement with additional playground space, the proposed green space becomes increasingly important with the anticipated expansion of Plastic View. Should the settlement grow beyond the high street, the proposed development reestablishes itself as a central buffer between the existing and new portions of the settlement. The central green space becomes a valuable point of gathering.

Smaller public spaces were established within the waste management hub, as it became a self-contained entity within the greater site development. The plastic brick factory was stepped back from the existing water tank to provide a public space around it. The current conditions at the water tanks in Plastic View are problematic due to poor drainage that leads to waterlogged streets. As a result, little ownership is taken of these active spaces that have the potential to be coveted points of gathering, be it for socialising or trading. According to Gehl (2011:33), optional activities thrive where physical conditions are of a higher quality. By designing more considerate spaces around the water tanks, with adequate drainage, shading and seating, they can become more substantial points of attraction within Plastic View.

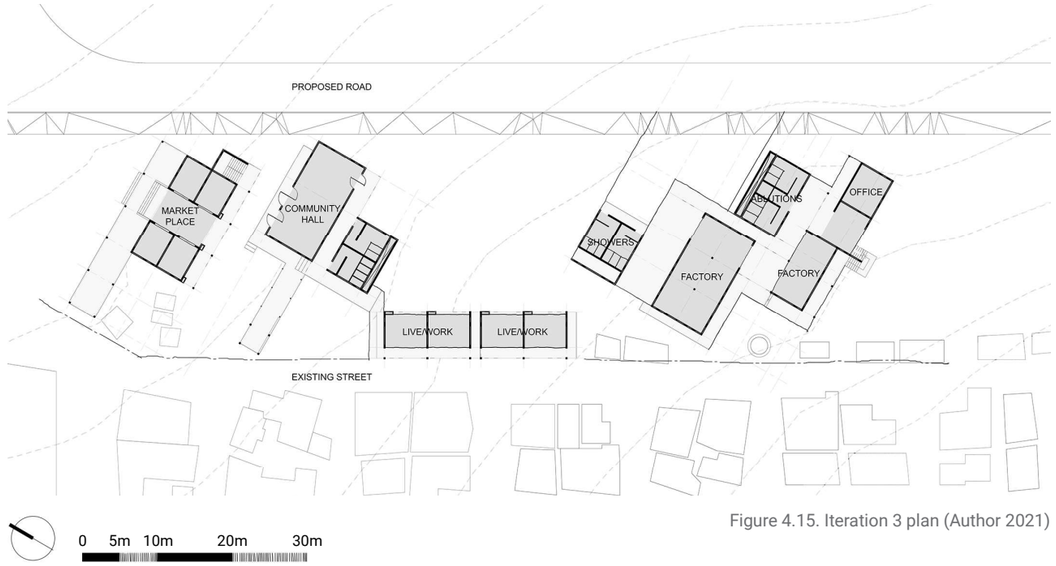


Figure 4.15. Iteration 3 plan (Author 2021)

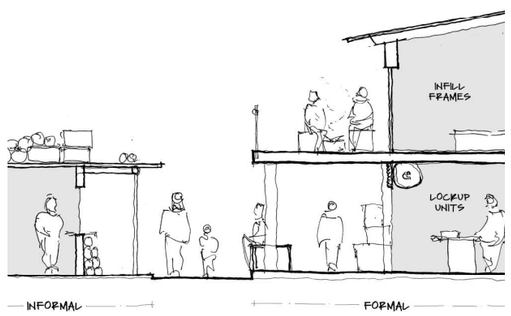


Figure 4.16. Marketplace section (Author 2021)

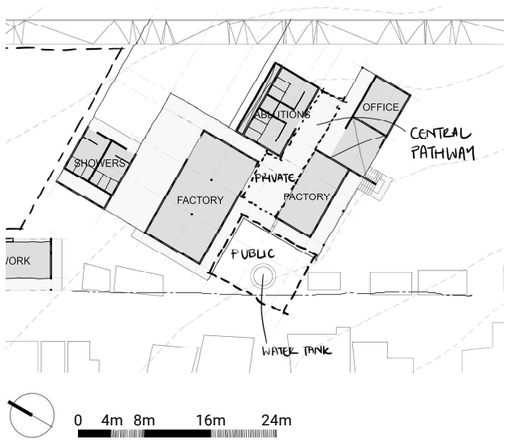


Figure 4.17. Iteration 3 waste management facility plan (Author 2021)

Critique

Despite a greater consideration for the public spaces and thresholds between structures, iteration three lacked a deeper exploration and resolution of these spaces and how elements including vegetation and street furniture articulate them. Public spaces, primarily along the streets, in Plastic View serve specific purposes depending on the elements that make up the spaces. For example, trees and chairs create shaded places for seating; and dwellings or screens subsequently dictate the level of privacy of those places. The public spaces proposed in the design require a consideration of how the spaces would traditionally, or could potentially, be used by the community to aid in articulating the spaces. The spatial planning on behalf of the architect can directly affect the possibility of social activity (Gehl 2011:13). This can assist in articulating a variation between the two larger public spaces proposed in this iteration, because initially they read as undefined, buffer zones around structures that lack a sense of hierarchy between the two.

The iteration also began to explore the spaces that form the waste management hub; however, it lacks clarification on the transitions between public and private spaces. The central pathway suggests a thoroughfare for the general public to move between the proposed road and the existing street. However, this could raise security issues in the factory and comfort in moving through the space.

Iteration four

The fourth design iteration sought to address the critiques of the previous iterations whilst stepping back and reconsidering how the public move towards and through the site. The scale of the two larger public spaces from iteration three was reconceived as the larger, central green space and a smaller courtyard in between the community hall and public ablutions. Covered walkways begin to articulate the thresholds between public and private, and inside and outside spaces, particularly for the live/work units along the high street. The waste management hub was reworked to have a private courtyard framed by the factory, ablutions and office. The public space for the water tank was resolved with shading and space for trading both outwards to the public space and inwards to the private courtyard for the factory workers. The market space was reimagined at the northern corner of the site, visually exposed to the proposed road and opposite the proposed taxi rank. With the early morning and late afternoon flux of employed residents, the marketplace becomes an easily accessible place to purchase food and supplies. Currently, an informal market operates on weekends along the road that leads to the entrance of Plastic View. With the proposal of a taxi rank in the place of the informal market, the weekend trading activity is moved to the covered marketplace and the trading stalls adjacent to it.

The other focus of iteration four was to explore how the anticipation of adaptation manifests in the design. Combrinck, Vosloo and Osman (2017:34) argue that informal settlements can allow residents to create and alter dwellings with an authority that formal construction operations tend to lack. Thus, iteration four explored how the proposed intervention could continue this authority. Drawing from the observed popular use of eucalyptus (gum) poles as structural elements within the settlement, eucalyptus poles became the informant for a language of flexible systems that aid in defining both public and private spaces. The systems are evident in the shading devices of the waste management hub and the outdoor extension of the community hall, allowing additions of shading, seating and enclosing. Timber provides for increments of change, such as attachment and replacement (Kamalipour & Dovey 2020:3), because of the versatility and modularity the material affords.

Figure 4.18. Iteration 4 plan (Author 2021)

Critique

Whilst the iteration begins to explore the flexible systems within the design, it lacks a resolved understanding of them. So, during the process of refinement of structures and materials, the full extent of the adaptability of the proposed intervention must be resolved. The residential, trading, and live/work units were designed with internal spaces derived from the observations of existing Plastic View dwellings. However, deeper analysis and speculation on the possible internal variations for these spaces is required. This may inform a more profound catering for adaptability in the structures.

Although the design includes greater consideration for public spaces than previous iterations, there lacks an articulation on how the community would appropriate these spaces over time. As stated in the project intention of incremental servicing, a degree of adaptation must be anticipated. Thus, the articulation of spatial appropriation is necessary for visualising the intended adaptations and defending the design decisions made for these to occur.

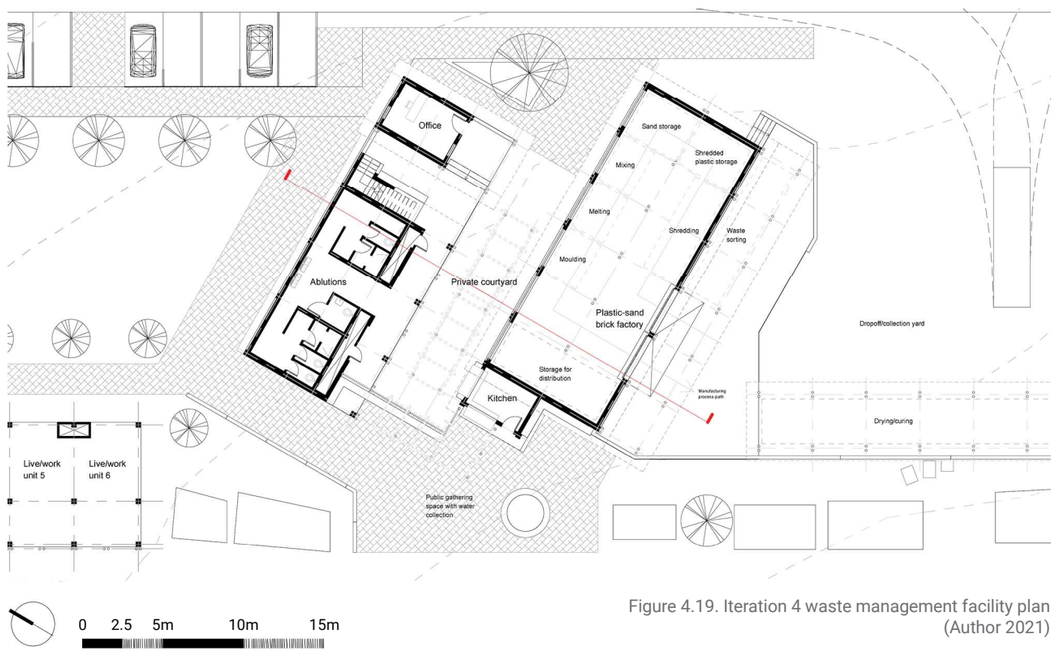


Figure 4.19. Iteration 4 waste management facility plan
(Author 2021)

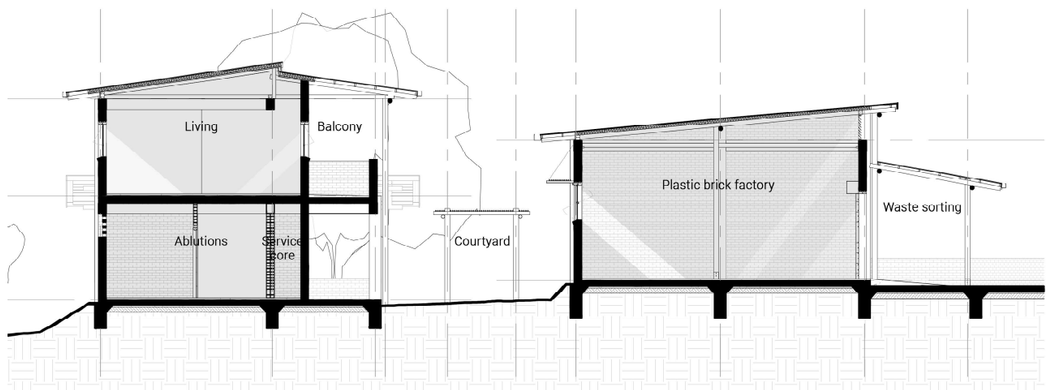


Figure 4.20. Iteration 4 waste management facility section
(Author 2021)

CHAPTER 05

TECHNICAL DEVELOPMENT

Figure 5.1. Plastic View dwelling structure (Author 2021)

5.1
INTENTION

The technical development of the dissertation encompasses the refinement of the structural language, material choices, systems and environmental strategies. The technical exploration comes as an extension and enrichment of the iterative design process and thus derives its intentions and conceptual approach from those of the design explorations in chapter two. As expressed in chapter one, the broader intention is to improve the resilience of Plastic View whilst anticipating the upgrading and expansion of the settlement. The design development process briefly discussed the themes of adaptability and multifunctionality, in its approach to architecture as an anchor, a catalyst and a connector. These themes, however, become the primary factor in the technical development of the dissertation.

The intention of the technical resolution is to provide an intervention that is wholly appropriate for the informal context of Plastic View. This brings integral factors of construction and maintenance costs, and the ease of maintenance and repurposing. To respond to these factors, the pattern language of Plastic View is reflected on and critiqued. The design iterations used the patterns to inform the scale and socio-spatial organisation of the intervention, whereas the technical development, and the factors of construction and maintenance, will be informed by the patterns at smaller scales of thresholds, private spaces and construction.

5.2
TECHNICAL CONCEPT

The technical concept draws from the established theoretical basis of the “safe-to-fail” mentality of Ahern (2011) and the open building systems thinking of Habraken (1987; 1988), as well as aspects of the design concept discussed in chapter 2. As a result, the technical concept expresses an interest in structural adaptability and transformative participation for settlement upgrading.

Structural adaptability

As anticipated in chapter 2, the expansion of Plastic View would bring about shifts in the spatial requirements and desires of the community. An efficient design fails to consider the dynamic role architecture needs to fulfil in the evolving context of an informal settlement, where an adaptable architecture is resilient in that it can continuously respond to its shifting needs. The structure thus requires two conditions; firstly, a fixed support that defines parameters and limitations of the structure, and secondly, a flexible infill that works within and extends from the support to suit the users’ needs.

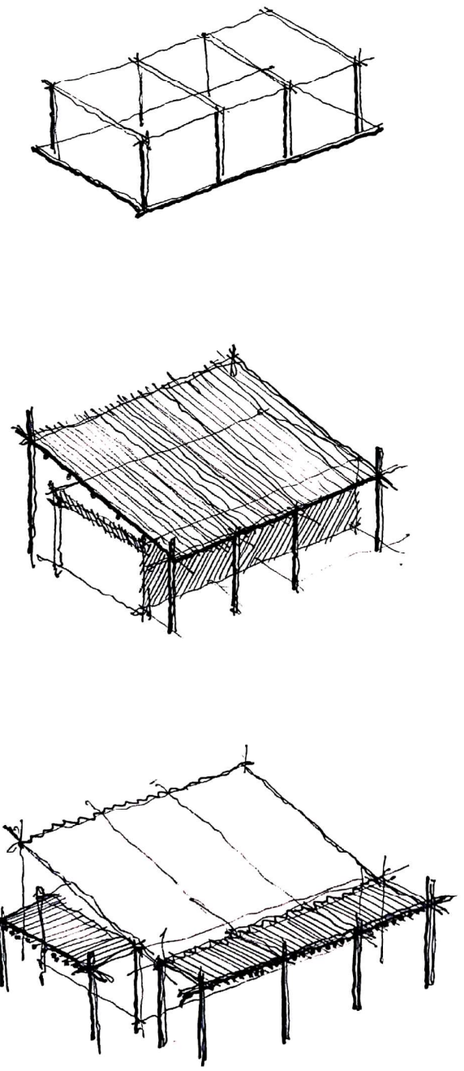


Figure 5.2. Structural adaptability sketch (Author 2021)

Transformative participation

The concept also considers architecture's potential to create an open dialogue of construction knowledge presented through structural articulation. Suppose architecture is communicated with transparency and rationality. In that case, it has a greater potential for the non-expert - or resident in the context of Plastic View - to actively engage with and understand the construction process (Till 2005:4). This knowledge can then be carried forward with the incremental upgrading of existing dwellings and the construction of future dwellings in the settlement. In this sense, architecture becomes an instructive tool for sustainability, safety and crisis mitigation in an environment that otherwise exists outside of regulation standards (Jones 2017:130).

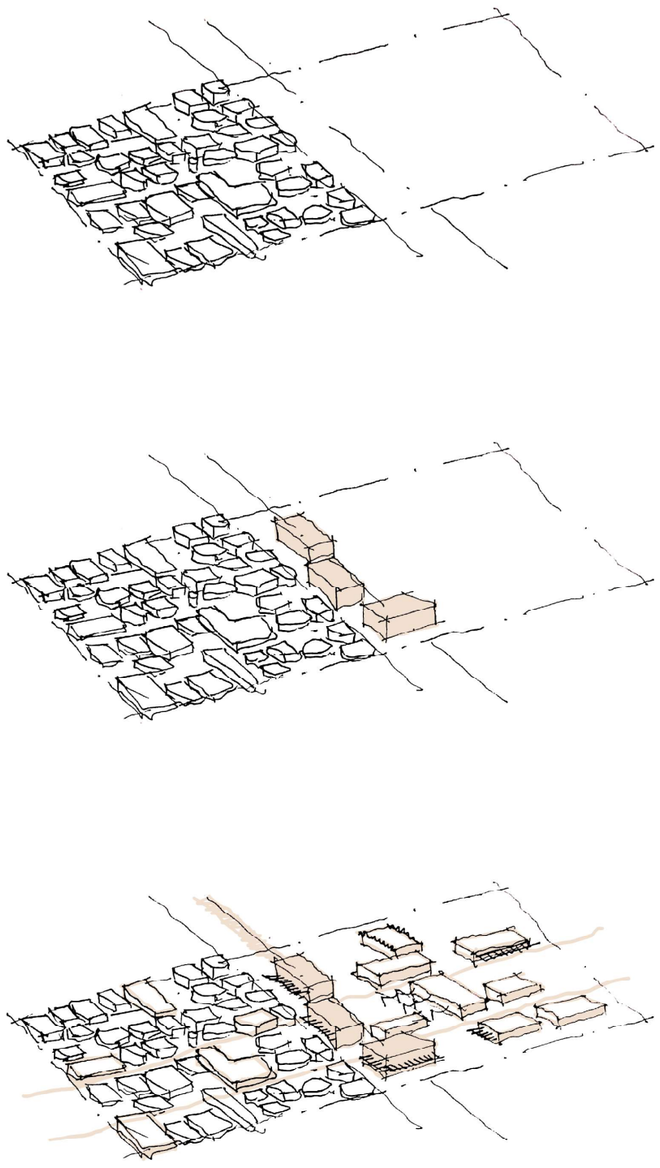


Figure 5.3. Transformative participation sketch (Author 2021)

5.3 TECHNICAL INFORMANTS

As discussed in chapter two, the spatial patterns within Plastic View informed the early design explorations, specifically in the development scale, functional requirements and third spaces. The technical development continues this intention, with a reflection on the tectonic and material patterns within Plastic View that reflect the lifestyle and identity of its community (Dawes & Ostwald 2017:3). The local construction knowledge acts as an informant for the technical language of the intervention. Continuing the layered format of observing the patterns, the layers at smaller scales; thresholds and private spaces, will be discussed. The analysis of construction patterns pertaining to methods and materials are incorporated into these two layers.

Thresholds

The thresholds between the street and the dwelling in Plastic View are calculated articulations of movement between public and private spaces. A large portion of activity and ritual occurs within these thresholds, including cooking, cleaning, trade, and socialising. With many of the dwellings in the settlement having spaza shops facing onto the street, thresholds are coordinated to attract residents to the shops. Overhangs are constructed with eucalyptus pole supports, creating shaded areas along otherwise exposed streets. The same frames are used for fixing signage and hanging goods from, defining the thresholds as points of business and trade. Seating is added, and with it comes social gathering.

Facades become extensions of the thresholds into dwellings, between the semi-private spaces under overhangs and the privacy of homes. Residents have become inventive in creating openings in facades for shops to operate out of, with doors being rotated and fixed in the walls to become bottom hung storefronts. The impermanent nature of the construction methods in Plastic View have allowed continuous adaptation and replacement of facades, and the continuous upgrading of dwellings to brick structures does not disrupt this quality. Brick facades can be highly flexible elements within structures when adaptive planning is made for supporting and distributing loads through various systems.

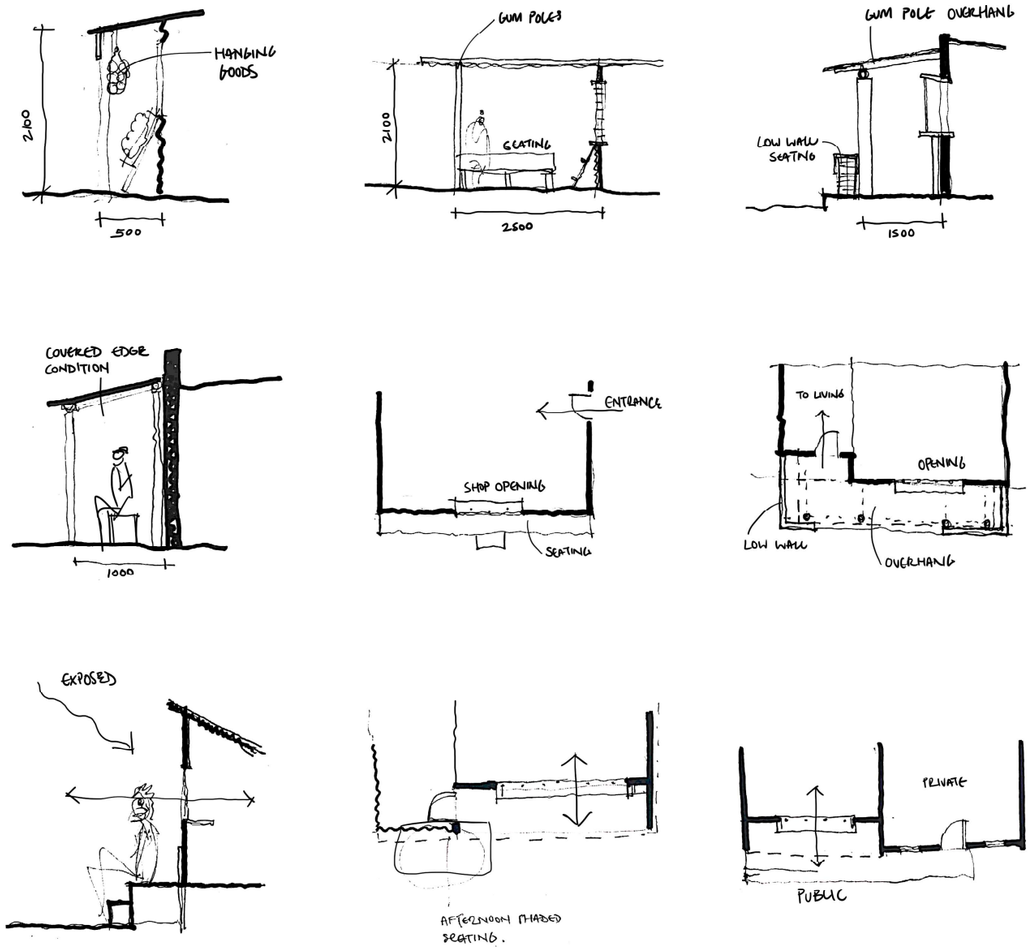


Figure 5.4. Threshold sketches (Author 2021)

As the dwellings in Plastic View are upgraded, the use of IBR and S-rib corrugated roof sheeting becomes more commonplace in the settlement. The versatile material, used with both eucalyptus pole frames and brick structures, is favoured for its durability and availability from hardware stores and second-hand sources such as construction companies. Its presence in the settlement suggests the local knowledge capacity for its installation and maintenance that can translate to its use in the proposed development.

Figure 5.5. Shop opening (Author 2021)

Figure 5.6. Dwelling roof structure (Author 2021)

Private spaces

Internal spaces are further illustrations of the incremental adaptation observed in informal settlements. In this sense, the dwellings should be analysed through the lens of Habraken (1988:12), consisting of supporting frames that are upgraded less frequently and infill partitions and fixtures that are upgraded more regularly as resources become readily available. As mentioned, the flexibility of brick suits the adaptive planning required in informal dwellings, particularly when one anticipates the continuous reorganisation of internal spaces. The conducted interviews (29 March - 31 March) showed that homeowners reconfigure rooms within their dwellings by reconstructing the internal walls. Bedrooms may be converted into shops or storage spaces, or divided into two so that one half can be rented out. The reconfigurations are expressions of the adaptive capacity that must be sustained in the formal structures to suit the changing needs within Plastic View.

Storage spaces are valued features of dwellings within Plastic View, especially with the recent upgrades that are being made. As mentioned in chapter two, residents are unlikely to attain enough construction materials on any one occasion to begin upgrades. Materials are thus collected incrementally and stored behind, within or adjacent to dwellings. As the intention is to allow the adaptation of structures, residents will require storage space for the incremental collection process.

Project: Bitterpan Wilderness Camp
Architect: Crafford & Crafford Architects
Location: Kgalagadi Transfrontier Park
Northern Cape
South Africa
Completion: Not dated

5.4 PRECEDENT STUDY

Whilst the residents of Plastic View express a diverse understanding of construction knowledge, financial and infrastructural constraints heavily dictate the construction methods and material choices. The formal nature of the architectural intervention allows the implementation of new or revised construction methods and materials that can encourage alternative desires and an evolved identity (Dawes & Ostwald 2017:5). The technical resolution draws inspiration from the informal architecture, to preserve its qualities of adaptability and contextual suitability, whilst creating formal opportunities otherwise unachievable in the existing development of Plastic View.

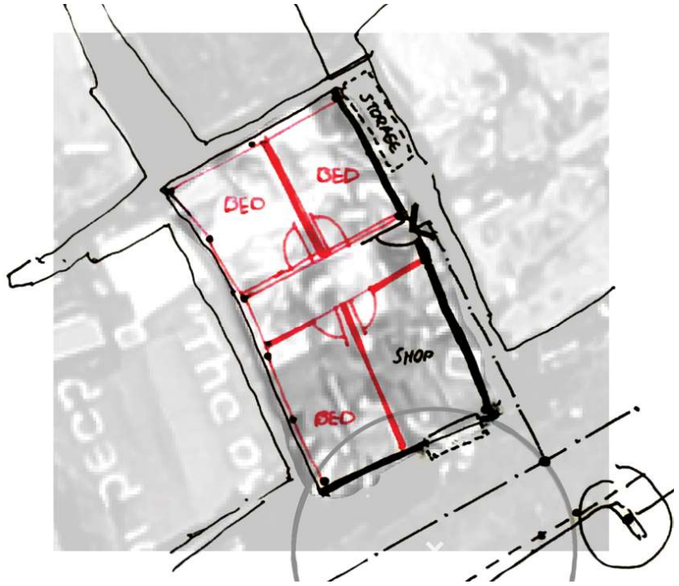


Figure 5.7. Internal spaces plan (MPIP 2021)

Figure 5.8. Material storage space (Author 2021)

The self-catering lodge accommodation, designed by Crafford & Crafford Architects, is located in the Northern Cape portion of the Kgalagadi Transfrontier Park. The project consists of a series of cabins connected by an elevated walkway overlooking a waterhole (SANParks n.d.). With timber being the dominant material used in the construction of the cabins, a structural pole frame was designed to support the floors, walls and pitched roofs. However, it is the manner in which the pole elements are joined that makes this project notable. The horizontal and vertical elements consistently overlap from the point where they join, as opposed to joining at the ends. Not only does this structurally allow for overhangs of the roofs and balcony extensions, but it also creates an architectural language that celebrates the frame of the cabins rather than, for example, the facade treatment or fenestration. The double pole columns become repeated dominant elements that visually define the architecture whilst still supporting the structure itself.

These design decisions can be beneficial within the context of Plastic View and the scope of the concept regarding transformative participation. As discussed, the intention is to create an open dialogue of construction knowledge in the intervention. The articulation of the structural components in the precedent shows an effective method of establishing this dialogue that, in the context of Plastic View, can guide residents towards continuing with such methods as they upgrade their dwellings.

Figure 5.9. Camp cabins (Fisher 2001)

Figure 5.10. Roof detail (Fisher 2001)

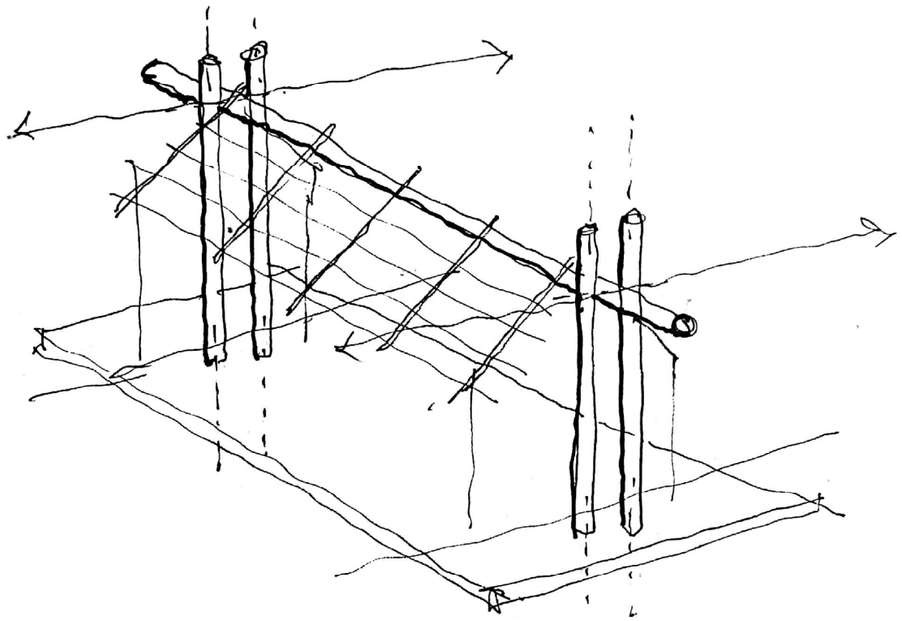


Figure 5.11. Cabin structure sketch (Author 2021)

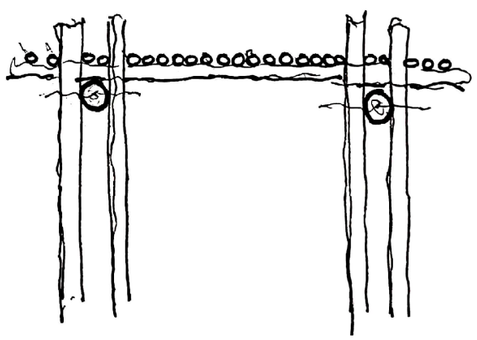


Figure 5.12. Cabin structure sketch (Author 2021)

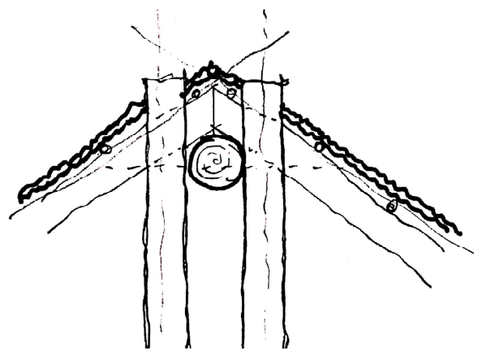


Figure 5.13. Cabin structure sketch (Author 2021)

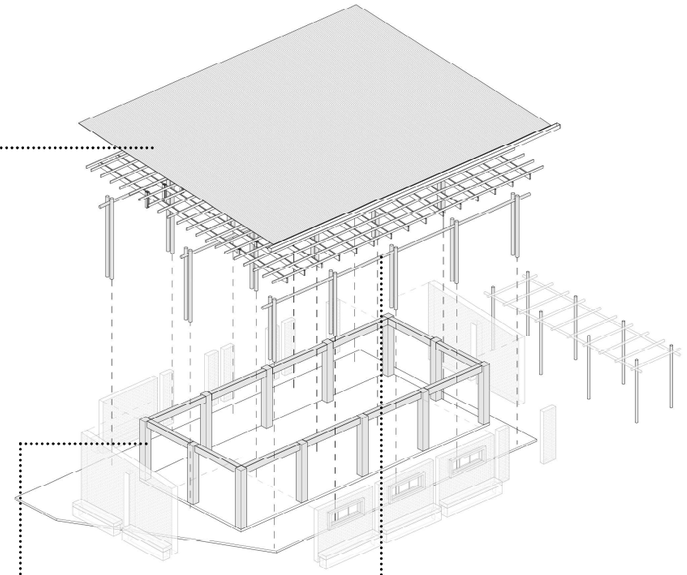
5.5 SYSTEMS

Structure

The structural language consists of three systems that connect and develop from one another but can be interpreted and understood as separate entities. The language stems from an understanding of Kamalipour and Dovey's patterns of increments of change within informal settlements (2020:3).

Primary structure

The primary structure consists of the fixed elements provided through formal intervention by the architect. The load-bearing elements, which make up the frame, include brick masonry columns, precast concrete beams and cast in situ concrete floor slabs. The local construction knowledge and limited water supply informed the choice to limit casting in situ concrete and instead construct brickwork columns and adopt precast beams that can be transported to the site on trucks. Whilst casting is required for raft foundation ground floor slabs, the use of precast rib and block systems for the first-floor slabs reduces the amount of concrete casting required. The roof systems are included in the primary structure, consisting of lightweight corrugated steel sheeting, supported by a combination of SA pine rafters and eucalyptus pole horizontal and vertical members. The eucalyptus poles read visually as being detached from the other load-bearing elements, lending to the dialogue of construction knowledge transferral. The system allows for low-profile pitches and wide overhangs in response to the local climatic conditions.



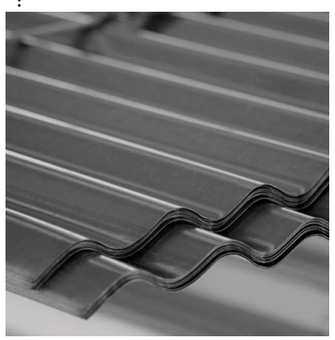


Figure 5.14. (Top) Primary structure axonometric (Author 2021)
Figure 5.15. (Left) Corrugated roof sheeting (Clotan Steel n.d.)
Figure 5.16. (Middle) Old cape blend face brick (Corobrik n.d.)
Figure 5.17. (Right) Eucalyptus poles (The Pole Yard n.d.)

Secondary structure

The secondary structure relates to the informal enclosure of the load-bearing frames (Kamalipour & Dovey 2020:4). It is the initial layer of spatial appropriation in the intervention by means of wall infills. The dissertation proposes that these walls be constructed with the in situ manufactured plastic bricks because, as discussed, bricks can allow a quality of flexibility, replacement and inclusion of various openings. Whilst the secondary structure is designed as part of the dissertation; it is understood that residents may opt for more affordable, less durable materials like timber and plastic sheeting initially. The load-bearing primary structure, however, allows incremental replacement of the impermanent walls to more permanent options suggested in the design.

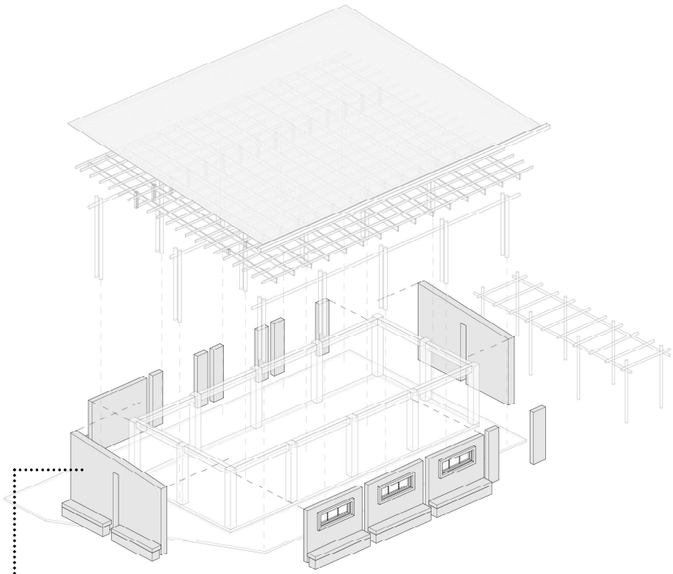


Figure 5.18. Secondary structure axonometric (Author 2021)

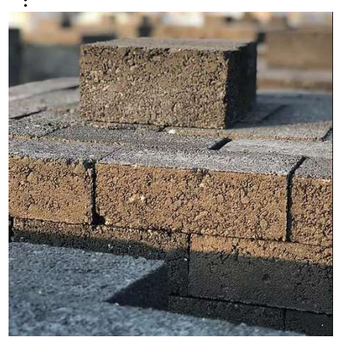


Figure 5.19. Plastic bricks (Ramtsilo 2018)

Tertiary structure

The tertiary structure completes the process of place-making that the primary and secondary structures initiate through various processes of attachment and extension. Recognising the favoured use of threshold spaces for social gathering and domestic routines, it consists of elements that enable residents to create shading devices, porch extensions and additional nuanced layers of appropriation in public and semi-public areas. As with the secondary structure, the dissertation presents suggestions and guidelines of how one can appropriate the spaces, whilst acknowledging the creative power is shifted to the hands of the community. The speculations of how these elements may alter and vary over time will thus be presented in conjunction with the design resolution.

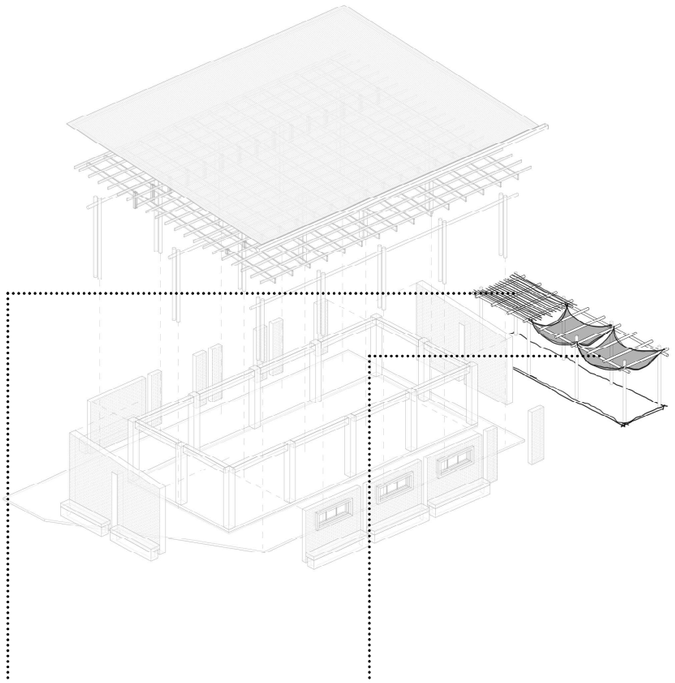


Figure 5.20. Tertiary structure axonometric (Author 2021)
Figure 5.21. (Right) Eucalyptus laths (Northern Poles n.d.)
Figure 5.22. (Left) Shade cloth (Mitre n.d.)

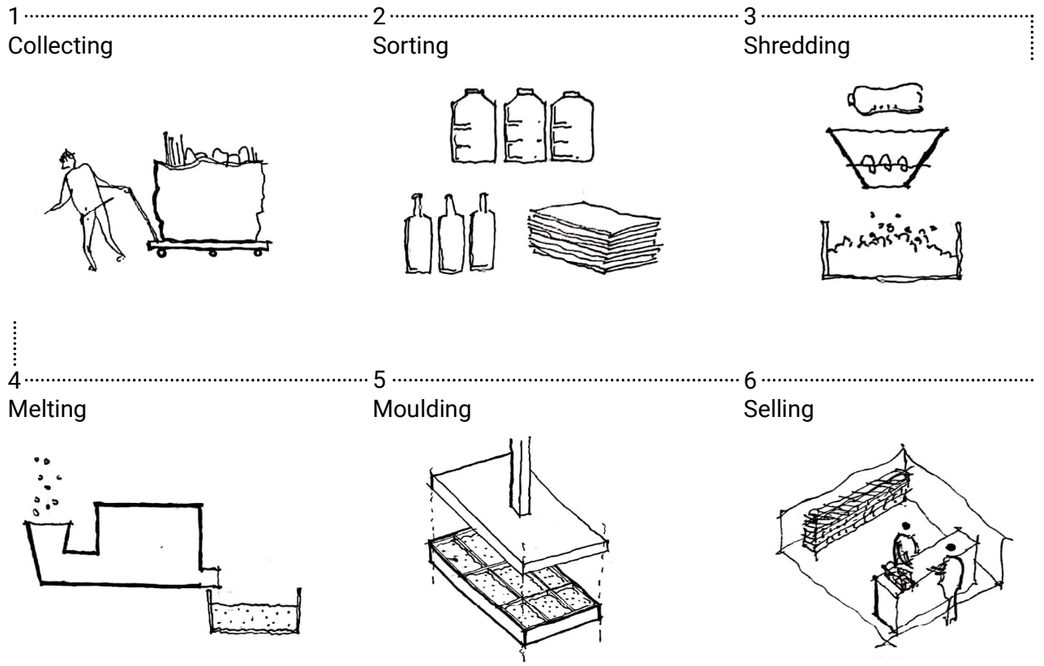


Figure 5.23. Brick manufacturing process (Author 2021)

Brick manufacturing

The process of manufacturing plastic bricks in the factory is considered part of a greater network of waste management within Plastic View. The process relies on the settlement's waste pickers (trolley pushers), who currently collect and sell plastics in bulk to recycling stations, to instead sell the waste directly to the plastic brick factory. According to research conducted by Trask (2013:92), in one week, a single waste picker can collect an average of 299 kilograms of polyethylene terephthalate (PET water and cold drink bottles) and high-density polyethylene (HDPE milk bottles, containers etc.). Considering that the required machinery has a daily output capacity of 800 bricks, which translates to approximately 500 kilograms of Plastic, a network of ten waste pickers can provide enough plastic for a five-day week of brick manufacturing. This process would yield approximately 4000 bricks per week which equates to 16000 bricks per month.

A 6 square metre double skin brick structure, similar in scale to the living units in the design, requires approximately 7400 bricks for construction. This means that the factory alone, as a source for construction materials, can contribute resources towards the infill walls of two living units per month. It must be noted that the plastic brick factory is not intended to replace but rather supplement the existing brick sourcing process in Plastic View, increasing the redundancy, and with it the resilience, of the settlement upgrading operation. Not only is it contributing to the upgrading operation, but also the local informal economy and the mitigation of pollution.

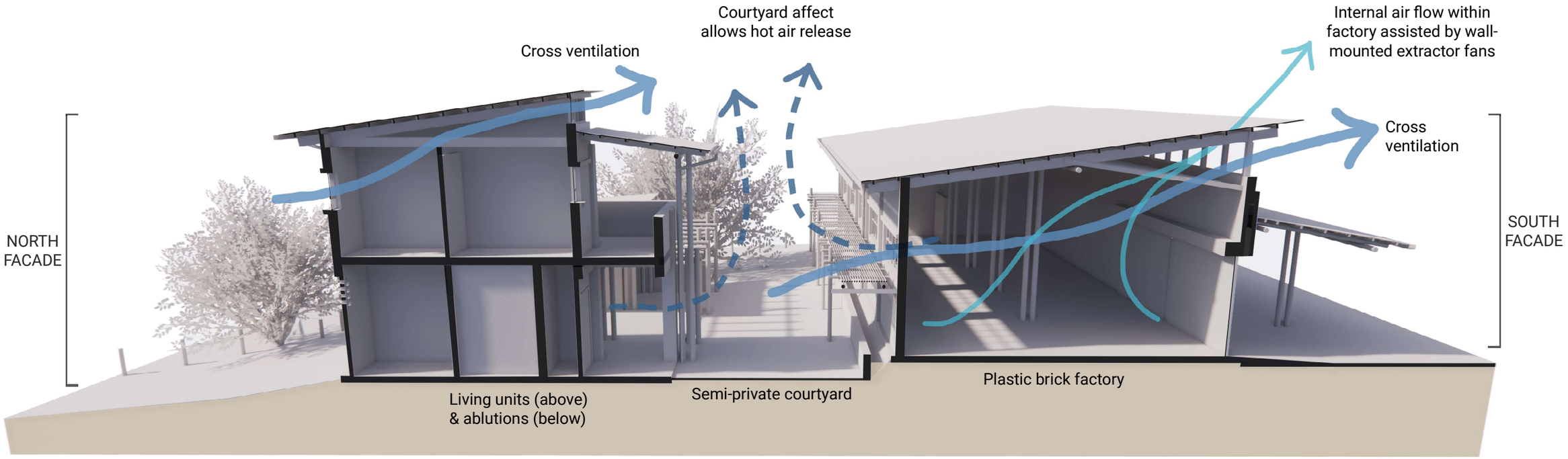


Figure 5.24. Passive solutions section (Author 2021)

Environmental strategies

The technical refinement of the dissertation also responds to the climatic conditions of the context through active and passive environmental strategies, including building orientation, daylighting, and natural ventilation. As it stands in Pretoria, Plastic View falls under climatic zone 2 as a temperate interior climate (SANS 204 2011:30), with hot to very hot summers and mild to cool winters (Muller 2013:105).

Daylighting

Designing for optimal daylighting is imperative in reducing the need for electrical lighting, limiting glare and maintaining a desirable heat gain (Muller 2013:109). To do so, the proposed design maximises north-facing walls and glazing with it whilst minimising east and west glazing (Muller 2013:105). This was possible in the case of all structures barring those that faced directly onto the existing street, in which alternate strategies were implemented. Shading elements were designed for north-facing windows, either through the overhangs of the roofs above or with additional brise soleil devices where overhangs were not sufficient.

Passive ventilation

Cooling strategies are integrated into the design by means of passive ventilation through structures. The pitched roofs common throughout the design allow for optimised cross ventilation through lower openings allowing natural airflow in and clerestory openings allowing airflow out again. In the waste management hub, the courtyard around which the structures are positioned allows hot air to move from interior spaces out to the courtyard, where it can escape upwards. In the plastic brick factory, wall-mounted extractor fans are fitted to assist in removing hot air, dust and residual fumes from the manufacturing process. The more exposed live/work units along the high street have vegetation planted along its north-eastern facades to shield them from the harsh morning sun and cool the air as it passes through.

Winter solstice
41°

Equinox
64°

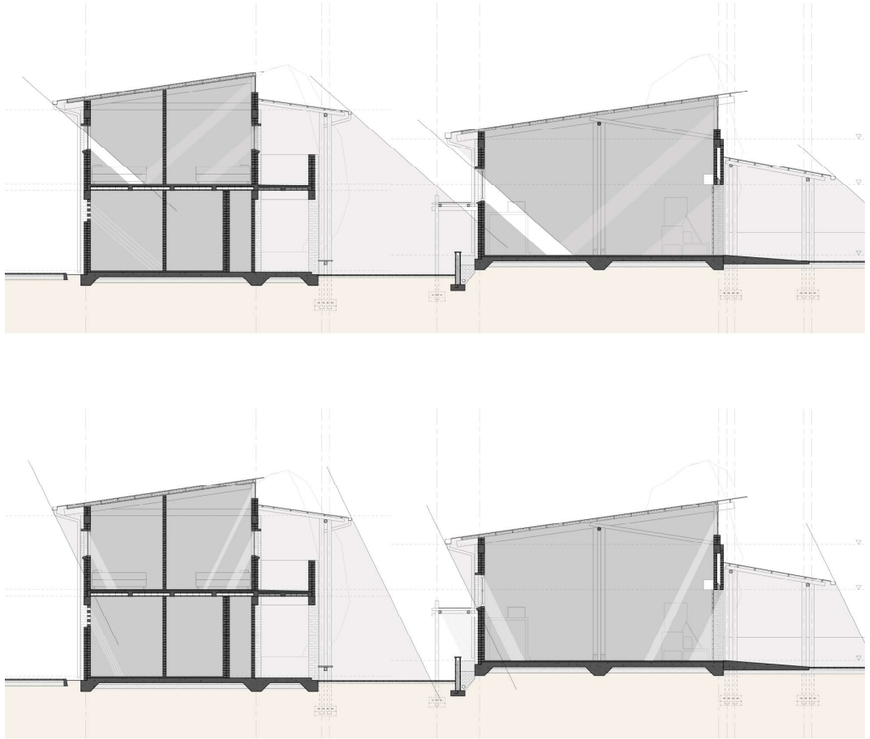


Figure 5.25. Sun angle sections (Author 2021)

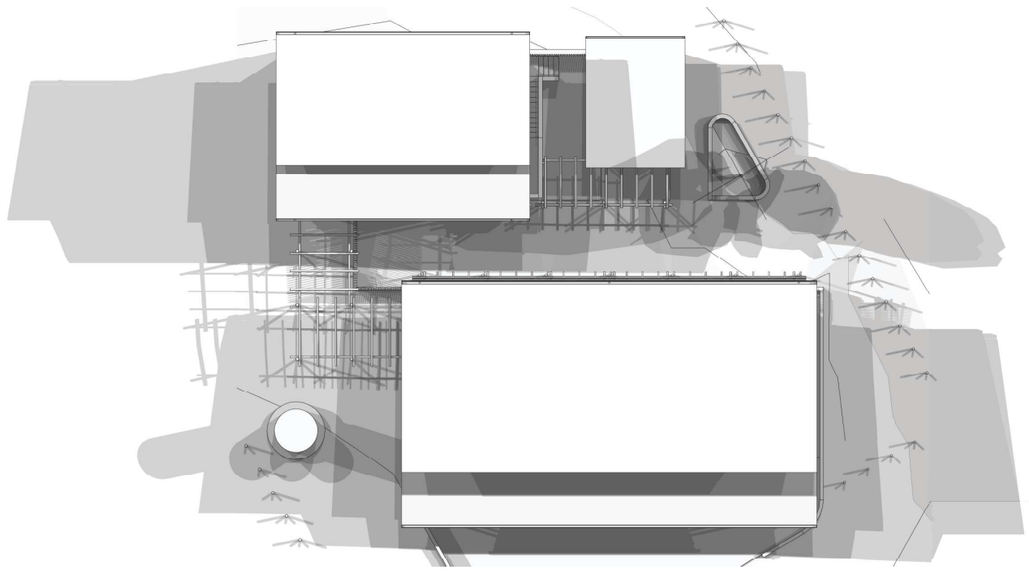


Figure 5.26. Equinox shadow study (Author 2021)

Water harvesting

The system begins with stormwater being collected on-site from roof structures and surface runoff, and greywater being collected from the living units and public ablutions. Both types of water travel via precast concrete channels and vegetated swales along the longitudinal boundaries to a preliminary storage sump. The collected water is then passed through a water treatment process of coagulation, sedimentation, filtration and ultraviolet disinfection that ultimately removes sand, bacteria, viruses, oils, metals and other debris (CDC 2015). Using a solar pump, the treated, potable water is transported to a storage tank at a higher position on site adjacent to the plastic brick factory, where it can be reused in the living units and public ablutions. The water harvesting strategy is intended to supplement the existing, limited water supply provided by the municipality.

Solar energy

Portable photovoltaic panels are currently used in Plastic View by residents to power music devices, cell phones and occasionally artificial lights; however, a lack of municipal service provision means electrical energy is limited across the settlement. The intervention proposes that solar energy is harnessed on-site through two separate systems to generate both electrical energy and heat energy. The first system consists of photovoltaic panels fixed to north-facing roofs (and north-east facing for the live/work units) that generate electrical energy for lighting, household inverters and machinery in the factory. The second system consists of solar water heaters fixed to the roofs of the live/work units and first-floor living units above the factory ablutions and the market lock-up units. These systems provide heating capacity for the geyser-stored water used in homes and the showers in the factory ablutions.

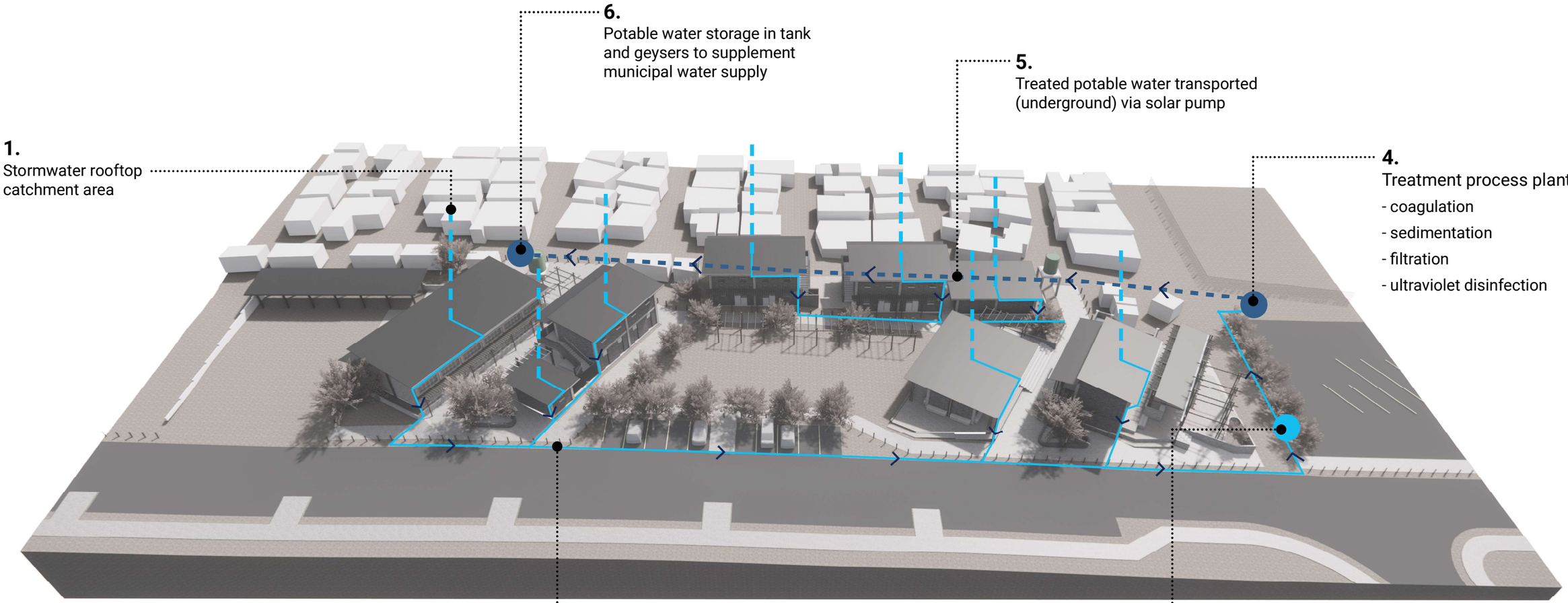


Figure 5.27. Water harvesting system (Author 2021)

CHAPTER 06

CONCLUSION

Figure 6.1. Prototype live-build (Author 2021)

6.1 REFLECTION

The dissertation was firmly rooted in the exploration of resilience within Plastic View, a dense, evolving informal settlement in the affluent Moreleta Park suburb of Pretoria. From the identification of the financial and municipal limitations faced by the settlement's community, the dissertation aimed to provide a solution to how Plastic View's resilience can be improved by developing existing conditions and systems. The intention was to plan for the incremental upgrading of Plastic View to improve living conditions whilst reducing its vulnerability to long term disturbances. Basic infrastructure, and specifically waste management, was identified as the most pragmatic avenue to meet the intentions. However, it was also understood that the intervention needed to allow continuous appropriation to meet the changing needs of the community. The design response, situated on the north-eastern boundary and high street of Plastic View, consisted of a composition of multifunctional internal and external spaces anchored by an upcycling plastic brick factory and a highly dynamic marketplace.

The improvement of resilience

The dissertation approached the discourse of resilience in architecture, specifically within the context of informal urban settlements. This entailed investigating the settlement's vulnerabilities, conceivable threats, and adaptive and transformative capacity. The research showed the community's capacity to pre-empt threats of fire outbreaks, flooding, and material degradation by upgrading their dwellings from existing weak plastics to more durable materials. Having recognized the slow and unreliable networks through which residents acquire construction materials, and simultaneously acknowledging the settlement's lack of infrastructure and basic services, it was decided to introduce a waste management system that connected to the existing recycling networks whilst creating a new upcycling operation to advance the settlement's upgrading process. The system needed a basis of guidelines that would aid in translating resilience theory into practical application, and for this, the "safe-to-fail" mentality (Ahern 2011) became a valuable informant. The upcycling operation of the plastic brick factory could hence be understood as a system of redundancy in the sourcing of construction materials, making the existing process of dwelling upgrading more resilient. This improvement would reflect across scales greater than individual dwellings because it would advance the entire settlement away from infrastructural and socio-economic deficit whilst mitigating pollution, material degradation and health issues.

To break away from the tendency of formal development to limit the possibility of adaptation of architecture (Kamalipour & Dovey 2020:1), it was conceived that the proposed architecture be designed in a manner that promotes continuous appropriation and adaptation. The capacity for adaptation was primarily resolved in the technical iterations, as the exploration of materials and joining of elements created possibilities for flexibility in spaces. The project stressed the importance of multifunctional spaces, both internal and external, as a means of catering for changing needs in Plastic View. This approach to design should be customary for all settlement upgrading because the possibility of failure of an intervention due to unforeseen changes in settlements must be accounted for, and can be avoided when spaces allow for reappropriation (Ahern 2011:342).

Not only was change considered at a scale within individual structures, but also with the larger transformation of the selected site. Assisted by the multifunctionality of the architecture, the site has the capacity to respond to larger changes like the anticipated expansion of Plastic View, where it would shift from being a boundary development to the point of transition between the existing and new occupations. Informal settlements are relatively unpredictable urban conditions (Wu & Loucks 1995:443), so the speculation relied heavily on Plastic View's past emergence and development to inform that which may occur in the future. Future expansion may result in a reinterpretation of the architectural intervention, and whilst it expresses a capacity to transform, there is limited certainty as to how and to what extent the architecture would be reinterpreted.

6.2
CONTINUATION

Challenges

The architectural approach maintained a degree of sensitivity to Plastic View's scale, construction language, and socio-spatial organisation, whilst suggesting more sustainable means of development commonplace in formal construction.
This act of balancing the scales between formality and informality became a continuous thread throughout the dissertation, linking back to the architect's responsibility, in this context, of transitioning between provision and enablement (Combrinck et al. 2017:34).
The notions of incrementality and appropriation within the architecture were necessary for achieving this balance as they allowed the architecture to become more than just formal, administered products. With its distinction between the provided, fixed structure and the flexible, user-owned structure, the architecture provided a platform of enablement through which informal agency can thrive.

Building density and land occupation became critical factors in the design process, heightened by the conversation around settlement fires and overpopulation. The existing building density of Plastic View needed to be contested as the current patterns present greater threats to the community's health and dwellings. This presented numerous challenges when designing on the selected site. The public interface along the high street had to be utilised in moderation to capitalise on the street edge as existing informal enterprises do, whilst providing sufficient fire breaks, public space and walkways. Similarly, the distribution of structures along the selected site required a trade-off between adequate public space and development sprawl. This matter is particularly critical in Plastic View as the sprawl of newly constructed dwellings continuously tests its boundary. The dissertation explored this struggle with the proposed development reinventing and redefining the existing boundary of the settlement.

Resilience thinking

The concept of resilience is often misconstrued by built environment practitioners as a purely positive condition or ideal state (Peres & du Plessis 2014:3). Because of this, resilience is becoming a popular substitute term for sustainability (Peres & du Plessis 2014:3), reducing its potential to inform a deeper understanding of desirable and undesirable urban conditions. The aim of this dissertation was to improve the resilience of Plastic View because, given the numerous factors that make the settlement's condition unstable, a resilient settlement has a greater capacity to continue providing a quality of life that many of the urban poor seek (Peres, du Plessis & Landman 2017:692). The research highlights the understanding of resilience as a neutral concept in that it recognises the positive aspects as well as the flawed yet likewise resilient conditions in Plastic View. This practice of thinking should become more commonplace in the architecture profession; otherwise, resilience will continue to be misapprehended as a solution to urbanization-related problems.

Community engagement

The dissertation relied on a balance between community engagement, in-depth data collection and grounded speculation of the future of Plastic View. The continuous visits to the settlement had a profound influence on the contextual sensitivity and programmatic direction of the design. Immersing oneself in an environment like Plastic View and interacting with its community is the most effective approach to comprehending its unique dynamics of living and collective needs. The engagement builds a level of trust between the architect and the residents, leading to mutual comfort when confiding local knowledge. Till (2005:7) reaffirms this in his argument that architectural knowledge, to enable transformative participation, must grow from within the given context. The idea of an "expert citizen" (Till 2005:8) suggests recognising that the user has knowledge grounded in everyday experience, and by involving them in the design process, the limited vision often held by professionals can be expanded.

As discussed in chapter one, a prototype build was conducted in the settlement in hopes of observing the continual appropriation of the structure. The exercise did not produce the feedback hoped for as the structure was removed after approximately two months; however, this was anticipated because of the complex, sensitive nature of the settlement. The prototype was a landmark procedure in

the developing relationship between the architecture department of the University of Pretoria and the community of Plastic View. This exercise highlighted the value community engagement can provide in professional practice in South Africa, where informal settlements and low-income peri-urban neighbourhoods form a critical part of the built environment. Transformative participation, and more so prototype testing, can allow for socio-spatial and construction ideas, like those proposed in this dissertation, to be tested in informal settlements like Plastic View. The immersion and knowledge sharing from these prototypical interventions can result in stronger contextual understandings and more successful contributions to settlement upgrading.

Figure 6.2. Final model 1 (Author 2021)

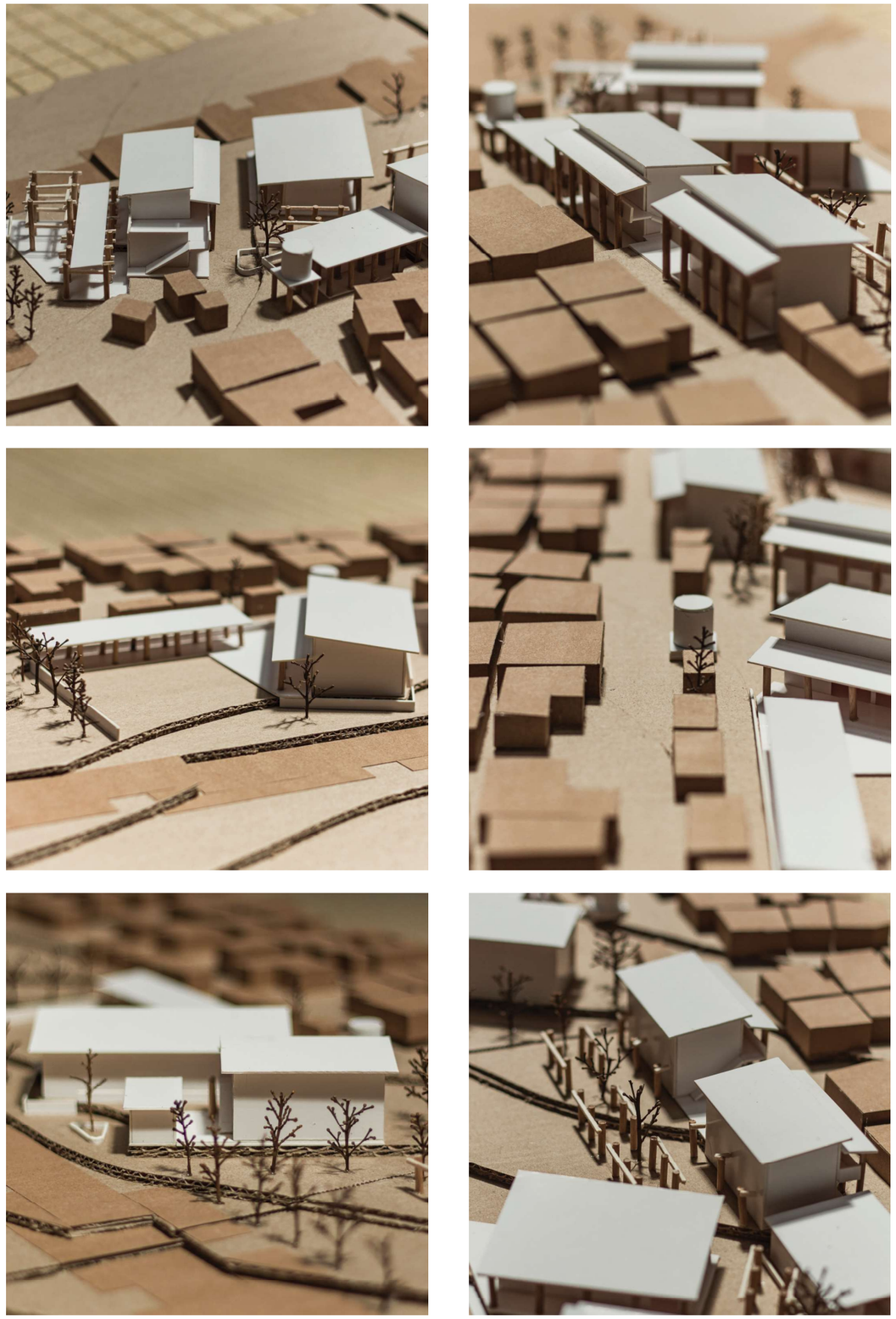
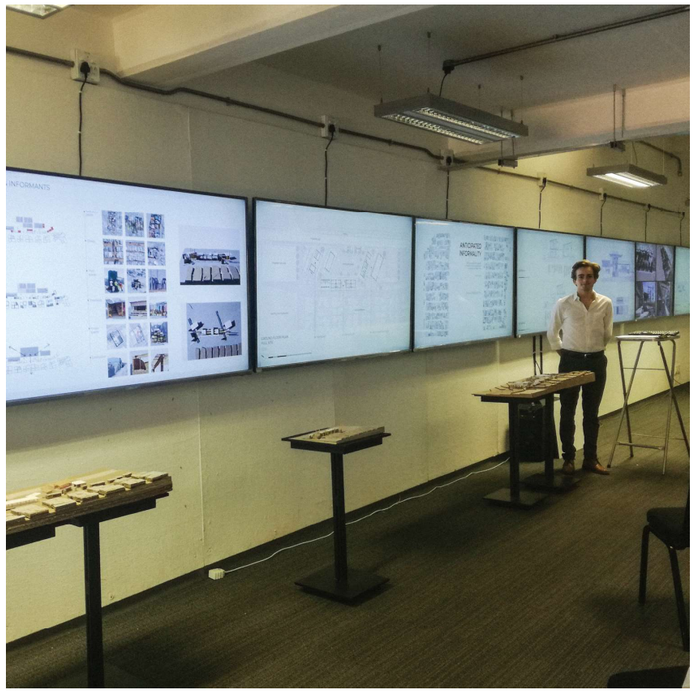


Figure 6.3. Final model 2 (Author 2021)



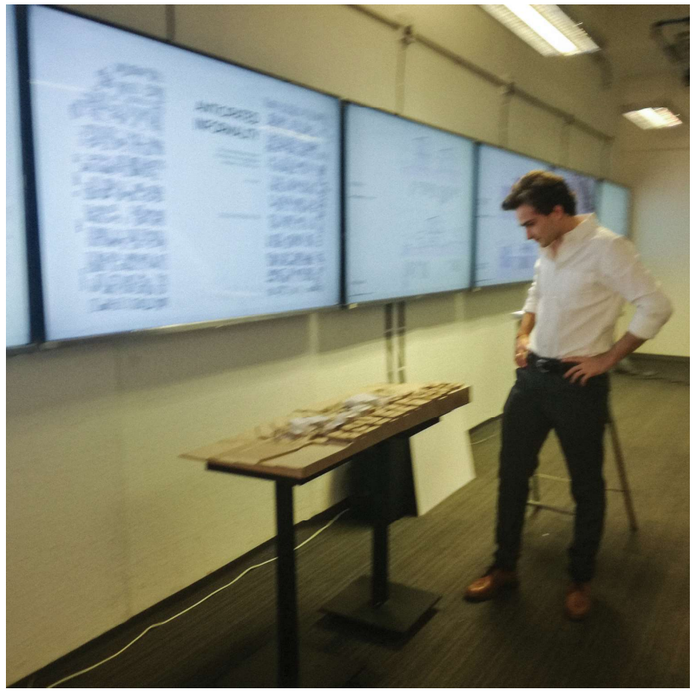
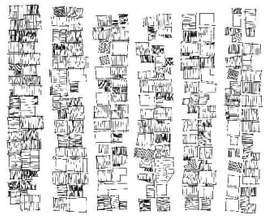


Figure 6.4. Final presentation (Author 2021)



CHAPTER 07

ANNEXURE

Figure 7.1. Design render 1 (Author 2021)

SITE PLAN

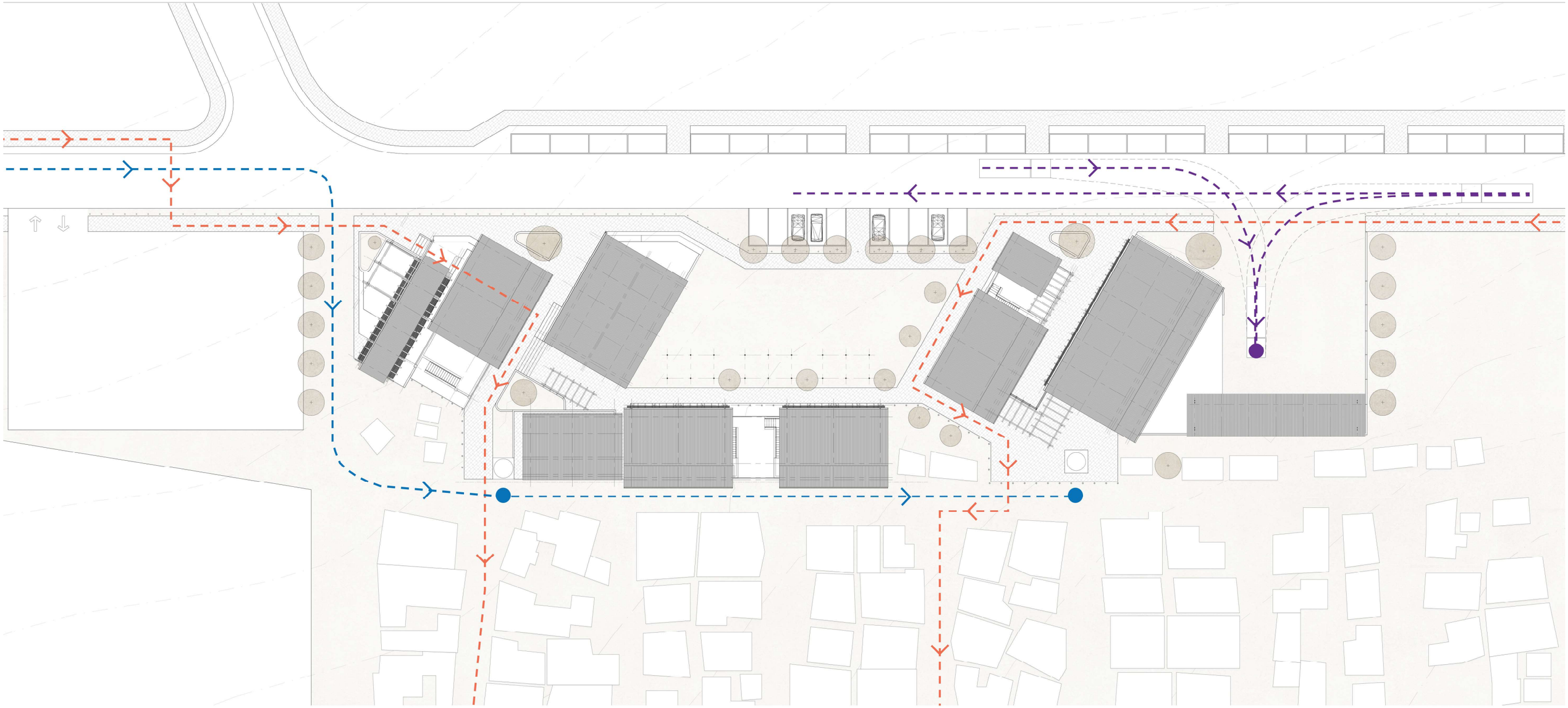


Figure 7.2. Site plan (Author 2021)

Figure 7.3. Ground floor plan (Author 2021)

GROUND FLOOR PLAN

Privacy levels

- Private
- Semi-private
- Public

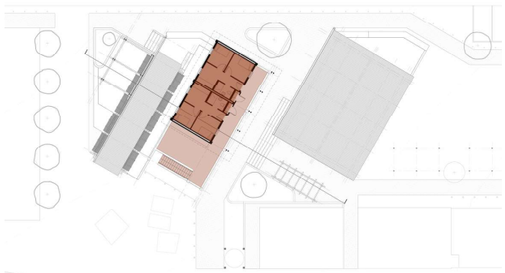
Ownership levels

- Individual
- Shared
- Public

GROUND FLOOR PLAN
SITE PORTION A

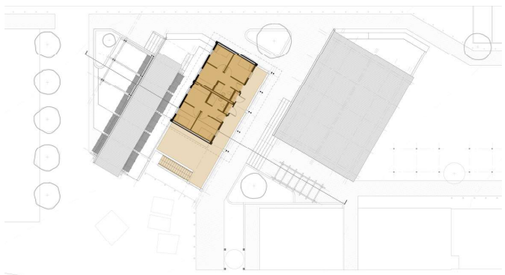
0 2m 4m 10m 20m

Figure 7.4. Ground floor plan A (Author 2021)



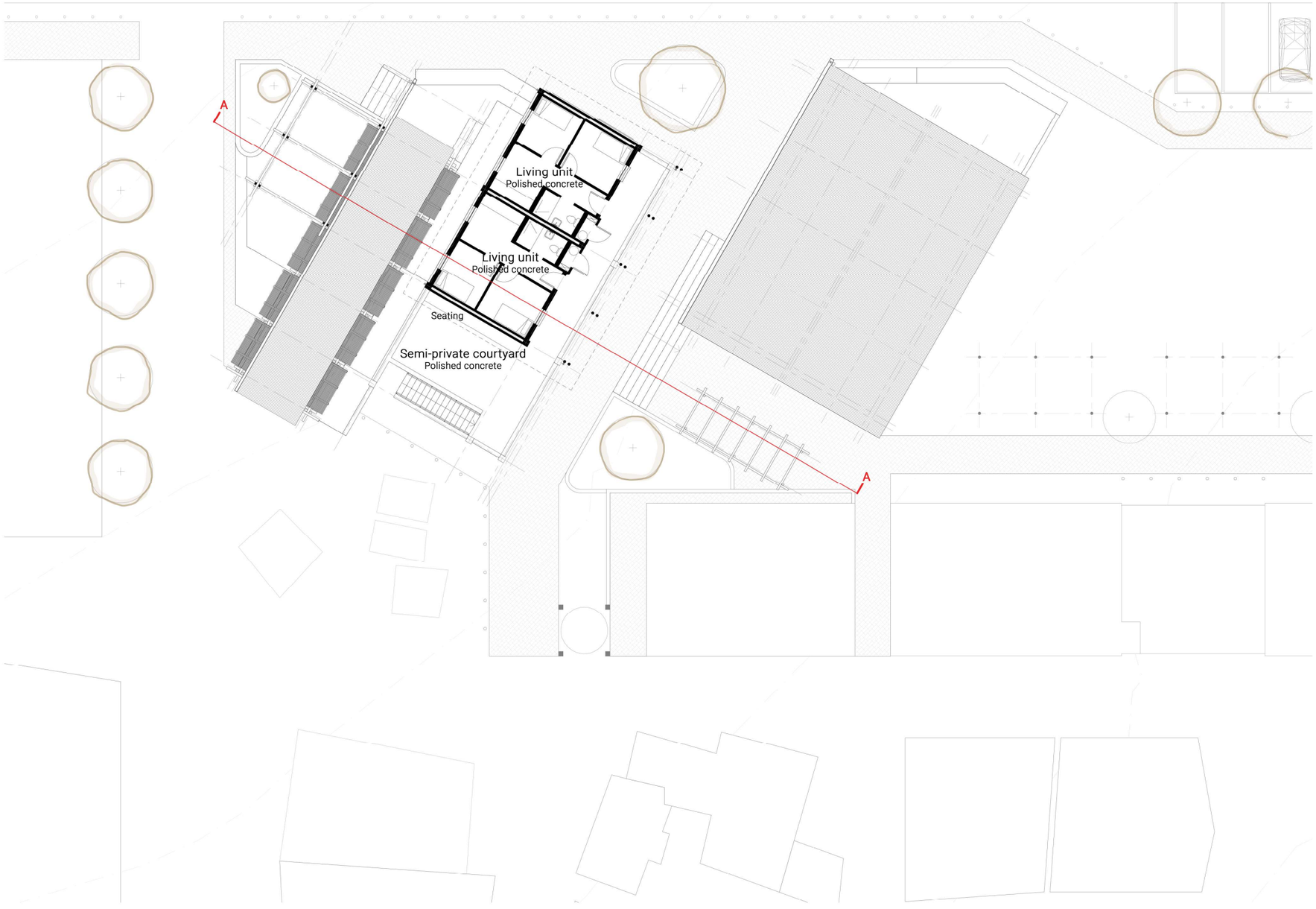
Privacy levels

- Private
- Semi-private
- Public



Ownership levels

- Individual
- Shared
- Public



FIRST FLOOR PLAN
SITE PORTION A

0 2m 4m 10m 20m

Figure 7.5. First floor plan A (Author 2021)

Figure 7.6. Render 2 (Author 2021)

Figure 7.7. Render 3 (Author 2021)

NORTH ELEVATION
SITE PORTION A

0 1m 2m 5m 10m

Figure 7.8. Elevation A (Author 2021)

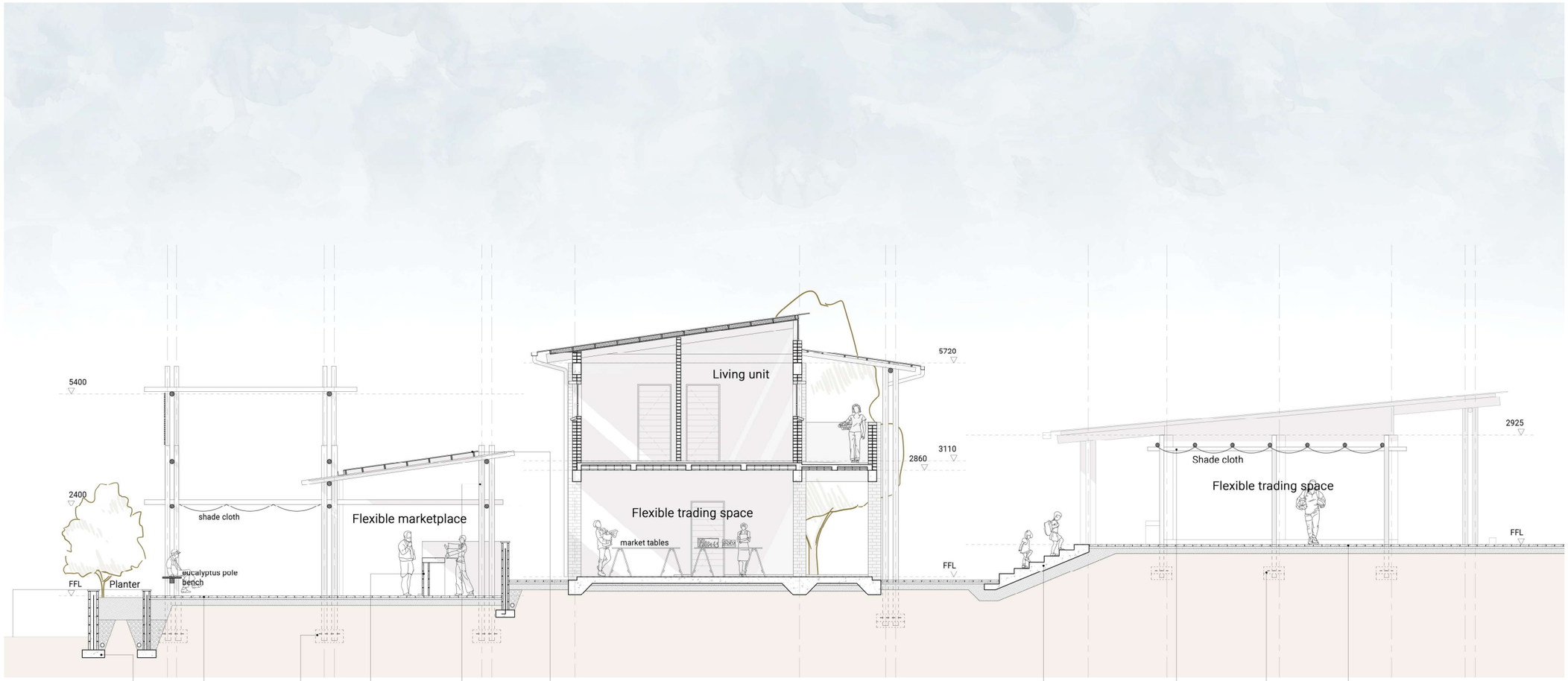
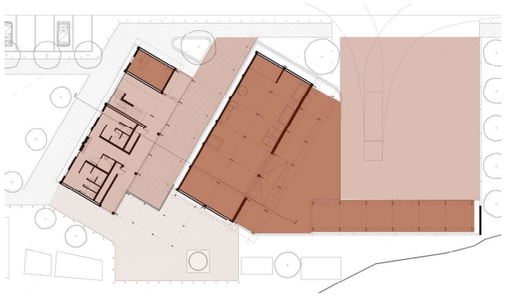


Figure 7.9. Section A-A (Author 2021)

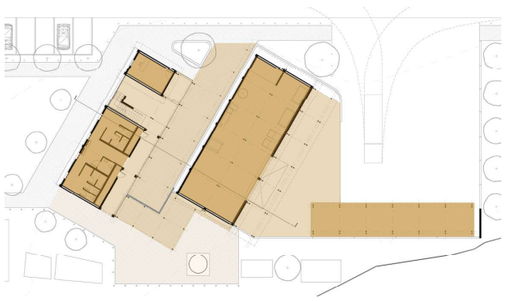
SECTION A-A

0 1m 2m 5m 10m



Privacy levels

- Private
- Semi-private
- Public



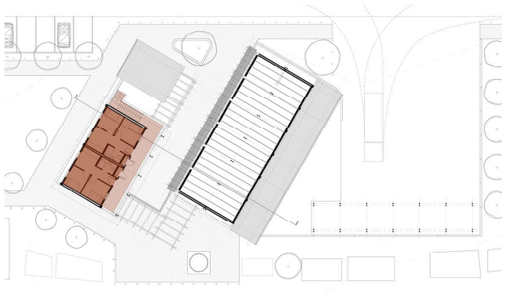
Ownership levels

- Individual
- Shared
- Public

GROUND FLOOR PLAN
SITE PORTION B

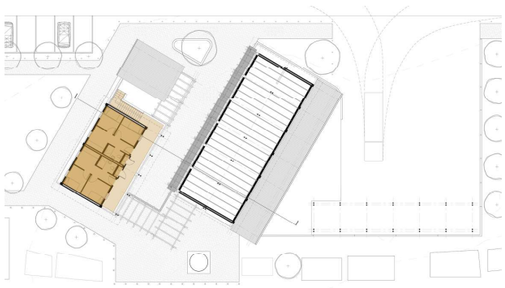
0 2m 4m 10m 20m

Figure 7.10. Ground floor plan B (Author 2021)



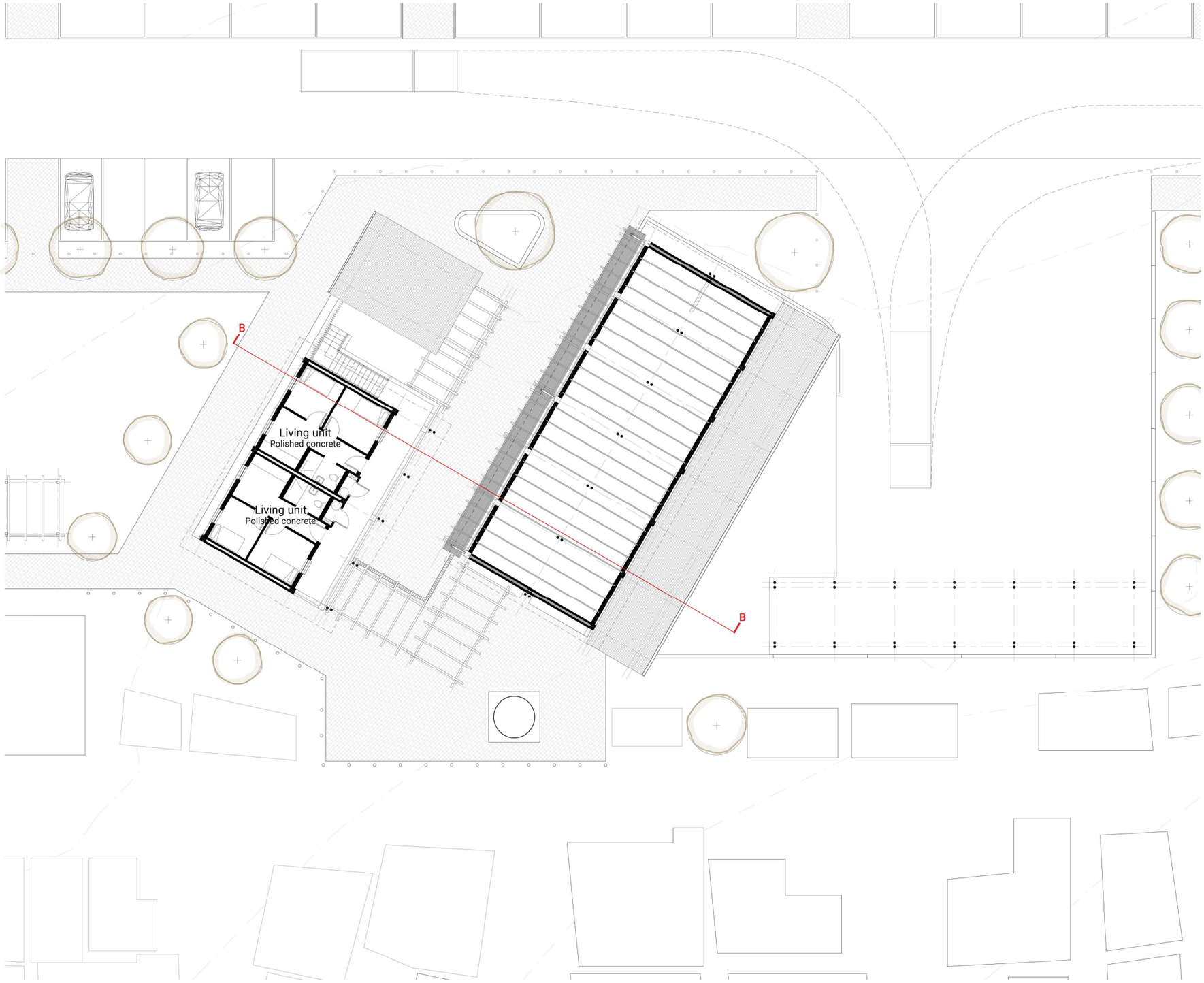
Privacy levels

- Private
- Semi-private
- Public



Ownership levels

- Individual
- Shared
- Public



FIRST FLOOR PLAN
SITE PORTION B

0 2m 4m 10m 20m

Figure 7.11. First floor plan B (Author 2021)

Figure 7.12. Render 4 (Author 2021)

Figure 7.13. Render 5 (Author 2021)

SOUTH ELEVATION
SITE PORTION B

Figure 7.14. Elevation B (Author 2021)

0 1m 2m 5m 10m

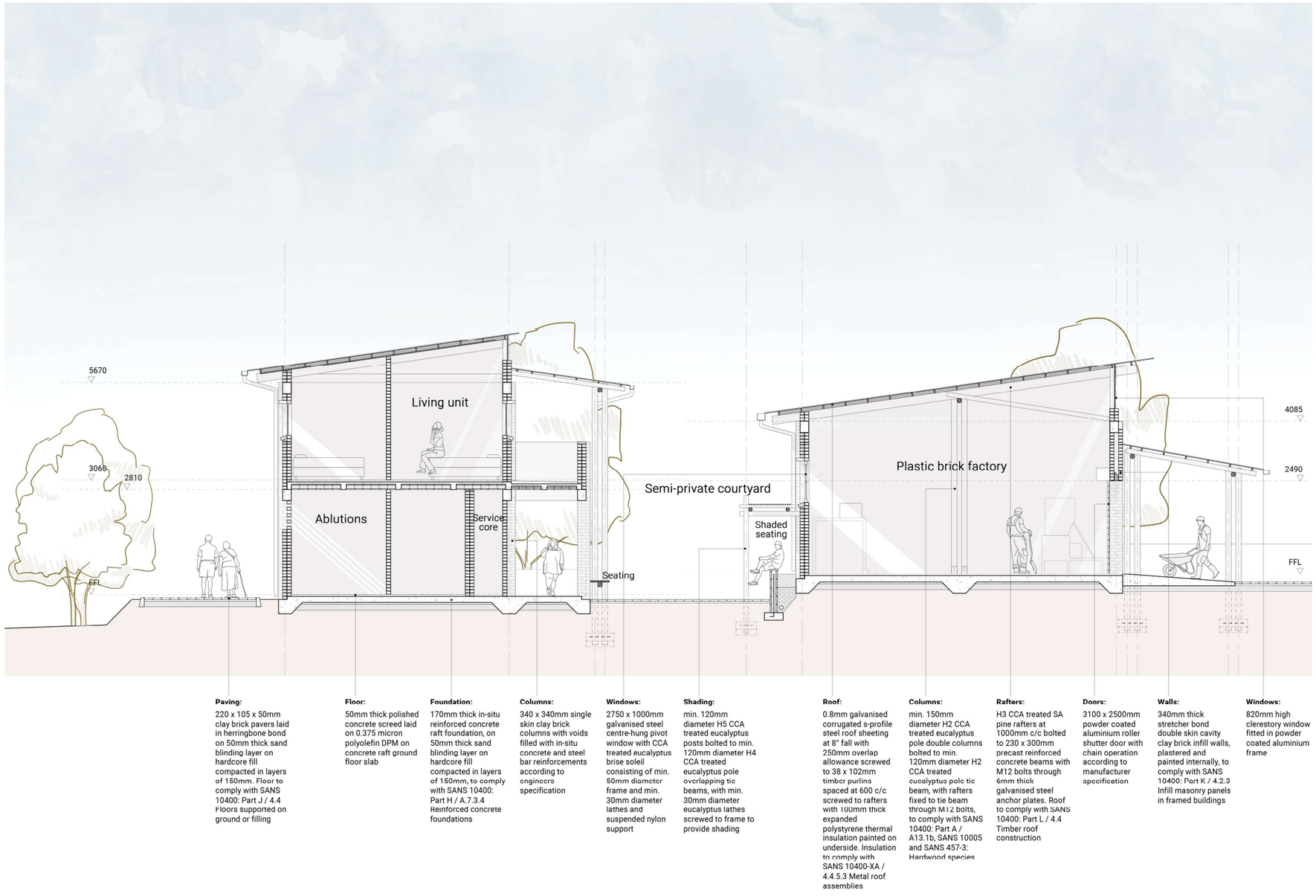
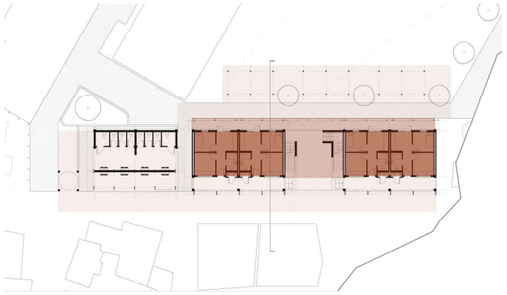


Figure 7.15. Section B-B (Author 2021)

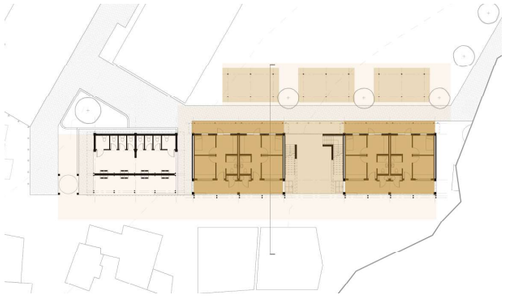
SECTION B-B

0 1m 2m 5m 10m



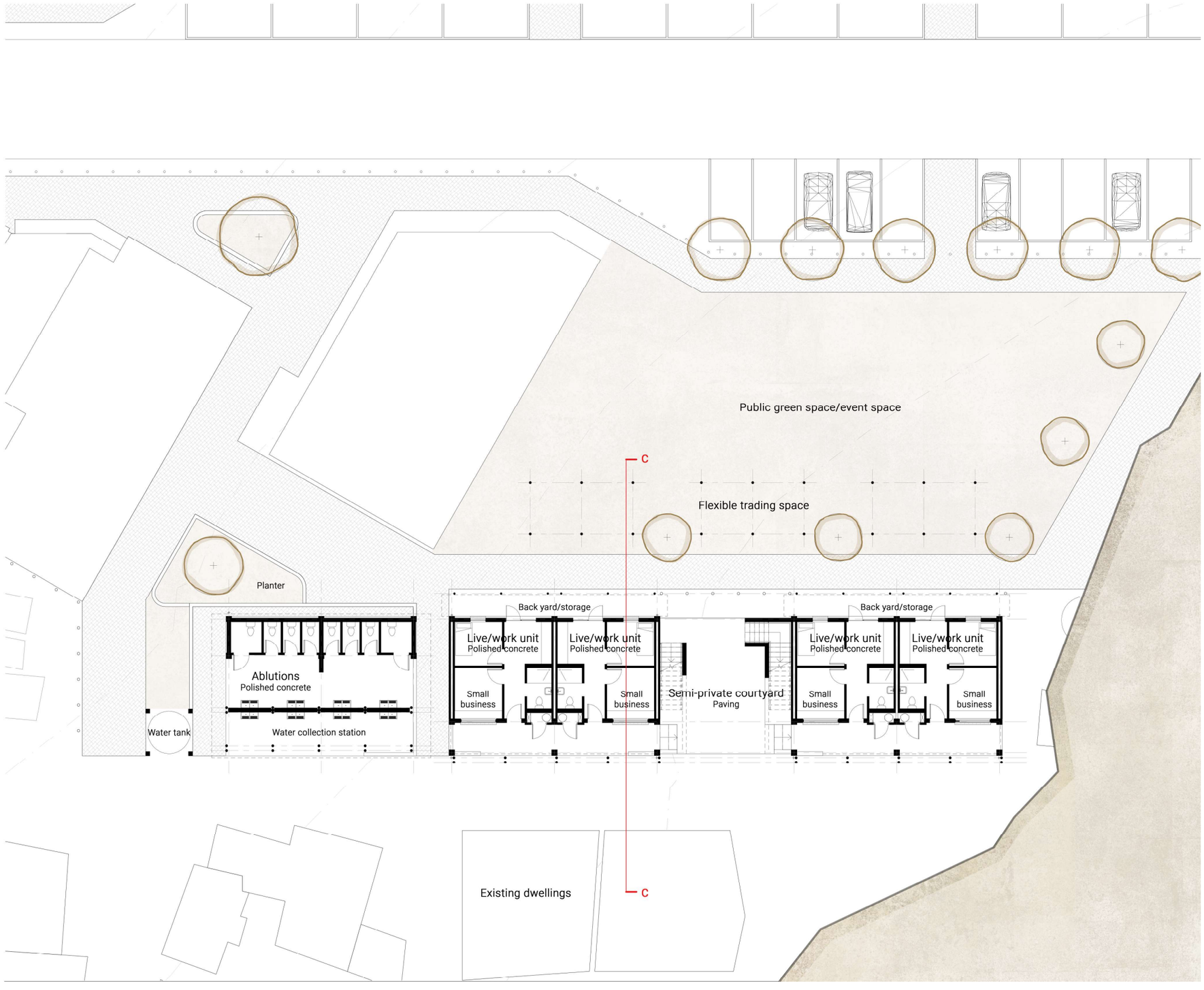
Privacy levels

- Private
- Semi-private
- Public



Ownership levels

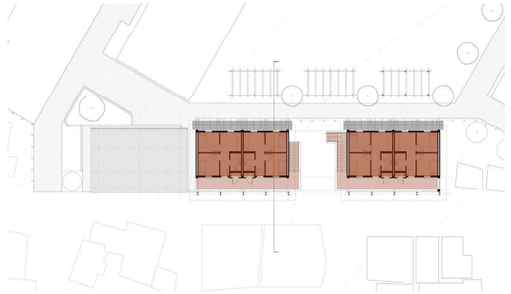
- Individual
- Shared
- Public



GROUND FLOOR PLAN
SITE PORTION C

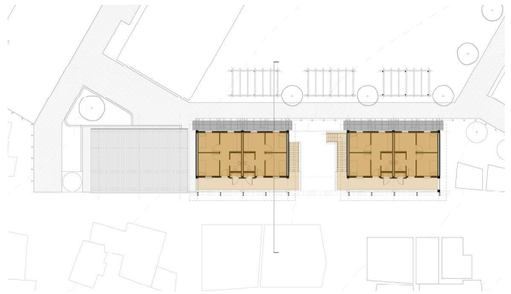
0 2m 4m 10m 20m

Figure 7.16. Ground floor plan C (Author 2021)



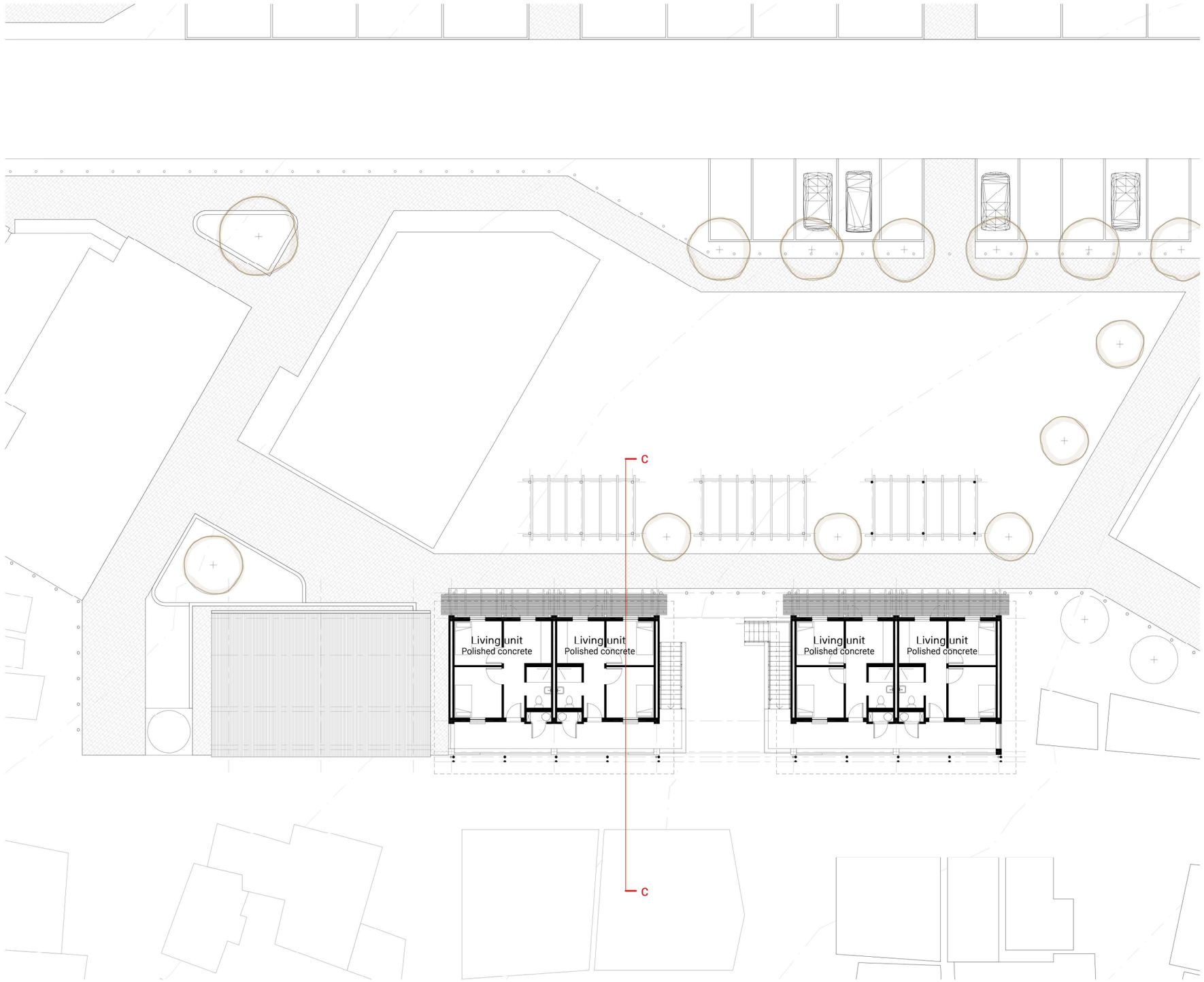
Privacy levels

- Private
- Semi-private
- Public



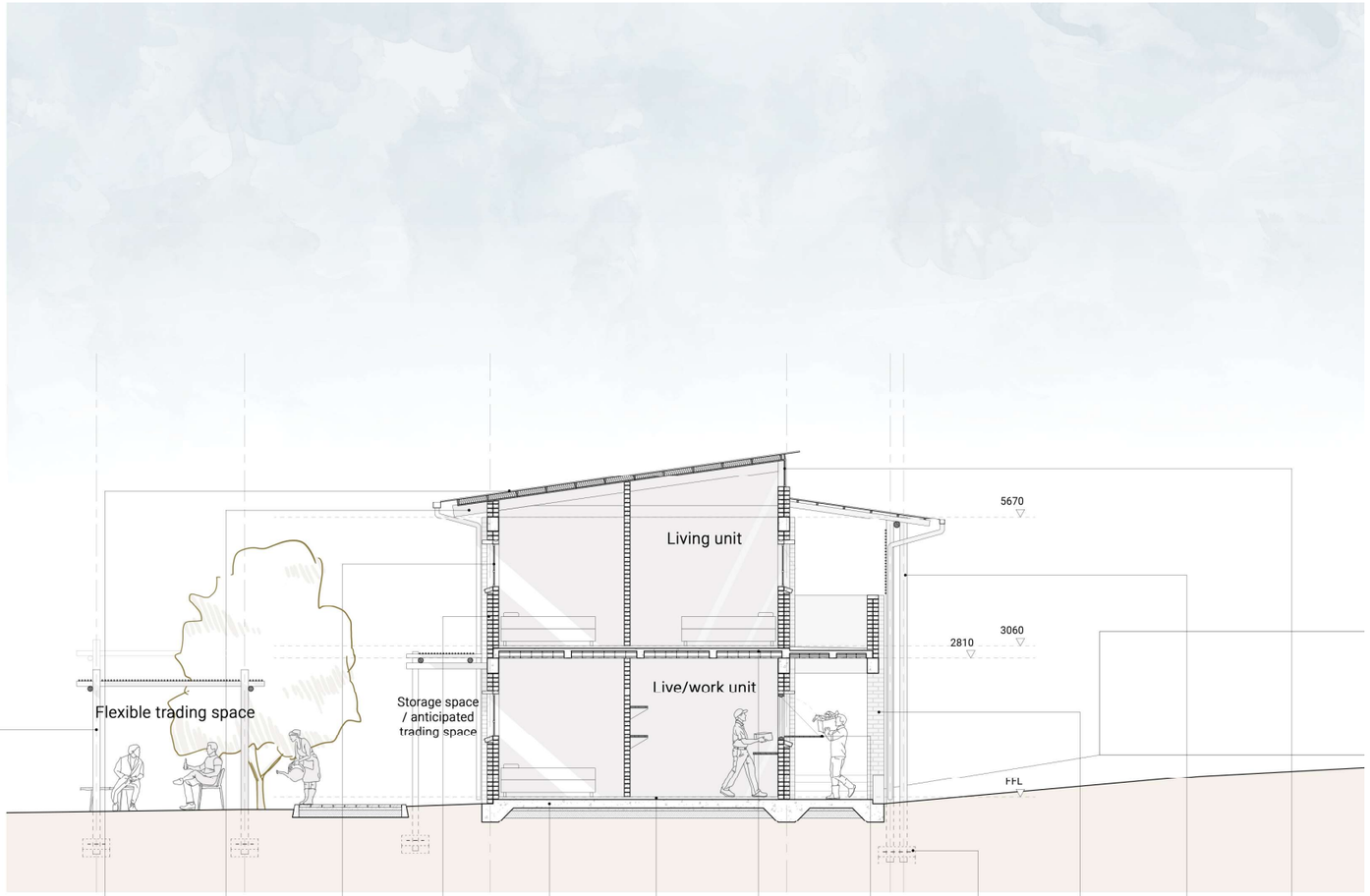
Ownership levels

- Individual
- Shared
- Public



FIRST FLOOR PLAN
SITE PORTION C

Figure 7.17. First floor plan C (Author 2021)



Shading: min. 120mm diameter H5 CCA treated eucalyptus posts bolted to min. 120mm diameter H4 CCA treated eucalyptus pole overlapping tie beams, with min. 30mm diameter eucalyptus lathes screwed to frame to provide shading

Roof: 0.8mm galvanised corrugated s-profile steel roof sheeting at 8° fall with 250mm overlap allowance screwed to 38 x 102mm timber purlins spaced at 600 c/c screwed to rafters with 100mm thick expanded polystyrene thermal insulation and 25 x 114mm timber panel ceiling screwed to purlins between rafters. Insulation to comply with SANS 10400-XA / 4.4.5.3 Metal roof assemblies

Rafters: H2 CCA treated SA pine rafters at 1000mm c/c bolted to 230 x 300mm precast reinforced concrete beams with M12 bolts through 6mm thick galvanised steel anchor plates. Roof to comply with SANS 10400: Part L / 4.4 Timber roof construction

Opening: 900 x 900mm top hung powder coated aluminium window frame with 6mm glazing to comply with SANS 10400: Part O / 4.3 Ventilation and SANS 10400-XA / 4.4.4 Fenestration

Walls: 230mm thick stretcher bond double skin upcycled plastic-sand brick infill walls, plastered and painted internally, with two precast concrete lintels laid column to column at height of 2100mm above FFL to allow anticipated adaptation of dwellings. Walls to comply with SANS 10400: Part K / 4.2.3 Infill masonry panels in framed buildings

Floor: 170mm thick in-situ reinforced concrete raft forming ground floor slab, with min. 300 x 750mm concrete edge beams, on 50mm thick sand blinding layer on hardcore fill compacted in layers of 150mm, to comply with SANS 10400: Part H / A.7.3.4 Reinforced concrete foundations

Floor: 50mm thick polished concrete screed laid on 0.375 micron polyolefin DPM on concrete raft ground floor slab

Floor: 50mm thick polished concrete screed laid on 0.375 micron polyolefin DPM on 200mm thick reinforced rib and block slab according to engineers specification, on 230 x 300mm precast reinforced concrete beams. Floors to comply with SANS 10400: Part J / 4.2 Water-resistant floors

Opening: Timber door rotated 90° to act as bottom hung opening for shopfronts, with suspended nylon support

Foundation: 750 x 200mm in-situ reinforced concrete pad foundation to engineer specification to comply with SANS 10400: Part H. With H5 CCA treated eucalyptus pole double columns cast through pads into 150mm thick gravel layer to allow drainage

Columns: 340 x 340mm single skin clay brick columns with voids filled with in-situ concrete and steel bar reinforcements according to engineers specification

Columns: min. 150mm diameter H5 CCA treated eucalyptus pole double columns bolted to min. 120mm diameter H4 CCA treated eucalyptus pole overlapping tie beam, with rafters fixed to tie beam through M12 bolts, to comply with SANS 10400: Part A / A13.1b, SANS 10005 and SANS 457-3: Hardwood species

Windows: 600mm high clerestory window fitted in powder coated aluminium frame

Figure 7.18. Section C-C (Author 2021)

Figure 7.19. Render 6 (Author 2021)

Figure 7.20. Render 7 (Author 2021)

SECTION C-C

0 1m 2m 5m 10m

Figure 7.21. Site plan post intervention (Author 2021)

SITE PLAN (POST INTERVENTION)

Figure 7.22. Site plan post expansion (Author 2021)

SITE PLAN (POST EXPANSION)

Figure 7.23. Render 8 (Author 2021)

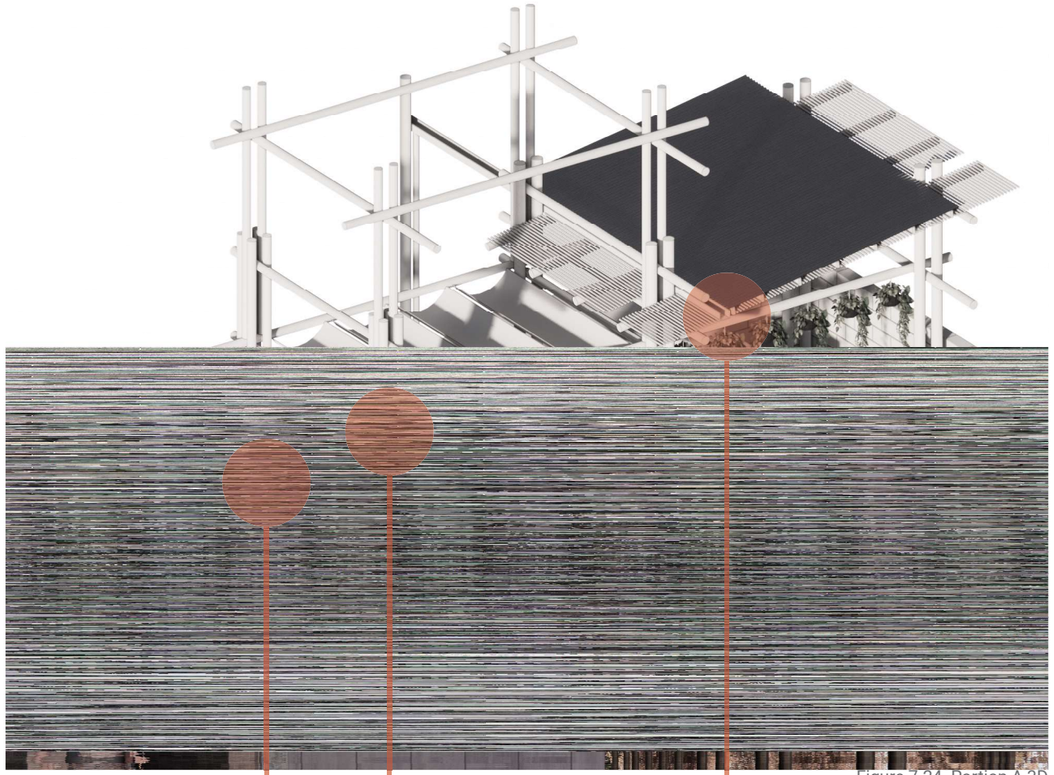


Figure 7.24. Portion A 3D (Author 2021)

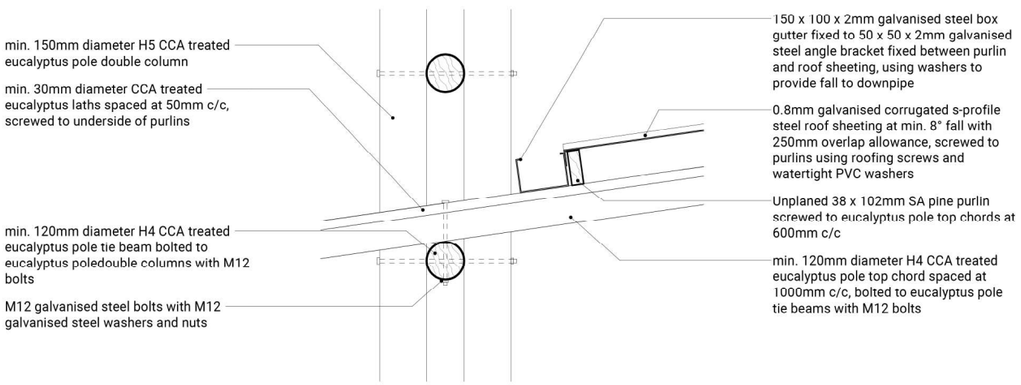


Figure 7.25. Detail A1 (Author 2021)

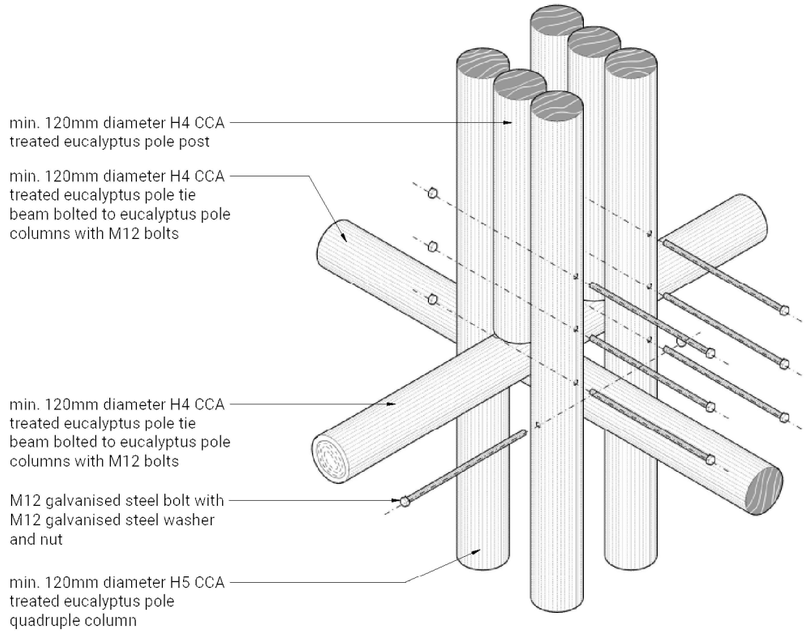


Figure 7.26. Detail A2 (Author 2021)

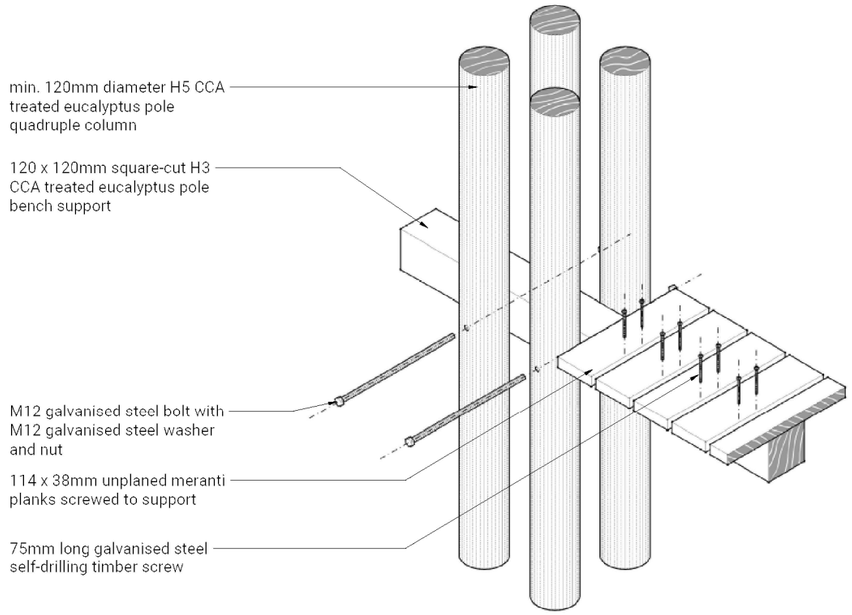
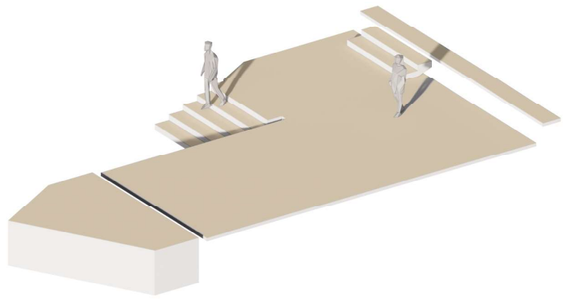
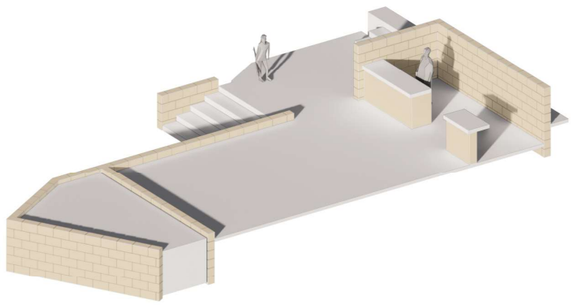


Figure 7.27. Detail A3 (Author 2021)

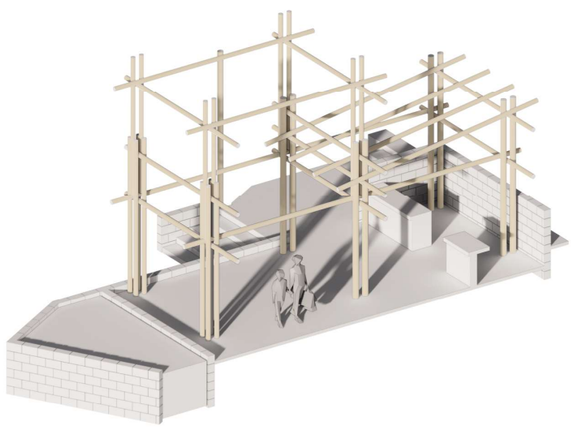
1 - Horizontal planes



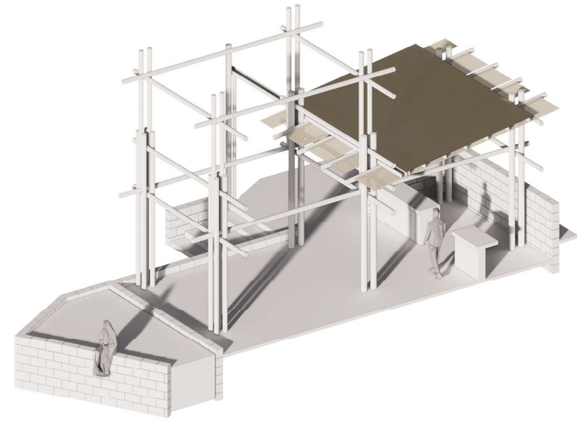
2 - Concrete block retaining walls



3 - Eucalyptus pole frame



4 - Covering



5 - Attachment and ownership

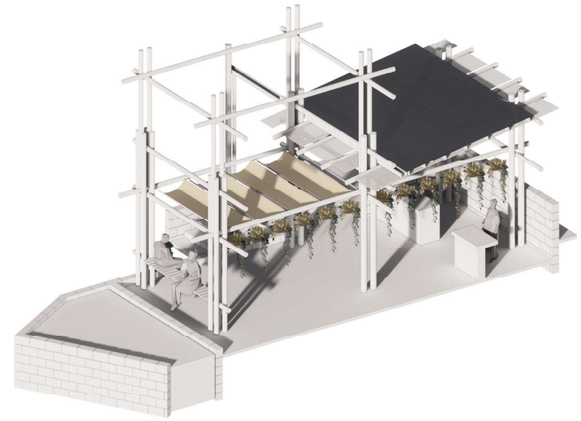


Figure 7.28. Structural appropriation A (Author 2021)

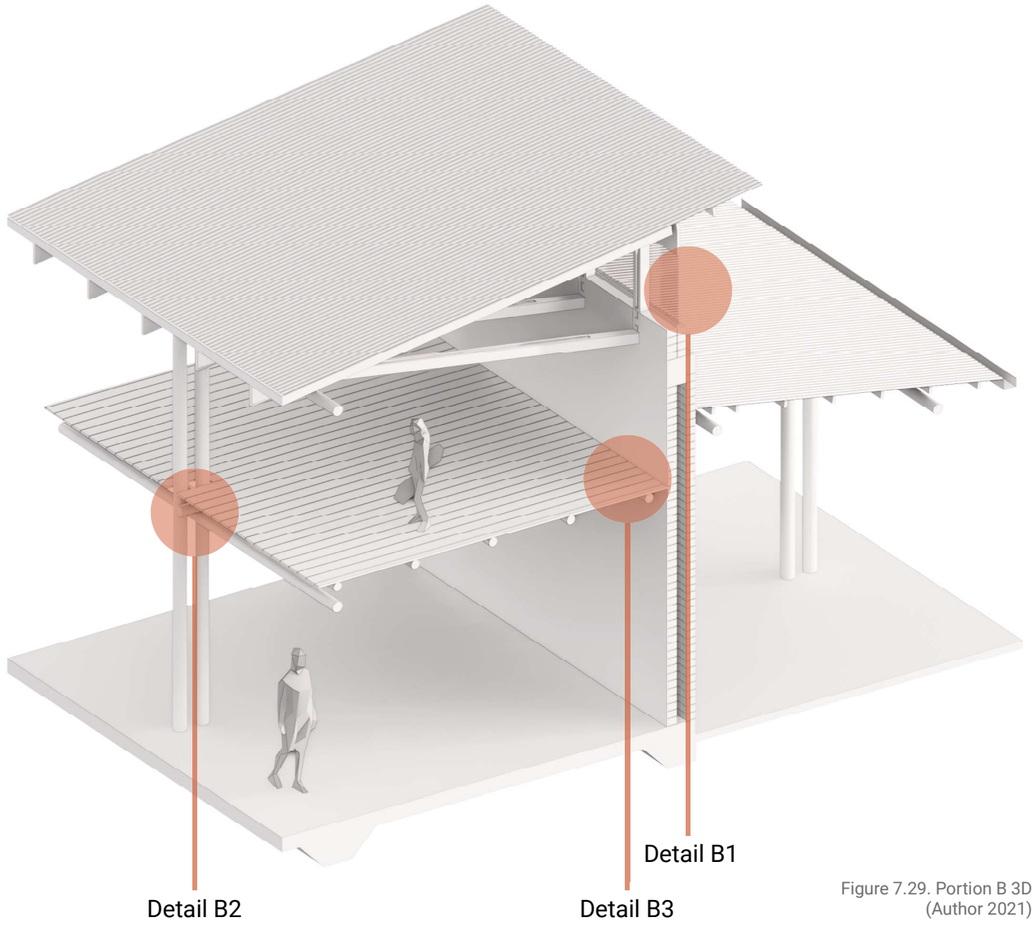


Figure 7.29. Portion B 3D (Author 2021)

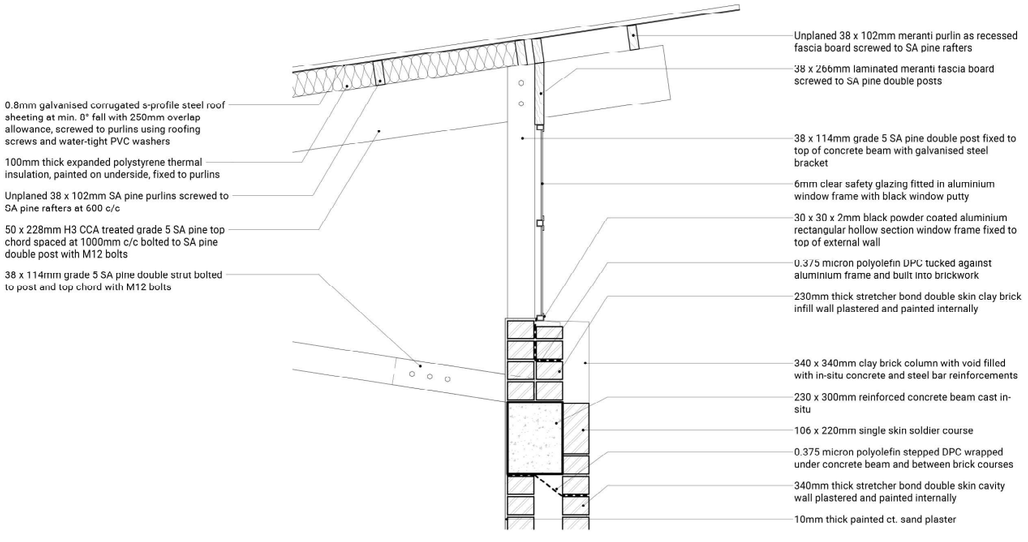


Figure 7.30. Detail B1 (Author 2021)

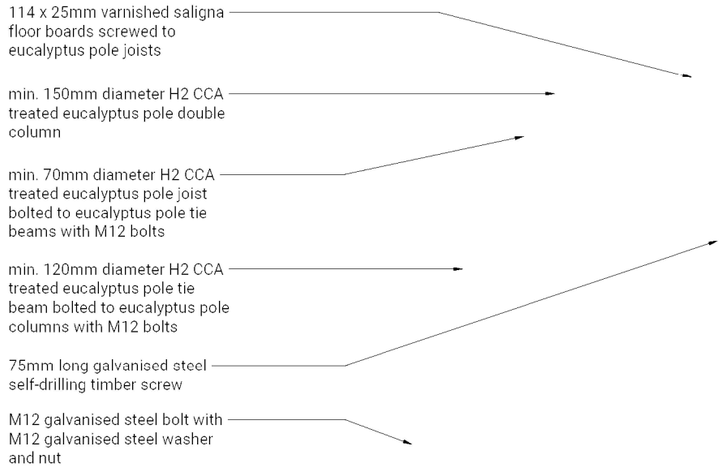


Figure 7.31. Detail B2 (Author 2021)

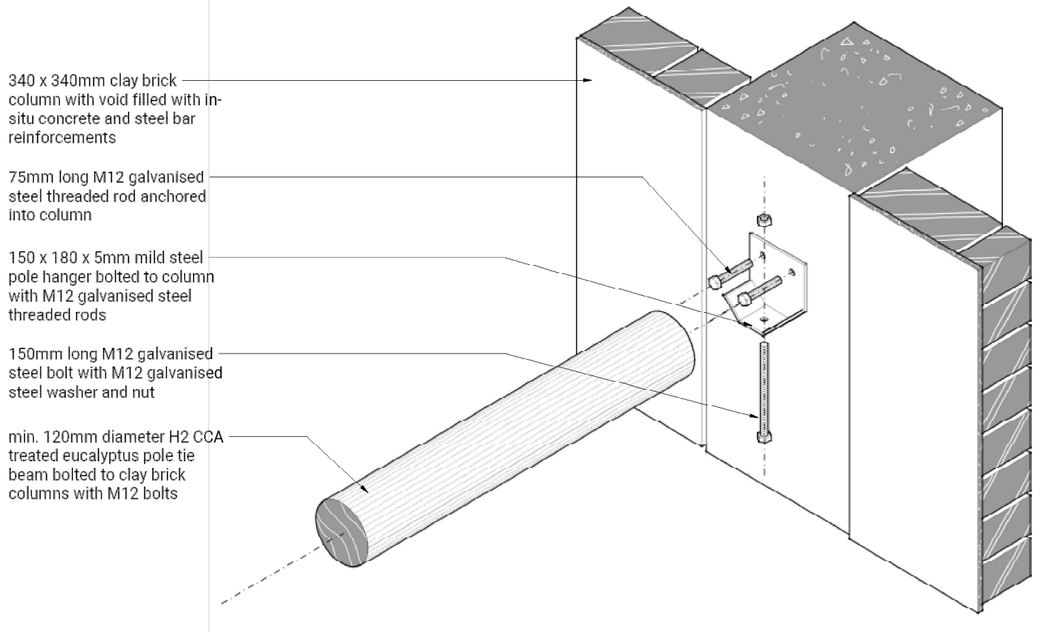
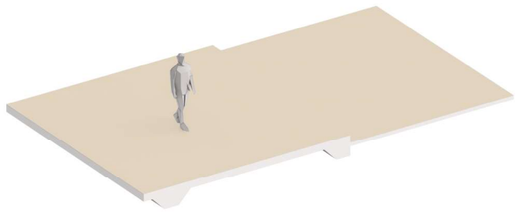
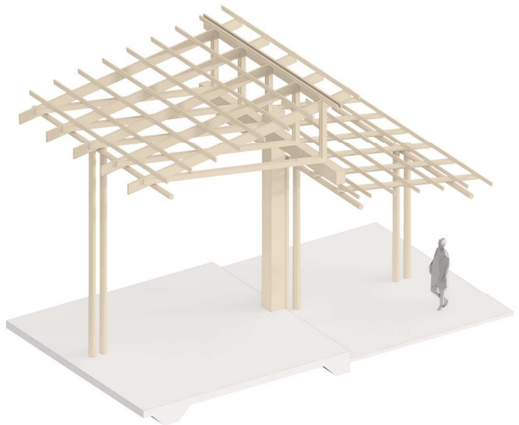


Figure 7.32. Detail B3 (Author 2021)



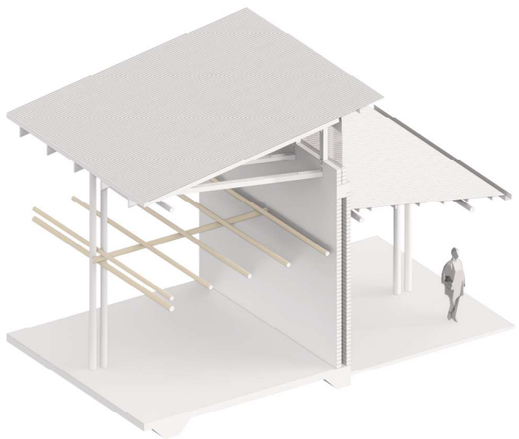
1 - Horizontal planes



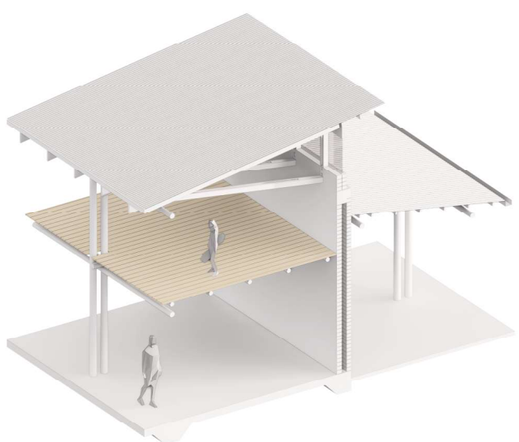
2 - Concrete and timber frame

3 - Covering

4 - Clay brick infill walls



5 - Additional mezzanine frame



6 - Mezzanine platform

Figure 7.33. Structural appropriation B (Author 2021)

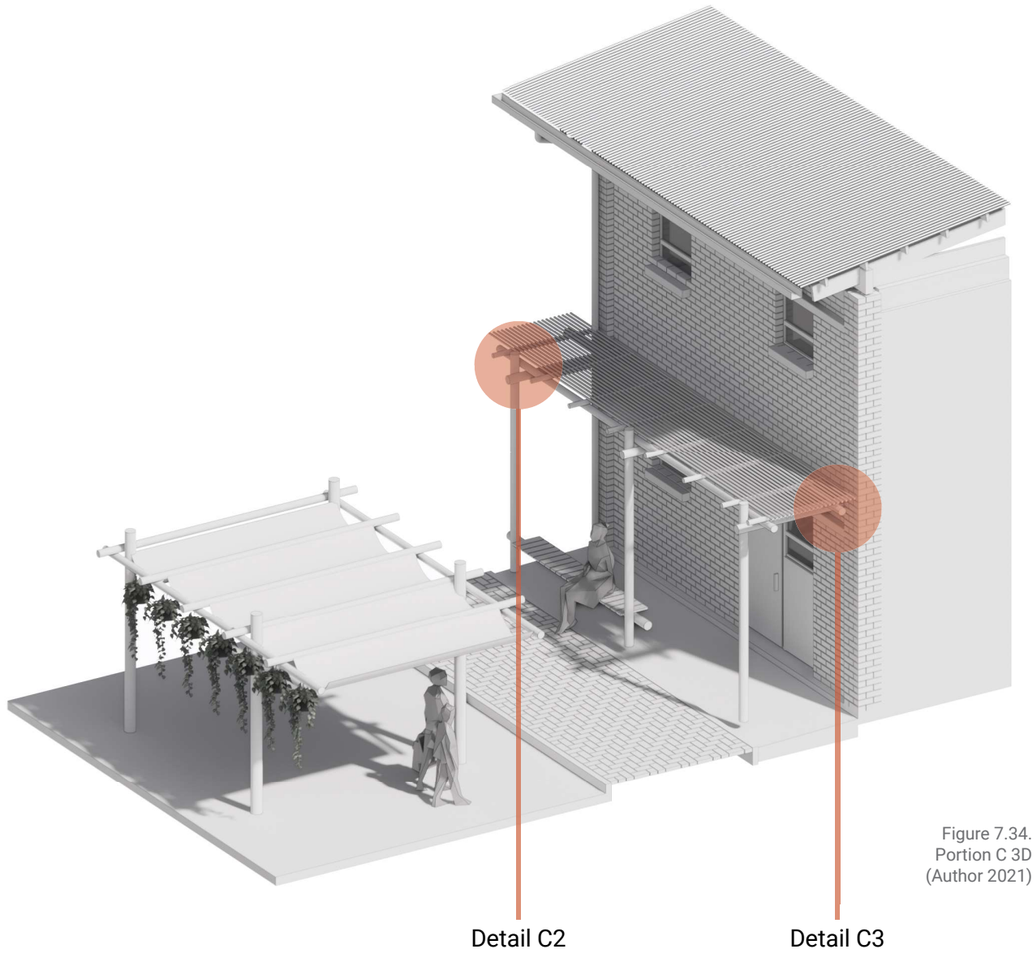


Figure 7.34.
Portion C 3D
(Author 2021)

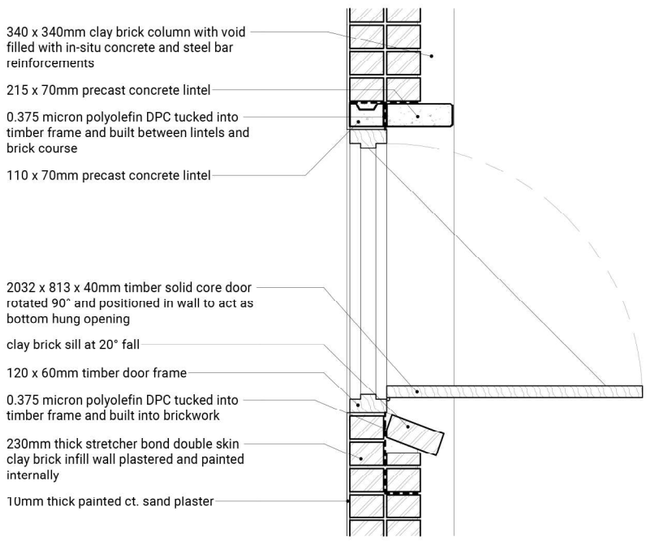


Figure 7.35. Detail C1 (Author 2021)

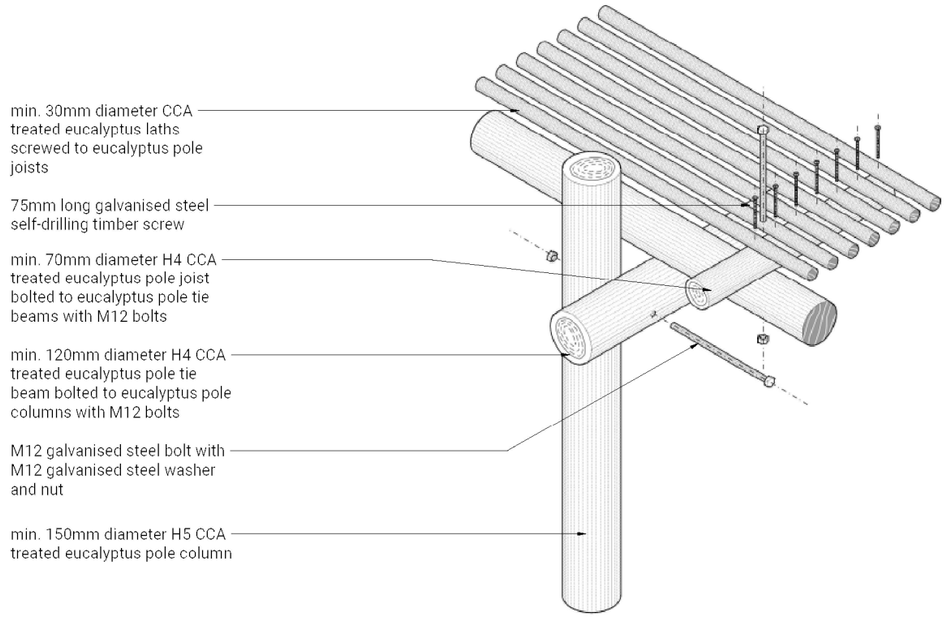


Figure 7.36. Detail C2 (Author 2021)

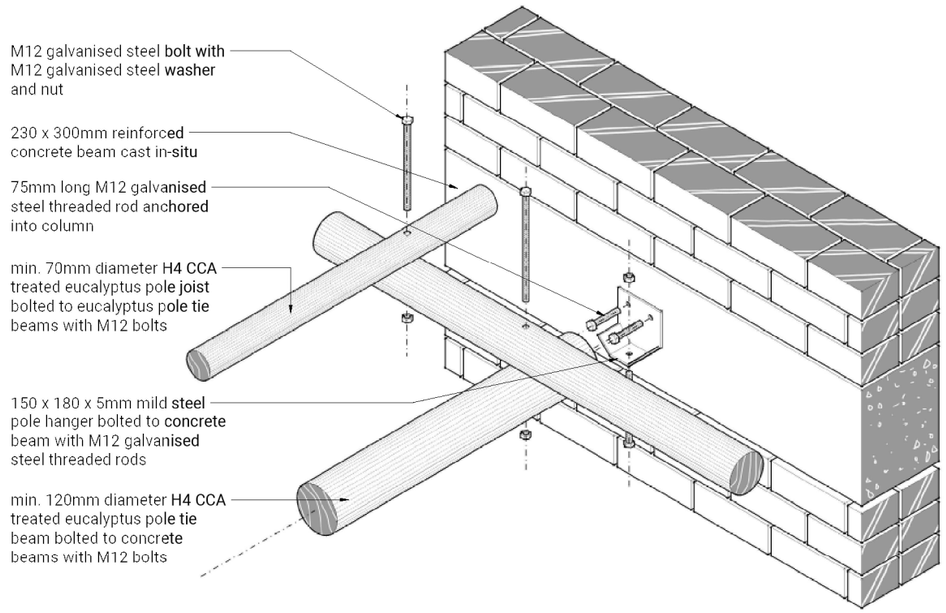
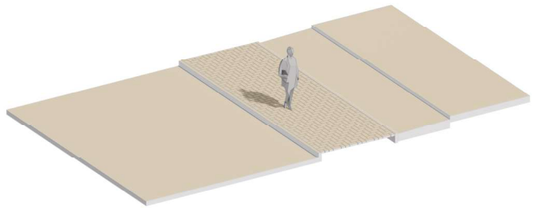
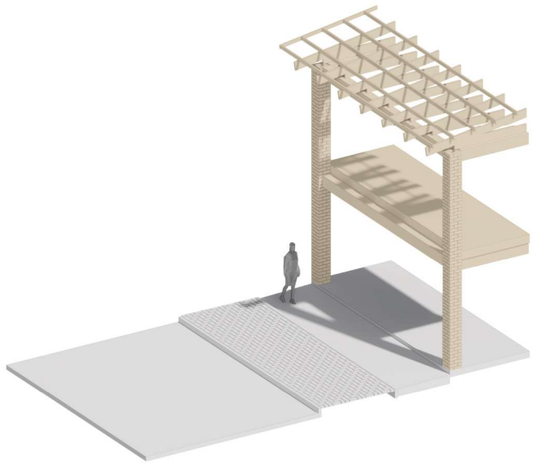


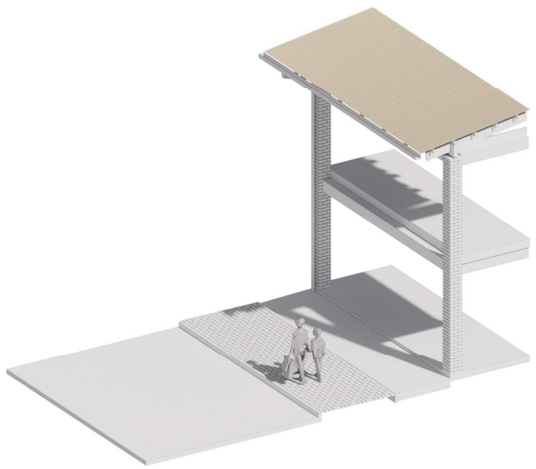
Figure 7.37. Detail C3 (Author 2021)



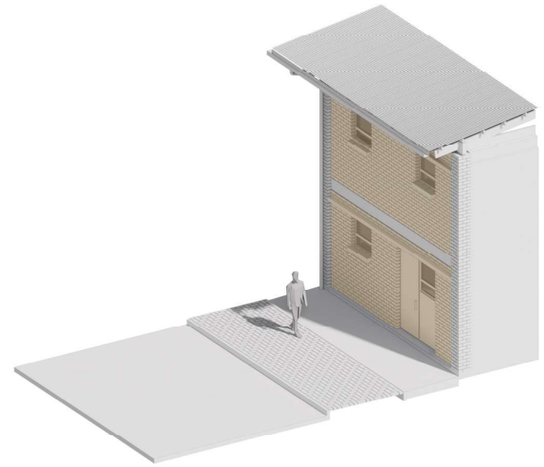
1 - Horizontal planes



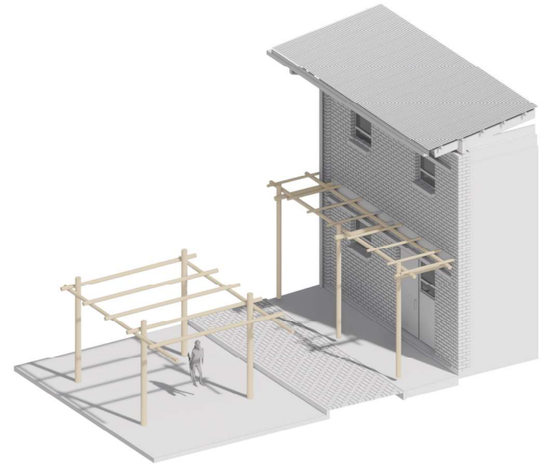
2 - Concrete and timber frame



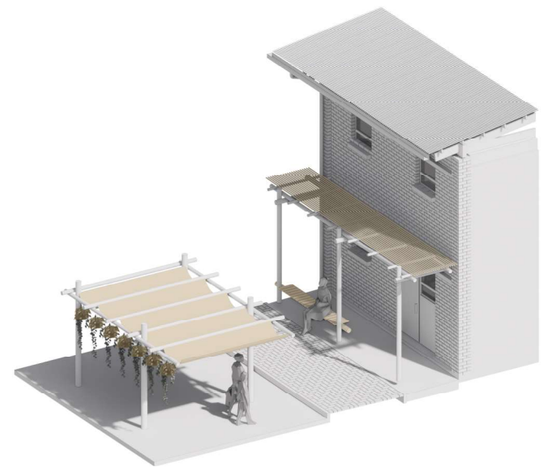
3 - Covering



4 - Plastic brick infill walls



5 - Additional frame



6 - Additional covering

Figure 7.38. Structural appropriation C (Author 2021)

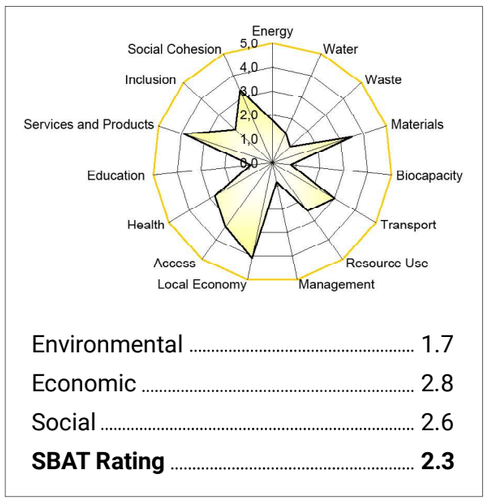


Figure 7.39. SBAT analysis of site pre-intervention (Author 2021)

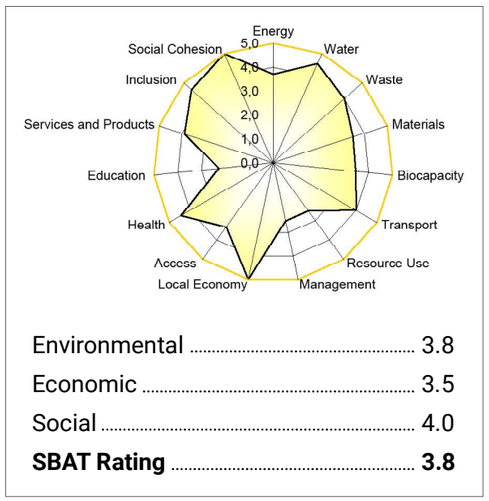


Figure 7.40. SBAT analysis of site post-intervention (Author 2021)

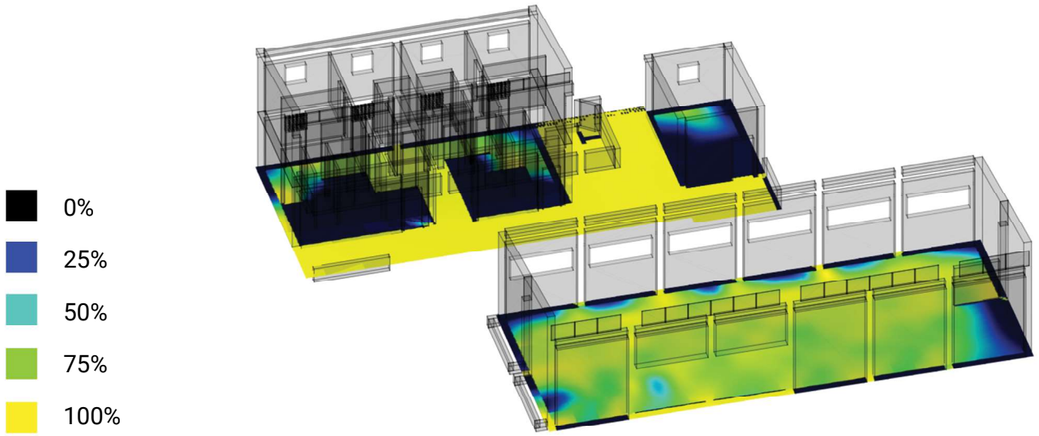


Figure 7.41. Daylight visualisation (Author 2021)

01 Catchment Area	
Surface	Area (m²)
Pitched roofs	1463
Permeable paving	1124
Total possible catchment area	2587
Runoff coefficient	0.9
Effective catchment area	2328.3

02 Rainwater yield		
Month	Av. rainfall (m)	Yield (m³) (Yield = P*A)
January	0.12	279.396
February	0.106	246.800
March	0.091	211.875
April	0.033	76.834
May	0.022	51.223
June	0.006	13.970
July	0.01	23.283
August	0.021	48.894
September	0.07	162.981
October	0.12	279.396
November	0.14	325.962
December	0.12	279.396
Annual average yield	0.072	166.667

Building & site water consumption						
Fixture	Quantity	Usage (l)	Times used per day per fixture	Total daily usage (l)	Daily 1000 litres (m³)	Monthly 1000 litres (m³)
Toilet	24	2	5	240	0.24	7.32
Handwash basins	22	0.5	3	33	0.03	1.01
Showers	14	30	2	840	0.84	25.62
			Subtotal	1113	1.11	33.95

Irrigation consumption				
Season	Area (m²)	Coefficient	Daily 1000 litres (m³)	Monthly 1000 litres (m³)
Summer	560	0.125	0.07	2.135
Winter	560	0.16	0.09	2.7328
			Subtotal	4.8678
Total system demand				38.81

Water budget (accumulative)				
Month	Yield (m³/month)	Demand (m³/month)	Monthly Balance (m³)	Volume in tank (m³)
January	279.396	36.085	243.311	1146.108
February	246.8	36.085	210.715	1356.823
March	211.875	36.085	175.79	1532.613
April	76.834	36.683	40.151	1572.764
May	51.2223	36.683	14.540	1587.304
June	13.97	36.683	-22.713	1564.591
July	23.283	36.683	-13.400	1551.191
August (Start month)	48.894	36.683	12.211	0
September	162.981	36.683	126.298	126.298
October	279.396	36.085	243.311	369.609
November	325.962	36.085	289.877	659.486
December	279.396	36.085	243.311	902.797
Annual average	166.667	36.384	130.284	

Figure 7.42. Water harvesting calculations (Author 2021)

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Faculty of Engineering, Built Environment and Information Technology

Fakulteit Ingenieurswese, Bou-omgewing en Inligtingtegnologie / Lefapha la Boetšenere, Tikologo ya Kago le Theknolotši ya Tshedimošo

Reference number: EBIT/259/2020

Dr C Combrinck
Department: Architecture
University of Pretoria
Pretoria
0083

Dear Dr C Combrinck

FACULTY COMMITTEE FOR RESEARCH ETHICS AND INTEGRITY

Your recent application to the EBIT Research Ethics Committee refers.

Conditional approval is granted.

This means that the research project entitled "Urban Citizen Studios: Public Interest Design" is approved under the strict conditions indicated below. If these conditions are not met, approval is withdrawn automatically.

Conditions for approval
Conditional approval on the understanding that:
- Applications from each student (including application forms and all necessary supporting documents such as questionnaire/interview questions, permission letters, informed consent form, researcher declaration etc) will need to be checked internally by the supervisor. A checklist will need to be signed off after the checking.
- All of the above will need to be archived in the department and at the end of the course a flash disc / CD clearly marked with the course code and the protocol number of this application will be required to be provided to EBIT REC administrator.
- Any personal and demographic data (eg gender, income, education) have provided the motivation that is acceptable based on the supervisor's evaluation.
- Students using organizations data not publicly available or collecting data from employees have the permissions in place.
- No data to be collected without first obtaining permission letters. The permission letter from the organisation(s) must be signed by an authorized person and the name of the organisation(s) cannot be disclosed without consent.
- Images and observation of people will require consent. Images and observation of minors are prohibited.

This approval does not imply that the researcher, student or lecturer is relieved of any accountability in terms of the Code of Ethics for Scholarly Activities of the University of Pretoria, or the Policy and Procedures for Responsible Research of the University of Pretoria. These documents are available on the website of the EBIT Ethics Committee.

If action is taken beyond the approved application, approval is withdrawn automatically.

According to the regulations, any relevant problem arising from the study or research methodology as well as any amendments or changes, must be brought to the attention of the EBIT Research Ethics Office.

The Committee must be notified on completion of the project.

The Committee wishes you every success with the research project.

Prof K.-Y. Chan
Chair: Faculty Committee for Research Ethics and Integrity
FACULTY OF ENGINEERING, BUILT ENVIRONMENT AND INFORMATION TECHNOLOGY

08 LIST OF REFERENCES

Ahern, J. 2011. From fail-safe to safe-to-fail: Sustainability and resilience in the new urban world. *Landscape and Urban Planning*, 100:341-343.

Alexander, C. 1979. *The timeless way of building*. New York: Oxford University Press

Allen, C.R., Angeler, D.G., Garmestani, A.S., Gunderson, L.H. & Holling, C.S. 2014. Panarchy: Theory and Application. *Ecosystems*, 17:578-589.

Bertaud, A. 2018. *Order without Design: How Markets Shape Cities*. Cambridge: MIT Press.

Centres for Disease Control and Prevention (CDC). 2015. *Water treatment*. [Online] Available from: https://www.cdc.gov/healthywater/drinking/public/water_treatment.html [Accessed: 10/11/2021]

Combrinck, C., Vosloo, P. & Osman, A. 2017. Informal Settlements: An Upgrade. *Architecture South Africa*, 85:42-48.

Combrinck, C., Vosloo, P. & Osman, A. 2017. Informal Settlements: An Upgrade. *Architecture South Africa*, 86:32-38.

Creighton, B., de Bruin, C., Herbst, D., Katranas, A., Kriek, D., Lindqvist, J., Mbedzi, A., Ramsey, N. & Zachrisson, L. 2021. About Us. *Moreleta Park Integration Project*. [Online] Available from: https://sites.google.com/tuks.co.za/mpip-2021/about [Accessed: 12/05/2021].

Davoudi, S. 2012. Resilience: A bridging concept or a dead end? *Planning, Theory and Practice*, 13(2):299-333.

Dawes, M.J. & Ostwald, M.J. 2017. Christopher Alexander's A Pattern Language: analysing, mapping and classifying the critical response. *City, Territory and Architecture*, 4(17):1-14.

Dovey, K. 2015. Sustainable Informal Settlements? *Procedia - Social and Behavioral Sciences*, 179:5-13.

Ebersohn, W., Goga, N., Haese, A., Hudson, N., Meij, R., Mojaphoko, T., Schmutz, I. & Swart, C. 2021. *Community mapping process*. Pretoria: Department of Architecture, University of Pretoria.

Galland, S., Guérin, P.Y., Guitard, S., Rohaut, A. & Sablé, C. 2015. Social Development Project / Indalo + Collectif Saga. *ArchDaily*. [Online] Available from: https://www.archdaily.com/775901/social-development-project-indalo-plus-collectif-saga?ad_medium=office_landing&ad_name=article [Accessed: 27/06/2021].

Galland, S., Guérin, P.Y., Guitard, S., Rohaut, A. & Sablé, C. 2016. Q+A: Collectif saga on building with the community. Vadot, C. *Architizer*. [Online] Available from: https://architizer.com/blog/practice/tools/qa-collectif-saga-on-building-for-the-community/ [Accessed: 27/06/2021].

Gehl, J. 2011. *Life between buildings: Using public space*. London: Island Press.

Griffiths, S., Vaughan, L., Haklay, M. & Jones, C.E. 2008. The sustainable suburban high street: A review of themes and approaches. *Geography Compass*, 2(4):1155-1188.

Groat, L. & Wang, D. 2002. *Architectural Research Methods*. New Jersey: John Wiley & Sons.

Habraken, N.J. 1987. The control of complexity. *Places*, 4(2):3-15.

Habraken, N.J. 1988. *The uses of levels*. Proceedings of Unesco Regional Seminar on Shelter for the Homeless, Seoul.

Holling, C.S. 1986. The resilience of terrestrial ecosystems: Local surprise and global change. In: Clark, W.C. & Munn, R.E. (eds.) *Sustainable development of the biosphere.* Cambridge: Cambridge University Press.

Jones, P. 2017. Housing resilience and the informal city. *Journal of Regional and City Planning*, 28(2):129-139.

Kamalipour, H. & Dovey, K. 2020. Incremental production of urban space: A typology of informal design. *Habitat International*, 98:1-8.

Kellett, P. & Napier, M. 1995. Squatter Architecture? A Critical Examination of Vernacular Theory and Spontaneous Settlement with Reference to South America and South Africa. *Traditional Dwellings and Settlements Review*, 6(2):7-24.

Kihato, C.W. & Napier, M. 2013. Choices and decisions: Locating the poor in urban land markets. In: Perold, H. & Jooste, P. (eds.) *Trading places: Accessing land in African cities*. Somerset West: African Minds.

Kivunja, C. & Kuyini, A.B. 2017. Understanding and applying research paradigms in educational contexts. *International Journal of Higher Education*, 6(5):26-41.

Landman, K. 2006. Privatizing Public Space in Post-apartheid South African Cities Through Neighbourhood Enclosures. *GeoJournal*, 66(1):133-146.

LKSVDD Architects. 2019. *Reuse pur sang: upcycle center in Almere*. [Online] Available from: https://www.lksvdd.nl/hergebruik-pur-sang-upcyclecentrum-in-almere/ [Accessed: 28/06/2021].

Lutzoni, L. 2016. In-formalised urban space design: Rethinking the relationship between formal and informal. *City, Territory and Architecture*, 3(20):1-14.

Muller, P. 2013. Climatic zones, SANS 204 and passive design strategies in SA. In: Schmidt, S. (ed.) *Architective: Building construction standards for South Africa*. Johannesburg: Architective Publications.

Ndlazi, S. 2020. New Mooikloof Mega City on cards east of Pretoria. *IOL*. [Online] Available from: https://www.iol.co.za/pretoria-news/news/new-mooikloof-mega-city-on-cards-east-of-pretoria-d87a34a4-dfdb-49aa-bdb4-8811bd51b584 [Accessed: 29/06/2021].

NM & Associates (not dated). *Philippi Public Transport Interchange*. [Online] Available from: https://www.nmassociates.co.za/projects/selected/philippi-public-transport-interchange [Accessed: 28/06/2021].

Oldenburg, R. & Brissett, D. 1982. The third place. *Qualitative sociology*, 5:265-284.

Osman, A. 2015. What architects must learn from South African student protests. *The Conversation*. [Online] Available from: https://theconversation.com/what-architects-must-learn-from-south-african-student-protests-50678 [Accessed 29/07/2021].

Peres, E. & du Plessis, C. 2013. *The threat of slow changing disturbances to the resilience of African cities*. Paper presented at the 19th CIB World Building Congress, Brisbane.

Peres, E. & du Plessis, C. 2014. *Be(a)ware: Resilience is about so much more than poverty alleviation*. Paper presented at the Architecture Otherwhere Conference, Durban, 4-6 August.

Peres, E., du Plessis, C. & Landman, K. 2017. Unpacking a Sustainable and Resilient Future for Tshwane. *Procedia Engineering*, 198:690-698.

Revi, A., Satterthwaite, D., Aragon-Durand, F., Corfee-Morlot, J., Kiunsi, R., Pelling, M., Roberts, D. & Solecki, W. 2014. Urban areas. In: Field, C.B., V.R. Barros, D.J. Dokken, K.J. Mach, M.D. Mastrandrea, T.E. Bilir, M. Chatterjee, K.L. Ebi, Y.O. Estrada, R.C. Genova, B. Girma, E.S. Kissel, A.N. Levy, S. MacCracken, P.R. Mastrandrea, & L.L.White (eds.). *Climate Change 2014: Impacts, Adaptation, and Vulnerability. Part A: Global and Sectoral Aspects*. Contribution of Working Group II to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA, pp. 535-612.

SANParks. Not dated. *Kgalagadi Transfrontier Park*. [Online] Available from: https://www.sanparks.org/parks/kgalagadi/tourism/accommodation.php [Accessed 30/09/2021].

Satterthwaite, D., Huq, S., Pelling, M., Reid, H. & Lankao, P.R. 2007. *Adapting to Climate Change in Urban Areas: The Possibilities and Constraints in Low- and Middle-income Nations*. London: International Institute for Environment and Development.

Soggot, M. & Amupadhi, T. 1997. A human flood is drowning Gauteng. *Mail and Guardian*. [Online] Available from: https://mg.co.za/article/1997-05-16-a-human-flood-is-drowning-gauteng/ [Accessed 12/06/2021].

South African National Standards. 2011. *204*. Pretoria: South African Bureau of National Standards.

Till, J. 2005. The negotiation of hope. In: Jones, P.B., Petrescu, D. & Till, J. (eds.) *Architecture and Participation*. London: Routledge.

Trask, S. 2013. *Up down recycle: Infrastructure for integrated waste management*. MTech (Architectural Technology). Johannesburg: University of Johannesburg.

Unit for Urban Citizenship. 2021. *Architectural research prototype*. Pretoria: Department of Architecture, University of Pretoria, 1-7.

Usamah, M., Handmer, J., Mitchell, D. & Ahmed, I. 2014. Can the vulnerable be resilient? Co-existence of vulnerability and disaster resilience: Informal settlements in the Philippines. *International Journal of Disaster Risk Reduction*, 10:178-189.

Wakely, P. & Riley, E. 2010. The case for incremental housing. *World urban forum 5*. [Online] Available from: https://www.citiesalliance.org/sites/default/files/CIVIS_3_English.pdf [Accessed 12/05/2021].

Walker, B. & Salt, D. 2006. *Resilience thinking: Sustaining ecosystems and people in a changing world*. Washington: Island Press.

Walker, B. & Salt, D. 2012. *Resilience practice: Building capacity to absorb disturbance and maintain function*. Washington: Island Press.

Warnich, S. & Verster, B. 2005. *The answer is: Corridor development, but what is the question?* Proceedings of 24th Southern African Transport Conference, Pretoria, 11-13 July.

Weichselgartner, J. and Bertens, J. 2000. Natural Disasters: Acts of God Nature or Society? On the Social Relation to Natural Hazards. *WIT Transactions on Ecology and the Environment*, 45:3-12.

Wu, J. & Loucks, O.L. 1995. From Balance of Nature to Hierarchical Patch Dynamics: A Paradigm Shift in Ecology. *The Quarterly Review of Biology*, 70(4):439-466.

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